Laying the Foundation for Effective Natural Resource Management

Teresa Scanlon
teresa.scanlon@umontana.edu

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Laying the Foundation for Effective Natural Resource Management

Teresa Scanlon
Laying the Foundation for Effective Natural Resource Management

M.S. Environmental Studies Portfolio

Teresa I. Scanlon
May 2016
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Laying the Foundation for Effective Natural Resource Management

Introduction

My graduate career in the Environmental Studies Department at the University of Montana came about from a desire to better understand how to advance the way science informs management policies for natural resources. The following portfolio describes three distinct, yet not mutually exclusive, approaches for managing water and other resources. A common theme throughout the three approaches is that they “lay the foundation” for future management, or that each represents a different approach for natural resource management planning.

Part One is the final report for a research and planning contract for Lolo Watershed Group. Watershed science and restoration field techniques are used to inform and develop a scope of work document for Montana Department of Environmental Quality for a future revegetation restoration project on Lolo Creek. Part Two describes some of the co-facilitation work and research that I completed in order to earn my certificate in Natural Resource Conflict Resolution from the Natural Resources and Conservation Department at the University of Montana. Part Two demonstrates how collaborative processes increase the capacity for information sharing and consequently improve natural resource management. Part Three is a final report to Trout Unlimited from an internship working to develop options for a drought plan in the Upper Clark Fork River Basin.

The planning phases of natural resource management projects are critically important because of the complexity of natural resource management decisions. The functioning of the ecosystems that supply these natural resources is often compromised over time. More than ever before there is a need for environmental scientists (both social & natural), such as myself, to coordinate these aspects into natural resource management in order to ensure efficient use, equitable distribution, and environmentally conscious decisions in our use of natural resources. With improved integration of natural science, social science, and local knowledge, managers can make more informed decisions in natural resource management.
Part 1
Project Planning for Plantings in Riprap

Sediment Reduction in Lolo Creek Watershed | Task 1 | DEQ Contract No. 214007

By
Teresa Scanlon
MS Environmental Studies
University of Montana
June 2016
Task 1: Project Planning for Plantings in Riprap

Contractor: Teresa Scanlon
633 S. 5th St. E.
Missoula, MT 59801

Contractor Liaison: Kascie Herron, (406) 546-2316, kascie.herron@gmail.com

Task 1 Funding

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1.0 Overview and Purpose for the Study

The purpose of this project is to meet the deliverables in Task 1: Project planning for plantings in riprap, Montana Department of Environmental Quality (DEQ) Contract No. 214007 between DEQ and Lolo Watershed Group (LWG): Sediment Reduction in Lolo Creek (the “DEQ Contract”).

The intent of Task 1 is to create a document that can be used by LWG and MDT as a guide to implement a streambank bioengineering project, planting riparian shrubs in riprap between Lolo Creek and HWY 12 in order to reduce sediment loading into the creek. The first part of the report is a summary of past plantings into similar sites and is followed by a complete scope of work for a future planting along the creek.

2.0 Contract Deliverables

The contract for task one of the DEQ Contract included two deliverables.

2.1 Deliverable No. 1

The first deliverable is a report with photo documentation of projects in western Montana where shrubs have been planted in sites similar to Lolo Creek. Data is collected through interviews with field technicians, project managers, and engineers, and past reports.
Report includes photographic records of survival and growth of vegetation, planting procedure, maintenance issues that developed, post-planting care used to enhance survival, costs that were incurred to plant sites, and a determination if planting or plant growth in riprap has caused road safety issues.

2.2 Deliverable No. 2

The second deliverable is a detailed project plan or scope of work for a planting of four priority sites along Lolo Creek. The scope of work includes all aspects of the planting project including plant selection, collection, and storage, safety issues associated with the site, site maintenance for two years, projected budget costs, a note on necessary permits, and personnel time required. A map of the recommended planting sites, GPS coordinates, and notes on the site investigation are also included in the scope of work.

3.0 Background Information

The purpose of the streambank bioengineering project is to improve Lolo Creek water quality and aquatic habitat by reducing non-natural sediment loading into the Creek. Lolo Creek abuts Highway 12 in multiple sections from its headwaters at Lolo Pass to the confluence with the Bitterroot River. Highway 12 is used heavily throughout the year, and during the winter, deicers are mixed with traction sand for road safety. Due to the proximity of Lolo Creek to the highway, traction sand is cleared from the road and deposited as a form of nonpoint-source pollution into the creek. Much of the road creek interface is riprapped to stabilize the streambanks and protect the road by minimizing creek meandering. Riprapped streambanks without vegetation further perpetuates the non-point source pollution issue (Klingeman et al., 2002). Without vegetation there is no natural vegetated buffer between Highway 12 and Lolo Creek.

Sediment loading degrades water quality and aquatic life and habitat (Buckler, 1999). Montana Department of Transportation (MDT) has worked with DEQ and LWG in the past
to mitigate effects from the sediment loading from deicers and traction sand by reducing the amount of deicers used on the road, and installing sediment traps and berms along the highway to trap sediment run-off, and collecting traction sand from along the roadside at the end of the winter season. While these techniques reduce total pollution entering the creek, reducing deicers requires MDT collect traction sand at the end of the season, and sediment traps and berms need continued maintenance.

To mitigate the effects of non-point source pollution entering the creek, Lolo Watershed Group has proposed a revegetation project to improve the natural buffer zone between the highway and the creek. A functioning buffer zone mitigates impacts from sediment loading into streams that are in close proximity to roads (Venner et al., 2004; Ellis, 2008). Vegetated corridors between roads and streams function as a buffer zone, catching, filtering, and consequently reducing runoff from the highway into the stream (MT DOT, 2010, and Johnson and Buffler, 2008).

The buffer zone areas proposed for a revegetation project are portions of riprapped streambank along the highway. While riprap installments stabilize the streambank, they are particular areas of concern, because they are not vegetated. MDT researched the effects of vegetated riprap and now requires that vegetation be planted with ripap installments, because vegetated riprap provides wildlife and riparian habitat, increases aesthetics, and increases riprap stability (Hoag and Sampson, 2007; MT DOT 2010).

A scientific review prepared for Montana DEQ, Scientific Recommendations on the Size of Stream Vegetated Buffers, concludes buffer zones 35-100m are the most effective in improving water quality. However, Lolo Creek at bankfull is as close as 25 feet from the road. Although research has not quantified sediment reduction from revegetated riprapped streambanks with a buffer zone smaller than 35m to the road, sediment reduction may be a secondary effect from vegetated riprap.

Moving the road or the creek to increase the buffer zone to 35-100m would be an alternative option for sediment reduction. However, a project to move the stream or the road would cost up to four times as much as a revegetation project, and here are substantial logistical challenges and costs associated with the approval and construction of a new road or stream channel. As a result, those projects have not been considered as a practical alternative at this time.

4.0 Summary Report: Past plantings into riprap in western MT using an expandable stinger and other techniques

This document is created from the findings on a study of successes and failures, methods and problems encountered at sites with similar conditions to Lolo Creek. Relevant conditions consider a combination of or all of the following: high spring runoff, proximity of the road to creek, riprapped streambanks for stabilization, streambanks with a 35° slope, and proximity of the road to the creek.
While many planting methods exist, the conditions described above make Lolo Creek a difficult planting site, and a controlling variable for a project on Lolo Creek specifically, is the cost of highway control. As a result, certain techniques were not studied as critically, because the extra time would exponentially increase the cost of the project.

Research conducted on planting techniques reveals that projects at sites similar to Lolo Creek have often used a mechanized stinger implement to quickly penetrate the ground for planting. The stinger implement attaches to an excavator, and can plant into the streambank from the road above. Many planting projects supplement stinger plantings with other planting techniques, some of which are mentioned below.

The following report describes the process and costs involved with using a stinger for revegetation projects. Pictures show survival of plants from the stinger. The report includes the planting procedure, maintenance issues that developed due to these planting projects, post-planting care used to enhance survival, costs that were incurred to plant sites, and determination if planting or plant growth in road safety.

**Lightning Creek – Funded by Lolo Forest Service**

The first two photos below show records of fascine installments and hand planting into cobble along Lightning Creek. Hand planting into riprap requires that the plant inserted into riprap come into contact with as much soil as possible. Fascine installments involve inserting and weighting a bundle of willows and other hardwood materials along the floodplain. Fascine installments rely on the floods to establish roots in the soil during the high water season, but at sites with multiple layers of riprap, the ground difficult to access in order to lay down a full bundle of woody material. Both techniques are highly susceptible to flood events, and a project manager from the Forest Service estimated a success rate of 50%.

Stinger planting success however, is described as much greater than that of hand planting and fascine installments. The difference in success between the stinger and hand planting is likely due to the depth at which plants are inserted. Plants may not reach wetted soil depth during hand planting, but the stinger reaches deep enough to ensure that the tip of the root will touch the wet zone in the soil.
The Lightning Creek stinger planting was the final phase of a larger restoration of large wood enhancement for food habitat in the creek. 1400 plants were planted in 2,000 stream feet. The project spanned three days, and The Forest Service provided one man for traffic control. The stinger left the road and moved through riparian area and the stream to access planting sites. Planting was focused along logjams with large cobble and boulders; space to maneuver the machinery was limited. The stinger penetrated the ground through thick cobble to reach the water table to drop tips of plants into wet soil, but as a result of limited space and time constraints, cuttings were doubled, or tripled in single holes. The cost per plant was about $15. No qualitative monitoring records were found, but a site visit in 2014 and again to different location in 2015 shows plant survival.

**Rock Creek and Cedar Creek** - funded by *Trout Unlimited and Lolo Forest Service*

Trout Unlimited and the Lolo Forest Service have completed multiple stinger revegetation projects in riprap on Rock Creek and Cedar Creek. Both creeks are along forest service roads, and the projects did not use traffic control. One year the project was delayed because of frozen ground in the spring.

In 2010, 2,700 dogwood and willows were planted 1.5 feet apart in two rows spaced 1.5 feet apart along 3,700 linear feet of streambank on Rock Creek. Volunteers collected 6-12 inch willows in early April. The willows soaked for one week before planting, but qualitative monitoring revealed willow survival better than the dogwood. The project crew included an excavator operator and 1-2 laborers. The cost amounted to about $200/day plus $2,000 to mobilize the stinger equipment to the site.

**Bitterroot River, Veterans Bridge** – Funded by *Montana Trout and MDT*

The east aspect streambank of the Bitterroot River by the Veterans Bridge near Hamilton has a stinger planting completed by Trout Conservancy and MDT. About fifteen volunteers collected the willow whips for an estimated 46 man-hours. The site enabled easy machinery access to the riprap on the streambank, and the project manager said that the planting did not experience any unexpected problems. Willow survival is not quantitatively measured, but site a site visit in 2016 shows willow survival.
Willows planted with a stinger from 2011 along the Bitterroot River near Veterans Bridge, Hamilton. (Photo: September, 2016).

**Pre-planting maintenance and storage**

The willows must be kept frozen or wet before planting. If the whips of willows to be planted are collected more than two weeks before planting, the willows can be kept in a freezer. Due to permit limitations in the past, some projects collect plants in spring and keep willows in storage for up to 6 months until they are planted. There are three ways to store the willows in the freezer at just about freezing temperatures. One technique is to keep the willow whips dry in the freezer. Another technique is to put the willow ends in a moist burlap bag, the willows can also be kept in a tub of water in the freezer. This technique has produced the most vigorous willows post-planting. The willows can soak in the river or a pond pre-planting if they are cut just prior to planting.
Willows soak in a pond without beaver activity for 2-14 days prior to planting to improve survival rates (photo: 2010).

**Timing of planting**

Stinger planting success is variable, but project managers consider dormant plantings best. Planting can be done in the spring or in the fall. Springtime issues include frozen ground, flashy creek or river systems that can dislodge whips, access to the ordinary high water mark can be unpredictable, and the water level drops too fast for the plant roots to chase it down before it is established. In the fall, the ordinary high water mark in the soil is easier to read, and the soil moisture is more stable, but planting during the fall means that dormant plants will have to be stored through a growing season before planted.

**Other stinger planting issues**

There are a few additional issues and considerations to acknowledge when working with the stinger. The size of the machinery can cause access issues and road damage. The stinger can be on a wheeled excavator to increase the speed of the planting, but the excavator will then still need to be reloaded, which can also slow the planting process. The project should have the city come out flag for buried electric lines. Some projects have used a water tank to enhance plant survival, but in order to keep the cost down; most revegetation projects do not water willows. As a result, plant survival is dependent on weather. The planting crew can ensure that each plant reaches a wetted soil depth. There have been no reported issues from obstructed road visibility.

**5.0 Revegetating riprap along Lolo Creek: Scope of work**

The final scope of work below includes all aspects of planting including the plant selection,
collection and storage of plants, potential safety issues during the planting project, costs and personnel time required for a planting project along Lolo Creek. A permit from the Missoula Conservation District will be needed when the funding for the project is available. A copy of the site map and photos of each section for planting are included in the report.

The project should use the patented expandable stinger, which is an implement attached to an excavator. The patented expandable stinger is identified as the best available technique for revegetating sites with conditions similar to Lolo Creek. As demonstrated from the report above, sites with conditions similar to these have used a stinger in order to access the streambank from the road as well as the ground beneath rocky streambanks.

Lolo Creek has high runoff during the spring, and as a result, water can dislodge hand plantings and fascine installments that do not penetrate the ground as deeply as the stinger can. The riprap sections of streambank on Lolo Creek further challenge hand planting because the water table cannot be reached through the rock. The stinger is necessary, because it can penetrate riprap and ground 5-6ft deep from above and drop a willow into the earth. Lastly, the slope of the riprap is steeper than 35° in some sections, and the road is within 25feet from the creek at bankfull. The stinger can access the streambank from the road despite the steep embankment and without a floodplain, and can penetrate the riprap, placing whips deep into the earth so as to prevent them from being dislodged during spring runoff.

Wildlands, Inc. based in Richmond, Washington a restoration revegetation business is a preferred contractor for Montana DEQ. They will provide the stinger and a planting crew of 4 personnel for the project. The projected cost for the mobilization of the stinger will be about $3,200. The excavator machine plus the is 10.5 ft. wide and 14.5 ft. long; access on Lolo Creek will able to accommodate expandable stinger with traffic control. Traffic control is absolutely necessary because of high volume of traffic on the highway.
The mobilization, including demobilization, of the Expandable Stinger, excavator, and support vehicle from Richland, WA to Hamilton, MT is $3,200.00. A price range for budgetary purposes per hole (plant material not included) is $7.50 to $8.50 per hole. Wildands, Inc. recommends planting in the fall with dormant willows. The machinery is 10.5ft wide and weights approximately 55,000lbs. It will cause damage to the road if it is not placed on steel plates or rubber mats.

**Willow selection**

Native willows are to be harvested in the spring when they are still dormant. The willows will be harvested from the OZ Ranch, whose relationship with LWG permits volunteers to come onto the land in order to harvest willow whips for plantings. Native willow species are important because they will break dormancy when the regional conditions are right. Native willows are the best choice of riparian plant, because they grow fast and their root systems are expansive, but do not grow in bundles like cottonwood roots, another fast growing riparian species.

The willow whips should be 1.5 inches or less in maximum diameter at the basal end, or within the size ranging between a dime to nickel in diameter. The willows should be 6 ft. to 8 ft. or less in maximum length (species dependent), and stems as straight as possible.

**Pre-Planting maintenance and planting method**

The willows should be soaked for at least 2 days prior to planting. They can be harvested sooner and stored in a cooler with tips in moist burlap bags or stored in bundles under water with weights to keep them under for up to two weeks. The whips should be planted when they are dormant in the spring at a distance of 1-2 feet apart in rows of two to improve survival rates. The creek’s flow regime changes the level of soil moisture in the riparian area beneath the riprap. Two rows of willows will increase survival rates. Whips should be planted into the earth at the top of the water table into moist soil, or what is commonly called the wet zone. Willow plantings that are not inserted into the wet zone will not survive. Willows that access water will break dormancy as soil and atmospheric temperatures near the native dormancy-breaking period for the region. Plants will be watered after planting. The number of times will depend on the weather patterns for three weeks following the installment.

**Personell Time Required**

The willow whips will be collected by volunteers for an estimated 150hrs. Wildlands, the preferred contractor will supply four employees: one operator, and three laborers, a laborer to feed the stinger with whips and two traffic controllers. Volunteers will water the plantings with the water pump that LWG purchased in the spring of 2016, and will water for the first three weeks, when necessary. The estimated volunteer hours for watering the whips will be dependent upon weather patterns at the time, and so those hours are not included in the budget. Volunteers will also monitor plant survival over two years over 5 site visits for a total of approximately 150hrs.
Site Assessment and Safety Concerns

Sites for the future planting are based on the physical characteristics at each location. For all sites, the average distance from the edge of the road to bankfull is 24 feet, and the average width of riprap from bankfull to the edge of the riprap is 8 feet. The proximity of the willows to the road could alter road visibility. The willows should be planted at the ordinary high water mark and reach wet soil. Willows planted at the ordinary high water mark will therefore be 25-28 feet from the road. Future plans should consider soil type and slope of the streambank in order to more accurately assess the depth of the water table.

To improve worker safety during project installment, Sites 1, 3, and the alternative 4, are straight sections, and Site 2 is a gradual curve. There are also pull offs along Highway 12 at or near each of the chosen sites for worker use.

The following maps show the location in the basin of each site, and a close up of the section of riprapped streambank that could be planted:
Lolo Watershed Riprap Sites

Map: Joe Krenzelok
**Site 1:** Downstream from mile marker 16 near Howard Cr.  
Distance: 700 stream feet

46°46.872 N  
114°23.623 W

**Site 2:** Upstream from mile marker 11 near Cedar Cr.  
Distance: 1,040 stream feet

46°45.889 N  
114°29.057 W
**Site 3**: Downstream from mile marker 11 near Cedar Cr.
Distance: 1,380 stream feet

46°45.574 N 114°29.450 W

**Alternate Site 4**: Near Lolo Hot Springs Resort
Distance: 540 stream feet
(No photo available)
46°43.524 N 114°31.857 W
# Project Budget

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References
The following list of references includes works cited within the report as well as other work relevant to the background information of this report.


Klingeman et al. 2002. Roadway Applications of Vegetation and Riprap for Streambank
Protection. Synthesis Report SPR 324. Oregon State University, Corvallis, OR.


Part 2 Natural Resource Conflict Resolution Certificate

Part 2A
Improving Natural Resource Management through Facilitating Collaborative Processes

1.0 Introduction

Natural resource management is inherently complex and controversial. It includes land use planning, water management, resource use, extraction, and conservation. The management of natural resources affects both the current and future conditions of ecosystems and economies, and decisions around natural resources are deeply value-based and political.

While statutory and administrative laws govern agency management of natural resources, and legislative and executive policies provide guidance to resource managers’ decision making, there is limited capacity from federal and state agencies to manage natural resources on the ground. Furthermore, ongoing litigation over many natural resource management decisions is evidence that many issues cannot be solved by policy alone. As such, effective and efficient management requires supplemental, more localized efforts now and into the future.

Natural resources are part of ecological systems, and managers and other decision makers of natural resources affect people as well as the ecological system with their choices. The impact of natural resource management often has unintended, and sometimes long-term, consequences. It is difficult to quantify, or monitor the effects of management decisions on the environment, because it is dynamic. Furthermore, changing land use and climate change consequently increase uncertainty in managing natural resources. The impacts of natural resource management are therefore inherently uncertain. Policies help to standardize management decisions and practices, but natural resource management demands an additional level of site-specific adaptive management over time.

*Stakeholder collaboration can create opportunities for adaptive management*

Adaptive management is often achieved through collaboration. There are many forms of collaboration and collaborative partnerships, but as a whole, collaboration provides a forum for discussions as well as for sharing and pooling data and resources amongst
organizations, businesses, and people. Integrating science and collaborative decision-making into management has proved to be an effective way to address environmental issues and the uncertainty involved in managing them (Scarlett, 2013). There is a limited capacity to monitor the impact of natural resource management, but having a platform to share information amongst multiple stakeholder groups and individuals is a way to illuminate issues as they arise. Communication and data sharing can initiate discussion and help create solutions aimed to improve management.

Collaborations result from a strong incentive to solve problems and solutions can be specifically tailored to the issue or site.

Collaborative partnerships arise when environmental problems are severe or perceived to be severe (Sabatier et al., 2005). Once this threshold is reached, it serves as a catalyst for change, and partnerships are more likely to form. Coming together to solve a common issue enables people to acknowledge common interests and identify potential solutions.

Although legislative processes are appropriate at times, collaborative problem solving is more flexible than legislative law and often addresses site-specific issues. Collaborative processes rely on negotiations; a desire to find solutions that all stakeholders can live with helps illuminate new options for dealing with old or emerging issues.

Collaboration improves connectivity across traditional management boundaries

Collaboration also incorporates more stakeholder and public input into the decision making process. While traditional division of natural resource management has created a patchwork of jurisdictional, management boundaries, collaborative management can span across such borders. When multiple groups come together to address their interests and needs, it improves communication streams, improves local participation and knowledge of natural resources, and helps to bridge the management patchwork.

2.0 Facilitating Collaboration

Facilitators are process managers that help to coordinate people’s efforts in collaborations. He or she serves as a central point for parties to discuss, listen, and decide on actions. The role of a process manager develops along with the collaborative process he or she is facilitating. The facilitator (as opposed to a negotiator) works within meetings to facilitate discussions, and is responsible for managing behaviors and meeting productivity. The facilitator organizes information, identifies opportunities and provides advice to stakeholders in order to provide a productive environment for decision-making.

Sustaining collaborative partnerships can be difficult, but strong leadership rallies and supports involvement from groups and individuals (Susskind et al., 2012), (Sabatier et al.,
A facilitator can demonstrate leadership by assisting meetings, workshops, and conferences to have effective discussions and continue partnership building.

3.0 Role of the Facilitator

The role of a facilitator is to initiate and maintain communication with diverse interest groups, stakeholders, and decision-makers. The facilitator conducts what is known as a stakeholder analysis, or situational analysis, in order to understand the issues and interests. Once the facilitator has a comprehensive understanding of the issues and interests involved, he or she designs, with the help from the stakeholders input, a collaborative or other type of multi-party or public process to coordinate natural resource issues.

The facilitator is also responsible for preparing meeting agendas, pre-meeting surveys, meeting summaries, as well as other documents that support the collaborative action. During meetings the facilitator often presents to the group on complex and technical topics.

The skills required for a facilitator to be effective can transfer into any field, but are particularly important within the natural resource management field. The ability to manage people's interests, understand natural resource management conflicts, and identify potential and creative solutions to complex issues is extremely valuable.

Some of the skills that facilitators employ and refine:

- Ability to listen
- Ability to be sensitive toward people's' interests
- Ability to quickly analyze problems and understand complex material and relationships
- Ability to use clear language in speaking and writing
- Ability to communicate with neutrality and be respectful
- Ability to convey technical information
- Ability to create conversation and discussion amongst a diversity of interests and/or peoples
- Ability to understand the difference between one's interests and one's needs
- Ability to see and understand management hierarchies as well as power imbalances

4.0 Active Facilitation

I assisted as a co-facilitator for the following meetings and workshops. The following short reflections address only a fraction of the breadth of topics covered during my work as a co-
facilitator, but they offer insights from perspective of someone honing and refining skills in natural resource management while assuming the role as a co-facilitator.

A co-facilitator, during natural resource management meetings and workshops, is not the expert, but a facilitator must be competent in analyzing and managing information, quickly understanding the power dynamics of those in the room and the decision making power structure, and is responsible for ensuring effective dialogue occurs through information sharing and constructive discussion.

Co-facilitating real-world natural resource collaborations through an academic lens provides another level of analysis. I assess the effectiveness of the collaborative processes that I facilitated with an academic focus, which offers insights into how and why these processes are effective as well as what barriers there are to their success.

4.1 Facilitating public meetings with the Forest Service

Public Meeting Co-facilitator

--with the Center for Natural Resources and Environmental Policy for the Helena-Lewis & Clark National Forest Management Plan

As a co-facilitator with the Center for Natural Resources and Environmental Policy, our job was to manage meetings and look for new techniques in which the Forest Service could better involve the public in developing a forest management plan. The purpose of the meetings was to incorporate more public participation into the planning of the next forest management plan. The 2012 Forest Planning Rule deviates from the previous Planning Rule policy in that it requires more public input as National Forests undergo periodic revisioning of forest management plans. The Helena-Lewis & Clark National Forest hired the Center for Natural Resources and Environmental Policy to help develop and guide a process in which the public could become involved. These public meetings were a part of that process.

The meetings were held in small, sometimes remote, towns throughout the newly joined Helena-Lewis & Clark National Forest management areas. The Forest Service would first explain the forest management plan process, then public would offer suggestions for problem or focus areas, or ask questions about the management scheme. Especially because opportunities to directly communicate with the Forest Service are infrequent, these public meetings provided a meaningful opportunity for the public to both learn from the Forest Service technical advising team and share input about their interests and/or issues regarding the management of forest land. The meetings also offer the Forest Service an opportunity to learn from the public.

The facilitators are responsible for setting up ground rules for respectful communication during the meetings and act as a communication liaison between the technical team and
the public. As a result, despite different interest groups having different values and goals for the forest, productive conversation between interest groups with the Forest Service occurred.

Collaborative planning meetings between the federal agency and the public are critical not just to help inform the agency of the public’s needs, but to also inform the public on how forest management plans are derived. Sharing information helps the agency find common ground with the interests of the public, which in turn helps the Forest Service generate new management opportunities and adapt their management to reflect more precise needs of local areas within the larger National Forest.

4.2 Facilitating a Regional Workshop for Biologists and Land Managers

Wildlife Monitoring Workshop Co-facilitator

--with the National Forest Foundation for Lynx, Wolverine, and Fisher in the Rocky Mountains

The multi-party facilitation workshop lasted three days, and those invited were land and wildlife managers and research groups throughout MT, WA, ID, OR, CA, UT, CO, and WY. The role of National Forest Foundation, as partner to the Forest Service, is to provide opportunities for wildlife managers and research groups to collaborate.

The goal is to have groups across a large landscape share data, ongoing projects, goals, successes, and challenges, so that management decisions can make use of the trends in declining and recovering wildlife populations. There is no other collaborative management entity for these declining species, and NFF is assuming an active role to assist partnership building and cross-party data management; the collaborative process, in this case, is imperative.

I worked with the National Forest Foundation to research, design, prepare for, and facilitate the workshop. These workshops enable parties to share data and projects to better inform land and wildlife management decisions, conservation strategies, and policy. This workshop in particular was focused on the conservation of Lynx, Wolverine, and Fisher, but other mid-size mammals in the forests were also included in the discussion.

Facilitated workshops between land and wildlife managers and researchers are valuable. They support engagement, increase the capacity for wildlife monitoring, and enable professionals and experts to discuss policy.
4.3 Facilitating Watershed Management Planning

Co-facilitator

--with the Montana Watershed Coordinating Council for the Re-envisioning of the Clark Fork Basin Task Force

History of the Original Task Force

The Clark Fork Task Force was originally created to provide a forum for all interests to communicate about water issues, advise government agencies about water management and permitting, and make recommendations to the Montana Department of Natural Resources and Conservation for consideration in the State Water Plan. Since its inception, many activities have been accomplished under the advice and guidance of the Task Force. Perhaps most significantly, the Clark Fork Task Force served as a “basin advisory committee” for the development of the 2015 Montana State Water Plan.

Since the State Water Plan has been finalized, the Montana Department of Natural Resources and Conservation largely views the work of the Task Force, as historically defined, to be complete. However, there is an ongoing interest in and need for a collaborative approach to watershed stewardship in the basin. In particular, there are pressing issues like more coordinated drought response planning, which could benefit from the existence of a basin-wide coordinating group.

Members of the Task Force who were available met in October 2015 and ultimately concluded that the group could be used as a launch pad for a new venue to coordinate watershed priorities, information and conservation across the boundaries of individual sub-watersheds within the basin. The group determined that they wanted to organize a basin-wide coordinating entity (Tribe et al., 2016).

Meeting Facilitation

I co-facilitated the follow up meeting in April of 2015. The Montana Watershed Coordinating Council (MWCC) received a grant to host the meeting and invited watershed managers, interest groups, stakeholders, policy makers, and academic advisers.

MWCC and I developed and analyzed pre-meeting survey results. The survey helped gather insights on what people thought an advisory committee for the Clark Fork Basin should do, or what their role would be for the basin. It provided topical substance from which discussions could start during the meeting.

The facilitation was also critical in order to help organize the group during the meeting, guiding discussion to focus on one issue at a time: including first, what are the potential
benefits of such an advisory group? What are the potential challenges? What should the group focus on? Where should the group meet in the future?

Creating an advisory board for across a major river basin must address a multitude of issues and concerns across a large landscape. The group can address watershed management regionally and fill a role in-between smaller narrow focused sub-basin watershed groups and the broader state government.

The connectivity of watersheds drives the need for coordinated water resource management. Climate change and changing downstream demands for water make water resource management ever changing. Without improved communication throughout watersheds, the management will fall short of being efficient. Co-facilitating this meeting helped to lay the foundation for future coordination of the Clark Fork River Basin.

See *Facilitator's Session Summary*, enclosed as an attachment with the portfolio, for further information about the meeting. Ginny Tribe compiled meeting facilitation notes. Vicki Watson, Jennifer Schoonen, and Teresa Scanlon provided facilitation assistance.
Bibliography

The references below are either cited in part 2A or are otherwise useful readings on the theory and practice of natural resource collaboration and negotiation.


Part 2 B Natural Resource Conflict Resolution Certificate

Part 2B

A Memorandum to Address Management of Groundwater and Surface Water Rights in Montana

TO: Natural Resource Conflict Resolution Certificate Program, University of Montana

FROM: Teresa Scanlon, M.S. Candidate Environmental Studies, University of Montana

SUBJECT: Addressing improvements to the conjunctive management of exempt wells and surface water in Montana

Summary:

Conjunctive surface water and groundwater management in Montana is politically charged and technically complicated. Groundwater withdrawals from exempt wells are a critical concern for water resource management throughout the arid west, because the impact is far greater than originally anticipated. Two predominant reasons explain why exempt wells adversely impact total water availability. One, the cumulative effect of exempt wells causes net depletions to basins, which reduces the surface flows and the groundwater table. Two, a growing trend for real estate development uses exempt wells to supply water to projects in basins where surface flows and basin water quantities are already stressed by existing water use. In order to lay the foundation and preemptively address the growing issues with exempt well use, this memo recommends the state of Montana Department of Natural Resources and Conservation (DNRC) in conjunction with the Montana Watershed

1 MTU v. MDNRC, (MT 2006).
Coordinating Council (MWCC) move to create a collaborative process. That collaboration will focus on assessing specific areas of concern, negotiating limitations, and formulating basin mitigation plans for exempt well use.

**Background:**

Conjunctive management of surface water and groundwater is a technical and political challenge. The Prior Appropriation Doctrine of water law gives priority to water rights through a permitting system. Although new permits hold junior water rights to all existing users, Montana law allows exemptions for water use permits through wells. The rate at which exempt wells are being created alarms water use permit holders and water resource managers alike. In effect, water users with permits fear and distrust exempt wells. The exempt well rule exists to expedite the DNRC permitting approval process. The rule allows small water users to access water from rural areas, yet the cumulative effect of small exempt wells is large.

Climate, geography, and hydrogeology effect surface and groundwater, and thus water availability fluctuates. Due to the heterogeneous landscape in Montana, stream flows and basin quantities are geographically and seasonally variable. Climate change alters historic stream flows and basin recharge, further exacerbating uncertainties in water availability. Despite the variability and uncertainty of water, the exempt well rule remains.

Montana district courts have accepted science that groundwater pumping can depress groundwater tables and reduce basin quantities and surface flows. Research shows net depletions occurring more often in “closed basins”. Basin closures result when the demand for water exceeds the legally or physically available amount. The basin closure policy protects existing permit holders by prohibiting new water use permits, but exempt wells are not prohibited in closed basins. As a result, net depletions continue and worsen.

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3 Wells pumping 35 gallons per minute (“gpm”) or less than 10 acre feet a year (ft/yr) are exempt from permitting and regulation from DNRC. Mont. Code Ann. See 85-2-306.
4 Kolman, (2012).
5 Kolman, (2012).
6 *MTU v. MDNRC* (MT 2006).
over time. A report from 2012, *A study of water wells allowed without a permit*, estimates that 46% of exempt wells occur in closed basins.\(^\text{10}\)

Net depletions in closed basins are, in part, a consequence of the ongoing trend to supply development projects with exempt wells. If development and exempt well use continue along the current trajectory, there will be 70,000 new exempt wells consuming a total of 23,000 acre-feet per year of water in closed basins by 2060.\(^\text{11}\)

Population growth, economic development, and climate change threaten existing water users and water availability in Montana. Given the current exempt well rule, additional lawsuits over the increasing number of wells are imminent. Legal disputes over the management of exempt wells are marginal in Montana, compared with other Western states, but “public awareness [around exempt wells and groundwater pumping effects on surface waters] is growing and changing”.\(^\text{12}\) Proactive planning to reduce impacts from exempt wells is critical in order to avoid additional conflicts and future litigation.\(^\text{13}\)

**Major issues:**

**Challenges to informing management with technical information:**

The 2014 DNRC State Water Plan maintains a need to find new ways to mitigate groundwater impacts to surface flows and basins.\(^\text{14}\) Geographic-based studies reveal critical information about specific basins that should considered for mitigation projects, but due to the complexity of hydrogeologic systems, the research is both time consuming and technically advanced. The DNRC alone does not have the capacity to achieve the research.

- **Identifying problem areas**

Fortunately, water resource monitoring in Montana is an excellent demonstration of joint-fact finding. The DNRC Water Resources Division, the Water Policy Interim Committee, Montana Bureau of Mines and Geology, Montana Trout Unlimited, United States Geological Survey, and others perform extensive water resource monitoring throughout the state. Water resource data can be analyzed by geographic and temporal parameters to identify water shortages. Identifying the basins in which water shortages persist will help DNRC control further adverse impacts from exempt wells. Adopting scientific analyses into

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\(^{10}\) Kolman, (2012).

\(^{11}\) WPIC, Effect of exempt wells on closed basins, (2008).

\(^{12}\) Vinett & Jarvis, (2012).

\(^{13}\) Bracken, (2010).

\(^{14}\) DNRC 2015 State Water Plan states that it (DNRC) wants to develop strategies for mitigating impacts of groundwater use on surface water users, and to facilitate decisions on new water use.
current political and social environments is extremely difficult, but can be achieved through more collaborative joint-fact finding and reporting.\textsuperscript{15}

\textbf{Adopting research into practice}

Another challenge to surface water and groundwater management is figuring out how to apply research toward decision-making. Technical experts can assess scientific data with resource managers in an effort to decrease uncertainty in management decision-making. Another way that scientists try to integrate scientific data into management options is through trade-off assessment models, for example cost-benefit analyses of demand and availability of groundwater resources for different climate and water use scenarios.\textsuperscript{16} Although theoretical models do not provide management actions, using these models can help inform DNRC about management options.

The next step for DNRC toward improving the conjunctive management of surface water and groundwater should be to increase conversation about regulation options from the research information available. Water monitoring studies determine where exempt wells adversely affect water availability, and management models assess regulation trade-offs. Together, this information can reduce uncertainty in exempt well management decisions.

\textbf{Tensions between water users:}

\textbf{Competition interests and the status quo produce}

While from a management perspective, the cumulative effects of exempt wells are the source of conflict; conflicts between water users arise from individual beliefs around water use. Harmon and McKinney said that, “conflicting interests over natural resources are often an issue of rights”.\textsuperscript{17} Exempt wells are a prime example of conflicting interests over rights, because many permit holders do not agree with the policy giving water rights to exempt wells.

Furthermore, in the report, \textit{Water Diplomacy: Creating Value and Building Trust in Transboundary Water Negotiations}, Susskind and Islam say, “a high priority is placed upon maintaining historical patterns of water use.”\textsuperscript{18} Exempt wells do not follow the status quo for historical water use. In effect, exempt wells make permit holders feel they are being undermined by competing interests. The power of the status quo in response to that fear effectively encourages adversarial relationships.\textsuperscript{19} Alliances of like water-users, between permit holders and non-permit water users, build and intensify competing interests.

\textsuperscript{15} Karl et al., (2007).
\textsuperscript{16} Zhang, (2015).
\textsuperscript{17} Harmon and McKinney, (2004).
\textsuperscript{18} Susskind and Islam, (2012).
\textsuperscript{19} Carpenter and Kennedy, (2001).
Individual beliefs about water use rights obscure the facts about water rights conflicts, and disputes arise out of distrust, dislike, and fear, rather than evidence of impacts from exempt wells. Despite current positions water users take, they share common ground: water availability. Disputes therefore can and must move beyond beliefs, toward common interests. Without recognition from water users about common interests, solutions to sharing the connected resource cannot evolve.

**Options for improving conjunctive management of surface water and groundwater:**

**Option 1: Require all wells to go through the regular permitting process**

It is unlikely that Montana would be able to pass a legislative action to implement regulation of all water uses.\(^{20}\) This approach would require a considerable amount more work for DNRC to review the increase in water use permit applications. Secondly, public resistance to reduce exemptions is strong. Attempts to change exempt well requirements in other states have received enormous public opposition from developers and rural users alike. Political defiance defeated the attempt to regulate groundwater.\(^{21}\) In summary, requiring all wells to go through the permitting process is an improbable solution for conjunctive management of surface water and groundwater.

**Option 2: Require real-estate developments engage in groundwater mitigation programs in closed basins**

Another option for Montana to consider, in an effort to reduce future adverse effects from exempt wells, would be to create a mandatory groundwater mitigation plan as a requirement for real-estate development in closed basins. In the report, *Mitigating for Growth: A Blueprint for a Ground Water Exchange Pilot Program in Montana*, the plan is proposed for Montana.\(^{22}\) In these programs, all real-estate developers in closed basins must create a plan to offset groundwater withdrawals in closed basins by purchasing water credits from other existing users in the basin.

Installing these programs in closed basins across Montana would require a considerable amount of initial financial support. Ideally, DNRC and other regulatory agencies including the Department of Environmental Quality (DEQ) would provide funds for the initial startup, because in theory, the program generates a cooperative effort amongst water users to reduce net depletions in the basin. And by reducing water conflicts in a market system, the program effectively reduces legal recourse and management costs.

\(^{20}\) Bracken, (2010).

\(^{21}\) *Id.,* (2010), tensions exploded and lawsuits were immediately filed in NM after the exempt well rule change, forcing the state to repeal the regulation on development.

\(^{22}\) Ziemer et al., (2012).
Kittitas and Wall Walla counties in Washington are testing this theory and compelling developers to purchase water credits, deviating from the status quo. Pending litigation in Washington confirms that some stakeholders see it as a policy to regulate development. They fear exempt well regulations limit economic development. The result is an increase in water use disputes, which limits effective mitigation. Although this approach has potential to generate cooperation between water users, Montana should first pursue a collaborative approach that elicits participation from multiple stakeholders, before introducing a program that will provoke strong political opposition.

**Option 3: Negotiate options for conjunctive management**

A third option to improve conjunctive management of surface water and groundwater is to have facilitated negotiations amongst stakeholders in an ongoing collaborative effort, to increase dialogue between conflicting water interests, and generate options for sharing water resources. The negotiations would include DNRC in the negotiations, so that the collaborative effort to reduce water conflicts produces politically feasible options.

**Recommendation:**

**Combining options 2 and 3 uses collaboration and negotiation to improve conjunctive management of surface and groundwater on the basin level.**

Convening stakeholders in a collaborative process can generate the capacity to (1) perform assessments and monitor impacts from exempt wells, (2) negotiate limits to exempt water use, and (3) facilitate future installments for a basin mitigation program. MWCC should be the platform from which these negotiations begin, and should work with a facilitator to perform an initial assessment for who will be on the collaborative team. The coordinating committee already works with watershed groups statewide, and watershed groups represent multiple interests within their individual groups. The assessment will further ensure that the team comprises all stakeholders, including both water use permit holders and exempt well users. Once MWCC creates a collaborative team, the coordinating committee can identify funds applicable for the collaborative effort from DEQ, DNRC, and other organizations that have an interest in partnering on a program to negotiate exempt well use.

A high priority should be placed on reaching out to community-based partnerships, in order to engage unaffiliated citizens throughout the process. Engaging both citizens and stakeholders on the impacts of exempt wells will help gather information about problem areas.

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23 Id., (2012).
Workshops and meetings during these negotiations can be a forum through which scientific models and data are presented to generate management options for exempt well regulations.\textsuperscript{24} Increased stakeholder conversations during workshops build trust and opens up opportunities for partnerships and/or further joint-fact finding between research groups and water users.

The facilitator will guide the focus of the meetings, diffuse tensions, and identify strengths and weaknesses of the negotiations as they unfold and build common ground.\textsuperscript{25} The team should identify key issues, and address less provocative issues first to generate willingness toward compromise. Once the team has gathered momentum and credibility from successes over easier issues, negotiations can move toward the larger problems: limitations for exempt wells, and water regulations in populated basins.

The collaborative team will have to decide limits for water users in areas and times of shortages. An exempt well user will be more likely to reduce their use if their neighbors reduce use as well. The team will also need to discuss restrictions for developers. Lastly, the team can begin to look at options for adopting basin mitigation plans. Three models for the basin mitigation plan can be tested for a trial period of three years in three separate basins. Each model will include separate options for how to manage exempt well pumping. The three-year trial period will show which management protocols work best. After the trial period a memorandum of agreement between the DNRC and MWCC can be written to provide the continued guidance by MWCC to the collaborative team.

Management of exempt wells and permitted water uses must diverge from the status quo toward a collaborative process before Montana courts are infiltrated by water disputes. Water rights holders and users must negotiate water resources. The process will help water users develop plans for future use and provide a sense of autonomy.\textsuperscript{26, 27, 28} The negotiation will involve serious compromises from all parties, but the end result will produce better management.

\textsuperscript{24} Vinett and Jarvis, (2012).
\textsuperscript{25} McKinney, (2015).
\textsuperscript{26} Harmon and McKinney, (2004).
\textsuperscript{27} McKinney, (2015).
\textsuperscript{28} Susskind and Islam, (2012).
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Part 3
Developing Options for a Drought Management Plan in the Upper Clark Fork River Basin

Final Report
Submitted to
Montana Trout Unlimited

By
Teresa Scanlon
M.S. Candidate
Environmental Studies &
Natural Resources Conflict Resolution
University of Montana

May 2016
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Acknowledgments

I would like to thank Stan Bradshaw and Matt McKinney for being receptive and open to my interest in working on a project this year. I am incredibly grateful for the proposal from TU, in particular Stan and Bruce Farling, to work on a valid and captivating contemporary issue in the Upper Clark Fork River Basin. I am especially appreciative of the time and effort Meg Casey put toward this project. The practicum provided by Matt and the Center for Natural Resources and Environmental Policy has been an inspiring opportunity. In particular, I am thankful for Matt’s support in this project. I look forward to my continued work in watershed policy and conservation.
1.0 Introduction

The negotiated water compact between the Confederated Salish and Kootenai Tribes (CSKT), State of Montana, and the U.S. Government requires a minimum instream flow of 2,000 cubic feet per second (cfs) for the Clark Fork River at the former Milltown dam site. To meet this requirement, Montana Trout Unlimited and several other stakeholders in the basin agree that water users and stakeholders should develop a voluntary drought management plan to satisfy this minimum instream flow during low water years.

At the invitation of Trout Unlimited (TU), I completed a series of tasks and activities during spring 2016 to help lay the groundwork to develop options for a voluntary drought management plan for the Upper Clark Fork River Basin (UCF). For a detailed list of tasks and objectives see Appendix 1. The following objectives are addressed in this final report:

1. Harvest lessons from the drought management plans on the Big Hole River, Blackfoot River, and Jefferson River;
2. Identify key stakeholder groups, their interests and concerns in the UCF regarding a voluntary drought management plan;
3. Identify and begin to prioritize main information needs for the development of a voluntary drought management plan in the UCF;
4. Present options on how to proceed in developing a drought management plan for the UCF.

The first half of this report describes the strategies and lessons harvested from existing drought plans. Those strategies and lessons influenced and refined objectives 2 and 3; they provide significant insight and advice toward future drought planning efforts in the UCF.

Objectives 2 and 3 begin to describe and highlight the interconnectedness of the social and technical aspects necessary for developing an effective voluntary drought management plan in the UCF; as a plan develops in the future, Objectives 2 and 3 will be ongoing. Objective 2 identifies past and current water conservation efforts from the UCF, major stakeholders, and interests and concerns stakeholders have regarding a drought plan at this time. Objective 3 addresses technical information needs for the development of a voluntary drought plan, including priority hydrological, biological, hydrogeological, and water rights data needs.

After a brief explanation of the methods used to address these objectives, the findings and conclusions for each objective are presented. Although the primary audience for this report is TU, I hope and trust that it will help inform and catalyze a comprehensive, intentional approach to develop a drought management plan for the UCF.
2.0 Strategies and Lessons Learned from Other Drought Management Plans

To help inform and invigorate efforts to create a drought management plan for the UCF, I started by reviewing existing drought management plans in the Blackfoot, Big Hole, and Jefferson River basins. In addition to reviewing the plans themselves, I interviewed several people familiar with each plan to clarify their perceptions of the following:

(a) How effective is the plan?
(b) What are the key elements of the plan?
(c) What are the primary challenges to developing and implementing the plan?
(d) What is the most important lesson you can share with people interested in developing a plan in the UCF in the future?

Appendix 2 presents a list the people interviewed for this section.

2.1 Profiles of Three Existing Plans

This section presents a brief profile of three voluntary drought plans in Montana.

2.1.1 Blackfoot River Basin

The Blackfoot Challenge is a landowner-based group that coordinates an organized voluntary drought management plan in the Blackfoot River. In order to keep the Blackfoot from dropping below 700cfs, stakeholders and agencies created the triggers that have been set as parameters to protect flows. The concept of sharing the water resource shortage has led to a collaborative effort between landowners, businesses, conservation groups, anglers, outfitters, and agencies to conserve water in the river. The Blackfoot has become a model for watershed collaboration.

Landowners develop individual water conservation plans with help from the Department of Natural Resources and Conservation (DNRC), Fish Wildlife & Parks (FWP), and the Blackfoot Challenge. Conservation plans include, but are not limited to, reducing total water use, reducing instantaneous use, using water rights in rotation with other rights holders, or discontinuing use.

DNRC and FWP monitor climate, snowpack, and weather throughout the year, and communicate with the Blackfoot Challenge about forecasted shortages. When forecasts predict low flows, participants are alerted and asked if they intend to participate. As conditions worsen, the Blackfoot Challenge requests participants to implement their plans. The plan is triggered when the river reaches critical flows and/or high temperature thresholds. At the highest threshold, FWP enacts mandatory fishing restrictions and closures.

The Blackfoot plan is unique in that it contains an agreement between FWP and water users on the river. The FWP Murphy Right at Bonner currently has a priority date of 1971,
which predates upstream water rights holders. If junior water rights holders to the Murphy Right at Bonner participate in the drought response plan, FWP agrees not to call on them to stop using water even though they legally could do so. As a result, junior water right users have a big incentive to participate, but it is not only users junior to the Murphy Right that make the plan effective.

Senior water rights holders also participate in the drought response actions as a part of the plan; their incentive is to participate in community collaboration and be community leaders. Together, water rights holders actively participate in the drought management plan to improve flows and reduce conflict during years of water shortage.

The Blackfoot Challenge plays a significant role in the administration of individual water conservation plans and promotes collaboration between the landowners and resource managers, but does not enforce participation in the drought management plan. FWP can enforce and monitor drought response actions—because they are the owner of the Murphy Right, but the Blackfoot Challenge focuses their efforts on building relationships and trust with and between stakeholders.

2.1.2 Big Hole River Basin

The Big Hole Watershed Committee (BHWC) originated after the river experienced a series of droughts—most notably in 1988 and 1994. The main reason a collaborative drought management plan was created was out of a common interest to avoid the listing of the Arctic grayling as endangered by the Endangered Species Act (ESA). The governor therefore paid for the facilitation of the creation of a voluntary drought management plan for the basin. An original version of the plan was finalized in 1997, and its purpose was, and still is to minimize adverse impacts from low stream flow, protect the fisheries, and provide equitable distribution of water resources during shortage years.

The plan includes the entire basin from its headwaters to the confluence with the Jefferson. Five sections with different triggers are monitored separately. The upper section of the plan is different than any other drought management plan in the state, in that it follows a specific federally supported Candidate Conservation Agreement with Assurances (CCAA) for Arctic grayling restoration to prevent the candidate species from being listed by the ESA. The CCAA plan was mandatory until 2014, when local efforts to improve stream habitat and flows worked to improve the Arctic grayling habitat, so FWP decided to drop it as a candidate for listing. Although the CCAA is no longer mandatory, the listing is being litigated, and FWP and landowners still participate in the CCAA.

While the impetus for cooperation was the threat of the ESA listing, the overall drought response was a collaborative effort. The BHWC drought committee follows clear directives to coordinate the plan with agricultural operations, conservation groups, municipalities, businesses, anglers, and the government agencies FWP, Natural Resources Conservation Service (NRCS), and DNRC.
Throughout the year, FWP, NRCS, and DNRC inform BHWC on snowpack, weather forecasts, and stream temperatures for the Big Hole. BHWC will release a notification to the community early in the year if there is a forecasted drought. BHWC also issues updates to irrigators during times of shortage.

When the temperature threshold or a flow trigger is reached in any of the five sections in the Big Hole River basin, BHWC initiates a phone tree to alert the community and water users in the basin. Water users respond by voluntarily reducing use and/or engaging in conservation techniques. Anglers and outfitters are encouraged to restrict their fishing hours. At temperature thresholds, mandatory fishing restrictions or river closures are put in place by FWP. BHWC monitors stream flows to measure water savings. The Big Hole plan does not specifically address when the drought period ends, but the plan stresses that conservation practices should be in place until conditions change.

2.1.3 Jefferson River Drought Management Plan

The Jefferson River Watershed Council (JRWC) met informally in to devise a voluntary drought management plan, presented the plan to the public to receive questions and commentary, and first adopted the plan in 2000. Motivation to create a plan was a matter of survival for agricultural members in the community, because of seasonal, severe dewatering. The original purpose of the plan was, “to reduce resource damage and to aid in the equitable distribution of water resources during water critical periods”. While target minimum flows were not met during the first five years of implementation, the river has maintained higher flows than it did before the plan was created.

The plan covers a large reach of the river from the confluence of the Ruby, Beaverhead, and Big Hole rivers to Cardwell. The target location is identified as the Waterloo Gage below Fish Creek Canal. The reach was identified as an area of critical concern due to the volume of users in this reach, and so it was agreed that water conservation in that area could produce a large impact downstream.

FWP monitors stream flows, snowpack, and weather forecasts for the Jefferson. When low flow triggers and high temperature thresholds are reached, JRWC initiates a phone chain to request voluntary water conservation. Anglers and outfitters are asked to reduce fishing hours JRWC is tasked with reviewing and adapting the plan as necessary.
2.2 **Basic Components of Existing Voluntary Drought Management Plans**

All three plans profiled above operate on the premise to watch for forecasted low water years and have an action plan ready if monitored temperature and flow triggers are reached. The following table compares the basic components across the basins:

**Table 1. Basic Components of Existing Voluntary Drought Management Plans**

<table>
<thead>
<tr>
<th>Basin</th>
<th>Jefferson</th>
<th>Big Hole</th>
<th>Blackfoot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical scope</td>
<td>A reach of the river from its start to Cardwell</td>
<td>Entire watershed from headwaters to confluence with Jefferson</td>
<td>Entire watershed from headwaters to confluence with Clark Fork</td>
</tr>
<tr>
<td>Purpose</td>
<td><em>To reconnect the river</em> and provide for equitable distribution of water resources during shortage; to protect water rights; prevent dewatering of river and protect fish populations</td>
<td><em>To protect all interests</em> and minimize adverse impacts and provide equitable distribution of water resources during shortage years; to protect fish populations, in particular the Arctic grayling</td>
<td><em>Share the sacrifice</em> through minimizing adverse impacts from low flows and provide for the equitable distribution of water resources during year of shortage; maintain critical flows</td>
</tr>
<tr>
<td>Plan type</td>
<td>Collaborative, voluntary</td>
<td>Collaborative, voluntary,</td>
<td>Collaborative, voluntary,</td>
</tr>
<tr>
<td>Triggers</td>
<td>High temperatures and Low flows</td>
<td>High temperatures and low flows</td>
<td>High temperatures and low flows</td>
</tr>
<tr>
<td>Actions</td>
<td>Voluntary water use reduction; mandatory angling restrictions; water savings monitoring</td>
<td>Upper section follows CCAAs; lower section voluntarily reduces personal and municipal water use; use of stock wells; voluntary and mandatory angling restrictions; media outreach and public education on current status of river and drought response</td>
<td>Individual voluntary conservation plans, pooling water rights to use in rotation, reducing use; mandatory angling closures; mandatory calls on junior users who do not participate in water conservation plans; monitoring regional rivers; field checks</td>
</tr>
<tr>
<td>Leading group</td>
<td>Jefferson River Watershed Council</td>
<td>Big Hole Watershed Committee</td>
<td>Blackfoot Challenge</td>
</tr>
</tbody>
</table>
2.2.1 Similarities within Existing Plans

The general activities and stakeholders involved in all of the existing plans are similar. The following section identifies those similarities:

- **Incentive**—The development of each drought plan came about from a specific incentive. In the Blackfoot, it was to avoid stream flows below 700cfs and consequent calls on users junior to the FWP instream flow right. In the Big Hole, it came about by a collective desire to avoid listing the Arctic grayling as endangered by the ESA. In the Jefferson, the drought plan was a matter of survival for some agricultural users because of severe and chronic dewatering.

- **Data monitoring**—Each plan monitors flows and temperatures along with various other data parameters. The capacity to which these are monitored depends on funding and staff personnel within each basin and drought plan. Monitored data includes:
  - Stream flows and temperatures
  - Snowpack and snow-water equivalent (SWE)
  - Precipitation, and weather patterns, and forecasted conditions
  - Soil moisture and Surface Water Supply Index (SWSI)
  - Observations of stress on fish
  - Closures in adjacent/nearby rivers and regional river closures
  - Land use and water consumption changes over time
  - Water savings

- **Voluntary participation**—All of the plans are based on voluntary participation from the participating groups and stakeholders including: nongovernmental organizations (NGO), individual landowners, recreationists, outfitters, businesses, and municipalities. Watershed committees and agency personnel are usually limited to a small group of staff. The effort to prepare and respond to drought is a collaborative and voluntary effort.

- **NGO watershed managing committee**—The committee managing each of the voluntary drought plans is a non-profit organization.

- **Year-round communication and committee meetings**—In all of the plans, stakeholders communicate about water and the river conditions year-round, and the managing committee hosts meetings year-round to further support communication and information sharing.

- **Public outreach**—The voluntary drought plans have specific roles defined in the plan for someone to notify the larger community or communities of river conditions. The
managing committee also produces public media to inform and educate communities about current events.

- **Planned Annual Reviews**—All of the plans are annually reviewed in order to make adaptations to the plan if necessary. Although the plans are not updated every year, the scheduled reviews ensure the plan is up to date.

Similarities across all three existing drought management plans highlight the basic components that are nuanced but exist as fundamental elements within voluntary drought plans.

### 2.2.2 Differences between Existing Plans

Although the basic components of the individual plans are similar, each drought plan is nuanced. Differences between the existing plans are important to note, because the degree to which those differences affect the operation can be great.

- **Geographical scope**—The geographical scope of each basin affects how each plan is activated. The entire Blackfoot River, from its headwaters to the confluence with the Clark Fork, is included in the plan. Similarly, the entire Big Hole River Basin is included in its plan, but it separates the basin into five separately monitored and triggered sections within the basin. The plan on the Jefferson includes the reach with the most concentrated water use.

- **Degree of streamflow monitoring**—All of the basins are working to increase the amount of streamflow monitoring, but each plan currently monitors to a different extent. The Blackfoot plan monitors streamflows infrequently—the least of each of the three plans. The Jefferson drought plan monitors streamflows in the mainstem of the Jefferson River at each of the four main ditches in the reach that is included in the plan. In contrast, the Big Hole monitors extensively, especially in the upper and middle sections of the plan because of the additional federal support from the CCAA. Despite inconsistent streamflow monitoring, it is not believed that it has adversely affected the success of the plans.

- **Incentive and plan development**—Each of the existing drought plans developed through a slightly different process in response to a few distinct driving factors. The incentive and the development process are two key elements for understanding how a drought plan is instigated, because a strong enough incentive catalyzes action to solve problems caused by water shortage. The Blackfoot drought plan, established by the Blackfoot Challenge organization, was the result of a collaborative effort to avoid calls on water rights holders junior to the FWP instream flow right of 700cfs. The Big Hole drought plan was developed through facilitated meetings funded by the governor because of the incentive to avoid ESA listing of Arctic grayling and prevent the Big Hole from being listed as a chronically dewatered river by FWP. The Jefferson River drought plan was
developed through informal meetings that later became the JRWC, in response to the recurrence of severe water shortage that incentivized the local community to protect their agricultural livelihoods.

- Monitoring participation—The existing drought plans monitor participation in the plan differently. Enforcing participation is done by the resource managers, but requires funding for people on the ground. The coordinating committees, the non-profits administering the plan, could have volunteers monitor participation, but they do not want to enforce participation, because it would put them at risk in losing trust from local stakeholders. On the Blackfoot, enforcement is the responsibility of FWP, the owner of the Murphy Right. In the Big Hole, enforcement is assisted by agency support from the CCAA plan to monitor diversions and flows. In the Jefferson, some ditches have a ditch commissioner who measures and controls diversions.

Comparing the differences across the three basins helps to highlight important functions and factors that play an important role in existing voluntary drought management plans. These differences also help identify possible options for the development of a drought plan in the UCF.

2.3 Effectiveness of Voluntary Drought Management Plans

As the UCF begins to develop a drought plan, prospective participants will likely want to know if and how other voluntary drought plans are successful. Interviews describe two kinds of success that together make drought plans effective over time. Success is therefore measured both by the environmental and social indicators. Although categorically distinct, these factors are not mutually exclusive. Identifying specific factors, or indicators of success from other drought plans is valuable, because indicators of success will be similar in the UCF.

2.3.1 Hydrological and Ecological Success Indicators

The interviews identified four primary hydrological and ecological success indicators:

- Measure improved flows over time
- Quantify water savings annually
- Measure improved riparian habitat over time
- Measure improved trends in fishery distribution and number of juveniles

The plans monitor flows, fish population and distribution, and riparian habitat. Water savings are also quantified by measuring instream flows and diversion reductions. These measurements are important in order to quantify success. Improved flows, riparian habitat, and fishery trends, along with identifiable water savings, are achievements that demonstrate effectiveness.
Elevated federal support in the Big Hole makes measuring success more feasible. The CCAA Plan in the upper and middle sections of the voluntary drought plan provide for regulatory assurances to monitor Arctic grayling populations. Therefore, extensive flow and diversion measurements, as well as fish surveys, are carried out and funded by federal agency personnel.

All of the existing plans are actively working to increase their capacity to measure these ecological and hydrological response factors. While quantifying these factors is challenging, presenting available data of the plan effectiveness has encouraged participation.

2.3.2 Social Success Indicators

Interviews also identified four social indicators in the continued success of drought management:

- Retain volunteer participation
- Increase participation over time
- Sustain year-round basin-wide communication networks
- Improve relationships between different stakeholder groups within communities

The effectiveness of existing drought plans can be measured by social parameters. Retaining and increasing stakeholder participation is an obvious indication of an effective plan. Participation in the Big Hole increased even after 2014, when the Arctic grayling was released from potential listing by FWP. The Jefferson River is looking to expand the scope of their drought plan, and landowners on the expanded reach want to join. Participation continues to grow in the Blackfoot, and the Blackfoot Challenge ability to manage individual water conservation plans has become a limiting factor to increased participation.

In order to effectively respond to drought during critical water months, the basin must have an organized method of communication. The Big Hole, Jefferson, and Blackfoot drought plans have year-round meetings and have developed strong communication systems set up in preparation to respond to water shortage and other water related issues in the basin.

Effective drought plans also offer individuals an opportunity to engage with their communities. Communities in the Jefferson, Big Hole, and Blackfoot coordinate community events and newsletters to celebrate the rivers. Over the years, communication and celebrations have united cross-cultural histories and rejuvenate the sense of community. In effect, different interest groups and stakeholders form a collective identity around the water resource.
2.4 Key Elements to Success

The interviews identify key elements that enable continued success in existing voluntary drought management plans. The same elements will be necessary for a successful plan in the UCF. The following key factors are summarized in Table 2 following the narrative:

- **Strong incentive to collaborate**—A strong incentive, or a clear threat to water distribution drives stakeholders to participate in a drought plan. Some stakeholders are willing to discuss and participate in drought planning if they feel threatened by future uncertainties. Others want to participate in drought planning in order to better understand the potential threats to the distribution of water and find ways to respond those challenges. Then again, some stakeholders and/or communities will not discuss drought management or unite to devise a plan unless there is a crisis.

- **Defined roles**—Clearly defined roles and respectful communication reduce conflict and make people more negotiable, which are two fundamental elements of voluntary drought management plans. Clearly defined roles and expectations make the process more transparent, and transparency helps multiple stakeholders trust the process and then become involved.

As triggers are reached, participants’ expectations are explicit. Predetermined expectations lessen miscommunication and conflict during times of stress. One outfitter explained that when triggers are reached, like-interest groups only communicate with each other—i.e. an outfitter would not tell a rancher that it is time to activate planned drought response action(s). Instead, drought plan volunteers communicate with those experiencing the same or a similar impact from drought.

- **Respectful communication**—Respectful communication promotes trust between stakeholders reduces tension and improves negotiations over water shortage conflicts. Stakeholders are more willing to negotiate issues when they feel respected. Expected and continued civil communication builds interpersonal relationships, even amongst opposing interest groups. Simple communication rules can reduce tension and conflicts during times of water shortage.

- **Neutral meetings**—A neutral meeting space can moderate respectful communication and facilitate information sharing. Discussions about the impacts and responses to water shortage in the basin help people understand the different interests and needs represented in the basin. Stakeholders, in particular local landowners and water rights holders, will participate in discussions and share information if they feel respected.
• **Share information and discuss opportunities**—Sharing information on water use and river conditions improves the effectiveness of drought plans, because it empowers people to respond proactively and continue to participate in drought planning. Data sharing increases education and trust in data and decision-making and identifies information gaps. A good forum for sharing information is through presentations and guest speakers during public meetings. Another way is to reach out to small groups of individual stakeholders and talk directly to them about their concerns and opportunities.

Technical experts can give educational presentations on climate, fishery trends, watershed restoration, water monitoring, and the potential impacts from infrastructure improvements—i.e. ditch capacity or flood protection. Presentations explain data and also open conversations about drought response and management.

Local stakeholders should also share information about water shortages. They can identify distinct issues caused by water shortages, and they provide collaborators an opportunity to respond to those issues.

As one landowner explained, “everyone is learning” during ongoing collaborative voluntary drought management. Rather than fear or ignore the threats of water shortage, people are discussing possible solutions and options available to face challenges. In the process, stakeholders with different interests learn from each other.

• **Local leadership garners community support**—Voluntary drought management plans are coordinated by a combination of both local stakeholder leaders and leadership from resource managers, interest groups, or a hired facilitator. Leadership strategies for developing a voluntary drought management plan can range from passive to active leadership, but local leadership is necessary. The local leadership garners community support and participation. Without local leadership, the voluntary plan will not work.

Other local stakeholders are less likely to feel threatened or marginalized by a drought management plan if locals lead the process. Some active leaders in the water rights community in other basins have used persuasion and peer-pressure to get neighbors involved, for example asserting the notion: “If you have a private right to use the water, then step-up and make it an asset rather than let it become a liability”. In this case, an active leadership role is targeting peoples’ interest by urging them to protect their water right. Other local leadership may be less direct, and instead urge the community to join in conversations about drought.

• **Ongoing projects**—Coordinating a collaborative, voluntary drought plan takes time to build people’s trust in the effort, but stakeholders lose interest and disengage if the conversation about a plan circulates for too long without action on the ground.
Ongoing and smaller projects will help to avoid exhaustion and give people a purpose to continue participating.

- **Positive reinforcement**— Although drought can cause suffering, planning efforts should focus on the fact that preparation helps everyone respond to the impending challenges of water scarcity. Positive reinforcement sustains participation and keeps people motivated. Community celebrations and watershed tours can encourage positivity and local engagement.

The common elements within the existing voluntary drought management plans are incredibly valuable in order to understand what motivates people to join and continue participating in voluntary drought management. These same elements will be important during future drought management planning efforts. The following table summarizes these common elements of success:
### Table 2. Key Elements for Success

<table>
<thead>
<tr>
<th>Key Element</th>
<th>Conditions</th>
<th>Effect(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong incentive to participate</td>
<td>Uncertainty, fear, negative public media, and local leadership can incentivize local stakeholders to participate</td>
<td>People will participate if they think the alternative is worse</td>
</tr>
<tr>
<td>Clearly defined roles</td>
<td>Collaborating stakeholders understand roles and expectations</td>
<td>Clear expectations improves drought response</td>
</tr>
<tr>
<td>Respectful communication</td>
<td>A facilitator and/or neutral meetings help enforce respectful communication</td>
<td>Builds relationships; Diffuses confrontations; Improves negotiations</td>
</tr>
<tr>
<td>Community support and local leadership</td>
<td>Developing strategies for basin-wide water conservation needs local input; local stakeholder knowledge differs from that of the resource managers</td>
<td>Community support and local leadership increases participation</td>
</tr>
<tr>
<td>Sharing data and information</td>
<td>Data sharing can identify information gaps; resource managers and stakeholders should both share information</td>
<td>Informs stakeholders about options; Provides autonomy; Builds trust</td>
</tr>
<tr>
<td>Ongoing projects</td>
<td>Some projects should be presented as examples of opportunities in order to engage stakeholders</td>
<td>New participants can get involved; People stay motivated</td>
</tr>
<tr>
<td>Positive reinforcement</td>
<td>Drought is painful for all, focus on the successes and the positive aspects of the plan</td>
<td>Keeps morale high and people motivated; Encourages participation</td>
</tr>
</tbody>
</table>

### 2.5 Barriers and Challenges

Efforts to develop a voluntary drought management plan in the UCF will encounter the same or similar challenges that existing drought plans face. While challenges are inherent to the process, identifying the common barriers to and challenges of existing drought plan success will better prepare the UCF. Table 3 at the end of this section summarizes the barriers to and challenges of voluntary drought management plans.

- *Changing behaviors*—A barrier to success in a voluntary drought management plans is the local stakeholders that choose not to participate. Not all stakeholders choose to participate, because participating requires changing behaviors and lifestyle. It is also important that stakeholders choosing to participate do not feel that they are
being told what to do by other groups, but that they feel supported by their choice to participate.

- **Retaining involvement**—Some people will lose interest in the effort, especially if they are not water rights holders. Ongoing projects give people something to do and retain participant involvement.

- **Volunteer participation and an inadequate capacity to measure effectiveness**—All existing voluntary drought plans face challenges associated with the limited capacity of people on the ground to monitor the effects of the plan and are based on volunteer efforts. There is an insufficient number of personnel, volunteer effort, and funding to monitor flows, fishery trends, and enforce water savings. As a result, lack of monitoring biological and ecological effectiveness is a barrier to the success of existing drought plans.

Diversion measurement devices can help local stakeholders conserve water, but the measurements are rarely recorded for measuring savings, because it is time consuming. Infrastructure efficiency-improvement projects help conserve water as well, but also need follow-up management when parts break. In the Blackfoot and Jefferson basins, participation in the plan during active years is hardly monitored, because of a lack of staff. In the Big Hole it is different in the upper and middle sections, because the CCAA provides federal support for extensive monitoring and follow-up management on projects.

Despite limited in funds for staff, monitoring, and enforcement, people continue to voluntarily participate in the plan. The lack of monitoring is exceeded by community support in the effort. Community support and peer pressure works to make people participate, and makes some neighbors not take excess water left instream.

- **Allocating water during low flows**—The hardest part in developing a drought management plan is figuring out the allocation of water for the basin during shortage years. A coordinated and holistic approach to water conservation should not focus on individual water savings, because that makes it difficult to monitor habitat improvements and downstream stream improvements. Priority reaches where water can be saved can determine areas where efforts should be focused.

- **Retaining Relationships**—It takes time and energy to build interpersonal relationships, which are valuable when collaborating over challenging issues, because they increase trust between people with different interests. When representatives from interest groups, outfitters, and state and government employees leave or change jobs, new employees must reestablish relationships within the basin. Additionally, employee turnover can cause projects to start and not be completed, which can exhaust local stakeholders interest in new projects.
It is important to understand these challenges to the development and implementation of voluntary drought management plans, because the same issues will likely arise in future planning efforts as well. The following table summarizes the challenges and opportunities to address the challenges that exist.

Table 3. Barriers to and Challenges of Voluntary Drought Management Plans

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Conditions</th>
<th>Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing stakeholder behaviors</td>
<td>Participating stakeholders must choose to change lifestyles and behaviors; telling folks where to irrigate doesn’t work</td>
<td>Local leadership and trust in an organizing committee gains local support and increases participation</td>
</tr>
<tr>
<td>Retaining involvement</td>
<td>People often lose interest; there will be less contribution in high water years</td>
<td>Keep projects going, give people something to do</td>
</tr>
<tr>
<td>Limited capacity to enforce</td>
<td>Monitoring is limited, because staffing is based on volunteer efforts and funding fluctuates</td>
<td>Interest in community involvement can exceed lack of ecological and hydrological monitoring; neighborly peer pressure works to get people involved; a trusted water commissioner can help</td>
</tr>
<tr>
<td>participation or measure success</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allocation of water</td>
<td>Allocation is most difficult when water is scarcest; site plan exclusivity doesn't work; piecemeal habitat can't be monitored</td>
<td>Priority reaches can be identified first</td>
</tr>
<tr>
<td>Employee turnover</td>
<td>People leaving the basin don't gain trust of local stakeholders</td>
<td>Effective and trusted coordinating committee can help to navigate issues with new representatives</td>
</tr>
</tbody>
</table>

2.6. The Most Important Lesson Learned from Experience

At the end of the interviews, each interviewee was asked to share what he or she thought was the most important lesson from experience in voluntary drought management planning, and to offer that lesson as advice for future planning efforts in the UCF. Those responses are described below:

- The plan is not just about the response to the triggers, but the response to triggers is possible because the plan coordinates awareness for and discussion about river conditions.

- Be proactive and not reactive in the development of a drought plan.
- Do not try to draft an entire plan before starting pilot projects, because the final product is influenced by smaller successful projects that make people participate in the collaborative effort.

- Make sure that a steering committee and the people in it are a trusted entity, otherwise your efforts to gain local stakeholder support will not be effective.

- Remember that drought planning and water conservation efforts are more of a social experiment than we want to admit, and social dynamics will start or stop the drought management planning process.

- Make sure that that landowner input is respected and let them show leadership in the process.

- Have a clear vision and plan before you ask landowners to participate in the planning process.

3.0 Issues and Concerns in the Upper Clark Fork River Basin

In an effort to assess how a drought plan might develop in the UCF, I interviewed a number of diverse stakeholders in the basin. This work is the start of a comprehensive stakeholder assessment on the interests, needs, and concerns of stakeholders with respect to a voluntary drought management plan in the UCF.

The following section is a compilation of the issues, concerns, and interests from the stakeholders in the basin pertaining to a voluntary drought management planning effort. The first subsection identifies the growing incentivize for this effort and how can garner widespread support. The next subsection looks at the interest from two water management coordinating committees within the Clark Fork Basin that are undefined at this time. Then a concise description of stakeholder issues and interests are provided, organized into geographical subsections. The last subsection describes the interests and concerns from local stakeholders and landowners. See Appendix 3 for the list of stakeholders interviewed.

See Appendix 3 for a list of those interviewed for this section, and Appendix 4 for a list of identified stakeholders that have expressed an interest or will be important in the development of a drought management plan for the UCF.
3.1 Incentive for Drought Management Planning in the UCF

There is a common incentive for both resource managers and individual water users in the UCF to participate in creating a collaborative drought management plan, because drought years are more common, and demands to the water resource are changing.

The CSKT water compact will also affect the level at which the downstream instream flow right at the former Milltown dam is enforced by FWP and the CSKT. As co-managers of that water right, their respective interests will affect the way in which they manage or call on users Junior to the water right. Connectivity in the Upper Clark Fork river system for fisheries is a main interest of both FWP and the CSKT. As a result, FWP and CSKT will use the Compact as a means to improve upstream flows in both the tributaries and the mainstem of the UCF.

In order to achieve their interests in a voluntary fashion and reduce the impact on select junior water users, CSKT and FWP will need senior water rights holders to agree to participate in a voluntary plan. At this time, the senior water rights holders in the UCF, which are also senior to the former Milltown dam instream flow right, legally control the majority of water in the tributaries during critical water months. As such, in order to improve tributary contributions to the mainstem, these senior water rights holders will need to voluntarily agree to participate in a plan, or else the onus will be entirely on a few junior water rights holders.

Instigating water conservation in the UCF will need to carefully incentivize a dissenting group of stakeholders into a collaborative effort. Historic autonomy and opposition to the Compact complicates the development of a drought management plan. In order for the development of a drought plan to gain the support from multiple stakeholders in the basin, the vision must be acceptable to water users, resource managers, and interest groups alike.

There is an opportunity for stakeholders in the UCF to coordinate and earn support from other organized drought management planning efforts. The Blackfoot Challenge is looking to coordinate with the UCF in drought planning efforts to meet the new enforceable instream flow requirement from the Compact. The drought resiliency planning project in the Missouri River Headwaters can also serve as a reference and support for organizing and drought planning efforts. Finally, there is a growing amount of funding available for large-scale watershed management efforts and drought resiliency planning. These opportunities and resources are available now, and should incentivize action on developing a drought management plan in the UCF.

3.3 Clark Fork Basin Task Force and Steering Committee

An important piece to the historic context of coordinated water management in the Clark Fork River Basin is the Clark Fork River Basin Task Force (Task Force) and the Upper Clark
Fork River Steering Committee (Steering Committee). Both committees were statutorily created to advise the state water planning as well as to coordinate more specific watershed management. These groups coordinated water conservation efforts in the past, and their work should not be duplicated, rather build upon, when appropriate.

The Task Force most recently served as an advisory group to the DNRC 2015 State Water Plan. The state funded the Task Force for that period in 2013 and 2014, and cut their funding when the advisory was concluded. In the fall of 2015, the Montana Watershed Coordinating Council earned a grant to host a series of meetings for stakeholders and previous Task Force members to envision a continued Clark Fork Basin-wide coordination group. As of now the group will meet again in the fall of 2016, and some of the stakeholders from that meeting believe it is the appropriate group to create a drought plan.

A formalized Clark Fork Basin-wide drought plan might be a different project than the type of voluntary drought management plan described in this report. Organizing a Clark Fork Basin-wide drought plan would not be as locally driven as it would if it was developed specifically within the UCF. Local control in developing a voluntary drought plan is a big reason why local stakeholders and water rights holders participate; it is a community effort.

In 1991, the Upper Clark Fork Steering Committee, a subcommittee of the Task Force, was established. Like the Task Force, it also has played an important role in water resource management in the UCF. The Steering Committee has been the only coordinated stakeholder group in the UCF. The Steering Committee was created during the contested case hearing on the instream flow reservation applications from the FWP 1986 Instream Flow Reservations Application. At the suggestion of the hearings examiner, a mediator and a Steering Committee were appointed. (Note: the instream flow reservations were put on hold at the time and never formally accepted but are still used as a reference for historical, healthy baseline instream flows). Over time, the Steering Committee morphed into a forum for discussion on activities in the basin was effective in influencing policies. During their active years, they coordinated the development of an instream flow pilot program in 2005, developed watershed plans, negotiated policies, and directed research on the ground.

Mediator changes and loss of a clear purpose over time caused representatives in the Steering Committee to lose interest in the group. Several members express an interest in coordinating drought management efforts in the UCF, but only if there is a clear vision for the group moving forward.

3.4 Stakeholder Interests and Concerns in the Main Geographical Areas

This section of the report captures the main interests and concerns of stakeholders from many of the main interest groups in the basin including CSKT, FWP, DNRC, TU, Watershed Restoration Coalition (WRC), NRCS, and Granite Headwaters Watershed Group (GHWG).
The information presented in this section can help to organize and prioritize a collaborative effort to move forward with a voluntary drought management plan.

Resource managers and local stakeholders alike express a need to address water scarcity throughout the basin and prioritize efforts to manage the impacts from changing river conditions and downstream demands. A common theme from these conversations is that there is not a basin-wide approach to water or more specifically, drought management in the UCF. Significant geographic and political barriers create satellite user groups and communities, and communication across these areas and groups is limited.

It is still unclear how, or if the basin should be divided into subsections for a drought plan, and interviews suggest that the stakeholders are unsure about how the basin might be subdivided. Four main sub-basins and/or tributaries within the Clark Fork have been identified at this time as potential sections for monitoring and triggering a drought management plan. Main issues in each of those four subsections of the basin are described below:

- **Flint Creek subbasin**—Flint Creek Valley will be key in the development of a UCF drought plan, and a lot of water rights in the Flint Creek valley are junior to the instream flow right at the former Milltown dam. There are mixed opinions for when Flint Creek should coordinate with the rest of the basin in drought management planning in the UCF. Some think it the basin should not be incorporated into a UCF plan until an effort becomes more organized, and others think its participation in a larger plan is necessary from the start. GHWG received a NRCS grant to develop a drought resiliency plan for the valley. Current GHWG interests include work to develop plans in the lower and upper Flint Creek Valley separately because of existing incongruences between the water user groups, and to progress slowly and allow local water users and landowners to set the pace for creating a plan. Though GHWG is working slowly and independently toward drought resiliency planning at this time, they are interested in coordinating with the rest of the basin.

- **Little Blackfoot River subbasin**—Many stakeholders suggest that the Little Blackfoot should not be addressed early in the development of a voluntary drought management plan and only after a plan gains momentum, because of the chronically low streamflows and the challenging social and political environment.

- **Upper section of the Upper Clark Fork**—This subsection begins at the start of the Clark Fork River and ends at Deerlodge. This section of the mainstem experiences critical low flows and chronic dewatering in the tributaries. It is the main priority area for many stakeholders. The following is a list of a problem and/or areas with potential in the upper section of the UCF. While this list is by no means comprehensive it highlights certain areas that will influence the development of a drought management plan.
The reach from Sager Lane to West Side Ditch on the mainstem experiences critical low flows. Flows here can be as low as 15cfs. It is a priority reach for instream flow improvements. There are large water rights holders junior to the water right at the former Milltown dam in this section of river.

The reach from Perkins Lane to Deerlodge might be a good initial project to monitor streamflows in the middle of the mainstem in between the USGS gages. The instream flows here are not well known, and might illuminate certain tributaries as valuable contributors to mainstem flows during months of critical water use.

Silver Lake water could help the basin meet the enforceable instream flow right the former Milltown dam. Water resource managers and interest groups alike are interested in water from the lake. The currently expired lease agreement from Butte-Silverbow was funded by NRDP and sent about 20-30cfs of water from Silver Lake in a pipeline to Warm Springs Creek. The water is now being saved for storage. A stored water right can be protected from use by senior water rights holders, and potentially very valuable for future drought response.

Arco Agreements on Warm Springs Creek—Arco leases approximately 20cfs of water to a user on Gardner Ditch. While there is a split-season agreement on the water right, Arco has not historically always exercised their authority to require the lessee to stop diverting when flows drop to 40cfs as stated in the lease. If the water is required to remain instream during water shortage years, it could provide valuable improvements to instream flows on Warm Spring Creek.

Lower section of the Upper Clark Fork—Some stakeholders suggest that the lower section of the UCF, excluding Flint Creek, is less critical for the development of a voluntary drought management plan. Largely this is because the main contribution to the river in this section is Rock Creek that already has protectable instream flows and is largely dominated by spring runoff, and so there may not be as great of potential to improve streamflows to the mainstem from this area.

3.5 Interests and Concerns from Local Stakeholders

A main lesson from existing drought management is that in order for a drought plan to be successful, local stakeholders must accept and participate in its development. Local stakeholders and landowners provide insight about the agricultural community and water rights holders; these findings are critically important to be aware of and can provide strategic advice in the development of a drought management planning effort.
Interviews found that some local stakeholders and landowners are open to discussing drought management planning in the UCF. Some are open to drought planning, because they think impacts from the Compact, other changing management policies, or changes in climate will be worse if they don’t have a drought plan in place. Others are not aware of impending or potential impacts changing conditions, but still want to plan to face future water shortages.

The potential implications and enforcement of the Compact is unknown. There is a lot of fear from local stakeholders that one could lose part of his or her water right, and many also do not know if/when the Compact will affect him or her. Many water rights holders are not willing to talk about the Compact, but may be open to discussing future drought, as long as they do not feel that the conversation puts them at risk.

However, there is also hope that the changing demands will create an opportunity for local stakeholders to unite and prepare for water shortage. Some local stakeholders suggest that discussions about drought be hosted in the UCF that would offer resource managers an opportunity to be transparent with water management policies that affect landowners and also incentivize participation in a drought plan. These stakeholders also suggest that discussing the implications of and impacts from water shortage is helpful, because it facilitates sharing concerns and learning about potential opportunities to better respond to the impacts of drought. As one landowner said about discussions around drought management planning, “it can help us help ourselves”.

There is also a big concern that water conservation efforts might produce unintended consequences. Local stakeholders want to be ensured that there will still be groundwater recharge after infrastructure efficiency improvement projects and that diversion improvements will not negatively affect return flows. They want to see data and models that show water conservation projects do not negatively affect those interests. Other concerns from local stakeholders and landowners in the UCF are the loss of community in the UCF and fear of upsetting neighbors. Communities in the UCF have been replaced with a lot of negativity and fear around water use in the basin.

Local stakeholders are also advocates of existing leadership. Interviews suggest that there are many “quiet leaders”, in the UCF who are not yet outwardly soliciting involvement from others, but are respected members in their communities that participate in water and resource conservation. These leaders in the UCF do not want to upset or negatively affect their neighbors by telling them to change their practices, but are also key players that can help garner more widespread support from local stakeholders toward a voluntary drought management effort. Interviews suggest that individuals who want to provide opportunities for both themselves and their communities will continue to lead in actions that prepare the basin for future water shortage.

Efforts to develop a voluntary drought management plan will need to continue identifying potential local stakeholder leaders and their roles will be critical for eliciting further local
stakeholder interest. Landowners on the WRC board expressed interest toward and a desire to become a resource for helping to further identify these individuals.

4.0 Information Needs for Developing a Drought Plan in the Upper Clark Fork River Basin

The findings presented below are organized into categories that identify the technical data necessary for developing a voluntary drought plan. There is more work to do in terms of specific identification of the information needs and existing data gaps for developing a drought plan. However, the following information, and this project overall, has begun to process to determine what the priority information needs are for a drought plan, and from where and how that information might be collected and organized.

See Appendix 6 Bibliography that identifies research and reports on the UCF. These documents contain information on water rights, hydrological factors, and biological factors relevant to the development of a drought management plan.

4.1 Identify Common Priorities

Stakeholders in the basin express an interest in a holistic approach to drought management. This report not only addresses that concern, but hopefully instigates an effort to continue collecting data and identifying common priorities to achieve that goal. NRDP, FWP, DEQ, and CFC have all released reports within the six years identifying the organization’s watershed restoration priorities in the UCF. These active priorities set a precedence for any effort to develop a drought management plan in the basin, because many of priorities also aim to improve instream flows and hydrologic connectivity in the basin. Collectively, these priorities can inform a strategic, basin-wide plan for drought management.

4.2 Identify Streamflow Monitoring Priorities and Streamflow Triggers

Other drought management plans identify several strategic locations that monitor streamflows and trigger the plan. Eventually, a few priority monitoring station locations in the UCF will need to be identified. Determining the locations of those gages and what the triggers will be is a complex challenge, especially because drought occurrence in the UCF is site specific and not basin-wide. In order to determine where the priority gages should be located and what the streamflow triggers should be, it is first necessary to determine the current flow monitoring needs.

- Inventory past and current gages and streamflow monitoring in the UCF. Collecting both the data and locations of streamflow monitoring will identify locations of critical low flows, and prioritize which gages are located in the most significant locations and where future gages could be installed. There is already extensive flow
monitoring on the mainstem of the Clark Fork. The USGS gages on the mainstem will provide data on historic flow patterns, but these gages are not permanently funded. These gages operate in conjunction with the settlement agreement for restoration. Most of the tributaries do not have state or federal funded gages, but independent interest groups like collecting streamflow data. The past and current gages and streamflow data will provide information about areas of critical low flow and tributary contributions from the mainstem.

- **Identify areas where common critical low flows are occurring in-between gages during low water months and critical water years.** Two potential methods to identify areas experiencing critical low flows in-between gages emerge at this time. One method to identify where critical low flows occur is to determine where previously irrigated acreage has been discontinued due to water shortage. Another method to identify where critical flows are occurring is to meet in small groups with local landowners and ask them to show where water shortage is occurring on a map. The WRC board has supported this method. A meeting with landowners on Gold Creek has been tentatively scheduled at this time (due to scheduling conflicts this meeting has not yet occurred, Meg Casey has offered to go if I do not). This method will gather valuable information from local landowners about streamflow patterns and can also identify their streamflow monitoring needs.

In areas that do not have a long history of streamflow monitoring, statistical analyses are available to assess information about historical flow regimes. The lead hydrologist for the CSKT specifically suggested using the method of deficit-surplus graphs to assess small streamflow monitoring datasets in the UCF with long-term gage station data.

- **Establish future gage location priorities.** After identifying areas experiencing critical low flows, prioritizing locations for future gage locations can be established, including locations for new gage installations.

- **Determine flow triggers.** A major priority for streamflow monitoring, in addition to flow monitoring locations, is to determine flow triggers. Currently, FWP uses average wetted parameters to enforce senior water rights. There has been some discussion that the average wetted parameters in the basin should be reevaluated in order to ensure the accuracy of streamflow triggers for a drought management plan in the UCF. A lot of work to establish streamflow and water user priorities has yet to be done, before efforts can go into determining streamflow triggers.
4.3 Prioritize Water Rights and Legal and Physical Water Availability

Key water users are a critical priority in the development of a voluntary drought management plan, and key water users are defined by a combination of the size, location, priority date, and social dynamics of the water right of interest. While the DNRC Water Rights Bureau is able to provide information about the size, location, and priority date of water rights, the social dynamics of a key water user is separate but essential to creating an effective voluntary drought plan. WRC and other stakeholders in the basin can continue to help identify which water rights holders might be open to a drought planning effort.

One priority group of key water users are the senior water rights holders. Senior water rights holders’ participation in a voluntary drought plan will improve tributary contributions to the mainstem of the UCF. Voluntary action by senior water rights holders could also incentivize others to participate in a drought plan. It will be important to identify the social dynamics of those senior water rights holders, and determine which of those stakeholders might be interested in participating in a plan.

To meet the Compact requirements, an effort should begin to assess where excess water could be kept instream, where the priority locations for that excess water will make an impact and act to augment flows, and which water rights are associated with those locations. Prioritizing locations for potential water availability is critical; certain tributaries and reaches may emerge as less of a priority because of severe dewatering and social and political barriers.

A technique used in the formation of the CSKT Compact is theoretical “call scenarios”. The concept is a combination of analysis and modeling and is based on applying different factors that affect instream flows to specific areas in order to imagine the outcome. Developing a geodatabase of spatially mapped water rights and possible hydrological conditions is one way to test different potential scenarios.

4.4 Questions for Further Discussion

Below is a summary of key questions that will continue to help guide development efforts for a voluntary drought management plan. These questions are also discussed throughout the section on information needs and addressed in the section below for next steps.

- Are the critical low flows, identified for the mainstem of the UCF still accurate from the 1989 instream reservation application?

- What are the recommendations for where flows should be monitored beyond gages?
• Where and when are chronically dewatered portions occurring (in-between gauges)?

• What areas are not irrigated due to low flows?

• Where/when does flood irrigation and return flows benefit downstream users?

• Who and where are the junior water rights to the former Milltown dam instream flow right?

• Will the plan need to be divided to implement a plan in response to drought? And if so, how?

• Which landowners will emerge as leaders in the basin?

5.0 Next Steps

The goal of this report is to lay the foundation for and catalyze the effort to create a drought management plan for the UCF. Based on the findings and conclusions presented in this report, three primary options seem to emerge in terms of next steps. These options are complimentary, not mutually exclusive.

- **Convene a meeting with TU** to review the findings of the report and to identify and assess strategies for moving forward. I believe this effort has been impactful for TU and other stakeholders in the basin to begin thinking about a plan. After reviewing this report, I think it would be valuable and interesting to have Stan, Bruce, and Meg, and sit down to discuss the following:
  1. Consider the merits of convening an exploratory meeting with other stakeholders to consider options on how to proceed (e.g., create an ad hoc working group to guide the initial stages of developing the drought plan); and,
  2. Develop a process for how to best synthesize and analyze hydrology, geomorphology, fisheries, and water rights data.

This report is a start, but there is more to do before a drought action plan for the UCF can be developed. Further groundwork will include two distinct but not mutually exclusive components: a stakeholder assessment and a scientific and technical planning component. Both will need to happen, but efforts moving forward will need to determine which and to what extent each component should be advanced at this time.

- **Complete a more comprehensive stakeholder assessment** that focuses on the social and political aspects of developing a voluntary drought plan. *This project started to consult water users and other stakeholders in the UCF, but the effort will*
need to continue identifying their interests and concerns, and exploring how they might want to be involved in creating a drought management plan for the UCF.

Meetings with local stakeholders have and can continue to facilitate important information sharing and gathering. Meeting with local stakeholders is one method that can continue to document experiences and concerns of water users facing water scarcity throughout the basin. Local stakeholders and water users in the basin can provide valuable information about specific areas experiencing critical low flows and chronic dewatering.

Local stakeholders will need to contribute to the support of a voluntary drought plan in the UCF if one should gain momentum. Meetings may illuminate potential local leaders and successful water conservation and restoration projects on private lands. Those projects can be used as examples for other local stakeholders in the basin. Stakeholders willing to talk about water conservation projects may be potential local leaders in the effort, and can also be a resource for connecting drought-planning efforts with more water users in the basin.

In addition to the social component of assessing people’s advice, interests, and potential involvement, developing a voluntary drought plan inherently involves a large technical piece.

- Develop and refine the scientific and technical information needed to create a drought management plan. This component includes information on hydrology, geomorphology, biology, and water rights in the UCF. A key piece to that effort will be to continue to conduct more comprehensive interviews with hydrologists, biologists, water rights experts, and other technical experts to review the information in this report and affirm, revise, and expand on information that informs drought planning.

A core question to creating a drought plan is where are the critical flows occurring? The next question is then; which areas have potential to improve flows to meet the instream flow right at the former Milltown dam site? These two general interests help determine where augmenting streamflows in critical areas improves mainstem river flows, and identify the priority dates of water rights associated with priority areas of concern and/or potential.

A strategy to organize the collected information is necessary. Data on the various technical pieces of information exists, and each interest group and agency has identified different priorities defined by information on areas of critical low flows and restoration needs, but data is not centralized.

A next step is to begin assessing a baseline of instream flows in the basin. An initial task might be to inventory past and current streamflow monitoring data and reassess the accuracy of average wetted parameters and instream flow recommendations. The
average wetted parameters and instream recommendations are considered baseline conditions. Assessing these values will help identify the potential streamflow triggers of a drought plan.

Along with a baseline of instream flows in the basin, a suggested strategy is to 
*gather and assess information from one tributary at a time and eventually spatially map that data.* Once data is organized on a spatial scale, different call scenarios can then be made in terms of; where is the water legally available, and how will augmented flows contribute to the mainstem flows at the former Milltown dam. Call scenarios first require a lot of the relevant technical information first be gathered and mapped, in order to really begin to change variables and imagine outcomes.

*The following information will begin to shape how that instream flow might be met during years of water shortage, and a GIS database can organize this data on a spatial scale:*

Identify the junior users to the CSKT Compact instream flow right at the former Milltown dam site and separate the supplemental junior water rights from the major water rights in the basin

- Identify potential areas where flood irrigation and return flows provide benefits to other users and where return flow studies are needed. Use NRCS and MBMG databases to identify hydraulic connectivity, soil type, texture, and depth of soils along the mainstem of and tributaries to the UCF, and on irrigated land.

- Identify locations for NRDP priority streams for riparian restoration

- Identify areas of critical low flows from current gages and perform a stream gage inventory to identify baseline flows where monitoring has occurred.

- Identify priority areas to improve flows based on basin connectivity for fish passage and locate fish barriers, flumes

- Compare current and historic irrigated acreage

- Begin to identify chronic dewatered areas from data provided directly from water users in the basin by talking with willing local stakeholders in each tributary to gain local knowledge of shortage areas

- Assess accuracy of reports on instream flows and FWP instream flow reservations proposal
In Summary, through the efforts of this project, Meg Casey and I have started to create a repository of information from the UCF relating to the technical data that will inform a drought management plan. The collection of the documents is the first step toward assessing information. Reports about instream flows and restoration priorities not only highlight focus or problem areas, but also help illustrate a baseline for what is going on in the basin. The information can be assessed in order to determine if, (1) that information is still accurate, and (2), where and what are the existing data gaps on information needs in the basin?

The upper portion of the mainstem of the Clark Fork is a priority for improving instream flows, and the tributaries contribute to the fish habitat and are therefore priority. There is a need to know where improving instream flows in the tributaries will affect the instream flow in the mainstem. The impending CSKT new instream flow right will compel certain users to reduce or stop their water use if the enforceable instream flow is not met.

- **Identify opportunities to fund staffing and development of a drought plan.** To make any serious progress on developing a drought plan for the UCF, it is essential to engage someone that can provide the necessary support – to plan, manage, and support the activities of stakeholders through facilitation, data collection; and refine strategic priorities as appropriate; work in consultation with partners to accomplish the activities and deliverables; and develop proposals to expand the capacity to create a drought management plan.
## APPENDIX 1  Draft Work Plan

### Draft Work Plan for Test Scenarios

### Drought Management Plan, Upper Clark Fork River Basin

**Spring 2015**

<table>
<thead>
<tr>
<th>Tasks &amp; Deliverables</th>
<th>Estimated hours</th>
<th>Expected completion date</th>
<th>Completion date</th>
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<tr>
<td><strong>TASK 1: Prepare Work Plan</strong></td>
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<td></td>
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<tr>
<td>Consult with Team Unlimited (TU) and Professor to define purpose and scope</td>
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<td>Dec. 2015</td>
<td>Dec. 2015</td>
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<tr>
<td>Identify tasks and deliverables</td>
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<td>Jan. 1</td>
<td>Jan. 8</td>
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<td>Estimate number of hours per task deliverable</td>
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<td>Jan. 11</td>
<td>Jan. 8</td>
</tr>
<tr>
<td>Prepare work plan</td>
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<td>Jan. 11</td>
<td>Jan. 11</td>
</tr>
<tr>
<td><strong>Subtotal hours</strong></td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **TASK 2: Review Existing Drought Management Plans** |                 |                           |                 |
| Assess existing drought management plans | 9               | Jan. 11                   | Jan. 11        |
| Identify common and different elements | 4               | Jan. 19                   | Jan. 28        |
| Prepare draft purpose, scope, timelines, and differences | 5               | Jan. 25                   | Jan. 29        |
| Share and discuss memo with TU and Professor | 2               | Feb. 1                    | Feb. 10       |
| **Subtotal hours** | 16              |                           |                 |

| **TASK 3: Conduct Interviews on Drought Management Plans** |                 |                           |                 |
| Prepare interview questions and format in consultation with TU and Professor | 5               | Feb. 1                    | Feb. 10       |
| Schedule interviews with at least two people per each watershed | 6               | Feb. 1                    | Feb. 9        |
| Travel to Blackfoot River Watershed and conduct interviews | 8               | Feb. 6-29                 | Mar. 11       |
| Travel to Big Hole Watershed and conduct interviews | 8               | Feb. 6-29                 | Mar. 10       |
| Travel to Jefferson River watershed and conduct interviews | 8               | Feb. 6-29                 | Mar. 22       |
| Interview 2-4 other people with expertise on drought management (Source, etc.) | 3               | Feb. 6-29                 | Mar. 9        |
| Review and synthesize findings, prepare short report | 24              | Mar. 14                   | Mar. 21       |
| Share, discuss, and adopt draft report with TU and Professor | 3               | Mar. 14                   | Mar. 21       |
| **Subtotal hours** | 30              |                           |                 |

| **TASK 4: Conduct Interviews with Hydrology Experts** |                 |                           |                 |
| Identify 2-4 experts to interview regarding drought planning in the US E | 1               | Mar. 24                   | Mar. 26       |
| Prepare interview questions in consultation with TU and Professor | 3               | Mar. 24                   | Mar. 21       |
| Conduct interviews by telephone if one is possible | 8               | Mar. 14-21                | Apr. 1        |
| Review and synthesize findings; prepare short report | 6               | Mar. 21                   | see final report |
| Share and discuss report with TU and Professor | 4               | Apr. 11                   | see final presentation |
| **Subtotal** | 30              |                           |                 |

| **TASK 5: Share Findings, Conclusions, Next Steps with Key Leaders** |                 |                           |                 |
| Integrate earlier model into a final report, consult with own team and other | 3               | Apr. 18                   | Apr. 18       |
| Share final report with TU and Professor | 2               | Apr. 18                   | TBD           |
| Prepare for meetings to share findings | 4               | Apr. 25                   | TBD           |
| Convene one or more meetings to share and discuss findings and conclusions | 9               | May. 2                    | TBD           |
| Conduct evaluation of progress with TU and Professor | 2               | May. 9                    | May. 10       |
| **Subtotal hours** | 10              |                           |                 |

| **TASK 6: Participate in Pracnom Symposium (9-2 hour readings per semester)** |                 |                           |                 |
| Exchange information, engage in peer to peer consultations, harvest and share lessons | 12              | TBD                       | ongoing       |
| **Subtotal hours** | 12              |                           |                 |

### TOTAL ESTIMATED HOURS | 153

### DIRECT COSTS

- Mileage for site visits
- Toluene
- Telephone

- **TOTAL DIRECT COSTS**
Strategies and lessons were harvested from interviews with the following people about their experiences with voluntary drought management plans. The findings from these interviews will help guide the development of a drought management plan for the UCF.

<table>
<thead>
<tr>
<th>First Last</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steve Luebeck</td>
<td>Big Hole Watershed Committee Board Member; Sportsman</td>
</tr>
<tr>
<td>Jennifer Downing</td>
<td>Big Hole Watershed Committee Executive Director</td>
</tr>
<tr>
<td>Ron Spoon</td>
<td>Jefferson River Watershed Council Board Member; FWP</td>
</tr>
<tr>
<td>John Kountz</td>
<td>Jefferson River Watershed Council Vice President; Rancher</td>
</tr>
<tr>
<td>Jodi Kountz</td>
<td>Jefferson River Watershed Council Coordinator</td>
</tr>
<tr>
<td>Gary Burnett</td>
<td>Blackfoot Challenge President</td>
</tr>
<tr>
<td>Jennifer Schoonen</td>
<td>Blackfoot Challenge Water Steward</td>
</tr>
</tbody>
</table>
APPENDIX 3 Stakeholders Interviewed from the Upper Clark Fork River Basin

This report was generated from interviews with the following stakeholders. They provided information about issues and concerns with respect to developing a drought plan.

<table>
<thead>
<tr>
<th>First Last</th>
<th>Affiliation</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethan Mace</td>
<td>DNRC</td>
<td>Surface Water Hydrologist</td>
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<tr>
<td>Seth Makepeace</td>
<td>CSKT</td>
<td>Hydrologist</td>
</tr>
<tr>
<td>Mike Roberts</td>
<td>DNRC</td>
<td>Surface Water Hydrologist</td>
</tr>
<tr>
<td>Jason Lindstrom</td>
<td>FWP</td>
<td>Fisheries Biologist</td>
</tr>
<tr>
<td>Ada Montague</td>
<td>DNRC</td>
<td>UCF Water Planner</td>
</tr>
<tr>
<td>Ian Magruder</td>
<td>Kirk Engineering</td>
<td>Hydrologist Consultant</td>
</tr>
<tr>
<td>Noorjahan Parwana</td>
<td>Granite Headwaters (GHWG)</td>
<td>Director of GHWG</td>
</tr>
<tr>
<td>Ted Dodge</td>
<td>Watershed Restoration Council (WRC)</td>
<td>Director of WRC</td>
</tr>
<tr>
<td>Will McDowell</td>
<td>Clark Fork Coalition</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Holly Franz</td>
<td>PPL Montana</td>
<td>Water Rights Attorney</td>
</tr>
<tr>
<td>John Hollenback</td>
<td>WRC</td>
<td>Board Chair; Rancher</td>
</tr>
<tr>
<td>Bruce Thomas</td>
<td>WRC</td>
<td>Board Member; Rancher</td>
</tr>
<tr>
<td>Jennifer Schoonen</td>
<td>Blackfoot Challenge</td>
<td>Water Steward</td>
</tr>
<tr>
<td>Vicki Watson</td>
<td>University of Montana</td>
<td>Academic</td>
</tr>
<tr>
<td>Stan Bradshaw</td>
<td>TU</td>
<td>Water Rights Attorney</td>
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<tr>
<td>Bruce Farling</td>
<td>MTU</td>
<td>Director</td>
</tr>
<tr>
<td>Casey Hackathorn</td>
<td>TU</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Meg Casey</td>
<td>TU</td>
<td>UCF Water Rights Attorney</td>
</tr>
<tr>
<td>Glen Green</td>
<td>NRCS</td>
<td>Soil Specialist</td>
</tr>
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</table>
### APPENDIX 4  Preliminary List of Emerging Stakeholders and Experts

<table>
<thead>
<tr>
<th>First Last</th>
<th>Affiliation</th>
<th>Title/Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike McLane</td>
<td>FWP</td>
<td>Water Resource/Streamflow Specialist</td>
</tr>
<tr>
<td>Andrew Brummond</td>
<td>FWP</td>
<td>Water Rights/Streamflow Specialist</td>
</tr>
<tr>
<td>Ethan Mace</td>
<td>DNRC</td>
<td>Surface Water Hydrologist; lead DNRC hydrologist for the CSKT Compact</td>
</tr>
<tr>
<td>Seth Makepeace</td>
<td>CSKT</td>
<td>Hydrologist; lead hydrologist for the CSKT Compact</td>
</tr>
<tr>
<td>Mike Roberts</td>
<td>DNRC</td>
<td>Surface Water Hydrologist for the Big Hole Watershed</td>
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<tr>
<td>Jason Lindstrom</td>
<td>FWP</td>
<td>Fisheries Biologist in the Deerlodge Valley</td>
</tr>
<tr>
<td>Andy Fischer</td>
<td>CFC</td>
<td>Project Manager in the Upper Clark Fork River Basin</td>
</tr>
<tr>
<td>Tom Mostad</td>
<td>NRDP</td>
<td>Instream flow project coordinator</td>
</tr>
<tr>
<td>Ann Schwend</td>
<td>DNRC</td>
<td>Water Planner for the Upper Missouri Drought Resilience Project</td>
</tr>
<tr>
<td>Mark Schafer</td>
<td>Copper Environmental Consulting</td>
<td>Hydrologist</td>
</tr>
<tr>
<td>Noorjahan Parwana</td>
<td>(GHWG)</td>
<td>Director; establishing a drought resiliency plan in the Flint Creek subbasin</td>
</tr>
<tr>
<td>Ted Dodge</td>
<td>Watershed Restoration Coalition (WRC)</td>
<td>Director</td>
</tr>
<tr>
<td>Will McDowell</td>
<td>Clark Fork Coalition (CFC) and WRC</td>
<td>CFC Project Manager in the Upper Clark Fork and WRC staff</td>
</tr>
<tr>
<td>Andy Fischer</td>
<td>CFC</td>
<td>Project Manager in the Upper Clark Fork</td>
</tr>
<tr>
<td>Ada Montague</td>
<td>DNRC</td>
<td>(New) Water Planner</td>
</tr>
<tr>
<td>Holly Franz</td>
<td>PPL Montana</td>
<td>Water Rights Attorney and former Steering Committee member</td>
</tr>
<tr>
<td>John Hollenback</td>
<td>WRC</td>
<td>Board Chair; Rancher</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Description</td>
</tr>
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<td>---------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Jim Dinsmore</td>
<td>GHWG</td>
<td>Board chair; Rancher</td>
</tr>
<tr>
<td>Maureen Connor</td>
<td>Granite County Resident</td>
<td>Granite County Conservation District; Former County Commissioner</td>
</tr>
<tr>
<td>Jennifer Schoonen</td>
<td>Blackfoot Challenge</td>
<td>Water Steward</td>
</tr>
<tr>
<td>Mike Sweep</td>
<td>Montana Climate Office and University of Montana</td>
<td>Academic</td>
</tr>
</tbody>
</table>
Developing Options for a Drought Management Plan in the Upper Clark Fork River Basin

APPENDIX 5 Bibliography

The following documents were referenced during interviews and collected for future use in any effort to build a drought management plan in the UCF.


Montana Department of Fish, Wildlife & Parks, An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin, 2008.

Montana Department of Fish, Wildlife & Parks, An Assessment of Fish Populations and Riparian Habitat in Tributaries of the Upper Clark Fork River Basin: Phase II, 2009.


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Smart, Eric W., M.S. *Surface Water and Groundwater Interaction in a Shallow Unconfined Alluvial Aquifer and Small Mountain Stream, Silver Bow Creek, Montana*, 1995.


Workman, Dennis, *Qualitative Assessment of Habitat in Eight Tributaries to the Upper Clark Fork River*, 2009.


Developing Options for a Drought Management Plan in the Upper Clark Fork River Basin

APPENDIX 6 Lessons Learned from Collaborative Conservation

The Practicum in Collaborative Conservation requires work with citizens, stakeholders, and decision-makers on a current natural resource issue and reading relevant information on the place and issues of interest. I developed and refined skills in the following competencies:

On Analytical Competency – The practicum required a large technical component. I spoke with professionals about the technical and political issues in the basin, which required that I quickly become competent on the basics of the hydrology, historical water use, and management of water resources in UCF. In order to collect valuable and relevant information from interviews, I had to understand various stakeholders’ interests. I also analyzed the social aspects of drought management. I had to be respectful of peoples’ interests and concerns regarding water use and water management, and also ask difficult questions about how drought is affecting people. I am competent enough about the social constructs in place in the basin, that I was able to effectively gather information about a politically and socially challenging topic.

On Process Competency – A big portion of this practicum was an assessment of the process involved for developing and implementing a voluntary, collaborative drought management plan; however, I did not only study the process, but I applied lessons learned from existing collaborations to discussions for how a similar process could be generated in the UCF.

On Professional Accountability Competency – I worked independently during the semester and held to professional standards when I produced reports for TU and Professor McKinney. The practicum was an academic exercise, but was done in hopes that a future effort toward a drought plan in the UCF would continue. I was accountable for producing a valuable and useful final report.

On Leadership and Management Competency – I was largely in charge of my own work progress throughout the practicum. I was able to manage the project as it evolved throughout the semester. I showed initiative and leadership with setting up my own interviews and driving many miles to attend interviews and meetings in person.

On Knowledge Management Competency – There is a vast amount of information out there on the UCF watershed. At times the project became overwhelming due to the vast amount of information that exists on the issue of drought management in the UCF. I necessarily tailored the project back to a manageable level, but still was able to collect and organize information about the technical and social components of the project.