Restoring Watersheds and Building Watershed Communities

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RESTORING WATERSHEDS AND BUILDING WATERSHED COMMUNITIES

By

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Portfolio

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The central theme of my four portfolio pieces is restoring watersheds and building watershed communities. Each component of my portfolio approaches this theme differently. Using a broad approach allowed me to explore the various ways communities, watersheds, and restoration can intersect. My first portfolio piece analyzes cost-effectiveness of low-technology erosion control structures. These were used as part of a project to restore California Gulch, near Anaconda, MT. The second piece begins with a legislative history of exempt well policy in Montana. It goes on to study the collaborative processes used in developing an exempt well bill in the 2017 legislature, then makes recommendations for future collaborative efforts in a memorandum to the Water Policy Interim Committee’s chair. The third piece is an interdisciplinary curriculum focused on the Big Hole watershed. Through service-learning, 8th-11th grade students learn about the area before participating in a local restoration project. The fourth piece contains two documents relating to work I have done in the field of watershed restoration, and building watershed communities. The first is a reflection from my summer working in the field for the Montana Department of Environmental Quality on the Stream Reference Project. The second is a memorandum to the executive director of the Montana Watershed Coordination Council, summarizing the findings of a survey I developed and sent out to MWCC’s membership.
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Portfolio Introduction—Why I Undertook these Projects

When I first applied to the Environmental Studies program, I was very interested in learning more about ways to restore watersheds, while developing meaningful connections to the land. I had recently worked on a restoration project in California Gulch through my AmeriCorps service with Montana Conservation Corps. Prior to California Gulch, I had been spending my energies doing trail work in the Selway-Bitterroot Wilderness. If there were people using those trails, I never saw them, and I liked it that way. This disconnect from society provided me the opportunity to reflect on how I want to live my life, develop deep connections to my crewmates, and be humbled by all that nature has to offer. However, I often wondered how valuable this work was on a large scale, rather than only looking at the personal gain.

Working on the California Gulch project offered something new. Not only was I working outdoors, with all the perks that come along, I was helping restore a watershed. I realized that the technical skills I had developed could be applied to something much greater than helping the occasional recreationist bag a peak, or access an alpine lake. When restoring sites as degraded as California Gulch, heavy machinery is often used. The lack of road access in the California Gulch project encouraged a different approach, using hand crews and low-technology approaches to restoration. My goal became to find ways to expose more people to the magnificence that I was experiencing.

As I progressed through the program, my interests expanded to include collaborative conservation, policy, and education. I believe each of these fields offers opportunity to restore watersheds, while building a watershed community.

This portfolio contains four pieces. Each piece is based on the central theme “restoring watersheds and building watershed communities.” I identify multiple ways to connect to the land, while working to conserve it. The first piece is a quantitative study of the cost-effectiveness of the structures built in California Gulch. This piece demonstrates the feasibility of using low-technology approaches and conservation corps. The second piece is a legislative history of exempt well policy in Montana. In this piece, I analyze HB339, an exempt well bill in the 2017 legislature, and explore the compromises made in its development. This piece opened my eyes to the opportunity for civic engagement in protecting watersheds through policy. The third component was inspired by a group of high school students I led in conservation work in 2015. It is a service-learning curriculum that educates students about an area, before having them participate in a watershed restoration project. The fourth piece has two parts. The first is a reflection of my time working with the Montana Department of Environmental Quality. Through this experience I learned how Montana water quality standards are determined and how they are used in setting restoration goals. The second part is a summary of a survey of watershed groups around Montana. This piece provided information about services that community-driven watershed groups need to build capacity.

The first component of my portfolio is a research paper I began in Vicki Watson’s Watershed Conservation Ecology class titled “Cost-Effectiveness of Erosion Control Structures in California Gulch, near Anaconda, MT.” I returned to the project site that kick-started my graduate school career. To pursue my goal of promoting low-technology solutions with small
crews, I focused on cost-effectiveness. I define cost-effective as the cost to trap one ton of sediment in the project area. I began my research by visiting California Gulch and collecting measurements of new sediment deposition trapped behind the structures installed. I then analyzed the data to determine how much total sediment was trapped, and, on average, how much each structure type could trap. I then looked at invoices and project reports to determine the cost-effectiveness of a low-technology approach, the cost-benefit of hiring an MCC crew, and the cost-effectiveness of beaver dam analogues. I concluded the following: over 500 tons of sediment have been trapped by low-technology structures in California Gulch; while each structure type is critical to the project’s success, slash filters are most effective at trapping sediment; it is over 50% more cost-effective to hire an MCC crew, rather than a professional crew; and while beaver dam analogues are less cost-effective than other structures, they provide significant benefit to the watershed’s connectivity.

My second portfolio piece is titled “Montana’s Exempt Wells Controversy: Analysis and Recommendations for Solution.” This piece was completed in Robin Saha’s Montana Environmental Policy class. This project also was the basis of my engagement requirement. Exempt wells are water wells that draw less than 35 gallons per minute. They are exempt from the Department of Natural Resource and Conservation’s permitting process and corresponding impact analysis. These wells are highly controversial. Developers have been using exempt wells to build many homes in Montana in recent history, while senior water users are defenseless to protect their water rights. This paper begins with a legislative history of exempt well policy in Montana. I explain two major court cases, multiple rule changes, and several critical bills that have shaped this era of controversy. I then delve deeper into HB 339, a pertinent piece of legislation from the 2017 Montana Legislative session. I focus on the compromises that were made in drafting HB339, and what led to that bill being vetoed in May. Using my knowledge gained from the Natural Resource Conflict Resolution certificate program, I develop a list of recommendations for the Water Policy Interim Committee chair, Chas Vincent. The four recommendations I make are 1) Hire a professional facilitator to mediate meetings; 2) Make sure all stakeholders are at the table; 3) Improve trust building among stakeholders; and 4) Develop a plan for joint fact-finding. Considering the mistakes made in HB339, I believe these four steps will help lead to successful exempt well legislation in 2019.

The third piece of my portfolio is an experiential-education, service-learning curriculum. I developed this curriculum after realizing the opportunity to develop a civically-engaged generation at the intersection of conservation work and education. The mission of the Big Hole Watershed Education and Restoration Project is to educate 8th-11th grade students about the Big Hole watershed while engaging in hands-on restoration projects, further fostering a sense of connection and responsibility to the continued welfare of the region and community. This mission is met through a five-unit curriculum that educates high school students about the Big Hole watershed in an outdoor setting, then engages them in a relevant restoration project. The five units are 1) Reflection; 2) Knowledge; 3) Problem-Solving Skills; 4) Service and Engagement; and 5) Project Work. This curriculum was developed using the educational philosophy of constructivism. Constructivism allows students to develop their own understanding of the world through experience and reflection. This educational experience is set-up to maximize students’ time outdoors. It is a curriculum that allows for curiosity to flourish and engagement to be at its peak.
My final portfolio component contains two summaries from relevant work experience. The first of these pieces is titled “‘I’m going to the Rivers:’ Reflections from the Best of Streams.” It is a reflection from my summer working on the Stream Reference Project for the Montana Department of Environmental Quality. The purpose of this project is to monitor the chemical, biological, and physical characteristics of high quality streams across Montana. This data helps develop the narrative and numeric standards for Montana’s different ecoregions. I spent the summer of 2017 on a small field crew visiting twenty-seven of these streams. This paper is a reflection from that work experience.

At the request of Montana Watershed Coordination Council, I administered a survey of MWCC members in October 2017. My final piece, “MWCC’s Survey on Capacity Building Services,” is a memorandum to the executive director of MWCC summarizing the survey’s findings. The survey had four main objectives 1) identify which services provided by MWCC are most valuable in helping organizations build capacity and achieve their desired outcomes; 2) define the Watershed Approach to natural resource management; 3) identify which metrics are used in measuring conservation progress; and 4) identify trends over time to determine if services are helping conservation organizations build capacity. The survey contained eight questions developed in consultation with MWCC’s executive director, two members of the Board of Directors, and the co-chairs of the Natural Resources Conflict Resolution Program. The purpose of this survey was to help MWCC shape their future work by providing a better understanding of the value and impact of MWCC’s services.
Part One

Cost-Effectiveness of Erosion Control Structures in Restoring California Gulch, near Anaconda, MT
Cost-Effectiveness of Erosion Control Structures in Restoring California Gulch, near Anaconda, MT
Lindsay P. Wancour, Portfolio Component, Environmental Studies Department, University of Montana. Dec 2017

Introduction

Beaver dam analogues (BDAs) and similar erosion control structures are used to mitigate sedimentation in waterways. However, few, if any, studies have been made of the cost-effectiveness of these methods. In this study, I explore the cost-effectiveness of low-technology erosion control structures that were constructed in California Gulch, near Anaconda, Montana. In this case, cost-effectiveness is defined as the cost per ton of sediment trapped. This paper answers the following research questions 1) How much sediment is trapped by erosion control structures in California Gulch? 2) How much sediment is trapped, on average, by the different structure types? 3) How does hiring a conservation corps impact cost-effectiveness? 4) What is the cost effectiveness of BDAs?

History of California Gulch – The Restoration Site:

1864 was a year full of excitement and development for Montana. It was the year Montana became a territory, and the year gold was discovered in what is now the city of Butte. The discovery of gold was followed shortly by the finding of copper and silver (Anaconda Company, 1920). These discoveries were in the Silver Bow Creek watershed in southwest Montana. At the time, it was extremely expensive and time consuming to transport and smelt copper, so it was left largely un-mined (Anaconda Company, 1920). However, by 1880, advances in electrical engineering resulted in a higher demand for copper. This increased demand paired
with railways connecting the east to the west, easing the transport of copper, was the catalyst for Butte producing 9 million pounds of copper in 1882 (Anaconda Company, 1920).

The original reduction works, where the copper was smelted, was located to the east of what is now Anaconda, MT. It was wood-fueled, and wood was harvested from what is now the Mount Haggin Wildlife Management Area (Day, 1962).

In 1902 the Washoe Reduction Works Smelter opened 26 miles away from Butte in Anaconda, Montana, the closest source of available water to the mine (Anaconda Company, 1920). At the time of its construction, the smelter was the tallest masonry structure in the world, standing at 585 feet tall (Anaconda Company, 1920). The Anaconda Copper Company owned the mining operation until Atlantic Richfield Company (ARCO) purchased it in 1977. In 1980 the smelter closed; then in 1983 the State of Montana filed lawsuit against ARCO for the environmental damage they had caused under the Superfund Law (Justia, 2003). The state has settled its lawsuit through a series of settlements completed in 1999, 2005, and 2008 (Fox, 2017). Out of the Superfund lawsuit, $13.2 million was allocated for Smelter Uplands Restoration (Fox, 2015).

During its years in operation, the massive smelter discharged 3-4 million ft$^3$ of polluted air every minute (Anaconda Company, 1920). Smelting released sulfur dioxide (SO2) into the air, which is toxic to vegetation. In addition, smelting released heavy metals (copper, arsenic, cadmium) into the air, and these were deposited on the recently clear-cut land in Mount Haggin Wildlife Management Area, making revegetation difficult (Watershed Consulting, 2014). Additionally, Montana’s cold, dry climate naturally slows the revegetation process. The soil in this area is a highly erodible volcanic tuff. The combination of highly erodible soil, a lack of stabilizing
vegetation, and the steep grade of the landscape has led to the formation of deep gullies (Watershed Consulting, 2014). During heavy rain events, tons of contaminated sediment wash into California Creek (CC) and the North Fork of California Creek (NF).

In 2006 California Creek was listed as impaired on the 303(d) List (DEQ, 2009). The Montana Department of Environmental Quality (DEQ) states that California Creek does not support drinking water, agriculture, primary contact recreation, and aquatic life beneficial uses. The cause of these impairments is listed as sedimentation/siltation (DEQ, 2008). The sources listed include atmospheric deposition – toxics, contaminated sediments, and impacts from abandoned mine lands (DEQ, 2008). As of 2009, the estimated load of sediment into the waterway is 1,328 tons/year (See table 1) (DEQ, 2009).

Restoration Project Goals

Through a 319 grant, the Big Hole Watershed Committee (BHWC), a watershed group comprised of Big Hole community members, received funding to restore California Gulch. They contracted with Watershed Consulting to design and implement a restoration plan. This project was overseen by the DEQ (Watershed Consulting, 2014). This project’s restoration goals were to stop degradation trends and to stop the transport of sediment from uplands to the stream via gullies (BHWC, 2017). It also aimed to enhance floodplain connectivity of the stream for improved wetland habitat and sediment deposition during high flows (BHWC, 2017).

Watershed Consulting contracted with a Montana Conservation Corps (MCC) crew to help reach these project goals. Conservation corps are programs for young adults with a focus on development through engagement in service projects and job training (TCN, 2014). These organizations are modeled after the Depression-era Civilian Conservation Corps (TCN, 2014).
Montana Conservation Corps crews are also funded through AmeriCorps, which has a similar mission to Conservation Corps, but have a broader focus. Because there is an emphasis on service in these programs, AmeriCorps participants are volunteers that receive a living stipend, rather than a paycheck. Partnering with organizations such as Montana Conservation Corps is a way to achieve desired outcomes, support development of America’s youth, and save on costs of labor on projects.

**Study Area Description**

The California Creek restoration project is located within the Mount Haggin Wildlife Management Area (WMA). The WMA is located between Wisdom and Wise River, and is south of Anaconda (see figure 1) (BHWC, 2017). This land is managed by the Montana Fish, Wildlife, and Parks (FWP). The WMA is 58,800 acres, and FWP operates grazing, timber, wildlife habitat, recreation opportunity, native fishery, and more in this space (FWP, 2017, BHWC, 2017).

A major constraint in the development of this project was the inaccessibility of the site (Watershed Consulting, 2014). There is no road access through the WMA to the project site. There are five reaches that had structures built in them. Four of the reaches feed into the North Fork of California Creek. They are labeled NFA – NFD; the uppermost reach is NFA, followed downstream by NFB and NFC. NFD is the most downstream and was the original demonstration project area. The fifth reach is CCA, which feeds directly into California Creek (see figure 2).

Rill treatments (SSR-2a) were typically used in the upper section of each reach, where the gullies were just forming. The actual gullies had a series of check dams (SSR-2d), and slash filters (SSR-2c) installed. This was the steepest terrain. On average, the slope of the gullies is
18.5% (calculated using Google Earth). The stream channel had BDAs (SSR-2b) installed. The stream channels had a gentler slope. Watershed Consulting reports the stream has characteristics of a Rosgen E channel type (Watershed Consulting, 2014).

**Restoration Project Methods**

Due to the lack of road access to most of the site, Watershed Consulting used an approach that minimized the use of heavy machinery. Using hand crews and mostly locally harvested materials, they constructed over 500 low-technology erosion control structures. Some of this work was done by a Montana Conservation Corps crew in June of 2014. Watershed Consulting crews completed the rest between 2013 and 2016.

**Types of Structures Studied**

There are four structure types monitored in this study. All four structures’ goal is to trap sediment, while allowing water to pass. Sediment backed up behind the structures 1) develops a new channel bottom with a gentler gradient, hence reducing the velocity and erosive force of gully flow; 2) stabilizes the side slopes of the gully; 3) promotes the establishment of vegetation on the gully slopes and bottom; and 4) stores soil water so that the water table can be raised, enhancing the vegetative growth outside of the gully (Brooks et al., 1997). Structures SSR-2a, -2b, and -2d were all built in a trapezoidal shape; the gully width being smaller at the bottom than the top, with two angled gully walls. Structures were built parallel and in close proximity to one another up the gully to increase the resiliency of the system. If one structure were to break, the stored sediment behind the structure would not travel far before being stopped by another structure.
The upper reaches’ rill treatments are designed to slow erosion processes where they begin (BHWC, 2017). They were constructed using slash from local trees, coir fabric, and wooden posts (BHWC, 2017). Rills were filled with slash, covered with coir, then secured with wooden stakes. The average height of these structures was .9ft, with an area of 1.2ft². There were 51 SSR-2a structures analyzed in this study. There are more SSR-2a structures in the project area, but they were not measured in this study.

In addition to trapping sediment, BDAs have further purpose. Beaver dams raise the water table which supports riparian vegetation and increases floodplain connectivity (Beechie et al., 2010). SSR-2b structures were built in the stream channels using wooden posts with locally harvested brush woven between posts. Structures were built perpendicular to stream flow to slow water flow and build up the bed of the stream. Two-hundred structures were analyzed in this cost-effectiveness report. There are over three hundred BDAs, constructed between 2013 and 2016 (BHWC, 2017). The average height of these structures is 1.7ft with an average area of 5.4ft².

The third structure type, slash filters, were not as carefully constructed as the other three styles. Rather than perpendicular structures that were secured in place, these were tree branches and brush put parallel to the gully to fill space and create roughness. Gullies were often treated with slash filters above check dams in the main part of the gully (BHWC, 2017). There were 12 structures, or 1392 feet of slash, analyzed in this study. Because of the unstructured nature of this method, it is difficult to quantify exactly how much of the site is treated with SSR-2c structures.
The final structure type that was used were check dams. These were made predominantly from locally harvested log and rock. The dams were constructed perpendicular to the gully and secured in place by digging notches into the gully wall for the logs or rocks to sit in. Logs and rocks were stacked on top of each other to create a barrier to prevent massive loads of sediment from passing through. These were constructed up and down the gullies, in the deepest and steepest parts. One-hundred sixty structures were built between 2014 and 2017. The average height of the check dams is 2.3ft and the average area is 14.1ft².

Data Collection

In this study, cost-effectiveness is defined as the cost per ton of sediment trapped behind structures. This required collecting measurements of sediment from each structure. In Fall 2015, I visited all of the SSR-2b structures installed at that time. Watershed Consulting collected measurements from the remaining structures in 2015. All measurements were collected at least one year after installation so that the structures had faced a full year of weather conditions. To ensure higher accuracy, I brought a partner with me to help with measuring. Our measuring rod had of 1/10th inch precision. When taking measurements, the sediment deposition was measured the same way a prism’s volume would be measured:

\[(a+b)/2 \times h \times l\]

Where \(a\) = width of the base of the gully;

\(b\) = width of the gully at the top of the sediment deposition;

\(h\) = depth of the sediment deposition;

\(l\) = length of deposition.

In addition to the measurements of the sediment build-up, the structure’s potential volume was also calculated by measuring the height of the structure and its width at the
highest point. These measurements were put into an excel sheet that calculated the volume and potential volume of each structure. The volcanic tuff found in this area tends to have a sandy loam texture. An average soil weight of 0.065 tons/ft$^3$ was used to convert volume to weight of sediment captured, based on a mid-range value of silty sand and gravel taken from standard professional engineering manuals (Lindeburg, 2014). The amount of sediment trapped has been converted to volume in cubic yards, then to weight in tons.

The newly deposited sediment was easily distinguished from old. It was a vastly different shade of gray. When it was difficult to tell where the sediment deposition ended, an underestimate was used.

Structures were stratified by their position on the landscape, whether low, middle, or high and averages for each landscape location were determined for the different structure types (BHWC, 2017). These averages were used to extrapolate the sediment accumulation of all the unmeasured structures installed after 2015 (BHWC, 2017).

**Data Analysis**

The next step in determining cost effectiveness was to break down the amount of sediment retained in four ways, then to integrate the cost of implementation. I first calculated the total tons of sediment retained by all of the structures in California Gulch. Next, I looked at the sediment trapped by different structure types: SSR-2a, -2b, -2c, and -2d.

Using invoices provided by the Big Hole Watershed Committee, I next looked at all of the structures that were constructed under two different invoices. One invoice represented 22 SSR-2d structures installed by a crew of Watershed Consulting employees. These were installed in the NFD area in 2013. The other invoice contained 177 SSR-2a, -2c, and -2d structures
installed by a Montana Conservation Corps crew. These were installed over 9 days in June of 2014 in reaches CCA, NFB, and NFC. To determine the total amount of sediment trapped, the average sediment accumulation from each type SSR-2a, -2c, and -2d structures was multiplied by the number of structures of that type. I calculated the tons trapped per structure for each reach, then averaged those five numbers to calculate the average amount of sediment trapped per structure type. These numbers were used to determine the average cost-effectiveness of all the structures included, then broken down to compare the cost of hiring a conservation corps to a professional crew.

The final breakdown was done using a third invoice that had the cost of constructing 200 BDAs. These were constructed in 2016 in reach CCA. In calculating cost-effectiveness for this invoice, the average sediment accumulation of SSR-2b structures across all reaches was used.

The costs that contributed to this analysis were the cost of labor, per diems, lodging, travel, and materials. Costs of project oversight, beaver ecologists, restoration ecologists, and extraneous costs (materials not used, etc.) were removed from the invoice total. Half of the time logged on the BDA invoice and Watershed Consulting crew invoice was spent on other tasks. Hence, the total invoice cost was cut in half to reflect this division of labor.

Results

The results to the four research questions are found below.
1) How much sediment is trapped by erosion control structures in California Gulch?

The total amount of sediment trapped by erosion control structures in California Gulch between 2013 and 2017 is 527 tons (See table 2). This calculation includes reaches CCA, NFA, NFB, NFC, and NFD, and all of the SSR-2a, -2b, -2c, and -2d structures – a total of 580 structures. This number was determined using collected measurements and extrapolated data. It was not determined using the averages provided below.

2) How much sediment is trapped, on average, by the different structure types?

All of the structures were successful in trapping sediment. Due to their different locations and how they were built, and sizes, each structure had a different average sediment entrapment (See table 2).

Rill treatments, located in the less steep terrain, trapped, on average, .56 tons of sediment per structure. There were 64 structures used in determining this calculation.

Beaver dam analogues, which were found at the bottom of the gullies in the flatter stream beds, trapped an average of .22 tons of sediment per structure. There were 332 structures used in this calculation.

Slash filters were found in the steepest part of the project, and trapped an average of 3.51 tons of sediment per structure. There were 24 structures used in this calculation.

Check dams, also in the steepest part of the project site, trapped an average of 1.84 tons of sediment per structure. This calculation used 160 structures.

3) How does hiring a conservation corps impact cost-effectiveness?

Using the two project cost invoices that had specific costs for structures built by a Watershed Consulting crew and an MCC crew provided the opportunity to determine an average
cost-effectiveness of these structures. The project costs were available for only 199 structures. The total cost to install the 199 structures included in the two invoices was $24,681.90 (See table 3). Using the average 2.02 tons trapped by SSR-2a, -2c, and -2d, I concluded that approximately 402 tons were trapped at that cost. The average installation cost is around $124 per structure, and it cost about $61 to trap one ton of sediment.

When looking at the invoices independently of one another, the findings were quite different. The cost of hiring a Watershed Consulting crew to install 22 structures was $5,075.90. The average installation cost is around $230 per structure, and it cost about $114 to trap one ton of sediment.

Using a conservation corps crew was significantly more cost-effective. It cost $19,606 for a crew to install 177 structures. The average installation cost with MCC is around $111. The approximate cost to trap one ton of sediment is $55.

4) What is the cost effectiveness of Beaver Dam Analogues?

BDA costs were on a separate invoice so were analyzed separately. This work was also done by a Watershed Consulting crew. The BDAs were smaller structures than the check dams, and were used in areas with a lesser gradient. It cost $12,995 to install 200 BDAs (see table 3). With these structures, 44 tons of sediment was trapped. It cost approximately $65 to install each BDA. SSR-2b structures trap one ton of sediment at a cost of $295.

Discussion

In calculating cost-effectiveness of erosion control structures in California Gulch, many approximations were used. It was not specifically documented on the invoice how many hours
were spent on each task. Approximately half of the Watershed Consulting crew’s time was spent on other projects. Further, the “other tasks” being done were also to trap sediment, but the project manager decided against measuring the amount of sediment trapped during that time.

The MCC invoice also indicated that all the hours were on structure construction. However, there was at least one day that the crew worked on revegetation in the uplands area. The MCC invoice also included some labor for Watershed Consulting’s sawyers, as they helped with felling trees the first few days. Theoretically, MCC crews could complete the work without the help of the sawyers, however this crew only had two sawyers trained on felling at this point in the season. Therefore, it was more efficient to have the Watershed Consulting sawyers help.

The MCC crew that was used was on their first project as a crew. As many of the members were not proficient with chainsaws and hand-tools yet, the amount of work completed was less than what a well-seasoned crew could accomplish. This is important to note when considering cost. A “green” crew’s capacity is much lower than a crew that has worked together, is proficient with tools, and can endure long days of manual labor.

Another approximation involved the number of BDAs constructed. The report associated with the invoice said around 200 structures were constructed. There could be more or less constructed, but since there was no way to determine an exact number, 200 was used.

A final approximation involved is the measuring of sediment. When it was unclear where the new deposition ended, an underestimate was used. In addition to specific structures potentially trapping more sediment than reported, there are many areas of the gullies that did not get measured. The slash filters were installed up and down the gullies without
documentation. Because of their unstructured nature, it was impossible to accurately measure all the sediment trapped. This approach helps for future budgeting by calculating for a higher cost to trap one ton of sediment.

Note that these structures will continue to trap sediment over time without significant maintenance requirements. These numbers reflect one year’s worth of sediment entrapment. At the time of this study, the structures had 527 tons of sediment trapped. However, at capacity, they could trap around 4,600 tons. Using the average cost determined earlier of $61/ton, it can be determined that it cost approximately $32,000 to trap the 527 tons of sediment trapped currently. Assuming the structures do not fail, no additional manpower is put into their upkeep, and the structures reach capacity, the cost per ton of sediment trapped could drop down to around $7 per ton over time. While there are many “ifs” involved to reach the $7 mark, some decrease in cost per ton over time is inevitable.

I am not aware of future management plans for these structures. Ideally, when the structures reach capacity, another set of structures will be built upstream, on top of the new channel bottom. This should continue until the gully has filled with sediment and access to the floodplain has been restored. The current structures’ capacity is 4,600 tons, and they have trapped 527 tons. Theoretically, if the rate of sediment collection remains the same, it should take 8-9 years for the current structures to reach capacity.

One of the stated project goals was to stop the transport of sediment from the uplands to the stream via gullies. The sediment accumulation will help with bank stabilization and reducing future erosion. With increasing environmental threats caused by climate change, these low-technology erosion control structures could be very beneficial. Wildland fires can
lead to increased erosion and sedimentation of streams. As climate change increases fire hazards, these low-tech approaches can help mitigate the impacts.

While there are many positives associated with this approach to restoration, it must be noted that the heavy metal contaminants are still present in the sediment. There are no measures being taken to eliminate contaminants.

While the uplands remain clear-cut and largely devoid of vegetation, the mid-reach of the gullies have had success in revegetating over time. Thanks to the local trees in the area, the cost for additional resources was very minimal. Occasionally wooden posts and coir fabric were used. When budgeting for future projects, the available resources on site are an important factor. In addition to available resources being site specific, the erosion control structure sizes, and sediment type can be drastically different. The sediment found at Mount Haggin is highly erodible. Sites with less erosive soil may take longer to trap as many tons of sediment.

Conclusion

After analyzing the costs for the various structure types, it is apparent that even small budget projects could afford to install quite a few of these structures at $55 to $230 each.

It would be misleading to say that one structure type is superior to the others, as they have vastly different roles in the system. The rill treatments are required for the early formation of gullies, the BDAs are required for floodplain connectivity at a low gradient, while the check dams and slash filters are necessary for stopping the bulk of the sediment in large gullies at steep grades. However, it is worth mentioning the simplicity of slash filters, and their effect. These structures were mostly created by throwing excess brush, trees, rocks, stumps, etc. into a
gully. This added roughness slowed and stopped sediment with very little time dedicated to construction.

To work within a tighter budget, it is much more cost-effective to hire a conservation corps, when possible. Again, an MCC crew with more experience will perform at a higher level, thus increasing cost-effectiveness. It is around $120 cheaper, per structure to install structures with an MCC crew. There is around a 52% decrease in cost to trap one ton of sediment using an MCC crew instead of a professional crew. The added benefits of personal development, and sense of purpose invoked in youth through these organizations should not go without mention.

The reduced installment cost of SSR-2b structures makes sense considering the location of the structures. They are at the bottom of the gully; any sediment at the bottom of the gully either made it past all the other structures, or has not had much time to mobilize before reaching a structure. They are at a flatter gradient, so there is less gravitational help bringing sediment to the structures. While it costs more money to trap one ton of sediment, the cost of their installation is 72% cheaper (this is looking exclusively at costs of Watershed Consulting Crews).

Big Hole Watershed Committee stated that their second project goal was to enhance floodplain connectivity for improved wetland habitat and sediment deposition. Through photographs and Google Earth imagery, substantial changes in stream morphological conditions with increased wetted widths and pool formation have been observed (BHWC, 2017). The added cost of BDAs seems to be paying off in helping BHWC reach their other project goals.

Considering the successes of this project, and the above findings, using conservation corps to install low-technology sediment retention structures is a cost-effective way to approach
some projects stemming from erosion. These structures’ ability to reduce sedimentation of streams, while connecting streams back to their floodplain is worth the average $61 per structure to install, in my view.
REFERENCES

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Big Hole Watershed Committee (BHWC) (2017b) California Creek Riparian Restoration Project: Final Report


Montana Department of Environmental Quality (DEQ) (2009) Middle and Lower Big Hole Planning Area TMDLs and Water Quality Improvement Plan. M03-TMDL-02A. Helena, Montana:


Appendix: Figures and Tables

Figure 1 Map of Big Hole Watershed, star indicates project site (image taken from BHWC, 2017)

Figure 2 Map of study area and reaches. Each reach includes the gullies that flow into it (image taken from BHWC, 2017)
### Table 1 California Creek Sediment Source Load Allocations (DEQ, 2009)

<table>
<thead>
<tr>
<th>Sediment Sources</th>
<th>Current Estimated Load (Tons/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>10</td>
</tr>
<tr>
<td>Streambank Erosion</td>
<td></td>
</tr>
<tr>
<td>Riparian Grazing</td>
<td>535</td>
</tr>
<tr>
<td>Mining</td>
<td>78</td>
</tr>
<tr>
<td>Silviculture</td>
<td>10</td>
</tr>
<tr>
<td>Natural Sources</td>
<td>79</td>
</tr>
<tr>
<td>Upland Sediment Sources*</td>
<td></td>
</tr>
<tr>
<td>Grazing/Smelter Fallout vegetation toxicity</td>
<td>578</td>
</tr>
<tr>
<td>Natural Sources</td>
<td>38</td>
</tr>
<tr>
<td>Total Sediment Load/TMDL</td>
<td>1,328</td>
</tr>
</tbody>
</table>

* Upland loading from reduced vegetation due to Anaconda smelter fallout was difficult to break out on its own upland sediment category and is lumped with upland grazing sources.

### Table 2 Total number of structures, average tons of sediment trapped, and total tons of sediment trapped

<table>
<thead>
<tr>
<th>Structure Type</th>
<th>Number of Structures</th>
<th>Average Tons of Sediment Trapped</th>
<th>Total Tons Trapped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rill Treatments (SSR-2a)</td>
<td>64</td>
<td>0.56</td>
<td>59.6</td>
</tr>
<tr>
<td>BDA (SSR-2b)</td>
<td>332</td>
<td>0.22</td>
<td>225.3</td>
</tr>
<tr>
<td>Slash Filters (SSR-2c)</td>
<td>24</td>
<td>3.51</td>
<td>44.3</td>
</tr>
<tr>
<td>Check Dams (SSR-2d)</td>
<td>160</td>
<td>1.84</td>
<td>197.8</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>580</td>
<td>2.02</td>
<td>527.0</td>
</tr>
</tbody>
</table>

### Table 3 Cost-effectiveness of Watershed Consulting crew compared to MCC crew, and cost-effectiveness of BDA installation

<table>
<thead>
<tr>
<th>Crew</th>
<th># of structures</th>
<th>Total tons sediment trapped</th>
<th>Total cost</th>
<th>Cost per structure</th>
<th>Cost per ton of sediment trapped</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>22</td>
<td>44</td>
<td>$5,076</td>
<td>$230</td>
<td>$114</td>
</tr>
<tr>
<td>MCC</td>
<td>177</td>
<td>358</td>
<td>$19,606</td>
<td>$111</td>
<td>$55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>199</strong></td>
<td><strong>402</strong></td>
<td><strong>$24,682</strong></td>
<td><strong>$124</strong></td>
<td><strong>$61</strong></td>
</tr>
<tr>
<td>WC (BDAs)</td>
<td>200</td>
<td>44</td>
<td>$12,995</td>
<td>$65</td>
<td>$295</td>
</tr>
</tbody>
</table>
Part Two

Montana’s Exempt Wells Controversy: Analysis and Recommendations for Solution
Montana’s Exempt Wells Controversy: Analysis and Recommendations for Solution

Lindsay Wancour

Portfolio Component

Environmental Studies Department, University of Montana

11/17/2017
Abstract

Water wells that draw less than 35 gallons per minute are exempt from the Montana Department of Resource and Conservation’s permitting process and corresponding impact analysis. Developers have been using these wells to build many homes in Montana in recent history, while senior water users are defenseless to protect their water rights. These exempt wells have been a highly contentious issue in Montana with rule changes, two court cases, and an abundance of legislation addressing them in just the past decade. As a student of watershed health, I have a strong interest in furthering my understanding of legislation that can impact watersheds. Through listening to recordings of legislative hearings, interviewing experts, and reading news coverage, agency documents, court cases, and legislative histories, I developed a deeper understanding of exempt wells in Montana. This paper delves into exempt well history, then goes on to explain pertinent legislation in the 2017 legislative session. The primary bill I focus on, HB 339, has been pitched as a compromise bill between agriculture and development. I dig deeper into the compromises made in the drafting of this bill and what that means for the future of water rights in Montana. I conclude that the 2017 legislation is rooted in fear of a future without Governor Bullock to consistently protect senior water users, leading stakeholders to make compromises to codify exempt wells into law.
Introduction to Montana’s Exempt Wells Controversy

Montana, a state caught between tradition and sprawling development, is destined to have controversy surrounding its use of natural resources. Water usage is arguably one of the most contentious issues facing Montana. According to a 1993 rule enacted by the Department of Natural Resources and Conservation (DNRC) under the Montana Water Use Act, wells that draw less than 35 gallons per minute (gpm), or 10 acre-feet per year, are not required to have a permit (or the associated impact analysis); these are called exempt wells (Howell, 2016). Since the introduction of exempt wells, developers have been building subdivisions without needing to obtain water permits by using this loophole. The DNRC estimates there are now 113,000 exempt wells in Montana, and it is projected that by 2020 there could be an additional 78,000 wells (Howell, 2016). Three out of every four new homes built in Montana in the past decade installed an exempt well (Clark Fork Coalition, 2017). With increasing threats of drought and development, these exempt wells are gaining more attention out of concern that senior water right users will be impacted. Reviewing the legislative history of the past decade, there have been around twenty proposed bills to resolve the controversy surrounding exempt wells.

As a student of watershed health, I have a strong interest in legislation that could impact the health of Montana’s most valuable resource. This has been a contentious issue since before I became a University of Montana student in 2015. The Environmental Studies program has afforded me the opportunity to delve deeper into the legislative complexities surrounding exempt wells. Further, as a student in the Natural Resource Conflict Resolution Program, I am interested in expanding my understanding of collaboration and how it applies to legislation.

I explored these interests through listening to legislative hearings, interviewing stakeholders and lobbyists, and reading news articles, court cases, legislative histories, and
agency documents. In the case of exempt wells, the DRNC developed policies to manage wells in Montana. There were several court cases that resulted from these policies, then legislation in response to the court cases. This paper is organized in that order. I begin with a history of policies relating to exempt wells. Then I go on to explore court cases in 2010, 2014, and 2016. After explaining this background in litigation, I explore some of the important legislation that was in the 2013 and 2015 legislative sessions. Finally, I dig into HB 339, the most prominent piece of exempt well legislation within the 65th Montana Legislature. Throughout the paper I strive to understand how stakeholders feel about legislation and why they feel the way they do. As HB 339 is marketed as a compromise bill, I continue with an analysis of the compromises made and work to predict what that means for the future of exempt well legislation. I conclude with my recommendations for exempt well legislation moving forward into the 2019 legislative session.

The intended audience for this research paper is the Montana Water Policy Interim Committee (WPIC). WPIC is a bipartisan committee of the Montana Legislature that has oversight of agencies that are involved with water quality and quantity. The members of WPIC begin to draft legislation pertaining to water issues in Montana the fall before legislative sessions. Further, I believe this paper would be beneficial for citizens interested in water issues in Montana; it could help build an information foundation for members of the community.

Montana Policies Related to Exempt Wells

An important component of the exempt well debate is the prior appropriations doctrine which protects the rights of senior water users; “First in time, first in right”. Senior water users are the individuals that hold the oldest water rights, and these water rights are treated reverentially in the West. The prior appropriations doctrine was first recognized in 1921 by the
Montana Supreme Court (WPIC, 2016). In 1972, Montana held a Constitutional Convention that identified the need for more regulation and record keeping. The Montana Legislature recognized and confirmed existing rights to water and was required to provide for “the administration, control, and regulation of water rights and a system of centralized records” (WPIC, 2016). The Montana Water Use Act of 1973 (the Act) was born from this constitutional convention with the intention of protecting senior water users. The Act spells out a legislative policy that is implemented by the Department of Natural Resource and Conservation. The Act created a revised permitting process for obtaining new water rights, a centralized records system, and it provided a system to reserve water to maintain water quality and provide for consumptive uses (DNRC, 2012). Water rights that existed prior to the Act were grandfathered into the system and are called pre-existing rights. In 1979, the Montana Supreme Court required that Montanans who believed they held pre-existing water rights officially claim them by 1982 to avoid forfeiture. (DNRC, 2014, p.7-8). However, it was determined that “existing water rights claims for livestock and domestic uses from instream flows or ground water sources were exempt from the requirement to file a claim” (DNRC, 2014, p. 8). This phrase begins to drive exempt well legislation in Montana.

The next major development in exempt well legislation was the introduction of the phrase “combined appropriation.” In 1987, the legislature amended 85-2-306, Montana Code Annotated (MCA) to state that if a combined appropriation exceeded the limit of 100 gallons per minute, the appropriation would need a permit (Bishop, 2014; Geer, 2016). Combined appropriation has become the crux of the dispute surrounding exempt wells. In 1987, the DNRC issued Administrative Rule of Montana (ARM) 36.12.101(7), which stated “groundwater developments need not be physically connected nor have a common distribution system to be considered a
combined appropriation.” It went on to say that wells were a combined appropriation if they were used for a single project or development (Clark Fork Coalition et al. v. Tubbs et al., 2016). The definition of combined appropriation is not in legislative law, it is defined through administrative rules (WPIC, 2012 p.2). DNRC has changed its rules defining combined appropriation on multiple occasions. “Within a period of six years, the DNRC promulgated consecutive rules with conflicting interpretations as to whether groundwater developments must be physically connected to constitute a ‘combined appropriation.’” (Clark Fork Coalition et al. v Tubbs et al., 2016). This distinction between wells needing to be physically connected or not is crucial to understanding the exempt well battle. If the wells need to be physically connected to one another, then developers are able to build subdivisions with a multitude of exempt wells without needing a permit or impact analysis. However, if wells do not need to be connected to be considered a combined appropriation (thus needing to acquire a permit), senior water users are better protected from development’s use. The permitting process includes an impact analysis that looks at how senior water users would be impacted by additional water withdrawals.

In response to new legislation requested by the DNRC in 1991, the 1987 rule was amended to include the volume limitations of 35 gpm and 10 acre-feet per year (Kolman, 2010 p.5). This legislation was requested due to concern that the 100 gpm exemption was being abused by irrigators and subdivision developments (Kolman, 2010, p.5). Thirty-five gallons per minute is still a substantial amount of water, as the average household uses 50-100 gallons of water per person per day (WPIC, 2007 and Penn State Extension, 2017). In 1993, the DNRC created ARM 36.12.101(13), stating that combined appropriations had to be physically manifold into the same system (Clark Fork Coalition et al. v. Tubbs et al., 2016). The contention surrounding combined appropriation deals with whether the definition requires the exempt wells
to be physically connected or not. If the definition of combined appropriation requires wells to be physically connected to one another, then it is easier for developers to take advantage of exempt wells. Developers can build subdivisions with many individual wells that are not connected to one another. Despite being part of one development, since they are not physically connected, the wells do not require permits. However, collectively they can draw a significant amount of water. In just two years, the understanding of exempt wells had drastically changed; the volume allowed was severely diminished, but the definition of combined appropriation opened a world of opportunity for exploitation by requiring a physical connection between wells.

**Court Cases Addressing Exempt Wells**

There has been much litigation surrounding exempt wells. In 2009, the Clark Fork Coalition (CFC) along with senior water rights users filed a petition to the DNRC requesting the 1993 ruling be amended to better protect senior water users. The DNRC determined that the 1993 rule was consistent with the Water Use Act (Geer, 2016). In 2010, the CFC sued the DNRC arguing that the 1993 rule is inconsistent with the legislative intent and underlying purpose of the Act, and threatens senior water rights (Bishop, 2010). The case was *Clark Fork Coalition et al. v. Tubbs et al.* The Clark Fork Coalition, along with senior water right users, sued John E. Tubbs, as director of the DNRC, the DNRC, Montana Well Drillers Associations, MT Association of Realtors, MT Building Industry Association, and Mountain Water Company (Clark Fork Coalition et al. v. Tubbs et al., 2016). The defendants were made up of advocates for development. Since environmental groups typically do not have a huge interest in senior water rights, I speculate the CFC became involved to keep Montana streams healthier by keeping more water in the ground and protecting hydrologically interconnected ground and surface water systems. The best way to do this was to use the prior appropriations doctrine in their favor. The
plaintiff’s main argument was that the current definition of combined appropriation as found in ARM 36.12.101(13), was inconsistent with the Water Use Act because the statute initially did not require a physical connection to be considered a combined appropriation (Clark Fork Coalition et al. v. Tubbs et al., 2016). This lawsuit was settled with the requirement that the DNRC would amend the 1993 rule. The DNRC made several attempts to amend the rule, but by 2014 the rule still had not officially changed (WWC, 2015). This led to the CFC petitioning for a judicial review (WWC, 2015). The Montana First Judicial Court sided with CFC, invalidating the 1993 rule, ARM 36.12.101(13), which states "Combined appropriation means an appropriation of water from the same source aquifer by two or more groundwater developments that are physically manifold into the same system.” (Justia, 2017). The court agreed that the 1993 rule did not protect senior water rights, as the Montana Water Use Act had intended. The court went on to reinstate the 1987 rule, ARM 36.12.101(7); “groundwater developments need not be physically connected” to be considered a combined appropriation. Additionally, the court ordered DNRC to develop a new administrative rule that was consistent with the court’s ruling (Clark Fork Coalition et al. v. Tubbs et al., 2016).

The Montana Well Drillers Association, the Montana Association of Realtors, and the Montana Building Industry Association went on to appeal the district court’s ruling in Clark Fork Coalition v. The Montana Well Drillers Association. The DNRC and John E. Tubbs were no longer involved in the litigation. This case was heard by the Montana Supreme Court in 2016. The court’s goal was to determine if the district court acted correctly in invalidating the 1993 rule, reinstating the 1987 rule, and ordering the DNRC to develop a new rule. The Montana Supreme Court agreed that the 1993 administrative rule did not align with the Montana Water Use Act’s original intention to protect senior water users. By a vote of 6 to 1, the Court upheld
the district’s ruling to invalidate the 1993 rule and reinstate the 1987 rule (Howell, 2016). However, the court determined that it was up to the DNRC whether to initiate rulemaking or to amend the reinstated 1987 rule (Justia, 2017). This litigation acted as a catalyst for legislators to develop comprehensive legislation regarding exempt wells in the recent legislative sessions. It has since been a mad scramble to codify a definition of combined appropriation and/or requirements for exempt wells into law so that they are not at the mercy of DNRC rule changes any longer.

**Past Legislation: 2007-2015**

Exempt wells became a prominent legislative issue around 2007. I was unable to find information of what prompted the 2007 legislation. However, in 2008, the Western States Water Council published a report that stated, “while the impact of an individual exempt well on water resources may be negligible, the aggregate impacts of many exempt wells can be significant” (Kolman, 2010). In addition to the 2008 report, the 2010 court case, and the 2016 Montana Supreme Court decision fueled more discussion and legislation pertaining to exempt wells. Since then, there have been approximately twenty drafted bills regarding exempt wells (see Appendix A). Three of these bills have attempted to solidify a definition of combined appropriation. Eleven of the bills have titles broadly referring to revising exempt well laws. Since the DNRC has created multiple rule changes defining combined appropriation, legislators have been trying to codify a definition into the Montana Code Annotated to minimize further contention. The following section examines three specific bills from 2013 and 2015: SB 019, HB 168, and HB 519.

In 2013, the 63rd Montana Legislature passed Senator Bradley Hamlett’s (D-SD15) SB019. Senate Bill 019 was requested by the Montana Legislature’s Water Policy Interim
Committee (WPIC). This bill was drafted and introduced during the time that the DNRC was supposed to be amending the 1993 definition of combined appropriation. Hamlett served in the Montana Legislature from 2008-2016. He is a fifth-generation rancher and a senior water user (Wrangler Gallery, 2017). His family has water rights dating back to 1865, so exempt wells are a personal issue for Hamlett (Wrangler Gallery, 2017). I find Hamlett to be an interesting choice as sponsor of this bill. I believe that choosing a Democrat with senior water rights may have been a strategy to garner bipartisan support. The short title of SB 019 is “Define Combined Appropriation of Wells.” SB019 defined combined appropriation as “an appropriation of water from the same source aquifer by two or more wells or developed springs that are physically connected into the same system.” This definition uses the same requirement for a physical connection that CFC was in the midst of fighting in court. However, it changed the definition of a developed spring; “‘Developed spring’ means any artificial opening or excavation in the ground at a point where water emerges naturally...” previously, the definition was “…opening or excavation in the ground, however made…” (emphasis added). By changing the phrase “however made” to requiring a natural emergence, the new definition of developed spring narrowed the circumstances under which a combined appropriation would apply.

The proponents who spoke at the House Committee on Natural Resources hearing included representatives from the Montana Building Industry Association (MBIA), Frontier Builders, Bridger Drilling, Montana Water Well Drillers Association (MWWDA), Hayes Drilling Inc., Montana Association of Realtors (MAR), Montana Association of Counties (MACo), and ranchers. It is important to note the abundance of developers and drillers in this group. Developers consistently support legislation using the 1993 definition of combined appropriation that requires a physical connection between wells. The opponents that spoke at the
same hearing represented the Senior Water Rights Coalition (SWRC), Association of Gallatin Agricultural Irrigators (AGAI), Clark Fork Coalition (CFC), Montana Stock Growers Association (MSGA), Montana Farm Bureau Federation (MFBF), Montana Trout Unlimited (MTU), Montana Farmer’s Union (MFU), Fish, Wildlife and Parks (FWP), Northern Plains Resource Council (NPRC), and the DNRC. This group was primarily made up of farmers and environmentalists. The opponents vehemently opposed the definition of combined appropriation used. Agriculture stakeholders often have great overlap with senior water users. The more accessible exempt wells are to developers, the greater the chances of senior water users being negatively impacted. The bill was passed through the Senate with a vote of 32-17 and passed through the House of Representatives with a vote of 54-45. Governor Bullock, a staunch advocate for senior water users, vetoed the bill due to the lack of protection for senior water users. In his veto letter, he discussed the need for agricultural senior water right users to have power to protect their rights from developers.

In 2015, the 64th Montana Legislature passed HB168; it was sponsored and requested by Representative Steve Fitzpatrick (R-HD20). The short title of this bill is “Define combined appropriations for exempt wells in some cases.” The proponents of this bill that spoke at the House Committee on Natural Resources represented the DNRC, Montana Building Industries Association (MBIA), MAR, SWRC, AGAI, Montana Bankers Association, Montana Independent Bankers, Montana Water Resources Association (MWRA), MTU, MWWDA, MFU, and small business owners. Groups that are typically divided over how to handle legislation dealing with exempt wells were on the same side for this bill (see Appendix B). The DNRC, MTU, SWRC, and MFU all testified as proponents. No opponents testified at the hearing. This bill was drafted in response to Clark Fork Coalition et al. v Tubbs et al. This bill
grandfathered in all wells that already existed prior to the court’s decision. HB168 states that “the definition of combined appropriation as an appropriation of water from the same source aquifer by two or more ground water developments that are physically manifold into the same system applies retroactively to any project, development, or subdivision in existence on or before October 17, 2014.” HB 168 retroactively protected exempt wells that existed prior to the district court issuing its ruling that invalidated the 1993 definition of exempt wells. HB168 was passed into law with sweeping success. The House voted 97-2 in favor and the Senate voted 50-0. The bipartisan support of this bill shows that legislators are not trying to take exempt wells away from anyone; they simply want better protection for senior water users in the future. Governor Bullock signed HB 168 into law April 10, 2015.

Representative Carl Glimm’s (R-HD6) first attempt at passing an exempt well law was HB519 in 2015. He was both the sponsor and requestor. HB519, “Generally Revise Exempt Well Laws,” sought to reduce the volume limit of exempt wells and determine enforcement measures for violations of laws relating to exempt wells. The volume limit of 10 acre-feet per year was reduced to 7.5 acre-feet per year per 20 acres (0.375 acre-foot per year for each acre over 20 acres) while maintaining the 35 gallons per minute limit. It is important to remember that 35gpm is more water than most wells will ever draw. These new volume limitations would do little to minimize the negative impacts on senior water users suggested in the 2008 report. This bill responded to the false assumption that the Clark Fork Coalition’s 2010 lawsuit was about water volume.¹ In reality, the lawsuit had been about needing to protect senior water users. The bill further requested more information be provided during subdivision reviews. This bill never uses the phrase “combined appropriation,” the crux of the exempt well contention. However, it states

¹ This was expressed as a false assumption during oral testimony at the House Committee on Natural Resources hearing on HB 339

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that for wells to be exempt from permitting, “More than one appropriation may not be physically connected if the total volume will exceed 7.5 acre-feet a year.” During the House Committee on Natural Resources hearing, the proponents included representatives from MBIA, MAR, Builders, Trade Representatives, Helena Homebuilders, Sand and Gravel Business, General Contractors, Montana Association of Registered Land Surveyors, and American Council of Engineering Companies of Montana. Again, these proponents, largely developers and well drillers, support legislation that allows them to continue functioning as they had prior to the lawsuit. As the volume limitations would do virtually nothing, and would be incredibly challenging to monitor, this would essentially negate the court ruling. The opponents were largely the same organizations represented in opposition to SB019 in 2013: CFC, SRWRC, AGAI, MTU, MSGA, MFBF, MFU, MWRA and DNRC. Mountain Water Company (a defendant in the 2014 court case), Montana League of Cities and Towns (MLCT), Montana Smart Growth were added to the list of represented opponents. It passed the House with a vote of 67-33 but died in the Senate Natural Resource Committee.

**Related Bills: 2017**

The main bill this legislative session I will focus on is Representative Glimm’s (R-HD6) second attempt at an exempt well law, HB339, “Revise laws related to exempt appropriations of water use.” Carl Glimm is a Republican representative based out of Kila, Montana. He is a general contractor and board member of the Flathead Building Association and is involved with the Montana’s Building Industry Association (Glimm, 2010). His interest in exempt well legislation, and his selection of bills he has sponsored makes sense considering his career as a general contractor.
House Bill 339 was drafted in response to the Supreme Court ruling in 2016. The purpose of the bill was to put an end to the ongoing debate surrounding exempt wells and codify a definition for combined appropriation, something all previous legislation failed to do. HB339 is a bill that tries to solve the issue of exempt wells from a density standpoint (HB339c, Revise Laws, Feb 1, 2017). Again, this is a grave mistake that HB 519 made in assuming the court cases were about anything other than protecting senior water users. One way HB 339 handles the perceived density issue is by differentiating between open and closed basins. Closed basins are basins with no more water to be appropriated; all the water is spoken for by pre-existing water right users. In closed basins, exempt wells must be at least 660’ apart, in open basins, they must be 330’ apart. As these are exempt wells, it is unclear how these spacing regulations would be enforced. After speaking with the DNRC’s Water Resources Regional Office in Missoula, I am still unsure how HB339 intended to regulate the spacing limitations. HB 339 also defines combined appropriation as "an appropriation of water from the same source aquifer by two or more ground water developments that are physically manifold into the same system.” This is the definition in DNRC’s 1993 rule (ARM 36.101.12 (13)) that was invalidated by the district court’s ruling, as upheld by the Montana Supreme Court. Again, ARM 36.101.12(13) stated that in order to be a combined appropriation, wells must be physically manifold into the same system. This definition allows development to punch wells into the ground, unconnected to one another, and evade the permitting process, causing potential harm to senior water users. Without the impact analysis that is done during the permitting process, there is no way of knowing how these wells could impact other water users. With a surplus of exempt wells, it is unknown how much water is being drawn at any time, and the consequences that could have on senior water users. During the House Committee on Natural Resources hearing, the proponents were representatives
of MAR, MBIA, MACo, MWWDA, SWRC, AGAI, MFBF, MWRA, MSGA, MFU, Montana Mining Association (MMA), and Montana Cattle Women (MCW). This grouping of proponents reveals an interesting turn of events. It is the first time in exempt well legislative history (except for HB 168, which everyone supported) that agriculture and development are on the same side. This will be discussed in greater detail below. The opponents represented CFC, Montana Association of Planners, MLCT, MTU, NPRC, Montana Environmental Information Center (MEIC), and Montana Audubon. While some of the proponents (SWRC, MWRA, AGAI) of the bill worked with groups they formerly were opposed to on other exempt well revision bills, no conservation groups supported this bill.

Proponents of the bill argue that everybody wants exempt wells. The issue people have is with density; HB339 claims to have found a simple solution by adding the spacing rules (HB339d, Revise Laws, Feb 1, 2017). During the House Committee on Natural Resource meeting, Abigail St. Lawrence from the Montana Association of Realtors states that nobody being in love with the bill is evidence of a great compromise (HB339d, Revise Laws, Feb 1, 2017). Proponents are proud of the distinction made between open and closed basins in HB 339.\(^2\) With the 1993 rule, 20 houses could be built on 40 acres of land, each using its own well. With the current rules in place resulting from the court ruling, that number drops down to 4 houses. The spacing language of HB339 allows for approximately 8 houses in a closed basin, and 17 houses in open basins on a 40-acre piece of land (HB339e, Revise Laws, Feb 1, 2017). This decrease in number was a compromise for well drillers, but they believe it is a workable solution.

\(^2\) This opinion was expressed during oral testimony at the House Committee on Natural Resources hearing on HB 339.
to keep their clients (homebuilders and stockgrowers, primarily) happy (HB339e, Revise Laws, Feb 1, 2017).

However, opponents feel as though their recommendations to create a compromise bill were ignored. To them, HB339 gives preference to developers and there is no science behind the distances allowed between wells. They view the spacing distances as arbitrary and not based on scientific hydrology. They argue that the original court case was not about density, it was about protecting existing water users (HB339a, Revise Laws, Feb 1, 2017). If existing users become harmed by these exempt wells, HB 339 has no recourse in place to handle such situations (HB339a, Revise Laws, Feb 1, 2017). Perhaps one of the strongest arguments the opponents have is that this bill is incompatible with the Supreme Court’s decision on the importance of protect existing water users (HB339a, Revise Laws, Feb 1, 2017). Passing HB 339 would likely spark more litigation surrounding the definition of combined appropriation. Opponents hoped they would be able to get a veto from the governor due to the lack of support from conservation groups (HB339b, Revise Laws, Feb 1, 2017).

While HB 339 was being debated in the House, Representative Zach Brown (D) HD63, proposed an amendment to change MCA 85-2-380 to make it easier for stream depletion zones to be established. A stream depletion zone is an area adjacent to a stream in which wells can serve to reduce stream flow. There is one permanent established stream depletion zone in Montana, Rye Creek, a tributary of the Bitterroot River (DNRC, 2017). In a stream depletion zone, exempt wells are limited to 20gpm and a maximum annual withdrawal of 2 acre-feet (DNRC, 2013). Rep. Brown’s amendment failed 42-58.

HB 339 made its way through the Montana State Legislature with ease due to the Republican majority willingness to support it. On February 8th, the bill was passed by the House
Committee on Natural Resources with an 8-7 vote. On February 18th, it was passed by the House 62-38. This was largely a partisan vote: only three Democrats voted in favor of HB 339, while three Republicans voted to oppose it. This party line voting strengthened as HB 339 worked its way through the Senate. The Senate Committee on Natural Resources passed HB 339 7-5 on April 7th. The Senate floor vote was completely along party lines April 11th, with all 32 Republican votes in favor, and all 18 Democrats in opposition. During this time, conservation groups were focusing their efforts on gaining enough opposition to show Governor Bullock that a veto would be sustained (Ullman, 2017). Lobbyists from Montana Conservation Voters and AGAI agreed that the fate of this bill was always going to be in the hands of the Governor; nobody expected any hiccups getting it passed through the chambers (Evans, 2017; Ullman, 2017).

Compromises in 2017 Legislature

A large reason why there was such confidence in HB 339 getting through the chambers is because of the Republican majority and the stakeholder composition. Having agriculture and development on the same side of an exempt well bill instantly garners additional support. In this section I will explore how these stakeholders came to join forces. House Bill 339 is a great bill to study to understand the compromises that go on in legislature. It allows a look into the long-game many legislators, lobbyists, and stakeholders are engaged in. In this section, I will examine two such deals that were attempted to be made this session. The first is delving deeper into what went on in the drafting of HB 339, and the second is understanding how the Republican majority used an infrastructure bill, HB 645, as leverage to get HB 339 passed. I interviewed Chelcie Cargill, a lobbyist for Montana Farm Bureau Federation (MFBF), Krista Lee Evans, a lobbyist for the Senior Water Rights Coalition (SWRC) and Association of Gallatin Agricultural
Irrigators (AGAI), and Neal Ullman from Montana Conservation Voters (MCV). Cargill and Evans both spoke at the hearing before the House Natural Resource Committee as proponents for HB 339. Montana Conservation Voters opposed HB 339, but did not testify at the hearing.

As stated above, during the hearing before the House Natural Resources Committee Abigail St. Lawrence claimed that nobody loving the bill was a sign of a good compromise bill. Through interviews with agriculture lobbyists, I was able to understand the compromises she was talking about a little better. This was the first exempt well bill that both agriculture groups and development were on the same side. This union certainly helped legislators feel confident voting in favor of HB 339, since they did not have to choose between development and senior water users (Evans, 2017). The proponents of HB 339 began meeting in October of 2016 bi-weekly to draft this bill (Cargill, 2017). It was an exercise in trust building with the goal of finally codifying a law pertaining to exempt wells.

I had been curious about the compromises involved in HB 339 from early on. However, after talking with Chelcie Cargill, I was left more confused, and certain there was a bigger picture to be painted. During our conversation, SB 019, Brad Hamlett’s bill from 2013, was mentioned, and she talked about how vehemently agriculture groups opposed it due to its definition of combined appropriation. It is worth remembering here that SB 019 used the same definition of combined appropriation that HB 339 was currently using; however SB 019 changed the definition of ‘developed spring’ to expand the overall application of combined appropriation. What this means, is that the definition used in SB 019 in 2013 is in fact more beneficial to agriculture groups than the definition used in HB 339. Yet, MFBF was a proponent of HB 339. What Cargill told me was that the greatest “give” that agriculture groups had in the compromise was the definition of HB 339 that required a physical connection between wells to be considered
a combined appropriation. She said the best thing they gained in the compromise was spatially
limiting development. The pieces were not fitting together for me. The 2016 court case ruled in
favor of agriculture groups like MFBF; they already had won their definition of combined
appropriation. Further, as mentioned above, with the 2016 ruling, development was limited to
four wells per forty acres; by passing HB 339 development was benefitting from the spatial
limitations.

When we got off the phone I was dumb-founded. I know that the lobbyists in Helena are
intelligent people, but I could not figure out why they would be making, what seemed to be, an
uninformed compromise. Throughout all my reading I could not find any reason that agriculture
would feel compelled to come to the table with development. What had changed between 2013’s
vehement opposition to SB 019, and today’s sacrificial support of HB 339?

An anonymous interviewee did well to articulate exempt well history from an agriculture
standpoint: currently, with the 2016 ruling, agriculture has the best-case scenario. They have the
perfect definition of combined appropriation, and development is limited. The 1993 rule is the
worst-case scenario for agriculture; development was thriving under this rule, and agriculture
had no protection. HB 339 is somewhere in the middle of these two situations. This interview
confirmed my understanding, and then it blew the lid off the whole situation.

In 2013 Governor Bullock was newly elected and openly supportive of protecting senior
water users. This, paired with the CFC court case, was a boost of confidence for agriculture
groups. They had the freedom to staunchly oppose bills they did not like because they had strong
support on the second floor of the Capitol Building. Now, in 2017, there is still no law codifying
exempt well regulations, and stakeholders are beginning to plan for 2020 when a new governor is
elected. An anonymous interviewee explained to me that Greg Gianforte (Bullock’s Republican
opposition in 2016), could very well be elected Governor in 2020, or Republican Attorney
General Tim Fox. Gianforte, at least, has openly stated that he believes the prior appropriations
doctrine is an outdated concept (this was disclosed during the same interview). If he, or another
far-right Republican, were elected, the fate of exempt wells will be in their hands and senior
water users could be all but forgotten. Currently, Governor Bullock is hugely supportive of
protecting senior water users, so it is in the best interest of agriculture to work with development,
make some sacrifices, and get a law passed under this administration that would be harder to
amend in the future.

I next wondered what the proponents did to garner the conservation groups’ support.
Krista Lee Evans informed me that the conservation groups were invited to the table; however
CFC, having just won a major court case, did not want to participate in negotiating. Montana
Trout Unlimited, however, said they would support HB 339 if statewide stream depletion zones
were created. This suggestion was not put in the bill, thus losing any chance of support from
conservation groups. As a student in the Natural Resource Conflict Resolution program, it has
been drilled into my head, time and time again, that you cannot proceed with a collaborative
process unless all stakeholders are at the table. In this situation, everyone was not present, and
the environmental groups expended many resources trying to stop HB 339.

Another component of the collaborative process that was neglected was the importance of
building trust. An anonymous interviewee informed me that all the proponents of HB 339 agreed
not to support any other exempt well legislation in 2017. By consolidating their efforts, they
would be able to stand as a united front. However, the well drillers chose to publicly support SB
248, a bill that allowed exempt wells to be drilled with family land transfers. This public support
damaged the relationships built during the drafting of HB 339.
The Republicans last chance at convincing Governor Bullock to sign HB 339 was through leveraging an $80 million infrastructure bill, HB 645. This bill would help with general infrastructure problems in Montana, such as repairing the Russell Street bridge. The Republican majority offered to pass the infrastructure bill in exchange for Governor Bullock signing HB 339, along with two other bills (one regarding charter schools, and one regarding abortion) (Ullman, 2017.) April 28th, HB 645 died in process. At that time, HB 339 was sitting on Governor Bullock’s desk, waiting to be signed or vetoed. The death of HB 645 tipped stakeholders off to the fact that Bullock would be likely to veto HB 339.

**HB 339’s Current Status**

On May 11th, Governor Bullock vetoed HB 339. In his veto letter, he stated “‘First in time, first in right’ is a bedrock principle of water law, but any right is only as good as one’s ability to protect it.” He went on to say that it is imperative to strike a balance between development of exempt wells and protection of senior water users, and that HB 339 fails to do so. While HB 339 has been put to bed, unfortunately, the dispute surrounding exempt wells will continue.

**Conclusion**

With the 2008 Western Water Council report drawing attention to the potential impacts of exempt wells on senior water users, the past decade has been inundated with exempt well legislation, regulation change, and litigation. Exempt wells pose a grave threat to senior water users by potentially depleting groundwater, leaving them high and dry.

Throughout this report, I focused on the actions that were most influential to understanding today’s policy battle. While gaining a deeper understanding of the bills mentioned throughout the legislative history, it is worth noting that I was not able to find audio for all the
hearings. This created a challenge in identifying why opponents and proponents felt the way they did about bills in previous years. Regardless, it was valuable to see which groups were on which side of bills. It was indicative of the nature of the bills. It also could be used to gauge how strong of a compromise a bill was (Appendix B). Thankfully, many of the gaps created by my readings were filled through the helpful interviews of lobbyists in Helena.

**Recommendations**

Following my new understanding of the competing interests and power politics of exempt wells, and the fear stakeholders hold for the future, I believe it would be in the best interest of all parties to have a formalized collaborative process. There were many missteps taken during the interim. All stakeholders were not part of the conversation, and adequate trust was not built. Moving forward, it would be worth the Water Policy Interim Committees time and energy to hire a professional facilitator to help develop a truly collaborative bill. By 2019 I believe that all stakeholders will understand the mounting pressure to codify a law before Governor Bullock leaves Helena, and will hopefully be interested in cooperating to work towards the common interests of all. Abigail St Lawrence stated that it was a sign of a good compromise because nobody loved it; good collaborative processes are about creating win-win situations for stakeholders involved.

Considering the major concerns with development exploiting the exempt well loophole, I further believe it would be wise to consider pairing land-use permits with water-use permits. While I do not know the specifics of land-use permitting, it seems as though it would a logical step in mitigating exploitation of resources in the name of development.

The history of exempt wells is incredibly complex. It has been a controversial issue since the legislature introduced “combined appropriation” in 1987. However, with cross-aisle
collaboration and patience, the legislature is on track to finding a solution to the controversy. HB 339 is a stepping stone towards a true collaborative bill. I believe there are many lessons to be harvested from the successes and ultimate failure of HB 339 this session. By learning from the mistakes made in collaboration and improving the collaborative process, I believe that in 2019 stakeholders and legislators will be able to finally codify an exempt well law.
References:


Cargill, Chelcie (Director of State Affairs at Montana Farm Bureau Federation), Interviewed by Lindsay Wancour and Naomi Neal by phone. April 24, 2017


Department of Natural Resource and Conservation (2012). Water rights in Montana. (retrieved 2017). Montana, USA:

Department of Natural Resource and Conservation (2013). Petition to Create a Stream Depletion Zone Form No. 652


Evans, K. L (Lobbyist, Senior Water Rights Coalition) Interviewed by Lindsay Wancour and Naomi Neal by phone May 4, 2017


HB339d: Revise laws related to exempt appropriations of water: Hearing before House Natural Resources Committee. 65th Session of the Montana Legislature (2017, Feb. 1) (Testimony of Abigail St Lawrence 9:30)


Ullman, Neal (Program Director, Montana Conservation Voters) Interviewed by Lindsay Wancour by phone March 10, 2017

Water Policy Interim Committee (WPIC) (2012). *The Exemption: To change or not to change?* (2017). Montana, USA.


Appendix A: Past legislation regarding exempt wells

<table>
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<tr>
<th>Bill Number</th>
<th>Sponsor</th>
<th>Progress Made</th>
<th>Date</th>
<th>Short Title</th>
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<td><strong>2015</strong></td>
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<tr>
<td>HB 168</td>
<td>Steve Fitzpatrick (R) HD 20</td>
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<td>Define combined appropriation for exempt wells in certain cases</td>
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<td>4/28/2015</td>
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<td>SB 37</td>
<td>Jennifer Fielder (R) SD 7</td>
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<td>4/24/2015</td>
<td>Revise laws for filing of exempt water right claims</td>
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<td>Bradley Hamlett (D) SD 15</td>
<td>(S) Missed Deadline for General Bill Transmittal*</td>
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<td>SB 19</td>
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<td>SB 38</td>
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<td>HB 602</td>
<td>Walter McNutt (R) HD 37</td>
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<td>Require interim study of exempt water wells</td>
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### 2009

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<td><strong>LC2077</strong></td>
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<td>Limit exempt wells in high growth counties</td>
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### Appendix B: Hearing Breakdown by Organization

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</table>

*Figure 1. Plus signs mean organization was proponent of bill, minus sign indicates opposition. Grey shading indicates group is a conservation group.*
To: Senator Chas Vincent  
From: Lindsay Wancour, University of Montana Masters Candidate and Natural Resource Conflict Resolution Certificate Candidate  
Date: May 12, 2017  
Subject: Proper utilization of collaborative processes in exempt well legislation  

This memo is in response to the collaborative efforts put forth by the Montana Water Policy Interim Committee in drafting House Bill 339, considered in the 2017 legislative session. The purpose of this memo is to advise WPIC on adjustments that should be made to enhance the collaborative process for future legislative sessions. Through my graduate studies in collaborative processes at the University of Montana, as well as research on exempt wells and a policy analysis of HB339, I have developed a knowledge base to analyze the collaborative processes present during the legislative interim session. With this analysis, I propose four recommendations to improve and formalize the 2019 legislative session’s collaborative efforts.  

1) Hire a professional facilitator; 2) Identify all stakeholders; 3) Improve trust building; 4) Use joint fact finding.

The Problem:  
Exempt wells have been a prominent issue in the Montana legislature for the past decade. During this time, there have been multiple court cases litigating exempt wells, and around 20 proposed bills regarding exempt wells. It has been a highly contentious issue with no amicable solution. House Bill 339 attempted to bring stakeholders together to compromise in finding a solution, but, due to flaws in their collaboration, the bill was not successful in being codified into law. Since it seems to be a universal belief that Montana needs exempt wells, it is important to find a way that Montana can have exempt wells, development, and protection for senior water users.

Policy Recommendations:  
1) Hire a professional facilitator to mediate meetings  
Hiring a professional facilitator will ensure the meetings run smoothly and that proper steps in a collaborative process are taken. A facilitator can help the group establish goals and mediate the development of ground rules. Ground rules are a crucial component of collaborative process that are often overlooked. These rules can define the roles and responsibilities of participants and determine how decisions will be made. Through the help of a facilitator, the group will be able to identify whether they want true consensus, or if partial is adequate. Considering the contentious history of exempt wells and hardened opinions of stakeholders, a facilitator will be critical in maintaining peaceful, progressive conversations. Further, a facilitator can mediate the whole process and make sure the following three recommendations are properly implemented.

2) Make sure all stakeholders are at the table  
A major pitfall of HB 339 was that all stakeholders impacted by exempt well legislation were not involved in the collaborative process. Exempt wells are contentious because of the vast array of people impacted by them. When identifying which participants should be involved, the group needs to identify the people and organizations affected by and interested in the issue, any agencies needed to implement the outcome (DNRC), and most importantly, considering the fate of HB 339, any people or organizations that might
undermine the process if not included. Had the conservation groups been engaged in the process from early on, they might not have expended resources encouraging a veto.

3) **Improve trust building among stakeholders**
Without adequate trust amongst collaborators, there can be no success. By the end of the 2017 legislative session, the relationships that had developed since October 2016 had largely deteriorated due to a breach of trust when the well drillers supported SB 248. Collaborative processes take a long time, and building trust is arguably the most time-consuming component. Hopefully some of the relationship-building that happened between October and April can be salvaged and built upon for future sessions. Exempt wells create an isolated intersection between agriculture and development. This is beneficial because there is only one topic that they need to agree upon, however, it is troubling because if they don’t agree on this issue – there is no incentive to get them to work together for the sake of maintaining positive relations for other issues. As HB 339 was the first bill that agriculture and development worked together on, it can be viewed as a first-step in trust building among stakeholders.

4) **Develop a plan for joint fact-finding**
There is miscommunication amongst stakeholders regarding what gaps need to be filled in addressing exempt well legislation. Development claims density was the cause of *Clark Fork Coalition vs. Montana Well Drillers Association*, while conservationists claim it is about protecting senior water users. The first step in joint fact-finding is that stakeholders need to agree on what the problem is, then what information is missing. The group can then develop a plan to find information to fill that gap. An option for this could be jointly funding hydrologic studies to better understand the impacts of wells in different basins, then establishing rules according to basin.

By following these four recommendations, I feel confident that the interim committee will produce a bill that will end the contention surrounding exempt wells and will be codified into law in the 2019 legislative session.

Sincerely,

Lindsay Wancour
MS Environmental Sciences Candidate
Natural Resource Conflict Resolution Certificate Candidate
Part Three

Big Hole Watershed Education and Restoration Project
The Big Hole Watershed Education and Restoration Project

A High School Environmental Education Curriculum

By: Lindsay Wancour

Portfolio Component
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Introduction

The Big Hole Watershed Education and Restoration Project (BHWERP) is a five-unit curriculum that educates high school students about the Big Hole watershed. The five units included are: Reflection, Knowledge, Problem-Solving Skills, Service and Engagement, and Project Work. Each unit contains one to two lessons with objectives that work to achieve the unit’s goal.

I developed the BHWERP after serving in Americorps and discovering my passion for service while doing trail work in public lands with Montana Conservation Corps. During this experience, I learned about the ecology of the areas, the politics involved in their protection, and developed a profound connection to the land and desire to share that connection with others. This Americorps service was followed by several jobs working in education with youth. Realizing the opportunity to help develop a civically engaged generation at the intersect between conservation and education, I developed this curriculum.

Mission

The mission of BHWERP is to educate 8th-11th grade students about the Big Hole watershed while participating in hands-on restoration projects, further fostering a sense of connection and responsibility to the continued welfare of the region and community.

Vision

The vision of BHWERP is to enhance the Big Hole watershed by developing a more engaged population to act on behalf of the ecosystem in a community-minded way for years to come.

Environmental Education Philosophies and Curriculum Design

This curriculum pairs experiential education with service-learning projects in the Big Hole watershed. Through this educational experience, students will reflect on issues impacting their community, further their knowledge of local geography and ecology, develop problem-solving skills and engage in service and action. A 2005 study suggested that there is a lack of civic engagement among teenage students; many young people feel as though they cannot make a difference or solve problems in their communities.² Studies have provided links between service-learning and an increase in civic related knowledge, skills, and attitudes, service behavior, and
social capital. This curriculum seeks to empower students and change the attitudes and behaviors of future generations.

The Big Hole Watershed Education and Restoration Project is based on the educational philosophy of constructivism. Constructivism allows students to develop their own understanding of the world through experience and reflection. By pairing previous ideas with new experiences and reflection, students have individually unique learning experiences. The lessons below assess students’ preexisting conceptions, then the activities address those concepts and build upon them. When students consistently reflect on their experiences, their ideas grow in complexity and power, and develop a stronger ability to integrate new information. A primary goal of the instructor in this curriculum is to encourage the learning and reflection process. It is crucial to the constructivist approach that the students are the active developers of their knowledge, rather than passive recipients of information.

When assessing a constructivist-based educational experience, it is important to check for understanding often. By having informal, qualitative, formative assessments, this curriculum allows for flexibility regarding when instructors check for understanding and it provides opportunity to monitor for changed perceptions frequently. Assessment tools assess indicators of personal growth and reflection, ecological understanding, development of problem-solving skills, and understanding of project work.

This curriculum is designed to be used for school field trips. It was developed using an adoptive model, meaning that it will provide the greatest benefit to students if educators complete the entire curriculum in the order it is presented.

This experience is set-up to maximize students’ time outdoors. It is a curriculum that allows for curiosity to flourish and engagement to be at its peak. This is done through place-based education and an inter-disciplinary model. The focal point of BHWERP’s place-based, inter-disciplinary model is the Big Hole watershed. This approach uses multiple aspects of the local environment to engage students in education. Students will develop a deeper connection to and understanding of the Big Hole through reflection, knowledge development, collaborative skill-building, engagement exercises, and project work.
### Unit Overview

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<th>Unit 1: Reflection</th>
<th>In this unit students will understand and enhance their connection to place through journaling and discussion</th>
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<tr>
<td>Unit 2: Knowledge</td>
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Unit 1: Reflection
In this unit students will understand and enhance their connection to place through journaling and discussion

Lesson 1: Sense of Place

Objectives:

- Using quiet time to reflect, students will journal about place
- With partner and group conversations, students will discuss what sense of place means to them
- Through group discussion and journaling students will demonstrate self-reflection

Materials Needed:

1) Sense of Place reading
2) Journal
3) Writing utensil

Time: 30-45 minutes

Lesson Outline:

1) Introduce the topic of Place to students, explain that as a group, we will be exploring the subjective side of place, and the relationships we develop with a place.
2) Ask students to share with the group what sense of place means to them
3) As a group, have students read “Sense of Place”
4) Have students re-read the passage quietly to themselves
5) Individually, have students take 15 minutes to journal about:
   a. A place that is special to them, and why
   b. A description of it using their senses
   c. Who else shares that place (not just human)
   d. The unique role they play in that place
6) After journaling is done, have students share with a partner what they wrote
7) After partner conversations are done, reconvene in the larger group and have students:
   a. Share what was discussed in partner groups
   b. Discuss if anyone had the same place, or overlap in places. If so, how do the students interact differently, or similarly with that place? What could those similarities or differences mean for the well-being of the place?
   c. Answer the questions in the final paragraph of the reading: Do they agree with the reading? What else would they like to add or know?

Assessment: Instructor will monitor discussions, listening for reflective understanding of place, and realistic grasp of role students play. As students share, instructor should ask questions to encourage a deeper reflection and check for understanding. Students should be able to provide
qualitative reflections to the reading and to their peers’ responses. Students should be able to articulate the changes in their understanding of place.

Source: Adapted from Montana Conservation Corps CORE lesson: Sense of Place

Unit 2: Knowledge
Students will develop an understanding of the landscape and watershed surrounding the Big Hole River

Lesson 1: Watersheds
Objectives:

- Through group discussion, students will define a watershed
- With active participation, students will develop skills to use a topographic map
- Using their new skill set and colored pencils, students will identify their watershed and key features on a topographic map
- Using proper vocabulary, a topographic map, and personal observations, students will describe their watershed

Materials Needed:

1) Topographic maps of the Big Hole watershed
2) Writing utensil
3) Colored pencils
4) List of key features in the Big Hole watershed

Time: 90-120 minutes

Background:
The Big Hole River, also known as Skʷumcné Sewíkw (Salish: “waters of the pocket gopher”), is a tributary of the Jefferson River, which flows into the Upper Missouri. It is located in southwestern Montana and flows uninterrupted its entire approximately 150 miles. It is surrounded by the Continental Divide, an imaginary line that sits atop a ridge of mountain summits that divides the continent into two main drainage areas. On one side, water flows west to the Pacific Ocean. On the other side it either flows northeast to Hudson Bay, Canada or southeast to the Gulf of Mexico. The Big Hole watershed ranges from elevations of 5,000 to over 10,000 feet. The Big Hole River starts its journey at Skinner Lake, which is about 35 miles south of Wisdom in the Beaverhead-Deerlodge National Forest, then feeds into the Jefferson River. To the east of the Big Hole river are the Pioneer Mountains with the Beaverhead Mountains to the west. This watershed drains approximately 2,800 square miles, or 1,800,000 acres.
Vocabulary:

**Watershed**: A watershed, or drainage basin, is the area of land where water drains into a common outlet. A watershed includes the water, as well as the land surfaces from which the water drains. The topography of an area determines the perimeter of the watershed. Watersheds drain into other watersheds in a hierarchical form.

**Topography**: The study of the Earth's surface shape and features. Topography specifically involves the recording of relief or terrain, the three-dimensional quality of the surface, and the identification of specific landforms.

**Topographic Map**: A detailed map that accurately represents the three-dimensional quality of an area using contour lines.

**How to Use a Topographical Map**:

Topographic maps allow you to see the three-dimensional terrain of a landscape. This is done using contour lines.

Contour lines indicate the steepness of terrain. Each line is representative of a different elevation. The closer that contour lines are together, the steeper the terrain is. A circular line indicates a peak or a basin.

Index lines are thicker lines that state an exact elevation. Every fifth line is an index line.
The **contour interval** of the map is the change in elevation between contour lines. They are typically either 40- or 80-foot intervals, depending on the map. This information is found in the legend of the map.  

Each square of the map grid typically represents 1 square mile. This is helpful in determining distances between two locations.

The **legend of the map** explains what each symbol, line, and color on the map means. Additionally, the legend explains the map’s scale, contour- and index-line intervals and grid system.  

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**Lesson Outline:**

1) Ask students the following, while facilitating a conversation about each question:
   a. Who lives in a watershed?
   b. What is a watershed?
   c. Can anyone explain what the Continental Divide is?
   d. Has anyone used a topographical map? / Can you explain what it is?

2) Show students a topographical map of the Big Hole. Explain how the map works and provide information about watersheds using the background provided above.

3) In partners, on the maps, have students identify all the figures listed in the appendix

4) Bring students back together to discuss how the exercise went
   a. Were students able to find all the features?
   b. What was challenging?
   c. What was easy?
   d. How did this activity change your understanding of the Big Hole watershed?
Assessment: Instructor will assess understanding by providing opportunities for student to demonstrate new knowledge. This will be done by monitoring discussions, asking students questions, and checking for correct identification of features on map.

Source: Adapted from the Clark Fork Watershed Education Program’s “What is a Watershed” and REI’s “How to Read a Topo Map”
Lesson 2: Stream Dynamics

Objectives:

• Through group discussion, students will learn the basics of watershed hydrology
• With hands-on observations, students will improve their understanding of a river’s channel, floodplain, and groundwater.
• With group demonstrations, students will share their findings on the dynamic nature of river systems

Materials Needed:

1) Large pad of paper
2) Markers
3) Measuring tape
4) Riparian vegetation field guide

Time: 90 minutes

Background:

There are three parts to a river system that we are going to discuss: the channel, where the water flows; the floodplain, where water goes when the channel overflows during spring runoff and after heavy rains; and the groundwater, which moves slowly through the sand and gravel beneath the river valley. Each part is dependent on the other two parts. It is an interrelated system that is constantly changing.

The shape of the channel is influenced by the amount of water stored in the floodplain and in the aquifer. The size and shape of the floodplains depend on the amount of water that can be carried in the channel and aquifer. The amount of water entering the aquifer depends on the character of the channel, floodplain, and the type of ground forming the aquifer.

The channel is an area that contains flowing water confined by banks. River channels vary in their sinuosity. Sinuosity is the river’s tendency to move back and forth across its floodplain in an S-shaped pattern over time. The bottom of the channel is called the bed. The material that makes up the bed is called substrate. The substrate can vary depending on the velocity, steepness, and location of the river. Streams are either perennial or ephemeral; the presence of water in the channel makes that distinction. Perennial streams have continuous flow all year round. Ephemeral streams only carry water in their channels following precipitation or snowmelt.

The floodplain is the land on either side of the channel that gets inundated with water during floods. A flood with a 100-year recurrence interval is a flood event that is likely to happen once every 100 years. (Floods can also be classified as having 5-year RIs, 10-year RIs, etc.) The floodplain contains the riparian zone. The riparian zone is the area of land and vegetation adjacent to a stream that has a direct effect on the stream.
Riparian zones can be distinguished by their vegetation. In Montana, the riparian zone often contains deciduous trees and shrubs such as birch, alder, willow, cottonwood and aspen. Thimbleberry, snowberry, roses, and currants are also among the vegetation found in the riparian zone.

Groundwater is the water that moves through the subsurface soil and rocks. Where groundwater can no longer saturate any more of the ground, the water table is formed. The water table is the upper level of an underground surface that is saturated with water. Streams can either be losing streams, or gaining streams. A losing stream is a stream above the groundwater table; water moves from the channel into the surrounding ground. A gaining stream is one in which the channel bottom is lower than the level of surrounding groundwater table; water moves from the ground into the channel.

Lesson Outline:

1) Ask students to describe a river
   a. How do the channel, floodplain, and groundwater interact with one another?
2) Review the background material listed above
3) Explain to students that in order to restore a river, it is important to understand how the river functions and its characteristics. As each river is different, its restoration approaches will also be different.
4) Have students break into three groups. While exploring and observing the river, they will prepare a poster presentation to share with the rest of the class. Each group will study the channel, floodplain, and groundwater. Encourage students to use field resources (measuring tape, field guide) when applicable.
   a. Channel
      i. Describe the river’s sinuosity
      ii. How wide is the channel? Is there a difference between the width at the top of the channel and the bed?
         1. Why might that exist?
      iii. What is the bed’s substrate? Why?
      iv. Is the stream perennial or ephemeral? How do you know?
      v. What do you know about the slope of the stream?
   b. Floodplain
      i. How did you identify the floodplain?
      ii. What vegetation could you identify?
         1. What benefits could this vegetation provide to the ecosystem and stream health?
      iii. What evidence of flooding events can you find?
   c. Groundwater
      i. What evidence can you find of the location of the water table? (there may not be any!)
1. What are some ways scientists could monitor ground water?
   ii. Do you think this is a gaining stream or a losing stream? Why?
5) Bring the groups back together. Have each group share their findings about one of the river components. Invite other groups to add information that may have been missed.
6) As a class, ask students what the following changes could mean for the river:
   a. Straightening of a stream
   b. Building a subdivision in the floodplain
   c. Taking unlimited amounts of water from the groundwater
   d. Adding beavers to the ecosystem
   e. Armoring the stream banks
   f. Increasing the sediment load to the stream bed (an increase in erosion)

**Assessment:** Instructor will look for the application of background information to students’ observations and presentations. Instructor will monitor field observations and poster development to make sure all students are actively participating. Increase in understanding can be assessed when students present their posters to the group. Instructor can assess critical thinking skills during part 5 of the lesson plan.

Source: *Adapted from: Clark Fork Watershed Education Program’s “Stream Dynamics”*
Unit 3: Problem-Solving Skills – Collaboration

The goal of this unit is for students to understand collaborative processes and how they can be used when dealing with natural resources

Lesson 1: Collaboration and Resource Use

Objectives:

- Using collaborative skills, students will maximize the benefits of the common resources they are provided

Materials Needed:

1) A pool of pennies
2) Candy for prizes
3) A way to play music

Time: 30 minutes

Background:

In the 1980’s and early 1990’s the Big Hole experienced drought and a decline in grayling populations. The grayling became a candidate for the Endangered Species Act, with the Upper Big Hole River being a stronghold for the threatened population. If the grayling were listed, land management protocols would be implemented on the Big Hole, potentially damaging landowners’ livelihoods. Rather than wait for the government to decide their fate, Big Hole ranchers worked together to develop the Big Hole Watershed Committee (BHWC).

The Big Hole Watershed Committee is a consensus-based nonprofit organization dedicated to the conservation of the Big Hole River and surrounding watershed. Upon its creation, this group knew that working with diverse interests would be their key to success. The group is made up of representatives from the ranching community, water utility, businesses, conservation groups, conservation districts, guides and outfitters, local government, and sportsmen.

Weeks after the group formed, they faced an additional challenge; the Montana Department of Natural Resources and Conservation (DNRC) proposed listing the Big Hole River as Chronically Dewatered. This designation would require control and measurement of all irrigation diversions. In response to the threat being labeled Chronically Dewatered, in 1997 the BHWC developed the first Drought Management Plan in the state.

The purpose of the Drought Management Plan (DMP) is to mitigate the effects of low stream flows and lethal water temperatures for fisheries (particularly grayling) through a voluntary effort among agricultural operations, municipalities, businesses, conservation groups, anglers, and affected government agencies.
Since the Drought Management Plan has been enacted, the DNRC has not labeled the Big Hole as Chronically Dewatered; the US Fish and Wildlife Services announced the grayling did not warrant listing under the Endangered Species Act, and the BHWC has become a model in watershed and drought management statewide.\textsuperscript{17}

Lesson Outline:

1) Ask students if they are familiar with the phrase common resources?
   a. Explain that common resources are shared goods used by a population that provides a tangible benefit

2) Ask students if they can list any common resources they use (general ideas are fine, they will delve into natural resources in the Big Hole later)

3) Explain the rules to the group:
   a. You may not talk to anyone during the game or communicate with hand or facial gestures
   b. The pennies belong to all of you – the group
   c. While music is playing, each person may take pennies out of the pool of pennies in the center
   d. When the music stops, you must stop taking pennies out. At that time, the number of pennies left in the pool will double, then the game will continue
   e. At the end of each round, players who have 10 pennies may trade them in for a piece of candy. Fewer than 10 pennies will not receive candy.
   f. There will never be more pennies in the pool than at the start of the game.
   g. The music will start and stop 5 times before we will pause for group discussion before conducting another round.

4) After the first round of music, ask the following questions:
   a. Did anyone in the group take too many pennies? What was the consequence? How did it make you feel? How did it make your group members feel?
   b. Did everyone try to take as many as possible? Why or why not?
   c. Did anyone sacrifice the number of pennies they got for the good of the community? Why or why not?

5) Conduct a second round of collecting, then ask the following questions:
   a. In the second round, did you change your strategy? If so, in what way and why?
   b. Did you discover a way to maximize the number of pennies collected per person AND the number of pennies remaining in the pot?

6) Ask students: What are some natural resources that are common resources?
   a. What can people do to use these resources more wisely? What is already happening in the Big Hole?
      i. Use this time to explain the BHWC’s history and objectives
b. Collaboration has been shown to be a powerful tool in managing natural resources in the Big Hole. What are some other ways you can use collaboration? Why does that matter?

**Assessment:** Instructor will facilitate discussions about resource sharing, listening for development of an understanding of common resources and collaboration. Instructor can assess success of lesson based on the amount of candy and pennies distributed. If instructor needs to provide more candy AND pennies each round, then students are grasping the collaborative concepts. If only candy is being distributed, more conversation is required.

*Source: Adapted from Earthwatch’s Go Fish! Exploring the Tragedy of the Commons by Claire Barnett*
Unit 4: Service and Action – Engagement
   This unit will empower students to enact change and act as stewards of the land

Lesson 1: Power of Youth

Objectives:
   • Students will understand the positive impacts they can have on the environment and a community by reviewing information about conservation organizations and news articles

Background:

Corps are youth development programs designed to engage members in service projects, academic programming, and job training. One network, The Corps Network (TCN), leads and supports over 130 corps organization. Every year, 24,000 individuals, through TCN’s network, work to strengthen communities, improve the environment and transform their lives through service.

Some of the services provided through TCN are
   - Increase access to public lands and water
   - Build and enhance multi-use trails
   - Increase recycling and revitalize neighborhoods
   - Restore communities and resources following disasters
   - Ensure productive fish and wildlife habitats
   - Prevent and fight wildfires
   - Create/maintain urban parks and recreational spaces
   - RemEDIATE invasive species
   - Address the maintenance backlog on public lands
   - Weatherize homes for money-saving resource efficiency

Materials Needed:
   1) Print out of organizations’ accomplishments (Fig 2, 3, and 4)
   2) Large pad of paper
   3) Markers

Time: 30-45 minutes

Lesson Outline:
   1) Tell students they are going to physically represent their opinions through a spectrum exercise
   2) Identify two end-points of a spectrum “agree” and “disagree”; Students will place themselves on this spectrum dependent on how they feel about the statements
3) Read the following statements, prompting students to explain their location choice between statements:
   a. Young people have the power to change their communities for the better
   b. Most teenagers don’t care about political, social, or environmental issues
   c. There are issues in my community that I think need to be improved

4) Have students sit in a circle, have the instructor facilitate a conversation about the students' opinions. Using a large pad of paper and markers, record students' responses.
   a. What are some environmental issues you care about?
   b. What issues in your community would you like to improve?

5) Referencing the lists of issues students developed ask the following (again recording responses on a large pad of paper):
   a. What are some ways you think young people can affect these issues?
   b. Can anyone share a personal experience when they took action on something they cared about? (do not record this portion)
      i. Were you successful? Why or why not? How did it make you feel? What did you learn?

6) Pass out the printouts highlighting groups’ accomplishments, and go over the above background information with students.
   a. Have students study the handouts
   b. Encourage question asking, make sure students understand what the accomplishments are.

7) After discussing the information, ask students to explain how their perceptions may have changed.
   a. How could those services provided by young people have a positive impact on a community?
      i. On the environment?
      ii. On the individual?
   b. Which of those tasks do you feel as though you could participate in?
   c. Do they think this work matters? Why? Why not?
   d. What else do they think young people could do to be engaged?

**Assessment:** The spectrum exercise provides an initial assessment of students’ beliefs. Instructor will assess changed perceptions by facilitating group discussions, listening for changed opinions, and innovative ideas.

**Source:** Adapted from North Carolina Civic Education Consortium: Power of Youth: Movements Past & Present.
Unit 5: Project Work

This unit’s goal is for students to begin to understand the degradation of the Big Hole system and develop work skills to use towards its restoration.

Lesson 1: Restoration Ecology

Objectives:

- Using group conversation and shared information, students will understand the ecosystem functions provided by a healthy stream, and how those functions are compromised with degradation.
- Students will learn some human activities can degrade or destroy ecosystems through group discussion and observation.

Materials Needed:

Time: 60-90 minutes

Background:

Restoration ecology is the practice of assisting the recovery of degraded, damaged, or destroyed ecosystems and habitats in the environment through human intervention and action. Part of the goal of ecological restoration is to return an ecosystem to the trajectory it was on prior to disturbance. As ecosystems are constantly changing, it is important to look at reference sites to understand where the project site would be had degradation not occurred. Further, the goal of restoration is to get the ecosystem on track to sustain itself without continued human intervention.

There are many ecosystem functions that come from healthy streambanks. Ecosystem functions are the chemical, physical, and biological processes that contribute to how the ecosystem works. Healthy streams function as habitat for many species of plants and animals, trap sediment, and filter water to improve water quality. The open connected land found in the Big Hole acts as a resource for migrating animals.

Erosion of streams is a major cause of stream degradation. Erosion is when the earth’s surface is removed by wind or water and redistributed somewhere new. It is a natural process, but human action can increase its impacts. Sedimentation is a result of erosion and occurs when the input of sediment surpasses the rate the flow can remove sediment. A few results of streams with excess sediment/erosions are:

- Altered vegetation and flow dynamic
- Reduced photosynthesis
- Altered macroinvertebrate communities
- Influences on fish distribution and food availability
Disruption of the food web

Some causes of increased erosion include:

- Removal of riparian vegetation
- Trampling of streambanks by cattle
- Channelization of streams
- Drought: results in encroaching vegetation, smaller stream channel, negative impact in non-drought years

Lesson Outline:

1) Ask students:
   a. What do you think “ecological restoration” is, can you give an example?
      i. What happens to the ecosystem when a stream is degraded?
      ii. What would a restored (healthy) stream provide to the ecosystem?
   b. What are some ways you could restore a stream?
2) Explain background reading to students.
3) As a group, with the help of project partner, identify the problem the project site is facing
4) In small groups, have students brainstorm ways to restore the project site, keeping in mind their new understanding of the project area and restoration ecology
5) Have students share their innovative ideas with the whole class
   a. Use this as a lead into the actual service-learning project students are about to participate in!!

Assessment: Students’ shared information will provide an opportunity for instructor to assess their understanding of the material provided, and their knowledge of the project site. Presentations should reflect changed perceptions from initial conversation about ecological restoration.

Source: Adapted from Dauphin Island Sea Lab’s “Restore It?: A Lesson in Restoration Ecology”
Lesson 2: Service Learning

Objectives:

- Students will develop new skills that will benefit an ecosystem through service learning
- Students will use their new understanding of restoration ecology to participate in a service project
- Through project work, students will learn how to use new tools and proper ergonomics
- Working with small groups, students will determine and achieve a common goal

Materials Needed:

1) Tools appropriate for project work
2) Personal Protective Equipment

Time: Varies by project

Lesson Outline:

Each project will have different specific needs. These specifics will be determined by project partners.

1) As a group, have students stretch their bodies to warm up muscles
2) Facilitate a safety talk highlighting potential hazards, and options for mitigation. If students are not participating in conversation, inform them they will not be able to participate. Safety is crucial. Conversation should include:
   a. Weather
   b. Tool use
   c. Working with/near others
   d. Heavy lifting
   e. Environmental hazards
3) Based on the number of adults you have available, create small groups accordingly. Each group will be assigned a task to work on with help of supervisor
   a. Have adults monitor students’ behavior to make sure they are participating, working together, and acting in a safety-oriented manner
4) After projects are completed, facilitate a conversation about the experience
   a. What did you enjoy about this project?
   b. What didn’t you enjoy?
   c. Was there any task you needed to work with a teammate on to complete?
   d. How did it make you feel to finish the project?

Assessment: Instructor, with help of other adults, will assess students’ attitudes, work ethic, and safety through monitoring their project work. The final conversation will be used to monitor the impact the experience had on students.
References

1 Billig, Shelley, Root, Sue, and Jesse, Dan (2005) *The Impact of Participation in Service-Learning on High School Students’ Civic Engagement* Circle Working Paper 33


11 CFWEP *Stream Dynamics* Clark Fork Watershed Education Program


18 BHWC (2017c) *Big Hole River Drought Management Plan* Big Hole River Watershed Committee. Retrieved Dec 3, 2017 from [file:///C:/Users/Lindsay/Downloads/BHWC%20DMP%202016_FINAL.pdf](file:///C:/Users/Lindsay/Downloads/BHWC%20DMP%202016_FINAL.pdf)


Appendix A: Course Materials

Unit 1 Lesson 1

Sense of Place

Conservationists often talk about a community’s “sense of place” in relation to creating, identifying or enhancing that sense of place. To those of us in the conservation field and those of us who interact with communities, sense of place is an expression that we inherently understand and unanimously agree is important. Yet, perhaps it sounds like an abstract concept to others.

What comes to mind when you hear “sense of place” in conversation? Without any further meaning it sounds like knowing where you are located – which town, city, state, country. But, sense of place isn’t really about directions. Aside from knowing your point on a map, knowing your location can be attributed to identifying landmarks – built and natural.

Alright, you know your location on a map, you can see familiar landmarks; but, what more is there to sense of place?

A good quote about sense of place, found via the Northwest Earth Institute is “If you don’t know where you are, you don’t know who you are.” If you know your location in all senses, you’ll understand its sense of place.

For simplicity’s sake, take the word “sense” literally and combine your five senses: sight, smell, hear, touch, taste. What do you see in a place (buildings, landscape)? What do you smell (agricultural, industry, nature)? What do you hear (cars, trains, river, ocean, wind)? What can you touch (street surface, building materials)? What do you taste (what are the local foods)?

Think about where you live or a particular place that you love. Can you answer those for your neighborhood, community or town? (A place does not have to be defined by town or city boundaries, remember.) Now consider the combination of those answers to the five senses and answer this: how do they make you feel about a place? What memories can you associate with those feelings (and senses)?

Sense of place is about identity and relationships: the identity of a place and the relationship that people have with it. In other words, how do people connect to a place? And how do they define that place, through what tangible (buildings, landscape) or intangible (smells, sounds, feelings) connections? So, sense of place is subjective, but not necessarily abstract. Would you agree? What else would you add or like to know?
Unit 2 Lesson 1

Map of Big Hole Watershed

List of Key Features

☐ Trace the Big Hole River
☐ Shade the Pioneer Mountain Range
☐ Shade the Beaverhead Mountain Range
☐ Label Skinner Lake
☐ Circle the Confluence with Jefferson River
☐ Outline the Big Hole Watershed
☐ Mark Xs on 5 peaks within the watershed
☐ Find and mark locations at the following elevations:
  o 5,500’
  o 6,500’
  o 7,500’
  o 8,000’
  o 9,500’
Unit 4 Lesson 1

Figure 2 TCN accomplishments since 1985

14,666,561 pounds of waste collected, recycled/disposed of
2,328,485 square feet of graffiti abatement
1,577,252 acres of habitat improved and made accessible
1,502,078 trees planted and managed
27,819 acres of hazardous fire fuel reduction
21,861 miles of multi-use trails constructed/improved
20,440 low-income homes audited and/or weatherized
445 major disasters and wildfires responded to
190 historic structures preserved

"I Am A Leader"

Hard hats have been hung, chainsaws have been tucked (safely) away, and Pulaskis have been stowed, which can only mean one thing: the 2017 field season has come to a close. Our 390 AmeriCorps members and 262 youth members made some serious strides on our public lands and in our communities this season. In 2017, MCC participants enhanced 4,405 acres of habitat, weatherized 1,323 homes, removed 14,185 acres of noxious weeds, planted 21,113 trees and plants, built 1,176 miles of trail, and responded to three different disasters: Hurricane Harvey in Texas, Hurricane Irma in Florida, and the Lodgepole Complex Fire in Eastern Montana.

Getting things done for our public lands and our communities is a big part of the MCC experience, but it's actually an entirely intentional consequence of our main charge: building leaders. And while leadership is not as easily captured as miles of trail cleared or acres of wildland fire mitigation, our success is measured by the testaments and trajectories of our participants. This season, 93% of MCC participants left the program feeling they have the ability to make a difference in their communities; 87% said they will stand up for what's right even if others disagree; 90% of participants feel they are better equipped to get a job; and 90% feel they are a better leader. And when participants were asked the most important thing they learned about themselves, time and time again we hear a single statement that lets us know that 26 seasons in, we're still succeeding: "I am a leader."

Figure 3 MCC accomplishments 2017
Figure 4 SCA 2016 Accomplishments
Part Four (a)

Relevant Work Experience:
“I’m Going to the Rivers:” Reflections from the Best of Streams
Introduction

The Clean Water Act of 1972, delegated to the Environmental Protection Agency (EPA), to establish national guidance for acceptable levels of pollutants allowed in waters of the US (Mohr, 2012). The state of Montana adopted water quality standards based on EPA guidance, and EPA delegated to the Montana Department of Environmental Quality (DEQ) to implement the act in Montana (Mohr, 2012). The water quality standards adopted by Montana include both numeric and narrative standards. Narrative standards often refer to the “naturally occurring” conditions in water bodies. What is “naturally occurring” has been established and refined with the help of the DEQ's Stream Reference Project (Mohr, 2012, Suplee et al., 2005). The Stream Reference Project is also used to inform numeric standards (Sada and Suplee, 2016). When certain aspects of a stream’s physical-chemical characteristics or biological community differ too much from the natural conditions embodied by relevant reference streams, the stream is considered to be impaired and not fully supporting the use of Aquatic Life Support. This use of natural conditions provided by reference stream data is explained in Bostrom, 2006.

Since 2001, the Montana Department of Environmental Quality has partnered with the University of Montana on the Stream Reference Project. The Stream Reference Project has identified and characterized the least disturbed examples of wadeable streams that provide our best understanding of the natural biological, chemical, and physical integrity of a region (Suplee et al., 2005).
Study Design

There are seven Montana ecoregions represented in the Stream Reference Project. These ecoregions are designed to be multi-purpose ecological zones with aquatic and terrestrial ecosystem compositions that differ from other zones (Suplee et al., 2005). As of 2016 there were 184 reference sites, representing all the major ecoregions across the state (Sada and Suplee, 2016). The ecoregions are split into cold and warm water regions. The cold-water regions include the Canadian Rockies (16 reference sites), Northern Rockies (23), Idaho Batholith (11), and Middle Rockies (64); they are found in the western mountainous region of the state (Suplee et al., 2005, Sada and Suplee, 2016). The warm water regions include the Northwestern Glaciated Plains (19), Northwestern Great Plains (33), and Transitional Sites (18); they are found east of the Rocky Mountain Front (Suplee et al., 2005, Sada and Suplee, 2016). It is important to have multiple reference sites in each ecoregion to document stream to stream variations in conditions. There are slightly different criteria identified and monitored for in the cold and warm water regions. Initial evaluation criteria for selecting the ecoregions’ potential reference streams included watershed road density, the percent land use in agriculture, logging density and its impacts, impacts from grazing, presence of active or abandoned mines, and the presence of point source pollution (Sada and Suplee, 2016). It is increasingly difficult to find new sites – most potential reference sites have already been visited and rejected or added to the network. A few new sites will likely be added each year.

Each year about 20-30 sites are visited (usually about 15 sites in each of two ecoregions.) Each ecoregion will be revisited about every 3 years, targeting those sites not resampled recently. Some ecoregions with fewer sites (Canadian Rockies; 17 sites) will be
completely resampled in about 4 field seasons. Ecoregions with more sites (Middle Rockies has 63 sites) will take about 9 field seasons to resample all the sites (DEQ, 2015).

In the summer of 2017, I was fortunate enough to tell all my friends and family “I’m going to the rivers.” From early July to mid-October of 2017, I worked on a field crew with two co-workers collecting data from 27 of these reference stream sites in the Middle Rockies ecoregion. We spent our summer traveling the state and seeing the beautiful reference streams Montana has to offer.

Sampling is consistently done in the summer so that the streams are at lower flow and are more accessible. Also, this is often the time of greatest stress on water resources so it is useful to know conditions in low impact streams at this time. Rosie Sada de Suplee, a water quality scientist for the DEQ, and Michael Suplee, the water quality planning group lead for the DEQ, trained us in Helena before we began our independent work. These two have run the project for the past 17 years and have trained all of the crews. During our training we spent time in Helena using coordinates to mark the location of the sites we were planning to visit on a map, and preparing our field equipment. Rosie and Michael joined us in the field for two sites at MPG Ranch while we became acquainted with equipment, sampling procedures, work flow and additional responsibilities. Trainings have slight variations depending on which ecoregion crews will spend their summer working in.

At each site our group would begin by using a GPS unit to find the center of the stream reach that was established previously by DEQ. Each stream was characterized using a stream reach that was 40 stream widths long or a minimum of 150m. We then set up 11 equally spaced transects (A-K) along the stream reach.
At the center transect we used a YSI Professional Plus multiparameter meter to measure pH, temperature, and specific conductance. We then collected water chemistry samples to be tested for nutrients, metals, cations, and anions in the water column, and sediment samples to be analyzed for metals (See Table 1). These samples are very sensitive to disturbance, so to limit our interaction with the stream, my teammate would stand in one spot in the creek, facing upstream, and collect all our samples from there. To minimize movement and disturbance, I would hand her the collection bottles.

In addition to the chemical sampling, we did biological and physical sampling. When collecting biological samples, we collected phytoplankton chlorophyll a, benthic chlorophyll a and ash free dry weight, macroinvertebrates for community composition analysis, periphyton for taxonomic analysis, and conducted an aquatic visual assessment (See Table 1). Our physical data included flow velocity, site photographs, slope, and stream type identification using the Rosgen method (Rosgen and Silvey, 1996). Additionally, each stream was assessed using the Natural Resource Conservation Service (NRCS) stream reach assessment forms. This assessment documented human impacts, riparian conditions, and geomorphic stability of each stream (Suplee et al., 2005). The final task was an overall summary of our impressions of each stream. This summary included human impacts, any indicators of wildlife, the vegetation present, and any other notable characteristics of the area (for example, if it was a recently burned area). The final sentence of the summary stated whether it was a tier one, or tier two stream. Tier one streams are essentially pristine, while tier two are minimally impacted (Sada and Suplee, 2016). Our field protocols can be found in DEQ’s Current Standard Operating Procedures (available at http://deq.mt.gov/Water/WQPB/qaprogram/sops). Specific protocols can be found in the
Field Procedures Manual (WQPBWQM-020), Macroinvertebrates (WQPBWQM-009), Periphyton (WQPBWQM-010); chlorophyll a (WQPBWQM-011). All chemical analyses followed EPA’s standard methods, while the algal biomass samples were analyzed using Sartory and Grobbelaar, 1984.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Bottle Size</th>
<th>Container</th>
<th>Preservation and Storage</th>
<th>Holding Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP, TN</td>
<td>250 ml</td>
<td></td>
<td>Freeze</td>
<td>45 days</td>
</tr>
<tr>
<td>Nitrate + Nitrite (NO&lt;sub&gt;2&lt;/sub&gt;++, NO&lt;sub&gt;3&lt;/sub&gt;-), NH&lt;sub&gt;3&lt;/sub&gt;+, SRP</td>
<td>250 ml</td>
<td></td>
<td>Field filter 0.45um; Freeze</td>
<td>45 days</td>
</tr>
<tr>
<td>TSS/TDS</td>
<td>1000ml</td>
<td></td>
<td>Cool to &lt;6°C (on ice)</td>
<td>7 days</td>
</tr>
<tr>
<td>Common Cations (Ca, Mg, K, Na)</td>
<td>250 ml</td>
<td>HDPE Bottles</td>
<td>Cool to &lt;6°C (on ice)</td>
<td>180 days</td>
</tr>
<tr>
<td>Common Anions (Sulfate, Chloride, and Total Alkalinity)</td>
<td>250 ml</td>
<td>HDPE Bottles</td>
<td>Cool to &lt;6°C (on ice)</td>
<td>Sulfate &amp; Chloride - 28 days; Alkalinity - 14 days</td>
</tr>
<tr>
<td>Total Recoverable Metals</td>
<td>500 ml</td>
<td></td>
<td>Field filter (only 180 ml) 0.45um, 1.5 ml conc. HNO&lt;sub&gt;3&lt;/sub&gt;, cool to &lt;6°C (on ice)</td>
<td>180 days</td>
</tr>
<tr>
<td>Dissolved Metals</td>
<td>250 ml</td>
<td></td>
<td>Cool to &lt;6°C (on ice)</td>
<td>180 days</td>
</tr>
<tr>
<td>Sediment Metals</td>
<td>2000 ml</td>
<td></td>
<td></td>
<td>180 days; Hg - 28 days</td>
</tr>
<tr>
<td>Periphyton (species present)</td>
<td>50 ml</td>
<td>Centrifuge tube</td>
<td>Formalin</td>
<td>n/a</td>
</tr>
<tr>
<td>Benthic Chlorophyll a &amp; Ash Free Dry Weight</td>
<td>n/a</td>
<td>Ziploc bag (hoop); Petri dish (template); Centrifuge tube (core)</td>
<td>Freeze</td>
<td>45 days</td>
</tr>
<tr>
<td>Phytoplankton chlorophyll a &amp; Ash Free Dry Weight</td>
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<td>Petri dish (filter)</td>
<td>Freeze</td>
<td>45 days</td>
</tr>
<tr>
<td>Macroinvertebrates</td>
<td>1 liter</td>
<td>HDPE bottle</td>
<td>Ethanol</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Table 1: Water Quality and Other Samples, and Associated Storage and Holding Times (DEQ, 2015)
Field Protocol Details

After flagging the 11 transects, the three of us started at transect A (the most downstream transect), and worked upstream rotating which side of the stream we were sampling (center, right, or left). At each transect I had three tasks; 1) I took photographs of the stream’s features; 2) I conducted an aquatic visual assessment that documented the percent cover of moss, microalgae, filamentous algae, and macrophytes; and 3) I collected samples off any surface that could contain periphyton.

Periphyton collection was the most meticulous task I participated in. Periphyton community composition is one stream characteristic used to predict the probability of impairment under 303(d) guidelines (Teply, 2010). The DEQ is specifically interested in periphyton responses that indicate impairment due to sediment, nutrients, and/or metals (Teply, 2010). I collected periphyton using the PERI-1 protocol. I began by identifying objects under the water's surface that periphyton could grow on. From there, I collected samples of those objects (rocks, roots, plant matter, sediment, sticks, etc.) and either put the sample directly into a collection tube, or used a scrub brush or small knife to remove periphyton from the surface with water into a plastic container, I then poured the solution into the collection tube. I collected approximately 5ml from each transect. One collection tube was compiled from 11 transects. There were a few streams that were not wadeable due to high waters. For those streams I used the PERI-1MOD protocol and collected the full tube from just one transect. At the end of collection, approximately 5ml of formalin was added to preserve the sample.
My final task was collecting physical data to determine geomorphological classification according to the Rosgen stream classification. The Rosgen classification system is a widely-used method for classifying streams and rivers based on common channel morphology (EPA, 2017). The primary objectives of the Rosgen classification include: Provide a mechanism to extrapolate site-specific data to stream reaches having similar characteristics; Provide a consistent frame of reference for communicating stream morphology and condition (EPA, 2017). We performed level II stream classifications which are based on characteristics of channel cross-section, longitudinal profile, and planform features (EPA, 2017). The planform features’ analysis was done after the season by my coworkers and will not be discussed in this reflection. We determined the entrenchment ratio, width/depth ratio, and slope using a rotary laser level. Entrenchment ratio is used to describe the degree of vertical containment of a river channel while width/depth ratio indicates the shape of the channel cross-section (EPA, 2017). Slope was determined by calculating the slope of the water surface over at least 2 transects (rise over run). Additionally, the average size of substrate was determined by randomly sampling the substrate at each transect and using the median size to represent the substrate of the stream reach. After collecting these measurements, we followed a Rosgen flow chart to determine the stream type.

**Reflective Critique**

While this project has existed for 17 years under the current management, I believe there is room for some improvement. Western mountainous cold-water streams are expected to support salmonids, yet none of the data collected provides direct information about the presence of these species (Suplee et al., 2005). To better understand the
conditions of a stream, it seems important to know which aquatic species are present. With advances in eDNA testing, crews could collect samples to test for specific species in a stream system (Carim et al., 2016). Having a more thorough knowledge base of species composition could help in future restoration projects as well as ESA work.

It would be impractical to recommend annually monitoring every stream, however, it could be beneficial to select one stream from each ecoregion to monitor every year. It would provide data on year to year variability in streams. The current design provides information on stream-to-stream variability, but is lacking in annual variability. Things like flow and temperature vary each year, and having a stream that can be used as an indicator of a low-flow, or high-temperature year would help inform data collected from other sites.

**Personal Reflection**

While I have engaged in field work in the past on many occasions, my experience working with the DEQ was my first experience working with this amount of assessments requiring a detailed quality assurance quality control protocol. Historically, my contributions to conservation in the field have revolved around trail work and connecting individuals to public spaces. Working in a meticulous hard-science-based position was vastly different for me. I found this experience to be invaluable to my understanding of restoration projects and watershed health, and showed me yet another side of conservation work. Upon further research, I also learned about the project’s connection to policies pertaining to water quality; this was a great connection for me to make as I have developed a sincere interest in watershed policy.

Not only did I learn some field methods during this experience, but I was able to hone my organizational skills as well. My team of three traveled across western and central
Montana collecting data. We worked in the following counties: Carbon, Park, Sweet Grass, Deer Lodge, Granite, Missoula, Ravalli, Beaverhead, Madison, Lewis & Clark, and Meagher. Each stream took approximately two days to complete. This far-reaching regional coverage, and quick turnover of streams, resulted in travelling to new hotels multiple times a week. Our immense amounts of travel required us to constantly plan ahead but at the same time, the nature of the work forced us to be incredibly flexible with those detailed plans. It was a lesson in the intersection between adaptability and patience. I believe these lessons will be valuable for any future work I engage in.

The stream restoration project that started my path to applying and joining the EVST program revolved around a stream that was listed as severely impaired (not meeting many of the standards that this Stream Reference Project has established.) Participating in this work the summer before my final semester was a great way for my graduate experience to come full circle. It afforded me the opportunity to reflect on how much I have learned about watershed health and restoration over the past four semesters, while building on that knowledge and offering me new experiences as well.
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Part Four (b)

Relevant Work Experience:
Montana Watershed Coordination Council’s Survey on Capacity Building Services
MEMORANDUM

To: Erin Farris-Olsen, Montana Watershed Coordination Council  
Matthew McKinney, Natural Resource Conflict Resolution Program

From: Lindsay Wancour, M.S. Candidate Environmental Studies

Subject: MWCC Survey on Capacity Building Services

Date: December 11, 2017

The purpose of this memorandum is to present the results of a survey of Montana Watershed Coordination Council (MWCC) members.

Objectives

At the request of Montana Watershed Coordination Council, I administered a survey of MWCC members in October 2017. The objectives of this survey were to (1) identify which services provided by MWCC are most valuable in helping organizations build capacity and achieve their desired outcomes; (2) define the Watershed Approach to natural resource management; (3) identify which metrics are used in measuring conservation progress; and (4) identify trends over time to determine if services are helping conservation organizations build capacity.

The purpose of this survey was to help MWCC shape their future work by providing a better understanding of the value and impact of MWCC’s services. This information will help MWCC prioritize staff time and resources, as well as consider needs that aren’t currently addressed.

Methods

The survey consisted of eight questions. The questions were developed in consultation with MWCC’s executive director, two members of the Board of Directors, and the co-chairs of the Natural Resources Conflict Resolution Program at the University of Montana. A review of relevant literature was also completed, and is presented in Appendix 1.

The survey was to be sent to all seventy-one members of MWCC. But one member opted out of receiving all MWCC surveys, leaving seventy possible respondents. Thirty-two watershed groups completed the survey for a 47% response rate. Due to a glitch in the survey, a SurveyMonkey employee is also listed as completing the survey. The results say there are thirty-three responses to some of the questions however, the employee’s involvement did not skew the findings.
Findings

The complete results of the survey are presented in Appendix 2. This section highlights the results from each question. The first question was simply to ask people to clarify their contact information, so it is not included in Appendix 2.

**Question 2: What are the most valuable services currently provided by MWCC to help your organization build capacity and achieve its desired outcomes?**

This question presented eight services MWCC currently provides and asked participants to rank these services as either “Very Useful,” “Somewhat Useful,” or “Not Useful” in building capacity. Each question received a number score representing its value. A score of 3 was the highest score a service could receive, 1 was the lowest. Respondents were encouraged to provide feedback on each service. Not every participant responded to every service. Response rate varied from twenty-four to thirty-one responses.

The eight services provided were (1) Website; (2) Watershed News; (3) Big Sky Watershed Corps; (4) Regional Coordination Assistance; (5) Annual Meeting; (6) Symposium; (7) Other Trainings; and (8) Sub Grants.

Watershed News, the highest rated service, received a score of 2.41. Of the twenty-nine individual responses, twenty-eight said this service was either Very Useful, or Somewhat Useful. There was significant overlap in participants’ feedback on how this service was beneficial. Ten of the respondents stated that it helped by providing information about upcoming events and trainings. Multiple groups (four or more) said that it aided in capacity growth by providing information about other groups and funding opportunities, relevant news, and useful resources.

The symposium received 2.27 points despite eight participants stating they either have not attended or were unaware it existed. Twenty-six participants responded to this service. Twelve stated that it was Very Useful, nine ranked it as Somewhat Useful. The main benefit reported was the opportunity for networking. Six groups said that the symposium was a good source of information, but did not provide specifics. One participant raved about their introduction to canva.com at a symposium and the assistance that website has provided to their organization.

The annual meeting was another highly praised service provided by MWCC. It received a score of 2.23. While there seemed to be more awareness of the annual meeting than the symposium, more individuals ranked the meeting as Somewhat Useful (12), rather than Very Useful (10). There were twenty-six responses. Networking with other groups and agencies was the most commonly identified benefit. Learning from and/or about other organizations via presentations, break out groups, and agency updates was noted as a benefit by seven groups. One critique was that the meetings are far away and organizations have limited funds to attend.
Hosting a Big Sky Watershed Corps member received a rating of 2.19. These responses were quite polarized. Of the thirty-one responses, sixteen said it was Very Useful, while ten ranked it as Not Useful. No service received more Very Useful or Not Useful ratings. With corps members, groups could complete projects they previously did not have the staffing to complete. BSWC members helped build partnerships with other organizations and assisted with grant writing, marketing, and communications. Six groups stated they have not yet hosted a BSWC member.

Sub grants scored 2.13. Seven participants stated they had not used sub grants – one specifically stating that it came with "too many strings." Twenty-four participants responded to this service. Two organizations reveled in the fact that these sub grants allowed them to host BSWC members. Sub grants were also used to participate in other MWCC services like the symposium, annual meeting, and trainings. Groups appreciated MWCC doing a lot of the leg work associated with acquiring funding, as that can be a time-consuming process.

The website received a score of 2.00. Of the twenty-nine responses, twenty-three of them rated this service as Somewhat Useful. Nine participants stated that they don’t use the website directly; they only access it through the watershed news. Four respondents stated that it provides valuable information about groups’ activities.

Also with a score of 2.00 are the other training provided by MWCC. There were twenty-five responses. Seven participants stated they have not attended any of the MWCC trainings. Specific trainings that were hailed were “monitoring for project effectiveness,” “WRP,” “Pollinators,” “Watershed planning in Missoula,” and the “MNA conference.” It was suggested that online trainings, or trainings in a place where travel and lodging weren’t problematic, would be helpful.

The lowest ranked service, Regional Coordination Assistance, received a score of 1.86. Five respondents stated that their organizations have not used the regional coordination, or the regional coordination has not provided capacity building. A more specific criticism was that the regional coordination efforts take up staff time and cost to attend, which can be problematic for small organizations. However, other groups felt that it helps connect local groups, provides a forum for discussion, and helps with organizations’ planning.

Participants were asked to list other MWCC services that helped their group build capacity that were not listed. Among those mentioned were MWCC staff support and mentorship (three groups mentioned this), development of “Watershed Stories,” reporting on issues at a statewide level, and facilitating the transition to the Clark Fork Basin Council.

**Question 3: MWCC is engaged in an effort to better define the Watershed Approach to natural resources management. As part of this process, please select all of the following statements your organization identifies with as part of your conservation model:**

Eight potential principles of the Watershed Approach were provided for groups to choose from.
Twenty-seven participants (84%) agreed that the Watershed Approach includes groups organizing around a common problem or threat. This was the most commonly selected principle.

Twenty-six groups (81%) believe providing all stakeholders the opportunity to share views and information is important.

Twenty-four respondents (75%) stated that the Watershed Approach needs to support landowner leadership.

Twenty-four people (75%) also believed that it should include creating local ownership and being community driven.

Twenty-one participants (66%) identified that monitoring and evaluating results was part of the Watershed Approach.

Nineteen (59%) responded that seeking solutions to integrate as many interests as possible was a principle their organization used.

Eighteen participants (56%) selected involvement in regional coordination as a component of the Watershed Approach.

Only thirteen groups (41%) identified avoiding using litigation as a strategy to resolve conflict as a utilized principle. This was the most infrequently selected response.

Participants were encouraged to list additional principles they felt were important to the Watershed Approach. Their suggestions are listed below.

- Tied to a distinct land area or watershed
- Connect university expertise and research to water resources, needs of communities, organizations, and state and federal agencies in Montana
- Limit board members to landowners in watershed
- Education is vital at all stages
- Non-regulatory county entity focused on research-monitoring, education-outreach, and data repository for the watershed

This question was developed after reviewing literature on collaborative approaches and watershed governance. Multiple sources (Oregon Watershed Forum, 1992, McKinney, 2011 and Brandes et al., 2016) highlight the importance of organizing around a problem or threat, and including all affected stakeholders. These were the two most agreed upon principles chosen by participants. The Oregon Watershed Forum also discusses the need to create local ownership. Participants responded favorably to principles that highlighted local buy-in (support landowner leadership, create local ownership). The full list of principles identified by the Oregon Watershed Forum is:

- Organize around a problem or threat
- Include all affected interests
• Identify a leadership group
• Create local ownership
• Develop an adequate data base
• Seek consensus solutions
• Be patient and persevere
• Monitor and evaluate results
• Provide an ongoing forum
• Establish a link with existing decision-making processes

Question 4: Which of the following metrics do you use to measure conservation progress?

This information will contribute to future fundraising efforts by MWCC. Ten possible metrics for measuring conservation progress were provided in this question. Groups were able to select all metrics that their group utilizes. The least common metrics used still had nine groups use them. The most common had twenty responses.

• The most common metric chosen was number of stakeholders engaged. Twenty conservation organizations (63%) measure progress this way.

• Nineteen (59%) selected improvements to water quality as a useful metric. Water quality improvement can be measured in myriad ways. A future survey could hone-in on the specifics of this metric.

• Like improvements to water quality, nineteen groups (59%) chose number of relationships built as a metric they utilize.

• Sixteen conservation organizations (50%) measure progress by monitoring changes in beliefs or behaviors by stakeholders.

• Fourteen participants (44%) use number of changed land management practices as their metric for progress.

• Thirteen groups (41%) measure their progress using number of conservation practices implemented.

• Ten participants (31%) identified number of acres made more resilient as a metric for measuring progress.

• There were three metrics that were selected by nine groups (28%). They were number of stream miles protected, number of acres protected, and number of flora or fauna species present

Again, respondents were encouraged to share additional metrics their organizations utilize. Some of those responses are listed below:
• Number of faculty and students engaged; collaboration with outside entities in research
• Awareness of potential problems/efforts to control problems
• Number of unconfirmed vs. confirmed cattle losses
- Number of volunteers
- Number of weed points
- Minimum flow sustained in the river throughout the season
- Conserved riparian buffers restored

The literature used in developing this question (Conley and Moote, 2010, and Perez, 2015) suggested socioeconomic, as well as environmental outcome criteria. The top three survey responses include two socioeconomic responses, and one environmental response. Survey results were well aligned with the literature's findings.

*Questions 5: Indicate the category that best describes the current life stage of your conservation organization*

This question was designed to begin to track organizations' capacity and growth over time. Participants chose which life stage they felt their organization was currently in. The options were (1) Getting started; (2) Still growing; (3) Mature; (4) Reevaluation/Renewal

Only one organization identified as just getting started. Twelve groups selected still growing as their current life stage. Twelve groups also identified their group as being in the mature life stage. Seven groups stated that they were in the reevaluation/renewal phase.

*Question 6: Please identify your organization's general operating budget for the following years*

This question was set up to begin to track budget growth over time for organizations. It asked for the operating budget for 2010 and 2017. Two participants chose not to answer any part of this question, while five chose not to fill out the 2010 data. There was no explanation provided.

In 2010 fifteen groups had budgets less than $50,000. Seven groups had budgets between $50,000 and $100,000. Four groups operated with $100,000 to $250,000. There was one conservation organization that operated on a budget greater than $500,000.

By 2017, there was a shift in responses indicating larger budgets for groups. There are only nine groups operating on less than $50,000. Ten groups are now managing $50,000 to $100,000 budgets. Five groups have budgets between $100,000 and $250,000. Previously there were no groups with budgets between $250,000 and $500,00; this has increased to four organizations. There are currently two groups operating on a budget greater than $500,000.

*Question 7: Please identify your organization's level of staff for the following years*

This question was also designed to begin to track organizations' capacity and growth over time. It collects data on the level of full- and part-time staff for 2010 and 2017.

In 2010 groups reported a total of fourteen full-time employees, and fifteen part-time employees. Those numbers increased to twenty, and nineteen, respectively, by 2017.
A more detailed breakdown of these results can be found in Appendix 2.

**Question 8: Please share any additional suggestions on how MWCC can help your organization build capacity and effectiveness**

The full responses to this question are found in Appendix 2. One criticism provided was to stop trying to create larger and larger regional efforts in areas in order to make it easier for state and federal officials to meet with groups. One participant felt a leadership development training or conference would be beneficial. Another thought a reference library on the website would be helpful for organizations. Largely, the responses were either praising the work MWCC already does, or in some cases, suggesting services MWCC already offers, that participants may not be knowledgeable of.

**Implications**

The results of question two, which focused on assessing the value of current MWCC services, largely affirm that all of MWCC’s services are highly valued by conservation groups. The relative strength of some services over others also needs to be viewed in light of how much staff time and resources are needed to deliver each service.

One theme that was prevalent throughout responses was inaccessibility to MWCC services such as trainings and events due to funding. With today’s technology, MWCC could improve accessibility to some events with live streaming. Groups that cannot afford to attend could still participate from home by sending in questions and comments while viewing the event.

A review of literature was completed in developing questions three, which aimed to define the watershed principle, and four, which sought to understand the metrics used in measuring conservation progress. The participants’ responses were reflective of the literature’s findings. MWCC could harvest additional lessons on both topics by reviewing the literature provided in Appendix 1.

With data in accordance with the literature on the Watershed Approach, MWCC can publish a statement, or document, outlining what Montanans consider principles of the Watershed Approach. As new groups emerge, these principles can help guide their understanding of, and framework for, watershed governance.

Considering the high level of responses to the progress metrics question, it would be wise to frame future questions with more context. At least nine groups use each method of measurement. By providing participants with context such as why the information is being collected, and what MWCC plans to do with it, it may help provide more specific responses. Many of the options available could be interpreted in a variety of ways. The most common response, “number of stakeholders engaged,” being one of them. The current information as a stand-alone data set does not paint a clear picture of conservation metrics used in Montana conservation groups. The data collected from this survey can help frame future surveys about conservation metrics.
The data collected from question five provides the opportunity for unique insight into conservation groups. MWCC could use this information to identify correlations between organizations' life-stages and which services they use, what their budgets are, how many staff they employ, etc.

As groups transition between life stages they will face new challenges that other organizations have likely already overcome. Developing a communication forum where questions can be posted and responded to by peers could be beneficial in (1) problem solving; (2) raising awareness of services MWCC provides; (3) increasing local involvement and awareness of challenges; and (4) continued opportunity for networking – a highly praised benefit of many services.

After analyzing the survey results, it is apparent that the MWCC services provided to conservation groups across the state are helping build capacity. This growth is well documented in questions six and seven. There is a clear trend in increasing budgets over time, as well as an increase in level of both full- and part-time staffing. Continuation of the MWCC services that help fuel this growth would certainly be beneficial to watersheds across Montana.

Conclusions

The data collected and presented in this report is valuable in meeting the survey's original objectives, while providing guidance on future resource use for MWCC.

The first objective was to identify which MWCC services were most valuable to conservation groups. Question two provides excellent information regarding service use, and services’ ability to provide capacity growth. MWCC will be able to use this data when deciding how to allocate their resources in the future.

The second objective was to define the Watershed Approach to natural resource management. Question three hones in on the principles that groups around Montana use, while confirming the definitions previously defined in literature. From this, MWCC can publish a statement for their directory regarding which principles to use when managing natural resources with a Watershed Approach.

The third objective was to identify which metrics are being used in measuring conservation progress. Question four sets MWCC up to further explore this objective. The information gathered also coincides with the findings from the literature. This indicates that MWCC can refer to the literature for future questions in this field.

Questions five through seven do well to begin to track capacity trends over time; the fourth objective. By gathering data from around thirty groups, MWCC has baseline data to track groups’ growth in future years.
As MWCC adapts and refines its services, it is imperative to continue monitoring groups. To best monitor the growth of organizations, it would be beneficial to secure commitments from at least ten organizations to participate in long-term monitoring. By tracking specific organizations over time, MWCC will be able to more accurately document organizational growth. This will provide better results than different groups responding each time a survey is sent out. A survey should be sent out every five years asking questions two, and five through seven.

Montana Watershed Coordination Council should continue seeking feedback and input from the conservation groups in their directory. This willingness to receive feedback not only helps MWCC improve, it also demonstrates MWCC’s commitment to its mission to “unite and support Montana’s watershed communities to promote healthy and productive landscapes.”
Appendix 1: Relevant Literature


Appendix 2: MWCC’s Survey on Capacity Building Results

The following pages contain the complete results from the MWCC survey conducted October 2017. The responses to the first question were intended to clarify contact information and are not included.
Q2 What are the most valuable services currently provided by MWCC to help your organization build capacity and achieve its desired outcomes? Please select the most appropriate response for the services listed. In the corresponding boxes, please provide specific examples of how each service has increased the capacity of your organization.

Answered: 32  Skipped: 1

# COMMENTS FOR "WEBSITE"                      DATE
1  It has made us think about goals                 11/17/2017 3:15 PM
2  Never go there except to register for an event. Sorry, I need to be spoonfed (ie email) 11/16/2017 11:06 AM
3  Helena                                            11/15/2017 1:00 PM
# MWCC's Survey on Capacity Building Services

<table>
<thead>
<tr>
<th>#</th>
<th>COMMENTS FOR &quot;WATERSHE NEWS&quot;</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Working with other groupshaving use</td>
<td>11/17/2017 3:15 PM</td>
</tr>
<tr>
<td>2</td>
<td>Information about upcoming events that expand our knowledge</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>3</td>
<td>Good resource for recent news.</td>
<td>11/13/2017 3:16 PM</td>
</tr>
<tr>
<td>4</td>
<td>I haven't had a chance to really use the News so can't say</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>5</td>
<td>Updates detail recent Council/Executive Committee work, activities, etc.</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>6</td>
<td>Provides notice of events and relevant news</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>7</td>
<td>see above</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>8</td>
<td>a way of getting information about watershed news</td>
<td>11/9/2017 10:39 AM</td>
</tr>
<tr>
<td>9</td>
<td>I love it! It has helped field grant ideas, shared CVA events, news articles. It’s wonderful!</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>10</td>
<td>Of all the newsletters I receive, this by far has the most relevant content for trainings and funding opportunities. Those are two of the most important pieces to building capacity.</td>
<td>11/9/2017 9:40 AM</td>
</tr>
<tr>
<td>11</td>
<td>I read it to stay up to date on the watershed issues around the state and to look at training and funding opportunities.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>12</td>
<td>Providing information on employees and keeping updat contact information.</td>
<td>11/2/2017 11:50 AM</td>
</tr>
<tr>
<td>13</td>
<td>It always great to hear what other groups are doing or not doing.</td>
<td>11/2/2017 10:17 AM</td>
</tr>
<tr>
<td>14</td>
<td>none</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td>15</td>
<td>provide info I don't already receive</td>
<td>11/1/2017 4:01 PM</td>
</tr>
<tr>
<td>16</td>
<td>Keeping us notified of state happenings</td>
<td>11/1/2017 3:52 PM</td>
</tr>
<tr>
<td>17</td>
<td>provides important news and resources</td>
<td>10/30/2017 8:54 AM</td>
</tr>
<tr>
<td></td>
<td>COMMENTS FOR &quot;BSWC&quot;</td>
<td>DATE</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>1</td>
<td>We're not in a position to make use of this, but evaluate it every year.</td>
<td>11/16/2017</td>
</tr>
<tr>
<td>2</td>
<td>Good concept, didn't work for our organization</td>
<td>11/13/2017</td>
</tr>
<tr>
<td>3</td>
<td>While these individuals have not helped the MWC specifically, I have seen their impact and work in the general water resources community and I think this is an exceptionally valuable program</td>
<td>11/13/2017</td>
</tr>
<tr>
<td>4</td>
<td>We will share a BSWC member's services in 2018 - this will aid in implementation of our work plan and all aspects of the Council's Mission.</td>
<td>11/12/2017</td>
</tr>
<tr>
<td>5</td>
<td>We have not been able to take advantage of this service yet but hope to at some point</td>
<td>11/11/2017</td>
</tr>
<tr>
<td>6</td>
<td>do not use</td>
<td>11/9/2017</td>
</tr>
<tr>
<td>7</td>
<td>We will be hosting a BSWC member in 2018- I see the value other districts have gained by hosting a member</td>
<td>11/9/2017</td>
</tr>
<tr>
<td>8</td>
<td>Overall, we had projects completed that would not have been finished if it were not for BSWC. It is also great that there is a network of Members so that we have access to their help as well.</td>
<td>11/9/2017</td>
</tr>
<tr>
<td>9</td>
<td>We've directly benefited from this program in many ways. Madison CD has hosted members for 4 years.</td>
<td>11/9/2017</td>
</tr>
<tr>
<td>10</td>
<td>well educated, talented, driven thoughtful member that has made our org better</td>
<td>11/3/2017</td>
</tr>
<tr>
<td>11</td>
<td>We have only has one BSWC member who did not complete his term.</td>
<td>11/3/2017</td>
</tr>
<tr>
<td>12</td>
<td>Helping provide corps members</td>
<td>11/2/2017</td>
</tr>
<tr>
<td>13</td>
<td>we have not had one, however we are looking at upcoming projects where a BSWC would be the perfect candidate. I have heard amazing things.</td>
<td>11/2/2017</td>
</tr>
<tr>
<td>14</td>
<td>While we haven't yet received our BSWC member, I know this program and our member will greatly enhance our organizations capacity and provide better services to constituents</td>
<td>11/1/2017</td>
</tr>
<tr>
<td>15</td>
<td>helped build partnerships to achieve riparian restoration goals</td>
<td>10/30/2017</td>
</tr>
<tr>
<td>16</td>
<td>We have had BSWC members since 2012. Members have been wide-ranging in their productivity, but the majority have been independent workers that perform multiple tasks at a high level. The MWC has one part-time staff person. The BSWC program provides another approximately 20 - 30 hours/week in staff time for the MWC.</td>
<td>10/30/2017</td>
</tr>
<tr>
<td>17</td>
<td>Though we have not hosted a Big Sky Watershed Corps member, we were able to hire an alumnus of the program who had developed skills at another organization that were directly applicable to our project.</td>
<td>10/27/2017</td>
</tr>
<tr>
<td>18</td>
<td>N/A. WLI has not participated</td>
<td>10/27/2017</td>
</tr>
<tr>
<td>19</td>
<td>Our BSWC members have filled role in capacity in a number of areas, including marketing and communications, grant writing, etc.</td>
<td>10/27/2017</td>
</tr>
<tr>
<td>20</td>
<td>Willingness to work with our organization in providing funding opportunities that allow us to host a BSWC Member has been great!</td>
<td>10/26/2017</td>
</tr>
<tr>
<td>21</td>
<td>The Big Sky Watershed Corps has been a large part of our conference in the past, increasing our ability connect across a large state.</td>
<td>10/26/2017</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>COMMENTS FOR &quot;REGION COORD&quot;</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Having us think through the process of where we are going and planing how to get there misery loves company</td>
<td>11/17/2017</td>
</tr>
</tbody>
</table>
### Networking

1. Fiscal sponsorship important, helpful to have additional support outside of MHP.  
   **Date:** 11/13/2017 3:16 PM

2. Very useful in the beginning stages (conversation, priority setting, organization) for Upper Yellowstone group  
   **Date:** 11/13/2017 10:44 AM

3. Assistance with: CFKRBC workplan, workplan implementation, securing funding to support activities, promotion, networking  
   **Date:** 11/12/2017 10:44 AM

4. Provided us connections though those connections have not provided us much benefit yet  
   **Date:** 11/11/2017 1:22 PM

5. provide forum to discuss local issues  
   **Date:** 11/9/2017 4:20 PM

6. I love MHP. It provides amazing conversation and focus, as well as a learning tool for me as I dig deeper in the Centennial Valley and where I see myself in the future.  
   **Date:** 11/9/2017 10:12 AM

7. The regional coordination piece is important, and I think MHP will benefit from being more strategic in its direction. The support through MWCC will certainly benefit the groups as they try to work toward developing their vision. There is certainly value in groups working together regionally, but there are also several challenges that need to be addressed in these coordinated efforts.  
   **Date:** 11/9/2017 9:40 AM

8. Have not taken advantage of this yet.  
   **Date:** 11/3/2017 8:27 AM

9. Has been of great help with the Upper Yellowstone Partnership!  
   **Date:** 11/2/2017 11:50 AM

10. none to date  
    **Date:** 11/2/2017 8:50 AM

11. Bighorn River Alliance  
    **Date:** 11/1/2017 3:52 PM

12. Cannot get in contact with Missouri Headwaters Partnership  
    **Date:** 10/29/2017 4:42 PM

13. Learned more about what is going on in the watershed and other regional issues, but don't know that this has necessarily increased the capacity of our organization. Most of the regional coordination efforts take up staff time and cost to attend for small organizations.  
    **Date:** 10/27/2017 11:36 AM

14. No direct link to our organization as yet  
    **Date:** 10/27/2017 11:33 AM

15. Stepped in to coordinate efforts in UYRP  
    **Date:** 10/27/2017 7:39 AM

16. While I serve on the MHP in my role on the Board of GGWC, I am replying to this survey with my GLWQD hat on. From that perspective, the regional coordination assistance has not increased the capacity of the water quality district.  
    **Date:** 10/26/2017 2:33 PM

### COMMENTS FOR "ANNUAL MEETING"

<table>
<thead>
<tr>
<th>#</th>
<th>COMMENTS FOR &quot;ANNUAL MEETING&quot;</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Misery loves company but to allow us to communicate with each other compare notes</td>
<td>11/17/2017 3:15 PM</td>
</tr>
<tr>
<td>2</td>
<td>Networking - can't give specifics</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>3</td>
<td>I haven't been yet, so can't comment</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>4</td>
<td>MWCC was instrumental in organizing and facilitating the 2017 Annual Meeting. Plans are underway for the next.</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>5</td>
<td>Great presentations that are thought provoking for our organization, connections, funding sources</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>6</td>
<td>see above</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>7</td>
<td>meetings are too far away and our funds are very limited</td>
<td>11/9/2017 10:39 AM</td>
</tr>
<tr>
<td>8</td>
<td>Networking is what I get most out of it! I enjoy the speakers, but having many different people in the same room is what makes it worthwhile...learning from others :)</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>9</td>
<td>A great opportunity to network and receive updates from agencies and other groups</td>
<td>11/9/2017 9:40 AM</td>
</tr>
<tr>
<td>10</td>
<td>Good to hear about new things and meet/network with other watershed and agency personnel.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>11</td>
<td>I have not attended yet</td>
<td>11/2/2017 11:50 AM</td>
</tr>
<tr>
<td>12</td>
<td>I have not attended one</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td>13</td>
<td>Networking opportunities are excellent, presentations are informative, and break-out sessions have been very useful in building our knowledge and making important connections.</td>
<td>10/30/2017 7:48 AM</td>
</tr>
<tr>
<td>14</td>
<td>Great networking opportunity</td>
<td>10/29/2017 4:42 PM</td>
</tr>
<tr>
<td>#</td>
<td>COMMENTS FOR &quot;SYMP&quot;</td>
<td>DATE</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>1</td>
<td>Again, general networking</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>2</td>
<td>Good source of information and networking</td>
<td>11/13/2017 3:16 PM</td>
</tr>
<tr>
<td>3</td>
<td>I haven't been yet, so can't comment</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>4</td>
<td>NA</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>5</td>
<td>I'm assuming this is the same as the annual meeting</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>6</td>
<td>do not use</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>7</td>
<td>I attended the meeting in billings - I found it very interesting and informative</td>
<td>11/9/2017 10:39 AM</td>
</tr>
<tr>
<td>8</td>
<td>See note above.</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>9</td>
<td>A great learning opportunity, and also a great opportunity to connect with people/groups</td>
<td>11/9/2017 9:40 AM</td>
</tr>
<tr>
<td>10</td>
<td>Good to hear about new things, successes, and meet/network with other watershed and agency personnel.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>11</td>
<td>I have not attended yet</td>
<td>11/2/2017 11:50 AM</td>
</tr>
<tr>
<td>12</td>
<td>have not attended</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td>13</td>
<td>wonderful information and presentations</td>
<td>11/1/2017 4:01 PM</td>
</tr>
<tr>
<td>14</td>
<td>good networking and learning opportunity</td>
<td>10/30/2017 8:54 AM</td>
</tr>
<tr>
<td>15</td>
<td>Networking, education, increased awareness of grant and other funding resources.</td>
<td>10/30/2017 7:48 AM</td>
</tr>
<tr>
<td>16</td>
<td>Have not attended</td>
<td>10/29/2017 4:42 PM</td>
</tr>
<tr>
<td>17</td>
<td>On a large scale, similar benefits to the annual meeting.</td>
<td>10/27/2017 11:36 AM</td>
</tr>
<tr>
<td>18</td>
<td>Networking. Information on new techniques.</td>
<td>10/27/2017 11:33 AM</td>
</tr>
<tr>
<td>19</td>
<td>I'm not sure what the symposium is?</td>
<td>10/27/2017 7:39 AM</td>
</tr>
<tr>
<td>20</td>
<td>Response here is the same as the previous question.</td>
<td>10/26/2017 2:33 PM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>COMMENTS FOR &quot;TRAIN&quot;</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Puts more tools in our toolbox; networking</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>2</td>
<td>NA</td>
<td>11/13/2017 3:16 PM</td>
</tr>
<tr>
<td>3</td>
<td>Have not experienced other trainings</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>4</td>
<td>Collaboration training was arranged by MWCC for our emergent Council in April 2017.</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>5</td>
<td>Haven't used them yet but I'm sure they will be helpful</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>6</td>
<td>do not use</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>7</td>
<td>if trainings were available online or held in an place where travel and lodging wouldn't be a burden, they would be helpful</td>
<td>11/9/2017 10:39 AM</td>
</tr>
<tr>
<td>8</td>
<td>Being able to go to the MNA conference was the best!! It helped me revision my job and place.</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>9</td>
<td>The &quot;monitoring for project effectiveness&quot; training and &quot;WRP&quot; training were both incredibly valuable to my work.</td>
<td>11/9/2017 9:40 AM</td>
</tr>
<tr>
<td>10</td>
<td>Have only attended one, but it was good and also good to network and talk with other watersheds.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>11</td>
<td>I have not attended training with MWCC yet.</td>
<td>11/2/2017 11:50 AM</td>
</tr>
<tr>
<td>#</td>
<td>COMMENTS FOR &quot;SUB GRANTS&quot;</td>
<td>DATE</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Provides some resource</td>
<td>11/17/2017 3:15 PM</td>
</tr>
<tr>
<td>2</td>
<td>All me to attend meetings, symposia, trainings</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>3</td>
<td>A good alternative for funders who prefer a larger coordination hub approach or resource.</td>
<td>11/13/2017 3:16 PM</td>
</tr>
<tr>
<td>4</td>
<td>Have not used sub grants</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>5</td>
<td>NA - we haven't had this need yet.</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>6</td>
<td>Haven't received them yet but hopefully will in future</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>7</td>
<td>do not use, too many strings</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>8</td>
<td>Extremely useful for MHP purposes! I am not sure if CVA has received other subgrants than for MHP work.</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>9</td>
<td>Like almost every other organization, funding is our biggest limitation. Additionally, we're limited on time available to search for grants, write grants, report on grants, etc. Having MWCC do some of the leg-work is helpful.</td>
<td>11/9/2017 9:40 AM</td>
</tr>
<tr>
<td>10</td>
<td>I have not personally taken advantage and do not know if SRWG has in the past.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>11</td>
<td>It helps me know what is out there!</td>
<td>11/2/2017 11:50 AM</td>
</tr>
<tr>
<td>12</td>
<td>not to date</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td>13</td>
<td>not sure what this is, but would be interested in learning more</td>
<td>10/30/2017 8:54 AM</td>
</tr>
<tr>
<td>14</td>
<td>We have been awarded monies through the BLM funding that helped to pay for BSWC time and creation of a development plan. This plan will contribute to our fundraising and membership efforts in the future.</td>
<td>10/30/2017 7:48 AM</td>
</tr>
<tr>
<td>15</td>
<td>Have helped us attend the symposium.</td>
<td>10/27/2017 11:36 AM</td>
</tr>
<tr>
<td>16</td>
<td>N/A. WLI has not participated</td>
<td>10/27/2017 11:33 AM</td>
</tr>
<tr>
<td>17</td>
<td>Helps Missouri Headwaters Partnership coordinate efforts</td>
<td>10/27/2017 8:44 AM</td>
</tr>
<tr>
<td>18</td>
<td>We have received a few smaller grants from DEQ and DNRC which have helped in efforts, but grant reporting process is so cumbersome, we use so much staff time meeting reporting requirements that it negates benefit of grant.</td>
<td>10/27/2017 7:39 AM</td>
</tr>
<tr>
<td>19</td>
<td>Has allowed us to host a BSWC Member.</td>
<td>10/26/2017 2:33 PM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#</th>
<th>COMMENTS FOR &quot;OTHER&quot;</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grant spreadsheet</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>2</td>
<td>Providing a voice and watching/reporting on issues at statewide level.</td>
<td>11/13/2017 3:16 PM</td>
</tr>
<tr>
<td>3</td>
<td>Greatly aiding our ability to conduct wide-ranging outreach to Stakeholder organizations in the two basins.</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>4</td>
<td>Provides organizational comparisons and focus</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>5</td>
<td>Being able to talk with a receive support on issues from the MWCC staff is very helpful.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
</tbody>
</table>
### MWCC's Survey on Capacity Building Services

<table>
<thead>
<tr>
<th>No.</th>
<th>Comment</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>I hope to learn more about it over the next few months to see where services can help increase capacity in my organization</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td>7</td>
<td>facilitating the transition to the Clark Fork Basin Council - hope it becomes a useful entity for partner cooperation and coordination</td>
<td>10/30/2017 8:54 AM</td>
</tr>
<tr>
<td>8</td>
<td>MWCC staff support for projects and brainstorming ideas. Photos of the Musselshell River tour. Development of &quot;Watershed Stories&quot; with some of the first being done with people from the Musselshell.</td>
<td>10/30/2017 7:48 AM</td>
</tr>
<tr>
<td>9</td>
<td>Mentorship. The advice and mentorship provided by MWCC staff and board members is also invaluable.</td>
<td>10/27/2017 11:36 AM</td>
</tr>
<tr>
<td>10</td>
<td>We're a support-based organization, so the more connected our partners are (such as MWCC), the more likely we are to meet our mission.</td>
<td>10/26/2017 2:04 PM</td>
</tr>
</tbody>
</table>
Q3 As you may know, MWCC is engaged in an effort to better define the Watershed Approach to natural resources management. As part of this process, please select all of the following statements your organization identifies with as part of your conservation model:

Answered: 32 Skipped: 1

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common problem or threat</td>
<td>27</td>
</tr>
<tr>
<td>All stakeholders</td>
<td>26</td>
</tr>
<tr>
<td>Landowner leadership</td>
<td>24</td>
</tr>
<tr>
<td>Local ownership/Community driven</td>
<td>24</td>
</tr>
<tr>
<td>Regional coordination</td>
<td>18</td>
</tr>
<tr>
<td>Avoid litigation</td>
<td>13</td>
</tr>
<tr>
<td>Monitor and evaluate results</td>
<td>21</td>
</tr>
<tr>
<td>Integrate as many interests as possible</td>
<td>19</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>8</td>
</tr>
</tbody>
</table>

Total Respondents: 32

<table>
<thead>
<tr>
<th>#</th>
<th>OTHER (PLEASE SPECIFY)</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tied to a distinct land area or watershed</td>
<td>11/13/2017 3:16 PM</td>
</tr>
<tr>
<td>2</td>
<td>Connect university expertise and research to water resources needs of communities, organizations, and state and fed agencies in MT</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>3</td>
<td>limit board members to landowners in watershed</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>4</td>
<td>I want to agree with seeking solutions that integrate as many interests, but for ours, ranching is the priority focus, but we will try to integrate other interests..which we do, but it is hard to explain. I should just check that box...</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>5</td>
<td>Education is vital at all ages and levels</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td></td>
<td>MWCC's Survey on Capacity Building Services</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I wouldn't say &quot;create local ownership&quot; but instead support projects with local ownership (we don't create the local ownership, it is already there).</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Non-regulatory county entity focused on research-monitoring, education-outreach, and data repository for the Gallatin Watershed.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I'm sorry, we don't have a conservation model. We're an education-based organization.</td>
<td></td>
</tr>
</tbody>
</table>
Q4 Which of the following metrics do you use to measure conservation progress?

Answered: 32    Skipped: 1

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream miles protected</td>
<td>28.13%</td>
</tr>
<tr>
<td>Acres protected</td>
<td>28.13%</td>
</tr>
<tr>
<td>Acres made more resilient</td>
<td>31.25%</td>
</tr>
<tr>
<td>Stakeholders engaged</td>
<td>62.50%</td>
</tr>
<tr>
<td>Conservation practices implemented</td>
<td>40.63%</td>
</tr>
<tr>
<td>Improvements to water quality</td>
<td>59.38%</td>
</tr>
<tr>
<td>Changed land management practices</td>
<td>43.75%</td>
</tr>
<tr>
<td>Relationships built</td>
<td>59.38%</td>
</tr>
<tr>
<td>Flora or fauna species present</td>
<td>28.13%</td>
</tr>
<tr>
<td>Changes in beliefs or behaviors by stakeholders</td>
<td>50.00%</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>28.13%</td>
</tr>
</tbody>
</table>

Total Respondents: 32

---

**OTHER (PLEASE SPECIFY)**

---

<table>
<thead>
<tr>
<th>#</th>
<th>OTHER (PLEASE SPECIFY)</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>We don't actually measure these, but they are part of the decision process when deciding what to do</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>2</td>
<td>Numbers of faculty and students engaged, collaboration with outside entities in research,</td>
<td>11/13/2017 10:44 AM</td>
</tr>
<tr>
<td>3</td>
<td>awareness of potential problems/efforts to control</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>4</td>
<td>Number of unconfirmed vs. confirmed cattle losses; number of volunteers; number of weed points</td>
<td>11/9/2017 10:12 AM</td>
</tr>
<tr>
<td>5</td>
<td>Minimum flows sustained in the river throughout the season.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>6</td>
<td>Positive responses from stakeholders, requests for information or practices from stakeholders interested in improving their practices and coming to the cd for guidance.</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Date</td>
</tr>
<tr>
<td>----</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>7</td>
<td>(conserved) riparian buffers restored</td>
<td>10/30/2017 8:54 AM</td>
</tr>
<tr>
<td>8</td>
<td>Depends on the project</td>
<td>10/27/2017 8:44 AM</td>
</tr>
<tr>
<td>9</td>
<td>We support member organizations to do a number of these metrics, however, we do direct programming.</td>
<td>10/26/2017 2:04 PM</td>
</tr>
</tbody>
</table>
Q5 Indicate the category that best describes the current life stage of your conservation organization

Answered: 32  Skipped: 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting Started</td>
<td>1</td>
</tr>
<tr>
<td>Still Growing</td>
<td>12</td>
</tr>
<tr>
<td>Mature</td>
<td>12</td>
</tr>
<tr>
<td>Reevaluation/ Renewal</td>
<td>7</td>
</tr>
</tbody>
</table>

**Answer Choices**

<table>
<thead>
<tr>
<th>Category</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting Started</td>
<td>3.13%</td>
</tr>
<tr>
<td>Still Growing</td>
<td>37.50%</td>
</tr>
<tr>
<td>Mature</td>
<td>37.50%</td>
</tr>
<tr>
<td>Reevaluation/ Renewal</td>
<td>21.88%</td>
</tr>
</tbody>
</table>
Q6 Please identify your organization's general operating budget for the following years

Answered: 30  Skipped: 3

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2010</strong></td>
<td><strong>2017</strong></td>
<td></td>
</tr>
<tr>
<td>LESS THAN $50,000</td>
<td>15 (55.56%)</td>
<td>9 (30.00%)</td>
</tr>
<tr>
<td>$50,000 - $100,000</td>
<td>7 (25.93%)</td>
<td>10 (33.33%)</td>
</tr>
<tr>
<td>$100,000 - $250,000</td>
<td>4 (14.81%)</td>
<td>5 (16.67%)</td>
</tr>
<tr>
<td>$250,000 - $500,000</td>
<td>0 (0.00%)</td>
<td>4 (13.33%)</td>
</tr>
<tr>
<td>GREATER THAN $500,000</td>
<td>0</td>
<td>2 (6.67%)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>27</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

**MWCC's Survey on Capacity Building Services**
Q7 Please identify your organization's level of staff for the following years

Answered: 32    Skipped: 1

Full-Time

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>2-3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4-6</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>7-10</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>MORE THAN 11</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>27</td>
<td>28</td>
</tr>
</tbody>
</table>

Part-Time

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2-3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>4-6</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>7-10</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>MORE THAN 11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>28</td>
<td>27</td>
</tr>
</tbody>
</table>
Q8 Please share any additional suggestions on how MWCC can help your organization build capacity and effectiveness.

<table>
<thead>
<tr>
<th>#</th>
<th>RESPONSES</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Funding sources are always important</td>
<td>11/17/2017 3:15 PM</td>
</tr>
<tr>
<td>2</td>
<td>Perhaps maintaining a reference library on the website I never go to :-) including things like protocols and data sheet formats. Handy 'how to' tips that would save time starting up new projects.</td>
<td>11/16/2017 11:06 AM</td>
</tr>
<tr>
<td>3</td>
<td>Thank you for all of your hard work to benefit Montana's waters and citizens!</td>
<td>11/12/2017 10:44 AM</td>
</tr>
<tr>
<td>4</td>
<td>SRHP values cross communication with other programs so that we're not working in a vacuum and our accomplishments can be replicated.</td>
<td>11/11/2017 1:22 PM</td>
</tr>
<tr>
<td>5</td>
<td>need more focus on grass roots and less on grubbing for money</td>
<td>11/9/2017 4:20 PM</td>
</tr>
<tr>
<td>6</td>
<td>Partner with other regional groups.</td>
<td>11/9/2017 8:52 AM</td>
</tr>
<tr>
<td>7</td>
<td>Organization may need to work on board recruitment and training, and could use help with that. Needs to look at many solutions to help with the Coordinator turnover issue.</td>
<td>11/3/2017 8:27 AM</td>
</tr>
<tr>
<td>8</td>
<td>Thank you for your support, I look forward to working with you all more in the future!</td>
<td>11/2/2017 11:50 AM</td>
</tr>
<tr>
<td>9</td>
<td>Please keep the information sharing process going.</td>
<td>11/2/2017 10:17 AM</td>
</tr>
<tr>
<td>10</td>
<td>continued communication, outreach and education.</td>
<td>11/2/2017 8:50 AM</td>
</tr>
<tr>
<td>11</td>
<td>provide funding; continue to provide opportunities to coordinate on a regional basis with other watershed groups and learn from their programs and experience</td>
<td>10/30/2017 8:54 AM</td>
</tr>
<tr>
<td>12</td>
<td>Leadership conferences/training</td>
<td>10/29/2017 4:42 PM</td>
</tr>
<tr>
<td>13</td>
<td>Do not continue to try and create larger and larger regional efforts which attempt to have areas in order to make it easier for state and federal officials to meet with local groups.</td>
<td>10/27/2017 8:44 AM</td>
</tr>
<tr>
<td>14</td>
<td>no suggestions at this time</td>
<td>10/27/2017 7:39 AM</td>
</tr>
<tr>
<td>15</td>
<td>We'd love to connect with MWCC to co-host or sponsor trainings or offer professional development opportunities.</td>
<td>10/26/2017 2:04 PM</td>
</tr>
</tbody>
</table>
Portfolio Conclusion – What I learned

When I applied to the Environmental Studies program at the University of Montana, I hoped to expand my understanding of watershed restoration. I wanted to help people better connect to their watersheds. While the basis of my interest has remained the same, this program afforded me the opportunity to take that passion and apply it in many new ways.

I did not come to this program as a “next-step” to getting my dream job. I have always focused more on gaining experiences and knowledge that will help me be a better person by allowing me to have a positive impact on the world. With this, I feel as though the EVST program was the perfect fit for me. As my interests and passions developed through the program, I was able to develop a portfolio that best represents that transformation. I feel confident that the skills I have acquired through my time at the University of Montana will be integral in helping me have a career path that allows me to help restore watersheds and build watershed communities. Whether I work with high schoolers in the field, help draft legislation in Helena, or manage a watershed group, I have developed a toolbox that will allow me to be successful.

My first piece was the catalyst for my joining the program. An earlier draft of this research was published in American Fisheries’ Montana Chapter’s newsletter, and a second version was presented at WetPol: The International Symposium for Wetland Pollutants Dynamics and Control. The experience presenting at WetPol forced me to think more critically about the work and dig deeper for answers. I originally did not set out to show the benefits of hiring an MCC crew over a professional crew, but after analyzing the data and seeing the stark contrast, it seemed like the right approach. Demonstrating the cost-effectiveness of MCC crews provides me with more fuel in advocating for conservation corps.

Since writing the second piece, I think I will always have a special place in my heart for policy. Initially, I was not looking forward to taking a policy course. That quickly changed as I began to research policy relating to exempt wells. Even though I had other projects I could have used as my engagement requirement, I decided to do an additional project relating to an exempt well bill. Through this piece, I not only learned about the intricacies of water policy, I also learned how citizens can be engaged and involved in the process.

Before my time in the EVST program, I had a fair amount of experience working in education. However, I had no experience developing curriculum. The third component allowed me to take my experiences working in the backcountry and with youth, and blend them together. I truly feel that the next generation has the power to change the world. Writing this curriculum taught me about different philosophical approaches to education, different applications of environmental education, and the necessary components of a curriculum. I know that I will be a better educator thanks to this experience. Additionally, I know I will be a better advocate for getting youth outdoors.

The first part of my final component reflects on my time working with the DEQ. This experience was critical to my graduate experience. I had started my time with EVST working on restoration of a damaged stream. Working on a project that used healthy streams to define the standards and goals for stream restoration projects was the perfect way for my graduate work to come full-
circle. I learned the protocols necessary to collect water samples, the logistics of working in a new place every day, I became more familiar with the geography of Montana, and continued gaining experience working on small crews.

The final piece of the fourth component provided me with insight to watershed groups, including the services most useful to these groups and the challenges they face. Summarizing their ideas about a Watershed Approach demonstrated what they value as a group. I could see myself working for any number of the groups represented in this survey. Seeing their challenges displayed allows me to see where there is room for improvement, and brainstorm ways to ease those challenges.

Through the development of this portfolio, I have learned about watershed restoration and watershed communities through various avenues. This broad approach has filled my personal tool-box with useful skills and knowledge that will be critical to my future successes. Like the rivers that inspired this work, this portfolio has set me up to have a future that is far-reaching and endlessly adaptable.