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# EXECUTIVE SUMMARY BEAR RIVER WATERSHED STUDY LEVEL I

For



## Wyoming Water Development Commission

## Lincoln and Uinta County Conservation Districts



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## I. INTRODUCTION

In June 2015-Sunrise Engineering was contracted by the Wyoming Water Development Commission (WWDC) to provide professional services for the preparation of the Bear River Watershed – Level I Study. The purpose of the contract was to provide professional and technical services necessary to 1) assess, describe, and inventory the watershed and 2) develop management and rehabilitation plans for the watershed. The watershed study provides both practical and economical recommendations that, if implemented, will help solve issues and realize opportunities identified during the inventory and assessment of the Bear River Watershed. Additionally, the study analyzes the potential for developing surface water within the Bear River Watershed with particular emphasis on irrigation and small upland water projects. These projects include both public and private lands and are intended to advance agriculture production and grazing management through public-private partnerships that develop small and under-utilized water resources. Larger scale water storage was evaluated in light of the many studies already completed while relying on the detailed analysis and concepts of earlier studies. To date, at least sixty-seven State or Federal studies related to basin water resources have been completed. The study was conducted in association with Biota Research and Consulting, Inc. (Biota), Pierson Landworks (Pierson), HDR, and RJH Consultants (RJH). Figure 1.1, Location Map, outlines the location and extent of the Bear River Watershed. It straddles the western border of Wyoming with the States of Idaho and Utah. Within the Wyoming portion, two counties; Lincoln and Uinta, further divide the watershed with administrative boundaries.

This study comprises two main documents divided to better meet the needs of the Lincoln and Uinta Conservation Districts. The first document is the Bear River Watershed Study - Level I that covers the entire watershed and is the main document. The second document is the Appendices to the report containing drawings, exhibits, tables, and data helpful to the understanding of the main study. Each County has its own section in the Appendices related to the specific projects in the County.

The Bear River Watershed in Wyoming is approximately 1.9 million acres in size and is located within Lincoln and Uinta Counties (79%). Significant portions also lay in Utah and Idaho with the main stem of the Bear River crossing state boundaries three times before exiting into Idaho near Border. The watershed includes the main stem of the Bear River, the primary river system and a variety of larger tributaries.

Elevations in the Uinta County portion of the Bear River range from 9,500' in the Willow Creek area to 6352' as the river exits Uinta County into Utah downstream of the Woodruff Narrows Dam. Portions of the basin further south in Utah extend to 12,700'. In the Lincoln County portion of the drainage, the higher elevations are the 10,780' Greysalt Ridge on the Smiths Fork down to Border Gauge Station at 6,051.6'.

Land ownership in the Bear River drainage is a mixture of public (federal and state) and private land. The ownership breakdown is as follows: Bureau of Land Management (BLM) (41%); Forest Service (12%); private land (37%); State of Wyoming (8%); National Park Service (1%); and U.S. Fish and Wildlife service (1%).

There are three incorporated municipalities within the project area; the Town of Cokeville in Lincoln County and the Town of Bear River and City of Evanston in Uinta County.

Administratively the study areas fall within Division IV of the State Engineer's Office water divisions and includes Districts 2 and 4.

During preparation of this study it became apparent that the watershed faces the following general challenges with regard to its land and water resources including:

- Distribution of water resources
- Water quality
- Infrastructure maintenance
- Erosion
- Rangeland health
- Maintenance of riparian habitat

The primary purpose of this Level I Study was to gather relevant existing information and combine that information with data generated by this study to form a comprehensive Watershed Management and Rehabilitation Plan. Specific objectives of the project include the following:

1. Conduct an evaluation and description of the watershed, including quantity and quality of surface water resources, and riparian/upland conditions.
2. Conduct an evaluation of water storage needs and opportunities to augment upland water available for livestock and wildlife.
3. Conduct an irrigation system inventory and develop a rehabilitation plan for those land owners expressing an interest in participating.
4. Promote public participation in the study.
5. Facilitate participation and consensus building with the landowners and the public at large, the Conservation Districts, and the Wyoming Water Development Commission.
6. Identify natural resource issues within the watershed and propose practical economic solutions.
7. Identify permits, easements and clearances necessary for plan implementation.
8. Develop a watershed management and rehabilitation plan describing and prioritizing potential projects and management strategies to address water resource related issues and water development opportunities identified in the watershed inventory.
9. Develop conceptual-level cost estimates of the projects identified in the watershed management and rehabilitation plan.
10. Compile and collate all spatial data, relevant published and unpublished reports, and other existing background information into a comprehensive digital library to be available as a resource for the conservation districts and future studies.
11. Conduct a geomorphic investigation of primary tributary channels within the watershed and identify potential mitigation measures to improve impaired channel reaches.

The Wyoming Water Development Commission's (WWDC) Level I Watershed Study is a fundamental landscape analysis confined to a hydrologically connected drainage area or watershed and is focused on two primary components. The first is an identification of the physical attributes of that analysis area. This is accomplished by conducting a comprehensive inventory of the natural resources and subsequently using that inventory to articulate a description of the current natural resource conditions. The second is a long range plan outlining management and/or rehabilitation opportunities and activities that address ecological enhancement and watershed function.

Identifying improvement opportunities for hydrologic and watershed function, including water quantity, yield and use, is an essential element of the Level I Watershed Study. Hydrologically, there are three fundamental watershed functions: (1) collection of the water from rainfall, snowmelt, and storage that becomes runoff, (2) storage of various amounts and durations, and (3) discharge of water as runoff [Black, 1997]. Watershed characteristics such as geologic structure, soils, landform, topography, vegetation, and climate influence the capture or collection of precipitation, infiltration and storage of surface and ground water, and the runoff or discharge of water.

Implementation of BMPs and conservation practices can improve water resource quantity through promotion of plant communities, vegetative diversity, and ecological site health. These are achieved by water development and the creation of reliable water sources in areas devoid of such allowing for the establishment of grazing systems and changes in grazing distribution.

Ecological enhancement is the act of improving the structure and/or function of a degraded ecosystem. This can be accomplished through a number of means such as stabilizing erosive soils, improving soil quality, planting or maintaining native vegetation, controlling invasive species, and restoring or protecting riparian/wetland areas. The watershed study area contains a diverse array of ecological sites, and the potential benefits achieved from implementing targeted conservation practices to restore or enhance the condition of these ecological sites are many. Benefits typically include improved water quality, plant community diversity, soil health, and fish and wildlife habitat. Cumulative benefits to water quality can be significant, as these practices often improve the chemical, physical, and biological constituents of a water body. Wetland and riparian enhancement and restoration can provide numerous ecological benefits such as water quality improvement, shoreline and streambank stabilization, flood attenuation, groundwater recharge, and enhanced fish and wildlife habitat.

Plant and animal communities are intrinsically bound together, and impacts to one community often affects the other. When the interactions between these communities are in balance, a functional, healthy, and resilient ecosystem can be maintained. Management practices and the spatial distribution of rangeland infrastructure including fences, watering points, and feeders can substantially impact overall health and productivity of vegetation communities. The use of rangelands for sustainable livestock production has the potential to ensure the maintenance of wildlife habitat which will ensure that wildlife habitat will persist into the future (NRCS 2011). Wildlife responses to conservation practices are usually species and even species-habitat specific, meaning not only that each species may respond differently to any specific practice, but also that a single species may respond differently to the same practice in different vegetation associations or conditions. For example, livestock grazing can have negative or positive impacts on game bird

habitat, depending on timing and intensity of grazing and the habitat being influenced (Beck and Mitchell 2000).

The watershed management and rehabilitation plan and components presented in the final report of the watershed study provides recommendations for improvements for the following:

- Irrigation system rehabilitation components
- Livestock/wildlife upland watering opportunities
- Grazing management opportunities
- Storage opportunities
- Stream channel condition and stability
- Wetland enhancement opportunities

## **II. PROJECT MEETINGS**

Various meetings were held by the Wyoming Water Development Office (WWDO) staff to inform the Lincoln and Uinta County Conservation Districts and the community of the WWDC's watershed study process. The meetings held were as follows:

- September 9th, 2015 – Kickoff Meeting at Cokeville Town Hall
- September 10th, 2015 – Kickoff Meeting at Uinta County Library, Evanston
- February 23<sup>rd</sup>, 2016 – Evanston - Landowner Meeting
- February 24<sup>th</sup>, 2016 – Cokeville - Landowner Meeting
- April 20<sup>th</sup>, 2016 - Kemmerer – Wyoming Water Update – Bear River

During the course of the study, meetings were conducted on two different levels. The first level of meetings were the publicly advertised and attended meetings held at the Cokeville Town Hall, and the Uinta County Library, or at the Offices of the Lincoln and Uinta County Conservation Districts. These meetings were general project meetings discussing approach and project findings. The attendance at the meetings was between eight and twenty individuals with roughly half being land owners at the public meetings. The remaining attendees were from State and Federal agencies. The Conservation Districts provided an initial contact list for the first meeting. Invitations to the meetings were by postcard, email, or telephone as contact information dictated.

The second level of meetings were arranged with individual property owners to review their proposed upland water projects and irrigation improvement projects. These contacts were initially made at the public meeting, or by referrals from the Conservation Districts, or by word of mouth.

The meetings with individual property owners were held in the field and where practical, (favorable weather and access conditions) included a site visit. In some cases the review was made using aerial photography. During the meeting, the landowner or allotment leasee described the purpose and location of the proposed improvement. In instances of existing failed infrastructure, the landowner provided information as to the probable cause of failure and ideas on what might be changed to rectify the problem. Using this data, proposed development concepts were discussed

with the landowner. The engineer subsequently prepared a sketch and estimate of cost for the proposed project.

A second follow-up meeting with individual landowners was accomplished via open-houses held at the Cokeville Town Hall and Unita County Library. At the meeting, maps and project descriptions based on the initial consultation were reviewed for accuracy by the landowner. After the landowner review, sketches and estimates were finalized according to the review comments. Section IV of this study contains additional detail and description of the results of these efforts.

### **III. WATERSHED DESCRIPTION AND INVENTORY**

A considerable amount of information pertaining to the Bear River Watershed already exists. These data span a wide variety of disciplines, including basin hydrology, water quality, wetlands, wildlife, land use and ownership, climate, geology, soils, agricultural practices and others. The data comes from Federal, State, local, corporate, and private interests and spans the previous century. Interest in the above topics began with early settlement in the basin and has since grown to the point of massive amounts of data being available to the general public at present through the use of computers and public data sets.

A primary goal of watershed planning studies conducted on behalf of the Wyoming Water Development Commission (WWDC) is to:

1. Collect, review, and compile pertinent information regarding the project area;
2. Collate the data in a single dataset; and
3. Use this information to characterize the watershed and facilitate current and future planning, permitting, and improvement efforts within the watershed.

The information collected during the course of this study primarily came from existing data sets already in existence. Many Federal, State and local governmental agencies have successfully cataloged and scanned historic paper documents into electronic databases and have made these documents available. In addition, on-going research and more recent studies completed in electronic format are available from various contacts including the following:

U.S. Geological Survey (USGS)

U.S. Forest Service (USFS)

U.S. Department of Agriculture (USDA)

U.S. Fish and Wildlife Service (FWS)

U.S. Environmental Protection Agency (EPA)

U.S. Bureau of Land Management (BLM)

U.S. Department of the Interior Bureau of Reclamation (BOR)

USDA Natural Resources Conservation Service (NRCS)

Wyoming Water Development Office (WWDO)

Wyoming Department of Environmental Quality (WDEQ)

Wyoming State Engineer's Office (SEO)

Wyoming Game and Fish Department (WGFD)  
Wyoming State Geological Survey (WSGS)  
Wyoming Geographic Information Science Center (WyGIS)  
Wyoming Oil and Gas Conservation Commission (WOGCC)  
Wyoming Secretary of State's Office  
Lincoln County  
Uinta County  
Lincoln County Conservation District  
Uinta County Conservation District  
Lincoln County Weed and Pest  
Uinta County Weed and Pest

Much of the collected data and some data generated during the preparation of the study are in GIS format. GIS is a powerful mapping tool that allows the map creator to collect and display graphical information in a variety of combinations and formats. The map becomes a window into larger data sets of attributes (tables of facts, descriptions, and numbers) associated with the graphically displayed map data. The GIS user can access the data sets through the user interface. In this way, a simple exhibit depicting various basin features can contain vast amounts of tabular data. For instance, a map of soil types can access portals to tabular data such as soil abbreviations, soil types, soil characteristics, acreage by type, etc.

#### **IV. WATERSHED MANAGEMENT AND REHABILITATION PLAN**

A primary objective of the watershed study was to develop a technically sound, practical and economically feasible watershed management plan. The investigative phase of this study focused on an assessment of the watershed characteristics and function, and the identification and evaluation of opportunities to address issues disclosed in Section III. Opportunities include the following:

- Livestock/Wildlife Upland Watering Opportunities – Potential upland water development projects were identified based on an evaluation of existing water sources, upland grazing conditions, and input from landowners.
- Stream Channel Condition and Stability – Stream channels within the watershed were characterized with respect to their condition and stability. Impaired channels were identified for further evaluation and alternative improvements developed.
- Grazing Management Opportunities – Grazing management strategies are presented based on a review of the Ecological Site Descriptions (ESDs), vegetation, and soil conditions within the watershed.
- Irrigation System Improvements - Diversion repairs, fish passage or exclusion, and conveyance efficiency projects were identified.
- Other Upland Management Opportunities – Additional upland management opportunities were identified.

The Bear River Watershed Study area supports all or portions of eighty eight grazing allotments on BLM (76) and USFS (12) administered land. These allotments are generally adjacent to and often encompass privately held ground and serve as summer and early fall range for the adjacent ranches. The allotment sizes range from a single section up to the sprawling Cumberland and Uinta allotment that has several hundred square miles in the basin. Extensive work has been done within the watershed to provide upland water sources for livestock and wildlife. Natural water features also provide similar services, and are found throughout the watershed. In the main body of the report there are maps that illustrate the locations of permitted, developed water features and wells permitted by the State Engineer. Some of these wells are used for upland stock pond viability based on an aerial review. Of note are the gaps in coverage such as North Muddy Creek, Mill Creek and other smaller areas.

Many of the allotments have small water improvements constructed by resource agencies or the permit holder. The facilities generally group into one or more of the following categories:

- Wells
- Springs
- Earthen Catchments (Reservoirs)
- Troughs
- Conveyance

In the case of springs there are both developed and undeveloped springs. The undeveloped springs in many cases could be improved and protected with development and troughs. In addition there are some natural features, such as ponds and pits, that also serve to water livestock.

Opportunities to develop additional water sources exist. Potential water sources that would provide at least seasonal water on underutilized rangelands include development of springs, and enlargement and/or rehabilitation of existing permitted stock reservoirs and wells. Development of springs that flow in excess of 2 gallons per minute and redevelopment of stock wells provide the greatest potential for new or expanded water sources. New or rehabilitated stock reservoirs could also provide upland water sources where wells or springs are not available, but these activities will likely require more work and are inherently more expensive to design, permit, and construct.

A list of interested landowners and allotment permittees was generated based upon input obtained at project meetings and from input obtained through project team member activities and interviews conducted during the completion of the project. Individual meetings with the landowners were scheduled and completed to gain their input on the water needs of their respective geographical areas of interest. Based upon the results of these interviews, and the information presented above pertaining to existing water supplies and areas in need of upland water development, numerous conceptual water development projects were identified. Table 4.2.1 summarizes the results of the upland water landowner consultations.

Table 4.2.1 Upland Water Projects

General Location	Owner or Operator	Number of Projects	Major Project Components					Estimated Total Project Costs	
			Spring Development	Water Well or Pump in Sump	Surface Catchment	Tank	Trough		Small Dia. Pipeline
Lincoln County	Boehme	6	3	2		2	10	3	\$ 644,298
	Benion	1		1			1		\$ 88,676
	BLM	11	12	4			26	3	\$ 937,060
	Clark	1		1			1		\$ 100,902
	Carter	2	1				2	1	\$ 58,950
	Cornia	1		1			1	1	\$ 48,456
	Circle B	5	6	1			8	2	\$ 225,237
	Etchevery	1	1						\$ 19,553
	Nate	1					1		\$ 2,878
	Roberts	1					2	1	\$ 35,658
	Thornock	2		2			2		\$ 168,435
	Julian	16	6	2	9		4	1	\$ 343,276
	Willis	3		1			5	4	\$ 198,916
	Pierce	1					3	1	\$ 190,375
	<b>Total for Lincoln County</b>	<b>52</b>	<b>29</b>	<b>15</b>	<b>9</b>	<b>2</b>	<b>66</b>	<b>17</b>	<b>\$ 3,063,000</b>
Uinta County	Cornielison	1	1				1		\$ 15,430
	Brieninger	1		1			1		\$ 51,424
	BLM	1		1					\$ 96,121
	Hayduk	1					1	1	\$ 52,995
	Hansen/YC Ranch	1	1						\$ 12,430
	Loham	1			1				\$ 134,368
<b>Total for Uinta County</b>	<b>6</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>\$ 363,000</b>	

## V. IRRIGATION SYSTEM INVENTORY AND REHABILITATION

Agricultural water use in the Bear River Basin consists primarily of irrigation and to a lesser degree stock watering. Although a few irrigation wells exist in the Bear River Basin, the predominant source of irrigation supply is surface water. Historically, a network of canals and ditches were constructed by producers to convey water from the natural tributaries and main stem Bear River to the meadows and cultivated lands. Flood irrigation remains the principal method of applying water to the fields. In recent years, through the NRCS Environmental Quality Incentives Program (EQIP), center pivot irrigation systems have emerged as an alternative to flood irrigation. Center pivot irrigation is being utilized in the Lincoln County area(s) of the Basin with a few sites in the Uinta County portion of the basin.

Approximately 233 irrigation diversions to ditches or pipeline intakes exist in the Bear River Watershed study area. In addition, another 109 diversions to various individuals and enterprises were tabulated, some of which are cancelled permits. The priority dates range from 1891 to 2018. A water rights tabulation is found in Appendix J containing the conveyance name along with the appropriator, permit number, priority date, diversion rate, acreage and source creek.

Much of the project need within the Bear River watershed study area is associated with aging headgate structures and diversion revetments that are difficult to maintain.



The analysis drops the data over 30 years old in exchange for the most recent data. Of note was the loss of the wet years 1982, 1983, and 1984 and their replacement with dry to normal years of 2012 to 2015.

Due to the updated source data, values for the new averages changed slightly (downward) from the 2011 Basin Plan Update reflecting a new normal. Table 6.2 shows the new normal, wet and dry years.

Table 6.2 30-Year Wet, Dry and Normal Years

USGS Gauge	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
10011500		Wet		Dry				Dry			Dry		Wet	Wet	Wet		Dry	Dry		Dry							Wet	Dry			
10016900		Wet						Dry	Wet	Dry			Wet	Wet	Wet	Dry	Dry	Dry									Wet	Dry			
10020100		Wet				Dry		Dry	Wet				Wet	Wet	Wet		Dry	Dry									Wet	Dry	Dry		
10020300	Wet	Wet				Dry							Wet	Wet	Wet		Dry	Dry	Dry								Wet	Dry	Dry		
10026500		Wet						Dry	x	x	x	x	x	x	x	x	x	x	x	x	x	x					Wet	Dry			Dry
10028500	Wet	Wet				Dry							Wet	Wet	Wet		Dry	Dry	Dry								Wet	Dry			
10032000	Wet	Wet	Dry					Dry		Dry			Wet	Wet	Wet		Dry	Dry				Dry					Wet	Dry			
10038000	Wet	Wet				Dry							Wet	Wet	Wet		Dry	Dry									Wet	Dry			
10039500	Wet	Wet				Dry		Dry					Wet	Wet	Wet		Dry	Dry									Wet	Dry			

	Dry Year
	Normal Year
	Wet Year
x	No data for entire year

The model was run for the dry, normal and wet year scenarios to project how these differing hydrological conditions interact with the terms of the Bear River Compact and to identify when the terms of the Compact would be enforced.

Water emergencies are predicted to occur in every year based on the updated model data. Wet years delay the emergency until August or September while dry years can be in regulation for the entire season.

This study does not pursue new detailed analysis of previously identified reservoir sites. A few new sites have been identified in this study by land-owners and operators. This study compiles the previously identified sites along with basic site information and study results.

Most studies focused on headwater sites located on the northeastern or southern portions of the drainage. One site (Twin Creeks) is about the middle of the basin. The above studies mentioned or reviewed about 40 potential reservoir sites or enlargements in the basin area. Of these sites several were constructed such as Sulpher Creek, Meyers, Neponset, and Chapman. More popular sites were reviewed by multiple studies. The potential sites range in size from 50,000 acre-feet (Tiechert Bagley on Smiths Fork) down to about 400 acre-feet (Stowe Creek site). The exact size at any given site can vary between studies. Since the earliest investigations, to the present, environmental and social changes, along with physical land development, have changed expectations of reservoir sizes and locations. The additional years of hydrologic data have also better defined what is possible and practical. Earlier documents tend to have fewer, but larger and more aggressive storage proposals, while later documents tend to focus on multiple smaller off-channel sites. The fact that the larger on-channel sites were eliminated in most recent studies

reflects the improbability anticipated with permitting of a large reservoir on the main stem of the Bear River or Smiths Fork.

Each reservoir project requires significant grant resources in order for the project to be financially affordable to the end user. The recent Sublette Creek Reservoir Mau/Covy Canal Rehabilitation Study, Level II established that grant levels on the order of 93% are required before the end user has the ability to pay the outstanding 7%. At lower grant levels, such as the standard 67% grant offered by the WWDO, the end user can only pay a portion of the outstanding debt payment.

None of the projects can finance and carry their entire cost as a loan paid by the subscribers to the system. All projects will require grants in the range of 90% in order for the irrigators to afford the user rates.

## **VII. PERMITTING**

Permitting can become a complex, lengthy and expensive process. The Bear River Watershed study area contains lands administered by the USFS, BLM, NPS, State, and private individuals. The projects identified in this study range from maintenance or replacement of existing and permitted facilities to new reservoirs. Depending on the location and type of project, permitting may be as simple as a water rights application to as complicated as a full Environmental Impact Statement (EIS).

All upland projects listed in this study are on land owned by the sponsor proposing the project or on State, BLM, or USFS administered lands. Most upland projects will require permits from one or more of these entities. Potential reservoir projects in the basin and ancillary canals can span multiple landowners and agencies. In this study, some upland water projects were identified that involve pipelines and easements across more than one private/public landowner, however, most upland projects involve State and/or Federal lands and possibly the private land of the project sponsor.

## **VIII. FUNDING OPPORTUNITIES**

Multiple funding sources exist to assist with the cost of project implementation. Selection of the proper program(s) can result in a significant portion of the cost being covered by complimentary sources.

An investigation of federal, state and local funding sources was conducted to identify potential opportunities for watershed improvement projects.

As government programs frequently change according to the available budgets of the funding agencies, the grants, loans, and cost share opportunities presented in the watershed study are subject to change. As such, it is recommended that additional inquiries be made if interested parties wish to pursue the opportunities presented.

## **IX. CONCLUSIONS AND RECOMMENDATIONS**

This study collected and inventoried various data sets and previous studies related to the Bear River Watershed study area and its resources, challenges and potential with regard to watershed

improvements. Potential improvements include both projects and management strategies related to rangeland health, irrigation potential, livestock watering, wildlife watering, wildlife habitat and general stream health.

The following conclusions and recommendations are the result of the data inventory, field observations, landowner and permittee recommendations, and previous studies. The concepts and ideas can be categorized into several broad categories:

- Livestock Water Availability and Distribution
- Stream Channel Condition and Stability
- Grazing Management Opportunities
- Invasive Species Treatment
- Irrigation System Rehabilitation
- Reservoir and Storage Rehabilitation and Opportunities

Within the Bear River Watershed study area additional opportunities exist to improve upland water availability for livestock and wildlife. The potential projects range from simple spring developments to projects with piped distribution to multiple tanks and troughs. Many opportunities lie on public lands and agency involvement is required for permitting. Agencies may also present opportunity for partnering on projects that improve range and offer wildlife watering opportunities. Partnering could take the form of design and permitting support or even financial participation.

Landowners and permittees pointed out several areas of concern related to channel stability. Many historic studies have also pointed to channel instability in the Bear River drainage as impacting water quality, irrigation structures and farmland. Many areas within the watershed have undergone restoration and the watershed will continue to benefit from continued implementation of these projects.

The basin-wide channel morphology classification identified numerous disequilibrium channel reaches and areas of morphologic concern based upon channel condition and valley setting. The effort generated a list of warranted treatment areas that watershed managers can utilize to identify meaningful channel restoration and stabilization projects across the watershed.

High width/depth ratio Rosgen C-type channels are prevalent within the Bear River Watershed study area. Numerous diversions within the study area incorporate instream structures or require regular channel manipulations to maintain diversion function. These locations present an opportunity where watershed managers and landowners could pursue alternative structure configurations that maintain year-round diversion functionality while minimizing the need for periodic channel manipulations or site maintenance. Such efforts would benefit water users and the aquatic ecology of the proximate watercourse.

Environmental conditions and constraints vary by location, but the following general best management practices (BMP) for range management can be implemented in concert with the ecological site descriptions (ESD) state and transition models to accomplish management objectives:

1. Upland (i.e., off-site) livestock watering systems

2. Strategic salting and/or herding
3. Riparian fences to exclude livestock from, or manage livestock use of, riparian areas
4. Pasture fences or cross-fences to facilitate rotational grazing systems
5. Prescribed fire
6. Chemical brush control

Noxious weed and invasive plant management should be integrated into planning, funding, and implementation of any surface disturbing projects. Recent or prolonged surface disturbing activities are the greatest contributors to the spread of noxious weeds and demands the highest level of proactive control of weed dispersal. Weed control BMP as described in this study are strongly recommended as the most cost effective way to manage weeds in coordination with any development projects.

Potential opportunities for irrigation projects identified in this study are associated with primary conveyance systems. Identified projects include piping canal sections, replacing head gates, and repairs to troubled spots on canals. Related stream work includes bank stabilization and head level control structures in the river to maintain diversion viability.

The Bear River Watershed produces excess water that could be beneficially utilized with additional storage capability. Reservoir sites range from small sites (<20 acre-feet) of local significance to larger sites (over 10,000 acre-feet) with potential for regional benefit to the entire Bear River Basin. The smaller sites tend to be located in tributary basins and off-channel of the tributaries. The larger sites (Smiths Fork and East Fork) are located on the main-stem tributaries of the Bear River. The smaller off-channel sites are favored in terms of permitting. Permitting of any of the sites will be rigorous with the main stem sites being the most difficult. Mitigation measures will be required for any site.

During this study, two reservoirs in Lincoln County were specifically pointed out by landowners as needing major maintenance or dredging (Quealy and Leeds). Two reservoirs in Uinta County were specifically pointed out by landowners; one new (Stowe Creek), and one enlargement (Coy). All reservoirs are more than 20 acre-feet but less than 2,000 acre-feet meaning they do not fit well in the reservoir program or the small water project program.

In Uinta County, landowners expressed continued interest in a reservoir such as Needles or Coyote Creek or something in the Yellow Creek drainage but did not have an organization pursuing any specific project.

Based on the interest and input provided by landowners and permittees, a variety of projects should be pursued. Many of the projects will qualify for the WWDC Small Water Project Program (SWPP). Use of other funding sources such as Trout Unlimited (TU) is also feasible as evidenced by the ongoing work TU is doing in the basin including some projects identified in this study.

The larger upland projects identified in this study have multiple troughs over multiple miles and exceed the cost for the SWPP when taken as a whole. However, by paring back the project to the source, tank and first trough, the project cost can be reduced to fit the program.

The primary reservoir storage projects identified in this study are Leeds, Quealy, and Stowe Creek. The Leeds outlet pipe project can qualify for the SWPP. The dredging project, depending on the extent, may exceed the program limit of \$135,000. The Quealy and Stowe projects fall in a

program funding gap; being too large for the small water program and too small for account III funds.