Mailing Address:
Water Resources Data System
University of Wyoming, Dept 3943
1000 E University Avenue
Laramie, WY 82071

Physical Address:
Wyoming Hall, Room 249
University of Wyoming
Laramie, WY 82071

Phone: (307) 766-6651
Fax: (307) 766-3785

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EXECUTIVE SUMMARY
BADWATER / POISON CREEK
WATERSHED LEVEL I STUDY

Prepared for:

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, WY 82002

Prepared by:

Anderson Consulting Engineers, Inc.
375 E. Horsetooth Road, Bldg. 5
Fort Collins, CO 80525
(ACE Project No. WYWDC33)

February 21, 2014

ANDERSON CONSULTING ENGINEERS, INC.
Civil • Water Resources • Environmental

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1.0 INTRODUCTION AND OVERVIEW

On June 7, 2012, Anderson Consulting Engineers, Inc. (ACE) entered into a contract with the Wyoming Water Development Commission (WWDC) to provide professional services for the Badwater / Poison Creek Watershed Level I Study. ACE was retained to evaluate and describe the study area and specifically develop a watershed management plan. Opportunities and issues within the watershed are to be identified and practical economic solutions proposed. The plan was prepared on behalf of the project sponsor, the Lower Wind River Conservation District (LWRCD).

This report documents the results of all tasks associated with this effort.

2.0 BACKGROUND

The project study area is the Badwater / Poison Creek watershed located in the Wind River basin near the town of Shoshoni in Fremont County (Figure 1). The project study area includes the Badwater Creek and Poison Creek watershed plus the adjacent Gold Creek and Cottonwood Creek watersheds. The total area encompassed by these watersheds is approximately 1,435 square miles.

The study area is primarily only sparsely populated. The Town of Shoshoni is the largest with a population of approximately 636. Other towns and town sites include Lost Cabin, Moneta, Lysite, Bonneville, Hiland, and Arminto. Elevations range from less than 4,740 feet above mean sea level at Boysen Reservoir to over 8,300 feet on Copper Mountain, resulting in overall relief of over 3,560 feet. The majority of the study area is extremely dry. Annual precipitation typically averages 7 to 9 inches throughout most of the watershed with much of the precipitation derived from summer thunderstorms.

The majority of the basin (approximately 56.0 percent) is federally owned and managed by the BLM. The remainder of the study area is either owned by the State of Wyoming (10.3 percent) or is deeded (33.3 percent). The remaining 1.4 percent is divided between the Bureau of Reclamation (1.1 percent) and the Bureau of Indian Affairs (0.3 percent).

Some of the issues facing the LWRCD which will direct their future planning efforts include the following:

- Information and Data Management
- Water Quantity, Location and Timing

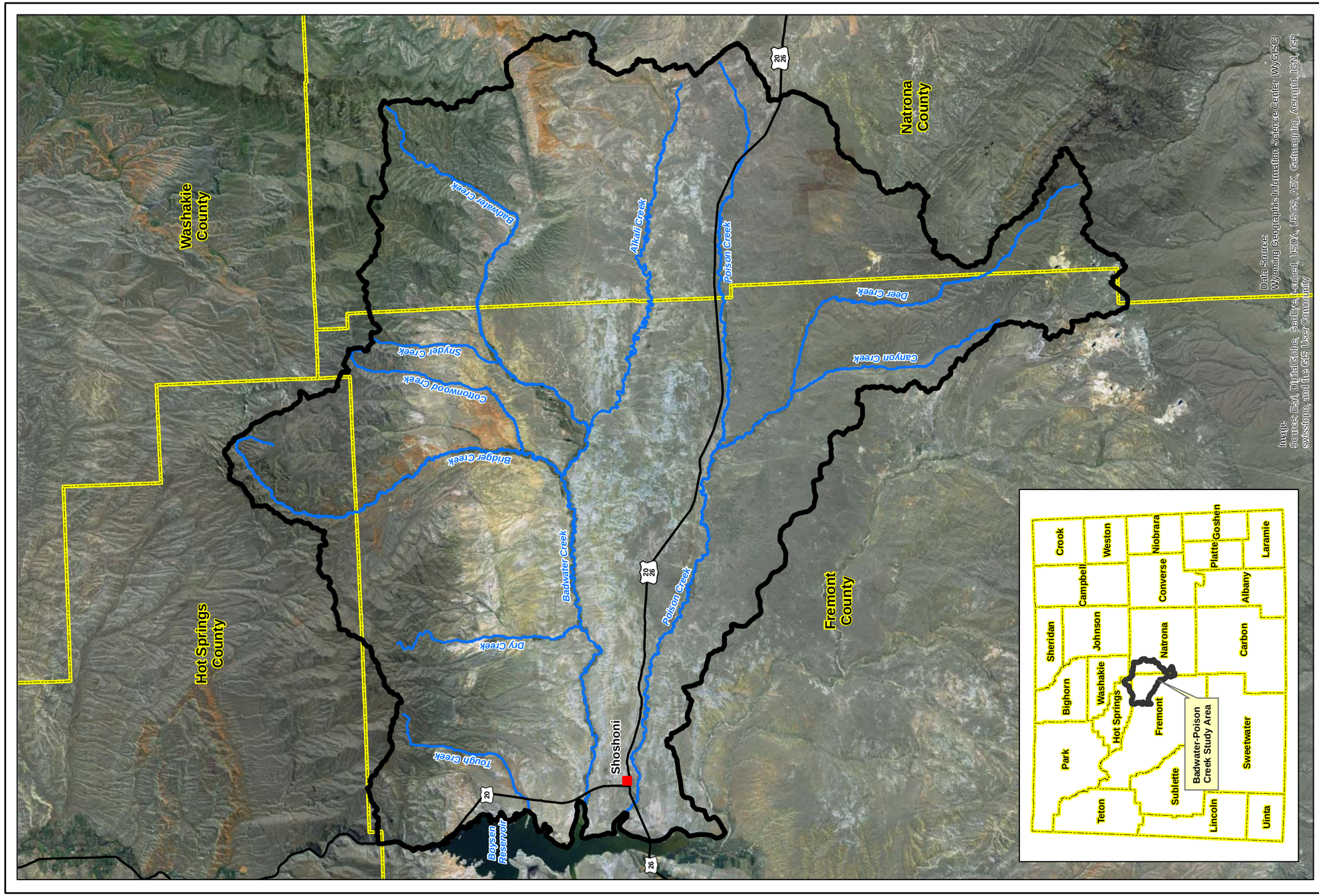

Figure 1 Badwater-Poison Creek Watershed: Location Map

- Impacts Associated with Energy Development
- Utilization of Grazing Allotments and Range Management
- Stream Channel Stability/Riparian Restoration/Wetlands Enhancement
- Irrigation System Rehabilitation Needs and Opportunities
- Water Storage Needs and Opportunities

3.0 PURPOSE AND SCOPE

In view of the previous discussions, the goal of this Level I Study is to combine all existing data with data collected and generated from this study to form a comprehensive Watershed Management Plan. The purpose and objectives of the proposed project are itemized below:

- *Facilitate consensus building among the LWRCD, landowners and the Wyoming Water Development Commission.*
- *Facilitate public participation.*
- *Develop a comprehensive GIS encompassing the vast amount of spatial data, background mapping, and aerial photography (including the legacy of historic aerial imagery,*
- *Construct a Digital Library with which the user can access the extensive amount of existing literature and data. The Digital Library should also be seamlessly available through the GIS environment.*
- *Conduct an evaluation and description of the* Badwater / Poison Creek *watershed (and associated watersheds) based to a large degree on the wealth of available information. Included in the summary should be the discussion of quantity and quality of surface water resources and riparian/upland conditions.*
- *Augment existing baseline geomorphic data by conducting a geomorphic investigation of the primary channels within the watershed and identify potential mitigation measures to improve impaired channel reaches.*
- *Conduct an irrigation system inventory and develop an enhancement / rehabilitation plan for those ditches expressing an interest to participate.*
- *Conduct an evaluation of water storage needs and opportunities to augment water available for livestock and wildlife.*
- *Develop a watershed management plan which identifies problem areas within the watershed and proposes practical economic solutions.*
- *Develop cost estimates for improvements.*

4.0 WATERSHED MANAGEMENT AND REHABILITATION PLAN

For the purposes of tracking individual components of the watershed management plan, each component was designated a unique project or 'improvement' number. The prefixes used for each improvement describe the category of the watershed management plan it falls under. The prefixes are as follows:

- Project Components "L/W": Livestock / wildlife upland watering opportunities
- Project Components "I": Irrigation system rehabilitation components
- Project Components "G": Grazing management opportunities
- Project Components "S": Storage opportunities
- Project Components "C": Stream channel stability components

The plan is summarized in Table 1.

5.0 POTENTIAL EFFECTS AND BENEFITS OF WATERSHED MANAGEMENT PLAN COMPONENTS

The potential effects and benefits associated with key BMPs and conservation practices were discussed in relation to the various plan components: Livestock/Wildlife water supply (Components L/W), irrigation system rehabilitation (Components I), storage (Components S), etc. The intent of this discussion is to provide the decision makers with the background necessary to make informed decisions regarding future planning efforts.

The NRCS prepares Network Effects Diagrams (NEDs) of conservation practices or BMPs which act together to achieve desired purposes. The NEDs "are flow charts of direct, indirect and cumulative effects resulting from installation of the practices. Completed network diagrams are an overview of expert consensus on the direct, indirect and cumulative effects of installing proposed practice installation. They show the potential positive and negative outcomes of practice installation, and are useful as a reference point for next steps, and as a communication tool with partners and the public" [Natural Resources Conservation Service, 2014].

Benefits associated with a particular conservation practice or BMP can be classified as direct, indirect or cumulative. Direct and indirect benefits would be considered measureable or tangible benefits. For example, construction of a reservoir designed to augment late season irrigation water supplies provides the direct, or measurable benefit, of providing a supply of

Table 1 Badwater-Poison Creek Watershed Management Plan

Watershed Plan Component: Livestock / Wildlife Water Supply Projects (L/W)										
Plan Component	Project Name	Field Notes Reference	Solar Pump / Windmill	Well Construction	Spring Development / Infiltration Gallery	Pipeline (ft)	Stock Tank	Storage Tank	Stock Reservoir Rehabilitation / Reconstruction	Land Ownership
L/W-01	Franks Upland Project #1	Franks 2	1		1	150	1			BLM
L/W-02	Franks Upland Project #2	Franks 3	1		1	75	1			P
L/W-03	Franks Upland Project #3	Franks 4	1			300	1			P
L/W-04	L/W-04 Franks Upland Project #4	Franks 5				100	1	1		BLM
L/W-05	Franks Upland Project #5	Franks 6				100	1	1		BLM
L/W-06	Franks Upland Project #6	Franks 7				10,560	2	1		BLM
L/W-07	Franks Upland Project #7	Franks 8				300	1			BLM
L/W-08	Cameron Upland Project #	Cameron 1			1	100	1			STATE
L/W-09	Cameron Upland Project #2	Cameron 2							1	P
L/W-10	Cameron Upland Project #3	Cameron 3			1	2,900	1			P
L/W-11	Cameron Upland Project #4	Cameron 4					1			BLM
L/W-12	Humphreys Upland Project #1	Humphreys 1				200	1			P
L/W-13	Humphreys Upland Project #2	Humphreys 2	1			500	2			P
L/W-14	Cady Upland Project #1	Cady 1				300	1	1		P, BLM
L/W-15	Cady Upland Project #2	Cady 2			1	300	2			P
L/W-16	Cady Upland Project #3	Cady 3			1	600	1			P
L/W-17	Cady Upland Project #3	Cady 4			1	300	1			P
L/W-18	Cady Upland Project #5	Cady 5			1		1			BLM
L/W-19	Allen Upland Project #1	Allen 1			1	200	1			P
L/W-20	Allen Upland Project #2	Allen 2		1		1,400	1			P
L/W-21	Allen Upland Project #3	Allen 3		1						P
L/W-22	Thoren Upland Project #1	Thoren 1							1	P, BLM
L/W-23	Thoren Upland Project #2	Thoren 2				400	1			P
L/W-24	Thoren Upland Project #3	Thoren 3			1	300	1			P
L/W-25	Thoren Upland Project #4	Thoren 4	1			4,600	1			BLM
L/W-26	Thoren Upland Project #6	Thoren 6							1	P
L/W-27	Bloomquist/McCoy Upland Project #1	Bloomquist / McCoy 1	1		1	900	1			P
L/W-28	Bloomquist/McCoy Upland Project #2	Bloomquist / McCoy 2			1	300	1			P
L/W-29	Bloomquist/McCoy Upland Project #3	Bloomquist / McCoy 3			1	1,500	1			STATE
L/W-30	Hendry Upland Project #1	Hendry 6			1	21,000	6	1		P, BLM
L/W-31	Campbell Upland Project #1	Jock 2 and 3			1	900				P
L/W-32	Campbell Upland Project #2	Jock 5			1	600	1			BLM
L/W-33	Campbell Upland Project #3	Jock 6			1	400	2			P
L/W-34	Bloomquist/McCoy Upland Project #4	Bloomquist / Mccoy 4			1	2,800	1			P
L/W-35	Pingetzer Upland Project #1	Pingetzer 1	1			6,300	2			P
L/W-36	Pingetzer Upland Project #2	Pingetzer 2	1			5,300	1			STATE, BLM
Totals:			8	2	18	63,685	41	5	3	

Watershed Plan Component: Grazing Management Opportunities (G)	
G-1	Expansion of grazing distribution / limited reliance on riparian areas.
G-2	Fencing to create pastures of similar ecological condition to enable a rest-rotation grazing system.
G-3	Strategic salting and herding are other tools that can be used to enhance grazing distribution.
G-4	Consideration of wildlife needs in upland water source development (escape ramps, wildlife watering facilities, etc).
G-5	Utilization of Ecological Site Description State and Transition Modeling to optimize range conditions.
G-6	Use of prescribed fire to assist in the restoration of range health areas benefitting by this treatment according to the state and transition models.
G-7	Application of chemicals may be utilized in the restoration of range health areas benefitting by this treatment according to the state/transition models.

Watershed Plan Component: Irrigation Infrastructure Projects (I)				
Plan Component	Ditch	Owner	Structure Type	Priority
I-01	Dry Creek Ditch No. 2	Frank	Grade Control / Headgate	2
I-02	Woodruff Ditch	Frank	Grade Control / Sand Trap Wasteway / Siphon	2
I-03	Elsass Ditch	Philp	Grade Control	1
I-04	Moore Ditch	Philp	Grade COntrol	1

Watershed Plan Component: Storage (S)						
Plan Component	Reservoir Site	Basin Contributing Area (acres)	Storage Capacity (acre feet)	Surface Area (acres)	Embankment Height (feet)	Embankment Length (feet)
S-01	Clear Creek Reservoir	10,734	1,000	33	60	430
S-02	Dry Fork Badwater Creek Reservoir	38,025	480	27	40	930

Watershed Plan Component: Other Watershed Management Opportunities (O)	
Plan Component	Action / Recommendation
O-1	Continuaton of eradication efforts targeting noxious weeds and undesirable vegetation
O-2	Prescribed burns planned and executed in an effort to control juniper encroachment.
O-3	Mechanical treatment of infestation should be completed in areas where prescribed burns are not feasible or practical.

water commensurate with its storage capacity. An indirect benefit could be the habitat provided to wildlife. Likewise, the same reservoir could provide the cumulative benefit of increased income to producers and improved health of the local economy.

Where appropriate, the NRCS NED for the conservation practice were presented within the document. The Digital Library contains the NED and associated project description of these and additional pertinent conservation practices and BMPs.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Upon completion of the watershed inventory phase of the project, the project team developed the watershed management plan. The plan was developed based upon findings of the inventory phase, a series of public meetings, questionnaires, and interaction with the project steering committee. In previous chapters, the key issues and problems were identified and ultimately, project goals and objectives were formulated to address them. Specifically, plans were developed to address issues associated with the following broad categories:

- Irrigation System Conservation and Rehabilitation,
- Livestock/Wildlife Upland Watering Opportunities,
- Stream Channel Condition and Stability,
- Surface Water Storage Opportunities,
- Grazing Management Opportunities, and
- Other Upland Management Opportunities.

In summary, the following conclusions are provided.

6.1 Irrigation System Components

1. Irrigation within the study area is limited to primarily the floodplain of Badwater Creek and its principal tributaries. Irrigation takes place in other portions of the watershed to a lesser extent. In addition to limited water supplies, irrigation appears to be at least partially restricted by incision of stream channels with makes diversion problematic.

   Completion of channel restoration projects in conjunction with an irrigation headgate would likely not require a 404 permit through the USACE due to the irrigation infrastructure exclusion. Coordination with the COE Omaha District's

Wyoming Regulatory Office in Cheyenne would be necessary to verify permit requirements.

2. Several irrigation system rehabilitation needs were identified during the course of this investigation. Responsible individuals and ditch owners should review the pertinent portions of this report and the specific recommendations reviewed for future planning efforts.

3. Funding assistance for irrigation system rehabilitation projects within the study area is available from a number of sources, especially the WWDC Small Water Project Program and various programs administered by the NRCS.

4. Given the propensity of weeds to become established with application of water, any irrigation system improvement projects should consider the potential impacts to weed infestations and should involve consultation with the local weed and pest district.

6.2 Livestock/Wildlife Upland Watering Opportunities

1. There appears to be numerous opportunities to improve range and riparian conditions by means of increasing the availability of upland water sources for wildlife and livestock use.

2. Pipeline/tank systems appear to offer the most efficient and cost-effective means to provide adequate watering to large areas of rangeland. Water sources for these systems will depend on the location of the rangeland to be served and the available alternative sources. The most likely sources are wells or spring developments.

3. A total of 36 potential wildlife/livestock water supply projects were identified based upon evaluation of available water sources and input from the LWRCD, local land owners and allotment permittees. Conceptual plans and conceptual level cost estimates were prepared for each project.

4. Any such improvements and practices must be fully implemented and maintained by the responsible landowner / agency to gain the maximum overall benefits to the watershed.

6.3 Stream Channel Condition and Stability

1. Based on the geomorphic assessment, several impaired channel reaches were identified within the watershed. The categories of impairments identified include, but are not limited to channel degradation and incision, degradation of riparian vegetation and degradation of riparian condition in the form of stream bank erosion and channel degradation.

2. Priority should be given to stabilization of active headcuts in an effort to limit continued entrenchment processes. Likewise, where feasible, channel gradient restoration projects should be investigated in an effort to restore entrenched stream channels to pre-incision profiles. Entrenchment of stream channels is deleterious to overall watershed health by (1) removing the connection between the stream and its floodplain, (2) lowering local groundwater tables, and (3) making irrigation diversions problematic.

3. Site-specific solutions should be developed to mitigate the channel impairment and ultimately included in the watershed management rehabilitation plan.

4. Locally-sponsored stream channel and habitat improvement projects could provide numerous benefits to the watershed. Potential projects would include efforts such as bank stabilization efforts using techniques such as willow plantings. In addition to providing direct benefits to the specific stream, ancillary benefits include education and community involvement.

6.4. Storage Opportunities

1. The results of the flow availability investigation confirmed in conjunction with the Wind / Bighorn Basin Planning study confirms that water is available for storage and is available primarily during the spring runoff period, predominantly during May and June.

2. A limited number of potential reservoir storage sites were included in the Badwater / Poison Creek watershed management plan. These sites are relatively limited in size but appear to be commensurate with local hydrologic conditions. Development of storage opportunities could provide a valuable source of late season irrigation water.

3. Permitting efforts and NEPA compliance associated with completion of reservoir projects will likely be complicated, lengthy, and involve coordination with several regulatory agencies.

6.5 Grazing Management Opportunities

1. Strategies recommended in the state and transition models associated with NRCS descriptions of the ecological sites found within the watershed should be adopted and employed to optimize range conditions through prescribed grazing management and best management practices.

6.6 Recommendations

Based upon the information presented throughout this report and the conclusions presented above, the recommendations listed below are presented for consideration:

All of the identified livestock/wildlife upland watering alternatives fall within the constraints for funding eligibility of the WWDC's Small Water Project Program (SWPP). These projects should be reviewed and selected alternatives should be implemented as soon as is practical. Completion of one or more of these projects in the near future would serve to benefit those directly involved in the project and increase interest and awareness of the benefits associated with the watershed planning process***.***

Funding through the SWPP does not require formation of a district but does require an entity sponsor such as the local conservation district. Consequently, individuals can seek funding through this program. As discussed in Chapter 8, projects providing multiple benefits and for which total project cost are less than $100,000 are eligible for funding under this program. Grants are available for up to 50 percent of the total project cost or $25,000, whichever is less.

Creative strategies for funding/financing of projects should be more fully investigated following identification of projects worthy of additional evaluation and potential implementation. *By combining funding sources, the sponsor could conceivably obtain grants for most, if not all, of the project costs.*

Local landowners in the project study area have shown a high level of interest and are proactive managers of their lands. Implementation of projects outlined in this report could serve to help maintain this interest and provide momentum to future planning efforts.