Bighorn River-Slick Creek Watershed Plan

Developed by: Washakie Watersheds Steering Commitee

2013 - 2015

Bighorn River – Slick Creek Watershed Implementation Plan

WASHAKIE COUNTY, WYOMING

2013-2015

DEVELOPED & PREPARED BY:

WASHAKIE COUNTY CONSERVATION DISTRICT
WASHAKIE WATERSHEDS STEERING COMMITTEE

ASSISTANCE PROVIDED BY:

WYOMING ASSOCIATION OF CONSERVATION DISTRICTS
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

Bighorn River – Slick Creek
Watershed Implementation Plan

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I. INTRODUCTION

The Bighorn River - Slick Creek Watershed improvement effort is a collaborative partnership among the Washakie County Conservation District (WCCD), landowners, and other local stakeholders.

An initial assessment of the Big Horn River and its tributaries within the WCCD was accomplished by WCCD personnel in 1998-2000. In 2000 and 2002, the Bighorn River and several of its tributaries were placed on Wyoming Department of Environmental Quality (WDEQ) 303(d) list, or impaired waterbodies list, for exceeding the fecal bacteria criteria. Under section 305(b) of the Clean Water Act (CWA), the State of Wyoming must report the condition of their water(s) to the U.S. Environmental Protection Agency (EPA) once every two years. This report, prepared by WDEQ, is known as the 305(b) report (2012 Integrated 305(b) and 303(d) Report). In addition to this report, under section 303(d) of the CWA, States must identify those waters within its boundaries that are not meeting the water quality criteria ("impaired waters") applicable to that waterbody based on its classification. WDEQ then must establish priority rankings for waters on the list and develop Total Maximum Daily Loads (TMDLs) for these waters, based on the severity of the pollution and the specific designated uses adversely impacted by the pollutant. States are required to complete TMDLs within 8 to 13 years from the time of initial listing.

In response to the WDEQ listings, in 2006 the WCCD formed the Washakie Watersheds Steering Committee to develop the Big Horn River Watershed Plan (2006, WCCD) and also began water quality monitoring to collect baseline information on six streams; Sage Creek, Slick Creek, Fifteenmile Creek, Nowater Creek and Nowood River as well as the Big Horn River. The Big Horn River Watershed Management Plan contained a variety of objectives and action items to address bacteria and other water quality concerns from septic systems, domestic animals and livestock and stormwater runoff. Several of the action items were directed toward increasing awareness of issues and programs.

In September 2010, WDEQ initiated the Big Horn River and Greybull River TMDLs for *E. coli* and fecal coliform (FC). RESPEC Consulting and Services from Rapid City, South Dakota was hired as the consultant to develop the TMDL with technical help provided by WWC Engineering in Sheridan. This was the largest TMDL project to be initiated in the state's history and required a lot of background information and organization.

A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards; it takes a more focused, targeted approach than a watershed plan. In this context, pollutant sources are characterized as either point sources, e.g. those sources that are regulated and require a permit such as wastewater treatment facilities or Confined Animal Feeding Operations (CAFOs), or nonpoint sources, e.g. those sources of pollution that do not require a permit and come from many diffuse sources such as field runoff. By taking the sum of the point source pollution loads, added to the sum of the nonpoint source pollution loads, and add a margin of safety, we obtain a Total Maximum Daily Load.

The Big Horn River and Greybull River TMDL (RESPEC, 2013) is anticipated to be completed by the end of 2013. The TMDL provides several recommendations through an implementation plan, for the Conservation Districts and other stakeholders within the Big Horn Basin, to address bacteria contributions, many of which are appropriate for use in the watershed. When EPA approves the TMDL, all listings will be removed from the 303(d) list.

II. REVIEW OF THE TOTAL MAXIMUM DAILY LOAD STUDY

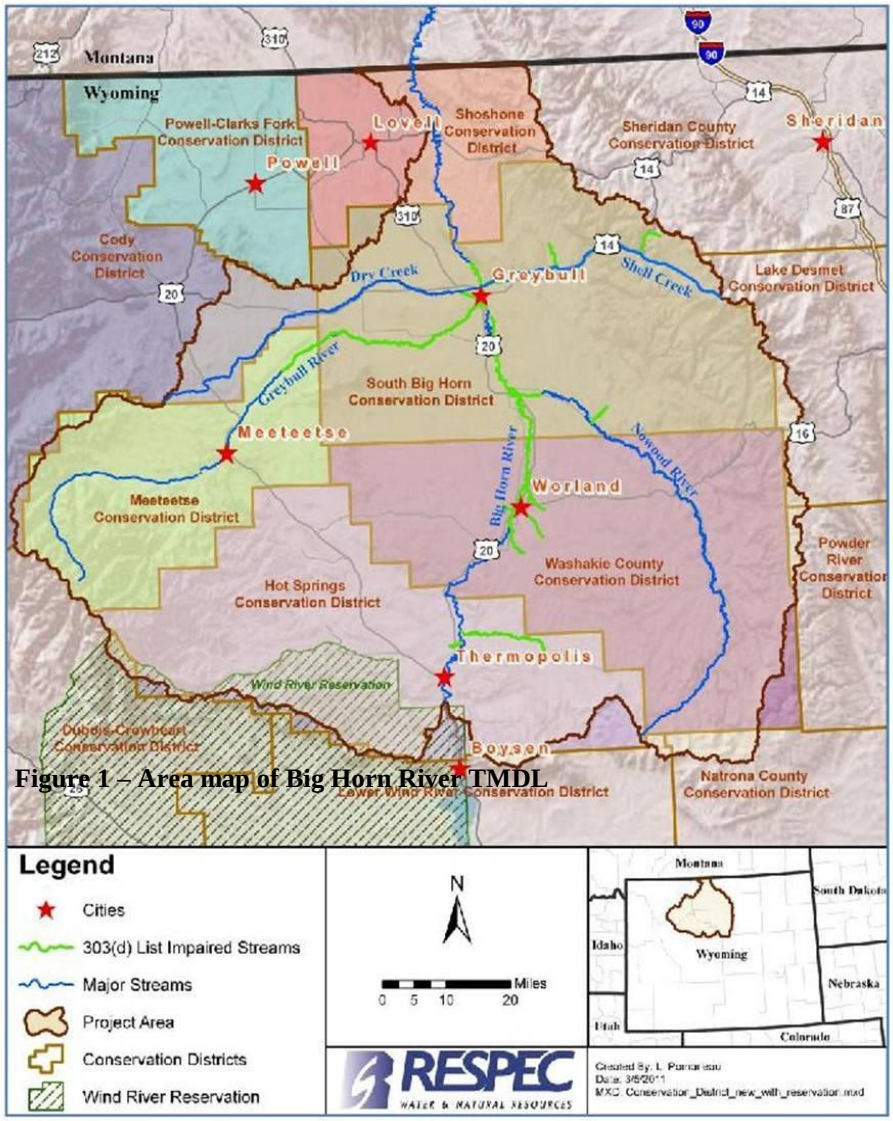

Figure 1 – Area map of Big Horn River TMDL

To address the severity of multiple listings within the Big Horn basin, the WDEQ chose to combine those listings that were not meeting the recreational designated use standard since 2000 & 2002, to be included in one overall TMDL document. However, in 2010, Sage and Slick Creeks, Fifteen Mile Creek, Nowater Creek and the Bighorn River within Washakie County were changed from threatened to not supporting their recreational uses after high levels of *E. coli* were reported during the primary contact recreation season by WCCD in a 2008 Section 319 report.

In all waters designated for primary contact recreation, during the summer recreation season (May 1 through September 30), concentrations of *E.coli* bacteria shall not exceed a geometric mean of 126 organisms per 100 milliliters based on a minimum of not less than 5 samples obtained during separate 24 hour periods for any 30 day period. All waters within Wyoming are designated for primary contact recreation unless identified as secondary contact water. During the period of October 1 through April 30, all waters are protected for secondary contact recreation only.

Each listed waterbody would receive its own TMDL, but instead of developing one report per waterbody WDEQ took an overall watershed and geographical approach to document all of the listings in one report. The TMDL project was broken into three phases and began with Phase 1 in January of 2011 and was completed that June. During this time RESPEC and WWC Engineering gathered background information on the watershed and identified additional monitoring needs. Phase 2 began in June 2011 and was completed in January of 2012. During this phase, RESPEC conducted a TMDL analysis to estimate the existing source loads, the allowable loading capacity, and the allocation of the loads required to the meet the TMDL. The last phase, Phase 3, began in January of 2012 and concluded in June 2012. As part of this phase RESPEC developed the TMDL implementation recommendations based on findings from Phase 1 and 2 as well as existing watershed plans completed by the Conservation Districts in the Big Horn Basin. Between June 2012 and January 2013, RESPEC finalized the TMDL and Implementation reports. Both reports were reviewed by WDEQ in the fall of 2012 and the Big Horn River TMDL Technical Steering Committee in December 2012 and January 2013.

Technical Steering Committee

The purpose of the Big Horn River TMDL Technical Steering Committee was to establish a group of stakeholders that monitored the project's progress and provided guidance to the project team. Conference calls were scheduled almost every month to discuss project progress, address technical concerns, and assist the project team by providing information about the watershed (RESPEC, 2013). A tour of the watershed was also conducted on July 12 and 13, 2011 to familiarize the project team, WDEQ and the Technical Steering Committee with the watershed and the BMPs that have been implemented in the watershed. The WCCD organized a stop on the tour with a landowner within the Nowater Watershed.

III. PLANNING AUTHORITY AND PUBLIC PARTICIPATION

The 2006 Big Horn River Watershed Management Plan was developed by the Washakie Watersheds Steering Committee and facilitated by the WCCD, and Wyoming Association of Conservation Districts (Appendix E) under Wyoming Statutes 11-16-103 and 11-16-122. In addition, the process was guided by the Watershed Strategic Plan updated in 2000 by the Wyoming Association of Conservation Districts, the USDA Natural Resource Conservation Service and Wyoming Department of Agriculture. These informational and planning meetings were open to all, and anyone with an interest in the Upper Big Horn watershed was encouraged to participate.

The initial intent and formation of the Big Horn River Watershed Management Plan was to establish goals and action items to implement best management practices (BMPs), and to work toward restoration which would result in the removal of waters from WDEQ's list of impaired waters. However, since most of the initial listings on the Big Horn River and its tributaries remained on the 303(d) list for over a decade, WDEQ initiated the Big Horn River TMDL.

In the spring of 2012, the WCCD saw the need to revisit the Big Horn River Watershed Management Plan as the Conservation District felt a large majority of the original action items and goals had been implemented. The WCCD also felt that since the TMDL was near completion with an integrated Implementation component, the timing was ideal to develop new goals and ideas that correlated with BMPs recommended in the TMDL. In order to move forward, the WCCD initiated a steering committee to guide improvement activities in accordance with the Implementation recommendations in the TMDL. The Washakie Watersheds steering committee began working on a monthly basis to develop an Implementation Strategy. Steering committee members include local landowners and residents, local resource professionals, and representatives from the Natural Resources Conservation Service, Wyoming Game & Fish Department, Farm Service Agency, Washakie County Cooperative Extension Service, Washakie County Conservation District, The Nature Conservancy, Bureau of Land Management, and Wyoming Association of Conservation Districts.

The first steering committee meeting was held in April 2012 to update those in attendance with the need for watershed planning and implementation as well as guidance on the Big Horn River TMDL. The second steering committee meeting was held in July of 2012 where the committee had a guest speaker talk about implementing practices and the benefits associated with those practices. At the third meeting, held in August of 2012, the group invited another guest speaker and decided the focus for implementation should first concentrate on Slick Creek and Sage Creek. Both waterbodies have been on the Wyoming 303(d) list for 10 years, and the draft TMDL indicated both waterbodies required overall load reductions of *E. coli* by 87% and 88% respectively, to meet water quality standards during the primary recreation season. The group felt that since these waterbodies had very high percentages for load reductions, similar land use types and both were within the Bighorn River- Sage Creek watershed the focus towards implementation should concentrate on these waterbodies (Table 1, page 4).

Table 1. Summary of the 2012 303(d) Big Horn River - Slick Creek Watershed impairments

Waterbody	Location	Listing Date	Uses not Supported	Pollutant	Cause/ Source
Slick Creek	From the confluence with the Bighorn River to a point 5.8 miles upstream	2002	Recreation	F. coliform	Unknown
Sage Creek	From the confluence with the Bighorn River to a point 7.4 miles upstream	2002	Recreation	F. coliform	Unknown
Big Horn River	From the Confluence with the Nowood River to a point 36.1 miles upstream	2002	Recreation	E. coli	Unknown

At the September 2012 meeting, the steering committee established an overall Mission Statement for the group to move forward with the planning process on Sage and Slick Creeks.

Mission: The mission of the Washakie Watershed improvement effort is to establish and maintain a voluntary watershed plan that engages local citizens in the remediation of water quality issues in the Bighorn River – Slick Creek watershed, now and in the future.

IV. WATERSHED DESCRIPTION

Sage Creek and Slick Creek are intermittent streams that originate in the badlands southeast of Worland in Washakie County in northern Wyoming. Sage Creek, located just south of Worland, is unique in that "it has been extensively channelized and has no discernible natural channel left" (WCCD SAP, 2008). Both streams flow north/northwest to their confluence with the Big Horn River north of Worland.

The WDEQ's Water Quality Division categorizes Sage Creek and Slick Creek as Class 3B waters for their entire lengths. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna which inhabit waters of the state at some stage of their life cycles. (WDEQ, 2007).

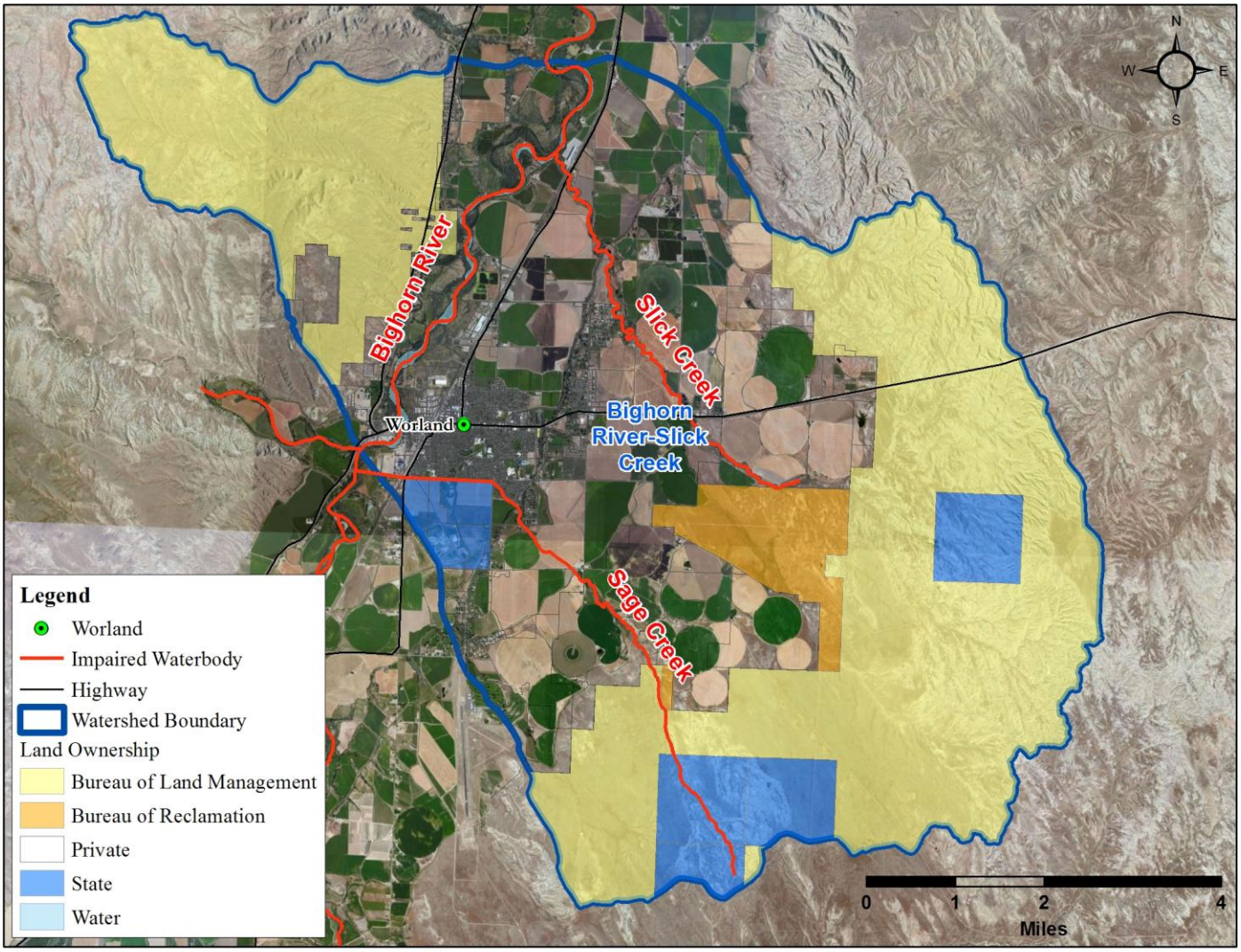

Figure 2 – Land Ownership Map of Bighorn River – Slick Creek Watershed

The Bighorn-River Slick Creek Watershed is a 12 digit Hydrologic Unit Code (100800071201), which is a sub-watershed of the Upper Bighorn Watershed. The watershed has a total of 40,729 acres and land management in the watershed is mixed. Private landowners are responsible for 44.91% of the surface, the United States Bureau of Land Management 44.40%, State of Wyoming 6.42%, Bureau of Reclamation 3.44% and Water 1% (Figure 2).

The average annual precipitation is 8 inches, with a range of 6 to 10 inches within the watershed.

The range of elevation in the Upper Big Horn watershed is from 7,053 feet in the upper portions of the watershed, to 3,796 feet at the outlet of the watershed. The mean elevation is 5,424 feet.

The three major land use types within the Bighorn-River Slick Creek Watershed, are Urban 5%, Irrigated Cropland 34% and Rangeland 61% (Figure 3).

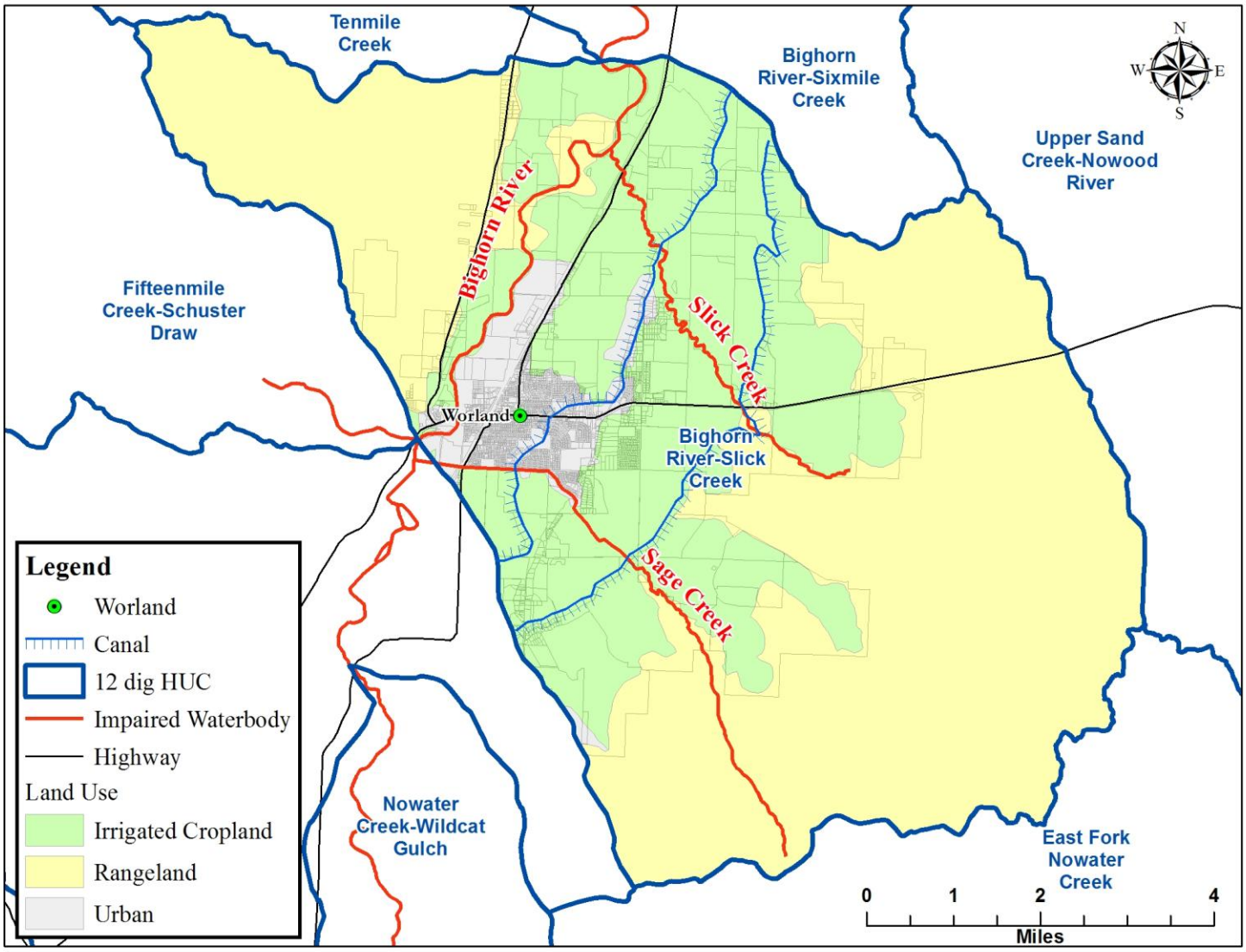

Figure 3 – Land Use Map of Bighorn River – Slick Creek Watershed

According to calculations produced using ArcGIS software and Suitewater, the Natural Resource Planning and Analysis tool, approximately 15,123 residents live within the larger Bighorn-River Elk Creek Watershed, which includes the Bighorn River – Slick Creek subwatershed (ArcGIS, 2013 & Suitewater, 2013). The majority of the residents reside within the city limits of Worland, the county seat and largest town in Washakie County, which has a population of 5,487 residents (2010 census).

Slick Creek is effluent (irrigation runoff) dominated and likely ephemeral under natural conditions (as per landowner interviews documented in the Upper Bighorn Watershed and Nowood River Data Analysis Report). From the beginning of the Slick Creek impairment (7.4 miles upstream from the confluence with the Big Horn River) Slick Creek flows 100% through private landownership. By land use type, Slick Creek flows through 27% Rangeland and 73% Irrigated Cropland.

From the beginning of the Sage Creek impairment (5.8 miles upstream from the confluence with the Big Horn River), Sage Creek flows 63% through private landownership, 15% through BLM and 22% through State. Sage Creek flows through 52% Rangeland, 19% through Irrigated Cropland and 29% through Urban.

V. WATERSHED ASSESSMENT & PREVIOUS MONITORING RESULTS

Sage Creek

The United States Geological Survey (USGS) synoptic study one-time sample in 2000 measured fecal coliform at 770 cfu/100 mL and *E. coli* bacteria at 550 cfu/100 mL (Clark and Gamper, 2003). The District established one monitoring site on Sage Creek in 2005.

Sage Creek Water Quality Results

The District measured flow rates in Sage Creek during the spring and fall of 2005, and summer 2008 sampling seasons. High flow rates and stream depths made it difficult for the District to measure discharge during the other sampling seasons. In general flow rates in summer 2008 were significantly higher than those measured in spring 2005. Results depicted a potential relationship between *E. coli* concentrations and discharge rates during the summer 2005 and summer 2008 sampling seasons. However, further data collection is necessary to substantiate this conclusion.

The District collected 26 bacteria samples between 2005 and 2008. Bacteria samples and field parameters (temperature, pH, EC, turbidity, DO) were measured at the monitoring site. Additionally, water chemistry samples were collected at least once per monitoring season. Field and water chemistry results were compared to water quality standards in Chapter 1 of the WDEQ Water Quality Rules and Regulations (WDEQ, 2013). Stream temperature was the only parameter to exceed the standards. Of the 25 measurements made, two were found to exceed the criteria of 20 ºC. The water type of Sage Creek is primarily sodium sulfate with significant concentrations of calcium and bicarbonate present.

Sage Creek Conclusions

During the monitoring project, bacteria concentrations in Sage Creek exceeded the geometric mean standard every sampling season and 20 of the 25 single sample measurements exceeded the 410 cfu/100 mL single sample limit. Overall, the highest concentrations of bacteria were measured in fall 2006 and summer 2008. A review of the data did not indicate any relationships between bacteria and field parameters or water chemistry. The data was analyzed and the above conclusions were provided by WWC Engineering, in a report completed for WCCD, called UPPER BIGHORN WATERSHED AND NOWOOD RIVER DATA ANALYSIS REPORT, December 2008, which is housed in the WCCD office.

Slick Creek

Slick Creek was listed as threatened for fecal coliform based on the USGS synoptic study where monitoring completed between June and July 2000. USGS collected one sample from a site on Slick Creek and found concentrations of 1,100 cfu/100 mL for fecal coliform and 800 cfu/100 mL for *E. coli* (Clark and Gamper, 2003).

The District established two sites on Slick Creek for the monitoring project. Due to the proximity of the sites, geometric means were calculated using data collected from both sites.

Slick Creek Water Quality Results

A total of 21 discharge measurements were taken on Slick Creek during the monitoring project. A relationship between flow and bacteria was not apparent on Slick Creek, based on the data collected.

The District analyzed Slick Creek stream samples for water chemistry and bacteria. The water chemistry samples were collected at least once per monitoring season. Slick Creek water chemistry was found to be dominated by sodium and calcium cations and sulfate and bicarbonate anions. Overall, TDS concentrations

were low and relatively consistent throughout the monitoring project. A comparison of Slick Creek water chemistry measurements to WDEQ standards found that all samples were well within standards.

A total of 26 bacteria samples were collected between spring 2005 and summer 2008 at both sites on Slick Creek. The District also measured field parameters (temperature, pH, EC, turbidity, DO) in conjunction with each *E. coli* sample. Temperature was the only field measurement in excess of the WDEQ Water Quality Rules and Regulations Chapter 1 water quality standard. The water temperature exceeded 20 ºC three times during the summer 2007 sampling season.

Slick Creek Conclusions

Bacteria concentrations exceeded the geometric mean standard during every sampling season on Slick Creek and 17 of the 26 single samples exceeded the WDEQ limit of 410 cfu/100 mL. The highest geometric mean occurred in summer 2007, when the lowest single bacteria concentration was 727 cfu/100 mL. Geometric means during the other sampling seasons did not vary significantly. There was a slight positive correlation between *E. coli* bacteria and stream temperature.

It is noteworthy that the majority of measurements fall into the moist conditions and mid range flow intervals (0% to 60%), suggesting that the bacteria may be attached to sediment entering the creek during runoff. The data was analyzed and the above conclusions were provided by WWC Engineering, in a report completed for WCCD, called UPPER BIGHORN WATERSHED AND NOWOOD RIVER DATA ANALYSIS REPORT, December 2008, which is housed at the WCCD office.

BMP Implementation

Voluntary BMP implementation has occurred in the sub-watershed that illustrates the commitment of local residents and land managers to improving water quality and compliance with Wyoming's Nonpoint Source Management Plan. However, as is typical, there is a lag between BMP implementation and improved measurements.

Best Management Practices (BMPs) are designed to reduce the quantities of pollutants that are introduced to surface and groundwater. BMPs are a practice or combination of practices that, after problem assessment and examination of alternative practices, are determined to be the most technically and economically feasible means of preventing or reducing nonpoint source pollution. A BMP should be based on existing physical, operational, and economic conditions, opportunities and constraints.

Figure 4 on page 9 depicts the locations of the monitoring sites and also completed BMP's to address failing septic systems, feedlots in close proximity to surface water, and waste management.

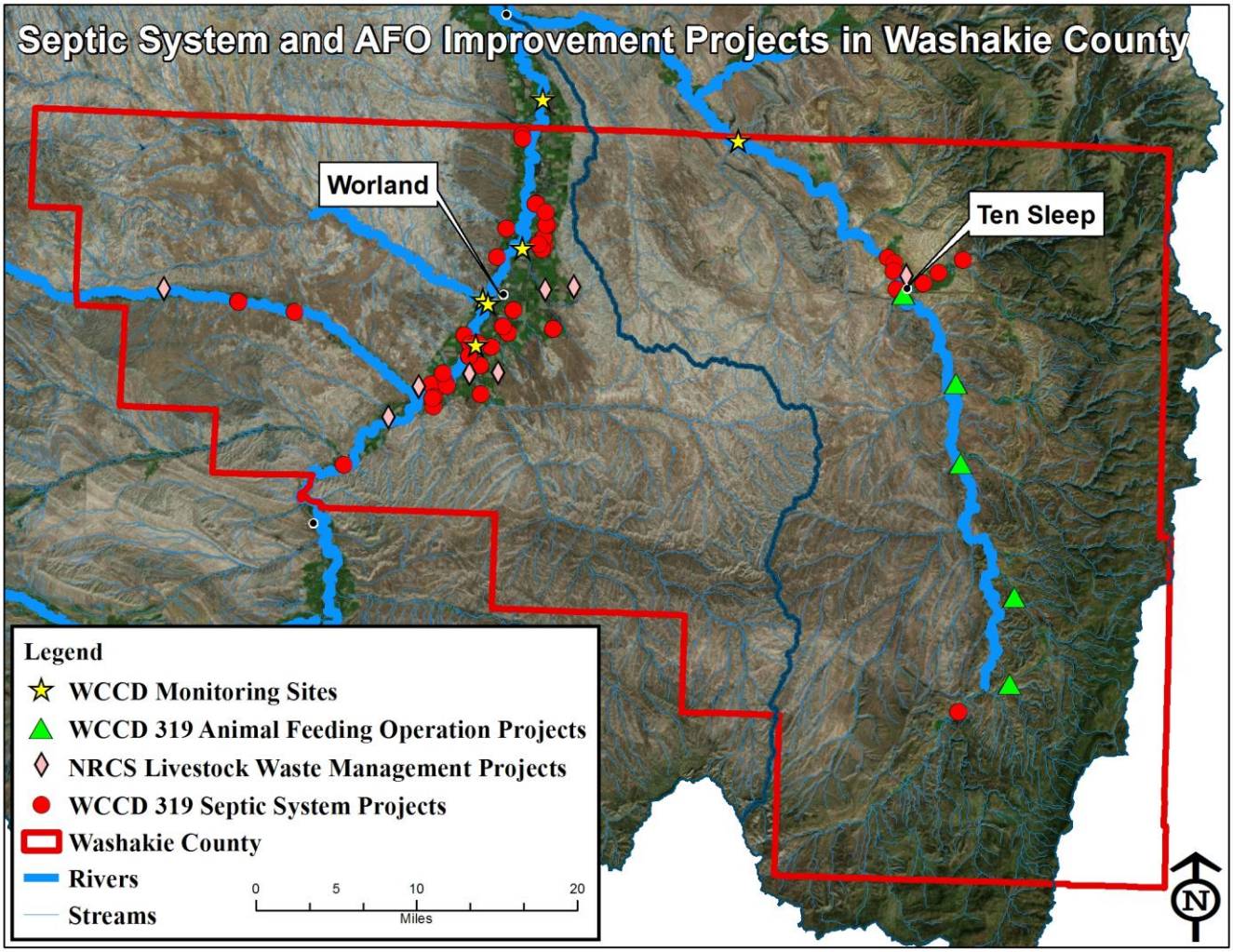

Figure 4 – Monitoring Locations, Septic System, & Waste Management BMP's within the Washakie County Conservation District

VI. WATERSHED IMPROVEMENT ACTIONS AND RECOMMENDATIONS

The bacterial impairments in the Bighorn River – Slick Creek watershed are thought to be the result of contributions from a combination of sources, including human, wildlife, and domestic animals. It is impossible to adequately address impairments by focusing on any single source. However, it is preferable to address as many potential contributors as possible through an incentive-based, voluntary program that encourages widespread cooperation, and participation from landowners. The overarching goal of the steering committee is that by working with landowners and implementing Best Management Practices to reduce runoff, prevent runoff from becoming polluted or treat runoff before it reaches surface waters, we will see an improvement in the water quality. The committee will use resources such as the USDA NRCS Conservation Practices Physical Effect (CCPE) guide and the WDEQ BMP Manuals for guidance with landowners within the watershed (See Appendix B for BMP information). It is a priority of the Washakie Watersheds Steering Committee to ensure that all practices installed to improve water quality also consider the economic impacts on agricultural producers and other residents within the community.

WCCD incorporated items from the Big Horn River TMDL and other studies and input from steering committee meetings into Objectives with Action Items and Milestones.

***PRIORITY*: Watershed Implementation Awareness and Education**

Recognition of water quality issues by landowners and the public at large within the Bighorn River – Slick Creek watershed is the initial challenge. In order to encourage participation in voluntary Best Management Practice (BMP) activities, the WCCD will inform watershed residents of the schedule of activities and cost-share opportunities available for BMP implementation. Continual updates provided to the community could enhance future participation, and documentation of implementation activities associated with this watershed plan could be beneficial to future applications for grant funds.

OBJECTIVE

Maintain an active, collaborative Sage Creek and Slick Creek watershed improvement effort; increase awareness through outreach strategies; and coordinate discussions with the community.

ACTION ITEMS

1. Steering committee will meet periodically to review progress on implementation efforts.
    a. Meet quarterly/as needed to review progress.
    b. Incorporate recommendations from Big Horn River TMDL
    c. Update Implementation Plan as needed
    d. Develop and prioritize parameters for information pertaining to grants
2. Participate in and/or host special forums or meetings to educate the public on implementation efforts.
    a. Develop informational booths to showcase before and after, implementation projects during WESTI Ag Days, Washakie County Fair, and other events.
    b. Develop handouts pertaining to the water quality issues associated with Slick Creek and Sage Creek.
    c. Inform the public through Radio, area News sources, and Social Media opportunities.
    d. Host educational workshops for landowners such as small acreage, range monitoring, and other natural resource topics of interest.
    e. Continue partnerships with others to host tours/forums to showcase projects that have provided an economic and environmental improvement.
    f. Survey landowners to gather local input regarding specific watershed project needs.
3. Improve Delivery of Cost-Share Programs to encourage participation and effective use of resources.
    a. Host special meetings with landowners to encourage participation in project implementation using 319 or other grant funds.
    b. Continue to provide materials to landowners on septic systems, feeding operations, and BMP's for small acreages.
    c. Distribute localized mailings to provide information on specific issues and programs.

COOPERATIVE PARTNERS: Washakie Watersheds Steering Committee, WCCD

***PRIORITY:* Runoff from Cropland**

The TMDL model calculated that by implementing Best Management Practices on Cropland such as irrigation efficiency projects, Sage Creek and Slick Creek could result in load reductions of 79% and 83%, respectively.

Cropland activities have the potential to contribute to nonpoint source pollution. The application of fertilizers to cropland can introduce nutrients, such as nitrogen and phosphorous, to surface and/or groundwater. In addition, the decomposition of organic matter from croplands and crop residue may be a source of mobile forms of nutrients that can be transported by surface water runoff or groundwater infiltration from agricultural lands to water systems. When nutrients are introduced to a natural water body, it can result in dramatic increases in

aquatic plant growth and dramatic decreases in available oxygen. This ecological response is known as eutrophication.

Cultivated croplands can also destabilize soils and lead to excess soil erosion and sedimentation. Transported soil and sediment from croplands often contain nutrients and chemicals, which can further impact water quality. In addition, irrigation waters generally have a natural base load of dissolved mineral salts. The repeated introduction of salts to surface waterbodies can progressively degrade water quality.

On cropland, pastureland, or hayland where manure is applied, or where wildlife and/or livestock directly defecate in the stream, there is the potential for excessive levels of pathogen or heavy metal loading into nearby surface or groundwater. The use of BMPs can help ensure that ground and surface water resources are protected.

OBJECTIVE

Reduce indirect and direct bacteria contributions from Agricultural production on Cropland; improve water quality from return flows.

ACTION ITEMS

1. Implement Cropland Best Management Practices with an emphasis on water quality, including:
    a. Irrigation Water Management with an emphasis on water efficiency
        i. Work with producers and partners to improve irrigation and delivery systems.
    b. Appropriate Tillage Practices
        i. Work with producers to apply Deep till practices in flood irrigation systems where necessary.
        ii. Work with producers to apply minimum till practices in Crop Rotation systems where necessary.
    c. Nutrient Management
        i. Work with producers to maximize utilization of nutrients by crops and minimize losses to groundwater and/or surface water.
2. Implement Cropland Best Management Practices with producers with an emphasis on proper vegetation techniques to include:
    a. Conservation Crop Rotation practices
    b. Cover Cropping
    c. Filter Strips
    d. Riparian Buffers
    e. Global Positioning Systems (GPS)
    f. Soil Moisture Sensors
3. Implement Cropland Best Management Practices for Livestock and Wildlife grazing on Cropland, including:
    a. Manage Waste
        i. Work with producers to implement relocation of waste and/or proper application
    b. Manage Winter Feeding areas
        i. Work with producers and partners to develop off-site watering facilities
        ii. Work with producers to manage stubble height
4. Encourage the use of Ag technologies:
    a. Work with producers to install P.V. Solar, and other innovative practices that also encompass NRCS's Integrated Pest Management and or Nutrient Management.

COOPERATIVE PARTNERS: Washakie Watersheds Steering Committee, WCCD

PRIORITY: **Runoff from Rangeland and Riparian Areas**

The TMDL model calculated that by implementing Best Management Practices on Rangeland and Riparian areas, and reducing the possibility for direct defecation, Sage Creek and Slick Creek could result in load reductions of 10% and 9% respectively. However, a small portion of the Fifteenmile drainage is also included in this watershed, where additional load reductions could also be achieved.

Overgrazing of upland areas by domestic livestock and wildlife can lead to unstable, exposed soil that is more susceptible to erosion. Livestock and wildlife management are important considerations to ensure proper forage utilization. Significant populations of livestock and big game species congregating on riparian areas and upland winter feeding areas may reduce vegetative cover. Excessive bank trampling and wading can result in increased erosion of stream banks and in-stream sedimentation.

Overgrazing of riparian areas can also have detrimental effects on vegetation that is essential for stable aquatic ecosystems and stable channel geomorphology. In addition, all warm-blooded animals have the potential to contribute pathogens to waterways through excretion directly into waterbodies, or from runoff carrying excrement from riparian and upland areas to surface waters. Animal population densities, the species present, the amount of time spent within or near waterbodies, and other site-specific factors will affect the amount of pollution that actually occurs.

OBJECTIVE

Reduce indirect bacteria contributions from Livestock and Wildlife on Rangeland and Riparian Areas.

ACTION ITEMS

1. Implement Rangeland and Riparian Best Management Practices with an emphasis on water quality including:
    a. Alternative Water Sources
        i. Work with producers and partners to evaluate existing reservoirs, and to determine the need for new reservoirs, retention ponds and stock ponds within the watershed.
        ii. Work with producers and partners to develop off-site watering facilities
    b. Work with producers and partners to enhance Stream Crossings and to control access
    c. Work with producers and partners to develop proper techniques for Streambank and Channel Stabilization, including:
        i. Vegetative buffer strips
        ii. Shrub and proper grass plantings
        iii. Weed management
        iv. Riparian fencing
2. Work with landowners and other partners to replace invasive species with natives within the Riparian areas
    a. Continue working with landowners on invasive species removal, control, and native re-establishment, and provide cost share from grants when possible.
3. Implement Rangeland and Riparian BMP's with an emphasis on vegetation.
    a. Work with producers to integrate proper Grazing Management such as proper timing and pasture rotation.

COOPERATIVE PARTNERS: Washakie Watersheds Steering Committee, WCCD

***PRIORITY:* Runoff from Confined and Animal Feeding Areas**

Poorly maintained and unlined corrals that are hydrologically connected to surface waters, allow contaminated wastewater to seep into groundwater and pollute rivers and streams. Inadequately sized and poorly-lined ponds or other storage structures allow manure to escape into the surrounding environment. Manure and wastewater-containing manure can severely harm river and stream ecosystems. Manure contains ammonia which is highly toxic to fish at low levels. Increased amounts of nutrients, such as nitrogen and phosphorus, from confined animal feeding operations can cause algal blooms which block waterways and deplete oxygen as they decompose.

OBJECTIVE

Reduce indirect bacteria contributions from runoff from Animal feeding operations/areas.

ACTION ITEMS

1. Implement Confined and Animal Feeding Area Best Management Practices with an emphasis on water quality, including:
    a. Vegetative filter strips
    b. Sediment basins
    c. Corral relocation
2. Pursue landowner outreach to determine potential use of a portable compost turner.
3. Manage Winter Feeding areas by providing off-site water facilities.

COOPERATIVE PARTNERS: Washakie Watersheds Steering Committee, WCCD

***PRIORITY*: Runoff from Urban and Small Acreages**

Worland, the county seat and most populated town within Washakie County, falls within the northwestern portion of the watershed. As stated in Section IV of this document, private ownership is responsible for 44.91 percent of the watershed, the highest ownership / land manager in the watershed. The TMDL model calculated that by fixing septic systems and reducing other loadings from the Urban environment, Sage Creek and Slick Creek could result in 6% load reductions, which could also include removal of direct defecation.

Urban nonpoint sources of pollution commonly include sediment from construction sites, metals and other contaminants washed from streets or parking lots, fertilizers or pesticides washed from lawns, pathogens from pet waste, and toxic compounds from improperly disposed hazardous materials. Generally, in urban environments, pollutants accumulate on impervious surfaces between rainfall events or before snow melt.

OBJECTIVE

Reduce indirect and direct bacteria contributions from straight pipe and faulty septic systems, and runoff from urban sources, such as stormwater.

ACTION ITEMS

1. Implement Urban Best Management Practices with an emphasis on water quality, including:
    a. Dry / wet retention ponds
    b. Bio-retention systems
    c. Storm drain modifications
    d. Septic and straight pipe replacement
    e. Pet waste dispensers
    f. Small acreage grazing management
    g. Clean up day event organization (incorporate community pride)

2. Provide community recycling education/events for proactive efforts
    a. Continue involvement with Reduce, Reuse, Recycle Coalition regarding every two year Household Hazardous Waste Collection Day event.
    b. Continue coordination and implementation of annual Christmas Tree recycling efforts.
3. Complete downtown demonstration project(s) to address runoff such as:
    i. Rain barrels
    ii. Rain gardens
    iii. Stormwater wetlands
    iv. Bank stabilization/willow plantings
4. Develop cost-share program to address residential and urban run-off specific to stormwater.
    a. Incorporate identified Best Management Practices from EPA Urban Small Water grant information completed by Anderson Consulting Engineers, Inc., into cost –share program.

COOPERATIVE PARTNERS: Washakie Watersheds Steering Committee, WCCD

VII. FUTURE MONITORING

With the aid of this watershed plan, the Washakie Watersheds Steering Committee and WCCD plan to work with landowners and partners to implement projects to improve the water quality in Slick Creek and Sage Creeks. After these projects have been implemented and established, the WCCD will evaluate the effectiveness of these BMPs by collecting data where previous monitoring was conducted on Sage Creek and Slick Creek, if possible.

The Steering Committee and WCCD realizes that even by making changes to some practices and application of BMPs, the probability of exceeding *E. coli* numbers may still be high. *E. coli* is a pathogen and is measured because it provides a good indication of other harmful pathogens which are hard to measure. However, *E. coli* is also thought to live in underwater sediments for extended periods of time, then re-suspend during high flows and storm events. These situations can be problematic when trying to analyze trend data and when trying to understand which BMPs are most effective.

VIII. TECHNICAL AND FINANCIAL RESOURCES

1. **Wyoming Department of Environmental Quality Programs**
   DEQ offers an abundance of information and technical assistance. They provide detailed information about grant programs, enforcement programs and approved BMPs. They promulgate standards for drinking water, fish, livestock and irrigation water which can be compared to local conditions to identify problems. They also employ groundwater and surface water experts that are available to answer questions.

   205j Funds - These funds are periodically available from DEQ. They can be used for problem identification and planning. When existing water quality data do not provide enough information to pinpoint problems, 205j funds can be used to establish a water quality monitoring network. A 25 percent nonfederal match is usually required. These funds can be allocated only to local governments such as Conservation Districts, Counties, and Municipalities.

   319 Funds - These funds are used for implementation of projects. After a problem has been pinpointed through existing water quality data and/or additional monitoring, 319 funds can be used to pay for corrective measures or for evaluation of improvement. The corrective measures are often referred to as

BMPs and typically include practices such as streambank stabilization, feedlot waste containment, grassed waterways, filter strips, sedimentation basins, etc.

2. **UW Cooperative Extension Service or local Cooperative Extension Service office**
   Local Extension Educators and University Extension personnel are available to assist producers with on-site assessments of operations. The University Cooperative Extension Service can assist producers through the Farm-A-Syst program in providing a complete assessment of a farm or ranch operation. In addition, Cooperative Extension assists with the development of Best Management Practices.

3. **Natural Resources Conservation Service**
   The NRCS has been heavily involved with water quality projects in Wyoming. Conservation Districts receive technical assistance from our NRCS partners for design and implementation of BMPs. The NRCS currently has several cost-share programs available to producers. They also have an Agricultural Waste Management Field Handbook which includes other Ag waste management options for producers.

4. **Farm Service Agency**
   The FSA offers the Continuous Conservation Reserve Program (CCRP) and Conservation Reserve Program (CRP). These programs provide 50% cost share on approved conservation practices and annual rental payments to landowners, to manage acres on 10 to 15 years contracts.

5. **Wyoming Department of Agriculture**
   The Wyoming Department of Agriculture, Natural Resource Section, is responsible for providing agriculture producers with the assistance needed to protect and enhance Wyoming's natural resources while maintaining agriculture productivity. The Department also coordinates and disseminates information between local Conservation Districts. The WDA offers grants to Conservation Districts for water quality and range monitoring programs.

6. **The Nature Conservancy**
   The mission of the Nature Conservancy is to protect the lands and waters on which all life depends. The Nature Conservancy in Wyoming works with willing landowners to coordinate resource improvement projects, including those funded by public and private funds. The Conservancy works closely with landowners to seek and manage funds for water quality improvement projects, and to implement solutions that benefit both human and wildlife communities.

APPENDIX A

MILESTONE TABLE

Bighorn-Slick Creek Watershed Implementation Plan
2013-2015
Milestone Table

Priority: Watershed Implementation Awareness and Education
Objective: Maintain an active, collaborative Sage Creek and Slick Creek watershed improvement effort, increase awareness through outreach strategies, and coordinate discussions with the community.

Action Item	2013	2014	2015
Action 1. Steering Committee will meet periodically to review progress on implementation efforts			
Meet quarterly/as needed to review progress. (either meeting/via email/teleconference)	July Oct	Jan April July Oct	Jan April July Oct
Incorporate recommendations from Big Horn River TMDL.	July-Dec		
Update Implementation Plan as needed.	Ongoing	Ongoing	Ongoing
Develop and prioritize parameters for information pertaining to grants.	Ongoing	Ongoing	Ongoing
Action 2. Participate in and/or host special forums or meetings to educate the public on implementation efforts			
Develop informational booth to showcase before and after, implementation projects during WESTI Ag Days, Washakie County Fair, and other events.	Aug	Feb Aug	Feb Aug
Develop handouts pertaining to the water quality issues associated with Slick Creek and Sage Creek.		Feb	
Inform the public through Radio, area News sources, and Social Media opportunities.	Ongoing	Ongoing	Ongoing
Host educational workshops for landowners such as small acreage, range monitoring, and other natural resource topics of interest.		March Sept	Feb March
Continue partnerships with others to host tours/forums to showcase projects that have provided an economic and environmental improvement.	Aug	July	July
Survey landowners to gather local input regarding specific watershed project needs.	Sept		Jan
Action 3. Improve Delivery of Cost-Share Programs to encourage participation and effective use of resources			
Host special meetings with landowners to encourage participation in project implementation using 319 or other grant funds.		Jan July	
Continue to provide materials to landowners on Septics, feeding operations, and BMP's for small acreages.	Ongoing	Ongoing	Ongoing
Distribute localized mailings to provide information on specific issues and programs.	Ongoing	Ongoing	Ongoing

Priority: Runoff from Cropland
Objective: Reduce indirect bacteria contributions from Agricultural production on Cropland, and improve water quality from return flows.

Action Item	2013	2014	2015
Action 4. Implement Cropland BMP's with an emphasis on water quality, including:			
Water Efficiency: -Work with producers and partners to improve irrigation and delivery systems.	Sept - Oct	March - Oct	March - Oct
Tillage Practices: -Work with producers to apply Deep till practices in flood irrigation systems where necessary. -Work with producers to apply minimum till practices in Crop Rotation systems where necessary.	Sept - Oct	March - Oct	March - Oct
Nutrient Management: -Work with producers to maximize utilization of nutrients by crops and minimize losses to groundwater and/or surface water.	Sept – Oct	March - Oct	March - Oct

Priority: Runoff from Cropland CONTINUED…

Action Item	2013	2014	2015
Action 5. Implement Cropland Best Management Practices with producers, with an emphasis on proper vegetation techniques, such as:			
Conservation Crop Rotation practices, Cover Cropping, Filter Strips, Riparian Buffers, GPS, and Soil Moisture Sensors	Sept – Oct	March - Oct	March - Oct
Action 6. Implement Cropland BMP's for Livestock and Wildlife grazing on Cropland			
Manage Waste: -Work with producers to implement relocation of waste and/or proper application.	Sept – Oct	March – Oct	March – Oct
Manage Winter Feeding areas: -Work with producers and partners to develop off-site watering facilities. -Work with producers to manage stubble height.	Sept – Oct	March – Oct	March – Oct
Encourage Use of Ag Technologies -Work with producers to install P.V. Solar and other innovative practices that also encompass NRCS's Integrated Pest Management and/or Nutrient Management.	Sept – Oct	March - Oct	March - Oct

Priority: Runoff from Rangeland and Riparian Areas
Objective: Reduce indirect bacteria contributions from Livestock and Wildlife on Rangeland and Riparian Areas.

Action Item	2013	2014	2015
Action 7. Implement Rangeland and Riparian BMP's with an emphasis on water quality			
Alternative Water Sources: -Work with producers and partners to evaluate existing reservoirs, and determine the need for new reservoirs, retention ponds, and stock ponds. -Work with producers and partners to develop off-site watering facilities to enhance stream crossings and to control access.	Sept – Oct	March – Oct	March – Oct
Streambank Stabilization: -Work with producers and partners to develop proper techniques for Streambank and Channel Stabilization, including: Vegetative Buffer Strips Shrub and Proper Grass Plantings Weed Management Riparian Fencing	Sept – Oct	March – Oct	March – Oct
Action 8. Work with landowners and other partners to replace invasive species with natives within the Riparian areas			
Work with landowners on invasive species removal, control, and native re-establishment, and provide cost share from grants when possible.	Sept – Oct	Ongoing	Ongoing
Action 9. Implement Rangeland and Riparian BMP's with an emphasis on vegetation			
Work with producers to integrate proper Grazing Management such as proper timing and pasture rotation.	Sept – Oct	Ongoing	Ongoing

Priority: Runoff from Confined and Animal Feeding Areas
Objective: Reduce indirect bacteria contributions from runoff from Animal Feeding Areas.

Action Item	2013	2014	2015
Action 10. Implement Confined and Animal Feeding BMP's with an emphasis on water quality, such as:			
Vegetative Filter Strips, Sediment Basins, and Corral Relocation	Ongoing	Ongoing	Ongoing
Pursue landowner outreach to determine potential use of a portable compost turner.		Jan – March	
Manage Winter Feeding areas by providing off-site water facilities.	Ongoing	Ongoing	Ongoing

Priority: Runoff from Urban and Small Acreages
Objective: Reduce indirect and direct bacteria contributions from straight pipe and faulty septic systems, and runoff from urban sources, such as stormwater.

Action Item	2013	2014	2015
Action 11. Implement Urban BMP's with an emphasis on water quality such as:			
Dry/wet retention ponds, Bio-retention systems, Storm drain modifications, Septic and straight pipe replacement, Pet waste dispensers, Small acreage grazing management, Clean up day event organization (incorporate community pride)	Ongoing	Ongoing	Ongoing
Action 12. Provide community recycling education/events for proactive efforts			
Continue involvement with Reduce, Reuse, Recycle Coalition regarding every two year Household Hazardous Waste Collection Day event.		Jan.-May	
Continue coordination and implementation of annual Christmas Tree Recycling efforts.		Dec.	
Action 13. Complete downtown demonstration project to address run-off using one or more of the following:			
Rain barrels, Rain gardens, Stormwater wetlands, Bank stabilization/willow planting		March - Sept	March - Sept
Action 14. Develop cost-share program to address residential and urban run-off specific to stormwater.			
Incorporate identified BMP's from Urban Small Water Grant information completed by Anderson Consulting Engineers, Inc. into cost-share program.	Aug		

APPENDIX B

USDA NRCS CONSERVATION PRACTICES PHYSICAL EFFECT (CPPE) GUIDE

NATIONAL CONSERVATION PRACTICE STANDARDS | *NRCS*

AND

WDEQ BMP Manuals

Cropland ***BMP Manual*** - ***Wyoming Department of Environmental***
Urban ***BMP Manual*** - ***Wyoming Department of Environmental***
Livestock/Wildlife - ***Wyoming Department of Environmental Quality***

A PAPER COPY OF EACH OF THE ABOVE IS AVAILABLE UPON REQUEST TO:

WASHAKIE COUNTY CONSERVATION DISTRICT
208 SHILOH ROAD
WORLAND, WYOMING 82401
(307) 347-2456 EXT. 101

APPENDIX C

REFERENCES

Clark and Gamper, 2003, A Synoptic Study of Fecal-Indicator Bacteria in the Wind River, Bighorn River, and Goose Creek Basins, Wyoming, June-July 2000. USGS Water-Resources Investigations Report: 2003-4055

RESPEC Consulting & Services, July 2013, E. Coli Total Maximum Daily Loads for the Big Horn River Watershed, Topical Report RSI 2290

Washakie County Conservation District (WCCD), 2006, Big Horn River Watershed Management Plan

Washakie County Conservation District (WCCD) (2005-2010) *Sampling and Analysis Plan, Washakie County Conservation District's Monitoring Program*

WDEQ. 2007, Water Quality Rules and Regulations Chapter 1, Quality standards for Wyoming surface waters. Cheyenne, Wyoming.

WWC Engineering, December (2008) *Upper Bighorn Watershed and Nowood River Data Analysis Report*

Wyoming Geographical Information Science Center, United States Census and Climate Data. (2012, 2013). Retrieved from *Suitewater* – Natural Resource Mapping Analysis tool, http://www.suitewater.wygisc.org

APPENDIX D

COMMENTS & WCCD RESPONSES

COMMENTS & RESPONSES

WYOMING DEQ COMMENTS – WCCD RESPONSES

Comment HK1 – Referred to: Page 1, I INTRODUCTION
DEQ's comment was as follows, "After the TMDLs are EPA approved all 16 listings will be removed from the 303 (d) list."
Response to HK1: Incorporated suggested language end of paragraph 6 on page 1 to read, "When EPA approves the TMDL, all listings will be removed from the 303(d) list."

Comment HK4 – Referred to Page 2, Technical Steering Committee, second sentence which reads, "Conference calls were scheduled almost every month to discuss project progress, address technical concerns, and assist the project team by providing information about the watershed (RESPEC, 2013)"
DEQ's comment was as follows, "There currently is not a reference section in the document and was wondering if one would be added."
Response to HK4: Appendix C was added to include references of documents referred to throughout the document.

Comment HK5 – Referred to Page 4, IV WATERSHED DESCRIPTION, second paragraph, last sentence which read, "(Wyoming Department of Environmental Quality, 2011)"
DEQ's comment was as follows, "The correct year should be 2007. This is the date of the latest Chapter 1."
Response to HK5: The date was changed from 2011 to 2007.

Comment HK9 – Referred to Page 7, V WATERSHED ASSESSMENT & PREVIOUS MONITORING RESULTS, Sage Creek Conclusions.
DEQ's comment was as follows, "This sub-heading is not used in the Slick Creek section. I would either remove heading or add heading in Slick Creek sections to ensure someone reading doesn't think there is a section missing."
Response to HK9: The title, "Slick Creek Conclusions" replaced the duplicate title for Slick Creek Water Quality Results on page 8.

Comment HK8 – Referred to Page 7, V WATERSHED ASSESSMENT & PREVIOUS MONITORING RESULTS, Sage Creek Water Quantity Results, second paragraph, sixth sentence which read, "Of the 25 measurements made, two were found to exceed the criteria of 20°C.
DEQ's comment was as follows, "The 20 degree Celsius temp criteria only applies to fisheries use and these waterbodies are 3B and do not support fish. I would remove this statement."

Comment HK10 – Referred to Page 7, V WATERSHED ASSESSMENT & PREVIOUS MONITORING RESULTS, Sage Creek Conclusions, first paragraph, first sentence which reads, "During the monitoring project, bacteria concentrations in Sage Creek exceeded the geometric mean standard every sampling season and 20 of the 15 single sample measurements exceeded the 410 cfu/100 mL single sample limit."
DEQ's comment was as follows, "Section 27 (c) of Chapter 1 only applies to WPDES permits and are not used for determining attainment of uses. I would remove this statement."

Comment HK11 – Referred to Page 7, V WATERSHED ASSESSMENT & PREVIOUS MONITORING RESULTS, Slick Creek Conclusions, first paragraph, first sentence which reads, "Slick Creek was listed as

threatened for fecal coliform based on the USGS synoptic study monitoring completed between June and July 2000."
DEQ's comment was as follows, "I would clarify if the samples were used for listing were geometric values or individual samples.

Comment HK13 – Referred to Page 8, second sentence which reads, "The water temperature exceeded 20°C three times during the summer 2007 sampling season."
DEQ's comment was as follows, "The 20 degree Celsius temp criteria only applies to fisheries use and these waterbodies are 3B and do not support fish. I would remove this statement.

Comment HK15 – Referred to Page 8, Slick Creek Conclusions, first paragraph, first sentence which reads, "Bacteria concentrations exceeded the geometric mean standard during every sampling season on Slick Creek and 68% of the single samples exceeded the WDEQ limit of 410 cfu/100 mL."
DEQ's comment was as follows, "Section 27 © of chapter 1 only applies to WPDES permits and are not used for determining attainment of uses. I would remove this statement."

Comment HK16 – Referred to Page 8, Slick Creek Conclusions, second paragraph which reads, "It is noteworthy that the majority of measurements fall into the moist conditions and mid range flow intervals (0% to 60%), suggesting that the bacteria may be attached to sediment entering the creek during runoff."
DEQ's comment was as follows, "What is the basis for this statement. If you don't have a reference I would avoid making bold statements about the reactions of sediment and bacteria."
Response to HK8, HK10, HK11, HK13, HK15, & HK16: All of the information written within V. WATERSHED ASSESSMENT AND PREVIOUS MONITORING RESULTS for Sage Creek and Slick Creek were obtained from a document developed by WWC Engineering, who was hired by WCCD to provide data analysis, conclusions, and recommendations based upon their analysis of the WCCD's 2005 to 2008 water quality monitoring data. The document, "UPPER BIGHORN WATERSHED AND NOWOOD RIVER DATA ANALYSIS REPORT, December 2008" is now referenced in this section in response to DEQ's comments HK8, HK10, HK11, HK13, HK15, and HK16. The WCCD chose to provide a reference of where the information was obtained versus changing the text written by WWC Engineering in their report.

Comment HK14 – Referred to Page 8, Slick Creek Conclusions, first paragraph, first sentence which reads, "Bacteria concentrations exceeded the geometric mean standard during every sampling season on Slick Creek and 68% of the single samples exceeded the WDEQ limit of 410 cfu/100 mL."
DEQ's comment was as follows, "If there were 26 samples collected on Slick Creek and 17 of them exceeded the 410 criteria then you would only have a 65% of the samples exceeding, but if you decide to remove the reference to this criterion then you would need to remove this also. It was stated that 26 bacteria samples were collected in the paragraph at the top of the page, in the first sentence of this paragraph it was stated that 68% of the samples exceeded the single sample max of 410 CFU and in the second to last sentence it states that 17 of the samples exceeded the single sample criterion."
Response to HK14 – Due to DEQ's comments regarding the inconsistencies in the wording of the first paragraph under Slick Creek Conclusions, page 8, it was re-written as follows, "Bacteria concentrations exceeded the geometric mean standard during every sampling season on Slick Creek and 17 of the 26 single samples exceeded the WDEQ limit of 410 cfu/100 mL. The highest geometric mean occurred in summer 2007, when the lowest single bacteria concentration was 727 cfu/100 mL. Geometric means during the other sampling seasons did not vary significantly. There was a slight positive correlation between *E. coli* bacteria and stream temperature."

Comment HK17 – Referred to Page 8, BMP Implementation, third paragraph which reads, "Figure 4 on page 9 depicts the locations of the monitoring sites and completed septic system projects."
DEQ's comment was as follows, "Figure 4 also depicts the locations of other types of projects. It might be good to mention these projects and describe the BMPs used on each type of project."
Response to HK17 - The wording referred to was corrected to read, "Figure 4 on page 9 depicts the locations of the monitoring sites and also completed BMP's to address failing septic systems, feedlots in close proximity to surface water, and waste management practices."

Comment HK18 - Referred to Page 9, Figure 4 Map caption which reads, "Figure 4 – Monitoring Locations and Septic System projects within the Washakie County Conservation District"
DEQ's comment was as follows, "If the discussion is added about other projects, I would recommend updating this caption text."
Response to HK18 – The wording referred to was corrected to read, "Figure 4 – Monitoring Locations, Septic System, & Waste Management BMP's within the Washakie County Conservation District"

Comment HK19 – Referred to Page 9, VI WATERSHED IMPROVEMENT ACTIONS AND RECOMMENTATIONS, first paragraph, last sentence which reads, "It is a priority of the Washakie Watersheds Steering Committee to ensure that all practices installed to improve water quality also consider the economic impacts on agricultural producers."
DEQ's comment was as follows, "Is there only concern about the financial effects to the ag community. Might think about adding discussion about financial concerns to urban or other stakeholder groups. I think the intent is to ensure any BMP and management actions is cost effective and doesn't create financial hardship if possible."
Response to HK19 – The above referenced sentenced was re-worded to read, "It is a priority of the Washakie Watersheds Steering Committee to ensure that all practices installed to improve water quality also consider the economic impacts on agricultural producers and other residents within the community."

Comment HK20 – Referred to Page 10, missing section under Watershed Implementation awareness and Education.
DEQ's comment was as follows, "Are you missing a Cooperative partner section?"
Response to HK20 – The section was added at the end of the section which read as follows, "COOPERATIVE PARTNERS: Washakie Watersheds Steering Committee, WCCD"

Comment HK21 – Referred to Page 10, Runoff from Cropland, first, second, & third paragraphs which read, "The TMDL model calculated that by implementing Best Management Practices on Cropland such as irrigation efficiency projects, Sage Creek and Slick Creek could result in load reductions of 54% and 79%, respectively. DEQ comments; HK24 on page 12 and HK27 on page 13, were also associated with HK21, only different sections (Runoff from Rangeland & Riparian and Runoff from Urban & Small Acreage)
DEQ's comment is as follows, "It appears that these numbers for this section and the other priority sections were calculated from Table C1 in the implementation plan. This table is not a table describing the percent reduction in the amount of pollutant, it is a reduction in the amount of time you have exceedances of the criteria. Table 7-1 of the TMDL should be the number you use if you want to display the load reductions for the different BMP scenarios."
Response to HK21 - The first paragraph of the above referenced sections of Cropland, Rangeland & Riparian, and Urban and Small Acreage were re-worded as follows: Runoff from Cropland - The TMDL model calculated that by implementing Best Management Practices on Cropland such as irrigation efficiency projects, Sage Creek and Slick Creek could result in load reductions of 79% and 83%, respectively. Runoff from Rangeland & Riparian - The TMDL model calculated that by implementing Best Management Practices on Rangeland and Riparian areas, and reducing the possibility for direct

defecation, Sage Creek and Slick Creek could result in load reductions of 10% and 9% respectively. However, a small portion of the Fifteenmile drainage is also included in this watershed, where additional load reductions could also be achieved. Runoff from Urban and Small Acreage - Worland, the county seat and most populated town within Washakie County, falls within the northwestern portion of the watershed. As stated in Section IV of this document, private ownership is responsible for 44.91 percent of the watershed, the highest ownership / land manager in the watershed. The TMDL model calculated that by fixing septic systems and reducing other loadings from the Urban environment, Sage Creek and Slick Creek could result in 6% load reductions, which could also include removal of direct defecation.

Comment HK22 – Referred to Page 10, Runoff from Cropland, second, third & fourth paragraphs which read, "Cropland activities have the potential to contribute to nonpoint source pollution. The application of fertilizers to cropland can introduce nutrients, such as nitrogen and phosphorous, to surface and/or groundwater. In addition, the decomposition of organic matter from croplands and crop residue may be a source of mobile forms of nutrients that can be transported by surface water runoff or groundwater infiltration from agricultural lands to water systems. When nutrients are introduced to a natural water body, it can result in dramatic increases in aquatic plant growth and dramatic decreases in available oxygen. This ecological response is known as eutrophication.

Cultivated croplands can also destabilize soils and lead to excess soil erosion and sedimentation. Transported soil and sediment from croplands often contain nutrients and chemicals, which can further impact water quality. In addition, irrigation waters generally have a natural base load of dissolved mineral salts. The repeated introduction of salts to surface waterbodies can progressively degrade water quality.

On cropland, pastureland, or hayland where manure is applied, there is the potential for excessive levels of pathogen or heavy metal loading into nearby surface or groundwater. The use of BMPs can help ensure that ground and surface water resources are protected when landowners apply manure."
DEQ's comment is as follows, "The discussion about nutrients, soil erosion and manure spreading are all great and inform readers about other potential pollutants. The TMDL also describes that livestock and wild animals contribute bacteria loads by direct defecation in the stream and indirectly by defecating on pastures and cropland. A portion of this bacteria and then washed into the stream. Controlling crop land loading and direct defecation is also very important. Don't think that all irrigation needs to be converted. There are other ways that irrigation can be made more efficient: e.g. Allowing more time after livestock have been removed from the field before it is irrigated."
Response to HK22 – The fourth paragraph was re-worded in response to HK22 to read as follows, "On cropland, pastureland, or hayland where manure is applied, or where wildlife and/or livestock directly defecate in the stream, there is the potential for excessive levels of pathogen or heavy metal loading into nearby surface or groundwater. The use of BMPs can help ensure that ground and surface water resources are protected." In addition, "and direct" was added to the wording of the OBJECTIVE, which reads as follows, "Reduce indirect and direct bacteria contributions from Agricultural production on Cropland; improve water quality from return flows."

Comment HK26 – Referred to Page 13, Runoff from Confined and Animal Feeding Areas.
DEQ's comment is as follows, "The TMDL did not identify CAFO's as significant sources. I would move this to a very low priority for implementation."
Response to HK26 – The word, "Confined" in this priority is not to be confused with permitted Confined Animal Feeding Operations (CAFO's). For the purposes of this plan, the word "Confined" is defined as an area where animals are confined within an enclosed area. Our use of the word "Confined" was to distinguish between openly grazed areas where animals are fed and areas where animals are fed within a confined area.

Comment HK28 - Referred to Page 14, FUTURE MONITORING, second paragraph which read, "The Steering Committee and WCCD realizes that even by making changes to some practices and application of BMP's, the probability of exceeding *E. Coli* numbers may still be high. *E. coli* can be a good indicator of waterborne pathogens, but many times it does not correlate well with the occurrence of waterborne pathogens. *E. coli* can live in underwater sediment for months and re-suspend during high flows and storm events. These situations can be problematic when trying to analyze trend data and when trying to understand which BMP's are most effective.
DEQ's comment is as follows, "Confusing sentence. Might want to reword?"

Comment HK30 - Referred to Page 14, FUTURE MONITORING, second paragraph, second sentence which read , "The Steering Committee and WCCD realizes that even by making changes to some practices and application of BMP's, the probability of exceeding *E. coli* numbers may still be high. *E. coli* can be a good indicator of waterborne pathogens, but many times it does not correlate well with the occurrence of waterborne pathogens. *E. coli* can live in underwater sediment for months and re-suspend during high flows and storm events. These situations can be problematic when trying to analyze trend data and when trying to understand which BMP's are most effective.
DEQ's comment is as follows, "If the WCCD has established monitoring sites, it would be best to sample at these locations after BMPs have been implemented if they are in the impaired segment. This will help with showing an improving trend."

Comment HK31, Referred to Page 14, FUTURE MONITORING, second paragraph, second sentence which read, ""The Steering Committee and WCCD realizes that even by making changes to some practices and application of BMP's, the probability of exceeding *E. coli* numbers may still be high. *E. coli* can be a good indicator of waterborne pathogens, but many times it does not correlate well with the occurrence of waterborne pathogens. E. coli can live in underwater sediment for months and re-suspend during high flows and storm events. These situations can be problematic when trying to analyze trend data and when trying to understand which BMP's are most effective.
DEQ's comment is as follows, "*E. coli* is a pathogen and is measured because it provides a good indication of other harmful pathogens that are hard to measure. See Tech Note 9 provided.
Response to HK28, HK30, & HK31 – The second paragraph was re-written as follows, "The Steering Committee and WCCD realizes that even by making changes to some practices and application of BMPs, the probability of exceeding *E. coli* numbers may still be high. *E. coli* is a pathogen and is measured because it provides a good indication of other harmful pathogens which are hard to measure. However, *E. coli* is also thought to live in underwater sediments for extended periods of time, then re-suspend during high flows and storm events. These situations can be problematic when trying to analyze trend data and when trying to understand which BMPs are most effective."

NOTE: All other comments from WDEQ referred to grammar or punctuation edits, which were corrected, but not noted here.

APPENDIX E

MEMBERS OF STEERING COMMITTEE
PLANNING TEAM
WCCD BOARD OF SUPERVISORS

WASHAKIE WATERSHEDS STEERING COMMITTEE:
Dave Slover, Landowner
Steve Snyder, Landowner
Vance Lungren, Jr., Landowner
Gary Throntveit, Landowner
Doug Hamilton, Landowner
Katherine Thompson, The Nature Conservancy
Kitsy Barnes, WCCD Board Member
Peggy Truman, Landowner
Jared Dalebout, Bureau of Land Management (BLM) Hydrologist
Ray Gullion, Natural Resources Conservation Service (NRCS) Range Conservationist
Amy Anderson, Wyoming Game & Fish Department
Sherri Foust, Farm Service Agency

PLANNING TEAM:
Cathy Rosenthal, Wyoming Association Of Conservation Districts
Victoria Dietz, Washakie County Conservation District
Jennifer Zygmunt, Wyoming Department Of Environmental Quality

WASHAKIE COUNTY CONSERVATION DISTRICT BOARD OF SUPERVISORS
Dan Rice
Vance Lungren
Kitsy Barnes
David Nicholas
Cal Jones

APPENDIX F

Bighorn River – Slick Creek
Watershed Implementation Plan

SIGNATURE PAGE

On October 1, 2013, the Washakie Watersheds Steering Committee adopted the Bighorn River-Slick Creek Watershed Management Plan as a method for addressing water quality concerns in the Sage Creek and Slick Creek watersheds in Washakie County.

_____
Washakie Watersheds Steering Committee Representative, Dave Slover

_____
Washakie Watersheds Steering Committee Representative, Vance Lungren Jr.

The Washakie County Conservation District's Board of Supervisors approved the Bighorn River-Slick Creek Watershed Management Plan on October 21, 2013.

Dan Rice, Chairman	Vance Lungren, Vice Chairman
Kitsy Barnes, Secretary/Treasurer	David Nicholas, Member
Cal Jones, Member	

The Bighorn River – Slick Creek Watershed Management Plan was approved by the Wyoming Department of Environmental Quality.

Wyoming Department of Environmental Quality	Date

APPENDIX G

PUBLIC NOTICE OF DRAFT BIGHORN RIVER-SLICK CREEK WATERSHED PLAN

PUBLIC NOTICE

PUBLIC NOTICE

WASHAKIE COUNTY CONSERVATION DISTRICT'S SAGE CREEK/SLICK CREEK WATERSHED MANAGEMENT PLAN RELEASED FOR PUBLIC COMMENT

The Washakie County Conservation District and the Washakie Watersheds Steering Committee will accept written comments on the Sage Creek/Slick Creek Watershed Management Plan beginning July 23, 2013 and will continue through September 6, 2013, until 4 p.m. Copies of the document are available at the Washakie County Conservation District office, located at 208 Shiloh Road in Worland, as well as on our web site at www.washakiecd.com. For more information, contact the Washakie County Conservation District at 347-2456 ext. 101 or email us at wccd@rtconnect.net.

July 23, 2013

Affidavit of Publication

STATE OF WYOMING)
) s.s.
COUNTY OF WASHAKIE)

I, Lee Lockhart

Do solemnly swear that I am Publisher of "THE NORTHERN WYOMING DAILY NEWS – WORLAND GRIT – WYOMING NEWS – WASHAKIE SIGNAL FIRE," a daily newspaper of general circulation, published daily at Worland, Washakie County, State of Wyoming; that the notice attached hereto, and which is a part of this affidavit and part of the proof of:

Washakie County Conservation District's Sage Creek/Slick Creek Watershed Management Plan Released for Public Comment.

was published in said newspaper for 1 consecutive weeks, the first publication having been made on the

23rd day of July, 2013,

and the last publication on the 23rd day of

July, 2013.

that said notice was published in the regular and entire issues of the paper during the period and time of publication and that the notice was published in the newspaper proper and not in a supplement.

IN WITNESS WHEREOF, I have hereunto set my hand this

25th day of July, 2013

Publisher

Subscribed and sworn to before me this 25th day

of July, 2013.

My commission expires on the 25th day of May, 2017.

Notary Public