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April 2018

New Fork River Watershed

Level I Study, Executive Summary

Prepared for
Wyoming Water Development Commission

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In association with
RJH Consultants, Inc.
Rio Verde Engineering

1 Introduction

In 2015, the Sublette County Conservation District (SCCD) requested that the Wyoming Water Development Commission (WWDC) conduct a comprehensive study of the New Fork River Watershed and its water resources. The local sponsors requested that the Level I watershed study evaluate watershed function; assess wetland and riparian conditions; develop geomorphic classifications; and identify resource concerns and water-development opportunities on irrigated lands, rangelands, wetlands, and streams. In 2016, the WWDC approved funding for the watershed study and then contracted with Tetra Tech, Inc. and its subconsultants, Rio Verde Engineering and RJH Consultants, Inc., to provide technical and professional services for the New Fork River Watershed Level I Study in June 2016.

The New Fork River Watershed Study is a comprehensive evaluation and an initial inventory of the water and land resources within the study area. This Level I study provides important information that the SCCD (the study's local sponsor) and the WWDC (the study's sponsor) can use in developing water resources and implementing conservation practices that address water- and land-resource concerns within the study area. This watershed study includes in-depth descriptions about needed water-development projects that could provide economic, ecological, and social benefits to the state of Wyoming and its citizens.

2 Study Area

The New Fork River is the uppermost major tributary of the Green River in Wyoming. It flows about 70 miles, entirely within Sublette County (**Figure 1**). The New Fork River drains a watershed of 1,257 square miles in southwestern Wyoming, south of the Wind River Range; the watershed is in the U.S. Geological Survey's (USGS) hydrologic unit code (HUC) 14040102. Its origin is at the Lozier Lakes in the Wind River Range, at just over 10,000 feet above sea level, in the Bridger–Teton National Forest. From there it flows southwest through a steep and narrow glacial canyon; it comes out of the mountains about 10 miles north of Cora, where it widens into the New Fork Lakes. After flowing out of the mountains, the New Fork River flows south then southeast, past Cora and on to Pinedale. Primary tributaries along this reach are Willow, Pine and Pole creeks; each discharging into the New Fork River from the east. At Boulder, the New Fork River receives Boulder Creek and turns south again. The East Fork River joins the New Fork River a few miles to the south. From the confluence with the East Fork River, the New Fork River meanders generally southwest between low bluffs and joins the Green River about 6 miles east of Big Piney.

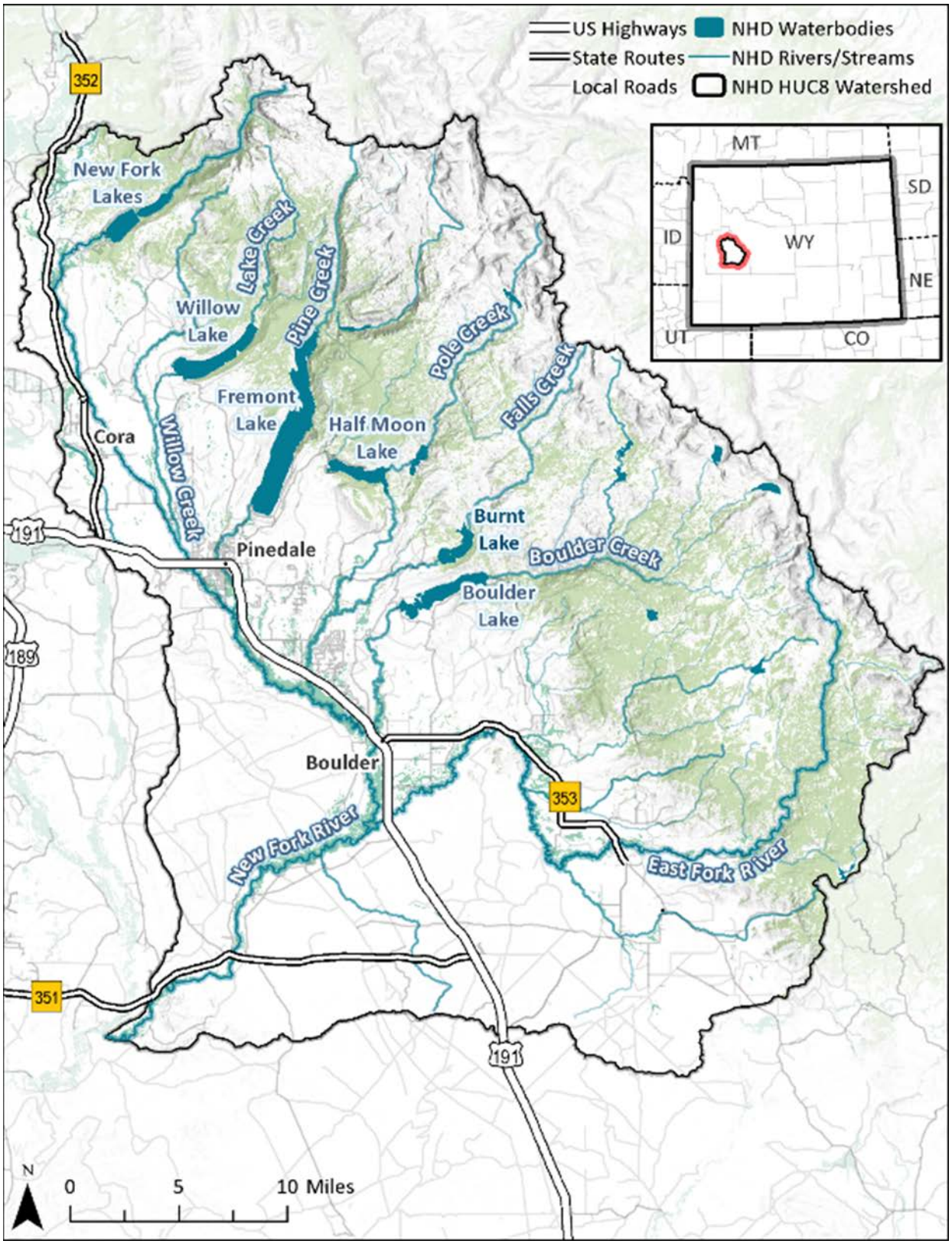

Figure 1. Study area.

3 Project Purpose and Objectives

The intent of this report, accompanied by the study's digital library and geographic information system (GIS) geodatabase, is to provide the results of the New Fork River Watershed Level I Study. This Level I watershed study included reviewing previously conducted work contained in numerous databases, studies, and reports regarding the natural resources within the study area. Additionally, the information reviewed and determined to be relevant to the study's purpose was compiled into a "digital library" and a GIS geodatabase.

The purpose of this Level I watershed study is to combine the available data and information with the study-generated inventory data to develop a comprehensive Watershed Management and Rehabilitation Plan that outlines proposed and potential water-development opportunities. To accomplish this effort, the following objectives were completed:

- Foster communication among residents and landowners, the local sponsor (e.g., the SCCD), and the WWDC.
- Solicit public participation in the watershed study.
- Inventory and evaluate the watershed with emphasis on surface water quantity and quality in addition to upland and riparian conditions.
- Perform a geomorphic classification of the major tributaries in the study area to identify unstable reaches and improvement options to restore channel stability.
- Assess existing irrigation systems and generate rehabilitation alternatives for the irrigators participating in the study.
- Evaluate existing surface water features, storage requirements, and potential opportunities to improve water availability for livestock and wildlife.
- Prepare a Watershed Management and Rehabilitation Plan that includes problem areas and proposes improvement alternatives within the watershed.
- Identify permits, easements, and clearances necessary for plan implementation.
- Estimate costs for proposed improvement alternatives and potential projects and identify potential sources of funding.

4 Unique/Important Watershed Features

The quantity and quality of natural surface and groundwater are a function of the characteristics and activities within the subject water's watershed. The main body of this document provides great detail regarding the characteristics of the New Fork River watershed. The following watershed features merit specific mention in this Executive Summary because they have an influence on the selection, design, and/or required approvals associated with projects proposed in the Watershed Management and Rehabilitation Plan.

- Land Ownership/Special Designated Areas
- Wetlands
- Mule deer migration
- Sage grouse
- Unique fish assemblages

4.1 Land Ownership/Special Designated Areas

The majority of the New Fork River watershed is publicly owned (78 percent), with the U.S. Forest Service (USFS), Bureau of Land Management (BLM), state of Wyoming, and Bureau of Indian Affairs owning 46, 28, 22, and less than one percent of the total, respectively (**Figure 2**). Most of the private lands are located at lower elevations along the primary stream valleys (**Figure 2**).

Approximately 47 percent of the New Fork River watershed is under some form of special management by the state or federal government including the Bridger Wilderness (a designated Wilderness Area that comprises approximately 30 percent of the total watershed area (**Figure 3**)).

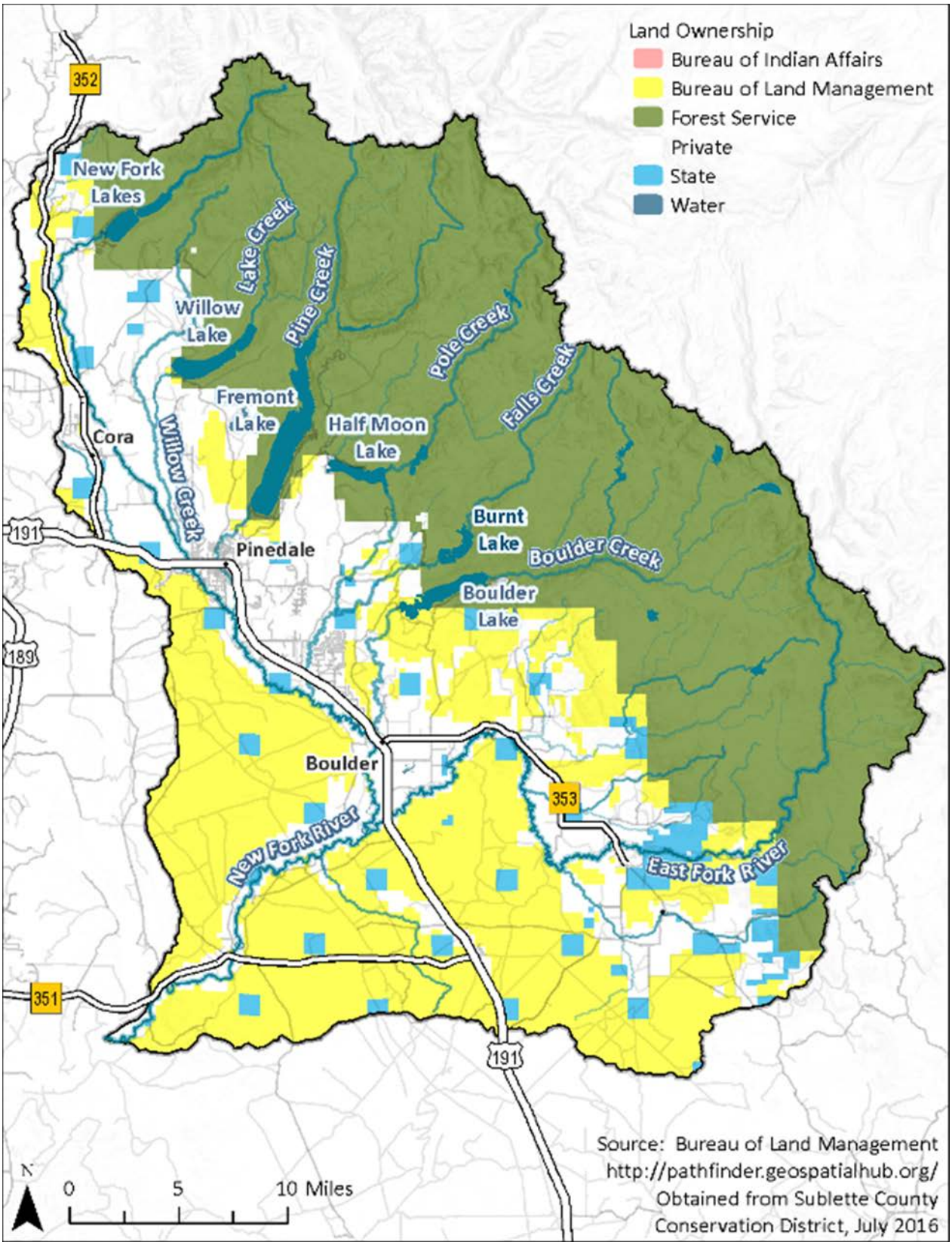

Figure 2. Land ownership.

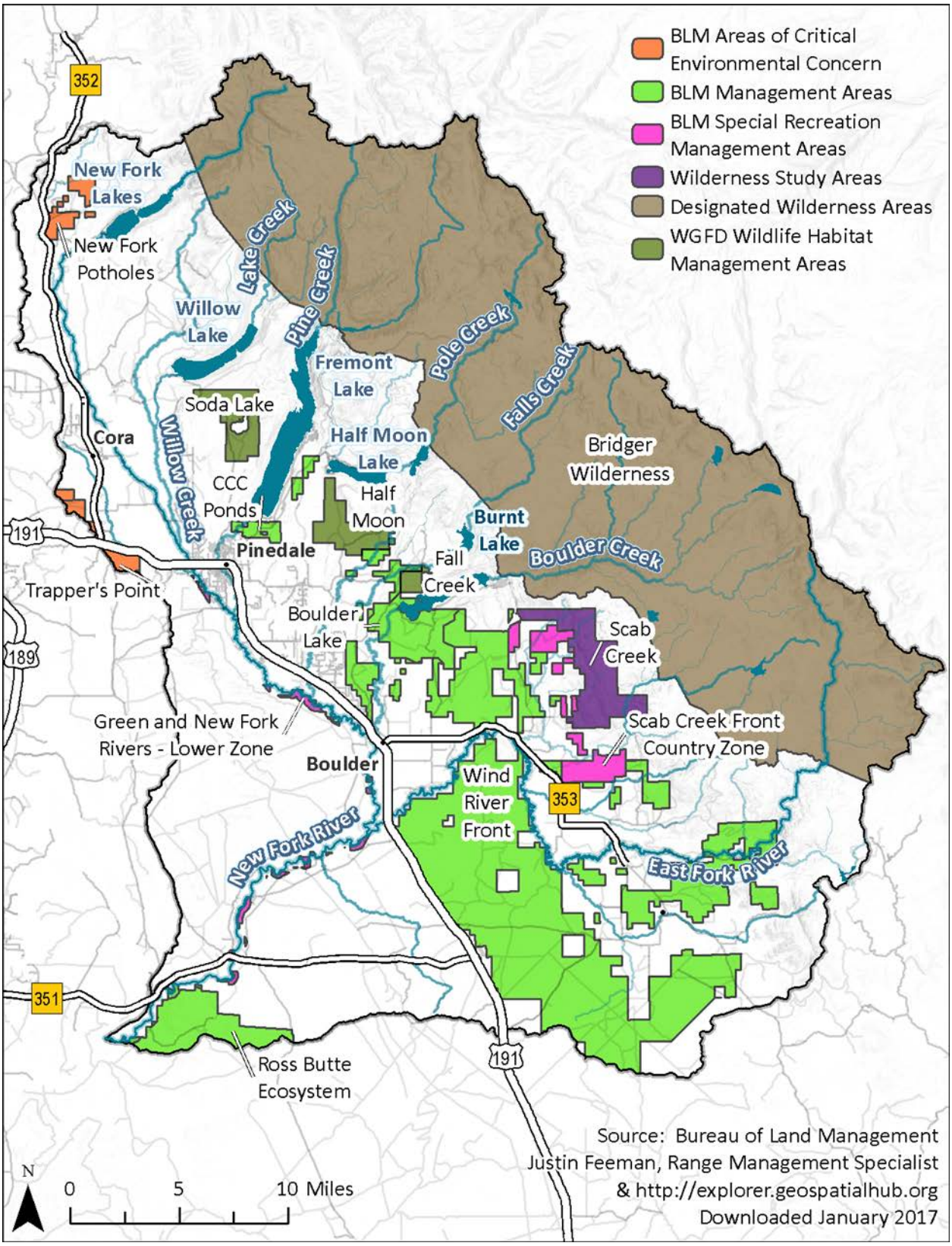

Figure 3. Special designated areas.

4.2 Wetlands

According to the National Wetland Inventory (NWI) (USFWS 2016), there are 58,021 acres of wetlands in the New Fork River watershed[1], which is 7 percent of the total area of the watershed. Over 60 percent of the wetlands within the New Fork River watershed are likely at least partially sustained through irrigation inputs (**Figure 4**). Although typical projects to conserve water such as conversion of flood irrigation to center pivot irrigation might ultimately increase stream flows, numerous wetlands sustained by flood irrigation could be lost. In addition, important foraging habitat used by waterfowl in spring and fall could be lost if flood irrigation from agricultural fields is eliminated.

[1] The NWI data includes nonwetland features such as deep water lakes and stream channels. While these features are important water resources in the basin and represent 33,179 acres or 4% of total land area, they are not considered further in this discussion of wetlands.

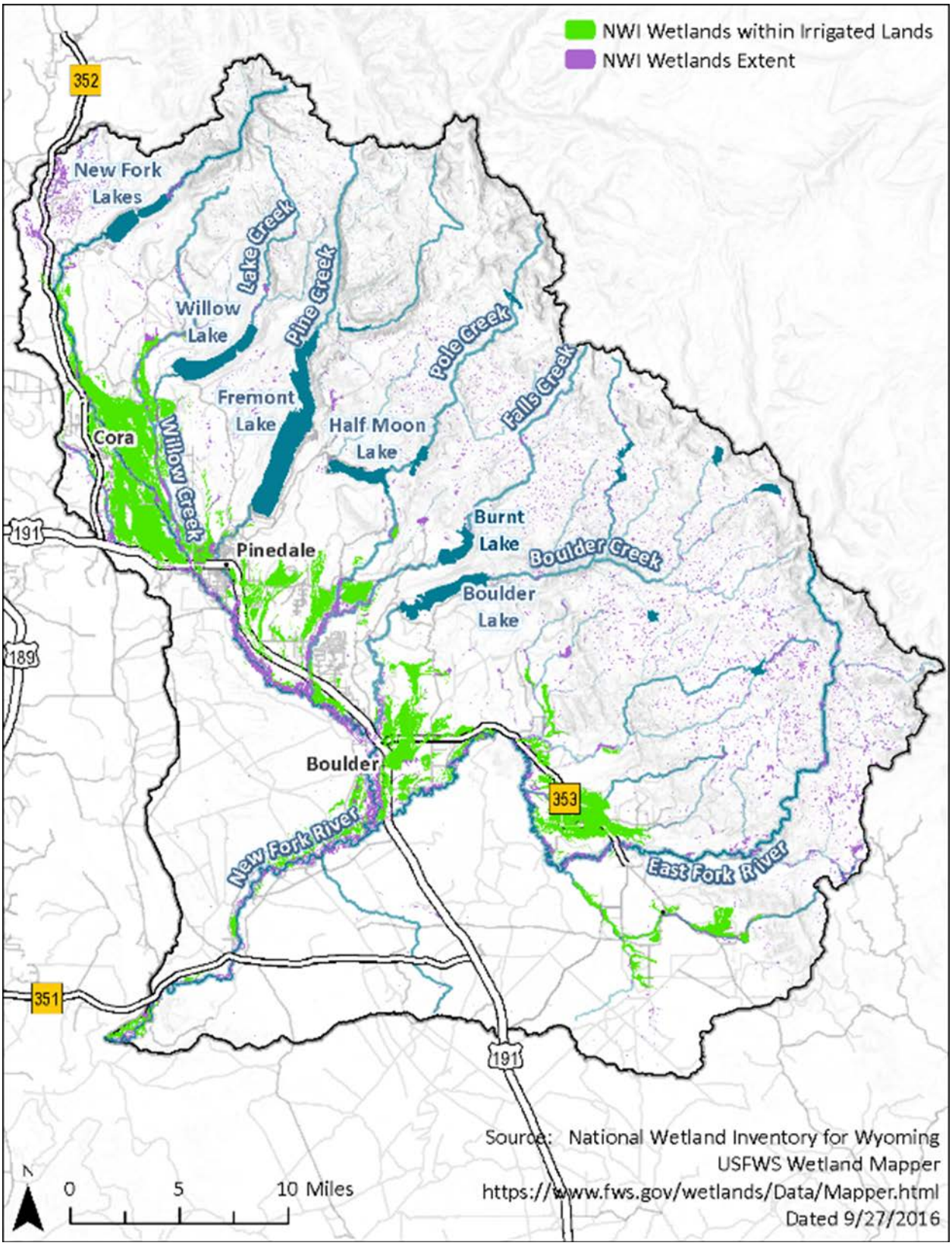

Figure 4. National Wetland Inventory wetlands intersecting irrigated lands.

4.3 Mule Deer Migration

In Wyoming, collar studies that track the detailed movements of animals suggest that more than 90 percent of ungulates (including mule deer, elk, pronghorn, moose, bighorn sheep, mountain goat, bison, and white-tailed deer) are migratory (Sawyer et al. 2014). The longest ungulate migration ever recorded in the lower 48 states was recently discovered in western Wyoming. Each spring and fall, mule deer travel a one-way distance of 150 miles from the Red Desert to the Hoback Basin and surrounding mountain through the New Fork River watershed (**Figure 5**). There are a number of critical areas along this migration corridor that may have relevance to future water developments in the New Fork River watershed. These include Fremont Lake, Boulder Lake, and Willow Lake. An estimated 4,000 to 5,000 mule deer cross the outlet from Fremont Lake (or Pine Creek) in an area only 400 meters wide. Similarly, thousands of mule deer migrate through narrow (less than 0.5-mile-wide) bottlenecks at the outlet of Boulder and Willow lakes.

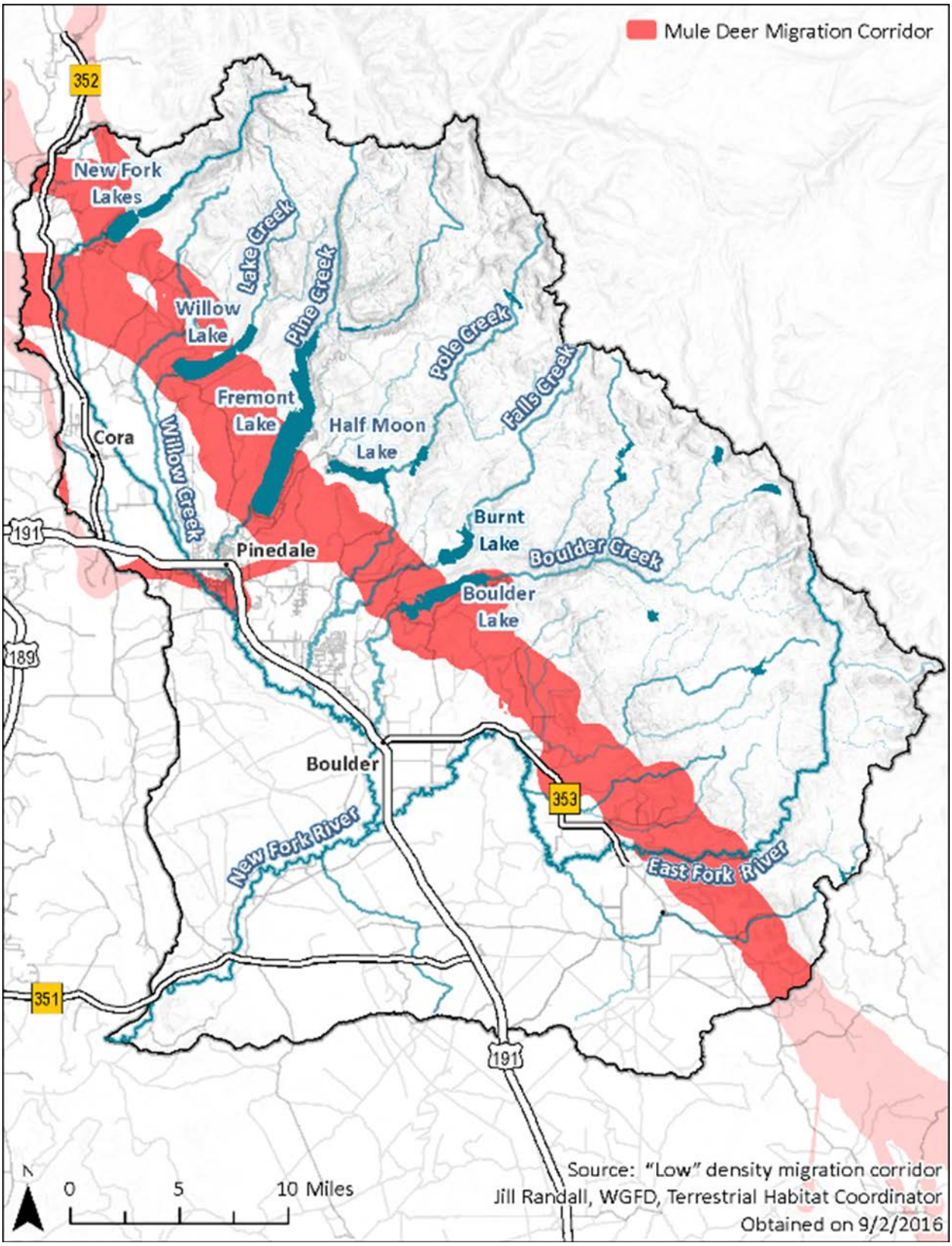

Figure 5. Mule deer migration route through the New Fork River watershed.

4.4 Sage Grouse

In 2008 the Governor of Wyoming implemented a Core Area Protection strategy for greater sage-grouse by executive order, designed to implement protective strategies for sage-grouse habitats, populations, and connectivity areas to conserve sage-grouse and preclude the need for listing the bird as a threatened or endangered species (Freudenthal 2008). The Executive Order and associated map of Core Area protected lands were revised by Governor Mead in 2015 (Freudenthal 2015). Sage-grouse core areas and leks (areas where male sage-grouse gather together to perform courtship displays) are shown in **Figure 6**.

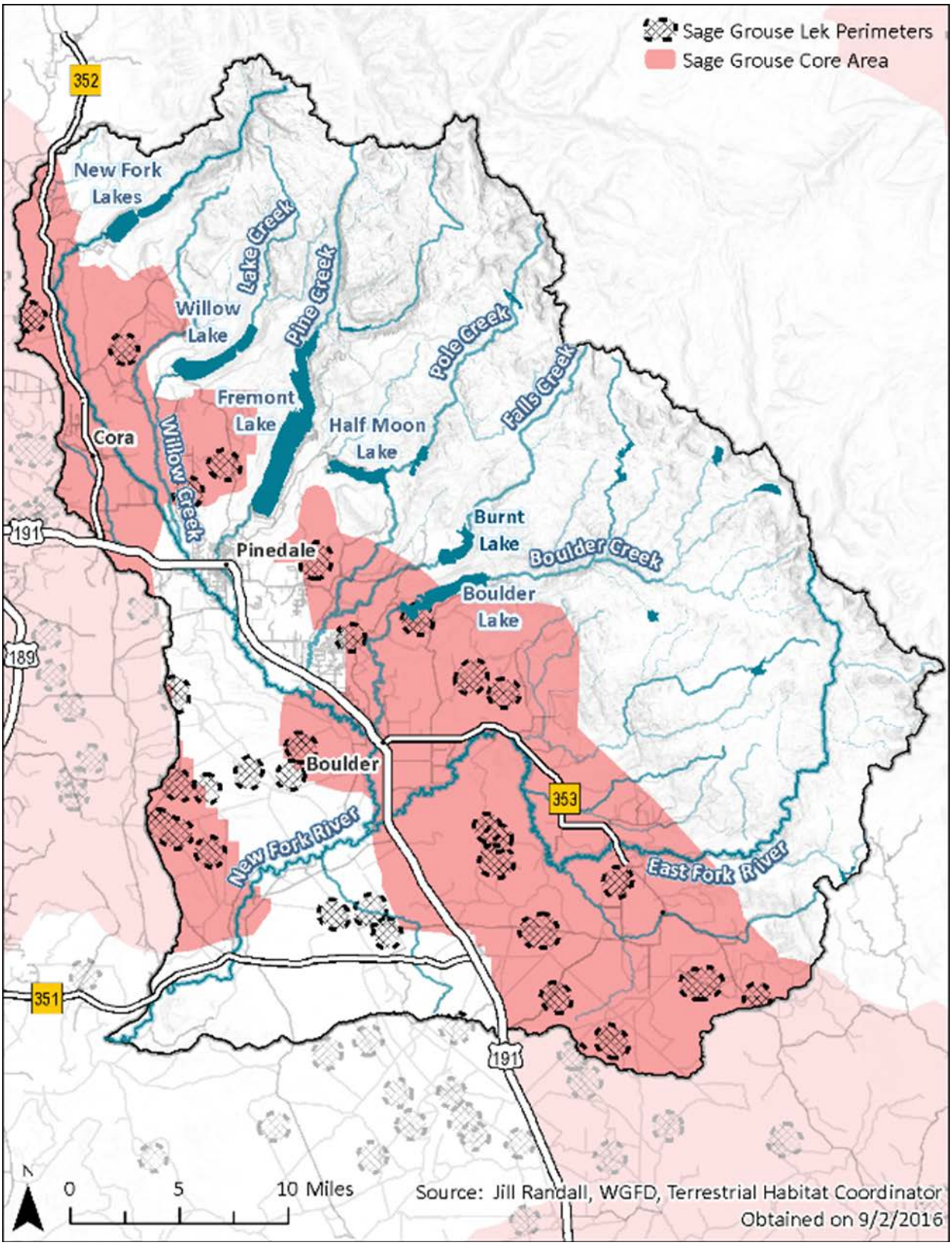

Figure 6. Greater sage-grouse critical habitats in the New Fork River watershed.

4.5 Unique Fish Assemblages

Of the observed native species that have been observed in the New Fork River watershed, three are considered Wyoming Species of Greatest Conservation Need (SGCN): the roundtailed chub (*Gila robusta)*, flannelmouth sucker (*Catostomus latipinnis*), Colorado cutthroat trout (*Oncorhynchus clarkia)* (WGFD 2016). The waterbodies where these SGCN species have been observed in the New Fork River watershed are identified in **Table 1**.

Table 1. Recorded observations of flannelmouth sucker, roundtail chub, and Colorado River cutthroat in WGFD's StreamLake Database

FLANNELMOUTH SUCKER	ROUNDTAIL CHUB	COLORADO RIVER CUTTHROAT TROUT
Boulder Lake	Boulder Lake	Sunrise Lake
Fremont Lake	Fremont Lake	August Lake
Burnt Lake	Burnt Lake	Irish Canyon Creek
Halfmoon Lake	Halfmoon Lake	
Halfmoon Lake, Little	Halfmoon Lake, Little	
Pole Creek	Willow Lake	
Willow Lake	Scab Lake	
Upper and Lower New Fork Lake	Upper and Lower New Fork Lake	
Silver Creek	Boulder Lake	

5 Watershed Management and Rehabilitation Plan

The objective of the Watershed Management and Rehabilitation Plan is to provide a technically sound, practical in nature, and economically feasible plan to improve water use and function in the New Fork River watershed.

5.1 Small Water Projects

Stakeholders brought forward a number of projects to meet this objective and they were evaluated and prioritized according to the factors listed in **Table 2**.

Table 2. Evaluation factors

EVALUATION FACTOR	ENVIRONMENTAL	PERMITABILITY	FUNDABILITY	TECHNICAL	SOCIAL
Land Ownership		✓			✓
Cultural and Historic Resources		✓			
Big Game	✓	✓			
Sensitive Species	✓	✓			
Sage-Grouse	✓	✓			
Fisheries	✓	✓			
Wetland Encroachment	✓	✓			
Wetland Hydrology	✓	✓			
Special Designated Areas	✓	✓			
Shovel-Ready			✓	✓	
Small Water Project Program Priorities			✓	✓	
Sustainability				✓	
Public Acceptability					✓
Overall Watershed Benefit	✓				✓

5.1.1 Irrigation

A total of 36 irrigation projects were identified and 27 progressed to development of conceptual designs, cost estimates, and identification of permit requirements. The majority of the projects involve irrigation system rehabilitation or the implementation of new irrigation structures.

5.1.2 Wildlife/Livestock Water Source

A total of 24 wildlife/livestock water projects were identified and 20 progressed to development of conceptual designs, cost estimates, and identification of permit requirements. The 20 projects vary greatly based on location, seasonal use, available power supply, stock tank preference, and water availability.

5.1.3 Stream Restoration

Two stream restoration projects were identified through this study. Each of these projects involves bank stabilization, one on the West Fork New Fork River and one on Duck Creek. Neither project progressed to conceptual designs as they both ranked low based on the factors in **Table 2**.

5.1.4 Small Water Storage

For the purposes of this study, small water storage projects were defined as any dam less than 20 feet in height and with less than 20 acre-feet of storage. A total of eight small water storage projects were

identified and all but one progressed to development of conceptual designs, cost estimates, and identification of permit requirements.

5.1.5 Summary of Proposed Small Water Projects

Conceptual designs and cost estimates were prepared for the 56 small water projects. These are summarized in **Table 3**.

Table 3. Proposed Small Water Projects and Estimated Costs

PROJECT #	NAME	TYPE	DESCRIPTION	OUTCOME/WATERSHED BENEFIT	ESTIMATED COST[a]
2	Mommy Moose Ditch P.O.D. Rehabilitation	Irrigation	Diversion rehabilitation on the north/south branch of Marsh Creek.	Increased water control and successful water delivery to existing adjudicated reservoir.	$7,147
4	Ingle Stock Water Development	Wildlife/Livestock Water Source	Develop stock watering well for summer grazing operations.	Minimize livestock and wetland interface and increase capacity for grazing efficiency.	$17,734
5	Hedrick Stock Water Development	Wildlife/Livestock Water Source	Develop stock watering well for summer grazing operations.	Minimize livestock and wetland interface and increase capacity for grazing efficiency.	$38,931
6	Anselmi Stock Water Development	Wildlife/Livestock Water Source	Develop stock watering well for summer grazing operations.	Minimize livestock and wetland interface and increase capacity for grazing efficiency.	$18,666
9	Stipa Ditch P.O.D. Rehabilitation	Irrigation	Rehabilitate existing rock check structure, fortify river bank, and replace aging concrete head gate.	Increased water control, irrigation efficiency, and decrease property and ditch damage due to flooding events.	$25,456
10	Stipa Ditch Overflow Diversion Rehabilitation	Irrigation	Rehabilitate existing emergency overflow structure	Increased water control and decrease property and ditch damage due to flooding events.	$3,503
12	Stipa Ditch Sluffing Area Mitigation	Irrigation	Construct pipeline through portion of existing ditch where sand stone escarpment sluffs and regularly blocks existing open channel conveyance system.	Increased water control, conveyance efficiency, and decrease property and ditch damage due to unexpected sluffing.	$22,486
16	Highland Ditch Seepage Area “C”	Irrigation	Alter alignment of the ditch and construct liner through reach of ditch that traverses a sandstone hillside.	Increase irrigation efficiency and crop production.	$9,876
17	Highland Ditch Seepage Area “D”	Irrigation	Construct ditch liner through reach of ditch that traverses a hillside composed of sand and cobble rock.	Increase irrigation efficiency and crop production.	$9,651
18	Highland Ditch Check Structure Rehabilitation “A”	Irrigation	Replace deteriorated CMP diversion pipe with HDPE and re-install screw gate.	Increase irrigation efficiency and eliminate breach hazard due to piping.	$3,473
19	Highland Ditch Check Structure Rehabilitation “B”	Irrigation	Replace deteriorated CMP diversion pipe with HDPE and re-install screw gate.	Increase irrigation efficiency and eliminate breach hazard due to piping.	$3,473

Table 3. Proposed Small Water Projects and Estimated Costs

PROJECT #	NAME	TYPE	DESCRIPTION	OUTCOME/WATERSHED BENEFIT	ESTIMATED COST[a]
22	Shriver #2 Stock Water Well Rehabilitation	Wildlife/Livestock Water Source	Re-develop existing well, construct stock tank and pipeline, and convert to solar power.	Increase capacity for grazing efficiency and reduce over grazing based on location of water.	$41,852
23	Welborn Smith No. 1 Stock Water Well Rehabilitation	Wildlife/Livestock Water Source	Re-develop existing well, construct stock tank and pipeline, and convert to solar power.	Increase capacity for grazing efficiency and reduce over grazing based on location of water.	$60,805
24	Horse Corral #1 Stock Water Well Rehabilitation	Wildlife/Livestock Water Source	Re-develop existing well, construct stock tank and pipeline, and convert to solar power.	Increase capacity for grazing efficiency, reduce over grazing based on location of water, and keep stock from eroding the natural banks of Willow Creek.	$41,373
25	Welborn #1 Well Rehabilitation	Wildlife/Livestock Water Source	Construct new control system (irrigation and stock water supply) and stock water tank.	Minimize livestock and wetland interface, increase capacity for grazing efficiency, and increase irrigation efficiency.	$16,273
26	Dumphy Hollow Spring Development (Stock Water)	Wildlife/Livestock Water Source	Construct a side hill spring box for allocation to stock water supply.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	$25,128
27	Noble Place Spring Development (Stock Water)	Wildlife/Livestock Water Source	Construct a side hill spring box for allocation to stock water supply.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	$25,900
28	Smith Place Spring Development (Stock Water)	Wildlife/Livestock Water Source	Construct a side hill spring box for allocation to stock water supply.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	$26,049
29	E.C. Walker Ditch P.O.D. Rehabilitation	Irrigation	Construct new diversion structure to replace existing degraded head gate and check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	$26,243
30	Seedings Meadow Irrigation Conveyance Rehabilitation	Irrigation	Implement a series of distributing gates within the subject field.	Increase water control capabilities, irrigation efficiency, and crop production.	$10,888
31	Converse Ditch P.O.D. Rehabilitation	Irrigation	Construct new diversion structure to replace existing degraded head gate and check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	$28,967
32	Martin Reservoir	Small Water Storage	Construct the permitted dam.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	$62,948

Table 3. Proposed Small Water Projects and Estimated Costs

PROJECT #	NAME	TYPE	DESCRIPTION	OUTCOME/WATERSHED BENEFIT	ESTIMATED COST[a]
33	Valerie Reservoir	Small Water Storage	Construct the permitted dam.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	See #32
34	Susan Reservoir	Small Water Storage	Construct the permitted dam.	Increase water control capabilities, irrigation efficiency, and crop production.	SEE ABOVE (Combined)
35	Annette Reservoir	Small Water Storage	Construct the permitted dam.	Increase water control capabilities, irrigation efficiency, and crop production.	SEE ABOVE (Combined)
36	New Fork No. 2 Ditch Piping	Irrigation	Convert existing open channel conveyance to pipeline conveyance through the entire corridor of the subject ditch.	Decrease conveyance losses and minimize maintenance costs.	Phase I- $120,555 Phase II- $116,812
37	Kaylou Stock Reservoir Outlet Works Rehabilitation	Small Water Storage	Rehabilitate the existing dam breach and install a new principal outlet structure.	Unappropriated water will be used to irrigate new lands for eventual adjudication. Crop production will also be created from this project.	$11,749
38	Cora Butte Stock Water Well Development	Wildlife/Livestock Water Source	Develop a new solar powered well to supply water to a stock tank.	Increase capacity for grazing efficiency and flexibility.	$70,595
39	Thompson Butte Stock Water Well Development	Wildlife/Livestock Water Source	Develop a new solar powered well to supply water to a stock tank.	Increase capacity for grazing efficiency and flexibility.	$69,260
40	McDowell Flats Stock Water Well Development	Wildlife/Livestock Water Source	Develop a new solar powered well to supply water to a stock tank.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	$60,963
41	Strong Ditch P.O.D. Rehabilitation	Irrigation	Construct new diversion structure to replace existing head gate and check structure.	Increase water control capabilities at low flows and reduce livestock impact to riparian area in the vicinity of the existing head gate.	$30,419
42	Marshal Bump Stock Water Well Development	Wildlife/Livestock Water Source	Develop a new well to supply water for stock use.	Increase capacity for grazing efficiency and flexibility.	$40,112
44	Brosman No. 2 Stock Water Well Development	Wildlife/Livestock Water Source	Develop a new solar powered well to supply water to a stock tank.	Increase capacity for grazing efficiency and flexibility.	$81,994

Table 3. Proposed Small Water Projects and Estimated Costs

PROJECT #	NAME	TYPE	DESCRIPTION	OUTCOME/WATERSHED BENEFIT	ESTIMATED COST[a]
46	Coleman Pasture Stock Water Tank & Pipeline	Wildlife/Livestock Water Source	Construct new supply pipeline and Stock Water Tank.	Increase capacity for grazing efficiency and flexibility.	A-$23,227 B- $34,542
48	Coleman Field Spring Development	Wildlife/Livestock Water Source	Construct a side hill spring box for allocation to stock water supply.	Minimize livestock and wetland interface and increase capacity for grazing efficiency and flexibility.	$22,383
49	Miller Field Stock Water Tanks and Pipelines	Wildlife/Livestock Water Source	Construct two (2) new supply pipelines and Stock Water Tanks.	Increase capacity for grazing efficiency and flexibility and provide for winter feeding location.	$47,084
50	Miller Field Stock Water Well Rehabilitation	Wildlife/Livestock Water Source	Re-develop the existing well and convert to solar power.	Increase beneficial supply for stock water use and reduce operating costs and emissions.	$20,432
51	Glover Field Head Gate 1	Irrigation	Construct two (2) distributing gates.	Increase water control capabilities, irrigation efficiency, and crop production.	$9,165
52	Glover Field Head Gate 2	Irrigation	Construct one (1) distributing gate.	Increase water control capabilities, irrigation efficiency, and crop production.	See #51 [b]
53	Glover Field Head Gate 3	Irrigation	Construct one (1) check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	See #51 [b]
54	Glover Field Head Gate 4	Irrigation	Construct one (1) distributing gate.	Increase water control capabilities, irrigation efficiency, and crop production.	See #51 [b]
55	Glover Field Head Gate 5	Irrigation	Construct one (1) check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	See #51 [b]
56	Glover Field Head Gate 6	Irrigation	Construct one (1) distributing gate.	Increase water control capabilities, irrigation efficiency, and crop production.	See #51 [b]
57	Glover Field Head Gate 7	Irrigation	Construct one (1) check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	See #51 [b]
58	Coleman Field Diversion Control Structure	Irrigation	Construct one (1) distributing gate and an accompanying check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	$3,030.00
59	Island Ditch Waste-Way Structure	Irrigation	Construct new diversion structure and integrated waste-way pipe (return flows).	Increase water control capabilities, irrigation efficiency, and crop production.	$20,885
60	Willow Creek Rock Check Structure	Irrigation	Construct a rock check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	$4,267

Table 3. Proposed Small Water Projects and Estimated Costs

PROJECT #	NAME	TYPE	DESCRIPTION	OUTCOME/WATERSHED BENEFIT	ESTIMATED COST[a]
61	2-Way Check Structure	Irrigation	Construct a new diversion check structure.	Increase water control capabilities, irrigation efficiency, and crop production.	$3,700
62-1	Lower State Reservoir-1	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$94,609
62-2	Lower State Reservoir-2	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$120,670
62-3	Lower State Reservoir-3	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$89,264
63-1	Dumpy Reservoir-1	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$126,455
63-2	Dumpy Reservoir-2	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$12,402
63-3	Dumpy Reservoir-3	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$11,574
63-4	Dumpy Reservoir-4	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$13,449
63-5	Dumpy Reservoir-5	Small Water Storage	Construct new stock water supply reservoir.	Increase capacity for grazing efficiency and flexibility.	$13,172
65	Orcutt Ditch – Change of P.O.D. & M.O.C.	Irrigation	Change P.O.D. and M.O.C. from Pine Creek to the Pine Creek Canal No. 1 and distribute permitted water rights in developed area.	Protect adjudicated water rights, transfer unused water rights to applicable lands, and properly document all changes through the SEO.	$103,574
66	Burgess Stock Water Well Development	Wildlife/Livestock Water Source	Develop a new well to supply water to a stock reservoir.	Increase capacity for grazing efficiency and flexibility.	$50,761
68	Alexander Ditch P.O.D. Check Structure Rehabilitation	Irrigation	Construct new check structure in the West Fork New Fork River to regulate flows to the Alexander Ditch head gate.	Increase water control capabilities, irrigation efficiency, and crop production.	$23,389
69	West Fork New Fork Primary Check Structure Rehabilitation	Irrigation	Construct new check/drop structure to replace the existing inoperable structure.	Increase water control capabilities, irrigation efficiency, crop production, and river stability.	$40,649

[a.] Refer to Appendix N for additional detail regarding project location, design considerations and cost estimates.
[b.] It is envisioned that Projects 51 – 57 will be implemented together. The total cost is presented for Project 51

6 Large Surface Water Storage Projects (Reservoirs)

A total of 40 potential reservoir sites were identified to provide additional water storage opportunities and flood control needs within the watershed (**Figure 7**). Alternatives included modifications to existing dams, enlargement of existing glacial lakes, and construction of new dams. New dams included on-channel dams that could be filled from direct stream inflows and off-channel dams that would require a new water conveyance canal or pipeline to fill the reservoir.

The three preferred sites are Willow Lake (lower inlet), Site 9, and Site 7. Willow Lake will include a new embankment, outlet works, and spillway downstream of the existing dam. The resulting new storage will be approximately 3,600 acre-feet at an estimated total cost of $2,607,112. Site 9 will include a new roller-compacted concrete (RCC) dam on the Big Sandy River, resulting in approximately 5,000 acre-feet of storage at an estimated total cost of $45,888,980. Site 7 is an off-channel reservoir that would be impounded by an earthen embankment that would include slope protection as well as filters and drains that would collect and manage seepage. The resulting storage would be approximately 5,000 acre-feet at an estimated total cost of $20,636,997.

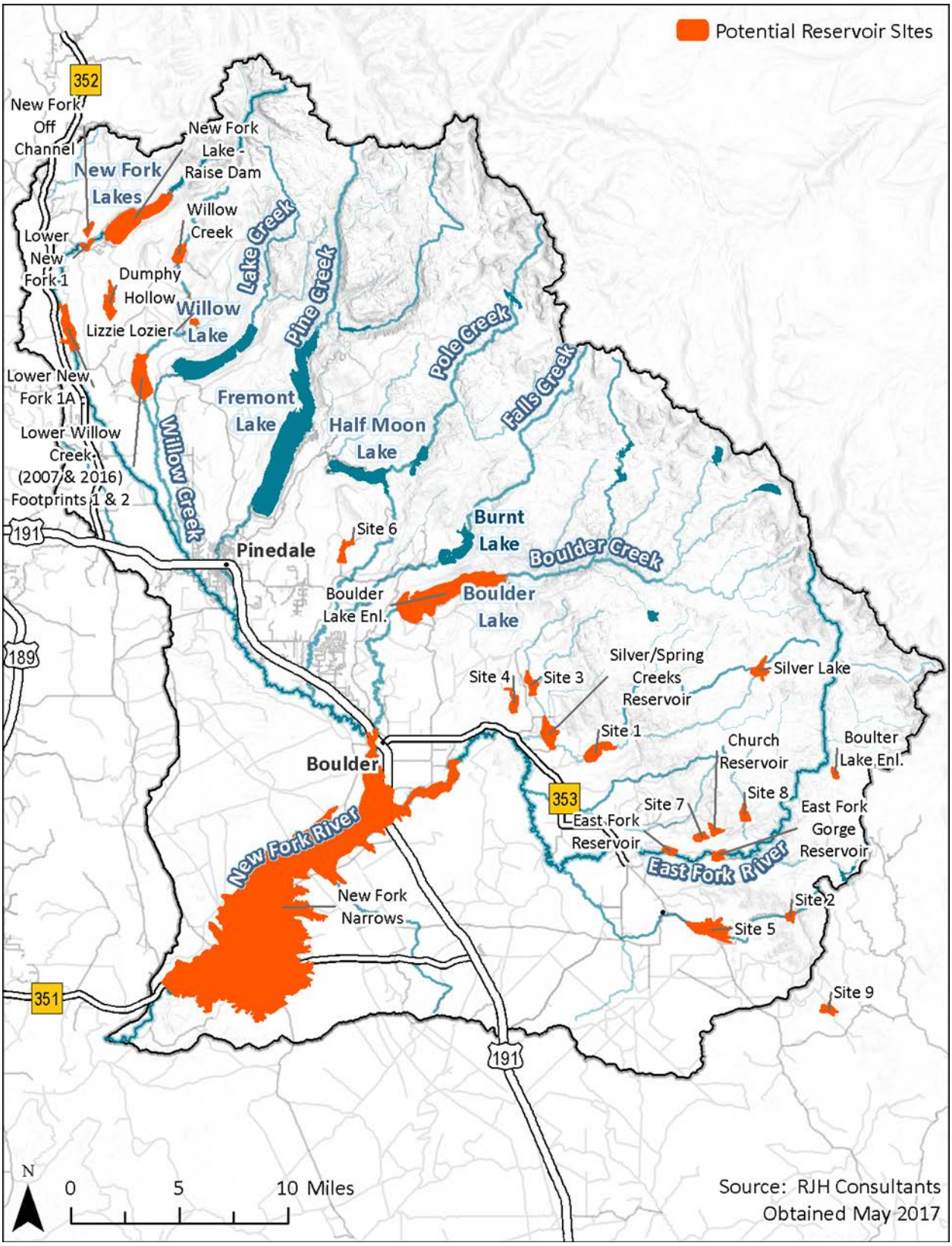

Figure 7. Potential reservoir sites.

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