

APPENDIX 1

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Figure 1. The Watershed Planning Model.

Watershed Planning Process

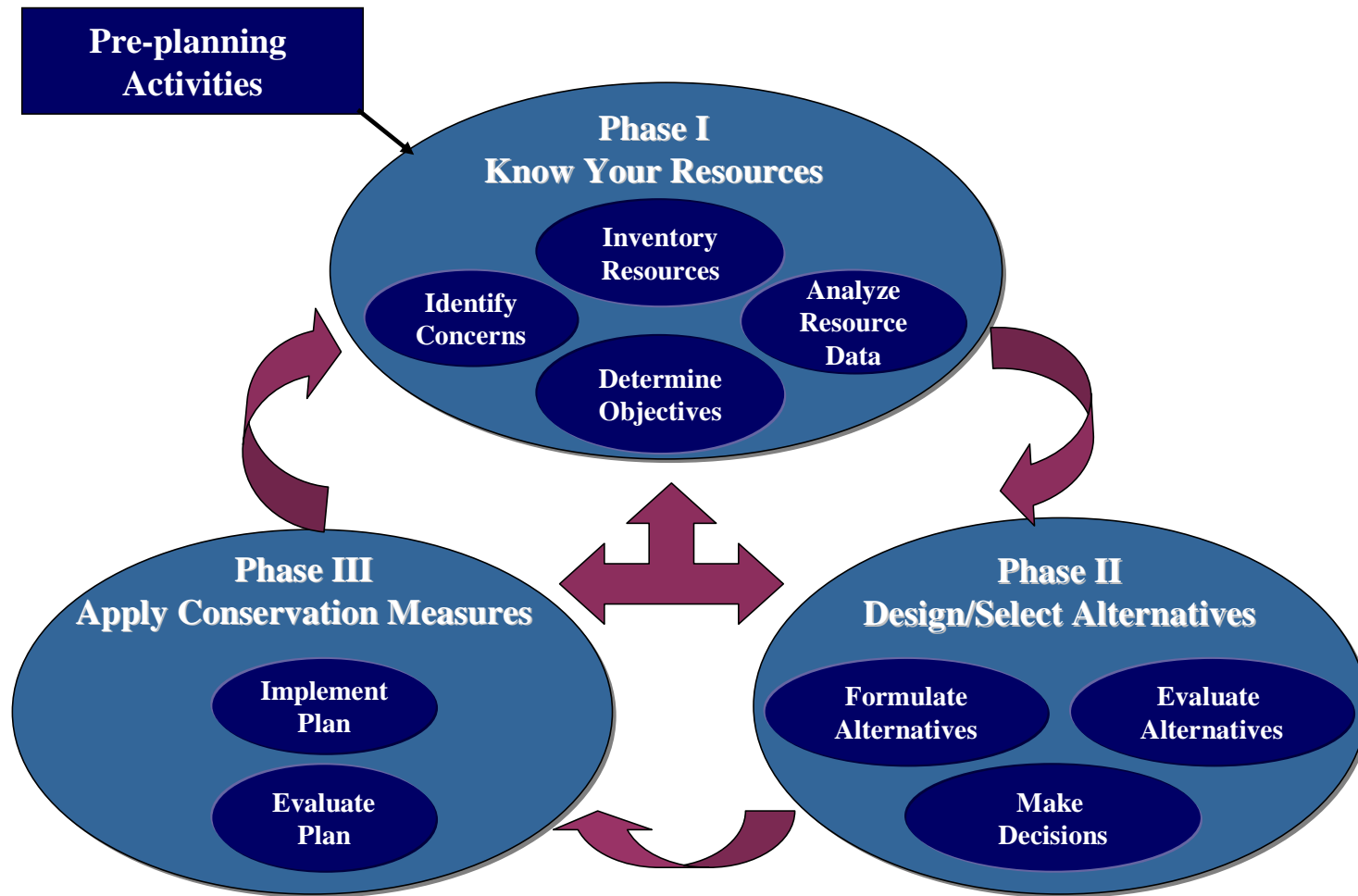
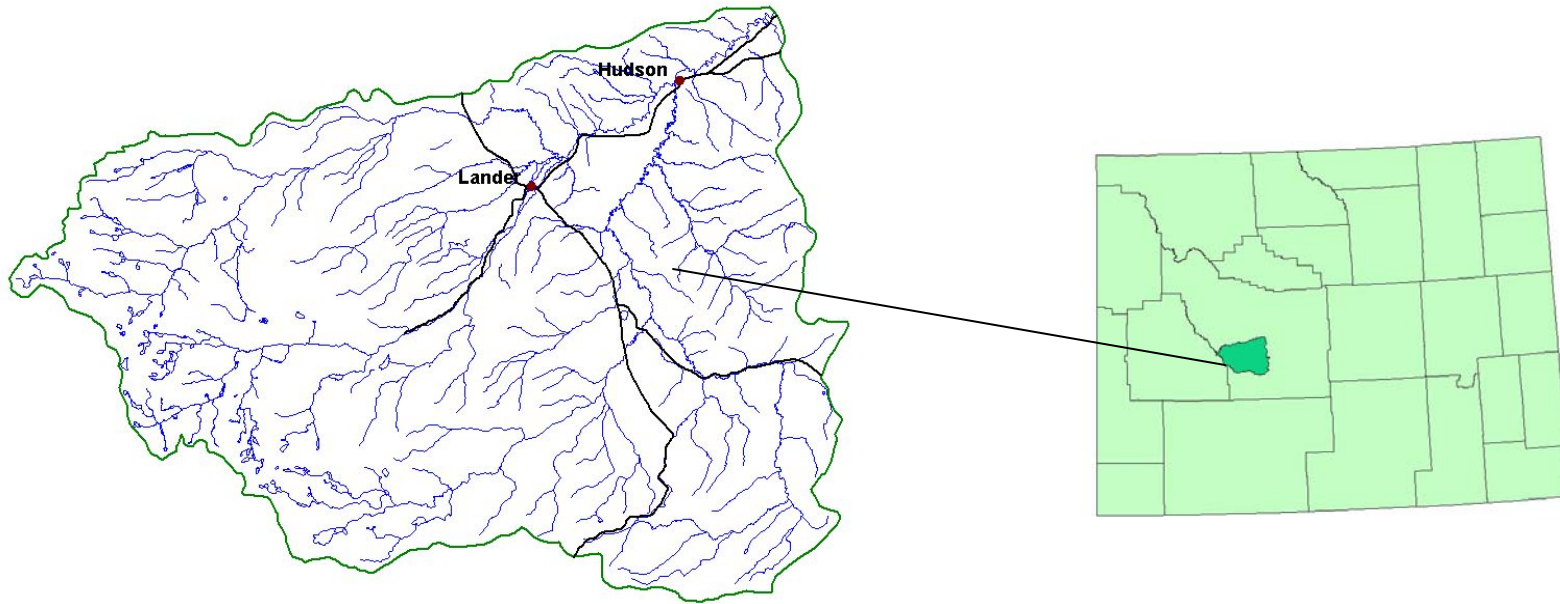


Figure 2. Location of Popo Agie Watershed, Fremont County, Wyoming.



Major Tributaries	Little, Middle, and North Forks of the Popo Agie River Confluence with the Little Wind River near Arapahoe, WY
Elevation Range	12,000' Headwaters to 5,200' Confluence
Acreage	522,350 Acres

Figure 3. Popo Agie Watershed Map Including Sub-Watersheds.

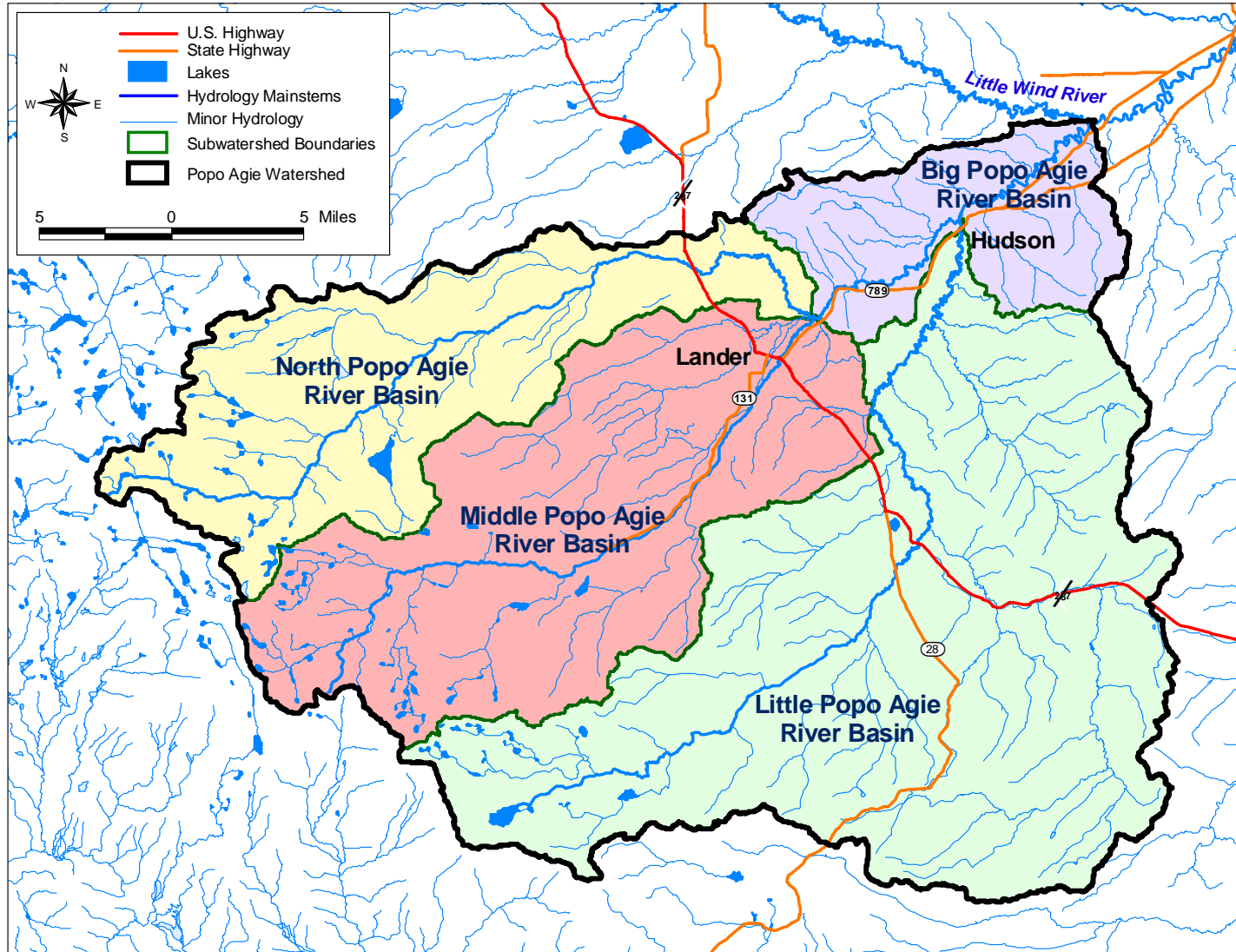


Figure 4. NCLD Vegetation Coverage in the Popo Agie Watershed.

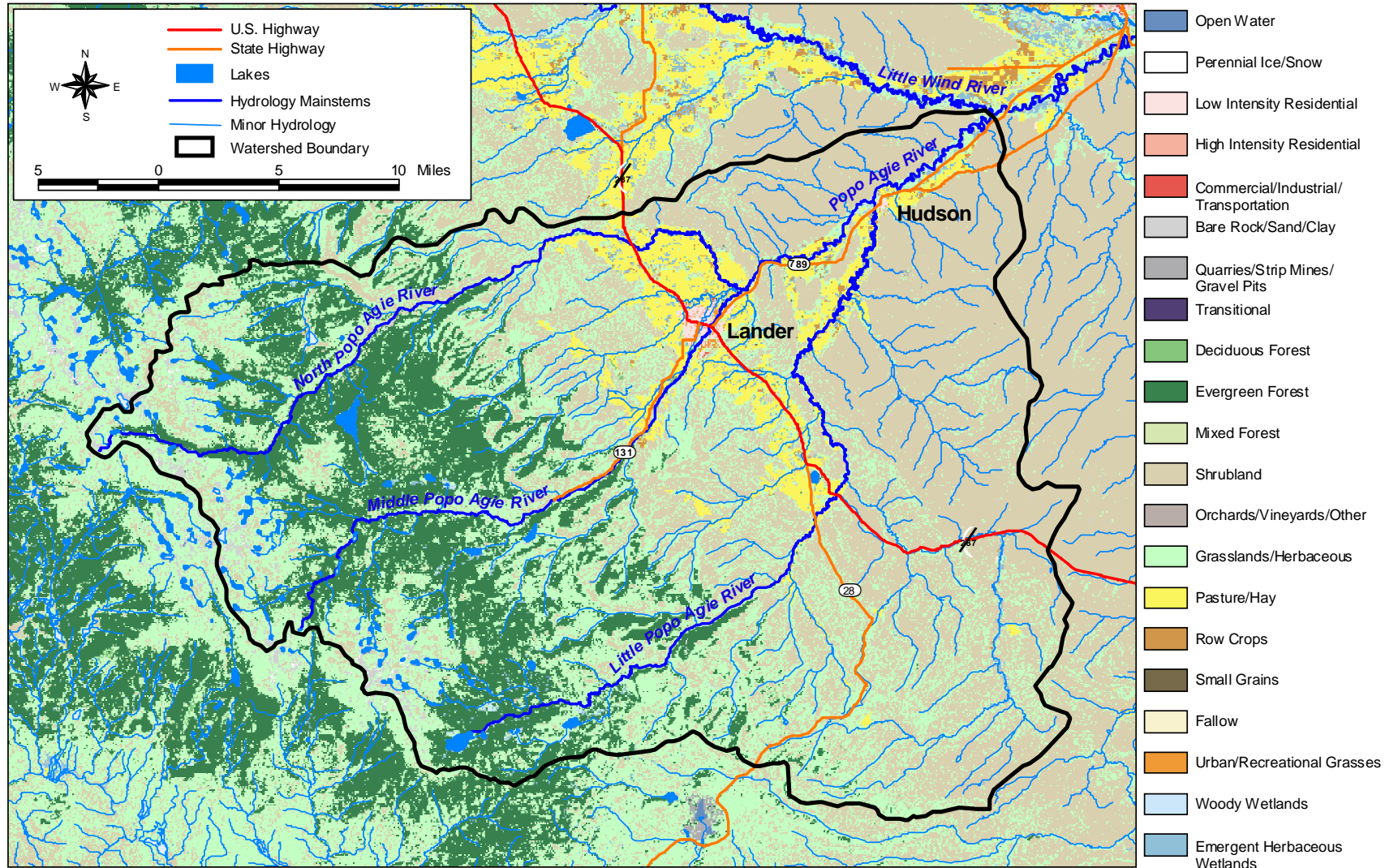


Figure 5. Summary of Normal Monthly Climate Statistics at Lander (1971 – 2000).

Variable		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Monthly Maximum	Mean Max. Temperature (F)	31.9	37.4	47.5	56.5	66.5	78.5	86.3	84.8	73	59.5	41.8	32.6	58
	Highest Mean Max. Temperature (F)	41.9	45.7	56.7	65.2	75.4	88.3	91.4	89	80.2	68	54.8	46	91.4
	Year Highest Occurred	1999	1991	1986	1992	1994	1988	1988	2000	1979	1988	1999	1980	1988
	Lowest Mean Max. Temperature (F)	12.7	20.4	38.1	45.8	59.2	66.7	79.5	80.3	64.7	53.2	25.1	15.6	12.7
	Year Lowest Occurred	1979	1989	1973	1973	1995	1998	1992	1977	1985	1971	2000	1983	1979
Monthly Mean	Mean Temperature (F)	20.3	25.6	35.5	43.9	53.4	63.7	70.9	69.4	58.7	46.4	30.3	21.3	45
	Highest Mean Temperature (F)	29.4	33.9	44.1	50.7	60.5	72.5	75.3	74	64.8	53.6	41.3	34.3	75.3
	Year Highest Occurred	1999	1991	1986	1987	1994	1988	1988	1983	1990	1988	1999	1980	1988
	Lowest Mean Temperature (F)	1.3	10.5	27.2	35	48.6	54.8	64.7	65.7	53.2	41.3	16	6.1	1.3
	Year Lowest Occurred	1979	1989	1973	1973	1983	1998	1993	1974	1985	1971	2000	1983	1979
Monthly Minimum	Mean Mn. Temperature (F)	8.7	13.9	23.5	31.3	40.3	48.9	55.4	54.1	44.4	33.2	18.9	9.9	31.9
	Highest Mean Mn. Temperature (F)	18.5	22	31.5	36.5	45.5	56.7	59.6	59.1	50.4	39.1	27.8	22.6	59.6
	Year Highest Occurred	1990	1991	1986	1987	1994	1988	1985	1983	1990	1988	1999	1980	1985
	Lowest Mean Mn. Temperature (F)	-10.1	0.5	16.3	24.3	35.6	42.8	49.4	49.4	40.1	28.8	6.9	-3.9	-10.1
	Year Lowest Occurred	1979	1989	1973	1973	1975	1998	1993	1974	1971	1984	2000	1978	1979
Monthly Precipitation	Mean Precipitation (in.)	0.52	0.54	1.24	2.07	2.38	1.15	0.84	0.57	1.14	1.37	0.99	0.61	13.42
	Highest Precipitation (in.)	1.1	1.73	3.44	6.44	5.47	4.96	2.5	2.3	4.68	4.9	3.37	2.02	6.44
	Year Highest Occurred	1994	1987	1998	1999	1995	1993	1977	1979	1973	1994	1983	1997	1999
	Lowest Precipitation (in.)	0.02	0.05	0.37	0.21	0.07	0	0.1	0.07	0.01	0	0.03	0.05	0
	Year Lowest Occurred	2000	1979	1989	1992	1994	1971	1996	1985	1992	1988	1999	1981	1971

Figure 6. Precipitation in the Popo Agie Watershed.

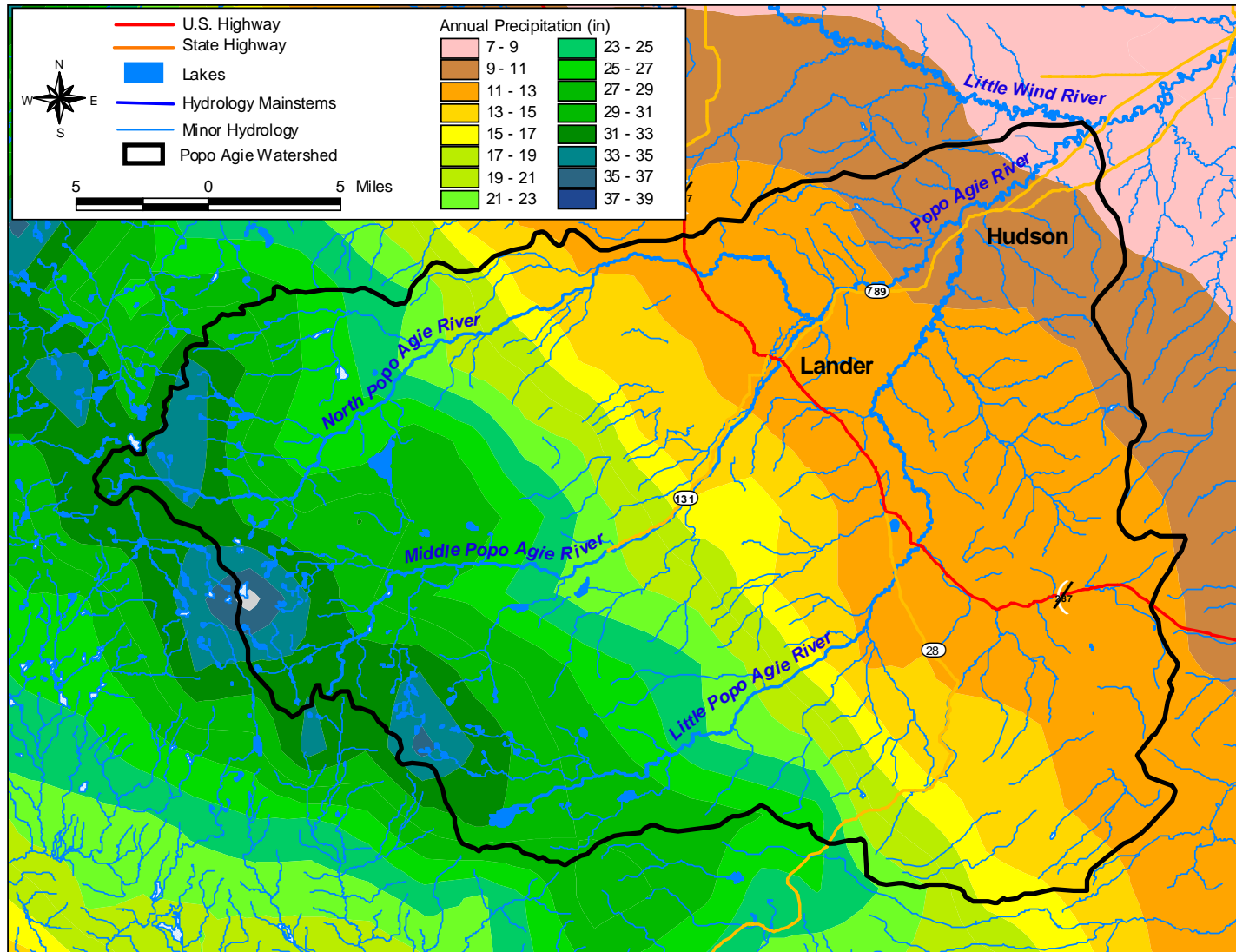


Figure 7. Surface Geology of the Popo Agie Watershed.

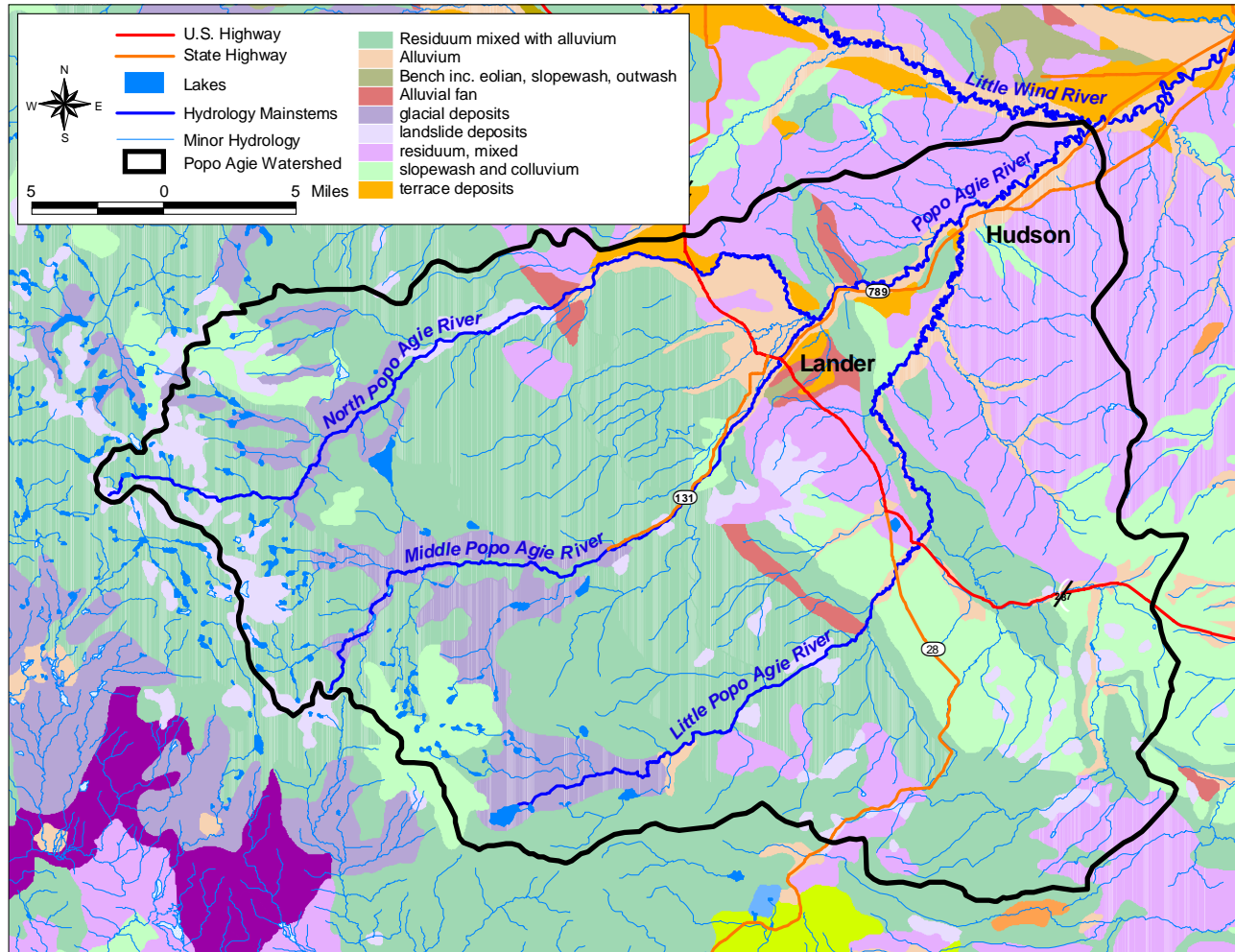


Figure 8. General Soils Map for the Popo Agie Watershed.

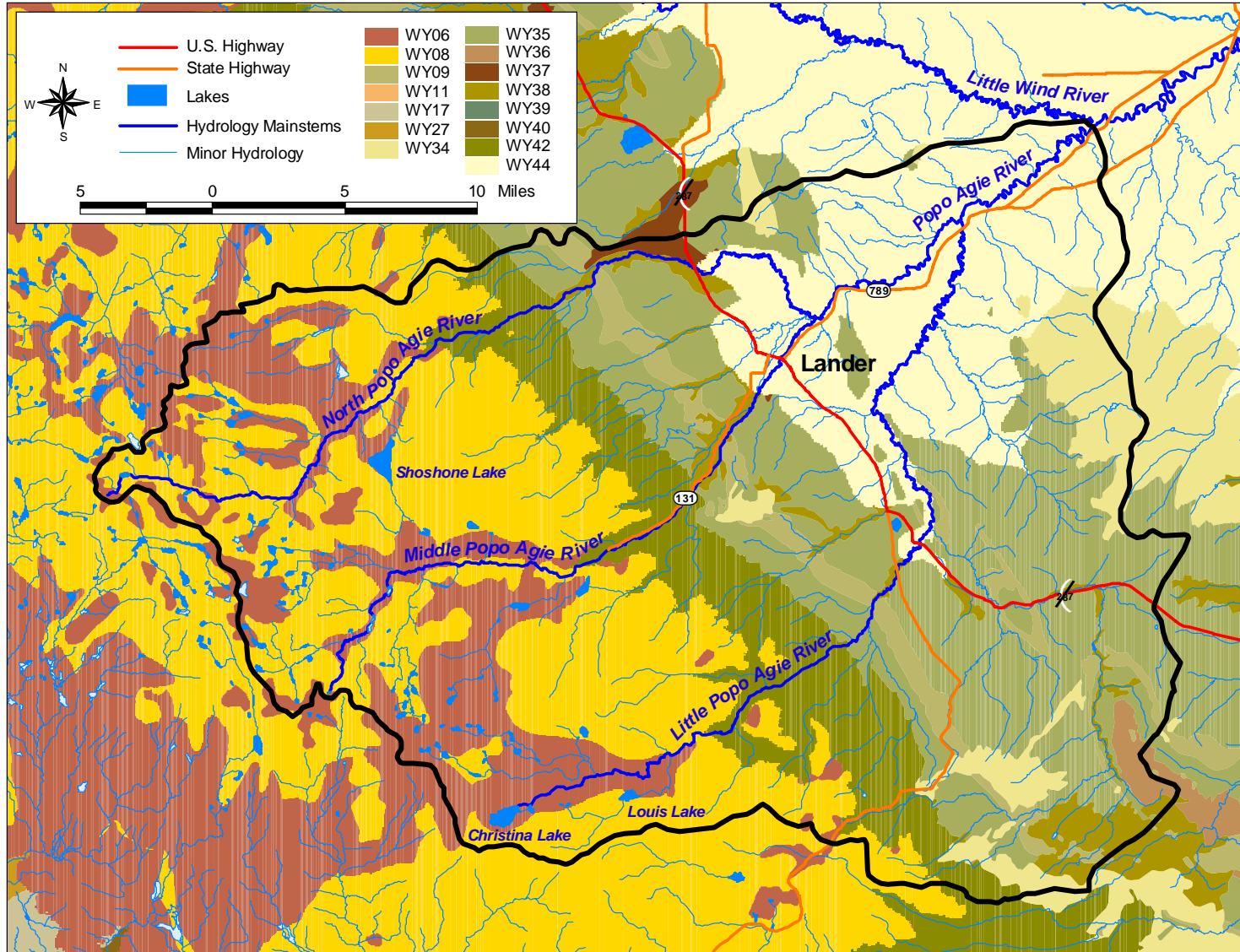
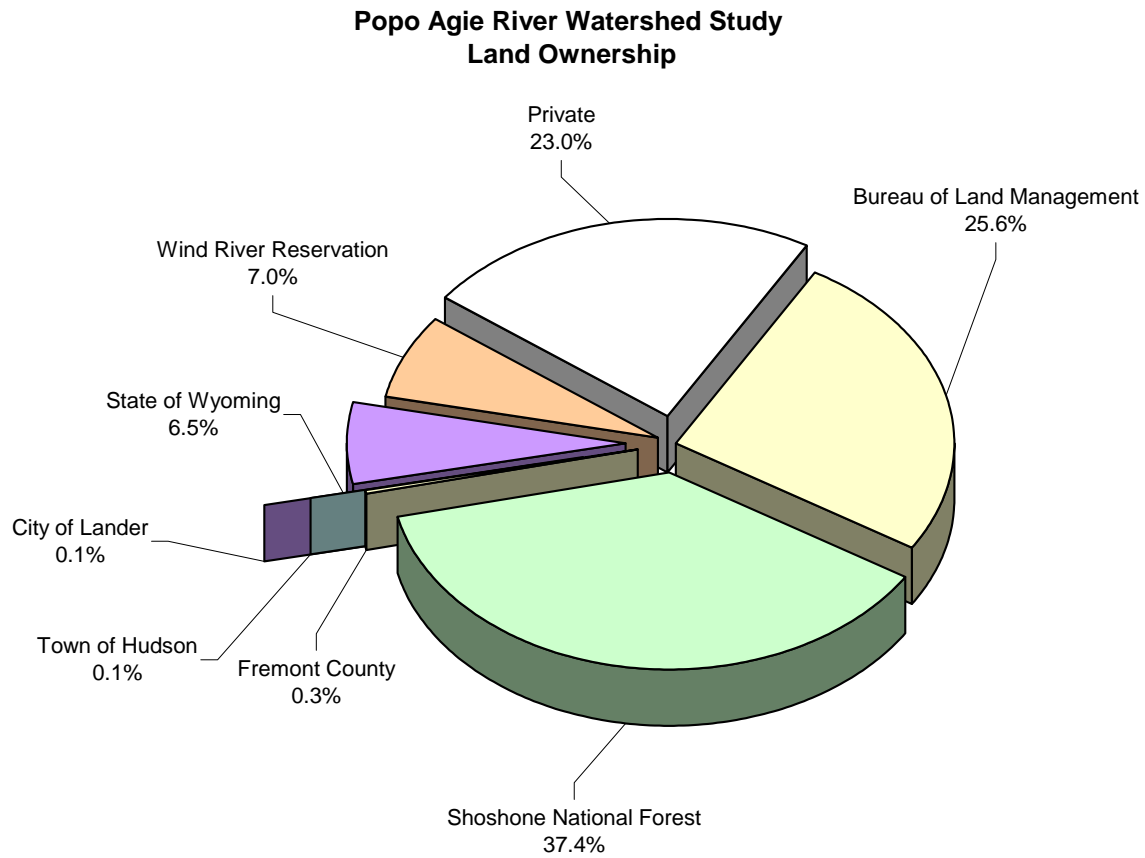


Figure 8 Continued. Popo Agie Watershed General Soils Map Legend

Soil Code	Soil Name
WY06	Nevee-Tilford Rock Outcrop
WY08	Citadel-Vanocker-Paunsaugunt
WY09	Stovho-Trebor-Rock Outcrop
WY11	Grummit-Samday-Minnequa
WY17	Busher-Rock Outcrop-Tassel
WY27	Mitchell-Epping-Dix
WY34	Rosebud-Aliance-Canyon
WY35	Haverson-Avar-Bayard
WY36	Stoneham-Nucla-Kim
WY37	Altvan-Ascalon-Peetz
WY38	Altavan-Treon-Rock Outcrop
WY39	Dix-Treon-Tolman
WY40	Marvan-Neldore-Bascovy
WY42	Crabbart-Yawdim-Hesper
WY44	Havre-Hanly-Glendive

Figure 9. Land Ownership in the Popo Agie Watershed.



APPENDIX 2

BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are defined by the Wyoming Department of Environmental Quality in Chapter 1 as:

“A practice or combination of practices that after problem assessment, examination or alternative practices and appropriate public participation, are determined to be the most technologically and economically feasible means of preventing or reducing nonpoint source pollution.”

Effective implementation of BMPs requires appropriate technical components including planning, siting, survey, and design. Installation of BMPs may also require permits from the US Army Corp of Engineers, US Fish & Wildlife Service, Wyoming State Engineer, or the Wyoming Department of Environmental Quality. A variety of Best Management Practices can be successfully utilized in the Popo Agie Watershed for both urban and rural resource concerns. The effectiveness of BMPs relies on local, voluntary participation from land owners and land managers. These guidelines and recommendations are not targeted at any particular site, but rather are suggestions for improving watershed health and overall water quality. BMPs which can be utilized in the Popo Agie Watershed include:

AFO/CAFO: Nutrients, pathogens, and other pollutants inherent in animal waste can be mitigated with a combination of filter strips, runoff management, waste/runoff storage, relocation of corrals, drains, etc.

Constructed Wetlands: Man-made wetland developments intended to collect storm water runoff, filter sediment and nutrients, and store excess water.

Grazing Management: Systematic Management of livestock by providing offsite stock water, riparian fencing, rotational grazing, herding, grazing/monitoring plan, etc. These practices ensure livestock health, prevent soil erosion/weed infestation, and create sustainable range/riparian condition. Offsite water development is particularly important for grazing management systems since these practices provide water for livestock and wildlife, and reduce water quality and riparian impacts because development and use are situated away from riparian areas/wetlands.

Irrigation Water Management: The practice of controlling the volume, frequency, and application rate of water to conserve irrigation water, reduce soil erosion, and reduce agricultural runoff (pesticides, animal waste). Irrigation water management may include delivery system rehabilitation (liner, pipe), conversion from flood irrigation to gated pipe or sprinkler systems, timing and duration of application, or fertilization rates.

Streambank Stabilization (Structural): Decreases bank erosion by deflecting water energy away by utilizing gabion baskets, rip rap, sloping, and grade control, weirs, and other in-channel structures.

Streambank Stabilization (Bio-engineering): Utilizes a combination of live, dormant and/or decaying plant materials embedded into banks to establish vegetative cover. Useful where structural treatment is not required, but works best in combination.

Urban Water Use: Wise water use in an urban environment reduces nonpoint source pollution by reducing the amount of surface runoff from urban areas, which can transport oil and grease from paved surfaces, pesticides and fertilizers from parks and lawns, litter, pet waste, and other pollutants directly to streams. Urban water conservation also lessens municipal waste loads requiring treatment which reduces operating costs and total treatment discharge.

Wastewater Treatment: Alternate designs are available for private wastewater treatment systems. Alternate wastewater treatment systems are beneficial for sites where conventional septic system engineering may not be suitable due to soils, percolation rates, depth to water table, or other factors. These systems include Aerobic Treatment Unit (ATU), sand filters, peat filters, wetland filters, and more.

APPENDIX 3

GLOSSARY OF TERMS

A

Aquatic Life Fish, invertebrates, amphibians, and other flora and fauna which inhabits waters of the state at some state of their life cycles (excluding pests and exotic species).

B

Best Management Practices (BMPs) A practice or combination of practices that after problem assessment, examination of alternative practices, and in some cases public participation, are determined to be the most technologically and economically feasible means of managing, preventing or reducing nonpoint source pollution.

BURP Beneficial Use Reconnaissance Protocol, developed by WDEQ as a methodology to gather rapid and defensible scientific water quality information for Wyoming.

C

Credible Data Scientifically valid chemical, physical, and biological monitoring data collected under an accepted sampling and analysis plan, including quality assurance and quality control procedures.

D

Designated Uses Those uses specified in water quality standards for each water body or segment whether or not they are being attained.

Discharge Any addition of any pollution or wastes to any waters of the state.

E

Ecological Function Ability of an area to support vegetation, fish and wildlife populations, recharge aquifers, stabilize base flows, attenuate flooding, trap sediment, and remove/transform nutrients and other pollutants.

Ecoregion An area, or region, identified by biological, chemical, and physical reference conditions classified depending on elevation, geomorphology, and stream origin.

E. coli Refers to a subset of fecal coliform bacteria, *Escherichia coli*, which has known pathogenic effects.

Environmental Impact Statement (EIS) Planning document that discloses the environmental effects of a plan, project, or actions.

F

404 Permit A permit issued pursuant to Section 404 of the Federal Act to regulate the discharge of dredged fill materials into surface waters of the United States.

Fecal coliform A subset of total coliform bacteria which are present in the gut or feces or warm-blooded animals and are known to have pathogenic effects. Currently used as an indicator of point or nonpoint source pollution.

G

Geographic Information System (GIS) A computer toll/system designed for the collection, storage, and analysis of geographic feature and location data and data related to those features.

Geometric Mean A calculation used by WDEQ to quantify bacterial impairments in surface waters. Five individual samples are obtained during separate 24 hour periods within a 30-day period.

M

Main Stem The major channel of a river or stream as shown on the latest and most detailed records of the Wyoming State Engineer.

N

Natural Wetlands Those wetlands that occur independently of human manipulation of the landscape.

Nonpoint Source Any source of pollution other than a point source including sediment, soil erosion, leaking storage tanks, urban runoff, etc.

P

Point Source Any discernible, confined and discrete conveyance from which pollutants are, or may be, discharged (pipe, ditch, channel, well, animal feeding operation, boat).

Q

Quality Assurance (QA) An integrated management system designed to ensure that a product or service meets defined standards of quality with a stated level of confidence and involves planning, assessment, reporting, and quality improvement.

Quality Control (QC) System of technical activities designed to measure quality and limit error in a product or a service to assure that data meets the needs of the user.

S

Standard Operating Procedures (SOP) A detailed description of the method to be used to perform technical or administrative activities to provide project consistency, quality, and defensibility.

T

Tributary Those streams or stream segments which flow into or contribute water to another stream, stream segment, downstream reach of the same stream or waterbody.

303(d): Refers to Section 303(d) of the Clean Water Act; requires states list waterbodies that are not meeting designated uses (i.e. “impaired waterbodies”).

305(b): Refers to Section 305(b) of the Clean Water Act; requires states report biennial water quality findings to the U.S. Environmental Protection Agency.

W

Wetland Those areas in Wyoming that have three essential characteristics: hydrophytic vegetation, hydric soils, and wetland hydrology.

APPENDIX 4

LIST OF ACRONYMS

ACE: Anderson Consulting Engineers, Inc.

AMA: USDA NRCS Agricultural Management Assistance Program

BLM: US Bureau of Land Management

BMP: Best Management Practices

BURP: Beneficial Use Reconnaissance Protocol

EIS: Environmental Impact Statement

EQIP: USDA NRCS Environmental Quality Incentives Program, Farm Bill Program

EPA: US Environmental Protection Agency

IWM: Popo Agie Conservation District Irrigation Water Management Program

NEPA: National Environmental Policy Act

NRCS: USDA Natural Resource Conservation Service

PACD: Popo Agie Conservation District

SEO: Wyoming State Engineer Office

TAG: Popo Agie Steering Committee Technical Advisory Group

USDA: United States Department of Agriculture

USFS: USDA Forest Service

USFWS: US Fish & Wildlife Service

USGS: United States Geological Survey

UW CES: University of Wyoming Cooperative Extension Service

WACD: Wyoming Association of Conservation Districts

WDA: Wyoming Department of Agriculture

WDEQ: Wyoming Department of Environmental Quality

WG&F: Wyoming Game & Fish Department

WHIP: Wildlife Habitat Incentives Program, Farm Bill Program

WWDC: Wyoming Water Development Commission

APPENDIX 5

POPO AGIE WATERSHED PLANNING STEERING COMMITTEE MEMBERS

Don Aragon	George Hunker
Dorothy Bartholomew	Carrie Johnson
Dick Bieber	Jack Kelly
Mac Blewer	Donn Kesselheim
Bob Budd	Doug Lemm
Bruce Campbell	Bob Lucas
George W. Cleek, IV	Tony Malmberg
Jack Corbett	Bob McClurg
Raymond Corning	Carolyn Royer
Burns Davison	Tom Satterfield
Don Gaddie	Laurie Sain
Milt Green	Art Shoutis
Bryan Hamilton	Mickey Simmons, Jr.
Duveene Hamilton	Jack States
Jerry Heckart	Doug Thompson
Jim Hellyer	Jeri Trebelcock
Martha Hellyer	Rubel Vigil
Pat Hickerson	Mick Wolfe
Stan Hovendick	Bill Yankee

APPENDIX 6

POPO AGIE WATERSHED PLANNING TECHNICAL ADVOSRY GROUP (TAG) MEMBERS

Water Quantity TAG

Beiber, Dick	Johnson, Kevin
Bennett, Edie	Killebrew, Howard
Biltoft, Nick	Lee, Kim
Bureau of Reclamation	Lucas, Bob
Claghorn, Melissa	McConnell, Angie
Collins, Gary	Myers, Jim
Cornia, Lynn	Oberlie, Dennis
Dietz, Dave	Opitz, Mark
Gaddie, Don	Russell, Bill
Green, Milt	Simmons, Mickey
Hogan, Mark	Swanson, Robert
Hovendick, Stan	Taylor, Dave
Howell, Liz	Trebelcock, Jeri
Jackson, John	

GIS/Data Management TAG

Baker, Lars

Johnson, Kim

Breckinridge, Connie

Kesselheim, Donn

Copeland, Holly

Schaad, Mindy

Doane, Marian

Shakespeare, Jimmy

Evans, Ernie

States, Jack

Freilich, Jerry

Trebelcock, Jeri

Gaddie, Don

Wiggins, Randy

Hayward, Jennifer

Williams, Chip

Riparian/Wetland Health TAG

Biltoft, Nick

Johnson, Carrie

Budd, Bob

Johnson, Kevin

Cerovski, Andrea

Mack, Barbara

Charging, Donna

McCullough, Mac

Cunningham, Ron

Packer, Roy

Gaddie, Don

Pokorny, Steve

Hamilton, Duveene

Scholl, Bob

Hansen, Ron

Stewart, Mike

Hellyer, George

Trebelcock, Jeri

Hogan, Mark

Weber, Jake/Scott

Hunker, George

Upland Health TAG

Allen, Rick

Hickerson, Pat

Alley, Charlotte/Ralph

Jacob, Bob

Baker, Lars

Kelly, Jack

Baldez, Dick

Likins, John

Bayless, Shawn

Malmberg, Tony

Bigelow, Jerry

Means, Larry

Blewer, Mac

Oakley, Chuck

Brauneis, Karl

Oberlie, Sue

Clark, Chuck

Packer, Roy

Cooper, Craig

Russell, Brad

Doane, Marion

Ryder, Tom

Ellis, Dick

Sain, Laurie

Fluer, Scott

Scott, Dick

Gaddie, Don

Smith, Preston

Graham, Todd

Thomsen, Bob

Hamilton, Bill

Trebelcock, Jeri

Haverkamp, Jim

Yates, Bob

Hedges, Jim

Water Quality

Bartholomew, Dorothy

Kehoe, Sharon

Biltoft, Nick

Malmberg, Tony

Blewer, Mac

McClurg, Bill

Budd, Bob

Oberlie, Dennis

Corning, Raymond

Oswald, Liz

Duda, Jeff

Satterfield, Tom

Erickson, Colby

Shoutis, Art

Freilich, Jerry

Smith, Jack

Gaddie, Don

States, Jack

Goggles, Dean

Swanson, Robert (USGS)

Haire, Dave

Trebelcock, Jeri

Hellyer, Jim

Weed, Baptiste

Johnson, Kevin

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