

# **Recommended Alternative for Long-Term Water Supply Community of Twin Buttes**

**Prepared for Northwest New Mexico Council of Governments  
Gallup, New Mexico**

**June 23, 2015**



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## Table of Contents

Section	Page
1. Background and Overview .....	1
2. Existing Conditions.....	1
3. Alternatives Examined .....	1
3.1 No Action Alternative .....	3
3.2 Connection with Master Meter Alternative .....	3
3.3 Connection with Individual Meters Alternative .....	3
4. Recommended Project.....	3
5. Costs .....	5
6. Permitting and Environmental Compliance .....	5
6.1 Biological Setting .....	5
6.2 Special-Status Species.....	5
6.3 Permitting and Compliance .....	6
References.....	7

## List of Figures

Figure	Page
1 McKinley County Rural Water Systems and Navajo Gallup Water Supply Project .....	2
2 Twin Buttes Proposed Water System Preferred Alternative .....	4

## List of Tables

Table	Page
1 Alternative Scores .....	5



## **List of Appendices**

### **Appendix**

- A Alternative Scoring
- B Preliminary Cost Estimate for Preferred Alternative
- C Vegetation and Wildlife



## Recommended Alternative for Long-Term Water Supply Community of Twin Buttes

### 1. Background and Overview

This document summarizes the recommendations for providing long term public water service to the community of Twin Buttes in McKinley County, New Mexico (Figure 1). Water service for a number of existing or potential small rural water systems in McKinley County was examined in the report *McKinley County Small Rural Water Systems Appraisal Level Investigation*, prepared by Daniel B. Stephens & Associates, Inc. (DBS&A) in partnership with DePauli Engineering and Surveying Co. The report was published June 9, 2015. The Appraisal Level Investigation was prepared for McKinley County, through the Northwest New Mexico Council of Governments (NWNMCOG) pursuant to the Reclamation Rural Water Supply Act of 2006 (43 USC §§ 2401-2409 (Supp. 2011)) and appraisal criteria included in the U.S. Bureau of Reclamation's (USBR's) Rural Water Supply Program interim final rule (43 CFR Part 404).

### 2. Existing Conditions

The community of Twin Buttes is located 1 mile southwest of Gallup's municipal boundary just east of Crestview (Figure 1). Twin Buttes homes are located on ½-acre lots served by domestic wells. The New Mexico Office of the State Engineer (OSE) lists a total of 22 domestic wells with 51 acre-feet of water rights in this area (NM OSE, 2014).

### 3. Alternatives Examined

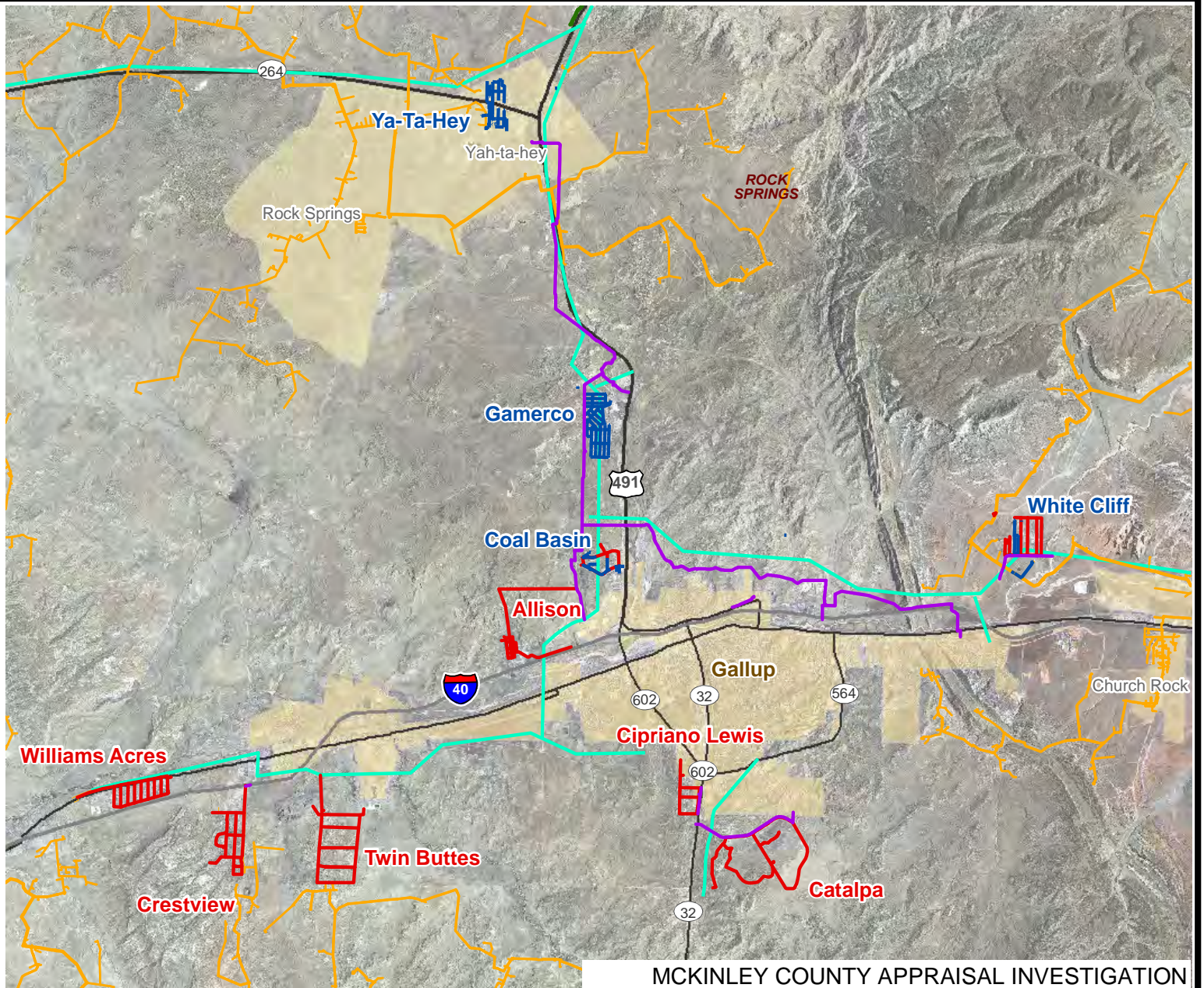
Three alternatives were examined for sustainable domestic water service to homes in Twin Buttes: (1) No Action (Groundwater), (2) Connection to the Navajo Gallup Regional Water Supply Project (NGWSP) with a Master Meter, and (3) Connection to the NGWSP with individual meters.



System	Number of Connections	
	2012	2060
Allison	31	38
Catalpa	97	120
Cipriano Lewis	27	33
Crestview	93	115
Coal Basin	34	42
Gamerco WSD	484	598
Twin Buttes	57	70
White Cliffs	48	59
Williams Acres	180	223
Yah ta hey	125	155
	1,176	1,453

### Explanation

- █ **Catalpa** Proposed water lines
- █ **Gamerco** Existing water lines
- Proposed water line
- Existing water line
- San Juan Lateral
- Navajo Tribal Utility Authority pressurized main
- Navajo Gallup Water Supply Pipeline water line



MCKINLEY COUNTY APPRAISAL INVESTIGATION  
**McKinley County Rural Water Systems and  
 Navajo Gallup Water Supply Project**

Figure 1





To evaluate future infrastructure needs, population and water demand were projected to the year 2060. It is estimated that in 2060 Twin Buttes will include 70 households, and will have an average water demand of 14,010 gallons per day (gpd), or 15.7 acre-feet per year (ac-ft/yr).

### **3.1 No Action Alternative**

The no action alternative for Twin Buttes would involve the installation of 28,700 feet of new 8-inch C-900 polyvinyl chloride (PVC) pipeline, in addition to 57 isolation valves and 26 fire hydrants. The no action alternative would also involve drilling a new 1,800-foot-deep well with a 5-horsepower pump to provide 15 gpm. The storage tank would be 150,000 gallons and is proposed to be installed near the northwest corner of the system.

### **3.2 Connection with Master Meter Alternative**

The master meter alternative would involve the installation of 27,700 feet of new 8-inch pipeline that would connect to the existing NGWSP Reach 27.3 transmission line coming west off of Rollie Road. This installation would require 56 isolation valves and 26 fire hydrants.

### **3.3 Connection with Individual Meters Alternative**

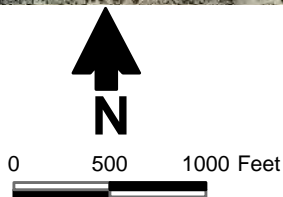
The connection with individual meters alternative would involve the installation of 27,700 feet of new 8-inch pipeline that would connect to the existing NGWSP Reach 27.3 transmission line coming west off of Rollie Road. This installation would require 56 isolation valves and 26 fire hydrants.

## **4. Recommended Project**

The alternatives described in Section 3 were scored based on performance goals that were associated with performance measures and attributes. Scores were assigned from 1 to 100, and criteria were weighted from 1 to 5. The scores for Twin Buttes alternatives are provided in Appendix A and summarized in Table 1. Based on the scoring, the connection alternative with individual meters is the preferred alternative, as shown in Figure 2.



October 2012 aerial photograph from Google Earth



**Explanation**

- Proposed water system (27,700)
- Navajo Gallup Water Supply Pipeline water line (Reach 27.3)
- City of Gallup water line
- ⬡ Tie-in

**MCKINLEY COUNTY  
APPRAISAL INVESTIGATION  
Twin Buttes  
Proposed Water System  
Preferred Alternative**





**Table 1. Alternative Scores**

Alternative	Score
No action (groundwater)	1,500
Connection with master meter	2,335
Connection with individual meters	2,830

## 5. Costs

The estimated capital cost of the preferred alternative is \$1,790,000. The annual household water cost (which would be billed to households by the City of Gallup) is \$414. The operating and maintenance costs have not been calculated, as they are included in the rates the utility company would charge to the individual customers. The detailed capital cost estimate is provided as Appendix B.

## 6. Permitting and Environmental Compliance

### 6.1 Biological Setting

The Southwest Regional Gap Analysis Project (SWReGAP) maps the Twin Buttes area as Colorado Plateau mixed bedrock canyon and tableland, Colorado Plateau pinyon-juniper woodland, inter-mountain basins big sagebrush shrubland, inter-mountain basins greasewood flat, inter-mountain basins mixed salt desert scrub, inter-mountain basins semi-desert grassland, inter-mountain basins semi-desert shrub steppe, and North American warm desert bedrock cliff and outcrop. These vegetation categories (termed “ecological systems”), together with typical wildlife of McKinley County, are described in Appendix C.

### 6.2 Special-Status Species

Federally listed endangered and threatened plant and animal species receive protection under the Endangered Species Act (ESA) of 1973. In McKinley County the black-footed ferret (*Mustela nigripes*), the southwestern willow flycatcher (*Empidonax traillii extimus*), the least tern (*Sternula antillarum athalassos*), and the Zuni bluehead sucker (*Catostomus discobolus*





*yarrowi*) are all listed as endangered, and the Mexican spotted owl (*Strix occidentalis lucida*), yellow-billed cuckoo (*Coccyzus americanus*), and Zuni fleabane (*Erigeron rhizomatus*) are listed as threatened.

Some of the above species, along with others, also receive protection under New Mexico's Wildlife Conservation Act [17-2-37 to 17-2-46 NMSA 1978] or at the Navajo Nation level. All of these species, including the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), Costa's hummingbird (*Calypte costae*), and gray vireo (*Vireo vicinior*) must be considered for planning purposes.

### **6.3 Permitting and Compliance**

Prior to construction of the preferred alternative, the contractor would be required to address applicable state and federal requirements for construction, including right-of-way for water lines. Additionally, this project falls within the project area of the NGWSP. Key requirements for that project are included here for reference. The *Record of Decision for the Navajo-Gallup Water Supply Project Planning Report and Final Environmental Impact Statement* (USBR, 2009) indicates steps needed for meeting all environmental compliance regarding final designs. Construction of water lines is expected to create temporary turbidity and other water quality concerns, and USBR is tasked with obtaining required permits under Section 404 of the Clean Water Act (CWA) for impacts associated with jurisdictional waters of the United States. Nationwide permits authorization under Nationwide Permits (NWP) No. 12 (Utility Line Activities) will be requested for temporary construction disturbances to perennial and intermittent stream pipeline crossings. Compliance with General Condition 18, Endangered Species, is required for all NWPs.

The New Mexico Wildlife Conservation Act (WCA) (NMSA 17-2-37) authorizes the New Mexico Department of Game and Fish to create a list of endangered or threatened wildlife within the state, and to take steps to protect and restore populations of species on the list. Actions causing the death of a state listed endangered animal are in violation of the WCA. For all of these reasons, in addition to other federal and state regulations and guidelines, the planning phase for any proposed new water line should include a biological survey with the following objectives:



- Determination of the ordinary high water mark at each stream crossing, in order to determine disturbance acreages for jurisdictional waters
- Wetland delineations, as needed
- Identification of noxious weeds along the route of the proposed water line
- Assessment of habitat for federal and state threatened and endangered species, as well as any additional species listed by the Navajo Nation, as needed

The Migratory Bird Treaty Act makes it unlawful to hunt, take, capture, kill, possess, import, or export any migratory birds, their nests, and eggs. Construction of the new water line should therefore occur outside the nesting season or be preceded by nest surveys to locate and protect any active nest at risk from construction activities.

Archaeological surveys are also needed along the route of the proposed new water line to avoid or mitigate losses of cultural resources that could be affected by the construction and operation of the water line. Native American human remains, funerary objects, or objects of cultural patrimony may also be encountered during the construction of new water lines of the NGWSP. Therefore, prior to issuing any approvals or permits for activities related to the NGWSP, USBR is tasked with not just the implementation of a program to avoid and mitigate the loss of cultural resources, but also full compliance with the relevant sections of the Native American Graves Protection and Repatriation Act (NAGPRA) and 43 CFR 10.3 (USBR, 2009).

## **References**

New Mexico Office of the State Engineer (NM OSE). 2014. New Mexico water rights reporting system. <<http://nmwrrs.ose.state.nm.us/nmwrrs/index.html>> Accessed January 2014.

U.S. Bureau of Reclamation (USBR). 2009. Planning report and final environmental impact statement, Navajo-Gallup Water Supply Project New Mexico – Arizona. July 2009. Available at <<http://www.usbr.gov/uc/envdocs/eis/navgallup/FEIS/index.html>>.

**Appendix A**  
**Alternative Scoring**

## Alternative Evaluation

Name of System: **Twin Buttes**

**Alternative:**

No Connection Alternative: Drill  
New or Supplemental well with  
service from small system

Connection with master meter to  
Gallup or NTUA (Water system still  
responsible for service)

Connection to Gallup or NTUA,  
who provides service to individual  
customers (water system no longer  
in place)

Goals	Performance Measures/Attributes	Score (0-100)	Criteria Weight	Evaluation Total
Long-term sustainable supply	Renewable water supply	40	4	160
Implementable	Project complexity	40	3	120
	Water right acquisition or transfer	10	4	40
Cost	Projected capital and O&M costs	40	4	160
Local environmental and health and safety benefits	Environmental considerations	50	4	200
	Health, safety, and welfare	60	4	240
	Watershed and regional approach	20	4	80
Community preference	Reliability of service	60	5	300
	Complexity of managerial and operations and maintenance requirements for systems and communities	50	4	200
<b>Total</b>				<b>1500</b>

## Alternative Evaluation

Name of System: **Twin Buttes**

**Alternative:**

No Connection Alternative: Drill New or Supplemental well with service from small system

Connection with master meter to Gallup or NTUA (Water system still responsible for service)

Connection to Gallup or NTUA, who provides service to individual customers (water system no longer in place)

Goals	Performance Measures/Attributes	Score (0–100)	Criteria Weight	Evaluation Total
Long-term sustainable supply	Renewable water supply	70	4	280
Implementable	Project complexity	65	3	195
	Water right acquisition or transfer	50	4	200
Cost	Projected capital and O&M costs	60	4	240
Local environmental and health and safety benefits	Environmental considerations	60	4	240
	Health, safety, and welfare	70	4	280
	Watershed and regional approach	90	4	360
Community preference	Reliability of service	60	5	300
	Complexity of managerial and operations and maintenance requirements for systems and communities	60	4	240
<b>Total</b>				<b>2335</b>

## Alternative Evaluation

Name of System: **Twin Buttes**

**Alternative:**

No Connection Alternative: Drill New or Supplemental well with service from small system

Connection with master meter to Gallup or NTUA (Water system still responsible for service)

Connection to Gallup or NTUA, who provides service to individual customers (water system no longer in place)

Goals	Performance Measures/Attributes	Score (0–100)	Criteria Weight	Evaluation Total
Long-term sustainable supply	Renewable water supply	70	4	280
Implementable	Project complexity	70	3	210
	Water right acquisition or transfer	95	4	380
Cost	Projected capital and O&M costs	80	4	320
Local environmental and health and safety benefits	Environmental considerations	60	4	240
	Health, safety, and welfare	70	4	280
	Watershed and regional approach	90	4	360
Community preference	Reliability of service	80	5	400
	Complexity of managerial and operations and maintenance requirements for systems and communities	90	4	360
<b>Total</b>				<b>2830</b>

**Appendix B**

**Preliminary  
Cost Estimate for  
Preferred Alternative**

### COST ESTIMATE SUMMARY

<b>FEATURE:</b> Twin Buttes - Connection Alternative - Connect to NGWSP and individual meters		<b>PROJECT:</b> McKinley County Regionalization Planning			
		<b>WOID:</b>		<b>ESTIMATE LEVEL:</b> Appraisal	
		<b>REGION:</b>		<b>UNIT PRICE LEVEL:</b> October 1, 2013	
		<b>FILE:</b> S:\Projects\WR12.0084_McKinley_County\Engineering\Cost Estimates\Cost Estimate- Improvements.xlsx			
PAY ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Waterline (8")	27,700	LF	\$ 22.24	\$ 616,048
2	Fittings	\$ 616,048	%	15%	\$ 92,407
3	Fire hydrants	26	EA	\$ 3,500.00	\$ 91,000
4	Water valves (8")	55	EA	\$ 875.06	\$ 48,478
5	Service connections, incl. tap	70	EA	\$ 1,750.00	\$ 123,323
6	Storage tank	0	GAL	\$ 1.50	\$ -
7	Tie-in 18"	1	EA	\$ 3,800	\$ 3,800
					\$ -
					\$ -
					\$ -
					\$ -
					\$ -
					\$ -
					\$ -
					\$ -
<b>SUBTOTAL</b>					\$ 975,057
	Contractor Overhead and Administration Costs	12.1%	(%)	\$ 975,057	\$ 117,689
<b>SUBTOTAL CONSTRUCTION</b>					\$ 1,092,746
	Design Contingency	10.0%	(%)	\$ 1,092,746	\$ 109,275
<b>SUBTOTAL WITH DESIGN CONTINGENCY</b>					\$ 1,202,021
	Engineering Design	12.0%	(%)	\$ 1,202,021	\$ 144,242
	QA/QC	6.0%	(%)	\$ 1,202,021	\$ 72,121
	Construction Administration	6.0%	(%)	\$ 1,202,021	\$ 72,121
	Environmental Assessment	4.0%	(%)	\$ 1,202,021	\$ 48,081
	Archaeological Survey	4.0%	(%)	\$ 1,202,021	\$ 48,081
	Biological Survey	4.0%	(%)	\$ 1,202,021	\$ 48,081
<b>SUBTOTAL, PROFESSIONAL SERVICES</b>					\$ 432,727
<b>SUBTOTAL, CAPITAL COSTS</b>					\$ 1,525,473
	Tax	8.3125%	(%)	\$ 1,525,473	\$ 126,805
	Contingency, % of capital costs	9%	(%)	\$ 1,525,473	\$ 137,293
<b>TOTAL CAPITAL COST</b>					<b>\$ 1,789,571</b>
<b>QUANTITIES</b>			<b>PRICES</b>		
<b>BY:</b>	M. Anderson		<b>BY:</b>	M. Anderson	
<b>DATE:</b>			<b>DATE:</b>		
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**Appendix C**  
**Vegetation and Wildlife**



## Appendix C. Vegetation and Wildlife

### C.1 Vegetation

The Southwest Regional Gap Analysis Project (SWReGAP) maps the Twin Buttes area as Colorado Plateau mixed bedrock canyon and tableland, Colorado Plateau pinyon-juniper woodland, inter-mountain basins big sagebrush shrubland, inter-mountain basins greasewood flat, inter-mountain basins mixed salt desert scrub, inter-mountain basins semi-desert grassland, inter-mountain basins semi-desert shrub steppe, and North American warm desert bedrock cliff and outcrop. These vegetation categories (termed “ecological systems”) are described in the following subsections.

#### **C.1.1 Colorado Plateau Mixed Bedrock Canyon and Tableland**

The distribution of this ecological system is centered on the Colorado Plateau, where it is composed of barren and sparsely vegetated landscapes (generally <10 percent plant cover) of steep cliff faces, narrow canyons, and open tablelands of predominantly sedimentary rocks, such as sandstone, shale, and limestone. Some eroding shale layers similar to inter-mountain basins shale badland (CES304.789) may be interbedded between the harder rocks. The vegetation is characterized by very open tree canopy or scattered trees and shrubs with a sparse herbaceous layer. Common species includes *Pinus edulis*, *Pinus ponderosa*, *Juniperus* spp., *Cercocarpus intricatus*, and other short-shrub and herbaceous species, using moisture from cracks and pockets where soil accumulates. It is geographically restricted and distinct from the related, but broader inter-mountain basins cliff and canyon (CES304.779). Shale areas are not extensive as in shale badlands.

#### **C.1.2 Colorado Plateau Pinyon-Juniper Woodland**

The Colorado Plateau pinyon-juniper woodland ecological system occurs in dry mountains and foothills of the Colorado Plateau region, including the western slope of Colorado to the Wasatch Range, south to the Mogollon Rim, and east into the northwestern corner of New Mexico. It is typically found at lower elevations ranging from 4,900 to 8,000 feet above mean sea level



(feet msl). Woodlands of this ecological system occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture, ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

Twoneedle pinyon (*Pinus edulis*) and/or Utah juniper (*Juniperus osteosperma*) dominate the tree canopy. In the southern portion of the Colorado Plateau in northern Arizona and northwestern New Mexico, oneseed juniper (*Juniperus monosperma*) and hybrids of juniper species (*Juniperus* spp.) may dominate or co-dominate the tree canopy. Rocky Mountain juniper (*Juniperus scopulorum*) may co-dominate or replace Utah juniper at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include greenleaf manzanita (*Arctostaphylos patula*), big sagebrush (*Artemisia tridentata*), littleleaf mountain mahogany (*Cercocarpus intricatus*), alderleaf mountain mahogany (*Cercocarpus montanus*), blackbrush (*Coleogyne ramosissima*), Stansbury cliffrose (*Purshia stansburiana*), antelope bitterbrush (*Purshia tridentata*), Gambel oak (*Quercus gambelii*), blue grama (*Bouteloua gracilis*), James' galleta (*Pleuraphis jamesii*), or muttongrass (*Poa fendleriana*). The Colorado Plateau pinyon-juniper woodland occurs at higher elevations than the Great Basin pinyon-juniper woodland and Colorado Plateau shrubland systems.

### **C.1.3 Inter-Mountain Basins Big Sagebrush Shrubland**

This ecological system occurs throughout much of the western United States, typically in broad basins between mountain ranges, plains and foothills between 1,500 and 2,300 meters in elevation. Soils are typically deep, well-drained and non-saline. These shrublands are dominated by *Artemisia tridentata* ssp. *tridentata* and/or *Artemisia tridentata* ssp. *wyomingensis*. Scattered *Sarcobatus vermiculatus* and *Atriplex* spp. may be present in some stands. *Ericameria nauseosa* or *Chrysothamnus viscidiflorus* may co-dominate disturbed stands. Perennial herbaceous components typically contribute less than 25 percent vegetative cover. Common graminoid species include *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus lanceolatus*, *Festuca idahoensis*, *Hesperostipa comata*, *Leymus cinereus*, *Pleuraphis jamesii*, *Pascopyrum smithii*, *Poa secunda*, or *Pseudoroegneria spicata*.



#### **C.1.4 Inter-Mountain Basins Greasewood Flat**

This ecological system occurs in intermountain basins throughout much of the western United States and extends onto the western Great Plains. It typically occurs near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas. Sites typically have saline soils and a shallow water table and flood intermittently, but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*). Fourwing saltbush (*Atriplex canescens*), shadscale saltbush (*Atriplex confertifolia*), or winterfat (*Krascheninnikovia lanata*) may be present to co-dominant. Occurrences are often surrounded by mixed salt desert scrub. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of alkali sacaton (*Sporobolus airoides*), saltgrass (*Distichlis spicata*) (where water remains ponded the longest), or common spikerush (*Eleocharis palustris*) herbaceous types.

#### **C.1.5 Inter-Mountain Basins Mixed Salt Desert Scrub**

This extensive ecological system includes open-canopied shrublands of typically saline desert basins, alluvial slopes, and plains across the Intermountain western United States. This type also extends in limited distribution into the southern Great Plains. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species such as *Atriplex confertifolia*, *Atriplex canescens*, *Atriplex polycarpa*, or *Atriplex spinifera*. Other shrubs present to co-dominant may include *Artemisia tridentata* ssp. *wyomingensis*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Ephedra nevadensis*, *Grayia spinosa*, *Krascheninnikovia lanata*, *Lycium* spp., *Picrothamnus desertorum*, or *Tetradymia* spp. *Sarcobatus vermiculatus* is generally absent, but if present does not co-dominate. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus lanceolatus* ssp. *lanceolatus*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Pleuraphis rigida*, *Poa secunda*, or *Sporobolus airoides*. Various forbs are also present.



### **C.1.6 Inter-Mountain Basins Semi-Desert Grassland**

This widespread ecological system occurs throughout the Intermountain western United States on dry plains and mesas, at approximately 1,450 to 2,320 meters (4,750 to 7,610 feet) in elevation. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often well-drained sandy- or loamy-textured soils derived from sedimentary parent materials, but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. When they occur near foothills grasslands they will be at lower elevations. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or co-dominated by *Achnatherum hymenoides*, *Aristida* spp., *Bouteloua gracilis*, *Hesperostipa comata*, *Muhlenbergia torreyana*, or *Pleuraphis jamesii*, and may include scattered shrubs and dwarf-shrubs of species of *Artemisia*, *Atriplex*, *Coleogyne*, *Ephedra*, *Gutierrezia*, or *Krascheninnikovia lanata*.

### **C.1.7 Inter-Mountain Basins Semi-Desert Shrub Steppe**

This ecological system occurs throughout the Intermountain western United States, typically at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe is typically dominated by graminoids (>25 percent cover) with an open shrub layer, but includes sparse mixed shrublands without a strong graminoid layer. Characteristic grasses include *Achnatherum hymenoides*, *Bouteloua gracilis*, *Distichlis spicata*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa secunda*, and *Sporobolus airoides*. The woody layer is often a mixture of shrubs and dwarf-shrubs. Characteristic species include *Atriplex canescens*, *Artemisia filifolia*, *Chrysothamnus greenei*, *Chrysothamnus viscidiflorus*, *Ephedra* spp., *Ericameria nauseosa*, *Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Scattered *Artemisia tridentata* may be present but does not dominate. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layer. Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some occurrences.



### **C.1.8 North American Warm Desert Bedrock Cliff and Outcrop**

This ecological system is found from subalpine to foothill elevations and includes barren and sparsely vegetated landscapes (generally less than 10 percent plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Species present are diverse and may include elephant tree (*Bursera microphylla*), ocotillo (*Fouquieria splendens*), Bigelow's nolina (*Nolina bigelovii*), teddybear cholla (*Opuntia bigelovii*), and other desert species, especially succulents. Lichens are predominant life forms in some areas. This ecological system may include a variety of desert shrublands less than 2 hectares (5 acres) (USGS, 2004).

## **C.2 Wildlife**

Mammals occurring in McKinley County and in the Great Basin Conifer Woodland biotic community (Brown and Lowe, 1977; Brown, 1982) typically include small mammals such as squirrels, mice, gophers, rats, rabbits, badgers, raccoon, and skunks, as well as larger mammals such as gray, kit, and red foxes (*Urocyon cinereoargenteus*, *Vulpes macrotis*, *V. vulpes*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and mule deer (*Odocoileus hemionus*).

Resident and migratory birds expected in the area include western kingbird (*Tyrannus verticalis*), northern mockingbird (*Mimus polyglottos*), broad-tailed and rufous hummingbirds (*Selasphorus platycercus*, *S. rufus*), black-chinned hummingbird (*Archilochus alexandri*), redheaded woodpecker (*Melanerpes erythrocephalus*), northern flicker (*Colaptes auratus*), dark-eyed junco (*Junco hyemalis*), red-breasted, white-breasted, and pygmy nuthatches (*Sitta canadensis*, *S. carolinensis*, *S. pygmaea*), western meadowlark (*Sturnella neglecta*), pinyon jay (*Gymnorhinus cyanocephalus*), common raven (*Corvus corax*), great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), northern harrier (*Circus cyaneus*), turkey vulture (*Cathartes aura*), several species of warblers, vireos, wrens, swallows, and sparrows, and numerous others.



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