Tongue Creek of the Gunnison River
Watershed Assessment

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BACKGROUND AND INTRODUCTION

The Western Slope Conservation Center (WSCC) is a grassroots organization in western Colorado. We began in 1977 when neighbors joined together to protect the North Fork of the Gunnison River. Over the years, we have worked to maintain and improve the health of the North Fork and Lower Gunnison watersheds by working with diverse partners to improve instream infrastructure, restore the streambank and wetlands areas, monitor water quality, and improve river access opportunities. In addition to watershed stewardship, our primary goal areas include public lands advocacy and community education and engagement.

Our mission is to build an active and aware community to protect and enhance the lands, air, water, and wildlife of the Lower Gunnison Watershed. As a result of our work, the communities of the Lower Gunnison Watershed will be characterized by intact and functioning ecosystems, clean and abundant water resources, well-managed lands with the highest level of protection they deserve, and an informed and engaged citizenry that understands the connection between the vitality of its ecological and social communities.

The purpose of this watershed assessment is to describe existing conditions, identify watershed needs, and outline project concepts that address those needs. This assessment will be a useful guide for stakeholders interested in learning more about the needs of the watershed, determining eligibility and priorities for future project concepts, and developing and implementing those projects.

The Western Slope Conservation Center (WSCC) in partnership with WaterSMART: Cooperative Watershed Management Program is expanding its watershed management activities and geographic scope beyond the existing North Fork of the Gunnison River to include the Tongue Creek watershed. Many stakeholders are committed to the health and productivity of every watershed, and developing plans such as this are critical for identifying and understanding the most salient issues, improving project coordination, and leveraging resources to accomplish listed project concepts and objectives.

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STATE OF TONGUE CREEK WATERSHED

Physical Environment

LOCATION

Tongue Creek watershed and is a tributary of the Gunnison River located in the Lower Gunnison Subbasin (4th field level Hydrologic Unit Code (HUC) 14020005). The watershed consists of approximately 3,700 acres of land (Google Earth Pro. Imagery Date 6/17/16) (Figure 3).

The watershed is north of the Gunnison River and about 8 miles northeast of the town of Delta. The town of Orchard City along with the unincorporated communities of Eckert, Austin and Cory are located just east the watershed. The watershed is defined as the valley bottom and side slopes from the beginning of Tongue Creek (the junction of Dirty George and Ward Creeks) to the mouth of Tongue Creek at the Gunnison River. Headwaters of Tongue Creek via Dirty George and Ward Creeks originate from lakes and reservoirs on the Grand Mesa. Dirty George Creek originates from Big Battlement Lake and reservoirs at an elevation of 10,068 feet and Ward Creek originates from Ward Creek Reservoir at an elevation of 9,760 feet. Dirty George Creek and Ward Creek join at an elevation of 5,800 feet to form main Tongue Creek.

FIGURE 0-2: LOOKING SOUTH AT TONGUE CREEK VALLEY (12-02-15)

FIGURE 0-1: LOOKING NORTH AT TONGUE CREEK VALLEY (12-02-15)

The watershed supports a traditional western farming and ranching economy that is increasingly supplemented in summer months by a tourism economy centered around hunting, outdoor recreation and visitation to the Grand Mesa National Forest. The Natural Resource Conservation Service (NRCS) Rapid Watershed Assessment for the Lower Gunnison Watershed identified three primary concerns within the Delta

Conservation District portion of HUC 14020005. The number one concern identified is water quality and quantity, the number two concern is land utilization and number three concern is weed control. These concerns coincide with findings in this report.

Tributaries that flow into Tongue Creek from the west are Oak Creek, Beebe Creek, Dougspoon Creek, and Negro Creek. Tributaries which flow into Tongue Creek from the east include Happy Hollow Gulch, Hamilton Draw, and Surface Creek.

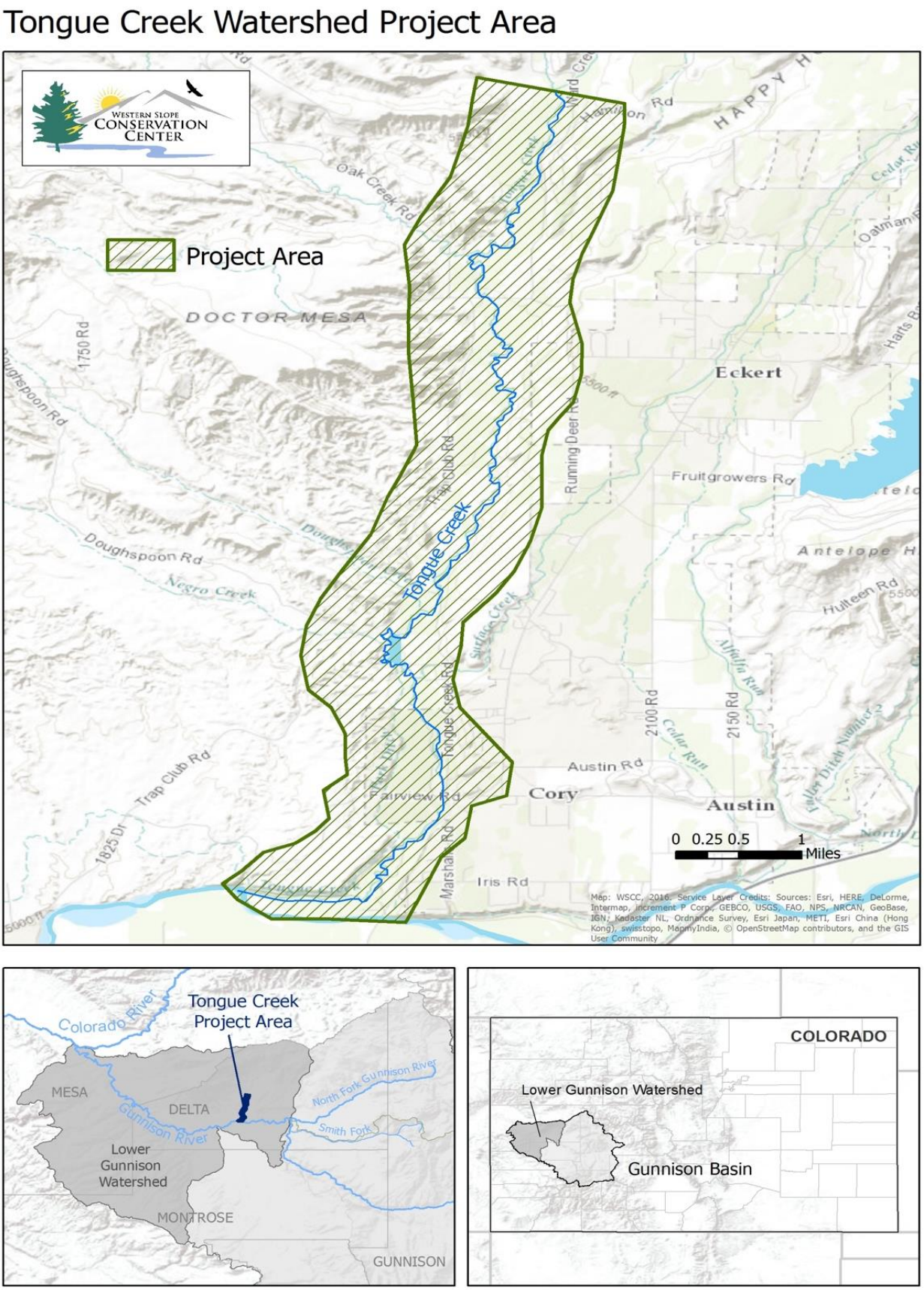

FIGURE 3: TONGUE CREEK WATERSHED SITE MAP

LANDFORM AND TOPOGRAPHY

Tongue Creek lies within the Gunnison River Basin at an elevation between 5,000 feet and 5,800 feet on the southern slope of the Grand Mesa. From the top of the Grand Mesa (10,000 foot elevation) large ridges and terraces drop 5,000 feet to the broad valley of the Gunnison River. Tongue Creek watershed lies within the lowest portion of the southern slopes of the Grand Mesa. At its southern terminus Tongue Creek flows into the Gunnison River, Gunnison Gorge is located to the southeast. The Uncompahgre Plateau lies to the west of Tongue Creek and the West Elk Mountains further to the east. Tongue Creek flows for approximately 7 miles in a southerly direction through a narrow nearly flat floodplain from 1/4 to 1 mile wide. The east slope rises gently 100 to 200 feet to sloping mesas and plateaus. The west slopes are drier and consists of dissected badlands and adobe hills. The valley floor is mostly cleared for irrigated agricultural use.

CLIMATE

Tongue Creek is located within the Colorado Plateau ecoregion, consisting of a semi-arid climate zone. Annual precipitation in the nearby town of Orchard City (elevation of 5,446 feet) has averaged 12.5 inches in the last 30 years. Most of the precipitation from rainfall occurs during frontal storms in spring and early summer and during high intensity storms in late summer. Annual total snowfall recorded for Orchard City is 49 inches in the last 30 years. Temperatures typically range from 15° F in January to highs around 88° F in July. The growing season typically lasts 146 days.

The area was affected by a drought in 2012 when the area only received 83% of normal precipitation, however conditions improved in 2013 and the National Drought Monitor showed drought conditions across Delta County during August through October of 2013 ranged from moderate drought to abnormally dry. Precipitation in 2013 was above average or 106% of normal. Other notable climate events over the last decade include an exceptional drought in 2002 and 2003, and abnormally dry to extreme conditions 68% of the last 14 years. Precipitation data from the town of Delta indicate that that 2000-2004, 2008-2009 and 2011-2012 were drier than average while 2005, 2006, and 2013 were wetter than average (BLM 2013-2014).

GEOLOGY AND SOILS

Tongue Creek watershed sits in the lower southern slope of the Grand Mesa. The mesa, formed approximately 10 million years ago by basalt flows, suppressed erosion compared to the surrounding sedimentary rock layers, which suffered rapid downcutting from the action of the Colorado and the Gunnison rivers. The top layer rests on a thick sequence of Eocene shale and sandstone known as the Green River and Wasatch Formations. These layers in turn rest on a Cretaceous layer known as the Mesa Verde Group that forms a cliff about halfway up the side of

the mesa. The lowest layers are yellow and gray Mancos Shale of late Cretaceous age. The shale continues outward into the surrounding valleys in the vicinity of the mesa, providing a soil base that is fertile for various kinds of agriculture in the Tongue Creek and Surface Creek valleys.

The soils in the bottomlands of the Tongue Creek valley are Billings silty clay loam, and Mesa and Avalon loams derived from alluvial deposits. These soils are deep and well drained, providing good rooting depth for plants. The southern portion of the Tongue Creek valley near the confluence with the Gunnison River consist of bottomland soil fluvaquents, alluvial soils stratified with layers of sand, gravel and cobble. In this portion of the watershed the water table is close to the surface seasonally and the soils are occasionally subject to flooding.

FIGURE 0-4: ADOBE BADLANDS ON WEST SIDE OF TONGUE CREEK VALLEY (12-02015)

East slopes in the watershed are primarily Utaline loam near slope bottoms and Torriothents on higher slopes. The higher eastern slopes contain alluvium consisting of large boulder and gravel deposits with fine soils. This area is highly permeable and where soils are shallow can contribute to rapid surface runoff, erosion and slope instability. West slopes are predominately adobe hills, containing silty, calcerous, or gypsum clay soils derived from Mancos shale. The adobe hills are steep, rolling hills with numerous gullies. Soils of the adobe hills are deep but impermeable, resulting in heavy runoff and erosion during significant precipitation events (Figure 0-4).

ENVIRONMENTAL RESOURCES

This section describes the environmental resources of the Tongue Creek watershed, including vegetation, wetlands and riparian zones, flora and fauna, species of special concern, invasive species and wildlife corridors.

VEGETATION

The Tongue Creek valley floor consists mostly of irrigated fields of grass hay, alfalfa, and seeded pasture, with a narrow riparian community paralleling Tongue Creek and along its most of its tributaries.

The east slopes of the watershed are comprised of a diverse mountain shrub over story with a

grass/forb understory. Riparian vegetation is associated with springs and seeps that occur along east slopes and benches. The drier and rockier areas contain shadscale, big sagebrush, black sagebrush and Mormon tea. The wetter sites with deeper soils contain big sagebrush skunkbrush, and mountain mahogany. Rubber rabbitbrush, broom snakeweed, greasewood, and four-wing saltbush are also present. Native perennial grasses are common, mostly needlegrass and galleta grass. Cheat grass and other weedy forbs including thistle, peppergrass and kochia are common.

The west slopes of the watershed contain arid desert salt shrub, which in some areas extends into the valley on unirrigated alluvial fans. The adobe hills also known as Mancos shale badlands are very sparse in vegetation. The dominant shrub is mat saltbush with shadscale and greasewood occurring on deeper loam sites of toe slopes and fans. Very sparse grasses and forbs occur on these slopes.

FIGURE 0-5: RIPARIAN VEGETATION IN THE UPPER-SECTION OF TONGUE CREEK

WETLANDS AND RIPARIAN ZONES

The riparian corridor along Tongue Creek is relatively narrow varying from about 200 feet to 1,000 feet wide. The more continuous riparian corridor lies between the confluences of Oak Creek and Cory Road. North of Oak Creek, riparian vegetation along Tongue Creek is thin, discontinuous, and mostly shrubby, consisting primarily of Gambel oak, skunkbrush, and coyote willow with scattered Fremont cottonwoods (Figure 0-5, Figure 0-6). From Oak Creek south to Cory Road, the riparian community widens and becomes more continuous, forested areas alternate with shrub-dominated stands and areas of emergent wetland dominated by cattails and bulrush. Forested areas consist of Fremont cottonwood and scattered Siberian elm. Other shrubs in the area include Gambel oak (*Quercus gambelii*), skunkbrush (*Rhus trilobata*), Wood's rose (*Rosa woodsii*), and coyote willow (*Salix exigua*). At the confluence with Surface Creek there is

a large contiguous area of Fremont cottonwood which extends for approximately one mile along Tongue Creek and also extends into the Surface Creek drainage. This area contains a variety of tree age classes, snags and down woody debris however tamarisk, Russian olive and Siberian elm appears to be encroaching in the understory, suggesting a shift in dominance to exotic species.

Wetlands occur on saturated ground in the valley floodplain and on the east slopes. Wetlands in the watershed are small only a few acres in size, with the exception of four large wetland areas in the valley floor which are between 5 and 20 acres in size (Figure 0-7). The most common wetland vegetation is roundstem bulrush mixed with cattail. Wetland areas also contain sedges, rushes, spikerush, horsetail, plaintain, reed canary grass, foxtail barley, alkali grass, and witchgrass. Wet sedge meadows occur near the confluence with Gunnison River. Figure 0-8 shows wetlands mapped by the USFWS National Wetlands Inventory for the Tongue Creek watershed.

FIGURE 0-6: RIPARIAN VEGETATION IN THE MID-SECTION OF TONGUE CREEK (07-26-16)

FIGURE 0-7: WETLAND AREA BELOW NORTH DELTA CANAL, WETLANDS EXTEND TO NORTH SIDE OF LOWER GUNNISON RIVER (12-02-15)

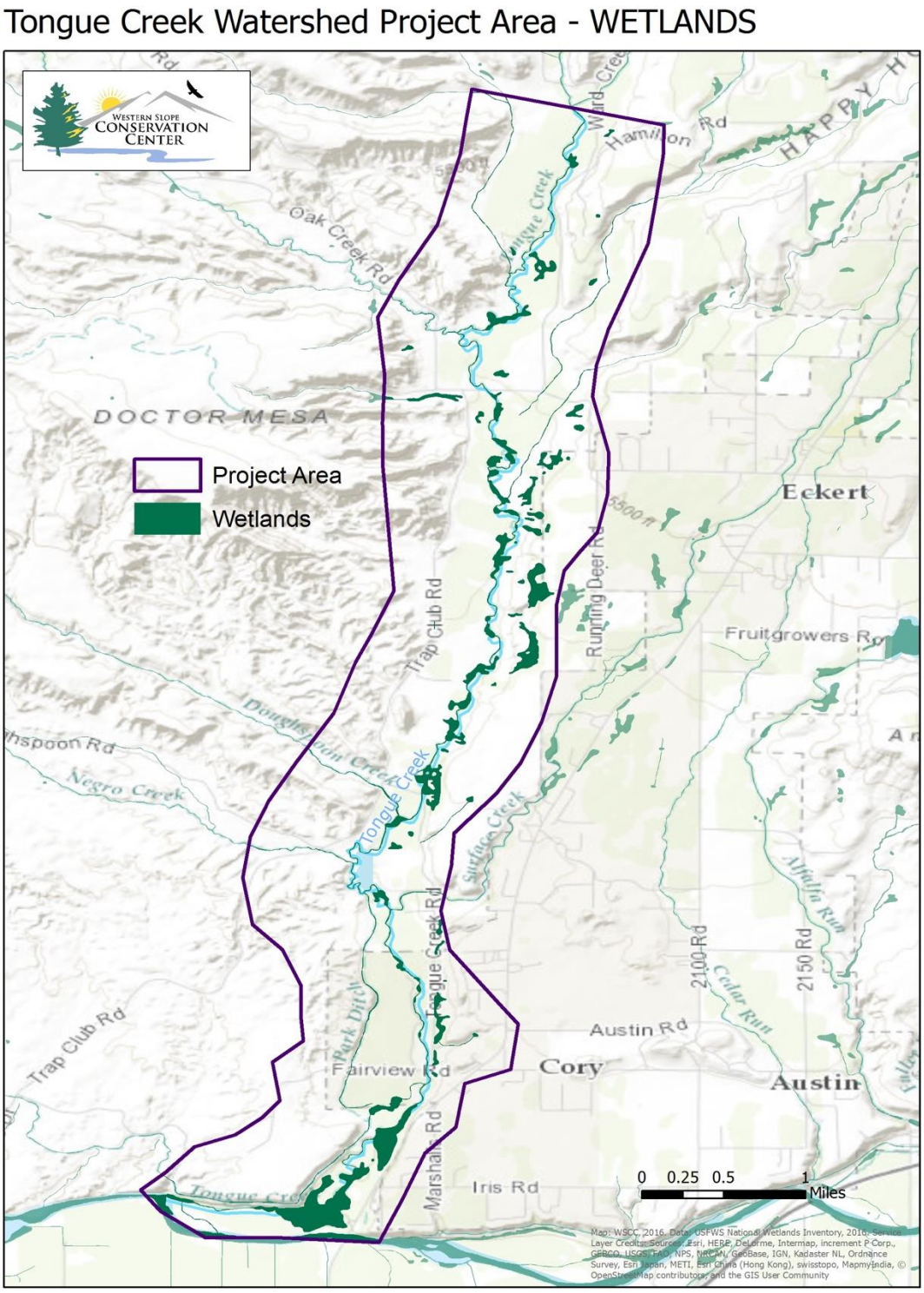

Figure 0-8: Tongue Creek Watershed Project Area Wetlands

NON-NATIVE SPECIES

Invasive weeds in the Tongue Creek watershed include Russian olive, Canada thistle, yellow clover, musk thistle, Russian knapweed, whitetop (*Cardaria draba*), chicory (*Cichorium intybus,*) cheatgrass, kochia, halogeton (*Halogeton glomeratus*), showy milkweed, common burdock, and tamarisk (*Tamarix chinensis*). Non-native annuals are pervasive throughout the watershed.

According to the Delta County Noxious Weed Management Plan (2010) the most common state designated noxious weeds in Delta County on private and BLM lands are Russian knapweed, whitetop, and Canada thistle. The most common weeds along the Gunnison River from Delta to Mesa County are Russian knapweed and tamarisk. In the west and southwest portion of Delta County the dominant invasive species are Russian knapweed, whitetop, and halogeton.

There are two large infestations of purple loosestrife, a Delta County special weed of concern located on private land three quarters of a mile west of Highway 65. Scattered locations occur along ponds and ditches in this same general area.

FISHERIES

There is little data on fish species for the Tongue Creek drainage. It's likely there are isolated individual fish species in sections of the creek but because of the highly diverted nature of the creek and all tributaries above it, fish populations are likely to be extremely small. Historically it is likely that warm water fish species such as roundtail chub in the Gunnison River made spawning runs up tributaries such as Tongue Creek. Bluehead and flannelmouth sucker in the Gunnison River may also have historically moved up into Tongue Creek. The Colorado pikeminnow and the razorback sucker, two federally endangered species, occur in the Gunnison River, where oxbows and backwater sloughs provide critical spawning areas and juvenile fish habitat. Both species may occur in the area of Tongue Creek confluence, juvenile fish may inhabit the lower reached of Tongue Creek.

The Gunnison River contains populations of brown trout, rainbow trout and a few cutthroat may be found. The Gunnison River is managed primarily as a wild trout water, with the exception that since 2004 whirling disease resistant rainbow trout have been stocked throughout the river to re-establish wild rainbow reproduction. Rainbow trout are regulated as catch and release, brown trout are regulated to 4 fish of any size limit. Some brook trout, rainbow trout, brown trout, and cutthroat trout also may be found in small numbers in perennial tributaries of the Gunnison River. Native fish species, bluehead sucker, speckled dace, sculpin, and flannelmouth sucker, are known to be present in the Gunnison River and some sections of other tributary streams. Some frogs, toads, and water snakes are known to be present, but their status is unknown. It is likely that cutthroat trout that may be present are hybrids rather than native Colorado River cutthroat.

The highest potential for recreational fishing opportunities occur in the very lower portion of the main Tongue Creek, at the confluence with the Gunnison River. It's unknown how many people fish this area especially in light of there being little to no public access.

WILDLIFE

The Tongue Creek watershed provides a mostly narrow corridor of cottonwood and riparian shrub habitat, wetlands, montane shrublands, and agricultural fields. The denser, more developed forested, wetland and shrubland habitats enhance the watersheds wildlife species diversity.

Riparian habitats are the richest wildlife habitats in Colorado, providing habitat to 75% or more of wildlife species found in the state. Tongue Creek watershed's mosaic of riparian, wetlands, upland shrub, and irrigated farmland vegetation provides a variety of ecotones important to wildlife.

Tongue Creek watershed lies within significant winter range for mule deer, and elk occasionally winter in the area. Deer are also resident year-round, attracted to dense shrubland and riparian cover adjacent to agricultural foraging areas.

Table 1 shows a list of the most common or noted wildlife species, their occurrence and the general habitat type in which they are found. Some species are yearlong residents, while others are migrants. A variety of small mammals, bird species and reptiles are scattered throughout the watershed where their specific habitats are present.

Species (Common Name)	*Habitat Type*	*Occurrence*
Mule Deer	Pinyon-juniper, oak-mountain shrub, riparian, sagebrush, grassland	Common yearlong, mostly during winter
Elk	Pinyon-juniper, oak-mountain shrub, riparian, sagebrush, grassland	Common mostly during winter
Black Bear	Spruce-aspen, oak-mountain shrub riparian	Uncommon, mostly spring and fall
Pronghorn	Grasslands, semidesert shrublands	Uncommon, year long
Mountain Lion	All types	Common, year long
Bobcat	All types	Uncommon, year long
Coyote	All types	Common, year long
Cottontail rabbit	Pinyon-juniper, riparian	Common, year long
Porcupine	Sagebrush, desert shrub	Common, year long
Prairie dog (White Tail)	Lower elevation grasslands and shublands	Common, year long
Raptors, Eagles, Hawks, Falcons	All types	Common, year long
Merriams Turkey	Riparian forests, Pinyon-juniper, Oak-mountain shrub	Uncommon, spring and fall
Gambel quail	Riparian communities and PJ in winter and oak-mountain shrub	Uncommon, yearlong
Pheasant	Brushy hillsides, field margins	Common, year long mostly warm season
Chuckar	Hay fields, shrubby field margins, dense bulrush-cattail stands	Common, year long mostly warm season
	Salt desert, drier slopes	Common, year long
		Common, year long
Neo-tropical birds	All types	Common, spring and summer
Small Mammals	All types	Common, year long
Amphibians-Reptiles	All types	Common, year long mostly warm season
Bats	All types	Common, year long mostly warm season

TABLE 0-1: LIST OF TONGUE CREEK WATERSHED TERRESTRIAL WILDLIFE SPECIES

THREATENED, ENDANGERED AND SPECIES OF SPECIAL CONCERN

The U.S. Fish and Wildlife Service maintains a list of federally designated threatened, endangered, and candidate species that may occur or be affected by activities occurring in Colorado. Tongue Creek watershed is located within Delta County, Colorado. The Delta County species list was obtained from the U.S. Fish and Wildlife Service website (USFWS 2015). Also based on data from Colorado Natural Heritage Program (CNHP) and Colorado Parks and Wildlife and BLM Uncompahgre Field Office, there are other species of special concern in the area. Table 2 below is a list of the Threatened, Endangered and Species of Concern that are found, or potentially found within Delta County. These species were reviewed to determine their potential for occurrence within the Tongue Creek watershed.

Wildlife species of concern include bald eagles (SC) which use winter roost sites in tall cottonwoods, and southwestern willow flycatcher (SC) which are not known to occur but suitable breeding habitat exists in dense shrubs and willow stands. River otter (SE) are seen rarely in Tongue Creek, they are known to occur in the Gunnison River. Sandhill cranes (SC) occur in agricultural fields adjacent to riparian areas during spring and fall migration. Breeding habitat exists for northern leopard frogs (SC). Great blue herons are common along the stream, and northern harriers occur in the area and potentially may nest in the riparian zone.

Common Name	*Scientific Name*	*Status*	*May Be Present*
Yellow-billed cuckoo	*Coccyzus americanus*	T	Yes
Bonytail chub	*Gila elegans*	E	No*
Colorado pikeminnow	*Ptychocheilus lucius*	E	No*
Humpback chub	*Xyrauchen texanus*	E	No*
Razorback sucker	*Gila cypha*	E	No*
Greenback cutthroat trout	*Oncorhynchus clarki stomias*	T	No
Clay-loving wildbuckwheat	*Eriogonum pelinophilum*	E	Yes
Colorado hookless cactus	*Sclerocactus glaucus*	T	Yes
American Peregrine falcon	*Falco peregrinus anatum*	SC	Yes
Bald Eagle	*Haliaeetus leucocephalus*	SC	Yes
Ferriginous hawk	*Buteo regalis*	SC	Yes
Greater sandhill crane	*Grus canadensis tabida*		Yes
Whooping crane	*Grus american tabida*	SC	Yes
Southwestern willow flycatcher	*Empidonax trallii extimus*	SC	Yes
		SC	
Northern leopard frog	*Rana pipiens*	SC	Yes
River otter	*Lontra canadensis*	ST	Yes
Colorado River cutthroat	*Oncorhynchus clarki pleuriticus*	SC	No
Roundtail chub	*Gila robusta*	SC	No
		SC	
	Cirsium perplexanus		
Rocky Mountain thistle	*Lomatium concinnum*	S1	Yes
Colorado desert parsley	*Penstemon retrorsus*	S1	Yes
Adobe beardtongue		S1	Yes

TABLE 0-2: LIST OF POTENTIAL THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN FOR THE TONGUE CREEK WATERSHED

STATUS: E- Federally-listed Endangered species
T- Federally-listed Threatened species
C- Federally-listed Candidate species
SC- State Special Concern species
S1- CNHP Critically Imperiled in state because of extreme rarity
*Species not known or suspected to occur in the Smith Fork watershed; water depletions may affect these species

Hydrology

RIVER FLOWS

Tongue Creek is a permanent water source that is primarily fed by Dirty George, Ward, and Oak Creeks, which all originate on the west slope of the Grand Mesa on National Forest Service land. Tongue Creek watershed drains approximately 197 square miles. The creek flows year-round, with average discharge between 10 to 100 cubic feet per second (cfs) (Photo 4a). The natural flow of the stream has been altered by irrigation diversions and return water flows. Irrigated mesas to the east contribute subsurface flow that emerges in seeps and springs along the watershed's east slope and in the floodplain. Tributary streams from the east include Ward Creek, Happy Hollow, Hamilton Draw, and Surface Creek. These are permanent streams which have also been altered by irrigation diversions and return water flows. Tributaries to the west include Dirty George Creek, Oak Creek, Beebe Creek, Doughspoon Creek, and Negro Creek. These streams carry intermittent or limited flows due to drier conditions and upstream diversions.

FIGURE 0-9: LOOKING NORTH AT UPPER-SECTION OF TONGUE CREEK (12-02-15)

Stream flows in Tongue Creek are highly variable depending on the season. Natural flow of the stream is affected by diversions for irrigation especially above the confluence with Ward and Dirty George Creeks and return flow from irrigated areas especially from the east slopes draining from the Surface Creek valley. Historical streamflow data for the years 1977 through 1988 were recorded at one USGS gaging station near Cory, at an elevation of 5,030 feet. Average monthly discharges measured at this gage were between 2.85 and 346.8 cfs with a mean of 122 cfs in May during peak run-off, from 24 cfs to 41 cfs during the irrigation months (June - October) and between 29 cfs and 39 cfs in winter months (Nov. through Feb.). The highest peak flow on record during the period the Cory gage has operated was 2,130 cfs, recorded on June 7, 1984 and the lowest flow is 0.9 cfs recorded in July, 1977. Currently there are no active streamflow gages on Tongue Creek. Average flows are highest during spring snowmelt runoff typically on Memorial Day in May and lowest in the summer months typically in July. Table 3a displays historical streamflow data in the Tongue Creek.

Water Year	Mean Annual Streamflow (cubic feet per second)
1958	84.2
1959	16.1
1960	13.5
1961	10.4
1962	32.6
1963	17.2
1964	10.5
1965	38.8
1966	32.4
1967	17.0
1968	25.7
1977	11.3
1978	36.6
1979	55.9
1980	79.2
1981	21.7
1982	39.5
1983	158.1
1984	100.7
1985	97.9
1986	102.7
1987	5.5

TABLE 0-3: HISTORICAL STREAM FLOW
SOURCE: USGS AT HTTP://WATERDATA.USGS.GOV/NWIS/RT

IRRIGATION DIVERSIONS (TONGUE CREEK)

There are 9 active irrigation diversions along the main channel of Tongue Creek. The majority of the diverted water flows through open unlined earthen ditches to irrigate agricultural lands. Most of the agricultural fields in the watershed are flood irrigated using furrows in the fields to help distribute water. Un-used irrigation water or outflow from ditches may be taken in by other

ditches or returned to Tongue Creek either through direct tributaries or tailwater channels or indirectly through groundwater recharge. A large portion of tailwater and groundwater recharge comes from the Surface Creek sub-basin which sits above and east of Tongue Creek. Some percentage of outflow is lost to evaporation and ditch seepage. During good water years Tongue Creek contains water flow the entire length of the creek, during very low water years the lower portion of the creek will carry very little water mainly due to decreases in tailwater and subsurface flow from the east slopes.

Table 4 lists the decreed ditches in Tongue Creek and the total amount of cubic feet per second (cfs) decreed. In some of these ditches a portion of the total cfs decreed includes stock water. Stock water decrees only run during the non-irrigation season. The Forked Tongue-Holman Ditch was piped in 2016 (a length of 1.89 miles) as part of the Bureau of Reclamation Salinity Control Program. The North Delta Canal/Willbanks Ditch is the largest decreed ditch; it services a portion of the North Delta area all the way west to the Westwinds Airport. The majority of irrigation diversions and ditches along Tongue Creek are owned by individual families. The North Delta Canal/Willbanks is owned and operated by the North Delta Canal Ditch Co. The Forked Tongue/Homan pipeline owned and operated by the Forked Tongue/Homan Ditch Co. consisting of four shareholders. The highest diversion on Tongue Creek is Perkins Ditch and lowest diversion in Tongue Creek is the North Delta Canal/Willbanks Ditch.

Ditch Name	Total Decreed Amount (cfs)
Perkins	12.5
Adobe	0.75
Forked Tongue-Holman	5.6 + 1.36 (transferable w/ Kennicot-Mawer)
Kennicot-Mawer	7.75 + 1.36 (transferable w/Forked Tongue-Holman)
Gallup Spring	abandoned
Pioneer	1.75
Volgamore	abandoned
Park	2.25
North Delta Canal-Willbanks	30.5
Koppe No.1	0.47
Koppe No.2	0.5
Koppe No.3	0.56

TABLE 0-4: TONGUE CREEK WATERSHED DECREED DITCHES
SOURCE: JAMES HOLLIMAN, WATER COMMISSIONER, DISTRICT 40, COLORADO DIVISION OF WATER RESOURCES.

River Condition

Tongue Creek is highly regulated by irrigation users above its point of origin and along the 7-mile stretch of the stream itself. The stream channel is narrow and confined, with an average width of 20 feet, stream gradient is low to moderate, averaging about 100 feet per mile. Water flow is relatively slow through alternating pools and riffles. Due to modifications in water flows, flooding is infrequent or occurs at very low intensities which has resulted in a narrow stream channel with few gravel bars or braided channels.

FIGURE 0-11: TONGUE CREEK

The majority of the stream channel contains stable, overhanging banks and healthy riparian vegetation (Photo 5). There are isolated areas where significant downcutting of the stream channel has occurred primarily where livestock have excessively grazed along the stream banks (Photo 6).

FIGURE 0-10: TONGUE CREEK BANK EROSION AND DOWNCUTTING

WATER QUALITY

The Gunnison and Colorado Rivers are threatened by high salinity and selenium levels. The Bureau of Reclamation (BOR) has estimated an annual average of approximately 7.7 million tons of salt in the Colorado River (BOR 2013). Irrigated agriculture is the highest use of water in the Colorado River Basin and is a major contributor to the salinity of the system. Irrigation increases salinity by depleting the amount of water flowing to the Colorado River and by dissolving salts found in underlying saline soils and geologic formations, usually marine (Mancos) shale. Deep percolation of irrigation water mobilizes the salts and selenium found naturally in the soils, especially if the lands are over-irrigated, which often occurs with flood irrigation practices. High salinity levels reduce agricultural productivity, and limit municipal uses of water. High levels of selenium lead to mortality, abnormalities, and reproductive failure in waterfowl and fish. The lower Gunnison and Colorado rivers and their tributaries currently exceed federal and state selenium levels considered to be safe for aquatic life. These rivers serve as critical habitat to four endangered fish species which have been adversely affected by reduced flows, diminished water quality, and other adverse changes in their habitat.

The Federal Clean Water Act (CWA) requires Colorado to complete a biennial report regarding water quality monitoring data to the U.S. Environmental Protection Agency (EPA). Waters classified as "impaired" (either partially supporting" or "not supporting" their designated uses), are placed on the state's list of impaired waters, as required by Section 303(d) of the Clean Water Act. The state is required to establish Total Maximum Daily Loads (TMDLs) to meet and maintain water quality standards for water bodies on the 303(d) List.

The Colorado Water Quality Control Commission updates the 303(d) list every two years. The major pollutant causing impairment in Tongue Creek is selenium (Se) and iron (Fe). Ward Creek, Surface Creek, Kiser Creek and Youngs Creek are tributaries of Tongue Creek and are identified as impaired stream segments due to selenium and iron loads (Table 5).

WBID	Segment Name	Portion	Impairment	Priority
COGULG07	Surface, Ward, Tongue, Youngs, and Kiser Creeks not on USFS land	Tongue Creek	Se, Fe (Trec)	Moderate
COGULG09	Fruitgrowers Reservoir	all	D.O (dissolved oxygen)	

TABLE 0-5: WBID SEGMENTS ON THE 2012 IMPAIRED WATERS LIST
SOURCE: 2012 303(D) LIST OF IMAPIRED WATERS

Colorado also maintains a Monitoring and Evaluation (M&E) List identifying water bodies with suspected water quality problems but with insufficient information regarding impairment standards. The 2012 M&E List identified Tongue Creek as a potential stream segment impaired by lead.

WBID	Segment Name	Portion	Impairment
COGULG07	Surface, Ward, Tongue, Youngs, and Kiser Creeks not on USFS land	Ward Creek	Se (selenium)
COGULG07	Surface, Ward, Tongue, Youngs, and Kiser Creeks not on USFS land	Surface Creek	Pb (lead)

TABLE 0-6: WBID SEGMENTS ON THE 2012 M&E LIST
SOURCE: 2012 MONITORING AND EVALUATION LIST

Electroconductivity sampling conducted during the months of March through October, 2015 at two locations along Tongue Creek (Kehmeier 2015) showed higher levels of salt concentration during the irrigation season. The lower sampling location (bridge at Tongue Creek Road) showed

increased conductivity early in the season, likely due to higher water flows during spring months and therefore more salt load. The higher sampling location (Forked Tongue Ditch headgate) showed higher concentrations of salt during August and September (after monsoon rains) compared to the lower sampling location. Kehmeier (2015) concluded that this may be due to two tributaries entering into Tongue Creek between the two sampling locations, contributing low-salt water and increased rainfall, potentially diluting the salt load in lower portion of Tongue Creek. Kehmeier's report can be found in the appendix.

RELATIONSHIP TO OTHER PROJECTS

Salinity Control Projects - Salinity control projects are implemented by the Bureau of Reclamation (BOR), the Bureau of Land Management (BLM), and the Natural Resource Conservation Service (NRCS). Projects implemented to date by these agencies prevent an estimated 1.30 million tons of salt from reaching the Colorado River system. Bureau of Reclamation, BLM, and NRCS have a combined salinity control target of 1.85 million tons by the year 2030.

Off-farm salt loading is targeted by Bureau of Reclamation in the Basinwide Salinity Control Program. The Basinwide Salinity Control Program seeks to control salt loading through a grant program whereby applications are accepted throughout the Colorado River Basin that propose methods for reducing salt loading to the Colorado River system. Applications to the Basinwide Program are primarily proposals for piping or lining irrigation delivery systems that reduce seepage and, consequentially, off-farm salt loading.

On-farm salt loading is targeted by the NRCS through its EQIP program. Individual landowners and producers participate in the EQIP program through an application sign-up process. Qualifying applicants typically receive 75% cost share towards on-farm irrigation improvements. Improvements such as sprinklers or improved flood irrigation practices increase efficiency which reduces deep percolation and, consequentially, on-farm salt loading.

FIGURE 0-12: SALINITY CONTROL PROJECT PIPING ALONG FORKED CREEK/HOLMAN DITCH (07-26-16)

The Forked Tongue/Holman Ditch Co., of Eckert, Colorado working with BOR to control salinity has completed 1.89 miles of piping of the Forked Tongue/Holman Ditch (Figure 0-12). The ditch is fed by Tongue

Creek and runs parallel to Trap Club Road. The project is anticipated to reduce the salinity loading by approximately 412 tons and selenium contributions to the Gunnison and Colorado River. The North Delta Canal has been accepted as a BOR salinity control project and is planned for piping between 2019 and 2020.

Conservation Easements - Conservation easements are voluntary legal agreements between a landowner and a land trust (or other qualified organization) in which the land owner, places restrictions on the use of his or her property, in order to protect the natural values of the land. They (easements) are flexible and tailored to meet a landowner's needs and vision for the land. Donation of a conservation easement protects land permanently while keeping it in private ownership. A conservation easement, held by a land trust, provides permanent protection of the natural values of the site. The land owner retains ownership of the property and all rights and privileges for its use, except for the uses restricted under the easement. Conservation easement properties within the main Tongue Creek drainage include:

1. Darrel & Betty Geyer - conveyed a conservation easement of 40.3 acres to Black Canyon Land Trust in 2006. Easement property is near where North Road enters the Tongue Creek Valley.
2. Dorothy & Norman Kehmeier (Keh-Land Co.) - Keh-land Co. conveyed conservation easements on portions of their ranch in 2001 (35 acres), 2002 (42 acres), 2003 (74 acres), 2004 (42 acres), 2005 (34 acres), and 2009 (61 acres) for a total of 288 acres. Easement properties lie in upper portion of the Tongue Creek valley between North Road and Trap Club Road. The 61-acre easement is located on the mesa above Tongue Creek valley on the west side of Running Deer Road.
3. William Patterson - conveyed a conservation easement of 122 acres to Three River Land Trust in 2000. Easement property lies in the floodplain of Tongue Creek just above its confluence with the Gunnison River.

The primary conservation values protected by the conservation easements are:

- Prime farmland, as recognized by the Natural Resources Conservation Service due to a combination of factors including productive soils, climate, and water, suitable for a variety of crops and currently used for hay production and livestock grazing.
- Important natural habitat for plants and a variety of wildlife, including extensive marshes and riparian woodlands; habitat for bald eagle and southwestem willow flycatcher and the state-threatened river otter; habitat for nesting songbirds and gamebirds such as pheasant and Gambel's quail, waterfowl, mule deer, and nongame waterbirds and other wildlife.
- Scenic open space of agricultural land visible to the public from Colorado Highway 65, a Colorado Scenic Byway, county roads, nearby farms and ranches, and public lands managed by the Bureau of Land Management (BLM) and U.S. Forest Service.

Figure 0-13 shows the location of the conservation easements within the Tongue Creek watershed.

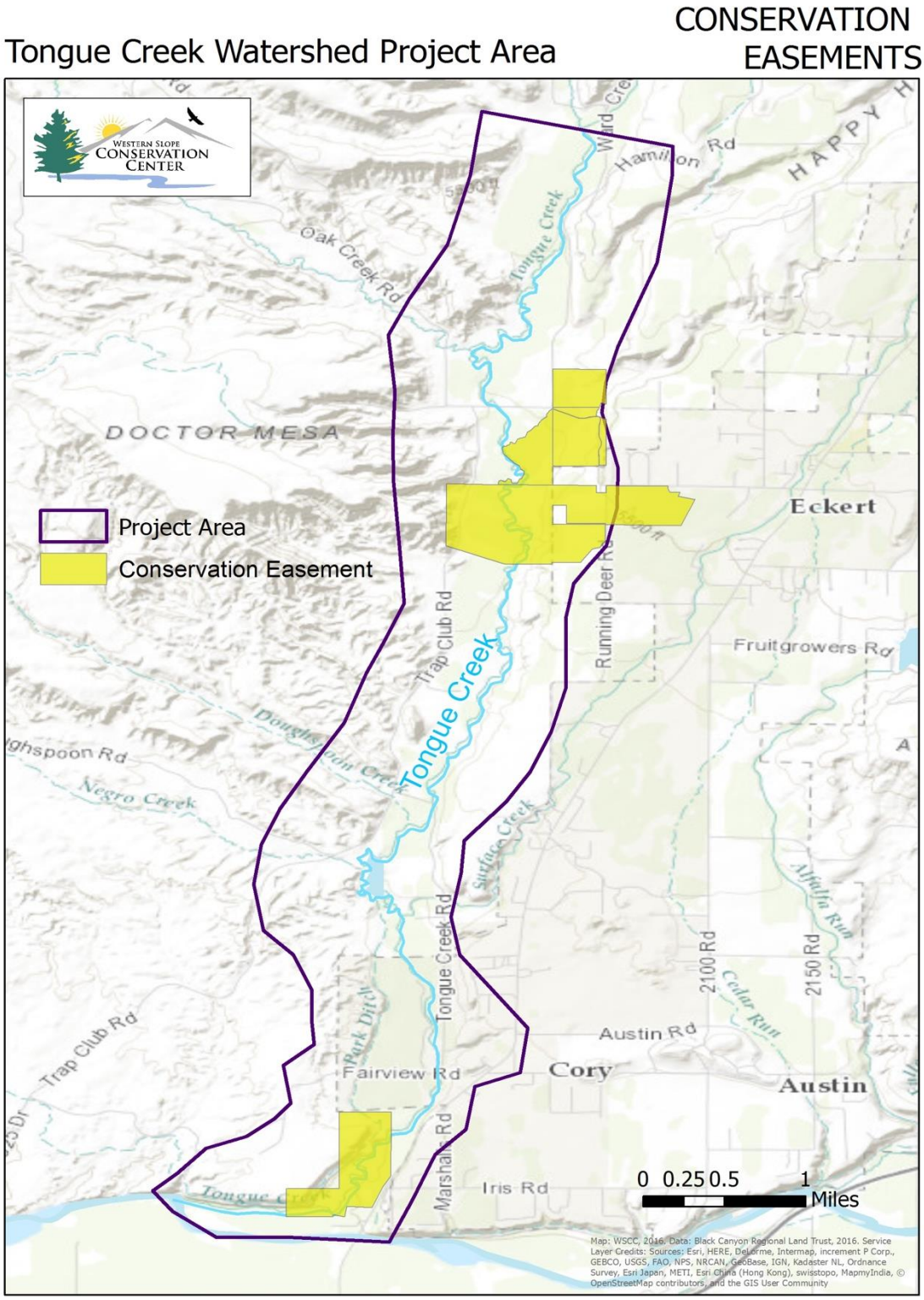

Figure 0-13: Tongue Creek Watershed Area Conservation Easements

FIGURE 0-14: ADOBE BUTTES LANDFILL LOCATED JUST WEST OF TONGUE CREEK VALLEY

Adobe Buttes Landfill - The Adobe Buttes landfill was constructed and opened in 1996. It is a solid waste facility for the residents of Delta County and is owned and operated by the County. The landfill is located on the lower slopes of the adobes on the west side of the Tongue Creek valley approximately 0.5 mile from the creek (Photo 8). The landfill is comprised of approximately 408 acres of which 28 acres is currently permitted for use. The landfill takes in between 30,000 to 35,000 tons of waste annually. A stormwater management plan for the landfill is filed with the State of Colorado. The plan includes drainage into Tongue Creek during large events and ground water monitoring wells. The landfill has water rights on the Forked Tongue - Holman ditch to fill water truck for dust abatement.

Cedaredge Water Treatment Facility - The Cedaredge wastewater treatment facility for the town of Cedaredge was completed in 2016. The new facility discharges treated effluent into Surface Creek near Cedaredge. Colorado Department of Public Health and Environment (CDPHE) mandates the effluent requirements. Discharged effluent will comply with state water quality regulations and be treated to the point that it will not need to be further diluted by additional water in Surface Creek. Since Surface Creek drains directly into Tongue Creek any concerns regarding impacts of effluent discharge from the wastewater treatment facility to the health of the watershed need to be addressed with CDPHE and the Town of Cedaredge.

Issues of Concern

Concerns for this watershed center around preserving agricultural uses and open space in the Tongue Creek valley, improving water quality, stream channel integrity, preserving healthy riparian conditions and terrestrial and aquatic species habitat.

Water Quality

Tongue Creek watershed is identified by BOR as a contributor of salt to the Colorado River System. BOR's Basinwide Salinity Control Program is less well known to valley farmers. Furthermore, there are only four ditch delivery systems that qualify for this program; Perkins Ditch, Forked Tongue-Holman, North Delta Canal-Willbanks Ditch and Park Ditch. Of these ditches the Forked Tongue-Holman Ditch Co. has received funding from BOR and has completed 1.89 miles of piping. The North Delta Canal is slated to receive funding for piping in

2017-2018. There is opportunity for the remaining qualifying ditches to receive funding for salinity control piping.

Tongue Creek and several of the small creeks in the surrounding area are classified by the Colorado Water Quality Control Commission as impaired waters due to high levels of selenium. Irrigation water seepage from unlined earthen ditches likely contributes to the selenium levels of these waterways.

Water quality data including continuation of the electroconductivity sampling should be prioritized to gather baseline conditions and monitor short and long-term water quality changes.

Stream Channel and Riparian Health

Tongue Creek contains low to moderately developed stream features and riparian habitat. Regulated water flows along with past and current grazing practices have caused downcutting of the stream channel as well as poor riparian conditions in isolated sections of the creek. Monitoring stream sections which are currently poor condition is recommended to prevent downward trends and identify potential improvements.

Invasive woody species, Tamarisk and Russian olive are common in the area between Oak Creek and Cory Road. There has not been a concerted effort to control exotic species, especially along the banks of Tongue Creek.

Terrestrial and Aquatic Species Habitat

Tongue Creek watershed provides mostly narrow bands of cottonwood and riparian shrub habitat adjacent to agricultural land, dry adobe hill slopes, small wetlands and seeps, and residential development. The larger patches of forested areas and wetlands enhance habitat quality for small mammals and tree and shrub-nesting birds (Figure 0-15). Dense riparian and shrub areas provide good cover for deer along with good proximity to agricultural foraging areas.

FIGURE 0-15: COTTONWOOD STAND ALONG MID-SECTION OF TONGUE CREEK (07-26-16)

Wildlife of concern include bald eagles which use winter roost sites in tall cottonwoods, great blue herons which are

common along the stream, and northern harriers which may nest in the riparian zone. River otter are seen rarely in the creek and sandhill cranes occur in agricultural fields adjacent to riparian areas during spring and fall migration.

Riparian, wetland and dense shrubland habitats should be protected and enhanced where possible to maintain diverse habitat for many species of game and nongame wildlife.

Lining or piping open ditches to reduce salinity could negatively impact existing wetlands, small drainages, and seeps which contribute aquatic and terrestrial species habitat and instream-flows in the Tongue Creek drainage.

There is a potential threat that large tracts of land could potentially be divided into smaller parcels resulting in more development and increasing infrastructure threatening the health and integrity of the existing stream channel, riparian and wetland habitat. Threat of development would greatly change the agricultural nature, and open space character of this valley.

GOALS, OBJECTIVES, AND PROJECT CONCEPTS

The following goals, objectives, and project concepts are identified for the Tongue Creek Watershed and are related directly to the identified issues of concern. The goals were developed through extensive research and will address respective watershed concerns. The objectives and project concepts are required to reach each goal and will ultimately improve the health of the Tongue Creek watershed.

Goals:

1. Improve water quality
2. Improve and/or maintain the integrity and health of stream and riparian habitats
3. Preserve and improve terrestrial and aquatic species habitats
4. Increase community involvement and educational outreach in Tongue Creek watershed

Goal #1 Improve water quality

OBJECTIVE 1.1: CHARACTERIZE BASELINE WATER QUALITY CONDITIONS

#	Project Concept	Watershed Benefit	Potential Partners
1	Develop water quality monitoring program: plan and execute a water quality monitoring plan to collect samples at key locations	• Knowledge of baseline conditions • Better data for decision making Establish long-term science based data • Fulfill Goal #4	CPW, Delta County School District Schools, River Watch, USGS, WSCC
2	Disseminate relevant information regarding the findings of water quality sampling	• Provide public data for decision making • Increase knowledge of baseline conditions • Fulfill Goal #4	BOR, Community Volunteers, Community K-12 Schools, River Watch, USGS, WSCC

OBJECTIVE 1.2: COORDINATE WATERSHED COMMUNITY AROUND SALINITY CONTROL EFFORTS AND MITIGATION

#	Project Concept	Watershed Benefit	Potential Partners
1	Connect stakeholders in salinity control projects with effective environmental mitigation projects Mitigation projects include 1. wetland preservation and enhancement in lower Tongue Creek on Conservation Easement properties 2. Russian olive and tamarisk removal in and close to cottonwood/forested stands 3. improvement of BLM pullout (west of Tongue Creek along Gunnison River) to a day-use and boaters area	• Better coordination and implementation of salinity reduction projects and mitigation measures with community benefit • Restore and enhance riparian vegetation and habitat	BLM, BOR, Conservation Easement Holders, Ditch Companies, Private Landowners, NRCS, WSCC

2	Compile list of conservation easement holders interested in habitat projects	• Better coordination and implementation of salinity reduction projects and mitigation measures	BCLT, Cattleman's Land Trust, COL, Conservation Easement Holders, CWCB, WSCC

Goal #2: Improve and/or maintain the integrity and health of stream and riparian habitats

OBJECTIVE 2.1: CONTROL INVASIVE WOODY SPECIES

#	Project Concept	Watershed Benefit	Potential Partners
1	Control invasive species: Tamarisk and Russian olive Use biological controls as a priority method	• Restore riparian vegetation and habitat • Decrease bank erosion • Decrease spread of invasive species • Increase species habitat	DRC, BLM, Colorado Water Conservation Board, Delta County Weed Program, Delta Conservation District, NRCS, Private Landowners and Easement Holders, Tamarisk Coalition, WCCC, WSCC
2	Replace invasive species with native vegetation	• Restore and enhance riparian vegetation and habitat • Decrease spread of invasive species	DRC, BLM, Colorado Water Conservation Board, Delta County Weed Program, Delta Conservation District, NRCS, Private Landowners and Easement Holders, Tamarisk Coalition, WCCC, WSCC
3	Conduct an on-farm demonstration of integrated pest management (IPM) control and revegetation methods	• Increase farmer understanding of weed control methods and costs • Restore and enhance native riparian habitat	DRC, BLM, Colorado Water Conservation Board, Delta County Weed Program, Delta Conservation District, NRCS, Private Landowners and Easement Holders, Tamarisk Coalition, WCCC, WSCC

OBJECTIVE 2.2: ENCOURAGE LAND-USE PRACTICES IN THE VALLEY THAT PROTECT AND IMPROVE WATER QUALITY, BANK STABILIZATION AND BANK VEGETATION

#	Project Concept	Watershed Benefit	Potential Partners
1	Monitor watershed condition and trends. If conditions degrade, provide support for farmers to take necessary action to protect and improve riparian areas.	• Maintain integrity of stream channel and riparian health • Improved understanding of hydrology and channel structure and complexity	NRCS, Private Landowners, USFWS
2	Connect stakeholders and provide support for NRCS on-farm habitat projects	• Restore riparian vegetation and habitat • Increase species habitat • Better coordination and implementation of habitat improvement/mitigation projects • Fulfill Goal #1	NRCS, Private Landowners

Goal #3: Preserve and improve terrestrial and aquatic species habitats

OBJECTIVE 3.1: ENCOURAGE PROTECTION AND ENHANCEMENT OF RIPARIAN WOODLANDS.

#	Project Concept	Watershed Benefit	Potential Partners
1	Protect and promote regeneration of key riparian woodland areas	• Maintain lower elevation agricultural habitats for wildlife species • Restore and enhance riparian vegetation and habitat	Landowners, NRCS, USFWS, WSCC, Black Canyon Audubon
2	Promote maintaining large cottonwoods	• Protect and stabilize stream banks • Restore and enhance riparian vegetation and habitat	Tamarisk Coalition, Private Landowners, CPW, USFWS,

OBJECTIVE 3.2: MAINTAIN AND CREATE WETLANDS, WETLAND MEADOWS, SEEPS AND WET DRAINAGES IN KEY HABITAT AREAS

#	Project Concept	Watershed Benefit	Potential Partners
1	Develop valley floor wetlands to create shallow open surface water and greater diversity of wetland vegetation	• Create quality habitat for wetland-dependent species • Fulfill Goal #1	Black Canyon Audubon, BOR, CPW, Private Landowners and Conservation Easement Holders, NRCS, USFWS, WSCC
2	Improve wetland area at Tongue Creek / Lower Gunnison confluence area	• Restore and enhance riparian vegetation and habitat • Fulfill Goal #1	BCLT, BOR, North Delta Canal Ditch Company, Selenium Taskforce, WSCC,

Goal#4: Increase community involvement and educational outreach in the Tongue Creek watershed

OBJECTIVE 4.1: EDUCATE LANDOWNERS ABOUT PROCESS AND BENEFITS OF CONSERVATION EASEMENT AGREEMENTS

#	Project Concept	Watershed Benefit	Potential Partners
1	Facilitate workshop with landowners to educate and promote conservation easement agreements	• Maintain integrity of stream channel and riparian health • Preserve agricultural uses and open space	BCRLT, BOR, COL, Cattlemens Land Trust, Private Landowners and Conservation Easement Holders, WSCC

2	Provide local support for landowners to facilitate conservation easement agreements	• Maintain integrity of stream channel and riparian health • Maintain and increase species habitat	BCRLT, COL, Private Landowners and Conservation Easement Holders, WSCC

OBJECTIVE 4.2: EXPAND RECREATION AND EDUCATION OPPORTUNITIES

#	Project Concept	Watershed Benefit	Potential Partners
1	Develop recreation areas including dispersed BLM campsite just below Tongue Creek / Lower Gunnison confluence, the Highway 65 Take Out, Hartland Diversion Signage	• Provide recreational benefits for water users • Reduce erosion at unofficial recreation sites	BLM, CPW, GOCO, WSCC,
2	Develop educational signage along HWY 65 where appropriate	• Improve community understanding of Tongue Creek watershed and value of wetland habitats and species.	CDOT, GOCO, Interpretive Association of Western Colorado, WSCC

Surface Creek is a tributary to Tongue Creek. Two potential projects on Surface Creek support the goals and objectives of the project concepts listed for Tongue Creek.

The first project concept includes expanding the existing Cedaredge walking path along Surface Creek and install educational signs along the path. This will increase community involvement and education outreach in the Surface and Tongue Creek watersheds. The project will provide recreational benefits for water users and develop low impact recreation opportunities for community members to access local waterways. Potential partners could include CPW, BLM, GOCO, landowners, and WSCC.

The second project concept would address the need for improved water quality at Fruitgrowers Reservoir. The reservoir has had water quality issues in the recent past, however at one time, it was provided vibrant recreation opportunities for the local community. Today, it is an important part of the Annual Eckert Crane Festival, and it provides habitat for birds and wildlife. While this report does not suggest any specific actions to address the water quality, it does recognize the potential of the area for habitat and recreation.

PROJECT CONCEPT IMPLEMENTATION STRATEGIES

Goal 1: Improve Water Quality

Objective 1.1: Characterize Baseline Water Quality Conditions

The Tongue Creek watershed water quality is highly impacted by seasonality. USGS data (Station 09137500), WSCC electroconductivity measurements, River Watch water quality samples reveal that the concentration of dissolved salts and metals is lowest in early spring during high snowmelt and highest during late summer when the water level in the creek is low and supplied by return flows. Beyond annual seasonality, the concentrations did not show any long term trends. However, long term, regular sampling would prove valuable, especially as ditches and other water conveyance and application mechanisms are improved to minimize high concentrations of salinity and selenium. Regular community sampling could also provide an engaging learning experience for local residents and students that volunteer to collect and test samples.

In order to provide an ongoing water quality characterization, the Tongue Creek watershed water quality must be sampled more regularly than what has been done in the past. Local schools, the Colorado Parks and Wildlife River Watch Program, and local organizations would likely be the most effective project implementers, and their involvement would maximize community education outreach as well. The data gathered should be disseminated to the local community, and any future reports would support existing water quality reports developed by the WSCC and other agencies.

Utilizing community-driven, volunteer sampling would minimize costs of water quality sampling; however volunteer coordination, supplies, and data dissemination is not free. Potential funding sources could include the NRCS National Water Quality Initiative, Colorado Department of Public Health and Environment Supplemental Environmental Projects, and private funding.

Potential funding sources: Colorado Department of Public Health and Environment Supplemental Environmental Projects; Colorado Parks and Wildlife, River Watch; Delta County Health Department; Private Grants; US Geological Survey

Objective 1.2: Coordinate Watershed Community Around Salinity Control Efforts and Mitigation

Agricultural producers, ditch companies, and other agencies have already initiated salinity control efforts in the Tongue Creek watershed. The associated piping projects require habitat mitigation that can be implemented on public lands or conservation easements. In order to maximize the public good associated with public project dollars, it is recommended that mitigation projects are implemented within the same immediate watershed as the piping project and on public lands to the greatest extent possible.

Connecting stakeholders in salinity control projects with effective mitigation projects will help improve landscape level coordination and implementation, and it will streamline

mitigation planning and implementation work for ditch companies and agricultural producers. Some pre-identified potential projects include:

- The preservation and enhancement of the Lower Tongue Creek wetland on conservation easement properties.
- Russian Olive and Tamarisk removal in and close to cottonwood/forested stands.
- Improvement of BLM pullout (west of Tongue Creek along Gunnison River) to remove invasive species and decrease erosion that occurs from recreation river access.

To further streamline the mitigation process, it is recommended that a list of conservation easement holders who are interested in habitat projects is compiled with a list of projects that could be implemented on the respective properties.

Potential Funding sources: Bureau of Reclamation; Colorado Water Conservation Board; Colorado River District

Goal 2: Improve and/or maintain the integrity and health of stream and riparian habitats

Stream and riparian habitat health is critical for water quality and watershed health. Stream bank health, stability, sinuosity, healthy vegetation, etc help maintain healthy water and habitat quality by minimizing erosion, maintaining cool water temperatures, and decreasing sedimentation.

Objective 2.1: Control Invasive Woody Species

In order to improve the integrity and health of the Tongue Creek stream and riparian habitats, invasive species such as Tamarisk and Russian Olive must be removed. Several potential organizational stakeholders such as the Desert Rivers Collaborative, Tamarisk Coalition, Delta Conservation District, etc have extensive experience with non-native species removal and could be effective partners to work with landowners to improve stream and riparian habitat on their property. Additionally, invasive species should be replaced with native vegetation to restore and enhance the Tongue Creek watershed. The success of this objective will depend on a multi-year commitment from stakeholders, however it will be an immensely valuable improvement to the integrity and health of stream and riparian habitats.

In order to promote ongoing and sustainable non-native species removal, it will be essential to develop landowner understanding and project buy-in. While some of this need will be met organically through direct removal projects supported by organizational and agency partners, educating landowners will be essential. On-farm demonstrations of integrated pest management control and revegetation methods will provide place-based, hands-on educational opportunities that will help ensure long term invasive species control and replacement.

Potential funding sources: Colorado River District; Colorado Water Conservation Board; Delta County, Municipalities; Natural Resources Conservation District; US Fish and Wildlife Service

Objective 2.2: Encourage Land-Use Practices in the Valley that Protect and Improve Water Quality, Bank Stabilization, and Bank Vegetation

Just as monitoring and characterizing water quality trends are important for long-term understanding, monitoring and characterizing stream and riparian habitat quality is critical for long-term watershed health. Should conditions degrade from the baseline, support for voluntary protections and improvements will be valuable tools for improvement and future maintenance. This support could be provided by the NRCS through their on-farm habitat improvement programs.

Potential funding sources: Colorado Parks and Wildlife; Natural Resources Conservation District; US Fish and Wildlife Service

Goal 3: Preserve and Improve Terrestrial and Aquatic Species Habitat

The Tongue Creek watershed provides a mostly narrow corridor of cottonwood and riparian shrub habitat, wetlands, montane shrublands, and agricultural fields. The denser, more developed forested, wetland and shrubland habitats enhance the watersheds wildlife species diversity. This is particularly important for threatened and endangered species that may be present in the watershed that depend on riparian habitat. These species include the Yellow-billed cuckoo, American Peregrine falcon, Bald Eagle, Ferriginous hawk, Greater sandhill crane, Whooping crane, and river otter (listed in Wildlife section).

Objective 3.1: Encourage Protection and Enhancement of Riparian Woodlands

The Tongue Creek Watershed riparian corridor vegetation is thin, discontinuous, and mostly shrubby, making existing woodlands critical habitat for wildlife. Key riparian woodland areas must be protected and promoted, with special attention given to the scattered Fremont cottonwood trees. This will be partially achieved through previously listed and described objectives, however additional conservation efforts may be necessary. This objective will require engagement from private landowners, supported by watershed organizations and agencies.

Potential Funding Sources: Colorado Parks and Wildlife; Great Outdoors Colorado; Natural Resources Conservation District; US Fish and Wildlife Service

Objective 3.2: Maintain and Create Wetlands, Wetland Meadows, Seeps and Wet Drainages in Key Habitat Areas

The maintenance and creation of wetlands can be promoted by salinity control mitigation projects, however interested project stakeholders should not consider such undertakings

entirely dependent on salinity control projects. Projects such as improving the Lower Tongue Creek wetland and developing other valley floor wetlands to create shallow, open surface water will improve and create quality habitat for aquatic species.

Potential Funding Sources: Bureau of Reclamation; Colorado Parks and Wildlife; Colorado Water Conservation Board; Great Outdoors Colorado; Natural Resources Conservation District; US Fish and Wildlife Service

Goal 4: Increase Community Involvement and Educational Outreach in the Tongue Creek Watershed

Tongue Creek is located just west of the town of Orchard City and the unincorporated communities of Eckert, Austin and Cory. Unless community members own property along the creek, they have no opportunity to access the creek. This lack of access can have negative impacts for community understanding and appreciation for the watershed, as often people do not understand nor appreciate what they have not experienced. Thus, providing opportunities for community members to have positive experiences on Tongue Creek are important for empowering community members to value their immediate water resources.

Objective 4.1: Educate Landowners about Processes and Benefits of Conservation Easements

Conservation easements are immensely important for the maintenance of stream channel and riparian health, traditional agricultural uses, and open space. However, the process of implementing a conservation easement is costly and can be complicated and may dissuade future holdings, especially is the benefits are unclear. Thus, educating and providing support for landowners interested in conservation easements on their property is critical. Ongoing support should be provided to interested landowners, but in order to develop more interest in the process, more proactive outreach is necessary. To that end, workshops with landowners and land trusts will help engage landowners that might not otherwise be interested in developing a conservation easement on their property.

Potential Funding Sources: Colorado Parks and Wildlife; Great Outdoors Colorado; Private Grants

Objective 4.2: Expand Recreation and Education Opportunities

While recreation and education opportunities within the Tongue Creek watershed are limited because of the lack of public land, some opportunities do exist for such development. A dispersed BLM campsite just below the Tongue Creek-Lower Gunnison Confluence is in a key location for boaters who float from the Gunnison Gorge to Confluence Park; the Highway 65 take-out could be developed; and signage regarding the Hartland Diversion downstream of Tongue Creek could be improved. Additionally, Highway 65 has views that overlook the Tongue Creek watershed, and highway signage

should be installed to educate motorists about the legacy of agriculture, conservation, and irrigation in the Tongue Creek Watershed.

This expansion of recreation and education opportunities also has significant implications for Delta County's economic development which has embraced river corridor recreation as an important resource for a diversified economy. Throughout the North Fork and Lower Gunnison rivers, various efforts are occurring to develop boat ramps and educational signage. Within this context, the development of the Highway 65 take-out will be particularly valuable because its location provides a public take-out site for boating trips that begin at Pleasure Park.

Potential Funding Sources: American Rivers; Colorado Parks and Wildlife; Delta County; Delta County Economic Development Inc.; Great Outdoors Colorado; Private Grants

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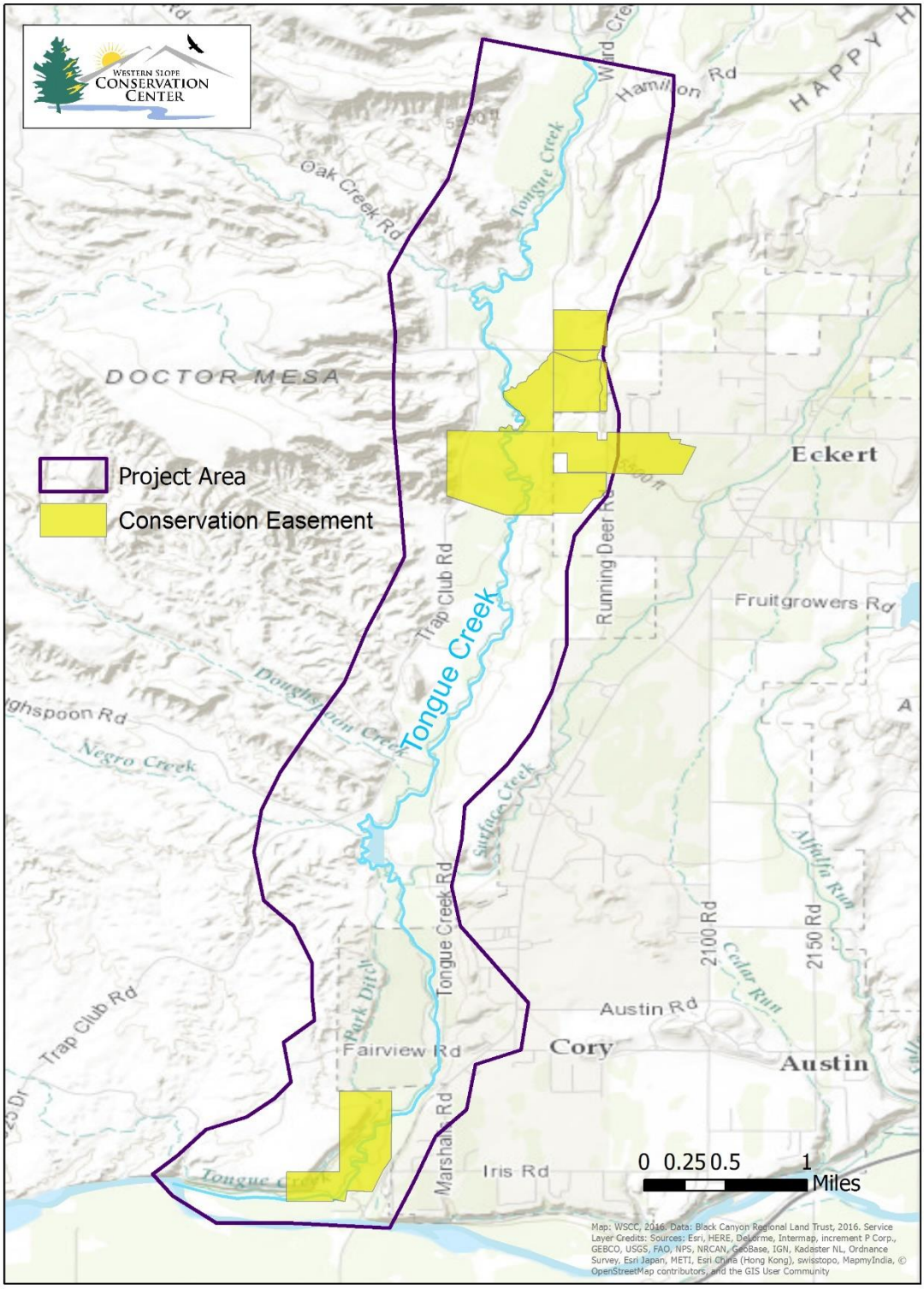
APPENDIX:

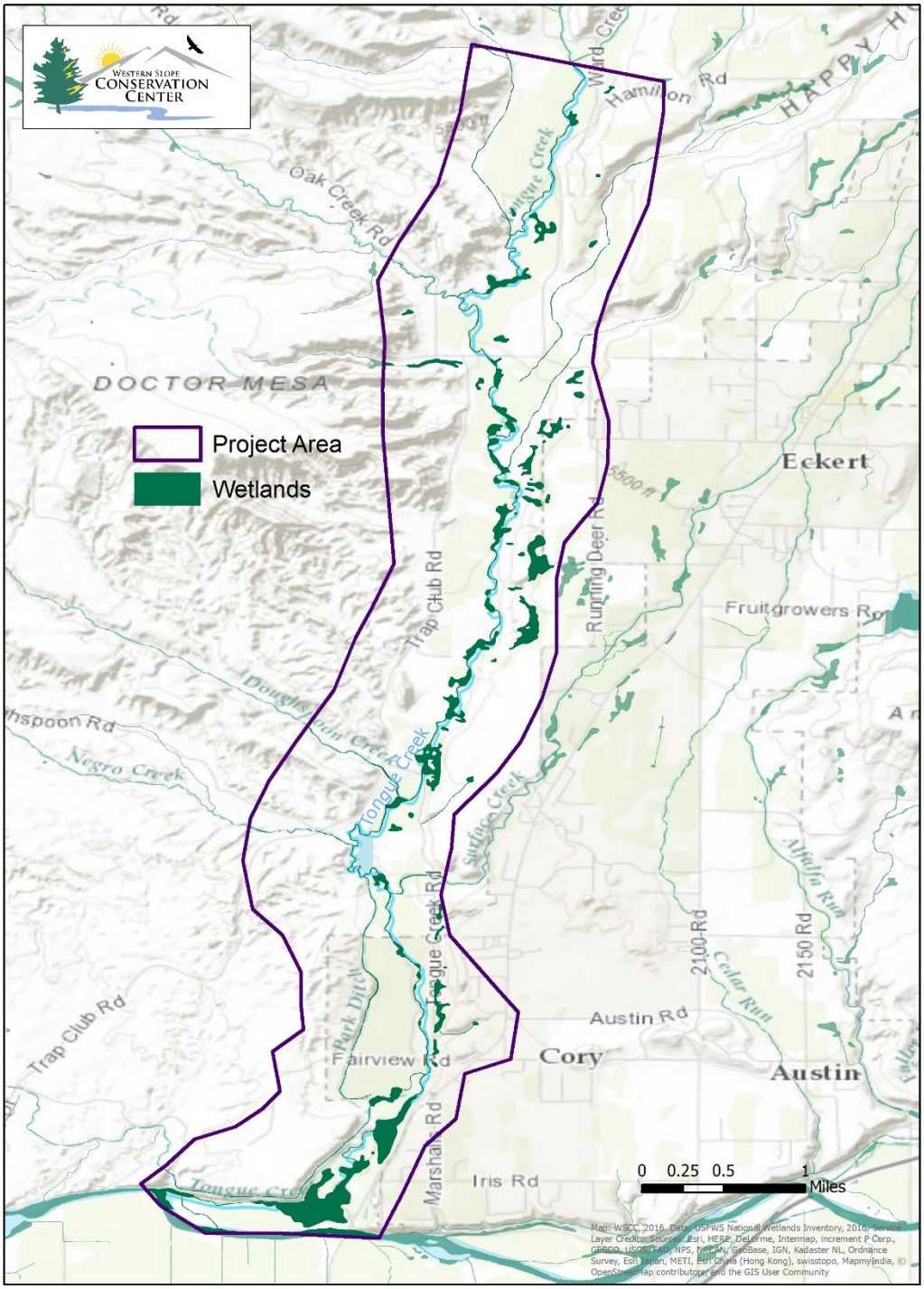
1. Tongue Creek Watershed Project Area—Conservation Easements
2. Tongue Creek Watershed Project Area—Wetlands
3. Tongue Creek Watershed Project Area—Diversions
4. Tongue Creek Watershed Project Area—Geology
5. Tongue Creek Watershed Project Area—Geology Key
6. Tongue Creek Watershed Project Area—Land Cover
7. Tongue Creek Watershed Project Area—Mule Deer Habitat
8. Tongue Creek Watershed Project Area—Elk Habitat
9. Analysis Of Water Quality Readings From Tongue Creek
10. Water Quality Readings From Tongue Creek Data

Tongue Creek Watershed Project Area

CONSERVATION EASEMENTS



Tongue Creek Watershed Project Area - WETLANDS



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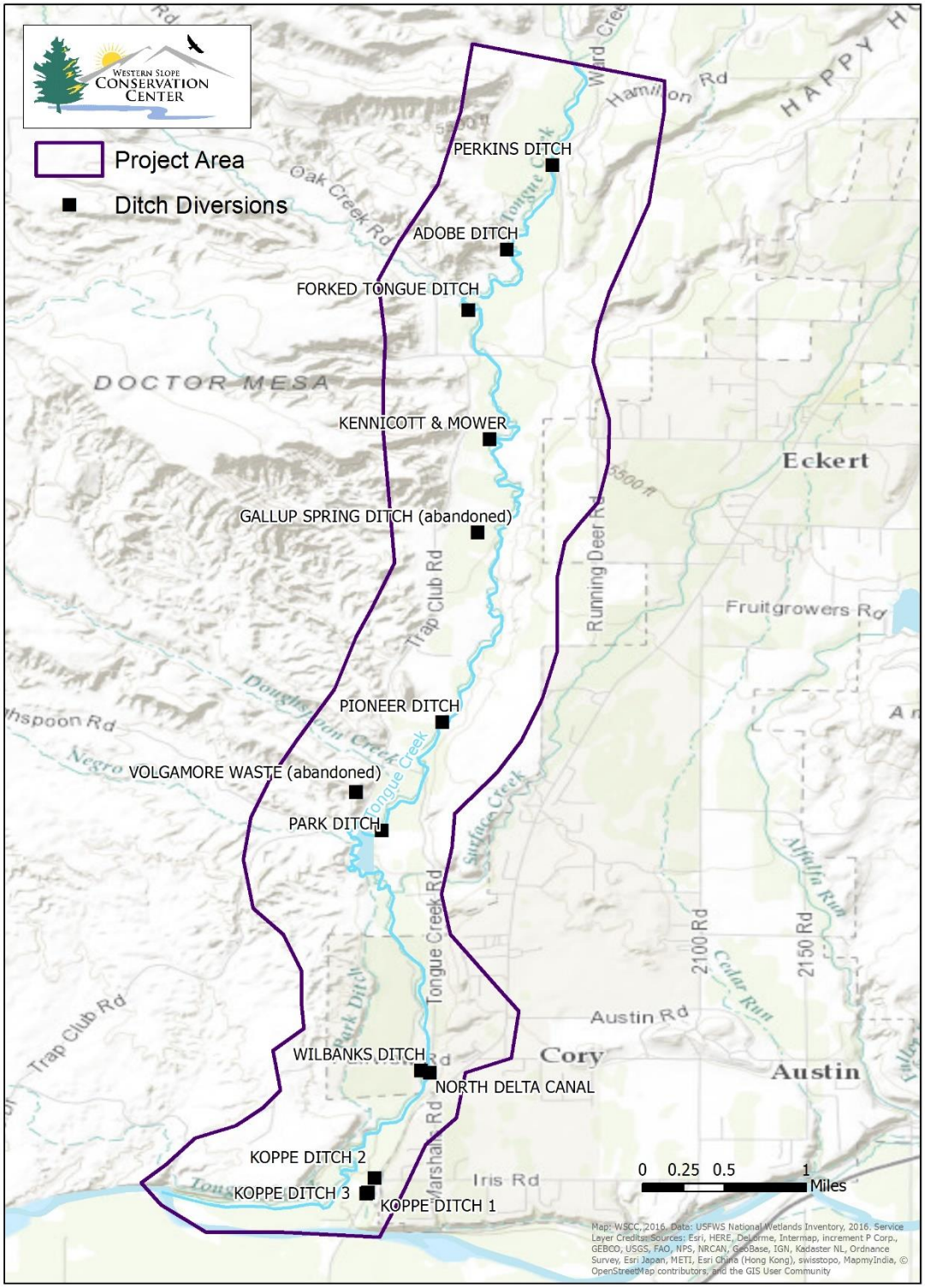

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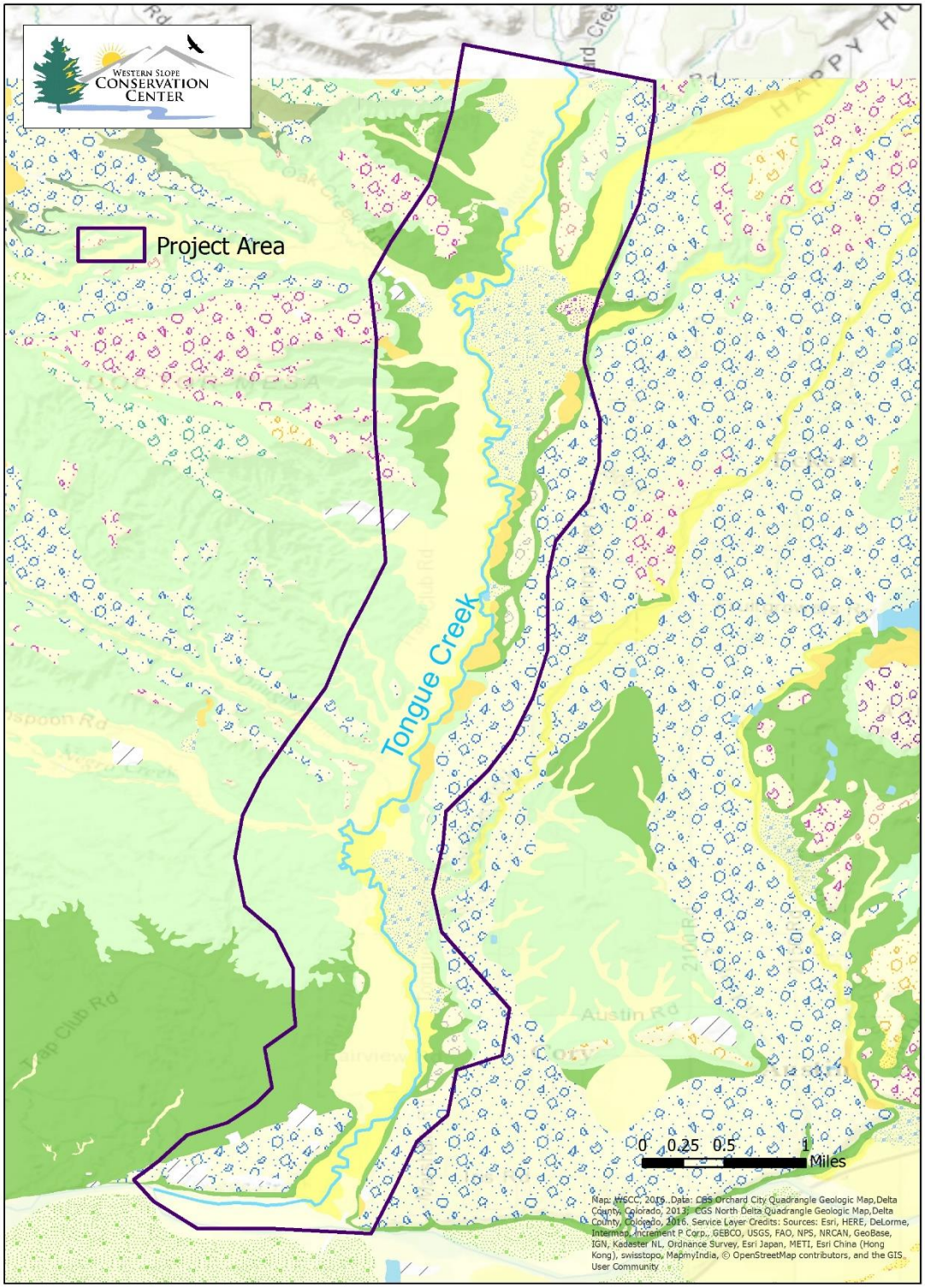
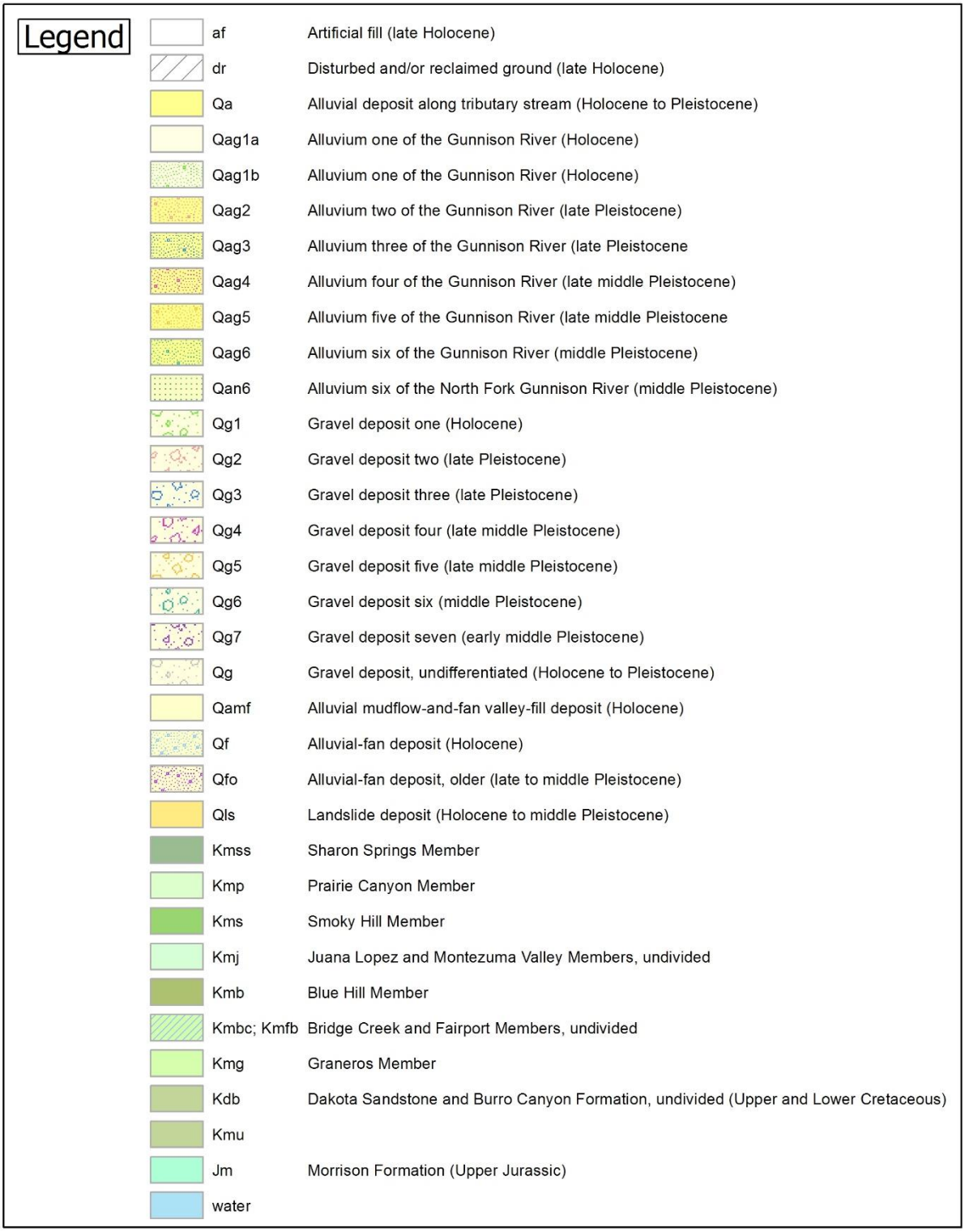
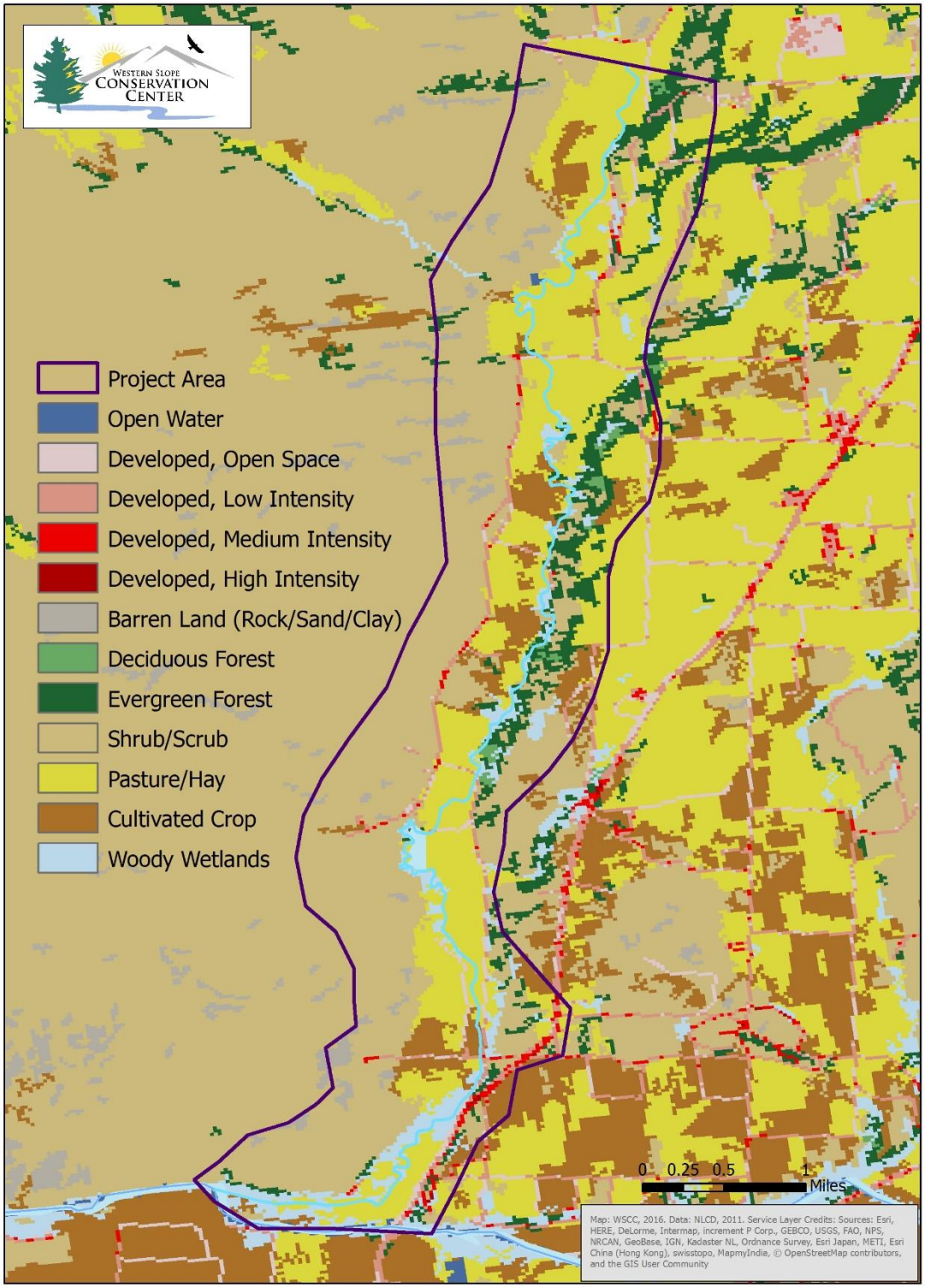


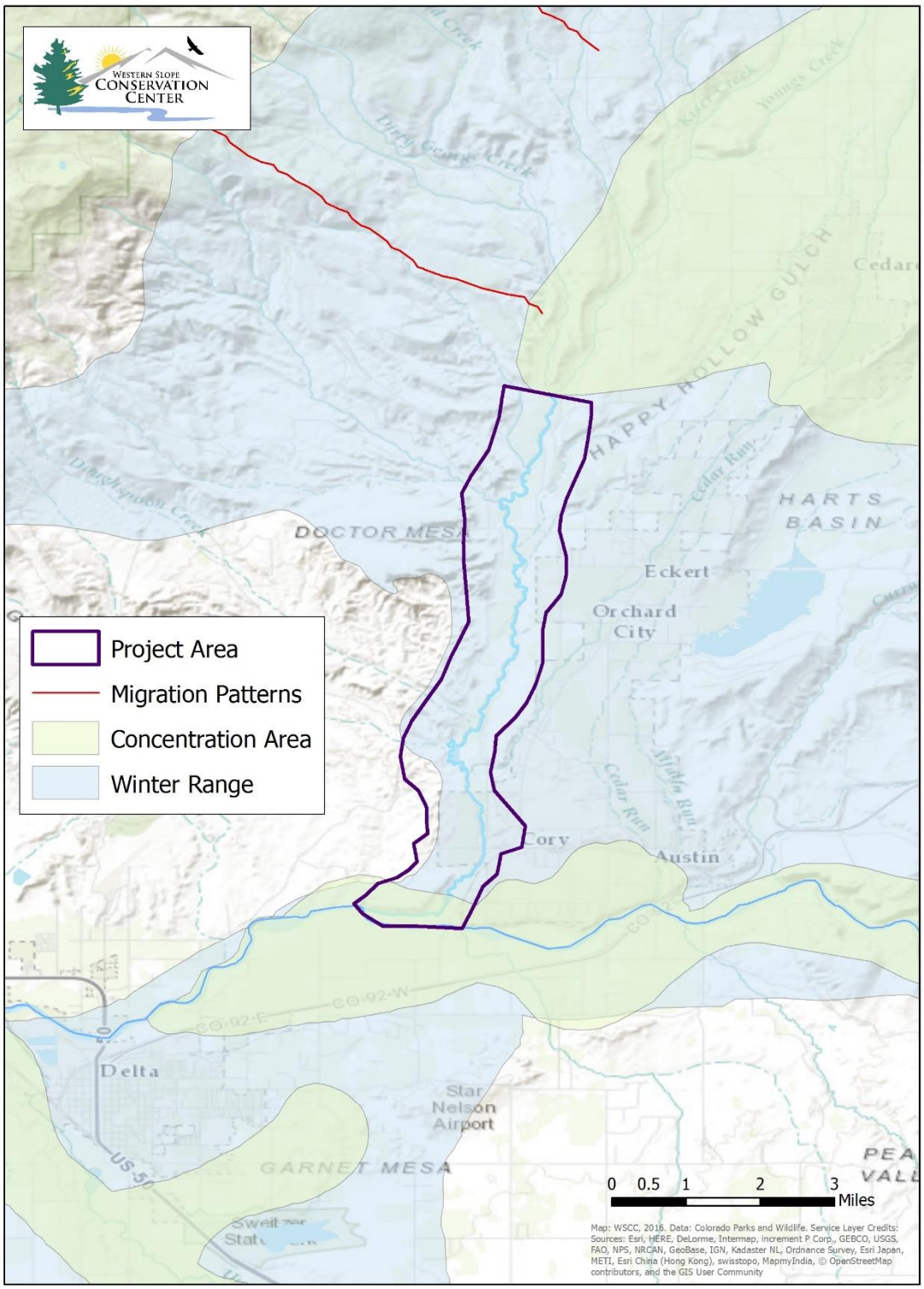
Tongue Creek Watershed Project Area - Geology



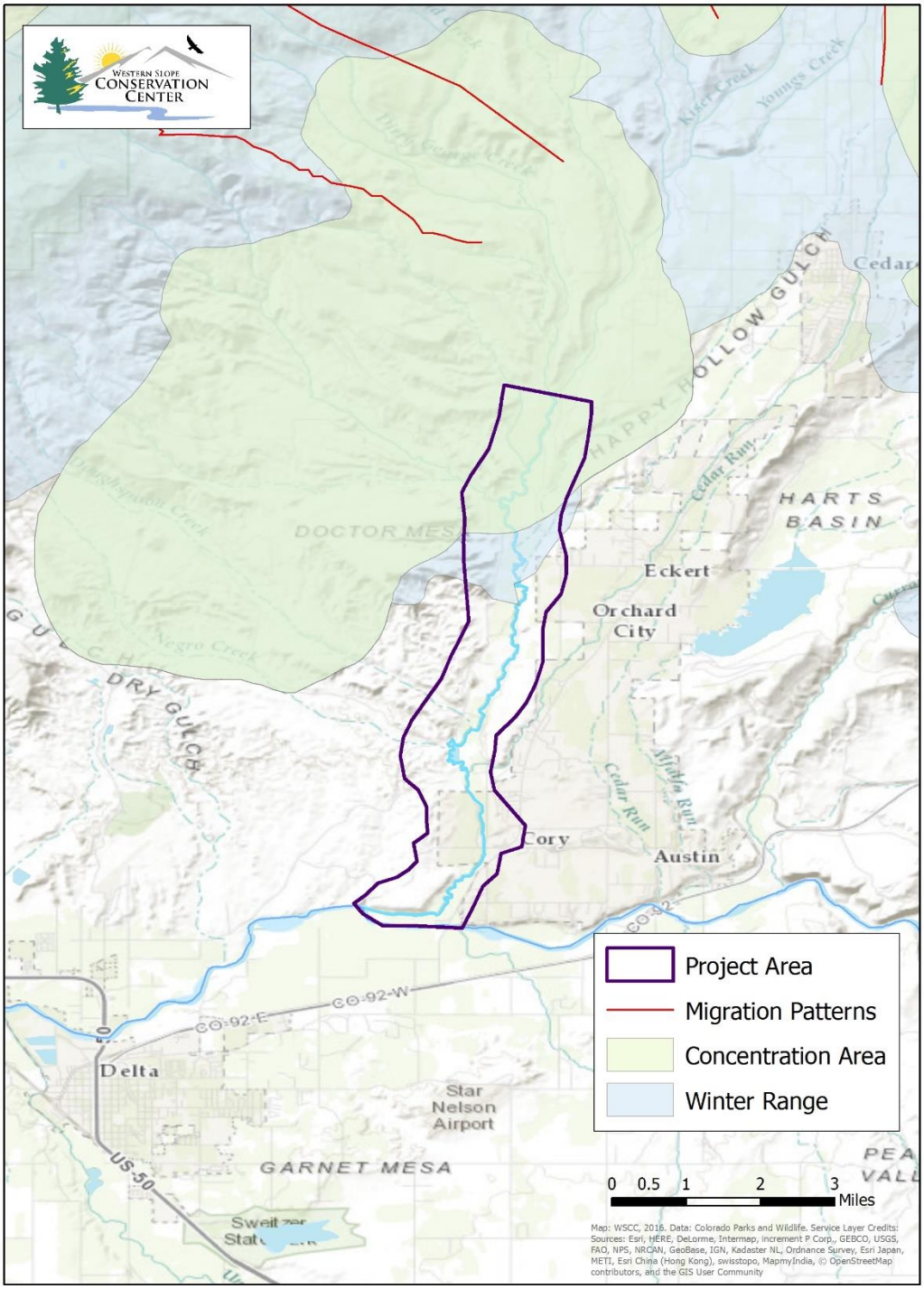
Tongue Creek Watershed Project Area - LAND COVER



Tongue Creek Watershed Project Area - MULE DEER HABITAT



Tongue Creek Watershed Project Area - ELK HABITAT



Analysis Of Water Quality Readings From Tongue Creek

Western Slope Conservation Center Watershed Health Project

Introduction

Water quality samples were taken during portions of 3 years (2014-2016) in the Tongue Creek Valley west of Eckert Colorado. Samples were taken every 10 days in two locations throughout the period. The locations were approximately 3 miles apart. Please see attached map for the exact locations, and attached data sheet for the water quality readings. The samples were analyzed for only 1 parameter, electro-conductivity. Electro-conductivity is an indirect measurement of the amount of salts dissolved in the water.

The purpose of the sampling was two fold:
1) To learn if fluctuation occurs in the water quality over the course of the seasons.
2) To establish baseline data to compare the water quality before and after large scale irrigation improvements in the valley.

The geology of the Tongue Creek valley is dominated by Mancos shale. As a result the water in Tongue Creek has relatively high rates of dissolved salts. It is likely that the dissolved salts come from the creek dissolving salts from the creek bed and from return flows coming into the creek.

Analysis and Discussion

The data in the table show a definite cyclic pattern to the water quality in Tongue Creek. In early spring when the creek runs high from snowmelt the concentration of dissolved salts is the lowest. In late summer when the water level in the creek is low the concentration of dissolved salts is highest. This pattern only speaks to salt concentration. It is possible that total salt load does not vary greatly, and that the spring runoff is merely diluting the salt load in the creek. However by late summer the creek is receiving return flows from nearby irrigated lands. It is likely that these return flows, especially the flows that are returning via deep percolation through the Mancos shale soils, are contributing sizable amount of salts to the creek.

One would expect the lower sampling site (Bridge at Tongue Creek Road) would show higher salt concentrations during the irrigation season since the creek receives more water from fields. There is a slight trend in the data to substantiate this expectation. However between the upper sampling site and the lower sampling site two tributary streams enter Tongue Creek. It is likely that these stream have lower salt concentration than Tongue Creek and are mitigating the effects of more return water at the lower site.

The data did not show any downward trend over the years that could be attributed to irrigation improvements on the fields bordering the creek. Only limited irrigation improvements were implemented during the study period. It is likely that any improvements in water quality will

show up over several decades of data rather than a few years. The U.S. Geological Service operates a sampling station in Tongue Creek at Cory. This station should be valuable to track long term trends.

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Electroconductivity Of The Water In Tongue Creek At 2 Different Locations

Notes:

1) Electroconductivitiy of the water sample (Ecw) is measured in the units of millisiemens (mS).

2) Electroconductivity is an indirect measurement of the amount of dissolved salts in the water. The higher the mS reading the higher amount of salts in the water.

3) Empty cells indicate that no reading was taken on that date.

4) Electroconductivity of 2016 samples from nearby Surface Creek is given for comparison

	2014		2015		2016		
Date	Forked Tongue Ditch headgate sampled ECw (mS)	Bridge at Tongue Creek road sampled Ecw (mS)	Forked Tongue Ditch headgate sampled ECw (mS)	Bridge at Tongue Creek road sampled Ecw (mS)	Tongue Cr. sampled ECw (mS)	Bridge at Tongue Creek road sampled Ecw (mS)	Surface Cr. Sampled ECw (mS)
1-Jan	1.38		1.20	1.25			
11-Jan	1.42		1.26	1.25	1.56	1.36	0.37
21-Jan			1.56	1.19	1.40	1.35	0.23
31-Jan			1.46	1.29	1.54	1.37	0.30
10-Feb	1.46		1.10	1.09	1.49	1.36	0.28
20-Feb	1.54		1.04	1.11	1.46	1.38	0.27
2-Mar	1.24	1.21	1.15	1.18	1.03	1.08	0.24
12-Mar	1.05	1.12	1.02	1.04	0.91	0.96	0.24
22-Mar	1.04	1.08	0.74	0.76	0.76	0.81	0.23
1-Apr	0.96	1.01	1.61	1.55	0.74	0.82	
11-Apr	0.54	0.59	3.26	1.78	0.53	0.61	0.16
21-Apr	0.74	0.81	1.27	1.64	0.80	0.85	0.19
1-May	1.33	1.54	1.56	1.57	1.11	1.24	0.24
11-May	1.22	1.38	0.72	0.83	0.72	0.77	0.19
21-May	0.73	0.82	0.76	0.86	0.55	0.60	0.19
31-May	1.19	1.36	0.75	0.86	0.80	0.82	0.17
10-Jun	1.48	1.38	1.00	1.11	1.12	1.24	0.15
20-Jun	1.19	1.43	1.17	1.27	1.60	1.48	0.18
30-Jun	1.47	1.81					
10-Jul	1.57	1.70	1.37	1.40	1.54	1.62	0.23
20-Jul	1.69	1.87	1.31	1.39	1.75	1.68	0.13
30-Jul	1.52	1.54	1.37	1.49	1.70	1.60	0.12
9-Aug	1.83	1.59	1.52	1.64	1.65	1.62	0.13
19-Aug	1.73	1.65	1.50	1.59	1.68	1.72	0.20
29-Aug	1.58	1.42	1.72	1.66	1.60	1.61	0.16
8-Sep	1.43	1.33	1.53	1.63	1.47	1.44	0.36
18-Sep	1.69	1.46	1.45	1.41	2.38	1.63	0.44
28-Sep	1.46	1.76	1.72	1.74	1.34	1.36	0.16
8-Oct	1.41	1.39	1.41	1.45			
18-Oct	1.40	1.30	1.70	1.54			
28-Oct	1.33	1.26	1.61	1.36			
7-Nov	1.54	1.45	1.65	1.50			
17-Nov	1.54	1.41	1.64	1.40			
27-Nov	1.47	1.33	1.70	1.39			
7-Dec	1.39	1.27	1.63	1.34			
17-Dec	1.35	1.60	1.54	1.36			