

USE ATTAINABILITY ANALYSIS AQUATIC LIFE USES FOR THE ANIMAS RIVER IN NEW MEXICO

INTRODUCTION

The New Mexico Environment Department (Department) conducted a Use Attainability Analysis (UAA) to determine the most appropriate and protective aquatic life use for the Animas River in New Mexico. This UAA concludes that **coolwater aquatic life** is the most protective aquatic life use attainable for the Animas River in New Mexico from the San Juan River to the Southern Ute Indian Tribe boundary. The coldwater and marginal coldwater aquatic life uses are *not attainable* because of the natural water temperatures resulting from natural ambient air temperatures. The applicable regulatory descriptor is at 40 CFR 131.10 (g)(1) (**Appendix A**).

The Clean Water Act (CWA) §101(a)(2) and 20.6.4.6 NMAC of the New Mexico surface water quality standards (NMAC 2013) require that wherever attainable, water quality shall provide for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water. These are often referred to as the ‘fishable, swimmable’ uses for a water body. In order to remove a §101(a)(2) use or change it to one with less stringent criteria, a state or tribe must conduct a Use Attainability Analysis (UAA) demonstrating that the use is not attainable due to one or more of the six factors listed in 40 CFR 131.10(g) (see Appendix A), and to determine the most protective aquatic life and contact uses that are attainable. New Mexico’s UAA procedure is described in 20.6.4.15 NMAC.

The New Mexico water quality standards classify surface waters of the state into “segments” (Subsection S, 20.6.4.7 NMAC). Each segment has several designated¹ uses, including an aquatic life (e.g., ‘fishable’) designated use. New Mexico’s water quality standards include seven aquatic life use categories which describe the aquatic community supported by the water body (**Appendix B**). Each designated use has specific associated criteria such as maximum water temperature.

Each segment contains one or more assessment units (AU), which are water bodies or sections of a water body with similar characteristics. Water quality data from each AU are evaluated to determine whether or not the designated uses are being supported. The 303(d) Integrated List is a catalog of all AUs and the status of their designated uses as fully supporting, not supporting (impaired), or not assessed. Once a use is determined to be impaired, a total maximum daily load (TMDL) guidance document may be developed specifically for that AU. In some cases, a designated use is not existing² or attainable³ and a UAA may be needed to revise the water quality standards before, or instead of, developing a TMDL.

The Animas River in New Mexico is currently classified in water quality standards segments 20.6.4.403 and 404 NMAC:

¹ “Designated” means a use specified in 20.6.4.9-899 (20.6.4.7 NMAC).

² “Existing” means any use attained in the water body since Nov 28, 1975 (20.6.4.7 NMAC).

³ “Attainable” means achievable through effluent limitations and best management practices (20.6.4.7 NMAC)

20.6.4.403 SAN JUAN RIVER BASIN - The Animas river from its confluence with the San Juan upstream to Estes Arroyo.

A. Designated Uses: public water supply, industrial water supply, irrigation, livestock watering, wildlife habitat, marginal coldwater aquatic life, primary contact and warmwater aquatic life.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

20.6.4.404 SAN JUAN RIVER BASIN - The Animas river from Estes Arroyo upstream to the New Mexico-Colorado line.⁴

A. Designated Uses: coldwater aquatic life, irrigation, livestock watering, wildlife habitat, public water supply, industrial water supply and primary contact.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criterion applies: phosphorus (unfiltered sample) 0.1 mg/L or less.

These segments contain one AU each: segment 20.6.4.403 contains the lower Animas River AU (*San Juan River to Estes Arroyo*), and segment 20.6.4.404 contains the upper Animas River AU (*Estes Arroyo to the Southern Ute Tribe boundary*). Both AUs were listed in the 2012-2014 Integrated List as impaired due to temperature (NMED/SWQB 2012a), according to thermograph data from the 2010 survey (NMED/SWQB 2012c) and the current Assessment Protocols (NMED/SWQB 2013a). A temperature TMDL was prepared and has been approved by EPA for the lower Animas River (NMED/SWQB 2013b). NMED observed that the temperature impairment of the upper AU may be due to inappropriate water quality standards, and therefore this UAA was prepared instead of a TMDL. The UAA evaluates the aquatic life uses for both AUs.

WATERSHED DESCRIPTION

The Animas River watershed (HUC 14080104) (**Figure 1**) is 1357 square mile (mi²) and is contained within the larger San Juan River basin in northwestern New Mexico and southwestern Colorado. The New Mexico portion of the watershed is approximately 227 mi². The Animas River is a tributary of the San Juan River with its headwaters in Colorado. The Animas River flows through the State of Colorado and the Southern Ute Indian Tribe (SUIT) reservation before entering New Mexico at an elevation of 6000 feet. It then flows approximately 37 miles south to its confluence with the San Juan River at an elevation of 5300 feet.

The lower Animas River AU (*San Juan River to Estes Arroyo*), shown in green in Figure 1, is 16.9 miles long from its confluence with the San Juan River at Farmington upstream to Estes Arroyo in Aztec. The upper Animas River AU (*Estes Arroyo to the Southern Ute Tribe boundary*), shown in blue, is 19.6 miles long from Estes Arroyo upstream to the New Mexico/SUIT boundary.

⁴ The Animas River flows through the Southern Ute Indian Tribe land before entering New Mexico, as reflected in the assessment unit description. The Department proposes to revise the segment description as well for consistency during the triennial review currently underway.

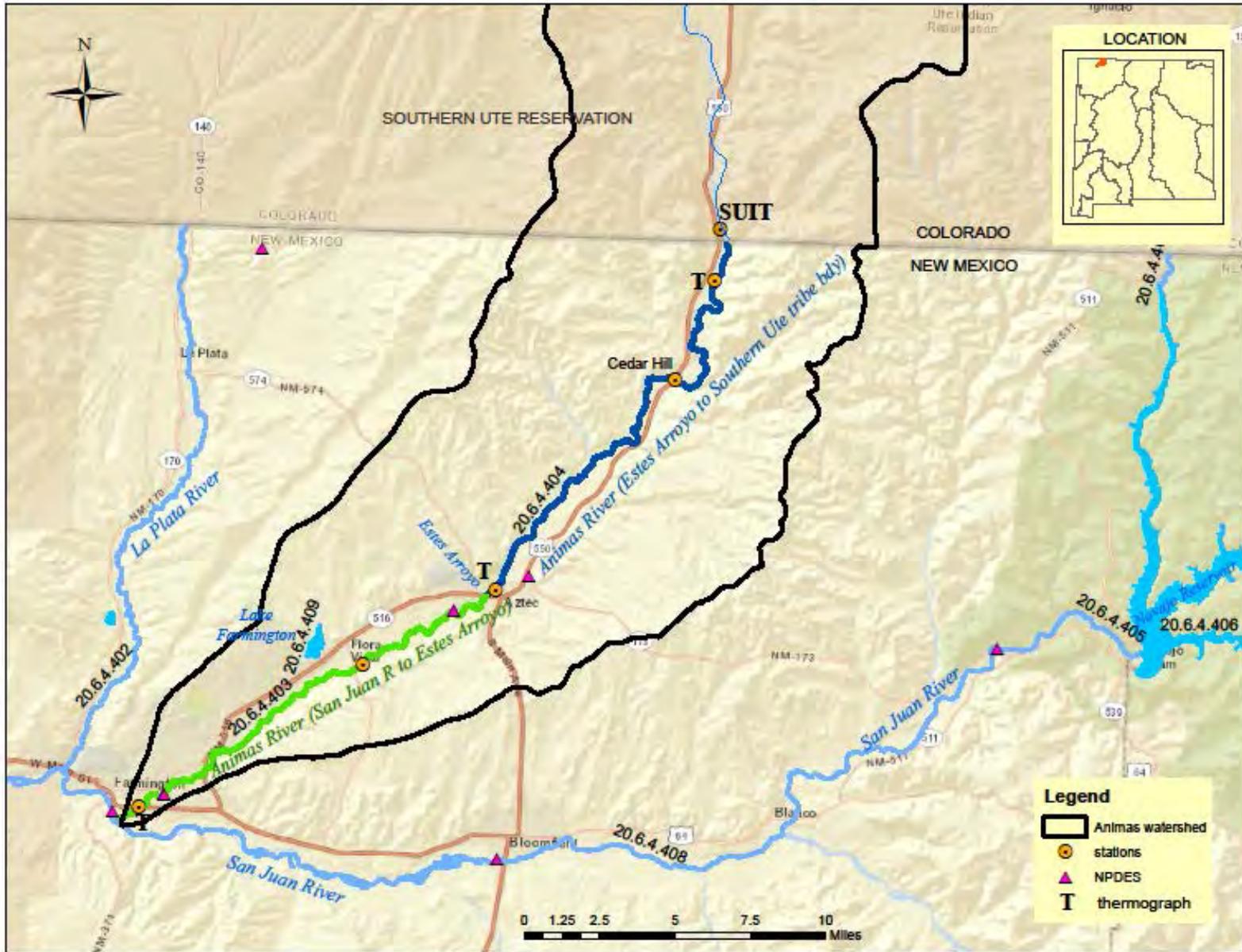


Figure 1. Animas River watershed

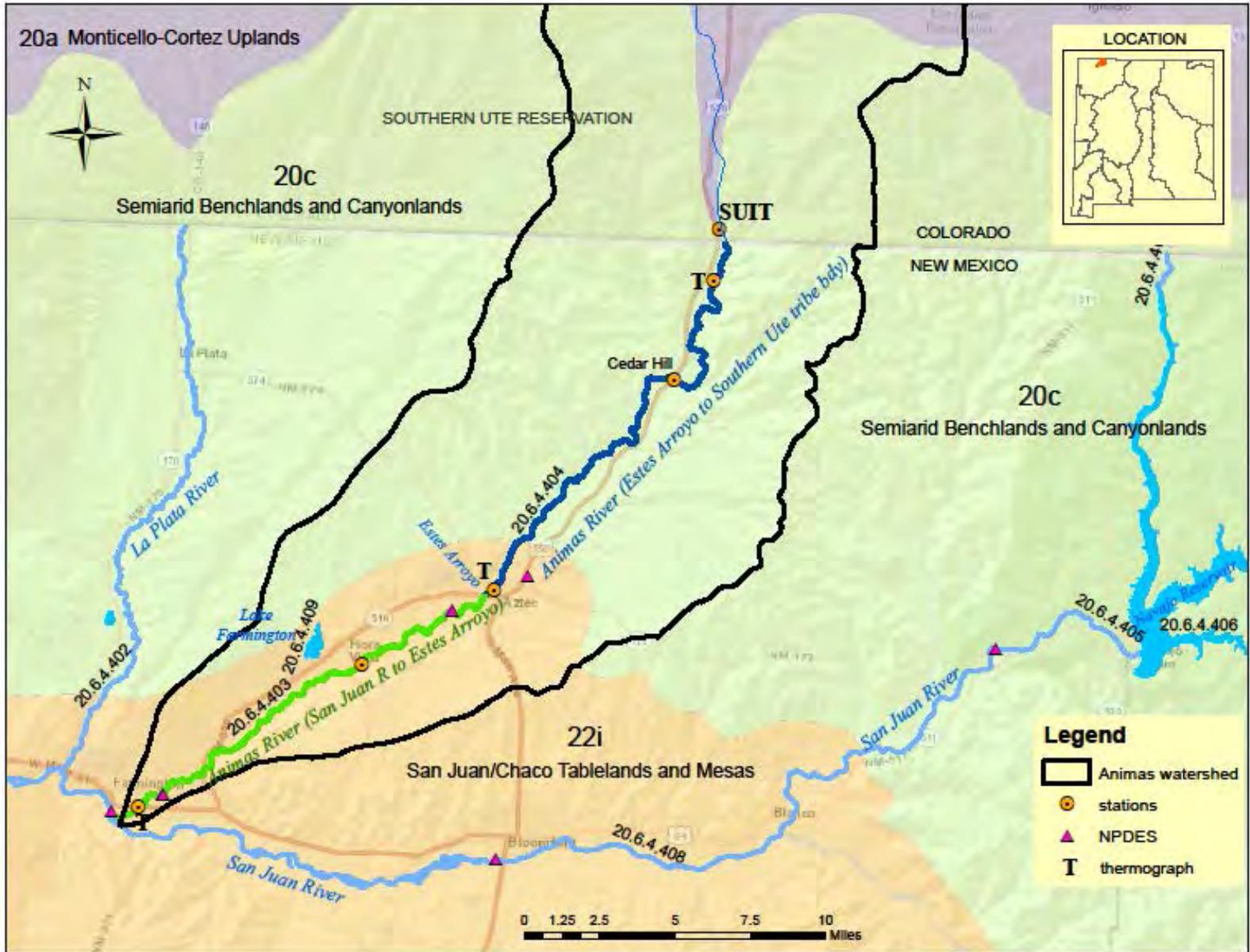


Figure 2. Animas River watershed ecoregions

Ecoregions are geographic areas of similar ecosystems characterized by common elevation, air temperature, precipitation, terrain, geology, soils, vegetation and fauna (Griffith 2006). The Animas watershed in New Mexico is contained in Ecoregions 22i (Semiarid Benchlands and Canyonlands) and 20c (San Juan/Chaco Tablelands and Mesas) (**Figure 2**). The lower Animas AU is located in Ecoregion 22i and most of the upper Animas AU in Ecoregion 20c. The characteristics of these ecoregions are summarized in **Table 1**.

Table 1. Characteristics of the Animas River watershed ecoregions*

Code	Name	Elevation (feet)	Primary Vegetation	Physiography	Hydrology	Mean Annual precip (in.)
20	Colorado Plateaus					
20c	Semiarid Benchlands and Canyonlands	4800-7785	Junipers, some pinyon pine at higher elevations, shrubs and grassland	Mesas, benches, cuestas, cliffs, and canyons	Mostly ephemeral and intermittent streams with a few larger rivers	10
22	Arizona/New Mexico Plateau					
22i	San Juan/Chaco Tablelands and Mesas	5500-7100	Mix of desert scrub, semi-desert shrub-steppe, and semi-desert grasslands	Plateaus, mesas, benches, cuestas, hogback ridges, cliffs, canyons, and valleys	Mostly ephemeral and some intermittent streams	6

*based on Griffith et al. 2006

There are three existing point sources with individual NPDES permits associated with the lower Animas River AU (*San Juan River to Estes Arroyo*)(see Figure 1). The City of Farmington Animas Steam Plant (permit NM0000043) intake and discharge is to Willett Ditch, which leads to the Animas River. The facility does not withdraw water from or discharge directly into the Animas River. The City of Aztec Waste Water Treatment Plant (permit NM0020168) discharges directly to the Animas River near the top of the AU. The City of Aztec Water Treatment Plant (permit NM0028762) discharges to the Lower Animas Ditch, not directly to the Animas River (NMED/SWQB 2013b). There are no NPDES permitted point source discharges to the upper Animas River (*Estes Arroyo to the Southern Ute Tribe boundary*).

WATER TEMPERATURE

Temperature criteria for New Mexico's aquatic life use subcategories are expressed as upper limits for TMAX, 4T3 and 6T3⁵ (**Table 2**). The SUIT has jurisdiction over the Animas River on tribal land and plans to propose its own water quality standards pursuant to the Clean Water Act, which must be protective of downstream uses. Table 2 includes a crosswalk between the aquatic life uses and criteria of the state of New Mexico and those proposed by the SUIT. The Tribe's proposed *Cool water* upper threshold is 75°F (24°C), the same as New Mexico's coldwater TMAX. The Tribe anticipates proposing the section of the Animas River immediately upstream of the New Mexico boundary as *Warm water*, which is similar to New Mexico's coolwater use.

⁵ TMAX is the maximum temperature recorded, 4T3 is the 4-hour maximum temperature that occurs for 3 consecutive days, and 6T3 is the 6-hour maximum temperature that occurs for 3 consecutive days.

Table 2. Aquatic life use temperature criteria (°C)

Criterion	High Quality		Marginal			Marginal Warmwater
	Coldwater	Coldwater	Coldwater	Coolwater	Warmwater	
NM 4T3	20	-	-	-	-	-
NM 6T3	-	20	25	-	-	-
NM TMAX	23	24	29	29	32.2	32.2
SUIT (proposed upper thresholds)	-	20	-	24	>24	-

- : not applicable to the aquatic life use

TMAX, 4T3 and 6T3 are summary measurements derived from water thermograph datasets. Thermographs are dataloggers that can record water or air temperatures continuously at a set interval (e.g., hourly) over several months. NMED deploys thermographs in a water body throughout the summer, and evaluates the data to identify impairments. NMED has deployed five water thermographs in the Animas River (see Figure 1) from June to September, two in 2003 (Aztec and Cedar Hill); and three in 2010 (Farmington, Aztec and near the state line). The SUIT provided NMED with thermograph data less than one mile upstream of the NM/SUIT boundary (SUIT 2013). These data assisted in evaluating the appropriate water temperature in the upper Animas River AU.

NMED has developed a correlation model using the average air temperature (ATEMP) on July 15⁶ to predict TMAX, 4T3 and 6T3 for a given water body (NMED/SWQB 2012b). Assessment of the water body and final impairment determinations are always based on actual water temperature measurements. However, the model can assist in evaluating the characteristics of water bodies where thermograph data are not available. Measured temperatures warmer than the predicted temperature may indicate impairment. Measured temperatures lower than predicted may reflect substantial input of groundwater, a cooling effect that cannot be predicted by air temperature. If measured and predicted temperatures are near agreement, the water body is likely achieving its natural air temperature-driven thermal condition. The model estimates the effect of air temperature on aquatic life uses as follows:

- high quality and coldwater uses *may be* attainable if $ATEMP \leq 18^{\circ}\text{C}$;
- marginal coldwater and coolwater uses *may be* attainable if $ATEMP \leq 23^{\circ}\text{C}$;
- warmwater *may be* the most protective use attainable if $ATEMP > 23^{\circ}\text{C}$.

NMED applied the temperature model described above to five (5) roughly equidistant locations along the Animas River including the thermograph locations, plus the SUIT thermograph site. Results are shown in **Table 3**.

AQUATIC LIFE

New Mexico's aquatic life uses and criteria protect the aquatic community overall based on habitat requirements. The specific temperature needs or preferences of a given species are usually presented in the research literature as a range. Research shows specific temperature

⁶ The model uses July 15 as the hypothetical date on which the highest annual temperature would typically occur.

Table 3. Measured and predicted water temperatures (°C)

Station # *	Station location	Elev (ft)	Reference Date**	actual TMAX	actual 6T3	# measure- ments	# 29°C exceed- ences	% 29°C exceed- ences	predicted TMAX	predicted 6T3	July Avg ATEMP
<i>Animas River (San Juan River to Estes Arroyo)</i>				<i>29</i>	<i>25</i>						
66Animas001.7	Farmington	5249	7/17/2010	29.9	27.2	2169	15	0.7	30.80	26.18	24.16
66Animas018.0	Flora Vista	5486	-	-	-	-	-	-	30.30	25.70	23.69
<i>Animas River (Estes Arroyo to SUIT boundary)</i>				<i>24</i>	<i>20</i>						
66Animas027.8	Aztec	5591	7/19/2003	29.8	26.0	2177	7	0.3	30.04	25.45	23.45
66Animas028.1	Aztec	5591	7/17/2010	29.2	26.0	2175	3	0.1	29.97	25.39	23.39
66Animas042.3	Cedar Hill	5791	7/19/2003	27.0	24.3	881	0	0.0	29.34	24.78	22.80
66Animas055.8	NM near state line	5912	7/29/2010	26.1	24.1	2177	0	0.0	28.72	24.18	22.22
Animas 3	SUIT near state line	5967	8/22/2011	24.3	-	26,495	0	0.0	28.28	23.76	21.81

* Stations are ordered from downstream to upstream

**Reference date is the first occurrence of the TMAX

Italics indicate applicable criteria

-: no data or not applicable

ranges for various life stages of fish species in the San Juan basin (ERI 2007). A species may also be referred to by a generalized thermal category such as *cold*, *intermediate* or *cool*, or *warm*. NMED has assigned general temperature categories for many fish species in New Mexico based on scientific consensus, review of the available research, and best professional judgment (NMED/SWQB 2008). NMED reviewed fish records for species documented in the Animas River in or near New Mexico (Miller 2000, Nehring 1992). **Table 4** lists these species along with their general thermal categories. **Table 5** shows the percent relative abundance of fish from these records grouped by thermal category.

Table 4. Fish species reported from the Animas River in or near NM

Common name	Species name	Thermal category (NMED)
NATIVE		
Bluehead sucker	<i>Catostomus discobolus discobolus</i>	Intermediate (Cool)
Colorado pikeminnow*	<i>Ptychocheilus lucius</i>	Warm
Flannelmouth sucker	<i>Catostomus latipinnis</i>	Intermediate (Cool)
Mottled sculpin	<i>Cottus bairdi</i>	Intermediate (Cool)
Razorback sucker*	<i>Xyrauchen texanus</i>	Warm
Roundtail chub**	<i>Gila robusta</i>	Intermediate (Cool)
Speckled dace	<i>Rhinichthys osculus</i>	Intermediate (Cool)
NON-NATIVE		
Black bullhead	<i>Ictalurus melas</i>	Warm
Brown trout	<i>Salmo trutta</i>	Cold
Common carp	<i>Cyprinus carpio</i>	Warm
Fathead minnow	<i>Pimephales promelas</i>	Warm
Plains killifish	<i>Fundulus zebrinus</i>	Warm
Rainbow trout	<i>Oncorhynchus mykiss</i>	Cold
Red shiner	<i>Cyprinella lutrensis</i>	Warm
Western mosquitofish	<i>Gambusia affinis</i>	Warm
White sucker	<i>Catostomus commersoni</i>	Intermediate (Cool)

*federally listed as endangered

**state listed as endangered, candidate for federal listing

Aquatic habitat in the San Juan basin has been impacted by human-caused changes in the water temperature, hydrograph, channel geomorphology, and by the introduction of exotic fish species. For example, Navajo Dam on the San Juan River created unnaturally cold water temperatures downstream, impacting the native fish community that depends on intermediate (cool) or warm water. Water temperature below the dam is 4-8°C now vs. 20-25°C before the dam was built (ERI 2007). This cold water habitat now supports a popular trout fishery, but at the expense of native species which require warmer water. As native fish species declined in the mainstem, so too did their dispersal into tributaries including the Animas River. The federally listed endangered Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) formerly occupied the Animas River (D. Propst, personal communication). Roundtail chub (*Gila robusta*) is now rare in the Animas River. It is state listed as endangered, and is a candidate for federal listing as well (BISON-M 2013).

Table 5. Percent (%) relative abundance of fish by thermal category in the Animas River (in or near NM)

River reach	% 1974-2000*	% 1992**
San Juan River to Estes Arroyo	n = 2006	
Cold	0.8	-
Intermediate (Cool)	83.1	-
Warm	16.1	-
Estes Arroyo to SUIT boundary	n = 6363	
Cold	3.1	-
Intermediate (Cool)	92.3	-
Warm	4.5	-
SUIT boundary to Florida River**		n = 22,624
Cold	-	1.0
Intermediate (Cool)	-	79.5
Warm	-	19.4

*Miller 2000

**Nehring 1992

n: total number of individuals

-: no data

DISCUSSION

The Animas watershed is contained in Ecoregions 22i and 20c, which are characterized by warm air temperatures, low precipitation, and limited surface water. Elevations in these ecoregions range from 4800 to 7785 feet. Plateaus, mesas, cliffs and canyons constitute the predominant landforms. Vegetation is predominantly a mix of desert and semi-desert scrub and grassland, with cottonwood and willow in riparian areas. Hydrology is characterized by mostly intermittent and ephemeral streams with some large rivers (such as the Animas and San Juan) originating in mountainous ecoregions. These naturally xeric ecoregions are not associated with cold water habitats.

Water temperatures in the Animas River are more closely associated with the coolwater use than the coldwater use. Thermographs have recorded very few or no exceedences of 29°C (see Table 3). The 2010 thermograph in Farmington, which is the lowest and warmest station, measured just 0.7% exceedences (15 out of 2169 measurements) of the TMAX criterion of 29°C, and all exceedences were within 1°C. The Aztec thermographs near the segment/AU break showed even fewer exceedences, all within 1°C. There were no exceedences at the Cedar Hill station or near the state line. A topographic change occurs in the vicinity of Cedar Hill. Measured water temperatures here were much lower than predicted, possibly due to a natural increase of groundwater input.

The majority of fish that currently inhabit the Animas River in or near New Mexico are species with intermediate (cool) thermal preferences (see Table 5). Furthermore, all *native* species documented in the Animas River are intermediate (cool) or warm water species, suggesting that these are in fact the natural thermal conditions in this river. Optimal water temperatures for the various life stages of several native species in the San Juan basin range from 19°C to 26°C (see

Appendix C). Optimal water temperatures are greater than 20°C for Colorado pikeminnow, razorback chub and roundtail chub. The current coldwater aquatic life use is not protective of the native fish community, and is in fact directly detrimental to the federally listed endangered and candidate species.

A small percentage of fish present in the Animas River in New Mexico are cold water fish, mostly brown trout (*Salmo trutta*) and some rainbow trout (*O. mykiss*)⁷ (see Table 4). The limited presence of trout in an aquatic community dominated by species with intermediate (cool) thermal preferences suggests that the habitat is not optimal for cold water species. Brown trout were widely stocked throughout the U.S. in the early 20th century. This species tends to occupy deeper, lower velocity, and warmer waters than other trout. Spawning occurs in the fall or winter when temperatures drop to less than 10°C. Laboratory research reported optimal temperature as 12-19°C and lethal temperature as 27°C (BISON-M 2013). Field investigations have reported brown trout occupying water temperature up to 26.3°C. Fish also exhibit behavioral thermoregulation, wherein individuals may seasonally migrate to cooler stream reaches (Wehrly 2007). Brown trout are not dependent on cold summer water temperatures for reproduction, and the absence of significant barriers allows them to migrate north to colder waters that provide more suitable habitat.

Low flow and permitted discharges were considered as possible impacts on water temperature. The Animas River TMDL incorporated the critical low flow (4Q3) of the Animas River into its calculations. The TMDL concluded that water temperature in the Animas River is driven mainly by air temperature and solar radiation, and that low flow was not a factor in impairment (NMED/SWQB 2013b). The permitted discharges associated with the lower Animas River AU have not been shown to be increasing water temperature in the Animas River. The NPDES discharge permit for the Animas Steam Plant has a maximum temperature criterion of 29°C. The TMDL assigned a Waste Load Allocation based on the more stringent 6T3 criterion of 25°C. Both the permit and TMDL ensure that discharge from the plant does not increase the temperature in the Animas River to over 29°C. The City of Aztec Waste Water Treatment Plant (permit NM0020168) discharges directly to the Animas River near the top of the AU. This permit does not have an effluent temperature limitation. Water temperatures measured at the plant outfall were approximately 25°C, which is cooler than the receiving water (see Table 3). The City of Aztec Water Treatment Plant (permit NM0028762) discharges to the Lower Animas Ditch, not directly to the Animas River (NMED/SWQB 2013b). This permit does not have an effluent temperature limitation; however, the facility discharge is located approximately one mile from the Animas River and is therefore unlikely to affect the temperature in the Animas River.

The marginal coldwater and coolwater aquatic life uses both have a TMAX criterion of 29°C, but these uses describe different habitats (see Appendix B). Marginal coldwater refers to habitat that would be coldwater were it not otherwise limited by certain conditions. Coolwater describes habitat that is naturally intermediate between cold and warm. Based on the conditions described in this UAA, coolwater is the best description of the attainable aquatic life use for the Animas River in New Mexico.

⁷ The only cold water fish native to the San Juan basin is a subspecies of cutthroat trout, the Colorado River cutthroat trout (*Oncorhynchus c. pleuriticus*) but there are no confirmed records from New Mexico.

CONCLUSION

This UAA demonstrates that the natural characteristics of the Animas River in New Mexico support aquatic life habitat that is intermediate between cold and warm. The natural ecoregions containing the Animas River, natural ambient air temperatures, predicted and actual measured water temperatures, and the fish communities all indicate that conditions in this system best support the coolwater aquatic life use. The coldwater and marginal coldwater aquatic life uses are not protective of the native aquatic life, and are not attainable because "*naturally occurring pollutant concentrations prevent the attainment of the use....*" (40 CFR 131.10 (g)(1), see Appendix A). Specifically, naturally occurring thermal pollution (heat) in the water body due to ambient air temperatures prevents attainment of the uses. The UAA concludes that **coolwater aquatic life** is the most protective attainable use for both the lower Animas River (*San Juan River to Estes Arroyo*) and the upper Animas River (*Estes Arroyo to the Southern Ute tribal boundary*).

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APPENDIX A**40 CFR 131.10(g):**

(g) States may remove a designated use which is not an existing use, as defined in Sec. 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

- (1) Naturally occurring pollutant concentrations prevent the attainment of the use; or
- (2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
- (3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
- (4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
- (5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
- (6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

APPENDIX B**20.6.4.7 NMAC****DEFINITIONS:****C.**

(4) “Coldwater” in reference to an aquatic life use means a surface water of the state where the water temperature and other characteristics are suitable for the support or propagation or both of coldwater aquatic life.

(5) “Coolwater” in reference to an aquatic life use means the water temperature and other characteristics are suitable for the support or propagation of aquatic life whose physiological tolerances are intermediate between and may overlap those of warm and coldwater aquatic life.

H.

(1) “High quality coldwater” in reference to an aquatic life use means a perennial surface water of the state in a minimally disturbed condition with considerable aesthetic value and superior coldwater aquatic life habitat. A surface water of the state to be so categorized must have water quality, stream bed characteristics and other attributes of habitat sufficient to protect and maintain a propagating coldwater aquatic life population.

L.

(2) “Limited aquatic life” as a designated use, means the surface water is capable of supporting only a limited community of aquatic life. This subcategory includes surface waters that support aquatic species selectively adapted to take advantage of naturally occurring rapid environmental changes, ephemeral or intermittent water, high turbidity, fluctuating temperature, low dissolved oxygen content or unique chemical characteristics.

M.

(1) “Marginal coldwater” in reference to an aquatic life use means that natural intermittent or low flows, or other natural habitat conditions severely limit maintenance of a coldwater aquatic life population or historical data indicate that the temperature in the surface water of the state may exceed 25°C (77°F).

(2) “Marginal warmwater” in reference to an aquatic life use means natural intermittent or low flow or other natural habitat conditions severely limit the ability of the surface water of the state to sustain a natural aquatic life population on a continuous annual basis; or historical data indicate that natural water temperature routinely exceeds 32.2°C (90°F).

W.

(1) “Warmwater” with reference to an aquatic life use means that water temperature and other characteristics are suitable for the support or propagation or both of warmwater aquatic life.