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WATER QUALITY CONTROL COMMISSION

STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF PETITION TO
AMEND USE FOR LOWER DRY CIMMARON RIVER
AND TO ESTABLISH WATER QUALITY STANDARDS
FOR LAKES, 20.6.4 NMAC,

WQCC 11-05 (R)

New Mexico Environment Department,

Petitioner.

NMED'S PETITION FOR HEARING
TO AMEND USE FOR LOWER DRY CIMARRON RIVER AND
<u>TO ESTABLISH WATER QUALITY STANDARDS FOR LAKES</u>

Pursuant to NMSA 1978, § 74-6-6.B, the New Mexico Environment Department ("NMED") hereby petitions the Water Quality Control Commission ("Commission") to grant a hearing on NMED's proposal to amend the Standards for Interstate and Intrastate Surface Waters (Standards) to, first, amend the aquatic life use for the lower Dry Cimarron River (segment 702) from coldwater to coolwater and, second, to add new segments establishing water quality standards for approximately 66 lakes in the Rio Grande, Pecos, Canadian, Gila, San Juan, and Little Colorado basins.

The following exhibits support NMED's petition:

Exhibit 1: NMED's Proposal and Statement of Basis
Exhibit 2: Proposed Amendments to 20.6.4 NMAC
Exhibit 3: Lower Dry Cimarron River Use Attainability Analysis
Exhibit 4: Summary of Proposed Changes to Designated Uses for Lakes
Exhibit 5: References

Wherefore, NMED respectfully requests the Commission to grant NMED's petition, and set a hearing on NMED's proposed amendments to 20.6.4 NMAC. NMED requests the Commission to schedule the hearing during the Commission's January 2012 meeting.

Respectfully submitted,

NEW MEXICO ENVIRONMENT DEPARTMENT

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NMED'S PROPOSAL AND STATEMENT OF BASIS

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EXHIBIT
1

LOWER DRY CIMARRON RIVER

PROPOSAL:

20.6.4.702 DRY CIMARRON RIVER - Perennial portions of the Dry Cimarron river below Oak creek, and perennial portions of Long canyon and Carrizozo creeks.

A. Designated Uses: [~~coldwater~~] coolwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact.

B. Criteria:

(1) 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 criteria apply: [~~temperature 25°C (77°F) or less;~~] the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

(2) TDS 1,200 mg/L or less, sulfate 600 mg/L or less and chloride 40 mg/L or less.

BASIS FOR PROPOSAL:

The New Mexico Environment Department ("NMED") proposes to amend the designated aquatic life use from coldwater to coolwater and to remove the segment-specific temperature criterion in the lower segment of the Dry Cimmaron River.

According to 20.6.4.15(A)(1) NMAC of the Standards for Interstate and Intrastate Surface Waters ("Water Quality Standards" or "Standards"), the Water Quality Control Commission ("Commission") may remove a designated use specified in Section 101(a)(2) of the federal Clean Water Act or adopt subcategories of a Section 101(a)(2) use requiring less stringent criteria only if a use attainability analysis ("UAA") demonstrates that attaining the use is not feasible because of a factor listed in 40 CFR § 131.10(g).

As required by the Standards, NMED has conducted a UAA, which supports the proposed amendments. The UAA is Exhibit 3 to NMED's petition for a hearing. The UAA demonstrates that the coldwater aquatic life use is not an existing use, and that attainment of the use is not feasible because of the first criterion listed in 40 CFR § 131.10(g): naturally occurring pollutant concentrations prevent the attainment of the use. In this case, the pollutant is heat resulting from naturally occurring ambient air temperatures. The UAA further demonstrates that the coolwater use is the highest attainable aquatic life use based on the presence of native fish species with intermediate temperature tolerance and estimated attainable temperatures derived from a statewide correlation between air temperatures and water thermograph data. The air-water correlation documentation is contained within the UAA.

LAKES

INTRODUCTION:

Water Quality Standards apply to all surface waters of the state, including lakes and reservoirs. However, compared to rivers and streams, relatively few lakes - only 28 - are currently identified by name as classified waters in 20.6.4.101-899 NMAC . Instead, many lakes are included in broad geographic groups, such as "all perennial tributaries to the Rio Grande in Santa Fe County". Some are included in the description of a stream system; an example is Eagle Nest Lake, considered part of "the Cimarron River and its perennial tributaries." Still other lakes are covered only as "unclassified perennial waters" in 20.6.4.99 NMAC. The inclusion of lakes in these groupings occurred without consideration of the characteristics of lakes in general or of specific lakes in particular.

As early as 1973, the Commission adopted specific standards for main-stem reservoirs in the Pecos, Canadian, and Rio Grande basins. Additional lakes were added in subsequent rulemakings, but the primary focus was on streams and rivers. Nevertheless, the Commission was correct to recognize that lakes and streams are different and should be addressed separately. Indeed, the Standards themselves contain this expectation by classifying waters into "segments" that are assigned the same designated uses and criteria. The definition of "segment" is:

> a classified water of the state described in 20.6.4.101 through 20.6.4.899 NMAC. The water within a segment should have the same uses, similar hydrologic characteristics or flow regimes, and natural physical, chemical and biological characteristics and exhibit similar reactions to external stresses, such as the discharge of pollutants.

20.6.4.7.S(2) NMAC.

Segments that include both lakes and streams generally are not consistent with this definition. Lakes and streams have different hydrologic characteristics: lakes are still, streams flow. This basic difference between the two affects physical characteristics such as bottom sediments, temperature, and dissolved oxygen, as well as chemical characteristics such as nutrient cycling and pollution assimilation capacity. The biological community responds to these differing characteristics. Human uses, such as recreational patterns, may also be affected. Classifying lakes into their own segments allows for the correct identification of existing and designated uses and the tailoring of criteria to appropriately protect those uses. It also avoids inaccurate water quality assessments that might otherwise lead to a false determination that a lake is either healthy or impaired.

This proposal recognizes the need to review, refine, and more clearly articulate water quality standards specific to lakes. The proposed amendments will establish 19 new lake-only segments containing approximately 65 lakes that are currently not identified by name in the Standards. Some of the segments consist of only one lake; others contain a group of lakes with similar characteristics. High-elevation natural lakes, reservoirs and natural sinkholes are represented in the proposal.

In preparing the proposal, NMED reviewed existing information on the characteristics, uses and water quality of the lakes. The proposed changes can be categorized as follows:

- *Colder aquatic life uses are proposed for some lakes to protect existing aquatic communities.* For example, NMED proposes changing the warmwater aquatic life use currently applicable to unclassified high-elevation natural lakes to the high quality coldwater aquatic life use. In addition, NMED proposes the coolwater use, created by the Commission during the most recent triennial review and approved by the United States Environmental Protection Agency in April 2011, for several lakes with intermediate temperature conditions. These aquatic life use changes affect only the temperature, dissolved oxygen, pH and specific conductance criteria described in 20.6.4.900.H NMAC. None of the other aquatic life criteria identified in 20.6.4.900.I and J NMAC is affected. NMED does not propose warmer aquatic life uses for any of the lakes in this proposal.

- *More stringent specific conductance criteria are proposed for some lakes.* The high quality coldwater aquatic life use has an associated specific conductance criterion that may range between 300 and 1500 microsiemens per centimeter ("µS/cm") based on natural background concentrations. *See* 20.6.4.900.H(1) NMAC. Measured specific conductance levels are lower than this range; therefore, a criterion of 300 µS/cm is uniformly proposed for all lakes with the high quality coldwater use.

- *More stringent E. coli criteria are proposed for some lakes to protect the primary contact use.* The primary contact use currently applies to all the lakes in this proposal. The use is defined as "any recreational or other water use in which there is prolonged and intimate human contact with the water … ." *See* 20.6.4.7.P NMAC. Acceptable levels of *E. coli* bacteria generally protective of this use are expressed as a monthly geometric mean of 126 colony-forming units per 100 milliliters ("cfu/100 mL") and a single sample maximum of 410 cfu/100 mL. *See* 20.6.4.900.D NMAC. A more protective single sample maximum of 235 cfu/100 mL already applies on a segment-specific basis to many of the lakes in this proposal. This higher level of protection is retained, and it is extended to currently unclassified high-elevation lakes, and also to other lakes that support a high level of water-based recreation. Less stringent *E. coli* criteria associated with low-frequency use currently apply to unclassified lakes; NMED proposes increasing the protection on some of these lakes as appropriate. NMED does not propose less stringent *E. coli* criteria for any of the lakes.

- *Few changes are proposed to other designated uses.* Aside from the changes to aquatic life uses noted above, NMED proposes few changes to currently applicable designated uses. Domestic water supply and irrigation uses, for example, are retained. These uses are also added to the currently unclassified high-elevation natural lakes. The irrigation use is also added to Springer Lake and Jackson Lake. NMED proposes to remove the fish culture use from lakes where no fish hatchery exists, and the livestock watering use from two saline sinkholes in Bottomless Lakes State Park.

Because most of the proposed changes concern the aquatic life and primary contact designated uses, summaries of existing water quality data are presented for the parameters pertaining to those uses. Characterizing current water quality conditions is helpful, though not required, for establishing water quality standards. Data are available for the Canjilon Lakes as a group, for the high-elevation natural lakes as a group, and for every other individual lake in the proposal. The data generally show that current conditions are consistent with the recommended uses and criteria. Although these data are sufficient to make the recommendations in this proposal, more data may be necessary for a formal assessment of the water body (NMED/SWQB 2010).[1] For this reason, a single data point that exceeds the criterion does not necessarily indicate non-support of the use.

Exhibit 2 attached to the petition sets forth all amendments proposed to 20.6.4 NMAC. Exhibit 4 sets forth a summary of information for each lake that is the subject of the proposal. Exhibit 5 is the list of references used in the proposal.

The following sets forth each proposed segment, and the basis for each proposal.

RIO GRANDE BASIN

PROPOSAL:

20.6.4.133 RIO GRANDE BASIN –Bull Creek lake, Cow lake, Elk lake, Goose lake, Heart lake, Hidden lake, Horseshoe lake, Horseshoe (Alamitos) lake, Jose Vigil lake, Lost lake, Middle Fork lake, Nambe lake, Nat II lake, Nat IV lake, No Fish lake, Pioneer lake, San Leonardo lake, Santa Fe lake, Serpent lake, South Fork lake, Trampas lakes and Williams lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create three new segments exclusively for high-elevation natural lakes: this segment for the Rio Grande Basin, segment 222 for the Pecos Basin, and segment 313 for the Canadian Basin. Due to their remote locations, these water bodies are minimally impacted by human activities. All are contained within Ecoregion 21, the Southern Rockies of the Xeric West (Omernik 2006). The lakes are located in the Sangre de Cristo mountain range in the Carson and Santa Fe National Forests.

Twenty-three lakes in the Rio Grande basin are included in this proposed segment. *See* Table 1 below. The largest is approximately eight acres in size, and all are situated above 11,000 feet in

[1] All references cited in this proposal are set forth in Exhibit 5.

elevation. Except for Cow, Goose, Middle Fork, Nat II and Pioneer Lakes, all are in congressionally designated wilderness areas and have been designated as Outstanding National Resource Waters ("ONRWs") by the Commission pursuant to 20.6.4.9 NMAC.

Table 1. Lakes in proposed segment 133

LAKE NAME	CURRENT WQS*	ELEVATION feet	LAKE SIZE acres
Bull Creek Lake	99	11460	2.0
Cow Lake	99	11290	2.0
Elk Lake	99	11835	2.0
Goose Lake	123	11640	6.0
Heart Lake	123	11490	4.3
Hidden Lake (Lake Hazel)	123	11280	3.6
Horseshoe Lake	123	11920	6.9
Horseshoe Lake (Alamitos)	123	11760	7.9
Jose Vigil Lake	121	11720	3.0
Lost Lake	99	11495	6.0
Middle Fork Lake	123	11500	8.3
Nambe Lake	121	11380	3.0
Nat Lake II	99	11500	2.0
Nat Lake IV	99	11700	1.5
No Fish Lake	123	11424	1.0
Pioneer Lake	123	11260	2.0
San Leonardo Lake	123	11340	3.5
Santa Fe Lake	121	11620	6.0
Serpent Lake	99	11740	3.0
South Fork Lake	123	11115	2.0
Trampas Lake (East)	123	11255	6.0
Trampas Lake (West)	123	11335	4.0
Williams Lake	123	11220	7.9

* "CURRENT WQS" refers to the currently applicable section of the water quality standards at 20.6.4.97-899 NMAC.

The lakes listed in Table 1 are currently either unclassified perennial waters covered under section 99 or classified perennial waters in segments 121 or 123.[2] These segments include a large number of perennial surface waters not specifically named within the segment description. However, segments 121 and 123 do not need to be amended because the segment descriptions specifically exclude waters "included in other segments."

The proposed designated uses and segment-specific criteria for the new segment are the same as those currently applicable to segment 121. *See* Table 2.

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[2] For ease of reference, citations to 20.6.4.97 to 900 NMAC omit title, chapter and part from the New Mexico Administrative Code; e.g., "section 99" is referenced instead of "20.6.4.99 NMAC." The full citation, however, is used in the rule language per New Mexico Administrative Code requirements. Sections 101 to 899 describe specific classified waters at 20.6.4.101-899 NMAC, and are referred to as "segments."

Table 2. Designated uses

Designated Uses	Segment 121	Segment 123	Unclassified 99	Proposed 133
High quality coldwater aquatic life	X	X		X
Specific-specific criteria – specific conductance (uS/cm)	300	400		300
Warmwater aquatic life			X	
Domestic water supply	X	X		X
Irrigation	X	X		X
Primary contact	X	X	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	126/235	126/235	206/940	126/235
Livestock watering	X	X	X	X
Wildlife habitat	X	X	X	X

NMED proposes the high quality coldwater aquatic life use for these lakes. Aquatic life includes the Rio Grande cutthroat trout, which is the New Mexico state fish and a Species of Greatest Conservation Need identified by the New Mexico Game and Fish Department ("NMFGD") (NMDGF 2006a). Two mollusk species listed by the state of New Mexico as "threatened" are known only from Nambe Lake (Lilljeborg's peaclam) and Middle Fork Lake (Sangre de Cristo peaclam) (NMDGF 2006b). The specific conductance criterion of 300 µS/cm is appropriate for these lakes because it is consistent with measured background concentrations. *See* Table 3.

Domestic water supply is considered an existing use because the lakes provide a drinking and cooking water source for backcountry travelers. NMED proposes adding this as a designated use to those lakes where it does not already apply.

The irrigation use likely is not an existing use on most of the high-elevation lakes, but NMED does not have sufficient information at this time to reach that conclusion for all of the lakes. Consequently, the proposal retains the irrigation use and adds it where it does not already apply.

NMED proposes retaining the protective *E. coli* criteria that already apply to most of these lakes. The area receives significant recreational use. *E. coli* data are available for six of the lakes; concentrations are well below the proposed criteria. *See* Table 3.

NMED also proposes the same uses and criteria for the high-elevation natural lakes in the Pecos and Canadian basins. *See* segments 222 and 313.

Selected water quality data are summarized in Table 3 (Lynch, et al. 1988; NMHED/SWQB 1990; NMED/SWQB 2007 and 2009). All data were collected in the summer or early fall. Data representative of high-elevation natural lakes are also presented in Table 10.

Table 3. Data summary[3]

LAKE NAME	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Goose Lake	2009	NMED/SWQB	11.7	6.5	73	7.8	4
Horseshoe Lake	1986	Lynch, et. al.	8.5	nd*	133	nd	nd
Horseshoe Lake	1987	Lynch, et. al.	8.0	8.3	136	nd	nd
Lost Lake	1986	Lynch, et. al.	10.0	nd	95	nd	nd
Lost Lake	1987	Lynch, et. al.	10.7	7.5	94	nd	nd
Middle Fork Lake	1986	Lynch, et. al.	17.0	6.4	104	nd	nd
Middle Fork Lake	2007	NMED/SWQB	16.4	6.0	125	8.5	3
Nambe Lake	2007	NMED/SWQB	13.4	7.2	33	7.9	1
San Leonardo Lake	1989	NMHED/SWQB	8.5	6.8	11	6.1	nd
Santa Fe Lake	2007	NMED/SWQB	16.6	7.3	22	7.7	1
Serpent Lake	2007	NMED/SWQB	15.3	5.9	50	7.0	1
Williams Lake	1986	Lynch, et. al.	8.0	nd	95	nd	nd
Williams Lake	2007	NMED/SWQB	12.5	6.9	163	7.5	37

* "nd" means no data.

PROPOSAL:

20.6.4.108 RIO GRANDE BASIN - Perennial reaches of the Jemez river and all its tributaries above Soda dam near the town of Jemez Springs, except San Gregorio lake and Sulphur creek above its confluence with Redondo creek, and perennial reaches of the Guadalupe river and all its tributaries.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat 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 criteria apply: specific conductance 400 µS/cm or less (800 µS/cm or less on Sulphur creek); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less; and pH within the range of 2.0 to 8.8 on Sulphur creek.

[Note: the standards for San Gregorio lake are in 20.6.4.134 NMAC, effective XX-XX-XX.]

20.6.4.115 RIO GRANDE BASIN - The perennial reaches of Rio Vallecitos and its tributaries, excluding Hopewell Lake,[~~and~~] perennial reaches of Rio del Oso and perennial reaches of El Rito creek above the town of El Rito.

A. Designated Uses: domestic water supply, irrigation, high quality coldwater aquatic life, livestock watering, wildlife habitat and primary contact; public water supply on the Rio Vallecitos and El Rito creek.

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-

[3] Abbreviations for parameters and units presented in data summaries are as follows: TEMP (temperature), DO (dissolved oxygen), mg/L (milligrams per liter), SC (specific conductance), µS/cm (microsiemens per centimeter), cfu/100 mL (colony-forming units per 100 milliliters).

specific criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.
[Note: the standards for Hopewell lake are in 20.6.4.134 NMAC, effective XX-XX-XX.]

20.6.4.119 RIO GRANDE BASIN - All perennial reaches of tributaries to the Rio Chama above Abiquiu dam, except Canjilon lakes and the Rio Gallina and Rio Puerco de Chama north of state highway 96 and excluding waters on Jicarilla Apache reservation, and the main stem of the Rio Chama from the headwaters of El Vado reservoir upstream to the New Mexico-Colorado line. Some Cañones creek and Rio Chama waters in this segment are under the joint jurisdiction of the state and the Jicarilla Apache tribe.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on the Rio Brazos and Rio Chama.

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 criteria apply: specific conductance 500 µS/cm or less (1,000 µS or less for Coyote creek); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.
[Note: the standards for Canjilon lakes are in 20.6.4.134 NMAC, effective XX-XX-XX.]

20.6.4.134 RIO GRANDE BASIN – Cabresto lake, Canjilon lakes, Fawn lakes, Hopewell lake and San Gregorio lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment to contain these small high-mountain reservoirs. *See* Table 4 below. Located in the Jemez and Sangre de Cristo mountains on the Carson National Forest, these lakes are popular with the public for recreation. Cabresto Lake is an impoundment on Lake Fork Creek just outside of the Latir Peak Wilderness (NMED/SWQB 1992). Canjilon Lakes are small impoundments created along tributaries of Canjilon Creek in the 1940s by NMDGF (NMED/SWQB 1992, 2007). Fawn Lakes are off-channel lakes supplied by water diverted a short distance from the Red River (NMED/SWQB 1992, 2009). Hopewell Lake was created on Placer Creek in north central New Mexico in 1930 (NMED/SWQB 1999b). San Gregorio Lake is located in the San Pedro Parks wilderness built as an irrigation supply reservoir (NMED/SWQB 2004).

Table 4. Reservoirs in proposed segment 134

LAKE NAME	CURRENT WQS	ELEVATION feet	LAKE SIZE acres
Cabresto Lake	123	9340	15.7
Canjilon Lake A	119	10100	5.9
Canjilon Lake B	119	9800	1.7
Canjilon Lake C	119	9800	3.0
Canjilon Lake D	119	9800	1.3
Canjilon Lake E	119	9800	6.5
Canjilon Lake F	119	9780	2.3
Fawn Lake (East)	123	9000	1.0
Fawn Lake (West)	123	9000	1.0
Hopewell Lake	115	9765	16.1
San Gregorio Lake	108	9410	35.7

The reservoirs are currently classified, but not specifically named, within segments 108, 115, 119 and 123. NMED proposes amendments to segment 115 to exclude Hopewell Lake and to segment 119 to exclude Canjilon Lakes. Segment 123, which contains Fawn Lakes, does not need to be amended because the segment description specifically excludes waters "included in other segments."

The proposed designated uses and segment-specific criteria for these reservoirs are the same as those currently applicable to segment 115, as shown in Table 5.

Table 5. Designated uses

Designated Uses	Segment 108	Segment 115	Segment 119	Segment 123	Proposed 134
High quality coldwater aquatic life	X	X	X	X	X
Specific-specific criteria-specific conductance (uS/cm)	400	300	500	400	300
Fish culture	X		X		
Domestic water supply	X	X	X	X	X
Irrigation	X	X	X	X	X
Primary contact	X	X	X	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	126/235	126/235	126/235	126/235	126/235
Livestock watering	X	X	X	X	X
Wildlife habitat	X	X	X	X	X

The fish culture use is not proposed for the new segment. This omission has no substantive effect because the fish culture use occurs only at the Los Ojos (formerly Parkview) fish hatchery on the Rio Chama and the Seven Springs hatchery on the Rio Cebolla.

NMED proposes retaining the high quality coldwater aquatic life use and the specific conductance criterion of 300 µS/cm associated with segment 115. These lakes are stocked with trout and most maintain resident populations (NMDGF personal communication). Measured temperatures and specific conductance in all of these lakes are consistent with the high quality coldwater criteria. *See* Table 6.

NMED proposes retaining the protective *E. coli* criteria that currently apply to these lakes. They are located on national forest land easily accessible to the public. Recreational uses include family camping and fishing. Existing data show bacterial concentrations well below the proposed criteria, with one exception discussed below.

NMED has sampled Cabresto Lake, Hopewell Lake, Fawn Lakes, San Gregorio Lake and two of the Canjilon Lakes. Selected water quality data are summarized in Table 6. A single sample collected from Canjilon Lake A in 2007 exceeded the *E. coli* criterion for secondary contact. NMED surveyors noted a cow carcass on the shore at the time of sample collection that may have caused the unusually high bacterial concentration in this small lake (NMED/SWQB 2007).

Table 6. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	BACT* cfu/100 mL
Cabresto Lake	June	1991	11.8	8.6	74	8.3	1
Cabresto Lake	Sept	1991	11.6	8.8	94	8.7	10
Canjilon Lake A	Aug	1991	17.8	8.8	18	8.4	1
Canjilon Lake A	Oct	1991	13.4	8.8	18	8.4	1
Canjilon Lake A	Aug	2007	17.7	8.5	22	7.0	2420
Canjilon Lake F	Aug	1991	21.3	6.5	66	7.8	2
Canjilon Lake F	Oct	1991	14.2	6.2	54	6.7	1
Fawn Lake (East)	Apr	1991	3.4	9.5	196	8.0	1
Fawn Lake (East)	July	2009	14.8	7.4	225	6.8	30
Fawn Lake (East)	Oct	2009	8.7	11.1	252	8.8	nd**
Fawn Lake (West)	July	2009	16.2	7.5	224	6.4	1
Fawn Lake (West)	Oct	2009	8.8	10.8	247	8.9	nd
Hopewell Lake	Aug	1999	12.5	8.1	44	7.2	nd
San Gregorio Lake	July	2004	19.7	7.2	61	8.7	1

* Bacteria samples from 2004 and earlier are for fecal coliform and, after 2004, for *E. coli*. The applicable fecal coliform single sample maximum criterion was 200 cfu/100 mL.
** "nd" means no data.

The dam on Cabresto Lake is currently undergoing reconstruction. NMED expects temporary disturbance until work is completed in 2012. After replacement the lake level will return to normal and recreational fishing and stocking will resume. The implementation of best management practices and reclamation of disturbed areas are expected to restore water quality and aquatic habitat to the current good conditions (USDA 2010).

PROPOSAL:

20.6.4.109 RIO GRANDE BASIN - Perennial reaches of Bluewater creek excluding <u>Bluewater lake and</u> waters on tribal lands, Rio Moquino upstream of Laguna pueblo, Seboyeta creek, Rio Paguate upstream of Laguna pueblo, the Rio Puerco upstream of the northern boundary of Cuba, and all other perennial reaches of tributaries to the Rio Puerco, including the Rio San Jose in Cibola county from the USGS gaging station at Correo upstream to Horace springs excluding waters on tribal lands.

A. Designated Uses: coldwater aquatic life, domestic water supply, fish culture, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on La Jara creek.

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 criteria apply: phosphorus (unfiltered sample) 0.1 mg/L or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.
[Note: the standards for Bluewater lake are in 20.6.4.135 NMAC, effective XX-XX-XX.]

20.6.4.135 **RIO GRANDE BASIN** – Bluewater lake.

A. **Designated uses:** coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering, wildlife habitat.

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 criteria apply: phosphorus (unfiltered sample) 0.1 mg/L or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Bluewater Lake within Bluewater Lake State Park. This 610 acre reservoir is located in northwestern New Mexico at an elevation of 7375 feet. The state park is a popular site for camping, fishing, boating and water skiing (NMED/SWQB 2004).

Bluewater Lake is currently an unnamed water classified in segment 109. NMED proposes an amendment to segment 109 to exclude this lake.

The proposed designated uses and segment-specific criteria for Bluewater Lake are the same as those currently applicable to segment 109, with the exception of fish culture. The fish culture use is an artifact from segment 2-106 in the 1988 Water Quality Standards that included tributaries of the Guadalupe River, Bluewater Creek and other waters now in segment 109. The Seven Springs fish hatchery is located on Rio Cebolla, a tributary of the Guadalupe River. When segment 2-106 was divided, Bluewater Creek was placed into the current segment 109 and all the designated uses of its former segment were applied. There is no fish culture use on Bluewater Lake.

NMED proposes retaining the coldwater aquatic life use. Bluewater Lake is one of New Mexico's oldest year-round trout fisheries (EMNRD 2000-2004). NMED has assessed the lake as fully supporting the coldwater use (NMED/SWQB 2010a).

NMED proposes retaining the protective *E. coli* criteria for Bluewater Lake. The lake is the centerpiece of a popular state park that receives 67,000 visitors annually (EMNRD 2000-2004). Existing data show low bacterial concentrations.

The segment-specific phosphorus criterion is retained because NMED does not have alternate nutrient criteria to propose at this time.

Selected water quality data are summarized in Table 7 (NMHED/SWQB 1990; NMED/SWQB 2004 and 2011).

Table 7. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	BACT* cfu/100 mL
Bluewater Lake	May	1989	11.5	8.0	741	8.6	1
Bluewater Lake	July	1989	12.8	6.9	722	8.2	20
Bluewater Lake	Oct	1989	13.9	6.8	605	8.2	1
Bluewater Lake	Apr	2004	9.9	7.1	833	7.8	1
Bluewater Lake	July	2004	25.2	11.2	941	7.8	2
Bluewater Lake	Oct	2004	13.9	5.5	1045	6.6	1
Bluewater Lake	Apr	2011	10.3	7.9	582	8.4	6
Bluewater Lake	June	2011	15.9	8.9	658	8.5	76

*Bacteria samples from 2004 or earlier are for fecal coliform and after 2004 for *E. coli.* The applicable fecal coliform single sample maximum criterion was 200 cfu/100 mL.

PECOS RIVER BASIN

PROPOSAL:

20.6.4.217 PECOS RIVER BASIN - Perennial reaches of Cow creek and all perennial reaches of its tributaries and the main stem of the Pecos river from Cañon de Manzanita upstream to its headwaters, including perennial reaches of all tributaries thereto except lakes identified in 20.6.4.222 NMAC.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on the main stem of the Pecos river.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.222 PECOS RIVER BASIN –Johnson lake, Katherine lake, Lost Bear lake, Pecos Baldy lake, Spirit lake, Stewart lake and Truchas lakes.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR CHANGE:

NMED proposes to create three new segments exclusively for high-elevation natural lakes in the Rio Grande, Pecos and Canadian Basins, as explained under proposed segment 133. Eight lakes in the Pecos Basin are included in this proposed segment 222. *See* Table 8. The lakes are located in the Sangre de Cristo mountain range in the Santa Fe National Forest. The largest is approximately 12 acres in size and all are situated above 10,000 feet in elevation. All are in the Pecos wilderness and thus have been designated as ONRWs.

Table 8. Lakes in proposed segment 222

LAKE NAME	CURRENT WQS	ELEVATION feet	LAKE SIZE acres
Johnson Lake	217	11090	2.5
Lake Katherine	217	11742	11.8
Lost Bear Lake	99	11220	2.0
Pecos Baldy Lake	99	11480	5.6
Spirit Lake	99	10809	7.0
Stewart Lake	217	10232	4.2
Truchas Lake (North/Upper)	99	11920	0.6
Truchas Lake (South/Lower)	99	11870	2.6

These lakes are currently either unclassified perennial waters covered under section 99 or classified perennial waters in segment 217. Segment 217 includes a large number of surface waters not specifically named within the segment description. NMED proposes an amendment to segment 217 to exclude the lakes in proposed segment 222.

NMED proposes the same designated uses and segment-specific criteria for this new segment as for the high-elevation natural lakes in the Rio Grande and Canadian Basins for the reasons given under segment 133. *See* proposed segment 133. These uses and criteria are also the same as those currently applicable to segment 217, with the exception of fish culture. *See* Table 9.

Table 9. Designated uses

Designated Uses	Segment 217	Unclassified 99	Proposed 222
Fish culture	X		
High quality coldwater aquatic life	X		X
Specific-specific criteria – specific conductance (uS/cm)	300		300
Warmwater aquatic life		X	
Domestic water supply	X		X
Irrigation	X		X
Primary contact	X	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	126/235	206/940	126/235
Livestock watering	X	X	X
Wildlife habitat	X	X	X

Selected water quality data are summarized in Table 10 (Lynch, et al. 1988; USDA 2004). All data were collected in the summer or early fall. Data representative of the high-elevation natural lakes are also presented in Table 3.

Table 10. Data summary

LAKE NAME	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH
Johnson Lake	1987	Lynch, et. al.	14.5	6.9	31	nd*

LAKE NAME	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH
Johnson Lake	2003	USDA	13.7	6.5	17	7.1
Lake Katherine	1986	Lynch, et. al.	13.1	7.1	27	nd
Lake Katherine	1987	Lynch, et. al.	11.0	7.5	25	nd
Lake Katherine	2003	USDA	12.7	6.3	13	8.6
Pecos Baldy Lake	1986	Lynch, et. al.	16.0	7.4	105	nd
Pecos Baldy Lake	1987	Lynch, et. al.	nd	nd	nd	nd
Spirit Lake	1986	Lynch, et. al.	8.0	7.6	28	nd
Spirit Lake	1987	Lynch, et. al.	nd	nd	nd	nd
Spirit Lake	1988	Lynch, et. al.	nd	nd	nd	nd
Spirit Lake	2003	USDA	16.5	5.9	26	6.8
Stewart Lake	1986	Lynch, et. al.	7.0	8.2	36	nd
Truchas Lake (North/Upper)	1988	Lynch, et. al.	6.5	8.3	7	nd
Truchas Lake (North/Upper)	2002	USDA	9.1	7.1	7	7.4
Truchas Lake (South/Lower)	1987	Lynch, et. al.	14.8	6.9	16	nd
Truchas Lake (South/Lower)	2002	USDA	9.9	6.3	5	7.0

* "nd" means no data

PROPOSAL:

20.6.4.209 PECOS RIVER BASIN - Perennial reaches of Eagle creek upstream of Alto dam to the Mescalero Apache boundary, perennial reaches of the Rio Bonito and its tributaries upstream of state highway 48 (near Angus) excluding Bonito lake, and perennial reaches of the Rio Ruidoso and its tributaries upstream of the U.S. highway 70 bridge near Seeping Springs lakes, above and below the Mescalero Apache boundary.

A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat, public 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 criteria apply: specific conductance 600 µS/cm or less in Eagle creek, 1,100 µS/cm or less in Bonito creek and 1,500 µS/cm or less in the Rio Ruidoso; phosphorus (unfiltered sample) less than 0.1 mg/L; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less. [NOTE: The standards for Bonito lake are in 20.6.4.223 NMAC, effective XX-XX-XX.]

20.6.4.223 PECOS RIVER BASIN – Bonito lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering, wildlife habitat and public water supply.

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 criteria apply: specific conductance 1100 µS/cm or less; phosphorus (unfiltered sample) less than 0.1 mg/L; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Bonito Lake, a 39 acre lake at 7377 feet in elevation. The Southern Pacific Railroad created Bonito Lake in 1931 by impounding the Rio Bonito with a concrete dam. Various entities use the water stored in Bonito Lake including Holloman Air Base, Fort Stanton, Alamogordo, Carrizozo, and the Nogal Water Users Association. The lake is located on land that is owned by the city of Alamogordo and is adjacent to the Lincoln National Forest (NMED/SWQB 2003).

Bonito Lake is currently classified, but not specifically named, in segment 209. NMED proposes an amendment to segment 209 to exclude Bonito Lake.

The proposed designated uses and segment-specific criteria for the new segment are the same as those currently applicable to segment 209. NMED proposes retaining the high quality coldwater aquatic life use and the specific conductance criterion of 1100 µS/cm. The lake has breeding populations of brook trout (NMED/SWQB 2003). Measured temperatures and specific conductance are consistent with the high quality coldwater criteria. *See* Table 11. The segment-specific phosphorus criterion is retained because NMED does not have alternate nutrient criteria to propose at this time.

NMED proposes retaining the protective *E. coli* criteria for Bonito Lake. Existing data show low bacterial concentrations. The lake is a recreational destination easily accessible to the public, and campgrounds are located nearby. *E. coli* criteria also protect the public water supply use in accordance with Subsection A of 20.6.4.900 NMAC, which notes that water quality adequate for the public water supply use is ensured in part by numeric criteria for bacterial quality.

Selected water quality data are summarized in Table 11 (NMED/SWQB 1999a, 2003).

Table 11. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	FECAL COLIFORM* cfu/100 mL
Bonito Lake	Aug	1997	18.0	13.6	273	9.1	3
Bonito Lake	June	2003	18.8	6.9	424	6.6	1

* The applicable fecal coliform single sample maximum criterion was 200 cfu/100 mL.

PROPOSAL:

<u>**20.6.4.224 PECOS RIVER BASIN** – Monastery lake.</u>

<u>**A. Designated uses:** coolwater aquatic life, primary contact, livestock watering and wildlife habitat.</u>

<u>**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 criteria apply: the monthly geometric mean of *E. coli* bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.</u>

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Monastery Lake, a six acre off-channel reservoir located near the village of Pecos at an elevation of 7040 feet.

Monastery Lake is currently covered as an unclassified perennial water under section 99. As shown in Table 12, NMED proposes changing the aquatic life use from warmwater to coolwater. Monastery Lake is a put-and-take trout fishery stocked by NMDGF (NMED/SWQB 2000). Measured summer temperatures are consistent with the coolwater criteria. *See* Table 13.

NMED proposes retaining the *E. coli* criteria associated with low-frequency primary contact use. NMED does not have bacterial data for Monastery Lake. The lake is open to the public, but swimming, boating and camping are not allowed (NMDGF 2011a).

Table 12. Designated uses

Designated Uses	Unclassified 99	Proposed 224
Warmwater aquatic life	X	
Coolwater aquatic life		X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	206/940
Livestock watering	X	X
Wildlife habitat	X	X

Selected water quality data are summarized in Table 13. NMDGF regularly monitors temperature and pH in Monastery Lake for stocking purposes (NMDGF 2011c). NMED sampled the lake during a summer visit in 2000 (NMED/SWQB 2000). Temperature data from NMDGF represent annual maxima.

Table 13. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH
Monastery Lake	May	2006	NMDGF	21.1	nd*	nd	8.2
Monastery Lake	June	2007	NMDGF	22.2	nd	nd	8.5
Monastery Lake	July	2000	NMED/SWQB	21.2	7.1	211	8.2
Monastery Lake	July	2003	NMDGF	23.9	nd	nd	8.0
Monastery Lake	July	2008	NMDGF	22.2	nd	nd	7.8
Monastery Lake	Aug	2004	NMDGF	22.8	nd	nd	8.0
Monastery Lake	Aug	2005	NMDGF	26.7	nd	nd	8.0
Monastery Lake	Aug	2009	NMDGF	24.4	nd	nd	7.5
Monastery Lake	Aug	2010	NMDGF	23.9	nd	nd	7.8
Monastery Lake	Aug	2011	NMDGF	22.2	nd	nd	7.9

*"nd" means no data.

PROPOSAL:

20.6.4.211 PECOS RIVER BASIN - The main stem of the Pecos river from the headwaters of Sumner reservoir upstream to Tecolote creek, excluding Santa Rosa reservoir.

A. Designated Uses: fish culture, irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

B. Criteria:

(1) The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

(2) At all flows above 50 cfs: TDS 3,000 mg/L or less, sulfate 2,000 mg/L or less and chloride 400 mg/L or less.

[NOTE: The standards for Santa Rosa reservoir are in 20.6.4.225 NMAC, effective XX-XX-XX.]

20.6.4.225 PECOS RIVER BASIN – Santa Rosa reservoir.

A. Designated uses: coolwater aquatic life, irrigation, primary contact, livestock watering and wildlife habitat.

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

BASIS FOR CHANGE:

NMED proposes to create a new segment for Santa Rosa Reservoir in Santa Rosa State Park. This 1500 acre lake is located at an elevation of 4710 feet. The dam began storing Pecos River water in April of 1980. The U.S. Army Corp of Engineers manages the lake for flood control, irrigation storage and sediment control. Santa Rosa State Park manages recreational camping, fishing and boating at the lake.

The reservoir is currently classified, but not specifically named, within segment 211. NMED also proposes an amendment to segment 211 to specifically exclude the reservoir. The proposed designated uses are shown in Table 14 below.

Table 14. Designated uses

Designated Uses	Segment 211	Proposed 225
Marginal warmwater aquatic life	X	
Coolwater aquatic life		X
Fish culture	X	
Irrigation	X	X
Primary contact	X	X
Standard *E. coli* criteria (cfu/100 mL) Geometric mean/single sample	126/410	126/410
Livestock watering	X	X
Wildlife habitat	X	X
TDS, sulfate and chloride criteria at flows above 50 cfs	X	

NMED proposes changing the aquatic life use from marginal warmwater to coolwater. Resident fish species include smallmouth and largemouth bass, bluegill, catfish and walleye (NMDGF 2011a). These species prefer intermediate or warm water temperatures. Measured summer temperatures are consistent with the coolwater criterion. *See* Table 15.

NMED proposes removing the fish culture use because there is no hatchery on Santa Rosa reservoir, and the flow-qualified salinity criteria because they do not apply to lake conditions.

NMED proposes retaining the standard *E. coli* criteria identified in section 900.D for the primary contact use. The lake is the centerpiece of a popular state park open year-around. Although there are no designated beaches, the public does swim and water ski at the lake (NMED/SWQB 2001). Existing data show bacterial concentrations well below the proposed criteria. *See* Table 15.

NMED sampled Santa Rosa Reservoir during the spring, summer and fall of 2001 and 2010 (NMED/SWQB 2001, 2010b). Selected water quality data are summarized in Table 15.

Table 15. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	BACT* cfu/100 mL
Santa Rosa Reservoir	Apr	2001	11.6	8.4	768	8.0	nd**
Santa Rosa Reservoir	July	2001	26.6	6.3	469	8.3	3
Santa Rosa Reservoir	Oct	2001	13.7	7.7	627	8.1	nd
Santa Rosa Reservoir	Apr	2010	10.0	10.1	599	8.1	11
Santa Rosa Reservoir	June	2010	21.5	7.8	366	7.8	1
Santa Rosa Reservoir	Oct	2010	15.3	8.3	382	7.9	nd

* Bacteria samples from 2004 or earlier are for fecal coliform and after 2004 for *E. coli*. The applicable fecal coliform single sample maximum criterion was 200 cfu/100 mL

** "nd" means no data.

PROPOSAL:

<u>**20.6.4.226 PECOS RIVER BASIN** – Perch lake.</u>

<u>**A. Designated uses:** coolwater aquatic life, primary contact, livestock watering and wildlife habitat.</u>

<u>**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 criteria apply: the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.</u>

BASIS FOR PROPOSAL:

Natural sinkhole lakes occur near Santa Rosa and in Bitter Lake National Wildlife Refuge and Bottomless Lakes State Park near Roswell. These sinkholes resulted from dissolution of underlying limestone accompanied by subsequent sinking of surface materials. They are generally deep relative to their surface area, and are fed by ground water rather than surface water. Although some provide recreational fishing, many are distinguished by high salinity. A number of specialized endemic fish and invertebrate species thrive within sinkhole habitats, including the Pecos pupfish, Pecos gambusia and Mexican tetra (NMDGF 1999), all protected fish species (NMDGF 2006b).[4] In arid southeastern New Mexico, sinkhole lakes provide important wildlife habitat. All sinkhole lakes in New Mexico are unclassified.

NMED proposes to create a new segment for Perch Lake. This 2.8 acre sinkhole lake is located near Santa Rosa at an elevation of 4595 feet. The lake is a popular community recreational area. Swimming is commonly enjoyed by visitors, and due to the high water clarity, the lake is popular for scuba diving (NMED/SWQB 2007).

Perch Lake is currently covered as an unclassified perennial water under section 99. Proposed designated uses and criteria for the new segment are presented in Table 16.

Table 16. Designated uses

Designated Uses	Unclassified 99	Proposed 226
Warmwater aquatic life	X	
Coolwater aquatic life		X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	126/235
Livestock watering	X	X
Wildlife habitat	X	X

NMED proposes changing the aquatic life use to coolwater. Salinity is relatively low, allowing for a sport fishery, including winter stocked trout. Perch Lake maintains cool temperatures in summer and has resident populations of species with intermediate and warm water temperature preferences, including perch, sunfish and largemouth bass (NMED/SWQB 2007).

NMED proposes applying the protective *E. coli* criteria because Perch Lake is a well-known swimming and diving destination for the public. Sampling data show *E. coli* concentrations well below the proposed criteria.

NMED sampled Perch Lake in 2007. Selected water quality data are summarized in Table 17.

Table 17. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Perch Lake	June	2007	24.8	8.9	3068	7.7	1
Perch Lake	Aug	2007	25.7	7.0	3137	7.4	2

PROPOSAL:

<u>**20.6.4.227 PECOS RIVER BASIN** – Lea lake in Bottomless Lakes state park.</u>

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[4] Pecos gambusia *(Gambusia nobilis)* is a federal and state endangered species. The Pecos pupfish *(Cyprinodon pecosensis)* and Mexican tetra *(Astyanax mexicanas)* are state-listed as threatened.

A. Designated uses: warmwater aquatic life, primary contact, livestock watering and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Lea Lake, located in Bottomless Lakes State Park at an elevation of 3450 feet. This 17 acre lake is the second largest sinkhole in the park and is a popular destination with developed recreational facilities for swimming and paddle-boating. Due to high water clarity, Lea Lake is also popular for scuba diving. The spring-supplied flow results in almost 2.5 million gallons of water per day, which flows from the lake through wetland areas and eventually to the Pecos River. The lake provides habitat for the protected Pecos pupfish and Mexican tetra (NMDGF 1999).

Lea Lake is currently covered as an unclassified perennial water under section 99. Proposed designated uses and criteria for the new segment are presented in Table 18.

Table 18. Designated uses

Designated Uses	**Unclassified 99**	**Proposed 227**
Warmwater aquatic life	X	X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	126/235
Livestock watering	X	X
Wildlife habitat	X	X

NMED proposes the warmwater aquatic life use to support the state and federally listed species that inhabit the lake. Summer temperatures are consistent with the warmwater criterion of 32.2°C. Salinity in Lea Lake is too high to support a recreational cool or coldwater fishery (NMED/SWQB 2007).

NMED proposes applying the protective *E. coli* criteria because Lea Lake is a well-known swimming and diving destination for the public. Sampling data show *E. coli* concentrations well below the proposed criteria.

NMED sampled Lea Lake in 1998 and 2007. The U.S. Fish and Wildlife Service (USFWS) also sampled Lea Lake (USFWS 1994-95). Selected water quality data from the warmest months of the year are summarized in Table 19.

Table 19. Data summary

LAKE NAME	**SAMPLE MONTH**	**SAMPLE YEAR**	**SOURCE**	**TEMP °C**	**DO mg/L**	**SC µS/cm**	**pH**	***E. coli* cfu/100 mL**
Lea Lake	Apr	1998	NMED/SWQB	17.5	7.9	12600	7.9	nd*

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Lea Lake	June	2007	NMED/SWQB	23.1	6.4	10901	7.7	5.2
Lea Lake	July	1994	USFWS	26.8	4.9	11200	nd	nd
Lea Lake	July	1995	USFWS	28.8	6.5	10400	nd	nd

* "nd" means no data.

PROPOSAL:

20.6.4.228 PECOS RIVER BASIN –Cottonwood lake and Devil's Inkwell in Bottomless Lakes state park.

A. Designated uses: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for two small sinkholes in Bottomless Lakes State Park. *See* Table 20. These two sinkhole lakes are characterized by relatively low salinity, specific conductance and temperatures.

Table 20. Sinkholes in proposed segment 228

LAKE NAME	ELEVATION feet	LAKE SIZE acres
Cottonwood Lake	3475	0.5
Devil's Inkwell	3460	0.4

The lakes are currently covered as unclassified perennial waters under section 99. Proposed designated uses and criteria for the new segment are presented in Table 21.

Table 21. Designated uses

Designated Uses	Unclassified 99	Proposed 228
Warmwater aquatic life	X	
Coolwater aquatic life		X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	206/940
Livestock watering	X	X
Wildlife habitat	X	X

NMED proposes the coolwater aquatic life use because these lakes maintain cool temperatures in summer and provide recreational trout fishing the rest of the year (NMED/SWQB 1998). Summer temperatures are consistent with the coolwater criterion of 29°C. Swimming is not permitted; therefore, NMED recommends retaining the primary contact criteria associated with low frequency use.

NMED sampled Cottonwood Lake and Devil's Inkwell in 1998. Bacterial sampling was not conducted. NMDGF generally monitors water quality from September to May for stocking purposes (NMDGF 2007-10). USFWS has also occasionally monitored water quality in these lakes (USFWS 1994-95). Selected water quality data from the warmest months of the year are summarized in Table 22.

Table 22. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH
Cottonwood Lake	May	2009	NMDGF	21.2	8.7	13310	nd*
Cottonwood Lake	May	2010	NMDGF	17.3	9.3	12620	7.9
Cottonwood Lake	July	1994	USFWS	24.7	5.1	7200	nd
Cottonwood Lake	July	1995	USFWS	23.0	5.5	10500	nd
Cottonwood Lake	Sept	2009	NMDGF	25.2	5.9	14000	nd
Devil's Inkwell	May	2006	NMDGF	21.6	7.2	7330	7.0
Devil's Inkwell	May	2009	NMDGF	21.2	6.8	7340	nd
Devil's Inkwell	May	2010	NMDGF	18.5	8.5	7130	8.0
Devil's Inkwell	July	1995	USFWS	24.9	5.5	7000	nd
Devil's Inkwell	Sept	2009	NMDGF	26.2	10.4	7450	nd

* "nd" means no data.

PROPOSAL:

<u>**20.6.4.229 PECOS RIVER BASIN** – Figure Eight lake and Mirror lake in Bottomless Lakes state park.</u>

<u>**A. Designated uses:** warmwater aquatic life, primary contact and wildlife habitat.</u>

<u>**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 criteria apply: the monthly geometric mean of *E. coli* bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.</u>

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for two small sinkholes in Bottomless Lakes State Park. *See* Table 23. These are highly saline sinkholes that provide habitat for specialized protected or endemic species, including the Mexican tetra and Pecos pupfish (NMDGF 1999).

Table 23. Sinkholes in proposed segment 229

LAKE NAME	ELEVATION feet	LAKE SIZE acres
Figure Eight Lake	3458	2.2
Mirror Lake	3480	3.4

Figure Eight and Mirror Lakes are currently covered as unclassified perennial waters under section 99. Proposed designated uses and criteria for the new segment are presented in Table 24.

Table 24. Designated uses

Designated Uses	Unclassified 99	Proposed 229
Warmwater aquatic life	X	X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	206/940
Livestock watering	X	
Wildlife habitat	X	X

Salinity in these sinkholes is too high to support either traditional recreational fisheries or livestock watering. NMED proposes to remove the livestock watering use. Although the Commission has not established salinity standards for specific designated uses, guidelines from the New Mexico State University Extension Service state that water containing a total dissolved solids concentration of 10,000 mg/L (approximately equivalent to a specific conductance of 16,000 uS/cm) is unsafe for livestock (Looper and Waldner 2002). Livestock watering is not an existing use as livestock are not allowed in the state park, which was established in the 1930s.

NMED proposes the warmwater aquatic life use to support the state and federally listed species that inhabit the lake. Summer temperatures are consistent with the warmwater criterion of 32.2°C.

NMED proposes retaining the *E. coli* criteria associated with low-frequency primary contact use. Swimming is not permitted in any of the sinkholes at Bottomless Lakes state park. A single *E. coli* measurement for Figure Lake met the single sample criterion for low-frequency use. NMED does not have bacterial data for Mirror Lake.

NMED has sampled these lakes (NMED/SWQB 1998, 2007). USFWS has also monitored water quality in these lakes (USFWS 1994-95, 97-98, 05). Selected water quality data from the warmest months of the year are summarized in Table 25.

Table 25. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	SOURCE	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Figure Eight Lake	June	2007	NMED	27.1	6.7	34860	8.0	920
Figure Eight Lake	July	1994	USFWS	28.5	7.3	20500	nd*	nd
Figure Eight Lake	July	1995	USFWS	29.3	5.9	33100	nd	nd
Mirror Lake	June	1997	USFWS	24.2	6.7	33700	nd	nd
Mirror Lake	July	1994	USFWS	27.3	10.0	24100	nd	nd
Mirror Lake	July	1995	USFWS	28.0	6.1	35100	nd	nd

* "nd" means no data.

CANADIAN RIVER BASIN

PROPOSAL:

20.6.4.307 CANADIAN RIVER BASIN - Perennial reaches of the Mora river from the USGS gaging station near Shoemaker upstream to the state highway 434 bridge in Mora, all perennial reaches of tributaries to the Mora river downstream from the USGS gaging station at La Cueva in San Miguel and Mora counties except lakes identified in 20.6.4.313 NMAC, perennial reaches of Ocate creek and its tributaries downstream of Ocate, and perennial reaches of Rayado creek downstream of Miami lake diversion in Colfax county.

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

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

20.6.4.309 CANADIAN RIVER BASIN - The Mora river and perennial reaches of its tributaries upstream from the state highway 434 bridge in Mora except lakes identified in 20.6.4.313 NMAC, all perennial reaches of tributaries to the Mora river upstream from the USGS gaging station at La Cueva, perennial reaches of Coyote creek and its tributaries, the Cimarron river and its perennial tributaries above state highway 21 in Cimarron except Eagle Nest lake, all perennial reaches of tributaries to the Cimarron river north and northwest of highway 64 except Shuree ponds, perennial reaches of Rayado creek and its tributaries above Miami lake diversion, Ocate creek and perennial reaches of its tributaries upstream of Ocate, perennial reaches of the Vermejo river upstream from Rail canyon and all other perennial reaches of tributaries to the Canadian river northwest and north of U.S. highway 64 in Colfax county unless included in other segments.

A. Designated Uses: domestic water supply, irrigation, high quality coldwater aquatic life, livestock watering, wildlife habitat, and primary contact; and public water supply on the Cimarron River upstream from Cimarron~~, on Eagle Nest lake~~ and on perennial reaches of Rayado creek and its tributaries.

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 criteria apply: specific conductance 500 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

[NOTE: The standards for Shuree ponds are in 20.6.4.314 NMAC and the standards for Eagle Nest lake are in 20.6.4.315 NMAC, effective XX-XX-XX.]

20.6.4.313 CANADIAN RIVER BASIN - Encantada lake, Maestas lake, Middle Fork lake of Rio de la Casa, North Fork lake of Rio de la Casa and Pacheco lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

<u>**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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.</u>

BASIS FOR PROPOSAL:

NMED proposes to create three new segments exclusively for high-elevation natural lakes in the Rio Grande, Pecos, and Canadian Basins, as explained under segment 133. Five lakes in the Canadian Basin are included in this proposed segment 313. *See* Table 26. The lakes are located in the Sangre de Cristo mountain range in the Santa Fe National Forest. Middle Fork Lake of Rio de la Casa and North Fork Lake of Rio de la Casa are in the Pecos wilderness and have been designated as ONRWs.

Table 26. Lakes in proposed segment 313

LAKE NAME	CURRENT WQS	ELEVATION feet	LAKE SIZE acres
Encantada Lake	99	10750	2.4
Maestas Lake	307	9951	3.0
Middle Fork Lake of Rio de la Casa	309	12000	1.5
North Fork Lake of Rio de la Casa	99	11810	2.0
Pacheco Lake	307	10865	5.0

These lakes are currently either unclassified perennial waters in section 99 or classified perennial waters in segments 307 or 309. These segments include a large number of surface waters not specifically named within the segment description. NMED proposes amendments to segments 307 and 309 to exclude the lakes in proposed segment 313.

NMED proposes the same designated uses and segment-specific criteria for this new segment as for the high-elevation natural lakes in the Rio Grande and Pecos Basins for the reasons given in the description of proposed segment 133. The uses and criteria are also the same as those currently applicable to Segment 309, as shown in Table 27, with the exception of the specific conductance criterion.

Table 27. Designated uses

Designated Uses	Segment 307	Segment 309	Unclassified 99	Proposed 313
High quality coldwater aquatic life		X		X
Specific-specific criteria – specific conductance (uS/cm)		500		300
Warmwater aquatic life	X		X	
Marginal coldwater aquatic life	X			
Domestic water supply		X		X
Irrigation	X	X		X
Primary contact	X	X	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	126/410	126/235	206/940	126/235
Livestock watering	X	X	X	X
Wildlife habitat	X	X	X	X

NMED has not surveyed these lakes. However, data representative of high-elevation natural lakes are presented in Tables 3 and 10.

PROPOSAL:

> **20.6.4.314 CANADIAN RIVER BASIN** - Shuree ponds.
> **A. Designated uses:** high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.
> **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 criteria apply: specific conductance 500 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment comprising Shuree Ponds. The lakes are located at 9330 feet elevation within the Valle Vidal Unit in the Carson National Forest. The two largest lakes are each 1.5 acres in size; they are two in a series of ponds that impound water from Shuree Creek, a small tributary to the Middle Ponil Creek. These lakes have been designated as Special Trout Waters (NMDGF 2011a) and as ONRWs.

These reservoirs are currently classified, but not specifically named, in segment 309. NMED proposes an amendment to segment 309 to specifically exclude Shuree Ponds. *See* proposed amendments to segment 20.6.4.309 NMAC above.

The proposed designated uses and segment-specific criteria for Shuree Ponds are the same as those currently applicable to segment 309. NMED proposes retaining the high quality coldwater aquatic life use and the specific conductance criterion of 500 µS/cm. NMDGF stocks Shuree Ponds with trout, and depths are adequate for an overwintering population (NMED/SWQB 2006). Measured temperatures and specific conductance are consistent with the high quality coldwater criteria. *See* Table 28.

NMED proposes retaining the protective *E. coli* criteria for Shuree Ponds. Shuree Ponds are located on national forest land easily accessible to the public, and two campgrounds are located nearby. Sampling by NMED showed *E. coli* concentrations well below the single sample criterion. *See* Table 28.

Selected water quality data are summarized in Table 28 (NMED/SWQB 2006).

Table 28. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Shuree Pond (North)	Apr	2006	9.7	9.6	222	8.9	nd*
Shuree Pond (South)	Apr	2006	8.6	9.8	163	8.9	nd
Shuree Pond (North)	May	2006	12.4	6.8	165	8.8	4

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Shuree Pond (South)	May	2006	13.1	4.7	265	7.6	36

* "nd" means no data.

PROPOSAL:

20.6.4.315 CANADIAN RIVER BASIN –Eagle Nest lake.
A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering, wildlife habitat and public water supply.
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 criteria apply: specific conductance 500 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Eagle Nest Lake, located in Eagle Nest Lake State Park. This lake is a 1334 acre impoundment that empties into the Cimarron River, a tributary to the Canadian River. It is New Mexico's highest large reservoir at 8200 feet in elevation and one the oldest, completed in 1918. The state park has camping and a visitors' interpretive center (NMED/SWQB 2005). Eagle Nest Lake supplies water to the Springer public water system.

Eagle Nest Lake is currently classified in segment 309 and specifically named as a public water supply. NMED proposes an amendment to segment 309 to exclude Eagle Nest Lake. *See* proposed amendments to segment 309 above.

The proposed designated uses and segment-specific criteria for Eagle Nest Lake are the same as those currently applicable to segment 309. NMED proposes retaining the high quality coldwater aquatic life use and the specific conductance criterion of 500 µS/cm. Eagle Nest Lake is an established fishery with resident coldwater species of trout and salmon. Measured temperatures and specific conductance are consistent with the high quality coldwater criteria. *See* Table 29.

NMED proposes retaining the protective *E. coli* criteria for Eagle Nest Lake. The lake is the centerpiece of a popular state park and swimming is allowed. *E. coli* criteria also protect the public water supply use in accordance with Subsection A of 20.6.4.900 NMAC, which notes that water quality adequate for the public water supply use is ensured in part by numeric criteria for bacterial quality. Sampling in 2005 showed an *E. coli* concentration well below the single sample criterion.

Selected water quality data are summarized in Table 29 (NMED/SWQB 2005).

Table 29. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Eagle Nest Lake	Apr	2005	8.9	7.4	310	6.5	1
Eagle Nest Lake	July	2005	19.3	5.5	288	7.9	nd*
Eagle Nest Lake	Oct	2005	13.5	5.5	309	7.6	nd

* "nd" means no data.

PROPOSAL:

20.6.4.316 CANADIAN RIVER BASIN – Clayton lake.

A. Designated uses: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Clayton Lake in northeastern New Mexico in Clayton Lake State Park. The lake size is 148 acres, located at an elevation of 5200 feet. The New Mexico State Game Commission created Clayton Lake as habitat for migratory waterfowl. Construction of a dam across Seneca Creek began in 1954, and was completed approximately two years later. (NMED/SWQB 2000.) Seneca Creek is fed by a series of seeps and springs that alone do not provide enough water to fill the lake, so water levels are also dependent upon storm runoff. Therefore, the lake experiences low water levels (EMNRD 2005-2009).

Clayton Lake is currently covered as unclassified perennial waters under section 99. As shown in Table 30, NMED proposes changing the aquatic life use from warmwater to coolwater. Resident fish species in Clayton Lake include trout, channel catfish and bass, as well as record-size walleye (EMNRD 2005-09). Measured summer temperatures are consistent with the coolwater criteria. *See* Table 31.

NMED proposes retaining the *E. coli* criteria associated with low-frequency primary contact use. NMED does not have bacterial data for Clayton Lake. Given that one of the lake's primary purposes is to provide waterfowl habitat, NMED recommends sampling for *E. coli* before proposing more stringent criteria.

Table 30. Designated uses

Designated Uses	Unclassified 99	Proposed 316
Warmwater aquatic life	X	
Coolwater aquatic life		X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	206/940
Livestock watering	X	X
Wildlife habitat	X	X

Selected water quality data are summarized in Table 31 (NMED/SWQB 2000).

Table 31. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH
Clayton Lake	Mar	2000	9.7	9.1	393	8.0
Clayton Lake	July	2000	26.7	7.9	372	9.0
Clayton Lake	Oct	2000	17.4	8.4	399	8.6

PROPOSAL:

20.6.4.317 CANADIAN RIVER BASIN – Springer lake.
A. Designated uses: coolwater aquatic life, irrigation, primary contact, livestock watering and wildlife habitat.
B. Criteria: The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Springer Lake in northeastern New Mexico. The lake is 459 acres, located at an elevation of 5900 feet. Springer Lake was created in 1920 in order to provide reliable water to farmers and ranchers in the area. Water is diverted through an extensive system of canals and ditches primarily from the Cimarron River and occasionally from Ponil Creek. During the irrigation season, the lake may experience low water levels (NMED/SWQB 2006).

Springer Lake is currently covered as unclassified perennial waters under section 99. As shown in Table 32, NMED proposes changing the aquatic life use to coolwater. Fish species in Springer Lake include largemouth bass, black bullhead, yellow perch, northern pike, sun fish, channel catfish, white suckers, fathead minnows and plains killifish, all of which prefer intermediate or warm temperatures. Measured summer temperatures are consistent with the coolwater criteria. *See* Table 33. NMED also proposes adding the irrigation use, which is an existing use by the Antelope Valley and Springer Ditch associations (NMSEO 1987).

NMED proposes applying the standard *E. coli* criteria identified in section 900.D. Swimming in Springer Lake is a common activity, as is water skiing when water levels are sufficient (NMED/SWQB 2006). Sampling by NMED showed an *E. coli* concentration well below the proposed criteria. *See* Table 33.

Table 32. Designated uses

Designated Uses	Unclassified 99	Proposed 317
Warmwater aquatic life	X	
Coolwater aquatic life		X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	126/410
Irrigation		X

Designated Uses	Unclassified 99	Proposed 317
Livestock watering	X	X
Wildlife habitat	X	X

Selected water quality data are summarized in Table 33 (NMED/SWQB 2006).

Table 33. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Springer Lake	Apr	2006	9.8	7.3	805	7.8	7
Springer Lake	July	2006	24.2	6.5	838	8.2	nd*

* "nd" means no data.

SAN JUAN RIVER BASIN

PROPOSAL:

<u>**20.6.4.410 SAN JUAN RIVER BASIN** – Jackson lake.</u>

<u>**A. Designated uses:** coolwater aquatic life, irrigation, primary contact, livestock watering and wildlife habitat.</u>

<u>**B. Criteria:** The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.</u>

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Jackson Lake. This 60 acre lake is located in northwestern New Mexico approximately eight miles northwest of Farmington at an elevation of 5488 feet. The lake was originally created in the early 1900s for irrigation (NMDGF personal communication). The State of New Mexico purchased the land area in 1948 for a wildlife preserve, and the lake itself was purchased in 1960 (NMED/SWQB 2002).

Jackson Lake is currently covered as an unclassified perennial water under section 99. As shown in Table 34, NMED proposes changing the aquatic life use from warmwater to coolwater. Resident fish in Jackson Lake include largemouth bass, channel catfish and bluegill (NMED/SWQB 2002). These fish prefer intermediate to warm water. Measured summer temperatures are consistent with the coolwater criterion. *See* Table 35.

NMED proposes retaining the *E. coli* criteria associated with low-frequency primary contact use. The designated purposes of the area are fishing and wildlife viewing. Camping and swimming are not allowed. NMED does not have bacterial data for Jackson Lake.

Table 34. Designated uses

Designated Uses	Unclassified 99	Proposed 410
Warmwater aquatic life	X	
Coolwater aquatic life		X
Primary contact	X	X

Designated Uses	Unclassified 99	Proposed 410
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	206/940
Livestock watering	X	X
Wildlife habitat	X	X

Selected water quality data are summarized in Table 35 (NMED/SWQB 2002).

Table 35. Data Summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH
Jackson Lake	July	2002	23.1	6.2	3268	8.2

LITTLE COLORADO RIVER BASIN

PROPOSAL:

20.6.4.453 LITTLE COLORADO RIVER BASIN – Quemado lake.
A. Designated uses: coldwater aquatic life, primary contact, livestock watering and wildlife habitat.
B. Criteria: The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Quemado Lake. This 130 acre lake, located at an elevation of 7630 feet, was created in 1971 by a dam that impounded Largo and El Caso Creeks, two ephemeral streams.

Quemado Lake is currently covered as an unclassified perennial water under section 99. As shown in Table 36, NMED proposes changing the aquatic life use to coldwater. Historically, NMDGF has maintained a rainbow trout fishery throughout the year at Quemado Lake. Tiger musky, also a sport fish, was introduced to control the exotic goldfish population (NMED/SWQB 2004). Summer temperatures meet the coldwater criteria. *See* Table 37.

NMED proposes increasing the protection for the primary contact use by applying the *E. coli* criteria identified in section 900.D. Quemado Lake is a popular lake located on national forest land easily accessible to the public. Recreational activities include camping, boating, picnicking and fishing. Sampling by NMED showed a low concentration of fecal coliform bacteria. *See* Table 37.

Table 36. Designated uses

Designated Uses	Unclassified 99	Proposed 453
Warmwater aquatic life	X	
Coldwater aquatic life		X
Primary contact	X	X

Designated Uses	Unclassified 99	Proposed 453
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	126/410
Livestock watering	X	X
Wildlife habitat	X	X

Selected water quality data are summarized in Table 37 (NMED/SWQB 2004, 2011).

Table 37. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	FECAL COLIFORM cfu/100 mL
Quemado Lake	July	2004	19.1	7.2	388	8.3	1
Quemado Lake	Apr	2011	9.1	8.9	316	8.7	nd**
Quemado Lake	July	2011	19.5	9.1	254	8.8	nd

** "nd" means no data.

GILA RIVER BASIN

PROPOSAL:

<u>**20.6.4.505** **GILA RIVER BASIN** – Bill Evans lake.</u>

<u>**A.** **Designated uses:** coolwater aquatic life, primary contact, livestock watering and wildlife habitat.</u>

<u>**B.** **Criteria:** The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.</u>

BASIS FOR PROPOSAL:

NMED proposes to create a new segment for Bill Evans Lake. This 62 acre lake is located in southwestern New Mexico at an elevation of 4800 feet. It was originally created in 1969 by the Phelps Dodge Mining Company to provide water for its Tyrone copper refining facility. Water for the lake is pumped from the Gila River 300 feet below (NMED/SWQB 2007).

Bill Evans Lake is currently covered as an unclassified perennial water under section 99. As shown in Table 38, NMED proposes changing the aquatic life use to coolwater. NMDGF stocks the lake with trout in the winter and catfish in the summer (NMDGF 2011b). May and August temperatures are consistent with the coolwater criteria. *See* Table 39.

NMED proposes increasing the protection for the primary contact use by applying the *E. coli* criteria identified in section 900.D. Bill Evans Lake is easily accessible and open to the public. Recreational activities include fishing, boating, camping and hiking. Sampling by NMED showed an *E. coli* concentration well below the proposed criteria. *See* Table 39.

Table 38. Designated uses

Designated Uses	Unclassified 99	Proposed 505
Warmwater aquatic life	X	

Designated Uses	Unclassified 99	Proposed 505
Coolwater aquatic life		X
Primary contact	X	X
Segment-specific criteria – *E. coli* (cfu/100 mL) Geometric mean/single sample	206/940	126/410
Livestock watering	X	X
Wildlife habitat	X	X

Selected water quality data are summarized in Table 39 (NMED/SWQB 2007).

Table 39. Data summary

LAKE NAME	SAMPLE MONTH	SAMPLE YEAR	TEMP °C	DO mg/L	SC µS/cm	pH	*E. coli* cfu/100 mL
Bill Evans Lake	May	2007	20.5	7.9	399	7.8	1
Bill Evans Lake	Aug	2007	27.2	6.2	391	7.8	nd*

* "nd" means no data.

PROPOSED AMENDMENTS TO 20.6.4 NMAC

20.6.4.108 RIO GRANDE BASIN - Perennial reaches of the Jemez river and all its tributaries above Soda dam near the town of Jemez Springs, except San Gregorio lake and Sulphur creek above its confluence with Redondo creek, and perennial reaches of the Guadalupe river and all its tributaries.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat 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 criteria apply: specific conductance 400 µS/cm or less (800 µS/cm or less on Sulphur creek); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less; and pH within the range of 2.0 to 8.8 on Sulphur creek.

[Note: the standards for San Gregorio lake are in 20.6.4.134 NMAC, effective XX-XX-XX.]

20.6.4.109 RIO GRANDE BASIN - Perennial reaches of Bluewater creek excluding Bluewater lake and waters on tribal lands, Rio Moquino upstream of Laguna pueblo, Seboyeta creek, Rio Paguate upstream of Laguna pueblo, the Rio Puerco upstream of the northern boundary of Cuba, and all other perennial reaches of tributaries to the Rio Puerco, including the Rio San Jose in Cibola county from the USGS gaging station at Correo upstream to Horace springs excluding waters on tribal lands.

A. Designated Uses: coldwater aquatic life, domestic water supply, fish culture, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on La Jara creek.

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 criteria apply: phosphorus (unfiltered sample) 0.1 mg/L or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

[Note: the standards for Bluewater lake are in 20.6.4.135 NMAC, effective XX-XX-XX.]

20.6.4.115 RIO GRANDE BASIN - The perennial reaches of Rio Vallecitos and its tributaries, excluding Hopewell Lake,[~~and~~] perennial reaches of Rio del Oso and perennial reaches of El Rito creek above the town of El Rito.

A. Designated Uses: domestic water supply, irrigation, high quality coldwater aquatic life, livestock watering, wildlife habitat and primary contact; public water supply on the Rio Vallecitos and El Rito creek.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

[Note: the standards for Hopewell lake are in 20.6.4.134 NMAC, effective XX-XX-XX.]

20.6.4.119 RIO GRANDE BASIN - All perennial reaches of tributaries to the Rio Chama above Abiquiu dam, except Canjilon lakes and the Rio Gallina and Rio Puerco de Chama north

EXHIBIT
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of state highway 96 and excluding waters on Jicarilla Apache reservation, and the main stem of the Rio Chama from the headwaters of El Vado reservoir upstream to the New Mexico-Colorado line. Some Cañones creek and Rio Chama waters in this segment are under the joint jurisdiction of the state and the Jicarilla Apache tribe.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on the Rio Brazos and Rio Chama.

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 criteria apply: specific conductance 500 µS/cm or less (1,000 µS or less for Coyote creek); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

[Note: the standards for Canjilon lakes are in 20.6.4.134 NMAC, effective XX-XX-XX.]

20.6.4.133 RIO GRANDE BASIN –Bull Creek lake, Cow lake, Elk lake, Goose lake, Heart lake, Hidden lake, Horseshoe lake, Horseshoe (Alamitos) lake, Jose Vigil lake, Lost lake, Middle Fork lake, Nambe lake, Nat II lake, Nat IV lake, No Fish lake, Pioneer lake, San Leonardo lake, Santa Fe lake, Serpent lake, South Fork lake, Trampas lakes and Williams lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.134 RIO GRANDE BASIN – Cabresto lake, Canjilon lakes, Fawn lakes, Hopewell lake and San Gregorio lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.135 RIO GRANDE BASIN – Bluewater lake.

A. Designated uses: coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering, wildlife habitat.

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 criteria apply: phosphorus (unfiltered sample) 0.1 mg/L or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

PROPOSED AMENDMENTS TO 20.6.4 NMAC

20.6.4.209 PECOS RIVER BASIN - Perennial reaches of Eagle creek upstream of Alto dam to the Mescalero Apache boundary, perennial reaches of the Rio Bonito and its tributaries upstream of state highway 48 (near Angus) excluding Bonito lake, and perennial reaches of the Rio Ruidoso and its tributaries upstream of the U.S. highway 70 bridge near Seeping Springs lakes, above and below the Mescalero Apache boundary.

A. Designated Uses: domestic water supply, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat, public 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 criteria apply: specific conductance 600 μS/cm or less in Eagle creek, 1,100 μS/cm or less in Bonito creek and 1,500 μS/cm or less in the Rio Ruidoso; phosphorus (unfiltered sample) less than 0.1 mg/L; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

[NOTE: The standards for Bonito lake are in 20.6.4.223 NMAC, effective XX-XX-XX.]

20.6.4.211 PECOS RIVER BASIN - The main stem of the Pecos river from the headwaters of Sumner reservoir upstream to Tecolote creek, excluding Santa Rosa reservoir.

A. Designated Uses: fish culture, irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

B. Criteria:

(1) The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

(2) At all flows above 50 cfs: TDS 3,000 mg/L or less, sulfate 2,000 mg/L or less and chloride 400 mg/L or less.

[NOTE: The standards for Santa Rosa reservoir are in 20.6.4.225 NMAC, effective XX-XX-XX.]

20.6.4.217 PECOS RIVER BASIN - Perennial reaches of Cow creek and all perennial reaches of its tributaries and the main stem of the Pecos river from Cañon de Manzanita upstream to its headwaters, including perennial reaches of all tributaries thereto except lakes identified in 20.6.4.222 NMAC.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact; and public water supply on the main stem of the Pecos river.

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 criteria apply: specific conductance 300 μS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.222 PECOS RIVER BASIN –Johnson lake, Katherine lake, Lost Bear lake, Pecos Baldy lake, Spirit lake, Stewart lake and Truchas lakes.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.223 PECOS RIVER BASIN – Bonito lake.

A. Designated uses: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering, wildlife habitat and public water supply.

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 criteria apply: specific conductance 1100 µS/cm or less; phosphorus (unfiltered sample) less than 0.1 mg/L; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.224 PECOS RIVER BASIN – Monastery lake.

A. Designated uses: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 206

20.6.4.225 PECOS RIVER BASIN – Santa Rosa reservoir.

A. Designated uses: coolwater aquatic life, irrigation, primary contact, livestock watering and wildlife habitat.

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

20.6.4.226 PECOS RIVER BASIN – Perch lake.

A. Designated uses: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.227 PECOS RIVER BASIN – Lea lake in Bottomless Lakes state park.

A. Designated uses: warmwater aquatic life, primary contact, livestock watering and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.228 PECOS RIVER BASIN –Cottonwood lake and Devil's Inkwell in Bottomless Lakes state park.

A. Designated uses: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

20.6.4.229 PECOS RIVER BASIN – Figure Eight lake and Mirror lake in Bottomless Lakes state park.

A. Designated uses: warmwater aquatic life, primary contact and wildlife habitat.

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 criteria apply: the monthly geometric mean of *E. coli* bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

20.6.4.307 CANADIAN RIVER BASIN - Perennial reaches of the Mora river from the USGS gaging station near Shoemaker upstream to the state highway 434 bridge in Mora, all perennial reaches of tributaries to the Mora river downstream from the USGS gaging station at La Cueva in San Miguel and Mora counties except lakes identified in 20.6.4.313 NMAC, perennial reaches of Ocate creek and its tributaries downstream of Ocate, and perennial reaches of Rayado creek downstream of Miami lake diversion in Colfax county.

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

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

20.6.4.309 CANADIAN RIVER BASIN - The Mora river and perennial reaches of its tributaries upstream from the state highway 434 bridge in Mora except lakes identified in 20.6.4.313 NMAC, all perennial reaches of tributaries to the Mora river upstream from the USGS gaging station at La Cueva, perennial reaches of Coyote creek and its tributaries, the Cimarron river and its perennial tributaries above state highway 21 in Cimarron except Eagle Nest lake, all perennial reaches of tributaries to the Cimarron river north and northwest of highway 64 except Shuree ponds, perennial reaches of Rayado creek and its tributaries above Miami lake diversion, Ocate creek and perennial reaches of its tributaries upstream of Ocate, perennial reaches of the Vermejo river upstream from Rail canyon and all other perennial reaches of tributaries to the Canadian river northwest and north of U.S. highway 64 in Colfax county unless included in other segments.

PROPOSED AMENDMENTS TO 20.6.4 NMAC

A. **Designated Uses:** domestic water supply, irrigation, high quality coldwater aquatic life, livestock watering, wildlife habitat, and primary contact; and public water supply on the Cimarron River upstream from Cimarron~~, on Eagle Nest lake~~ and on perennial reaches of Rayado creek and its tributaries.

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 criteria apply: specific conductance 500 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

[NOTE: The standards for Shuree ponds are in 20.6.4.314 NMAC and the standards for Eagle Nest lake are in 20.6.4.315 NMAC, effective XX-XX-XX.]

20.6.4.313 **CANADIAN RIVER BASIN** - Encantada lake, Maestas lake, Middle Fork lake of Rio de la Casa, North Fork lake of Rio de la Casa and Pacheco lake.

A. **Designated uses**: high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 300 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.314 **CANADIAN RIVER BASIN** - Shuree ponds.

A. **Designated uses:** high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering and wildlife habitat.

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 criteria apply: specific conductance 500 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.315 **CANADIAN RIVER BASIN** –Eagle Nest lake.

A. **Designated uses:** high quality coldwater aquatic life, irrigation, domestic water supply, primary contact, livestock watering, wildlife habitat and public water supply.

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 criteria apply: specific conductance 500 µS/cm or less; the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

20.6.4.316 **CANADIAN RIVER BASIN** – Clayton lake.

A. **Designated uses**: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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

PROPOSED AMENDMENTS TO 20.6.4 NMAC

20.6.4.317 CANADIAN RIVER BASIN – Springer lake.

A. Designated uses: coolwater aquatic life, irrigation, primary contact, livestock watering and wildlife habitat.

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

20.6.4.410 SAN JUAN RIVER BASIN – Jackson lake.

A. Designated uses: coolwater aquatic life, irrigation, primary contact, livestock watering and wildlife habitat.

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

20.6.4.453 LITTLE COLORADO RIVER BASIN – Quemado lake.

A. Designated uses: coldwater aquatic life, primary contact, livestock watering and wildlife habitat.

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

20.6.4.505 GILA RIVER BASIN – Bill Evans lake.

A. Designated uses: coolwater aquatic life, primary contact, livestock watering and wildlife habitat.

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

20.6.4.702 DRY CIMARRON RIVER - Perennial portions of the Dry Cimarron river below Oak creek, and perennial portions of Long canyon and Carrizozo creeks.

A. Designated Uses: [~~coldwater~~] coolwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact.

B. Criteria:

(1) 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 criteria apply: [~~temperature 25°C (77°F) or less;~~] the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less.

(2) TDS 1,200 mg/L or less, sulfate 600 mg/L or less and chloride 40 mg/L or less.

Lower Dry Cimarron River
Use Attainability Analysis
New Mexico Environment Department
August 2011

Summary

The purpose of this Use Attainability Analysis (UAA) is to identify the highest attainable aquatic life use in 20.6.4 NMAC Segment 702 (referred to here as the lower Dry Cimarron, Segment 702 or 20.6.4.702 NMAC).

The US Environmental Protection Agency's (US EPA) Water Quality Standards Handbook (US EPA, 1994) recommends that a UAA should answer the following questions:

- What are the aquatic life uses currently being achieved in the water body?
- What are the causes of any impairment of the aquatic uses?
- What are the aquatic uses that can be attained based on the physical, chemical and biological characteristics of the water body?

In response to these questions, this UAA finds:

- Warmwater and coolwater aquatic life uses are currently being achieved throughout the segment, despite slight exceedences of the coolwater criteria at the lowermost monitoring stations;
- The coldwater aquatic life use with a 25°C segment-specific temperature criterion is impaired by temperature; and
- The highest aquatic life use that can be attained based on the physical, chemical and biological characteristics of the water body is coolwater aquatic life.

The coolwater aquatic life use is the highest attainable use in the lower Dry Cimarron because (1) the attainable water temperature is in the range of 28 – 30°C and (2) the native fish species have water temperature tolerances that are either warm or are intermediate between warm and cold. The combination of these factors best matches the coolwater aquatic life use.

According to federal regulations and state water quality standards, an aquatic life use may be removed or changed to a use with less stringent criteria if the use is unattainable due to one or more of six factors listed in 40 CFR 131.10(g). This UAA demonstrates that the current coldwater aquatic life use is unattainable because of factor 131.10(g)(1): Naturally occurring pollutant concentrations prevent the attainment of the use. In particular, the pollutant of heat resulting from naturally occurring ambient air temperatures prevents the attainment of the coldwater aquatic life use.

This UAA is organized into five parts. There is a brief segment description and background, then information about the ecoregion, native fishery and water quality. Next, naturally attainable water temperatures are estimated based on a statewide relationship between air and water temperatures, and then the Stream Segment Temperature Model (Bartholow, 2002) is used to evaluate the reasonable potential for reducing existing temperatures through stream restoration efforts. Finally, the attainable

temperature along with information about the native fish species is used to identify the appropriate aquatic life use subcategory.

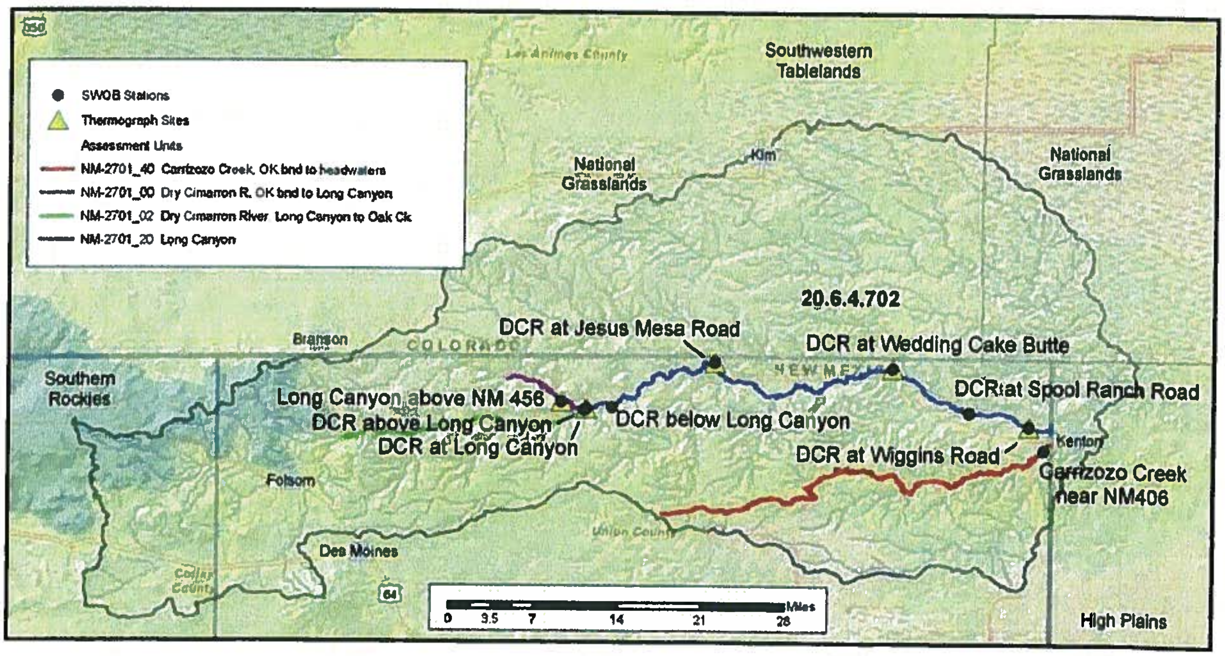
Segment Description and Background

The segment is described in New Mexico's *Standards for Interstate and Intrastate Surface Waters*, 20.6.4 NMAC (1/14/11), as:

> Perennial portions of the Dry Cimarron River below Oak Creek, and perennial portions of Long Canyon and Carrizozo Creeks (20.6.4.702 NMAC).

The segment is located in Union County in northeastern New Mexico. Total stream length is approximately 130 miles; elevations range from 4,300 feet at the eastern New Mexico border to 6,000 feet at the Dry Cimarron and Oak Creek confluence. Figure 1 indicates the four assessment units (AUs) into which the segment is divided for monitoring purposes. The AUs encompass all of the steam reaches listed in the segment description. A larger map is included as Attachment 1.

Figure 1.



A New Mexico Environment Department Surface Water Quality Bureau (SWQB) water quality survey report concluded that the Dry Cimarron River from the Oklahoma border to Oak Creek and Long Canyon were impaired due to temperature. However, the report also noted that the designated coldwater aquatic life use was not likely existing or attainable. (NMED/SWQB, 2004).

Partly as a result of the survey conclusions, in 2005 the New Mexico Water Quality Control Commission separated the upper portion of the Dry Cimarron from the lower, creating Segment 20.6.4.702 for the lower Dry Cimarron River, Long Canyon and Carrizozo Creek. For the new segment, the Commission also changed the aquatic life use to warmwater with a 32.2°C temperature criterion. However, the US EPA in its

Record of Decision on the 2005 changes said that it "did not find adequate supporting documentation justifying the less protective warmwater aquatic life designations and associated criteria" and that "the State must provide a UAA as required by 40 CFR 131.10(j)(2)." In response to US EPA's action, the Commission in 2010 returned the segment to the pre-2005 coldwater designated use and a 25°C temperature criterion, with the understanding that a use attainability analysis would be undertaken to review the appropriateness of the standard.

Ecoregion, Aquatic Life and Water Quality

Ecoregion

The lower Dry Cimarron is in Level III Ecoregion 26 (Southwestern Tablelands), which stretches from Colorado south to Artesia, New Mexico and Midland, Texas; and from the Rio Grande valley near Socorro, New Mexico east to south-central Kansas. At a finer level of detail, the majority of the lower Dry Cimarron is in Level IV Ecoregion 26f (Mesa de Maya/Black Mesa), and a small portion in Level IV Ecoregion 26l (Upper Canadian Plateau). The land cover is mostly woodland and grassland; maximum July daily mean temperatures are in the middle to upper 80°F (30°C) range (Griffith et al., 2006).

Aquatic Life

Propst (1999) discusses the native fish of the Dry Cimarron:

> "A short reach of the Dry Cimarron River, which is tributary to the Arkansas River, drains a small portion of extreme northeastern New Mexico. The Dry Cimarron River flows east from its origins on Johnson Mesa through a broken mesa and low hill landscape and exits New Mexico to Oklahoma north of Clayton. The native fish fauna of the Dry Cimarron River in New Mexico likely consisted of eight and perhaps nine species. Of these, only suckermouth minnow is protected and this species has probably been extirpated from the Dry Cimarron River in New Mexico."

The nine species are listed below. According to BISON-M (NMDGF, 2002), none of the native species are considered coldwater fish. According to Halliwell et al. (1999) and NMDGF (2002), two species have thermal tolerances between warm and coldwater (i.e., intermediate). In 2000, the SWQB collected fish in the lower Dry Cimarron. The collection included five of the native species listed below, including the two species with intermediate thermal tolerances (central stoneroller and flathead chub). A summary of University of New Mexico Museum of Southwestern Biology fish collection records is included in Attachment 2.

Table 1. Dry Cimarron River Native Fish Species

Species Name	Common Name	Thermal Tolerance	Reference
Ameiurus melas	black bullhead	Warm	NMDGF, 2002
Campostoma anomalum	central stoneroller	Intermediate	Halliwell et al., 1999
Cyprinella lutrensis	red shiner	Warm	NMDGF, 2002
Fundulus zebrinus	plains killifish	Warm	NMDGF, 2002
Hybognathus placitus	plains minnow	Warm	NMDGF, 2002
Ictalurus punctatus	channel catfish	Warm	NMDGF, 2002; Zaroban et al., 1999; Halliwell et al., 1999
Phenacobius mirabilis	suckermouth minnow	Warm	NMDGF, 2002
Pimephales promelas	fathead minnow	Warm	NMDGF, 2002; Zaroban et al., 1999; Halliwell et al., 1999
Platygobio gracilis	flathead chub	Intermediate	NMDGF, 2002

Water quality

As indicated in Figure 1 and in Table 3 below, Segment 702 is divided into four AUs. Each AU has at least one monitoring station. Temperatures have been measured at each station, although not every station includes a water thermograph.

Table 3. Segment 702 Monitoring Stations and Associated Assessment Units

Station ID	Station Description	Water Tgraph ?	Max Tgraph Temp °C	Associated AU Description
02Carriz002.7	Carrizozo Creek near NM 406	No		Carrizozo Creek, OK bnd to headwaters
02DryCim003.2	Dry Cimarron River at Wiggins Road	**Yes**	29.5	Dry Cimarron River, OK bnd to Long Canyon
02DryCim011.4	Dry Cimarron River at Spool Ranch Road	No		
02DryCim024.6	Dry Cimarron River at Wedding Cake Butte	**Yes**	30.0	
02DryCim047.2	Dry Cimarron River at Jesus Mesa Road	**Yes**	30.2	
02DryCim070.3	Dry Cimarron River below Long Canyon	No		
02DryCim074.5	Dry Cimarron River at Long Canyon	**Yes**	28.6	Dry Cimarron River, Long Canyon to Oak Creek
02DryCim075.0	Dry Cimarron River above Long Canyon	No		
02LongCa004.1	Long Canyon Creek 2 miles above NM 456	**Yes**	30.5	Long Canyon

The Dry Cimarron and Long Canyon AUs are listed as impaired for the coldwater aquatic life use due to temperature. The Dry Cimarron, OK bnd to Long Canyon AU is also listed as impaired due to low dissolved oxygen. Insufficient data were available to list the Carrizozo Creek AU, but a water temperature measurement in August 2000 exceeded the 25°C criterion.

Relationship of Water Temperature to Air Temperature

Attached to this UAA is a statewide Air-Water Temperature Correlation (NMED/SWQB, 2011) that correlates water thermograph data from 293 New Mexico locations and ambient air temperature from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) dataset. The correlation can be used at any New Mexico location to estimate naturally attainable water temperature statistics such as the MWAT and 6T3. As described in the correlation document, the MWAT is the maximum seven-day running average temperature and the 6T3 is the 6-hour maximum temperature that occurs for 3 consecutive days.

Attainable water temperature statistics at six representative locations are shown in Table 4. Figure 2 is a plot of the five stations where thermographs are located, and compares the predicted attainable temperatures with coldwater and coolwater criteria.

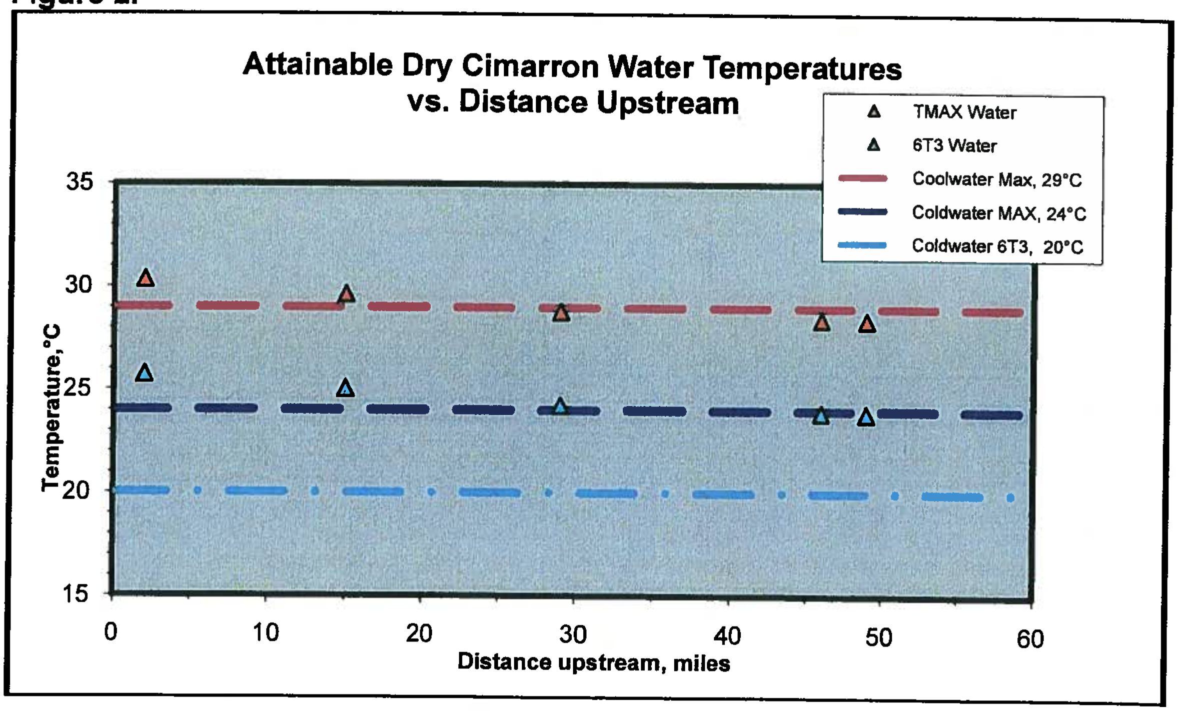
Table 4. Segment 702 Attainable Temperature Statistics

Station ID	Station	Distance from bottom of segment, mi.	July Average Air Temp,°C (PRISM)	TMAX	6T3	MWAT
	Midway up Carrizozo Creek[1]	20	22.20	28.70	24.17	22.20
02LongCa004.1	Long Canyon Creek above NM 456	49[2]	21.91	28.39	23.87	21.91
02DryCim074.5	Dry Cimarron River at Long Canyon	46	21.94	28.43	23.90	21.94
02DryCim047.2	Dry Cimarron River at Jesus Mesa Road	29	22.27	28.78	24.24	22.27
02DryCim024.6	Dry Cimarron River at Wedding Cake Butte	15	23.05	29.61	25.04	23.05
02DryCim003.2	Dry Cimarron River at Wiggins Road	2	23.72	30.33	25.73	23.72

[1] This location is not a monitoring station, but was chosen to be representative of the AU.
[2] Distance on the Dry Cimarron from the Oklahoma border plus distance on Long Canyon Creek.

The water temperature statistics indicate that the coldwater 20°C 6T3 criterion and 24°C maximum criterion are not achievable anywhere along the segment, and that the attainable maximum temperatures are in the range of 28 – 30°C.

Figure 2.



Modeling

The attainable temperatures presented in the previous section are based on a statewide correlation. Stream restoration activities can influence stream temperature by modifying flow, width-to-depth ratio and stream shading. In order to confirm the conclusion that coldwater criteria are not attainable, site-specific modeling was done using SSTEMP (Bartholow, 2002) to evaluate the effect that changes in these variables would have on water temperature.

For modeling, the stream was divided into four reaches from upstream to downstream: the first from Folsom Falls (the nearest upstream monitoring station to the segment break at Oak Creek) to Long Canyon; the second from Long Canyon to Jesus Mesa Road; the third from Jesus Mesa Road to Wedding Cake Butte; and the fourth from Wedding Cake Butte to Wiggins Road. The entire length from Folsom Falls to Wiggins Road was also modeled.

Table 5. Modeled Dry Cimarron Reaches

Station	Distance from bottom of segment, mi.	Elevation, ft.	Reach	Reach Length, mi.
Dry Cimarron at Folsom Falls	67	6140		
Dry Cimarron at Long Canyon	46	5130	Folsom Falls to Long Canyon	21
Dry Cimarron at Jesus Mesa Road	29	4850	Long Canyon to Jesus Mesa Road	23
Dry Cimarron at Wedding Cake Butte	15	4540	Jesus Mesa Road to Wedding Cake Butte	14
Dry Cimarron at Wiggins Road	2	4355	Wedding Cake Butte to Wiggins Road	13
Dry Cimarron at Wiggins Road	2	4355	Folsom Falls to Wiggins Road	65

Baseline conditions for the model runs were as follows:

Modeled date 7/15; Inflow 3 cfs; Inflow temperature 20°C; Outflow 3 cfs; Accretion temperature 10°C; Latitude 36.9 °; Width's A term 12.5 s/ft^2; Width's B term 0.2; Manning's n 0.035; Air temperature 20°C; Relative humidity 50%; Wind speed 8 mph; Ground temperature 10°C; Thermal gradient 1.65 j/m^2/s/°C; Possible sun 90%; Solar radiation 550 Langleys/d; Total shade: variable, 25 to 75%.

To investigate the variables of flow and width-to-depth ratio, larger changes than could actually be implemented were modeled. In both cases, the temperature response was minimal. Changes in flow did not reduce temperature – increasing flow from 3 cfs to 100 cfs raised the water temperature approximately 1°C probably because of increased water surface area exposed to solar insolation. Reducing the width-to depth ratio from 80:1 (baseline condition) to 8:1 reduced the mean daily water temperature by less than 0.1°C.

Stream shading was investigated at levels of 25 and 75%. The existing levels of shade along this segment have not been characterized, nor is it clear what the naturally occurring shade levels would have been in this ecoregion, where the land cover is mostly woodland and grassland (Griffith et al., 2006). A 50% increase was chosen to represent an upper limit on the increase that could be achieved with any reasonable human intervention.

As reported in the water quality section, with thermographs the SWQB has measured maximum water temperatures ranging from 28.6 to 30.5°C at five stations in the segment. For all reaches, at the baseline temperature of 20°C the model indicates that increasing shade from 25% to 75% decreases the maximum temperature by 3.2°C. Subtracting 3.2°C from the maximum measured temperatures indicates that with an upper-limit increase in shading, maximum water temperatures would be greater than 25°C.

Attainable Designated Use

The designated aquatic life use could be guided by all of the aquatic life, including plants, insects, macro and microinvertebrates, and vertebrates that would naturally occur in the stream. However, data to describe the distribution of all forms of aquatic life are often not available. Alternatively, the distribution of fish species is fairly well known and fish species integrate many of the variables that control the distribution aquatic life. Therefore, the fish species that can be supported or propagated are generally used to guide the selection of the aquatic life designated use.

The Dry Cimarron native fish species listed in Table 1 are representatives of the Mississippian-Missourian fish fauna. All of the native fish are either warm or warm/cold water intermediate species. There is no evidence that the native fauna included coldwater fish, particularly cutthroat trout (*Oncorhynchus clarkii*), which is the only coldwater species native to neighboring watersheds.

The attainable temperature can also be used to guide the selection of the attainable aquatic life use from the six designated aquatic life use subcategories that are nominally identified by temperature. The six aquatic life use subcategories and associated temperature criteria are listed below:

Table 6. Aquatic Life Temperature Criteria

Temp, °C	High Quality Coldwater[1]	Coldwater	Marginal Coldwater	Coolwater	Warmwater	Marginal Warmwater
Maximum	23	24	29	29	32.2	32.2
6T3	-	20	25	-	-	-

[1]High quality coldwater has a 4T3 (4-hour maximum temperature that occurs for 3 consecutive days) criterion of 20°C.

Comparing the criteria to the temperatures in Table 4, for even the most upstream reach in Segment 702, the maximum temperatures and the 6T3 temperatures are higher than coldwater criteria. For the entire segment, the attainable temperatures are in the marginal coldwater to warmwater range.

Definitions of marginal coldwater and coolwater from New Mexico Water Quality Standards are:

> "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).

"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.

Regarding the marginal coldwater use, the analysis presented in this UAA indicates that it is natural conditions of ambient air temperature that limit the use. Although at some locations intermittent or low flows may also limit the use, low flows are not necessary to limit a use that is already limited by air temperature. Also, coldwater species are not native to the segment. Therefore, "marginal coldwater" is not the best description of the attainable use.

The coolwater use best describes the highest attainable use because of the native fish requirements and the attainable water temperatures. Of the nine native fish species that have been found in the Dry Cimarron, seven are considered warmwater and two are considered warm/cold intermediate fish. The attainable water temperature is estimated to be in the range of 28 – 30°C. Measured temperatures have exceeded the coolwater maximum criterion of 29°C in the lower portion of the segment, but only slightly. With modest stream restoration efforts, the coolwater criterion is likely achievable.

References

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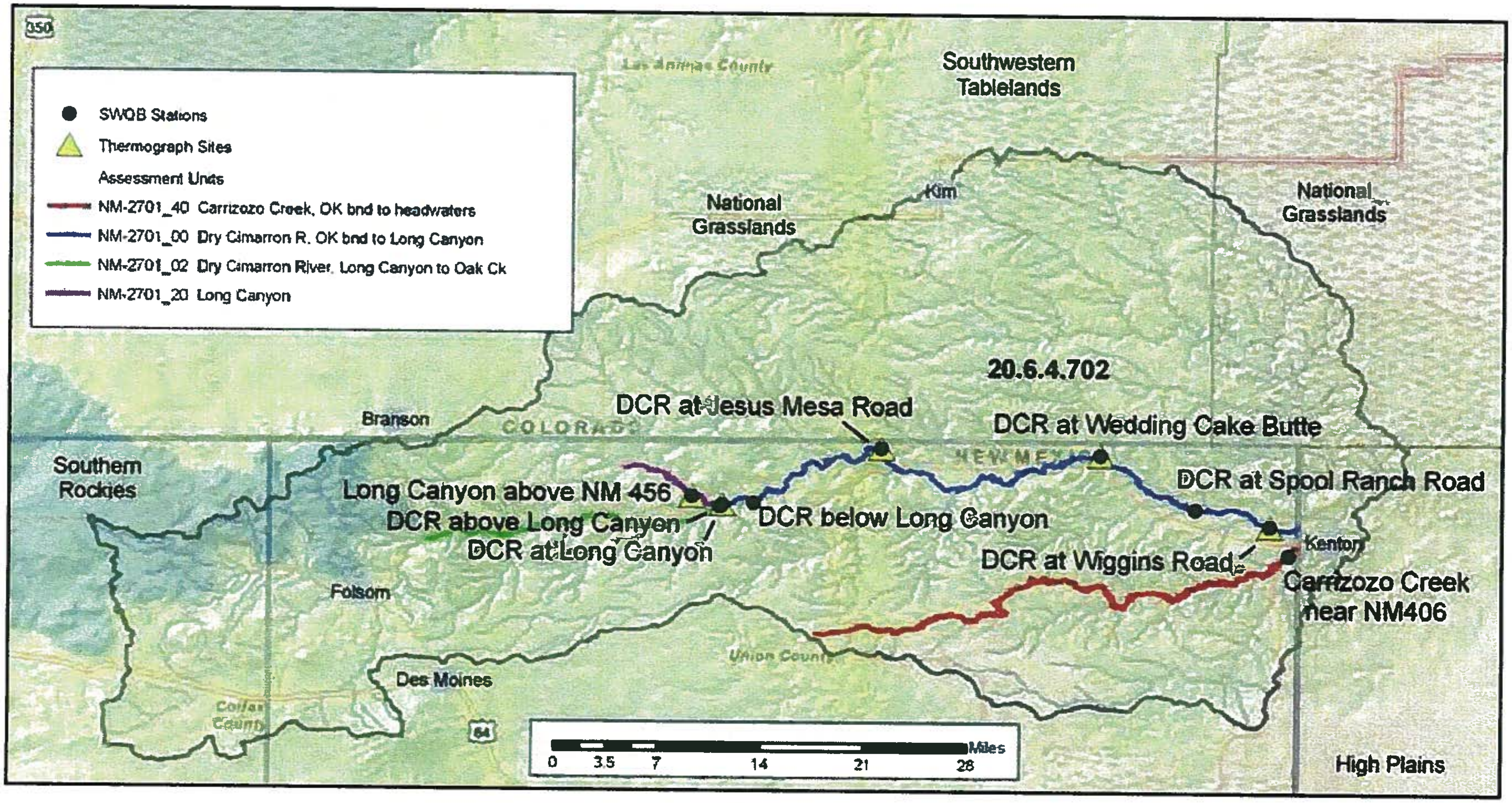
Attachment 1

Segment 20.6.4.702



Attachment 2

Museum of Southwestern Biology Records

Elevation, ft	Location	Date	bullhead (*Ameiurus*)	central stoneroller	red shiner	plains killifish	green sunfish	sand shiner	suckermouth minnow	fathead minnow	flathead chub	plains minnow
4370	Carrizozo Creek .5 mi E of SR 406	9/20/2000	X	X		X	X			X		
4500	Carrizozo Creek @ SR 406	8/15/1939		X		X		X		X		
4500	Carrizozo Creek @ SR 406	8/16/1939				X						
4520	Carrizozo Creek N of Atencio	4/1/1986	X	X		X		X		X		
4800	Carrizozo Creek 6 mi N of Atencio	4/1/1986		X						X		
4300	Dry Cimarron River .5 km upstream NM/OK border	8/15/1939	X	X	X	X		X	X	X		X
4300	Dry Cimarron River .5 km upstream NM/OK border	8/16/1980		X	X	X		X		X		
4300	Dry Cimarron River .5 km upstream NM/OK border	5/28/1949		X	X	X		X		X		
4300	Dry Cimarron River .5 km upstream NM/OK border	4/1/1986		X	X	X		X	X	X		
4300	Dry Cimarron River .5 km upstream NM/OK border	4/1/1961				X				X		
4300	Dry Cimarron River 2 mi upstream NM/OK border	6/25/1992	X	X	X	X	X	X	X	X		
4300	Dry Cimarron River 2 mi upstream NM/OK border	5/29/1975			X	X		X		X		X
4300	Dry Cimarron River 2 mi upstream NM/OK border	8/16/1939				X						
4300	Dry Cimarron River 2 mi upstream NM/OK border	8/16/1939						X				
4300	Dry Cimarron River 2 mi upstream NM/OK border	8/16/1939								X		
4300	Dry Cimarron River 2 mi upstream NM/OK border	8/16/1939		X								
4300	Dry Cimarron River 2 mi upstream NM/OK border	8/16/1980			X	X		X	X			
4300	Dry Cimarron River 2 mi upstream NM/OK border	8/16/1980								X		
4500	Dry Cimarron River 10 mi upstream NM/OK border	6/23/1968		X	X			X		X	X	
4500	Dry Cimarron River 10 mi upstream NM/OK border	12/8/1977	X	X	X	X		X	X	X	X	
4500	Dry Cimarron River 10 mi W of NM/OK border	4/2/1986				X				X	X	
4400	Dry Cimarron River 8 mi W of NM/OK border	9/20/2000	X	X		X				X	X	
4600	Dry Cimarron River 25 mi W of NM/OK border	8/15/1939	X	X						X	X	
4600	Dry Cimarron River 25 mi W of NM/OK border	8/15/1939		X								
4600	Dry Cimarron River 25 mi W of NM/OK border	4/2/1986	X	X			X			X	X	
4700	Dry Cimarron River 35 mi W of NM/OK border	8/15/1939								X		
4800	Dry Cimarron River 45 mi upstream NM/OK border S of Jesus Canyon	5/29/1975		X								
4800	Dry Cimarron River 45 mi upstream NM/OK border S of Jesus Canyon	12/8/1977			X						X	
4800	Dry Cimarron River 45 mi upstream NM/OK border S of Jesus Canyon	8/15/1939		X						X		
4800	Dry Cimarron River 45 mi upstream NM/OK border S of Jesus Canyon	4/2/1986	X	X						X	X	
4800	Dry Cimarron River 45 mi upstream NM/OK border S of Jesus Canyon	9/20/2000	X	X			X			X	X	
5000	Dry Cimarron River 2 mi downstream Long Canyon	4/2/1986		X						X	X	
5000	Dry Cimarron River at Long Canyon	9/17/1986	X	X						X	X	
5100	Long Canyon .5 mi upstream Dry Cimarron	9/17/1986	X	X						X		
5200	Long Canyon 5.5 mi upstream Dry Cimarron River	9/17/1986	X	X						X		
5300	Dry Cimarron River along SR 456, 5 mi S of Island Mesa	9/18/1986		X						X		
5500	Dry Cimarron River on SR 456 10 mi E of SR 551 intersection	6/23/1968		X						X	X	
5500	Dry Cimarron River on SR 456 10 mi E of SR 551 intersection	9/17/1986		X						X		
5600	Dry Cimarron River 1 mi downstream of Oak Creek	8/16/1980		X						X		

Attachment 3

Public Comments

In an April 2004 letter to Scott Hopkins (SWQB), Fred Like, who identified himself as someone who has "...fished the (Dry Cimarron) River all my life" says that "...this river would be better suited for Chanel Cat and Bass because the water gets too warm for trout."

Henry Brown, who says that he has lived and ranched near Long Canyon all of his life, in a February 2009 email to Heidi Henderson (SWQB) says that "Long Canyon needs to be classified as a warm water body, or at the very least cool water. During the summer the daily temperatures can exceed 100 °F for most of July and August." He goes on to say, "It seems in Long Canyon that the exceedences come from natural sources as no point source pollution is observed."

On a Public Comment Card completed in response to a February 2009 public meeting, Donald Berg, who has lived and ranched along the Dry Cimarron since 1969, says that "...the only portion capable of supporting cold water fish is a reach of about 3 miles in the Folsom Falls area." (This location is upstream from Segment 702). Similar comments were provided by Fred Daniel, who says the he has "...lived on this river all of my life." Brett Bannon makes the following statement: "Historically no salmonids were indigenous to the Dry Cimarron, and though they have been introduced by the NM Game and Fish, they do not reproduce. Green sunfish (*Lepomis cyanellus*) are found 5 miles west of and upriver from Folsom. I feel that there should be more emphasis on Warm Water Aquatic life and even more emphasis on the 'marginal' in Marginal Coldwater Aquatic life." Shari Morrow has similar comments: "I disagree that the classification for the water is cold. Trout are unable to propagate in (the) waters. Additionally the NM Game and Fish have trouble with the viability of trout they stock in the Dry Cimarron River especially in the summer months. Mainly because of the warm temperature of the water. The classification of the Dry Cimarron River needs a hard look and in my opinion would have a warm classification."

Again, Henry Brown, in response to an August 12, 2010 public meeting had the following comments: "After viewing your Folsom presentation, it is evident to me there is quite a bit of difference in the water temperature of the Dry Cimarron from the head waters on down to the Oklahoma border. I am somewhat familiar with the lower portion as I have lived in Long Canyon all my life. The lower portion of the Dry Cimarron is definitely intermittent as most of Long Canyon is. As one leaves Folsom and travels toward Oklahoma, two things become evident. The first is the altitude is decreasing and secondly the air temperature is increasing. While growing up we sometimes fished and swam in the 'river' near our home. We always enjoyed the cool water and the occasional 'mud catfish'."

Attachment 4

Air-Water Temperature Correlation

New Mexico Environment Department
Surface Water Quality Bureau
August 2011

Air-Water Temperature Correlation

New Mexico Environment Department
Surface Water Quality Bureau
August 2011

Summary

This document provides a tool for identifying appropriate stream classifications and attainable aquatic life use subcategories. The investigation described here demonstrates that, based on data for approximately 300 New Mexico streams, air temperature is highly correlated with stream water temperature and subsequently with the attainable aquatic life use subcategory.

The key results presented in this document are these, which are applicable unless there are significant groundwater inputs or microclimate effects:

(1) maximum weekly average (water) temperature is equal to July average air temperature; and
(2) attainable aquatic life use subcategories can be related to July average air temperature, as follows:

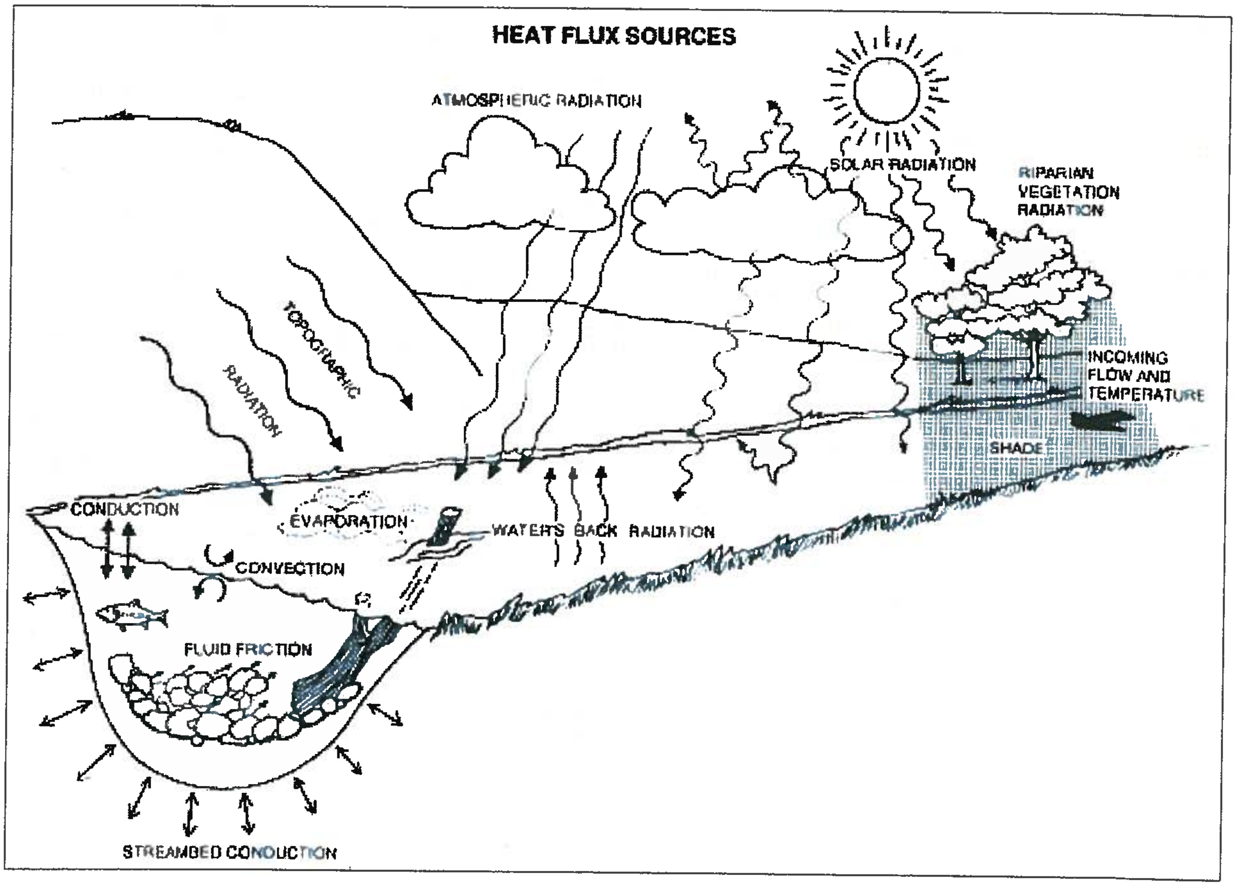
- high quality and coldwater uses may be attainable if July average air temperature is ≤18°C;
- marginal coldwater and coolwater uses may be attainable if July average air temperature is ≤23°C;
- uses more restrictive than warmwater are generally not attainable if July average air temperature is >23°C.

Introduction

Temperature has been identified as a leading cause of impairment in rivers and streams in New Mexico (NMED/SWQB 2009). However, the Surface Water Quality Bureau (SWQB) suspects that many of these waters are misclassified; that is, the designated aquatic life use or associated criteria cannot be attained because of naturally limiting conditions.

In the absence of significant groundwater input, stream water temperature is the result of the relationship of eight heat flux components: convection, conduction, fluid friction, evaporation, water back radiation, atmospheric (long wave) radiation, vegetative and topographic (long wave) radiation and solar (short wave) radiation, as illustrated in following figure from the SSTEMP water temperature model (Bartholow, 2002).

Figure 1



Five of the components (evaporation, water back radiation, atmospheric radiation, solar radiation and vegetative-topographic radiation) generally account for more than 90% of the stream heat flux. The significant positive heat fluxes are atmospheric and vegetative-topographic long wave radiation, and short-wave solar radiation.

With the exception of solar radiation, the heat flux components cannot be measured directly, but a number of related factors (and solar radiation) can be. These factors include:

Meteorological Factors

- air temperature
- solar radiation
- relative humidity
- wind speed
- possible sun
- ground temperature

Water or Streamcourse Factors

- inflow temperature
- accretion (groundwater inflow) temperature
- segment inflow (water flow at the top of the segment)
- segment outflow (water flow at the bottom of the segment)
- thermal gradient

Geographical Factors

- latitude
- segment length
- upstream elevation
- downstream elevation

Insolation Factors

- shading
- width-to-depth ratio

Air temperature is highly correlated with the significant positive heat flux components including solar radiation, and consequently with stream water temperature. The correlation is supported by the SSTEMP water temperature model documentation, which asserts: "Air temperature will usually be the single most important factor in determining mean daily water temperature."

The factors of relative humidity and wind speed are not directly associated with positive heat flux, although they have some influence on water temperature. The remaining meteorological and geographical factors have less influence on water temperature. None of the meteorological or geographical factors are amenable to human intervention.

The water or streamcourse factors are inflow temperature, groundwater inflow, stream segment inflow and outflow, and thermal gradient. With few exceptions, the inflow temperature is correlated to meteorological factors, chiefly air temperature. Although most New Mexico streams are shallow and are not "gaining streams" (not fed by groundwater) for most of their length, there are specific instances where groundwater inflow influences water temperature. Stream flow may influence water temperature, although it may not be amenable to modification. The insolation factors of shading and width-to-depth ratio have some influence on water temperature and are amenable to human intervention through stream restoration activities.

Correlation between Air Temperature and Water Temperature

The SWQB has developed a statewide correlation between July average air temperature and MWAT water temperature (MWAT - maximum weekly average temperature). The MWAT is defined as the seven-day mean of consecutive daily mean temperatures, where daily means are calculated from multiple, equally spaced values per day (Todd et al., 2008). Water quality criteria documents such as EPA (1972) recommend aquatic life temperature limits for prolonged exposure based on the MWAT. Chronic water temperature criteria based on the MWAT have recently been developed in Colorado (Todd et al., 2008).

The analysis provided here verifies a strong correlation between weekly and monthly averages of stream and air temperature. The relationship can be used to estimate the naturally attainable water temperature at any location in the state, absent site-specific mitigating conditions.

Water Temperature Data

Water temperatures were obtained from SWQB water thermograph data. Since 1999, SWQB has deployed long-term temperature data recorders (thermographs) at approximately 300 monitoring stations on New Mexico streams. During the summer season of June through August the thermographs record hourly temperatures, providing approximately 3,000 data points at each station. We reduced the data to summary statistics: the reference date (date of the first maximum temperature); the maximum temperature; the maximum weekly average temperature (MWAT); the 4-hour maximum temperature that occurs for 3 consecutive days (4T3); and the 6-hour maximum temperature that occurs for 3 consecutive days (6T3).

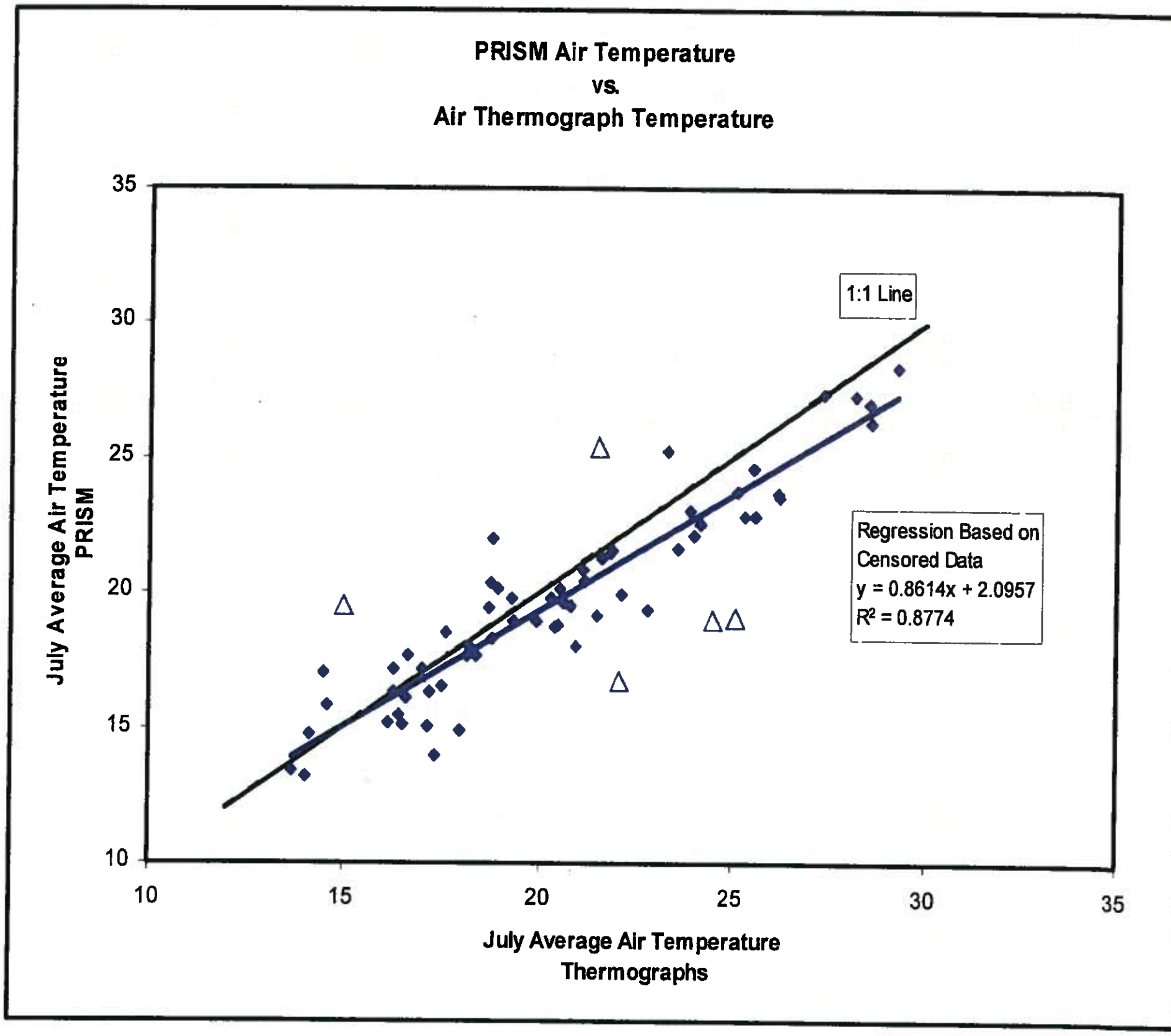
Air Temperature Data

Air temperatures were obtained from two sources: a publically available temperature model known as PRISM (Parameter-elevation Regressions on Independent Slopes Model) and SWQB air thermographs. PRISM, available at http://www.prism.oregonstate.edu/, provides gridded data that can be used to find representative July temperatures for any location in the United States. PRISM can be used to provide July average temperatures that can be associated with any SWQB water monitoring location. The SWQB co-deployed ambient air thermographs at approximately 70 water thermograph stations. Data provided by these thermographs was also used to calculate July average air temperatures.

PRISM Data Evaluation

Because the PRISM data is potentially more useful than the limited number of SWQB air thermographs, we evaluated the suitability of PRISM data by comparing the SWQB air thermograph data to the PRISM data. The comparison is shown in Figure 2.

Figure 2



The figure shows July average PRISM air temperatures plotted against July average temperatures measured using SWQB air thermographs. If the PRISM model correlated exactly with the air thermographs, the PRISM data would plot on the 1:1 line. The PRISM data may not plot precisely on the line for a number of reasons such as microclimate effects and imprecision of the PRISM model. To adjust for some of this variation, five data points where the thermograph and PRISM values were more than 3.8°C different were not used to develop the regression line. The points that were not used are plotted as triangles in the figure. The cutoff of 3.8°C was chosen because it is two standard deviations from the mean difference between the two datasets.

The regression indicates strong correlation and a slope of nearly 1. Based on this evaluation, we concluded that the PRISM dataset was suitable for use in providing July average temperatures at SWQB water monitoring locations.

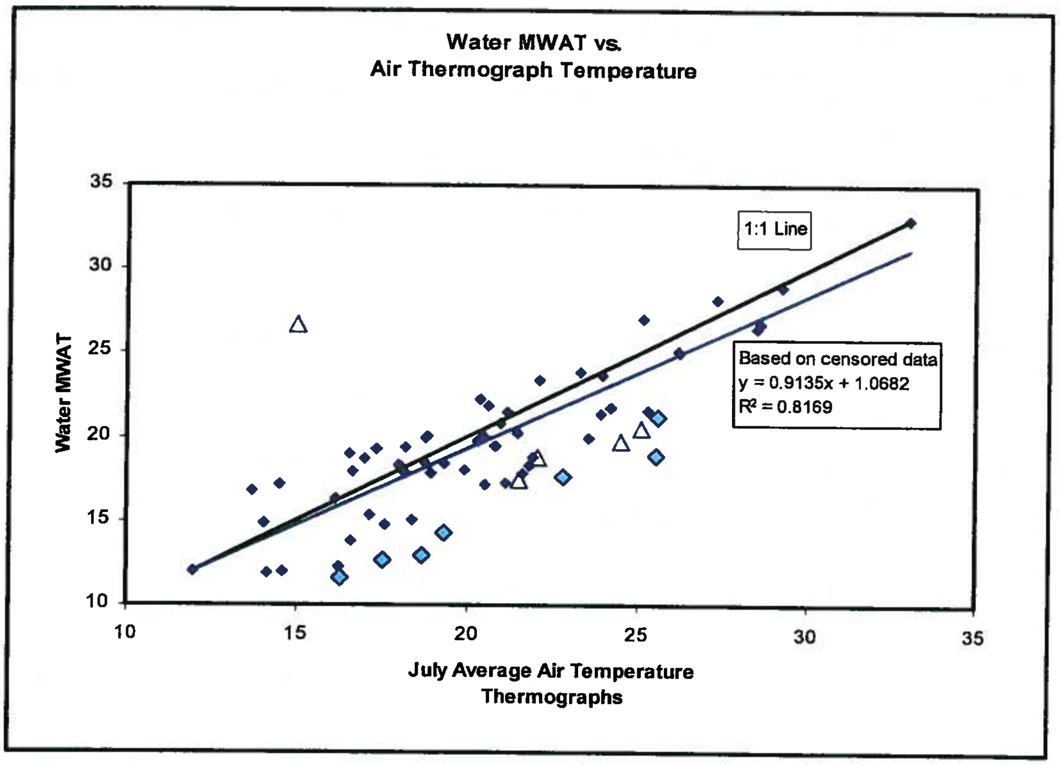
Outlier Analysis

Although other investigators have reported an almost 1:1 relationship between weekly average stream temperature and monthly average air temperature (Morrill et al. 2005), there are a number of reasons why the SWQB dataset may not correlate precisely with the July average air temperatures. These reasons include local conditions that cause the water temperature to be unusually high or low, unrepresentative thermograph locations, inconsistent periods of record and other causes.

To develop a basis for removing data points not well-correlated with July air temperature, particularly where the water temperature is influenced by groundwater, we considered the locations where we had both air and water thermograph data. Based on visual examination of the thermographs, it appeared that at locations where the air – water difference was greater than 4°C, the temperatures were either outliers, influenced by microclimate effects or moderated by groundwater.

To test this, we plotted air thermograph and water MWAT data (Figure 3). Locations identified as outliers in the *PRISM Data Evaluation* (Figure 2) are shown as triangles. Of the five points identified in the *PRISM Data Evaluation*, four also have an air-water difference greater than 4°C. One (15.00°C air, 26.62°C water) appears to be an outlier due to unusually low air thermograph readings, with an air – water difference of negative 11.6°C. The unshaded triangle, identified in the *PRISM Data Evaluation*, had a difference of 3.3°C which is less than the 4-degree cutoff.

Figure 3



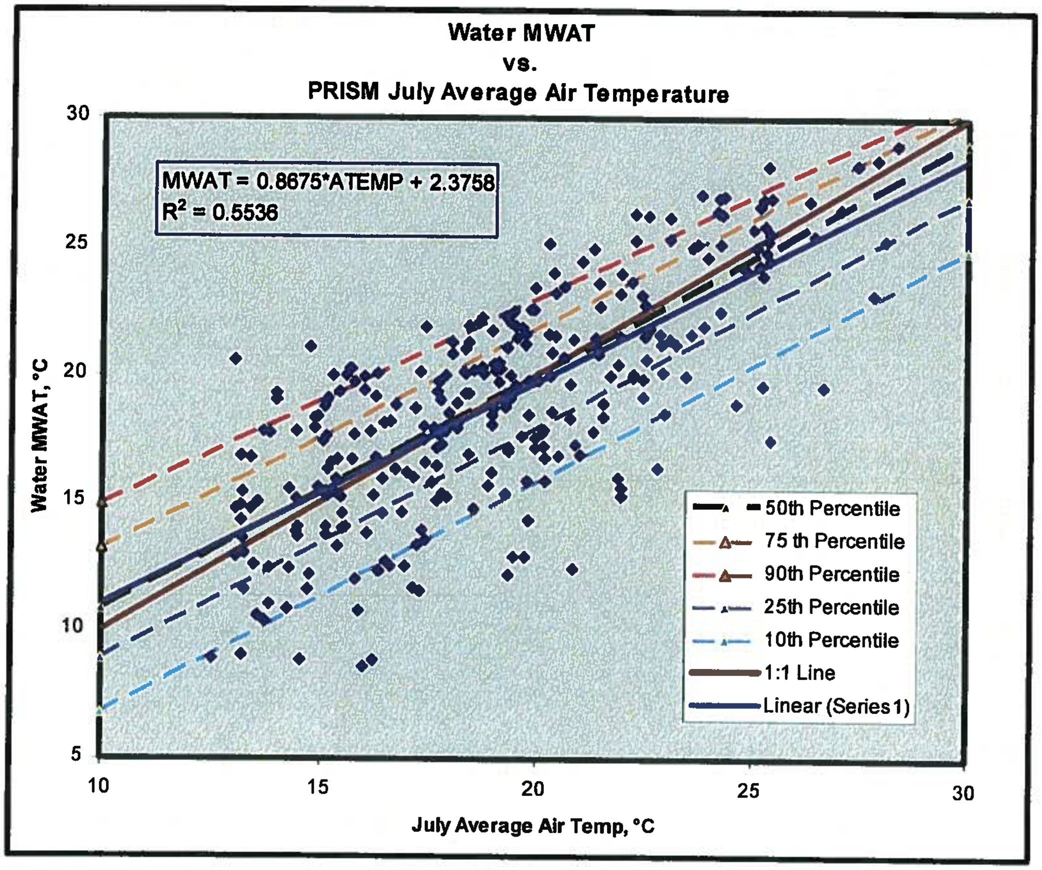
We identified seven additional points (the larger shaded diamonds) based on a positive air – water difference greater than 4°C. At five of the locations, the daily water temperature variation was low (a reference date diel water temperature difference less than 6°C), indicating groundwater influence. Two had a diel difference greater than 12°C. For these, however, the thermograph temperature was about 3°C greater than predicted by PRISM. If the PRISM temperature had been used these points would have been within the 4°C cutoff and would not be shown as shaded diamonds. All seven points, as well as four of those identified by the *PRISM Data Evaluation,* plot in the lower range of the relationship.

Based on this evaluation, we concluded that a July average air – water MWAT difference of 4°C was a reasonable value for use in removing data from locations significantly influenced by groundwater or microclimate effects.

Statewide Correlation

We compared thermograph data from 293 monitoring locations to July average air temperatures from PRISM and plotted the results in Figure 4. No data points were removed. The figure includes the linear least squares regression, the 1:1 line and percentile regression lines.

Figure 4



Regression Coefficients

	m	b
10th percentile	0.9033	-2.2126
25th percentile	0.9015	-0.1133
50th percentile	0.9097	1.7368
75th percentile	0.8571	4.6514
90th percentile	0.8005	6.9644
Linear regression	0.8675	2.3758

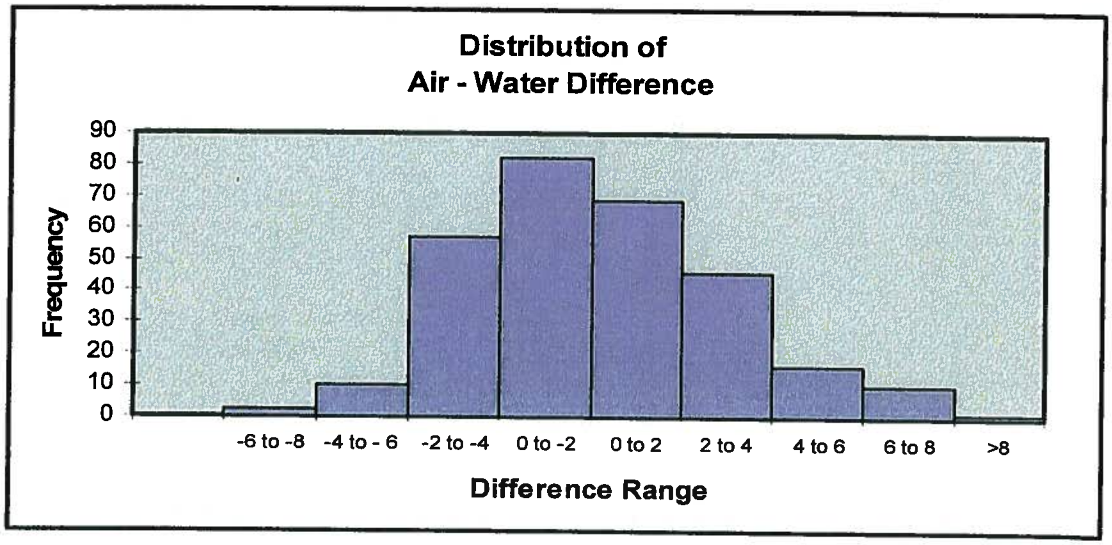
Representative results from the regressions are shown below:

Table 1

July Average Air Temp, °C	Water MWAT based on Regression, °C	Water MWAT 50th Percentile, °C	Water MWAT 25th Percentile, °C	Water MWAT 10th Percentile, °C
15	15.39	15.38	13.41	11.34
20	19.73	19.93	17.92	15.85
25	24.06	24.48	22.43	20.37

Consistent with the *Outlier Analysis*, we calculated the air – water difference. There are 27 locations with an air – water difference greater than 4°C, and 12 with a difference less than 4°C. The distribution is shown in Figure 5.

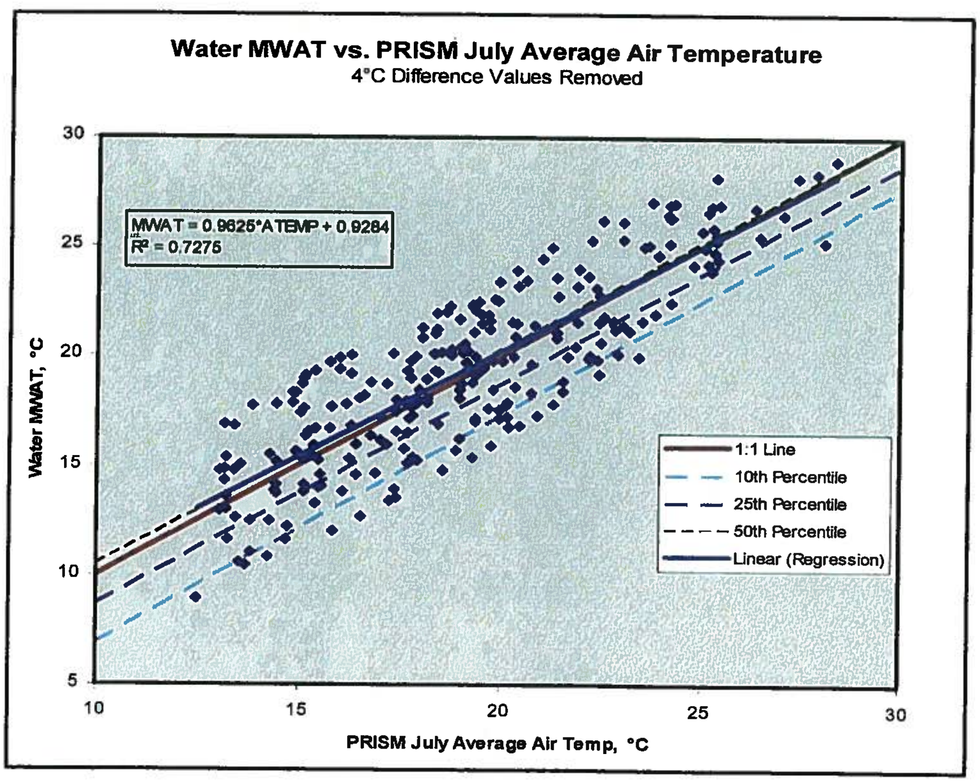
Figure 5



Difference	-6 to -8	-4 to - 6	-2 to -4	0 to -2	0 to 2	2 to 4	4 to 6	6 to 8	>8
Frequency	2	10	57	82	69	46	16	10	1

After removing points with a greater than 4°C difference, we plotted the remaining 254 data points as water MWAT vs. PRISM July average air temperature in Figure 6.

Figure 6



Regression Coefficients

	m	b
10^{th} percentile	1.0353	-3.4280
25^{th} percentile	1.0000	-1.3400
50^{th} percentile	0.9768	0.6900
Linear regression	0.9625	0.9284

Representative results from the regressions are shown below:

Table 2

July Average Air Temp, °C	Water MWAT based on Regression 4°C Δ Removed, °C	Water MWAT 50^{th} Percentile, 4°C Δ Removed, °C	Water MWAT 25^{th} Percentile, 4°C Δ Removed, °C	Water MWAT 10^{th} Percentile, 4°C Δ Removed, °C
15	15.37	15.34	13.66	12.10
20	20.18	20.23	18.66	17.28
25	24.99	25.11	23.66	22.45

Tables 1 and 2 show that in the 15 to 25°C air temperature range, both the 4°C Δ removed and all data regressions predict a temperature within 1°C of the 1:1 line (MWAT = July Average Air Temperature).

Reference Site Evaluation

A list of New Mexico locations considered to be reference sites has recently been developed. *Sediment in New Mexico Streams: Existing Conditions and Potential Benchmarks* (Jessup et al. 2010) includes a file, AppF_NM Datasets2.xlsx, that lists 45 New Mexico locations considered to be reference sites based on characteristics other than temperature. The 45 locations are listed in the file *Bedded Sediment Reference Sites*. SWQB has collected thermograph data at only 13 of these sites. The sites are listed in Table 3.

At the first three sites (Rito Resumidero blw Resumidero Spring, Rio Puerco de Chama @ FR 103 and Bear blw Dorsey Spring), the July average air temperature (PRISM) minus the water MWAT was more than 4°C, and the thermographs did not exhibit the usual diel variation. As with the previous statewide analysis, these characteristics suggest that groundwater inflow are moderating the air temperature influence, so these sites were not used for this analysis.

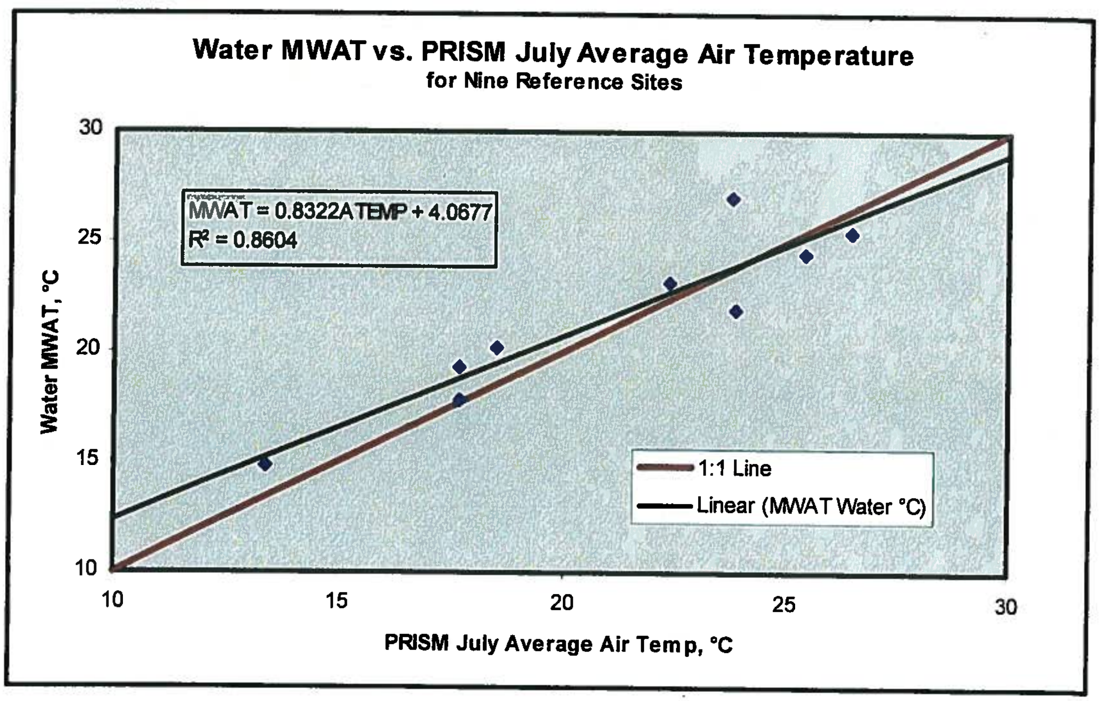
The Dry Cimarron River @ Jesus Mesa site had an air – water difference slightly greater than 4°C, and the air temperature was lower than the water temperature. Although the water temperature exhibited diel variation, the difference between the daily maximum and minimum was less than expected, indicating that factors other than air temperature may be influencing water temperature. The stream at this site is surrounded by exposed bedrock that may elevate the water temperature. Because of this potential microclimate effect, and in order to be consistent with the 4°C cutoff, the Jesus Mesa site was also not used for the reference site correlation.

Table 3

STORET ID	Station	July Average Air Temp (PRISM) °C	MWAT Water °C	Air-Water Difference °C
29RResum001.9	~~Rito Resumidero blw Resumidero Spg~~	~~16.26~~	~~8.87~~	7.39
78BearCr027.0	~~Bear blw Dorsey Spg~~	~~23.45~~	~~18.01~~	5.44
29RPuerc037.5	~~Rio Puerco de Chama @ FR 103~~	~~16.97~~	~~12.54~~	4.43
77Turkey001.8	Turkey Creek	23.87	21.92	1.95
78GilaRi025.5	Gila blw Blue	26.44	25.44	0.99
78GilaRi069.2	Gila blw Mangas	25.41	24.45	0.96
28RGRanc013.1	RG del Rancho @ Talpa-1305269	17.68	17.82	-0.14
77EFkGil000.2	E Fk Gila	22.40	23.14	-0.74
28RCosti032.5	Costilla abv Comanche (blw impoundment)	13.41	14.79	-1.39
05MPonil000.1	M Ponil abv S Ponil	17.70	19.30	-1.60
05NPonil000.1	N Ponil abv S Ponil	18.53	20.19	-1.66
10UteCre104.3	Ute nr Bueyeros	23.79	27.04	-3.26
02DryCim047.2	~~Dry Cim @ Jesus Mesa~~	~~22.27~~	~~26.28~~	-4.02

Figure 7 is a graph of the data from the remaining nine sites.

Figure 7



Representative results are shown below:

Table 4

July Average Air Temp, °C	Water MWAT based on Regression using Reference Data °C
15	16.55
20	20.71
25	24.87

At 15 and 20°C, the predicted MWAT using the reference data is 0.7 to 1.6°C *greater* than the 1:1 line. At 25°C, the reference data regression predicts a water temperature within 0.2°C of the 1:1 line. Despite the limited number of data points, it is clear that the reference sites fall along the same 1:1 air-water temperature relationship found for all sites.

MWAT Prediction Equation

Representative results from the previously discussed regressions are shown below:

Table 5

July Average Air Temp, °C	Water MWAT based on Regression 4°C Δ Removed, °C	Water MWAT based on Regression using All Data, °C	Water MWAT based on Regression using Reference Data °C	Water MWAT 25th Percentile, All Data °C
15	15.37	15.39	16.55	13.41
20	20.18	19.73	20.71	17.92
25	24.99	24.06	24.87	22.43

In the15 to 25°C air temperature range, the 4°C Δ removed and all data regressions predict a temperature within 1°C of the 1:1 line (MWAT = July Average Air Temperature). The reference data regression predicts a water MWAT slightly *greater* than the 1:1 line at 15 and 20°C.

The 1:1 relationship holds for the regression based on all data and also holds when sites expected to be influenced by groundwater are removed. Because of this, and significantly because it also is consistent with the regression based on reference sites, the 1:1 relationship represents the *attainable* water MWAT for locations where water temperature is controlled by ambient air temperature.

We conclude that for New Mexico streams not significantly influenced by groundwater, the *attainable* water MWAT equals the July average air temperature from the PRISM dataset. That is,

MWAT = ATEMP (PRISM July Average Air Temperature)

The regressions based on all of the data, on data without locations suspected of being groundwater dominated, and on reference sites all follow the 1:1 line. Based on this, the 1:1 line appears to represent the physical relationship that exists where the attainable water temperature is correlated to air temperature.

Points that plot below the 1:1 line may represent sites where the water temperature is somewhat influenced by groundwater, or may result from microclimate effects or data collection problems including unrepresentative thermograph locations or inconsistent periods of record. For these reasons, the 25th percentile does not appear to be useful in estimating the naturally attainable water temperature unless there is specific local information to suggest otherwise.

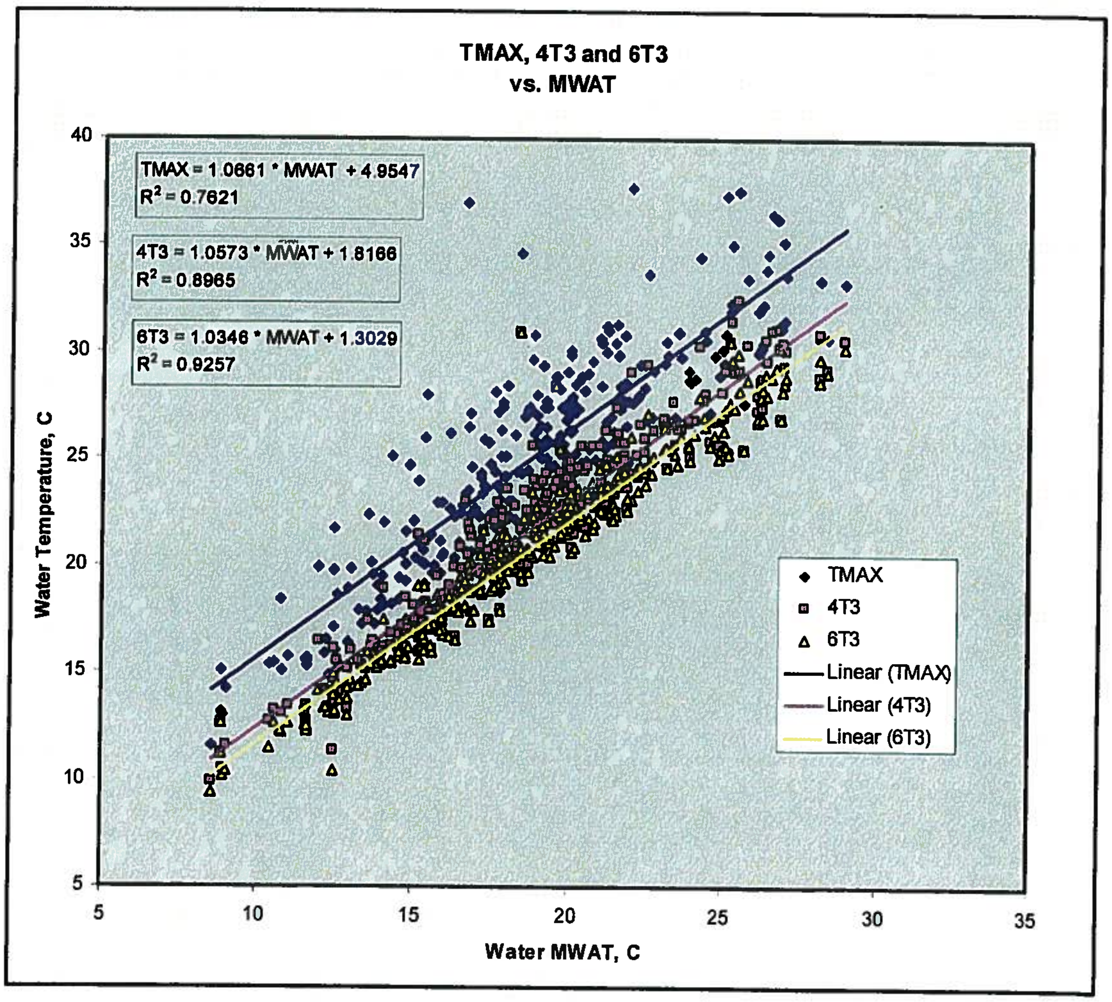
Relationship of MWAT and Air Temperature to NM Criteria

New Mexico aquatic life temperature criteria are not based on the MWAT. As reflected in 2010 amendments to New Mexico's *Standards for Interstate and Intrastate Waters* (20.6.4 NMAC), the criteria are based on maximum, 4T3 and 6T3 temperatures defined as follows: maximum temperature means the instantaneous temperature not to be exceeded at any time; 4T3 temperature means the temperature not to be exceeded for four or more consecutive hours in a 24-hour period on more than three consecutive days; and 6T3 temperature is means the temperature not to be exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days.

The air-water temperature correlation was developed to predict water MWAT values based on July average temperatures. Because New Mexico criteria are not based on MWAT, predicted MWATs need to be related to New Mexico criteria statistics.

To do this, the dataset that includes the statistics from 293 sites was used to develop a relationship between maximum (TMAX), 4T3 and 6T3 temperature and MWAT. Four TMAX values that were greater than 38°C (100 °F) were removed before doing the correlation, because water temperatures greater than 100°F are usually the result of the thermograph being out of the water. Correlations are in Figure 8.

Figure 8



The air – water temperature correlation indicated that MWAT = ATEMP (PRISM July Average Air Temp). Substituting ATEMP for MWAT yields the following:

6T3 = 1.03 * ATEMP + 1.30
4T3 = 1.06 * ATEMP + 1.82
TMAX = 1.07 * ATEMP + 4.95

Based on these relationships, if the water temperature is not reduced by groundwater input or microclimate effects, the designated use based on water temperature is related to July average air temperature as follows:

- If the air temperature is ≤18, high quality coldwater or coldwater may be attainable;
- If the air temperature is between 18 and 23, marginal coldwater or coolwater may be attainable;
- If the air temperature is >23, uses more restrictive than warmwater are generally not attainable.

Table 7

Temp, °C	High Quality Coldwater	Coldwater	Marginal Coldwater	Coolwater	Warmwater	Marginal Warmwater
Maximum Criterion	23	24	29	29	32.2	32.2
4T3 Criterion	20	-	-	-	-	-
6T3 Criterion	-	20	25	-	-	-
ATEMP (July Average Air Temperature)	≤17	≤18	≤23	≤23	>23	>23
Water Stats @ ATEMP	TMAX 23.1 4T3 19.8	TMAX 24.2 6T3 19.8	TMAX 29.6 6T3 25.0	TMAX 29.6		

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