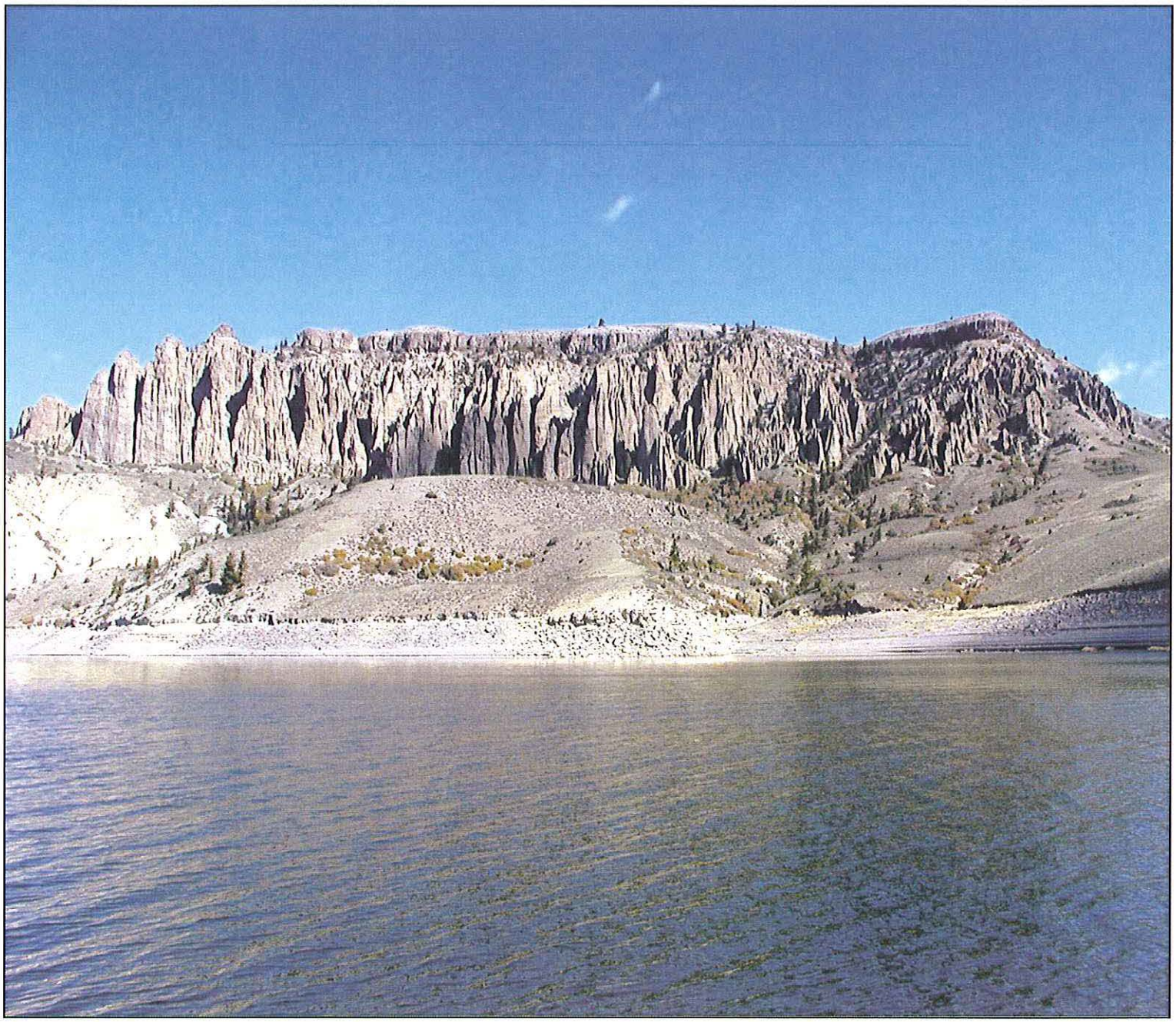
National Park Service
U.S. Department of the Interior

Curecanti
National Recreation Area

08-06

Outstanding Waters Designation; Data Collection & Analysis of Water Quality Parameters

Final Report to Western National Parks Association



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Approved: _____

Constance Rudd
Superintendent

Introduction:

Curecanti National Recreation Area is located near the bottom of the 3900 mi^2 Upper Gunnison Basin watershed. This area encompasses the Aspinall Unit of the Colorado River Storage Project (Blue Mesa, Morrow Point, and Crystal Reservoirs), which provides a substantial natural and recreational resource for the enjoyment of over 1 million local and national visitors annually. These reservoirs also provide a significant economic source for the surrounding communities. In 2003, visitors to Curecanti spent $35.51 million dollars in the local economy which supported a total of $14.89 million in personal income and 853 jobs.

High quality water is very important to residents of the Gunnison Valley. A 2001 long-range planning survey concluded that out of over 100 options, water quality is the 3rd most important natural feature to visitors and residents of Gunnison County. Colorado, however, is the 7th fastest growing state in the United States and the Gunnison basin as a whole is experiencing an explosive increase in both permanent population and seasonal visitation. Currently, annexation proposals for both Mount Crested Butte and Gunnison, both upstream of Curecanti could see resident, municipal populations double and increase by one-third, respectively. This increase in basin-wide population has the real potential to overburden existing municipal treatment plants, add more private treatment facilities to developed areas, as well as add to the number of sanitary septic systems with close proximity to the rivers and streams which are tributary to Curecanti .

In light of this imminent threat to the significant natural and economic aquatic resources offered by the reservoirs of Curecanti, the National Park Service is embarking on an intensive investigation to consider the appropriateness of a an Outstanding Waters, anti-degradation designation. National Park Service guidance states that, "The National Park Service will seek state support in helping to protect and enhance the quality of park water through special use classifications, such as outstanding resource waters." This designation affords more protection to the water body than state-wide standards, based on the actual, baseline existing quality of water as defined by state statute. Colorado has actively implemented Outstanding Waters designations in most Wilderness areas in the state, including Rocky Mountain National Park.

The National Park Service has collected a minimal schedule of water quality constituents since the 1980's as part of a baseline water quality monitoring program. Based on limited data and types of constituents collected, Blue Mesa, Morrow Point, and Crystal Reservoirs have shown existing water quality that is better than ambient water quality standards and could be designated as Outstanding Waters. To support this designation the National Park Service needs to collect and provide high-quality data to support these goals and objectives.

Methods:

Water quality samples were collected from Blue Mesa, Morrow Point, and Crystal Reservoirs between October 2007 and September 2008. To obtain a comprehensive seasonal assessment of the existing quality of those waters, 7 reservoir sites (Appendix B) were sampled throughout the year to assess seasonal variations. Samples were collected and processed using rigorous techniques required as part of the USGS National Field Manual for the Collection of Water Quality (U.S. Geological Survey, variously dated).

The Outstanding Waters Designation is based on the results of the following water quality constituents (Nitrate, Dissolved Cadmium, Dissolved Copper, Dissolved Lead, Dissolved Manganese, Dissolved Selenium, Dissolved Silver, Dissolved Zinc, Dissolved Oxygen, E. coli). These constituents were analyzed in either the in-house NPS laboratory or by the USGS National Water Quality Laboratory. Quality assurance and quality control procedures were followed though sample collection, processing, and analysis including the use of blank and replicate samples (Maloney, T.J., ed., 2005) (U.S. Geological Survey, variously dated).

Data were analyzed for existing quality according to State requirements (Colorado Department of Public Health, 2007). "Existing Quality" is defined as a parameter-specific 85th or 15th percentile (or range between), or geometric mean of existing data. Appendix A contains graphs of these analysis compared to the regulatory Numeric or Table Value Standard.

Results:

Existing quality calculations (Appendix A) from each analyte clearly show that each reservoir of the Aspinall Unit has water quality which is far better than standards. Parameters such as dissolved oxygen, E coli, nitrate, and selenium have set numeric standards (solid blue line) which are consistent from site to site for the protection of aquatic life and human health. The graph of dissolved oxygen shows the values above the standard value of 6mg/L. In this case the parameter will be higher than the standard since higher oxygen levels are beneficial for aquatic life. Dissolved metals table value standards are dependent on the hardness of each water body, and therefore have more site-specific standards. Numeric values on each data point for both the standard and existing quality calculation show water quality that is sometimes 10 times better than standards.

Existing quality of sites on Blue Mesa, Morrow Point, and Crystal reservoirs unquestionably show water quality better than standards. In addition to this, no single lab value for any site or parameter exceeded the state standard.

Discussion:

The Gunnison Basin is a snowmelt dominated system with the majority of runoff occurring between mid-May and mid-June. The winter 2007 snowpack of the basin was 141% of average, and therefore yielded a very high run off. Even during this unique runoff event calculations of existing quality and the individual results did not exceed state standards.

These data, in addition to data collected from streams and rivers flowing into Curecanti and the Aspinall Unit, provide further insight to the overall stability of seasonal and annual water quality in the Gunnison Basin. In addition to the research waters being part of a National Park, the stability of the water quality of these water bodies is the basis for an Outstanding Waters designation. This designation would assure protection of the natural and recreational resource values offer by the streams, rivers, and reservoir of Curecanti.
This investigation provides another defensible argument for Outstanding Waters to be used during the next State regulatory rulemaking.

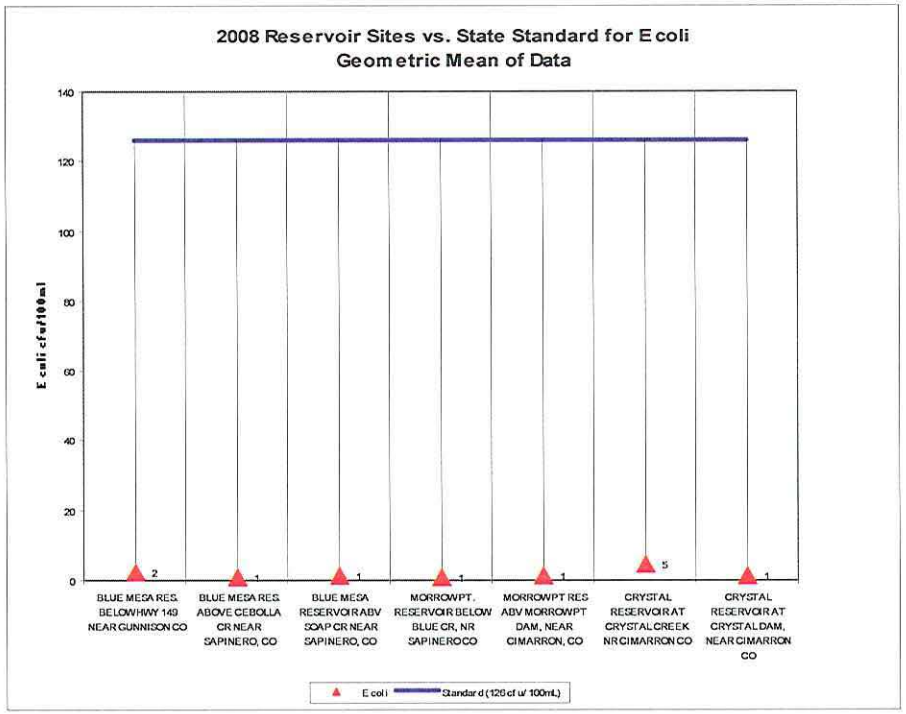
Literature Cited

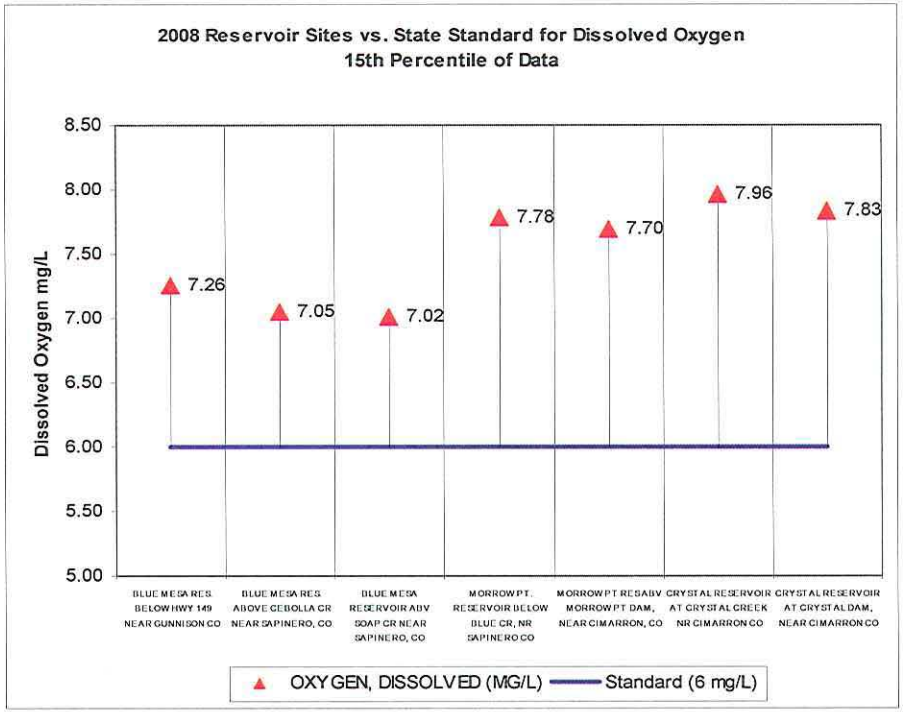
Colorado Department of Public Health and Environment. 2007. Regulation No. 31. The Basic Standards and Methodologies for Surface Water. (5 CCR 1002-31)

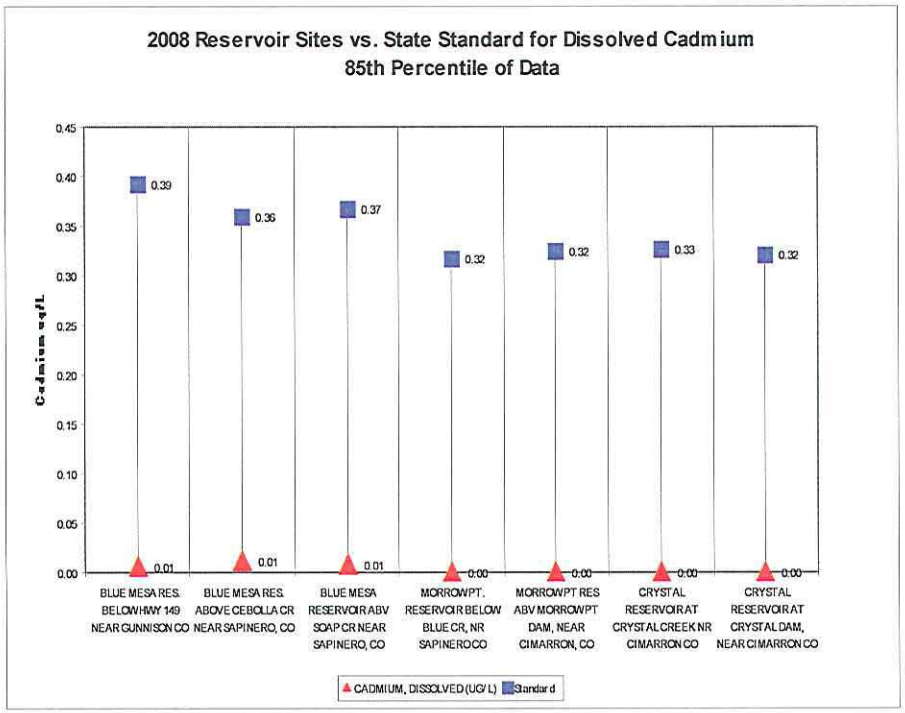
Maloney, T.J., ed., 2005, Quality management system, U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 2005-1263, version 1.3, 9 November 2005, chapters and appendixes variously paged.

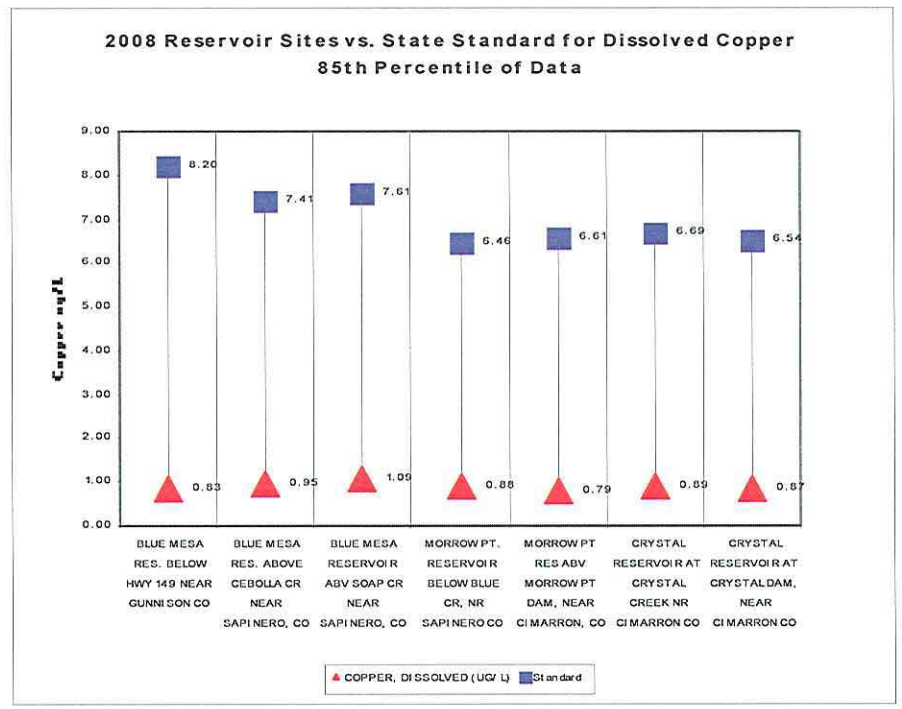
U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at http://pubs.water.usgs.gov/twri9A.

Appendix A:

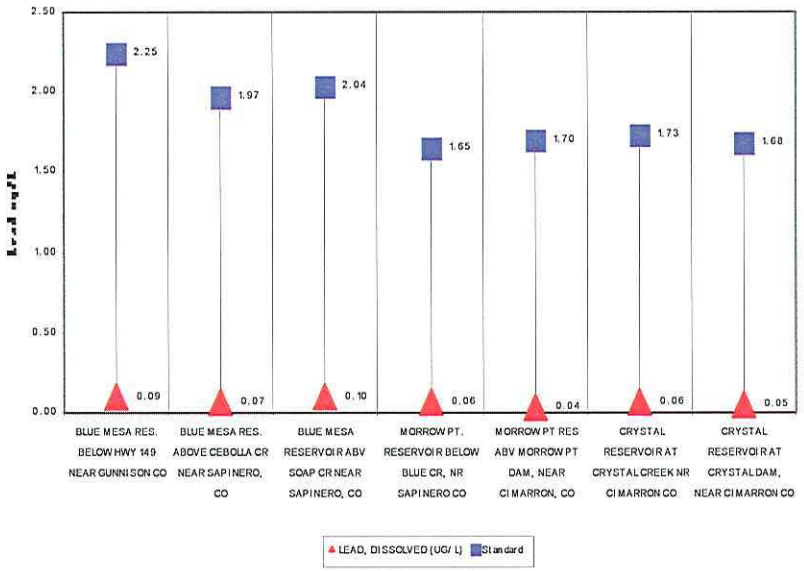

2008 Reservoir Sites vs. State Standard for E coli
Geometric Mean of Data
E coli cfu/100ml
140
120
100
80
60
40
20
0
2
1
1
1
1
5
1
BLUE MESA RES. BELOW HWY 149 NEAR GUNNISON CO
BLUE MESA RES. ABOVE CEBOLLA CR NEAR SAPINERO, CO
BLUE MESA RESERVOIR ABV SOAP CR NEAR SAPINERO, CO
MORROW PT. RESERVOIR BELOW BLUE CR, NR SAPINERO CO
MORROW PT RES ABV MORROW PT DAM, NEAR CIMARRON, CO
CRYSTAL RESERVOIR AT CRYSTAL CREEK NR CIMARRON CO
CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON CO
E coli
Standard (126 cfu/ 100mL)


2008 Reservoir Sites vs. State Standard for Dissolved Oxygen
15th Percentile of Data
Dissolved Oxygen mg/L
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
7.26
7.05
7.02
7.78
7.70
7.96
7.83
BLUE MESA RES. BELOW HWY 149 NEAR GUNNISON CO
BLUE MESA RES. ABOVE CEBOLLA CR NEAR SAPINERO, CO
BLUE MESA RESERVOIR ABV SOAP CR NEAR SAPINERO, CO
MORROW PT. RESERVOIR BELOW BLUE CR, NR SAPINERO CO
MORROW PT RES ABV MORROW PT DAM, NEAR CIMARRON, CO
CRYSTAL RESERVOIR AT CRYSTAL CREEK NR CIMARRON CO
CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON CO
OXYGEN, DISSOLVED (MG/L)
Standard (6 mg/L)

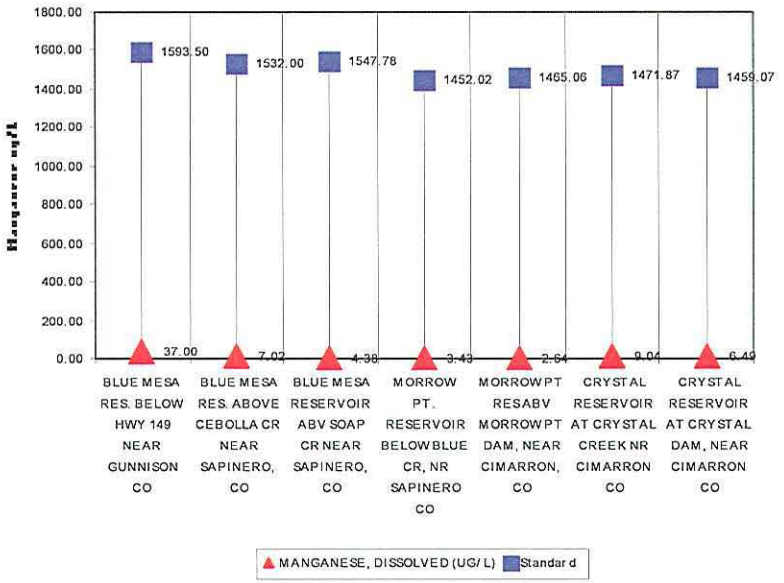

2008 Reservoir Sites vs. State Standard for Dissolved Cadmium
85th Percentile of Data
Cadmium ug/L
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.39
0.36
0.37
0.32
0.32
0.33
0.32
0.01
0.01
0.01
0.00
0.00
0.00
0.00
BLUE MESA RES. BELOW HWY 149 NEAR GUNNISON CO
BLUE MESA RES. ABOVE CEBOLLA CR NEAR SAPINERO, CO
BLUE MESA RESERVOIR ABV SOAP CR NEAR SAPINERO, CO
MORROW PT. RESERVOIR BELOW BLUE CR, NR SAPINERO CO
MORROW PT RES ABV MORROW PT DAM, NEAR CIMARRON, CO
CRYSTAL RESERVOIR AT CRYSTAL CREEK NR CIMARRON CO
CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON CO
CADMIUM, DISSOLVED (UG/L)
Standard


2008 Reservoir Sites vs. State Standard for Dissolved Copper
85th Percentile of Data
Copper ug/L
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8.20
7.41
7.61
6.46
6.61
6.69
6.54
0.83
0.95
1.09
0.88
0.79
0.89
0.87
BLUE MESA RES. BELOW HWY 149 NEAR GUNNISON CO
BLUE MESA RES. ABOVE CEBOLLA CR NEAR SAPINERO, CO
BLUE MESA RESERVOIR ABV SOAP CR NEAR SAPINERO, CO
MORROW PT. RESERVOIR BELOW BLUE CR, NR SAPINERO CO
MORROW PT RES ABV MORROW PT DAM, NEAR CIMARRON, CO
CRYSTAL RESERVOIR AT CRYSTAL CREEK NR CIMARRON CO
CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON CO
COPPER, DISSOLVED (UG/L)
Standard

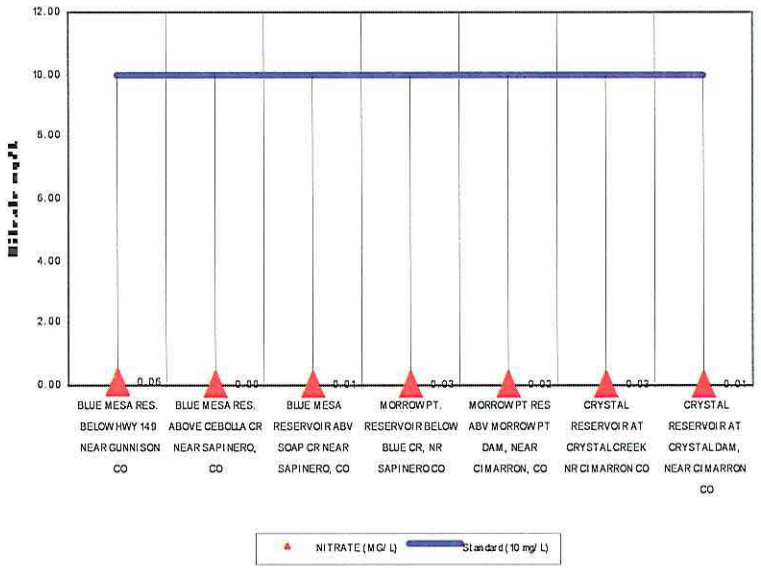
2008 Reservoir Sites vs. State Standard for Dissolved Lead
85th Percentile of Data



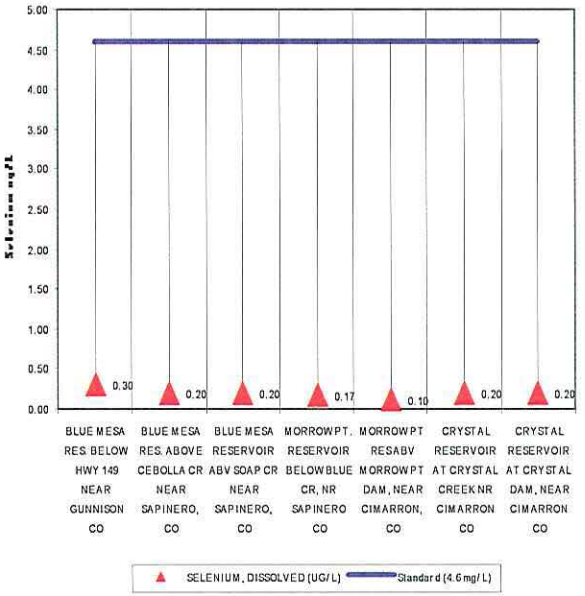
2008 Reservoir Sites vs. State Standard for Dissolved Manganese
85th Percentile of Data

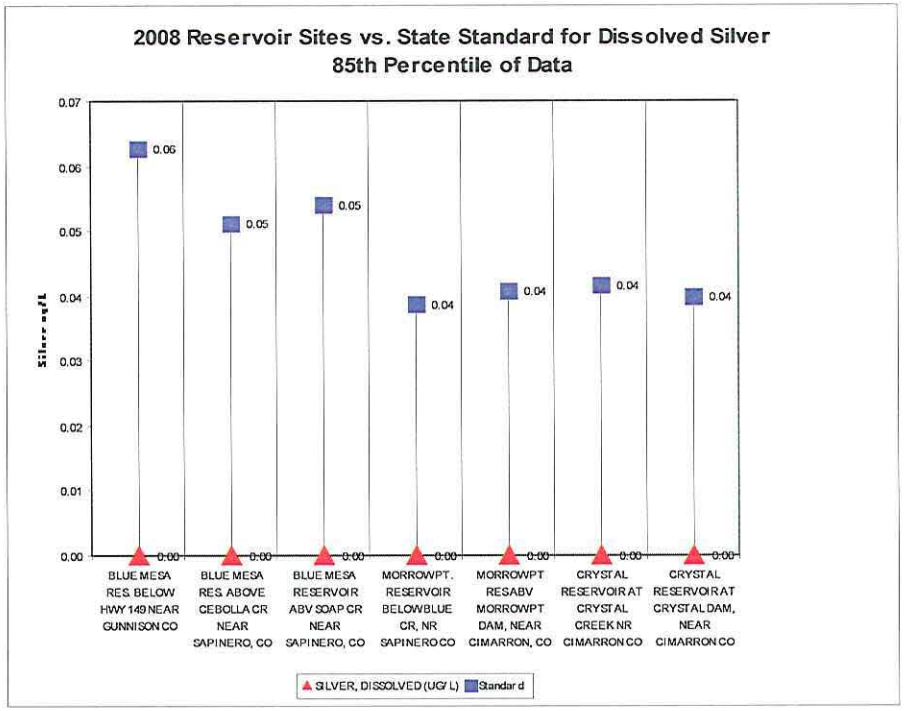


2008 Reservoir Sites vs. State Standard for Nitrate
85th Percentile of Data



2008 Reservoir Sites vs. State Standard for Dissolved Selenium
85th Percentile of Data




2008 Reservoir Sites vs. State Standard for Dissolved Silver
85th Percentile of Data
Silver ug/L
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.06
0.05
0.05
0.04
0.04
0.04
0.04
0.00
0.00
0.00
0.00
0.00
0.00
0.00
BLUE MESA RES. BELOW HWY 149 NEAR GUNNISON CO
BLUE MESA RES. ABOVE CEBOLLA CR NEAR SAPINERO, CO
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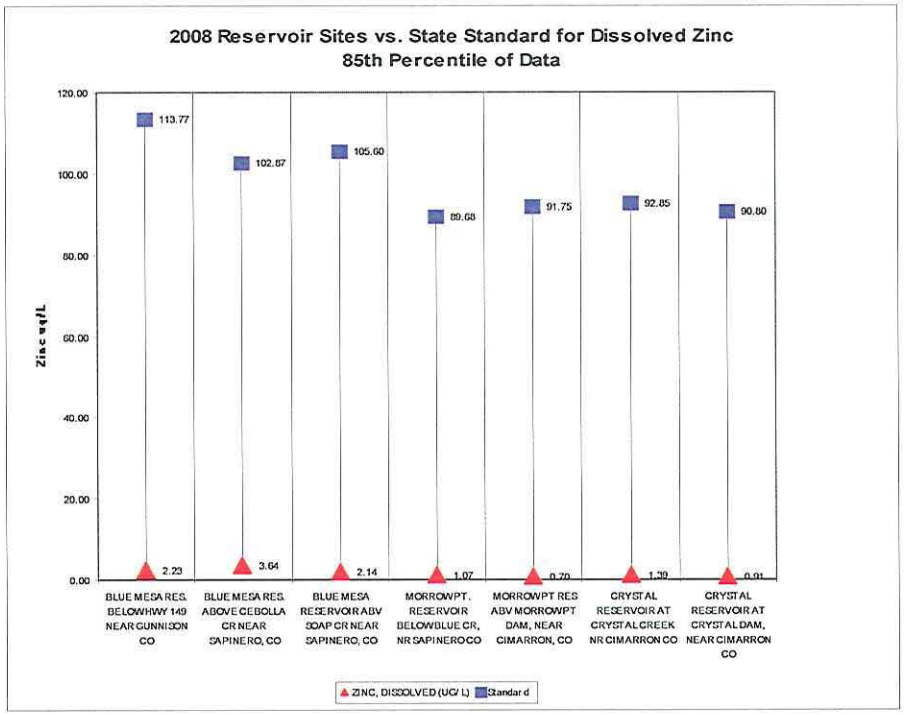
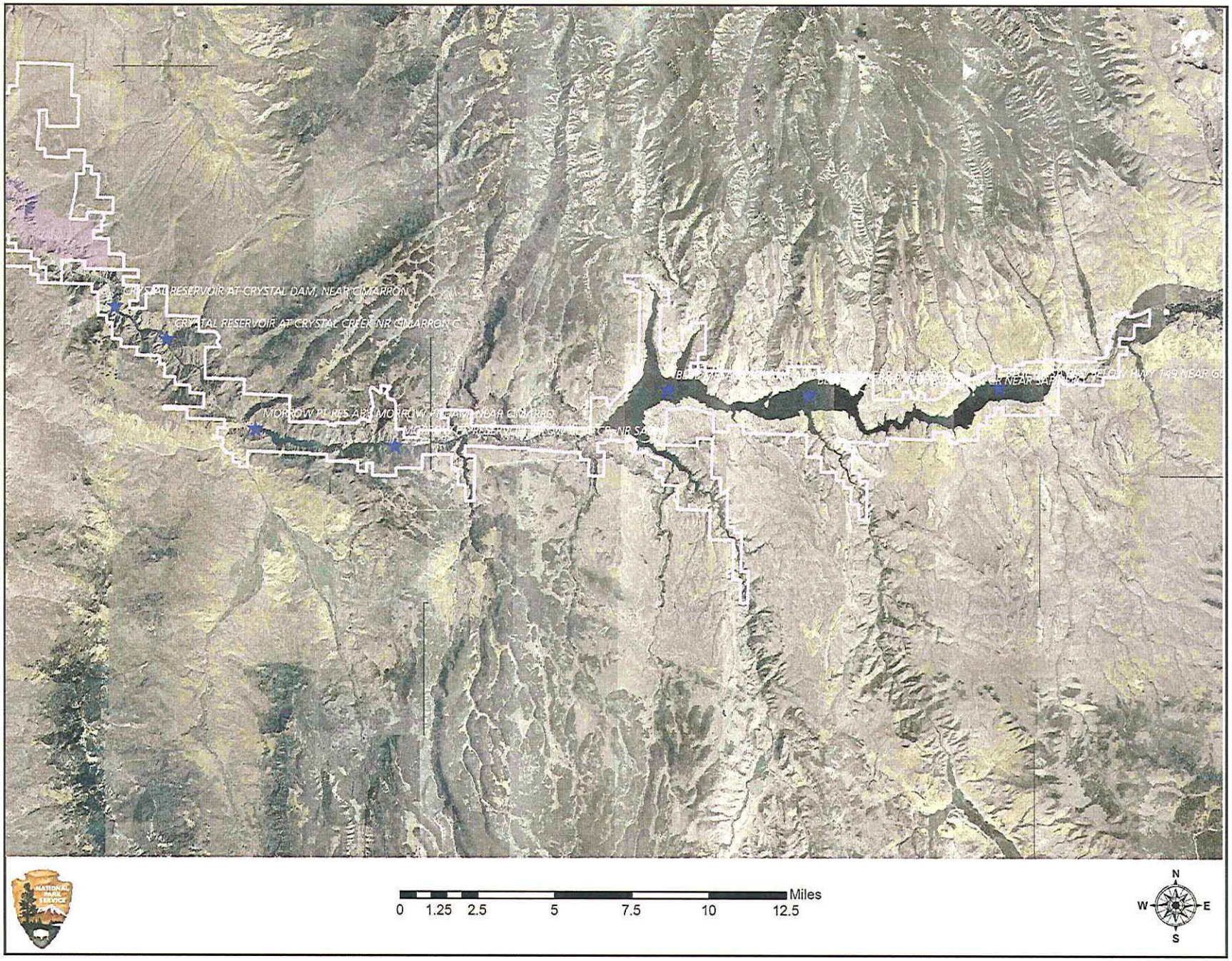
MORROWPT RESABV MORROWPT DAM, NEAR CIMARRON, CO
CRYSTAL RESERVOIR AT CRYSTAL CREEK NR CIMARRON CO
CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON CO
SILVER, DISSOLVED (UG/L)
Standard


2008 Reservoir Sites vs. State Standard for Dissolved Zinc
85th Percentile of Data
Zinc ug/L
120.00
100.00
80.00
60.00
40.00
20.00
0.00
113.77
102.67
105.60
89.68
91.75
92.85
90.80
2.23
3.64
2.14
1.07
0.70
1.39
0.91
BLUE MESA RES. BELOWHWY 149 NEAR GUNNISON CO
BLUE MESA RES. ABOVE CEBOLLA CR NEAR SAPINERO, CO
BLUE MESA RESERVOIR ABV SOAP CR NEAR SAPINERO, CO
MORROWPT. RESERVOIR BELOWBLUE CR, NR SAPINERO CO
MORROWPT RES ABV MORROWPT DAM, NEAR CIMARRON, CO
CRYSTAL RESERVOIR AT CRYSTAL CREEK NR CIMARRON CO
CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON CO
ZINC, DISSOLVED (UG/L)
Standard

Appendix B:


CRYSTAL RESERVOIR AT CRYSTAL DAM, NEAR CIMARRON
CRYSTAL RESERVOIR AT CRYSTAL CREEK, NR CIMARRON C
MORROW PT RES ABV MORROW, NEAR CIMARRON
Miles
0
1.25
2.5
5
7.5
10
12.5
N
W
E
S