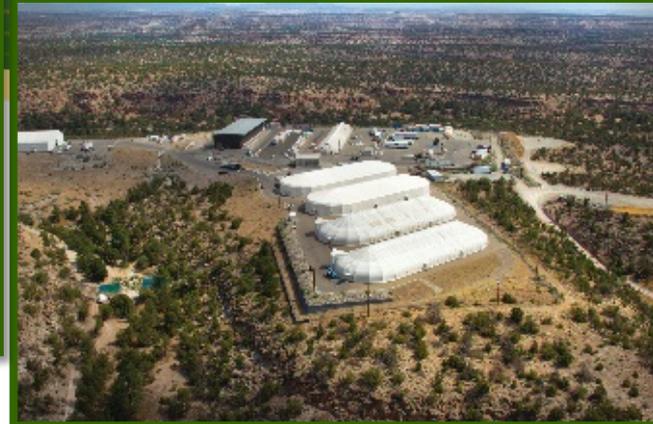
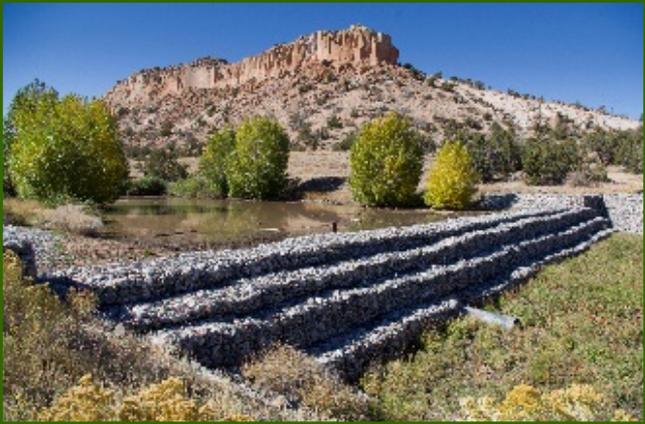




U.S. DEPARTMENT OF
ENERGY

OFFICE OF
**ENVIRONMENTAL
MANAGEMENT**



Site-Specific Water Quality Criteria Development Pajarito Plateau

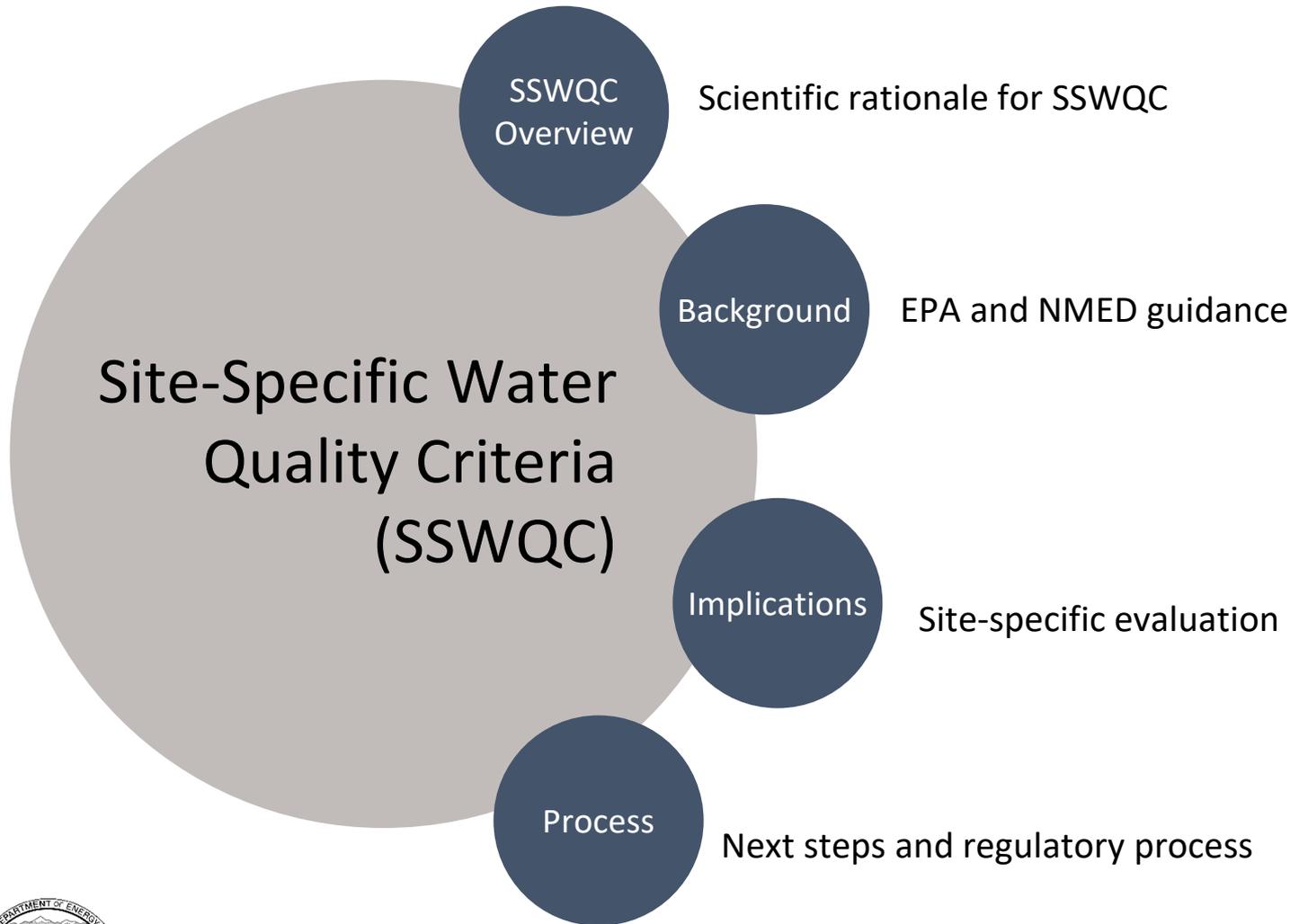
Barry Fulton
Principal Scientist
Windward Environmental

Individual Permit Public Meeting
December 16, 2020



ENVIRONMENTAL MANAGEMENT
SAFETY ♦ PERFORMANCE ♦ CLEANUP ♦ CLOSURE





Site-Specific Water Quality Criteria (SSWQC)

SSWQC
Overview

Scientific rationale for SSWQC

Background

EPA and NMED guidance

Implications

Site-specific evaluation

Process

Next steps and regulatory process





History of U.S. EPA National Recommended Aquatic Life Criteria for Copper

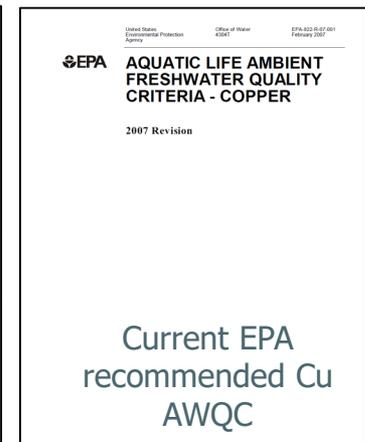
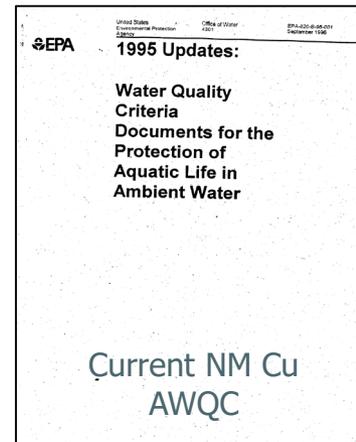
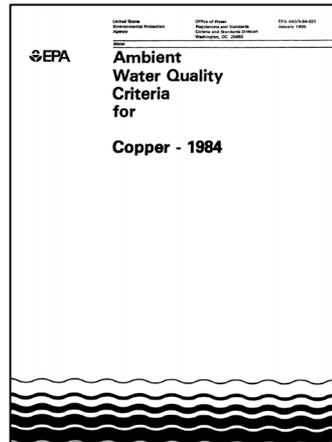
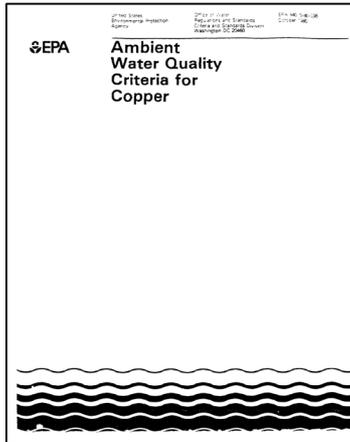
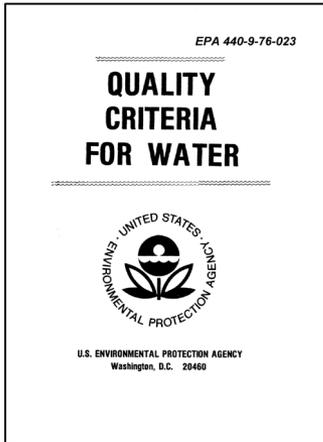
1976 "Red Book"

1980

1984

1995

2007 "Cu BLM"

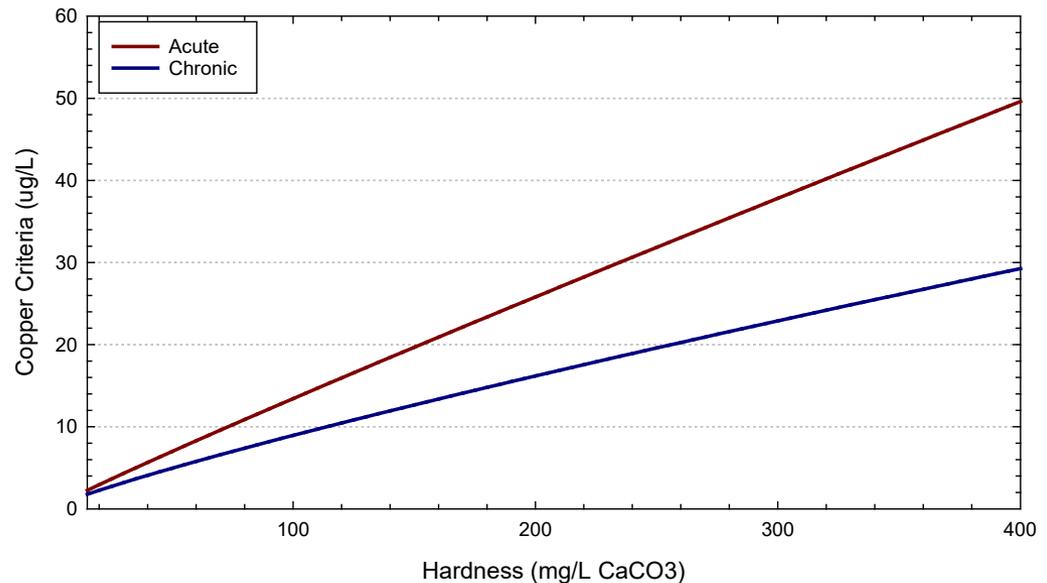


Updates based on best available science





- The bioavailability and toxicity of metals depends on water chemistry (EPA 1985, 2007a, 2007b, 2016)
- EPA has addressed water chemistry and metals bioavailability by adjusting criteria to hardness (EPA 1996, 2016)
- Current New Mexico criteria for copper and other metals are calculated as a function of hardness based on EPA (1996) recommended criteria



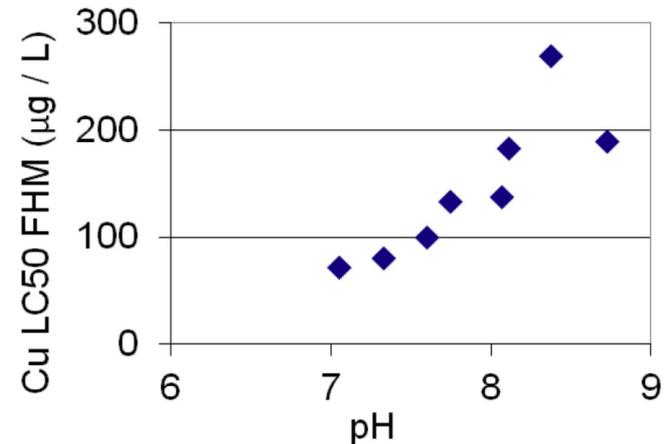
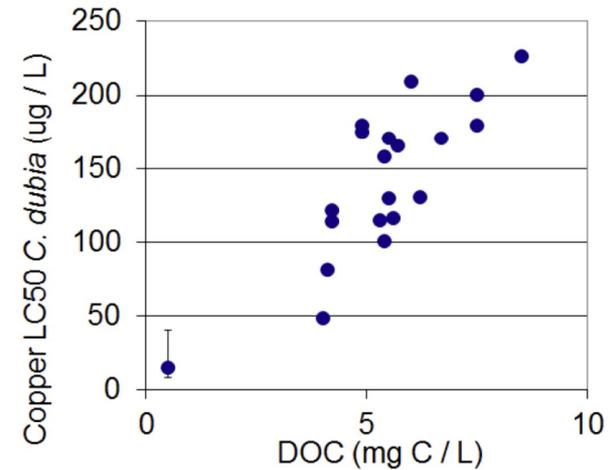
$$\text{Acute Copper Criteria} = \exp(0.9422 * [\ln(\text{hardness})] - 1.700)$$

$$\text{Chronic Copper Criteria} = \exp(0.8545 * [\ln(\text{hardness})] - 1.702)$$



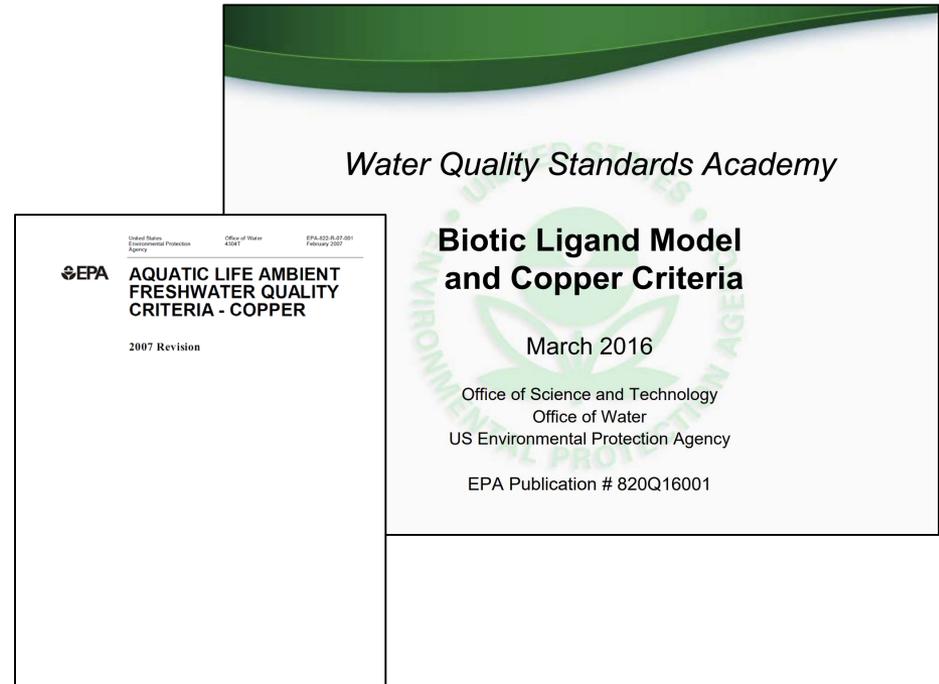


- Hardness-based criteria do not consider other water chemistry parameters (e.g., pH and dissolved organic carbon)
- Therefore, hardness-based criteria do not reflect all the effects of water chemistry on metals bioavailability (USEPA 2007, 2016)
- U.S. EPA developed the copper biotic ligand model (BLM) to reflect the latest scientific knowledge on metals speciation and bioavailability (EPA 2007, 2016)



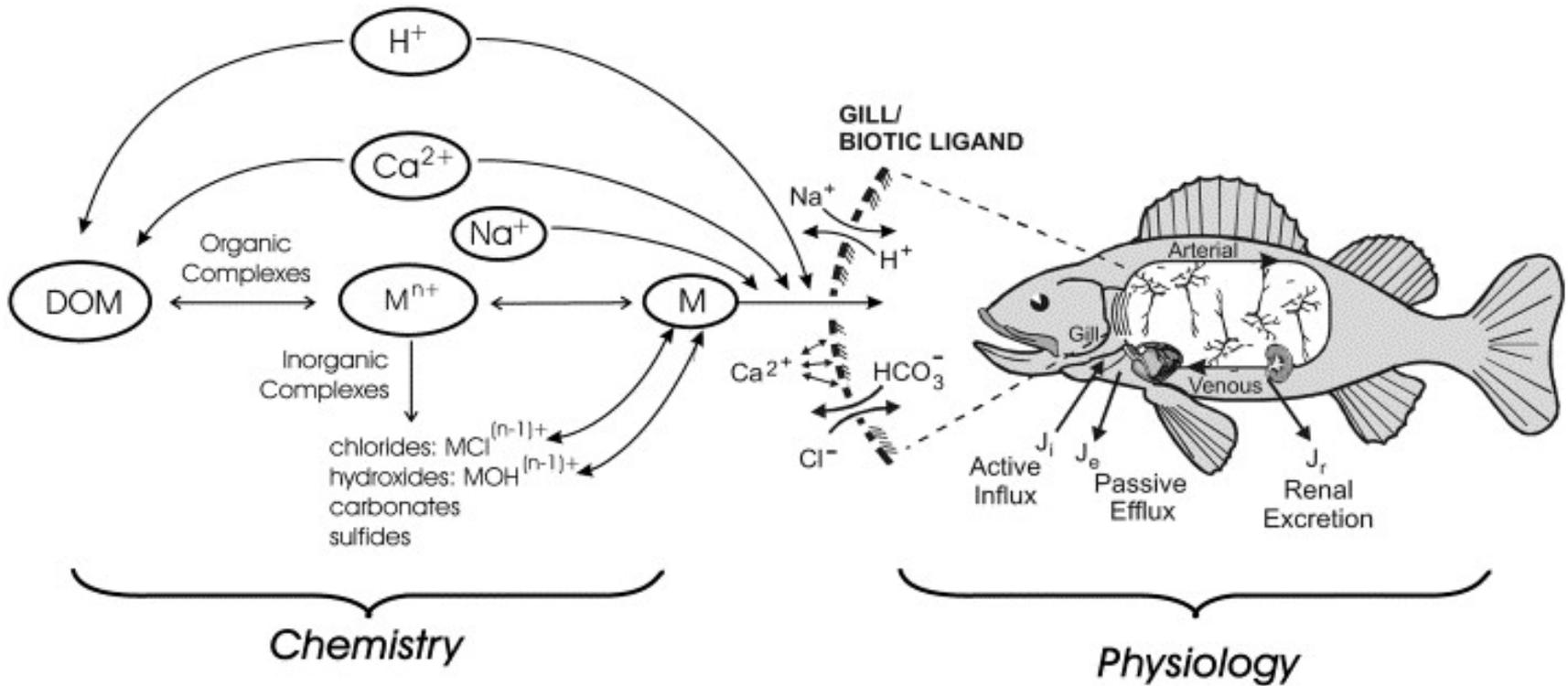


- The biotic ligand model (BLM) is a software tool that accounts for the effect of water chemistry on the bioavailability and toxicity of copper based on local water chemistry
- The BLM reflects the latest science on metals toxicity to aquatic organisms (US EPA 2007, 2016)
- The BLM for copper uses ten input parameters: pH, DOC, Ca, Mg, Na, SO4, K, Cl, alkalinity & temperature (but only sensitive to a few parameters)



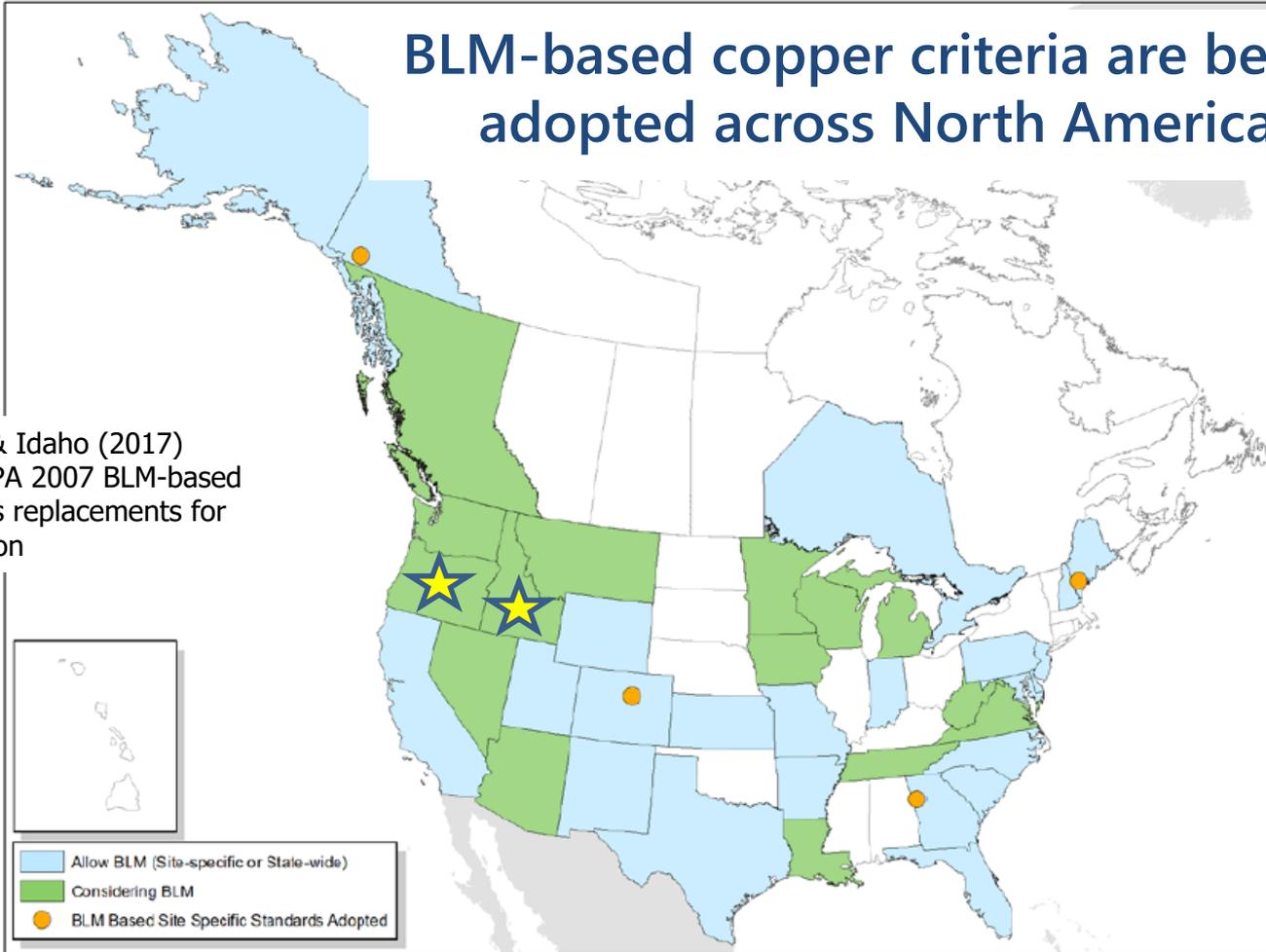


Biotic Ligand Model Conceptual Framework





BLM-based copper criteria are being adopted across North America



Oregon (2016) & Idaho (2017) have adopted EPA 2007 BLM-based copper AWQC as replacements for hardness equation



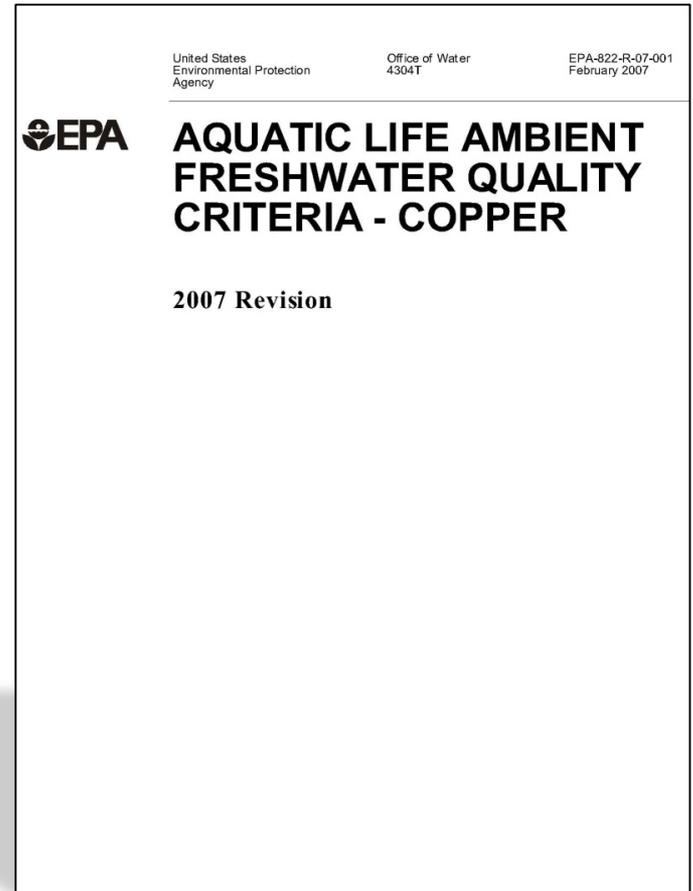
■ Allow BLM (Site-specific or State-wide)
■ Considering BLM
● BLM Based Site Specific Standards Adopted





Protectiveness of BLM-Based Criteria

- Hardness-based criteria are potentially under-protective (i.e., not stringent enough) or over-protective (i.e., too stringent) depending on site-specific water chemistry (EPA 2020).
- “Stringency” varies depending on water chemistry of the site (EPA 2020).
- BLM-based criteria will provide a level of protection that is intended to protect aquatic life based on EPA guidelines (EPA 2007).
- By using the latest available science, BLM-based criteria should be neither under-protective nor over-protective (EPA 2020).



EPA 2020: <https://www.epa.gov/wqc/supplementary-training-materials-background>





Biotic Ligand Model, Version 2.1.2 - Instantaneous Cu WQC:

File Edit Inputs Help

Current Selections: Metal: Copper Prediction Mode: Instantaneous WQC Calculation

	Site Label	Sample Label	Temp. °C	pH	Cu ug/L	DOC mg C/L	HA %	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO4 mg/L	Cl mg/L	Alkalinity mg/L CaCO3	S mg/L
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															

Displays current selections.

BLM User Interface

- Not all BLM parameters are significant
- Therefore, BLM can be simplified into an equation consistent with other aquatic life criteria for more transparency:

Copper BLM-based criteria =

$$\text{Exp} [\text{Intercept} (x * \text{pH}) + (x * \text{DOC}) + (x * \text{hardness})]$$





New Mexico Water Quality Standards

New Mexico Water Quality Standards – Site-Specific Water Quality Criteria

**TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 6 WATER QUALITY
PART 4 STANDARDS FOR INTERSTATE AND INTRASTATE SURFACE WATERS**

20.6.4.1 ISSUING AGENCY: Water Quality Control commission.
[20.6.4.1 NMAC - Rp 20 NMAC 6.1.1001, 10/12/2000]

20.6.4.2 SCOPE: Except as otherwise provided by statute or regulation of the water quality control commission, this part governs all surface waters of the state of New Mexico, which are subject to the New Mexico Water Quality Act, Sections 74-6-1 through 74-6-17 NMSA 1978.
[20.6.4.2 NMAC - Rp 20 NMAC 6.1.1002, 10/12/2000; A, 5/23/2005]

20.6.4.3 STATUTORY AUTHORITY: This part is adopted by the water quality control commission pursuant to Subsection C of Section 74-6-4 NMSA 1978.
[20.6.4.3 NMAC - Rp 20 NMAC 6.1.1003, 10/12/2000]

20.6.4.4 DURATION: Permanent.
[20.6.4.4 NMAC - Rp 20 NMAC 6.1.1004, 10/12/2000]

20.6.4.5 EFFECTIVE DATE: October 12, 2000, unless a later date is indicated in the history note at the end of a section.
[20.6.4.5 NMAC - Rp 20 NMAC 6.1.1005, 10/12/2000]

20.6.4.6 OBJECTIVE:
A. The purpose of this part is to establish water quality standards that consist of the designated use or uses of surface waters of the state, the water quality criteria necessary to protect the use or uses and an antidegradation policy.

B. The state of New Mexico is required under the New Mexico Water Quality Act (Subsection C of Section 74-6-4 NMSA 1978) and the federal Clean Water Act, as amended (33 U.S.C. Section 1251 *et seq.*) to adopt water quality standards that protect the public health or welfare, enhance the quality of water and are consistent with and serve the purposes of the New Mexico Water Quality Act and the federal Clean Water Act. It is the objective of the federal Clean Water Act to restore and maintain the chemical, physical and biological integrity of the nation's waters, including those in New Mexico. This part is consistent with Section 101(a)(2) of the federal Clean Water Act, which declares that it is the national goal that wherever attainable, an interim goal of water quality that provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water be achieved by July 1, 1983. Agricultural, municipal, domestic and industrial water supply are other essential uses of New Mexico's surface water; however, water contaminants resulting from these activities will not be permitted to lower the quality of surface waters of the state below that required for protection and propagation of fish, shellfish and wildlife and recreation in and on the water, where practicable.

C. Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.
[20.6.4.6 NMAC - Rp 20 NMAC 6.1.1006, 10/12/2000; A, 5/23/2005]

20.6.4.7 DEFINITIONS: Terms defined in the New Mexico Water Quality Act, but not defined in this part will have the meaning given in the Water Quality Act.

A. **Terms beginning with numerals or the letter "A," and abbreviations for units.**

(1) "413 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.

(2) "613 temperature" means the temperature not to be exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days.

(3) **Abbreviations** used to indicate units are defined as follows:

(a) "cfu/100 mL" means colony-forming units per 100 milliliters; the results for *E. coli* may be reported as either colony forming units (CFU) or the most probable number (MPN), depending on the analytical method used;

(b) "cfs" means cubic feet per second;

20.6.4 NMAC

1





New Mexico Water Quality Standards

NMAC §20.6.4.10 D(1):

SSWQC may be developed based on relevant site-specific conditions, such as:

- a Actual species present at a site
- b Physical or chemical characteristics alter the bioavailability and/or toxicity of a chemical
- c Physical, biological, or chemical factors alter the bioaccumulation potential of a chemical
- d Natural background exceed numeric criteria
- e Other factors or combination of factors approved by the commission

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 6 WATER QUALITY
PART 4 STANDARDS FOR INTERSTATE AND INTRASTATE SURFACE WATERS

20.6.4.1 ISSUING AGENCY: Water Quality Control commission.
 [20.6.4.1 NMAC - Rp 20 NMAC 6.1.1001, 10/12/2000]

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 [20.6.4.2 NMAC - Rp 20 NMAC 6.1.1002, 10/12/2000; A, 5/23/2005]

20.6.4.3 STATUTORY AUTHORITY: This part is adopted by the water quality control commission pursuant to Subsection C of Section 74-6-4 NMSA 1978.
 [20.6.4.3 NMAC - Rp 20 NMAC 6.1.1003, 10/12/2000]

20.6.4.4 DURATION: Permanent.
 [20.6.4.4 NMAC - Rp 20 NMAC 6.1.1004, 10/12/2000]

20.6.4.5 EFFECTIVE DATE: October 12, 2000, unless a later date is indicated in the history note at the end of a section.
 [20.6.4.5 NMAC - Rp 20 NMAC 6.1.1005, 10/12/2000]

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- B. The state of New Mexico is required under the New Mexico Water Quality Act (Subsection C of Section 74-6-4 NMSA 1978) and the federal Clean Water Act, as amended (33 U.S.C. Section 1251 *et seq.*) to adopt water quality standards that protect the public health or welfare, enhance the quality of water and are consistent with and serve the purposes of the New Mexico Water Quality Act and the federal Clean Water Act. It is the objective of the federal Clean Water Act to restore and maintain the chemical, physical and biological integrity of the nation's waters, including those in New Mexico. This part is consistent with Section 101(a)(2) of the federal Clean Water Act, which declares that it is the national goal that wherever attainable, an interim goal of water quality that provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water be achieved by July 1, 1983. Agricultural, municipal, domestic and industrial water supply are other essential uses of New Mexico's surface water; however, water contaminants resulting from these activities will not be permitted to lower the quality of surface waters of the state below that required for protection and propagation of fish, shellfish and wildlife and recreation in and on the water, where practicable.
- C. Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.
 [20.6.4.6 NMAC - Rp 20 NMAC 6.1.1006, 10/12/2000; A, 5/23/2005]

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 - (a) "cfu/100 mL" means colony-forming units per 100 milliliters; the results for *E. coli* may be reported as either colony forming units (CFU) or the most probable number (MPN), depending on the analytical method used;
 - (b) "cfs" means cubic feet per second;

20.6.4 NMAC 1





New Mexico Water Quality Standards

NMAC §20.6.4.10 D(4):

A derivation of site-specific criteria shall rely on a scientifically-defensible method, such as:

a The recalculation procedure, the water-effect ratio procedure, or the resident species procedure

b The streamlined water-effect ratio procedure for copper

c The biotic ligand model for copper

d EPA methods for deriving AWQC for human health

e A determination of natural background

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 6 WATER QUALITY
PART 4 STANDARDS FOR INTERSTATE AND INTRASTATE SURFACE WATERS

20.6.4.1 ISSUING AGENCY: Water Quality Control commission.
[20.6.4.1 NMAC - Rp 20 NMAC 6.1.1001, 10/12/2000]

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[20.6.4.2 NMAC - Rp 20 NMAC 6.1.1002, 10/12/2000; A, 5/23/2005]

20.6.4.3 STATUTORY AUTHORITY: This part is adopted by the water quality control commission pursuant to Subsection C of Section 74-6-4 NMSA 1978.
[20.6.4.3 NMAC - Rp 20 NMAC 6.1.1003, 10/12/2000]

20.6.4.4 DURATION: Permanent.
[20.6.4.4 NMAC - Rp 20 NMAC 6.1.1004, 10/12/2000]

20.6.4.5 EFFECTIVE DATE: October 12, 2000, unless a later date is indicated in the history note at the end of a section.
[20.6.4.5 NMAC - Rp 20 NMAC 6.1.1005, 10/12/2000]

20.6.4.6 OBJECTIVE:

A. The purpose of this part is to establish water quality standards that consist of the designated use or uses of surface waters of the state, the water quality criteria necessary to protect the use or uses and an anti-degradation policy.

B. The state of New Mexico is required under the New Mexico Water Quality Act (Subsection C of Section 74-6-4 NMSA 1978) and the federal Clean Water Act, as amended (33 U.S.C. Section 1251 *et seq.*) to adopt water quality standards that protect the public health or welfare, enhance the quality of water and are consistent with and serve the purposes of the New Mexico Water Quality Act and the federal Clean Water Act. It is the objective of the federal Clean Water Act to restore and maintain the chemical, physical and biological integrity of the nation's waters, including those in New Mexico. This part is consistent with Section 101(a)(2) of the federal Clean Water Act, which declares that it is the national goal that wherever attainable, an interim goal of water quality that provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water be achieved by July 1, 1983. Agricultural, municipal, domestic and industrial water supply are other essential uses of New Mexico's surface water; however, water contaminants resulting from these activities will not be permitted to lower the quality of surface waters of the state below that required for protection and propagation of fish, shellfish and wildlife and recreation in and on the water, where practicable.

C. Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.
[20.6.4.6 NMAC - Rp 20 NMAC 6.1.1006, 10/12/2000; A, 5/23/2005]

20.6.4.7 DEFINITIONS: Terms defined in the New Mexico Water Quality Act, but not defined in this part will have the meaning given in the Water Quality Act.

A. Terms beginning with numerals or the letter "A," and abbreviations for units.

(1) "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.

(2) "6T3 temperature" means the temperature not to be exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days.

(3) Abbreviations used to indicate units are defined as follows:

(a) "cfu/100 mL" means colony-forming units per 100 milliliters; the results for *E. coli* may be reported as either colony forming units (CFU) or the most probable number (MPN), depending on the analytical method used;

(b) "cfs" means cubic feet per second;

20.6.4 NMAC

1





Draft SSWQC Analysis for the Pajarito Plateau





Pajarito Plateau BLM Evaluation

- DQO/DQA Evaluation (Windward 2018)
- Prepared in collaboration with SWQB
 - SWQB guidance (locations, methods, reporting)
- Used EPA's DQO/DQA process

**DATA-QUALITY OBJECTIVES AND DATA QUALITY
ASSESSMENT: APPLICATION OF THE BIOTIC LIGAND
MODEL TO GENERATE WATER QUALITY CRITERIA
FOR FOUR METALS IN SURFACE WATERS OF THE
PAJARITO PLATEAU NEW MEXICO**

Prepared for:
Los Alamos National Security

April 27, 2018

Prepared by:  Windward
environmental LLC

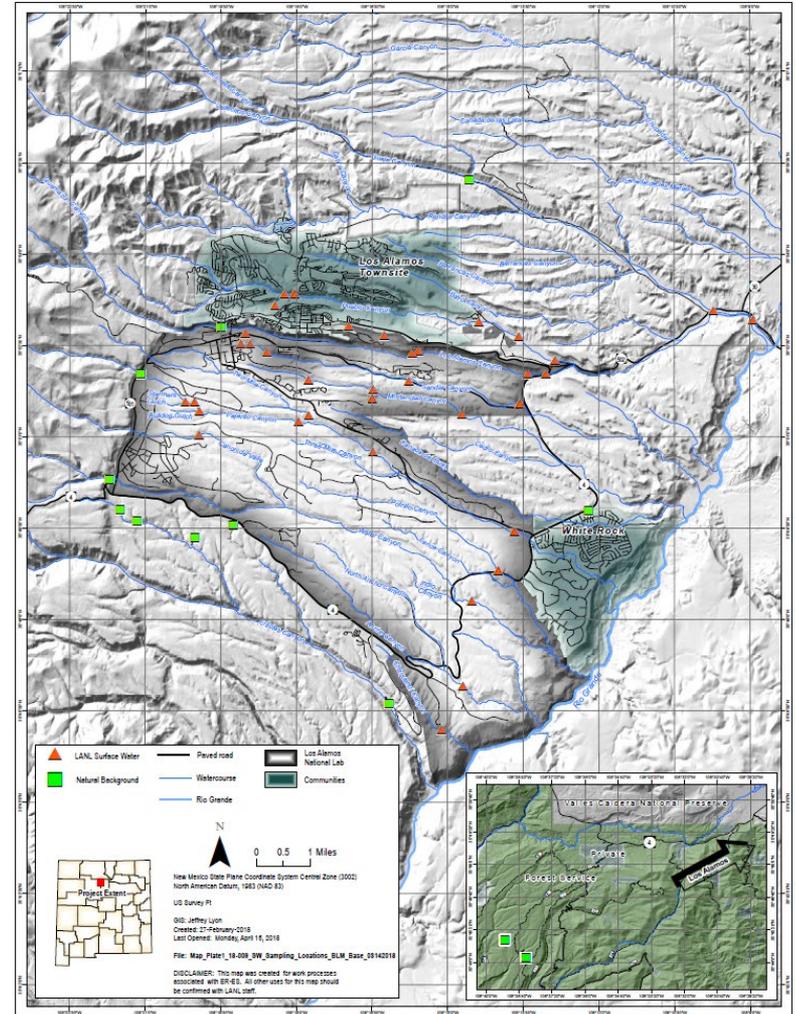
200 West Mercer Street, Suite 401 • Seattle, Washington • 98119





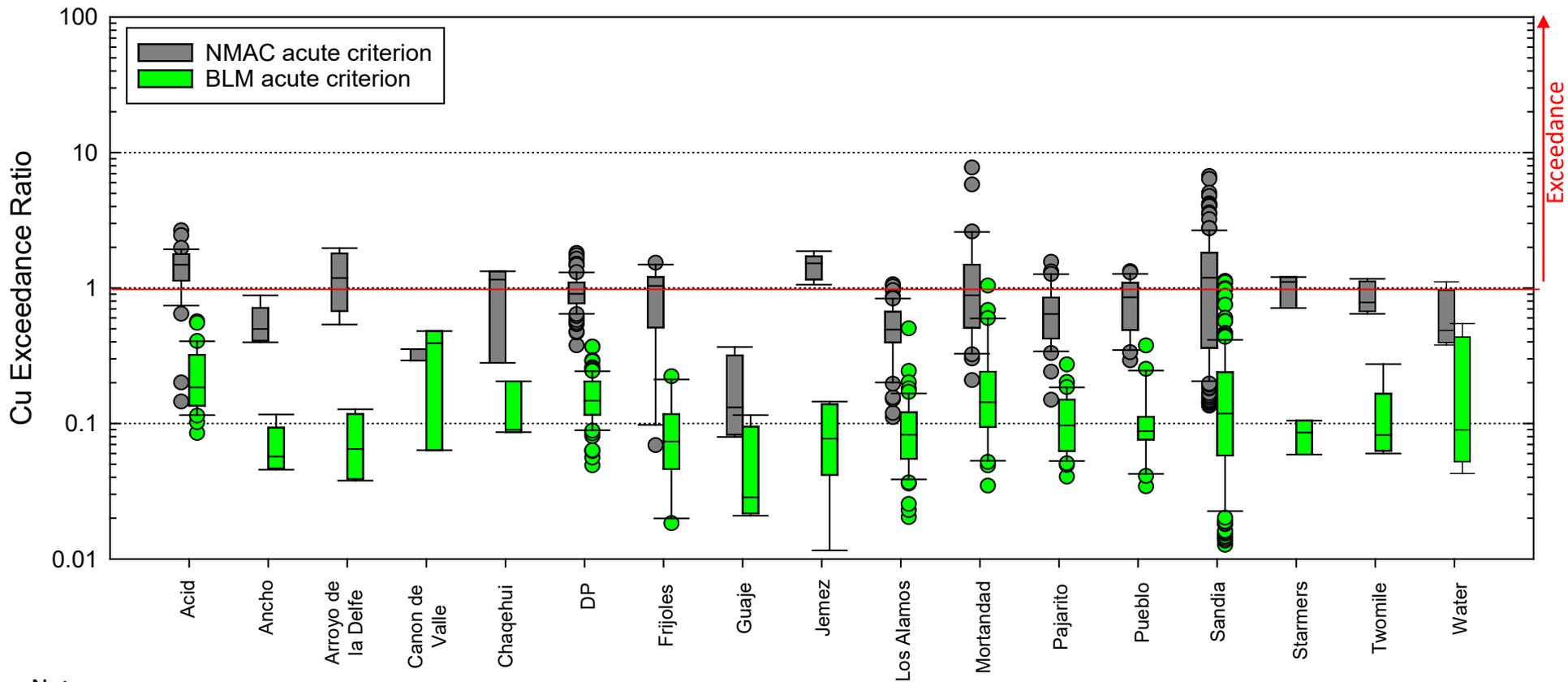
Pajarito Plateau BLM Evaluation

- Data for 48 surface water locations
- >500 events with BLM inputs
 - Includes storm-flow and base-flow events
- April 2005 to October 2019





Pajarito Plateau BLM Evaluation



Notes:

1. DQO/DQA BLM dataset augmented with 2018-2019 data (n= 521)
2. Sub-watershed data includes all samples (developed and undeveloped landscapes)
3. Excludes samples with MDLs > criterion

$$\text{Exceedance Ratio} = \frac{\text{Metal concentration}}{\text{Criterion}}$$





Pajarito Plateau BLM Evaluation

303(d) listings - NMED 2018-2020 Integrated Report

AU Name	WQS Reference	IMPAIRMENT	IR Category (by AU)	CYCLE FIRST LISTED
Pajarito Canyon (Two Mile Canyon to Arroyo de La Delfe)	20.6.4.128	Cu, Acute	5/5B	2016
		Ag, Acute	5/5C	2018
Mortandad Canyon (within LANL)	20.6.4.128	Cu, Acute	5/5B	2010
Sandia Canyon (Sigma Canyon to NPDES outfall 001)	20.6.4.126	Cu, Acute	5/5B	2010
		Al, TR	5/5B	2018
Acid Canyon (Pueblo to headwaters)	20.6.4.98	Cu, Acute	5/5B	2010
	20.6.4.98	Al, Acute	5/5B	2018
Walnut Canyon (Pueblo Canyon to headwaters)	20.6.4.98	Cu, Acute	5/5B	2014
Graduation Canyon (Pueblo Canyon to headwaters)	20.6.4.98	Cu, Acute	5/5B	2010
South Fork Acid Canyon (Acid Canyon to headwaters)	20.6.4.98	Cu, Acute	5/5B	2014
DP Canyon (Grade control to upper LANL bnd)	20.6.4.128	Cu, Diss.	5/5B	2018
		Al, TR	5/5B	2018
Pueblo Canyon (Acid Canyon to headwaters)	20.6.4.98	Cu, Acute	5/5B	2018
		Al, Acute	5/5B	2018
Arroyo de la Delfe (Pajarito Canyon to headwaters)	20.6.4.128	Cu, Diss.	5/5B	2018
		Al, TR	5/5B	2018
Pajarito Canyon (Lower LANL bnd to Two Mile Canyon)	20.6.4.128	Cu, Acute	5/5B	2018
		Al, TR	5/5B	2018
Two Mile Canyon (Pajarito to headwaters)	20.6.4.128	Cu, Acute	5/5B	2018
		Al, Acute	5/5B	2018

- Copper on NMED 303(d) list for several stream reaches throughout the Pajarito Plateau
- Listing category is “5B” = Review of water quality standard is needed prior to TMDL development

5B: Impaired, review of the WQS in needed prior to TMDL development
 5C: Impaired, additional data collection is needed prior to TMDL development





Regarding 303(d) listings for metals on the Pajarito Plateau:

“Specific impairments are noted as IR Cat 5 B to acknowledge LANL’s ongoing discussions and research regarding applicable water quality standards on the Pajarito Plateau for these parameters.”

5B: Impaired, review of the WQS in needed prior to TMDL development

2020-2022
State of New Mexico
Clean Water Act
§303(d)/§305(b)
Integrated Report

Assessment Rationale

Prepared by:
New Mexico Environment Department
Surface Water Quality Bureau
1190 St. Francis Drive
Santa Fe, New Mexico 87505
<https://www.env.nm.gov/surface-water-quality/>





1

Work Plan: Not a specific requirement under per 20.6.4.10 NMAC but developed for transparency and planning purposes (draft available).

2

Technical Report: Present & justify the derivation of copper SSWQC, including specific surface waters to which SSWQC would apply & the rationale for proposing SSWQC (targeting Q1 2021).

3

Stakeholder & Public Review: Solicit input from stakeholders (NMED, EPA) and from the general public; respond to all input received (targeting Q1 2021 for report comments & next public meeting).

4

Petition & Rulemaking: A petition for copper SSWQC will be developed based on (1) conclusions presented in the final Technical Report, (2) NMED and EPA comments, and (3) input from other potential stakeholders and the general public (rulemaking schedule TBD).





Copper SSWQC – Process & Schedule

- Content: Describes regulatory and scientific basis of BLM and an approach to develop SSWQC for the Pajarito Plateau.
- Status: Submitted July 7th, 2020, comments requested from NMED & DOE
- Process: Next step is a Technical SSWQC Report with recommended SSWQC:
 - (a) for stakeholder (NMED, EPA, public) review/comments
 - (b) Report will provide the technical & regulatory basis of the SSWQC petition (technical exhibit to petition)

DRAFT WORK PLAN: DEVELOPMENT OF SITE-SPECIFIC COPPER CRITERIA FOR SURFACE WATERS OF THE PAJARITO PLATEAU NEW MEXICO

Prepared for:
N3B Los Alamos

July 6, 2020

Prepared by: **Windward**
environmental LLC

200 West Mercer Street, Suite 401 • Seattle, Washington • 98119

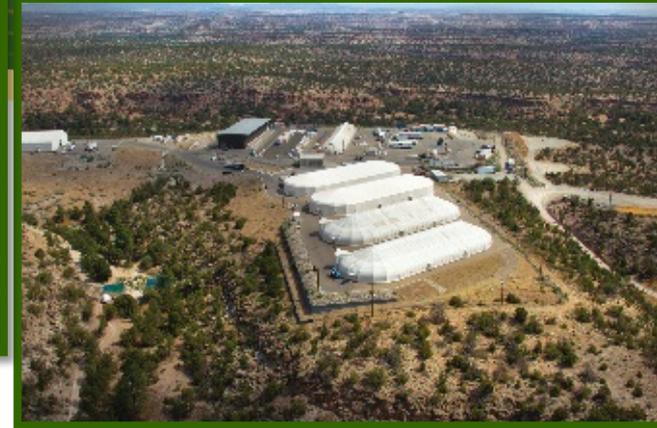
Draft SSWQC Work Plan
July 6, 2020





U.S. DEPARTMENT OF
ENERGY

OFFICE OF
**ENVIRONMENTAL
MANAGEMENT**



Questions



ENVIRONMENTAL MANAGEMENT
SAFETY ♦ PERFORMANCE ♦ CLEANUP ♦ CLOSURE

Produced by Los Alamos Legacy Cleanup Contractor, N3B Los Alamos
on behalf of DOE's Environmental Management Los Alamos Field Office

