STATE OF NEW MEXICO
BEFORE THE WATER QUALITY CONTROL COMMISSION

In the Matter of:	)	
PROPOSED AMENDMENTS TO ***STANDARDS FOR INTERSTATE AND INTRASTATE WATERS*****, 20.6.4 NMAC**	)	**No. WQCC 14-05 (R)**
New Mexico Environment Department,	)	
Petitioner.	)	

REBUTTAL TESTIMONY OF BRYAN DAIL

I. INTRODUCTION

My name is Bryan Dail. I am currently employed as an Environmental Scientist with the New Mexico Environment Department ("NMED") Surface Water Quality Bureau ("SWQB"). I have a Bachelor's degree in Biology with Chemistry as a minor and a Ph. D in Microbiology. My professional resume is included as SWQB Exhibit 58, in the Notice of Intent ("NOI") direct testimony filed on December 12, 2014.

The rebuttal testimony I am presenting concerns two proposals to amend water quality standards criteria. The first is Amigos Bravos' ("AB") proposal to replace the hardness-based water quality standard (WQS) for aluminum ("Al") with the U.S. Environmental Protection Agency's ("EPA") nationally recommended §304(a) criteria (EPA, 1988). The second proposal is for site-specific copper criteria based on a report conducted by Freeport-McMoRan Chino Mines ("Chino Mines") and applicable to certain streams located within the area known as the

Chino Mines Smelter Tailings and Soil Investigation Unit ("STSIU") near the towns of Bayard and Hurley in Grants County, New Mexico. I will present rebuttal testimony on these proposals in the order mentioned above.

II. PROPOSALS AND REBUTTALS

A. CRITERIA APPLICABLE TO EXISTING, DESIGNATED OR ATTAINABLE USES UNLESS OTHERWISE SPECIFIED IN 20.6.4.97 THROUGH .899 NMAC

SUMMARY

Amigos Bravos proposes to remove in its entirety the hardness-based water quality standard ("WQS") for Al adopted by the Water Quality Control Commission ("WQCC") during the 2009 Triennial Review and replace it with the EPA's nationally recommended §304(a) criteria (EPA, 1988). The SWQB recommends that this proposal be rejected by the WQCC because Amigos Bravos has provided no scientific evidence that the current hardness-based Al standard is not sufficiently protective of aquatic life. Further, as detailed below, the current standard is more protective than what AB proposes and would protect for alkaline waters with low hardness as has been reported by Gunderson (1994) and others. Below, the SWQB provides its point-by-point rebuttal responses to Amigos Bravos' arguments.

SWQB REBUTTAL RESPONSES

AB: The current hardness-based criteria for aluminum pH 6.5 to 9.0, previously approved by the WQCC and the EPA, is not protective of aquatic life. Accordingly, it should be replaced with the EPA-recommended dissolved Al criteria of 87 ug/l and 750 ug/l that New Mexico had in place

prior to 2010, until such time that there is sufficient scientific data to develop a hardness-based criterion that is appropriate in western waters.

SWQB Rebuttal Response: The SWQB appreciates the concern expressed by Amigos Bravos about the aquatic life protections previously adopted and approved by the WQCC, and approved by the EPA. The current hardness-based Al criteria are the culmination of analyses of multiple studies of the effects of water hardness on Al toxicity that were not part of the 1988 EPA guidance.[1]

The Federal water quality standards ("WQS") regulation at 40 CFR §131.11(a) require that water quality criteria must be adopted that protect the designated use, and that such criteria *"must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use."* Numeric criteria, based on relevant site specific conditions, are allowed in New Mexico's WQS under Subsection 20.6.4.10.D NMAC. This allowance is also consistent with the federal WQS regulations under 40 CFR §131.1 l(b)(l)(ii) that provide States with the opportunity to adopt water quality criteria that are modified to reflect site-specific conditions.

The EPA will approve site-specific criteria developed using appropriate and scientifically defensible procedures. For example, the EPA recognizes that laboratory toxicity studies may not represent site-specific water quality that impacts toxicity of metals and therefore, EPA allows for a determination of factors that ameliorate metal toxicity. From the EPA website:

"National water quality criteria for aquatic life may be under- or over-protective if:

[1] U.S. Environmental Protection Agency (EPA). 1988. *Ambient Water Quality Criteria for Aluminum - 1988.* EPA 440/5-86-008. Office of Water, Washington, DC.

72 *The species at the site are more or less sensitive than those included in the national*
73 *criteria data set (e.g., the national criteria data set contains data for trout, salmon,*
74 *penaeid shrimp, and other aquatic species that have been shown to be especially sensitive*
75 *to some materials), or physical and/or chemical characteristics of the site alter the*
76 *biological availability and/or toxicity of the chemical (e.g., alkalinity, hardness, pH,*
77 *suspended solids and salinity influence the concentration(s) of the toxic form(s) of some*
78 *heavy metals, ammonia and other chemicals)*[2]*."*
79
80 *The Guidelines for Deriving Numerical National Water Quality Criteria for the*
81 *Protection of Aquatic Organisms and Their Uses* (EPA, 1985), and subsequent guidance (*Interim*
82 *Guidance on Determination and Use of Water-Effect Ratios for Metals* (EPA, 1994)) were the
83 basis for the development of New Mexico's current hardness-based formula for the protection of
84 aquatic life use ("ALU") and represent a significant increase in the understanding of metal
85 toxicity in natural waters. Amigos Bravos, in their filed testimony (AB NOI, p.15), acknowledge
86 and support hardness-based criteria development as potentially more realistic than the 1988
87 guidance. There are available today the results of a considerable number of additional toxicity
88 studies that have been conducted for Al. Thus, absent a demonstration of protection outside of
89 the pH range of the current hardness-based Al criteria or the 1988 guidance, a reversion to the
90 1988 aluminum guidance does not meet the WQCC's task of developing "*criteria for water*
91 *quality that accurately reflects the latest scientific knowledge*" (§304(a)(1), Clean Water Act
92 ("CWA")). Rather, the proposal is a reversion to previous standards when less was known, and
93 advances protection only insofar as it is over-protective in some circumstances and under-
94 protective in others. Moreover, AB promotes applying the older criteria to waters outside of the
95 pH range for which the criteria were developed and provides scant support (only a handful of
96 studies) for application in these waters. Furthermore, new Al guidance that uses water hardness
97 as well as other ameliorative water constituents is forthcoming from the EPA, anticipated later in

[2] http://water.epa.gov/scitech/swguidance/standards/handbook/chapter03.cfm

98 2015 (Eignor, 2013). Therefore, the most prudent action would be to maintain current approved
99 criteria as they are based upon the state-of-the-science, more protective at low hardness, and
100 fully consider new guidance as it may help fine tune the previously-demonstrated water
101 hardness/aquatic life protection relationship, as well as the concern for ALU protections outside
102 of pH 6.5 to 9.

103

104 **AB:** New Mexico's hardness-based standard fails to address important pH effects where the pH
105 is >7.5, a condition prevalent in many New Mexico streams. Hardness protects against, but does
106 not eliminate, lethality at low concentration dissolved Al over long periods. According to a peer-
107 reviewed study, a mortality of 50% would be projected at a little more than 3 mo.(109d): at 100
108 mg/J CaC03, 0.16mg/I dissolved Al, pH=8.6.

109 **SWQB Rebuttal Response:** The optimal pH for salmonid species is reported to range from 6.5
110 to 8.0 (Hartman and Gill, 1968; Behnke and Zarn, 1976), and AB is correct in stating that some
111 New Mexico streams naturally exceed pH 7.5. However, AB cites only one study that shows
112 toxic effects of Al on salmonids at moderately alkaline conditions (pH 7.98 to 8.58; Gundersen
113 *et al*., 1994). The development of New Mexico's current hardness-based Al standards used the
114 Gundersen *et al*., 1994 study in the acute aluminum criteria equation; however, that study did not
115 meet data use requirements for the development of the chronic or sub-lethal levels of Al criteria.
116 At pH>8, the alkalinity of waters alone may cause physiologic challenges to salmonids given
117 their pH preferences. A review of the literature regarding Al toxicity at alkaline pH suggests
118 equivocal effects at best, and suggest that initial toxicity trial conditions, rather than natural
119 water conditions, may dictate observed negative salmonid physiologic responses (Poléo and

120 Hytterød, 2003; Winter *et al.,* 2005). In natural alkaline waters, the dominant form of aluminum
121 is the aluminate ion, and this ion has been reported to be in a non-toxic state. For the one study
122 cited by AB, which concluded higher toxicity at alkaline pH, it is not clear if the aluminum form
123 used was in steady state (*i.e.*, not undergoing reactions because of differences in the pH of the Al
124 supply tank, dilution tanks, and fish exposure tanks as these undergo mixing). This is crucial
125 because reactive Al intermediates formed in mixing waters of differing pH could lead one to
126 erroneously conclude that steady-state Al at alkaline pH is toxic to aquatic life, when the state of
127 the aluminum form is not actually known. In other words, it is not known whether the lethal
128 effects are the result of alkaline pH, or its impact on the form and pH of the supplied Al.

129

130 **AB:** First, the proposed change is vague and confusing. There is no indication what water quality
131 standards will apply for purposes of the CWA to those waters where the pH is less than 6.5.
132 Second, the SWQB problematically states that the hardness-based criteria will not apply in
133 waters with a pH of 6.5 for "federal CWA purposes" but will apply for non-CWA purposes (*i.e.,*
134 for exclusively State purposes and per the New Mexico Water Quality Act).

135 **SWQB Rebuttal Response:** The EPA approved the hardness-based criteria for chromium III,
136 copper, lead, manganese, nickel, and silver, which were adopted by the WQCC during the 2009
137 Triennial Review, without exception, but initially declined to take action on the hardness-based
138 criteria for three other metals (aluminum, cadmium, and zinc), citing the need for additional
139 review. After the State of New Mexico ("State") provided clarification, the EPA, in a letter dated
140 April 30, 2012 and Record of Decision ("ROD") Addendum, approved the hardness-based

141 criteria adopted for cadmium and zinc. For aluminum, the EPA provided limited approval
142 stating:

143 *"EPA has determined that the hardness-based equations would be protective for waters*
144 *within the pH range of 6.5 to 9.0, particularly at low hardness levels, but would not be*
145 *protective for waters below that pH range. Therefore, EPA is approving the hardness-*
146 *based equation for aluminum for only those waters of the State where pH is equal to or*
147 *greater than 6.5, but is disapproving these equations in waters where the pH is less than*
148 *6.5. Consistent with EPA's regulations, the previously approved 304(a) criteria for*
149 *aluminum are thus the applicable water quality standards for purposes of the CWA in*
150 *waters where the pH is at or below 6.5. In such cases, as the permitting authority in New*
151 *Mexico, EPA will apply the previously approved 87 µg/L chronic total recoverable*
152 *aluminum criterion."*

153 The EPA later explained by letter dated June 18, 2012 that the ROD contained a mistake,
154 it erroneously referred to total recoverable instead of the dissolved fraction applicable to the
155 chronic criterion, 87 µg/L aluminum (as dissolved).

156 However, the EPA's recommendations remain problematic. The State's proposal for
157 hardness-based equation for Al included separate equations for both acute and chronic criteria.
158 The EPA's pH limitation apparently applies to both equations as it *"is disapproving these*
159 *equations in waters where the pH is less than 6.5."* (EPA letter and ROD, April 30, 2012)
160 However the EPA states they will apply *"the previously approved 304(a) criteria for aluminum*
161 *... 87 µg/L chronic [dissolved] aluminum criterion"* for both the acute and chronic criteria despite
162 that fact that there is a previously approved §304(a) criteria for acute dissolved aluminum, which
163 is 750 µg/L. (EPA letter and ROD, April 30, 2012) The EPA's letter does not provide a
164 justification to apply the chronic criterion in place of the previously approved acute aluminum
165 criterion in low pH waters. The SWQB's goal is to clarify in the WQS the applicable water
166 quality criterion for aluminum. We understand that the EPA has disapproved the hardness-based
167 equations for aluminum for water below pH 6.5, and this would be the same exception were the

168 WQCC to adopt the 1988 criteria. The SWQB further finds the EPA's recommendation is not
169 well justified, and appears ambiguous about what criteria should apply in low pH waters. In this
170 situation, the approach suggested by the EPA to resolve the disapproval appears to apply the
171 criteria for Al in a different way than recommended in the EPA's §304(a) criteria document, and
172 also deviates from use of the acute criteria of 750 ug/L (as dissolved) previously adopted by the
173 State and approved by the EPA. Because of the EPA's disapproval, and to clarify the
174 applicability to the extent possible, the WQS simply state that the EPA has disapproved the
175 formulae for low pH waters. This was explained in the amended SWQB Petition filed on October
176 24, 2014. As a practical matter, the EPA has both water discharge permits and WQS oversight
177 authorities, and for purposes of the CWA, the EPA shall apply their recommendation
178 accordingly. For other purposes (*i.e.*, non-CWA or State purposes consistent with the New
179 Mexico Water Quality Act) the formulae approved by the WQCC apply.

180

181 **AB:** Third, while it is true that the current standard was approved by the WQCC during the last
182 Triennial Review, this approval was given prior to the EPA's determination that hardness-based
183 criteria are not protective of waters with a pH of 6.5 or less. The SWQB and this WQCC must
184 account for this new information and should adopt Amigos Bravos proposed changes to ensure
185 that New Mexico's water quality standards are, in fact, protective of water quality in all waters of
186 the State.

187 **SWQB Rebuttal Response:** The hardness-based criteria adopted by the WQCC for New
188 Mexico did not promote applicability below pH 6.5. Indeed, excepting a segment specific
189 criterion, pH below this value would indicate impairment.

190

191 **1) AB/GUNDERSEN:** Some research indicates that calcium can be protective against some
192 forms of aluminum toxic to aquatic life, particularly at low pH values. However less is known
193 about the potential protective effects of calcium at near-neutral to alkaline pH. As the pH
194 decreases from 7.0 (becomes more acidic), the solubility of aluminum increases. Studies have
195 shown that these soluble forms of aluminum are acutely toxic (causing death) to aquatic life.
196 However, the toxic mechanisms of both inorganic monomeric aluminum (soluble aluminum) and
197 polymeric forms of aluminum (insoluble aluminum) at alkaline pH are poorly understood. This
198 coincides with a lack of understanding on the effects of other water quality parameters (*i.e.*,
199 hardness) on aluminum toxicity to aquatic life at alkaline pH.

200 **SWQB Rebuttal Response:** Toxic effects of Al outside the 1988 EPA guidance in the peer-
201 reviewed literature is somewhat equivocal, however, the guidance provides for aquatic life
202 protections between pH 6.5 and 9, which addresses all but a small number of New Mexico
203 waters. The EPA used this range because it is within pH 6.5 to 9 that, absent other toxics, "*water*
204 *quality is adequately protective of freshwater fishes and invertebrates*" (EPA, 1976)[3]. Thus,
205 outside the range of pH 6.5 to 9, pH itself may be the limiting factor to aquatic life, and likely
206 explains the dearth of literature. Much of the variability in existing peer-reviewed toxicology
207 trials at higher pH are attributable to the unfavorable conditions to aquatic life at high pH, the
208 ameliorative effects of other dissolved substances in natural waters, and specifics related to the
209 manner in which the trials were run (*e.g.,* the form of Al used and the ageing of Al in solution).

[3] U.S. EPA. 1976. Quality criteria for water [The Red Book]. PB-263943 or EPA-440/9-76-023. National Technical Information Service, Springfield, VA.

210 The 1988 EPA guidance notes that numerous studies were not used in criteria development
211 because pH was less-than 6.5 or greater than 9, and that "*control mortality was too high in many*
212 *tests reported…*"

213 Subsequent to the 1988 EPA guidance, several studies have addressed Al mortality at higher pH.
214 A notable study by Gundersen *et al*., (1994) showed significant mortality at moderately high pH
215 (exceeding 8), and also demonstrated acceptable control survivorship. These researchers
216 manipulated the acute exposure trial pH (7.97 to 8.58), total aluminum (~0 µg/L to 11,960 µg/L)
217 and Total Hardness (21.9 mg/L to 144.5 mg/L) to investigate interactions of these three variables
218 on Rainbow trout survivorship (Table 1). They reported the first signs of mortality in acute trials
219 (15% loss) at pH 8.34, a Total Hardness of 23.4 mg/l and a Total Al of 3,730 µg Al/l. As a
220 comparison, a calculation using New Mexico's hardness formula would set the acute Al criteria
221 for this hardness to 468 µg Al/l. Therefore, the currently adopted hardness-based Al formula
222 calculates a criterion that is almost 8-fold less than the concentration of initial onset Al-induced
223 mortality in the Gundersen *et al.* study. More importantly, the hardness-based calculation results
224 in a more stringent Al threshold than AB's proposed reversion to the 1988 guidance of 750 µg/l.

225 Table 1. Adapted from Gundersen *et al.*, 1994. Acute Rainbow trout mortality trials in weakly
226 alkaline waters and variable Al and pH. NA=not applicable.

Toxicity Trial pH	Total Hardness	Total Al	Filterable Al*	As Filterable Al	% Survival	NM's Acute Al limit by Hardness Calc	EPA's 1988 Acute Al Guidance
	(mg/L as CaCO3)	(µg/L)	(µg/L)	(%)	(%)	(µg/L)	(µg/L)
7.97	23.1	NA	NA	NA	100	459.8	750
8.02	34.2	NA	NA	NA	100	787.0	750
8.06	83.3	NA	NA	NA	100	2,663.4	750
8.06	112.5	NA	NA	NA	100	4,019	750
8.12	21.9	810	110	13.6	100	427.4	750
8.10	33.1	1,120	90	8.8	100	752.5	750
8.23	84.2	910	160	17.6	100	2,702.8	750
8.25	144.5	1,050	200	19.0	100	5663	750
8.22	22.9	1,860	180	9.7	100	454.4	750
8.20	33.9	2,040	210	10.3	100	777.5	750
8.23	84.2	1,920	160	8.3	100	2,702.8	750
8.25	114.5	1,680	200	11.9	100	4,117.6	750
8.34	**23.4**	**3,730**	420	11.3	**85**	**468**	**750**
8.36	36.3	4,320	460	10.6	85	853	750
8.36	83.0	4,170	420	10.1	95	2,650.2	750
8.33	188.4	3,940	520	13.2	100	4,310.8	750
8.58	24.6	11,960	1,000	8.4	0	501.2	750
8.58	37.7	9,330	940	10.1	5	899.3	750
8.56	83.3	7,950	880	11.1	35	2,663.4	750
8.56	120.2	9,850	900	9.1	15	4,400.8	750

At onset of mortality (15%, in **bold**) and low hardness (23.4 mg/L as $CaCO_3$), New Mexico's hardness-based calculation affords more protection than a reversion to 1988 EPA Al guidance. *Filterable Al in Gundersen *et al*., 1994 is defined as that which passes a 0.4 µm nominal pore size filter.

More recently in the peer-reviewed literature, several studies have illustrated that the aluminum species predominating at alkaline pH is unlikely to exert toxic effects (Poléo and Hytterød, 2003). They report:

235 "*Under alkaline (pH 9.5) steady state conditions, 350 mg Al/ l (predominantly aluminate*
236 *ion, $Al(OH)_4^-$) had no acute toxic effect on the salmon…"* Moreover: *"No increase in*
237 *toxicity was evident under non-steady state conditions, i.e. lowering Al solubility as pH*
238 *was lowered from 9.5 to 7.5. The results indicate that the toxicity of the aluminate ion*
239 *($Al(OH)_4^-$) is low, and particularly lower than the corresponding toxicity of cationic Al*
240 *hydroxides.*"
241
242 In addition, a Rainbow trout study by Winter *et al*., (2005) found that:

243 "*Aluminum accumulation by trout gills was highest at pH 6–8,…moderate Al*
244 *accumulation by trout gills at pH 5 and 9, and trout at pH 4 and 10 did not accumulate*
245 *any Al on their gills.*"

246

247 These findings indicate that protections afforded between pH 6.5 and 9 identify the most
248 important water quality conditions at which aquatic life is vulnerable to Al. Winter *et al*., (2005)
249 also found that additions of natural organic matter ("NOM"), a water quality constituent not
250 measured by the SWQB, and thus not part of the hardness-based criteria, ameliorated toxic
251 effects at all pH levels tested. Combined, these data suggest that the form of Al does indeed
252 matter, that pH between 6.5 and 9 is the range of concern, that other water constituents
253 (hardness, NOM) afford significant protections, and that the physical ageing of Al solutions used
254 in toxicology tests is important to best mimic natural conditions, and thus the forms of Al likely
255 to be present.

256

257 **2) AB/GUNDERSEN:** *"In my professional judgment and consistent with the scientific*
258 *evidence, New Mexico's aluminum criteria—which are the least protective of anywhere in the*
259 *country—should be replaced by the EPA approved Aluminum criteria of 87ug/L chronic and 750*
260 *ug/L acute, and based on total recoverable aluminum, rather than dissolved aluminum, as*
261 *proposed by Amigos Bravos. These criteria—based on total recoverable aluminum—are*

262 *protective of aquatic life uses in New Mexico, particularly since New Mexico waters have*
263 *species (rainbow trout) that are sensitive to the toxic effects of aluminum."*

264 **SWQB Rebuttal Response:** Approximately 25 states lack Al criteria altogether[4], thus it is
265 disingenuous to state that New Mexico's is the least protective anywhere in the country. In fact,
266 as demonstrated in Table 1 above, the SWQB's hardness-based calculation provides greater
267 protections to aquatic life at low hardness concentrations than would a reversion to the EPA's
268 1988 Al guidance. Regarding the AB proposal to use a total recoverable aluminum rather than
269 dissolved aluminum: The metals criteria for the protection of aquatic life uses, Subsection
270 20.6.4.900.I NMAC, states that the SWQB uses the dissolved form <u>except</u> in the case of
271 aluminum, wherein the Total Recoverable Al is used:

272 *"Except for aluminum, the criteria are based on analysis of dissolved metal. For aluminum, the*
273 *criteria are based on analysis of total recoverable aluminum in a sample that is filtered to*
274 *minimize mineral phases as specified by the department."*

275 A notable exception to the rule is in the instance where high geologic or "mineral" forms
276 of Al, forms not typically associated with toxicity exist, a filtered sample may be taken. In waters
277 with extraordinarily high turbidity, the SWQB filters the sample through a 10 µm filter to
278 remove most mineral-associated material. This does not create a *de facto* dissolved Al sample as
279 the operational definition of dissolved metal is that which passes through a 0.45 µm nominal
280 pore size filter (Subsection 20.6.4.7.D(4) NMAC).

281

[4] http://water.epa.gov/scitech/swguidance/standards/wqslibrary/

3) AB/GUNDERSON: In GEI Consultants' ("GEI") report to the Colorado Mining Association (March 2010) regarding development of a hardness based aluminum water quality criteria, GEI pointed out that the 1988 EPA criteria were "21 years old" and since publication of the 1988 Aluminum Document that "information on the environmental significance of freshwater organism Al exposure and available toxicity studies has increased" but did not provide sound scientific evidence that the current 1988 EPA criteria were "substantially overprotective" or that the new information presented a sound scientific basis for changing the EPA standard.

SWQB Rebuttal Response: In Colorado, an EPA-accepted methodology was used by GEI to develop ambient water quality standards. Exhibit 1 of the GEI testimony to Colorado's WQCC states:

> *"There are standard procedures for developing ambient water quality standards, based on the EPA criteria derivation and recalculation guidance (Stephan et al. 1985,* EPA 1994). GEI further states*: "The first step is to gather all available data on the toxicity of a chemical to various forms of aquatic life. These studies are then subjected to detailed technical review to determine if the data are valid. Stephan et al. (1985) provides guidelines for determining whether data from a particular study are acceptable for use. Acceptable data are then compiled to develop acute and chronic toxicity databases containing data for a variety of species. In the case of updating older standards documents, as is the case for the metals in this proposal, existing toxicity databases are reviewed for accuracy and literature searches are performed to ensure the databases are complete and include the most up-to-date science."*
> (SWQB Rebuttal Exhibit 15)

The SWQB has no indication that this was not performed in the development of Colorado's Al criteria and, to the contrary, approval by both Colorado's WQCC and the EPA indicates the demonstration of protectiveness was effectively made for Colorado's waters.

309 **4) AB/GUNDERSON:** Furthermore, the EPA has been working on revising the 1988 aluminum
310 water quality criteria and expects to have a draft of these revisions ready by fall 2015 (Eignor,
311 2013; Eignor *et al.*, 2014). In the EPA document "National Recommended Water Quality
312 Criteria – Correction," the EPA states that while existing criteria are under revision the "*water*
313 *quality criteria published by the EPA remain the Agency's recommended water quality criteria*
314 *until EPA revises or withdraws the criteria*" (U.S.E.P.A. 1999). Indeed, EPA region III rejected
315 the proposal submitted by the West Virginia Department of Environmental Protection for
316 hardness-based aluminum criteria (Developed by GEI, August 2011) due to concerns over lack
317 of protection for local species (InsideEPA.com; Doc. ID: 2461044), and the current development
318 of new National aluminum criteria.

319 **SWQB Rebuttal Response:** The SWQB is aware that new, hardness-based, scalar national
320 criteria are close to being released for public review by the EPA and that absent a state-specific
321 or regional demonstration that national criteria might not fit for all water quality circumstances,
322 the 1988 publication remains the EPA's recommended guidance. This does not preclude,
323 however, accepted procedures for the demonstration and determination of criteria outside the
324 national recommendations (EPA criteria derivation and recalculation guidance (Stephan *et al.*,
325 1985; EPA, 1994))[5,6] Indeed, in the EPA's letter of comments on the New Mexico 2008-2010
326 Triennial Review regarding New Mexico's proposed hardness-based criteria, they note:

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[5] Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman and W.A. Brungs, January 1985. "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," USEPA Office of Research and Development, Environmental Research Laboratories: Duluth, Minnesota; Narragansett, Rhode Island and Corvallis, Oregon, 98 pp.

[6] U.S. Environmental Protection Agency (EPA). 1994. *EPA Interim Guidance on Determination and Use of Water-Effect Ratios for Metals.* EPA-823-B-94-001. Office of Water, Washington, DC.

327 "*EPA considers the hardness-dependent equations for aluminum to be an improvement*
328 *over the existing criteria for waters within the circumneutral pH range (6.5 - 9.0)...*"

329 (SWQB Rebuttal Exhibit 16)

330 Regarding the EPA Region 3's concerns about West Virginia's ("WV") proposed Al
331 criteria, the SWQB understands these concerns were based on local species' sensitivity,
332 specifically endangered (and other) mussel species, some of which are endemic to WV.
333 Protection of highly sensitive mussels endemic to WV does not, *ipso facto*, indicate that New
334 Mexico's Al criteria are not protective for the State. The EPA encourages the development of
335 criteria that are tied to species indigenous to the State.

336

337 **5) AB/GUNDERSON:** The EPA, in its revisions, is evaluating the use of a simplified aluminum
338 Biotic Ligand Model ("BLM") using four parameters (pH, dissolved organic carbon, hardness,
339 and temperature), due to the complex nature between aluminum toxicity and water quality
340 (Eignor, 2014). In addition, there are recent studies (soon to be published) that will provide
341 additional information on aluminum toxicity at the neutral and alkaline pH ranges. One of these
342 studies looking at chronic aluminum exposures to a variety of species at pH 6.0 found that the
343 zebrafish had an EC_{10} of 80 µg/L total aluminum (Stubblefield *et al.,* 2012). This suggests that
344 application of hardness-based aluminum criteria, such as New Mexico's current criteria, at least
345 before these studies are published, is not practical or scientifically sound. Accordingly, and in
346 my professional judgment and consistent with the scientific evidence, New Mexico's aluminum
347 criteria—which are the least protective of anywhere in the country—should be replaced by the
348 EPA approved aluminum criteria of 87 ug/L chronic and 750 ug/L acute, and based on total
349 recoverable aluminum.

350 **SWQB Rebuttal Response:** The latest information New Mexico has regarding the EPA's
351 development of a BLM and emergent data regarding pH effects is that pH added no additional
352 information once water hardness was considered (Eignor, 2013)[7].

353

354 The study by Stubblefield *et al*., 2012, on Zebrafish Al sensitivity at pH 6 is apparently a
355 conference paper (non-refereed publication of emergent results) and the SWQB does not have
356 access to the abstract, nor an extended peer-reviewed manuscript, in order to ascertain the
357 reliability of the sensitivities of the six species tested.[8] However, Zebrafish are known to inhabit
358 alkaline tropical waters and are not the ideal organism with which to model Al effects at acidic
359 pH, as they are likely already stressed outside of their preferential pH range. Moreover, as Dr.
360 Gundersen points out in later testimony: "*EPA recommends the use of indigenous species in the*
361 *development of criteria intended to apply statewide*" (AB NOI, p.10). As previously discussed, a
362 pH below 6.5 is already below New Mexico's WQS criteria for all classified waters (pH 6.6 to

[7] Eignor, D. 2013. Draft Reassessment of the 1988 Ambient Water Quality Criteria for Aluminum. SETAC 34th North America Annual Meeting, Nashville, TN, USA.

[8] Stubblefield WA, Cardwell, AS, Adams WJ, Gensemer RW, Nordheim E, Santore RC. 2012. Society of Environmental Toxicology and Chemistry North America 33rd Annual Meeting. Long Beach CA.

8.8, or 9, depending on Aquatic Life Use, Subsection 20.6.4.900.H NMAC), so a lack of protections under the current standards is not demonstrated by the Stubblefield study.

6) AB/GUNDERSON: Why are the GEI Derived Colorado, West Virginia, and New Mexico Hardness-Based Aluminum Criteria Different? The original hardness-based aluminum criteria for Colorado were the same as the criteria developed for New Mexico (GEI report to the CMA, March 2010) but the final Colorado chronic equation was adjusted, which resulted in the chronic criteria being more protective than the New Mexico hardness-based aluminum chronic criteria (Table 1). It is apparent that the Colorado Water Quality Control Commission felt that the original GEI hardness-based aluminum chronic criterion equation was not protective enough. This is reflected in an adjustment in the y intercept of the chronic equation (changed from 0.9161 to -0.1158) resulting in a more protective chronic value (Table 1). In addition, the same hardness based equations produced by GEI were proposed by West Virginia yet they were for dissolved aluminum, making them less protective of aquatic life (Table 1). However, I am unaware of a valid scientific basis for using the same equation for both total recoverable and dissolved aluminum. Equally troubling was the development of the New Mexico hardness-based aluminum equations in 2009 (Chevron Mining Inc.'s notice of intent to present technical testimony – WQCC NO. 08-13), which was for dissolved aluminum. However, the final criteria are based on total recoverable aluminum using the same equations that were derived for dissolved aluminum. If the original criteria were developed for dissolved aluminum, then new equations should have been developed for total recoverable aluminum.

384 **SWQB Rebuttal Response:** New Mexico's Al criteria were developed using the EPA-approved
385 methods of acute-to-chronic ratio ("ACR") data. We are not aware of how Colorado derived and
386 adopted their chronic Al criteria.

387

388 **7) AB/GUNDERSEN:** Interestingly, the EPA-funded Arid West Water Quality Research Project
389 (AWWQRP, May 2006) developed hardness-based aluminum equations for the region (which
390 includes New Mexico) that are different from the New Mexico/Colorado equations, which
391 included recreationally important species (rainbow trout). Some of the material in this report was
392 also put together by GEI (then Chadwick Ecological) who evaluated the EPA recalculation
393 procedure for the Arid West effluent-dependent waters. Both the acute and chronic equations are
394 substantially more protective than the New Mexico equations. In addition, site-specific equations
395 were calculated, which were even more protective than the regional equation. However, the
396 AWWQRP report pointed out that data to appropriately develop site specific equations was
397 lacking. The variability in these 6 equations demonstrates both a lack of understanding and the
398 lack of data needed to properly calculate hardness-based equations either nationally, regionally,
399 or on a site-specific basis. Therefore, to be protective of aquatic life, it is advisable to adopt 1988
400 EPA recommended criteria on the basis of total recoverable aluminum, at least until pending
401 studies on aluminum toxicity to aquatic life are made available (published in peer-review
402 scientific journals) and the EPA finishes developing new national aluminum criteria (Biotic
403 Ligand Model). Otherwise, New Mexico risks causing potentially irreparable harm to aquatic
404 life.

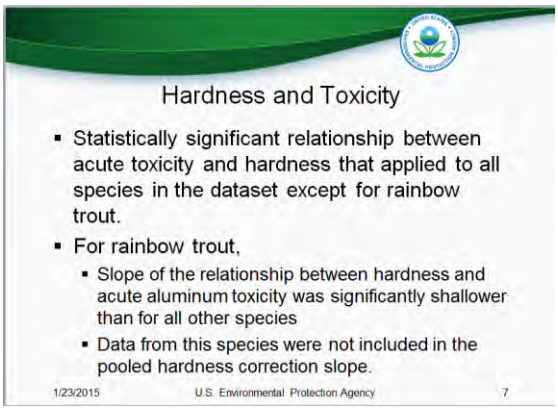
405 **SWQB Rebuttal Response:** Adopting a national standard when regional or site specific data
406 suggest that there are ameliorative qualities to natural waters fails to recognize that these
407 differences exist. Furthermore, the EPA has a mechanism to address differences that allows for
408 development of a protective criterion that better fits local and/or regional conditions. Different
409 regional criteria guidance through the EPA-funded Arid West Water Quality Research Project
410 ("AWWQRP") is not a weakness of the undertaking but a strength, and was the point of the
411 exercise. The fact that New Mexico and Colorado criteria were, again, different than the regional
412 standards could be expected given differences in the intrinsic water quality in each state.
413 Moreover, additional data available subsequent to the AWWQRP and incorporated into the effort
414 to develop New Mexico's Al criteria would be expected to generate somewhat different water
415 hardness scale results.

416

417 **8) AB/GUNDERSEN:** GEI's omission of recreationally important species is troubling. In GEI's
418 original calculation of a pooled-hardness slope for the Arid West (AWWQRP, May 2006), data
419 from a study looking at the effects of hardness on aluminum toxicity to develop rainbow trout
420 was used (Thomsen *et al*., 1988). The study was omitted when GEI calculated the pooled-
421 hardness slope for New Mexico criteria. GEI's reasoning was that hardness was not reported in
422 this study (only calcium).However, many studies have shown that it is calcium that reduces
423 aluminum toxicity, with the proposed mechanism being competition of calcium with monomeric
424 aluminum for gill binding sites (Gensemer and Playle, 1999). Hardness measures primarily
425 calcium and magnesium yet magnesium has not been shown to ameliorate aluminum toxicity.
426 The study by Thomsen reported two 48 hour LC50s (the lethal concentration of aluminum that
427 kills 50% of the population) based on two calcium values (1 and 150 mg/L). The hardness for

428 these 2 calcium values would be 2.5 and 375 mg/L as $CaCO_3$ respectively. Typically
429 reconstituted laboratory dilution waters have calcium magnesium ration of 1:1, which can be
430 quite different to what is measured in the surface waters that can have ratios ranging from 1.6:1
431 to 8:1 (Naddy *et al*., 2002). If magnesium were factored into these hardness values, the 2.5 mg/L
432 would not be significantly different (a 1:1 ratio would result in a hardness of 5.6 mg/L as
433 CaCO3). The calcium concentration of 150 mg/L would result in a hardness of 375 mg/L as
434 CaCO3 which is higher than any of the hardness values listed as acceptable aluminum toxicity
435 acute data in the 2010 GEI report. Therefore it seems acceptable to use these values (2.5 and 375
436 mg/L as $CaCO_3$), particularly when rainbow trout are recreationally important species in New
437 Mexico.

438 **SWQB Rebuttal Response:** The non-inclusion of important game fish, namely Rainbow trout,
439 may be attributed to the "shallow response" of salmonids to hardness as compared to other
440 species in the analysis. This phenomenon was reported by Eignor (2015) as a finding in the EPA
441 analysis for the development of new Al criteria as summarized in the slide below:



442

443 The omitted Thomsen *et al.*, (1988) paper show an LC_{50} mortality in soft water (1 mg
444 Ca/l or 2.5 mg/L as $CaCO_3$ Total Hardness) at 3,800 µg Al/l and at 71,000 µg Al/l for hard water

445 (150 mg Ca/l or 374 mg/L as $CaCO_3$ Total Hardness). New Mexico's hardness-based formula
446 would set the Al levels for these soft and hard water examples at 21.8 µg Al/l and 10,071 µg
447 Al/l, respectively. Or, if New Mexico uses the adjusted total hardness suggested by Dr.
448 Gundersen, 2.5 mg/L and 375 mg/L as $CaCO_3$ (New Mexico WQS has an upper limit of 220
449 mg/L Total Hardness, so for purposes of this discussion, we report this number), New Mexico's
450 hardness-based limits would be 21.9 µg Al/l and 10,071 µg Al/l for either low or high water
451 hardness, respectively. In this case, New Mexico's hardness-based acute Al limits are well below
452 the LC_{50} reported in Thomsen *et al*., 1988. However, these hardness-based Al limits are not
453 directly comparable to LC_{50} data without further analysis using the *Guidelines for Deriving*
454 *Numerical National Water Criteria for the Protection of Aquatic Organisms and Their Uses*
455 (EPA, 1985) Ibid. Using data from the Thomson, *et al.* (1988) study in conjunction with other
456 species/taxon data to derive a Final Acute Value and thus an Acute Criterion or Criterion
457 Maximum Concentration was not demonstrated, however, and thus the significance of not using
458 this study cannot be easily ascertained. On the point of reporting Ca hardness and not Ca plus
459 Mg hardness because Mg hardness protections have not been demonstrated, almost all
460 toxicological studies, Gundersen *et al*., (1994) included, report and/or manipulate both elements
461 that contribute to hardness. At this point it is not possible to disentangle the relative
462 protectiveness of Ca and Mg. However, the SWQB does regularly require dissolved Ca and Mg
463 independent of the water hardness metric and may be able to analyze the meaningfulness of this
464 observation in the future.

465

466 **9) AB/GUNDERSEN:** Gundersen *et al.* (1994) was another study using rainbow trout that was
467 omitted for use in derivation of the pooled-hardness slope for New Mexico criteria. GEI's

468 rationale for not using this study (according to their March 2010 report) was that the aluminum
469 LC50 calculated for the highest hardness (115.8 mg/L as $CaCO_3$) had undefined confidence
470 limits. However it is not clear why GEI did not use the other 3 LC_{50}s that were calculated at three
471 different hardness values. It is possible that GEI determined that these 3 LC_{50}s did not coincide
472 with the EPA guideline that the highest hardness (83.6 mg/L) value is at least 100 mg/L higher
473 than the lowest (23.2 mg/L). However, in the March 2010 report, GEI used data for *C. dubia* in
474 the hardness regression analysis where the range did not meet the EPA guidelines as well
475 (hardness range 26– 98.5 mg/L). GEI stated that they did not use the high hardness value for C.
476 dubia (194 mg/L) because the LC_{50} for that value was undefined (>99,600 mg/L) but they did
477 count it as fulfilling the EPA guideline requirement for hardness being 100 mg/L higher than the
478 lowest value.

479 **SWQB Rebuttal Response:** The SWQB appreciates AB's concern, but it has not been
480 demonstrated how inclusion of some studies mentioned, or non-inclusion of others, would
481 impact the hardness-based Al criteria calculation.

482

483 **10) AB/GUNDERSEN:** Some of the studies used by GEI to derive values in the hardness based
484 aluminum equations should not be used GEI's proposed final Al acute database (Table 4, March
485 2010 report) list *Tubifex tubifex* (Khangarot, 1991) as the 4th most sensitive species (Genus
486 Mean Acute Value 5,698 ug/L). The GMAV from this species is used to calculate the final acute
487 value (FAV). However there are significant problems with this study. First, the exposure water
488 hardness listed in this study (245 mg/L as $CaCO_3$) does not correspond to the listed calcium and
489 magnesium concentrations (160 and 90 mg/L respectively). Based on these values, the hardness

490 should be 769 mg/L as $CaCO_3$, which is over 3-fold higher than the listed hardness. Second, the
491 aluminum that was added to exposure water was Al(NH4SO4)2•12H20 (aluminum ammonium
492 sulfate). There is concern that the aluminum ammonium sulfate would contribute ammonia to the
493 exposure solutions (2 ammonia/ammonium ions for every one aluminum ion). The level of
494 aluminum in exposure chambers was not measured in this study as well. Therefore this study
495 should not be used, particularly when this species represents the 4th most sensitive species based
496 on acute toxicity.

497 **SWQB Rebuttal Response:** The SWQB concurs with Dr. Gundersen's observation that the
498 combined hardness contributions of reported Ca and Mg for this study calculate to 769 mg/L as
499 $CaCO_3$ hardness rather than that reported (Khangarot *et al*., 1991). The SWQB is concerned
500 about many of the associated anions and cations introduced in toxicity studies of this type and
501 notes, for instance, potential problems regarding the use of certain Al salts, including $Al(Cl)_3$,
502 which introduces three chlorines for every Al introduced and may cause toxic and/or synergistic
503 effects. However, the SWQB cannot demonstrate this as anything more than a potential problem.
504 Absent specific data that illustrates toxic effects of non-target anions and cations, we conclude
505 that a genus mean acute value ("GMAV") calculated from waters more toxic than expected
506 would likely lead (erroneously) to a more protective (*i.e.*, more stringent) standard.

507

508 **10) AB/GUNDERSEN:** Data from a study looking at the toxicity of a variety of metals
509 (including aluminum) on *D. magna* were used to calculate the pooled-hardness slope, final acute
510 value, and final acute/chronic ratio (Biesinger and Christensen, 1972). However, there are
511 several problems with this study that warrants omission from the database: First, the exposure

512 water (Lake Superior water had other metal contaminants in addition to the added aluminum
513 (range; Cr = 2-20 ppb, Al 1-26 ppb, Zn 1-2.7 ppb, Cu 0.3-3.2 ppb, Sr 12-27ppb, barium 8-22
514 ppb, Fe 2-83 ppb, Mn 0.2-11.5 ppb) and the aluminum concentration was not measured in
515 exposure water. Second, the number of test concentrations was not listed, and the pH of the
516 exposure water (before addition of metals had a large range (7.4 – 8.2) was not reported for the
517 acute test chambers. Third, the authors reported that, in the chronic chambers with added
518 aluminum, the pH changed from 6.5 to 7.5, which suggests that the pH likely changed in the
519 acute exposures as well but this was not measured or reported (pH has a very significant effect
520 on aluminum speciation/toxicity).

521 **SWQB Rebuttal Response:** It would appear that waters containing other potentially harmful
522 constituents are not ideal for the determination of standards for one constituent, but would seem
523 to potentially skew the hardness-based formulae calculation toward being overly protective.

524

525 **11) AB/GUNDERSEN:** The study by Kimball (1978 manuscript) was used to calculate the
526 slope value from *D. magna* data and provided the acceptable hardness range for the species. Use
527 of this study, like the studies above, is problematic, and calls into question the scientific validity
528 of the current New Mexico hardness based criteria.

529 • First, this study does not seem to be validated in any way (master's thesis, dissertation

530 • Second, looking at the unpublished manuscript a hardness value was not reported, only
531 alkalinity was measured and it was not measured in the acute *D. magna* aluminum exposures.
532 However, in the GEI analysis a hardness value of 220 mg/L was reported along with a rather

533 high LC50 value of 38,000 mg/L. Based on EPA guidelines, this study cannot be used without a
534 measured hardness value. Even more troubling, in the acute *D. magna* aluminum exposure
535 chambers there was a huge difference in the measured pH values between the lowest and highest
536 aluminum exposures (control pH = 8.18, 4 mg/L Al = 7.95, 6 mg/L Al = 7.61, 9 mg/L Al = 7.2,
537 22 mg/L Al = 6.85, 34 mg/L Al = 6.39, 43 mg/L Al = 5.14). This is unacceptable and these data
538 should not be used. Overall the quality of this manuscript is poor and is not validated by any
539 means. Third, the data for *P. promelas* and *C. dubia*, (ENSR, 1992a and 1992b), as a report for
540 Climax Metals Company, Golden, Colorado, is not a peer-reviewed published study, which
541 makes it difficult to properly evaluate the experimental conditions. Prior to being used as a basis
542 for adopting hardness criteria, this report should be made available for review, particularly since
543 several of the studies used to derive hardness-based aluminum criteria are not acceptable. The
544 fact that NM hardness based criteria was based on these scientifically questionable reports and
545 studies is troubling and is more than enough reason to discredit the standard and provide rational
546 to revert back to the EPA-recommended total recoverable Aluminum criteria.

547 **SWQB Rebuttal Response:** It is the SWQB's understanding that this paper/thesis/dissertation
548 (Kimball, 1978) was used to develop the EPA's 1988 Al criteria guidance.

549

550 **12) AB/GUNDERSEN:** The use of data to derive parameters for the New Mexico acute
551 equation (*i.e.* pooled-hardness slope) should not be applied to the chronic equation when peer-
552 reviewed research indicates that the aluminum chronic toxicity mechanism differs from the acute
553 mechanism. The differing chronic (*i.e.,* growth inhibition, reduced reproductive success) and
554 acute effects (death) of aluminum are likely due to two different mechanisms of aluminum

555 toxicity to aquatic organisms. The survey of scientific literature by Muniz and Leivestad (1980)
556 and Gensemer and Playle (1999) described two mechanisms of aluminum toxicity to fish: 1)
557 ionoregulatory disturbances due to binding of aluminum to gill binding sites; and 2) respiratory
558 distress due to clogging of gills by insoluble forms of aluminum. The respiratory effects of
559 aluminum were clearly demonstrated by the work of Malte and Weber (1988), who eliminated
560 the ionoregulatory effects of aluminum on cannulated rainbow trout by elevating the NaCl levels
561 in the exposure water. Fish showed large respiratory disturbances that were accompanied by
562 aluminum precipitation and clogging of gills. Respiratory disturbances due to aluminum
563 exposures can lead to growth inhibition since fish have to expend more energy on respiration.
564 Gundersen *et al*. (1994), looking at the effects of hardness and dissolved organic matter on
565 aluminum toxicity to fingerling rainbow trout at near-neutral and weakly alkaline pH, found that
566 at near-neutral pH, specific growth rate was inhibited more than at weakly alkaline pH, yet there
567 was no mortality in fish exposed to aluminum at near-neutral pH. However, while there were
568 significant mortalities of fish exposed to aluminum at weakly alkaline pH, specific growth rates
569 were inhibited less at this pH versus near-neutral pH. This shows that aluminum has different
570 effects at different pH values. At alkaline pH, aluminum has more pronounced acute effects
571 (lethal or severe effects) and at near neutral pH aluminum has more pronounced chronic effects
572 (impacts a species over the species lifespan and can result in reproductive impacts), likely due to
573 differences in aluminum species at near neutral versus alkaline pH. These observations are also
574 supported by the work of Freeman and Everhart (1971) who also looked at aluminum toxicity to
575 fingerling rainbow trout at alkaline pH. These authors reported that insoluble polymeric and
576 colloidal aluminum species reduced growth more effectively than soluble aluminum species at
577 pH 7.0 and 8.5. Deriving a pooled-hardness slope from only acute studies and then applying this

578 to a chronic equation may not properly protect aquatic species from the chronic effects of
579 aluminum. In addition, this shows how pH has a significant influence on aluminum toxicity,
580 where mechanisms of toxicity differ at different pH values.

581

582 **SWQB Rebuttal Response**: Regardless of mode of toxicity, standards developed from Al
583 toxicity trials at a range of pH between 6.5 and 9 can be said to appropriately capture toxicity
584 regardless of the particular mechanism at work. High toxicity observed in circumneutral waters
585 wherein Al is only sparingly soluble, even in acute toxicity studies, suggests that the non-
586 ionoregulatory toxicity is being captured by the shorter toxicological assays (Winter *et al.,* 2005).

587

588 **13) AB/GUNDERSEN:** Hardness has only a minor effect on aluminum toxicity and may not
589 be protective at near-neutral to alkaline pH compared to other water-quality parameters (pH,
590 DOC, temperature).

591 Several studies have shown that other water quality parameters have a more significant
592 effect on aluminum toxicity than hardness. There are a number of studies that indicate that pH
593 has a more pronounced effect on aluminum toxicity than hardness. Gundersen *et al.* (1994) found
594 that, based on multiple regression analysis, pH was determined to be the most important
595 independent variable affecting aluminum-induced mortality in rainbow trout (a recreationally
596 important species in New Mexico) in 96-hr tests when looking at the effects of hardness and pH
597 on aluminum toxicity. In addition, the authors noted that the best predicting model for the effects
598 of aluminum on specific growth rate in rainbow trout included pH, filterable aluminum, and total

599 aluminum. Specific growth rate was affected most at near-neutral pH (where insoluble polymeric
600 forms of aluminum predominate) and that hardness did not protect fish from the toxic affects of
601 aluminum on growth. Stubblefield *et al.* (2012) looked at the effects of various water quality
602 parameters on the toxicity of aluminum to eight different aquatic species (representing 5 groups)
603 at pH 6. They found that pH, dissolved organic matter, and temperature had the largest influence
604 on aluminum toxicity with calcium, sodium and fluoride having only having a minor influence.
605 Lydersen *et al*. (2002) found that mortality increased in brown trout exposed to aluminum in
606 natural waters with increasing temperature and that temperature had a more significant affect on
607 aluminum toxicity versus total organic carbon. Poleo *et al*. (1991) and Poleo and Muniz (1993)
608 saw a similar relationship between aluminum toxicity and temperature for Atlantic salmon. The
609 observed increase in toxicity was explained by enhanced aluminum polymerization with
610 increased temperature and an increase in fish metabolism (higher O_2 demand) and a decrease in
611 surface water dissolved oxygen levels. This could be particularly significant for salmonid species
612 (species that are sensitive to water temperature and dissolved oxygen levels) that inhabit surface
613 waters where temperature and dissolved oxygen levels can be limiting late in summer (*i.e.* some
614 New Mexico waters). Again, this shows that there are other water quality parameters (dissolved
615 organic carbon, temperature, and pH) that play a significant role in influencing aluminum
616 toxicity to aquatic species and that hardness may play only a minor role.

617 **SWQB Rebuttal Response:** As noted in the response to AB/GUNDERSEN #5, the effect of pH
618 on aluminum toxicity may be equivocal at best. The most-recent multivariate statistical analyses
619 of which the SWQB is aware, those reported by Eignor (2013) Ibid. regarding the EPA's
620 development of new Al criteria, suggests that pH adds little to no toxicological information after
621 water hardness is considered. The SWQB acknowledges that other factors such as temperature

622 impact toxicity, and other dissolved chemical species (NOM, sodium, and fluoride) may provide
623 varying levels of additional protections against Al toxicity, however, a reversion to the 1988
624 EPA guidance does not account for these factors, and indeed, removes the well-described
625 significant factor, water hardness, from consideration. For these reasons, the SWQB believes it
626 would be in error to return to prior criteria.

627

628 **14) AB/GUNDERSEN**: Little data exists for aluminum toxicity at pH range 8.5 – 9.0

629 As stated above, pH has a significant effect on aluminum toxicity and more information
630 is needed on the toxicity of both monomeric and polymeric forms of aluminum at this pH range.
631 The New Mexico aluminum criteria are stated to be protective from pH 6.5 – 9.0. However, very
632 little is known about the effects of pH on aluminum toxicity at pH 8.0 – 9.0, pH values that are
633 seen in New Mexico waters. There is evidence that there are differing effects to a recreationally-
634 important species, rainbow trout, at near neutral pH as opposed to slightly basic conditions, and
635 that both dissolved and polymeric forms of aluminum result in toxicity. The statement made by
636 EPA in their final approval of the GEI proposal in 2010 reflects their concern for not using
637 available data for recreational important species. As the EPA explained: Based on our detailed
638 review and correspondence with the State, EPA noted concerns with the selective exclusion and
639 inclusion of specific studies that were used in the recalculation, including the use of non-native
640 species. The EPA learned that the recalculated criteria were derived by GEl as if they were an
641 update to the national criteria. Although GEI generally followed methods outlined in EPA's
642 criteria derivation and recalculation procedures (Stephan *et al.,* 1985; EPA, 1994), since these
643 updates are submitted by the State, EPA views them as State, not national criteria. As such, EPA

644 recommends the use of indigenous species in the development of criteria intended to apply
645 statewide. In addition, the lack of data on aluminum toxicity at the pH 8.0 – 9.0 range is
646 troubling since the solubility on monomeric anionic aluminum changes significantly over this pH
647 range (Figure 1). As shown in the figure the solubility of monomeric aluminum changes from
648 285 µg/L at pH 8.0 to 2,855 µg/L at pH 9.0. This is problematic since scientific studies have
649 shown that the toxic mechanism of monomeric aluminum differs from polymeric forms, and that
650 monomeric aluminum appears to be more responsible for acute toxicity versus insoluble
651 polymeric forms that appear to be more chronically toxic (Muniz and Leivestad, 1980; Exley *et*
652 *al.,* 1991; Gundersen *et al.,* 1994; Poleo, 1995; Sparling and Lowe, 1996). In addition several
653 reports (including the March 2010 GEI report) have noted that most of the research addressing
654 aluminum toxicity has been at acidic pH with very few studies looking at toxic effects at the
655 circumneutral to weakly alkaline pH values. In the Arid West report (AWWQRP, May 2006) it
656 was pointed out that a pH-based equation could not be developed because there was a limited
657 number of studies conducted for any species at a range of pH values. Gensemer and Playle
658 (1999) pointed out that the toxicity of $Al(OH)_4$ is poorly understood because of the lack of
659 research at weakly alkaline pH.

660 **SWQB Rebuttal Response:** The SWQB recognizes the dearth of literature covering Al toxicity
661 at pH >8.5, however for reasons already illustrated (*i.e.*, low toxicity of the aluminate ion), there
662 has been no well-demonstrated reason in AB's proposal to re-adopt the 1988 EPA guidance.
663 Indeed, Colorado (prior to adopting hardness-based criteria) and North Dakota (currently)
664 incorporate(d) the EPA's 1988 guidance with the caveat that the chronic criteria would not apply
665 at high pH, or with appreciable water hardness, due to the low toxicity of Al at this pH range.

666 See Colorado's and North Dakota's pH and hardness exceptions below, as implemented before
667 the adoption of hardness based criteria:

668 **Colorado's past implementation statement for higher pH waters and hardness:**

Aluminum: A footnote was added to the chronic aluminum value to explain the application of the standard. Application of the 87 µg/l total recoverable aluminum chronic table value is based on toxicity studies with brook trout and striped bass. The studies underlying the 87 µg/l chronic value, however, were conducted at low pH (6.5-6.6) and low hardness (<10 ppm $CaCO_3$), conditions uncommon in Colorado surface waters. A water effect ratio toxicity study in West Virginia indicated that aluminum is substantially less toxic at higher pH and hardness (although the relationship is not well quantified at this time). Further, field data indicate that many high quality waters in the U.S. contain more than 87 µg/l aluminum when either the total recoverable or dissolved aluminum is measured. Based on this information and considering the available toxicological information in EPA's Aluminum Criteria Document (EPA 440/5-86-008), the 87 µg/l chronic table value standard for aluminum will be implemented as follows: where pH is equal to or greater than 7.0 and hardness is equal to or greater than 50 ppm as $CaCO_3$ in the receiving water after mixing, the 87 µg/l standard will not apply, and aluminum will be regulated based on compliance with the 750 µg/l acute standard. In situations where the 87 µg/l chronic standard applies, a discharger may propose a site-specific chronic standard based on a water effect ratio.
669

670

671 **North Dakota's current implementation statement for high pH and hardness waters:**

TABLE 1

MAXIMUM LIMITS FOR SUBSTANCES IN
OR CHARACTERISTICS OF CLASS I STREAMS

CAS[1] No.	Substance or Characteristic	Maximum Limit
		Acute Standard
7429905	Aluminum	750 ug/l
		Chronic Standard
		87 ug/l Where the pH is equal to or greater than 7.0, and the hardness is equal to or greater than 50 mg/l as $CaCO_3$ in the receiving water after mixing, the 87 ug/l chronic total recoverable aluminum criterion will not apply, and aluminum will be regulated based on compliance with the 750 ug/l acute total recoverable aluminum criterion.

672

673

674 **AB/GUNDERSEN**: It is misleading to state that hardness (magnesium and calcium measured as
675 caco3) ameliorates aluminum toxicity when many scientific studies show that only calcium
676 ameliorates aluminum toxicity.

677 Since there is a lack of data on the effects of water quality on aluminum toxicity at the pH
678 6.5 to 9.0 range, it is recommended that the New Mexico surface water criteria revert back to the
679 original EPA values (87 and 750 µg/L, based on total recoverable aluminum). There are still
680 serious questions about how well certain water quality parameters can protect against the toxic
681 effects of aluminum. For example, the EPA needs to reevaluate its position on hardness and
682 aluminum toxicity. It is well established that it is calcium that is protective against aluminum
683 toxicity. The review by Gensemer and Playle (1999) cites several studies that show protective
684 effects of calcium on aluminum toxicity, particularly protection against aluminum induced
685 ionoregulatory disturbances. However, hardness measures the divalent cations in water
686 (predominantly calcium and magnesium). Typically, the ratio of calcium to magnesium in
687 laboratory-reconstituted waters differs from ratios seen in surface waters. Studies looking at the
688 effects of constant hardness concentrations at different Ca:Mg ratios on copper toxicity to a
689 variety or aquatic organism generally showed that exposure water of similar hardness but higher
690 calcium concentrations were more protective (Welsh *et al.,* 2000; Naddy *et al.,* 2002). These
691 studies report that failure to account for differences in calcium between exposure water and
692 surface waters can produce significant errors when predicting metal toxicity. It seems that a more
693 useful approach would be for State agencies to measure calcium in surface waters and consider
694 laboratory studies where the calcium concentration in exposure water is reported. This suggests
695 that hardness-based equations are invalid and, if a model predicting toxicity is desired, that a
696 more effective approach would be to develop an equation based on calcium. Again, if this
697 approach is desired more research on calcium's effect on aluminum toxicity would be needed to
698 cover the broad pH range of 6.5 to 9.0. The Canadian Council of Ministers of the Environment
699 recognizes both the role calcium plays (versus hardness) in ameliorating aluminum toxicity and

700 the lack of data over a wide pH range and subsequently has issued a conservative water quality
701 guideline for aluminum that somewhat accounts for both calcium (not hardness) and dissolved
702 organic carbon (DOC). CEQG guideline for aluminum = 5 µg/L at pH<6.5; [Ca2+]<4 mg/L;
703 DOC <2 mg/L = 100 µg/L at pH >6.5; [Ca2+] >4 mg/L; DOC >2 mg/L For waters with a pH >
704 6.5 the recommended guideline is 100 µg/L and for acidic waters with a pH < 6.5 a guideline of
705 5 µg/L is recommended (see Table 1). These conservative numbers are based on the same studies
706 (Neville, 1985) used in the original EPA document (Ambient Water Quality Criteria for
707 Aluminum 1988) and toxicity tests with amphibians (Clark and LaZerte, 1985).
708
709 **SWQB Rebuttal Response:** As demonstrated in Table 1, a reversion to prior guidance would
710 reduce protections where they are most needed (*i.e.*, in waters with low hardness). It may be that
711 forthcoming Al guidance for hardness based criteria will account for the differences in Ca versus
712 Mg protections, however, both the 1988 EPA guidance and the current New Mexico hardness-
713 based criteria acknowledge or implement the protectiveness of the hardness-based metric
714 regardless of the relative contributions of Ca and Mg, consistent with the use of this metric in
715 toxicological studies. As more is learned regarding Ca, Mg, and dissolved organic carbon
716 ("DOC"), New Mexico will strive to incorporate findings as appropriate for the protection of
717 aquatic life.
718
719 **16) AB/GUNDERSEN:** Adopting the 1988 EPA recommended total recoverable aluminum
720 criteria is protective of aquatic life.
721 Based on the lack of adequate data looking at the effects of various water quality
722 parameters (*i.e.* calcium, dissolved organic matter, temperature) on aluminum toxicity,

723 particularly for the pH range of 6.5 to 9.0, I recommend, to protect aquatic life, that New Mexico
724 revert back to the current EPA criteria (87 and 750 µg/L, total recoverable aluminum). These
725 criteria are based on studies evaluating aluminum toxicity to aquatic life at pH 6.5 to 9.0. I
726 recommend adopting the EPA recommended total recoverable aluminum criteria of 87 and 750
727 ug/L rather than the dissolved aluminum criteria of 87 and 750 ug/L that was previously in place
728 in New Mexico because my previous research has shown that the dissolved criteria is not
729 protective of aquatic life. The 16-day LC_{50}s for rainbow trout fingerlings exposed to aluminum at
730 weakly alkaline pH and two different hardness values (20.3 – 103.0 mg/L as $CaCO_3$) were 430
731 and 670 µg/L respectively based on dissolved aluminum. These values are lower than the
732 previous New Mexico chronic standard of 750 µg/L for dissolved aluminum (measured by
733 filtration through a 0.4 µm filter). In addition my work also showed that growth in trout was
734 inhibited at dissolved aluminum concentrations between 20 – 30 µg/L. Based on these findings a
735 chronic criterion of 750 µg/L based on dissolved aluminum would not be protective. What is
736 important is that these criteria take into account studies where sensitive species were identified,
737 some of which are related to recreationally important species in New Mexico (*i.e.,* rainbow
738 trout). This was not done in the development of the current, and deficient, New Mexico
739 hardness-base aluminum criteria. The current EPA chronic value of 750 µg/L was derived due to
740 tests with 2 sensitive fish species (brook trout and striped bass). In particular, the chronic value
741 was influenced by values of 87 µg/L (where no striped bass died after a 7-day exposure to
742 aluminum), and 174.4 µg/L (where 58% of the fish died). The EPA went with a chronic value of
743 87 µg/L to protect this sensitive species. Some may argue that taking the geometric mean (122
744 µg/L) of these two values would be more appropriate. However, since the effects of water quality
745 cannot be accounted for, it is best to go with the lower values. Recent work by Stubblefield et al.

746 (2012), calculated an EC_{10} (effective aluminum concentration that inhibited growth of 10 % of
747 the population) of 80 µg/L total aluminum based on studies looking at the effects of aluminum
748 on growth and survival on zebrafish in 35-day exposures. This shows that, depending on
749 exposure conditions, the EPA criteria would barely be protective for this species (although this
750 species is typically used exclusively in the laboratory, it does suggest that there may be other
751 sensitive species in local waters, *i.e.*, in New Mexico waters). In addition, at high temperatures
752 and low hardness values it is possible that sensitive species like rainbow trout may not be
753 protected with a chronic value of 122 µg/L. The EPA criteria have been in effect for over 20
754 years and utilized by most states, where direct observation of natural surface waters has shown
755 that most species are protected using these values (87 and 750 µg/L).

756 **SWQB Rebuttal Response:** As previously noted, New Mexico measures Total Recoverable
757 Aluminum with the exception of high geologic, mineral-bound aluminum waters wherein a high
758 turbidity measurement may lead to the option of filtration through a 10 µm pore-size filter. This
759 is not operationally defined as "dissolved Al" but is an effort to reduce inert forms of mineral Al
760 common to the State's geology, while still accounting for the dissolved and polymeric Al
761 thought to be problematic to aquatic life. Absent additional information on endemic New Mexico
762 species, speculating on their Al sensitivities to derive appropriate criteria is not an acceptable
763 process for criteria development. The hardness-based derivation was based on numerous studies,
764 which concluded that water hardness is a water quality parameter that, among others, provides
765 protections that are acknowledged, but not accounted for in the 1988 EPA guidance. Rainbow
766 trout, a species native to cold water tributaries of the Pacific Ocean, while not native to New
767 Mexico, is a species of economic importance and deserving of protection. However, the State's
768 natural geologic Al loading, and flashy, sediment-laden waters may preclude certain habitats

769 from providing an adequate and protective niche for this Al-sensitive non-native salmonid. A
770 broadly applied standard for Al may not be fitting for these reasons, and New Mexico will adapt
771 as new information and guidance is made available; fine tuning the hardness-Al relationship and
772 including other water quality parameters that impinge on Al toxicity.

773

774 **AB/GUNDERSEN: CONCLUSIONS**

775 Going through the process of looking at studies on aluminum effects to aquatic organisms and
776 the processes used to calculate hardness-based aluminum criteria equations it is apparent that
777 there is simply not enough data to derive equations that would protect all aquatic life, particularly
778 factoring in other water quality parameters (pH, DOC, temperature, calcium, fluoride, sodium).
779 There are at least 4 studies that will soon be published that will add to the database on aluminum
780 toxicity but it seems that EPA will need to support further investigations on aluminum toxicity
781 and the influence of water quality on toxicity if the EPA (and State agencies) want to adequately
782 protect aquatic life. While it is true that, while the development of a Biotic Ligand Model may
783 more accurately allow for higher aluminum levels in surface waters while still protecting aquatic
784 life, it will most likely push the limits of organism tolerance while not accounting for the
785 synergistic or additive effects of other contaminants in an ever-increasing complexity of
786 chemical inputs into environmental compartments. Therefore, to adequately protect aquatic life
787 pending the completion of further research, New Mexico should adopt the 1988 EPA
788 recommended criteria.

789

790 **SWQB Rebuttal Response and Summary:** The SWQB appreciates the thoughtful and well-
791 reasoned concerns regarding the current hardness-based Al criteria. The hardness-based formulae

792 were developed using EPA-approved methods for the advancement of criteria outside the
793 national guidance for Al, published in 1988. Several concerns were elucidated regarding the
794 inclusion or non-inclusion of studies in the development of the current criteria, however, absent a
795 demonstration that inclusion/non-inclusion would significantly change New Mexico's hardness-
796 based calculator, and thus the protections of aquatic life, the SWQB concludes that the
797 protections afforded to low hardness streams, which are stronger than the 1988 guidance, are the
798 prudent criteria that should remain in place.

799

800 **B. SITE SPECIFIC COPPER CRITERIA FOR NEW SEGMENT 20.6.4.808 NMAC**
801 **CLOSED BASINS**

802

803 **SUMMARY**

804 Chino Mines has filed a Petition and Notice of Intent to Present Technical Testimony
805 ("NOI") in this matter. Chino Mines' petition adds site-specific aquatic life criteria for copper
806 ("Cu") to Section 20.6.4 NMAC for surface waters located within the area known as the Chino
807 Mines Smelter Tailings and Soil Investigation Unit ("STSIU") near the towns of Bayard and
808 Hurley in Grants County, New Mexico.

809 Specifically, Chino Mines petitioned that site-specific aquatic life criteria for copper shall
810 apply only to certain surface waters located in the Mimbres River Closed Basin and also within
811 an area known as the Chino Mines Site STSIU and described as follows:

812 (a) the mainstem of Lampbright Draw beginning at the confluence of Lamp bright Draw
813 with Rustler Canyon to the intersection of Lambright Draw with the southern STSIU
814 boundary and all tributaries thereof that originate west of Lampbright Draw, including
815 Rustler Canyon and Martin Canyon;

816 (b) Lucky Bill Canyon and all tributaries thereof;

817 (c) Chino Mines property Subwatershed drainages A, B, C, D-1, D-2, D-3 and all
818 tributaries thereof; and

819 (d) Chino Mines property Subwatershed Drainages E-1, E-2, and E-3 (Subwatersheds
820 delineated in Exhibit A, Chino Mines petition).

821 The NMED's SWQB and Ground Water Quality Bureau ("GWQB") have reviewed and
822 commented on model development, model improvements, applicability, and encouraged external
823 peer-review. Chino Mines published a paper on the model in scientific, peer-reviewed literature.
824 As detailed below the SWQB finds that the proposed criteria have been developed based on
825 credible scientific data and provide sufficient protection for aquatic life use. For this reason the
826 SWQB generally supports the STSIU site-specific Cu criteria as proposed in Exhibit I of Chino
827 Mines direct testimony, however the SWQB has specific concerns related to the geographic
828 extent and variable nature of the waters to which this criteria would apply, and the details of the
829 required public participation process. The SWQB recommends that the WQCC ensure that Chino
830 Mines address these concerns before adopting the proposal. Finally, the SWQB recommends that
831 if the WQCC chooses to adopt their proposal that the format should follow the amended
832 proposed rule provided in Exhibit I rather than Exhibit H. All current site specific standards are
833 found in the classified reach description (Sections 20.6.4.97 through .899 NMAC), whereas
834 Section 20.6.4.900 NMAC provides for general criteria.

835

836 **<u>SWQB REBUTTAL RESPONSE</u>**

837 History of the Site Specific Criteria Development and SWQB Review:

838 Pursuant to the WQS for site-specific criteria under Subsection 20.6.4.10.D NMAC, the
839 SWQB received a draft report from Chino Mines titled "*Draft Site-Specific Copper Toxicity*
840 *Model Report*" ("Report") in support of the development of Site Specific Criteria ("SSC") for
841 copper on April 18, 2013. On June 10, 2013, staff from the SWQB and GWQB met with
842 representatives of Chino Mines and the ARCADIS consulting firm to discuss preliminary results
843 of the Report, and application of SSC to certain surface waters located in the Mimbres River
844 Closed Basin and within an area known as the Chino Mines STSIU. The SWQB's understanding
845 was that Chino Mines intended to propose a Cu SSC for the STSIU in a petition to the WQCC
846 during the next Triennial Review of New Mexico's WQS. The SWQB reviewed and made
847 comments on the draft report without implying any acceptance or specific requirements that
848 needed to be met for the WQCC's approval (SWQB Rebuttal Exhibit 17). Rather, comments
849 were provided to ensure that the proposal would conform to the State's requirements for
850 adopting SSC such that the SWQB could support the technical merit of Chino Mines' proposal.
851 The SWQB also reminded Chino Mines at that time that adoption of any proposed SSC would
852 require approval from the WQCC for State purposes and subsequent approval of the EPA for
853 CWA purposes.

854 New Mexico's Water Quality Act (NMSA 1978, §§ 74-6-1 to -17 (1967, as amended
855 through 2013)) requires that the WQCC shall adopt WQS for surface and ground waters of the
856 State based on credible scientific data and other evidence appropriate under the Water Quality
857 Act (NMSA 1978, §74-6-4.D). Likewise the CWA and associated federal regulations (40 CFR
858 §131.11) require water quality criteria to be based on a sound scientific rationale and contain
859 sufficient parameters or constituents to protect designated uses.

860 The State and federal WQS rules allow for the adoption of criteria that reflect site-
861 specific conditions and rely on a scientifically derived method including the use of the EPA's
862 Water Effects Ratios[9] ("WER") and Biotic Ligand Model[10] ("BLM") guidance (Subsection
863 20.6.4.10.D NMAC; 40 CFR §131.12(2)(b)(1)). New Mexico's WQS, specifically Subsection
864 20.6.4.10.D NMAC, also allow that site specific numeric criteria may be developed based on
865 relevant site specific conditions and a scientifically defensible method, such as presented by
866 Chino Mines in the Report. Therefore, any proposal for adoption of a new WQS should be based
867 on sound, credible, and defensible scientific information, and demonstrate it is protective of the
868 appropriate designated use.

869 The EPA guidance for conducting WER, BLM, and a multitude of other peer-reviewed
870 scientific studies indicated water chemistry characteristics can influence metals toxicity. The use
871 of these studies and models can potentially be used to predict Cu toxicity for surface waters on a
872 site-specific basis and develop appropriate SSC adjustments. The Chino Mines Report uses
873 accepted EPA methodologies, specifically the WER cited under Subsection 20.6.4.10. D(4)(a)
874 NMAC as a starting point, however, given the variable chemistry the use of single water
875 chemistry parameters (*e.g.,* pH, hardness, alkalinity, etc.) as the sole criterion for a WER model
876 was insufficient to explain relationships between Cu concentrations and toxicity for the STSIU
877 waters.

[9] Interim Guidance on Determination and Use of Water Effects Ratios for Metals. 1994. United States Environmental Protection Agency. Washington D.C.

[10] The Biotic Ligand Model: Technical Support Document for Its Application to the Evaluation of Water Quality Criteria for Copper. 2009. United States Environmental Protection Agency. Washington D.C.

878 Development of toxicity criteria for waters within STSIU drainages required an iterative
879 and step-wise approach. First, site specific data were used to apply the EPA methodology in the
880 development of WER equations. A regression model was then developed with multiple water
881 chemistry parameters from STSIU sample sites that included Total Organic Carbon ("TOC"),
882 Hardness ("H"), Alkalinity ("A") and Total Dissolved Solids ("TDS"). Therefore this approach
883 can be used to develop criteria that avoid both over- and under-prediction of Cu toxicity. The
884 publication of this study in the peer-reviewed literature demonstrates the validity of this
885 approach. The regression model results were able to account for 85% of the observed variability
886 in Cu toxicity. This demonstrates a very strong ability to predict Cu toxicity and that the
887 regression model thus suitable for development of a Cu SSC. As such, the proposed criterion
888 presents a significant improvement on predicting Cu toxicity at the STISU.

889 The Cu model presented in the Report addresses site-specific challenges, and reduces the
890 uncertainty associated with other approaches including hardness-based criteria and the BLM;
891 however, further detail is needed regarding the implementation of the regression model to the
892 entire STSIU. The direct testimony of Dr. Joseph Meyer states that *"water chemistry changes*
893 *along the elevation gradient from the higher, mountainous portions of the STSIU down to the*
894 *lower valley-and-basin portions of the STSIU"* (Chino Mines NOI, Meyer Testimony, p. 12) and
895 further states that *"the ranges of water chemistry parameters in the tested STSIU waters are*
896 *representative of water chemistries known to occur in the STSIU drainages"* (Chino Mines NOI,
897 Meyer Testimony, p. 13). While the SWQB acknowledges that a wide range of water chemistries
898 were sampled and used in the regression model development, these were based only on water
899 collected from perennial pools found in the northeast quadrant of the STSIU, which is generally
900 the higher mountainous portion. Water chemistry data from the lower valley-and-basin portions

or from periods of stormwater flow in the ephemeral channel is not included in the analysis. While the testimony of Dr. Meyer indicates that these waters would be found within the sampled range of water chemistries in the STSIU drainages, no data or analysis has been provided to support this claim. The SWQB recommends that the WQCC limit the geographic applicability of the proposed standards to those actually sampled unless Chino Mines is able to provide additional water chemistry data to support this statement.

Other NOI Testimony regarding Chino Mines' Site Specific Copper Criteria Proposal

Amigos Bravos NOI Testimony (Section II.A.4): This WQCC Should Reject Freeport-McMoRan Chino Mines Company's ("Chino Mines") Proposal For Site-specific Copper criteria For Waters In The Mimbres River Closed Basin

Chino Mines proposes to add Section 20.6.4.902 NMAC. This section would add site-specific copper criteria for the applicable aquatic life designated use for a segment of Lampbright Draw and certain of its tributaries as well as certain tributaries of Whitewater Creek located in the Mimbres River Closed Basin. Amigos Bravos opposes this proposed change. As per Subsection (D)(3)(c) of 20.6.4.10 NMAC, any person petitioning the WQCC to adopt site-specific criteria must "describe the method used to notify and solicit input from potential stakeholders and from the general public in the affected area, and present and respond to the public input received." Chino Mines, in their September 30, 2014 petition, notes that they presented information about the site-specific criteria during one of their regular Community Working Group (CWG) meetings, that they referenced this item on the agenda when advertising for the meeting, and "answered questions from the public" at the meeting.

Chino Mines fails, however, to indicate how many members of the public or other stakeholders attended this meeting and does not disclose, let alone "present and respond to the public input received," in their petition. This lack of information compels the conclusion that Chino Mines has not complied with Subsection (D)(3)(c) of 20.6.4.10 NMAC or demonstrated stakeholder engagement sufficient to justify the promulgation, by this WQCC, of site-specific criteria. Moreover, Chino Mines has made it difficult for this WQCC, Amigos Bravos, and other parties including NMED, to identify issues of potential concern to stakeholders and members of the public in the immediate vicinity of the Chino Mines and the waterbodies in question. Thus,

932 adoption of Chino Mine's proposed change, in addition to not, on its face, complying with
933 Subsection (D)(3)(c) of 20.6.4.10 NMAC, risks the exclusion of local voices and input, and, as a
934 consequence, the arbitrary and capricious adoption of its proposed change by this WQCC.
935
936 **SWQB Rebuttal Response:** The SWQB understands that Chino Mines presented their proposal
937 at a regular Community Working Group meeting on September 16, 2014. As such, Chino Mines
938 has clearly taken steps to notify and solicit input from potential stakeholders and the general
939 public in the affected area. However the SWQB also recommends that Chino Mines provide
940 additional details regarding the specifics of the presentation and how Chino Mines responded to
941 the public input received so that the WQCC can be sure that provision in Subparagraph
942 20.6.4.10(D)(3)(c) NMAC has been satisfied.