HYDROLOGY PROTOCOL
RESPONSE TO COMMENTS

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COMMENT SET A: Amigos Bravos

From: Brian Shields [mailto:bshields@amigosbravos.org]
Sent: Thursday, October 29, 2009 2:07 PM
To: Drinkard, Shelly, NMENV
Subject: Amigos Bravos Comments - Draft Hydro Protocol

The HP does not satisfy the rigors of a scientifically based UAA study as outlined by EPA's 1983 *Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses* (EPA Number: 440486037), nor does it provide the level of supporting documentation presently required by New Mexico's water quality standards.

SWQB Response: According to New Mexico's water quality standards, "A use attainability analysis (UAA) shall assess the physical, chemical, biological, economic or other factors affecting the attainment of a use. The analysis shall rely on scientifically defensible methods." The *Hydrology Protocol* is a tool to distinguish ephemeral from non-ephemeral streams, and intermittent from perennial streams by using a combination of hydrological, physical, and biological characteristics of the stream or river. It was developed to provide the necessary supporting documentation for an expedited UAA process (NMAC 20.6.4.15C) and can also be used to support a standard UAA.

In order to justify a standards change, the UAA must be sufficient to demonstrate to the satisfaction of the Water Quality Control Commission (WQCC) and U.S. Environmental Protection Agency (EPA) that the use is not attainable based on a factor in 40 CFR 131.10(g). The two factors most likely to apply under ephemeral or intermittent conditions are that "natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the use…" or that "physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses." The HP provides a tool for evaluating these factors as they relate to flow and water level.

The solicitation for public comment on the UAA, the required response to comments and the requirement for EPA approval all ensure that the UAA will contain sufficient documentation regarding attainable uses.

What concerns Amigos Bravos most is that many of the judgments are qualitative and subjective, and offer opportunities to bias the outcome… We therefore insist that if the HP is to be used to gather information, NMED be the sole entity with the authority to carry out the proposed evaluations.

SWQB Response: The HP recommends that, "… the evaluator should have experience making geomorphic, hydrological, and biological observations for New Mexico streams." However, according to New Mexico's water quality standards, "Any person may submit notice to the department stating the intent to conduct a use attainability analysis… the proponent may petition the commission to modify the designated use if the conclusions of the analysis support such action." As such, the SWQB wanted to develop a scientifically sound protocol that was relatively resilient to user variability (weighted, four-tiered scoring system), robust with regards

to environmental variability (multiple indicators), and practical to use (not very labor or resource intensive). Furthermore, if other parties conduct a UAA using the HP, SWQB will review the submitted documentation to ensure consistency and validity of the data required.

"We therefore recommend that the HP take into account and score the level of connectivity of a segment of stream to downstream and upstream uses. For instance, an arroyo that is discharging to a river or stream used for ceremonial purposes or containing an endangered species, or with important habitat upstream, should score higher than an arroyo without such connections."

SWQB Response: The SWQB recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or local land managers, reviewing historic or aerial photographs, or identifying key biological indicators like endangered species, are necessary to determine the status of the stream. The protocol specifically addresses additional information that may be used to support a hydrologic determination. Additional evidence may be provided with any stream determination to make a stronger case for or against the water quality standards change.

Amigos Bravos is also highly concerned with the proposal to only assess a stream reach that is 40 times the stream width (or 150 meters, whichever is greater) of what could be a 25 mile long Assessment Unit.

SWQB Response: The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

While we agree with the concept that the evaluations should not be undertaken during periods of flooding or drought, we disagree with the proposed Level 1 evaluation windows of late May to mid July and mid September to early November (p. 6). Amigos Bravos believes that the best time to undertake the Level 1 evaluation will vary with what part of the state and at what elevation the Assessment Unit is located. The timing of the evaluation should be determined after consultation with US Fish and Wildlife Service and the NM Department of Game and Fish.

SWQB Response: The intent of providing an evaluation window is to assess stable, baseflow conditions outside of snowmelt and/or monsoonal floods. Review of USGS gage records across the State indicate that these are consistently the best seasons for evaluation. The protocol was revised to better clarify this intent. The SWQB does not believe that the timing of the evaluation needs to be determined after consultation with other agencies. Although field evaluations during unstable or extreme conditions is not recommended, the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even after a recent rainfall or during drought conditions. Field observations of any noteworthy conditions, such as recent flooding/scouring, extreme drought conditions, diversions or discharges, should be documented on the field forms to support (or refute) the final determination.

To determine attainable uses on ephemeral streams full consideration should be given to historic and existing uses. Therefore we make the following recommendations:

- Information gathering procedures identified in Level 2 Evaluation, such as interviewing long-term residents, gathering written and oral testimony and reviewing historic photographs, aerial and otherwise, should be undertaken prior to conducting a Level 1 Evaluation. Moreover, conversations with long-term residents should be documented and focus on identifying recreation, wildlife, livestock and irrigation uses.

SWQB Response: Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or reviewing historic photographs, are necessary to determine the hydrologic condition of the stream. Because this supporting documentation is not always necessary to make a hydrologic determination, the Bureau felt it was best gathered during a Level 2 Evaluation, after the Level 1 Evaluation was judged to be inconclusive.

- The up front information gathering should include mapping of riparian vegetation from the GAP Analysis Program, aerial photographs and other appropriate sources.

SWQB Response: Those who do not have access to the SWQB GIS station or other research tools utilized by the SWQB may use whatever tools and programs they have at their disposal – the idea being to gather as much physical and geographic information about the study reach and site location as possible prior to going out into the field.

- Determination should be made regarding how historic land use practices, such as grazing and timber harvesting, as well as how ground water depletions and global warming have impacted uses.

SWQB Response: As noted above, SWQB recognizes that in certain instances more data and supporting information are necessary to determine the hydrologic condition of the stream. This supporting information could include addressing the issues raised in this comment, however it is beyond the scope of the HP to address these issues.

- The evaluation procedures should identify and score for signs that the stream is being used by livestock and wildlife, and/or holds aesthetic values that are enjoyed by individuals, as well as other uses that have been identified in the above mentioned historic information gathering process

SWQB Response: This information is not necessary because in its Statement of Reasons, dated May 13, 2005, the Water Quality Control Commission expressed the intent to ensure that all unclassified nonperennial waters are protected in compliance with the Clean Water Act. The Commission also explained that this provision formalizes its presumption that the livestock watering and wildlife habitat uses are default uses for all unclassified waters. Therefore, livestock watering and wildlife habitat are presumed uses in all ephemeral, intermittent, and perennial waters of the State.

- For best photodocumentation (p.10), each photo should list the coordinates (GPS) where taken, the datum the GPS was set to, the direction of the photo (azimuth and up or down stream), and the date and the time of the photo. Moreover, a compass

should be included in the "field equipment," so that the direction of each photo is accurately documented.

SWQB Response: The photodocumentation section was modified to include, "The assessor should include a detailed description of each photo on the *Stream Determination Field Sheet*, including date, description of the photo (e.g. left bank, right bank, upstream, downstream, etc.), and GPS coordinates (if different from site location)." A compass was added to the list of field equipment.

- Biological surveys should also be conducted during the wet season when water is present in the stream. Documentation of use by shellfish, amphibians and other species of wildlife will be difficult to impossible during the dry season.

SWQB Response: Hydrological indicators, which are more likely to fluctuate with given climatic or seasonal changes, are only one component of the *Hydrology Protocol*. Other indicators, such as vegetation, filamentous algae, and hydric soils are more indicative of processes that occur over time. Furthermore, evidence of aquatic species can be found in dry channels. The HP recommends that the evaluator search sandy channel margins for mussel and aquatic snail shells, under cobbles and other larger bed materials for caddisfly casings, and cobbles or stream-side vegetation for casings of emergent mayflies or stoneflies. As stated previously, SWQB recommends that the evaluation be performed during stable baseflow conditions, however the protocol and scoring mechanism have been designed with redundancy to allow for satisfactory ratings even after a recent rainfall or during drought conditions.

At this point Amigos Bravos would like to reemphasize that certain aquatic species including peaclams and some aquatic snails can live for long stretches of time without water, if they can reach damp or hydric soils, and could inhabit many of New Mexico's arroyos. The Clean Water Act explicitly requires that water quality standards be protective of these shellfish species.

SWQB Response: During the Triennial Review, NMED proposed that all unclassified nonperennial waters be subject to 20.6.4.98 NMAC and presumed to support the uses specified in Section 101(a)(2) of the federal Clean Water Act unless a UAA demonstrates otherwise for an ephemeral water. Section 98 has designated uses of livestock watering, wildlife habitat, marginal warmwater aquatic life and primary contact. The protocol also includes a qualifier for scoring, which states, "If there are aquatic macroinvertebrates and/or fish then the stream is *at least* intermittent [regardless of the final score]."

COMMENT SET B: Carlsbad Soil and Water Conservation District

From: Judy Bock, District Manager, Carlsbad Soil and Water [mailto:swcd@carlsbadsoilandwater.org]
Sent: Monday, September 21, 2009 3:17 PM
To: Drinkard, Shelly, NMENV
Subject: Hydrology Protocol

Dear Ms. Drinkard:

The Carlsbad Soil and Water Conservation District (SWCD) has reviewed the referenced document and offer the following comments.

1. You would need an individual that is a specialist in hydrology; plant identification; and soils, and assume they are competent with field monitoring equipment and computers.

SWQB Response: The HP recommends that, "… the evaluator should have experience making geomorphic, hydrological, and biological observations for New Mexico streams." However, according to New Mexico's water quality standards, "Any person may submit notice to the department stating the intent to conduct a use attainability analysis… the proponent may petition the commission to modify the designated use if the conclusions of the analysis support such action." As such, the SWQB wanted to develop a scientifically sound protocol that was relatively resilient to user variability (weighted, four-tiered scoring system), robust with regards to environmental variability (multiple indicators), and practical to use (not very labor or resource intensive). Furthermore, if other parties conduct a UAA using the HP, SWQB will review the submitted documentation to ensure consistency and validity of the data required.

2. The availability of an individual to be present at critical moments along a given stretch of a stream (48 hours after a major precipitation event) would require intense monitoring of weather events as they happen and rapid response and drivable access to the study area.

SWQB Response: The protocol recommends sampling *at least* 48 hours after a major precipitation event, meaning anytime after that 48-hour period to reduce the influence of excess precipitation and/or flooding. The intent is to assess stable, baseflow conditions. Although field evaluations during unstable or extreme conditions is not recommended, the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even after a recent rainfall or during drought conditions.

3. The protocol clearly states that the determination should not be made during drought years. How many non-drought years has New Mexico had in the last decade?

SWQB Response: The Standardized Precipitation Index (SPI) is used to identify drought conditions for the purposes of the Hydrology Protocol. The 12-month SPI is used because SPIs of this time-scale can be linked to streamflows, reservoir levels, and even groundwater levels. According to the 12-month SPIs from 2000-2009, there was only one year with moderately to severely dry conditions throughout the state (2003). The

north-central region of the state was moderately to severely dry in 2001 and 2002, however the rest of the state was near normal. Conversely, in 2004 and 2006 portions of southern and eastern New Mexico ranged from very wet to extremely wet conditions.

4. There was not any recommendation as to the number of characterizations required for a given stretch of a stream. Is it one or is it several over a given number of years?

SWQB Response: SWQB agrees that further clarification was needed regarding the sampling plan for a stream evaluation. The protocol was modified to better explain this process.

5. The background information on the development of the protocol states that it was modeled after one used by the state of North Carolina. There are too many carry-overs in the protocol, such as high-rainfall and east coast humidity, that may be applicable in North Carolina but are very unrealistic when it comes to New Mexico and the arid southwest.

SWQB Response: The SWQB agrees that conditions in North Carolina are markedly different from conditions in New Mexico, so the Bureau adapted a stream evaluation methodology developed by the North Carolina Division of Water Quality *to conditions in New Mexico*. The adapted methodology was beta tested during the 2009 field season across a range of hydrologic and ecological conditions. Data from the test sites were analyzed to verify which field indicators are useful in differentiating hydrologic systems in New Mexico. Based on the results of this analysis a number of indicators were removed from the protocol because they were not statistically significant field indicators for New Mexico streams and rivers. Refer to Appendix A of the protocol for more information.

Thank you for the opportunity to review and comment on the protocol. Although, the Carlsbad SWCD believes the protocol is highly idealistic and would take an intense semester to thoroughly cover in an upper level undergraduate program. It is all encompassing, highly academic in nature and not "hands on". This is not a protocol you can mail to a field office and expect your "normal" technician to pick up and implement (especially considering the broad backgrounds and the level of expertise required).

Sincerely,

Ridley Gardner, Chairman

COMMENT SET C: Chevron Mining Inc.

From: Wagner, Anne [mailto:awagne@chevron.com]
Sent: Friday, October 23, 2009 3:30 PM
To: Drinkard, Shelly, NMENV
Subject: CMI comments on Draft Hydrology Protocol

Comments on Draft Hydrology Protocol
dated August 26, 2009

This document provides general comments, specific comments (levels one and two), and conclusions the "Draft Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters" prepared by the Surface Water Quality Bureau ("Bureau").

General Comments

It appears that the methodology to determine perennial, intermittent or ephemeral streams relies more on circumstantial evidence than strong scientific information on the hydrologic connections of the water body.

Although the proposed two-level approach provides a good start for this protocol, the document lacks detailed information in both sections. An extensive revision is needed to address major gaps before it can be used as a guidance document in New Mexico.

It is unclear whether the proposed methodology is applicable for all the ecoregions of New Mexico. For example, some of the fluvial geomorphology criteria (i.e., measurement of sinuosity, assessment of pool-riffle development) seem to be more applicable to mountainous ecoregions than to lowland, plateau, or plains-type systems.

This document would benefit from an additional section explaining the details of the implementation process. The underlying objective(s) should be laid out in the introduction section.

SWQB Response: The *Hydrology Protocol* (HP) is a tool to distinguish ephemeral, intermittent, and perennial streams and rivers in New Mexico. The objective was to develop a scientifically sound protocol that was relatively resilient to user variability (weighted, four-tiered scoring system), robust with regards to environmental variability (multiple indicators), and practical to use (not very labor or resource intensive). It was designed to provide supporting documentation for the Use Attainability Analysis (UAA) process, however the HP is only one tool out of many that may be used to support a UAA.

Based on recent changes in New Mexico Water Quality Standards, SWQB will document the implementation process (including the expedited UAA process, in an update to the Water Quality Management Plan and the HP will be incorporated as an appendix.

1.0 Specific Comments

1.1 Definitions

The definition of "intermittent" streams is incomplete; intermittent streams can also exhibit spatial and temporal variability in flow permanence. Intermittent streams often have year-round "refuge habitats"—aquatic organisms retreat to these when other portions of the stream are dry (Dodds et al. 2004, Labbe and Fausch 2000, Fausch et al. 1997). It would be helpful to include definitions based on more quantifiable flow conditions (e.g., flow as percentage of time) with respect to ephemeral, intermittent, and perennial streams to be consistent with neighboring states (e.g., Colorado Department of Public Health and Environment: Regulation 31, Section 31.5, Subsections 17, 18, and 19; Arizona Department of Environmental Quality, Title 18, Chapter 11, Section R18-11-101).

SWQB Response: The definitions of ephemeral, intermittent, and perennial are tied to New Mexico's Water Quality Standards. SWQB agrees that intermittent systems can contain refugia such as perennial pools. The scoring for metrics such as fish and macroinvertebrates within the HP reflects this fact and is supported by the marginal warmwater aquatic life use designation.

A definition of drought conditions would be helpful in the document. The Standardized Precipitation Index (SPI) is cited as the most appropriate index to determine drought conditions. However, it appears that any negative SPI value is indicative of drought conditions in this protocol. Because there are various levels or severity of drought conditions in the arid west, it would be useful to identify these conditions in the context of the SPI and identify when hydrological evaluations should not be performed because of drought conditions.

SWQB Response: The SWQB agrees that an SPI value of -1.0 (moderately dry) may not be appropriate for defining drought considering the naturally arid climate of New Mexico. After further consideration, SPI values less than -1.5, which indicate severely dry to extremely dry conditions, will be used as indicators of drought conditions in New Mexico. The SWQB strongly recommends that field evaluations be conducted outside of drought conditions whenever possible; however the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even during drought conditions. Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding or scouring, diversions, and discharges, should be documented on the field forms to support (or refute) the final determination.

1.2 Section 1: Stream Determination and Rating Form

User/Evaluator Experience

It would be helpful to have an interdisciplinary team (geologist, hydrologist, and biologist) with experience in river systems throughout the arid west region, rather than with experience restricted only to New Mexico.

SWQB Response: The HP recommends that, "… the evaluator should have experience making geomorphic, hydrological, and biological observations for New Mexico streams." SWQB agrees

that it would be helpful to have experience in river systems throughout the arid west to provide a better working knowledge of the range of conditions that can be found in this region, but does not believe that this should be a requirement. Furthermore, if other parties conduct a UAA using the HP, SWQB will review the submitted documentation to ensure consistency and validity of the data required.

Assessment Unit Identification and Field Map Generation

This section needs more detail about "assessment units" (AU) in terms of the way these units are going to be grouped, for example hierarchically, by ecoregion, regulatory segments in the water quality standards, 20.6.4 NMAC (WQCC 2009), or by the classifications assigned to the streams in the Appendices. The provision of this information is crucial given the diversity of New Mexico's aquatic habitats.

The Bureau recommends the use of SPI, which may provide useful information regarding regional drought conditions. However, it is not clear how the index will be used to help define hydrological conditions in a specific stream channel, especially when trying to find the distinction between intermittent and ephemeral. In addition, it may be necessary to evaluate longer periods (i.e., > 1 year) to fully assess drought conditions, due to the extreme seasonal nature and localization of precipitation events in the arid west.

SWQB Response: More discussion of AUs can be found in the SWQB Assessment Protocol.

The understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993. The SPI was designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. Soil moisture conditions respond to precipitation anomalies on a relatively short scale. Groundwater, streamflow, and reservoir storage reflect the longer-term precipitation anomalies (6-, 9-, and 12-month SPIs).

The SPI was chosen for use in the *Hydrology Protocol* because it can be computed for longer time scales (i.e. 12 months) that are linked to groundwater and surface water fluctuations and reservoir storage, it can provide an early warning of drought, and it can help assess drought severity. The SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are influencing the overall rating, they may want to postpone a final decision until another evaluation can take place during more normal conditions.

2.0 Level 1 Evaluation: Data collection for Hydrologic Determination of NM Streams and Rivers

2.1 Office Procedures

It would be useful to include any information on anthropogenic hydrologic disturbances (i.e., point source discharges, water diversions), unless this information will be available from the listed digital resources on page 8.

2.2 Field Procedures

In the event of a major rainfall event at a site, the suggested wait period before both Level 1 and 2 indicators are evaluated is at least 48 hours. A recent study demonstrated that water could remain in the channels of intermittent streams for substantially longer than 2 days after a major rainfall event, particularly in New Mexico. For example, water was still present in remnant pools in the Río Puerco over a week after the last rainfall event, apparently because the fine-grained sediments in the banks retained and released water slowly over time (AWWQRP 2006). This is an ephemeral drainage, but could be classified as intermittent or even perennial if the visit is timed poorly. CMI suggests a longer time period be used in the event of major rainfall events and identification of the amount of rainfall (inches) that constitutes a major rainfall event.

SWQB Response: Recent (generally considered to be within 48 hours) rainfall can influence scoring, therefore it is recommended that the field evaluations be conducted during stable baseflow conditions to reduce this source of variability. However, the SWQB recognizes that time and resources are often limited so the protocol and scoring mechanism were designed with redundancy to allow for satisfactory ratings even after a recent rainfall or during drought conditions. Any noteworthy field observations, such as drought, recent flooding or scouring, diversions, and discharges should be documented on the field forms to support (or refute) the final determination. If the evaluator believes that extreme conditions such as drought or flooding have influenced the overall rating, he may want to postpone a final decision until another evaluation can take place during more normal conditions.

Reach Selection

A less intensive, larger scale observation of the drainage basin is appropriate; however, several points within the AU should be examined (but not sampled) to determine the presence of flowing or standing waters. These supplementary "reconnaissance sites" could be determined during the office procedures phase of the sampling and selected using a formal sampling framework.

Specific information about the decision-making process for the assessment of the entire segment or multiple reaches would be helpful to increase the "representative" nature of the sampling site (i.e., addition of sampling sites, how this fits into the AU selection process).

SWQB Response: The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

2.3 Level 1 Indicators

Water in Channel

Consideration of quantitative measures of recent drought and wet conditions is relevant; details for the determination of artificial flows are necessary (i.e., how will anthropogenic flows and their associated water quality affect water quality standards?). A discussion of their effects

is included on the classification scheme. The water quality standards issue should be included in the suggested implementation process section.

Alternative feasible methodologies for flow estimates should be included in the protocol.

Fish (qualitative observations)

The assumption of flow permanence based on the presence/absence of fish is untenable. Intermittency has different consequences, depending on ecoregion. For example, in mountainous regions where fish assemblages are dominated by coldwater species such as Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), intermittent systems are usually fishless. However, this is not the case in the remainder of the state. At least 13 fish species from six families (Cyprinidae: *Agosia chrysogaster*, *Cyprinella lutrensis*, *Dionda episcopa, Hybognathus amarus*, *H. placitus*, and *Pimephales promelas*; Cyprinodontidae: *Cyprinodon pecoensis* and *C. tularosa*; Fundulidae: *Fundulus zebrinus*; Poeciliidae: *Gambusia affinis* and *G. nobilis*; Ictaluridae: *Ameirus melas*; Centrarchidae: *Lepomis cyanellus*) regularly inhabit intermittent streams in the State of New Mexico (Sublette et al. 1990), if only briefly.

Collecting and identifying fish may be more appropriate when a Level 2 assessment becomes necessary, but fish community species composition can be a very strong indicator of flow permanency.

Excluding "obvious" streams from further survey is a more efficient approach—the hierarchical sampling scheme seems practical.

Benthic Macroinvertebrates (qualitative observations)

There is little consideration about the presence or absence of various biotic components (e.g., fish, bivalves, benthic macroinvertebrates) that may have been washed down into intermittent or ephemeral reaches from perennial reaches located further upstream. A previous study indicated that upstream sources are potentially very important in bringing organisms to an ephemeral/intermittent reach on a short-term basis (AWWQRP 2006). Mature organisms can be among those that drift into the site from upstream perennial reaches, so maturity of the organisms collected is not a reliable indicator. Circumstantial evidence of life, such as empty clam shells, can also be washed in from upstream perennial sources. The protocol should determine the presence of upstream perennial reaches.

Differences in Vegetation

Another characteristic of true riparian vegetation (present in perennial and ephemeral streams) that may need to be included in the protocol is that this type of vegetation serves as valuable wildlife habitat. A large percentage of all wildlife species depend on riparian areas (for foraging, nesting, or cover) for some portion of their life cycle (Thomas et al. 1979, Johnson et al. 1977). Species should be identified and recorded for each analyzed stream reach, particularly aquatic dependent vegetation (e.g., cottonwoods versus mesquite).

Entrenchment Ratio

We caution using metrics, such as the entrenchment ratio, that rely on maximum water depth to characterize streams based on their perennial, intermittent, or ephemeral nature. Based on

the field protocol, this metric requires sufficient flows to define key characteristics of the channel just to allow such measurements to be recorded; hence, in order to record this metric, the stream would have to be either perennial or intermittent in nature.

The correlation between proposed indicator parameters should be evaluated to reduce redundancy among the parameters.

In-channel Structure Riffle-pool Sequences
The consideration of this parameter could bias the scores. Pool-riffle sequences do require channel-forming flows, but stream gradient, bedload, and dominant substrate are also major determinants of streambed morphology. For example, large, perennial lowgradient streams such as the Rio Grande are (or were, historically) characterized by a braided channel, shifting sand bars, and few to no permanent pools.

Particle Size
This parameter appears to be useful to distinguish streams based on regional locations (i.e., mountainous versus plains-type systems), but it may be impractical to differentiate streams with respect to permanence of flow conditions within each ecoregion.

Hydric Soils
This is one of the key parameters used to distinguish ephemeral from intermittent channels. Thus, a more detailed description to evaluate soil conditions is necessary.

Sediment on Plants or Debris
The monsoonal rainfall and flashy nature of runoff in the arid west region combined with watershed size may limit the overall usefulness of this metric to differentiate sites based on flow conditions.

Seeps and Springs
This parameter is not useful in distinguishing whether a site is classified as intermittent or perennial, because the presence of seeps or springs automatically places a site in a perennial category – at least for that portion affected by spring/seep flows.

Iron Oxidizing Bacteria/Fungi
Similar to the seeps and springs parameter, the presence of iron oxidizing bacteria/fungi is dependent upon groundwater flows and their presence automatically places a site in a perennial category.

SWQB Response: The *Hydrology Protocol* is a technical document that was developed as a tool to distinguish between ephemeral, intermittent and perennial streams and rivers in New Mexico. The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. A stream reach is determined to be ephemeral, intermittent, or perennial based on the overall score and other supporting information. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions.

Data from perennial, intermittent, and ephemeral streams and rivers were analyzed to verify which field indicators were useful in differentiating hydrologic systems in New Mexico. It was quite evident from the data that there were scores that strictly fell within one particular waterbody type (ephemeral, intermittent, or perennial) and scores that overlapped between the different groups. For more information on the development process for this protocol refer to **Appendix A**.

The SWQB is confident in its approach and analysis; however the HP is considered to be an evolving, living document. Current thresholds are based on data collected by SWQB from 57 stream reaches throughout the state of New Mexico during the 2008 and 2009 field seasons. In the event that new data indicate the threshold values used in the protocol are not appropriate and/or if new standards are adopted, the threshold values and differentiating scores will be adjusted accordingly.

3.0 Level 2: Evaluation: Borderline Determinations

3.1 Office Procedures

Key Biological Indicators

The presence of certain fish species can indicate a perennial system, but the presence of fish, by itself, is not necessarily conclusive. Temporary habitat use (i.e., utilization of temporarily inundated stream reaches) is common for fish inhabiting warmwater streams, especially intermittent ones.

SWQB Response: The SWQB agrees that fisheries data by itself should not determine whether or not a stream is perennial. As stated in the protocol, additional supporting information, such as current or historic fisheries data, may be used to support a hydrological determination.

3.2 Field Procedures

It seems that most of these functions have already been performed as part of the Level 1 survey.

Hyporheic Zone/Groundwater Table

We suggest moving this section to the Level 1 survey.

SWQB Response: The SWQB felt that the level of effort required to dig a bore hole and/or install piezometers was appropriate for a Level 2 evaluation. In addition, several indicators from the Level 1 evaluation are indicative of subsurface flow, such as water in channel (which is weighted more than other indicators), riparian vegetation, hydric soils, seeps and springs, and iron-oxidizing bacteria and fungi.

Amphibians

The amphibian section needs to be revised to reflect the actual requirements of amphibians potentially present. Several species of anurans require water to be present for only a short period (even < 2 weeks) to complete development from egg to adult. Some amphibians mature into terrestrial adult stages and therefore they are not necessarily indicative of a perennial or

even an intermittent system. Some of these species can successfully reproduce in ephemeral systems (Baxter and Stone 1992). Thus, the species and life stage of the observed amphibians should be identified and recorded.

It is also important to consider natural events, such as flooding or unusual rain events, that can cause movement of anuran species from a perennial stream to an ephemeral stream, (i.e., presence of bullfrogs in Tanque Verde Wash in Tucson, AZ, an ephemeral reach, coming from a perennial, off-channel source; AWWQRP 2006).

SWQB Response: A species/life stage list would provide strong, additional supporting documentation for the final stream determination if the evaluator has the experience and/or knowledge to identify and record the amphibian species that are present in the steam. However, the SWQB does not believe that that level of identification is necessary given the nature of the protocol (i.e. weight-of-evidence approach) and variety of data and information that is gathered to make a final stream determination.

Benthic Macroinvertebrates

The basis for the benthic macroinvertebrate protocol (Level 2 assessment) is the EMAP protocol, which was originally developed to provide an abundance of data and determine potential metrics for use in water quality assessments in perennial, wadeable streams across the western United States (Klemm et al. 2001). The samples yielded from the field activities are intended for comparison with the hundreds of samples collected during the EMAP field project – again from perennial, wadeable streams. As such, it provides only relative information on water quality (not water permanence) at the site compared with samples collected across the geographic area from Washington State to the Black Hills south to western Texas and California. Additionally, the EMAP protocol relies on random sampling within each site along transects or within riffles, and is not designed to preferentially target certain benthic macroinvertebrate taxa.

Only a minimal amount of benthic macroinvertebrate information is used in the document for determining the perennial nature of streams in New Mexico. The determination relies on the presence/absence of 15 EPT families and a few other “rheophilic” indicator taxa. Given the modest amount of information incorporated in the document, the use of the labor-intensive EMAP protocol for benthic macroinvertebrate collection is unnecessary and may cause a considerable extra burden in terms of time and resources. If the purpose of the collection efforts is to determine the presence or absence of these particular taxa, then a targeted search for those particular taxa would be more appropriate, economical, and efficient than the full EMAP protocol.

The lists of perennial water indicator taxa that are being developed for North Carolina and West Virginia are likely not appropriate for use in New Mexico; many taxa found in those lists will not be found in New Mexico and may lead to confusion in the analysis of the benthic macroinvertebrate data. It would be more appropriate for New Mexico to develop its own list of indicator taxa, research the life histories of those taxa, and then develop the sampling protocol to selectively and efficiently search for those taxa. Apparently, this is an ongoing task developed by NMDGF, but the results are still preliminary and not yet published.

SWQB Response: The EMAP protocol was used as an example of a collection method that may be used to collect benthic macroinvertebrates because this is the method that SWQB employs. The SWQB wants to retain a consistent methodology within our programs so the data could be used for multiple purposes, if needed. Other macroinvertebrate collection techniques may be used to sample a stream or river. The specific reference to the EMAP method was removed from the protocol because it is not required. A list of potential sampling methods was provided in the protocol.

Tables 2 and 3 (the lists of perennial water indicator taxa) were derived from North Carolina and West Virginia, but adapted using information on species found in New Mexico. The SWQB in cooperation with NM Department of Game and Fish continues to compile a list of organisms of intermittent ecosystems and SWQB scientists have been looking for the presence of long-lived aquatic species as reliable determinants for perennial channels. As stated in the protocol, further information on life histories of specific macroinvertbrates found through the application of this protocol can be researched, if necessary.

Fish (quantitative observations)

It is unclear if the "Strong" score refers to multiple age classes, and the "Moderate" score refers to dominance by a single age class. This metric should be applied with care. Although it is easy to determine whether large-bodied fishes such as trout, suckers, and some species of chub (e.g., *Platygobio gracilis*, *Gila robusta*, etc.) are juveniles or adults, this determination in smaller-bodied fishes may be problematic. Many small-bodied fishes have short life spans. For example, the predominance of age-0 individuals in a population of Rio Grande silvery minnow (*Hybognathus amarus*) is entirely normal at certain times of the year and would not be related to flow permanence. The number of species of large-bodied, long-lived fishes tends to increase as flow permanence does, but this is also a function of stream size (Fausch et al. 1997). Perhaps some qualitative measure of "presence of large-bodied fishes" or "number of large-bodied fish species" might be more appropriate.

"Prime habitat" should be defined as a measurable metric or omitted. Although some fishes such as trout (e.g., *Oncorhynchus* spp.) and suckers (*Catostomus* spp.) tend to select pool habitats, others do not. Many fish indigenous to the southern Great Plains are habitat generalists that show little to no habitat selectivity.

It would be advisable to include a fish sampling protocol in the Appendices Section. Sampling these sites should be a fairly straightforward process. We do not believe quantitative population estimates would be necessary (or even meaningful). However, a semi-quantitative sampling protocol that identifies the species present and estimates their relative abundance would provide useful information about the flow stability of the system. Use of multiple gear types should be considered for each site, but the primary sampling gear should be chosen to maximize sampling efficiency given physical site conditions.

SWQB Response: The potential for large-bodied fish was added to the *strong* and *moderate* scores. "Prime" was omitted as a descriptor for habitat.

Any collection and identification of aquatic species should be performed by an aquatic or fisheries biologist, environmental scientist, or other professional. Several options for fish sampling were included in the HP; however the SWQB believes that best professional judgment should be exercised to determine sampling methodology (e.g. shocking, seining, etc.) and to ensure that safety concerns are addressed.

4.0 Appendix A: How the was the Protocol Developed?

The use of the ANOVA is unnecessary at this point because the hydrological groupings (ephemeral, intermittent, and perennial) are based on the collective sum of all individual stream indicators. The individual metrics should have been selected *a priori* with some level of knowledge about the differentiation of flow conditions and the ability to distinguish conditions in the transition zones (i.e., ephemeral to intermittent or intermittent to perennial) rather than just being able to distinguish between perennial and ephemeral streams. Box plots would be more useful to illustrate the capacity of an individual stream indicator's ability to distinguish flow conditions.

SWQB Response: ANOVA was used to determine if a particular indicator was significantly different between groups (ephemeral, intermittent, perennial). ANOVA was used to verify which indicators were relevant for differentiating NM streams and rivers. Once relevant indicators were verified, the minimum and maximum total score in each waterbody class were determined and the distribution of total scores was evaluated to develop numeric thresholds for the three different hydrologic systems. Unfortunately, the dataset is not large enough at this time to perform a distribution analysis to evaluate the fit of the score ranges.

5.0 Conclusions

This protocol should be refined and modified to evaluate conditions that are more commonly present in the arid west region of the United States. Until those refinements are made, this should not be adopted as protocol for classifying hydrological nature of a New Mexico stream at this time.

Overall, the protocol provides a representative, although basic, list of the types of parameters that would cover a variety of hydrological, geomorphological, and biological characteristics of streams that can be refined or modified to adequately evaluate whether a channel exhibits ephemeral or intermittent flows, or intermittent or perennial flows. However, some prioritization should occur in the parameters, particularly with those that are key to defining the transition zones between hydrological conditions.

Biological parameters can be a good indicator of hydrological conditions; however; it relies too heavily on qualitative visual confirmation of the presence of fish, amphibians, invertebrates, and bivalves for determining hydrological conditions.

Parameters should also be evaluated with respect to redundancy, because some parameters appear to be correlated to other information.

All parameters should have a similar descriptive level of detail with respect to their protocol and details about their field evaluation in order to promote consistency in determinations for water bodies that cross state lines.

SWQB Response: The SWQB adapted a stream evaluation methodology developed by the North Carolina Division of Water Quality *to conditions in New Mexico*. The adapted methodology was beta tested during the 2009 field season across a range of hydrologic and ecological conditions. Data from the test sites were analyzed to verify which field indicators are useful in differentiating hydrologic systems in New Mexico. Based on the results of this analysis a number of indicators were removed from the protocol because they were not statistically significant field indicators for New Mexico streams and rivers. Therefore, the SWQB believes that the protocol has been refined and modified to conditions that are more commonly present in the arid west and more specifically to New Mexico.

The Level 1 Evaluation provides a tiered methodology to prioritize parameters according to the relative strength of their discriminating abilities. Field indicators 1.1 – 1.6 were lumped together because they have a strong ability to identify "clearly" ephemeral and "clearly" perennial streams such that time and resources can be minimized (if it is a straightforward case). Likewise, field indicators 1.7 – 1.9 were lumped together as the second tier to possibly reduce the amount of time and resources used.

The protocol utilizes a weight-of-evidence approach that was intentionally designed with redundancy to allow for satisfactory ratings over a range of conditions.

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COMMENT SET D: Dairy Producers of New Mexico

From: Jay Lazarus [mailto:lazarus@glorietageo.com]
Sent: Wednesday, October 28, 2009 6:01 PM
To: Pam.Homer@state.nm.us; Joseph, Seva, NMENV
Cc: Sharon Lombardi; TJ Trujillo; Dalva L. Moellenberg; Paul Drakos
Subject: DPNM Comments on Hydrology Protocols

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October 28, 2009

Surface Water Quality Bureau
New Mexico Environment Department
Runnels Building
1190 St. Francis Dr.
Santa Fe, NM

RE: DRAFT HYDROLOGY PROTOCOLS FOR THE DETERMINATION OF EPEHEMERAL, INTERMITTENT AND PERENNIAL WATERS

Dear Sir of Madam:

Enclosed please find comments from Dairy Producers of New Mexico (DPNM) on the Draft Hydrology Protocols for the Determination of Ephemeral, Intermittent and Perennial Waters

Thank you for your consideration of these comments.

Sincerely,

Jay Lazarus
Pres./Sr. Geohydrologist
Glorieta Geoscience, Inc.

Xc: Sharon Lombardi, Executive Director, DPNM
T.J. Trujillo, Esq., Gallagher and Kennedy

DPNM are presenting our comments on topics in the order they are presented in the Draft Hydrology Protocol

SUMMARY

It is unclear to DPNM what NMED means by "at this time applies only to streams and rivers". What does "at this time" mean? DPNM also needs further explanation of the statement "Waters determined to be intermittent or perennial prior to the effective date of the protocol will not be reevaluated unless there is a specific need to do so". Who has classified these waters and where are they classified?

Proposed Definitions

DPNM has consistently proposed that the definitions of ephemeral, intermittent and perennial streams be changed to conform to the U.S. Geological Survey's (USGS) Glossary of Water Terms for New Mexico. The USGS establishes hydrologic standards and definitions nationwide. Hydrologic definitions should be standardized based on peer-reviewed scientific research, not based on regulatory objectives. NMED and the New Mexico Water Quality Control Commission (WQCC) should encourage the use of USGS definitions wherever possible to insure consistency with commonly adopted scientific terms. The proposed definitions for intermittent and perennial streams have too much overlap that have the potential of causing difficulties in the application of the protocol. The definition for an intermittent stream contained in the *Hydrology Protocol* is that it "contains water for extended periods only at certain times of year, such as when it receives seasonal flow from springs or melting snow". This definition does not define what is meant by an "extended period", nor is it specific as to what those certain times of year should be.

During a particularly wet year, a normally intermittent stream may flow for an entire year or more reflecting an increase in groundwater discharge to the stream system, via either increased base flow, spring discharge, or both. If the assessment is made during or following such a wet year, it could lead to an erroneous classification. Where streams are impacted by seasonal diversion and/or groundwater withdrawals, the stream may be dry during peak growing season with flows returning after the cessation of irrigation, typically in the September to October time frame. The definition for ephemeral and intermittent streams should be changed to the U.S. Geological Survey definition:

Intermittent Stream: A stream that ceases to flow occasionally or seasonally because evaporation and leakage to ground water exceed the available water supply.

Ephemeral Stream: A stream or reach of a stream that flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times higher than the water table.

Similarly the definition of a perennial stream is problematic with respect to the application of the protocol. Various definitions have been used by differing agencies to define perennial streams, and while some include the caveat of flow throughout the year

except during periods of drought, it can be equally argued that perennial flow, is not a sometimes situation. If a stream does not flow because of drought, it is intermittent, or that specific reach is intermittent, not perennial. If the definition is to remain as proposed, then the length of drought and the severity of that drought must be taken into account and defined as well.

It is recommended that the definition be changed to the USGS definition:

Perennial Stream: A stream that flows continuously.

What is the definition of a natural interruption in ephemeral, intermittent, or perennial waters? DPNM does not agree that "if an otherwise intermittent water exhibits perennial indicators due to anticipated and/or frequent discharges, then the water may be considered perennial as appropriate based on the site evaluation." Anticipated discharges do not constitute flows. Language should be added to clarify that "***human-caused flows shall not be used to reclassify an ephemeral stream to intermittent or intermittent stream to perennial.***"

Standard Precipitation Index

Although the protocol specifies the use of the Standard Precipitation Index (SPI), there is no indication how the SPI is actually used in the stream determination, if it is used at all. The SPI and recent weather conditions are to be noted at the top of both the Level 1 and Level 2 Stream Determination Field Sheets, but no indicator score is associated with the SPI value or the recent weather conditions on either of the work sheets. If, as stated on page 5 and again on page 9, "it is *strongly* recommended that field evaluations be conducted outside of drought conditions whenever possible", then some measure of drought and drought severity should be a determinant in the score, either directly, or as a measure of uncertainty.

Table 2 and Figure 1 demonstrate that the SPI was of no utility in applying the Hydrology Protocol to the classification of the streams. This is not meant as a criticism of the SPI, rather a statement that it is a superfluous parameter in the protocol. A different index, such as the Palmer Drought Severity Index would not be any better because the problem is not the index selected; it is the fact that the index is not used in the determination of the stream classification. Either a precipitation or drought criteria should be used in the scoring, or it should be dropped from the protocol.

If a precipitation index is to be used, the cumulative departure from the mean monthly average monthly precipitation is a better indicator of drought than the SPI, the Palmer Drought Severity Index, the Surface Water Supply Index, the Reclamation Drought Index or other indices. The reason the cumulative departure method is preferable is because it is calculated on the basis of observed precipitation at an individual station or a few stations rather than an entire climate division. In New Mexico, there can be significant variability in rainfall within a region. One area may receive normal precipitation while another is under drought conditions. The use of normalized probabilistic methods such

as the SPI tends to smooth this variability which could result in the erroneous classification of a stream study reach.

Drought Conditions

The protocol repeatedly states that the assessment should not be performed during periods of drought, and this approach requires rethinking. It may, in fact, be preferable to conduct the assessments during periods of extreme drought. Wet years add recharge that results in groundwater mounds in the recharge areas with radial flow from the sources to the hydrologic sinks represented by the streams. During drought, the groundwater mounds associated with recharge over the upland areas begin to decay and water levels drop under the recharge area. However, as the groundwater declines in the recharge area, the water is transferred to the flanks of the groundwater mound resulting in an increase in groundwater base flow and/or spring discharge rates during periods of drought. Thus a stream reach that might be intermittent would not be properly identified unless it is assessed during drought conditions. DPNM recommends that the wording regarding the timing of the assessments be dropped from the protocol.

Recent Rainfall Activity

The Draft Hydrology Protocol proposes that the Level 1 Field Evaluation should occur between late May and mid July OR mid September and early November (i.e., during the "dry" seasons – after snowmelt runoff and avoiding monsoonal rain) to reduce this source of variability. Based on our field experience in the northern portion of New Mexico snowmelt runoff can persist through late May and into June.

Scoring

The Draft Hydrology Protocol proposes that the scoring should include the amount and date of the last recent rain and evidence of stream modifications. Unless there is a permanent stream gage and continuous recording rain gage in the immediate vicinity of the stream reach being assessed, quantification of the amount of rain and date will have little accuracy.

Springs

The presence of springs and seeps within a study reach could lead to improper classifications, especially during wet climatic periods. Stream discharge rates can be ephemeral and during particularly wet seasons, springs and seeps may discharge for the first time in decades. Again, the proposed definitions can lead to inconsistent results when the protocol is applied during or following a period of heavy precipitation.

Level 1 Office Procedures

The Draft Protocol relies on stream gauge data if available. The USGS stream gauging system in New Mexico has been significantly reduced since the 1970s due to funding constraints. Although gauges exist on ephemeral streams in the Los Alamos area, DPNM is unaware of ephemeral or intermittent streams with stream gauges elsewhere. This scoring criterion does not seem to be well developed.

Level 1 Field Procedures

Reach Selection

The Draft Protocol proposes that field evaluations should be performed at least 48 hours after the last known major rainfall event. In addition, the protocol *strongly* recommended that field evaluations be conducted outside of drought conditions whenever possible. The southwest US has been in drought or near drought conditions since the late 1990s. Although the most recent major rainfall event may have occurred more than 48 hours prior to field investigations, ground water contributions to streams may have resulted from water in storage that is discharged to the stream in response to rainfall events further upgradient and not related to rainfall events in the immediate area of study.

Photodocumentation

This section can easily be condensed to say that digital photos should be taken to evaluate reach conditions

Level 1 Field Equipment and Supplies

1:250 scale mapping is only feasible with surveyed control points or high resolution LIDAR or detailed survey topographic maps.

LEVEL 1 INDICATORS

1.1 Water in Channel

The Draft Protocol states that "perennial streams will have water in their channels year-round in the absence of drought conditions". If there is not water in the channel year-round, the stream or reach is intermittent or ephemeral, not perennial. It also goes on the say that "the 12-month SPI should be determined and noted on the field survey sheet." This method is not described in the Appendix and is not part of the ranking score.

1.7. Sinuosity

The initiation of meanders requires: 1) bedload transport and 2) bank erosion (Parker, 1976; Ritter, 1986). According to Schumm (1967), sinuosity decreases and meander wavelength increases when a river transports sand and gravel instead of fine-grained material. A relationship between sinuosity and ephemeral-vs-intermittent-vs-ephemeral streams is not established in the literature. Indeed, many ephemeral streams have high sinuosity. The Rio Puerco of the East is a good example of a highly sinuous, ephemeral stream. The scoring system is also odd. According to Ritter (1986, p. 232), the distinction between a straight and meandering stream is usually placed at a sinuosity value of 1.5. Therefore, all of the categories listed in the Hydrology Protocol could qualify as straight stream. Sinuosity should not be used as an indicator for the Hydrology Protocol.

1.8. Entrenchment Ratio

Incised or entrenched perennial streams are typically associated with the mid-western and eastern United States (Schumm et al., 1984). In the arid western United States, including New Mexico, an arroyo is a "term applied in the arid and semiarid regions of southwestern U.S. to the small, deep, flat-floored channel or gully of an ephemeral stream or of an

intermittent stream usually with vertical or steeply cut banks of unconsolidated material at least 60 centimeters high, is usually dry, but may be transformed into a temporary water course of short-lived torrent after heavy rains" (American Geological Institute Glossary, 1972, p. 40). The premise that entrenched streams in New Mexico are typically perennial, or that entrenchment is an indicator of perennial flow, is incorrect. Figure 1 is a photograph that presents an example of a typical ephemeral arroyo, located south of Mt. Taylor in western New Mexico. Note that this ephemeral channel is deeply entrenched (arroyo is incised approximately 30 ft into the valley floor). Entrenchment should not be used as an indicator for the Hydrology Protocol.

1.9. In-channel Structure -- Riffle-Pool Sequences

The criteria for distinguishing between strong and moderate scoring for the riffle-pool criteria appears to be highly subjective. It is also unclear if there is a clear relationship between development of pool-riffle sequences and a tendency toward perennial flow. Figure 1 provides an example of well developed pool-riffle sequences in an ephemeral stream. It is recommended that the riffle-pool indicator be dropped from the hydrology protocol.

1.10. Particle size or Stream Substrate Sorting

The premise of these criteria is that in ephemeral stream channels, "Sediment in the bed of ephemeral channels typically have the same or comparable texture (i.e. particle size) as areas close to but not in the channel." In contrast, "The bottom substrate of non-ephemeral streams often has accumulations of coarse sand and larger particles." This criteria does not account for other factors, such as sediment supply or stratigraphic control on sediments deposited in the bed of an incised channel. As an example, an ephemeral arroyo may incise through a coarse gravel bed, resulting in deposition of a bouldery deposit in the arroyo floor (Figure 1). Flash floods in arroyos also commonly transport and deposit coarse-grained sediments on the channel floor. Both of these processes can result in a coarse-grained stream bed deposit that differs greatly from the finer-grained texture of the adjacent valley floor (Figure 1). Particle size or stream substrate sorting should not be used as an indicator for the Hydrology Protocol.

LEVEL 1 SUPPLEMENTAL INDICATORS

2.2 Hyporheic Zone/Groundwater Table; Water in Channel

The criteria proposed to evaluate potential baseflow to a stream is flawed. The protocols apparently recognize that the field criteria cannot apply to bedrock channels. Water standing in the borehole above the channel bottom may be perched water, disconnected from deeper, permanent ground water.

DPNM propose that NMED develop a "Reconnaissance Level" field screening protocol for determination of perennial, intermittent or ephemeral streams. Simple, easily accessible data such as USGS definitions, air photo interpretation, and reconnaissance-level field work to identify pools, springs, or seeps would be a cost-effective field evaluation technique. A simple, cost effective protocol is particularly important for classification of the many obviously ephemeral streams in New Mexico. Persons seeking classification of obviously ephemeral streams should not be required to spend

significant resources to collect data when reconnaissance level information can readily be used to make a definitive determination. More resource-intensive efforts should be saved for close cases.

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Figure 1. Incised arroyo near the mouth of Water Canyon, Mt. Taylor area, New Mexico. Note that this ephemeral stream is: 1) deeply entrenched; 2) when flowing, would have a well-developed pool and riffle sequence; and 3) contains bouldery gravel deposits in the stream bed that differ greatly from the fine sand texture of the adjacent valley floor.

SWQB Response: SWQB is presenting responses in the order they were received by DPNM.

SUMMARY

"At this time" means currently. Waters of the state are classified in the Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC) and referenced in the State of New Mexico CWA §303(d)/§305(b) Integrated Report.

Proposed Definitions

The definitions of ephemeral, intermittent, and perennial are tied to New Mexico's Water Quality Standards and as such any questions, comments, or improvements to these definitions should be handled through the triennial review process.

Standard Precipitation Index

The 12-month Standardized Precipitation Index (SPI) is used to identify drought conditions for the purposes of the Hydrology Protocol and was chosen because SPIs of this time-scale can be linked to streamflows, reservoir levels, and even groundwater levels. The SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination. The SPI value should be used to assess whether or not the stream evaluation and final score are consistent with the true nature of the stream or if they may be skewed by extreme conditions occurring at the time of the field evaluation. Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding, diversions, or discharges, should be documented on the field forms to support (or refute) the final determination. If the evaluators believe that extreme conditions such as drought or abnormal precipitation are influencing the overall rating, they may want to postpone a final decision until another evaluation can take place during more normal conditions.

Drought Conditions

Hydrologic indicators, which are more likely to fluctuate with given climatic or seasonal changes, are only one component of the *Hydrology Protocol*. Other indicators, such as vegetation, filamentous algae, and hydric soils are more indicative of processes that occur over multiyear timescales. The SWQB recommends that the evaluation be performed during stable baseflow conditions, however the protocol utilizes a weight-of-evidence approach (i.e. multiple and varied indicators) that has been designed with redundancy to allow for satisfactory ratings even after a recent rainfall or during drought conditions.

Recent Rainfall Activity

The intent of providing an evaluation window is to assess stable baseflow conditions outside of snowmelt and/or monsoonal floods. The protocol now states, "… the Level 1 Field Evaluation should occur during stable baseflow conditions which will vary by region and elevation of the study reach, but is typically between *late-May and mid-July* OR *mid-September and early-November*."

Scoring

The idea behind the protocol is to gather a wide range of information in the most streamlined fashion possible to make an accurate assessment of the stream. As stated previously, field observations of any noteworthy conditions, including recent rainfall and floods, should be

documented on the field forms to support (or refute) the final determination. If rain gauge data are not available then the evaluator will have to use their field observations and judgment to determine if extreme conditions, such as excess rainfall or severe drought, have influenced the scoring.

Springs

The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. Hydrologic indicators, which are more likely to fluctuate with given climatic or seasonal changes, are only one component of the *Hydrology Protocol*. The SWQB agrees that the presence of springs and seeps by itself should not determine whether or not a stream is perennial. As stated in the protocol, additional supporting information, such as the presence of springs and seeps, may be used to support a hydrological determination.

Level 1 Evaluation

Water in Channel

Both stream gauge data, if available, and the 12-month SPI should be used as further evidence of the nature of the stream.

There are USGS gauges on non-perennial waters in New Mexico, such as Tijeras Arroyo, Galisteo Creek, Rocky Arroyo, Dark Canyon, and Revuelto Creek. Admittedly, they are few and far between; however, the intent is to use gauge data if it is available. Hydrologic indicators, such as surface flow, are only one component of the protocol. It is up to the evaluator to use whatever supplemental data are available to make the most informed decision.

The 12-month SPI is used as an indicator of abnormal conditions because SPIs of this time-scale can be linked to streamflows, reservoir levels, and even groundwater levels. According to the 12-month SPIs from 2000-2009, there was only one year with moderately to severely dry conditions throughout the state (2003). The north-central region of the state was moderately to severely dry in 2001 and 2002, however the rest of the state was near normal. Conversely, in 2004 and 2006 portions of southern and eastern New Mexico ranged from very wet to extremely wet conditions.

Geomorphic Indicators

Sinuosity, Entrenchment Ratio, Riffle-Pool Sequence, and Particle Size – Stream Substrate

The SWQB agrees that an ephemeral stream may have high sinuosity or well developed riffle-pool sequences and a perennial stream may be entrenched or have sandy substrate; however these indicators are only a few of many used in this protocol. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even if one or several indicators are not what would be expected given the nature of the stream. In addition, the SWQB's analysis found significant differences between ephemeral, intermittent, and perennial streams for all of these indicators (sinuosity, $p < 0.001$; entrenchment ratio, $p < 0.005$; riffle-pool sequence, $p < 0.001$; and substrate, $p < 0.01$). Thus, the SWQB believes that these indicators should be used until additional data prove otherwise.

The scoring system for sinuosity was based on data collected by Knight, et al. (1999) for a study on stream channel morphology in New Mexico. Geomorphic data were collected from 77 streams and rivers throughout New Mexico, which included ephemeral, intermittent, and perennial drainages. The maximum sinuosity recorded was 1.8 and the minimum was 1.0. Additionally, according to Knight, et al. (1999), dryland ephemeral channels tend to have low entrenchment ratios *relative to* intermittent and perennial channels.

For entrenchment – please keep in mind that the metric is the "entrenchment ratio" which is the flood prone width divided by the bankfull width. As such a low entrenchment ratio stream will visually appear "entrenched" as with the example provided in this comment. This stream would likely have a low entrenchment ratio and score as "Weak - Ratio < 1.2 - Stream is entrenched" consistent with an ephemeral system. Likewise in this example while there are large boulders in the stream channel – they are also present on the banks indicating that the system is not well sorted – it is really the difference/contrast between the two locations that is critical.

Besides utilizing multiple indicators, the protocol is also tiered such that clearly evident ephemeral arroyos and clearly evident perennial streams are quickly assessed to save time and resources. Referring to Figure 1 provided by the DPNM, a "typical ephemeral arroyo" – if the steps outlined in the *Hydrology Protocol* were followed to make a stream determination for this arroyo, it would be considered ephemeral based on its scores from indicators #1.1 – 1.6. According to the protocol, the arroyo in Figure 1 would score between 0 and 2 for the first six indicators and would therefore be characterized as ephemeral without having to collect field data for the other eight indicators.

Finally, the *Hydrology Protocol* is considered to be an evolving, living document. In the event that new data indicate the indicators or numeric values used in this protocol are not appropriate, the threshold values and differentiating scores will be adjusted accordingly.

Knight, K., T. Moody, W. Odem, and M. Wirtanen. 1999. Stream Channel Morphology in New Mexico: Regional Relationships. Department of Civil and Environmental Engineering, Northern Arizona University, Flagstaff, AZ. 53 p.

Water in Channel (OPTIONAL) and Hyporheic Zone/Groundwater Table

The SWQB designed the protocol with two levels to be cost- and resource-effective. The Hyporheic Zone/Groundwater Table and optional Water in Channel are Level 2 indicators, which should only be used if the Level 1 Evaluation is indeterminate because the waterbody is borderline and more data are required to make an accurate assessment.

The SWQB also encourages the evaluator to gather as much information as possible about the study reach prior to the field evaluation. Recommendations are provided in the "office procedures" sections of the protocol, but other data not included in these recommendations may be gathered as well.

COMMENT SET E: Elephant Butte Irrigation District

From: Dr. John W. Hernandez, Consulting Engineer for the Elephant Butte Irrigation District
Sent: Monday, September 21, 2009 2:40 PM
To: Drinkard, Shelly, NMENV
Cc: hernandez0025@worldnet.att.net
Subject: Comments on the NMED Hydrology Protocol of Late August 2009

Introduction:

Each of the following headings below provides for subject-matter consolidation of the Elephant Butte Irrigation District's (EBID) comments on the New Mexico Environment Department (NMED) draft Hydrology Protocol. Our comments are gathered by subject area rather than on a sequential basis as material appears in the draft document.

If the Hydrology Protocol is to be just a scientific document, then serious consideration should be given to re-publishing this document in two separate forms; one would be the technical methodologies used to classify "waters of the state", and a second publication on the policy issues related to the regulatory aspects of the interpretation of the results of a technical evaluation. If the Protocol is re-issued in the present form, NMED should note that it contains regulatory statements and should be adopted by the Department as a rule. The New Mexico Water Quality Control Commission (NMWQCC) is probably the right authority for adoption of the Protocol as a water quality regulation.

In addition, NMED should consider providing a statement on how and who, others than a team of hydrologists and biologists employed by NMED, would be expected to be qualified to apply the technical methodology presented in the Protocol. Without any guidance as to who NMED expects to use the Protocol, it appears to aimed at proving to the US Environmental Protection Agency (US EPA) that the Surface Water Quality Bureau at NMED has a valid methodology for doing "use attainability analysis" (UAA) on the many dry arroyos it the State that have been included (EBID believes needlessly) in the 2005 definition of the "waters of the state". The discussion in Appendix A, particularly the section titled "*Why Develop a Hydrology Protocol?*" is consistent with this interpretation of the purpose of the Hydrology Protocol.

The view that the Hydrology Protocol has been developed to satisfy a US EPA requirement is supported by a September 15, 2009 e-mail sent by Mr. Eric Ames of the NMED,

in response to a motion by Peabody Energy, to parties in the on going Triennial Review where he said in his introduction:

> "The New Mexico Environment Department ("Department") responds to Peabody Energy's motion to strike the Department's proposed amendments related to the hydrology protocol. The motion reflects a fundamental misunderstanding of the Department's proposal, which is designed to facilitate an expedited and cost-effective approach to removing inappropriate uses from ephemeral waters subject to subsequent review by the Water Quality Control Commission ("WQCC")."

Mr. Ames continues in a section of his e-mail titled "Factual Back-ground I).

> "To demonstrate that these presumed uses are not attainable, EPA requires the state to submit a use attainability analysis ("UAA"). Accordingly, the Department's petition allowed the application of Section 97 uses only after completion of a UAA. Typically, the process for conducting a UAA and obtaining Commission approval to remove a designated use is time-consuming and costly.

EBID supports the intent of the SWQB of NMED in its development of the Hydrology Protocol. The state needs to eliminate some of the regulatory burden placed needlessly on those who use, and rely on the storm-water runoff from the states many, many dry arroyos. However, the inclusion of policy statements in the Hydrology Protocol, and, at the same time, its presentation as just a valid scientific document, and not a regulation, has lead to concerns by some in the regulated community including EBID. NMED is encouraged to re-edit the document and to seek the approval of the Hydrology Protocol by the NMWQCC after an appropriate hearing.

SWQB Response: Many of the issues and concerns raised by EBID in the preceding paragraphs were addressed prior to the triennial review hearing in cooperation with various stakeholders, including EBID. Please refer to the Stipulated Motion for Order on Dept.'s Proposed Revisions to Sections 15 and 97 Concerning the Hydrology Protocol for more details. Specifically, this will include incorporation of the HP in SWQB's Water Quality Management plan which is reviewed and approved by both the WQCC and EPA.

The two sections below, offer NMED some thinking points in their editing of the Hydrology Protocol. The scientific aspects of the document confirm the EBID belief on two issues: First, the SWQB is the only state group capable of fully using the Protocol, and second, performing and obtaining approval of a "UAA" is not some thing that irrigation districts across the state are design to accomplish. EBID agrees with Mr. Ames (in the e-mail referenced above) that "typically, the process for conducting a UAA and obtaining Commission approval to remove a designated use is time-consuming and costly.

1. **Policy Implications the NMED Hydrology Protocol:**

   Each of the following statement has some policy implications in their context in the Hydrology Protocol.

   Page 3. **SUMMARY "**The ability to make such determinations is often key to assuring that the appropriate water quality standards are applied to a water body." Reference to a regulatory document and the regulatory process has no role in a defensible scientific document.

   Page 3. **SUMMARY** "New Mexico's water quality standards (*Standards for Interstate and Intrastate Waters*, 20.6.4. NMAC) set distinct protections for unclassified ephemeral, intermittent and perennial waters and also identify many classified waters by the nature of their hydrology." This statement should be rejected for the same rational as above.

   SWQB Response: This is a document that the SWQB developed to help discern between ephemeral, intermittent, and perennial waters for the purpose of properly classifying and protecting waters of the State. This language provides the motivation for applying this protocol does not change the "scientific facts" that the protocol uses to distinguishes between waterbody types. The SWQB believes that the protocol is straightforward such that that other managers, watershed groups, permitees, and individuals may use it to help identify different hydrological regimes for their own purposes. The summary provides an example of a practical way to implement the results from this protocol.

   Page 4. **Definitions "**The draft Hydrology Protocol is based on the definitions of "ephemeral," "intermittent" and "perennial" recommended in 20.6.4.7 NMAC of the New Mexico Environment Department's Revised Triennial Review Petition of the water quality standards dated July 6, 2009." These definitions have not been

adopted by the NMWQCC making the inclusion of the reference to the 'water quality standards' a statement of regulatory support and not a statement of the scientific quality of the definitions.

> Page 4. **Definitions "***Intermittent* means the water body contains water for extended periods only at certain times of the year, such as when it receives seasonal flow from springs or melting snow." The reference as to why this definition has been used is a statement of regulatory intent.
>
> Page 4. **Definitions** "*Perennial* means the water body contains water throughout the year except during periods of drought." The inclusion of "drought" conditions as a part of the definition makes this a regulatory statement, not a scientific statement.

Page 4. **Definitions "**The draft Hydrology Protocol is based on the definitions of "ephemeral," "intermittent" and "perennial", but these definitions all include the term "the body of water". This is a phrase used in a regulatory definition and not necessarily a scientific definition.

Page 4. **Definitions** "If an otherwise **perennial** water exhibits intermittency or interruptions due to hydrologic modifications, it is considered perennial." A policy statement.

Page 5. **Section 1, Assessment unit Identification "**Stream or river AUs in New Mexico are typically no more than 25 miles in length, unless there are no tributaries or land use changes to consider along the reach (NMED/SWQB 2008)." A non-scientific reference to an NMED proposed regulation.

Page 5. **Section 1, Assessment unit Identification** "Before a determination of hydrology can be made for a stream or river reach that currently does not fall under a classified segment as described in 20.6.4.101 through 20.6.4.899 NMAC, the appropriate AU must be identified." This a non-scientific reference to an NMED regulation.

SWQB Response: The SWQB is a regulatory agency and as such needs to connect our protocols with definitions and procedures adopted and approved in the water quality standards. If the proposed definitions of ephemeral, intermittent, and perennial are not approved by the WQCC then the protocol (and possibly the scoring mechanism and numeric thresholds) will be modified accordingly.

"Assessment Unit Identification…" was changed to "Stream Segment Identification…" and language was added to clarify SWQB's process of segment identification.

2. **Terms Needing Definition in the Hydrology Protocol:**

Page 3. **SUMMARY** Define the terms "streams" and "rivers" as the terms "streams or rivers" is used (see page 5. line 13) as is the term"streams and rivers". The word

"stream" is used throughout the document and the term should have a consistent meaning.

Page 4. **Introduction** The statement that starts out "A stream"; is this meant to be a definition of a "stream"? If so how is it different from a "river" or a "water course"? Is water diverted from the Rio Grande for use by the City of Albuquerque, for their water supply, "a stream" because it is a 'flowing surface water in a channel'?

Page 4. **Introduction** The terms "stream flow" and "Base flow" as used in the Protocol are not scientific definitions.

Page 4. **Introduction** In the "storm flow" definition: "increased" from what?

Page 4. and Page 22. The term "extended periods" is used in several places. The term should have consistent meaning and be defined.

Pages 4., 5., 19., 20., and 37 The term "seasonal" is used in several places. The term should have consistent meaning and be defined or explained in detail where used.

SWQB Resonse:

The definition of "streamflow" was modified to be more consistent with the definition found in the *Handbook of Hydrology* (Maidment 1993). The following sentence was added to the introduction, "In this protocol, the term "stream" refers to a wadeable, lotic water body (typically 1st, 2nd, or 3rd order) and the term "river" refers to a non-wadeable, lotic water body (generally 4th order or higher). Throughout this document the terms are interchangeable with one another as the same process and procedures are used regardless of whether the channel is wadeable or not."

The SWQB does not believe the terms "extended periods" and "seasonal" need to be better defined or explained in detail. The terms are used appropriately and consistently in the document.

Comment Set F: Freeport McMoRan

From: Mohr, Richard N. [mailto:Richard_Mohr@FMI.com]
Sent: Friday, October 30, 2009 3:49 PM
To: Drinkard, Shelly, NMENV
Cc: Deely, Sheila H.; Eastep, Tim; dld@gknet.com
Subject: Freeport-McMoRan Copper & Gold Inc.'s Comments on Draft Hydrology Protocol

New Mexico Operations
Box 7
Hurley, NM 88043

Dear Ms. Drinkard:

Freeport-McMoRan New Mexico Operations ("Freeport-McMoRan"), consisting of Freeport McMoRan Tyrone Inc., Freeport McMoRan Chino Mines Company, and Freeport McMoRan Cobre Mining Co., hereby provide the following initial comments in response to the New Mexico Environment Department's ("NMED") draft "Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters," dated August 2009.

Freeport supports NMED's efforts toward developing a clear approach to consistently and appropriately classifying waters defined by NMAC 20.6.4, and we believe that the draft hydrology protocol is an appropriate first step, and with certain improvements, incorrect conclusions could be avoided. In addition, as Freeport-McMoRan has communicated in its filings to the Water Quality Control Commission ("WQCC") in the pending Triennial Review of New Mexico's surface water quality standards ("SWQS"), we strongly believe that further review of the draft hydrology protocol should be delayed until the SWQS is complete and until the final definitions of "ephemeral," "intermittent," and "perennial" in the pending Triennial Review proceeding are known. Because the draft protocol has direct and significant impacts on how the regulations will apply, it must be developed through an ongoing and open, multi-stakeholder process that includes scientific input and peer review, with oversight by the WQCC. Accordingly, we wholeheartedly support the Stipulated Order signed by the Triennial Review Hearing Officer on September 30, 2009 to the extent it clarified that the final development of the hydrology protocol will require additional stakeholder comments and input as well as WQCC oversight and approval.

At this time, Freeport-McMoRan is offering preliminary comments. We respectfully reserve the right to submit additional comments and positions as the hydrology protocol continues to be developed. Please note that in several cases our comments are in the form of questions, as the basis for and/or the intent of a number of specific components of the protocol is not currently clear.

We appreciate this opportunity to provide comments, and look forward to working cooperatively with NMED and other interested parties to support the development of a reliable and technically defensible means to classify New Mexico's surface waters.

GENERAL COMMENTS

1. Purpose and Scope of the Draft Hydrology Protocol. The need for and development of the draft hydrology protocol arises out of the WQCC's determination in the last Triennial Review proceeding that there was not an adequate scientific basis to apply chronic aquatic life water quality criteria to unclassified ephemeral waters. EPA was not willing to approve the revised designated uses and standards applicable to unclassified "ephemeral" waters in the absence of a use attainability analysis ("UAA") explaining why all aquatic life standards were not attainable in ephemeral waters. Consequently, in the pending Triennial Review proceeding, NMED has proposed to treat unclassified "ephemeral" waters as unclassified "intermittent waters" for purposes of aquatic life standards, unless a UAA is performed to demonstrate that the aquatic life uses are not attainable in a particular stream segment. While NMED appears to agree that a different set of "limited aquatic life" standards should typically apply to ephemeral waters, NMED contends that a UAA is needed to satisfy EPA's requirements for approval of the standards. It is our understanding that the primary purpose of the draft protocol is to provide an expedited means to satisfy the UAA requirement by establishing criteria to distinguish ephemeral waters for which not all aquatic life uses are attainable from intermittent and perennial waters where those uses are attainable.

Based on this understanding, we believe that the draft protocol should be revised to clarify at least several important points. First, the protocol should clarify that it is not the only way to justify the removal or downgrading of designated uses for surface waters in New Mexico. Rather, the protocol is simply an expedited method to achieve the objective of determining and applying appropriate designated uses. Other options remain available to further define the appropriate uses for surface waters in New Mexico. Second, the proposal also should clarify that in certain cases, it can be used to justify not only the placement of surface waters into the pre-identified designated uses for unclassified waters in Sections 97, 98, and 99 of the New Mexico SWQS, but also to justify the removal or downgrading of the pre-identified designated uses for unclassified or even other surface waters. The basis for this request is that it is unclear how the draft protocol can be used to identify attainable uses on ephemeral streams, and/or to establish that Section 101(a)(2) uses are not feasible, while the only possible outcome of a UAA based on the draft protocol is to slot an unclassified ephemeral water under Section 97 and the designated uses identified in that section. Rather, we believe that in certain circumstances, the information obtained through the draft protocol should be used not only to slot unclassified ephemeral waters under Section 97, but also to support removal or downgrading of the uses identified in Section 97.

Third, the draft protocol should clarify how the protocol will be used in the overall UAA process, including the following: (1) what other information besides the protocol would be required for a UAA to determine if a water should be classified as ephemeral, intermittent or perennial – we assume that no other information would be necessary at least for an expedited UAA, but this is unclear; (2) how would the protocol be used to determine if primary or

secondary contact is the appropriate use for perennial or intermittent waters – for instance, if pools or runs large enough for complete immersion are absent from an ephemeral or intermittent stream, then only secondary contact would be possible; and (3) how would the protocol be used to determine if acute or chronic criteria are appropriate for perennial or intermittent waters?

SWQB Response: NMED or any other party may conduct a UAA. The Standards explain the requirements at 20.6.4.15 NMAC. Designated uses and associated criteria, including those for unclassified segments, are detailed in the Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC).

Regarding the specific comments – for the first this is correct and is explained within SWQB's revision to the WQMP, which the HP will be incorporated as an appendix. Second – consistent with the first point the HP can be used as a supporting document in any regular UAA process including the removal of uses associated with section 97; this process however would not be an expedited UAA as described in 20.6.4.15C. And the third and final issue – details on how the HP will be used in the expatiated UAA are provided in the revision to the WQMP.

2. Numeric Cut-offs and Numeric Scoring Criteria. The draft protocol includes "bright line" numeric criteria which at best are not technically supported (detailed technical rationale are not provided in the protocol), and appear to be arbitrary in some cases. We believe that the numeric cut-offs, among other potential aspects of the protocol, should be subject to additional scientific input and peer review before final adoption of the protocol. In addition, certain indicators in the draft protocol appear to be viewed as definitive evidence of a stream's classification. For example, the draft protocol states that "if base flows are present during a site inspection that is more than 48 hours after a major rainfall event, the stream is either perennial or intermittent." But a stream can be appropriately classified as ephemeral consistent with the SWQS even when it has seeps 48 hours after a major rainfall event. Would surface water be classified as perennial or intermittent based on these criteria alone, even if a complete Level 1 and or Level 2 assessment concluded that a water should be classified as ephemeral?

The criteria proposed for numeric scoring for individual criteria are in some instances vague and highly subjective and thus do not provide a clear basis for score determination. For example, scores may be based in part on the following criteria: found "easily" vs. found "with little difficulty"; a "distinct corridor" exists vs. "dramatic compositional differences" are present; particle size is "moderately different" vs. "moderately similar"; and "flowing surface water in channel", which is not specifically defined (e.g., contiguous flowing water within an assessment unit? Over what unit area? Does a seep which results in water which flows for meters meet this definition?).

3. Qualitative Scoring v. Quantitative Numeric Score. The protocol relies on qualitative scoring and application of professional judgment to assess nearly all of the criteria proposed, yet the outcome of application of the protocol is a quantitative numeric score which is compared to bright line numeric criteria. This translates to a protocol that could be implemented with inconsistent results depending on the experience and perspective of the person conducting the assessment.

SWQB Response: The *Hydrology Protocol* (HP) is a tool to distinguish ephemeral, intermittent, and perennial streams and rivers in New Mexico. The objective was to develop a scientifically sound protocol that was relatively resilient to user variability, robust with regards to environmental variability, and practical to use. Hydrologic indicators, such as surface flow, are only one component of the HP. The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. Multiple indicators allow for satisfactory ratings over a range of conditions. A final hydrologic determination is based on the overall score and other supporting information.

The protocol applies a four-tiered scale to rank the stream's features and attributes. A "yes" / "no" format was determined to be inadequate to properly assess the natural variability encountered in the field. The scores, "Poor", "Weak", "Moderate", and "Strong" are intended to allow the evaluator flexibility in assessing variable features or attributes. "Moderate" scores are intended as an approximate qualitative midpoint between the two extremes of "Poor" and "Strong." The remaining qualitative description of "Weak" represents gradations that will often be observed in the field. These gradations are intended as guidelines. The evaluator must select the most appropriate category based upon experience and observations of the stream being evaluated. The small increments in scoring between gradations were incorporated to help reduce the range in scores between different evaluators.

4. Relationship of Indicators to Hydrologic Stream Definitions. The draft hydrology protocol is based on the NMED's proposed definitions in the Revised Triennial Review Petition dated July 6, 2009 for "ephemeral," intermittent", and "perennial." It is unclear how the conclusions of the draft hydrology protocol for a given stream segment support and/or translate directly to the definitions. These definitions embody two key concepts: the duration of flow and the position of the water table. Simply stated, the terms ephemeral, intermittent, and perennial indicate the approximate time that a stream experiences above-ground flow. The matrix below summarizes how the NMED definitions use these two key concepts.

Key Concept	Ephemeral	Intermittent	Perennial
Duration of Flow	Brief	Extended	Always
Position of Bed Relative to the Water Table	Above	Not included in the NMED definition	Not included in the NMED definition

Other specific definitions for these terms exist, but all are based on the same two key concepts. For example, a perennial reach may be defined by the condition where the water table is continuously above the channel bed, yet the NMED definition does not include this basis of determination. The position of the water table is indeterminate in intermittent reaches, as it may be seasonally above or below the channel bed, or in some cases always below the channel bed (e.g., infiltration from snowmelt runoff as it leaves a mountain front and flows for an extended period into an alluvial basin with a deep water table). Note that the magnitude and frequency of flow also do not enter into the definitions.

The duration of flow and the position of the water table can be determined by direct or indirect indicators that are observed once or repeatedly. Direct indicators are those that

quantify the number of days of flow or the groundwater elevation, such as stream gages, groundwater contour maps, wells, and other instrumentation. Conversely, indirect indicators allow the duration of flow or the position of the water table to be inferred, with some inferences being more reliable than others. Indirect indicators require a greater degree of training and professional judgment, especially if observed only once.

Table 1 (attached) presents a preliminary classification of the indicators in the draft hydrology protocol with respect to direct or indirect indicators. Of the 21 indicators, four are direct and the remaining 17 are indirect. According to the draft hydrology protocol, all indicators are to be evaluated during the dry season at least 48 hours after major precipitation, except for Indicator 2.1 (Water in Channel via thermistors), which provides a continuous record of water temperature with time as a surrogate for flow. The draft hydrology protocol arguably gives too much weight to observations of indirect indicators, and does not sufficiently allow for use of other direct indicators.

The draft hydrology protocol should include other direct indicators for the position of the water table. Groundwater contour maps and/or adjacent wells should be used to the extent they are available, and when available should be weighted highly as a direct indicator of the position of the water table. Groundwater contours or groundwater elevations from wells quantify the depth of the water table, and a water table that is below the channel bed is a direct indicator of an ephemeral condition (although it does not rule out extended flow during a wet season, such as spring runoff). The shape of groundwater contours which indicate whether groundwater converges toward the channel (a potential indicator of an intermittent or perennial condition) or diverges from the channel (a potential indicator of an ephemeral or intermittent condition) may also be used as a direct indicator of hydrologic condition. Time series of groundwater elevations from adjacent wells, if appropriately screened and located may also quantify the duration of above-ground flow.

Other direct indicators for the duration of flow that should be considered and highly weighted when available include continuous data from stream gages, data sondes with pressure transducers, conductivity probes, thermistors, or other instruments.

Not all reaches will have information on the other direct indicators mentioned above. However, when these types of data are available, they should be used and weighted higher than the indirect indicators. At a minimum, owners and other affected parties should be allowed to provide these data to NMED, and if the data contradict the results of the draft hydrology protocol, there should be a mechanism to resolve the discrepancy in favor of the direct indicators.

Finally, the draft hydrology protocol states in Appendix A that a number of indicators were removed or were limited to applying only when observed. For completeness and transparency, NMED should present and discuss these indicators in the future drafts of the protocol.

SWQB Response: The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol (e.g. gauge data), but other data not included in these recommendations may be

gathered as well, such as groundwater contour maps or data from adjacent wells. It is up to the evaluators to make an argument to support (or refute) the final hydrologic determination and present their argument to the WQCC and EPA for approval.

The SWQB disagrees that certain indicators, which are not used in the protocol, should be presented and discussed in document. Based on the SWQB's statistical analysis, several indicators were not useful for distinguishing streams and rivers in NM. Presenting and discussing these indicators in the protocol would be confusing as they are not used nor are they scored. The indicators are presented in Appendix A as part of SWQB's data analysis.

Other concerns noted above were addressed prior to the triennial review hearing in cooperation with various stakeholders, including Freeport-McMoRan. Please refer to the Stipulated Motion for Order on Dept.'s Proposed Revisions to Sections 15 and 97 Concerning the Hydrology Protocol for more details.

5. Temporal Representativeness. One-time observation of the indirect indicators may be appropriately considered as evidence of stream classification, but the protocol should clarify that repeated observations of direct indicators are stronger evidence given the closer relationship of the direct indicators to the actual definitions of "ephemeral," "intermittent," and "perennial."

With respect to timing of observations after significant rainfall, we agree with NMED that observations should not be made during a rainfall event. We do not agree, however, that the 48-hour "waiting period" is sufficient to avoid data collection that may reflect a "wet" condition and therefore could provide misleading information. In at least some situations, a more appropriate waiting period is likely to be on the order of a week, especially if repeated rains have temporarily wetted the vegetation (i.e., precipitation interception), filled the depression storage, and increased the soil moisture in the watershed.

SWQB Response: The protocol recommends sampling *at least* 48 hours after a major precipitation event, meaning anytime after that 48-hour period to reduce the influence of excess precipitation and/or flooding. The intent is to assess stable, baseflow conditions. Although field evaluations during unstable or extreme conditions is not recommended, the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even after a recent rainfall or during drought conditions.

6. Spatial Representativeness. The draft hydrology protocol seems to envision a single application in a 150 meter-long representative reach in an Assessment Unit up to 25 miles long. NMED states on page 9 of the draft protocol that "…the reach on which to conduct the assessment can influence the resulting conclusion…" We view this influence more strongly, because the reach selected as representative *determines* the resulting conclusion.

NMED's approach amounts to applying a microscope to a small portion of a larger system. As in all field investigations, there are tradeoffs between a higher level of detail in a

smaller area versus a lower level of detail in a larger area. Unfortunately, the draft protocol does not strike a balance between these tradeoffs. We suggest this could be remedied by (1) expanding on the procedures for selection of a representative reach; (2) allowing the use of multiple representative reaches, especially in watercourses with natural interruptions, such as wider alluvial pockets interspersed between narrower canyons; and (3) applying the full protocol in a representative reaches, but accompanied by multiple observations of only the direct indicators (see General Comment #4 above) in a number of other locations.

SWQB Response: The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

7. Drought Conditions. The applicability and utility of the draft protocol in the short- and long-term is unclear as the protocol strongly discourages application during what may be frequent and extended periods of time characterized as "drought" conditions (based on a single precipitation metric). The draft protocol describes a decision-making process based on a "snap shot" of the river/stream section in question, which is to occur during the dry/growing season (late May to mid-July or mid-September to early November), but it is "strongly recommended that field evaluations be conducted outside of drought conditions whenever possible". Based on the language in the draft protocol, if an assessment were conducted in June during a drought year (for example), there appears to be a risk that the results would not be viewed as representative (especially if the results indicated an ephemeral condition). If this is a real potential risk, the state should consider the possibility of granting variances during drought conditions for unclassified waters which are likely ephemeral, but currently being regulated as intermittent/perennial waters, and cannot be subjected to the hydrology protocol due to the presence of drought conditions.

SWQB Response: The intent of providing an evaluation window is to assess stable, baseflow conditions outside of snowmelt and/or monsoonal floods. The protocol was revised to better clarify this intent. Although field evaluations during unstable or extreme conditions is not recommended, the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even after a recent rainfall or during drought conditions. Field observations of any noteworthy conditions, such as recent flooding/scouring, extreme drought conditions, diversions or discharges, should be documented on the field forms to support (or refute) the final determination.

In regards to variances, these are currently not permitted under New Mexico's Water Quality Standards.

SPECIFIC COMMENTS

1. In the definitions section (p. 4), the draft protocol states that "if an otherwise perennial water exhibits intermittency or interruptions due to hydrologic modifications, it is considered perennial." Is this language intended to apply to waters that were perennial at some point in the past, but now display intermittency due to a permanent hydrologic modification? If so, is it the intent of the state to require attainment of uses that can't be supported due to a permanent stream modification? Would intermittent or

ephemeral waters downstream of a dam be classified as perennial (and regulated to associated uses) based on this language? This language should be removed from the draft protocol.

SWQB Response: This language has been deleted.

2. The draft protocol (p. 4) states that if an ephemeral water exhibits intermittent or perennial indicators due to anticipated and/or frequent discharges, then the water may be considered intermittent or perennial. What perennial indicators are being referenced here? How can indicators be exhibited (in the present) due to anticipated events (in the future)? The word "anticipated" should be removed from this provision, and NMED should revise the draft protocol to provide guidance on the types of perennial indicators it references. Furthermore, NMED should clarify the relevance of "frequent" discharges, given that the frequency of flow does not enter into the definitions of ephemeral, intermittent, and perennial (see General Comment #2 above).

SWQB Response: This language has been deleted. However an existing or potential discharger should be aware that if the discharge significantly alters the hydrology of the receiving waterbody the attainable/existing uses will also change.

3. The draft protocol (p. 5) states "it is strongly recommended that field evaluations be conducted outside of drought conditions whenever possible", and "if observations are made during a drought, then a Level 2 evaluation that relies on more intensive data collection will be needed to make a final decision." The draft protocol also states (in the "Recent Rainfall Activity" section (p. 6)) that the protocol and scoring mechanisms have been designed to "allow for satisfactory ratings even after a recent rainfall or during drought conditions." The Level 2 Evaluation includes more detailed information including flow and biological indicators. Is the state indicating that although it is not preferred to implement this protocol during drought conditions, one can still do so, and use information as a basis of classification or re-classification as long as a more detailed Level 2 assessment is conducted?

SWQB Response: The intent is to assess stable, baseflow conditions outside of snowmelt and/or monsoonal floods. The protocol was revised to better clarify this intent. Although field evaluations during unstable or extreme conditions is not recommended, the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even after a recent rainfall or during drought conditions. Field observations of any noteworthy conditions, such as recent flooding/scouring, extreme drought conditions, diversions or discharges, should be documented on the field forms to support (or refute) the final determination. A Level 2 evaluation may certainly be used to strengthen an argument for classification or re-classification or to gather more data when a stream is borderline.

4. The draft protocol (p. 5) states that Assessment Units ("AUs") are designed to represent waters with assumed homogeneous water quality. NMED should revise the draft protocol to provide guidance on how such homogeneity is to be determined, and provide additional guidance on the process for AU identification. In addition, if justified,

a stream should be allowed to be segmented into more than one assessment unit and have more than one classification.

SWQB Response: More discussion of AUs can be found in the SWQB Assessment Protocol. The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

5. The draft protocol proposes a single metric (the Standardized Precipitation Index, or SPI) to define drought conditions. There are a number of different drought indexes which often provide different and sometimes conflicting information about the presence, severity, and projected duration of drought conditions. Since the SPI is a precipitation index, its use may not be appropriate to identify water presence and persistence impacts associated with drought conditions that could confound a hydrologic assessment. For example, the 12-month SPI on the national scale for August 2008 shows southwester New Mexico with a range of -1.29 to -0.8. This range would be inconclusive of whether the region is in a drought. The surface water supply index and the various Palmer Drought Indices account for factors other than precipitation that impact the presence of water (including base flows and thus provide potentially a clearer determining of drought conditions). The draft protocol should either provide a more detailed evaluation of drought indices and provide rationale for the selection of a single index, or provide a range of options that can be consulted to assess the potential influence of drought conditions, including calculating the SPI based on local data using a protocol included in the Level 1 assessment.

SWQB Response: The understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993. The SPI was designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. Soil moisture conditions respond to precipitation anomalies on a relatively short scale. Groundwater, streamflow, and reservoir storage reflect the longer-term precipitation anomalies (6-, 9-, and 12-month SPIs).

The SPI was chosen for use in the *Hydrology Protocol* because it can be computed for longer time scales (i.e. 12 months) that are linked to groundwater and surface water fluctuations and reservoir storage, it can provide an early warning of drought, and it can help assess drought severity. The SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination. The SPI value should be used to assess whether or not the stream evaluation and final score are consistent with the true nature of the stream or if they may be skewed by extreme conditions occurring at the time of the field evaluation. Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding, diversions, or discharges, should be documented on the field forms to support (or refute) the final determination. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are influencing the overall rating, they may want to postpone a final decision until another evaluation can take place during more normal conditions.

6. The draft protocol (p. 6) establishes a four-tiered, weighted scale to evaluate and score attributes of variability in a stream. The score "reflects the evaluator's judgment of the average degree of development of the attribute along a representative reach of the stream." Evaluator judgment may introduce bias into the scoring. NMED should revise the draft protocol to provide a more quantitative assessment of these attributes which would reduce the potential for bias (e.g., in a 300 meter reach, measure the length of continuous water and calculate the percentage of the channel that has free standing water). Furthermore, the language in Table 1 on page 7 of the draft protocol, which provides guidance on evaluator determination of stream attributes, should include more definitive, quantifiable timelines, rather than the qualitative terms "easily" and "more minutes."

SWQB Response: The descriptions in Table 1 should provide general guidance for the evaluator; however the indicator-specific descriptions for each tier (strong, moderate, weak, poor) are meant to provide an easily discernible way to score the attribute consistently between evaluators. The small increments in scoring between tiers were incorporated to help reduce the range in scores between different evaluators. Furthermore the indicators selected within the HP exhibit a wide range of variability across the ephemeral to perennial stream gradient, such that making quantitative measurement is an exercise in "proving the obvious". Given this SWQB believes a qualitative assessment is appropriate – however quantitative supporting documentation would certainly strengthen any proposed UAA.

7. The draft protocol (p. 11) provides that artificial (i.e., point-source) discharges should be noted on the field assessment form. Point source discharges then appear to be considered the same as groundwater inflow. However, this is not appropriate because although point source discharges may sustain flow in the channel for a distance until the cumulative infiltration rate into the stream bed equals the discharge rate, this should not support the consideration of the stream as an intermittent or perennial flow because the groundwater system is not necessarily supporting the surface water system.

SWQB Response: Noting a point-source discharge on the field form is not the same as scoring it. Making notes of the general conditions of the stream, water discharges or withdrawls, land uses in the watershed, and climatic conditions help the evaluator obtain a broader picture of the stream. This information may also be important if the stream is borderline because such information may be used to help make a final determination even if these attributes are not scored.

Revised definitions adopted by the WQCC for intermittent and perennial do not provide any relationship to groundwater level. This is appropriate for WQS as what is critical is the use supported by the stream. Consider a stream that leaves the mountains and enters an alluvial basin – as it cross that threshold it will likely become a losing stream (i.e. the groundwater table is below the stream surface) however these streams often maintain "perennial" flow for some distance and as such support a more stringent aquatic life use designation. SWQB believes that the WQCC in adopting standards wished to focus on the consistency of flow (i.e. duration) which is directly related to the uses supported and not the connection to the groundwater system. Likewise a continuous discharge may result in a stream segment having "perennial

flow" as defined in the WQCC adopted definition and as such will support a more stringent aquatic life use designation.

8. The draft protocol (p. 11) states that the "presence of plants as well as saturated or moist sediment underneath rocks located within the stream channel are also good indications of the presence of water during dry (drought) conditions or during the growing season." Moist conditions under rocks are not an indication of groundwater. Sediments and soils beneath large rocks can remain moist for long periods of time after a rainfall and are more an indication of lack of direct evaporation beneath the rock than the presence of groundwater. The term "moist" should be removed from the draft protocol.

SWQB Response: The term moist was removed from the protocol.

9. The draft protocol (p. 14) provides guidance on determining stream sinuousity. In regions where there is bedrock control on the channel alignment or significant topographic relief, the sinuousity of the stream may be governed by local geology rather than merely the stream type. The draft protocol should be revised to consider local geology in evaluating stream sinuousity. In addition, if aerial photos are not available, sinuosity can be measured using a GPS's trip computer function to measure channel length and valley length.

SWQB Response: The use of a GPS unit was added the sinuosity section. Geomorphic indicators, such as sinuosity, are only one component of the HP, and as noted may be locally bedrock controlled. The protocol utilizes a weight-of-evidence approach to make a final stream determination. Multiple indicators allow for satisfactory ratings even if one or several indicators are not what would be expected given the nature of the stream.

10. Section 1.8 (p. 15) of the draft protocol discusses the entrenchment ratio indicator. However, we do not believe that entrenchment ration can be measured in a dry stream bed.

SWQB Response: According to Knight, et al. (1999), "[ephemeral channels] tend to have low entrenchment ratios relative to intermittent and perennial channels." The SWQB agrees that in some dry channels it may be extremely difficult to measure entrenchment ratio because the channel is not clearly defined; however the evaluator should be able to observe whether or not the reach is slightly entrenched, moderately entrenched, or definitely entrenched and score the stream accordingly. Geomorphic indicators, such as entrenchment ratio, are only one component of the HP. The protocol utilizes a weight-of-evidence approach to make a final stream determination. Multiple indicators allow for satisfactory ratings even if one or several indicators are not what would be expected given the nature of the stream.

11. The draft protocol (p. 21) suggests that the presence of seeps and springs suggests that groundwater is a source of stream flow except during a period of drought. The presence of seeps and springs is not always an indicator of perenniality. Seeps and springs may be seasonal and may also be controlled by geometry and local geology in a way more comparable to a stormwater discharge than a perennial stream. In classifying an entire stream, the portion of the stream that is sustained by seeps or springs should be taken

into consideration and their presence should not indicate that the entire stream is perennial.

SWQB Response: The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. Hydrologic indicators are only one component of the *Hydrology Protocol*. The SWQB agrees that the presence of springs and seeps by itself should not determine whether or not a stream is perennial. As stated in the protocol, additional supporting information, such as the presence of springs and seeps, may be used to support a hydrologic determination.

12. The draft protocol (p. 22) provides for certain additional supporting information that may not be scored, but can be used to support a Level 2 hydrological determination (such as long-term resident observations or professional judgment). This additional, unscored, supportive information is vague and subjective, dependent on faulty memories or interpretation of outdated and/or poor-quality photographic evidence. This information should be removed from the protocol or appropriate defined and limited.

SWQB Response: Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or reviewing historic photographs, are necessary to determine the hydrologic condition of the stream. Because this supporting documentation is not always necessary to make a hydrologic determination, the Bureau felt that it was best gathered during a Level 2 Evaluation, after the Level 1 Evaluation was judged to be inconclusive.

13. The draft protocol (p. 24) states that "[d]etermination of stream type is accomplished by evaluating 7 different attributes of the stream and assigning a numeric score to each attribute. Scores should reflect the persistence of water with higher scores indicating perennial streams." The draft protocol gives no guidance on how to interpret scoring for Level 2 evaluations. NMED should revise the draft protocol to emphasize quantitative evaluation for Level 2 assessments as Level 1 is entirely qualitative.

SWQB Response: As explained in Section 2: Guidance for Overall Score Interpretation, "for a Level 2 evaluation, higher scores indicate that a channel has more perennial characteristics. While SWQB has not developed thresholds for the determination of waterbody's hydrologic type, the data collection and analysis performed for a Level 2 evaluation can be used to develop a detailed UAA to support the proper standards classification for a given reach."

14. The draft protocol (p. 36) provides that "if a stream is recognized as borderline or substantially affected by man-made activities or if observations are made during a drought, then a Level 2 evaluation that relies on more intensive data collection will be needed to make a final determination." It is unclear how the Level 2 evaluation helps if the evaluation is completed in a drought and the Level 2 data does not represent non-drought conditions.

SWQB Response: The phrase, "…or if observations are made during a drought…" was removed from the protocol. The intent of the Level 2 Evaluation is to gather more information if a Level 1 Evaluation was inconclusive.

15. The draft protocol (p. 36) states that a Level 2 evaluation "can more clearly determine that the stream is ephemeral." NMED's proposed surface water quality standard regulations under the current Triennial Review provide that the hydrology protocol will be used to expedite the UAA process. NMED has gone on in its filings in the Triennial Review to state that the definition of "ephemeral" in the surface water quality standards regulations stands alone and is not influenced by the hydrology protocol. Yet the draft protocol itself provides that part of its purpose is to determine if a stream is ephemeral. How then can the definition of "ephemeral" in the regulations stand alone? What then is the purpose of the hydrology protocol – to expedite the UAA process or characterize the stream as ephemeral, intermittent or perennial?

SWQB Response: New Mexico Water Quality Standards provide definitions of ephemeral, intermittent and perennial and identified the supported uses of these water types. The *Hydrology Protocol* (HP) is a tool to distinguish streams and rivers in New Mexico based on these characteristics to properly implement the Water Quality Standards. It was designed to provide necessary supporting documentation for an expedited Use Attainability Analysis (UAA) process (20.6.4.15C), however the HP is only one tool out of many that may be used to support a standard UAA.

16. The draft protocol (p.37) discusses scoring for Level 2 evaluations, but is unclear which borderline interval is being evaluated by Level 2. Additionally, Appendix A of the draft protocol states that "the dataset is not large enough at this time to perform a distribution analysis to evaluate the fit of the score ranges in Table 3." This implies that score ranges are based on an inadequate number of reference sites.

SWQB Response: A Level 2 evaluation should be conducted if the Level 1 score falls within a gray zone (Appendix A, Table 3) and the evaluator feels that the stream is improperly classified (e.g. ephemeral stream that is still classified as an intermittent). The SWQB is confident in its approach and analysis; however the HP is considered to be an evolving, living document. Current thresholds are based on data collected by the SWQB from 57 stream reaches throughout the state of New Mexico during the 2008 and 2009 field seasons. Furthermore, in recognition of the uncertainty of our current Level 1 dataset we identified "transition zones" where the stream may be, for example, ephemeral but will be classified as intermittent. In the event that new data indicate the threshold values used in the protocol are not appropriate and/or if new standards are adopted, the threshold values and differentiating scores will be adjusted accordingly.

17. The draft protocol is unnecessarily restrictive as to the qualifications of evaluators, in that it requires that evaluators have experience making geomorphic, hydrological, and biological observations for New Mexico streams. The hydrology protocol should insist only that evaluators have sufficient education and experience to conduct evaluations in streams within the southwestern United States.

SWQB Response: The SWQB agrees that it would be helpful to have experience in river systems throughout the arid west to provide a better working knowledge of the range of conditions that can be found in this region, but does not believe that this should be a requirement. The HP was modified to state that, "… the evaluator should have experience making geomorphic, hydrological, and biological observations in New Mexico or in the semi-arid climate of the southwestern U.S."

18. The draft protocol should be revised to provide some guidance on the quality of photographic evidence relied on in documenting stream conditions.

SWQB Response: The photodocumentation section was modified to include, "The assessor should include a detailed description of each photo on the *Stream Determination Field Sheet*, including date, description of the photo (e.g. left bank, right bank, upstream, downstream, etc.), and GPS coordinates (if different from site location)."

19. The draft protocol provides guidance for field observations for fish (Section 1.2), differences in vegetation (Section 1.5), and the absence of rooted upland plans in the streambed (Section 1.6), for purposes of making evaluations. These qualitative observations are vague and unnecessarily subjective, as they are often dependent on timing and rely on undefined terms, such as "true riparian vegetation."

SWQB Response: The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. The indicator-specific descriptions for each tier (strong, moderate, weak, poor) are meant to provide an easily discernible way to score the attribute consistently between evaluators. Additionally, the small increments in scoring between tiers were incorporated to help reduce the range in scores between different evaluators. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions.

20. The draft hydrology protocol should provide alternative measures to installation of temperature sensors to estimate the onset and cessation of flow, such as stream gauging instruments or stilling wells. The draft protocol is intended to be applied at least 48 hours after a major rainfall event during the "dry" season which is defined in the draft protocol as late May to Mid-July or mid September to early November. In some systems, flow and biological indicators of water presence and persistence are like to be very different just prior to the summer monsoon season (e.g., late June), and the just after the summer monsoon season (e.g., late September). Was this potential source of variability and uncertainty considered when developing the proposed thresholds based on application of the protocol on 57 stream reaches throughout the state of New Mexico? This variability (if unaccounted for) could significantly influence the development of the proposed thresholds. Furthermore, there may be no local rain gage data near the AU at issues. In such instances, the hydrology protocol should allow field observations in the basin or channel to provide the basis for documenting that at least 48 hours have passed since the last major rainfall event.

SWQB Response: The SWQB recommends that, "Historic or recent flow data from gauges such as those managed by the USGS or Los Alamos National Laboratory (LANL) should be used to

make hydrological determinations. Gauge data, if available, may clearly indicate ephemeral, intermittent, or perennial flow patterns for the available period of record..."

The SWQB sampled at various sites from May through October in 2008 and 2009. In addition, some sites were not evaluated because of late snowmelt conditions and/or recent monsoon storms. The intent of providing an evaluation window is to assess stable baseflow conditions outside of snowmelt and/or monsoonal floods.

The protocol recognizes that not all information (i.e. rain gauge data) will be available for every AU. If rain gauge data are not available then the evaluator will have to use his field observations and judgment to determine if extreme conditions, such as rainfall or drought, are influencing the overall rating. In such instances, the evaluator may want to postpone a final decision until another evaluation can take place during more normal conditions.

21. The rationale for including Indicator 1.12, Sediment on Plants or Debris, is suspect. The draft protocol states (p. 20) that "sediment on plants or other debris in the stream channel may be an important indicator of recent high flows". Floods can indeed leave sediment and debris behind, particularly on the overbanks, but the magnitude of flow does not enter into the definitions of ephemeral, intermittent, and perennial (see General Comment #2 above). The indicator may be applicable because a film of fine sediment (i.e., a silt drape) can indicate a decrease in sediment transport capacity due to rapid infiltration into the channel bed (i.e., transmission losses). Transmission losses in turn imply that the position of the water table is below the channel bed, which does enter into the definitions. This indicator was statistically significant at the $p<0.01$ level (rather than the more stringent $p<0.005$ level) perhaps because it does not differentiate between flood deposits and silt drapes due to transmission losses.

SWQB Response: SWQB agrees in general with this comment – however the goal was to develop a protocol that utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions. As such we used all indicated which were found to be significant. In recognition of the lower level of significant, this indicator is scored at half the values of other metrics.

Freeport-McMoRan New Mexico Operations appreciate the opportunity to submit these preliminary comments on NMED's draft hydrology protocol. We respectfully request that NMED revise the draft consistent with these comments. If you have any questions, please do not hesitate to contact me.

Very truly yours,

Richard N. Mohr

Enclosure
2273613

COMMENT SET G: Los Alamos National Laboratory

From: Steve Veenis
Sent: Friday, September 25, 2009 1:05 PM
To: Drinkard, Shelly, NMENV
Cc: saladen@lanl.gov; wardwell@lanl.gov; sandovalt@lanl.gov

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
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Date: September 22, 2009
Refer To: ENV-RCRA-09-176
LAUR: 09-06116

Ms. Shelly Drinkard
Surface Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2050
1190 St. Francis Dr.
P.O. Box 5469
Santa Fe, NM 87502-5469

Dear Ms. Drinkard:

SUBJECT: COMMENTS ON "PUBLIC COMMENT DRAFT, HYDROLOGY PROTOCOL FOR THE DETERMINATION OF EPHEMERAL, INTERMITTENT, AND PERENNIAL WATERS"

The Los Alamos National Laboratory appreciates the opportunity to provide comments on the New Mexico Environment Department's (NMED) "Public Comment Draft, Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters". Our comments focus on the following topics.

1. General Comments on the Draft Protocol.
2. Specific Comments regarding definitions, use of flow gaging records, areas without gaging records, reliability of indicators, consideration of water quality standards, antecedent weather conditions, and reach selection.
3. Other Specific Comments.

We hope you will consider incorporating these comments into the draft Hydrology Protocol to establish a more detailed approach for determining ephemeral, intermittent and perennial waters in New Mexico. Our detailed comments follow in Enclosure 1.

Please call Mike Saladen at (505) 665-6085 or Steve Veenis at (505) 667-0013, if you have questions or need additional information.

Sincerely,

Mike Saladen,
Team Leader
Water Quality and RCRA Group

Sincerely,

Steve Veenis
Project Leader
ADEP Program Management

MS:SV/lm

Cy: Gene Turner, LASO-EO, w/enc. A316
Michael B. Mallory, PADOPS, w/o enc., A102
Chris Cantwell, ADESHQ, w/o enc., K491
Paul Huber, LWSP, w/o enc., M992
Phil Wardwell, LC-LESH, w/enc., A187
ENV-DO File, w/o enc., J978
ENV-RCRA File, w/enc., K490
IRM-RMMSO, w/enc., A150

ENCLOSURE 1

LOS ALAMOS NATIONAL LABORATORY
COMMENTS ON NMED'S DRAFT HYDROLOGY PROTOCOL

Background

The state of New Mexico is proposing to use the protocol for determining hydrologic stream types so that unclassified streams can be appropriately classified as ephemeral, intermittent or perennial stream types, thus determining their accompanying designated uses and water quality standards. According to the current state water quality standards, each of these three stream types is typically afforded different designated uses and associated numeric criteria when applied to a classified segment.

Given the many unclassified waters in the state, the current NM standards provide "default" ephemeral, intermittent and perennial classifications (20.6.4.97, 98 and 99 NMAC). The default ephemeral class provides for a "limited aquatic life" use, which applies only the acute aquatic life numeric criteria and not the chronic criteria. In the last Triennial Review, EPA said that all waters must be presumed to have the "fishable and swimmable" uses provided by the Clean Water Act Section 101(a)2 and could not default to something less. Thus, to be considered ephemeral, a stream must have some form of actual information as the basis and not be assumed ephemeral by default.

Given that most perennial streams in the state have probably been appropriately classified specifically (e.g., NMAC 20.6.4. 100 through 899), the need for gathering information to avoid use of the default classes would be most applicable to differentiating ephemeral from intermittent streams.

General Comments

The following are general comments on the draft protocol:

- It is very important that professional judgment and corroborating information be given equal consideration to the protocol so that it does not become a "mathematical exercise" in which the information on the form and the associated scoring calculations become the sole determiner of stream classification. Alternative methods such as streamflow gaging records, groundwater monitoring records, remote sensing, documented observations, etc. should be given consideration when these records exist. In addition, the draft hydrology protocol would be most applicable to unaltered, stable streams and potentially more difficult to apply in altered channels. Use of alternative methods and professional judgment are sometimes the only way to classify a stream that has been altered because of agricultural or urban disturbances.
- Overall, the guidelines seem vague on some critical issues. For example, recommendations such as where and when to do the field investigations or how to select a site that is representative of the subject stream reach are not discussed in enough detail. Rather, the document focuses its attention on how to measure parameters, many of which are subjective, expensive, and indirectly linked to the flow regime. Specific training would be needed to make these observations reliable and minimize observer bias. These vagaries could lead to varying

classifications depending on how evaluators select "representative" reaches. Technologies such as remote sensing and modeling could help address site selection/representativeness issues.

- The terms "gauge" and "gage" are used interchangeably throughout the document. Either spelling can be used, but regardless, should be used consistently throughout the document. The U.S. Geological Survey (USGS) uses the spelling "gage" while "gauge" tends to be more common elsewhere.
- It would be beneficial to summarize the most important parts of the protocol that are required to differentiate between the three stream classes. The guidance includes metrics that are fairly direct/conclusive (e.g., presence of macroinvertebrates that require water) with metrics that are less directly connected (sinuosity) and/or are very qualitative (e.g., difference in composition or density of riparian and upland vegetation).
- Less important stream characteristics could take substantial work to measure but add little to the evaluation. For example, the training, cost and data quality issues associated with benthic invertebrate characterization may be justifiable for the State's new biocriteria, but less so for purposes of this protocol given other higher quality/lower cost alternatives for generating strong evidence.
- The summary section should also emphasize that the Hydrology Protocol supports a Use Attainability Analysis (UAA) and can not be used in place of the UAA. The information from the site evaluation could be used to support the classification of a stream segment; however, it must be reviewed and approved by the New Mexico Water Quality Control Commission to complete the classification process.
- The protocol does not provide any information regarding how the decisions regarding classifications will ultimately be made and communicated to stakeholders. In addition, there is no information in the protocol concerning the process for the public to submit relevant evidence of stream characteristics that may lead to a classification contrary to that reached using the protocol. It is also unclear as to how protocol data and contrary evidence would be evaluated. It is recommended that the protocol include a section that describes the decision making process, public notice and opportunities for public input, and periodic review of classifications (i.e. during the Triennial Review).
- The draft Hydrology Protocol states the 12-month Standard Precipitation Index (SPI) *will be used* to determine drought conditions. LANL agrees that field evaluations should be conducted outside of drought conditions and supports the recommendation for using the 12-month SPI. There may be value in looking at the one month, three months, six months and twenty-four months SPI values also. For example, the SPI for August 2009 for Los Alamos ranged from "extremely dry" to "near normal" within a 24-month range. The SPI value(s) should be noted in the Stream Determination Field Sheet and justification should be documented.

ENCLOSURE 1

LOS ALAMOS NATIONAL LABORATORY
COMMENTS ON NMED'S DRAFT HYDROLOGY PROTOCOL

- LANL assumes the User/Evaluator can be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. Please add clarification language regarding the User/Evaluator. Please note that we feel it is essential for achieving consistent results among a number of evaluators, that the protocol user is trained and qualified in the application of the protocol.

Specific Comments

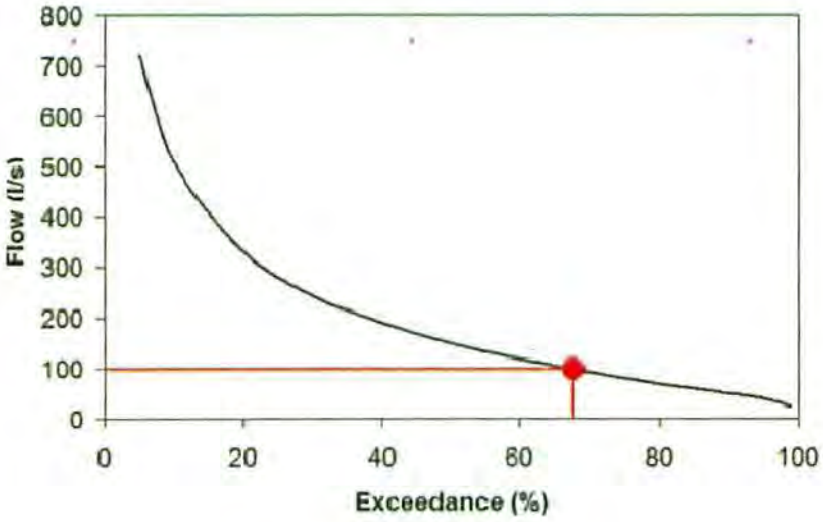
Definitions: Ephemeral, intermittent, and perennial streams are defined qualitatively in NMAC 20.6.4.7 based on the relative periods of time in which the stream channel contains water. These definitions do not clearly distinguish between ephemeral and intermittent, or intermittent and perennial in terms of the duration over which water can be observed in a particular stream. These definitions could be refined in the protocol to include quantifiable criteria for differentiating between each stream type. Examples include:

- Matthews (1988) regarded intermittent streams as those which flow 20%-80% of the time, and ephemeral streams as those which flow <20% of the time.
- Hedman and Osterkamp (1982) defined perennial streams as those having measurable discharge 80% of the time, intermittent 10-80% of the time, and ephemeral <10% of the time.
- Hewlett (1982) defined perennial streams as having water present >90% of the time. As shown by the literature, there are even discrepancies in the stream class definitions.

We recall that there was substantial discussion during the last Triennial Review regarding relative periods of time in which a stream channel contains water and how to apply periods of flow and no-flow in distinguishing between ephemeral and intermittent channels. Clarification such as those suggested above should not be inconsistent with the definitions adopted by the WQCC.

Use of surface flow gaging records: If a reliable stream gage is located on the reach of interest and if that stream gage has a sufficient period of record, it should be evaluated first, before conducting the proposed field protocols. Good gage records may provide all the information necessary and could be used in place of the proposed field protocols. Stream gage data provides objective and quantified measures of the flow durations and periodicity that are needed to distinguish a water body that "contains water briefly" (ephemeral) from one that "contains water only at certain times of the year" (intermittent). The methods proposed in the hydrology protocol are heavily reliant on indirect indicators of stream flow. A stream gage directly measures duration and magnitude of stream flow and is the best source of data for classifying streams. Data supplied by a stream gage can be used in the following ways to classify streams:

- **Flow duration:** The simplest way to quantifiably differentiate between ephemeral, intermittent, and perennial streams is in terms of the percent of time flow is observed in a channel; i.e., what is the percentage of time in which flow in the stream exceeds a minimum measurable threshold. This can be accomplished using stream flow records recorded at a stream gage. Stream stage or flow should be measured at equal time intervals for a period of record composed of at least one complete water year (October 1 through September 30). When taken in equal time intervals, stage/flow readings exceeding a specific threshold can be summed and divided by the total number of time intervals to get the percentage of time exceeded. This can be done for several thresholds over the entire range of observed values, and then plotted to obtain a flow duration curve.



Example Flow Duration Curve

- **Low-flow frequency (gaged streams):** The definition for a perennial stream includes the concept of drought, which indicates a need to account for variability in flows from year to year. Low-flow frequency can be evaluated through regression analysis if sufficient streamflow measurement has been completed. Low-flow frequency is often described in terms of mean daily flow averaged over a period of "n" consecutive days. For example, Idaho Administrative Code defines an intermittent stream as one having a hydrologically-based, unregulated 7-day, 2-year low flow (7Q2) of less than 0.1 cfs (State of Idaho, 2006). The 7Q2 is the annual minimum mean streamflow over seven consecutive days that has a 50 percent probability of not being exceeded in any one year.
- **Low-flow frequency (provision for ungaged streams):** Regional regression equations can be used to estimate low-flow frequency for ungaged streams

based on parameters such as drainage area and mean annual precipitation. As an example, NMED and USGS prepared a document entitled "Analysis of the Magnitude and Frequency of the 4-Day Annual Low Flow and Regression Equations for Estimating the 4-Day, 3-Year Low-Flow Frequency at Ungaged Sites on Unregulated Streams in New Mexico". (Waltemeyer, 2002).

Areas without gaging records: In assessment units (AUs) without suitable stream gages, simple pressure transducers could provide useful water level data that could be analyzed for flow duration without having to set up rating curves. For about $1,000 purchase price, a vented sensor with a logger could be deployed in early spring to catch the end of snowmelt (if the watershed is suspected to have snowmelt) and record water levels through the summer monsoonal rains into the early fall. The approximate six-month to one-year data set could then be readily analyzed for water level durations and periodicity, and if a nearby rain gage exists, could be further analyzed for relative responses to rainfall. This approach could provide objective evidence and may be more cost effective than the draft protocol field approach.

Reliability of indicators: While we agree with using a field indicator approach in general, applying scores based on indicators can be unreliable. The following are several examples describing the unreliability of several indicators:

- **Water in channel:** Scores based on sediment moisture could vary tremendously depending on the timing of the site visit.
- **Fish presence:** The amount of time it takes to find fish is an unreliable indicator of flow category. In streams that have excellent fish habitat, the fish are very hard to find. Also, the presence of biological indicators may be heavily affected by previous disturbance or by water quality.
- **Differences in vegetation:** Differences in riparian vegetation could also be due to livestock (grazing/trampling).
- **Sinuosity:** Sinuosity can be an unreliable indicator of flow category. It may be difficult to accurately apply sinuosity to disturbed channels in agricultural areas or urban areas. Also, there are very stable natural channels with intermittent or perennial flow that have very low sinuosity due to slope or valley confinement. For example, a stream with a steep slope in a confined valley would have a sinuosity of less than 1.2, but it can easily have intermittent or perennial flow. In addition, sinuosity would also be expected to be a function of surficial geology and sediment loads, which would be independent of flow regimes. Finally, it could be hard to discern sinuosity where channels are braided.
- **Entrenchment ratio:** Local geology and topography can render this indicator as an unreliable characteristic of flow category. For example, an ephemeral channel in the plains could have a very high entrenchment ratio and would

score 3 points, while a perennial stream in a steep, confined valley could score a zero.

- **In-channel structure:** This is applicable to lower gradient streams that would naturally form a riffle-pool sequence. For step-pool channels, plane beds, cascades, and others, a different set of criteria should be developed so that appropriate score can be assigned.

Consideration of water quality standards: This protocol provides a tool for distinguishing among unclassified ephemeral, intermittent and perennial streams and rivers in New Mexico. The outcome of completing such determinations will assure that the appropriate water quality standards are applied to a water body. It is important to consider the difference between applicable water quality standards for ephemeral and intermittent streams. Typically, ephemeral streams are given the "limited aquatic life" designated use, which does not apply chronic aquatic life criteria in view of the short duration of the flows. We recommend a brief description in the Summary section explaining the difference in standards that may apply to ephemeral versus intermittent, and perennial streams (i.e., acute vs. chronic standards, coldwater aquatic life vs. limited aquatic life, temperature, etc.).

Antecedent weather conditions: The protocol acknowledges that classification could vary depending on antecedent weather conditions. However, the protocol does not explain how to select a representative precipitation gage, interpolate rainfall, etc. Also, the protocol might be harder to apply in areas that do not have a rain gage that can be reliably associated with flows in the subject stream, or that do not have real time precipitation data available to verify 48-hour prior rainfall.

Sampling after recent rainfall activity: Sampling shortly after a rainfall event can sometimes be advantageous. Based on the definitions in the draft protocol, if a stream does not carry flow during a year of average rainfall, regardless of the time of year, then it cannot be perennial. If it is dry during a rainfall event, then it cannot be intermittent. LANL subcontractor staff have applied field protocols during every season, and the amount of stream flow at the time of sampling is rarely the deciding factor. Because of this, LANL recommends that consideration be given to relaxing recommendations for not conducting evaluations within 48 hours of rainfall activity.

Reach selection: This portion of the protocol should be focused on finding the transition point between flow categories, not as a general characterization of a stream reach. One should survey enough of a stream to get an idea of its typical characteristics. Typically one would walk upstream until a change in characteristics is observed. An obvious example is the confluence of tributaries. The field protocol would be applied to the main stem downstream of the confluence and then on a typical reach on each tributary immediately upstream of the confluence. This would allow the determination of the flow category for each reach.

- **Identifying representative reaches:** Identifying a "representative" reach can be difficult. Limitations posed by access, private property, safety, etc., plus the evaluator's bias could influence the outcome of the assessment. Reach lengths of 150 meters could be a very small fraction of an AU, especially if as noted in the protocol; AUs can be up to 25 miles in length. Multiple monitoring/evaluation sites within a single AU may be warranted under certain circumstances (See Assessment Protocol, June 19, 2009). Assessment units within homogenous landscape features are "expected" to have homogenous water quality. However, this may not be true due to point source discharges within a reach, and/or lack of adequate best management practices (BMPs) that are needed to address non-point source pollution. NMED's Assessment Protocol recommends the AU to be broken into smaller units if conflicts arise and the attainment conclusions for sites are not in agreement within an AU. This scenario has relevance with the Hydrology Protocol also. We recommend more detailed guidance on developing representative reaches with respect to the overall AU. Larger scale/remote sensing approaches may be helpful but only as a first cut to identify likely homogeneous reaches within an AU.

Other specific comments

- Does "discharges" mean man-made flows such as waste water treatment plant effluent (see pg 4, last paragraph)?
- State how the outcome of the triennial review may require changes to this draft (see pg 4).
- It would be helpful to add to the Introduction, a brief outline of the protocol, activities, and limitations on its use and who can/should use it. When should Level 1 vs Level 2 evaluations be used, options, etc.?
- The "evaluator flexibility" referred to on pg 6, second paragraph, could lead to subjective evaluations, in which case scores could vary considerably depending on the evaluator. Observer bias could be minimized through specific limitations and provisions, and required minimum training or experience.

References

Hedman, E.R., and W.R. Osterkamp. 1982. Streamflow Characteristics Related to Channel Geometry of Streams in Western United States. USGS Water-Supply Paper 2193. 17 p.

Hewlett, J.D. 1982. Principles of Forest Hydrology. University of Georgia Press. 183p.

Matthews, W. J. (1988). "North American prairie streams as systems for ecological study." Journal of the North American Benthological Society 7: 387-409.

Waltemeyer, Scott D. 2002. "Magnitude and Frequency of the 4-Day Annual Low Flow and Regression Equations for Estimating the 4-Day, 3-Year Low-Flow Frequency at Ungaged Sites on Unregulated Streams In New Mexico." U.S. Department of the Interior U.S. Geological Survey Water-Resources Investigations Report 01-4271. Prepared in cooperation with the New Mexico Environment Department.

SWQB Response: SWQB is presenting responses in the order they were presented by LANL.

General Comments

- SWQB developed the HP to be applicable at all locations within New Mexico and as such the protocol is based on general field observations. If stream gauge data existed at all sites, which LANL notes it does not, then the HP would not be necessary. If gauge data do exist they certainly should be used and SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol (e.g. stream gauge data), but other data not included in these recommendations may be gathered as well, such as groundwater monitoring records, remote sensing, or documented observations. It is up to the evaluator to make an argument to support (or refute) the proposed water quality standards change and to present his argument to the WQCC and EPA for approval.
- The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. The indicator-specific descriptions for each tier (strong, moderate, weak, poor) are meant to provide an easily discernible way to score the attribute consistently between evaluators. Additionally, the small increments in scoring between tiers were incorporated to help reduce the range in scores between different evaluators. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions and/or evaluators. The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.
- Page 6, "gage" was replaced with "gauge."
- The Level 1 Evaluation provides a tiered methodology to prioritize parameters according to the relative strength of their discriminating abilities. Field indicators 1.1 – 1.6 were lumped together because they have a strong ability to identify "clearly" ephemeral and "clearly" perennial streams such that time and resources can be minimized (if it is a straightforward case). Likewise, field indicators 1.7 – 1.9 were lumped together as the second tier to possibly reduce the amount of time and resources used. The protocol is also designed with 2 different levels of data collection. The Level 1 Evaluation is designed to be "quick, easy and inexpensive" and is based on more qualitative measures. Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information are necessary to determine the hydrologic condition of the stream. The Level 2 Evaluation is more quantitative and time consuming and should be conducted after the Level 1 Evaluation was judged to be inconclusive.
- The Hydrology Protocol (HP) was designed to provide the necessary supporting documentation for the expedited Use Attainability Analysis (UAA) process (20.6.4.15C), however the HP is only one tool out of many that may be used to support either an expedited or standard UAA. The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol, but other data not included in these recommendations may be gathered as well. It is up to the evaluator to make an

argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

- The summary section was revised.
- Many of the issues and concerns raised by LANL regarding the decision-making, stream reclassification, and public participation processes were addressed prior to the triennial review hearing in cooperation with various stakeholders. Please refer to the Stipulated Motion for Order on Dept.'s Proposed Revisions to Sections 15 and 97 Concerning the Hydrology Protocol for more details.
- The understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993. The SPI was designed to quantify the precipitation deficit for multiple time scales. These time scales reflect the impact of drought on the availability of the different water resources. Soil moisture conditions respond to precipitation anomalies on a relatively short scale. Groundwater, streamflow, and reservoir storage reflect the longer-term precipitation anomalies.

  The 12-month Standardized Precipitation Index (SPI) was chosen for use in the Hydrology Protocol because SPIs of this time-scale can be linked to groundwater-surface water fluctuations and reservoir storage, it can provide an early warning of drought, and it can help assess drought severity. The 12-month SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are influencing the overall rating, he may want to postpone a final decision until another evaluation can take place during more normal conditions.
- NMED or any other party may conduct a Use Attainability Analysis (UAA), therefore the User/Evaluator may be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. The Standards explain the requirements of a UAA at 20.6.4.15 NMAC. The "User/Evaluator" section was amended to clarify this fact.

Specific Comments

Definitions: The definitions of ephemeral, intermittent, and perennial are tied to New Mexico's Water Quality Standards and as such any questions, comments, or improvements to these definitions should be handled through the triennial review process.

Use of surface flow gauging records (flow duration curves, low-flow frequency): The SWQB agrees that gauge data are the best means for classifying a stream reach. As stated in the Level 1 Office Procedures, "…Gather as much information as you can prior to field work… Historic or recent flow data from gages such as those managed by the USGS or Los Alamos National Laboratory (LANL) should be used to make hydrological determinations. Gage data, if available, may clearly indicate ephemeral, intermittent, or perennial flow patterns for the available period of record…" Gauge records may negate the need to perform the Hydrology Protocol, especially if the stream has flow >90% or <10% of the time. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

Areas without gauging records: The SWQB agrees that pressure transducers are another alternative for collecting streamflow data. Indicator #2.1 (Water in Channel – Optional) was revised to include various examples of gathering flow data depending on the available resources.

Reliability of indicators: The SWQB agrees that if an indicator were to be observed independently, the evaluator may come to the wrong conclusion based on that one, single indicator. However, the protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. Taken together, multiple indicators allow for satisfactory ratings over a range of conditions even if one or several indicators are not what would be expected given the nature of the stream.

Consideration of water quality standards:
The SWQB does not believe that this information is appropriate to include in the Hydrology Protocol. The expedited UAA process and difference in standards is discussed in SWQB's Water Quality Management Plan, "UAAs and the Use of the Hydrology Protocol." The HP is incorporated into the WQMP as an appendix. The table outlining the differences in protection is included below:

Applicable Criteria	**20.6.4.97 NMAC** Unclassified Ephemeral (UAA required)	**20.6.4.98 NMAC** Unclassified Intermittent (includes ephemeral unless identified in 20.6.4.97)
Aquatic life and contact uses	Limited aquatic life Secondary contact	Marginal warmwater aquatic life Primary contact
Acute aquatic life criteria	Yes	Yes
Chronic aquatic life criteria	No	Yes
Human health – organism only criteria	Only for persistent pollutants	Yes
Temperature	None	32.2ºC maximum
Dissolved oxygen	None	5.0 mg/L minimum
pH	None	6.6-9.0
E. coli	548 cfu/100 mL geometric mean 2507 cfu/100 mL single sample	206 cfu/100mL geometric mean 940 cfu/100 mL single sample

Antecedent weather conditions/Sampling after a recent rainfall event: Although field evaluations during unstable or extreme conditions is not recommended, the protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings even after a recent rainfall or during drought conditions. Field observations of any noteworthy conditions, such as recent flooding/scouring, extreme drought conditions, diversions or discharges, should be documented on the field forms to support (or refute) the final determination.

Reach selection/Identifying representative reaches: More discussion of AUs can be found in the SWQB Assessment Protocol. The SWQB agrees that further clarification was needed regarding the length of "representative" reach evaluated. The protocol was modified to better explain this process.

Other Specific Comments:

- "Discharges" refer to man-made flows.
- Without knowing the future outcomes of the Triennial Review, the SWQB cannot state what changes may be required.
- More information regarding the protocol's use and limitations was added to the Summary section at the beginning of the document.
- The User/Evaluator may be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. The indicator-specific descriptions for each tier (strong, moderate, weak, poor) are meant to provide an easily discernible way to score the attribute consistently between evaluators. Additionally, the small increments in scoring between tiers were incorporated to help reduce the range in scores between different evaluators. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions and/or evaluators.

Comment Set H: Lea Ranch Coal Company

From: Wendy C. Young
Sent: Friday, September 25, 2009 4:27 PM
To: Drinkard, Shelly, NMENV
Cc: John Cochran; Stuart R. Butzier; Mark Hiles; M. Frontczak
Subject: Lee Ranch Coal Company's Comments on Draft Hydrology Protocol

MODRALL SPERLING

LAWYERS

September 25, 2009

Stuart R. Butzier
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Via electronic and U.S. mail

Ms. Shelly Drinkard
New Mexico Environment Department
Surface Water Quality Bureau
1190 St. Francis Drive
Santa Fe, New Mexico 87505

Re: Preliminary Comments of Lee Ranch Coal Company on NMED's Draft Hydrology Protocol Announced August 26, 2006

Dear Ms. Drinkard:

On August 26, 2009, the New Mexico Environment Department ("NMED") announced the publication of a Draft Hydrology Protocol ("Protocol") and invited comments from the public by September 25, 2009. Lee Ranch Coal Company ("LRCC") appreciates both the opportunity to comment as well as the efforts of NMED to develop a means of expediting the Use Attainability Analysis process. LRCC submits these as "preliminary" comments because it maintains, and hereby expressly reserves its position, that the Protocol is either a "rule" or a "standard" that is properly within the rulemaking authority of the Water Quality Control Commission ("WQCC") under the New Mexico Water Quality Act ("WQA") and is subject to the public participation requirements on that Act. *See* §§ 74-6-6 NMSA 1978.

COMMENTS

General Comments:

The Protocol itself, as further illuminated by positions taken by NMED in the pending Triennial Review proceeding under the Clean Water Act, appears to be narrowly tailored for one purpose, which is to provide a means of justifying the listing of a particular stream or river segment as an "ephemeral" water that would be eligible for lesser designated uses than otherwise might obtain under the designated uses for "intermittent" or "perennial" waters as proposed by NMED in the pending Triennial Review proceeding.

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NMED apparently interprets the Environmental Protection Agency's response to NMED's 2005 Triennial Review submission as requiring a Use Attainability Analysis for the listing of unclassified waters as "ephemeral" waters. NMED also apparently understands that any waters which have not been classified to be either perennial, intermittent or ephemeral under the WQCC's surface water regime, and essentially would "presume" that waters are perennial or intermittent unless and until a Use Attainability Analysis, whether based on the Protocol or some other acceptable methodology, has justified "ephemeral" status for the water.

LRCC respectfully submits that this construct confuses the concepts of water types with designated uses. LRCC believes the UAA process is intended not to be a means of distinguishing between types of water bodies, and instead is intended to be a means of justifying the removal of one or more designated uses. LRCC further submits that it is inappropriate to presume that all waters not otherwise classified are either perennial or intermittent simply because NMED understands the EPA to presume certain designated uses are attainable unless shown otherwise.

Further, although the Protocol does indicate the limitation on its applicability to the analysis of particular stream or river segments, and therefore does not apply to other types of waters, LRCC believes the Protocol should expressly recognize other limitations as well. Specifically, for example, the Protocol cannot and should not be interpreted as an analytical tool for the broader opportunities which are available to justify the removal or downgrading of designated uses which may be totally separate from the intended context of distinguishing ephemeral waters from perennial or intermittent waters. Again, the UAA process, which LRCC understands the Protocol is designed to satisfy, allows a means of removing or downgrading designated uses and associated water quality criteria.

Without expressly clarifying these points, one might misinterpret the Protocol, as well as NMED's Protocol-related amendments proposed in the existing Triennial Review process, as an implied limitation on what designated uses may be shown to be unattainable. For example, employing the Protocol as NMED has proposed it would only indirectly downgrade primary human contact uses to secondary human contact uses, etc., whereas the opportunity in fact exists under the Clean Water Act to justify removing designated human contact uses altogether from a particular water. There in fact is no limitation on what designated uses might be shown to be unattainable through the UAA process, and this point may have gotten lost or obscured through NMED's development of a Protocol addressed to distinguishing between types of waters rather than what uses are appropriate for particular waters.

Further, Peabody believes that the so-called rebuttable presumption that all waters must meet the "fishable-swimmable" standard under the Clean Water Act is carried too far by NMED under its program. First of all, such a presumption, if it in fact it is properly attributed to the EPA under its Clean Water Act regulations, would only apply to "waters of the United States" within EPA's jurisdiction under the Clean

Water Act. Inasmuch as the WQCC has purportedly included waters that may no longer be deemed "waters of the United States" within the coverage of its surface water standards, through its definition of "waters of the state," NMED should not just assume that one needs to justify that a given designated use is not attainable under the federal regime applicable to "waters of the United States."

LRCC respectfully submits that for waters of the state that are not waters of the United States, a more streamlined and common sense designation of appropriate uses is desirable, should be expressly provided for by the WQCC, and should be promoted and employed by NMED. By way of example only, man-made ponds and constructed wetlands used for livestock and wildlife purposes, if there are any that qualify as "waters of the state" but do not qualify as "waters of the United States," should not have to meet water quality criteria associated with human contact uses. Moreover, NMED should advance this approach as a matter of common sense, rather than feel compelled to overlay its interpretations of cumbersome presumptions and processes the EPA might require if the waters in question were waters of the United States.

Specific Comments:

SECTION 1 – Stream Determination and Rating Form

User/Evaluator Experience

The Protocol recommends evaluators have experience making geomorphic, hydrological, and biological observations for New Mexico streams. LRCC believes this is too restrictive. LRCC suggests the NMED modify this recommendation to require evaluators to have a combination of education and experience for collecting the observations in streams of comparable climates, vegetation and land use. Evaluators with sufficient experience and education to conduct the observations in streams other than New Mexico yet within the southwestern U.S. should be allowed to perform the work described in the Protocol. Inasmuch as NMED borrowed heavily from North Carolina in developing the Protocol, LRCC sees no real justification for so strictly limiting the range of potential evaluators who might have occasion to employ the Protocol.

Assessment Unit Identification & Field Map Generation

LRCC believes this section should provide more guidance. What is required by the NMED for identifying an appropriate AU that does not fall under a classified segment? What is required by the NMED for identifying a segment of a classified stream or river? The process for AU identification is critical for insuring the assessments conducted according to the Protocol are applicable to the AU in which the assessments are made.

Drought Conditions

The Protocol "*strongly*" recommends field evaluations not be conducted during drought conditions, defined as being any time the SPI is less than -1.0. LRCC urges reconsideration of this Protocol recommendation and believes it would render any field assessment to be questioned if the SPI was determined to be less than -1.0. The recommendation effectively dissuades reliance on the Protocol as a useful tool for evaluating the Use Attainability of streams in New Mexico during times of drought. Would periods of prolonged drought, which of course are common in parts of New Mexico, effectively prohibit performing field assessments using the Protocol, and also effectively postpone any actions under Use Attainability rules until wetter conditions return?

Streams located in semi-arid or arid regions of New Mexico may or may not be affected by drought conditions as defined by the SPI. LRCC also believes there are streams in New Mexico that would clearly be classified as ephemeral or even intermittent using the protocol regardless of drought or wetter conditions. At a minimum, the NMED should expand the Protocol and provide more guidance regarding how the SPI index would be used to assess the viability of information collected based on the Protocol. Would an SPI of -1.0 render all field assessments questionable or even invalid?

Recent Rainfall Activity

LRCC recognizes the Protocol and scoring mechanisms are designed with redundancies to allow for satisfactory ratings; however, the statements in the Protocol that use language such as "*strongly* recommended" signal unnecessary inflexibility, and warrant our comments. LRCC generally agrees with NMED that field observations be conducted at least 48 hours after the last knows major rainfall. However, the possibility exists that there are no available local rain gage data in the vicinity of the AU under investigation. In these cases, only field observations of conditions in the drainage basin or stream channel will be available for providing documentation that at least 48 hours has passed since the last known major rainfall. Will this information be sufficient absent rain gage data? LRCC believes it should be.

Scoring

LRCC believes the Protocol should provide a citation for the criterion that requires conducting field evaluations along reaches of streams that are at least 40 times the average stream width. What is this based upon, and if it is not based upon anything in particular, is the criterion too inflexible or arbitrary?

Table 1. Guide to scoring categories

LRCC believes the use of time to provide examples for the Moderate and Weak categories for scoring in Table 1 are too subjective, and should be removed.

Level 1 Office Procedures

Does the Protocol restrict information sources to be reviewed prior to conducting field evaluation to the list provided? Is the use of data collected by stream gages not operated by either the USGS or LANL prohibited? To what levels will the NMED require documentation that the recommended resources listed for office procedures have been checked?

Photodocumentation

LRCC recommends the NMED delete the citations to Wikipedia and the Chinese proverb, and provide some minimum level of criteria for photographic documents recommended in the Protocol for documenting reach conditions at the time of the evaluation and to support conclusions reached using the Protocol.

LEVEL 1 INDICATORS

1.1. Water in Channel

LRCC recommends adding language that allows for alternative documentation in areas with no representative rain gage data available. LRCC points out supplemental information such as water levels from shallow wells constructed along the floodplain proximate to a reach under investigation can also provide good information regarding the status of base flow.

1.2. Fish (qualitative observations)

LRCC argues that fish may not be easily observed within a minute or two in small streams. Depending on the time of day and nature of the bank materials along a given reach, fish may be thriving but not observable within a few minutes. LRCC believes the use of time for assigning a category to qualitative fish observations is subjective, and at a minimum, should be carefully evaluated taking into account other factors such as time of day, water temperature, bank and stream bottom habitat, etc.

1.5. Differences in Vegetation

LRCC believes observations of vegetation differences can be subjective without some level of documentation regarding vegetation species. In addition, this section should define what "true riparian vegetation" consists of as opposed to upland vegetation.

1.6. Absence of Rooted Upland Plants in Streambed

As in the previous comment, LRCC believes observation of rooted upland plants is too subjective without some level of species identification for the rooted plants.

LEVEL 2 EVALUATION: Borderline Determinations

Other information to be considered:

LRCC believes information provided by a long-term resident may be too subjective to be used in support or opposition of a Level 2 evaluation without providing some assurance that the information has some level of scientific credibility. The NMED should develop some guidance or standards regarding the use of information provided by long-term residents or local professional who have observed the streams under investigation during various seasons and hydrologic conditions.

LEVEL 2 INDICATORS

2.1. Water in Channel (Optional)

LRCC believes other methods should be mentioned in the Protocol as options other than temperature sensors to estimate the onset and cessation of flow. Stream gaging instruments such as transducers or combinations of stilling wells and recording devices can provide similar useful documentation. Establishing temporary monitoring sites using an appropriate recording device other than temperature sensors should be allowed as long as appropriate installation, data collection and quality assurance procedures are well documented and provided.

Again, LRCC appreciates this opportunity to provide preliminary comments on the Protocol, and looks forward to any further proceedings that may occur in this regard.

Very truly yours,

John Cochran
Peabody Investments Corporation

and

Stuart R. Butzier
Modrall Sperling

cc: Mr. Mark Hiles

1051456.DOC

SWQB Response: SWQB is presenting responses in the order they were presented by LRCC.

General Comments

Many of the issues and concerns raised by LRCC regarding the decision-making, stream reclassification, and public participation processes were appropriately raised and addressed during the triennial review process in cooperation with various stakeholders. LRCC is correct that the standard UAA process maybe used to downgrade or remove any use and the HP places no limitations on this process. Rather the HP was developed to provide the necessary documentation to support the (20.6.4.15C) UAA process for unclassified waters – be they waters of the US or just waters of the State.

As stated above, the HP was developed to provide the necessary supporting documentation for the expedited UAA process, however the HP is only one tool out of many that may be used to support an expedited or regular UAA. The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol, but other data not included in these recommendations may be gathered as well. It is up to the evaluator to make an argument to support the proposed UAA.

Specific Comments

User/Evaluator Experience: NMED or any other party may conduct a UAA, therefore the User/Evaluator may be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. The HP recommends that, "… the evaluator should have experience making geomorphic, hydrological, and biological observations for New Mexico streams." SWQB agrees that it would be helpful to have experience in river systems throughout the semi-arid southwest to provide a better working knowledge of the range of conditions that can be found in this region. The "User/Evaluator" section was amended to include these changes.

Assessment Unit Identification & Field Map Generation: More discussion of AUs can be found in the SWQB Assessment Protocol. The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

Drought Conditions/Recent Rainfall Activity: The SPI was chosen for use in the *Hydrology Protocol* because it can be computed for longer time scales (i.e. 12 months) that are linked to groundwater and surface water fluctuations and reservoir storage, it can provide an early warning of drought, and it can help assess drought severity. The SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination.

The SWQB recommends that the evaluation be performed during stable baseflow conditions; however the protocol utilizes a weight-of-evidence approach (i.e. multiple and varied indicators) that has been designed with redundancy to allow for satisfactory ratings even after a recent rainfall or during drought conditions. Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding, diversions, or discharges, should be documented on the field forms to support (or refute) the final determination. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are

influencing the overall rating, he may want to postpone a final decision until another evaluation can take place during more normal conditions.

Scoring: The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. The descriptions in Table 1 should provide general guidance for the evaluator; however the indicator-specific descriptions for each tier (strong, moderate, weak, poor) are meant to provide an easily discernible way to score the attribute consistently between evaluators. Additionally, the small increments in scoring between tiers were incorporated to help reduce the range in scores between different evaluators. The protocol and scoring mechanism have been designed with redundancy to allow for satisfactory ratings over a range of conditions and/or evaluators.

Level 1 Office Procedures: The SWQB encourages the evaluator to gather as much information as possible about the study reach prior to the field evaluation. Recommendations are provided in the "office procedures" sections of the protocol, but other data not included in these recommendations may be gathered as well.

Photodocumentation: The photodocumentation section was modified to include, "The assessor should include a detailed description of each photo on the *Stream Determination Field Sheet*, including date, description of the photo (e.g. left bank, right bank, upstream, downstream, etc.), and GPS coordinates (if different from site location)."

Level 1 Indicators

Water in Channel

The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol (e.g. gauge data), but other data not included in these recommendations may be gathered as well, such as groundwater contour maps or data from adjacent wells.

Fish (qualitative observations)/Differences in Vegetation/ Absence of Rooted Plants

Biological indicators, such as fish and vegetation, are only one component of the HP. The protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions and/or evaluators.

Level 2 Evaluation

Other Information to be Considered

Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or local land managers, reviewing historic or aerial photographs, or

identifying key biological indicators like endangered species, are necessary to determine the status of the stream.

The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol, but other data not included in these recommendations may be gathered as well. It is up to the evaluator to gather the necessary evidence that supports (or refutes) the proposed water quality standards change and present this information and data to the WQCC and EPA for approval.

Level 2 Indicators

Water in Channel (Optional)

The SWQB agrees that pressure transducers or stilling wells are other alternatives for collecting streamflow data. Indicator #2.1 (Water in Channel – Optional) was revised to include various examples of gathering flow data depending on the available resources.

Comment Set I: New Mexico Department of Agriculture

From: Brinegar, Hilary
Sent: Tuesday, September 22, 2009 8:45 AM
To: Drinkard, Shelly, NMENV
Cc: Maitland, Julie; Brinegar, Hilary
Subject: Hydrology Protocol comment submittal by NMDA

September 22, 2009

Dear Ms. Drinkard:

The New Mexico Department of Agriculture (NMDA) submits its agency comments on the New Mexico Environment Department Surface Water Quality Bureau (NMED-SWQB) August 2009 Public Comment Draft ofthe Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters. The importance of establishing scientifically-based protocols for differentiating among hydrologically diverse water bodies is demonstrated by the regulatory nature of state and federal water quality standards and management. For example, the current Outstanding National Resource Water (ONRW) petition process contains proposed amendments to Section 20.6.4.8.A(3) NMAC *Antidegradation Policy and Implementation Plan* and the State ofNew Mexico's Continuing Planning Process *Antidegradation Policy Implementation Procedures;* these proposed amendments contain monitoring requirements for perennial and non-perennial waters. NMDA appreciates the opportunity to contribute to this process, as it is a mission ofNMDA to protect natural resources and the environment.

NMDA supports the use of successfully implemented hydrology protocols for the distinction between perennial, intermittent, and ephemeral waters, as did the NMED-SWQB with use of North Carolina's Division of Water Quality stream evaluation methodology. A preferred alternative would be a method modeled after a semi-arid or arid region that experiences or contains more similar hydrology, biology, and geomorphology processes and features than does North Carolina. This is noted on page 15:

> *The relative importance of many fluvial processes in arid regions, especially the magnitude and frequency of their operation, differs considerably from more humid regions. As a result, channel forms differ considerably from humid regions.*

According to the North Carolina State Climate Office at North Carolina State University, http://www.ncclimatc.ncu.edu/climate/ncclimate.html, annual precipitation averages between 37 and 90 inches while New Mexico precipitation averages ~ 14 inches per year according to the New Mexico Climate Center at New Mexico State University. North Carolina also differs from New Mexico in hydrologic processes, temperature, topography, vegetation, and soil type. Being situated on a coastal plain, North Carolina experiences climatic variations due to the direct effect of the Gulf Stream; tropical cyclones, hurricanes and severe flooding are common. Coastal plain ecosystems contain tidewater and wetland areas with surface-ground water interactions divergent from those of the arid southwest. These hydrologic interactions, also including percolation and drainage, are impacted by soil type and

vegetation species. Regional temperatures can affect the hydrology of surface waters as well; New Mexico experiences high temperatures which affect evaporation on open surface water.

NMDA's comments on the Hydrology Protocol are as follows:

- What form of public input was utilized to develop the protocol? What opportunities existed for stakeholders to be a part of the development process?

SWQB Response: The draft protocol was made available for a 65-day public comment period beginning on August 26, 2009. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, and webpage postings (http://www.nmenv.state.nm.us). As the Hydrology Protocol will be incorporated into the WQMP – further public comment as well as approval by the WQCC and EPA will also be necessary.

- Page 5 "User/Evaluator Experience": An ideal situation for distinguishing among surface waters would be for the evaluator to have experience in observing streams and rivers in New Mexico or other arid regions. But, a general protocol should be set up for an evaluator external to New Mexico to accomplish the task in the same manner as an internal evaluator would. The scientific community holds replicability in high regard and it demonstrates strength in process.

SWQB Response: NMED or any other party may conduct a UAA, therefore the User/Evaluator may be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. As such, the SWQB wanted to develop a scientifically sound protocol that was relatively resilient to user variability (weighted, four-tiered scoring system), robust with regards to environmental variability (multiple indicators), and practical to use (not very labor or resource intensive).

The *Hydrology Protocol* recommends that, "… the evaluator should have experience making geomorphic, hydrological, and biological observations for New Mexico streams." SWQB agrees that it would be helpful to have experience in river systems throughout the semi-arid southwest to provide a better working knowledge of the range of conditions that can be found in this region. The "User/Evaluator" section was amended to include these changes.

- Page 6 "Scoring": The statement *'The remaining qualitative description of "Weak" represents gradations that will often be observed in the field.* ' indicates a predetermination of field observations that should be excluded from this protocol.

SWQB Response: SWQB disagrees. A "yes" / "no" format was determined to be inadequate to properly encompass and assess the natural variability encountered when making hydrologic determinations in the field. The scores, "Poor", "Weak", "Moderate", and "Strong" are applied to sets of geomorphic, hydrologic and biological attributes. The descriptions in Table 1 should provide general guidance for the evaluator; however the indicator-specific descriptions for each tier (strong, moderate, weak, poor) are intended to allow the evaluator flexibility in assessing variable features or attributes while also providing consistency between evaluators. The four tiers were developed to better assess the often gradual and variable transitions of streams from ephemeral to non-ephemeral.

- Instructions for determining indicator scores are clear and calculation procedures are provided when necessary. The use of photographs and diagrams is helpful throughout - visual aids could be augmented in the protocol.

SWQB Response: Thank you for your comment.

- Appendix A *'Why Develop a Hydrology Protocol?* ':
  - It would be useful to include specific citations of standards, amendments and provisions as they are noted throughout this appendix.
  - Are the creation of Use Attainability Analyses for unclassified waters in New Mexico a priority for NMED? Are additional funds being allocated for this purpose?
  - What are the regulatory implications as unclassified waters become identified? What types of protection will be provided by New Mexico water quality standards as it pertains to compliance with the Clean Water Act? What types of enforcement will be implemented?

Drought conditions have affected New Mexico's ecosystems and natural resources for periods of time longer than records exist and these impacts are exacerbated by climate change. The demand for water grows as population increases in New Mexico. NMDA encourages the use of strong science in a hydrology protocol for distinguishing among surface water classifications and would like demonstration on how hydrologic expertise was utilized to convert a North Carolina model into a protocol for use in the arid southwest. Thank you for your consideration of these comments. Please feel free to contact Julie Maitland (jmaitland@nmda.nmsu.edu) with any questions or comments.

SWQB Response: The SWQB agrees that conditions in North Carolina are markedly different from conditions in New Mexico, so the Bureau adapted a stream evaluation methodology developed by the North Carolina Division of Water Quality *to conditions in New Mexico*. The adapted methodology was beta tested during the 2009 field season across a range of hydrologic and ecological conditions. Data from the test sites were analyzed to verify which field indicators are useful in differentiating hydrologic systems in New Mexico. Based on the results of this analysis several indicators were removed from the protocol because they were not statistically significant field indicators for New Mexico streams and rivers. Refer to Appendix A of the protocol for more information.

Sincerely,

Julie Maitland
Division Director

JM/hb

COMMENT SET J: NEW MEXICO DEPARTMENT OF TRANSPORTATION

From: Frischkorn, Curt, NMDOT
Sent: Friday, October 30, 2009 2:03 PM
To: Drinkard, Shelly, NMENV
Cc: Vaughn, Colleen E., NMDOT; Kelso, Christina, NMDOT; Byars, Rochelle, NMDOT; Coleman, Kathleen, NMENV; Walton, Lori, NMDOT; Duncan, Gwyneth, NMDOT
Subject: Comment on the Draft Hydrology Protocol

NMDOT Environmental Design Division

Comments on the Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters

1. Will the use of this protocol become a regulatory requirement for obtaining a 401 water quality certification?

2. Will the protocol be required for all biological surveys performed by project proponents for areas that include a natural drainage? This process is time intensive and costly, including the purchase of additional equipment, with a narrow window of time to perform the protocol (i.e. late May and mid July OR mid September and early November). This would add significant cost to the NMDOT process of clearing and permitting projects under NEPA. The narrow time window would significantly impact project schedules, and could result in the loss of federal funding due to missed deadlines for design and construction. This loss of funding would negatively affect the ability of the NMDOT to comply with federal regulations that require FHWA and NMDOT to maintain safe transportation facilities.

3. Can the protocol be applied only when there is a disagreement between the NMED and project proponents regarding the status of a stream within the project area? In the case of a disagreement, would the NMED-SWQB perform the protocol within the project area?

4. Is the main purpose of this protocol to provide a method for NMED-SWQB to classify streams for the purpose of meeting EPA requirements for designating uses, TMDLs, and criteria for point-source NPDES permits? To whom does this protocol apply?

SWQB Response to #1-4: NM's water quality standards assign distinct designated uses to unclassified ephemeral, intermittent and perennial waters (see 20.6.4.97-99 NMAC), and identify many classified waters by their hydrology, e.g., "perennial tributaries to" or "perennial reaches of" (see 20.6.4.101-899 NMAC). Use of the Hydrology Protocol can facilitate implementation of the appropriate water quality standards for a particular water.

The Hydrology Protocol presents a methodology for distinguishing among ephemeral, intermittent and perennial streams and rivers in NM. The protocol was specifically developed to generate documentation of the uses supported by the hydrology of a given waterbody. This information can then be used for Use Attainability Analyses (UAAs) and for identifying unclassified waters within otherwise classified segments. Other applications where a determination of stream hydrology is necessary (e.g. §401 water quality certifications, §404

dredge and fill permits) are possible, but results of the hydrology protocol must be evaluated cautiously within the specific decision framework.

5. When would NMED require the use of this protocol?

6. Who would be expected to perform the protocol?

SWQB Response to #5-6: The Hydrology Protocol was designed to provide necessary supporting documentation for the expedited Use Attainability Analysis (UAA) process (20.6.4.15C), however the protocol is not a requirement for conducting a regular UAA or any other CWA related activity. In particular, it will be useful if the factor limiting attainment of a use is "natural, ephemeral, intermittent or low flow conditions or water levels."

NMED or any other party may conduct a UAA, therefore the User/Evaluator may be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. The Standards explain the requirements of a UAA at 20.6.4.15 NMAC. The "User/Evaluator" section was amended to clarify this fact.

7. Will NMED offer training in the use of the protocol?

SWQB Response: NMED is always willing to provide training on any of our protocols if there is an interest to do so.

8. Does the protocol consider the potential effects of climate change?

SWQB Response: No, it does not; however additional supporting information can be used to support a hydrological determination. The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Examples of additional supporting information are provided in the protocol (e.g. flow data, fisheries data, historic photographs, etc.), but other data not included in the protocol may be gathered as well. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and present his argument to the WQCC and EPA for approval.

9. How much longer than 10 minutes should be spent looking for macroinvertebrates, algae, periphyton, fish, etc. before concluding that none are present and rating the indicator as poor?

SWQB Response: The descriptions in Table 1 should provide general guidance for the evaluator; however the indicator-specific descriptions for each tier (strong, moderate, weak, poor) are intended to allow the evaluator flexibility in assessing variable features or attributes. Therefore, it is up to the evaluator to decide how long to search for a specific indicator and if the indicator should be scored as "poor." The protocol and scoring mechanism have been designed with redundancy to allow for relatively consistent ratings between evaluators.

10. Access to land adjacent to the right-of-way may not be possible for survey of a "representative reach" as defined in the protocol. Protocol should address property access issues.

SWQB Response: Property access issues are always a concern, but if a land owner denies access to his property SWQB must move the monitoring location to a site that is accessible.

11. How will the protocol apply to situations where a project area is located next to two different stream types, such as a bridge over an ephemeral arroyo located within 150 meters of the confluence with a perennial or intermittent stream?

SWQB Response: This would depend on site-specific information and would have to be dealt with on a case-by-case basis. Again, the SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream(s). It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and present his argument to the SWQB, WQCC, and/or EPA for approval.

12. What if the "representative reach" is not representative of the conditions at the project area? Will NMED require the project proponent to survey areas outside of the project area?

SWQB Response: The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

13. The protocol includes subjective references such as "long piece of string" and "ten minutes or more", etc. How long is long? How much is more?

SWQB Response: A long piece of string is optional equipment that can be used to measure the flood-prone width, so the length is dependent on the flood-prone width of the stream being evaluated. If the evaluators decide to use a piece of string, they should use their best judgment when determining the length of string needed. In addition, it is up to the evaluators to decide how long to search for a specific indicator and how the indicator should be scored (see response to #9 above).

COMMENT SET K: New Mexico Office of the State Engineer (NM OSE)

From: Johnson, Mike S., OSE
Sent: Tuesday, September 29, 2009 10:00 AM
To: Drinkard, Shelly, NMENV
Cc: Myers, Kevin, OSE
Subject: NMOSE Hydrology Bureau comments on draft NMED Hydrology Protocol

NM OSE Hydrology Bureau
September 15, 2009

RE: Comments on Hydrology Protocol for SWQB-NMED

The NM OSE Hydrology Bureau reviewed the *Draft Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters* dated August 2009 prepared by the NMED Surface Water Quality Bureau (SWQB). Many of the comments below relate to the omission of surface water diversions during irrigation season, which may affect flows observed during the evaluation of perennial waters.

1. Page 4, last paragraph. Only natural interruptions of discharge are mentioned. The document should address anthropogenic interruptions of flow due to irrigation diversion and pumping shallow ground water near a river course.

SWQB Response: This entire section has been removed in response to comments from other parties.

2. Page 5, last paragraph. The analysis uses precipitation data going back only as far as 1996. Elaborate on the rationale for using the last 12 years of data versus a longer record.

SWQB Response: The understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993; however, the SPI calculation for any location is based on the long-term precipitation record for a desired period. Values of SPI are derived by comparing the total cumulative precipitation for a particular station or region over a specific time interval (for example: the last month, the last 3 months, the last 6 months) with the average cumulative precipitation for that same time interval over the entire length of the record. For example, a **12-month** SPI is a comparison of the precipitation for 12 consecutive months with the same 12 consecutive months during all the previous years of available data.

The protocol now reads, "… The SPI calculation for any location is based on 10 climate regions of New Mexico and long-term precipitation records (both rainfall and snowpack), and has available archived ~~information~~ maps dating back to 1996."

3. Page 6, first paragraph; and Page 11, paragraph 2. Time period of May to June measurement includes the irrigation season, so some field inspections should note whether the stream reach

has diversions nearby and identify ditches that are diverting water or returning water.

SWQB Response: Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding, diversions, or discharges, should be documented on the field forms to support (or refute) the final determination. If the evaluators believe that conditions occurring during the stream evaluation are influencing the overall rating, they may want to postpone a final decision until another evaluation can take place during more normal conditions.

4. Page 9, Level 1 Field measurement. The strong recommendation to not make field evaluations during drought conditions should be cross referenced to Section 1.1, which defines the drought conditions to a specific index that should be noted on the field survey sheet.

SWQB Response: The SWQB strongly recommends that field evaluations be conducted outside of drought conditions whenever possible. As suggested by NM OSE, this statement was reiterated in Section 1.1.

5. Page 21, Section 1.14. This paragraph attributes natural iron oxidizing solely to a ground water source and a petroleum leak as an unusual anthropogenic source. In New Mexico, mineralized rock and mineral laden waters may carry iron from natural and anthropogenic sources. For example, reaches of Hanover Creek, Whitewater Creek and Red River may show mineral staining. Changes in pH as waters mix may cause precipitation of iron and other secondary minerals.

SWQB Response: The SWQB agrees that iron and other secondary minerals may precipitate out as waters mix and the pH changes. As stated in the protocol, Indicator #1.14 (Iron Oxidizing Bacteria/Fungi) is a supplemental indicator that does not occur consistently throughout NM. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions and/or evaluators.

6. Pages 27-28, Section 2.5; and Page 34, Section 2.6. Augment the reference to specific individuals (Lang and Hogan) with more general contact information, such as a phone number for the specific bureau or section in case personnel change. Add a citation in the references, web page address or contact information in the text for a North Carolina State study and a list maintained by the West Virginia Department of Environmental Protection. Note that Section 2.6 seems to have the reference that may apply to Section 2.5.

SWQB Response: Thanks you for your suggestions. The protocol has been changed to include more general contact information for NMDGF and SWQB as well as contact information for NCSU and WVDEP.

7. Page 37, Second full Paragraph. Level 2 evaluation mentions consideration of man-made impacts without specifying examples such as surface water diversions for irrigation or nearby impoundments for livestock that intercept runoff.

SWQB Response: Specific examples of man-made impacts have been added to the discussion.

8. Appendix A, Page 48. The upper part of the form should incorporate observations for irrigation season or nearby head gate. The diversion of water on certain days may significantly affect some reaches of rivers and streams.

SWQB Response: The SWQB agrees that the diversion of water may significantly affect some reaches. There is already a check-box on the field form for stream modifications, diversions, and discharges located in the upper part of the form (*OTHER*). The form also highlights that these check-boxes should be explained in more detail in the NOTES section of the field form.

COMMENT SET L: San Juan Coal Company

From: Nazaryk, Paul A
Sent: Friday, September 25, 2009 7:48 AM
To: Drinkard, Shelly, NMENV
Cc: Perkins, Steven R; Luther, James JG
Subject: BHP Billiton Comments on NMED Draft Hydrology Protocol

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300 West Arrington Street
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Tel +1 505 598 4200 Fax +1 505 598 4229
www.bhpbilliton.com

September 25, 2009

Via E-Mail: shelly.drinkard@state.nm.us

Ms. Shelly Drinkard
NMED-SWQB
1190 Saint Francis Drive,
Santa Fe, New Mexico NM 87505

Dear Ms. Drinkard:

Re: San Juan Coal Company Comments on Public Comment Draft of *Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters* (August 2009)

The San Juan Coal Company (SJCC) appreciates the opportunity to comment on the New Mexico Environment Department, Surface Water Quality Bureau Public Comment Draft of *Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters* (August 2009).

SJCC operates the San Juan Mine, an underground mine, located approximately fifteen (15) miles west of Farmington, New Mexico on land leased from the federal government and State of New Mexico.

Our overall impression of the *Hydrology Protocol* is positive and we appreciate the time and effort that you and your agency have devoted to its development. SJCC understands the need for developing such a protocol. SJCC is generally supportive of the technical approach that was taken in its development and we wish to offer the following comments on the document.

- Summary, Page 3, 3rd Paragraph. The document states: "Waters determined to be intermittent or perennial prior to the effective date of the protocol will not be reevaluated unless there is a specific need to do so." It is not clear what protocol or protocols were used to make previous determinations and what would constitute a specific need to review these determinations. As a matter of public policy, SJCC believes that these determinations should be available to the public. There is no reason that past determinations should not be reviewed or reevaluated if these determinations were made using a less rigorous scientific method. Likewise, if conditions change, there should be some method for a party to request a reevaluation.

- Introduction, Page 4. The document describes sources of surface flow which is described as base flow, storm flow, contributions of upstream tributaries, and discharges from point source

dischargers. By implication, we assume that this would also include irrigation return flows and this should be specifically addressed in the document.

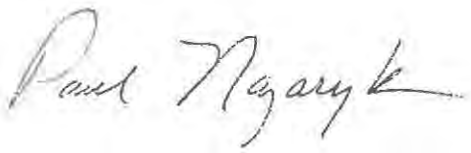
- Section 1 – Stream Determination and Rating Form, User/Evaluator Experience, Page 5. It states in the document that the evaluator should have experience making geomorphic, hydrologic, and biological observations in New Mexico streams. NMED should consider developing a standardized New Mexico stream determination training class or program to facilitate consistency in stream determinations. The program should be available to both agency and other personnel.

- Section 1 – Stream Determination and Rating Form, Drought Conditions, Page 5. The document defines "drought conditions" as any time the Standardized Precipitation Index (SPI) is less than -1.0. SJCC maintains that while the use of SPI to define drought is appropriate, the use of -1.0 to demarcate drought conditions is not suitable. According to the developers of SPI (McKee et al, 1993), if -1.0 is the threshold to define drought, then drought conditions would be expected more than 15% of an extended time period. Consequently, an SPI value of -1.5 to -2.0 would better reflect the infrequency of drought conditions that would be expected to impact perennial flow.

- Appendix A - Table 1. The document notes that the Shumway at the U.S. Highway 64 bridge was evaluated using the *Hydrology Protocol* on June 17, 2009 and was determined at that location to be "Intermittent". We tend to agree with this evaluation and believe that the determination is largely based upon irrigation return flows. However, as the document states on Page 4: "Streams are drainage features that may change from ephemeral to intermittent and intermittent to perennial along a gradient or continuum - sometimes with no single distinct point demarcating these transitions." Based upon our knowledge of the Shumway, which crosses our leased property, the channel upstream of that point the stream would likely be classified as "Ephemeral".

Thank you for the opportunity to comment on this draft document. Should you have any questions or comments, your may contact either Steve Perkins or myself at steven.r.perkins@bhpbilliton.com or paul.a.nazaryk@bhpbilliton.com. We can be reached by phone at either (505) 598-3327 or (505) 598-2217, respectively.

Sincerely,



Paul Nazaryk
Environmental Regulatory Affairs Coordinator

cc: Steven R. Perkins, Ph.D., BHP Billiton

SWQB Response: SWQB is presenting responses in the order they were presented by SJCC.

- **Summary, Page 3, 3rd paragraph:** Previous hydrology determinations are available in SWQB's List of Assessed Surface Waters in the current State of New Mexico Clean Water Act §303(d)/§305(b) Integrated Report. To determine the applicable standards, one needs to look at "WQS reference" section for the water body of interest. The 2010-2012 Integrated List does not contain any "WQS reference" of 20.6.4.97 (ephemeral waters). Instead, the assigned "WQS reference" for all unclassified non-perennial waters is noted as 20.6.4.98 (intermittent waters) with applicable uses including *at a minimum* livestock watering, wildlife habitat, marginal warmwater aquatic life, and primary contact.

  Use of the Hydrology Protocol can facilitate implementation of the appropriate water quality standards for a particular water body. SWQB agrees with SJCC that, "There is no reason that past determinations should not be reviewed or reevaluated if these determinations were made using a less rigorous scientific method." The protocol was specifically developed to generate documentation of the uses supported by the hydrology of a given waterbody. This information can then be used for Use Attainability Analyses (UAAs) and for identifying unclassified waters within otherwise classified segments.

- **Introduction, Page 4:** Irrigation return flows were added as a potential source of streamflow.

- **Section 1 – Stream Determination and Rating Form, User/Evaluator Experience, Page 5** NMED is always willing to provide training on any of our protocols if there is an interest to do so.

- **Section 1 – Stream Determination and Rating Form, Drought Conditions, Page 5:** The 12-month Standardized Precipitation Index (SPI) is used to identify drought conditions for the purposes of the Hydrology Protocol and was chosen because SPIs of this time-scale can be linked to streamflows, reservoir levels, and even groundwater levels. The SWQB agrees that a 12-month SPI value of -1.0 (moderately dry) may not be appropriate for defining drought considering the naturally arid climate of New Mexico. After further consideration, 12-month SPI values less than -1.5, which indicate severely dry to extremely dry conditions, will be used as indicators of drought conditions in New Mexico.

- **Appendix A – Table 1:** Thank you for your comment. The SWQB believes that further clarification was needed regarding the length of "representative" reach. The protocol was modified to better explain this process. Based on your description of Shumway Arroyo it is possible that two designations would be required – upstream of the agricultural returns would be ephemeral and downstream intermittent. Documentation at sites within each section would be required to achieve this.

By default under the CWA, unclassified nonperennial waters are subject to the water quality standards specified in 20.6.4.98 NMAC (Intermittent Waters), with designated uses of wildlife habitat, livestock watering, marginal warmwater aquatifc life and primary contact. EPA presumes that all waters can attain "fishable/swimmable" uses unless a Use Attainability Analysis (UAA) demonstrates otherwise. The WQCC expects that many ephemeral waters are not capable of attaining a marginal warmwater or primary contact use, and has therefore established a separate section in the water quality standards for ephemeral waters at 20.6.4.97 NMAC with designated uses of wildlife habitat, livestock watering, limited aquatic life and secondary contact. Ephemeral waters may be placed into this section only if justified by a UAA. If Shumway Arroyo upstream of Highway 64 is ephemeral, this reach will require a UAA to change its classification. The Hydrology Protocol would be used to conduct an expedited UAA (20.6.4.15C) however it is not a requirement for conducting a regular UAA. It is simply one available methodology that may provide technical support for a UAA.

COMMENT SET M: San Juan Water Commission (SJWC)

From: San Juan Water Commission [mailto:sjwcoffice@sjwc.org]
Sent: Thursday, September 24, 2009 1:06 PM
To: Drinkard, Shelly, NMENV
Subject: Comments of San Juan Water Commission on August 2009 Draft Hydrology Protocol

San Juan Water Commission
7450 East Main Street, Suite B • Farmington • New Mexico • 87402
Office: 505-564-8969 • Fax 505-564-3322 • Email: sjwcoffice@sjwc.org

MEMBERS:
City of Aztec
City of Bloomfield
City of Farmington
San Juan County
S.J. County Rural Water Users Assoc.

September 24, 2009

Shelly Drinkard
NMED-SWQB
1190 St. Francis Dr
Santa Fe, NM 87505

Via U.S. Mail and E-mail (*shelly.drinkard@state.nm.us*)

Re: Comments of San Juan Water Commission on August 2009 Draft Hydrology Protocol

Dear Ms. Drinkard:

Thank you for publishing, and accepting public comment on, the New Mexico Environment Department's ("NMED") Draft Hydrology Protocol for the Determination of Ephemeral, Intermittent, and Perennial Waters (August 2009) (the "Hydrology Protocol" or "Protocol"). Through this letter, I hereby submit San Juan Water Commission's ("SJWC") comments on the draft Hydrology Protocol. SJWC appreciates the opportunity provided by NMED to comment on the draft Protocol and specifically requests that NMED make any future changes to the Protocol subject to public comment, as it has for its current proposal.

GENERAL COMMENTS

SJWC has the following general comments concerning the Protocol. Comments concerning specific Protocol provisions are provided after these general comments.

1. Based on the definitions of ephemeral, intermittent, and perennial streams recommended in 20.6.4.7 NMAC of NMED's revised Triennial Review petition, dated July 6, 2009, these stream categories should be defined by flow conditions; *i.e.*, frequency and duration of flows. Only in the absence of hydrologic data, or where data is indeterminate, should the Level 1 and Level 2 procedures of the Hydrology Protocol be required.

2. The explanation and rationale for applying the Standardized Precipitation Index ("SPI") in the Hydrology Protocol is not justified in the Protocol and is inadequate. No justification is provided for applying this index in New Mexico. No comparison is made between the SPI and historic hydrologic conditions in New Mexico during

droughts. In addition, the procedures for applying this complex procedure to streams in New Mexico to determine whether a "drought" exists are not clear. It is also not clear how the SPI Index of "-1" was selected as an indicator of drought, nor is there any evidence of its applicability to New Mexico conditions.

SJWC recommends that an appendix be added to the Protocol providing additional explanation and comparisons among SPIs and hydrologic conditions that actually have occurred during droughts in New Mexico to demonstrate the validity of the SPI. The appendix should provide examples and explanations of application of the SPI Index in New Mexico. The website referenced in the document does not provide an adequate definition, discussion, or explanation of the SPI Index.

SWQB Response to #1: The Hydrology Protocol (HP) was designed to provide necessary supporting documentation for an expedited Use Attainability Analysis (UAA) process (20.6.4.15C), however the HP is only one tool out of many that may be used to support a standard UAA. SWQB developed the HP to be applicable at all locations within New Mexico and as such is based on general field observations. If stream gauge data existed at all sites, which obviously is not the case, then the HP would not be necessary. If it does exist it certainly should be used and SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol (e.g. stream gauge data), but other data not included in these recommendations may be gathered as well, such as groundwater monitoring records, remote sensing, or documented observations. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

SWQB Response to #2: The understanding that a deficit of precipitation has different impacts on groundwater, reservoir storage, soil moisture, snowpack, and streamflow led to the development of the Standardized Precipitation Index (SPI) in 1993; however, the SPI calculation for any location is based on the long-term precipitation record for a desired period. Values of SPI are derived by comparing the total cumulative precipitation for a particular station or region over a specific time interval (for example: the last month, the last 3 months, the last 6 months) with the average cumulative precipitation for that same time interval over the entire length of the record. For example, a **12-month SPI** is a comparison of the precipitation for 12 consecutive months with the same 12 consecutive months during all the previous years of available data. As stated in the protocol, the SPI calculation for New Mexico is based on 10 climate regions and long-term precipitation records (both rainfall and snowpack). Please refer to http://www.drought.unl.edu/monitor/spi.htm for more information on the Standardized Precipitation Index. To view current SPI maps of the U.S. click this link: SPI Maps.

The SWQB recommends that the evaluation be performed during stable baseflow conditions. Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding, diversions, or discharges, should be documented on the field forms to support (or refute) the final determination. The 12-month SPI was chosen for use in the Hydrology Protocol because SPIs of this time-scale can be linked to groundwater-surface water fluctuations and reservoir storage, it can provide an early warning of drought, and it can help assess drought severity. The 12-month SPI value for a particular stream is included as another piece of

evidence to be evaluated before making a final stream determination. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are influencing the overall rating, he may want to postpone a final decision until another evaluation can take place during more normal conditions.

The SWQB agrees that a 12-month SPI value of -1.0 (moderately dry) may not be appropriate for defining drought considering the naturally arid climate of New Mexico. After further consideration, 12-month SPI values less than -1.5, which indicate severely dry to extremely dry conditions, will be used as indicators of drought conditions in New Mexico.

3. SJWC generally supports the application of methodologies that can be replicated to determine ephemeral, intermittent, and perennial streams, where such determinations are needed in the absence of hydrologic data.

SWQB Response: Thank you for your comment.

4. There is some confusion in the text regarding the relationship of the determinations to human-caused hydrologic modifications; *e.g.*, "if an otherwise perennial water exhibits intermittency or interruptions due to hydrologic modifications, it is considered perennial." The rationale for this position is not clear. There are numerous streams in New Mexico that historically have been subject to hydrologic modification for diversion of water for municipal, industrial, and agricultural purposes, resulting in intermittent streams. The reality is that these diversions will continue henceforth. Streams that are intermittent because of such diversions should be classified as intermittent streams.

SWQB Response: The text referenced has been deleted and the HP has been modified to make clear that it identifies the existing uses. In providing the documentation supporting an expedited UAA (20.6.4.15C) the proponent would need to identify the that the existing use are the attainable use based on factors 2 or 5 (see below) as outlined in the WQMP. If a proposed UAA is based on other factor (such as 4) a standard UAA process would be required.

A Use Attainability Analysis (UAA) is a "structured scientific assessment of the factors affecting attainment of a use which may include physical, chemical, biological or economic factors." Federal regulation and NM's water quality standards do not allow a Clean Water Act §101(a)(2) use (i.e. fishable/swimmable use) to be removed or changed to a use requiring less stringent criteria unless a UAA demonstrates that attainment of the use is not feasible based on one of the factors identified in 40 CFR 131.10(g):

> *(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or*
> *(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or*
> *(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or*

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 [technology-based effluent limitations] of the Act would result in substantial and widespread economic and social impact.

The Hydrology Protocol is not a requirement for conducting a standard UAA. It is simply one available methodology that may be useful to provide technical support for a UAA. In particular, it will be useful if the factor limiting attainment of a use is "natural, ephemeral, intermittent or low flow conditions or water levels." Depending on the specific situation, the data collected using the Hydrology Protocol may be sufficient to justify that attainment of the designated use is not feasible. In many cases, however, additional information may be needed. For example, if the intermittency of a stream were caused by a dam or diversion, then the UAA would rest on factor (4) above concerning hydrologic modifications. In this case, additional documentation would be needed to demonstrate that "it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use."

5. In certain instances, the Hydrology Protocol references the use of "professional judgment" in making determinations of ephemeral, intermittent, and perennial streams. Where subjective information or professional judgment is used, it should be clearly identified in the evaluation process and should be a defined "add on" to the Level 1 and Level 2 evaluations.

SWQB Response: The SWQB disagrees with this statement. The protocol applies a four-tiered scale to rank the stream's features and attributes. The scores, "Poor", "Weak", "Moderate", and "Strong" are intended to allow the evaluator to assess variable features or attributes. These gradations are intended as guidelines. The evaluator must select the most appropriate category based upon observations of the stream being evaluated. The small increments in scoring between gradations were incorporated to help reduce the range in scores between different evaluators. The protocol also utilizes a weight-of-evidence approach (i.e. multiple and varied indicators) that has been designed with redundancy to allow for satisfactory ratings over a range of conditions and/or evaluators.

6. Peer Review: Following revisions to the draft protocol based on public comments received by NMED, and prior to finalizing the document, NMED should have the document peer reviewed by qualified hydrologists and biologists, including personnel of the New Mexico State Engineer's Office. Such a peer review would ensure that appropriate procedures are being applied and assure the public and the regulated community that professional standards are being met in the protocol.

SWQB Response: The draft protocol was made available for a 65-day public comment period beginning on August 26, 2009. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, and SWQB webpage postings. The draft protocol was reviewed by numerous agencies including the NM Office of the State Engineer, NM Department of Agriculture, Amigos Bravos, Elephant Butte Irrigation District, and Los Alamos National Laboratory. The protocol has been revised based on comments received and will be incorporated into the NM Water Quality Management Plan (WQMP) and approved by the Water Quality Control Commission (WQCC) and EPA. The solicitation for public comment on the updated WQMP, the required response to comments, and the requirement for WQCC and EPA approvals all ensure that the *revised* Hydrology Protocol has gone through the peer review process, and appropriate procedures and professional standards were met.

7. Development of Protocols: NMED should consider a more collaborative and open process in the development of protocols. In the past, NMED has issued protocols, asked for public comment, and then published a final document. NMED has placed itself in the positions of both judge and jury of the protocols. SJWC believes that both the process and the products could be much improved if NMED develops an initial draft and then engages in a collaborative process by establishing a committee of interested parties, including representatives of the regulated community and others, that will participate in development of the final Protocol. Open discussions through a meeting process would enhance the final product, create more public acceptance, and improve the scientific validity of the document. This step could be combined with the peer review process mentioned above.

SWQB Response: NMED believes that protocol development is an open and straight-forward process. NMED usually develops a draft protocol based on internal and EPA Region 6 reviews. The solicitation for public comment and public participation process in general as well as the formal approval process by the WQCC and EPA provide opportunities for interested parties to collaborate with NMED by offering suggestions and modifications that enhance the final protocol. This level of public participation is above and beyond what is required and, furthermore, SWQB views this as an opportunity for stakeholders, including the regulated community, to engage in the process. Collaboration is a two-way process and if any party, such as SJWC, wished to engage SWQB in a more collaborative process related to protocol development they need only contact us.

8. NMED should take into account the comments received, modify the protocol, and reissue it for additional review.

SWQB Response: The protocol has been revised based on comments received and will be incorporated into the NM Water Quality Management Plan (WQMP) and approved by the Water Quality Control Commission (WQCC) and EPA. There will be another opportunity for public input during the WQMP approval process.

Our more detailed comments on the Hydrology Protocol follow.

SPECIFIC COMMENTS

I. INTRODUCTION

A. First paragraph (5th bullet, page 4). The following changes (identified in bold) are needed:

- Contributions of discharge from point **and/or non-point** source dischargers.

SWQB Response: Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. The SWQB believes that non-point source discharges are covered under *stormflow* and *baseflow*.

B. Definitions (page 4).

1. General Comment. The entire discussion in this section tends to bias the analysis towards classifying streams at a higher level than they otherwise would be. It denies the fact that hydrologic modifications are common and have been historically common in New Mexico.

The language of this section should be modified so that evaluations are done objectively based on actual, observed field conditions. If the stream is intermittent due to hydrologic modifications, then it should be considered intermittent. There should be no allowance in the evaluations for "anticipated…discharges." Such allowances incorporated in the field evaluations bias the evaluations and introduce inappropriate subjectivity, based on what is "anticipated," into the evaluation. The assessments and field evaluations should include objective information collected at the time of the evaluation. Incorporation of subjective factors, such as "anticipated" discharges or flows or "professional judgment," should be done postevaluation and should be clearly identified so that everyone understands what objective and subjective information has been incorporated into the determinations.

SWQB Response: A Use Attainability Analysis (UAA) is a "structured scientific assessment of the factors affecting attainment of a use which may include physical, chemical, biological or economic factors." Federal regulation and NM's water quality standards do not allow a Clean Water Act §101(a)(2) use (i.e. fishable/swimmable use) to be removed or changed to a use requiring less stringent criteria unless a UAA demonstrates that attainment of the use is not feasible based on one of the factors identified in 40 CFR 131.10(g).

The Hydrology Protocol is not a requirement for conducting a UAA. It is simply one available methodology that may be useful to provide technical support for a UAA. In particular, it will be useful if the factor limiting attainment of a use is "natural, ephemeral, intermittent or low flow conditions or water levels." Depending on the specific situation, the data collected using the Hydrology Protocol may be sufficient to justify that attainment of the designated use is not feasible. In many cases, however, additional information may be needed. For example, if the

intermittency of a stream were caused by a dam or diversion, additional documentation would be needed to demonstrate that "it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use."

2. **"*Perennial* means the water body contains water throughout the year, except during periods of drought."**

Comment: See comments concerning SPI reference definitions of droughts. A hydrologic definition of drought in terms of flow frequency and duration is needed.

3. **"If an otherwise perennial water exhibits intermittency or interruptions due to hydrologic modifications, it is considered perennial."**

Comment: Under this definition, many intermittent streams in New Mexico will be considered perennial. This is not a realistic definition given that "hydrologic modifications," *e.g.*, diversions of water from streams for municipal, industrial, agricultural and other purposes, are common in New Mexico and result in "intermittent streams" or stream segments. Hydrologic modifications will continue for the foreseeable future.

4. **"If an otherwise intermittent water exhibits perennial indicators due to *anticipated* and/or frequent discharges, then the water may be considered perennial as appropriate based on the site evaluation. If an otherwise ephemeral water exhibits intermittent or perennial indicators due to *anticipated* and/or frequent discharges, then the water may be considered intermittent or perennial as appropriate based on the site evaluation."** [Emphasis added.]

Comment: What is the definition of "anticipated…discharges"? How are anticipated discharges specifically addressed in Level 1 and Level 2 evaluations? What are the criteria for making this judgment? These sentences indicate an inherent bias toward classifying streams as intermittent and/or perennial.

SWQB Response: The definitions of ephemeral, intermittent, and perennial are tied to New Mexico's Water Quality Standards and as such any questions, comments, or improvements to these definitions should be handled through the triennial review process.

This language related to anticipated discharges has been deleted. However an existing or potential discharger should be aware that if the discharge significantly alters the hydrology of the receiving waterbody the attainable/existing uses will also change.

II. SECTION 1 – STREAM DETERMINATION AND RATING FORM

A. Drought Conditions (page 5).

1. **Reference is made to drought conditions being defined as "any time the [SPI] is less than -1.0 (NDMC 1995). The 12-month SPI will be used to determine drought conditions and noted on the *Stream Determination Field Sheet* (Appendix B). SPIs of a 12-month time scale may be tied to streamflows, reservoir levels, and even groundwater levels."**

Comment: No examples were provided or comparisons made between the SPI index and frequency or duration of flows. Frequency and duration of flows should be used as the indicator of drought.

SWQB Response: The 12-month SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination. Field observations of any noteworthy conditions, including recent rainfall and floods or drought conditions, should be documented on the field forms to support (or refute) the final determination. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are influencing the overall rating, he may want to postpone a final decision until another evaluation can take place during more normal conditions.

The SWQB encourages the evaluator to gather as much information as possible about the study reach prior to the field evaluation. As stated in the Level 1 Office Procedures, "…Gather as much information as you can prior to field work… Historic or recent flow data from gauges such as those managed by the USGS or Los Alamos National Laboratory (LANL) should be used to make hydrological determinations. Gauge data, if available, may clearly indicate ephemeral, intermittent, or perennial flow patterns for the available period of record…" Gauge records may negate the need to perform the Hydrology Protocol, especially if the stream has flow >90% or <10% of the time. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and present his argument to the WQCC and EPA for approval.

2. **The third paragraph states that the SPI Drought Index was chosen "because it can be computed for different time scales, can provide early warning of drought, and can help assess drought severity."**

Comment: There are numerous indicators of drought conditions. The rationale for using the SPI is inadequate, and the manner in which it is to be applied is not described. Information from the referenced website is inadequate to understand the SPI or to justify its application to New Mexico.

An Appendix needs to be added to the Protocol explaining the SPI and its application in New Mexico, as well as the rationale for selecting the SPI as opposed to other drought indices. Examples need to be provided. Some examples of the application of the SPI compared to known drought periods in New Mexico should also be provided; *e.g.*, what is the relationship between the SPI and known drought periods? Is the SPI valid for New Mexico?

SWQB Response: The 12-month SPI value for a particular stream is included as another piece of evidence to be evaluated before making a final stream determination. The SPI value should be recorded on the field sheet to indicate climatic conditions at the time of sampling. If the evaluator believes that extreme conditions such as severe drought or abnormal precipitation are influencing the overall stream rating, he may want to postpone a final decision until another evaluation can take place during more normal conditions.

The 12-month SPI was chosen for use in the protocol because SPIs of this time-scale can be linked to groundwater-surface water fluctuations and reservoir storage, which are linked to stream flow and duration. The SPI calculation for New Mexico is based on 10 climate regions and long-term precipitation records (both rainfall and snowpack). Values of SPI are derived by comparing the total cumulative precipitation for a particular station or region over a specific time interval (for example: the last month, the last 3 months, the last 6 months) with the average cumulative precipitation for that same time interval over the entire length of the record. For example, a **12-month SPI** is a comparison of the precipitation for 12 consecutive months with the same 12 consecutive months during all the previous years of available data.

B. Recent Rainfall Activity (page 6). The procedures include conducting the Level 1 Field Evaluation between "late May and mid July OR mid September and early November . . ."

Comment: This procedure appears to be appropriate.

C. Scoring (page 6). The first paragraph states: "These [observations] should include the amount and date of the last recent rain and evidence of stream modifications."

Comment: This procedure should be clarified by adding the bolded words: "evidence of stream modifications **due to the recent rainfall**."

SWQB Response: Under "**Scoring**", the protocol now states:

"…The [field] sheet specifically requests information regarding Date, Project, Evaluator, Site, Assessment Unit, 12-month SPI Value, and Latitude/Longitude. However, any other pertinent observations will also be recorded on this sheet, such as indications of recent rain events. These should include the amount and date of the last recent rain, if available, and evidence of ~~stream~~ any anthropogenic influences and modifications. The *Field Sheet* is an official record, so all pertinent observations will be recorded on it."

D. Table 1. Guide to Scoring Categories (page 7).

Comment: In the table, the word "character" is used. It appears to be more appropriate to use the term "characteristic."

SWQB Response: *Character* was changed to *characteristic*.

III. LEVEL 1 EVALUATION: DATA COLLECTION FOR THE HYDROLOGIC DETERMINATION OF NM STREAMS AND RIVERS

A. Level 1 Office Procedures (page 8). "Historic or recent flow data from gauges... should be used to make hydrological determinations. Gauge data, if available, may clearly indicate ephemeral, intermittent, or perennial flow patterns for the available period of record and will facilitate the scoring of Indicator # 1.1, *Water in Channel*."

Comment: It is unclear as to whether gauge data or field determinations are to be used as a measure of "water in channel." No frequency guidelines are provided indicating what may be considered ephemeral, intermittent, or perennial flow patterns. Gauge data and frequency/duration criteria should be the determining factor, where available.

SWQB Response: Hedman and Osterkamp (1982) defined perennial streams as those having measurable discharge 80% of the time, intermittent 10-80% of the time, and ephemeral <10% of the time while Hewlett (1982) defined perennial streams as having water present >90% of the time. As shown in the literature, there are discrepancies in frequency/duration criteria (and stream class definitions). Are streams that flow an average of 11 months a year intermittent or perennial? Conversely, are streams that flow 1 month a year intermittent or ephemeral?

The SWQB reviewed the literature and could not definitively choose one approach over another, thus the protocol encourages the evaluator to use gauge data when available but does not recommend specific thresholds for the determination of perennial, intermittent, or ephemeral. Instead of relying on one indicator (in this instance stream flow), the protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. The protocol and scoring mechanism have been designed with redundancy (i.e. multiple indicators) to allow for satisfactory ratings over a range of conditions and/or evaluators.

The SWQB agrees that gauge data are the best means for classifying a stream reach. As stated in the Level 1 Office Procedures, "…Gather as much information as you can prior to field work… Historic or recent flow data from gages such as those managed by the USGS or Los Alamos National Laboratory (LANL) should be used to make hydrological determinations. Gauge data, if available, may clearly indicate ephemeral, intermittent, or perennial flow patterns for the available period of record…" Gauge records may negate the need to perform the Hydrology Protocol, especially if the stream has flow >90% or <10% of the time. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

REFERENCES

Hedman, E.R., and W.R. Osterkamp. 1982. Streamflow Characteristics Related to Channel Geometry of Streams in Western United States. USGS Water-Supply Paper 2193. 17 p.

Hewlett, J.D. 1982. Principles of Forest Hydrology. University of Georgia Press. 183p.

B. Reach Selection (page 9).

1. **The second paragraph states that the reach should be "representative of the AU being characterized."**

Comment: Given that Assessment Units ("AUs") can be quite large, no objective criteria are provided for defining the meaning of "representative." Given the variability in the size of the AUs, various criteria should be defined for specifying representative stream reaches within an AU. This is particularly critical for large AUs. A 150-meter reach may not be representative of the entire AU. This assumes, also, that AUs have common geomorphological characteristics, which is a very broad assumption within New Mexico.

SWQB Response: The SWQB agrees that further clarification was needed regarding the length of "representative" reach assessed. The protocol was modified to better explain this process.

2. **The third paragraph indicates that the stream assessor "can identify if the stream segment in question is generally uniform . . . or should be assessed in two or more distinct reaches."**

Comment: If the stream is assessed in two or more distinct reaches, how are the results of the field survey adjusted? Which is more representative?

SWQB Response: The results for each reach would be assessed and evaluated independently. If the results indicate that the reaches are distinct then they would be classified as two (or more) distinct AUs. If the results indicate that the reaches are generally uniform then they would be classified as one AU.

C. Level 1 Indicators.

1. **1.1. Water in Channel (page 11). The second paragraph states: "Artificial (*i.e.* point-source) discharges should also be noted on form."**

Comment: Does this mean a legal definition of point sources? Does it include, for example, irrigation drain flows, storm drains, etc? This needs to be better defined. If irrigation return flows from drains or non-point sources are sustaining the stream, how does this affect the evaluation?

SWQB Response: Field observations of any noteworthy conditions, such as extreme drought conditions, recent flooding, diversions, or permitted or agricultural discharges, should be documented on the field forms to support (or refute) the final determination.

The same paragraph states: "A good rule of thumb for differentiating ephemeral streams from intermittent ones is if they have water in them during dry (drought) conditions or during the growing season."

Comment: It is not clear what this means. The entire portion of the paragraph is unclear with respect to "during the growing season" and what criteria should be applied.

This section also refers to "moist sediment underneath rocks located within the stream channel" as a "good indication of the presence of water during dry (drought) conditions or during the growing season."

Comment: Is this really a valid indicator of an intermittent stream? Is 48 hours after a major rainfall event an adequate period of time for soil beneath rocks to dry out? If not, ephemeral streams could be inappropriately classified as intermittent streams based on this criterion.

SWQB Response: Reference to the growing season was removed. The protocol now reads:

"A good rule of thumb for differentiating ephemeral reaches from intermittent ones is if they have water in them during the dry season or during a ~~(~~drought~~)~~ ~~conditions or during the growing season~~… If the site is visited during the dry season (typically defined in NM as **late May to mid July** and **mid September to early November**, but also varies by region and elevation of the study reach~~during an average year~~)…"

"Moist" was removed from the protocol. The SWQB agrees that if an indicator were to be observed independently, the evaluator may come to the wrong conclusion based on that one, single indicator. For this reason, the protocol utilizes a weight-of-evidence approach that ranks various hydrological, biological, and physical indicators of the persistence of water. Taken together, multiple indicators allow for satisfactory ratings over a range of conditions. Hydrological indicators, which are more likely to fluctuate with given climatic or seasonal changes, are only one component of the *Hydrology Protocol*. Other indicators, such as vegetation, filamentous algae, and hydric soils are more indicative of processes that occur over time.

2. **1.2. Fish (qualitative observations) (page 11).**

Comment: The procedure for this evaluation appears to be appropriate.

3. **1.7. Sinuosity (page 14). Sinuosity ratios ranging from 1.0 to 1.4 are used as indications of poor to strong sinuosity.**

Comment: Is there data that supports the application of these ratios to New Mexico's large and small streams? Is there a need for differentiation among large and small streams with respect to application of these ratios? The supporting data should be provided.

4. **1.8. Entrenchment Ratio (page 15). "Although one of the difficulties of characterizing dryland ephemeral channels is their enormous variability in form, they tend to have low entrenchment ratios relative to intermittent and perennial channels (Knight, et al, 1999)."**

Comment: Does this reference apply to New Mexico perennial, intermittent, or ephemeral streams? Is there data that supports the application of this methodology to New Mexico streams? In particular, are the entrenchment ratios ranging from less than 1.2 to greater than 2.5 applicable to the range of large and small New Mexico streams?

SWQB Response: The scoring systems for sinuosity and entrenchment ratio were based on data collected by Knight, et al. (1999) for a study on stream channel morphology in New Mexico. Geomorphic data were collected from 77 streams and rivers throughout New Mexico, which included ephemeral, intermittent, and perennial drainages. Geomorphic indicators, such as sinuosity and entrenchment ratio, are only one component of the *Hydrology Protocol* (HP). The protocol utilizes a weight-of-evidence approach to make a final stream determination. Multiple indicators allow for satisfactory ratings even if one or several indicators are not what would be expected given the nature of the stream.

The HP is considered to be an evolving, living document. In the event that new data indicate the indicators or numeric values used in this protocol are not appropriate, the threshold values and differentiating scores will be adjusted accordingly.

Knight, K., T. Moody, W. Odem, and M. Wirtanen. 1999. Stream Channel Morphology in New Mexico: Regional Relationships. Department of Civil and Environmental Engineering, Northern Arizona University, Flagstaff, AZ. 53 p.

5. 1.10. Particle Size or Stream Substrate Sorting (page 18).

Comment: Two examination methods are provided. Both appear to be quite subjective. The "Pebble Count Field Protocol," which is optional and is only necessary "if field investigators cannot determine between the categories described below," provides a methodology for comparing in-channel and out-of-channel particle sizes. Has this methodology been tested against standard sieve analyses to determine the accuracy and variability in results? If not, the validity of the methodology may be questionable.

SWQB Response: The Pebble Count procedure described in the *Hydrology Protocol* was adapted from SWQB's Standard Operating Procedures. The SWQB would like to retain a consistent methodology within our programs so the data can be used for multiple purposes, if needed. Other pebble count techniques may be used to sample a stream or river. The specific reference to this procedure was removed from the protocol because it is not required. A list of potential sampling methods was provided in the protocol.

Geomorphic indicators, such as particle size, are only one component of the *Hydrology Protocol*. The protocol utilizes a weight-of-evidence approach to make a final stream determination. Multiple indicators allow for satisfactory ratings even if one or several indicators are not what would be expected given the nature of the stream.

D. Level 1 Supplemental Indicators (page 21). These indicators may not occur; however, the guidance indicates that "when they occur they are useful

indicators . . . [and] [i]f the indicator is present [then] record the score . . . and include the score when calculating the total points."

Comment: This procedure builds an inherent bias towards driving up the score; *i.e.*, the indicators are only scored when they are present, and they are *added* to the score. The objective way to do this is to either eliminate the supplemental indicators or, if they are absent, consider absence in the scoring.

SWQB Response: As stated in the protocol, scores should reflect the persistence of water with higher scores indicating intermittent and perennial streams. The supplemental indicators are useful in the determination of perenniality and similar to other "present/absent" indicators (i.e. hydric soils, bivalves, amphibians, and EPT taxa) they only contribute to the score if they are present.

IV. LEVEL 2 EVALUATION: BORDERLINE DETERMINATIONS

A. Level 2 Office Procedures.

1. Additional Supporting Information (page 22).

- **Observation of Flow. "[C]are must be taken in evaluating the upper limits of perenniality because some perennial streams may only contain isolated pools o water or be dry during periods of drought."**

Comment: While the meaning of this sentence is unclear, it implies a bias towards identifying intermittent streams as perennial.

- **Other Information to Be Considered. "Professional judgment may be used in conjunction with the total score and supporting information in making the final determination."**

Comment: This procedure creates an opportunity to introduce bias into the process. Application of professional judgment should be clearly identified in the evaluations, as opposed to application of objective field data. In those cases in which a determination is borderline and requires a Level 2 evaluation, the criteria should be *more* stringent than those in the Level 1 determination and evaluation.

SWQB Response: Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or reviewing historic photographs, are necessary to determine the hydrologic condition of the stream. Because this supporting documentation is not always necessary to make a hydrologic determination, the Bureau felt that it was best gathered during a Level 2 Evaluation, after the Level 1 Evaluation was judged to be inconclusive. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

B. Level 2 Indicators.

1. 2.1. Water in Channel (Optional) (page 25).

Comment: It is unclear why the water in channel indicator is "optional," given that this is the best indicator of perennial or non-perennial conditions.

This section includes a description of the use of temperature sensors to mark the onset and cessation of flow. The circumstances under which temperature sensors should be used, as opposed to observation of flows or flow measurements, should be specified.

SWQB Response: The SWQB agrees that water in the channel is the best indicator of perenniality if a long record of observations is available. However, unless there is a stream gauge present or the evaluator has access to equipment such as temperature sensors or pressure transducers and the knowledge to install them properly to record flow data, this level of analysis is not possible, thus the "optional" rating. Under Level 2 Office Procedures/Additional Supporting Information, the protocol states that, "Observation of flow under certain seasonal or hydrologic conditions can directly support classifying a reach as perennial… **Do thermograph and/or streamflow data (or lack thereof) warrant the use of equipment to estimate the onset and cessation of flow?** (See *Indicator #2.1* below)"

Electrical resistance sensors and pressure transducers were added as other types of equipment that could be used to gather flow data in the absence of a gauge and depending on the available resources. The scoring mechanism was revised to include these methods.

V. SECTION 2—GUIDANCE FOR OVERALL SCORE INTERPRETATION

A. First Sentence (page 36). The final determination of whether a stream is perennial is based on a variety of information, including "the total score, supporting information, and professional judgment."

Comment: The procedures described for Level 1 and Level 2 Evaluations are fairly technical. Professional judgment is not incorporated. The role of professional judgment in making these decisions needs to be clarified, including its limitations and appropriate application in certain cases. Otherwise, "professional judgment" can cloud the scoring and lead to decisions that are not appropriate. When professional judgment is applied, it should be clearly identified on the evaluation forms.

SWQB Response: Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or reviewing historic photographs, are necessary to determine the hydrologic condition of the stream.

The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol, but other data not included in these recommendations may be gathered as well. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

B. First Paragraph (page 36). "[I]f a stream is recognized as borderline or substantially affected by man-made activities or if observations are made during drought, then a Level 2 evaluation that relies on more intensive data collection will be needed to make a final determination."

Comment: The impact of man-made activities on the Level 1 Evaluation is not clear; *e.g.*, what man-made activities require a Level 2 Evaluation? A Level 2 Evaluation is required if observations are made during drought. The reason for this is not clear.

SWQB Response: The sentence was changed to, "… if a reach is recognized as borderline or if observations are made during a severe or extreme drought (12-month SPI value less than -1.5), then a Level 2 evaluation that relies on more intensive data collection can be used to make a final hydrological determination or to verify the Level 1 evaluation."

C. Second Paragraph (page 36). If Level 1 scores are between 9 and 12, the stream may be ephemeral but will be recognized as intermittent until further data collection and analysis through a Level 2 Evaluation or detailed UAA can more clearly determine that the stream is ephemeral.

Comment: If the score on the Level 1 Evaluation is between 9 and 12, NMED *should conduct* a Level 2 Evaluation to determine whether the stream is ephemeral or intermittent, rather than leave this to a future finding. The same comment applies to Level 1 scores between 19 and 22. If Level 1 scoring falls within this range, a Level 2 analysis should be performed to determine the appropriate classification with respect to ephemeral, intermittent, or perennial. This should be a routine part of the evaluation process—not an exception—in cases where results are ambiguous.

D. Last Sentence (page 36). If the stream determination "cannot be made because more information is required, then a Level 2 evaluation which uses more intensive data collection *can* be conducted." [Emphasis added.]

Comment: The word "can" should be changed to "will" in this sentence, and the words "by NMED" should be added.

SWQB Response to "C" and "D": The Hydrology Protocol (HP) was designed to provide the necessary supporting documentation for an expedited Use Attainability Analysis (UAA) process (20.6.4.15C). The HP is not a requirement for conducting a standard UAA. It is simply one available methodology that may provide technical support for a UAA. NMED or any other party may conduct a Use Attainability Analysis (UAA), therefore the User/Evaluator may be a member

of NMED, another regulatory agency, a contractor, and/or a member of the public. The Standards explain the requirements of a UAA at 20.6.4.15 NMAC.

E. <u>Second Full Paragraph (page 37).</u> The last sentence of this paragraph states that "[t]he final hydrological determination must take these factors into account."

<u>Comment</u>: It is not clear what the "final hydrological determination" is in this context. Is this different from the Level 1 or Level 2 evaluations?

<u>SWQB Response</u>: "Final hydrological determination" refers to whether the stream or river is determined to be ephemeral, intermittent, or perennial.

F. <u>Key Biological Indicators (page 37).</u> "If a stream or river is recognized as borderline, a qualified aquatic biologist/environmental scientist should evaluate the presence and abundance of such macroinvertebrates and vertebrates species before determining the final stream classification."

<u>Comment</u>: SJWC supports this statement.

G. <u>Additional Supporting Information to Be Considered (page 37).</u> "Professional judgment may be used in conjunction with the total score and supporting information in making the final determination."

<u>Comment</u>: The following language should be added to this paragraph: "Any additional supporting information used to make a determination that is outside the Level 1 or Level 2 scoring process should be clearly identified. Sources of information need to be identified, as well as the nature of the information and how it was used in the determination of the final classification. Any 'professional judgments' made in conjunction with the total score and supporting information should be clearly identified."

<u>SWQB Response</u>: The Hydrology Protocol (HP) was designed to provide the necessary supporting documentation for the expedited Use Attainability Analysis (UAA) process (20.6.4.15C). The HP is not a requirement for conducting a standard UAA. It is simply one available methodology that may provide technical support for a UAA. NMED or any other party may conduct a Use Attainability Analysis (UAA), therefore the User/Evaluator may be a member of NMED, another regulatory agency, a contractor, and/or a member of the public. The Standards explain the requirements of a UAA at 20.6.4.15 NMAC.

Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information, such as interviewing long-term residents or reviewing historic photographs, are necessary to determine the hydrologic condition of the stream.

The SWQB encourages the evaluator to gather as much information as possible to make an accurate assessment of the stream. Recommendations are provided in the protocol, but other

data not included in these recommendations may be gathered as well. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

APPENDIX A: DEVELOPMENT OF THE HYDROLOGY PROTOCOL

I. TABLE 1. SITE LIST FOR HYDROLOGY PROTOCOL

Comment: The table should indicate whether a Level 1 or Level 2 analysis was performed for each stream.

SWQB Response: Only Level 1 evaluations were conducted. Data gathered during the Level 1 Evaluation should provide enough information to provide a clear indication of the hydrologic status of the stream, in most cases. However, the SWQB also recognizes that in certain instances more data and supporting information are necessary to determine the hydrologic condition of the stream, hence the Level 2 Evaluation.

Results presented in Table 1 provide a definition of waterbody types based on the methodology described in the Protocol. In order to evaluate the validity of the procedure used, particularly as it applies to the definitions of intermittent and perennial streams, there needs to be an objective comparison between the findings resulting from the application of the protocol and flow frequency durations based on stream gauge data, where available. For example, for those streams classified as intermittent:

- Are gauges available to compare the classification using the protocol versus flow data from the gauges?

SWQB Response: In 2008, only 3 of the 25 streams assessed had gauges to measure flow. After the 2008 field season, members of the field crews expressed that they felt like they were conducting meetings in the field to develop a *Preliminary Draft* of the Hydrology Protocol. After receiving comment from the field crews, another season of data collection and evaluation was deemed necessary to refine and improve the protocol for public comment. SWQB decided to field test the *Preliminary Draft* during the 2009 index period using the information and data gained in 2009 to revise the protocol for public review. Sixteen of the 32 streams in 2009 had gauges on them to compare the results of the protocol to actual flow data. The results of the Level 1 evaluations and gage data are presented in the table below:

STATION NAME (Stream Gage ID)	Ecoregion	Flow Type	Gauge Data (% days w/ no flow)	Level 1 Score
Canon de Valle abv SR 501 (E253)	Mtns	ephemeral	97.0%	**5.5**
Guaje abv Rendija (E089)	Xeric	ephemeral	93.3%	**8.3**
Tijeras Arroyo near Albuquerque, NM (08330600)	Xeric	ephemeral	89.1%	**3.0**
Rocky Arroyo at Hwy bridge nr Carlsbad, NM (08401900)	Xeric	ephemeral	97.5%	**6.5**
Dark Canyon at Carlsbad, NM (08405150)	Xeric	ephemeral	99.2%	**4.5**
Galisteo Creek blw Galisteo Dam (08317950)	Xeric	intermittent??	49.3%	**9.5**
Pueblo Canyon abv SR 502 (E060)	Mtns - Xeric	intermittent	4.1%	**16.5**
Water Canyon abv SR 501 (E252)	Mtns	intermittent??	24.1%	**9.8**
Revuelto Creek nr Logan, NM (07227100)	Plains	intermittent??	11.5%	**20.8**
Tesuque Creek abv diversions near Santa Fe (08302500)	Mtns	perennial	0.6%	**31.3**
Pecos River at Windy Bridge (08378500)	Mtns	perennial	0%	**32.0**
Vermejo River near Dawson, NM (07203000)	Mtns	perennial	0.3%	**30.0**
Ponil Creek near Cimarron, NM (07207500)	Mtns	perennial	4.2%	**29.5**
Rio Nutria near Ramah, NM (09386900)	Mtns	perennial	7.1%	**31.0**
Rayado Creek near Cimarron, NM (07208500)	Plains	perennial	0%	**31.8**
Coyote Creek near Golondrinas, NM (07218000)	Plains	perennial	0%	**29.0**
Pecos River blw Dark Canyon at Carlsbad, NM (08405200)	Xeric	perennial	2.0%	**29.3**
La Plata River near Farmington, NM (09367500)	Xeric	perennial	14.2%	**28.0**
Animas River at Farmington, NM (09364500)*	Xeric	perennial	0%	**24.8**

* The Animas River scored lower than other perennial waters because there were five missing data points, therefore these attributes could not be added to the total score.

Level 1 scores less than 9 indicate an ephemeral stream. Scores between 12 and 19 indicate an intermittent stream. Scores greater than 22 indicate a perennial stream. Galisteo Creek, Water Canyon, and Revuelto Creek had scores within the gray zones indicating more data should be collected to determine their stream classification. For the most part, gauge data agree with the classifications achieved using the Hydrology Protocol. The two that stand out are **Pueblo Canyon** that scored in the intermittent range using the protocol but only has 4.1% of days with no flow and **La Plata River** that scored relatively high and definitely within the perennial range even though 14.2% of days are without flow. However, the lack of flow in the La Plata is most likely due to agricultural impacts and diversions.

- Does the flow data from gauges support the proposed regulatory definitions in 20.6.4.7 NMAC for intermittent and perennial streams?

SWQB Response: Gage data, if available, may clearly indicate ephemeral, intermittent, or perennial flow patterns for the available period of record…" Gage records may negate the need to perform the Hydrology Protocol, especially if the stream has flow >90% or <10% of the time. It is up to the evaluator to make an argument to support (or refute) the final hydrologic determination and to present his argument to the WQCC and EPA for approval.

This type of objective comparison is needed to determine the validity of the protocol.

Thank you for your consideration of these comments. If you have any questions about SJWC's position, or would like to discuss these issues in more detail, please do not hesitate to call me. We look forward to receiving your responses to these comments.

Sincerely,

L. Randy Kirkpatrick
Executive Director
San Juan Water Commission