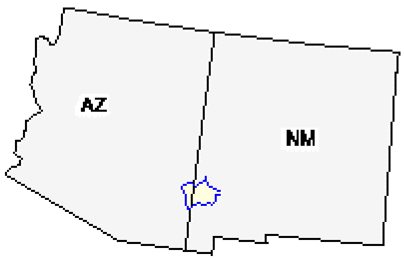
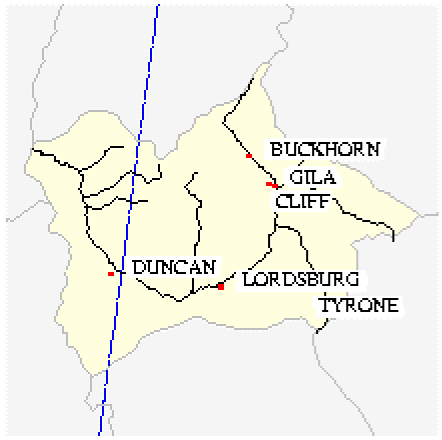
DRAFT
TOTAL MAXIMUM DAILY LOAD FOR CHRONIC ALUMINUM ON WHITEWATER CREEK





Summary Table

New Mexico Standards Segment	San Francisco River, 20.6.4.603 (formerly 2603)
Water body Identifier	Whitewater Creek from the mouth on the San Francisco River to Whitewater Campground, 5.6 mi.
Parameters of Concern	Metals (dissolved chronic aluminum)
Uses Affected	Fish culture and high quality coldwater fishery
Geographic Location	San Francisco River Basin (SFR4-20100)
Scope/size of Watershed	TMDL area: 52 mi^2
Land Type	Ecoregions: New Mexico/Arizona Mountains
Land Use/Cover	Forest (70 %), Rangeland (27%), Agriculture (3%), Water (<1 %), Built-up (<1%)
Identified Sources	Hydromodification, Road maintenance/runoff, Removal of Riparian Vegetation, Streambank Modification/Destabilization
Watershed Ownership	Forest Service (97 %), Private (3 %)
Priority Ranking	3
Threatened and Endangered Species	No
TMDL for: Aluminum (chronic)	WLA (0) + LA (0.00376) + MOS (0.00094)= **0.0047 lbs/day**

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List of Abbreviations

BMP	Best Management Practice
BLM	United States Department of Interior Bureau of Land Management
CCCG	Catron County Citizens Group
CFS	Cubic Feet per Second
CWA	Clean Water Act
CWAP	Clean Water Action Plan
CWF	Coldwater Fishery
EPA	United States Environmental Protection Agency
FS	United States Department of Agriculture Forest Service
GM	Gila Monster
GNF	Gila National Forest
HQCWF	High Quality Coldwater Fishery
LA	Load Allocation
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
MOS	Margin of Safety
MOU	Memorandum of Understanding
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSGF	New Mexico State Game and Fish
NMSHD	New Mexico State Highway and Transportation Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
UWA	Unified Watershed Assessment
WLA	Waste Load Allocation
WPS	Watershed Protection Section
WQLS	Water Quality Limited Segment
WQCC	New Mexico Water Quality Control Commission
WQS	Water Quality Standards
WRAS	Watershed Restoration Action Strategy

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop Total Maximum Daily Load (TMDL) management plans for waterbodies determined to be water quality limited. A TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety (MOS), and natural background conditions.

Whitewater Creek looking downstream from the Catwalk sampling site.

The Whitewater Creek watershed is a sub-basin of the San Francisco River Basin, located in southwestern New Mexico. Two stations were located on the creek to evaluate the impact of the watershed and to establish background conditions. As a result of this monitoring effort, several exceedances of New Mexico water quality standards for dissolved aluminum were documented on Whitewater Creek. This TMDL document addresses dissolved aluminum for Whitewater Creek. When formally adopted by the New Mexico Water Quality Control Commission (WQCC), the TMDL will be incorporated into the State's Water Quality Management Plan by reference.

A general implementation plan for activities to be established in the watershed is referred to in this document. The Surface Water Quality Bureau (SWQB) Watershed Protection Section (WPS) will further develop the details of this plan. Implementation of recommendations in this document will be done with full participation of all interested and affected parties. During implementation, additional water quality data will be collected. As a result targets will be re-examined and potentially revised; this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be removed from the 303(d) list.

Background Information

Whitewater Creek below the Catwalk

The Whitewater Creek watershed is approximately 52 mi^2 and is located in southwestern New Mexico. The Whitewater Creek watershed is dominated by forest and rangeland, with some agriculture, water, and built-up areas (Figure 1). Whitewater Creek flows through the town of Glenwood and into the San Francisco River. The watershed is almost entirely Forest Service managed lands (97%), with very little privately held lands (3%) (Figure 2).

Surface water quality monitoring stations were used to characterize the water quality of the stream reaches. Stations were located to evaluate the impact on the stream and to establish background conditions. Several sample results from Whitewater Creek at the Catwalk exceed New Mexico water quality standards for chronic dissolved aluminum.

Endpoint Identification

Target Loading Capacity

Overall, the target values for this TMDL will be determined based on 1) the presence of numeric criteria, 2) the degree of experience in applying the indicator and 3) the ability to easily monitor and produce quantifiable and reproducible results. For this TMDL document target values for metals are based on numeric criteria. This TMDL is consistent with the State antidegradation policy.

Metals (dissolved aluminum)

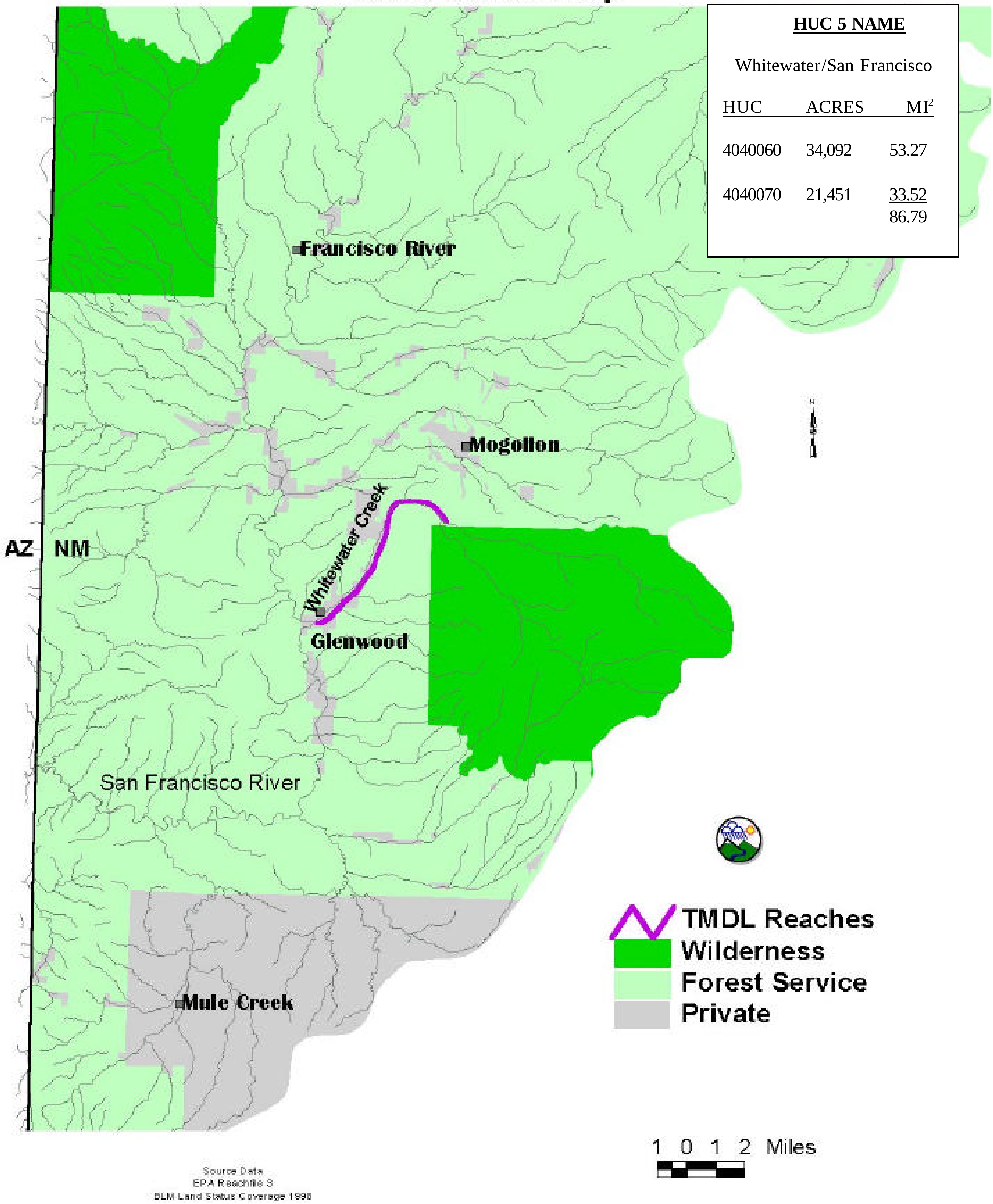
> According to the New Mexico water quality standards (20.6.4.900.J NMAC) the State's standard leading to an assessment of use impairment is the numeric criteria stating that "chronic dissolved aluminum shall not exceed 87 ug/L" and "acute dissolved aluminum shall not exceed 750 ug/L" for all subcategories of fisheries.

Although there are no adverse affects to biota at acute levels of 750 ug/L, or chronic levels of 87 ug/L, high chronic levels of dissolved aluminum are toxic to fish, benthic invertebrates, and some single-celled plants. Chronic dissolved aluminum concentrations from 100 to 300 ug/L increases mortality, and retards growth, gonadal development, and egg production of fish (http://h2osparc.wq.ncsu.edu).

Figure 1


Lower San Francisco River Basin
Land Use/Cover
6th code Watersheds
Francisco River
Mogollon
15040004040070
Whitewater Creek
15040004040060
Glenwood
Francisco River
6th Code Watersheds/Areas
TMDL Reaches
Built-up
Agricultural
Rangeland
Forested
Water
Wetland
Barren
Source Data
USGS 1:250,000 and 1:100,000 Scale Maps
Clifton, AZ Quadrangle 1982
1 0 1 2 Miles

Figure 2 **Lower San Francisco River Basin Land Ownership**



HUC 5 NAME

Whitewater/San Francisco

HUC	ACRES	MI^2
4040060	34,092	53.27
4040070	21,451	33.52
		86.79

Exceedances of the chronic and acute numeric criteria for dissolved aluminum were observed during the summer and fall of 1996 and summer of 1999. These exceedances resulted in the listing of Whitewater Creek for metals (chronic aluminum), and the drafting of this TMDL document. To be conservative, this TMDL was drafted for compliance with the chronic aluminum criterion, which will also result in compliance with the acute numeric criterion.

Flow

Metals concentrations in a stream vary as a function of flow. In this case the target flow was critical low flow. Exceedances of the criterion were seen in the summer and fall months at lower flows.

When available, United States Geological Survey (USGS) gages are used to estimate flow. Where gages are absent or poorly located along a reach, either actual flow (measured as water quality samples are taken) is used as target flows or geomorphologic sectional information is taken to model the flows. In this case, 1) there was no USGS gage for Whitewater Creek, 2) the critical flow was modeled and 3) the presence of dissolved aluminum can vary in a stream as a function of flow. Thus, a TMDL is calculated for each reach at a particular flow. The flow value used to calculate the TMDL for dissolved alunimum on Whitewater Creek obtained using the 4-day, 3-year low flow frequency 4Q3 regression model. The New Mexico Surface Water Quality Standards (20.6.4 NMAC) describe critical low flow using the term 4Q3. The 4Q3 is the minimum arithmetic average four-consecutive-day flow, which occurs with a frequency of once in three years. This flow is used in calculation of point source (NPDES) permit wasteload allocations (WLA) and in the development of total maximum daily loads (TMDLs).

It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in these systems at water quality standards the target load will vary based on the changing flow. Management of the load should set a goal of water quality standards attainment, not of meeting the calculated target load.

Calculations

A target load for dissolved aluminum is calculated based on a flow, the current water quality standards, and a unitless conversion factor, 8.34 that is used to convert mg/L units to lbs/day (see Appendix A for Conversion Factor Derivation). The target loads (TMDLs) predicted to attain standards were calculated using Equation 2 and are shown in Table 1.

Equation 2. critical flow (mgd) x standard (mg/L) x 8.34 (conversion factor) = target loading capacity

Table 1: Calculation of Target Loads

Location	Flow+ (mgd)	Standard Chronic Al (mg/L)	Conversion Factor	Target Load Capacity (lbs/day)
Whitewater Creek	0.0065	0.087	8.34	0.0047 lb/day

+Because there is no USGS station on this reach, the flow is the 4Q3 flow of 0.01 cfs, which converts to 0.0065 mgd. See Appendix C for derivation.

The measured loads were calculated using Equation 2. The flows used were taken from the critical low flow, 4Q3 determination. The geometric mean of the data that exceeded the standards from the data collected at each site for dissolved aluminum was substituted for the standard in Equation 2. The same conversion factor of 8.34 was used. Results are presented in Table 2.

Table 2: Calculation of Measured Loads

Location	Flow+ (mgd)	Field Measurements* (mg/L)	Conversion Factor	Measured Load (lbs/day)
Whitewater Creek	0.0065	0.147	8.34	0.00797

+Because there is no USGS station on this reach, the flow is the 4Q3 flow of 0.01cfs, which converts to 0.0065 mgd. See Appendix C for derivation

* Measurements are the geometric mean of the exceedances seen over the three season sampling regime, Appendix B.

It was not possible to calculate background loads in this watershed. A reference reach, with similar stream channel morphology and flow was not identified. It is assumed that a portion of the load allocation is made up of natural background loads. In future water quality surveys, finding a suitable reference reach will be a priority.

Waste Load Allocations and Load Allocations

Waste Load Allocation

There are no point source contributions associated with this TMDL. The waste load allocation is zero.

Load Allocation

In order to calculate the load allocation (LA) the waste load allocation (WLA), and margin of safety (MOS) were subtracted from the target capacity (TMDL) following Equation 2.

Equation 3. $WLA + LA + MOS = TMDL$

Results are presented in Table 3.

Table 3: Calculation of TMDL for Chronic Aluminum

Location	WLA (lbs/day)	LA (lbs/day)	MOS (20%) (lbs/day)	TMDL (lbs/day)
Whitewater Creek	0	0.00376	0.00094	0.0047

The load reduction that would be necessary to meet the target loads were calculated to be the difference between the target load (Table 1) and the measured load (Table 2) as shown in Table 4 (Calculation of Load Reductions). For example, for Whitewater Creek, achieving the target load of 0.0047 lbs/day would require a load reduction of 0.00327 lbs/day. Achieving the target load for dissolved aluminum on Whitewater Creek would require a load reduction of approximately 59%.

Table 4: Calculation of Load Reductions (in lbs/day)

Location	Target Load	Measured Load	Load Reduction
Whitewater Creek	0.0047	0.00797	0.00327

Identification and Description of Pollutant Sources

Table 5: Pollutant Source Summary

Pollutant Sources (% from each)	**Magnitude** (WLA + LA + MOS)	**Location**	**Potential Sources**
Point: 0%	0	--------	None
Nonpoint: 100% Dissolved Aluminum	0.0047	Whitewater Creek	Hydromodification, Road maintenance/runoff, Removal of Riparian Vegetation, Streambank Modification/Destabilization

Linkage of Water Quality and Pollutant Sources

Where available data are incomplete or where the level of uncertainty in the characterization of sources is large, the recommended approach to TMDLs requires the development of allocations based on estimates utilizing the best available information. Data that were collected and used for the calculation of the existing condition for Whitewater Creek, with respect to dissolved aluminum, are included in Appendix B.

The over story within a typical sub-watershed, can contribute conifer needles and other organic debris, possibly reaching an exposed mineral body.

Generally exposed surfaces are relatively low in metallic cation concentration and, on decomposition of deposited organics, can give rise to acid products. As the acids generated in the organic layer are moved downward, by percolating water, into the mineral body below, the acids produced can dissolve the alkaline earth carbonates (lime such as calcite and dolomite) along with other soluble salts which then move downward in solution. Once carbonates have been removed from an exposed geologic body, the hydrogen ions of percolating acid-waters replace many of the metallic cations on the cation exchange complex (Positively charged cations can exchange for each other on the surface of the negatively charged clay particles.). The metallic cations move downward in solution, and the upper part of the mineral body becomes acid. Under acid conditions, many iron and aluminum compounds are unstable. Minerals containing these compounds break down.

The iron and aluminum oxides are carried downward. Since quartz is fairly stable under acid conditions, it remains behind as a residue in the upper part of the mineral body. During intermediate stages, quartz may form just a residual coating of mineral particles, as the particles are weathering and losing iron, aluminum and other less resistant materials (Hovland, Dwight, 1997).

SWQB fieldwork includes an assessment of the potential sources of impairment (SWQB/NMED revised 10/2/00). The Pollutant Source(s) Documentation Protocol, shown as Appendix D, provides an approach for a visual analysis of a pollutant source along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Table 5 (Pollutant Source Summary) identifies and quantifies potential sources of nonpoint source impairments along each reach as determined by field reconnaissance and assessment. A further explanation of the sources follows.

Whitewater Creek

The primary sources of impairment along this reach are hydromodification, road maintenance/runoff, removal of riparian vegetation, natural and streambank modification/destabilization. The stream has been hydromodified (channelized and levied) in an effort to protect the main road along the creek. Landowners have also built up banks in the area in an attempt to prevent floodwaters from flooding their properties. Roads running along the creek provide direct conduits for sediment erosion and deposition into Whitewater Creek. These sediments, as eroded counterparts to their parent geologic bodies, have a high probability of containing leached aluminum compounds.

There are subdivisions, houses, ranches/farms, bridges, roads, and low water crossings within the segment. Parts of this segment of Whitewater Creek are not perennial. The land surrounding this creek is almost entirely Forest Service managed lands with very little privately owned land.

Margin of Safety (MOS)

Whitewater Creek looking upstream from the 1998-1999 sampling station "Whitewater Creek at Catwalk". Most of the watershed is located above this site and consists of national forest and wilderness.

TMDLs should reflect a margin of safety based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. For this TMDL, there will be no margin of safety for point sources, since there are none. However, for the nonpoint sources the margin of safety is estimated to be an addition of **20%** for Whitewater Creek for dissolved aluminum to the TMDL, excluding the background. This margin of safety incorporates several factors:

Errors in calculating NPS loads

A level of uncertainty exists in sampling nonpoint sources of pollution. Analytical techniques used for measuring metals concentrations in stream water are accurate to within +/- 15%. Accordingly, a conservative margin of safety for metals increases the TMDL by **15%.**

Errors in calculating flow

Flow estimates were based on a modeled flow. To be conservative, an addition of **5%** MOS to account for accuracy of flow measures will be included.

Consideration of Seasonal Variation

Data used in the calculation of this TMDL were collected during spring, summer, and fall in order to ensure coverage of any potential seasonal variation in the system. Critical condition is set to the lowest critical flow for metals. Low flow was chosen as the critical flow as there is more potential to have higher concentrations of metals in the stream during summer and early fall. Data where exceedances were seen were used in the calculation of the measured loads.

Future Growth

Future growth and growth estimates are of interest to Western New Mexico University (WNMU), who in cooperation with other groups and agencies, has produced documentation pertaining to socio-economic studies of the southwestern counties in an attempt to better understand trends.

Estimations of future growth are not anticipated to lead to a significant increase for dissolved aluminum that cannot be controlled with best management practice implementation in this watershed. Whitewater Creek runs through almost entirely Forest Service managed lands with very little privately held lands.

Monitoring Plan

Pursuant to Section 106(e)(1) of the Federal Clean Water Act, the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico Water Quality Act, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State. The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based controls, to evaluate the effectiveness of such controls and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of every five to seven years.

The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document, “Quality Assurance Project Plan for Water Quality Management Programs” (QAPP) is updated annually (SWQB/NMED 2001). Current priorities for monitoring in the SWQB are driven by the 303(d) list of streams requiring TMDLs. Short-term efforts will be directed toward those waters which are on the EPA TMDL consent decree (Forest Guardians and Southwest Environmental Center v. Carol Browner, Administrator, US EPA, Civil Action 96-0826 LH/LFG, 1997) list and which are due within the first two years of the monitoring schedule. Once assessment monitoring is completed those reaches showing impacts and requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority water bodies, including biological assessments, and compliance monitoring of industrial, federal and municipal dischargers, and are specified in the SWQB Assessment Protocol (SWQB/NMED revised 2000).

Long term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited every five to seven years. This gives an unbiased assessment of the waterbody and establishes a long term monitoring record for simple trend analyses. This information will provide time-relevant information for use in 305(b) assessments and to support the need for developing TMDLs.

The approach provides:

- a systematic, detailed review of water quality data, allowing for a more efficient use of valuable monitoring resources;
- information at a scale where implementation of corrective activities is feasible;
- an established order of rotation and predictable sampling in each basin which allows for enhanced coordinated efforts with other programs; and
- program efficiency and improvements in the basis for management decisions.

It should be noted that a basin would not be ignored during its four to six year sampling hiatus. The rotating basin program will be supplemented with other data collection efforts. Data will be analyzed, field studies will be conducted to further characterize acknowledged problems, and TMDLs will be developed and implemented. Both long term and field studies can contribute to the 305(b) report and 303(d) listing processes.

The following schedule is a draft for the sampling seasons through 2002 and will be followed in a consistent manner to support the New Mexico Unified Watershed Assessment (UWA) and the Nonpoint Source Management Program. This sampling regime allows characterization of seasonal variation and through sampling in spring, summer, and fall for each of the watersheds.

- 1998 Jemez Watershed, Upper Chama Watershed (above El Vado), Cimarron Watershed, Santa Fe River, San Francisco Watershed
- 1999 Lower Chama Watershed, Red River Watershed, Middle Rio Grande, Gila River Watershed (summer and fall), Santa Fe River
- 2000 Gila River Watershed (spring), Dry Cimarron Watershed, Upper Rio Grande 1 (Pilar north to the NM/CO border), Shumway Arroyo
- 2001 Upper Rio Grande 2 (Pilar south to Cochiti Reservoir), Upper Pecos Watershed (Ft Sumner north to the headwaters
- 2002 Lower Pecos Watershed (Roswell south to the NM/TX border including Ruidoso), Canadian River Watershed, Lower Rio Grande (southern border of Isleta Pueblo south to the NM/TX border), San Juan River Watershed, Rio Puerco Watershed, Closed Basins, Zuni Watershed, Mimbres Watershed

Implementation Plan

Management Measures

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, citing criteria, operating methods, or other alternatives"(USEPA, 1993). A combination of best management practices (BMPs) will be used to implement this TMDL.

Introduction

The uptake and transport of metals in surface waters can pose a considerable nonpoint source pollution problem. Metals such as aluminum, lead, copper, iron, zinc and others can occur naturally in watersheds in amounts ranging from trace to highly mineralized deposits. Some metals are essential to life at low concentrations but are toxic at higher concentrations.
Metals such as cadmium, lead, mercury, nickel, and beryllium represent known hazards to human health. The metals are continually released into the aquatic environment through natural processes, including weathering of rocks, landscape erosion, geothermal or volcanic activity. The metals may be introduced into a waterway via headcuts, gullies or roads.

Depending on the characteristics of the metal, it can be dissolved in water, deposited in the sediments or both. Metals become dissolved metals in water as a function of the pH of a water system. In urban settings, storm water runoff can increase the mobilization of many metals into streams.

Examples of sources that can cause metals contamination:

- Activities such as resource extraction, recreation, some agricultural activities and erosion can contribute to nonpoint source pollution of surface water by metals.
- Storm water runoff in industrial areas may have elevated metals in both sediments and the water column.

Actions to be Taken

For this watershed the primary focus will be on the control of dissolved aluminum. On this watershed the primary focus will be on the control of dissolved aluminum listed in the CWA §303(d) report as exceeding the State of New Mexico Standards for Interstate and Intrastate Surface Waters.

During the TMDL process in this watershed, point sources have been reviewed and will be addressed through the permit process. The nonpoint source contributions will need to address aluminum exceedances through BMP implementation. In addition, sediment loads may need to be addressed.

BMPs can be implemented to address and remediate metal contamination. They include, but are not limited to:

1. Wetlands are used to filter runoff water and sediment from source areas in the watershed. Metals may be bound up in the root systems of wetlands vegetation, preventing them from entering a waterway. (The Use of Wetlands for Improving Water Quality to Meet Established Standards, 1992, Filas and Wildeman.)

2. Improving the pH in a stream. Neutral to alkaline pH waters will generally not pose a metal exceedance problem. An acidic pH will dissolve available metals.

In such a case, a remedy for metals contamination could be an adjustment of the pH of runoff before it enters the water body. An approach may be the construction of an anoxic alkaline drain to raise the pH and precipitate the contained metals.

An anoxic alkaline drain is constructed by placing a high pH material in a trench between runoff and the stream to be used as a buffer (Red River Groundwater Investigation- NMED-SWQB-Nonpoint Source Pollution Section, 1996, D. Slifer).

3. A method for reducing metals used in controlled situations includes the use of sulfate and sulfate reducing bacteria. The sulfate, (if not already present), and the sulfate reducing bacteria are applied into the water column. This provides a mechanism for some metals to precipitate out of solution. (A Treatment of Acid Mine Water Using Sulfate-Reducing Bacteria, 1979, Wakao, Saurai, and Shiota).

4. Storm water and construction BMPs can be used to divert flows off metal-producing areas directing them away from streams into areas where the flows may infiltrate, evaporate, or accumulate in sediment retention basins.

(Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, 1997, Delaware Department of Natural Resources and Environmental Control, Sediment and Stormwater Program & the Environment Management Center, Brandywine Conservancy.

Additional sources of information for BMPs to address metals are listed below. Some of these documents are available for viewing at the New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section Library, 1190 St. Francis Drive, Santa Fe, New Mexico.

Mining

Internet websites:

- http://www.epa.gov/region2/epd/98139.htm
- http:www.epa.gov/OSWRCRA/hazwast/ldr/mining/docs/hhed1196.pdf

- Caruso, B.S., and R. Ward, 1998, Assessment of Nonpoint Source Pollution from Inactive Mines Using a Watershed Based Approach, Environmental Management, vol.22, No.2, Springer-Verlag New York Inc. pp.225-243.
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- Coleman, M.W., 1999, Geology-Based Analysis of Elevated Aluminum in the Jemez River, North-Central New Mexico. Unpublished Report to USEPA Region 6, New Mexico Total Maximum Daily Load (TMDL) Team, New Mexico Environment Department Surface Water Quality Bureau, Santa Fe, 2p.

- Coleman, M.W., 2000, Rio Puerco Watershed Mining Impacts. New Mexico Environment Department, Clean Water Act (CWA) Section 319(h) Grant Project Summary Report to USEPA Region 6 Dallas, New Mexico Environment Department Surface Water Quality Bureau Watershed Protection Section, Santa Fe.

- Eger, P., and K. Lapakko, 1988, Nickel and Copper Removal From Mine Drainage by a Natural Wetland. U.S. Bureau of Mines Circular 9183. pp.301-309.

- Filas, B., and T. Wildeman, 1992, The Use of Wetlands for Improving Water Quality to Meet Established Standards, Nevada Mining Association Annual Reclamation Conference, Sparks, Nevada.

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- Machemer, S.D., 1992, Measurements and Modeling of the Chemical Processes in a Constructed Wetland Built to Treat Acid Mine Drainage. Colorado School of Mines Thesis T-4074, Golden, CO.

- Metish, J.J. and others, 1998, Treating Acid Mine Drainage From Abandoned Mines in Remote Areas. USDA Forest Service Technology and Development Program, AMD Study 7E72G71, Missoula, MT, US Govt. Printing Office: 1998-789-283/15001.

- Royer, M.D., and L. Smith, 1995, Contaminants and Remedial Options at Selected Metal-Contaminated Sites: Battelle Memorial Institute-Columbus Division, under contract # 68-CO-0003-WA41 to Natl. Risk Management Lab-Office of Research and Development, USEPA. EPA/540/R-95/512.

- Slifer, D.W., 1996, Red River Groundwater Investigation- New Mexico Environment Department Surface Water Quality Bureau Nonpoint Source Pollution Section; CWA Section 319 (h) Grant Project Final Report to USEPA Region 6 - Dallas.

- US EPA, 1996, Seminar Publication Managing Environmental Problems at Inactive and Abandoned Metals Mine Sites, Office of Research and Development, EPA/625/R-95/007.

- Wakao, N., T. Takahashi, Y. Saurai, and H. Shiota. 1979. A Treatment of Acid Mine Water Using Sulfate-reducing Bacteria. Journal of Ferment. Technology 57(5):445-452.

Riparian and Streambank Stabilization

- Colorado Department of Natural Resources, Streambank Protection Alternatives, State Soil Conservation Board.

- Meyer, Mary Elizabeth, 1989, A Low Cost Brush Deflection System for Bank Stabilization and Revegetation.

- Missouri Department of Conservation, Restoring Stream Banks With Willows, (pamphlet).

- New Mexico State University, Revegetating Southwest Riparian Areas, College of Agriculture and Home Economics, Cooperative Extension Service, (pamphlet).

- State of Pennsylvania Department of Environmental Resources, 1986, A Streambank Stabilization And Management Guide for Pennsylvania Landowners, Division of Scenic Rivers.

- State of Tennessee, 1995, Riparian Restoration and Streamside Erosion Control Handbook, Nonpoint Source Water Pollution Management Program.

Storm Water

Internet website

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  Construction Sites
  Developed Areas
  Sand and Gravel Pits
  Farms, Golf Courses, and Lawns

Other BMP Activities in the Watershed

The following are activities in this watershed that have occurred, are occurring, or are in the planning stages to address dissolved aluminum sources or other nonpoint source issues in the Whitewater Creek watershed.

The Gila National Forest has been and continues to be involved in management activities on lands in the upper reaches of the Whitewater Creek watershed. Many of these management activities are undertaken to address issues with sediment, metals transport, turbidity, and water temperature. Mining, grazing and logging were all historic uses made of the land. Currently, the Whitewater Creek watershed is managed with an emphasis focused on recreation, wildlife, fisheries and grazing. Recreational developments consist of the Catwalk at Glenwood, Glenwood Fish Hatchery and local development. There are many established trails above and below this segment.

Coordination

In this watershed public awareness and involvement will be crucial to the successful implementation of this plan and improved water quality.

Staff from the SWQB is available to work with stakeholders to provide the guidance in developing the Watershed Restoration Action Strategy (WRAS). The WRAS is a written plan intended to provide a long-range vision for various activities and management of resources in a watershed. It includes opportunities for private landowners and public agencies to reduce and prevent impacts to water quality. This long-range strategy will become instrumental in coordinating and achieving a reduction of metals and will be used to prevent water quality impacts in the watershed. SWQB staff is available to provide any technical assistance such as selection and application of BMPs needed to meet WRAS goals.

The SWQB cooperates with stakeholders in this watershed and encourages the implementation of BMPs. Certain reaches in the Whitewater Creek watershed may be suitable habitat for beaver that face extirpation in other locations.

Beaver activities can bring about a rapid growth of riparian vegetation, change an ephemeral stream into a perennial stream, capture sediment, raise the water table, and reduce flood velocities. SWQB encourages efficient management of livestock and wildlife. Lastly, the SWQB will encourage all landowners in the watershed to consider road issues that may cause impairment of the streams ability to function.

Stakeholders in this process will include SWQB, and other members of the Watershed Restoration Action Strategy such as the Catron County Citizens Group (CCCG), the Gila Monster (GM) group, Gila National Forest (GNF), State Game and Fish (NMSGF), the Town of Glenwood, the Glenwood Fish Hatchery, the New Mexico State Highway Department (NMSHD), the Catron County Road Department and other private landowners. Stakeholder public outreach and involvement in the implementation of this TMDL will be ongoing.

Timeline

The New Mexico Watershed Protection Program (NMED/SWQB 1999), published by the New Mexico Environment Department, describes the dynamics of our attempts to reduce nonpoint source pollution. The following is an anticipated timeline for TMDL implementation in this watershed.

Implementation Action	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Public Outreach and Involvement	X	X	X	X	X
Establish Milestones	X				
Secure Funding	X		X		
Implement Management Measures (BMPs)		X	X		
Monitor BMPs		X	X	X	
Determine BMP Effectiveness				X	X
Re-evaluate Milestones				X	X

Section 319(h) Funding Options

The Watershed Protection Section of the SWQB provides USEPA 319(h) funding to assist in implementation of BMPs to address water quality problems on reaches listed on the 303(d) list or which are located within Category I Watersheds as identified under the Unified Watershed Assessment of the Clean Water Action Plan. These monies are available to all private, for profit, and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, Federal agencies, or agencies of the State. Proposals are submitted by applicants through a request for proposals (RFP) process and require a non-federal match of 40% of the total project cost consisting of funds and/or in-kind services.
Further information on funding from the Clean Water Act, Section 319(h) can be found at the New Mexico Environment Department website: http://www.nmenv.state.nm.us.

Assurances

New Mexico's Water Quality Act (Act) does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to nonpoint source water pollution. The Water Quality Act (NMWQCC 1995a) also states in §74-6-12(a):

> *The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, the State of New Mexico Surface Water Quality Standards (Sections 20.6.4.6.C and 20.6.4.10.C NMAC) states:

> *These water quality standards do not grant the Commission or any other entity the power to create, take away or modify property rights in water.*

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water, which have been established by any State.*
>
> *Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

New Mexico's Clean Water Action Plan has been developed in a coordinated manner with the State's 303(d) process.

All Category I watersheds identified in New Mexico's Unified Watershed Assessment process are totally coincident with the impaired waters lists for 1996 and 1998 as approved by EPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

The description of legal authorities for regulatory controls/management measures in New Mexico's Water Quality Act does not contain enforceable prohibitions directly applicable to nonpoint sources of pollution.
The Act does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. Several statutory provisions on nuisance law could also be applied to nonpoint source water pollution.
NMED nonpoint source water quality management utilizes a voluntary approach. The state provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through section 319 of the Clean Water Act. Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Watershed Protection Program will target efforts to this and other watersheds with TMDLs. The Watershed Protection Program coordinates with the Nonpoint Source Taskforce. The Nonpoint Source Taskforce is the New Mexico statewide focus group representing federal and state agencies, local governments, tribes and pueblos, soil and water conservation districts, environmental organizations, industry, and the public. This group meets on a quarterly basis to provide input on the section 319 program process, to disseminate information to other stakeholders and the public regarding nonpoint source issues, to identify complementary programs and sources of funding, and to help review and rank section 319 proposals.

Milestones

Milestones will be used to determine if control actions are being implemented and standards attained. For this TMDL, several milestones will be established which will vary and will be determined by the BMPs implemented. Examples of milestones for metals include:

- increases in wetland areas to filter associated reductions in metals concentrations found in the stream;
- increases in stabilized streambank and enhanced riparian areas to decrease erosion and potential loading of sediment associated with metals into a stream; and
- monitoring within a time frame and continued public outreach effort to educate watershed stakeholders on measures to prevent further water quality exceedances.

Milestones will be coordinated by SWQB staff and will be re-evaluated periodically depending on which BMPs were implemented. Further implementation of this TMDL will be revised based on this reevaluation. As additional information becomes available during the implementation of the TMDL, the targets, load capacity, and allocations may need to be changed. In the event that new data or information shows that changes are warranted, TMDL revisions will be made with assistance of watershed stakeholders. The re-examination process will involve: monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and re-evaluating the TMDL for attainment of water quality standards. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

Public Participation

Public participation was solicited in development of these TMDLs. See Appendix E for flow chart of the public participation process.

The draft TMDLs were made available for a 30-day comment period starting **October 9, 2001**. Response to comments is attached as Appendix F of this document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us/) and press releases to area newspapers.

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Appendices

Appendix A: Conversion Factor Derivation

Appendix B: Collection Data for the Determination of Measured Loads

Appendix C: 4Q3 Determination for Whitewater Creek

Appendix D: Pollutant Source(s) Documentation Protocol

Appendix E: Public Participation Process Flowchart

Appendix F: Response to Comments

Appendix A: Conversion Factor Derivation

8.34 Conversion Factor Derivation

Million gallons/day **x** Milligrams/liter **x** 8.34 = pounds/day

10^6~~gallons~~/day **x** 3.7854 liters/~~1 gallon~~ **x** 10^{-3}gram/liter **x** 1 pound/454 ~~grams~~ = pounds/day

10^6 (10^{-3}) (3.7854)/454 = 3785.4/454

= 8.3379
= **8.34**

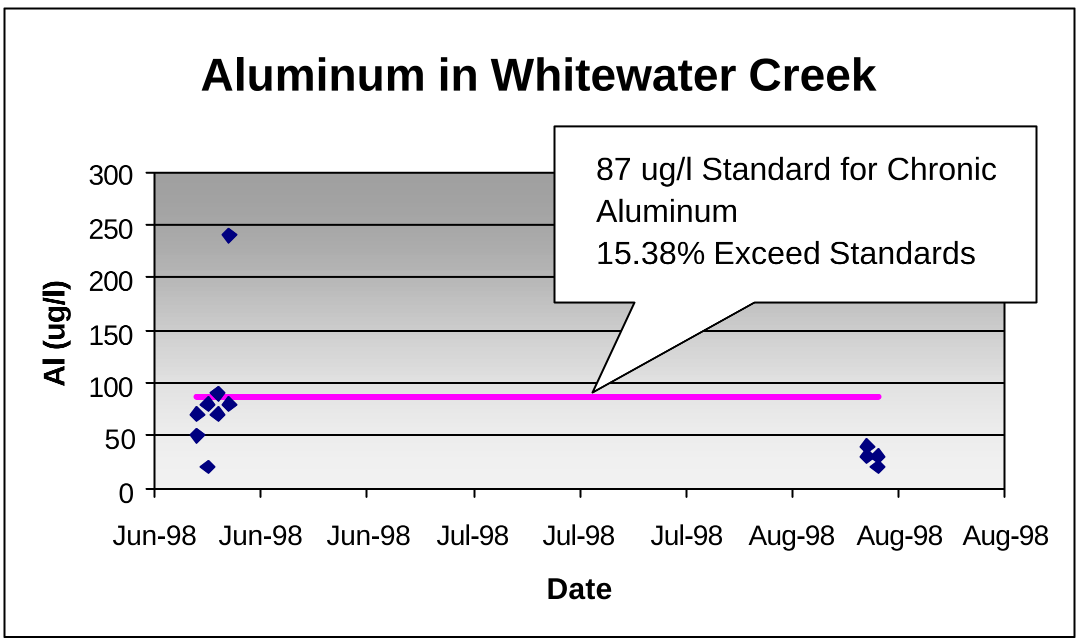
Appendix B: Collection Data for the Determination of Measured Loads

Location	Date	Al (ug/l)	Al + MOS(ug/l)
At Glenwood	06/08/1998	50	57.5
At Catwalk	06/08/1998	70	80.5
At Glenwood	06/09/1998	20	23
At Catwalk	06/09/1998	80	92
At Glenwood	06/10/1998	70	80.5
At Catwalk	06/10/1998	90	103.5
At Glenwood	06/11/1998	80	92
At Catwalk	06/11/1998	240	276
At Glenwood	08/10/1998	40	46
At Catwalk	08/10/1998	30	34.5
At Glenwood	08/11/1998	30	34.5
At Catwalk	08/11/1998	20	23
At Catwalk	10/19/1998	***10k***	***10k***

k denotes below the detection limit

	n=	13	13
	# exceed	2	4
	% Exceed	15.38%	30.77%

146.9693846 = Geometric Mean



Appendix C: 4Q3 Determination for Whitewater Creek

The regression model developed for mountainous regions above 7,500 feet in New Mexico is as follows:

$$4Q3 = 7.1023 \times 10^{-5} DA^{0.68} P_w^{3.59} S^{1.23}$$

Where;

4Q3 = 4-day, 3-year, low-flow frequency, in cubic feet per second;

DA = drainage area, in square miles; and

P_w = average basin mean winter precipitation 1961-1990, in mm

S = average basin slope

Whitewater Creek:

P_w = 5487.8 or 2.16 inches

DA = 54.7

Slope = 0.473

Elevation = 7772

$$0.01 \text{ cfs} = 7.1023 \times 10^{-5}(54.7)^{0.68}(2.16)^{3.59}(0.473)^{1.23}$$

Appendix D: Pollutant Source(s) Documentation Protocol

POLLUTANT SOURCE(S) DOCUMENTATION PROTOCOL

New Mexico Environment Department
Surface Water Quality Bureau
July 1999

This protocol was designed to support federal regulations and guidance requiring states to document and include probable source(s) of pollutant(s) in their §303(d) Lists as well as the States §305(b) Report to Congress.

The following procedure should be used when sampling crews are in the field conducting water quality surveys or at any other time field staff are collecting data.

Pollutant Source Documentation Steps:

1). Obtain a copy of the most current §303(d) List.

2). Obtain copies of the **Field Sheet for Assessing Designated Uses and Nonpoint Sources of Pollution**.

3). Obtain digital camera that has time/date photo stamp on it from the Watershed Protection Section.

4). Obtain GPS unit and instructions from Neal Schaeffer.

5). Identify the reach(s) and probable source(s) of pollutant in the §303(d) List associated with the project that you will be working on.

6). Verify if current source(s) listed in the §303(d) List are accurate.

7). Check the appropriate box(s) on the field sheet for source(s) of nonsupport and estimate percent contribution of each source.

8). Photodocument probable source(s) of pollutant.

9). GPS the probable source site.

10). Give digital camera to Gary King for him to download and create a working photo file of the sites that were documented.

11). Give GPS unit to Neal Schaeffer for downloading and correction factors.

12). Enter the data off of the **Field Sheet for Assessing Designated Uses and Nonpoint Sources of Pollution** into the database.

13). Create a folder for the administrative files, insert field sheet and photodocumentation into the file.

This information will be used to update §303(d) Lists and the States §305(b) Report to Congress.

FIELD SHEET FOR ASSESSING DESIGNATED USES AND NONPOINT SOURCES OF POLLUTION

CODES FOR USES NOT FULLY SUPPORTED

☐ HQCWF = HIGH QUALITY COLDWATER FISHERY
☐ CWF = COLDWATER FISHERY
☐ MCWF = MARGINAL COLDWATER FISHERY
☐ WWF = WARMWATER FISHERY
☐ LWWF = LIMITED WARMWATER FISHERY

☐ DWS = DOMESTIC WATER SUPPLY
☐ PC = PRIMARY CONTACT
☐ IRR = IRRIGATION
☐ LW = LIVESTOCK WATERING
☐ WH = WILDLIFE HABITAT

Fish culture, secondary contact and municipal and industrial water supply and storage are also designated in particular stream reaches where these uses are actually being realized. However, no numeric standards apply uniquely to these uses.

REACH NAME:

SEGMENT NUMBER:
BASIN:
PARAMETER:

STAFF MAKING ASSESSMENT:
DATE:

CODES FOR SOURCES OF NONSUPPORT (CHECK ALL THAT APPLY)

☐ 0100 INDUSTRIAL POINT SOURCES

☐ 0200 MUNICIPAL POINT SOURCES
☐ 0201 DOMESTIC POINT SOURCES

☐ 0400 COMBINED SEWER OVERFLOWS

☐ 1000 AGRICULTURE
☐ 1100 NONIRRIGATED CROP PRODUCTION
☐ 1200 IRRIGATED CROP PRODUCTION
☐ 1201 IRRIGATED RETURN FLOWS
☐ 1300 SPECIALTY CROP PRODUCTION (e.g., truck farming and orchards)
☐ 1400 PASTURELAND
☐ 1500 RANGELAND
☐ 1600 FEEDLOTS - ALL TYPES
☐ 1700 AQUACULTURE
☐ 1800 ANIMAL HOLDING/MANAGEMENT AREAS
☐ 1900 MANURE LAGOONS

☐ 2000 SILVICULTURE
☐ 2100 HARVESTING, RESTORATION, RESIDUE MANAGEMENT
☐ 2200 FOREST MANAGEMENT
☐ 2300 ROAD CONSTRUCTION or MAINTENANCE

☐ 3000 CONSTRUCTION
☐ 3100 HIGHWAY/ROAD/BRIDGE
☐ 3200 LAND DEVELOPMENT
☐ 3201 RESORT DEVELOPMENT
☐ 3300 HYDROELECTRIC

☐ 4000 URBAN RUNOFF/STORM SEWERS

☐ 5000 RESOURCES EXTRACTION
☐ 5100 SURFACE MINING
☐ 5200 SUBSURFACE MINING
☐ 5300 PLACER MINING
☐ 5400 DREDGE MINING
☐ 5500 PETROLEUM ACTIVITIES
☐ 5501 PIPELINES
☐ 5600 MILL TAILINGS
☐ 5700 MINE TAILINGS
☐ 5800 ROAD CONSTRUCTION/MAINTENANCE 8400
☐ 5900 SPILLS

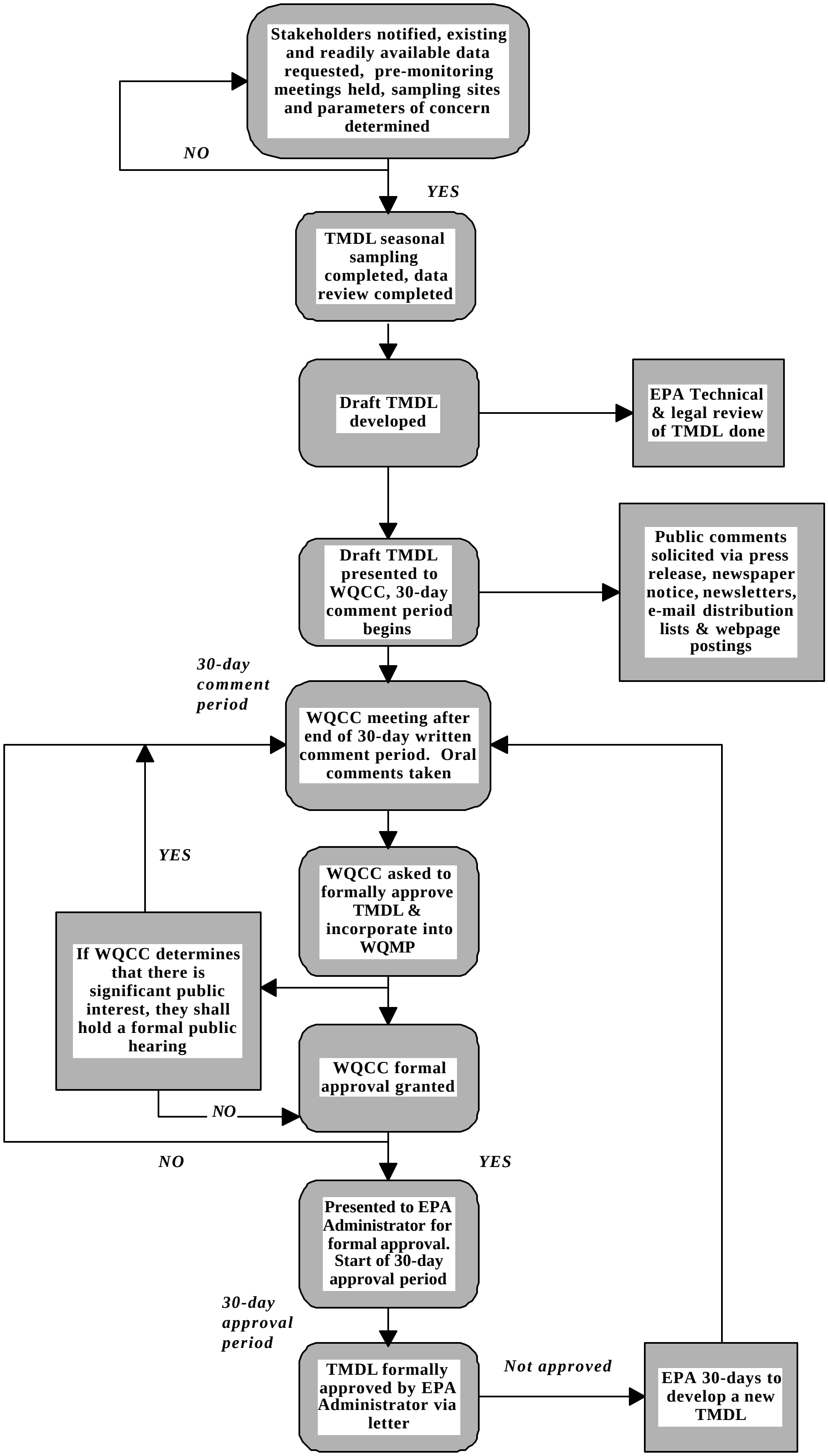
☐ 6000 LAND DISPOSAL
☐ 6100 SLUDGE
☐ 6200 WASTEWATER
☐ 6300 LANDFILLS
☐ 6400 INDUSTRIAL LAND TREATMENT
☐ 6500 ONSITE WASTEWATER SYSTEMS (septic tanks, etc.)
☐ 6600 HAZARDOUS WASTE
☐ 6700 SEPTAGE DISPOSAL
☐ 6800 UST LEAKS

☐ 7000 HYDROMODIFICATION
☐ 7100 CHANNELIZATION
☐ 7200 DREDGING
☐ 7300 DAM CONSTRUCTION/REPAIR
☐ 7400 FLOW REGULATION/MODIFICATION
☐ 7500 BRIDGE CONSTRUCTION
☐ 7600 REMOVAL OF RIPARIAN VEGETATION
☐ 7700 STREAMBANK MODIFICATION OR DESTABILIZATION
☐ 7800 DRAINING/FILLING OF WETLANDS

☐ 8000 OTHER
☐ 8010 VECTOR CONTROL ACTIVITIES
☐ 8100 ATMOSPHERIC DEPOSITION
☐ 8200 WASTE STORAGE/STORAGE TANK LEAKS
☐ 8300 ROAD MAINTENANCE or RUNOFF
☐ 8400 SPILLS
☐ 8500 IN-PLACE CONTAMINANTS
☐ 8600 NATURAL
☐ 8700 RECREATIONAL ACTIVITIES
☐ 8701 ROAD/PARKING LOT RUNOFF
☐ 8702 OFF-ROAD VEHICLES
☐ 8703 REFUSE DISPOSAL
☐ 8704 WILDLIFE IMPACTS
☐ 8705 SKI SLOPE RUNOFF
☐ 8800 UPSTREAM IMPOUNDMENT
☐ 8900 SALT STORAGE SITES

☐ 9000 SOURCE UNKNOWN

Appendix E: Public Participation Flow Chart



Appendix F: Response to Comments

To be completed later.