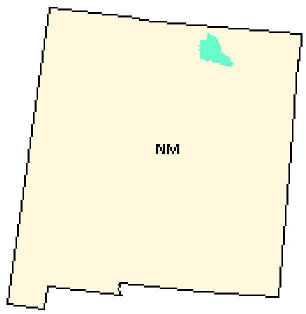
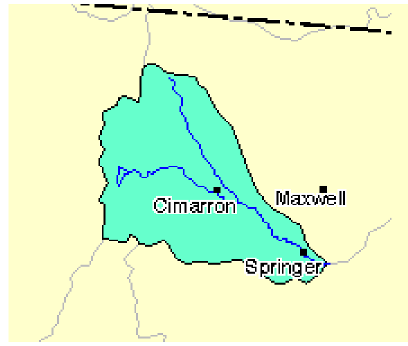
TOTAL MAXIMUM DAILY LOAD FOR TURBIDITY, STREAM BOTTOM DEPOSITS, AND TOTAL PHOSPHORUS
In the Canadian River Basin (Cimarron)





Summary Table

New Mexico Standards Segment	Canadian River, 2306
Waterbody Identifier	•Cieneguilla Creek from the inflow to Eagle Nest Lake to the headwaters (CR2-50000) 13.6 mi. •Six-Mile Creek from the inflow to Eagle Nest Lake to the headwaters (CR2-40000) 6.6 mi. •Moreno Creek from the inflow to Eagle Nest Lake to the headwaters (CR2-30000) 14.4 mi. •North Ponil Creek from the confluence with South Ponil Creek to the mouth of M^{c}Crystal Creek (CR2-10400) 17.6 mi.
Parameters of Concern	Stream Bottom Deposits, Turbidity, Total Phosphorous
Uses Affected	High Quality Coldwater Fishery
Geographic Location	Canadian River Basin (Cimarron)
Scope/size of Watershed	1032 mi^2 (Cimarron)/ 225 mi^2 (TMDL area)
Land Type	Ecoregions: Southern Rockies (210, 211) Southwestern Tablelands (260, 261)
Land Use/Cover	Forest (51%), Rangeland (38%), Agriculture (9%), Urban (1.4%), Water (0.6%)
Identified Sources	Streambank Modification/Destabilization, Rangeland, Unknown
Watershed Ownership	Private (89%), Forest Service (9%), State (2%)
Priority Ranking	4
Threatened and Endangered Species	None
TMDL for: Turbidity (as TSS) Moreno Creek Six-Mile Creek Cieneguilla Creek North Ponil Creek Stream Bottom Deposits Cieneguilla Creek North Ponil Creek Total Phosphorus North Ponil Creek	 WLA(0) + LA(3160) + MOS(1054)= **4214 lbs/day** WLA(0) + LA(1144) + MOS(381)= **1525 lbs/day** WLA(0) + LA(4750) +MOS(1584)= **6334 lbs/day** WLA(0) + LA(1258) +MOS(420)= **1678 lbs/day** WLA(0) + LA (15) + MOS(5)= **20 % fines** WLA(0) + LA(15) + MOS(5)= **20 % fines** WLA(0) + LA(4) + MOS(1.4)= **5.4 lbs/day**

Table of Contents

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop TMDL management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body 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 and natural background conditions.

The Cimarron River Basin is a sub-basin of the Canadian River Basin, located in northeastern New Mexico. Stations were located throughout the basin to evaluate the impact of tributary streams and to establish background conditions. As a result of this monitoring effort, several exceedances of New Mexico water quality standards for turbidity were documented on Cieneguilla Creek from the inflow to Eagle Nest Lake to the headwaters (13.6 mi.), Six-Mile Creek from the inflow to Eagle Nest Lake to the headwaters (6.6 mi.), Moreno Creek from the inflow to Eagle Nest Lake to the headwaters (14.4 mi.), and North Ponil Creek from the confluence with South Ponil Creek to the mouth of McCrystal Creek (17.6 mi.). An exceedance of New Mexico water quality standards for total phosphorus was documented on North Ponil Creek from the confluence with South Ponil Creek to the mouth of McCrystal Creek (17.6 mi.). Some level of impairment due to embeddedness was seen on both reaches listed for stream bottom deposits, Cieneguilla Creek from the inflow to Eagle Nest Lake to the headwaters (13.6 mi.) and North Ponil Creek from the confluence with South Ponil Creek to the mouth of McCrystal Creek (17.6 mi.). This Total Maximum Daily Load (TMDL) document addresses these three constituents.

A general implementation plan for activities to be established in the watershed is included in this document. The Surface Water Quality Bureau's Nonpoint Source Pollution Sections 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 generated. 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 what quality standards have been achieved, the reach will be removed from the TMDL list.

List of Abbreviations

BMP	**Best Management Practice**
CFS	**Cubic Feet per Second**
CWA	**Clean Water Act**
CWAP	**Clean Water Action Plan**
CWF	**Coldwater Fishery**
EPA	**Environmental Protection Agency**
FS	**United States Department of Agriculture Forest Service**
HQCWF	**High Quality Coldwater Fishery**
ISI	**Interstitial Space Index**
LA	**Load Allocation**
MGD	**Million Gallons per Day**
mg/L	**Milligrams per Liter**
MOS	**Margin of Safety**
MOU	**Memorandum of Understanding**
NMED	**New Mexico Environment Department**
NMSHD	**New Mexico State Highway and Transportation Department**
NPDES	**National Pollutant Discharge Elimination System**
NPS	**Nonpoint Source**
NTU	**Nephelometric Turbidity Units**
SBD	**Stream Bottom Deposits**
SWQB	**Surface Water Quality Bureau**
TMDL	**Total Maximum Daily Load**
TSS	**Total Suspended Solids**
UWA	**Unified Watershed Assessment**
WLA	**Waste Load Allocation**
WQLS	**Water Quality Limited Segment**
WQCC	**New Mexico Water Quality Control Commission**
WQS	**Water Quality Standards**

Background Information

The Cimarron River Basin is a sub-basin of the Canadian River Basin, located in northeastern New Mexico. This 1032 $mi.^2$ watershed is dominated by both forest and rangeland (Figure 1) on mostly private land. Cieneguilla Creek from the inflow to Eagle Nest Lake to the headwaters (13.6 mi.), Six-Mile Creek from the inflow to Eagle Nest Lake to the headwaters (6.6 mi.), and Moreno Creek from the inflow to Eagle Nest Lake to the headwaters (14.4 mi.) all drain into Eagle Nest Lake at the western side of the watershed on mostly private land. North Ponil Creek from the confluence with South Ponil Creek to the mouth of McCrystal Creek (17.6 mi.) is located on the northern part of the watershed on US Forest Service and private land.

Surface water quality monitoring stations were used to characterize the water quality of the stream reaches (see Figure 2). Stations were located to evaluate the impact of tributary streams and to establish background conditions. As a result of this monitoring effort, several exceedances of New Mexico water quality standards for turbidity were documented on these streams flowing into Eagle Nest Lake. On the North Ponil reach, exceedances of New Mexico water quality standards for turbidity and total phosphorus were documented. Stream bottom deposits were assessed using techniques in the draft New Mexico Sediment Protocol (NMED 1999b). Some level of impairment due to embeddedness was seen on both reaches listed for stream bottom deposits, Cieneguilla Creek and North Ponil Creek.

Endpoint Identification

Target Loading Capacity

Target values for turbidity, stream bottom deposits and total phosphorus 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.

Turbidity

The State's standard leading to an assessment of use impairment is the numeric criteria for turbidity of 25 NTU for a High Quality Coldwater Fishery (HQCWF). Turbidity levels are inferred from studies which monitor total suspended sediment (TSS) concentrations. Extrapolation from these studies is possible because of the relationship between concentrations of suspended sediments and turbidity. Activities that generate varying amounts of suspended sediment will proportionally change or affect turbidity (USEPA 1991). In this watershed both total suspended sediment (TSS) and turbidity were measured. A strong correlation (R^2=0.84) was found between TSS and turbidity (Appendix A).

Stream Bottom Deposits

Surface Water Quality Bureau (SWQB) has combined techniques to measure the level of embeddedness of a stream bottom in a SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) in order to address the narrative criteria for stream bottom deposits (SBD). The purpose of the Protocol is to provide a reproducible quantification of the narrative criteria for stream bottom deposits (SBD).

Figure 1

Figure 2

The impact of fine sediment deposits is well documented in the literature. USEPA (1991) states that "An increased sediment load is often the most important adverse effect of ....activities on streams." This impact is mediated through the reduction in available habitat for macroinvertebrates and fish species which utilize the streambed in various life stages. An increase in suspended sediment concentration will reduce the penetration of light, decreases the ability of fish on fingerlings to capture prey, and reduce primary production (US EPA 1991). The SWQB Sediment Workgroup evaluated a number of methods described in the literature that would provide information allowing a direct assessment of the impacts to the stream bottom substrate. A final list of monitoring procedures was implemented at a wide variety of sites during the 1998 monitoring season. These procedures included conducting pebble counts (a measurement of % fines), stream bottom cobble embeddedness, Rosgen (1996) geomorphology, and various biological measures.

The SWQB examined two ways to base the target levels for stream bottom deposits. The first is the nominal stream morphology for the specific stream type (Rosgen 1996). Using this Rosgen approach, data collection at each impaired site included an evaluation of the stream geomorphology. Cieneguilla Creek was determined to be an E5 stream type and North Ponil Creek an E4 stream type. Figures from Rosgen (1996) show the derivation of percent fines give target values for an E4 stream type of 27.7% and for an E5 stream type of 60.4%. The disadvantage of Rosgen's approach is that it is not based on streams in New Mexico and is based on the existing condition of a stream, not a desired or "natural" stream type.

The second methodology chosen to estimate target levels involved the examination of developed relationships between embeddedness, fines, and biological score. Evaluation of data collected at various locations in New Mexico showed a relationship (R^2=0.7511) between embeddedness and the biological score results from the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) sampling from 1998 (Appendix B). A correlation (R^2= 0.7199) was also found between embeddedness and percent fines (Appendix B). These relationships show that at the desired biological score (at least 70, per the SWQB Assessment Protocol, 1998) the target maximum embeddedness (for fully supporting a designated use) would be 45%, and the target fines would be 20%. Since this relationship is based on New Mexico streams it was chosen for the target value for percent fines.

Results from biological sampling at each sampling site are used to support the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) results. In this case, Cieneguilla Creek at the USGS gage scored a loss in EPT (Ephemeroptera, Plecoptera, Tricoptera) taxa compared to its reference site, and was rated as partially supporting its designated use for biological quality. Decreases in the EPT taxa are most likely due to increased sedimentation from upstream inputs to this site. The macroinvertebrate community at the North Ponil Creek site was similar to its reference site, and was rated as being fully supporting for biological quality.

Total Phosphorus

The standard leading to an assessment of use impairment is the numeric criterion for total phosphorus (TP) of 0.1 mg/L for a HQCWF.

Due to sorbtion characteristics phosphorus loads may be closely linked to sediment loads. This is the case in this watershed; a strong correlation (R^2=.89) was seen between turbidity and total phosphorus (Appendix C). Given attainment of the standard for turbidity (25 NTU) the total phosphorus level would calculate to approximately 0.05 mg/L. This is one half the current standard for total phosphorus. This standard is under review in New Mexico's Triennial review process, and may be changed to 0.1 mg/L, which would be used only as an indicator of possible nutrient enrichment. The Triennial review process is expected to conclude during fall of 1999.

Flow

Sediment movement in a stream varies as a function of flow. As flow increases the concentration of sediment increases. This TMDL is calculated for each reach at a specific flow. When available, US Geologic Survey gages are used to estimate flow. Where gages are absent, geomorphological cross sectional information is taken at each site and the flows are modeled. 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 the target load will vary based on the changing flow. Management of the load should set a goal at water quality standards attainment not meeting the calculated target load.

Calculations

Target loads for turbidity (expressed as TSS) and total phosphorus are calculated based on a flow, the current water quality standards, and a unit less conversion factor, 8.34 that is a used to convert mg/L units to lbs/day (see Appendix D for Conversion Factor Derivation). The target loading capacity is calculated using Equation 1.

Equation 1. critical flow (mgd) x standard (mg/L) x 8.34 (conversion factor) = target loading capacity

The target loads (TMDLs) predicted to attain standards were calculated using Equation 1 and are shown in Table 1.

Table 1: Calculation of Target Loads

Location	Flow (mgd)	Standards			Conversion Factor	Target Load Capacity
		TSS* (mg/L)	Stream Bottom Deposits (%fines)	Total Phosphorus (mg/L)		
Moreno	16.3+	31			8.34	4214 (lbs/day)
Six-Mile	5.9‡	31			8.34	1525 (lbs/day)
Cieneguilla	24.5+	31	None		8.34	6334 (lbs/day) 20%fines**
North Ponil	6.49^	31	None	0.1	8.34 8.34	1678 (lbs/day) 20%fines** 5.4 (lbs/day)

+Flow is the greatest monthly mean flow at each location from 1928-1993 (USGS 1994).
‡Flow is the greatest monthly mean flow at each location from 1958-1993 (USGS 1994).
^Since a USGS gage was unavailable on this reach, flow is modeled using cross sectional data that is used to estimate stream discharge using USGS Technical paper 2193 (USGS 1982) and the channel cross-section analyzer WinXSPRO® (USDA-FS 1998).

*This value is calculated using the relationship established between TSS and turbidity (y=.7973x) R^2=0.841 (Appendix A). The turbidity standard is 25 NTU.
** The background values for stream bottom deposits were taken from the NMED Draft Sediment Protocol for the Assessment of Stream Bottom Deposits (1999b).

The measured loads were calculated using Equation 1. The flows used were either taken directly from a USGS gage or from field measurements. The geometric means of the data that exceeded the standards from the data collected at each site was substituted for the standard in Equation 1. The same conversion factor of 8.34 was used. Results are presented in Table 2.

Background loads were not possible to calculate in this watershed. A reference reach, having similar stream channel morphology and flow, was not found. 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.

Table 2: Calculation of Measured Loads

Location	Flow	Geometric Mean		Conversion	Measured
□	(mgd) □	TSS*□(mg/L)	TP□(mg/L)	Factor□	Load□(lbs/day)
Moreno	12.7†	133		8.34	14087
Six-Mile	6.2†	81.2		8.34	4199
Cieneguilla	26.4†	32		8.34	7046
North Ponil	6.71^	209.3	□0.17	8.34□8.34	11713 9.5

† Flow is the geometric mean of USGS daily gaged flows taken on days samples were collected.
^ Since a USGS gage was unavailable on this reach, flow is modeled using cross sectional data that is used to estimate stream discharge using USGS Technical paper 2193 (USGS 1982) and the channel cross-section analyzer WinXSPRO® (USDA-FS 1998).
*TSS measured during critical condition (spring sampling) were used to calculate these values.

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, background, and margin of safety (MOS) were subtracted from the target capacity (TMDL) following Equation 2.

Equation 2. $WLA + LA + MOS = TMDL$

Results are presented in Table 3a (Calculation of TMDLs for Turbidity), Table 3b (Calculation of TMDLs for Stream Bottom Deposits), and Table 3c (Calculation of TMDLs for Total Phosphorus).

Table 3a: Calculation of TMDL for Turbidity

Location	WLA (lbs/day)	LA (lbs/day)	MOS (25%) (lbs/day)	TMDL (lbs/day)
Moreno	0	3160	1054	4214
Six-Mile	0	1144	381	1525
Cieneguilla	0	4750	1584	6334
North Ponil	0	1258	420	1678

Table 3b: Calculation of TMDL for Stream Bottom Deposits

Location	WLA (% fines)	LA (% fines)	MOS (25%) (% fines)	TMDL (% fines)
Cieneguilla	0	15	5	20
North Ponil	0	15	5	20

Table 3c: Calculation of TMDL for Total Phosphorus

Location	WLA (lbs/day)	LA (lbs/day)	MOS (25%) (lbs/day)	TMDL (lbs/day)
North Ponil	0	4	1.4	5.4

Table 4: Calculation of Load Reductions

Location	Target Load			Measured Load			Load Reduction		
	TSS (lbs/day)	SBD (%fines)	TP (lbs/day)	TSS (lbs/day)	SBD (% fines)	TP (lbs/day)	TSS (lbs/day)	SBD (% fines)	TP (lbs/day)
Moreno	4214 (TLC) – 1054 (MOS) = **3160**			14087			14087 (ML) – 3160 (TL)= **10927**		
Six-Mile	1525 (TLC) – 381 (MOS) = **1144**			4199			4199 (ML) – 1144 (TL) = **3055**		

Cieneguilla	6334 (TLC) – 1584 (MOS) = **4750**	20		7046	65		7046 (ML) – 4750 (TL) = **2296**	45	
North Ponil	1678 (TLC) – 420 (MOS) = **1258**	20	5.4	11713	63	9.5	11713 (ML) – 1258 (TL) = **10455**	43	4.1

The following calculations were used to determine *actual* load reductions:

Target Load = target load capacity (TLC) – margin of safety (MOS)
Load Reduction = measured load (ML) – target load (TL)

Identification and Description of pollutant source(s)

Table 5: Pollutant Source Summary

Pollutant Sources	Magnitude (WLA + LA + MOS)	Location	Potential Sources (% from each)
Point: None	0	--------	0
Nonpoint:			100%
•Sediment			
Turbidity (as TSS in lbs/day)	4214	Moreno	Streambank Modification/Destabilization and Unknown
	1525	Six-Mile	Streambank Modification/Destabilization and Rangeland
	6334	Cieneguilla	Streambank Modification/Destabilization
	1678	North Ponil	Streambank Modification/Destabilization
Stream Bottom Deposits (% fines)	20	Cieneguilla	Streambank Modification/Destabilization
	20	North Ponil	Streambank Modification/Destabilization
•Total Phosphorus (lbs/day)	5.4	North Ponil	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.

SWQB fieldwork includes an assessment of the potential sources of impairment (SWQB/NMED 1999b). 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.

Cieneguilla Creek

The main source of impairment on this reach appears to be the improper installation and maintenance of culverts. This has led to serious streambank destabilization and has altered the geomorphology of the stream near roads. SWQB will continue to monitor bank pins that were installed in the fall of 1998 in order to evaluate the amount of bank erosion occurring along Cieneguilla Creek that may be attributable to these culverts. Recreation in this area is associated with the development of resort areas in the watershed. These activities may result in erosion from ski slopes, parking areas, road construction and maintenance, and land development. Allocation of loads across these varied sources is problematic.

Six-Mile Creek
The main source of impairment along this reach is streambank destabilization. According to results from the Pollutant Source Summary it is estimated that this impairment is most likely due to removal of over 95% of the riparian vegetation (except for short grass) and the extensive grazing of rangeland along this reach. The land surrounding this creek is privately owned.

Moreno Creek
This creek is predominantly impaired due to streambank destabilization as well as an unknown source. There is a gravel operation located about a half mile upstream of the sampling station that may have some inputs into the creek. This land is privately owned; access for sampling is restricted. SWQB is investigating whether this gravel operation is subject to any permitting, such as 401, 404, or NPDES.

North Ponil Creek
In 1996 the US Forest Service removed a fishing pond that had been established some years earlier. It appears that the stream was not restored to its natural geomorphology, therefore causing serious streambank destabilization.

<u>Margin of Safety (MOS)</u>
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 **25%** of the TMDL, excluding the background. This margin of safety incorporates several factors:

•*Errors in calculating NPS loads*

A level of uncertainty exists in the relationship between TSS and turbidity. In this case, the TSS measurements do not include bedload and therefore do not account for a complete measure of sediment load. This does not influence the MOS since the only concern is the turbidity portion of the sediment load, which is the basis for the standard. Accordingly, a conservative margin of safety increases the TMDL by **25%**.

•*Errors in calculating flow*

Flow estimates were based primarily on USGS gages. Conservative values were used to calculate loads and do not warrant additional MOS.

<u>Consideration of seasonal variation</u>
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. Since the critical condition is set to the highest flows, data where exceedances were seen (primarily during high flows) were used in the calculation of the measured loads.

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 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.

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 1998).

Pebble counts are used to develop a particle size distribution curve of the bed surface material. The measurement method described by Wolman (1954) was selected for inclusion in the parameter suite evaluated during the sample season.evaluation during the 1998 sample season. The advantage of this procedure is relatively quick to perform and is reproducible. In streams dominated by fine sediments, coarser particles that provide beneficial habitat tend to become surrounded or buried in fines leading to a loss of suitable habitat. Cobble embeddedness is a measure of the extent to which these coarser particles are buried by the finer sediments and has both biological and physical significance (USEPA 1991). The sampling procedure chosen for New Mexico streams is that devised by Skille and King (1989). This technique uses 60-cm diameter hoops as the basic sampling unit. The use of hoops rather than individual particles as the basic unit of measure reduces the variability of the sample. Software obtained from the Idaho Bureau of Reclamation allows for the evaluation of the data (Burton 1990). Values calculated and reported by the software are percent embeddedness, the Interstitial Space Index (ISI), and percent free matrix cobble. Also available in the software is a sample size evaluator that helps in determinations of whether sufficient sample size has been collected to statistically define the population. The advantage of this procedure is that it is quantifiable. The major disadvantage is in the substantial effort required to complete the data collection.

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 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:

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

It should be noted that a basin will not be ignored during its four 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 identified problems, and TMDLs will be developed and implement. 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, Chama (above El Vado), Cimarron (above Springer), Santa Fe River, San Francisco
1999 - Chama (below El Vado), middle Rio Grande, Gila, Red River
2000 - Mimbres, Dry Cimarron, upper Pecos (headwaters to Ft. Sumner), upper Rio Grande (part1)
2001 - Upper Rio Grande (part 2), lower Pecos (Roswell south), Closed Basins, Zuni
2002 - Canadian Basin, lower Rio Grande, San Juan, Rio Puerco

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, siting criteria, operating methods, or other alternatives" (USEPA 1993). A combination of best management practices (BMPs) will be used to implement this TMDL. For this watershed the focus will be on sediment control, which in the case of North Ponil Creek will subsequently control total phosphorus levels. On North Ponil Creek the SWQB will begin working with the US Forest Service (under the existing MOU) to remediate a small pond area along McCrystal Creek, which is the presumptive source of sediment problems in this reach. BMPs in this area will include riparian restoration and geomorphological rehabilitation in the McCrystal Creek area (which flows directly into North Ponil Creek). Good range management will be encouraged along the entire

reach of North Ponil Creek. Along the other river reaches that enter Eagle Nest Lake several types of BMPs should be implemented. SWQB will work with private land owners and the local and state highway departments in this area to encourage the implementation of BMPs such as: riparian restoration, repair and maintenance of culverts, erosion control mechanisms, streambank stabilization, and road maintenance. A nonpoint source project, funded with money provided by §319 of the Clean Water Act, is scheduled to start in 1999 on Angle Fire Resort property. The goal of this project is to increase vegetative cover of the ski slopes as a means of reducing erosion.

Stakeholder and public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholder participation will include choosing and installing BMPs, as well as potential volunteer monitoring. Stakeholders in this process will include: SWQB, US Forest Service, New Mexico State Highway Department, local government, private land owners, environmental groups, Angel Fire Ski Area, and the general public.

Other studies are ongoing throughout this watershed. A §319 project designed to establish sediment rating curves should be completed in the next few years. Bank pins were also installed in fall of 1998 to examine the bank erodibility in several locations throughout the watershed. Information derived from these studies, as well as SWQB continued monitoring efforts, will be used in the determination and implementation of BMPs in the watershed.

Time Line

Implementation Actions	**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

Assurances

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.

Nonpoint source water quality improvement work utilizes the voluntary approach. This provides technical support and grant money for the implementation of best management practices and other NPS prevention mechanisms through §319 of the Clean Water Act. Since this TMDL will be implemented through NPS control mechanisms the New Mexico Nonpoint Source Program is targeting efforts to this and other watersheds with TMDLs. The Nonpoint Source 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.

In order to ensure reasonable assurances for implementation in watersheds with multiple landowners, including Federal, State and private, NMED has established MOUs with several Federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other State agencies, such as the New Mexico Highway Department. These MOUs provide for coordination and consistency in dealing with nonpoint source issues.

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 list for 1996 and 1998 approved by EPA. The State has given a high priority for funding assessment and restoration activities to these watersheds.

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. The cooperation of private landowners and federal agencies, particularly the USDA Forest Service, will be pivotal in the implementation of this TMDL.

Milestones

Milestones will be used to determine if control actions are being implemented and standards attained. For this TMDL several milestones will be established that will vary based on the BMPs implemented at each site. Examples of milestones include a percentage reduction in stream bottom deposits within a certain time frame, update or develop MOUs with other state and federal agencies by 2001 to ensure protection and restoration in this watershed, and to increase education and outreach activities regarding sediment erosion in this watershed, particularly for private landowners.

Milestones will be reevaluated periodically, depending on what BMP was implemented. Further implementation of this TMDL will be revised based on this reevaluation. The process will involve: monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and reevaluating the TMDL for attainment of water quality standards.

Public Participation

Public participation was solicited in development of this TMDL. See Appendix F for flow chart of the public participation process. The draft TMDL was made available for a 30-day comment period starting June 8, 1999. Response to comments is attached as Appendix G of this document. The draft document notice of availability were extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us/) and press releases to area newspapers.

References Cited

Burton, T. and G. Harvey. 1990. Estimating intergravel salmonid living space using the cobble embeddedness sampling procedure. Report No. 2. Idaho Department of Health and Welfare, Division of Environmental Quality, Water Quality Bureau.

Forest Guardians and Southwest Environmental Center v. Carol Browner, Administrator, US EPA, Civil Action 96-0826 LH/LFG, 1997.

Skille and King. 1989. Proposed cobble embeddedness sampling procedure. Unpublished paper available from the USDA for. Serv., Intermount. Res. Sta. Boise, ID.

SWQB/NMED. 1999a. SWQB/NMED Draft Protocol for the Assessment of Stream Bottom Deposits.

SWQB/NMED. 1999b. Draft Pollutant Source Documentation Protocol.

SWQB/NMED. 1998. State of New Mexico Procedures for Assessing Standards Attainment for 303(d) List and 305(b) Report Assessment Protocol

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO. pp 5-131-136.

USDA-FS. 1998. WinXSPRO A channel Cross-Section Analyzer. West Consultants Inc. San Diego, CA.

USEPA. 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. EPA-840-B-92-002. Washington, D.C.

USEPA. 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. EPA-910-9-91-001. Seattle, WA.

USGS. 1994. Water Resources Data New Mexico Water Year 1993. Data Report NM-93-1. Albuquerque, NM.

USGS. 1983. Streamflow Characteristics Related to Channel Geometry of Streams in Western United States. Water Supply Paper 2193. Albuquerque, NM. 17pp.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of American Geophysical Union 35:951-956.

Appendices

Appendix A: Relationship between Total Suspended Sediment and Turbidity

Appendix B SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) Relationships

Appendix C: Relationship between Turbidity and Total Phosphorus

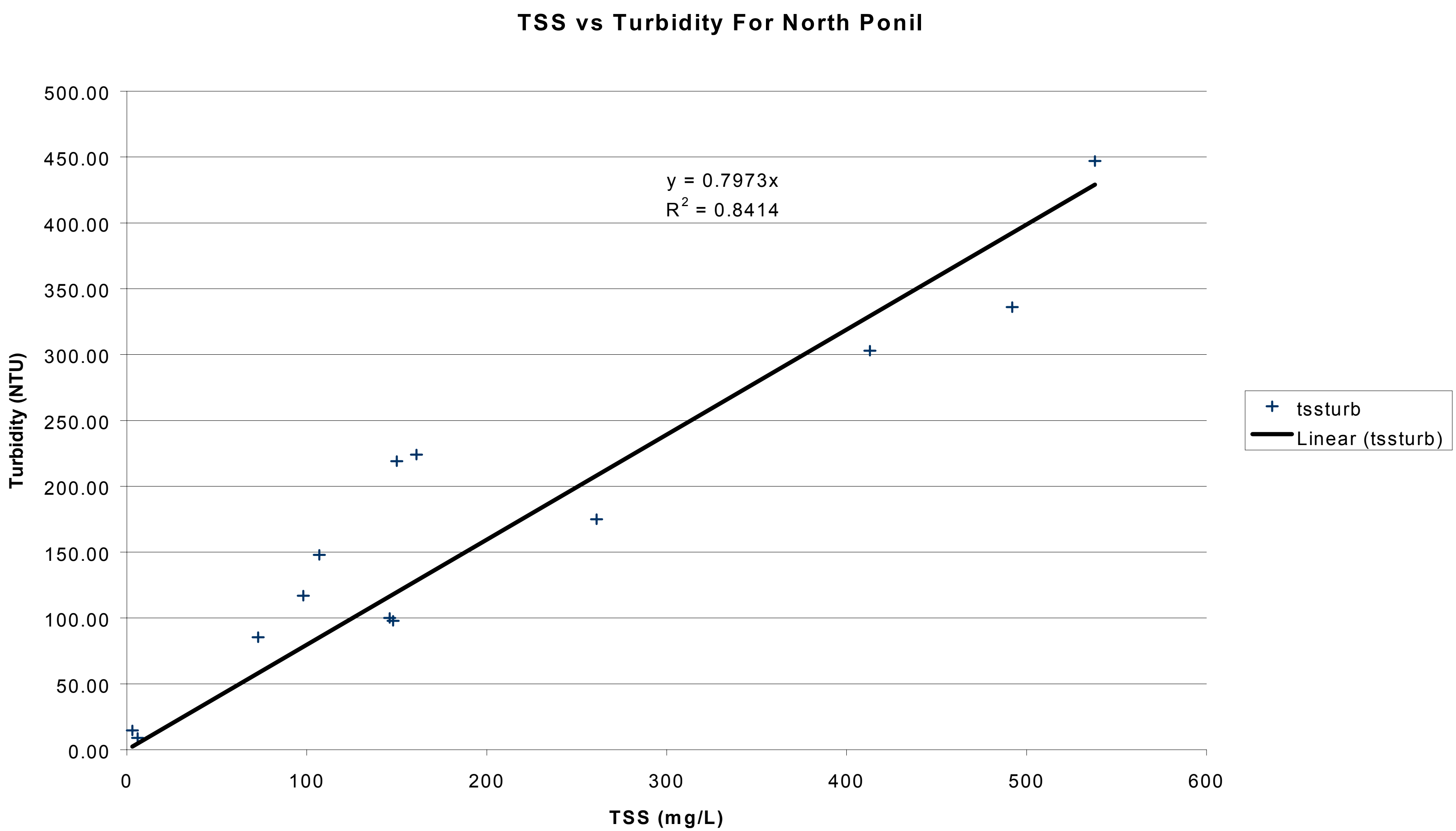
Appendix D: Conversion Factor Derivation

Appendix E: Pollutant Source(s) Documentation Protocol

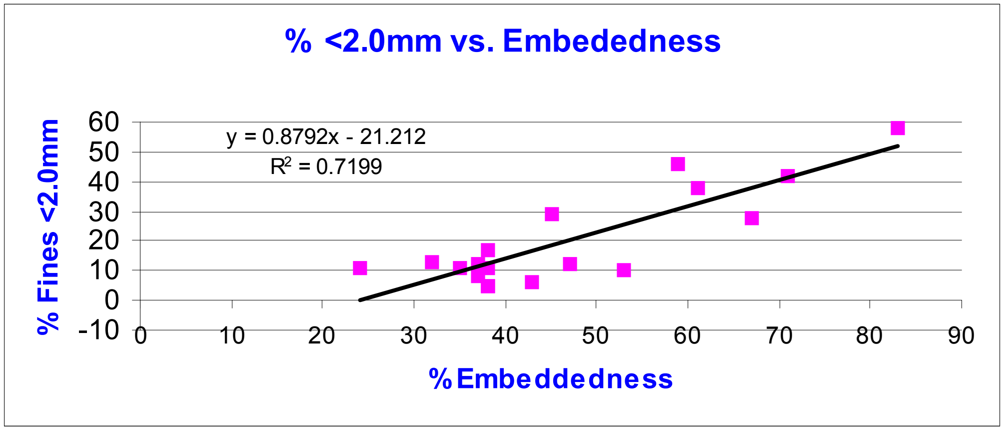
Appendix F: Public Participation Process Flowchart

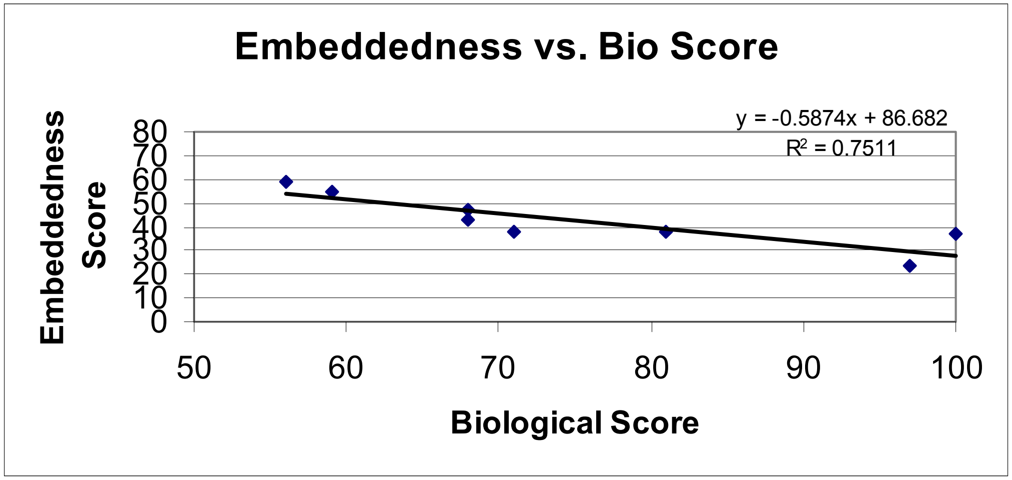
Appendix G: Response to Comments

Appendix A: Relationship between Total Suspended Sediment and Turbidity

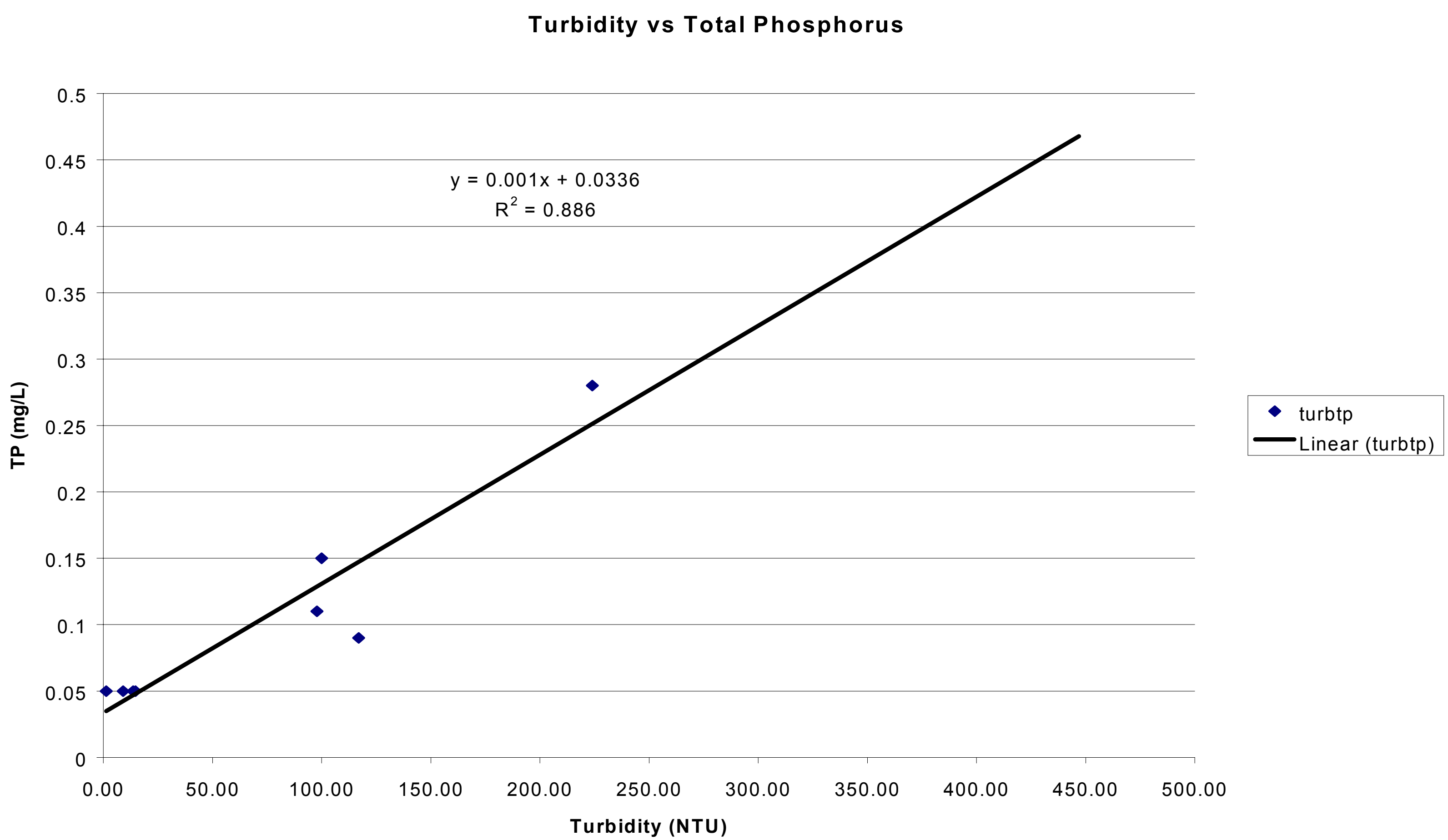


Appendix B: SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) Relationships





Appendix C: Relationship between Turbidity and Total Phosphorus



Appendix D: 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**

POLLUTANT SOURCE(S) DOCUMENTATION PROTOCOL

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 35mm camera that has time/date photo stamp on it. **DO NOT USE A DIGITAL CAMERA FOR THIS PHOTODOCUMENTATION**

4). 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.

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

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

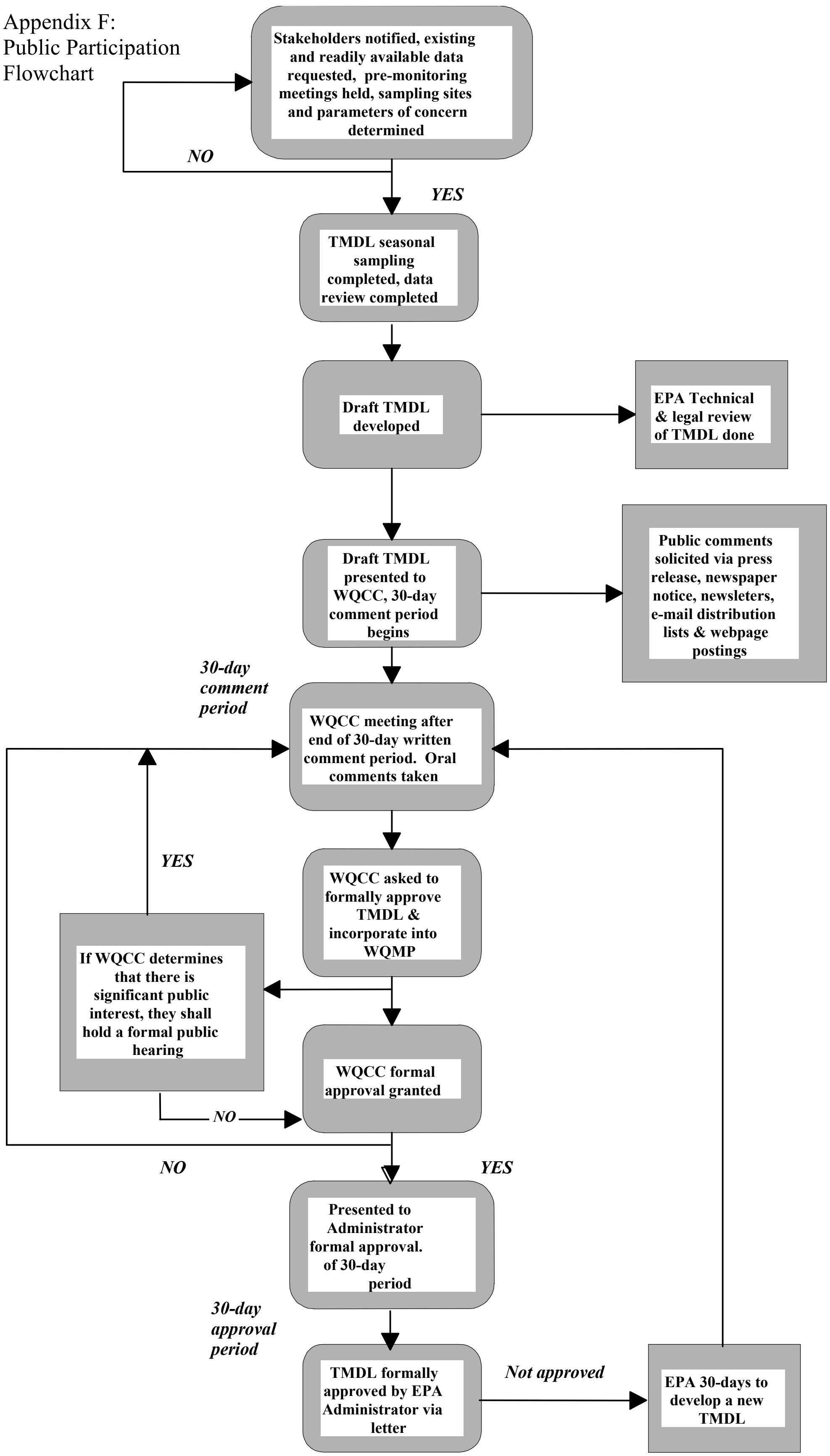
7). Photodocument probable source(s) of pollutant.

8). Create a folder for the TMDL 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.

Appendix E: Cont.

Appendix F:
Public Participation
Flowchart



Appendix G: Response to Comments

In response to the Draft Total Maximum Daily Loading document for the Canadian River Basin, issued June 8, 1999, the Carson National Forest would like to offer the following comments.

C Public Notification – typically correspondence between the State Environment Department and the Forest is conducted in a formal manner with hard copy letters sent to the Forest Supervisor or District Ranger. An E-mail notification was sent out via mailing list announcing the draft of this document but it was not clearly stated in that electronic message that this was the only notification that would be made. We feel that a formal hard copy transmittal is appropriate. While the use of electronic mail and document distribution via web sites is becoming more prevalent in this day and age, we feel it is still appropriate to formally transmit this type of information in a traditional manner, especially if you are seeking comment to a document of this type.

R The public notification process for TMDLs is extensive. The announcements of availability for the 30-day public comment period go out via email, in several newspapers and to those on the WQCC mailing list. Although we understand that this may not be the most convenient for everyone, the SWQB has been moving towards a "paperless" workplace and it has not been our practice to mail copies of the document to each individual on these lists. The SWQB will address the Forest Service's desire for a more "formal process" through the use of the existing liaison from the Forest Service to SWQB. Hard copies of the TMDLs will be provided to the liaison for distribution to the Forest Service Ranger District(s) concerned.

C Document Readability – the TMDL document is not particularly "reader friendly" in that it uses many technical terms that are not understood quickly and easily by the public at large. Technical terms, when used, should be defined and referenced either in the body of the text or in a glossary of terms at the end of the document. In addition, many assumptions are made which serve as the basis for your conclusions and these assumptions and their sources are not clearly defined or explained within the context of their use in this document.

R The SWQB agrees that this document is somewhat technical in nature. It was necessary to strike a balance between "readability" and technical accuracy throughout the document. It is understandable that this document may not be "understood quickly and easily by the public at large." In order to provide an opportunity to ensure public understanding of not only the document but the entire TMDL process, the SWQB provided a forum for clarification and discussion of the TMDL in the watershed in the form of a public meeting held in Angel Fire June 16, 1999. It was unfortunate that no Forest Service representatives were able to attend this meeting. Without more specific instances where clarification in the document is needed it is difficult to address this comment.

C Land use/cover and Cimarron (sic) watershed Figures (1 and 2) – these two figures display various types of information without citation as tot he source of the information (ie – land cover and use Southern Rockies – Eco #210, etc.). Also, Figure 1 displays "TMDL segments" with a bold line type indicating various stream segments of interest but Figure 2 does not display the same stream segments with this bold line type in all cases. This is confusing from the standpoint of what these two figures are intended to display or not display.

R The two figures have been updated to address your concern. Both figures now show the Impaired Reaches (in pink) that are being addressed in this document.

C Rosgen Stream type and stream bottom deposits – on page 4 of the document there is a discussion of Rosgen type for Cieneguilla (sic)(E5) and North Ponil (E4) Creeks. This discussion goes on to indicate that a target value of 27.7 (E4) and 60.4 (E5) percent fines was derived from Mr. Rosgen's published data (1996). We do not understand how these target values were derived, a cursory review of Mr. Rosgen's publication did not readily answer this question. Also in the next paragraph you state that a target level for percent fines would be 20 percent. If the published data you cite (Rosgen, 1996) indicate a Rosgen E channel can range from approximately 28-60 percent fines, is a target level of 20 percent fines within the natural capability of these stream types? Again, this portion of the document utilizes many terms and concepts not completely familiar to the general public. We would suggest that a discussion of Rosgen methodology and the terms used within this methodology would be helpful to enable persons unfamiliar with the topic to understand more completely.

R The text in this document (in the References) has been updated to include the page numbers in the Rosgen text from which the values you questioned were obtained. However, the SWQB does not feel that it is necessary to include any further discussion of Rosgen methodology. The reference to Rosgen's book on the topic should provide those interested with a place to start for more information. As mentioned in the text of the TMDL (p 4), the relationships between embeddedness and biological scores and embeddedness and percent fines indicate a target percent fines of 20%. This methodology is based on New Mexico streams (unlike the Rosgen approach) and was considered a more representative and conservative value.

C Linkage of water quality and pollutant sources – on page 9 of the document there is a short paragraph describing the removal of McCrystal Dam and the resulting damage. The Carson National Forest recognizes that this stream segment is a source of sediment. We would like to extend an invitation to the Surface Water Quality Bureau personnel to meet with forest personnel and evaluate this situation on site and discuss possible remediation efforts to alleviate this situation. Please contact the Questa District Forest Ranger to arrange a date convenient to all.

R The SWQB appreciates the invitation by the Forest Service to address the sediment loads resulting from the removal of McCrystal Dam and we look forward to the opportunity to address nonpoint source pollution in this watershed.