2.0 ENDPOINT IDENTIFICATION

2.1 USEPA's Recommended Ecoregional Nutrient Criteria

The U.S. Environmental Protection Agency (USEPA, 2000) has published recommended nutrient criteria for causal (total nitrogen and total phosphorus) and response (chlorophyll a and turbidity) variables associated with the prevention and assessment of eutrophic conditions. The criteria are empirically derived from data in USEPA's Storage and Retrieval database (STORET) to represent conditions of surface waters that are minimally impacted by human activities and protective of aquatic life and recreational uses. Ideally, USEPA wanted to base these criteria on actual reference conditions. The criteria would have been based on the 75th percentile of reference condition data. However, much of USEPA's data could not be considered to be reference conditions. Consequently, USEPA performed a statistical analysis of the entire body of non-reference data. The 25th percentile of each season (winter, spring, summer, fall) was calculated, and then the median of these four values was calculated. This approach assumes that the lower 25th percentile of all data overlaps with the 75th percentile of reference condition data, so therefore the 25th percentile data can be used to represent reference conditions.

The upper Rio Hondo watershed is located in subecoregion 21, the Southern Rocky Mountains of the Western Forested Mountains Ecoregion (Ecoregion II). USEPA's recommended criteria for total nitrogen and total phosphorus in streams in this subecoregion are presented in Table 2-1 below.

Table 2-1. USEPA's Recommended Nutrient Criteria for Ecoregion II, Subecoregion 21 (Western Forested Mountains)

Nutrient Parameter	Recommended Value	
	Ecoregion II	Subecoregion 21
Total Nitrogen	0.12 mg N/L	0.09 mg N/L
Total Phosphorus	0.01 mg P/L	0.006 mg P/L

The State of New Mexico has the option to adopt USEPA's recommended values or to develop alternative criteria based on another scientifically defensible approach in establishing numeric nutrient water quality objectives for the different ecoregions in the state. In 2004, the Monitoring and Assessment Section of the Surface Water Quality Bureau (SWQB) started conducting research on reference streams throughout the state in order to develop scientifically defensible and applicable numeric standards for nitrogen and phosphorus in the diverse ecoregions of New Mexico.

2.2 Target Loading Capacity

The target values for nutrient loads are determined based on 1) the presence of numeric and narrative 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 the target value for plant nutrients is based on both narrative and numeric criteria. This TMDL is consistent with the New Mexico State antidegradation policy.

2.3 Plant Nutrients

The New Mexico WQCC has adopted narrative water quality standards for plant nutrients to sustain and protect existing or attainable uses of the surface waters of the state. This general standard applies to surface waters of the state at all times unless a specified standard is provided elsewhere. These water quality standards have been set at a level to protect cold-water aquatic life.

The HQCWF use designation requires that a stream have water quality, streambed characteristics, and other attributes of habitat sufficient to protect and maintain a HQCWF. The plant nutrient standard leading to an assessment of use impairment is as follows (NMAC 20.6.4.12.E):

> *Plant nutrients from other than natural causes shall not be present in concentrations, which will produce undesirable aquatic life or result in the dominance of nuisance species in surface waters of the state.*

There are two potential contributors to nutrient enrichment in a given stream: excessive nitrogen and/or phosphorus. The reason for controlling plant growth is to preserve aesthetic and ecologic characteristics along the waterway. The intent of numeric standards for nitrogen and phosphorus is to control the excessive growth of attached algae and higher aquatic plants that can result from the introduction of these plant nutrients into high quality coldwater streams. In 1981, algal bioassays and laboratory analysis of ambient waters determined that the Rio Hondo was a phosphorus-limited system (NMEID, 1981b). In 2004, algal bioassays and laboratory analysis of waters sampled above and below the WWTP showed varied results (Appendix B). The Rio Hondo above the WWTP is limited by nitrogen, meaning phosphorus addition did not stimulate algal growth either by itself or in combination with nitrogen addition. On the other hand, the Rio Hondo below the WWTP was stimulated by the addition of both nitrogen and phosphorus indicating that both elements are limiting algal growth. These results indicate that both nitrogen and phosphorus are driving the productivity of algae and macrophytes in the stream below the treatment plant. Therefore, to ensure that the narrative water quality standards are met, management procedures should avoid any increase in both nitrogen and phosphorus inputs.

Currently, there are no numeric standards applicable to the Rio Hondo for total phosphorus (TP) and total nitrogen (TN). Numeric standards are necessary to control the amount of nutrients in the stream, to prevent excessive plant growth, to provide WWTFs with target loads, and to support designated uses within the Rio Hondo. This TMDL document is adopting the

philosophy and target concentrations suggested in the 1981 Waste Load Allocation (WLA) for Twining Water and Sanitation District (NMEID, 1981) because the numeric targets in the 1981 document are segment specific criteria that have proven effective at maintaining water quality standards and fully support the designated uses along the upper Rio Hondo. The 1981 WLA suggests an in-stream TP concentration of less than 0.10 mg/L and an in-stream TN concentration of less than 1.0 mg/L (Table 2-2). Total Nitrogen is defined as the sum of Nitrate-N, Nitrite-N, and Total Kjeldahl Nitrogen. At the present time, there is no EPA-approved method to test for Total Nitrogen, however a combination of EPA method 351.2 (Total Kjeldahl Nitrogen) and EPA method 353.2 (Nitrate + Nitrite) may be appropriate for monitoring Total Nitrogen.

Table 2-2. Numeric Targets

Constituent or Factor	TMDL Target Concentrations
Total Phosphorus	0.1 mg P/L
Total Nitrogen	1.0 mg N/L

2.4 Critical Low-Flow Criterion

The **critical condition** can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. The flow is used in calculation of point source (NPDES) permit waste load allocations (WLA) and in the development of TMDLs.

The presence of plant nutrients in a stream can vary as a function of flow. As flow decreases, the stream cannot effectively dilute its constituents, which causes the concentration of plant nutrients to increase. Thus, a TMDL is calculated for each reach at a specific flow. The critical flow conditions for this TMDL occur when the ratio of effluent to stream flow is the greatest and was obtained using 4-day, 3-year low-flow frequency (4Q3) regression models (Appendix C). The 4Q3 is the minimum average four consecutive day flow that occurs with a frequency of at least once every 3 years. The 4Q3 flow for this report was estimated through application of USGS gage data to a log Pearson Type III distribution using "*Input and Output for Watershed Data Management*" (IOWDM) software, Version 4.1 (USGS, 2002a) and "*Surface-Water Statistics*" (SWSTAT) software, Version 4.1 (USGS, 2002b). It is assumed that 4Q3 flows will be the critical periods for aquatic life.

It is often necessary to calculate a critical flow for a portion of a watershed where there is no stage gage. This can be accomplished by applying one of two formulas developed by the USGS. One formula (USGS, 1993) is recommended when the ratio between the gaged and ungaged watershed areas is between 0.5 and 1.5. The other formula, to be used when the watershed ratio

is outside this range, is a regression formula developed by James P. Borland (USGS, 1970). These methods of estimating low flows are currently used by the NMED to establish TMDLs for watersheds and to administer water-quality standards through the NPDES program. The basin and climatic characteristics used to derive the critical low flows are listed in Table 2-3.

Table 2-3. Basin and climatic characteristics used to derive the critical low-flow (4Q3) at the bottom of the assessment unit (ungaged station)

USGS gaging-station number	Station Name	Drainage Area (mi^2)	Annual 4Q3 (cfs)	Av. Basin $Precip_w$ (inches)	Av. Basin Slope (percent)	Basin Aspect (degrees from N)	Av Basin Elevation (ft above sea level)	Av. Basin $Precip_a$ (inches)
08267500	Rio Hondo 1.5 miles above Valdez, NM	36.2	7.87	13.90	0.517	225	10,500	25.93
-----	Rio Hondo 2.4 miles below WWTP	20.9	5.77	14.15	0.497	270	10,768	26.27

In 1981, the NMEID determined that computation and application of the critical low-flow criterion on a seasonal basis might significantly reduce operational costs for the TWSD while still protecting stream standards. The ability of the Rio Hondo to dilute wastewater is least during the winter months (Figure 2-1). Winter is also the period during which the District's wastewater discharges are greatest. At other times, stream standards are attainable with less stringent wastewater treatment. Significant savings in treatment plant operation could thereby be achieved by applying seasonal 4Q3s to the WWTP waste load allocation (Appendix C; Tables 7-1 and 8-1).

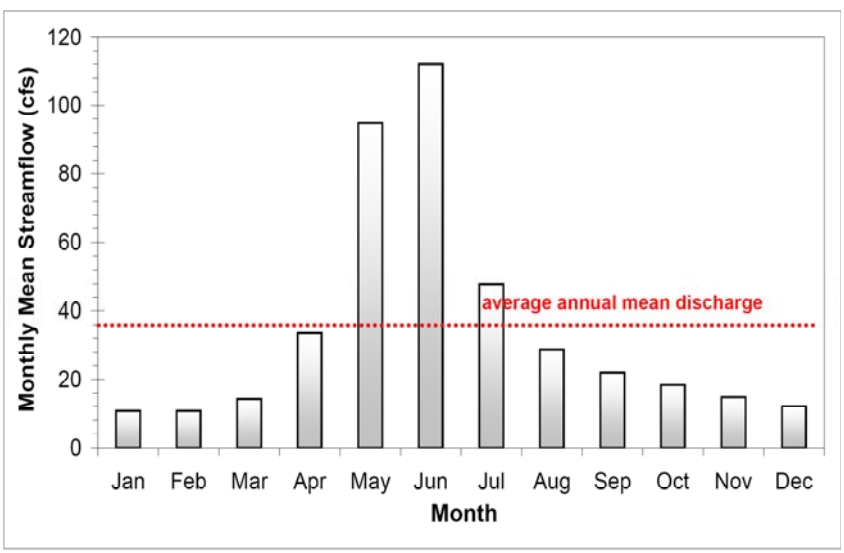

Figure 2-1. Monthly Mean Streamflow at USGS Stream Gage 08267500 (1934-2002)