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The Development of a Coordinated Database for Water Resources and Flow Model in the Paso Del Norte Watershed (Phase III)

Part II
Availability of Flow and Water Quality Data for the Rio Grande Project Area

By
Sue Tillery, New Mexico State University
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College Station, Texas 77843-2118

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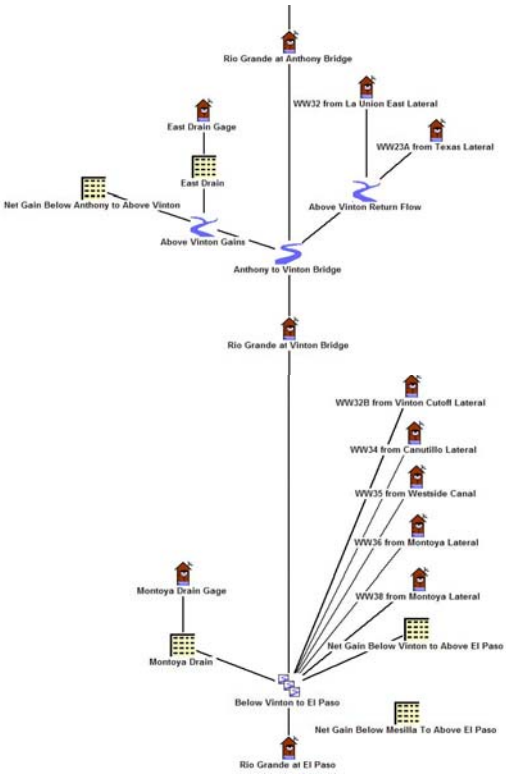

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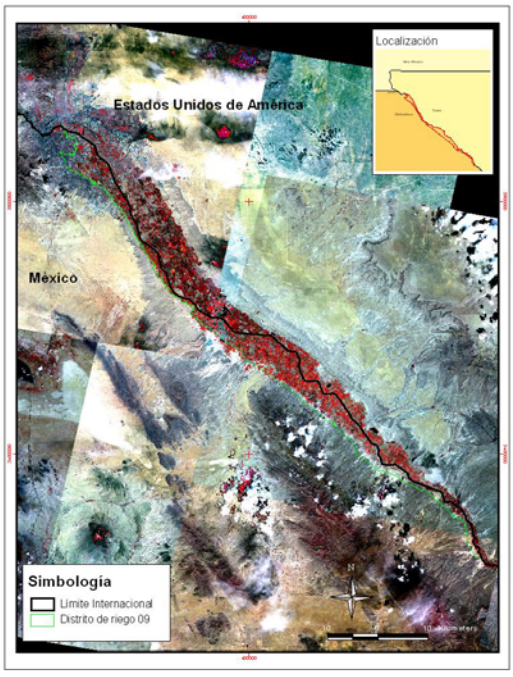

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Technical Completion Report

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Texas Water Resources Institute

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Availability of Flow and Water Quality Data for the Rio Grande Project Area

Phase III Final Project Report of Work Completed under the Cooperative Agreement between the U.S. Army Corps of Engineers and Texas AgriLife Research

(TAES/03-PL-02)
Modification No. 3

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Abstract

This report fulfills the deliverables required by the cooperative agreement between the U.S. Army Corps of Engineers and Texas AgriLife Research (TAES/03-PL-02: Modification No. 3) on behalf of the Paso del Norte Watershed Council. Tasks accomplished in this phase include (a) assess the data availability for expansion of the URGWOM model, identify data gaps, generate data needed from historic data using empirical methods, compile and verify the water quality data for reaches between the Elephant Butte reservoir, New Mexico and Fort Quitman, Texas; (b) develop the RiverWare physical model for the Rio Grande flow for the selected reaches between Elephant Butte Reservoir and El Paso, beginning with a conceptual model for interaction of surface water and groundwater in the Rincon and Mesilla valleys, and within the limits of available data; (c) implement data transfer interface between the coordinated database and hydrologic models.

This Project was conducted by researchers at Texas A&M University (TAMU) and New Mexico State University (NMSU) under the direction of Zhuping Sheng of TAMU and J. Phillip King of New Mexico State University. It was developed to enhance the coordinated database, which was originally developed by the Paso del Norte Watershed Council with support of El Paso Water Utilities to fulfill needs for better management of regional water resources and to expand the Upper Rio Grande Water Operations Model (URGWOM) to cover the river reaches between Elephant Butte Dam, New Mexico and Fort Quitman, Texas. In Phases I and II of this Project (TAES/03-PL-02), hydrological data needed for flow model development were compiled and data gaps were identified and conceptual model was developed. The objectives of this phase were to develop a physical model of the Rio Grande flow between Elephant Butte Dam and American Dam by using data collected in the first development phase of the PdNWC/Corps Coordinated Water Resources Database and to enhance the data portal capabilities of the PdNWC Coordinated Database Project.

This report is Part II of a three part completion report that combines data compilation of the Phase I report prepared by Sue Tillery and J. Phillip King and part of the completion report for Phase III prepared by Z. Sheng, J.P. King and B. Creel. It identifies and evaluates the availability of historical flow and water quality data that has been collected at different sites along the Rio Grande between Elephant Butte Dam, New Mexico and Fort Quitman, Texas. This includes monitoring sites from associated canals, drains, and dams along the Rio Grande. Flow data for the years from 1908 through 2002 and water quality data for the years 1938 to 2005 collected periodically by different agencies include historic chemical analytical results and real-time monitoring values. This report includes a description of the agencies that collected water quality data, a summary of the sites found along the Rio Grande, and finally a data matrix and parameter summary for each site. Data downloaded were collected from the U.S. International Boundary and Water Commission (USIBWC), El Paso, Texas; US Geological Survey (USGS), U.S. Bureau of Reclamation, Elephant Butte Irrigation District (EBID), El Paso County Water Improvement District No. 1, and Parsons Engineering Science, Inc. compiled for the New Mexico-Texas Water Commission by contract through El Paso Water Utilities.

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Availability of Flow and Water Quality Data for the Rio Grande Project Area

Introduction

Historical and real-time flow and water quality data have been collected by multiple agencies on different sites along the Rio Grande between Elephant Butte Dam, New Mexico and Fort Quitman, Texas. Data have also been collected at sites associated with canals, laterals, drains, wasteways, and dams along the Rio Grande (Figure 1). Initially, historic flow data for the years 1975 to the most recent data available were formatted and verified. Then data for the entire period of record (1908 to 2002) were formatted and verified. Water quality data for the years 1938 to 2005 collected periodically by different agencies include historic chemical analytical results and real-time monitoring values.

This report identifies each site for which data were acquired, which agency(s) provided the data, and the years of record for the data. This document also describes the file format for the collected data. Finally Appendix A (contained on CD) provides Flow Data Availability Matrices and Flow Data Summaries. Appendix B (contained on CD) provides Water Quality Data Availability Matrices, Water Quality Data Summaries, and Water Quality Parameters Tested and Monitored.

Flow Data Collection

The first step in acquiring this data was to contact the agencies responsible for the actual data collection. The agencies contacted were:

- U.S. Bureau of Reclamation (USBR), El Paso, TX
- U.S. International Boundary and Water Commission (USIBWC), El Paso, TX
- U.S. Geological Survey (USGS), Las Cruces, NM; and the NM District Database Manager for USGS
- Elephant Butte Irrigation District (EBID), Las Cruces, NM
- El Paso County Water Improvement District #1 (EP #1), El Paso, TX.

Data were collected from each of these agencies in various electronic data formats. The USBR also provided paper copies of their data. In addition to this data, electronic data from a previous data collection effort completed by Parsons Engineering Science, Inc. and Boyle Engineering Corporation (Final – August 1996) was included.

In general, the electronic data were converted to a common electronic format so all data could be presented in the same manner. Details for collecting and processing the data from each agency are presented in the following sections.

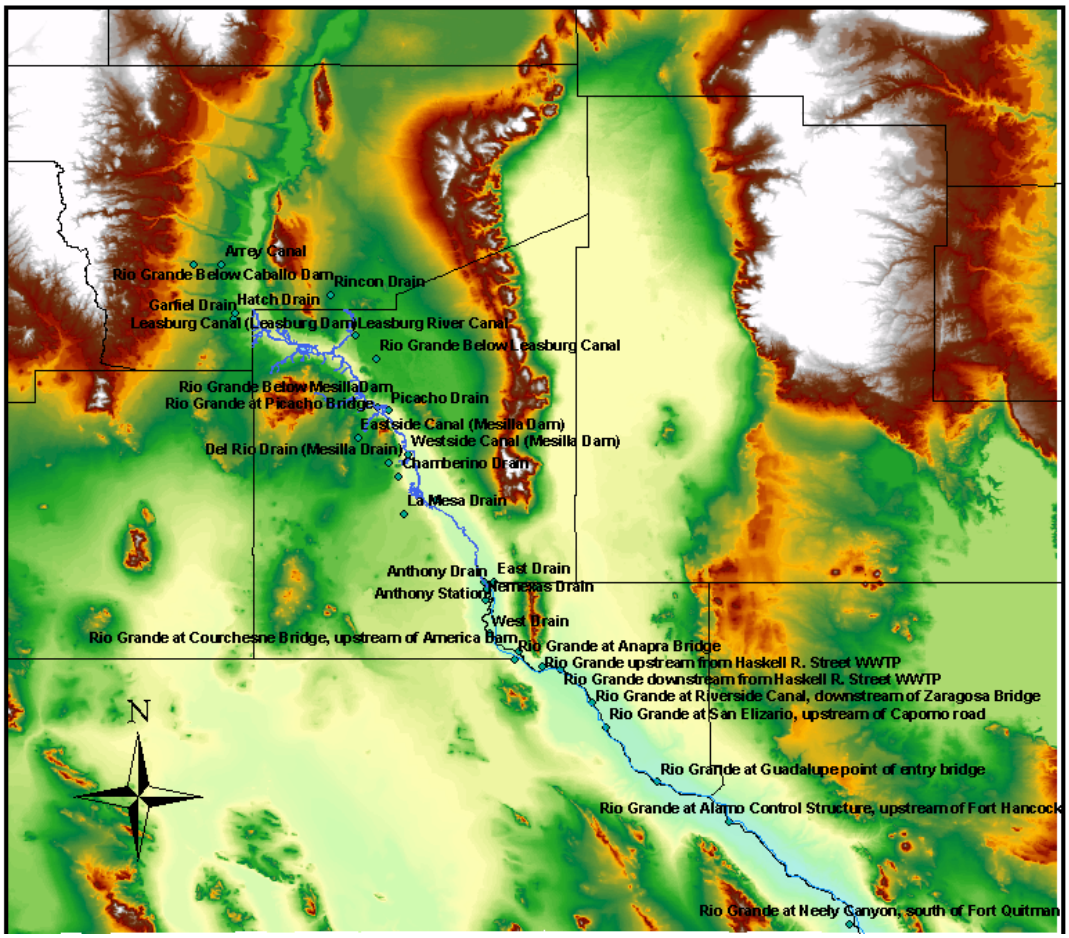

Figure 1. Gage stations and water quality sampling locations along the Rio Grande between Elephant Butte Dam and Fort Quitman, TX

USBR Data Collection

The USBR provided both paper and electronic data. The electronic data for the flow data were provided as separate data files for each year from 1908 through 1999. However, not all sites had data for all of these years. Electronic data for Elephant Butte Storage and Caballo Storage were provided in two files, one for each reservoir. Even though this data had been entered electronically, it had not been thoroughly checked for accuracy. We requested the corresponding original paper data in order to verify, and correct as necessary, their electronic data.

The method used to verify this data was to compare for each site the monthly acre-feet (AF) totals of the electronic data to the monthly AF totals on the paper data. When these monthly totals did not match, the electronic daily data for that month was compared to the paper daily data for that month. When any daily values were found in error, they were corrected in the electronic data. Occasionally the monthly totals didn't match because the total on the paper data was incorrect.

A complete list of all daily electronic data in error was created as well a list of all monthly totals on the paper data that were in error. Once the electronic data were verified and

corrected, they were copied to a set of Microsoft Excel files in a format that would be common to the final data.

The paper data received from the USBR were entered in the common electronic format, and also scanned into *PDF* type files to provide access to the original data in a convenient manner.

IBWC Data Collection

All data collected and maintained by the IBWC were downloaded from their website.

USGS Data Collection

Data published by the USGS for the Rio Grande below Elephant Butte and below Caballo were downloaded from the USGS website. Additional data provided by the USGS were acquired via their FTP site.

EBID Data Collection

A variety of electronic data were acquired from the EBID. Data for the time period between 1993 and 1999 were provided in a single Excel data file. Some data for the time period 2001 thru 2003 were provided in three Excel data files (one file for each year). Some of the sites in these files had two sets of data for the year; normally (regularly collected in person) collected data and real-time data from an electronic data logger. Sometimes this data overlapped and sometimes it did not. Additional data for some sites for the time period March 2001 thru September 2003 were downloaded from EBID's website.

The time period 2001 thru 2003 resulted in multiple sets of data for the same time period, in which some of the overlapping data matched and some of it did not. Also, some of the data in this time period were clearly incorrect. Usually this occurred in the data logger and website data when flow for a site went dry. The explanation was that the electronics interpreted the dry site as negative values, which resulted in large positive values in the data file. Whatever the reason, values that were clearly incorrect or very questionable were replaced with the '—' designation in the data file.

In general, when data overlapped and were not identical, the normally collected data were chosen first as the data to use. If there were no normally collected data, then the data logger data were chosen. If the only data were the website data, then these data were used.

EP#1 Data Collection

Data for the time period between 1997 and 2002 were provided in two Excel data files for each year. Real time data for some gage stations are also available on line now. http://www.epcwid1.org/telemetry

WATER QUALITY DATA COLLECTION

Most of the water quality data were provided at the agencies website. Electronic data downloaded were converted to Microsoft Excel ™ files so all data would be presented in the same manner. Details for collecting and processing the data from each agency are presented in the following sections.

Water quality data in paper format were not complied and are not included in the report. It is recommended that such data be complied and verified in future project phases. The processed data will be provided through the Paso del Norte Watershed Council website (http://www.pdnwc.org).

U.S. IBWC Data Collection

A segment list of monitoring stations in the Rio Grande basin was found at the website. Each segment had a station ID number to download as an Excel format file. Each file contains all of the available historical water quality data for each station from 1995 to present. The stations downloaded at the IBWC (United States and Mexico) website were between El Paso and Fort Quitman, Texas. The URL for this data is http://www.ibwc.state.gov/html/environment.html

EBID Data Collection

Data from EBID were downloaded from its website. There were three Telemetry sites containing real time water quality readings for different stations along the Rio Grande. Daily average format with range of 2001 to present was downloaded. Each file downloaded was converted to Excel format. One station was established and equipped by EBID in collaboration with El Paso Water Utilities/Public Service Board (EPWU/PSB) and more stations will be added as part of ongoing projects supported by the U.S. Bureau of Reclamation 2025 Challenge Grant.

USGS Data Collection

Data published by the USGS for the Rio Grande below Elephant Butte and below Caballo were downloaded from the USGS website: http://nwis.waterdata.usgs.gov/nwis/qw.

Parson's Data Collection

Water quality data from above-mentioned agencies were also compiled by Parsons Engineering, Inc. (PARSONS thereafter) for the El Paso-Las Cruces Regional Sustainable Water Project; Data Collection Technical Memorandum prepared for New Mexico – Texas Water Commission (Final – August 1996) by Boyle Engineering Corporation and Parsons Engineering, Inc. It is available at the Paso del Norte Watershed project website (http://www.pdnwc.org or ftp://river.nmsu.edu/LRG/WAT_QUAL/**)**

DATA FORMAT

The common format selected for the collected data would use Microsoft Excel as the application software. The database will be available at http://www.pdnwc.org/. This format would consist of a single Excel file for each data site, with daily, monthly and annual data

included in the file. Within each Excel file, these data would be included on separate tabs, with the format of the data on each tab described in the following sections.

Daily Data Tab

The *Daily Data* tab provides the data in columns, with a single day value of data in each row. There are columns in this tab for the **Day**, **Month**, **Year** and **Date** for each day. Then there is a column allowed for data from each agency: **Parson's Data**, **USGS Data**, **IBWC Data, USBR Data, EBID Data** and **EP#1 Data**. It should be noted that **Parson's Data** included data from agencies and other sources.

If an agency did not provide data for this site, then the daily data would consist of the letters **NR**, indicating **N**o **R**ecord. This designation was also used when an agency had a gap in the data provided. For example, if an agency provided data for the years 1970 through 1990 with no record provided for the year 1982, then each day of 1982 would have **NR** entered into it. Within any year that contains data provided for it, missing data for any day are represented by '—'. This would correspond to blank entries in the paper or electronic data, where it is not clear that it is blank because it is the end of the irrigation season.

A column is also included with the heading **NMSU Data**. The intent of this column is to combine data from the various agencies that collected data into a single record. For example, data collection for many sites was transferred from the USBR to EBID and EP#1 between 1993 and 1996. Thus we may have a site with data from the USBR from 1960 thru 1992, and then from EBID for 1993 thru 2001. For this case, the **NMSU Data** column would contain the USBR data for the period 1960 thru 1992 and it would contain the EBID data for the period 1993 thru 2001.

The units used for daily flow data is cubic-feet-per-second (cfs). The units used for daily storage data is AF.

Monthly Data Tab

The *Monthly Data* tab provides the data in columns, with a single month value of data in each row. There are a couple of columns with values used for calculating the monthly data from the daily data in the *Daily Data* tab. These columns are **Index** and **NumDays**. Then there are columns in this tab for the **Month**, **Year** and **Date** for each month. There are also columns allowed for data from each agency: **Parson's Data**, **USGS Data**, **IBWC Data, USBR Data, EBID Data** and **EP#1 Data**. The **NMSU Data** column for the composite data is also present.

The **NR** designation is used for the monthly data is the same way as it was used for the daily data. The '—' designation is entered for any month that had '—' entered for any day of that month. This is to prevent inadvertently using partial monthly totals when analyzing monthly data.

The units used for both flow and storage data is AF.

Annual Data Tab

The *Annual Data* tab provides the data in columns, with a single annual value of data in each row. There are a couple of columns with values used for calculating the annual data from the monthly data in the *Monthly Data* tab. These columns are **Index** and **NoMos**. Then there are columns in this tab for the **Year** and **Date** for each year. There are also columns

allowed for data from each agency: **Parson's Data**, **USGS Data**, **IBWC Data, USBR Data, EBID Data** and **EP#1 Data**. The **NMSU Data** column for the composite data is also present.

The **NR** designation is used for the annual data in the same way as it was used for the daily data. The '**—**' designation is entered for any year that had '**—**' entered for any month of that year. This is to prevent inadvertently using partial annual totals when analyzing annual data. The units used for both flow and storage data is AF.

File Description Tab

The *File Description* tab provides information about the data collected for the site. Information included on this tab includes:

- File - the name of the Excel file with the data for this site.
- Location - for some sites, the location of the site (Lat. and Long.).
- NMSU Data – the data selected for the composite NMSU record.
- Parson's Data – if any Parson's data are available for this site, the period of record of the data, along with the name of the file containing the original data.
- USGS Data – if any USGS data are available for this site, the period of record of the data, along with the source location or name of the file containing the original data.
- IBWC Data – if any IBWC data are available for this site, the period of record of the data, along with the source location or name of the file containing the original data.
- USBR Data – if any USBR data are available for this site, the period of record of the data, along with the source location or name of the file containing the original data. This entry also gives the name of the *PDF* file that the paper data was scanned into.
- EBID Data - if any EBID data are available for this site, the period of record of the data, along with the source location or name of the file(s) containing the original data.
- EP #1 Data - if any EP#1 data are available for this site, the period of record of the data, along with the source location or name of the file(s) containing the original data.

WATER QUALITY PARAMETERS

The parameters available from the Parsons Engineering Inc. (PARSONS) historic data included Total Dissolved Solids (TDS), Sodium, Sulfate, and Chloride for most of the sites except some that only include TDS. Stations found at the USGS data site contain complete chemical parameters for all of the stations and are available on a weekly, bi-weekly, and monthly basis. Stations found at the EBID website have very little real-time monitoring parameters data, it only contains Total Dissolved Solids (TDS) and Electrical Conductivity (EC) data. EBID parameters are available in a daily basis. The chemical parameter found at the IBWC data site also has very complete chemical analysis parameters available for all of the stations found at there web site. A summary of the Records for the chemical parameters for each of the stations along the Rio Grande are show in Appendix B – Water Quality Parameters Tested and Monitored.

DATA VERIFICATION

After all of the data were collected, verified, and reformatted into the common Excel spreadsheet format, a second verification of the data was performed. This was deemed necessary due to the large amount of data being manipulated, copied, and reformatted. The second verification of the data consisted of comparing the monthly AF totals of the final electronic data to the monthly AF totals of the original data. For the USBR data, the original data compared to was the paper data. For all of the other data, the original data compared to was the electronic data provided by the agency.

Availability of flow data at different locations along the Rio Grande and irrigation networks of the Rio Grande Project was listed in Table 1 (Brown, et al. 2004). Availability of water quality data at different locations along the Rio Grande and irrigation networks of the Rio Grande Project are listed in Table 2.

Table 1. Availability of Flow Data along in the Rio Grande Project area
(Brown, et al. 2004)

Site	***Available Data Since 1975*** [1]
Rio Grande Below Caballo Dam	1975-5/2005 (d)
Arrey Canal (Percha Div. Dam)	1975-1999 (d), 2000 (n), 2001-2004 (d)
Percha Lateral (Percha Div. Dam)	1979-1999 (d), 2000 (n), 2001-2004 (d)
WasteWay (WW) #5 (Garfield Canal)	1979-1984 (d), 1985-1986 (n), 1987 (d), 1988-1992 (n) 1993-1999 (d), 2000 (n), 2001-5/2005 (d)
Garfield Drain	1975-1981 (m), 1982-1999 (d), 2000 (n), 2001-2004 (d)
WW #16 (Hatch Canal)	1979-1999 (d), 2000 (n), 2001-5/2005 (d)
Hatch Drain	1975-1981 (m), 1982-1999 (d), 2000 (n), 2001-2004 (d)
Angostura Drain	1975-1983 (m)
WW #18 (Rincon Canal)	1979-1999 (d), 2000 (n), 2001-2004 (d)
Rio Grande at Hayner Bridge	2001-5/2005 (d)
Rincon/Tonuco Drain	1975-1981 (m), 1982-1999 (d), 2000 (n), 2001-2004 (d)
Rio Grande Above Leasburg Dam	1975-1983 (d)
Leasburg Canal (at Heading)	1975-1995 (d), 1996 (n), 1997-1999 (d), 2000 (n) 2001-6/2003 (d)
WW #1A (Leasburg Canal)	1989-1992 (d), 1993 (n), 1994-1997 (d), 1998-2000 (n) 2001-2002 (d)
WW #1 (Leasburg Canal)	1997-1999 (d), 2000 (n), 2001-2002 (d)
Rio Grande Below Leasburg Dam	1975-1999 (d), 2000 (n), 2001-5/2005 (d)
Selden Drain	1975-1983 (m)
WW #5 (Leasburg Canal)	1979-1999 (d), 2000 (n), 2001-6/2003 (d)
WW #8 (Taylor Lateral)	1979-1999 (d), 2000 (n), 2001-5/2005 (d)
Rio Grande at Picacho Bridge	1991-1999 (d), 2000 (n), 2001-5/2005 (d)
City of Las Cruces WWTP	5/1976-2/1996 (d)
WW #40 (Picacho Lateral)	1991-1999 (d)
Picacho Drain	1975-1983 (m), 1984-1990 (n), 1991-1999 (d) 2000 (n), 2001-6/2003 (d)
Rio Grande Above Mesilla Dam	(n)
Westside Canal (Mesilla Div. Dam)	1975-1983 (d), 1984 (n), 1985-1999 (d), 2000 (n) 2001-6/2003 (d)
Eastside Canal (Mesilla Div. Dam)	1975-1999 (d), 2000 (n), 2001-6/2003 (d)
Del Rio Lateral (Mesilla Div. Dam)	1975-1992 (d), 1993 (n), 1994-1999 (d), 2000 (n) 2001-6/2003 (d)
Rio Grande Below Mesilla Dam	1985-1999 (d), 2000 (n), 2001-5/2005 (d)
WW #15 (Eastside Canal)	1985-1999 (d), 2000 (n), 2001-6/2003 (d)
Santo Tomas River Drain	1985-1990 (d)
WW #25 (Santo Tomas Lateral)	1985-1999 (d), 2000 (n), 2001 (d)
WW #26 (Upper Chamberino	1979-1999 (d), 2000-5/2001(n), 6/2001-5/2005 (d)

[1] d - daily data, m - monthly data, n – no data

Site	***Available Data Since 1975*** [1]
Lateral)	
WW #16B (Brazito Lateral)	1985-1990 (d)
WW #18 (Eastside Canal)	1985-1999 (d), 2000 (n), 2001-5/2005 (d)
Leasburg / Mesilla / Del Rio Drain	1975-1980 (m), 1981-1999 (d), 2000 (n), 2001-5/2005 (d)
WW #19 (Three Saints Lateral)	1982-1999 (d), 2000 (n), 2001-6/2003 (d)
WW #29 (Chamberino East Lateral)	(n)
WW #30 (Chamberino East Lateral)	1985-1999 (d), 2000 (n), 2001-5/2005 (d)
Santo Tomas/Chamberino/La Mesa Drain	1975-1980 (m), 1981-1999 (d), 2000 (n), 2001-5/2005 (d)
WW #31 (La Union Main Canal)	1981-1999 (d), 2000 (n), 2001-6/2003 (d)
WW #20 (Three Saints West Lateral)	1979-1980 (d), 1981-1984 (n), 1985-1988 (d)
WW #21 (Three Saints West Lateral)	1985-1991 (d), 1992-1996 (n), 1997-6/2003 (d)
WW #31B (Jimenez Lateral)	1985-1988 (d), 1989-2000 (n), 2001-5/2005 (d)
Rio Grande at Anthony Bridge	1986-1989 (d), 1990-2000 (n), 2001-5/2005 (d)
WW #32 (La Union East Lateral)	1979-1992 (d), 1993-1996 (n), 1997-1999 (d), 2000 (n) 2001-6/2003 (d)
WW #23 (Three Saints East Lateral)	(n)
WW #32A (Rowley Lateral)	1985-1988 (d)
WW #23A (Texas Lateral)	1985-1992 (d), 1993-1996 (n), 1997-1999 (d), 2000 (n) 2001-6/2003 (d)
Mesquite/Anthony/East Drain	1975-1980 (m), 1981-1992 (d), 1993 (n), 1994-5/2005 (d)
Rio Grande at Vinton Bridge	1985-1992 (d)
WW #32B (Vinton Cutoff Lateral)	1985-1992 (d), 1993-1996 (n), 1997-2002 (d)
Vinton River Drain	(n)
WW #34 (Canutillo Lateral)	1983 (d), 1984 (n), 1985-1992 (d), 1993-1996 (n) 1997-2002 (d)
WW #34A (Pence Lateral)	1985-1988 (d)
WW #35 (Westside Canal)	1980-1992 (d), 1993-1996 (n), 1997-2002 (d)
WW #35C (Schutz Lateral)	1985-1988 (d)
WW #36 (Montoya Lateral)	1985-1992 (d), 1993-1996 (n), 1997-2002 (d)
Nemexas / West /Montoya Intercept./ Montoya Drain	1975-1980(m), 1981-1995 (d), 1996 (n), 1997-2002 (d)
WW #38 (Montoya Lateral)	1985-1992 (d), 1993-1996 (n), 1997-2002 (d)
Rio Grande at El Paso	1975-3/2003 (d)
Rio Grande Below American Dam	1975-2003 (d)
American Canal	1975-2003 (d)
Franklin Canal	1975-1994 (d), 1995-1996 (n), 1997-2002 (d)
Franklin Drain	1975-1983 (m), 1984-2002 (n)
Acequia Madre (International Div. Dam)	1975-2003 (d)
Ascarate Wasteway	1975-1994 (d), 1995-1996(n), 1997-2002 (d)
Rio Grande at Coffer Dam	1975-1987(n), 1988-1993 (d), 1994-1996 (n), 1997-

Site	***Available Data Since 1975*** [1]
	2002 (d)
Riverside Canal	1975-1995 (d), 1996 (n), 1997-2002 (d)
Wasteway #1 (Riverside Canal)	1975-1980 (n), 1981-1984 (d), 1985-1997(n), 1998-2002 (d)
Wasteway #2 (Riverside Canal)	1975-1980 (n), 1981-1984 (d), 1985-1997(n), 1998-2002 (d)
Fabens Waste Channel	1975-1992 (d), 1993-1996 (n), 1997-2002 (d)
Fabens Drain (Fabens Waste Drain)	1975-1983 (m), 1984-1991 (d), 1992-1996 (n), 1997-2002 (d)
River Drain	1975-1983 (m), 1984-2002(n)
Tornillo Canal at Heading	1975-1983 (d), 1984-1995 n), 1996-1999 (d), 2000-2002(n)
Wasteway #1 (Tornillo Canal)	1975-1980 (n), 1981-1986 (d), 1987-2002(n)
Tornillo Canal at Alamo Alto (WW#2)	1975-1994 (d), 1995-1996(n), 1997-2002 (d)
Tornillo Drain	1975-1994 (d), 1995-1996 (n), 1997-2002 (d)
Hudspeth Feeder Canal	1975-1994 (d), 1995-1996 (n); 1997-2002 (d)
Rio Grande at Fort Quitman	1975-2005 (d)

Table 2. Availability of Water Quality Data along in the Rio Grande Project area

Site	***Available Data Since 1938*** [2]
Rio Grande Below Elephant Butte Dam	2/1980-5/1994 (m)
Rio Grande Below Caballo Dam	1/1939-7/1996 (m)
Arrey Canal	1/1980-2/1996 (m)
Garfield Drain	2/1938-12/1996 (m)
Hatch Drain	2/1938-2/1996 (m)
Angostura Drain	2/1938-12/1982 (m)
Rincon Drain	2/1938-2/1996 (m)
Leasburg River Canal	3/1980-2/1996 (m)
Leasburg River Cable	9/2004-12/2005 (d)
Rio Grande Below Leasburg Dam	1/1938-12/1963 (m), 1/1980-12/1995 (m)
Selden Drain	2/1938-10/1942 (m), 6/1970-1/1971 (w,m)
Rio Grande at Picacho Bridge	1/1994-12/1995 (m)
Picacho Drain	1/1938-7/1942 (m), 6/1966-1/1984 (w,m)
Westside Canal (Mesilla Div. Dam)	3/1980-10/1995 (m)
Eastside Canal (Mesilla Div. Dam)	3/1980-10/1995 (m)
Rio Grande Below Mesilla Dam	1/1980-5/1994 (m), 2005 (d)
Santo Tomas River Drain	8/1939-7/1942 (m), 1966 (w,m), 1/1980-2/1985 (m)
Rio Grande Above Vado Bridge	2/1994-12/1995 (m)
Mesilla Drain	2/1938-12/1942 (m)

[2] d - daily data, w – weekly data, m - monthly data, n – no data

Site	***Available Data Since 1938*** [2]
Del Rio Drain	2/1938-12/1942 (m), 6/1966-12/1991 (w,m), 1/1994-12/1995(m)
Chamberino Drain	2/1938-12/1942 (m)
La Mesa Drain	2/1938-12/1942 (m), 1-1966 - 12/1967 (m), 4/1969-12/1990 (m), 1/1994-12/1995 (m)
Rio Grande Upstream of East Drain	3/1995-10/2004 (m)
East Drain	2/2002-12/2005 (d)
Anthony Drain	7/2001 (m), 2/2002-12/2005 (d,m)
Rio Grande Immediately Upstream of the confluence with Anthony Drain	2/2002-8/2003 (d,m)
Nemexas Drain	2/1938-10/1942 (m)
West Drain	2/1938-10/1942 (m), 5/1970-2/1985 (m), 2/2002-12/2005(d,m)
Rio Grande at Anapra Bridge	12/1999-8/2003 (m)
Montoya Drain	2/1938-10/1942 (m), 6/1966-12/1991 (m)
Rio Grande at El Paso (Rio Grande at Courchesne Bridge, 1.7 mi. upstream of America Dam)	1/1938-12/1972 (m), 1980 (m), 1/1988-12/1991 (w,m), 2/1995-8/2005 (d,w,m)
Rio Grande 2.4 km upstream from Haskell R. Street WWTP outfall, south of Bowie High School football stadium at El Paso	12/1995-12/1966 (m), 1/1998-10/2004 (w,m)
Rio Grande 1.3 km downstream from Haskell R. Street WWTP Outfall	12/2003-8/2005 (w,m)
Rio Grande at Riverside Canal 1.8 km downstream of Zaragoza International Bridge	12/1996-8/2005 (w,m)
Rio Grande at San Elizario	11/2000-5/2005 (m)
Rio Grande at Alamo Control Structure	11/1997-5/2005 (w,m)
Rio Grande at Guadalupe Point of Entry Bridge at FM 1106 West of Tornillo	11/2000-6/2005 (m)
Rio Grande at Alamo Control Structure, 9.7 km upstream of Fort Hancock Port of Entry	12/1995 (m), 12/1996 (m), 1997 (m), 1998 (m), 2004 (m)
Rio Grande at Fort Quitman	Data starts from 1/1934, 1/938-12/1963 (m) with few gaps in 1952, 1954-1959. 4/1966-9/1993 (m)
Rio Grande At Neely Canyon, South of Fort Quitman	6/1992 (m), 12/1993-11/2004 (m)
Rio Grande at Little Box Canyon	11/2000-8/2001 (m)
Rio Grande at Calendario	11/2000-8/2001 (m)
Rio Grande 2.4 mi upstream from Rio Conchos Confluence	1/1992-8/2005 (w,m)

REFERENCES

Brown, C., Z. Sheng and M. Rich. 2004. *Paso del Norte Watershed Council Coordinated Water Resources Database Project*, New Mexico Water Resources Research Institute and Texas Water Resources Institute, Technical Completion Report 327.

Elephant Butte Irrigation District. 2006. Telemetry Sites: Available Water Quality Readings. http://www.ebidnm.org/Hydrology/RTUSites.asp?SiteType=WATERQUALITY, Retrieved on Feb. 2006

International Boundary and Water Commission United States Section. 2006. Environmental Water Division (EMD). Clear Rivers Program Water Quality Monitoring Data http://www.ibwc.state.gov/html/environment.html, Retrieved on Feb. 2006

Parsons Engineering Science, Inc., Boyle Engineering Corporation. 1996. Data Collection Technical Memorandum: Rio Grande Project Conveyance System. Prepared for New Mexico – Texas Water Commission.

Paso del Norte Watershed Council. 2006. Water quality data prepared by Parsons Engineering, http://www.pdnwc.org or ftp://river.nmsu.edu/LRG/WAT_QUAL/, Retrieved on Feb. 2006

U.S. Geological Survey. 2006. USGS Real-Time Water Data for the Nation. http://waterdata.usgs.gov/nwis/current/?type=quality, Retrieved on Feb. 2006

Wilcox, L.V. 1968. Discharge and salt burden of the Rio Grande above Ft. Quitman, Texas and salt-balance conditions on the Rio Grande Project. Summary Report for the 30-year Period 1934-1963. U.S. Salinity Laboratory Research Report No. 113. Soil and Water Research Division, Agricultural Research Service, USDA. Riverside, CA.

Williams, J.H. 2001. Salt Balance in the Rio Grande Project from San Marcial, New Mexico to Fort Quitman, Texas: unpublished M.S. Thesis, New Mexico State University, Las Cruces, 42 p.

Appendix A (contained on CD)

Flow Data Availability Matrices

Flow Data Summary

Appendix A (contained on CD) provides summaries of the source(s) of data for each website. The stations are ordered in approximately the same manner as they occur physically, going from north to south along the Rio Grande.

Data summary are grouped by the reservoirs and river reaches:

- RESERVS
- PERCHA
- LEASBURG
- MESILLA
- EL PASO, TX

Appendix B (contained on CD)

Water Quality Data Availability Matrices

Water Quality Data Summary

Appendix B provides summaries of the source(s) of data for each website. The stations are ordered in approximately the same manner as they occur physically, going from north to south along the Rio Grande.

Data summary are grouped by the reservoirs and river reaches:

- RESERVS
- PERCHA
- LEASBURG
- MESILLA
- EL PASO, TX

Water Quality Parameters Tested and Monitored