No. 141, Original

In the

SUPREME COURT OF THE UNITED STATES

STATE OF TEXAS,

Plaintiff,

v.

STATE OF NEW MEXICO and
STATE OF COLORADO,

Defendants.

OFFICE OF THE SPECIAL MASTER

DECLARATION OF WILLIAM R. HUTCHISON, PH.D., IN SUPPORT OF JOINT MOTION OF THE STATE OF TEXAS, STATE OF NEW MEXICO, AND STATE OF COLORADO TO ENTER CONSENT DECREE SUPPORTING THE RIO GRANDE COMPACT

November 14, 2022

I, William R. Hutchison, declare as follows:

1.0 Background and Experience

1. My name is William R. Hutchison, Ph.D., P.E., P.G., I was born on November 4, 1958 in Nueces County, Texas. The following matters are within my personal knowledge and, if called as a witness, I can competently testify thereto.

2. I am an independent consultant with professional experience as a groundwater hydrologist since 1983. I have been retained by the State of Texas (Texas) to provide consulting services on hydrologic issues presented in *Texas v. New Mexico, and Colorado*, Original Action 141. My professional resume is included as Attachment 1.

3. My street address is 16717 Captain Hook Road, Jamaica Beach, Texas 77554. The United States Postal Service does not provide home mail service to my address. My mailing address is 9305 Jamaica Beach, Jamaica Beach, Texas 77554.

4. My education includes a Bachelor of Science degree in Soil and Water Science from the University of California, Davis, a Master of Science degree in Hydrology from the University of Arizona, and a Ph.D. in Environmental Science and Engineering from the University of Texas at El Paso.

5. I am licensed in the State of Texas as follows: Professional Engineer (Geological and Civil) No. 96287, Engineering Firm No. 14526, and Professional Geoscientist (Geology) No. 286.

6. From August 1983 to October 2001, I was employed by various consulting firms or worked as an independent consultant in California and Arizona.

7. From October 2001 to June 2009, I was employed by El Paso Water Utilities in El Paso, Texas.

8. From June 2009 to August 2011, I was the Director of the Groundwater Resources Division of the Texas Water Development Board in Austin, Texas.

9. From August 2011 to July 2012, I was employed by LBG-Guyton Associates in Austin, Texas.

10. Since July 2012, I have been an independent consultant based in Austin, Texas (July 2012 to July 2015), Aberdeen, North Carolina (July 2015 to January 2016), and Jamaica Beach, Texas (January 2016 to present).

11. I have completed (or I am actively working on) over 60 consulting assignments for over 30 different clients in Texas.

12. In the last four years, I have testified as an expert witness in one case.

13. My direct experience in the El Paso, Texas area began in 2001 as an employee of El Paso Water Utilities.

14. In 2006, I completed my doctoral dissertation, titled Groundwater Management in El Paso, Texas, which included details of modeling and management of the Mesilla Basin in New Mexico and Texas.

15. I have reviewed the Declarations of Robert J. Brandes, Ph.D., and I endorse and agree with his statements and opinions.

2.0 Overview of the Effective El Paso Index (EEPI)

16. This Declaration will present an overview of the development of the Effective El Paso Index (EEPI) which is the foundation of the Consent Decree negotiated by the Compacting States. (Section II.B. of the Consent Decree describes the EEPI).

17. On behalf of Texas, I participated as a primary member of the technical review and support committee that assisted the States' counsel in extensive negotiations and drafting of the Consent Decree and supporting Index appendix. I worked closely

with counsel on developing the Index methodology and the data supporting the calculations for the Index methodology. The States' final Consent Decree and supporting appendix are a result of my work with counsel and other State technical representatives. The statements in this Declaration are my opinions and derived from my direct involvement in developing the Consent Decree and assisting with compilation and analysis of supporting materials.

18. The Effective El Paso Index Obligation (EEPI Obligation) is a calculation that represents the annual amount of water that should be delivered to Texas under the Rio Grande Compact.

19. The Effective El Paso Index Delivery (EEPI Delivery) is a calculation that represents the annual amount of water that is actually delivered to Texas.

20. Effective El Paso Index Departures (EEPI Departures) are the annual differences between the annual EEPI Obligations and the annual EEPI Deliveries. A positive departure represents an annual EEPI Delivery that is higher than the EEPI Obligation (an over delivery). A negative departure represents an annual EEPI Delivery that is less than the EEPI Obligation (an under delivery).

21. These departures are calculated annually. Ideally, departures would be zero in each year. However, limitations to operations and limitations to the data used to develop the EEPI Obligation led to the development of accrued EEPI departure accounts and triggers to allow New Mexico to take corrective water administration action in advance of reaching thresholds in the Consent Decree that would lead to violation of the Decree. As stated in Section II.C. of the Consent Decree, New Mexico is in compliance with this Decree if New Mexico is within the accrued Negative Departure Limits. Exceedance of accrued Negative Departure Limits means New Mexico is in violation of this Decree.

22. My Declaration is limited to the development of EEPI components and an analysis of applying the EEPI concept to historic data from 1951 to 2021 that yielded EEPI Departures for that period. These departures are part of the development of accrued departure concepts and the limits and trigger concepts that are covered in the Declarations of Robert J. Brandes and Margaret Barroll.

23. The EEPI Obligation and EEPI Delivery each consists of five components: 1) streamflow at the Rio Grande at El Paso gage, 2) calculation of Texas Mesilla agricultural depletions from surface water diversions and groundwater pumping, 3) data related to Texas Mesilla depletions resulting from groundwater pumping for domestic, commercial, municipal, and industrial (DCMI) uses, 4) data reflecting delivery of water to Mexico under the 1906 Convention, and 5) excess flows that are not available for beneficial use.

24. The EEPI Obligation was developed based on an analysis of historic data from 1951 to 1978 (the "D2 period"). The analyses included the quantitative relationship between Caballo Releases and Rio Grande at El Paso flow using regression analysis and estimated and calculated Rio Grande depletions in the Texas portion of the Mesilla Basin.

25. The D2 period (1951 to 1978) was chosen because this period represented a time period when, on average, 57 % of the Rio Grande Project deliveries were used in New Mexico and 43 % of the Rio Grande Project deliveries were used in Texas. (Consent Decree, Section II.A.5.) The D2 period was also the basis for the 2008 Operating Agreement, which has formed the basis for Rio Grande Project operations for nearly 15 years.

26. I will describe each of the inputs to the EEPI and summarize the analysis of the historic data from D2 period (1951 to 1978) that yielded the EEPI Obligation. In

addition, I will describe the EEPI Departures that were calculated by applying the EEPI concept to historic data from 1951 to 2021.

27. All data and calculations described in this Declaration are contained in an Excel spreadsheet named ***"EEPI Declaration Spreadsheet 2022.11.02.xlsx"*** attached as Attachment 2 which contains tabs with individual components of the EEPI, and data and calculations related to various calculations used in applying the EEPI. Each tab is documented below.

28. The most critical element to the EEPI Obligation and EEPI Delivery is the first component listed above: the streamflow at the Rio Grande at El Paso gage. The other four components of the EEPI Obligation and EEPI Delivery represent adjustments to the streamflow component. Once these adjustments are included, the gaged flow represents the compliance point for measuring New Mexico's compliance with the EEPI Obligation.

3.0 Rio Grande at El Paso Gage

29. The map below shows the location of the El Paso gage in relation to the state line, as well as the portion of Texas which is upstream of the El Paso gage.

/

/

/

/

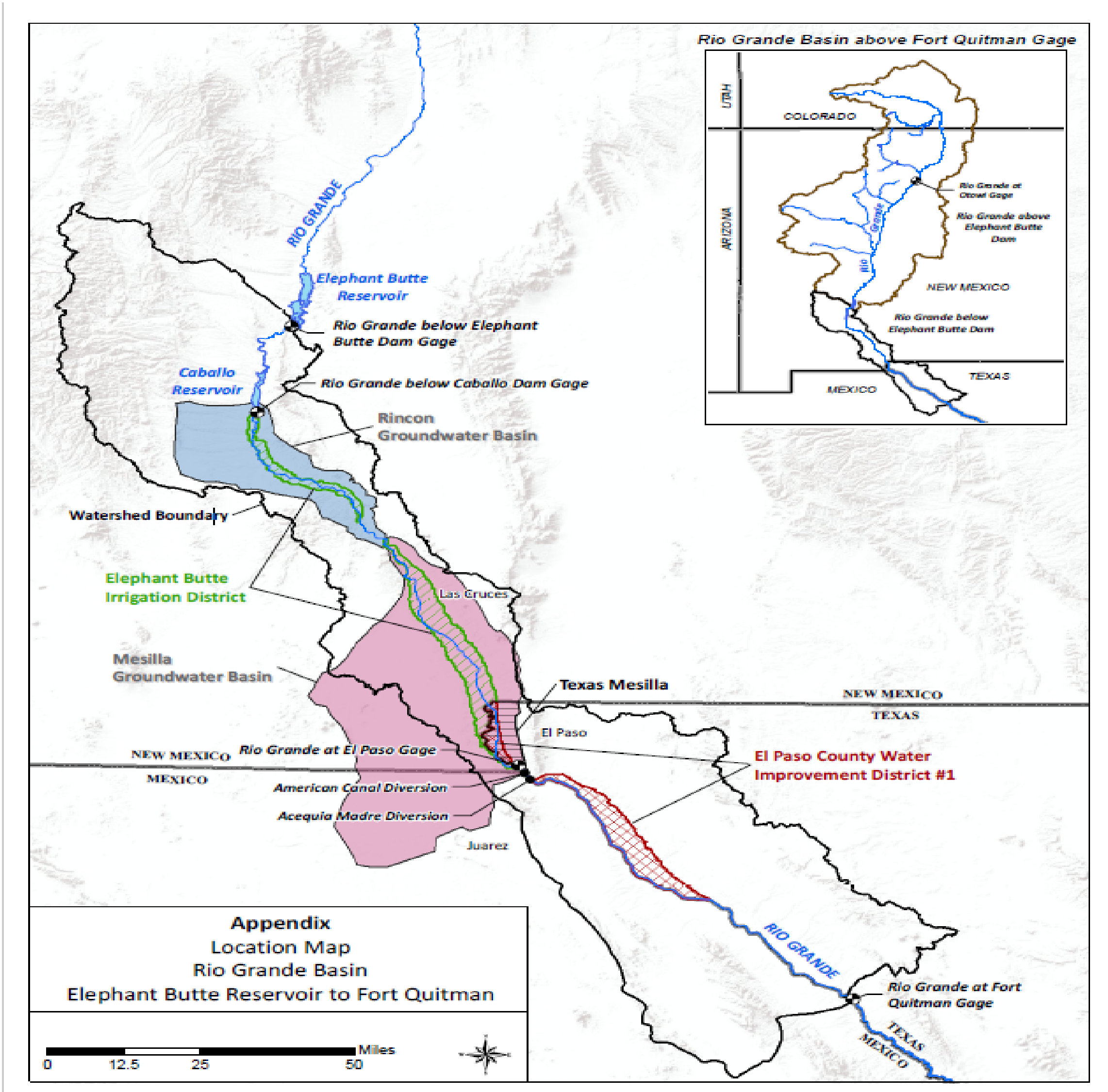
/

/

/

/

/



30. Texas's apportionment under the Rio Grande Compact is released from Caballo Reservoir and flows in the Rio Grande through the Rincon Basin.

31. The Rio Grande flows through Selden Canyon from the Rincon Basin to the Mesilla Basin in New Mexico.

32. The Rio Grande flows through the El Paso Narrows from the Mesilla Basin to the El Paso Valley.

33. The Rio Grande at El Paso stream gage is in the El Paso Narrows.

34. The Rincon Basin is entirely in New Mexico.

35. Most of the Mesilla Basin is in New Mexico. A small area at the southern end of Mesilla Basin (upstream of the El Paso Narrows) is in Texas.

36. Due to its geographic location, as well as related geologic and hydrologic features, the El Paso gage is the ideal location to measure New Mexico's compliance with the EEPI Obligation.

4.0 Components of the EEPI

37. The largest component by volume of the EEPI is the measured gage data (Rio Grande below Caballo Dam, Rio Grande at El Paso, and Acequia Madre flows). Other components of the EEPI are estimated or calculated depletions in the Texas portion of the Mesilla Basin and calculated "excess flows" that are not available for beneficial use in Texas.

4.1 Measured Gage Data for EEPI

38. The measured gage data for Rio Grande below Caballo Dam, Rio Grande at El Paso, and Acequia Madre flows from 1951 to 2021 are included in the associated Excel Spreadsheet in the tab named *Gaged Flows*.

4.2 Estimated and Calculated Components of EEPI

39. The estimated and calculated components of the EEPI Obligation are: 1) depletions to Rio Grande flow caused by agricultural use in the Texas portion of the Mesilla Basin; 2) depletions to Rio Grande flow caused groundwater pumping for DCMI uses in the Texas portion of the Mesilla Basin; and 3) the excess flows that are not available for beneficial use in Texas. These components from 1951 to 2021 are included in the associated Excel Spreadsheet in the tab named *Estimated EEPI Components*.

40. The development of each of these estimated and calculated components is detailed below.

4.2.1 Texas Mesilla Agricultural Depletions

41. Texas agriculture depletions represent the annual volume of Rio Grande flow depleted or consumed as applied irrigation in the Texas portion of the Mesilla Basin.

42. The Texas Mesilla Agricultural Depletion term is calculated by multiplying the annual irrigated acreage in the Texas Mesilla (in acres) and the annual crop irrigation requirement (CIR) of irrigated land in the Texas Mesilla (in acre-feet per acre). The result is a volume in acre-feet per year that is used in the calculation of the EEPI Obligation.

43. Crop and Non-Crop acreage estimates are documented in a technical memorandum.[1] The acreage estimates for cropped areas and non-cropped areas are summed to obtain the data in the column labeled Texas Mesilla Acreage Total. A time varying adjustment to annual irrigated lands from 1979 to 2014 was applied based on linear interpolation of the acreage of urban lands for the years 1979 and 2014 estimated from high resolution aerial imagery. The annual irrigated acreage of urban lands was assumed constant from 2014 to 2021 (i.e. 2014 values were used from 2015 to 2021). Annual irrigated acreage from 2018 to 2021 was estimated as the average annual irrigated acreage over the period 2013 to 2017.

44. The CIR estimates labeled Sullivan & Welsh CIR are documented in the expert report[2]: Annual CIR values were averaged over selected periods to reduce the uncertainty and variability in the estimated CIR for individual years. Five averaging

---

[1] Analysis of Amount of Land Irrigated from 1951 to 1978 in the Texas Portion of the Mesilla Valley Using USBR Crop, USBR MWD, USDA Census Reports, and Aerial Photographs by Al Blair, Ph.D., P.E. (draft Jan. 9, 2021)

[2] Expert Report of Gregory K. Sullivan, P.E. and Heidi M. Welsh (Oct. 31, 2019.)

periods were selected based on consideration of historical Rio Grande Project water supply and operations: 1951 to 1978, 1979 to 2002, 2003 to 2007, 2008 to 2017, and 2018 to 2021.

45. The period 1951 to 1978 represents the D2 period that is used for calculation of the EEPI Obligation.

46. The period 1979 to 2002 was characterized by consistently wet conditions in all years, with full Rio Grande Project allocations to the New Mexico and Texas Irrigation Districts, as well as Mexico. This period also included the time when the operation and maintenance of the Rio Grande Project distribution and drainage facilities were transferred to EBID and EPCWID.

47. The period 2003 to 2007 is characterized by less-than-full Rio Grande Project allocations and was the period that immediately preceded the implementation of the Rio Grande Project Operating Agreement.

48. The period 2008 to 2017 was characterized by less-than-full Rio Grande Project allocations. This period also represents the initial years following implementation of the Rio Grande Project Operating Agreement.

49. Annual CIR estimates were not available for the period 2018 to 2021. Annual CIR values for this period were assumed equal to the average CIR for the period 2008 to 2017.

50. Finally, the Texas Mesilla Agricultural Depletion term is calculated by multiplying the Texas Mesilla Acreage Total and the D2 Period Average CIR.

51. The data and calculated Texas Mesilla Agricultural Depletions from 1951 to 2021 are included in the associated Excel Spreadsheet with the name *TX Mesilla Ag*.

4.2.2 Texas Mesilla DCMI Depletions - Overview

52. Texas Mesilla DCMI Depletions represent the annual volume of Rio Grande flow depleted due to groundwater pumping for domestic, commercial,

municipal and industrial (DCMI) uses. The Texas Mesilla Depletions include two subcomponents: 1) Canutillo Well Field pumping; and 2) other DCMI pumping. These subcomponents are treated differently because the Canutillo Well Field wells are metered and the other DCMI wells are either not metered or the meter records are not available.

53. In general, the depletion is calculated by the total pumping times a depletion factor minus return flows.

4.2.2.1 Texas Mesilla DCMI Depletions - Canutillo Well Field

54. The Canutillo Well Field is owned and operated by El Paso Water, the municipal water utility for the City of El Paso. All pumping from the Canutillo Well Field has been metered since the initial operation of the wells in 1952. Data were obtained from El Paso Water.

55. The depletion factor applied to the pumping is 0.95. This is an assumed factor that means that 95 percent of the pumping is sourced from induced inflow of Rio Grande surface water, and 5 percent of the pumping is sourced from reduced evapotranspiration from riparian vegetation and reduced evaporation from open water surfaces resulting from lowered groundwater levels and reduction in open water surface area. This is a long term (steady state) depletion factor and ignores the contributions of annual groundwater storage reductions to the groundwater pumping.

56. From the initial operation of the wells (1952) to 1984, some of the pumped water was discharged directly into the Rio Grande. Annual values of the amount of pumped water discharged into the Rio Grande were obtained from a report prepared by Lee Wilson and Associates, Inc. in 1986 on behalf of El Paso Water Utilities Public Service Board.

57. The depletion factor was applied to the total pumping before subtracting the “return flow” (the amount of pumped water discharged directly to the Rio Grande).

58. The metered pumping data, the volume discharged to the Rio Grande, the depletion factor, and the calculated depletion from the Canutillo Well Field from 1951 to 2021 are included in the associated Excel Spreadsheet in a tab named *Canutillo.*

4.2.2.2 Texas Mesilla DCMI Depletions – Other DCMI Groundwater Pumping

59. Groundwater pumping in the Texas Mesilla from other DCMI wells includes groundwater pumped for use by municipalities, self-supplied domestic wells, schools, commercial (non-agricultural) businesses, industrial facilities, and other non-irrigation uses. Pumping from these "Other DCMI" wells are not metered or, if metered, records are generally not available. Annual pumping from "Other DCMI" wells was estimated by experts for New Mexico and Texas based on estimates of population, per capita use, and water use surveys conducted by the Texas Water Development Board prepared by experts for Texas and New Mexico in this matter.[3]

60. New Mexico's and Texas's estimates were averaged to reduce uncertainty, and the average was used for further calculations related to return flows and depletion factors.

61. A portion of the groundwater pumped from the "Other DCMI" wells returns to the Rio Grande above the Rio Grande at El Paso gage or to the hydrologically connected groundwater system in the Mesilla Basin. These other DCMI return flows include treated wastewater effluent discharged to the Rio Grande, groundwater recharge from treated or septic effluent, and other incidental surface runoff or groundwater recharge resulting from DCMI groundwater uses. These return flows are not typically measured or estimated and limited data and information exist. Based on experience,

[3] Expert Report of Gregory K. Sullivan, P.E. and Heidi M. Welsh (Oct. 31, 2019), and Expert Report of William Hutchison (May 31, 2019).

and the fact that these are relatively low flows, a fraction of 1/3 was considered appropriate for use as a return flow factor.

62. Consistent with the Canutillo Well Field depletion factor, the depletion factor applied to the "Other DCMI" pumping is assumed to be 0.95. This factor means that 95 percent of the pumping is assumed to be sourced from induced inflow of Rio Grande surface water, and 5 percent of the pumping is sourced from reduced evapotranspiration from riparian vegetation and reduced evaporation from open water surfaces resulting from lowered groundwater levels and reduction in open water surface area. This is a long term (steady state) depletion factor and ignores the contributions of annual groundwater storage reductions to the groundwater pumping.

63. The two expert report estimates of Other DCMI pumping, the average that was used for the EEPI Obligation, and the calculated Other DCMI Depletion for the period 1951 to 2021 are included in the associated Excel Spreadsheet in the tab named *Other DCMI.*

4.2.3 Excess Flows

64. The Excess Flow component of the EEPI Obligation reflects the volume of water in the Rio Grande at El Paso, excluding water delivered to Mexico at the Acequia Madre, that is either in excess of the operational capacity of the EPCWID distribution system below the Rio Grande at El Paso gage or is the result of excess release from Caballo Dam and cannot be put to beneficial use in Texas. In general, Excess Flows may result from three sources.

65. The first potential source of Excess Flow can be stormwater reaching the Rio Grande downstream of Caballo Dam and upstream of the Rio Grande at El Paso gage.

66. The second potential source of Excess Flow can be excess releases from Caballo Dam, including water released for flood control, operations and maintenance

activities, or any purpose other than water released to meet orders from EBID, EPCWID, or Mexico.

67. The third potential source of Excess Flow can be operational spills or accidents, or failure of Rio Grande Project infrastructure upstream of the Rio Grande at El Paso gage.

68. The Excess Flows for the period 1951 to 1978 (D2 Period) were calculated based on the operational capacity criteria. This approach quantified streamflow in the Rio Grande at El Paso, excluding water delivered to Mexico at the Acequia Madre, that cannot be diverted and used in Texas due to historic operational capacity of the American Canal and the EPCWID distribution system downstream of the Rio Grande at El Paso gage.

69. The historical operational capacity of the EPCWID distributions system downstream of the Rio Grande at El Paso gage is approximately 1,000 cubic feet per second (cfs). For the purposes of this calculation, average daily streamflow at the Rio Grande at El Paso gage, excluding daily water delivered to Mexico at the Acequia Madre, above 1,000 cfs is therefore considered excess flow. The calculated Excess flow from 1951 to 2021 is included in the associated Excel Spreadsheet in the tab named *Excess Flow.*

4.3 Net Streamflow at El Paso Gage

70. Acequia Madre flows and Excess Flows were subtracted from Rio Grande at El Paso flow to yield annual volumes of Net Rio Grande at the El Paso flows. These data and calculations for the period 1951 to 2021 are included in the associated Excel Spreadsheet in the tab named *Net RGEP*.

4.4 EEPI Delivery: 1951 to 2021

71. Each of the components of the EEPI Delivery using the data, estimates, and calculations for the period 1951 to 2021 described above are included in the associated Excel Spreadsheet in the tab named *EEPI Delivery*.

5.0 Caballo Release – Net Rio Grande at El Paso Regression

72. The critical component of the EEPI Obligation is the Net Rio Grande at El Paso flow that would be expected for a given Caballo release under D2 conditions. This was achieved with the establishment of a quantitative relationship between Caballo Release and the net streamflow of the Rio Grande at the El Paso gage during the D2 period (1951 to 1978). This quantitative relationship was developed using regression analysis.

73. As developed below, the initial regression analysis only considered the quantitative relationship between current year Caballo Release and the Net Flow of the Rio Grande at El Paso. Subsequent analyses suggested that the regression was improved when both the current year and prior year Caballo Release flows were included in the regression analysis.

74. The use of a two-year regression to quantitatively relate Caballo Release to Net Rio Grande at El Paso flows also yielded conclusions related to the need to upgrade the D2 allocation procedure to a two-year regression analysis, as developed further below.

5.1 One-Year Regression Analysis

75. The one-year regression analysis yielded a strong quantitative relationship between Net Rio Grande at El Paso flow and current-year Caballo Release.

76. The coefficient of determination (or r^2 value) was 0.93, which means that 93 percent of the variation in Net Rio Grande at El Paso flow can be described by the

variation in Caballo Release. The standard error was about 24,000 AF/yr. The residuals from 1951 to 1978 were calculated as the predicted Net Rio Grande at El Paso flows minus the actual Net Rio Grande at El Paso flows. The residuals ranged between an under prediction of about 42,000 AF/yr to an over prediction of about 50,000 AF/yr.

77. The data and regression analysis associated with the one-year Net Rio Grande at El Paso flow regression are included in the associated Excel Spreadsheet in the tab named *1-yr RGEP Regression.*

78. Based on an inspection of the residuals, it appeared that the one-year regression tended to overestimate the Net Rio Grande at El Paso flows when the Caballo release in the prior year was less than about 400,000 AF/yr, and tended to underestimate Net Rio Grande at El Paso flows when the Caballo release in the prior year was greater than 400,000 AF/yr. As a result of this observation, a two-year regression analysis was completed.

5.2 Two-Year Regression Analysis

79. The two-year regression analysis yielded an improved quantitative relationship between Net Rio Grande at El Paso flow and current and prior year Caballo Release.

80. The coefficient of determination (or r^2 value) was 0.96, which means that 96 percent of the variation in Net Rio Grande flow can be described by variation in current and prior year Caballo Release. The standard error was about 17,000 AF/yr. The residuals from 1951 to 1978 were calculated as the predicted Net Rio Grande at El Paso flows minus the actual Net Rio Grande at El Paso flows. The residuals ranged from an under prediction of about 35,000 AF/yr to an over prediction of about 23,000 AF/yr.

81. The two-year regression yielded an improvement in the coefficient of determination (0.96 vs 0.93), reduced the standard error (17,000 vs. 24,000), and

reduced the range of residuals. The highest under prediction improved to 35,000 AF/yr as compared to 42,000 AF/yr. The highest over prediction improved to 23,000 AF/yr as compared to 50,000 AF/yr.

82. The data and regression analysis associated with the two-year Net Rio Grande at El Paso flow regression are included in the associated Excel Spreadsheet in the tab named *2-yr RGEP Regression.*

6.0 EEPI Obligation

83. The EEPI Obligation is the amount of water Texas should receive under D2 conditions and is the sum of two major components: 1) the Net Rio Grande at El Paso flow calculated from the two-year Net Rio Grande at El Paso regression equation and 2) the Texas Mesilla depletions.

84. The Net Rio Grande at El Paso flow regression equation was presented earlier.

85. The Texas Mesilla depletions are based on the data, estimates, and calculations presented earlier for the period 1951 to 1978.

86. Texas Mesilla Agricultural Depletions averaged 26,960 AF/yr during the D2 period (1951 to 1978), and this average is used for purposes of EEPI Obligation.

87. Texas Mesilla DCMI Depletions averaged 12,224 AF/yr during the D2 period (1951 to 1978), and this average is used for purposes of EEPI Obligation.

88. The following equation is used to calculate EEPI Obligation:

/

/

/

EEPI Obligation = -90,149.4 1
+0.485886 * Current Year Caballo Release 2
+0.113382 * Prior Year Caballo Release 3
+26,860 4
+12,224 5

Where:

[1] ***= Regression Intercept***
[2] ***and*** [3]***= Caballo Release is actual release up to 790,000 AF/yr***
[4] ***= Average Texas Mesilla Agricultural Depletions from 1951 to 1978***
[5] ***= Average Texas Mesilla DCMI Depletions from 1951 to 1978***

89. Line 1 represents the regression intercept of the two-year Net Rio Grande at El Paso flow as described in the two-year regression analysis described above.

90. Lines 2 and 3 represent the regression coefficients multiplied by the appropriate Caballo Release (current year in line 2 and prior year in line 3). The regression coefficients from the two-year regression are described above. The Caballo Releases are limited to flows equal to or less than 790,000 AF/yr, and greater than 200,000 AF/yr. If either the current or prior year Caballo Release is greater than 790,000 AF/yr, this value is set equal to 790,000 AF/yr. If the current year Caballo Release is less than 200,000 AF/yr, there is no calculation of EEPI Obligation due to drought conditions that are so severe that Rio Grande Project operations must be managed under adaptive and ad hoc management practices.

91. Line 4 represents the average agricultural depletions in the Texas Mesilla for the years 1951 to 1978 (the D2 period). The data to calculate this average were presented earlier.

92. Line 5 represents the average DCMI depletions in the Texas Mesilla for the years 1951 to 1978 (the D2 period). The data to calculate this average are the average of the sum of the Canutillo Well Field depletions and the Other DCMI depletions presented earlier.

7.0 EEPI Departures – 1951 to 2021

93. The data, estimates, and calculations for all the components of the EEPI presented above from 1951 to 2021 were used to calculate annual EEPI Delivery, EEPI Obligation, and EEPI Departure values.

94. These data and calculations are included in the associated Excel Spreadsheet in the tab named *EEPI Departure All,* organized as follows:

95. The current year Rio Grande below Caballo data (column B) and the prior year Rio Grande below Caballo data (column C) were used as input to the two-year regression equation to yield the estimate of Net Rio Grande at El Paso (column E). The regression coefficients are in cells P4, P5, and P6.

96. The actual Net Rio Grande at El Paso flow (column D) is also presented in order to calculate a regression residual of the Net Rio Grande flow term of the EEPI Obligation (column F). The residual is calculated as actual flow minus regression-predicted flow (Column D minus Column E) to conform with the EEPI Departure calculation method.

97. The EEPI Obligation (column G) is the sum of the Regression Net Rio Grande at El Paso (column E) plus the average D2 period Texas Mesilla depletions for agricultural and DCMI uses (26,860 AF/yr and 12,224 AF/yr, respectively).

98. The EEPI Delivery is presented in Column H.

99. The EEPI Departure (column I) is calculated as the EEPI Delivery (column H) minus the EEPI Obligation (column G).

100. This version of the departure analysis includes all years. However, seven years (1985 to 1988 and 1994 to 1996) are spill years. Also, one year is an extremely dry year (2013) with Caballo Release less than 200,000 AF/yr which is outside the limits of the EEPI calculation (i.e. no EEPI would be calculated). In the associated Excel Spreadsheet, the tab named *EEPI Departure Filtered*, the calculations and data

are unchanged, but the results from the eight years listed above are removed from the table.

101. Details of these analyses of these departures are covered in the Declaration of Robert J. Brandes.

7.1 Implication for D2 Allocation

102. Rio Grande Project Allocations are made based on a one-year regression equation known as the D2 curve. These allocations limit orders for Rio Grande Project water. Because Caballo Releases are made in response to orders of Rio Grande Project water, Caballo Releases are affected by this allocation process.

103. If the allocation procedure remains unchanged from historic practice (i.e. based on a one-year regression) and the EEPI Obligation is based on a two-year regression, it is likely that some annual EEPI Departures will be unnecessarily created by the allocation process unless the allocation regression is also updated to a two-year regression. The development of a two-year D2 equation is documented below.

8.0 D2 Equation Analysis

104. The D2 curve is an equation developed through regression analysis that quantifies the relationship between Total Heading Diversions for the Rio Grande Project and Caballo Releases. The original one-year regression analysis was developed with data from 1951 to 1978 as documented in an undated Bureau of Reclamation paper that is believed to have been written around 1980.[4]

105. The data from this paper were used to recreate the one-year D2 regression (for quality control purposes) and develop a two-year D2 regression equation. The results were compared in terms of coefficient of determination (r^2 values), standard error, and range of residuals.

[4] Bureau of Reclamation, Albuquerque Area Office, El Paso Field Division, El Paso, TX. (Undated) Rio Grande Project Water Supply Allocation Procedures is attached as Attachment 3.

106. There are slight differences between the Caballo Release data that were used in the D2 regression, and the data used for the EEPI. These differences are considered minor and were ignored in order to reproduce the one-year D2 regression analysis as a quality control check as part of the development of the two-year D2 regression analysis.

107. The one-year D2 regression yielded a coefficient of determination (or r^2 value) of 0.95, which means that the 95 percent of the variation in the Total Heading Diversions can be explained by variation in the current year Caballo Release. A standard error of estimate was calculated as about 49,000 AF/yr. Annual residuals for the regression predictions were calculated as the predicted Total Heading Diversions minus the actual Total Heading Diversions. The residuals ranged from an under prediction of about 85,000 AF/yr to an over prediction of 109,000 AF/yr.

108. The two-year D2 regression yielded a coefficient of determination (or r^2 value) of 0.98, which means that 98 percent of the variation in the Total Heading Diversions can be explained by variation in the current year and prior year Caballo Release. A standard error of estimate was calculated as about 31,000 AF/yr. Annual residuals for the regression predictions were calculated as the predicted Total Heading Diversions minus the actual Total Heading Diversions. The residuals ranged from an under prediction of about 52,000 AF/yr to an over prediction of 50,000 AF/yr.

109. Similar to the comparison of the one-year and two-year regression analyses for Net Rio Grande flow, the two-year regression represents an improvement to the one-year regression. The coefficient of determination improves from 0.95 to 0.98. The standard error is reduced from 49,000 to 31,000. The highest over prediction dropped from 109,000 AF/yr to 50,000 AF/yr. The highest under prediction dropped from 85,000 AF/yr to 52,000 AF/yr.

110. All data and calculations for the D2 regression analysis are included in the associated Excel Spreadsheet in the tab named *D2 Regression.*

9.0 Conclusions

111. The EEPI Obligation quantifies the amount of water Texas should receive under D2 conditions. On average during the D2 period (1951 to 1978), 57 % of the Rio Grande Project deliveries were used in New Mexico and 43 % of the Rio Grande Project deliveries were used in Texas. The D2 period was also the basis for the 2008 Operating Agreement, which has formed the basis for Rio Grande Project operations for nearly 15 years.

112. The EEPI Obligation is the sum of the two components: 1) results of a regression equation that quantifies how much Net Rio Grande flow at the El Paso gage should occur under D2 conditions, and 2) average Rio Grande flow depletions in the Texas portion of the Mesilla Basin during the D2 period (1951 to 1978).

113. The EEPI Delivery is the amount of water Texas actually receives each year. It is the sum of Net Rio Grande flow at the El Paso gage and the Rio Grande flow depletions in the Texas portion of the Mesilla Basin.

114. Each year, an EEPI Departure is calculated as the difference between EEPI Delivery and EEPI Obligation. These departures are then used in a compact accounting process that is described in the Declarations of Robert Brandes and Margaret Barroll.

115. The EEPI approach utilizes measured data for the major components. By volume, the largest component is the measured data at the Rio Grande at El Paso gage. This gage is located in an ideal geographic, geologic, and hydrogeologic location to provide for a full accounting of all water delivered to Texas or used by Texas above the

gage, and measure compliance with New Mexico's compliance with the EEPI Obligation.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 12th day of November, at San Clemente, California

William R Hutchison

____
William R. Hutchison, Ph.D., P.E., P.G

ATTACHMENT 1

November 2022

WILLIAM R. HUTCHISON, Ph.D., P.E., P.G.

Independent Groundwater Consultant
9305 Jamaica Beach
Jamaica Beach, TX 77554
512-745-0599
billhutch@texasgw.com

EDUCATION

University of Texas at El Paso: Ph.D., Environmental Science and Engineering, 2004-2006
University of Arizona: M.S., Hydrology, 1980-1981, 1982-1983
University of California, Davis: B.S., Soil and Water Science, 1976-1980

PROFESSIONAL LICENSES

Professional Engineer (Geological and Civil) No. 96287 (Texas)
Engineering Firm Registration No. 14526 (Texas)
Professional Geoscientist (Geology) No. 286 (Texas)
Registered Professional Geologist No. 0779 (Mississippi)

PROFESSIONAL HISTORY

Organization and Location(s)	Position(s)	Dates
Independent Groundwater Consultant Austin, TX (2012 to 2015) Aberdeen, NC (2015 to 2016) Jamaica Beach, TX (2016 to present)		2012 – pres.
LBG-Guyton Associates Austin, TX	Associate	2011 – 2012
Texas Water Development Board Austin, TX	Director, Groundwater Resources Division	2009 – 2011
El Paso Water Utilities El Paso, TX	Water Resources Manager Hydrogeology Manager Hydrogeologist	2001 – 2009
TEAM Engineering and Management, Inc. Phoenix, AZ and Bishop, CA	Senior Hydrologist	1998 – 2001
Woodward-Clyde Consultants Santa Ana, CA and Phoenix AZ	Associate Sr. Project Hydrologist	1993 – 1998
Luhdorff & Scalmanini Consulting Engineers Woodland, CA	Principal Hydrologist Senior Hydrologist	1988 – 1993
Inyo County Water Department Bishop, CA (now in Independence, CA)	County Hydrologist	1985 – 1988
Geothermal Surveys, Inc. South Pasadena, CA	Hydrologist	1983 – 1985
University of Arizona Tucson, AZ	Research Assistant	1982 – 1983
Mobil Oil Corporation Denver, CO and Glendive, MT	Hydrologist	1981
Metropolitan Water District of Southern California Yorba Linda, California	Intern	1979

REPRESENTATIVE CONSULTING EXPERIENCE SINCE 2011

Texas v. New Mexico Litigation - Rincon and Mesilla Basins (New Mexico, Texas, Mexico)
As an expert witness for the State of Texas, developed a groundwater model using MODFLOW-USG along with associated pre- and post-processors. The primary issue of the litigation is the impact of groundwater pumping on Rio Grande streamflow. The model uses a variable grid of Voronoi cells and incorporated data and information on historic surface water and groundwater use for irrigation. Assignments also included reviewing models and analyses of expert witnesses of New Mexico and United States. Currently, efforts are underway to settle the case through a formal mediation process. These efforts included running additional simulations with the Texas model developed as part of this litigation and reviewing New Mexico and United States model simulations. (2012 to present)

Groundwater Management Activities in Kinney County, Texas
Completed two management plan updates (a third update is in process), reviewed permit applications, and initiated a data collection effort in Kinney County for the Kinney County Groundwater Conservation District. Currently developing an updated groundwater flow model of Kinney County that will be used for management initiatives and rules revisions. Intermediate work products included satellite analysis of irrigated acreage, preliminary management zone delineation based on a correlation between Las Moras spring flow and groundwater elevation data, and the development of an empirical model of Las Moras spring flow that was used to develop initial estimates of groundwater pumping that affects spring flow (2013 to present)

Review of Blanco River Aquifers Assessment Tool
Part of a review panel for the development of a collection of numerical and statistical model that simulate basin-scale watershed processes and stream discharge routing calculations combined with loss and gain estimates in the Blanco River and Onion Creek basins in central Texas. The surface water model will be coupled with a MODFLOW 6 model of the Trinity and Edwards (Balcones Fault Zone) aquifers. (2021 to present)

Groundwater Permit Application
Prepared a hydrogeologic report in support of a permit application for a new water well in Newton County, Texas. The report was completed in compliance with the requirements of the Southeast Texas Groundwater Conservation District guidelines. The report covered the hydrogeologic setting, proposed well construction, and the simulation of the proposed pumping. Simulation results included estimates of drawdown, subsidence in the area and at specific nearby wells sites. A water budget analysis of the proposed pumping was also included. (2021)

Groundwater Management Plan for Middle Pecos Groundwater Conservation District

Consultant to the Middle Pecos Groundwater Conservation District in Pecos County, Texas in the preparation of an update to their management plan. This assignment required revising the previous plan in terms of format and content to reflect updated policies related to updated management zone boundaries, special permit conditions, and comparisons of monitoring data to adopted desired future conditions. A review draft plan was prepared and approved by the Texas Water Development Board with no changes. After a public hearing, the plan was approved by the District Board of Directors, and final administrative completeness approval was obtained by the Texas Water Development Board. (2020)

Update to Groundwater Availability Model for the Southern Carrizo-Wilcox Aquifer

Principal Hydrogeologist for a team of consultants developing an updated flow model for the Southern Carrizo-Wilcox Aquifer (GMA 13 area of Texas) under a contract with the Texas Water Development Board. The updated model uses MODFLOW 6 and will address documented issues with the current model related to outcrop area calibration, surface water-groundwater interactions, and application to long-term predictive simulations. (2019 to present)

Update to Groundwater Availability Model for the Northern Carrizo-Wilcox Aquifer

Principal Hydrogeologist for a team of consultants developing an updated flow model for the Northern Carrizo-Wilcox Aquifer (GMA 11 area of Texas) under a contract with the Texas Water Development board. The updated model uses MODFLOW 6 and will address documented issues with the current model related to outcrop area calibration, surface water-groundwater interactions, and application to long-term predictive simulations. (2017 to 2020)

Groundwater Monitoring Thresholds in Pecos County, Texas

Reviewed historic groundwater data and model results to develop a groundwater monitoring plan, including regulatory thresholds and triggers, for eleven specific monitoring wells. The regulatory thresholds were used in the settlement of several years of litigation between the Middle Pecos Groundwater Conservation District and a permit applicant. Work on implementing the settlement continues with the development of an expanded monitoring program, including expansion of establishing a baseline of groundwater quality, spring flow, and vertical gradients. (2017 to present)

Joint Planning in Groundwater Management Areas 2, 3, 4, 7, and 11 (3rd Round)

Consultant for GMAs 2, 3, 4, 7, and 11 to develop updated desired future conditions. Included in this effort are the review of aquifer conditions and uses, review of water management strategies, review of hydrologic information and data, developing future pumping estimates, running alternative simulations with the Groundwater Availability Models, and preparing explanatory reports. (2019 to present)

Groundwater Model for Pecos County, Texas

Developing a groundwater model that covers all aquifers in Pecos County. The five aquifers in the county are covered in four regional groundwater models which limits the ability to fully understand the vertical connection between the aquifers. Initial geologic work to focus and improve the complex faulting and structure has been completed by other District consultants. Work on developing a numerical groundwater flow model is underway. (2019 to present)

Lower Colorado River Authority Groundwater Permit Contested Case Hearing

Consultant for the General Manager of the Lost Pines Groundwater Conservation District. The Lower Colorado River Authority (LCRA) submitted eight applications to the Lost Pines Groundwater Conservation District seeking authorization to withdraw 25,000 acre-feet of water per year from eight wells in Bastrop County. Dr. Hutchison was retained an expert witness for the General Manager of the Lost Pines Groundwater Conservation District for a contested case hearing before the Texas State Office of Administrative Hearings. Dr. Hutchison prepared an expert report and pre-filed written testimony regarding the use of models to evaluate potential impacts of the proposed pumping. As part of the assignment, Dr. Hutchison reviewed model runs completed by the applicant's and protesting parties' experts. Specifically, Dr. Hutchison processed model output to assess surface water-groundwater interaction impacts, provided predicted impacts to over 2,600 registered wells in the district, and processed model output to provide predicted impact to 39 monitoring wells for use in future monitoring. Dr. Hutchison was deposed on the expert report and pre-filed testimony and testified at the hearing. In a Proposal for Decision, the Administrative Law Judges recommended that the Lost Pines Groundwater Conservation District issue the Operating and Transport Permits with some recommended changes. The Lost Pines Groundwater Conservation District approved a permit for 8,000 acre-feet per year in October 2021. (2019)

Joint Planning in Groundwater Management Areas 2, 3, 4, 7, 11, and 13 (2nd Round)

Consultant for GMAs 2, 3, 4, 7, 11 and 13 to develop updated desired future conditions. Included in this effort were the review of aquifer conditions and uses, review of water management strategies, review of hydrologic information and data, developing future pumping estimates, running alternative simulations with the Groundwater Availability Models, and preparing explanatory reports. (2012 to 2018)

Groundwater Flow and Transport Model of Lower Rio Grande Valley

Principal Hydrogeologist for a team of consultants that developed a flow and transport model for the Lower Rio Grande Valley using MODFLOW-USG under a contract for the Texas Water Development Board. The model objectives included the simulation of 23 water management strategies related to proposed fresh groundwater development and brackish groundwater desalination plants. Simulation results included quantitative estimates of groundwater elevation changes, changes in salinity, and impacts to surface water flows. (2015 to 2017).

Joint Planning Support for Bluebonnet Groundwater Conservation District and Lower Trinity Groundwater Conservation District

Dr. Hutchison has provided consulting services to the Bluebonnet Groundwater Conservation District (Austin, Grimes, Waller, and Walker counties) and the Lower Trinity Groundwater Conservation District (Polk and San Jacinto counties) to support the joint planning process in Groundwater Management Area 14. Completed analyses and simulations related to a proposal to revise the desired future conditions pursuant to a request by Lone Star Groundwater Conservation District. The request to revise the desired future conditions adopted in 2016 was part of the settlement of litigation over the reasonableness of the desired future conditions. The requested revision was reviewed, and documented, and various alternative revisions were simulated using inverse runs of the Groundwater Availability Model to provide perspective on the requested revision. Work continues in the support of these districts in the development of new desired future conditions by Groundwater Management Area 14. As part of the proposal of a GMA-wide multi metric desired future condition, work has included documenting the approach to develop district-specific desired future conditions and the link between planning, management, and regulation (2018 to present)

Groundwater Model Reviews in Pecos County, Texas

Reviewed two existing groundwater models for Middle Pecos Groundwater Conservation District: one developed by the USGS in 2014 and one developed by a team of consultants in 2011. The models were evaluated in terms of how they could be used for predictive simulations in support of developing desired future conditions and in support of permit applications. (2016 to 2017)

Groundwater Availability Model Development using MODFLOW-USG

As a consultant to the Hickory Underground Water Conservation District No. 1, Dr. Hutchison worked with staff of the Texas Water Development Board in the development of the Groundwater Availability Model for the Llano Uplift Aquifers. This model was developed with MODFLOW-USG. (2013 to 2016)

Hydrogeologic Study of Val Verde County, Texas
Completed a hydrogeologic study of the Edwards-Trinity (Plateau) Aquifer in Val Verde County for the County of Val Verde and City of Del Rio. The study included developing, calibrating, and applying a groundwater flow model of the area to assess impacts of proposed pumping on local spring flow and Rio Grande flows. (2013 to 2014)

Subsidence Analysis for Bluebonnet Groundwater Conservation District
As part of a rules revision that simplified the permitting process for small diameter wells and included more detailed requirements to consider subsidence analysis in the permit review process, simulations have been completed to estimate the maximum pumping that would avoid subsidence using the Houston Area Groundwater Model, which had been adopted by TWDB as the Groundwater Availability Model for the northern portion of the Gulf Coast Aquifer. (2014 to 2015)

Comparison of Groundwater Monitoring Data with Groundwater Model Results
As part of the current round of joint groundwater planning, completed assignments for groundwater conservation districts in Groundwater Management Area 9 and Groundwater Management Area 13 to compare groundwater monitoring data with groundwater model results from the desired future conditions process. These efforts examined, in detail, the various assumptions used in developing the initial round of desired future conditions adopted in 2010. (2012 to 2013)

Groundwater Transport Permit Review
A private landowner submitted a permit application to transport 22,500 acre-feet per year of groundwater from Austin and Waller Counties to the cities of Richmond and Rosenberg in Fort Bend County. Dr. Hutchison completed the technical review of the application for the Bluebonnet Groundwater Conservation District as part of a contested case hearing. The applicant subsequently withdrew the application. (2012 to 2014)

Groundwater Model Review Panel
Participated as a member of the Groundwater Review Panel for the Edwards Aquifer Authority related to the new finite element model being developed for the Edwards Aquifer by Southwest Research Institute. (2012 to 2015)

Well Classification Study and Hydrogeologic Report Guidelines Update
Over 2,500 wells in the Bluebonnet Groundwater Conservation District (Austin, Grimes, Waller and Walker Counties) were evaluated to determine the aquifer completion interval by comparing the screened interval with various groundwater models of the region (Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast). The results of this evaluation were used to update and enhance the review process of permit applications submitted to the district. (2012 to 2014)

Rules Update for Bluebonnet Groundwater Conservation District

Based on the well classification study and the review of the groundwater transport permit (please see above), the Board of Directors completed a revision to the district rules that simplified the permitting process for small diameter wells and included more detailed requirements to consider subsidence analysis in the permit review process. (2014)

Mine Dewatering Groundwater Pumping Permit

Hickory Underground Water Conservation District No. 1 received a permit application from Premier Silica LLC to pump groundwater for dewatering associated with an expansion of an existing aggregate mine in the Brady area. Dr. Hutchison was retained to review the groundwater model that has been developed in support of the permit application, and to review the impact of the proposed pumping on the adopted desired future condition for the Hickory Aquifer. (2012 to 2013)

Evaluation of a Proposed Groundwater Development Project in East Texas

Completed an evaluation of potential effects of a proposed groundwater development project located in Anderson, Cherokee, and Houston counties in east Texas for the Neches & Trinity Valleys Groundwater Conservation District. Consultants for the project proponents and the Texas Water Development Board (TWDB) had previously completed simulations of the proposed pumping using the Groundwater Availability Model (GAM) of the Northern Carrizo-Wilcox Aquifer. Neches & Trinity Valleys Groundwater Conservation District asked for the completion of three tasks: 1) review TWDB GAM run reports, including the GAM run model run that was used to establish Desired Future Conditions, and the GAM run that was used to evaluate the regional effects of the proposed project, 2) extend the previous analyses of the project proponent's consultant and the TWDB by evaluating the effects of the proposed pumping on specific wells, and 3) recommend and monitoring network. The analysis was presented to the Neches & Trinity Valleys Groundwater Conservation District and was presented at the GMA 11 petition hearing in February 2012. (2011 to 2012)

Groundwater Management Plan for Red River Groundwater Conservation District

Consultant to the Red River Groundwater Conservation District in Fannin and Grayson Counties in the preparation of their initial management plan. This assignment required compiling and organizing the goals, objectives, and performance measures from management plans of neighboring districts, preparing a handout for Board members, and reviewing the various approaches with the Board in an open workshop session. Based on the discussion, a draft plan was prepared and approved by the Board. The review draft was subsequently approved by the Texas Water Development Board with no changes. The public hearing and final approval were completed by District personnel as a means of reducing costs. (2012)

Evaluation of Groundwater Availability using Groundwater Budget Analysis

Completed a groundwater budget analysis to provide data and information pertaining to groundwater availability for a private property owner in California. The analysis involved identifying and quantifying individual components of the inflows to and outflows from the defined area. Based on an analysis of precipitation and groundwater elevation changes, a series of historic groundwater budgets were developed for 20-year periods ranging from 1949-1968 to 1991-2010. The analysis was extended to estimate changes to the groundwater budget, generally, and groundwater elevations, specifically under alternative groundwater pumping scenarios from the subject property. (2011 to 2012)

REPRESENTATIVE AGENCY EXPERIENCE (EPWU and TWDB, 2001 to 2011)

Joint Groundwater Planning in Texas (1st Round)

In 2005, the Texas Legislature adopted HB 1763, which required that groundwater conservation districts within each groundwater management area adopt desired future conditions by September 1, 2010. The Texas Water Development Board provided technical assistance to this process. As Director of the Groundwater Resources Division, Dr. Hutchison was responsible for coordinating the effort of division staff and took the lead in 9 of the 15 Groundwater Management Areas. Technical support included developing and running groundwater models to estimate impacts of alternative pumping scenarios and attending meeting to discuss and interpret the results of these analyses. Partly because of the technical support provided by the Groundwater Resources Division staff, all desired future conditions were adopted prior to the statutory deadline. (2009 to 2010)

Challenges to the Reasonableness of Desired Future Conditions in Texas

Prepared technical reports related to petitions challenging the reasonableness of desired future conditions for Groundwater Management Area 1 (Ogallala Aquifer) and Groundwater Management Area 9 (Edwards Group of the Edwards-Trinity (Plateau) Aquifer). These petitions were filed with the Texas Water Development Board in accordance with statute and agency rules. The technical analysis was submitted to the Board for consideration in their deliberations as to the reasonableness of the adopted desired future condition. (2009 to 2010)

Modeled Available Groundwater Development in Texas

Managed development of modeled available groundwater estimates that were based on the desired future conditions adopted by the groundwater conservation districts. These estimates, required by statute, include estimating the total pumping that will achieve the desired future condition and estimating the exempt use of the area. Prior to the 2011 legislative session, these estimates were termed Managed Available Groundwater, and represented the amount of groundwater available for permitting, and were calculated as the total pumping minus the exempt use. (2010 to 2011)

Update of the Hueco Bolson Model in Chihuahua, New Mexico and Texas
Completed an update of the USGS model of the Hueco Bolson (Texas, New Mexico, and Chihuahua) by extending the model period to 2002. The model was used to complete simulations of alternative groundwater management strategies. Based on the results of this work, recommendations were developed regarding long-term groundwater management strategies for the Hueco Bolson. (2001 to 2003)

Groundwater Availability Model Updates in Texas
Completed updates to groundwater availability models in support of the Joint Groundwater Planning Process in Texas. Updated models included: Dockum Aquifer, Edwards-Trinity (Plateau) Aquifer and Pecos Valley Aquifer, Barton Springs Segment of the Edwards (Balcones Fault Zone) Aquifer, Kinney County portions of the Edwards (Balcones Fault Zone) Aquifer and Edwards-Trinity (Plateau) Aquifer, and Southern Gulf Coast Aquifer (GMA 16 portion). These models were updated because the existing models proved to be inadequate for assisting the groundwater conservation districts in developing desired future conditions. (2009 to 2010)

Groundwater Model of the Dell City, Texas Area
Developed a regional groundwater flow model covering a large area in Hudspeth and Culberson Counties, Texas and Otero County, New Mexico. This objective of this groundwater model was to develop a more complete understanding of the hydrogeology of the karstic aquifer in the region, and develop data and information related to acquiring property and water rights for a potential groundwater importation project for the City of El Paso. In 2016, the model was adopted by the Texas Water Development Board as the official Groundwater Availability Model for the Bone Spring-Victorio Peak Aquifer. (2001 to 2008)

Hueco Bolson Evaluation, Texas
Completed analyses of groundwater flow and groundwater quality of the Hueco Bolson covering west Texas, southern New Mexico, and northern Chihuahua. These analyses included evaluating historic groundwater flow patterns, mapping current groundwater quality in three dimensions, evaluating historic groundwater quality changes caused by pumping, and changes in the groundwater budget including induced inflow from the Rio Grande. Prepared comprehensive report of findings that was peer reviewed by a 5-member panel. Results included the finding that the reduction in groundwater pumping from 1989 to 2002 had fundamentally changed conditions in the Hueco Bolson. Moreover, the assumptions that were the foundation of a conclusion made in a 1979 analysis (depletion of fresh groundwater by 2030) were no longer applicable. (2001 to 2004)

Mesilla Bolson Groundwater Management, El Paso, Texas

Completed analyses of groundwater flow and groundwater quality of the Mesilla Bolson in west Texas and southern New Mexico. These analyses included evaluating previous groundwater models developed for a variety of objectives and analyzing the role of the Rio Grande in the recharge of the Mesilla. As a result of the analyses a series of piezometers were constructed to improve data coverage and long-term monitoring of the area. In addition, limitations to previous models were identified, and work is currently underway to better incorporate the known hydrostratigraphy in an updated and improved model of the area. (2001 to 2009)

Model Documentation of Groundwater Availability Models in Texas

Completed documentation of the Hueco Bolson and Mesilla Bolson groundwater flow models (Texas, New Mexico, and Chihuahua). These models had been previously developed and were designated as official Groundwater Availability Models (GAM) for the Hueco-Mesilla Aquifer by the Texas Water Development Board. Documentation was needed to fully satisfy the requirements of the Texas Water Development Board. (2001 to 2004)

Brackish Groundwater Well Location, El Paso, Texas

Completed analyses of the Hueco Bolson related to locations of new wells for use in the Kay Bailey Hutchison Desalination Plant, a joint project between El Paso Water Utilities and Fort Bliss. After initial concerns were raised by Fort Bliss, an investigation was completed in cooperation with the US Army Corps of Engineers to evaluate five alternative well field locations. The wells were sited to meet the dual objectives of producing a targeted quantity of brackish groundwater for treatment and establishing a hydraulic barrier to prevent further movement of brackish groundwater into areas with municipal wells. Based on this analysis, an alternative was selected and agreed upon. (2003)

Desalination Concentrate Injection Wells in El Paso, Texas

Completed preliminary analyses of impacts from injection wells that were proposed for use as part of the Kay Bailey Hutchison Desalination Plant in El Paso, Texas. The analyses included the development of a simple numerical flow model based on a subsurface geologic model developed by researchers at UTEP from gravity data and on the results from slug tests completed during a test hole drilling project funded and managed by the US Army Corps of Engineers. These analyses were incorporated into the Environmental Impact Statement (EIS) for the overall project. Based on the results of the analysis, a full-size injection well was constructed and tested to obtain better data to support authorization from the Texas Commission on Environmental Quality (TCEQ) under the Underground Injection Control (UIC) program. Once authorization was obtained, two additional wells were constructed, and all three wells were equipped and tested. Issues related to the potential for mineral precipitation in the well bores and reservoir were evaluated with a combination of geochemical modeling, experiments with formation samples, formation water and concentrate, and monitoring of initial operation. (2004 to 2009)

Simulations of Potential Desalination Plant in Mission Valley, El Paso, Texas

Completed a preliminary analysis of a proposed desalination plant in the Mission Valley area of El Paso. This analysis consisted of simulating three potential configurations of well fields to assess impacts to groundwater elevations and gradients, and to estimate potential impacts to the groundwater budget of the area. Based on this analysis, and a companion engineering analysis completed by a consultant, future pre-design work was recommended. (2003)

Impacts of Climate Variability and Climate Change in El Paso, Texas

Analyzed the reliability of El Paso's municipal water supplies under a wide range of climate scenarios, including integration of the Intergovernmental Panel on Climate Change (IPCC) projections for the region. Because El Paso practices conjunctive use management, the analysis included evaluation of impacts to both surface water (Rio Grande) and groundwater impacts. The analysis included developing simulated Rio Grande flows entering Elephant Butte reservoir based on a published 1000-yr tree ring record, developing a simple reservoir operations model to estimate Elephant Butte outflows and El Paso municipal diversions, estimating groundwater pumping, and simulating groundwater storage changes using a groundwater model. A total of 60 climatic scenarios were developed. Each scenario was simulated under 958 50-year simulations for a total of 57,480 simulations. The results demonstrated the effectiveness of the investments in water infrastructure and the efficacy of the management approach that has been developed over the last several decades in meeting municipal water demands over a wide range of climatic conditions. (2007 to 2008)

Region E Water Planning, Far West Texas

Developed the conceptual approach of an Integrated Water Management Strategy for El Paso County that was used in the 2005 Regional Water Plan for Far West Texas. Working with Far West Texas Regional Planning Group and their consultants, the conceptual plan was used to develop six specific alternatives designed to meet expected increased water demands in El Paso County through 2060. Alternatives ranged from reliance on single existing sources to a balanced approach that relied on numerous sources, including importation from Hudspeth, Culberson, Jeff Davis, and Presidio Counties. (2004 to 2005)

Well Construction

Managed a well construction and equipping program while employed by El Paso Water Utilities that resulted in:

- Drilling of 50 test holes
- Construction of 14 monitoring wells
- Construction of 3 multi-zone piezometers
- Construction and equipping of 16 fresh groundwater production wells
- Construction and equipping of 32 brackish groundwater production wells

Well designs and construction management were completed in-house. Equipping design and construction management were supervised through a consulting engineer. (2001 to 2009)

REPRESENTATIVE CONSULTING EXPERIENCE (1983 to 2001)

Owens Valley, California

Hydrology consultant to the Inyo County (California) Board of Supervisors, Water Department, Water Commission and Environmental Health Department from 1985 to 1999 on issues related to water resources management and protection in the Owens Valley and Death Valley regions, including a key role in the development and negotiation of an historic water management agreement between Inyo County and the City of Los Angeles for the Owens Valley and the preparation of the associated environmental documentation. Assignments also included review and analysis of the Anheuser-Busch groundwater export project in the Cartago area, review and analysis of the groundwater pumping proposed by OLSAC in the Cottonwood Creek area, review and analysis of the groundwater export project proposed by Western Water in the Olancha area, and many others. Many of these assignments included the development and application of groundwater models and the development of monitoring networks and environmental triggers and thresholds to manage the pumping operations. (1985 to 1999)

Owens Valley Indian Reservation Groundwater Modeling

Completed local scale groundwater models of three Indian Reservations in the Owens Valley, California. The regional model developed by the USGS was used as a starting point for these models. The initial phase consisted of using Telescopic Mesh Refinement to define the boundary conditions of the three local scale models. Subsequent phases included enhancing and updating the local scale models. The preliminary model of the Big Pine area was used to evaluate potential increases in pumping that are associated with the Big Pine Ditch System project. (2000 to 2006)

Los Angeles Aqueduct Simulation Model

Consultant to the California State Water Resources Control Board related to the Mono Basin Water rights decision, a court ordered review of water rights licenses held by the City of Los Angeles. Working in partnership with State Board staff and Board members, hydrologic analyses were completed, and a simulation model (LAAMP) of the Mono Basin and Los Angeles Aqueduct system was developed and applied to evaluate the impacts of alternative water rights decisions. The simulation model was accepted by all parties involved in the process and was ultimately used in the final water rights decision that resulted in decreased diversions in order to maintain fish flows and restore lake elevation. (1992 to 1994)

Tri-Valley Groundwater Evaluation, Mono County, California

Completed a preliminary groundwater model for the Tri-Valley Groundwater Management District in Mono County, California. This model was based on existing data and was used to preliminarily evaluate the potential impacts of a proposed groundwater export project. Based on the model results, additional data requirements were identified and recommended for Phase 2 of the project. (2000 to 2001)

Evaluation of Impacts of Increased Capacity of Salinas Dam, California

Completed analyses related to the evaluation of potential downstream impacts of increased storage capacity of the Salinas Dam in central California. These analyses included estimates of reduced spills associated with the increased storage, evaluating the relationship of river flows and groundwater levels in the Atascadero area, and estimating potential groundwater level impacts that may result from the reduced spills. The analyses were summarized in an Environmental Impact Report, and in several technical appendices to the EIR. Because the work involved modification of a water right held by the City of San Luis Obispo, expert witness testimony was given at the California State Water Resources Control Board. (1997 to 1999)

Aggregate Mine Expansion, Ventura County, California

Consultant to Ventura County (California) Resource Management Agency on the analysis of potential hydrologic impacts of the expansion of an aggregate mine. Concerns had been raised about the potential impact of the mine expansion on seawater intrusion and nitrate contamination. The assignment began with the review of a groundwater model prepared by the project proponent’s consultant. As a result of the review, the existing analyses was expanded with the development of a site-specific groundwater model to enhance the simulation of the potential impacts on nearby spreading facilities, the development of a solute transport model, the completion of a risk assessment of potential groundwater pollution, and the preparation of the water resources and water quality sections of an Environmental Impact Report. (1995 to 1996)

Simulation of Impacts of Tunnel Construction, California
Developed a finite element model for the Metropolitan Water District of Southern California using FRAC3DVS to simulate groundwater inflow during the construction of the Inland Feeder East Tunnel near San Bernardino, California. The model was calibrated under steady-state conditions using groundwater level data from geotechnical boreholes constructed during the design-phase geotechnical investigation. The model was calibrated under transient conditions using tunnel inflow data and groundwater level changes caused by groundwater inflow into the tunnel. Based on the model results, recommendations were made regarding grouting operations for later phases of construction. (1996 to 2002)

Los Osos Groundwater Model
Updated and enhanced a groundwater model and developed a groundwater management plan for the three water purveyors in Los Osos, California (Southern California Water Co, S&T Mutual Water Company, and Los Osos Community Services District). The original model had been developed in 1987 by the USGS, and the updated version was used to address specific management questions related to construction and operation of a sewer project, seawater intrusion, conjunctive use strategies, and the need to import surface water. (1997 to 2000)

San Benito County Groundwater Evaluation, California
Conducted a countywide evaluation of the groundwater resources of San Benito County, California. This effort included the evaluation of surface water and groundwater quantity and quality, development and calibration of a basin wide numerical model of the groundwater system, and the evaluation of recharge patterns altered by the delivery of supplemental surface water, some of which is used for direct groundwater recharge. At the completion of the model and report, expert witness testimony was given in a groundwater rights lawsuit between a developer and the local water district. Four years after the model was completed, the County requested that the model be updated and enhanced. (1991 to 1992, 1996)

San Luis Obispo Groundwater Evaluation
Completed analyses related to a proposed increase in groundwater pumping in the San Luis Obispo area of central California. The initial analysis consisted of integrating potential local groundwater pumping increases into the reservoir operations planning model used by the City of San Luis Obispo to identify conjunctive use opportunities and limitations. The second phase of the analysis consisted of developing and calibrating a groundwater model of the entire groundwater basin. This model was then used to identify potential impacts of increased pumping on groundwater levels in nearby wells, potential reductions in streamflow, and potential subsidence effects. (2000 to 2001)

Cadiz Valley Groundwater Exploration and Development
Completed a comprehensive groundwater exploration and development project in the Cadiz Valley near the Fenner Gap in the Mojave Desert region of southeastern California. Exploration work included review of available information and data on groundwater conditions and geology. An extensive geophysical study using shallow ground temperatures was completed and results were used to select drilling sites. Three test holes were drilled, and two production wells were constructed and tested. Based on the results of the investigations, a report was prepared, and a groundwater budget of the area was estimated. Sixteen years later, assisted the Metropolitan Water District of Southern California in the review of a proposed groundwater storage and recovery project in the Cadiz Valley. As part of this assignment, the groundwater model that had been developed to evaluate the feasibility and potential impacts of the project was modified and enhanced. (1983 to 1984, 2000 to 2001)

Groundwater Management Spreadsheet Models
Developed management tools in the form of empirical models that can be run in a spreadsheet format for the Soquel Creek Water District in central California, and the Vista Irrigation District in southern California. The models were designed to provide a tool for Soquel Creek Water District to manage their groundwater pumping with the objective of preventing seawater intrusion, and by Vista Irrigation District to conjunctively use local surface water, local groundwater, and imported water (1988 to 1991).

Groundwater Storage Project Evaluation in Southeastern California
Developed groundwater models for four basins in southeastern California to evaluate the feasibility of storing Colorado River water for the Metropolitan Water District of Southern California. These models were used to simulate the storage of water in wet years, "holding" the water for 5 to 10 years, then extracting after the "hold" period. Models were developed for the Hayfield, Palen, Chuckwalla, and Rice Valleys. Based on the initial modeling work, a focused field investigation was completed in the Hayfield Valley are, the site chosen as the most desirable. (1996 to 2001)

PEER REVIEWED PUBLICATIONS

Druhan, Jennifer L., Hogan, James F., Eastoe, Christopher J., Hibbs, Barry J., and Hutchison William R., 2008. Hydrogeologic Controls on Groundwater Recharge and Salinization: A Geochemical Analysis of the Northern Hueco Bolson Aquifer, El Paso, Texas, USA. Hydrogeology Journal, Vol. 16, No. 2, pp. 281-296.

Eastoe, Christopher J., Hibbs, Barry J., Granados-Olivas, Alfredo, Hogan, James F., Hawley, John, and Hutchison, William R., 2008. Isotopes in the Hueco Bolson Aquifer, Texas (USA) and Chihuahua (Mexico): Local and General Implications for Recharge Sources in Alluvial Basins. Hydrogeology Journal, Vol. 16 No. 4, pp.737-747.

Eastoe, Christopher J., Hutchison, William R., Hibbs, Barry J., Hawley, John, and Hogan, James F., 2010. Interaction of a River with an Alluvial Basin Aquifer: Stable Isotopes, Salinity and Water Budgets. J. Hydrol. doi:10.1016/j.jhydrol.2010.10.012.

Hutchison, William R., 2006. Groundwater Management in El Paso, Texas. Ph.D. Dissertation, The University of Texas at El Paso. Obtainable at http://www.dissertation.com/book.php?method=ISBN&book=1581123280

Hutchison, William R. and Hibbs, Barry J., 2008. Ground Water Budget Analysis and Cross-Formational Leakage in an Arid Basin. Ground Water, Vol. 46, No. 3, pp. 384-395.

OTHER PUBLICATIONS (e.g. Conference Proceedings, Magazine Articles)

Hibbs, Barry J. and Hutchison William R., 2006. Environmental Isotopes and Numerical Models Estimate Induced Recharge in the El Paso/Juarez Area. In: Increasing Freshwater Supplies, 2006 UCOWR/NIWR Annual Conference Proceedings, Santa Fe, New Mexico.

Hutchison, William R., 2006. Desalination of Brackish Groundwater and Deep Well Injection of Concentrate in El Paso, Texas. In: Stars of the Future, Reuse & Desalination, 2006 WateReuse Association Annual Symposium Proceedings.

Hutchison, William R., 2006. Integrated Water Management Strategies for the City and County of El Paso. In: Increasing Freshwater Supplies, 2006 UCOWR/NIWR Annual Conference Proceedings, Santa Fe, New Mexico.

Hutchison, William R., 2007. El Paso Groundwater Desalination Project: Initial Operation. Water Reuse and Desalination, As Bright as the Florida Sun, 2007 WateReuse Association Annual Symposium Proceedings.

Hutchison, William R., 2008. Deep Well Injection of Desalination Concentrate in El Paso, Texas. Southwest Hydrology, Vol. 7, No. 2, March/April 2008, pp. 28-30.

Hutchison, William R., 2008. Climate change impacts on municipal water management in El Paso, Texas. Abstract in Far West Texas Climate Change Conference, June 17, 2008 in El Paso, Texas. Pdf pages 29-30.

Hutchison, William R., 2008. Desalination of Brackish Groundwater and Deep Well Injection of Concentrate in El Paso, Texas. Texas WET, Vol. 25, No. 5, September 2008, pp. 5-8.

Hutchison, William R., 2008. Climate change impacts on municipal water management in El Paso, Texas. Proceedings of International Conference on Water Scarcity, Global Changes, and Groundwater Management Responses, Convened by UNESCO, University of California, Irvine, and USGS. Irvine, California, December 2008. Pdf pages 144-165. Obtainable at: http://geodesy.unr.edu/hanspeterplag/publications/pubs/2011_Fried_Scherfig_UNESCO_Proceedings.pdf

Norman, Monique and Hutchison, William R., 2022. Groundwater Management Area Joint Planning. Chapter 21 of Essentials of Texas Water Resources, Seventh Edition, State Bar of Texas, Environmental & Natural Resources Law Section.

AGENCY REPORTS (2002-present)

Hutchison, William R., 2002. Documentation of Files for Steady State and Annual Versions of Groundwater Flow Model of Hueco Bolson. El Paso Water Utilities Hydrogeology Report 02-01.

Hutchison, William R., 2002. Conceptual Model of the Groundwater Flow System, Bone Spring-Victorio Peak Aquifer, Salt Basin and Diablo Plateau, Hudspeth and Culberson Counties, Texas. El Paso Water Utilities Hydrogeology Report 02-02.

Hutchison, William R., 2003. Hueco Bolson Groundwater Model Update. El Paso Water Utilities Hydrogeology Report 03-01.

Hutchison, William R., 2003. Lower Valley Desalination Well Analysis. El Paso Water Utilities Hydrogeology Report 03-03.

Hutchison, William R., 2004. Hueco Bolson Groundwater Conditions and Management in the El Paso Area. El Paso Water Utilities Hydrogeology Report 04-01

Hutchison, William R., 2004. Documentation of Files for Canutillo Wellfield Groundwater Flow Model. El Paso Water Utilities Hydrogeology Report 04-03.

Hutchison, William R., 2008. Preliminary Groundwater Flow Model, Dell City Area, Hudspeth and Culberson Counties, Texas. El Paso Water Utilities Hydrogeology Report 08-01.

Hutchison, William R., 2008. Conceptual Evaluation of Surface Water Storage in El Paso County. El Paso Water Utilities Hydrogeology Report 08-02. Prepared for the Far West Texas Regional Planning Group.

Hutchison, William R., 2017. Predictive Simulation Report: Lower Rio Grande Valley Groundwater Transport Model. Report Submitted to Texas Water Development Board, October 31, 2017.

Hutchison, William R., Davidson, Sarah C., Brown, Brenner J., and Mace, Robert E. (editors), 2009. Aquifers of the Upper Coastal Plains of Texas. Texas Water Development Board, Report 374.

Hutchison, William R. and Granillo, Jose A., 2004. Preliminary Analysis of Impacts of Joint Desalination Facility Injection Wells. El Paso Water Utilities Hydrogeology Report 04-02.

Hutchison, William R. and Hill, Melissa E., 2011. Recalibration of the Edwards BFZ (Barton Springs Segment) Aquifer Groundwater Flow Model. Texas Water Development Board, Unnumbered report.

Hutchison, William R.; Hill, Melissa E.; Anaya, Roberto, Hassan, Mohammed M.; Oliver, Wade; Jigmond, Marius; Wade, Shirley, 2011. Groundwater Management Area 16 Groundwater Flow Model. Texas Water Development Board, Unnumbered report.

Hutchison, William R.; Jones, Ian C.; Anaya, Roberto; and Jigmond, Marius, 2011. Update of the Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers. Texas Water Development Board, Unnumbered report.

Hutchison, William R., Pease, R. Eric and Hess, Suzanne, 2003. Joint Desalination Facility Blend Well Analysis. El Paso Water Utilities Hydrogeology Report 03-02.

Hutchison, William R.; Shi, Jerry; and Jigmond, Marius, 2011. Groundwater Flow Model of the Kinney County Area. Texas Water Development Board, Unnumbered report.

Jigmond, Marius, Hutchison, William R., Shi, and Jianyou (Jerry), 2014. Final Report: Groundwater Availability Model of the Seymour Aquifer in Haskell, Knox, and Baylor Counties. Texas Water Development Board, Unnumbered report.

Oliver, Wade and Hutchison, William R., 2010. Modification and Recalibration of the Groundwater Availability Model of the Dockum Aquifer. Texas Water Development Board, Unnumbered report.

Panday, Sorab; Rumbaugh, James; Hutchison, William R.; and Schorr, Staffan; 2017. Numerical Model Report: Lower Rio Grande Valley Groundwater Transport Model. Report submitted to Texas Water Development Board, 23 October 2017.

Panday, Sorab; Rumbaugh, James; Hutchison, William R.; and Schorr, Staffan, 2020. Numerical Model Report: Groundwater Availability Model for the Northern Portion of the Queen City, Sparta, and Carrizo-Wilcox Aquifers. Report submitted to Texas Water Development Board, December 7, 2020.

Schorr, Staffan; Hutchison, William R.; Panday, Sorab; and Rumbaugh, James, 2017. Conceptual Model Report: Lower Rio Grande Valley Groundwater Transport Model. Report submitted to Texas Water Development Board, June 30, 2017.

Schorr, Staffan; Zivic, Megan; Hutchison, William R.; Panday, Sorab; and Rumbaugh, 2020. Conceptual Model Report: Groundwater Availability Model for Northern Portion of the Queen City, Sparta, and Carrizo-Wilcox Aquifers. Report submitted to Texas Water Development Board, November 30, 2020.

Shi, Jianyou(Jerry): Boghici, Radu: Kohlrenken, William, and Hutchison, William R., 2016. Conceptual Model Report: Minor Aquifers in Llano Uplift Region of Texas. Texas Water Development Board, March 7, 2016, 305p.

Shi, Jianyou(Jerry): Boghici, Radu: Kohlrenken, William, and Hutchison, William R., 2016. Numerical Model Report: Minor Aquifers of the Llano Uplift Region of Texas (Marble Falls, Ellenburger-San Saba, and Hickory). Texas Water Development Board, November 4, 2016.

Wade, Shirley C., Hutchison, William R., Chowdhury, Ali H., and Coker, Doug, 2011. A Conceptual Model of Groundwater Flow in the Presidio and Redford Bolsons Aquifers. Texas Water Development Board, August 2011, 102p.

ATTACHMENT 2

EXCEL SPREADSHEET - EEPI

Year	Rio Grande below Caballo Dam (AF/yr)	Rio Grande at El Paso (AF/yr)	Acequia Madre (AF/yr)
1951	469,455	251,990	33,064
1952	543,979	283,631	49,891
1953	528,620	264,577	37,791
1954	244,155	93,723	10,147
1955	219,156	67,083	8,183
1956	246,139	57,453	7,862
1957	397,092	139,578	23,284
1958	737,127	392,848	60,054
1959	687,409	385,869	60,111
1960	705,161	378,148	60,313
1961	561,695	300,805	48,616
1962	651,940	376,150	60,081
1963	517,169	263,707	39,694
1964	206,081	64,304	6,652
1965	505,606	202,389	36,674
1966	610,330	308,776	49,606
1967	456,585	232,740	29,825
1968	505,673	264,404	39,667
1969	667,658	365,402	59,898
1970	661,118	360,713	60,075
1971	498,375	244,156	34,845
1972	260,902	133,568	16,070
1973	617,462	301,788	59,993
1974	640,852	382,954	60,050
1975	580,607	360,959	60,063
1976	679,684	402,831	60,161
1977	417,495	214,553	24,815
1978	356,169	156,025	14,904
1979	568,687	312,594	60,043
1980	658,694	353,983	60,043
1981	608,163	333,329	60,267
1982	643,169	326,643	59,267
1983	648,380	331,956	60,624
1984	653,151	359,362	58,590
1985	677,397	359,917	60,282
1986	1,396,165	1,048,973	66,171
1987	1,376,100	1,076,182	65,880
1988	838,011	570,032	61,927
1989	736,865	428,248	58,868
1990	680,106	391,901	58,353

Year	Rio Grande below Caballo Dam (AF/yr)	Rio Grande at El Paso (AF/yr)	Acequia Madre (AF/yr)
1991	625,956	372,078	59,242
1992	734,981	470,359	58,080
1993	823,244	508,005	63,763
1994	893,383	508,594	60,166
1995	1,096,145	702,426	63,619
1996	774,335	446,835	60,064
1997	798,621	483,092	59,441
1998	808,661	456,585	60,629
1999	735,467	457,373	58,308
2000	751,373	433,257	60,612
2001	786,559	453,491	61,038
2002	801,147	473,506	60,325
2003	364,528	172,330	26,948
2004	399,520	186,902	27,613
2005	676,031	329,797	58,091
2006	434,228	278,511	27,117
2007	636,730	337,852	51,245
2008	675,356	377,851	53,684
2009	693,667	382,039	57,726
2010	659,246	363,823	56,385
2011	396,843	230,397	25,724
2012	371,515	132,946	23,072
2013	168,639	57,452	3,765
2014	306,050	105,270	17,923
2015	434,855	170,508	33,402
2016	545,476	228,375	43,783
2017	623,080	270,499	52,589
2018	491,560	262,485	39,493
2019	453,971	177,495	39,721
2020	593,110	294,899	50,924
2021	229,892	104,300	12,827

Rio Grande below Caballo Dam: USBR Data (https://www.usbr.gov/uc/water/hydrodata/gage_data/site_map.html)
Rio Grande at El Paso: IBWC Data (https://www.ibwc.gov/Water_Data/histflo1.htm)
Acequia Madre: IBWC Data (https://www.ibwc.gov/Water_Data/histflo1.htm)

Year	Texas Mesilla Agricultural Depletions (AF/yr)	Texas Mesilla DCMI Depletions (AF/yr)	Excess Flow (AF/yr)
1951	31,034	202	0
1952	30,589	370	1,870
1953	31,556	265	3,069
1954	27,703	1,057	0
1955	27,823	350	296
1956	25,528	9,342	0
1957	25,648	10,201	8,466
1958	27,287	8,553	25,255
1959	27,279	11,598	10,295
1960	25,919	13,664	6,573
1961	25,093	13,859	6,904
1962	26,291	14,325	13,298
1963	26,728	15,212	2,817
1964	26,637	17,847	0
1965	26,432	18,649	1,260
1966	26,730	15,586	11,823
1967	26,133	13,621	4,245
1968	26,858	12,764	3,279
1969	27,195	12,498	6,795
1970	27,017	14,337	4,803
1971	26,631	16,078	139
1972	26,011	17,147	0
1973	26,490	14,908	3,124
1974	26,171	13,631	6,147
1975	25,887	14,852	5,353
1976	25,605	17,485	1,095
1977	25,746	20,487	0
1978	24,063	23,395	986
1979	23,425	21,518	9,420
1980	22,584	21,435	670
1981	23,151	18,805	1,341
1982	22,801	19,863	615
1983	22,837	18,352	0
1984	22,086	16,830	3,096
1985	21,403	17,121	1,533
1986	21,343	16,418	364,405
1987	21,994	18,508	440,737
1988	20,144	18,976	64,285
1989	20,529	21,457	6,579

Year	Texas Mesilla Agricultural Depletions (AF/yr)	Texas Mesilla DCMI Depletions (AF/yr)	Excess Flow (AF/yr)
1990	19,004	17,723	4,876
1991	21,274	15,899	3,869
1992	22,456	13,985	2,618
1993	22,393	16,411	6,081
1994	22,384	21,240	36,634
1995	22,308	24,122	166,654
1996	19,517	26,383	7,346
1997	20,449	23,299	13,753
1998	20,520	24,959	7,242
1999	19,993	22,709	17,109
2000	18,942	25,436	11,075
2001	15,167	24,623	4,513
2002	14,879	23,348	22,266
2003	12,148	25,494	0
2004	13,294	22,812	484
2005	13,496	21,558	975
2006	12,432	25,010	20,415
2007	12,770	22,014	318
2008	13,379	23,050	11,223
2009	12,566	24,890	872
2010	12,626	22,990	6,597
2011	12,138	25,588	3
2012	9,991	26,024	0
2013	11,887	26,729	0
2014	11,134	25,177	0
2015	10,487	23,764	59
2016	11,006	22,334	2,403
2017	11,206	22,953	683
2018	11,131	23,672	84
2019	11,131	24,076	447
2020	11,131	27,691	0
2021	11,144	30,543	0

DCMI = Domesitic, Commercial, Municipal, and Industrial

Year	Texas Mesilla Crop Acreage	Texas Mesilla Non-Crop Acreage	Texas Mesilla Acreage Total	Sullivan & Welsh CIR (AF/ac)	D2 Period Average CIR (AF/ac)	Texas Mesilla Agricultural Depletion (AF/yr)
1951	10,436	1,500	11,936	2.51	2.60	31,034
1952	10,265	1,500	11,765	2.53	2.60	30,589
1953	10,637	1,500	12,137	2.63	2.60	31,556
1954	9,155	1,500	10,655	2.63	2.60	27,703
1955	9,201	1,500	10,701	2.40	2.60	27,823
1956	8,318	1,500	9,818	2.70	2.60	25,528
1957	8,364	1,500	9,864	2.19	2.60	25,648
1958	8,995	1,500	10,495	2.05	2.60	27,287
1959	8,992	1,500	10,492	2.61	2.60	27,279
1960	8,469	1,500	9,969	2.57	2.60	25,919
1961	8,151	1,500	9,651	2.46	2.60	25,093
1962	8,612	1,500	10,112	2.54	2.60	26,291
1963	8,780	1,500	10,280	2.34	2.60	26,728
1964	8,745	1,500	10,245	2.64	2.60	26,637
1965	8,666	1,500	10,166	2.70	2.60	26,432
1966	8,781	1,500	10,281	2.52	2.60	26,730
1967	8,551	1,500	10,051	2.56	2.60	26,133
1968	8,830	1,500	10,330	2.40	2.60	26,858
1969	8,960	1,500	10,460	2.39	2.60	27,195
1970	8,891	1,500	10,391	2.83	2.60	27,017
1971	8,743	1,500	10,243	3.06	2.60	26,631
1972	8,504	1,500	10,004	2.80	2.60	26,011
1973	8,689	1,500	10,189	2.82	2.60	26,490
1974	8,566	1,500	10,066	2.68	2.60	26,171
1975	8,457	1,500	9,957	2.87	2.60	25,887
1976	8,348	1,500	9,848	2.97	2.60	25,605
1977	8,402	1,500	9,902	2.78	2.60	25,746
1978	7,755	1,500	9,255	2.59	2.60	24,063
1979	7,499	1,511	9,010	2.66	2.60	23,425
1980	7,199	1,487	8,686	2.80	2.60	22,584
1981	7,440	1,464	8,904	2.82	2.60	23,151
1982	7,329	1,440	8,769	2.87	2.60	22,801
1983	7,367	1,417	8,784	2.77	2.60	22,837
1984	7,101	1,393	8,494	2.58	2.60	22,086
1985	6,862	1,370	8,232	2.39	2.60	21,403
1986	6,862	1,347	8,209	2.32	2.60	21,343
1987	7,136	1,323	8,459	2.40	2.60	21,994
1988	6,448	1,300	7,748	2.33	2.60	20,144
1989	6,619	1,276	7,896	2.50	2.60	20,529
1990	6,056	1,253	7,309	2.33	2.60	19,004

Year	Texas Mesilla Crop Acreage	Texas Mesilla Non-Crop Acreage	Texas Mesilla Acreage Total	Sullivan & Welsh CIR (AF/ac)	D2 Period Average CIR (AF/ac)	Texas Mesilla Agricultural Depletion (AF/yr)
1991	6,953	1,230	8,182	2.28	2.60	21,274
1992	7,431	1,206	8,637	2.48	2.60	22,456
1993	7,430	1,183	8,613	2.60	2.60	22,393
1994	7,450	1,159	8,609	2.85	2.60	22,384
1995	7,444	1,136	8,580	3.10	2.60	22,308
1996	6,394	1,112	7,507	2.81	2.60	19,517
1997	6,776	1,089	7,865	2.57	2.60	20,449
1998	6,827	1,066	7,892	2.56	2.60	20,520
1999	6,647	1,042	7,690	2.51	2.60	19,993
2000	6,267	1,019	7,285	2.49	2.60	18,942
2001	4,838	995	5,834	2.72	2.60	15,167
2002	4,751	972	5,723	2.64	2.60	14,879
2003	3,958	949	4,906	2.73	2.48	12,148
2004	4,444	925	5,369	2.46	2.48	13,294
2005	4,549	902	5,451	2.44	2.48	13,496
2006	4,143	878	5,021	2.28	2.48	12,432
2007	4,303	855	5,158	2.46	2.48	12,770
2008	3,947	831	4,778	2.68	2.80	13,379
2009	3,680	808	4,488	2.80	2.80	12,566
2010	3,725	785	4,509	2.74	2.80	12,626
2011	3,574	761	4,335	3.08	2.80	12,138
2012	2,831	738	3,568	3.12	2.80	9,991
2013	3,531	714	4,245	2.78	2.80	11,887
2014	3,285	691	3,976	2.85	2.80	11,134
2015	3,054	691	3,745	2.48	2.80	10,487
2016	3,240	691	3,931	2.82	2.80	11,006
2017	3,311	691	4,002	2.66	2.80	11,206
2018	3,284	691	3,975	2.72	2.80	11,131
2019	3,284	691	3,975	2.72	2.80	11,131
2020	3,284	691	3,975	2.72	2.80	11,131
2021	3,284	691	3,980	2.72	2.80	11,144

CIR = Consumptive Irrigation Requirement

Year	Total Canutillo Well Field Pumping (AF/yr)	Pumped Water Discharged to Rio Grande (AF/yr)	Depletion Factor	Canutillo Well Field Depletion (AF/yr)
1951	0	0	0.95	0
1952	2,435	2,203	0.95	110
1953	5,826	5,626	0.95	-91
1954	7,061	6,122	0.95	586
1955	3,648	3,648	0.95	-182
1956	9,271	0	0.95	8,807
1957	10,162	0	0.95	9,654
1958	9,550	1,115	0.95	7,957
1959	13,988	2,269	0.95	11,019
1960	15,690	1,866	0.95	13,040
1961	16,133	2,330	0.95	12,996
1962	17,076	2,861	0.95	13,361
1963	20,999	5,716	0.95	14,233
1964	22,188	4,355	0.95	16,723
1965	20,671	2,687	0.95	16,951
1966	19,289	4,122	0.95	14,203
1967	24,277	11,387	0.95	11,676
1968	16,147	4,403	0.95	10,936
1969	14,197	2,601	0.95	10,886
1970	18,804	5,418	0.95	12,446
1971	25,291	9,798	0.95	14,229
1972	23,626	7,025	0.95	15,420
1973	19,937	5,764	0.95	13,176
1974	17,596	4,631	0.95	12,086
1975	19,133	4,763	0.95	13,413
1976	18,008	1,149	0.95	15,959
1977	25,257	5,887	0.95	18,107
1978	26,817	3,642	0.95	21,834
1979	22,272	1,050	0.95	20,108
1980	20,914	121	0.95	19,748
1981	18,221	0	0.95	17,310
1982	19,743	0	0.95	18,756
1983	18,298	93	0.95	17,290
1984	17,974	1,418	0.95	15,657
1985	16,660	0	0.95	15,827
1986	15,822	0	0.95	15,031
1987	17,894	0	0.95	16,999
1988	18,338	0	0.95	17,421
1989	20,841	0	0.95	19,799

Year	Total Canutillo Well Field Pumping (AF/yr)	Pumped Water Discharged to Rio Grande (AF/yr)	Depletion Factor	Canutillo Well Field Depletion (AF/yr)
1990	16,920	0	0.95	16,074
1991	15,024	0	0.95	14,273
1992	12,956	0	0.95	12,308
1993	15,477	0	0.95	14,703
1994	20,526	0	0.95	19,500
1995	23,605	0	0.95	22,425
1996	26,019	0	0.95	24,718
1997	22,772	0	0.95	21,633
1998	24,509	0	0.95	23,284
1999	22,136	0	0.95	21,029
2000	24,682	0	0.95	23,448
2001	23,823	0	0.95	22,632
2002	22,591	0	0.95	21,461
2003	25,053	0	0.95	23,800
2004	22,221	0	0.95	21,110
2005	20,871	0	0.95	19,827
2006	24,489	0	0.95	23,265
2007	21,339	0	0.95	20,272
2008	22,430	0	0.95	21,309
2009	24,376	0	0.95	23,157
2010	22,410	0	0.95	21,290
2011	25,241	0	0.95	23,979
2012	25,768	0	0.95	24,480
2013	26,521	0	0.95	25,195
2014	24,924	0	0.95	23,678
2015	23,437	0	0.95	22,265
2016	21,929	0	0.95	20,833
2017	22,583	0	0.95	21,454
2018	23,332	0	0.95	22,165
2019	23,763	0	0.95	22,575
2020	27,568	0	0.95	26,190
2021	30,570	0	0.95	29,042

Year	Sullivan & Welsh Estimate (AF/yr)	Hutchison Estimate (AF/yr)	Average of Sullivan & Welsh and Hutchison (AF/yr)	Other DCMI Annual Depletion (AF/yr)
1951	342	313	328	202
1952	455	388	422	260
1953	769	388	578	357
1954	1,139	388	764	471
1955	1,213	511	862	532
1956	1,222	511	866	534
1957	1,261	511	886	547
1958	1,417	514	966	595
1959	1,145	731	938	578
1960	1,331	694	1,012	624
1961	2,017	782	1,399	863
1962	2,417	709	1,563	964
1963	2,251	922	1,586	978
1964	2,857	787	1,822	1,124
1965	2,749	2,757	2,753	1,698
1966	2,423	2,061	2,242	1,383
1967	3,244	3,064	3,154	1,945
1968	3,046	2,882	2,964	1,828
1969	2,797	2,430	2,613	1,612
1970	3,207	2,927	3,067	1,891
1971	3,148	2,850	2,999	1,850
1972	2,966	2,636	2,801	1,727
1973	2,952	2,664	2,808	1,732
1974	2,729	2,283	2,506	1,545
1975	2,576	2,089	2,333	1,438
1976	2,879	2,072	2,475	1,526
1977	4,125	3,596	3,860	2,381
1978	2,887	2,176	2,531	1,561
1979	2,663	1,909	2,286	1,410
1980	3,089	2,383	2,736	1,687
1981	2,750	2,098	2,424	1,495
1982	2,293	1,296	1,795	1,107
1983	2,222	1,219	1,721	1,061
1984	2,400	1,404	1,902	1,173
1985	2,395	1,803	2,099	1,294
1986	2,437	2,062	2,250	1,387
1987	2,621	2,273	2,447	1,509
1988	2,737	2,307	2,522	1,555
1989	2,879	2,498	2,689	1,658

Year	Sullivan & Welsh Estimate (AF/yr)	Hutchison Estimate (AF/yr)	Average of Sullivan & Welsh and Hutchison (AF/yr)	Other DCMI Annual Depletion (AF/yr)
1990	2,867	2,481	2,674	1,649
1991	2,792	2,481	2,637	1,626
1992	2,956	2,481	2,719	1,677
1993	3,058	2,481	2,770	1,708
1994	3,163	2,481	2,822	1,740
1995	3,024	2,481	2,752	1,697
1996	2,920	2,481	2,701	1,665
1997	2,919	2,481	2,700	1,665
1998	2,951	2,481	2,716	1,675
1999	2,965	2,481	2,723	1,679
2000	3,084	3,363	3,223	1,988
2001	3,124	3,334	3,229	1,991
2002	3,130	2,988	3,059	1,887
2003	3,234	2,259	2,747	1,694
2004	3,057	2,462	2,759	1,702
2005	3,117	2,496	2,807	1,731
2006	3,205	2,456	2,830	1,745
2007	3,206	2,443	2,824	1,742
2008	3,213	2,435	2,824	1,741
2009	3,223	2,399	2,811	1,733
2010	3,272	2,243	2,757	1,700
2011	3,273	1,947	2,610	1,609
2012	3,283	1,725	2,504	1,544
2013	3,252	1,725	2,488	1,534
2014	3,136	1,725	2,430	1,499
2015	3,136	1,725	2,430	1,499
2016	3,145	1,725	2,435	1,501
2017	3,136	1,725	2,430	1,499
2018	3,161	1,725	2,443	1,506
2019	3,143	1,725	2,434	1,501
2020	3,144	1,725	2,434	1,501
2021	3,146	1,725	2,435	1,502

Assumed Depletion Factor = 0.95
Assumed Return Flow Factor = 1/3
Calculated Depletion = (Pumping*Depletion Factor)-(Pumping * Return Flow Factor)

Year	Excess Flow (AF/yr)
1951	0
1952	1,870
1953	3,069
1954	0
1955	296
1956	0
1957	8,466
1958	25,255
1959	10,295
1960	6,573
1961	6,904
1962	13,298
1963	2,817
1964	0
1965	1,260
1966	11,823
1967	4,245
1968	3,279
1969	6,795
1970	4,803
1971	139
1972	0
1973	3,124
1974	6,147
1975	5,353
1976	1,095
1977	0
1978	986
1979	9,420
1980	670
1981	1,341
1982	615
1983	0
1984	3,096
1985	1,533
1986	364,405
1987	440,737
1988	64,285
1989	6,579
1990	4,876
1991	3,869
1992	2,618

Year	Excess Flow (AF/yr)
1993	6,081
1994	36,634
1995	166,654
1996	7,346
1997	13,753
1998	7,242
1999	17,109
2000	11,075
2001	4,513
2002	22,266
2003	0
2004	484
2005	975
2006	20,415
2007	318
2008	11,223
2009	872
2010	6,597
2011	3
2012	0
2013	0
2014	0
2015	59
2016	2,403
2017	683
2018	84
2019	447
2020	0
2021	0

Year	Rio Grande at El Paso (AF/yr)	Acequia Madre (AF/yr)	Excess Flow (AF/yr)	Net Rio Grande at El Paso (AF/yr)
1951	251,990	33,064	0	218,926
1952	283,631	49,891	1,870	231,870
1953	264,577	37,791	3,069	223,717
1954	93,723	10,147	0	83,576
1955	67,083	8,183	296	58,604
1956	57,453	7,862	0	49,591
1957	139,578	23,284	8,466	107,829
1958	392,848	60,054	25,255	307,539
1959	385,869	60,111	10,295	315,463
1960	378,148	60,313	6,573	311,261
1961	300,805	48,616	6,904	245,285
1962	376,150	60,081	13,298	302,771
1963	263,707	39,694	2,817	221,197
1964	64,304	6,652	0	57,652
1965	202,389	36,674	1,260	164,455
1966	308,776	49,606	11,823	247,347
1967	232,740	29,825	4,245	198,670
1968	264,404	39,667	3,279	221,458
1969	365,402	59,898	6,795	298,709
1970	360,713	60,075	4,803	295,836
1971	244,156	34,845	139	209,172
1972	133,568	16,070	0	117,498
1973	301,788	59,993	3,124	238,670
1974	382,954	60,050	6,147	316,757
1975	360,959	60,063	5,353	295,543
1976	402,831	60,161	1,095	341,575
1977	214,553	24,815	0	189,738
1978	156,025	14,904	986	140,135
1979	312,594	60,043	9,420	243,131
1980	353,983	60,043	670	293,270
1981	333,329	60,267	1,341	271,721
1982	326,643	59,267	615	266,761
1983	331,956	60,624	0	271,332
1984	359,362	58,590	3,096	297,675
1985	359,917	60,282	1,533	298,102
1986	1,048,973	66,171	364,405	618,396
1987	1,076,182	65,880	440,737	569,565
1988	570,032	61,927	64,285	443,819
1989	428,248	58,868	6,579	362,800
1990	391,901	58,353	4,876	328,672
1991	372,078	59,242	3,869	308,967
1992	470,359	58,080	2,618	409,661

Year	Rio Grande at El Paso (AF/yr)	Acequia Madre (AF/yr)	Excess Flow (AF/yr)	Net Rio Grande at El Paso (AF/yr)
1993	508,005	63,763	6,081	438,161
1994	508,594	60,166	36,634	411,793
1995	702,426	63,619	166,654	472,153
1996	446,835	60,064	7,346	379,425
1997	483,092	59,441	13,753	409,898
1998	456,585	60,629	7,242	388,713
1999	457,373	58,308	17,109	381,956
2000	433,257	60,612	11,075	361,569
2001	453,491	61,038	4,513	387,941
2002	473,506	60,325	22,266	390,915
2003	172,330	26,948	0	145,382
2004	186,902	27,613	484	158,804
2005	329,797	58,091	975	270,731
2006	278,511	27,117	20,415	230,979
2007	337,852	51,245	318	286,289
2008	377,851	53,684	11,223	312,944
2009	382,039	57,726	872	323,441
2010	363,823	56,385	6,597	300,841
2011	230,397	25,724	3	204,670
2012	132,946	23,072	0	109,874
2013	57,452	3,765	0	53,687
2014	105,270	17,923	0	87,348
2015	170,508	33,402	59	137,047
2016	228,375	43,783	2,403	182,189
2017	270,499	52,589	683	217,228
2018	262,485	39,493	84	222,908
2019	177,495	39,721	447	137,327
2020	294,899	50,924	0	243,975
2021	104,300	12,827	0	91,473

Year	Net Rio Grande at El Paso (AF/yr)	Texas Mesilla Agricultural Depletion (AF/yr)	Canutillo Well Field Depletion (AF/yr)	Other Texas Mesilla DCMI Annual Depletion (AF/yr)	EEPI Delivery from 1979 to 2021 (AF/yr)
1951	218,926	31,034	0	202	250,162
1952	231,870	30,589	110	260	262,830
1953	223,717	31,556	-91	357	255,539
1954	83,576	27,703	586	471	112,336
1955	58,604	27,823	-182	532	86,776
1956	49,591	25,528	8,807	534	84,461
1957	107,829	25,648	9,654	547	143,677
1958	307,539	27,287	7,957	595	343,379
1959	315,463	27,279	11,019	578	354,340
1960	311,261	25,919	13,040	624	350,845
1961	245,285	25,093	12,996	863	284,237
1962	302,771	26,291	13,361	964	343,387
1963	221,197	26,728	14,233	978	263,136
1964	57,652	26,637	16,723	1,124	102,136
1965	164,455	26,432	16,951	1,698	209,536
1966	247,347	26,730	14,203	1,383	289,663
1967	198,670	26,133	11,676	1,945	238,423
1968	221,458	26,858	10,936	1,828	261,080
1969	298,709	27,195	10,886	1,612	338,402
1970	295,836	27,017	12,446	1,891	337,190
1971	209,172	26,631	14,229	1,850	251,881
1972	117,498	26,011	15,420	1,727	160,657
1973	238,670	26,490	13,176	1,732	280,068
1974	316,757	26,171	12,086	1,545	356,558
1975	295,543	25,887	13,413	1,438	336,282
1976	341,575	25,605	15,959	1,526	384,665
1977	189,738	25,746	18,107	2,381	235,971
1978	140,135	24,063	21,834	1,561	187,594
1979	243,131	23,425	20,108	1,410	288,074
1980	293,270	22,584	19,748	1,687	337,288
1981	271,721	23,151	17,310	1,495	313,677
1982	266,761	22,801	18,756	1,107	309,424
1983	271,332	22,837	17,290	1,061	312,521
1984	297,675	22,086	15,657	1,173	336,591
1985	298,102	21,403	15,827	1,294	336,626
1986	618,396	21,343	15,031	1,387	656,157
1987	569,565	21,994	16,999	1,509	610,068
1988	443,819	20,144	17,421	1,555	482,940
1989	362,800	20,529	19,799	1,658	404,785

Year	Net Rio Grande at El Paso (AF/yr)	Texas Mesilla Agricultural Depletion (AF/yr)	Canutillo Well Field Depletion (AF/yr)	Other Texas Mesilla DCMI Annual Depletion (AF/yr)	EEPI Delivery from 1979 to 2021 (AF/yr)
1990	328,672	19,004	16,074	1,649	365,399
1991	308,967	21,274	14,273	1,626	346,141
1992	409,661	22,456	12,308	1,677	446,101
1993	438,161	22,393	14,703	1,708	476,966
1994	411,793	22,384	19,500	1,740	455,418
1995	472,153	22,308	22,425	1,697	518,583
1996	379,425	19,517	24,718	1,665	425,326
1997	409,898	20,449	21,633	1,665	453,645
1998	388,713	20,520	23,284	1,675	434,192
1999	381,956	19,993	21,029	1,679	424,657
2000	361,569	18,942	23,448	1,988	405,947
2001	387,941	15,167	22,632	1,991	427,731
2002	390,915	14,879	21,461	1,887	429,142
2003	145,382	12,148	23,800	1,694	183,024
2004	158,804	13,294	21,110	1,702	194,910
2005	270,731	13,496	19,827	1,731	305,785
2006	230,979	12,432	23,265	1,745	268,421
2007	286,289	12,770	20,272	1,742	321,073
2008	312,944	13,379	21,309	1,741	349,372
2009	323,441	12,566	23,157	1,733	360,897
2010	300,841	12,626	21,290	1,700	336,458
2011	204,670	12,138	23,979	1,609	242,396
2012	109,874	9,991	24,480	1,544	145,889
2013	53,687	11,887	25,195	1,534	92,303
2014	87,348	11,134	23,678	1,499	123,658
2015	137,047	10,487	22,265	1,499	171,298
2016	182,189	11,006	20,833	1,501	215,530
2017	217,228	11,206	21,454	1,499	251,387
2018	222,908	11,131	22,165	1,506	257,711
2019	137,327	11,131	22,575	1,501	172,533
2020	243,975	11,131	26,190	1,501	282,797
2021	91,473	11,144	29,042	1,502	133,161

Year	Rio Grande at Caballo (AF/yr)	Net Rio Grande at El Paso (AF/yr)	Regression Net Rio Grande at El Paso (AF/yr)	Residual (AF/yr)
1951	469,455	218,926	195,237	-23,689
1952	543,979	231,870	234,652	2,782
1953	528,620	223,717	226,529	2,811
1954	244,155	83,576	76,080	-7,496
1955	219,156	58,604	62,859	4,255
1956	246,139	49,591	77,129	27,538
1957	397,092	107,829	156,966	49,137
1958	737,127	307,539	336,805	29,266
1959	687,409	315,463	310,510	-4,953
1960	705,161	311,261	319,898	8,637
1961	561,695	245,285	244,022	-1,263
1962	651,940	302,771	291,751	-11,020
1963	517,169	221,197	220,473	-724
1964	206,081	57,652	55,943	-1,709
1965	505,606	164,455	214,357	49,902
1966	610,330	247,347	269,744	22,396
1967	456,585	198,670	188,430	-10,239
1968	505,673	221,458	214,392	-7,065
1969	667,658	298,709	300,064	1,355
1970	661,118	295,836	296,605	769
1971	498,375	209,172	210,533	1,360
1972	260,902	117,498	84,937	-32,561
1973	617,462	238,670	273,516	34,846
1974	640,852	316,757	285,886	-30,870
1975	580,607	295,543	254,024	-41,519
1976	679,684	341,575	306,424	-35,151
1977	417,495	189,738	167,757	-21,981
1978	356,169	140,135	135,323	-4,813

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.964058
R Square	0.929408
Adjusted R	0.926693
Standard E	23818.28
Observatio	28

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	1	1.94E+11	1.94E+11	342.3139	1.73E-16
Residual	26	1.48E+10	5.67E+08		
Total	27	2.09E+11			

	Coefficients	*andard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Jpper 95.0%*
Intercept	-53049.3	15154.06	-3.50067	0.001693	-84199	-21899.7	-84199	-21899.7
X Variable :	0.528883	0.028586	18.50173	1.73E-16	0.470124	0.587641	0.470124	0.587641

min	-41,519
max	49,902

Year	Current Year Rio Grande at Caballo (AF/yr)	Prior Year Rio Grande at Caballo (AF/yr)	Net Rio Grande at El Paso (AF/yr)	Regression Net Rio Grande at El Paso (AF/yr)	Residual (AF/yr)
1951	469,455	719,339	218,926	219,513	586
1952	543,979	469,455	231,870	227,390	-4,480
1953	528,620	543,979	223,717	228,377	4,660
1954	244,155	528,620	83,576	88,418	4,842
1955	219,156	244,155	58,604	44,019	-14,585
1956	246,139	219,156	49,591	54,295	4,703
1957	397,092	246,139	107,829	130,700	22,871
1958	737,127	397,092	307,539	313,034	5,495
1959	687,409	737,127	315,463	327,430	11,968
1960	705,161	687,409	311,261	330,419	19,158
1961	561,695	705,161	245,285	262,723	17,439
1962	651,940	561,695	302,771	290,306	-12,465
1963	517,169	651,940	221,197	235,055	13,858
1964	206,081	517,169	57,652	68,620	10,968
1965	505,606	206,081	164,455	178,883	14,429
1966	610,330	505,606	247,347	263,728	16,381
1967	456,585	610,330	198,670	200,899	2,230
1968	505,673	456,585	221,458	207,319	-14,139
1969	667,658	505,673	298,709	291,591	-7,118
1970	661,118	667,658	295,836	306,780	10,944
1971	498,375	661,118	209,172	226,963	17,791
1972	260,902	498,375	117,498	93,126	-24,372
1973	617,462	260,902	238,670	239,448	778
1974	640,852	617,462	316,757	291,241	-25,516
1975	580,607	640,852	295,543	264,621	-30,922
1976	679,684	580,607	341,575	305,930	-35,645
1977	417,495	679,684	189,738	189,770	32
1978	356,169	417,495	140,135	130,245	-9,890

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.983413
R Square	0.9671
Adjusted R	0.964468
Standard E	16582.32
Observatio	28

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	2	2.02E+11	1.01E+11	367.4429	2.92E-19
Residual	25	6.87E+09	2.75E+08		
Total	27	2.09E+11			

	Coefficients	*andard Errc*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Jpper 95.0%*
Intercept	-90149.4	12623.96	-7.14113	1.75E-07	-116149	-64149.8	-116149	-64149.8
X Variable :	0.485886	0.021462	22.63955	3.57E-18	0.441685	0.530087	0.441685	0.530087
X Variable :	0.113382	0.021186	5.351806	1.5E-05	0.069749	0.157016	0.069749	0.157016

min	-35,645
max	22,871

A	B	C	D	E	F	G	H	I
Year	EEPI Obligation Calculations						EEPI Delivery (AF/yr)	EEPI Departure (AF/yr)
	Current Year Rio Grande at Caballo (AF/yr)	Prior Year Rio Grande at Caballo (AF/yr)	Net Rio Grande at El Paso (AF/yr)	Regression Net Rio Grande at El Paso (AF/yr)	Regression Residual (AF/yr)	EEPI Obligation (AF/yr)		
1951	469,455	719,339	218,926	219,513	-586	258,597	250,162	-8,435
1952	543,979	469,455	231,870	227,390	4,480	266,474	262,830	-3,645
1953	528,620	543,979	223,717	228,377	-4,660	267,461	255,539	-11,922
1954	244,155	528,620	83,576	88,418	-4,842	127,502	112,336	-15,167
1955	219,156	244,155	58,604	44,019	14,585	83,103	86,776	3,673
1956	246,139	219,156	49,591	54,295	-4,703	93,379	84,461	-8,917
1957	397,092	246,139	107,829	130,700	-22,871	169,784	143,677	-26,107
1958	737,127	397,092	307,539	313,034	-5,495	352,118	343,379	-8,739
1959	687,409	737,127	315,463	327,430	-11,968	366,514	354,340	-12,175
1960	705,161	687,409	311,261	330,419	-19,158	369,503	350,845	-18,658
1961	561,695	705,161	245,285	262,723	-17,439	301,807	284,237	-17,571
1962	651,940	561,695	302,771	290,306	12,465	329,390	343,387	13,998
1963	517,169	651,940	221,197	235,055	-13,858	274,139	263,136	-11,002
1964	206,081	517,169	57,652	68,620	-10,968	107,704	102,136	-5,568
1965	505,606	206,081	164,455	178,883	-14,429	217,967	209,536	-8,432
1966	610,330	505,606	247,347	263,728	-16,381	302,812	289,663	-13,149
1967	456,585	610,330	198,670	200,899	-2,230	239,983	238,423	-1,560
1968	505,673	456,585	221,458	207,319	14,139	246,403	261,080	14,677
1969	667,658	505,673	298,709	291,591	7,118	330,675	338,402	7,727
1970	661,118	667,658	295,836	306,780	-10,944	345,864	337,190	-8,674
1971	498,375	661,118	209,172	226,963	-17,791	266,047	251,881	-14,166
1972	260,902	498,375	117,498	93,126	24,372	132,210	160,657	28,447
1973	617,462	260,902	238,670	239,448	-778	278,532	280,068	1,536
1974	640,852	617,462	316,757	291,241	25,516	330,325	356,558	26,233
1975	580,607	640,852	295,543	264,621	30,922	303,705	336,282	32,577
1976	679,684	580,607	341,575	305,930	35,645	345,014	384,665	39,651
1977	417,495	679,684	189,738	189,770	-32	228,854	235,971	7,117
1978	356,169	417,495	140,135	130,245	9,890	169,329	187,594	18,265
1979	568,687	356,169	243,131	226,551	16,580	265,635	288,074	22,439
1980	658,694	568,687	293,270	294,380	-1,110	333,464	337,288	3,824
1981	608,163	658,694	271,721	280,033	-8,311	319,117	313,677	-5,440
1982	643,169	608,163	266,761	291,312	-24,551	330,396	309,424	-20,972
1983	648,380	643,169	271,332	297,813	-26,481	336,897	312,521	-24,377
1984	653,151	648,380	297,675	300,723	-3,047	339,807	336,591	-3,216
1985	677,397	653,151	298,102	313,044	-14,943	352,128	336,626	-15,502
1986	1,396,165	677,397	618,396	370,506	247,891	409,590	656,157	246,567
1987	1,376,100	1,396,165	569,565	383,273	186,292	422,357	610,068	187,711
1988	838,011	1,376,100	443,819	383,273	60,546	422,357	482,940	60,583

Intercept	-90149.4
X Variable 1 (Column B)	0.485886
X Variable 2 (Column C)	0.113382
Avg D2 TX Mesilla Ag Depletions	26860
Avg D2 TX Mesilla DCMI Depletions	12224
Sum of All Constants	-51065.4

	Net RGEP F	EEPI Dep
min	-57,216	-62,141
max	247,891	246,567
avg	9,528	9,555

Year	EEPI Obligation Calculations						EEPI Delivery (AF/yr)	EEPI Departure (AF/yr)
	Current Year Rio Grande at Caballo (AF/yr)	Prior Year Rio Grande at Caballo (AF/yr)	Net Rio Grande at El Paso (AF/yr)	Regression Net Rio Grande at El Paso (AF/yr)	Regression Residual (AF/yr)	EEPI Obligation (AF/yr)		
1989	736,865	838,011	362,800	357,455	5,344	396,539	404,785	8,246
1990	680,106	736,865	328,672	323,852	4,820	362,936	365,399	2,463
1991	625,956	680,106	308,967	291,106	17,862	330,190	346,141	15,951
1992	734,981	625,956	409,661	337,940	71,721	377,024	446,101	69,077
1993	823,244	734,981	438,161	377,035	61,127	416,119	476,966	60,847
1994	893,383	823,244	411,793	383,273	28,521	422,357	455,418	33,061
1995	1,096,145	893,383	472,153	383,273	88,880	422,357	518,583	96,227
1996	774,335	1,096,145	379,425	375,661	3,764	414,745	425,326	10,580
1997	798,621	774,335	409,898	381,497	28,401	420,581	453,645	33,064
1998	808,661	798,621	388,713	383,273	5,441	422,357	434,192	11,836
1999	735,467	808,661	381,956	356,776	25,180	395,860	424,657	28,797
2000	751,373	735,467	361,569	358,321	3,248	397,405	405,947	8,542
2001	786,559	751,373	387,941	377,221	10,720	416,305	427,731	11,426
2002	801,147	786,559	390,915	382,883	8,032	421,967	429,142	7,175
2003	364,528	801,147	145,382	176,542	-31,160	215,626	183,024	-32,602
2004	399,520	364,528	158,804	145,303	13,501	184,387	194,910	10,523
2005	676,031	399,520	270,731	283,623	-12,892	322,707	305,785	-16,922
2006	434,228	676,031	230,979	197,486	33,493	236,570	268,421	31,851
2007	636,730	434,228	286,289	268,463	17,826	307,547	321,073	13,526
2008	675,356	636,730	312,944	310,191	2,753	349,275	349,372	98
2009	693,667	675,356	323,441	323,467	-27	362,551	360,897	-1,654
2010	659,246	693,667	300,841	308,819	-7,977	347,903	336,458	-11,445
2011	396,843	659,246	204,670	177,418	27,252	216,502	242,396	25,894
2012	371,515	396,843	109,874	135,360	-25,486	174,444	145,889	-28,555
2013	168,639	371,515	53,687	33,913	19,774	72,997	92,303	19,306
2014	306,050	168,639	87,348	77,677	9,671	116,761	123,658	6,897
2015	434,855	306,050	137,047	155,842	-18,795	194,926	171,298	-23,628
2016	545,476	434,855	182,189	224,195	-42,005	263,279	215,530	-47,749
2017	623,080	545,476	217,228	274,444	-57,216	313,528	251,387	-62,141
2018	491,560	623,080	222,908	219,339	3,569	258,423	257,711	-712
2019	453,971	491,560	137,327	186,163	-48,836	225,247	172,533	-52,714
2020	593,110	453,971	243,975	249,507	-5,532	288,591	282,797	-5,794
2021	229,892	593,110	91,473	88,800	2,673	127,884	133,161	5,276

A	B	C	D	E	F	G	H	I
Year	**EEPI Obligation Calculations**						EEPI Delivery (AF/yr)	EEPI Departure (AF/yr)
	Current Year Rio Grande at Caballo (AF/yr)	Prior Year Rio Grande at Caballo (AF/yr)	Net Rio Grande at El Paso (AF/yr)	Regression Net Rio Grande at El Paso (AF/yr)	Regression Residual (AF/yr)	EEPI Obligation (AF/yr)		
1951	469,455	719,339	218,926	219,513	-586	258,597	250,162	-8,435
1952	543,979	469,455	231,870	227,390	4,480	266,474	262,830	-3,645
1953	528,620	543,979	223,717	228,377	-4,660	267,461	255,539	-11,922
1954	244,155	528,620	83,576	88,418	-4,842	127,502	112,336	-15,167
1955	219,156	244,155	58,604	44,019	14,585	83,103	86,776	3,673
1956	246,139	219,156	49,591	54,295	-4,703	93,379	84,461	-8,917
1957	397,092	246,139	107,829	130,700	-22,871	169,784	143,677	-26,107
1958	737,127	397,092	307,539	313,034	-5,495	352,118	343,379	-8,739
1959	687,409	737,127	315,463	327,430	-11,968	366,514	354,340	-12,175
1960	705,161	687,409	311,261	330,419	-19,158	369,503	350,845	-18,658
1961	561,695	705,161	245,285	262,723	-17,439	301,807	284,237	-17,571
1962	651,940	561,695	302,771	290,306	12,465	329,390	343,387	13,998
1963	517,169	651,940	221,197	235,055	-13,858	274,139	263,136	-11,002
1964	206,081	517,169	57,652	68,620	-10,968	107,704	102,136	-5,568
1965	505,606	206,081	164,455	178,883	-14,429	217,967	209,536	-8,432
1966	610,330	505,606	247,347	263,728	-16,381	302,812	289,663	-13,149
1967	456,585	610,330	198,670	200,899	-2,230	239,983	238,423	-1,560
1968	505,673	456,585	221,458	207,319	14,139	246,403	261,080	14,677
1969	667,658	505,673	298,709	291,591	7,118	330,675	338,402	7,727
1970	661,118	667,658	295,836	306,780	-10,944	345,864	337,190	-8,674
1971	498,375	661,118	209,172	226,963	-17,791	266,047	251,881	-14,166
1972	260,902	498,375	117,498	93,126	24,372	132,210	160,657	28,447
1973	617,462	260,902	238,670	239,448	-778	278,532	280,068	1,536
1974	640,852	617,462	316,757	291,241	25,516	330,325	356,558	26,233
1975	580,607	640,852	295,543	264,621	30,922	303,705	336,282	32,577
1976	679,684	580,607	341,575	305,930	35,645	345,014	384,665	39,651
1977	417,495	679,684	189,738	189,770	-32	228,854	235,971	7,117
1978	356,169	417,495	140,135	130,245	9,890	169,329	187,594	18,265
1979	568,687	356,169	243,131	226,551	16,580	265,635	288,074	22,439
1980	658,694	568,687	293,270	294,380	-1,110	333,464	337,288	3,824
1981	608,163	658,694	271,721	280,033	-8,311	319,117	313,677	-5,440
1982	643,169	608,163	266,761	291,312	-24,551	330,396	309,424	-20,972
1983	648,380	643,169	271,332	297,813	-26,481	336,897	312,521	-24,377
1984	653,151	648,380	297,675	300,723	-3,047	339,807	336,591	-3,216
1985	677,397	653,151	298,102	Spill Year				
1986	1,396,165	677,397	618,396	Spill Year				
1987	1,376,100	1,396,165	569,565	Spill Year				
1988	838,011	1,376,100	443,819	Spill Year				

Intercept	-90149.4
X Variable 1 (Column B)	0.485886
X Variable 2 (Column C)	0.113382
Avg D2 TX Mesilla Ag Depletions	26860
Avg D2 TX Mesilla DCMI Depletions	12224
Sum of All Constants	-51065.4

	Net RGEP F	EEPI Dep
min	-57,216	-62,141
max	71,721	69,077
avg	885	632

Hutchison Decl. Att. 2 - EEPI Spreadsheet
Tab: EEPI Departure Filtered

Year	EEPI Obligation Calculations						EEPI Delivery (AF/yr)	EEPI Departure (AF/yr)
	Current Year Rio Grande at Caballo (AF/yr)	Prior Year Rio Grande at Caballo (AF/yr)	Net Rio Grande at El Paso (AF/yr)	Regression Net Rio Grande at El Paso (AF/yr)	Regression Residual (AF/yr)	EEPI Obligation (AF/yr)		
1989	736,865	838,011	362,800	357,455	5,344	396,539	404,785	8,246
1990	680,106	736,865	328,672	323,852	4,820	362,936	365,399	2,463
1991	625,956	680,106	308,967	291,106	17,862	330,190	346,141	15,951
1992	734,981	625,956	409,661	337,940	71,721	377,024	446,101	69,077
1993	823,244	734,981	438,161	377,035	61,127	416,119	476,966	60,847
1994	893,383	823,244	411,793	Spill Year				
1995	1,096,145	893,383	472,153	Spill Year				
1996	774,335	1,096,145	379,425	Spill Year				
1997	798,621	774,335	409,898	381,497	28,401	420,581	453,645	33,064
1998	808,661	798,621	388,713	383,273	5,441	422,357	434,192	11,836
1999	735,467	808,661	381,956	356,776	25,180	395,860	424,657	28,797
2000	751,373	735,467	361,569	358,321	3,248	397,405	405,947	8,542
2001	786,559	751,373	387,941	377,221	10,720	416,305	427,731	11,426
2002	801,147	786,559	390,915	382,883	8,032	421,967	429,142	7,175
2003	364,528	801,147	145,382	176,542	-31,160	215,626	183,024	-32,602
2004	399,520	364,528	158,804	145,303	13,501	184,387	194,910	10,523
2005	676,031	399,520	270,731	283,623	-12,892	322,707	305,785	-16,922
2006	434,228	676,031	230,979	197,486	33,493	236,570	268,421	31,851
2007	636,730	434,228	286,289	268,463	17,826	307,547	321,073	13,526
2008	675,356	636,730	312,944	310,191	2,753	349,275	349,372	98
2009	693,667	675,356	323,441	323,467	-27	362,551	360,897	-1,654
2010	659,246	693,667	300,841	308,819	-7,977	347,903	336,458	-11,445
2011	396,843	659,246	204,670	177,418	27,252	216,502	242,396	25,894
2012	371,515	396,843	109,874	135,360	-25,486	174,444	145,889	-28,555
2013	168,639	371,515	53,687	Extreme Dry Year				
2014	306,050	168,639	87,348	77,677	9,671	116,761	123,658	6,897
2015	434,855	306,050	137,047	155,842	-18,795	194,926	171,298	-23,628
2016	545,476	434,855	182,189	224,195	-42,005	263,279	215,530	-47,749
2017	623,080	545,476	217,228	274,444	-57,216	313,528	251,387	-62,141
2018	491,560	623,080	222,908	219,339	3,569	258,423	257,711	-712
2019	453,971	491,560	137,327	186,163	-48,836	225,247	172,533	-52,714
2020	593,110	453,971	243,975	249,507	-5,532	288,591	282,797	-5,794
2021	229,892	593,110	91,473	88,800	2,673	127,884	133,161	5,276

Year	Current Year Rio Grande at Caballo (AF/yr)	Prior Year Rio Grande at Caballo (AF/yr)	D2 Data Total Heading Diversions (AF/yr)	One-Year Regression D2 Estimate (AF/yr)	Two-Year Regression D2 Estimate (AF/yr)	One-Year Regression Residuals (AF/yr)	Two-Year Regression Residuals (AF/yr)
1951	469,450	719,339	574,230	538,060	592,679	-36,170	18,449
1952	543,975	469,450	622,320	637,759	621,428	15,439	-892
1953	528,628	543,975	601,969	617,228	621,392	15,259	19,423
1954	244,165	528,628	285,762	236,674	264,431	-49,088	-21,331
1955	219,157	244,165	177,939	203,218	160,831	25,279	-17,108
1956	246,140	219,157	186,272	239,316	187,940	53,044	1,668
1957	397,103	246,140	332,319	441,274	382,183	108,955	49,864
1958	737,125	397,103	821,762	896,155	842,691	74,393	20,929
1959	687,414	737,125	841,358	829,652	867,730	-11,706	26,372
1960	705,162	687,414	852,181	853,395	877,077	1,214	24,896
1961	561,697	705,162	688,184	661,468	703,550	-26,716	15,366
1962	651,941	561,697	830,758	782,196	778,955	-48,562	-51,803
1963	517,172	651,941	687,348	601,902	634,715	-85,446	-52,633
1964	206,085	517,172	236,589	185,730	214,248	-50,859	-22,341
1965	505,598	206,085	479,788	586,419	506,618	106,631	26,830
1966	610,341	505,598	694,612	726,544	713,016	31,932	18,404
1967	456,517	610,341	532,866	520,758	548,824	-12,108	15,958
1968	505,691	456,517	579,555	586,543	570,615	6,988	-8,940
1969	667,669	505,691	802,427	803,237	784,189	810	-18,238
1970	661,125	667,669	803,162	794,483	817,386	-8,679	14,224
1971	498,375	661,125	591,757	576,756	613,728	-15,001	21,971
1972	260,911	498,375	295,695	259,077	277,498	-36,618	-18,197
1973	617,461	260,911	706,177	736,069	659,436	29,892	-46,741
1974	640,843	617,461	764,594	767,349	779,407	2,755	14,813
1975	580,617	640,843	753,661	686,779	710,625	-66,882	-43,036
1976	679,676	580,617	868,341	819,300	818,203	-49,041	-50,138
1977	416,496	679,676	493,063	467,218	516,841	-25,845	23,778
1978	356,167	416,496	336,381	386,510	374,833	50,129	38,452

ATTACHMENT 3

RIO GRANDE PROJECT

WATER SUPPLY ALLOCATION PROCEDURES

Bureau of Reclamation
Albuquerque Area Office
El Paso Field Division
El Paso, Texas

E. Definitions

1. Project Water Supply - stored water legally available for release from Elephant Butte and Caballo Reservoirs and including the legally appropriated waters reaching the bed of the Rio Grande between Caballo Dam and Riverside Diversion Dam.

2. Allocated Water - that portion of the project water supply, as defined in Article E.1. above, which is determined to be available for diversion and use by the Elephant Butte Irrigation District (EBID), and El Paso County Water Improvement District (EPCWID) and the Republic of Mexico during any irrigation season. The irrigation season is defined as that period of a year when storage releases are being made from Caballo Reservoir for irrigation purposes.

3. Non-Allocated Water - water in the Rio Grande, during non-irrigation season and after the closing of Caballo Dam gates, which originates from drain flows and other sources which may be diverted by the irrigation districts for application to irrigable land areas within their boundaries. All diversions made by the districts during the non-irrigation season utilizing return flow made by the districts during the non-irrigation season utilizing return flow waters shall not be charged against the Districts' respective allocations.

II. ALLOCATION

A. Procedure

The following procedure is used for the allotment and control of the Rio Grande Project water supply. It is required because the Bureau no longer delivers water at the farms, but rather at the districts' river headings. The procedure provides for an equitable distribution of project water between the U.S. and Mexico consistent with historic operations.

The 1906 Treaty with Mexico requires that Mexico be provided 60,000 AF/yr at the bed of the Rio Grande at the headworks of the Acequia Madre except in times of extraordinary drought or serious accident to the irrigation system in the United States. The amount delivered to the Mexican Canal (Acequia Madre) shall be diminished in same proportion as the water delivered to lands under said irrigation system in the United States. The first allocation to lands in the United States was made in 1951. An analysis done at that time established 3.024 AF/acre (applied to lands) as a full supply to U.S. farms of 468,720 AF (3.024 AF/acre x 155,000 acres) for the full project water right acreage of 155,000 acres. This analysis was based on the period of 1946 - 1950 during which a full water supply was available and deliveries were considered "normal".

Statistical evaluations of operational records for the period of 1951 through 1978 inclusive have been made. These evaluations have provided graphs, equations, and data that can be used to ensure that future allocations to Mexico and the allocations to the U.S. maintain the historical relationship between the delivery of water to U.S. farms and Mexico. The historical period of relationship is defined as the years 1951-1978 inclusive.

Curve D-1, enclosed as Exhibit No. 1, illustrates the historic water relationship between the water released from storage and the corresponding delivery to farms in the United States and to the heading of the Mexican Canal. Curve D-1 is used to determine the allocation to the Mexican heading and the two U.S. Irrigation Districts.

Prior to application of Curve D-1, it is necessary to determine the amount of water in storage available for release. This determination takes into account minimun pool requirements, non-project waters in storage, and estimated reservoir losses. Reservoir losses include evaporation, bank storage and seepage.

The amount available for irrigation to U.S. river headings is determined from Curve D-2, enclosed as Exhibit No. 3, which shows releases from Caballo vs. Net Diversions from the river (U.S. + Mexico). Mexico's allotment is subtracted from Net Diversions to obtain the amount available to the U.S. The diversion of water between the U.S. districts is based on acreage.

Curve D-1 will not be adjusted as it is based on the 1951-1978 period in which the allocations were made to farm deliveries. It should be noted that Curve D-2 is to be used as a guide and adjustments may be necessary due to current conditions. A review of the data base for curve D-2 will be made annually using the preceding year's data.

Reclamation will make the initial allocation of project water each year by December 1. In years of less than a full allotment, the allocation will be reviewed and updated as determined necessary. A review of the allocation will be made on a monthly basis and in conference with officials of EBID, EPCWID, and the U.S. Section of the IBWC, no later than the 10th of the following month.

B. Determination of Allotment for Full Supply

This procedure is based on a full supply of 468,700 acre-feet to authorized irrigated lands in the U.S. and full allocation to Mexico of 60,000 AF for a total of 528,700 AF.

Curve D-1 can be used to determine the historic release requirement necessary to deliver a full supply to U.S. authorized lands and Mexico (528,700 AF). From D-1, the required release from project storage is 763,800 AF. The release for a full supply is not limited to 763,800 AF.

$$\text{Release Required} = \frac{(\text{Full Supply}) - (\text{Y-Intercept})}{(\text{Slope})}$$

$$= \frac{(528{,}700) - (-102{,}305)}{(0.8260932)}$$

$$= 763{,}842 \text{ AF} \quad (763{,}800 \text{ AF})$$

From Curve D-2, the Net Diversion at Headings (US and Mexico) for a release of 763,800 AF is 931,841 AF (1951-1978 data).

$$\text{Net Diversions} = (\text{Slope})(\text{Release}) + (\text{Y-Intercept})$$

$$= (1.3377994)\ (763{,}800) + (-89{,}970)$$

$$= 931{,}841 \text{ AF}$$

Allocation for a full supply:

Delivery to U.S. Headings and to Mexico	=	931,841 AF
Delivery to Mexico	=	-60,000 AF
Delivery to U.S. Headings	=	871,841 AF

EBID Delivery to Headings = 56.774% of 871,841 AF = 494,979 AF
EPCWID Delivery to Headings = 43.226% of 871,841 AF = 376,862 AF

C. Example for 100% Allotment

Net diversion requirement for a full supply of 528,700 AF to authorized irrigated lands in the U.S. and Mexico has been found to be 931,841 AF.

Step 1. From Curve D-2, the Caballo release required to meet a net diversion at Headings of 931,841 AF is 763,800 AF.

Step 2. Determine amount of water in storage available for release.

Total Storage
-Estimated Reservoir Losses
-Storage for Others
=Water in Storage Available for Release

Storage for others is the City of Albuquerque which is limited to a maximum storage of 50,000 AF.

Water available for release is greater than 763,800 AF.

Step 3. If amount of water in storage available for release (from Step 2) equals or exceeds the release requirement (from Step 1), then the allotment is 100%. Then, the net diversions are 931,841 AF for a full supply to U.S. farms and Mexico.

Step 4. Available for diversions at headings:

Mexico	60,000 AF
EBID	494,979 AF
EPCWID	376,862 AF
	931,841 AF

D. Example of Allotment for Less Than Full Supply

Step 1. Determination of water in storage available for release assumed storage:

Elephant Butte	600,000 AF
Caballo Dam	32,000 AF
Total	632,000 AF
Minimum pool requirement	-50,000 AF
	582,000 AF
Estimated reservoir evaporation losses	-90,000 AF
Total water in storage available for release	492,000 AF

492,000 AF is less than 763,800 AF, the net diversion which would provide a full supply to U.S. farms and Mexico.

Step 2. From Curve D-1, total delivered to U.S. farms and Mexico vs. releases from storage

For a release of 492,000 AF, the total delivered to U.S. farms and Mexico = 304,133 AF

Step 3. Mexico's allotment = 11.3486% of total deliveries to U.S. farms and Mexico's headgate

$$\left[\frac{60,000}{528,700} = 0.113486 \right]$$

304,133 X 0.113486 = 34,515 AF

Step 4. Delivery to U.S. Headings from Curve D-2, for:

Caballo releases of 492,000 AF

Delivery to U.S. Headings and to Mexico (492,000 x 1.3377994 - 89,970)	568,227 AF
Delivery to Mexico	34,515 AF
Delivery to U.S. Headings	533,712 AF

Step 5. Allocation to Districts:

EBID	= 56.774% of 533,712 =	303,010 AF
EPCWID#1	= 43.226% of 533,712 =	230,702 AF

CURVE D-1

CALENDER YEAR	DELIVERED TO FARMS ACRE-FEET	ACEQUIA MADRE ACRE-FEET	NON-FARM DELIVERIES ACRE-FEET	Y TOTAL DELIVERY ACRE-FEET	X RELEASE FROM STORAGE	X*Y	X^2	Y^2
1951	287,618	33,059	7,018	327,695	469,450	153836417750	2.2038E+11	1.0738E+11
1952	331,846	49,890	6,597	388,333	543,975	211243443675	2.9591E+11	1.5080E+11
1953	310,440	37,760	5,955	354,155	528,628	187216249340	2.7945E+11	1.2543E+11
1954	102,270	10,147	1,752	114,169	244,165	27876073885	5.9617E+10	1.3035E+10
1955	80,463	8,185	2,071	90,719	219,157	19881703883	4.8030E+10	8.2299E+09
1956	69,458	7,864	1,002	78,324	246,140	19278669360	6.0585E+10	6.1346E+09
1957	170,117	23,290	2,155	195,562	397,103	77658256886	1.5769E+11	3.8244E+10
1958	400,767	60,050	6,432	467,249	737,125	344420919125	5.4335E+11	2.1832E+11
1959	406,989	60,110	6,772	473,871	687,414	325745559594	4.7254E+11	2.2455E+11
1960	402,400	60,320	6,527	469,247	705,162	330895153014	4.9725E+11	2.2019E+11
1961	325,981	48,610	4,949	379,540	561,697	213186479380	3.1550E+11	1.4405E+11
1962	411,420	60,057	6,234	477,711	651,941	311439387051	4.2503E+11	2.2821E+11
1963	313,006	39,693	3,828	356,527	517,172	184385781644	2.6747E+11	1.2711E+11
1964	64,968	6,653	938	72,559	206,085	14953321515	4.2471E+10	5.2648E+09
1965	234,600	36,658	4,034	275,292	505,598	139187084616	2.5563E+11	7.5786E+10
1966	301,468	49,618	8,341	359,427	610,341	219373034607	3.7252E+11	1.2919E+11
1967	225,269	29,829	4,021	259,119	456,517	118292228523	2.0841E+11	6.7143E+10
1968	255,721	39,677	7,475	302,873	505,691	153160150243	2.5572E+11	9.1732E+10
1969	364,068	59,884	10,423	434,375	667,669	290018721875	4.4578E+11	1.8868E+11
1970	388,549	60,065	9,670	458,284	661,125	302983009500	4.3709E+11	2.1002E+11
1971	269,090	34,847	5,722	309,659	498,375	154326304125	2.4838E+11	9.5889E+10
1972	122,652	16,077	2,719	141,448	260,911	36905339128	6.8075E+10	2.0008E+10
1973	338,769	60,000	10,850	409,619	617,461	252923757359	3.8126E+11	1.6779E+11
1974	351,904	60,050	13,291	425,245	640,843	272515281535	4.1068E+11	1.8083E+11
1975	345,686	60,052	13,545	419,283	580,617	243442837611	3.3712E+11	1.7580E+11
1976	375,070	60,172	13,794	449,036	679,676	305198992336	4.6196E+11	2.0163E+11
1977	193,221	24,824	5,234	223,279	416,496	92994810384	1.7347E+11	4.9854E+10
1978	112,349	14,903	3,587	130,839	356,167	46600534113	1.2685E+11	1.7119E+10
TOTAL	7,556,159	1,112,344	174,936	8,843,439	14,172,701	5049939502057	7.8682E+12	3.2884E+12
AVG.	269,863	39,727	6,248	315,837	506,168	180,354,982,216	2.8101E+11	1.1744E+11

SLOPE= 0.8260932

Y-INTRCPT= -102,305

CORR. COEFF.= 0.9781202

X STD. DEV.= 160,375

Y STD. DEV.= 135,448

CURVE D-2 DATA 1951-1978

ALENDER R	B ACEQUIA MADRE ACRE-FEET	E PROJECT NET SUPPLY ACRE-FEET	Y (B+E) TOTAL HEADING DIVERSIONS ACRE-FEET	X G RELEASE FROM STORAGE ACRE-FEET	X*Y	X^2	Y^2
1951	33,059	541,171	574,230	469,450	269572273500	2.2038E+11	3.2974E+11
1952	49,890	572,430	622,320	543,975	338526522000	2.9591E+11	3.8728E+11
1953	37,760	564,209	601,969	528,628	318217668532	2.7945E+11	3.6237E+11
1954	10,147	275,615	285,762	244,165	69773078730	5.9617E+10	8.1660E+10
1955	8,185	169,754	177,939	219,157	38996577423	4.8030E+10	3.1662E+10
1956	7,864	178,408	186,272	246,140	45848990080	6.0585E+10	3.4697E+10
1957	23,290	309,029	332,319	397,103	131964871857	1.5769E+11	1.1044E+11
1958	60,050	761,712	821,762	737,125	605741314250	5.4335E+11	6.7529E+11
1959	60,110	781,248	841,358	687,414	578361268212	4.7254E+11	7.0788E+11
1960	60,320	791,861	852,181	705,162	600925658322	4.9725E+11	7.2621E+11
1961	48,610	639,574	688,184	561,697	386550888248	3.1550E+11	4.7360E+11
1962	60,057	770,701	830,758	651,941	541605201278	4.2503E+11	6.9016E+11
1963	39,693	647,655	687,348	517,172	355477139856	2.6747E+11	4.7245E+11
1964	6,653	229,936	236,589	206,085	48757444065	4.2471E+10	5.5974E+10
1965	36,658	443,130	479,788	505,598	242579853224	2.5563E+11	2.3020E+11
1966	49,618	644,994	694,612	610,341	423950182692	3.7252E+11	4.8249E+11
1967	29,829	503,037	532,866	456,517	243262387722	2.0841E+11	2.8395E+11
1968	39,677	539,878	579,555	505,691	293075747505	2.5572E+11	3.3588E+11
1969	59,884	742,543	802,427	667,669	535755632663	4.4578E+11	6.4389E+11
1970	60,065	743,097	803,162	661,125	530990477250	4.3709E+11	6.4507E+11
1971	34,847	556,910	591,757	498,375	294916894875	2.4838E+11	3.5018E+11
1972	16,077	279,618	295,695	260,911	77150078145	6.8075E+10	8.7436E+10
[illegible]	60,000	646,177	706,177	617,461	436036756597	3.8126E+11	4.9869E+11
1974	60,050	704,544	764,594	640,843	489984712742	4.1068E+11	5.8460E+11
1975	60,052	693,609	753,661	580,617	437588388837	3.3712E+11	5.6800E+11
1976	60,172	808,169	868,341	679,676	590190537516	4.6196E+11	7.5402E+11
1977	24,824	468,239	493,063	416,496	205358767248	1.7347E+11	2.4311E+11
1978	14,903	321,478	336,381	356,167	119807811627	1.2685E+11	1.1315E+11
TOTAL	1,112,344	15,328,726	16,441,070	14,172,701	9250967124996	7.8682E+12	1.0960E+13
AVG.	39,727	547,455	587,181	506,168	330,391,683,036	2.8101E+11	3.9143E+11

SLOPE=	1.3377994
Y-INTRCPT=	-89,970
CORR. COEFF.=	0.9754545
X STD. DEV.=	160375
Y STD. DEV.=	219948

RIO GRANDE PROJECT
ALLOTMENT PROCEDURES

REGRESSION ANALYSIS CURVE D-1

- Annual Data Used (1951-1978)

- Y-Axis - Sum of Deliveries, including:

  Acre-Feet Delivered to Farms
  Acre-Feet Delivered Internationally to Mexico
  Non-Farm Deliveries (M&I) in Acre-Feet

- X-Axis:

  Acre-Feet Releases from Storage

- Regression Analysis Curve D-1 Data:

Slope	=	0.8260932
Y-Intercept	=	- 102,305
Corr Coeff	=	0.9781202
Y Std Dev	=	160,375
X Std Dev	=	135,448

RIO GRANDE PROJECT
ALLOTMENT PROCEDURES

REGRESSION ANALYSIS CURVE D-2

- Annual Data Used (1951-1978)

- Y Axis - Total Diversions:

  Total Acre-Feet Diverted

- X-Axis - Total Releases:

  Water Supply Releases from Storage

- Regression Analysis Curve D-2 Data:

Slope	=	1.3377994
Y-Intercept	=	- 89,970
Corr Coeff	=	0.9754545
X Std Dev	=	160,375
Y Std Dev	=	219,948

RIO GRANDE PROJECT
ALLOTMENT PROCEDURES

- Full Allotment to U.S. Farms and Mexico:

3.024 AF/Ac x 155,000 Ac =	468,720 AF
Full Allotment to Mexico (1906 Treaty)	+ 60,000 AF
	528,720 AF
	Use: 528,700 AF

- Using D-1 Curve, Determine Release for Full Allotment:

Slope = 0.8260932; Y-Intercept = -102,305 AF

$$Y = (0.8260932)\,X + (-102{,}305 \text{ AF}) = 528{,}700 \text{ AF}$$

$$X = \text{Releases} = \frac{(528{,}700 + 102{,}305)}{0.8260932} = \quad 763,\ 842 \text{ AF}$$

Use: 763,840 AF

- Using D-2 Curve, Determine Total Diversions:

Slope = 1.3377994; Y-Intercept = -89,970 AF

$$Y = (1.3377994)(763{,}840)\text{AF} + (-89{,}970)\text{AF} = \quad 931{,}841 \text{ AF}$$

RIO GRANDE PROJECT
ALLOCATION PROCEDURES

- Full Water Supply Allocation:

Total Allocation Diversions:	931,841 AF
Allocation to Mexico (1906 Treaty):	-60,000 AF
Allocation to U.S. Districts	871,841 AF

- Full Allocation to U.S. Districts:

EBID = (88,000/155,000)(871,841)AF

= (0.56774)(871,841)AF = 494,979 AF

EPCWID = (67,000/155,000)(871,841)AF

= (0.43226)(871841)AF = 376,862 AF

RIO GRANDE PROJECT
ALLOTMENT PROCEDURES

- Example of a 100% Allocation:

Allotment Letter:

Mailed to the IBWC and U.S. Districts in Dec.
(Year prior to irrigation season)

Full allocation is based on:

Full Supply to authorized U.S. Lands:	468,700 AF
Full allocation to Mexico :	+60,000 AF
	528,700 AF

From Curve D-1, release from storage is: (Full Allotment to U.S.Farms & Mexico)	763,840 AF
From Curve D-2, total diversions are: (Full Allotment to U.S. Farms & Mexico)	931,841 AF
Full Allocation to Mexico (1906 Treaty):	60,000 AF
Full Allocation to U.S. Districts:	871,841 AF
Full Allocation to EBID: (871,841)(0.56774)AF = 494,982 AF	494,979 AF
Full Allocation to EPCWID: (871,841)(0.43226)AF = 376,862 AF	376,862 AF

RIO GRANDE PROJECT
ALLOTMENT PROCEDURES

- Example - Allotment for Less than Full Supply:

Determine Project Water Supply Available in Storage:

Elephant Butte Reservoir		600,000 AF
Caballo Reservoir		+32,000 AF
	Total	632,000 AF
Minimum Pool	:	-50,000 AF
Evaporation Losses	:	-90,000 AF
Available In storage	:	492,000 AF

492,000 AF is less than the 763,840 AF which would provide a full supply to the U.S. Farms and Mexico.

From Curve D-1, 492,000 AF release would provide the U.S. Farms and Mexico with:

$$Y = (0.8260932)(492{,}000\text{ AF}) + (-102{,}305) = 304{,}133\text{ AF}$$

Mexico's Allotment = 11.3486% of the total deliveries to the U.S. Farms and Mexico:

$$(60{,}000\text{ AF}/528{,}700\text{ AF})(100\%) = 11.3486\%$$

Mexico's Allotment would be:

$$(304{,}133\text{ AF})(0.113486) = \quad 34{,}515\text{ AF}$$

RIO GRANDE PROJECT
ALLOTMENT PROCEDURES

- Example - Allotment for Less than full Supply (Cont.):

Deliveries to U.S. Headings:

Available in Storage =	492,000 AF

From Curve D-2, Diversions to the U.S. Districts and Mexico:

(492,000)(1.3377994)AF + (-89,970)AF =	568,227 AF
Delivery to Mexico =	-34,515 AF
Delivery to U.S. Headings =	533,712 AF

Allocations to U.S. Districts:

EBID = (533,712)AF(0.56774) =	303,010 AF
EPCWID = (533,712)AF(0.43226) =	230,702 AF