

**GILA RIVER/INTERSTATE STREAM COMMISSION STREAMFLOW/ALLUVIAL  
GROUNDWATER STUDY:**

**Piezometer and surface water data collection and management**

**FINAL REPORT, 2014**

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This is the final report for the 2014 data collection project year, through mid-June 2014. Included on the report CD are all data downloaded from the four Cliff-Gila Valley well transects installed by TetraTech for NMISC, and data sheets recording manual measurements and notes from the site visits. Also included are data from two recording surface water stage gages (RSGs), and from 16 monitoring wells or piezometers installed for a separate, complementary project with New Mexico Department of Game & Fish (NMDGF) and The Nature Conservancy (TNC) (Figure 1). All data supplied with this and previous years' reports are transformed into groundwater elevations format after compensation for barometric pressure effects, and delivered as standard spreadsheets by water year (WY).

In June 2013, an RTK survey of two to three permanent survey monuments at the NMDGF transects on which surface and groundwater data are recorded was contracted. The purposes were 1) to collect coordinates and elevation data at sufficient precision to enable transformation of water levels to water elevations (NAD83; US survey feet) within +/- 0.3 ft; and 2) to check and if necessary, to correct elevation data at these sites collected by TetraTech in 2010. Evaluation of the earlier elevation data at some sites (particularly around T2-T3, and at T5; Figure 1) suggested that errors were present in the earlier data set. The June 2014 RTK data were evaluated in conjunction with SS Papadopoulos staff who had worked with the previous (TetraTech) data sets. Corrected elevations were used to re-transform water elevation data as reported in the current spreadsheets of NMDGF transect data. However, for data from the Lichty NMISC groundwater wells transect, SS Papadopoulos staff performed the final water elevation corrections (a 0.5-ft correction).

Previously downloaded data and photographic documentation collected since the start of the project in mid-2009 were supplied on the 2010-2011 final report CD. The overall study purpose is to utilize ground- and surface water data collected at sites along the Gila River in southwestern New Mexico to calibrate models of surface water and alluvial groundwater interactions along the river.

### **Summary**

One of the largest flood peaks on record at the USGS Gila near Gila gaging station just upstream of the Cliff-Gila Valley occurred in mid-September, 2013, peaking at about 30,000 cfs on September 16. (For comparison, in 1984 the flood of record peaked at about 35,200 cfs.) A number of the NMISC installations were destroyed during the flood, as detailed in the site summaries below.

Manual QA/QC measurements were collected, and transducer data were downloaded, at some of the four NMISC piezometer/observation well sites in the Cliff-Gila Valley between the end of the 2012-13 project year, and the beginning of the 2013-14 project year. Regular site visits resumed at the beginning of the current project period, in January 2014. Correspondence between the manual measurements and barometrically compensated data recorded by the transducers is generally very good; within < 0.02 ft. All water level data is recorded at 30-minute intervals by the transducers installed in the wells and surface water gages (Solinst Corp.). The raw water levels data are compensated for barometric pressure effects with barometric pressure data simultaneously recorded by one of four Barologgers (Solinst Corp.) at 30-minute intervals.

**Available surface stage data.** The NMDGF/TNC surface stage gage data substitute for surface water data originally recorded at Tetra Tech installations on three of the four transects; two of the Tetra Tech installations were destroyed by floods in January 2010 (FM1 and FM2 sites). High water levels during installation of a third left it positioned well off the active low flow channel (at TNC's Lichty Center), and few valid data were recorded between installation in 2010 and September 2013, when it was destroyed during the floods. A fourth (in the Gila National Forest "Bird Area" downstream of Mangas Creek) was also installed during high flows in 2010, and the actual transducer housing, attached to pipe buried in the river bank, could not be relocated after flows receded. (The Tetra Tech installation memo of June 2010 provides details on construction methods.) However, data from this stage installation reviewed after downloading visits in 2010– June 2013 appeared likely to be valid, although only repeat surveys of surface water levels, or an excavation of the buried PVC and metal pipe that housed the transducer and its cable, might have determined with complete certainty the validity of all data points. This installation was also destroyed during floods in September 2013, but the transducer and part of the pipe housing it were excavated from beneath the river channel in May 2014 and the transducer was successfully downloaded. Data recorded prior to the flood peak were transformed to groundwater level elevations in the data spreadsheets that accompany this report; those recorded after the peak are reported simply as recorded water levels.

Both NMDGF stage gages survived the September floods intact. The river channel at the T10 gage (Figure 1) shifted right, however, so that the transducer recorded groundwater

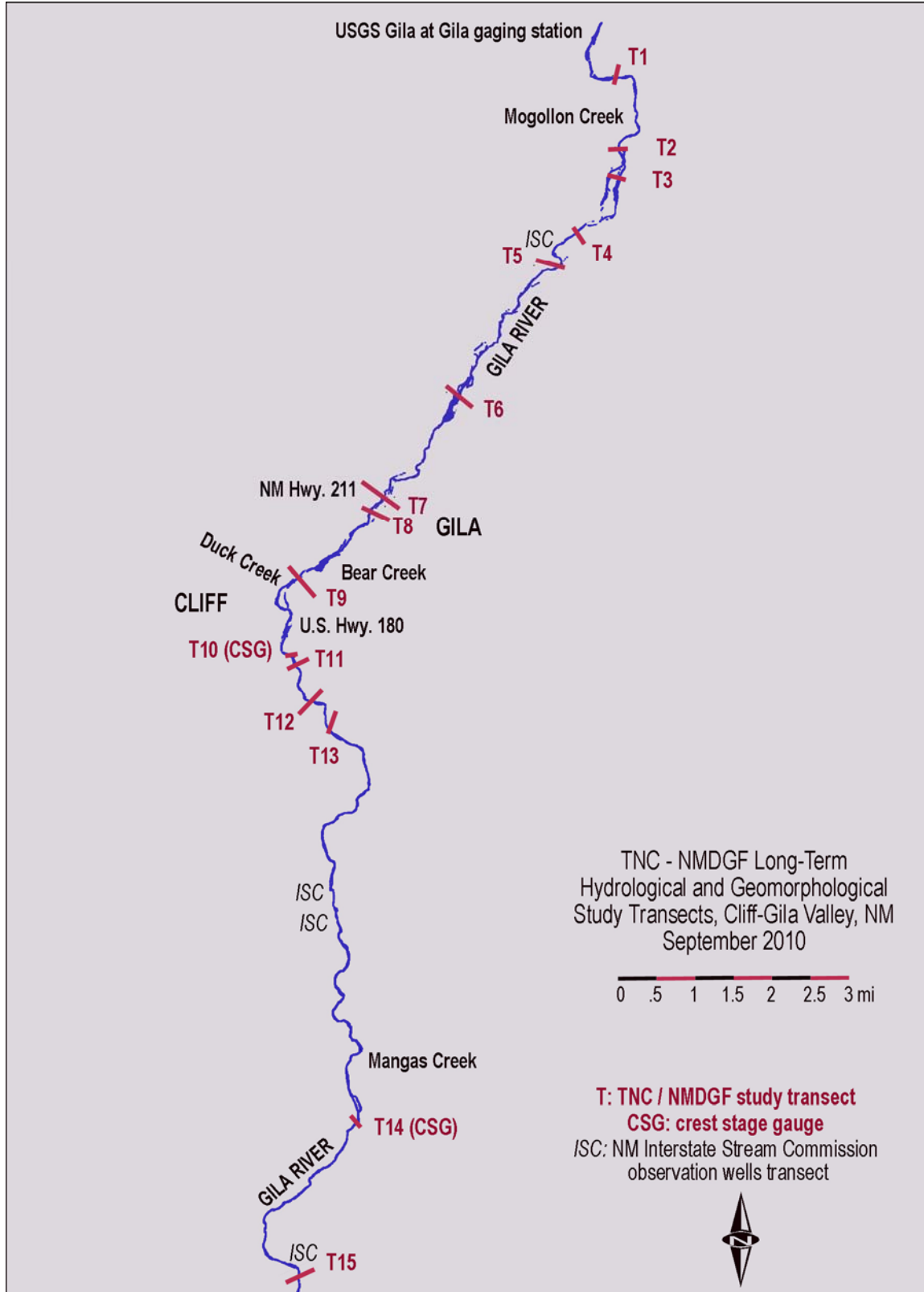


Figure 1. Sketch map (to scale) of data collection sites in and near the Cliff-Gila Valley, NM for NMISC and NMDGF/TNC groundwater studies.

Table 1. NMISC groundwater and surface stage gauging installations, Cliff-Gila Valley; TNC/NMDGF surface stage installations, and data status as of June 2014 for collection of surface- and groundwater modeling data.

Site/Piezometer or stage	Status (see footnote)	Available data for project year 2014	Notes
<b>Bird Area</b>			
B-1S	2	6/2013-6/2014	
B-1D	2	(B-1S, 1D, 2, 3)	
B-2	2		
B-3	2		
B-stage	4	6/2013-5/2014	Installation destroyed Sept. 2013; transducer retrieved and downloaded May 2014.
<b>FM-1</b>			
FM1-1S	1	6/2013-6/2014	
FM1-1D	1	6/2013-6/2014	
FM1-2	1	6/2013-6/2014	
FM1-3	1	6/2013-6/2014	
FM1-stage	4	--	
<b>FM-2</b>			
FM2-1S	4	--	Destroyed 9/2013.
FM2-1D	4	--	Destroyed 9/2013.
FM2-2	1	6/2013-6/2014	
FM2-3	1	6/2013-6/2014	
FM2-stage	4	--	
<b>Lichty</b>			
TNC-2D	4	--	Destroyed 9/2013.
TNC-3S	4	--	Destroyed 9/2013.
TNC-4	4	6/2013-10/2013	Destroyed 9/2013; transducer retrieved and downloaded thru 10/2013.
TNC5	1	6/2013-6/2014	
TNC-stage	4	--	Destroyed 9/2013.
<b>Iron Bridge RSG</b>	3	6/2013-4/2014	Channel shift 9/2013 necessitates re-location of RSG, scheduled summer 2014.
<b>BLM RSG (below Mangas Cr. confluence)</b>	2	2/2014-6/2014	Transducer lost in flood 9/2013; replaced 2/2014. RSG undamaged.

Status codes: 1: Functional; installed 2009. 2: Functional; installed 2010 or 2011. 3: Probably functional but data supplied with cautionary notations. 4: Destroyed by floods in 2010 or 2013.

Table 2. Groundwater installations in the Cliff-Gila Valley for corollary NMDGF/TNC study, and data collection periods for all NMDGF/TNC data supplied to NM ISC in this project period.

<b>Site/Piezometer or stage</b>	<b>Data provided in project year 2014</b>	<b>Notes*</b>
<b>T2</b>		
BME	6/2007-5/2014	
BMC	6/2010-5/2014	
BMW	6/2007-5/2014	
<b>T3</b>		
DS E	9/2010-4/2014	
DS W	9/2010-4/2014	
<b>T5</b>		
GRF E	6/2007-6/2014	
GRF W	11/2008-6/2014	
GRF C	5/2010-6/2014	
<b>T6</b>		
E1	7/2010-9/2013; 1/2014-5/2014	
E2	7/2010-9/2013; 1/2014-5/2014	
<b>T11</b>		
RC	7/2010-3/2014	
R	7/2010-3/2014	
<b>T12</b>		
IBE	7/2009-5/2012; 4/2013-5/2014	
IBC	12/2010-9/2012	Data collection ended 9/2012; destroyed 9/2013
<b>T13</b>		
T13W	10/2010-12/2013	Site discontinued
<b>T15</b>		
B4	5/2010-6/2014	
USFS	12/2010-6/2014	

\*All data available from 2007 through mid-2013 were also supplied to NM ISC contractor SS Papadopoulos in October 2013, by NMISC request.

levels beneath the sand/gravel floodplain, approximately 5 m from the left edge of surface flow, after flows receded. It was removed in April, 2014, in preparation for re-location of the stage gage in July 2014. At the T14 stage gage, the transducer was dislodged and lost during the flood. It was replaced in February 2014. Each transect (T10 and T14; see Figure 1) on which the NMDGF stage gages are installed was surveyed by total station in mid-2013 and again in early 2014 to capture geomorphic changes resulting from the September 2013 flood events. Both the 2013 and 2014 survey data (NM State Plane coordinates, US survey feet, NAD83) were supplied to NMISC in April 2014.

**NMDGF wells/piezometers.** Additionally, continuous groundwater data collected on seven other transects (16 wells or piezometers total) as part of the NMDGF/TNC study were provided in April 2014 and June 2014 (see Figure 1). Data from these sites through mid-2013 were also provided to NMISC contractor SS Papadopoulos in October 2013. None of these wells or piezometers were damaged during the September 2013 flood. During site visits in the fall and winter of 2013-14, all were bailed to remove any sediment taken on during overtopping by floodwaters. The transducers in two piezometers on T6 were dislodged but were recovered and replaced; data for the interim period are excluded from the spreadsheets. An old brick well on T12 (Figure 1), briefly employed as a data collection site for the project, was completely destroyed by the floods. However, data collection at this site had ended in 2012.

The installation dates for the NMDGF sites vary. Consequently the data sets provided encompass a range of dates, with the earliest data sets extending to mid-2007. Coordinate and elevation data for each well or piezometer are provided in the water level spreadsheets, and Table 2 summarizes the data sets supplied to NMISC from these sites to date.

### **NMISC site notes**

**Bird Area:** The four monitoring wells were undamaged during the September 2013 floods, and all groundwater level data are reported on the WY 2013 and WY 2014 spreadsheets supplied to NMISC in April and June 2014. As described above, the surface stage installation was destroyed during the flood, but part of the transducer housing and the transducer were recovered from the site in May 2014. The transducer was successfully downloaded and water level data are reported on the WY 2013 and WY 2014 spreadsheets.

**FM1 and FM2:** The original stage gage at each site was destroyed in January 2010 by floods. The nearest surface stage data is collected at the RSG installed just downstream of the Gila River/Mangas Creek confluence (T14; Figure 1) since June 2011. The

transducer installed in this gage was dislodged and lost during the September 2013 floods, but the gage itself was undamaged. A replacement transducer was installed in February 2014. Water elevation data for the entire period of record, 2011–June 2013, and February–June 2014, were supplied to NMISC in April and June 2014.

All four FM1 monitoring wells were intact after the floods in September 2013. However, flood debris nearly buried FM-1S and FM-1D, both on the right river floodplain. FM-1S appears to be leaning downstream. In conjunction with a similar problem noted in 2011 (when the heavy metal casing and concrete base began to sink into the floodplain around the PVC well; it has been impossible to close and lock the casing since that time), this suggests that a repeat survey of these two installations is needed to ensure that water level data continue to be correctly transformed to water elevations. All groundwater elevation data for the current project year, 6/2013-6/2014, were reported in April and June 2014 using the currently available survey data (from 2009).

The two FM2 wells nearest the river channel (FM-2S and FM-2D) were completely destroyed during the September 2013 flood. No evidence of the wells was found during a search of the river channel though approximately ½ mile downstream of the site in February, 2014. The Barologger housed in FM-2S was also lost. Barometric pressure compensations of FM1 and FM2 water level data collected since June 2013 use barometric pressure data collected by Solinst Barologger at the Bird Area site downstream, adjusted for the elevation difference between the two sites. The transducer in well FM2-3 failed to download at the site in early June. It was replaced the following day by the transducer recovered from the Bird Area stage gage. Diagnostic testing of the original transducer off site reported a low battery, and enabled data retrieval. All data for the period 6/2013-6/2014 from the existing wells at the FM sites were reported to NMISC in April and June 2014.

Of the six monitoring wells now remaining at the FM sites, two are located on the right river floodplain (FM-1S and FM-1D), and a third (FM-2-2) is next to a cross-fence between alfalfa fields currently cultivated by the site landowner. The other three wells (FM1-2, FM1-3, and FM2-3) are located in actively cultivated areas within the alfalfa fields. In early 2014, the landowner expressed concerns about these wells, which can be difficult to see during mowing of the alfalfa and therefore present some danger to farming equipment. I made a visit in early 2014 with one of the members of the Grant Soil & Water Conservation District to talk with the landowner, who agreed to wait to request that NMISC remove the wells after the end of the current project year. The landowners assured us that they have no concerns with the three wells that present no danger to equipment.

The FM sites were last visited for measurements and downloads on June 18, 2014, and instrumentation in the wells was left in place. I emailed NMISC staff for guidance on



whether to remove instrumentation from the three wells slated for removal and will make a return trip to the site if requested.

**Lichty:** The river segment upstream and downstream of the NMISC Lichty wells transect has experienced substantial geomorphic change during major floods over the past three decades, and that trend continued with the September 2013 floods. The stage gage and three of the four monitoring wells on the transect were destroyed. However, the metal casing and transducer of well TNC-4 were found resting on the channel bottom a short distance downstream in October 2013. The transducer was successfully downloaded and data are included in the WY 2014 spreadsheets supplied in April and June 2014. Well TNC-5, farthest from the main channel, was undamaged and remains instrumented. All data from June 2013-June 2014 were supplied to NMISC in April and June 2014.

All data listed in Tables 1 and 2 are also provided on the CD accompanying this report.

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June 25, 2014