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**TWDB CONTRACTS**

**Final Report**

**Guadalupe Blanco River Authority**

**Early Warning System – Hays County Rainfall Gauges**

**TWDB Contract No. 1600012043**

# **RAINFALL SCADA – HAYS COUNTY**

December 21, 2018

Ms. Sarah Husted  
Texas Water Development Board  
PO Box 13231  
Austin, TX 78711-3231

Re: TWDB Contract No. 1600012043  
Early warning system Report – Hays County Rainfall Gauges

Dear Ms. Husted:

The project for the installation of eight rainfall gauges in Hays County is complete. In accordance with the construction grant, transmitted is our final report entitled: Early Warning System Report – Hays County Rainfall Gauges.

This revised report includes a Table of Contents, Scope of Work, photos of Equipment Installed and List of Figures as set out in Contract No. 1600012043.

Please contact me should you have any questions or require any additional information to finalize the reporting requirements

Sincerely,



Thomas D. Hill, P.E.  
Chief Engineer

TDH:mcn

Enclosures as stated

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**GBRA**

**Guadalupe-Blanco River Authority**  
*flowing solutions*

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## **LIST OF ACRONYMS**

**EAA** – Edwards Aquifer Authority

**EMC** – Emergency Management Coordinator

**GBRA** – Guadalupe Blanco River Authority

**HADS** – Hydrometeorological Automated Data System

**HAYS** – Hays County

**NEMA** – National Electrical Manufacturers Association

**NWS** – National Weather Service

**NWS-RFC** – National Weather Service River Forecast Center

**RAWS** – Servicio Meteorologic Nacional (Mexico)

**SCADA** - Supervisory Control and Data Acquisition

# RAINFALL SCADA HAYS COUNTY

## INTRODUCTION

### A. General Purpose

The areas all along the Blanco River and San Marcos River watershed have seen considerable growth. With rapidly developing communities bringing concerns about the increasing threat of flooding and associated damages due to increased urbanization. These areas have been hit hard affecting many populated areas, scenic and environmental resources since major flood events in 1998, 2002, the Memorial Day Flooding in May 2015 and again on October 30, 2015.

The Texas Hill Country is known as “Flash Flood Alley”. This area is the most flash flood-prone in the state, and among the most flood-prone areas in the country. Much like other flash flood-prone communities across the country, the geography in this region can rapidly transform the rivers and creeks in the Hill Country into raging tidal surges of water, mud and debris that is capable of taking out entire homes, businesses, roads and bridges.

The purpose of this project provided additional rainfall gauges to an existing early warning system in the watersheds of the Blanco and San Marcos rivers. Using an existing supervisory control and data acquisition (SCADA) system, the Guadalupe-Blanco River Authority (GBRA) network incorporated these gauges into their monitoring network. The real-time monitoring of the rainfall gauges allows for a rapid response to changing conditions, reducing losses and improving the overall efficiency by City Officials and Emergency Management Coordinators (EMC) and officers of potential flooding.

The Blanco - Memorial Day Flood of 2015 brought to light the need to improve metrological data collection within the watershed. Due to the steep terrain of the upper watershed, floodwaters peak higher and travel faster than most rivers. The high growth rate of the region, and the accompanying additions of impervious cover leading to runoff of floodwaters in major rain events, increase the potential for additional loss of life in the future for residents and those coming to the area for recreational activities.

## **B. SCOPE OF WORK**

The primary purpose of the project is to expand the existing GBRA rainfall network into the eastern Hays County. The existing GBRA rainfall program was created to provide a data collection platform within the Guadalupe River Watershed to support flooding monitoring and flood forecasting efforts by the National Weather Service (NWS) and local emergency responders. The network in Hays county assists in improved forecasting and warning dissemination along the San Marcos River watershed and the Plum Creek watershed.

Additional rain gauges maintained by other entities are also located in Hays County and are shown in Figures “A-2” and “A-3”. These gauges are sponsored by Edwards Aquifer Authority (EAA); Hydrometeorological Automated Data System (HADS); Hays County (HAYS); Lower Colorado River Authority (LCRA); National Weather Service (NWS); and Servicio Meteorologico Nacional – Mexico (RAWS).

### **Type of Equipment:**

The eight rainfall gauging sites utilized equipment which was consistent with the existing GBRA rainfall network. Each rain gauge site consisted of a 6 inch diameter tipping bucket rain gauge Model TR-525 by Texas Electronics, Inc., a SCADA-Pack Model 201 programmable logic controller with a built-in Freewave Radio and a Yagi antenna. Power was provide by a 50 watt solar panel and 75 amp-hour battery. The battery has the electrical storage capacity to last 6 or 7 days with minimal sunlight.

The equipment was placed in a NEMA 4 Electrical metal box and mounted on a vertical 4 inch diameter galvanized pole which transitioned to a 3 inch pole at the top. The electrical enclosure equipment was placed 6 to 7 feet above the ground to minimize vandalism. The solar panel, tipping bucket and Yagi antenna was located toward the top of the pole.

### **Siting of Rainfall Gauges**

A number of factors were used to select the gauge locations including:

- a) Maintain spacing between gauges to 5 or 6 miles.
- b) Insure an unobstructed radio frequency path to the site,
- c) The ease of obtaining right of way for the equipment.
- d) A site location which provides ease of access for maintenance.

A review of past studies suggested rain gauges should be spaced approximately 7 to 8 miles apart. Due to the compact nature of storm events in Central Texas, a spacing of 5-6 miles was selected and used where possible. The map showing the location and coordinates for the rain gauges can be found in Figure “A-1”. It should be noted gauging site H-09, H-10 and H-11 shown on figure “A-1” were installed using a different funding source, but included in the Hays County map. .

## **Use of Data**

Rainfall data is available for use by a number of entities and include:

- a) County Road Administrator to identify and install safety barriers around low water crossings.
- b) County Emergency Management Coordinator (EMC) to assist with localized flooding issues.
- c) The NWS Forecast Office to help forecasters decide whether to issue flood and weather warning.
- d) The NWS River Forecast Center in Fort Worth utilizes this data to assist with the calibration of NEXRAD weather radar rainfall estimates. This process is sometimes referred to as “ground-truthing.”
- e) General Public

## **Access to Data**

The rainfall-telemetry gauge reports every 6 minutes to the Master GBRA computer located in Seguin, Texas. A web report is published every 10 minutes in a tabular format. The data can be accessed from two sources:

- a) Data can be found at <https://www.gbra.org/rain>. The web report displays rainfall totals for every 1-hour, 3-hour, 6-hour and 24-hour. See Figure “C-a”
- b) The Hays county eight gauging sites along with the other GBRA gauging sites are also displayed on the TWDB TexMesonet web-site and can be found at <https://www.texmesonet.org/>. TexMesonet provides access to rainfall data from not only GBRA but from LCRA, USGS, FAA, and EAA. See Figure “C-b”.

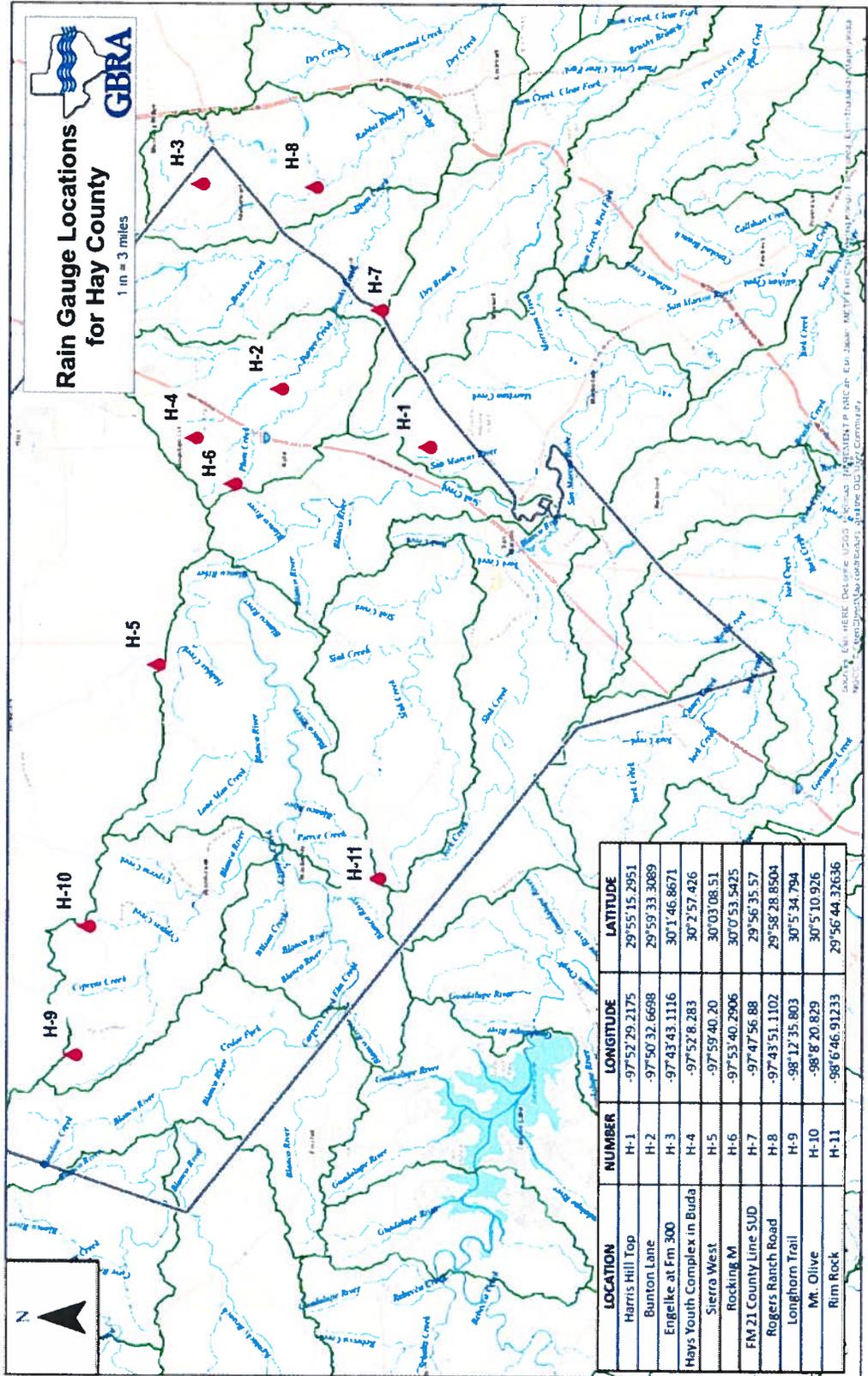
## **Maintenance**

Rainfall sites will be visited at least every two to three months to check for visual signs of damages from high wind or vandals. The rain gauges will be inspected to insure the tipping bucket mechanism is not jammed. The battery will need to be checked at least once a year. The battery is expected to last for four to six years. The remaining equipment will have a life expectancy of twenty-five to thirty years.

FIGURE "A-1"

AREA MAP

RAINFALL GAUGE PLACEMENT MAP FOR NEW INSTALLS  
IN HAYS COUNTY WITH TWDBB FUNDING



## FIGURE “A-2”

### ALL RAINFALL GAUGE COORDINATES IN HAYS COUNTY

Map Label	Station	Location Name	Latitude	Longitude
EAA-1	EA003	DiLeo Ranch - EAA	30°1'28.26"N	98°12'39.27"W
HAYS1		NRCS Dam 4 - HAYS	29°52'59.66"N	98°1'53.39"W
HAYS2	50021011	Uhland Rd (CR 161) - HAYS	29°53'40.59"N	97°54'2.30"W
HAYS3	50024011	Post Rd (CR 140) - HAYS	29°56'14.58"N	97°53'42.06"W
HAYS4	50022011	Hilliard Rd (CR222) - HAYS	29°56'53.97"N	97°57'37.75"W
HAYS5	50025011	Wayside Dr. (CR 179) - HAYS	29°58'2.25"N	98°11'22.59"W
HAYS6		Little Arkansas Rd (CR 174) - HAYS	29°59'2.27"N	98°3'9.84"W
HAYS7		CR1492 at Blanco River - HAYS	29°59'6.07"N	98°6'33.59"W
HAYS8	50031011	Chaparral Rd at Little Bear Creek - HAYS	30° 8'16.96"N	97°52'36.68"W
HAYS9	50029011	Rohde Rd (CR126) - HAYS	30°0'48.77"N	97°46'11.08"W
HADS-1	KYET2	Blanco River Near Kyle 25W - HADS	29°58'51.99"N	97°54'24.2"W
HADS-2	BFST2	Blanco River at Fischer Store near Wimberley 6W - HADS	29°59'51.94"N	98°11'59.71"W
HADS-3	HFXT2	Blanco River at Halifax Ranch Near Kyle 5W - HADS	30°0'28.33"N	97°57'9.82"W
HADS-4	DRWT2	Onion Creek Near Driftwood 3SSE - HADS	30°4'55.8"N	98°00'42.41"W
LCRA-1	DRGT2	Dripping Springs 5 SSW - LCRA	30° 7'31.91"N	98°6'55.67"W
LCRA-2	DIRT2	Dripping Springs 8 W - LCRA	30°12'3.34"N	98°13'21.29"W
LCRA-3	DRPT2	Dripping Springs 4 NNE - LCRA	30°14'54.21"N	98°3'32.75"W
LCRA-4	PFCT2	Flat Creek Near Perdenales Falls State - LCRA	30°16'28.15"N	98°12'26.91"W
LCRA-5	BDUT2	Onion Creek at Buda - LCRA	30°5'12.91"N	97°51'6.45"W
LCRA-6	MTCT2	Manchaca 4W - LCRA	30°7'12.67"N	98°16'31.63"W
NWS-1	KHY1	San Marcos, San Marcos Municipal Airport - NWS/FAA	29°53'54.24"N	97°52'0.83"W
RAWS-1	SRWT2	San Marcos - West - RAWS	29°56'2.8"N	97°59'55.44"W
RAWS-2	KRET2	Kyle-East - RAWS	30° 0'21.9"N	97°50'59.03"W
RAWS-3	AURT2	South Austin RAWS - RAWS	30°10'37.61"N	97°52'46.28"W
RAWS-4	DSRT2	Dripping Springs North - RAWS	30°13'9.56"N	98°5'11.85"W
RAWS-5	HWWT2	Wimberley-West - RAWS	30°2'49.58"N	98°12'12.07"W
RAWS-6	AUWT2	Austin Water QD - RAWS	30°4'40.83"N	97°58'43.75"W
GBRA - H-1	H-1	Harris Hill Top	29°55'15.30"N	97°52'29.22"W
GBRA - H-2	H-2	Bunton Lane	29°59'33.31"N	97°50'32.67"W
GBRA - H-3	H-3	Engelke at FM 300	30°1'46.87"N	97°43'43.11"W
GBRA - H-4	H-4	Hays Youth Complex in Buda	30°2'57.43"N	97°52'8.28"W
GBRA - H-5	H-5	Sierra West	30°03'08.51"N	97°59'40.20"W
GBRA - H-6	H-6	Rocking M	30°0'53.54"N	97°53'40.29"W
GBRA - H-7	H-7	FM 21	29°56'35.57"N	97°47'56.88"W
GBRA - H-8	H-8	Rogers Ranch Road	29°58'28.85"N	97°43'51.11"W

<b>Map Label</b>	<b>Station</b>	<b>Location Name</b>	<b>Latitude</b>	<b>Longitude</b>
GBRA - H-9	H-9	Longhorn Trail	30°5'34.79"N	98°12'35.80"W
GBRA H-10	H-10	Mt. Olive	30°5'10.92"N	98°8'20.83"W
GBRA - H-11	H-11	Rim Rock	29°56'44.33"N	98°6'46.91"W

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FIGURE "B-1"  
Rain Gauges Installed



GBRA - H-1

Harris Hill Road

$29^{\circ}55'15.30''\text{N}$       $97^{\circ}52'29.22''\text{W}$

FIGURE "B-2"  
Rain Gauge Installed



GBRA - H-2

Bunton Lane

29°59'33.31"N    97°50'32.67"W

FIGURE "B-3"  
Rain Gauge Installed



GBRA - H-3  
Engelke Rd at FM 300  
30°1'46.87"N 97°43'43.11"W

FIGURE "B-4"  
Rain Gauge Installed



GBRA - H-4  
Hays Youth Complex in Buda  
30°2'57.43"N 97°52'8.28"W

FIGURE "B-5"  
Rain Gauge Installed



GBRA - H-5

Sierra West

30°03'08.51"N    97°59'40.20"W

FIGURE "B-6"  
Rain Gauge Installed



GBRA - H-6  
Rocking M  
 $30^{\circ}0'53.54''\text{N } 97^{\circ}53'40.29''\text{W}$

FIGURE "B-7"

Rain Gauge Installed



GBRA - H-7

FM 21

29°56'35.57"N      97°47'56.88"W

FIGURE "B-8"  
Rain Gauge Installed



GBRA - H-8

Rogers Ranch Road

29°58'28.85"N    97°47'56.88"W

FIGURE "B-9"  
Rain Gauge Installed



GBRA - H-9  
Longhorn Trail  
30°5'34.79"N 98°12'35.80"W

FIGURE "B-10"  
Rain Gauge Installed



GBRA - H-10  
Mt. Olive  
30°5'10.92"N 98°8'20.83"W

FIGURE "B-11"  
Rain Gauge Installed



GBRA - H-11

Rim Rock

29°56'44.33"N 98°6'46.91"W

FIGURE “C-a”  
Public Information – Rain Gauge Reports  
[www.gbra.org/rain](http://www.gbra.org/rain)



**Rain Gauge Report**  
**Monday, October 8, 2018**

**3:42 PM CST (RTU Times Do Not Reflect Daylight Saving Time)**

Note: Data is gathered by remote automated sensors and is posted without a quality check. GBRA assumes no responsibility for inaccuracy due to equipment failure. [Interactive map](#) [Comal and Guadalupe County rain gauge map \(PDF\)](#)

County	Station Name	RTU Time	Rainfall Total (inches)			
			1-Hr	3-Hr	6-Hr	24-Hr
<b>Caldwell</b>						
	Sunset Trail	2:36 PM	0.00	0.00	0.01	0.01
	Chuck Wagon Rd	2:36 PM	0.00	0.03	0.03	0.03
	Taylorville Rd	2:36 PM	0.00	0.00	0.00	0.00
	Liberty Lane	2:36 PM	0.00	0.06	0.06	0.07
	Grandpa Rd	2:36 PM	0.00	0.09	0.09	0.09
	Rolling Ridge	2:36 PM	0.00	0.18	0.18	0.18
	Tower Rd	2:36 PM	0.00	0.00	0.06	0.06
	Acorn Rd	2:36 PM	0.00	0.00	0.00	0.01
	Rogers Ranch Rd	2:36 PM	0.00	0.17	0.17	0.17
<b>Comal</b>						
	GBRA Tower	2:29 PM	0.00	0.10	0.10	0.20
	Bear Creek	2:14 PM	0.00	0.00	0.00	0.06
	Startzville	2:48 PM	0.00	0.00	0.00	0.11
	Hoffman Road	2:44 PM	0.01	0.31	0.31	0.35
	Third Crossing	3:02 PM	0.00	0.01	0.01	0.23
	Waggoner Ranch	2:17 PM	0.00	0.00	0.00	0.00
	Stenen Road	2:39 PM	0.00	0.00	0.00	0.27
	Shadow Hills	3:17 PM	0.00	0.01	0.01	0.01
	NBU Tower on Geronimo Creek	2:30 PM	0.03	0.19	0.19	0.19
	FM 3009 on Dry Comal Creek	2:30 PM	0.00	0.00	0.00	0.01
	Kruger Canyon Rd on Dry Comal	2:30 PM	0.00	0.00	0.00	0.01
	Bresky Road on Isaac Creek	2:30 PM	0.03	0.03	0.04	0.22
<b>Guadalupe</b>						
	Seguin WTP	2:30 PM	0.00	0.11	0.11	0.11
	Hwy 123 @ Geronimo Creek	2:30 PM	0.00	0.30	0.30	0.30
	Branch Road on Geronimo Creek	2:30 PM	0.04	0.07	0.10	0.10
	FM 1044 on Young Creek	2:30 PM	0.00	0.06	0.06	0.36
	FM 1044 on Long Creek	2:30 PM	0.01	0.16	0.16	0.19
	FM 775 on Deadmans Creek	2:30 PM	0.02	0.16	0.16	0.19
	Still Meadow Rd on Cottonwood Cr	2:31 PM	0.00	0.01	0.01	0.05
	Nash Creek Road on Darst Creek	2:31 PM	0.00	0.01	0.02	0.03
<b>Hays</b>						
	Harris Hill Rd	2:36 PM	0.00	0.00	0.05	0.05
	Bunton Lane	2:36 PM	0.01	0.01	0.03	0.03
	Engelke Rd	2:36 PM	0.00	0.25	0.25	0.25
	Hays Youth Complex	2:36 PM	0.00	0.01	0.19	0.19
	Sierra West Rd	2:36 PM	0.01	0.09	0.23	0.35
	Rocking M Rd	2:36 PM	0.00	0.07	0.86	0.89
	FM 21 off FM 2720	2:36 PM	0.00	0.00	0.01	0.04
	Long Horn Trail	2:37 PM	0.00	0.06	0.06	0.34
	Mt. Olive School Rd	2:37 PM	0.00	0.29	0.29	0.29
	Rim Rock Rd	2:37 PM	0.00	0.48	0.48	0.50

