Contract 1600012047
FINAL REPORT

Flood Early Warning System Pilot Project in McKinney, Texas

North Central Texas Council of Governments

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List of Acronyms

DFW – Dallas-Fort Worth
E&D – Environment & Development Department, North Central Texas Council of Governments
HSE – High Sierra Equipment
NCT – North Central Texas
NCT9-1-1 – North Central Texas Emergency Communications District
NCTCOG – North Central Texas Council of Governments
PSAP – Public-Safety Answering Point
TWDB – Texas Water Development Board

Flood Early Warning System Pilot Project in McKinney, Texas

Introduction

The North Central Texas Council of Governments (NCTCOG) is a voluntary association of, by, and for local governments, established to assist in regional planning. NCTCOG's purpose is to strengthen both the individual and collective power of local governments and to help them recognize regional opportunities, eliminate unnecessary duplication, and make joint decisions. NCTCOG covers a 16-county area (Figure 1) with a population of over 7 million people. This population is projected to grow to 12 million by the year 2050 (Vision North Texas 2010).

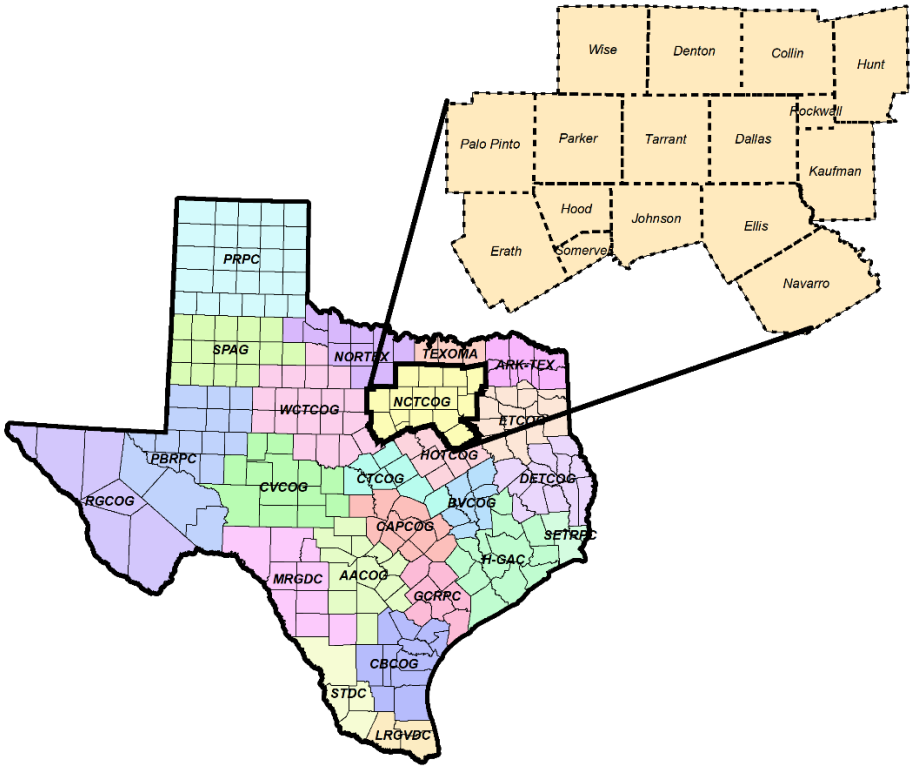

Figure 1. NCTCOG Region

The NCTCOG Environment and Development Department (E&D) has six strategic initiatives for Sustainable Environmental Excellence, one of which is Watershed Management. Floodplain and stormwater management is a significant aspect of this strategic initiative. As the North Central Texas (NCT) region continues to grow, the built environment exacerbates flooding. It is a goal of E&D to provide opportunities for training, partnerships, collaborative forums, and grant funding so that member entities can access resources needed to protect their residents from flooding and have the best available data to make sound development decisions.

Project Background

Flood Early Warning Systems are present throughout the NCT region, but as of 2019 are located primarily in the cities of Dallas, Fort Worth, Grand Prairie, and Arlington. NCTCOG pursued the Texas Water Development Board (TWDB) 2016 Flood Protection Planning Grant as a pilot project to bring these systems to smaller cities that desired them for their road crossings which experience flooding during rain events, in the hopes that these systems would become more common in the growing areas of the NCTCOG region outside of the Dallas-Fort Worth (DFW) Metroplex.

The City of McKinney, located in the East Fork Trinity HUC-8 watershed in Collin County in the northern portion of the NCTCOG region, partnered with NCTCOG as a subrecipient of the grant (Figure 2). They were a prime candidate as a project partner due to their current and projected population growth, their location outside the central core of the DFW Metroplex, and the unique site. The population of McKinney at the 2010 Census was 131,117. By 2018, as the project was underway, the City of McKinney was estimated to have a population of 179,970, reflecting the fourth highest absolute population growth in the region. The NCTCOG 2045 Demographic Forecast (NCTCOG 2017) projected that the city will have a population of 238,474. Collin County had 26% of the share of regional population growth from 2017-2018, the most of any county in the NCTCOG region (NCTCOG 2018). At the time of grant application, McKinney did not have a flood early warning system. The city did have some low water crossings and flood-prone roads that had been troublesome from a management and public notification aspect. This grant opportunity enabled the city to address some of the challenges.

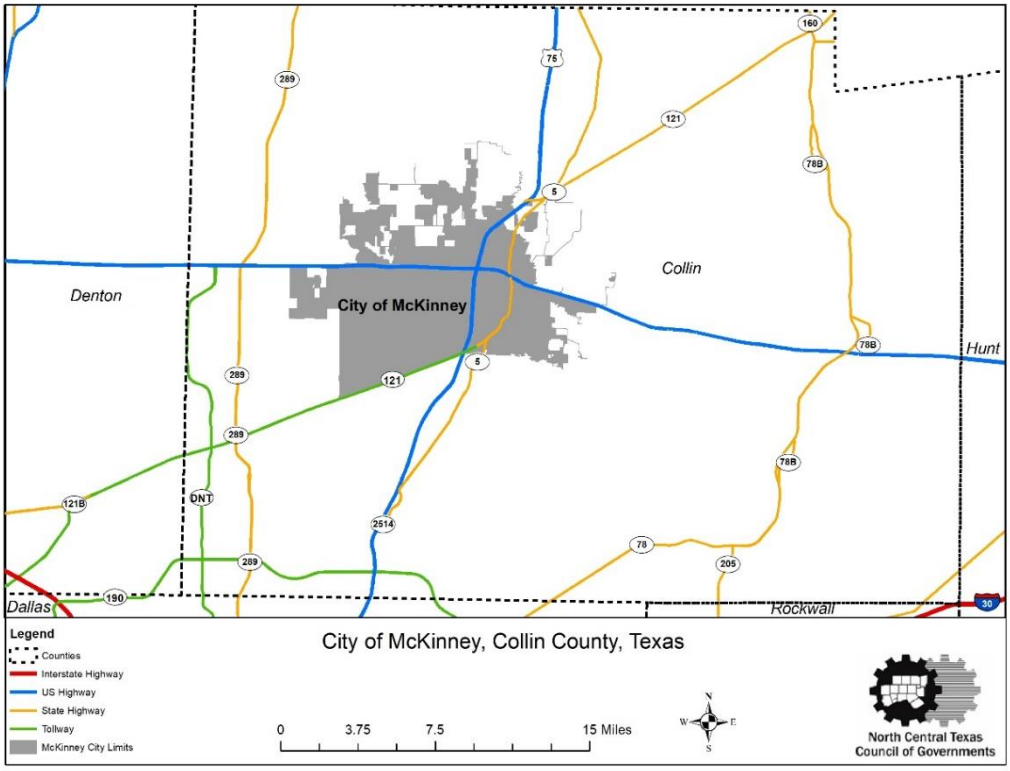

Figure 2. City of McKinney

Scope of Work

McKinney has several known flooding hotspots in different quadrants of the city. The location selected by the city for this project is located at Valley Creek Trail and U.S. Highway 75. Towne Lake and McKinney High School are located on the east side of the highway and the Ruschhaupt Soccer Complex and El Dorado Country Club along with adjoining subdivisions are located on the west side of the highway. Wilson Creek runs east to west underneath the highway. This intersection includes the approach of three different roads: Valley Creek Trail, Park Road, and Park View Avenue. The complex nature of this intersection, history of swift water rescues during rain events, and its proximity to a large, well established neighborhood to the west and a city park to the east were factors in the selection of this location for installation of a flood early warning system.

Hardware

The hardware component of this project was manufactured by High Sierra Equipment, Inc. (HSE). The project site is not a typical four-way intersection. With multiple roads converging into one area from different angles, and limited locations for vehicles to turn around, this site was surveyed by HSE and determined to require a high-water detection system comprised of one master gauging station and five remote advance warning sites. The sites have warning signs indicating the intersection is closed when lights are flashing. Table 1 shows the latitude/longitude coordinates for each flasher and Figure 3 shows the location of each flasher at the intersection. The system is comprised of a Model HSE 3345 ALERT 2-way transceiver and utilizes the ALERT protocol for communication between the master and remote stations via radio frequency. Model HSE 6640 pressure transducers measure water levels above the road and trigger the command-response communication between stations at the pre-determined threshold. The Model HSE 3580 controller assembly, which contains the Model HSE 3512 HydroMet Data Logger, records rainfall data during storm events.

Table 1: Latitude and longitude of the Master Gauging Station and Remote Stations

Site	Latitude	Longitude
Master Gauging Station	33.18535937325071	-96.64038839494773
Remote Station 1 (Park View West)	33.18684918303733	-96.64212441354476
Remote Station 2 (Park View East)	33.18642525677429	-96.64048746681696
Remote Station 3 (Valley Creek West)	33.18599928805571	-96.64906337594546
Remote Station 4 (Valley Creek East)	33.18355390200274	-96.64465250248377
Remote Station 5 (Park Road East)	33.18355822836064	-96.64265885842107

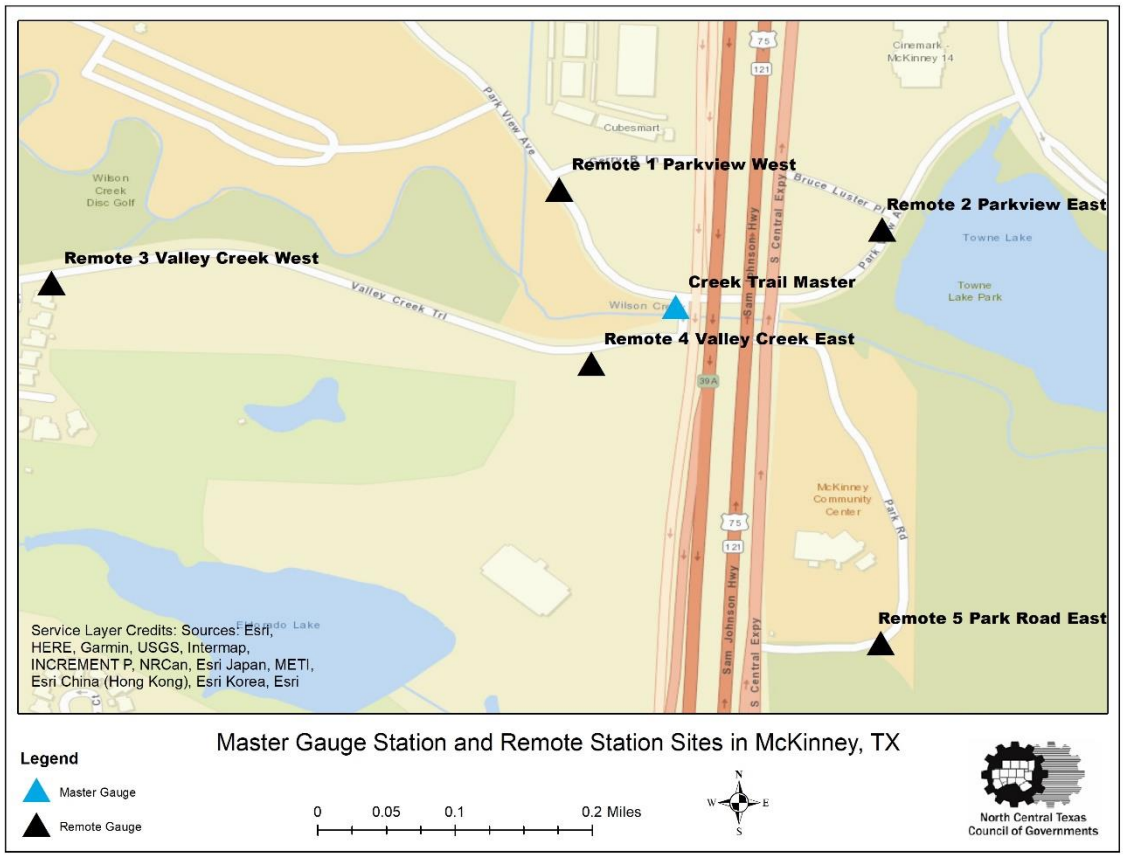

Figure 3. Master Gauge Station and Remote Station Sites in McKinney, Texas

Software

The software component of this project was produced by OneRain, Inc. The software, Contrail, provides multiple configurations that the individual community can customize, including hardware status, alarms, rainfall summaries, and 2-way control of flashers. City of McKinney emergency management staff received training from OneRain, Inc., to use the Contrail software. The software will also communicate with City of McKinney's 911 public-safety answering point (PSAP) via cell signal to alert emergency responders of hazardous road conditions. This enables responders to determine the next fastest route for response before any delay occurs due to encountering an intersection closed due to high water. The North Central Texas Emergency Communications District (NCT9-1-1), a department of NCTCOG, tested this ability through the existing flood early warning system in the City of Grand Prairie and implemented it in the City of McKinney with training to those working at the PSAP.

Project Implementation

The contract between the TWDB and NCTCOG was fully executed on January 23, 2017. The implementation of the project consisted of coordination meetings between City of McKinney and NCTCOG, hardware and software selection, three public meetings, training for City of McKinney staff, and equipment installation and commissioning.

The project kickoff meeting was held on July 7, 2017. E&D and NCT9-1-1 staff met with City of McKinney emergency preparedness and public works staff to discuss the project and the city's needs. NCTCOG staff agreed to research software and hardware options and present them to City of McKinney emergency preparedness staff for consideration.

NCTCOG staff researched multiple hardware and software options, looking at cost effectiveness, procurement method, and how each solution would meet the needs of the project. Purchasing cooperatives were utilized for both hardware and software to save money in the project budget and time needed for City of McKinney staff to initiate a procurement process. The McKinney City Council approved the purchase of hardware and software from those contracts on February 6, 2019. NBC 5 DFW ran a news segment about the project that night following council approval (Russell 2019).

The first public meeting was held just prior to purchase of hardware and software on January 14, 2019, from 6:00 p.m.to 7:00 p.m. at the McKinney Fire Station #9, 4900 Summit View Drive, McKinney, TX, 75071. NCTCOG sent notices of the meeting (and subsequent meetings) to the following agencies: The Federal Emergency Management Agency Region 6, United States Army Corps of Engineers Fort Worth District, North Texas Municipal Water District, Texas Commission on Environmental Quality, and the Texas Department of Transportation. The City of McKinney publicized the meeting, and as a result Community Impact News and North Texas E-News published articles about the meeting (Davis 2019, City of McKinney 2019). Karen Adkins, Emergency Manager for the City of McKinney, gave a presentation on the recent history of swift water rescues in the city, the intersection selected for the project and the area around it, the hardware and software that would be used at the intersection, description of state funding and local match, and the roles and responsibilities of the city, NCTCOG, and the TWDB through the course of the project. One member of the public attended, voicing support for the project. After the public meeting, Emergency Management Magazine published a short article about the project in their February 2019 edition (McKay 2019).

The second public meeting was held prior to delivery and installation of the hardware on April 11, 2019, from 6:00 p.m. to 7:00 p.m. at the Wysong Central Fire Station, 301 N. McDonald Street, McKinney, TX, 75069. No members of the public attended.

The third public meeting was held after installation and commissioning of the hardware on June 11, 2019, at Fire Station #5, 6600 Virginia Parkway, McKinney, TX, 75071. No members of the public attended.

The master gauging station and five remote warning sites were installed from May 6-17, 2019. Pictures taken during installation are included in this report.

Figure 4. Installation of Remote 1, Park View West

Figure 5. Installation of Remote 2, Park View East

Figure 6. Installation of Master Gauging Station, U.S. 75 and Wilson Creek Bridge

Figure 7. Installation of the Pressure Transducer, Wilson Creek

Data

Rainfall data is available to the City of McKinney Emergency Management and Public Works departments for placement of barriers at the low water crossings and the 9-1-1 Communications Center, Police, and Fire departments to assist in response.

The rainfall-telemetry gauges report every five minutes to the Contrail cloud server in Colorado. Data is available at http://flooddatantx.com and https://mckinneytexas.onerain.com. Web reports display rainfall totals in increments of 1-hour, 3-hour, 6-hour, 12-hour, and 24-hour. Current stage levels are viewable on an interactive web map.

Data will be reported yearly for a minimum of five years to the TWDB, and the Contrail software will be configured to display data on the TWDB TexMesonet website at https://www.texmesonet.com. Data is also available to the Dallas-Fort Worth National Weather Service Forecast Office for routine monitoring and severe weather situations per the March 2019 cooperative agreement for City of McKinney's use of Federal Hydrologic Frequencies.

If data issues arise or website feeds are inoperable, the City of McKinney will engage OneRain to resolve the issues and ensure continuous access to the data.

Schedule of Equipment Maintenance and Monitoring

The City of McKinney Public Works Department will visit the master and remote station sites at least once per quarter to check for visual signs of damage from high wind, vandals, or motor vehicle accidents. The rain gauges will be inspected to ensure the tipping bucket mechanism is not jammed. Battery status will be available through Contrail. The battery is expected to last for four to six years.

If maintenance needs are identified, the City of McKinney will coordinate with HSE to determine the appropriate course of action.

Challenges and Lessons Learned

As a pilot project, one of the goals was to bring flood early warning systems to communities that lack funding resources to purchase the equipment and software. This grant required a 50% match, which was challenging for communities to meet. The City of McKinney was capable of providing the 50% match through cash and in-kind materials and staff time. NCTCOG also approached the City of Cleburne, Hood County, and Johnson County prior to grant application for participation in the project. These three entities provided letters at the time of application stating that they intended to commit local matching funds, but ultimately the funds were not approved in their Fiscal Year 2017 budgets, as the 50% match requirement was a budgetary barrier.

Another component of the pilot project was that NCTCOG wanted to integrate novel additions to add value beyond just flood warning systems on roadways. There were a variety of ideas proposed, and we were realistically able to implement the 9-1-1 PSAP integration. This integration of real time flood data into the 9-1-1 PSAP is a new function provided as a result of this project. This element could be replicated by other PSAPs. Basic training was developed for the PSAP dispatchers. NCTCOG can share this information with other entities.

Procurement also presented challenges. When presented with the option of going through a bid process for hardware and software or utilizing cooperative contracts, the City of McKinney opted for the latter. Hardware was only available on one contract through U.S. Communities purchasing cooperative, and at the time of the decision to initiate procurement, the contract had expired and was undergoing negotiation, causing a delay since it was not available until fall 2018. Software was available through the North Texas SHARE purchasing cooperative, but it was under development during the project and was not available until July 2018. A coordination meeting was held between E&D and City of McKinney emergency preparedness staff on November 28, 2018, to discuss the options and pricing. Further negotiations with HSE, the hardware vendor on the cooperative contract, were required prior to city approval. These negotiations also caused a delay in the project.

Many lessons were learned throughout this project. NCTCOG would be happy to share experiences with others who may want to replicate something similar.

Acknowledgements

NCTCOG would like to thank the TWDB for the opportunity to pursue a flood early warning system project through this grant. NCTCOG would also like to thank the City of McKinney for their willingness to pursue this pilot project and their energy during project implementation.

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ATTACHMENT 1
NCTCOG addressed these comments in the above report.

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North Central Texas Council of Governments
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Texas Water Development Board Comments to Draft Report

REQUIRED CHANGES

General Draft Report Comments:

In general, the study follows standard methodologies and practice. Mitigation alternatives identified may be eligible for funding under the Texas Water Development Board's financial assistance programs. Application requirements and eligibility criteria are identified by Texas Water Development Board rules specified in Section 363 of the Texas Administrative Code (TAC). The report would be appropriate for use in support of an application to the Board for financing the proposed improvements. All additional information required by Board rules, 31 TAC 363.401-404, as well as necessary information to make legal findings as required by Texas Water Code chapter 17.771-776, would be required at the time of loan application.

Please conduct a final edit of the document for grammar, spelling, typographical errors, and inconsistent usage of acronyms, and abbreviations. Please spell out all acronyms, with the acronym in parentheses, the first time they are used. Please include a list of acronyms used in the report after the Table of Contents.

Specific Draft Report Comments:

1. **Project Background, page 6** – Please note that there were, initially, a few more participants on the project, but that they dropped off. Please also state the reason that these applicants dropped off.
2. **Figures 4-7** – Please provide the name of each station in these figures. For example, "Parkview East, Parkview West", etc.