

Repetitive Loss Area # 18

East Branch of Joe Creek
E. 35th St. & S. Darlington Ave. Area



August 17, 2017



ENGINEERING SERVICES

August 17, 2017

Dear Resident/Property Owner:

Once considered the most flood-prone city in America, Tulsa has worked hard to reduce or eliminate flooding of its homes and neighborhoods. The City joined the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) in 1974 and through decades of effort is now recognized as a national leader in flood hazard mitigation. As a result, property owners in Tulsa receive as much as 40% discount on their flood insurance.

A key component of the NFIP has been its focus on Repetitive Loss Properties, which make up only 1 percent of insured properties, but account for over 30 percent of flood insurance claims payments. A Repetitive Loss Property is defined by FEMA as any property that has been paid two or more flood insurance claims of \$1,000 or more in a 10-year time period.

The NFIP recently expanded its flood hazard mitigation program to include the identification of "Repetitive Loss Areas" (RLA)—those properties near an existing Repetitive Loss Property that may be subject to the same general flooding conditions. In most instances, 95% of the properties in an RLA will never have experienced flooding—especially if the cause of damage is shallow, overland flow due to local drainage conditions. Once the City has identified an RLA, we are required to contact the owners and residents of the area and, work together to develop a plan to reduce or eliminate flooding in the neighborhood.

Your property has been identified as being in an Repetitive Loss Area. We want to re-emphasize that this does not mean your property has flooded or is even likely to flood—only that it is in the same area, and in a similar geographical situation, as an existing Repetitive Loss Property.

You can protect your property from flooding. We would like to invite you to participate in our flood prevention and mitigation efforts for your neighborhood. We need your input. What can we do, working together, to eliminate potential flood losses in your area? We look forward to hearing from you.

To learn more about your risk of flooding visit www.floodsmart.gov or contact the City of Tulsa Customer Care Center at (918) 596-7777.

Sincerely,
CITY OF TULSA, ENGINEERING SERVICES

Bill Robison, P.E., CFM
Senior Special Projects Engineer
Stormwater Project Coordination

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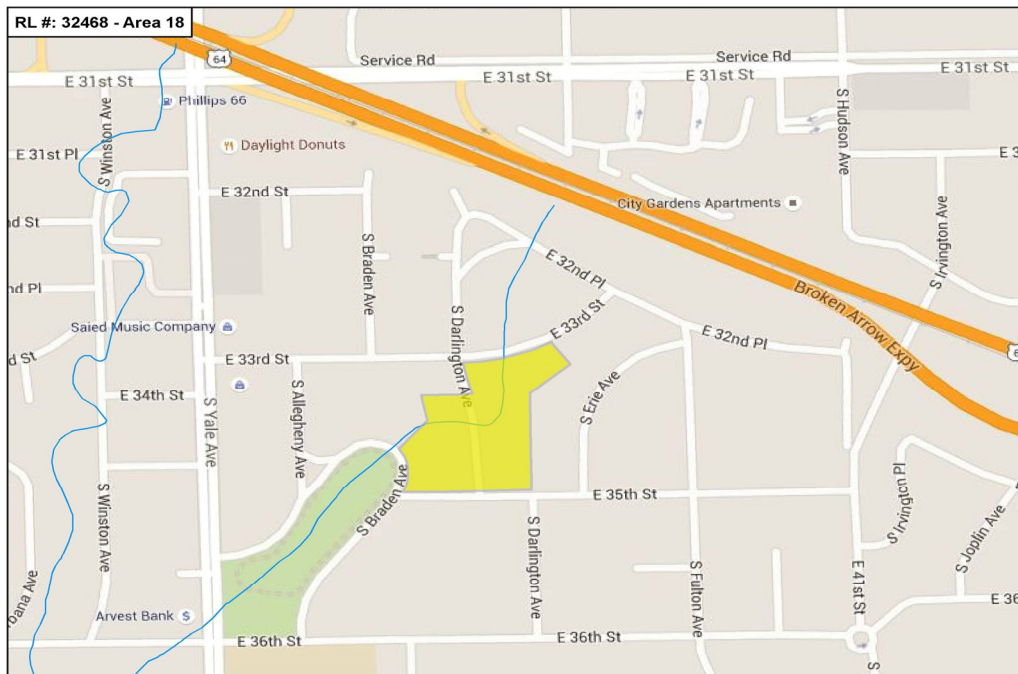
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Repetitive Loss Area # 18

East Branch of Joe Creek E. 35th St. & S. Darlington Ave. Area

Overview

Repetitive Loss Area (RLA) #18 is located on the East Branch of Joe Creek, at about E. 35th St. and S. Darlington Ave., south of the Broken Arrow Expressway and northeast of Highland Park. The RLA is about 6.0 miles above where the creek joins the Arkansas River. There are 14 properties in the RLA, including one Repetitive Loss Property. The structures are single-family residences built between 1940 and 2014, with all but four constructed between 1940 and 1947. The four newer homes were built in 1956, 1960, 1961 and 2014. Ten of the homes have foundations with crawl spaces, while three are slab-on-grade and one conventional. The homes are part of the Highland Park Addition and Yorkshire Estates Resubdivision.



RLA #18 is located in the East Branch of Joe Creek drainage on the west side of Mockingbird Lake, generally along S. Sandusky Ave. between E. 37th St. and E. 38th Pl.

The properties are within the original floodplain of the East Branch tributary ELB.3A, which rises on the south side of the Broken Arrow Expressway, at about 32nd Pl. and Darlington Ave. Development filled the original floodplain and routed runoff through bar ditches and storm sewers. Some of the old course of the creek still exists as a narrow channel cut between property lines from E. 33rd St. south and west to Darlington Ave. Between 1980 and 2010 bar ditch overflow, storm sewer backup and overland flow resulted in four flood damage claims from two properties totaling \$62,489—with three of

the claims being from the local Repetitive Loss Property. The claims averaged about \$15,500 and ranged from a low of \$2,636 to a high of \$36,063. In addition, the City has received 14 stormwater complaints from eight properties in the immediate area, most having to do with deteriorating or inadequate bar ditches and storm sewers. Three properties in the RLA directly northeast of Highland Park are within an area of shallow flooding, according to the City's Regulatory Floodplain.

The general location of RLA #18 is shown on the map above and on the more detailed photo/topography map on page 5. The detailed map identifies properties, County Assessor parcels, floodplains, and the existing storm sewers and inlet systems.

I. Background

During the post-World War building boom of the 1950s and 1960s, Tulsa expanded rapidly east and south into the basins of Mingo and Joe creeks. Because of the city's climate and the broad floodplains along these creeks this growth brought with it an increased risk of flooding. And indeed, by the mid-1980s floods were occurring almost yearly and flooding had become Tulsa's most destructive natural hazard. One researcher at the time declared Tulsa "the most flood-prone community in the nation."

Tulsa was not unique in its rapid post-war development and attendant risks. Cities across America were experiencing similar problems as they spread out into prosperous subdivisions. In response, the U.S. Congress created the National Flood Insurance Program (NFIP) in 1968 to help property owners protect themselves from flood losses. The NFIP offered flood insurance to homeowners, renters, and business owners if their community participated in the NFIP and agreed to adopt and enforce ordinances that met or exceeded FEMA requirements for reducing the risk of flooding.

Tulsa joined the NFIP in 1974, and through great effort and considerable expense has significantly reduced its exposure to flooding. As a result, the City has been awarded a Class II rating in the NFIP's Community Rating System (CRS), which grants its residents a 40 percent discount on the cost of flood insurance for structures in the Special Flood Hazard Area (SFHA), also known as the 1% or 100-year floodplain. Since the Biggert-Waters Flood Insurance Reform Act of 2012, many properties have seen a substantial increase in their premiums, making this discount even more important.

For its part, the NFIP is continually faced with the job of paying claims while trying to keep the price of flood insurance at an affordable level. Properties that flood repeatedly—known as "Repetitive Loss Properties," have been a particular problem for the program: Although they make up only 1 percent of insured properties, they account for one-third of all claims payments (about \$200 million a year, or \$4.5 billion to date). A Repetitive Loss Property is defined by FEMA as any property that has been paid two or more flood insurance claims of \$1,000 or more in a 10-year time period.

Consequently, one of the requirements of the CRS is that communities identify all Repetitive Loss Properties in their jurisdiction and work with the owners to find ways to reduce or eliminate future flood damage. This initiative has been very successful in reducing flood losses and claims.

FEMA has recently extended its repetitive loss program to include "Repetitive Loss Areas" (RLA). To maintain a Class II rating in the CRS, Tulsa is now required to analyze

the area surrounding each of its Repetitive Loss Properties and identify any neighboring properties (including uninsured ones) that may be subject to the same general flooding conditions. This group of nearby properties is then designated as an RLA. The City is required to contact the owners of the properties in all its RLAs, inform them that they are located in an area subject to flooding, and develop a plan for mitigating or eliminating flooding in the area, much as is being done for the individual Repetitive Loss Properties.

It is important to note that most of the homes in an RLA—perhaps as many as 80% or 90%—may not have experienced flooding of any kind. What they have in common is being subject to the same general geographical and flood conditions as the nearby repetitive loss property. It should also be stressed that the flooding events in question may have had little or nothing to do with overflow from a creek, but perhaps may have been the result of storm sewer backup or overland flow from a neighbor’s property into a low-lying, slab-on-grade home or garage.

II. Location

Joe Creek is about 6.5 miles in length and drains an area of 13.7 sq. miles in southeast Tulsa. The creek has several tributary branches (East and West Joe Creek, Little Joe and South Joe) that converge near E. 53rd and S. Evanston Ave., at Manion Park, just north of Eisenhower International School, to form lower Joe Creek mainstem. The mainstem and its tributaries have been channelized through much of their lengths.

Upper Joe Creek has two branches: West Branch and East Branch. The West Branch rises near E. 23rd St. and S. Oswego Ave. and flows south for about 3 miles to join the East Branch at Skelly Dr. and I-44, and then the mainstem at Manion Park. Almost all of the West Branch is underground. The creek surfaces at E. 28th St. and S. Florence Ave. as Lakewood Lake, and again briefly between E. 33rd and E. 36th St. before returning underground until Skelly Dr. where it merges with the East Branch under I-44, just west of Harvard Ave.



This drainage cut between properties follows the original ELB.3A stream bed to the storm sewer on S. Darlington Ave.

The East Branch of Joe Creek has its origins in several tributary streams that flow for about 3 miles south southwest from high ground along the Broken Arrow Expressway—beginning near E. 25th and S. Quebec Ave., at E. 26th and S. Yale Ave., at E. 32nd Pl. and S. Darlington, and at 38th and S. Hudson Ave. These tributaries flow underground in storm sewers for most of their lengths, to occasionally emerge as small neighborhood amenity streams or lakes, such as Mockingbird Lake near E. 36th and S. Yale Ave., and the creek and small lake on the grounds of Methodist Manor between E. 31st and 33rd and S. Sandusky Ave. The East Branch emerges fully from underground near 46th Pl. and S.

Louisville Ave., where it is channelized until its junction with the West Branch under Skelly Dr. and I-44.

RLA #18 is situated in the Highland Park Addition in the former floodplain of Tributary ELB.3A immediately northeast of Highland Park and southwest of the Broken Arrow Expressway. There are 14 structures in the RLA, about half of which are within the gentle swale that follows the course of the original stream.

III. History

Development

The properties of RLA #18 are in the Highland Park addition and Yorkshire Estates Resubdivision and were mostly developed between 1940 and 1947. Homes were added in 1956, 1960, 1961 and 2014. The original drainage along East Branch Tributary ELB.3A flowed south from what is now the Broken Arrow Expressway, near E. 32nd Pl. and S. Darlington Ave., crossed 33rd St. and turned southwest across Darlington Ave. between 33rd and 35th St., and then across Braden Ave. into Highland Park. The ELB.3A drainage was filled when Highland Park Addition was developed, and surface runoff was subsequently carried in bar ditches along the streets and overland down the gentle swales that followed the original floodplain to storm sewers along Darlington Ave.

Flooding

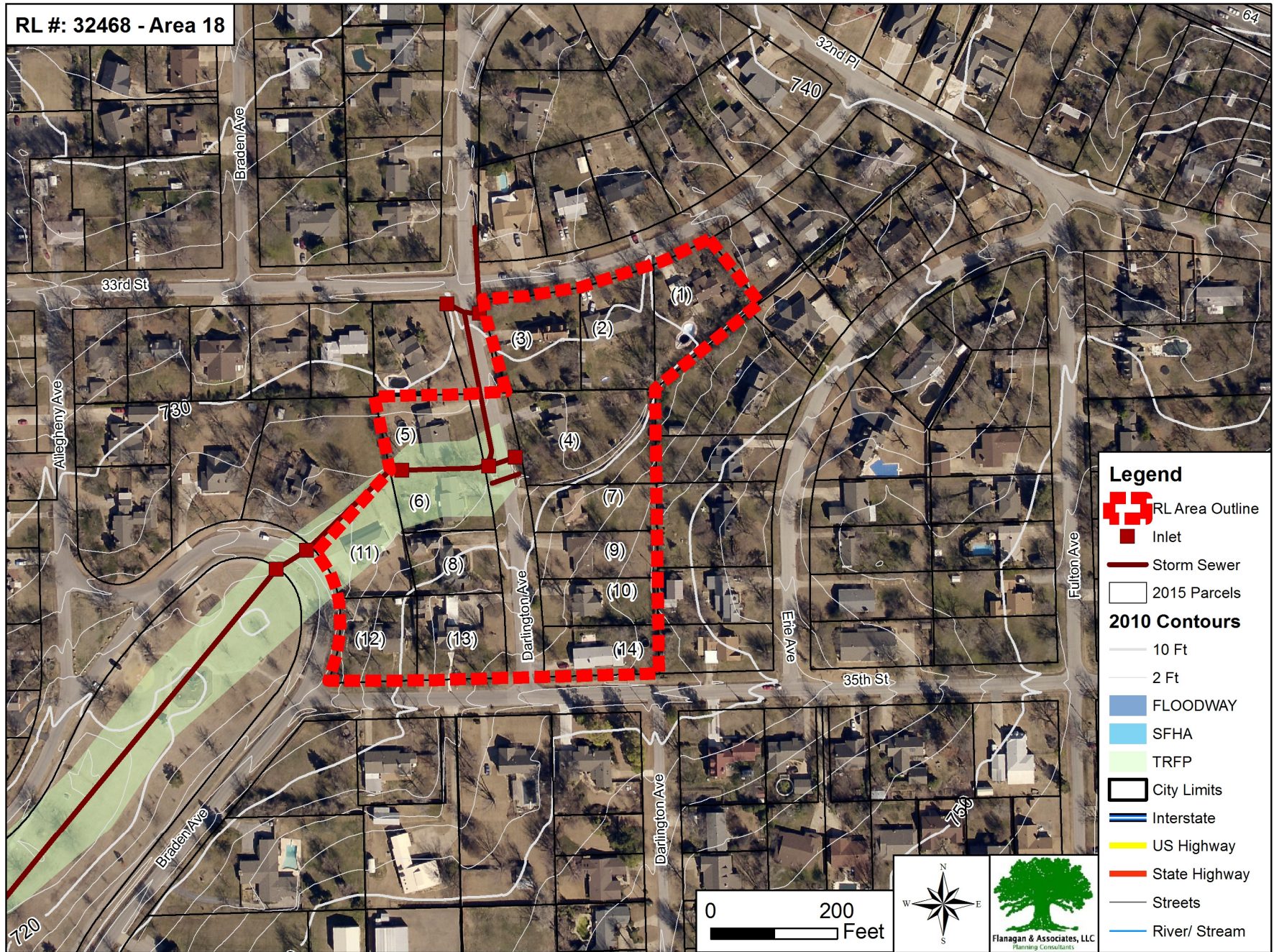
There was significant flooding on Joe Creek in October 1959, May 10-11, 1970 (Mothers Day flood), June 7-9, 1974, May 31, 1976 (Memorial Day flood), June 21, 1979, June 17, 1980, May 27, 1984 (another Memorial Day flood), August 11, 1992, May 7, 1993, July 1994, May 6, 2000, May 8, 2007, and May 20, 2010. The storms that resulted in the four damage claims in RLA #18 totaling \$62,489 were in 1980, 1984 and 2010.

The greatest contributions to flooding in RLA #18 are the generally level terrain, shallow bar ditches, undersized storm sewers and overland flow. During exceptionally heavy downpours, such as the 300-year rainfall event in May 1984 when 9-12 inches of rain fell in three hours, the drainage ditches are filled, storm sewers overwhelmed and the consequent overland flow follows the swales of the original floodplain and inundates any low-lying streets and properties, some of which are slab-on-grade homes with their first-finished floors or garages set lower than the level of the surrounding streets and ditches.

Improvements

Improvements to the Joe Creek channel by the City and the US Army Corps of Engineers in the 1970s and 1980s channelized a good deal of Joe Creek and its tributaries and installed parallel storm sewers along much of Joe Creek's East and West Branches. In the 1990s the City enlarged the storm sewer system in the Joe Creek drainage to solve chronic backup problems at numerous locations, including the box culverts under the Skelly Bypass and through much of the East Branch. The expansion of I-44 in 2010-2012 further increased drainage beneath the I-44. These improvements have virtually eliminated flooding along the main stem of Joe Creek, but local problem areas remain.

RL #: 32468 - Area 18



Legend

- RL Area Outline
- Inlet
- Storm Sewer
- 2015 Parcels
- 2010 Contours**
 - 10 Ft
 - 2 Ft
 - FLOODWAY
 - SFHA
 - TRFP
- City Limits
- Interstate
- US Highway
- State Highway
- Streets
- River/ Stream

IV. Research and Analysis

The analysis of Repetitive Loss Area #18 was conducted by the Project Team through interviews with City officials, research into Engineering Services and Stormwater Drainage files, including the Joe Creek Master Drainage Plan, review of the City's extensive flood history documentation, assessment of insurance claims, field trips to the RLA, interviews with home owners, and questionnaires mailed to owners and residents soliciting information about prior and existing flooding issues, if any.

Agencies and Organizations

The City of Tulsa's Storm Drainage & Hazard Mitigation Advisory Board (SDHMAB), which also serves as the City's Hazard Mitigation and CRS Committee, and the CRS Public Participation Involvement & Information Committee (PPI) met monthly during the two-year Repetitive Loss Area Planning process. Each committee was updated on the status of the planning process, discussed issues, and provided guidance. Research and analysis were done in accordance with guidelines from the Federal Emergency Management Agency (FEMA), the National Flood Insurance Program (NFIP) and the Community Rating System (CRS).

Local, State & Federal Agencies and non-profit organizations are represented on the PPI Committee. The RLA plans were discussed at the PPI Committee meetings, and other agencies such as TAEMA were contacted by phone or email. The RLA plans were presented to City Council for adoption; the agenda was made public and furnished to the media. The council meeting is a public meeting and the local media was present at the meeting. In addition the council meetings are aired on our local government network TV channel TGOV.

Participating agencies and organizations involved were: City of Tulsa (CoT) Storm Drainage & Hazard Mitigation Advisory Board, CRS PPI Committee, CoT Communications Department, CoT Development Services, Working in Neighborhoods, CoT Engineering Services, CoT Finance Department, CoT Legal Department, CoT Streets & Stormwater, CoT Water & Sewer Department, Child Care Resource Center, Indian Nations Council of Governments, Tulsa Area Emergency Management Agency (TAEMA), Disaster Resilience Network, Metropolitan Environmental Trust, Oklahoma Insurance Department, Tulsa Association of Realtors, U.S. Army Corps of Engineers.

Studies and Documents

The following City of Tulsa and FEMA documents were used in the analysis:

- *Flood Insurance Rate Map*, City of Tulsa, October 16, 2012
- *Regulatory Floodplain Map Atlas*, Tulsa Engineering Services, October, 2016
- *2014 City of Tulsa Hazard Mitigation Plan Update*, Flanagan & Assoc., 2014
- *City of Tulsa Stormwater Management Plan*
- *Stormwater Design Criteria Manual: Critical Neighborhood Flood Control Projects*
- *Stormwater Capital Improvements List*, City of Tulsa, Engineering Services
- *Joe Creek Flood Survey and Study*, Owen, Mansur & Steele, 1955
- *Joe Creek East and West Branches Master Drainage Plan, Interim Report*, W.R. Holway & Associates., March 1988

- *Joe Creek East and West Branches Master Drainage Plan, Final Report*, W.R. Holway and Associates, 1989.
- *Guidebook to Conducting Repetitive Loss Area Analyses*, UNO and FEMA

Capital Improvements Plans

No City of Tulsa Capital Improvements are currently planned that could have a positive impact on the flooding problems in Repetitive Loss Area # 18.

Flood Insurance Data

None of the properties in the RLA currently carry flood insurance.

Claims Data.

Between 1980 and 2010 bar ditch overflow, sewer backup and overland flow generated four damage claims from two properties, all of which were paid, for a total of \$62,489. There were two claims in 1980, one in 1984 and another in 2010. On all three occasions, heavy rain (6-10 inches in 1980, 9-13 inches in 1984, and 3 inches in 2010) resulted in widespread street flooding in South Tulsa and in the Joe Creek basin. Because the Privacy Act of 1974 (5 USC 522a) restricts the release of flood insurance policy and claims data to the public, neither the Repetitive Loss Property nor specific claim data are detailed in this Plan.

Field Surveys and Site Visits

Site visits were conducted during the study, primarily to confirm foundation type and view local on-site overland flow drainage patterns.

Review Drainage Patterns.

The Project Team examined aerial topography maps, master drainage plans, storm sewer plans, City Customer Care Center complaints and comments, and conducted field checks to determine area drainage patterns and identify flood problem areas. The results of the research and analysis are described in the following paragraphs and summarized in the table below.

Structures

The Project Team has made numerous visits to RLA #18 to determine the situation and condition of the structures. On-site, visual analysis was verified by queries of Tulsa County Assessor data.

Structure Type.

The structures in RLA #18 are all single-family, ranch and modified ranch-style homes of one, 1.5 and two-stories.

Foundation Type.

The types of foundations were determined by field investigation and query of Tulsa County Assessor records. Ten structures have foundations with crawl spaces, and four are slab-on-grade.

Condition of Structures.

The condition of the structures in the RLA was determined by field investigation and a search of the County Assessor’s records: all properties are in Average to Excellent condition. These findings are summarized in the following table.

Properties in the RLA

Address	Year Built	Structure Type	Foundation Type	Condition
Property 1	2014	Ranch 2 story	Slab	Excellent
Property 2	1956	Ranch 1 Story	Slab	Average
Property 3	1942	1.5 Story	Crawl Space	Average
Property 4	1941	Ranch 1.5 Story	Crawl Space	Average
Property 5	1947	1 Story Fin	Crawl Space	Average
Property 6	1940	Ranch 1 Story	Crawl Space	Very Good
Property 7	2002	Ranch 1 Story	Crawl Space	Excellent
Property 8	1947	Ranch 2 Story	Crawl Space	Average
Property 9	1941	1 Story	Slab	Good
Property 10	1960	Ranch 1 Story	Crawl Space	Very Good
Property 11	1941	Ranch 1 Story	Crawl Space	Average
Property 12	1940	1.75 Story Fin	Crawl Space	Average
Property 13	1946	1.5 Story Fin	Crawl Space	Average
Property 14	1961	Ranch 1 Story	Slab	Good

Notification

Annual Floodplain Notification. Each year, in March, the City notifies all homeowners and residents living in a 100-year floodplain that their properties are subject to flooding and informs them of what steps they can take to protect their residences, businesses and families, including the purchase of flood insurance.

Annual Repetitive Loss Area Notification. Residents and property owners in Repetitive Loss Area #18 are notified annually that their properties are located in a Repetitive Loss Area, and are potentially subject to flood damage from overland flow.

Property Owners/Residents Notification. Property owners and residents/occupants were advised of the Repetitive Loss Area study and analysis by letter, were sent a questionnaire soliciting information and input, and asked to contact the City for more information or a copy of the completed RLA Plan.

Public Participation and Involvement. City Staff/Consultants interviewed selected property owners and tenants, and a public meeting was held with Repetitive Loss Area residents to brief them on the Study/Plan, receive their input, and discuss possible mitigation measures. A notice will be mailed notifying all of the property owners in the RLA that this draft plan is available online at www.cityoftulsa.org/RLA and will solicit their comments on the draft plan. A public meeting will also be held to explain the process of the study and the findings.

Property Owner Response to Notifications. There have been eight complaints concerning stormwater drainage issues from three property owners in the RLA. These

were received in 2003, 2004, 2005, 2007, 2009 and 2011. Most had to do with the bar ditches being too small to carry storm runoff, a culvert under Darlington Ave. crumbling, and inadequate drainage in the area generally. There have been six other calls from nearby neighbors outside the RLA about street flooding and the need for better drainage. As of June 17, 2016, there have been two responses from property owners or residents of the RLA to notifications about the Repetitive Loss Area designation. One respondent said their house had not flooded since purchase in 2003, and another reported that their yard floods every year due to inadequate capacity in the bar ditch along the street, with the overflow occasionally flooding the garage.

Conclusions

RLA #18 is in the Upper Joe Creek drainage, on East Branch Tributary ELB.3A, northeast of Highland Park and south of the Broken Arrow Expressway. The drainage was filled when Highland Park Addition was developed, with runoff carried along streets and bar ditches to storm sewers on Darlington Ave. There is little curbing in the RLA to direct runoff, and several streets and a number of properties are not protected even by bar ditches. Runoff flows off the higher ground to the northwest and southeast into the gentle swale that follows the course of the original stream bed. Residents in the RLA and the surrounding neighborhood have complained to the City about poor drainage, shallow bar ditches and inadequate storm sewer capacity. The Repetitive Loss Property in the RLA, for example, is a slab-on-grade structure situated at below the level of the street and bar ditch. When heavy rains and runoff overflow the bar ditch, the home is flooded. The other properties in the RLA that have frequently complained of flooded yards are situated in the swale that follows the course of the original ELB.3A. Runoff from nearby properties tends to flow overland into this depression, making its way slowly southwest towards Braden Ave. and Highland Park. In places, residents have constructed channels to direct this overland flow safely across their properties to the storm sewers on Darlington Ave. Indeed, the original course of ELB.3A is still visible as a narrow, shallow channel between property lines from the south side of E. 33rd St. to the east side of Darlington Ave., midway between 33rd St. and 35th St.

Three properties in the RLA that are between Darlington Ave. and Braden Ave., immediately northeast of Highland Park, are within the old floodplain and in an area of shallow flooding, according to the City's Regulatory Floodplain Atlas. At present, these properties have their first-finished-floor elevations between 0.5 and 2.5 feet above the level of the 100-year flood.

V. Mitigation Measures

Overview

The Master Drainage Plan for Joe Creek identifies the most cost-effective structural solutions (channel improvements, enlarged inlets and storm sewers, stormwater detention ponds) for the area. The Non-Structural Plan identifies buildings where a structural solution is not cost-effective, and acquisition is the recommended solution. The *Joe Creek Final Plan* recommended additional storm sewers in this reach of ELB.3A and a detention area at Highland Park capable of storing 22 acre-feet. These improvements have not yet been made.

Individual Flood Protection Measures: What You Can Do

Individual property protection actions are usually undertaken by property owners on a lot-by-lot, building-by-building basis, and include private floodproofing, moving mechanical equipment above flood levels, installing French drains and minor site grading to move local drainage to the street, sanitary sewer backup protection, and flood insurance.

The City of Tulsa is willing to have a stormwater engineer do a site visit to assist you in analyzing your specific drainage problems and discuss potential solutions. Contact the Customer Care Center at (918) 596-7777, or go online to www.cityoftulsa.org/connect/contact-the-city.

Know and Understand Your Flood Risk. As stated above, being located in a Repetitive Loss Area does *not* mean a property will flood. Nevertheless, it is important that residents and property owners in flood hazard areas know and understand their flood risk and take what steps they can to protect their homes, families and possessions. City staff is available to explain the local flood risk, interpret floodplain maps, and determine if an area or property has drainage problems or a history of prior flooding. Staff can also discuss the ways a specific property can be protected from flooding. An Elevation Certificate can help define a property's flood risk under various rainfall scenarios (e.g., in a 10-year, 50-year, 100-year, or 300-year storm). You can receive a free flood zone determination by contacting the City with the correct legal description and street address, or the Tax Assessor/Parcel Number of the property.

Make a Disaster Preparedness Plan. It is always a good idea for residents and property owners in flood hazard zones to prepare a disaster preparedness and response plan that addresses all the steps and details that will demand attention once a flood watch or warning is issued. A Building Permit is required to install a safe room in a flood-prone area.

Create Berms, Swales or Redirected Drainage. Flood waters can be diverted away from structures using such things as berms, brick planter boxes and swales, but these may not be done in ways that cause damage to other properties. Owners and residents can request a meeting with a City Engineer to discuss the best ways to solve existing drainage problems, and whether a Building Permit will be required. Contact the Customer Care Center at (918) 596-7777. Berms or redirected drainage is often the most feasible solution for areas with flooding due to overland flow, such as RLA #18.



This platform and wall protect the home and air conditioning equipment from shallow flooding.

Install Local, Property-Specific Paving, Plantings and Catchment Basins. City Engineering staff can explain the natural functions of floodplains and how they act to slow and purify urban runoff and reduce flooding. Staff can also suggest low-impact

development projects which imitate natural floodplain functions by slowing runoff and filtering out impurities. These include such things as rain gardens, catchment basins and pervious paving materials.

Acquisition. The City of Tulsa has a repetitive loss acquisition program to purchase repeatedly flooded properties. This voluntary program offers property owners who are in this situation a way out. The City applies to FEMA for funds using the Hazard Mitigation Grant Program. Once the grant is awarded, the property is appraised as if it were not a flooded property and the offer for the property is based on this appraisal. In addition to getting the best possible price, the owner receives moving expenses, a \$1,000 stipend for purchasing a home outside the floodplain, and a 30-day rent free period after closing in which to move. All closing costs and other fees are paid by the City. Once the owner has moved out, the home is demolished and restored as open space to protect the natural and beneficial function of the floodplain. Property owners who would like more information about this program are encouraged to contact the City's Customer Care Center at (918) 596-7777.

Acquisition is usually not feasible or cost effective for areas of shallow flooding, as in RLA #18. If a property is located in an existing FEMA Floodway or Special Flood Hazard Area, demolition, acquisition and relocation may be feasible and cost-effective.

Elevate Your Structure. Elevating the structure is only suitable for areas of shallow flooding, and is usually not feasible or cost-effective for masonry homes built on concrete slabs. It can sometimes be cost-effective for wood frame buildings on crawlspaces. None of the structures in RLA #18 is a candidate for elevation.

Dry Floodproof Your Structure. This can include actions that seal a structure and prevent floodwaters from entering. This method is best applied in areas where flood depths are no more than two or three feet. Buildings can be made watertight by sealing the walls with waterproof coatings, impermeable membranes, or additional layers of masonry or concrete. Doors, windows, and other openings below the base flood elevation must also be equipped with permanent or removable shields, and backflow valves must be installed in sewer lines and drains. Dry floodproofing needs to be designed by an engineer to insure the structure can resist the force of the water.

Wet Floodproof Your Building. Wet floodproofing allows water to enter a structure, while removing, protecting or elevating items that can be damaged, such as air conditioning equipment. This is often used on structures with crawl spaces and shallow flood depths. The City does not allow basements in flood-prone areas, or the wet floodproofing of basements.

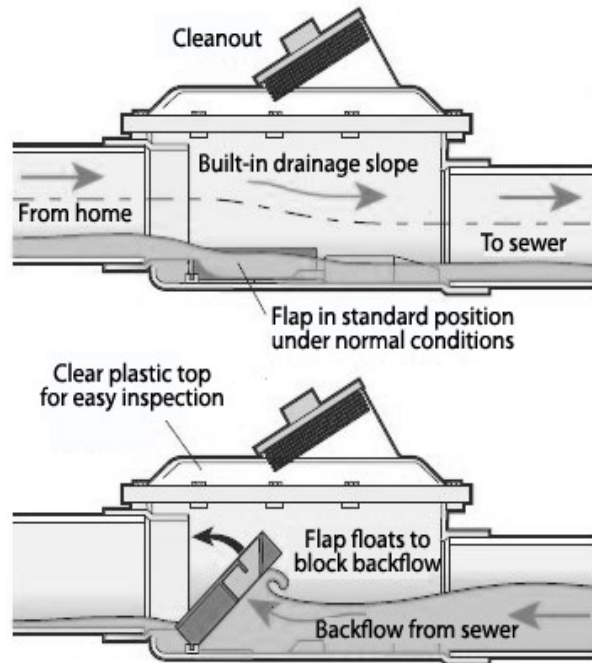
Wet Floodproof Your Garage. The garage, with its slab-on-grade construction, is one of the most vulnerable areas of your home to overland flow flooding. Remove, relocate, elevate, or otherwise protect items that can be damaged from flooding.

Elevate Damage-Prone Components. Critical items such as furnace or air conditioning units, should be elevated to avoid flood damage. This should be done for components that are in the wet-floodproofed area of the building as well as for units that are outside of the structure but subject to shallow flooding.

Maintain Nearby Streams, Ditches, and Storm Drains. Local flooding can often be caused by brush and other debris blocking drainage ways and culverts. Debris can block bar ditches, culverts and storm sewer inlets in RLA #18 and increase flood damage from overland flow. Residents and property owners should do their part in keeping inlets and drainage ways clear of brush and debris. Do not attempt to clear debris during a flood event.

Correct Sanitary Sewer Backup Problems. Sanitary sewer backup can be a cause of home damage in low-lying, flood-prone areas like RLA #16. The installation of backflow prevention valves on your sanitary sewer lines is highly recommended.

Purchase and Maintain Flood Insurance. Flood Insurance is available and recommended for the structure and contents for all properties in Tulsa. A large percentage of all flood insurance claims are for properties that are outside the FEMA floodplain. Because of the City of Tulsa’s sustained efforts to reduce flooding, you are entitled to a discount on your flood insurance. A property does not have to be in a floodplain to qualify for flood insurance.



Sewer backflow prevention valves are essential components for homes in low-lying, flood-prone areas.

Repetitive Loss Area Mitigation Measures: What the City Can Do

The City of Tulsa is actively committed to the following floodplain management activities:

- Preventative activities to keep flood problems from getting worse.
- Natural resource protection activities to preserve or restore natural areas or the natural functions of floodplain and watershed areas.
- Emergency services measures taken during an emergency to minimize its impact.
- Structural projects to keep flood waters away from properties.
- Public information activities to advise property owners, potential property owners, and visitors about flood hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains.

As funding becomes available for this Repetitive Loss Area, the City will undertake a more detailed Mini-Master Drainage Plan to identify alternative solutions to the flooding problems and recommend a public works project. The actual construction of any public works project may require the acquisition of properties and/or drainage easements. The

City will continue to fulfill its maintenance responsibility for channels, drainageways, and storm sewer inlets and pipes. At this time, the City has identified the following actions which may be appropriate for RLA #18.

- Extend and/or improve storm sewer system to better collect storm water runoff.
- Acquire flood prone properties on a voluntary basis.

VI. Funding

Due to the nature of the flooding problems and the localized, minor damages involved in RLA #18, the funding of needed site improvements will have to be borne by the individual property owner. The City will investigate the availability of funding for the public works actions listed above. Funding for ongoing City maintenance responsibilities is provided by the Stormwater Utility Fee. Funding for a public works project in this RLA is dependent of several factors, including the prioritized ranking of the project with other Capital Improvement projects, inclusion in future street maintenance projects, being part of a Bond Issue project, etc. The City will increase the storm sewer capacity with any future street projects in the area. Another potential funding source is FEMA's Hazard Mitigation Grant Program (HMGP), which can be implemented after a Presidential Major Disaster Declaration in the State.

VII. Conclusions and Recommendations

RLA #18 is situated in the original floodplain of East Branch Tributary ELB.3A, which flowed south from its origin near E. 32nd Pl. and Darlington Ave. to E. 33rd St., between Darlington Ave. and E. 32nd Pl., and then turned eastward across Darlington Ave. to Highland Park. The construction of Highland Park Addition in the 1940s filled in most of the original drainage, and runoff was subsequently carried in bar ditches to storm sewers along Darlington Ave. Some of the old course of the creek still exists as a narrow channel cut between property lines from E. 33rd St. south and west to Darlington Ave. The streets in the RLA are largely without curbing and not all properties are protected by bar ditches. Often the bar ditches that do exist are shallow, deteriorated and clogged with sediment and debris. The Repetitive Loss Property in the RLA is a case in point: It is a slab-on-grade structure built below street level on a roadway without curbing, protected only by a shallow bar ditch. When rainfall is heavy, as in the storms of 1980, 1984 and 2010, the bar ditches quickly fill and runoff floods into the home. Most of the properties that have complained about frequent flooding are located along the original course of Tributary ELB.3A. The City's Regulatory Floodplain Atlas has three properties in RLA #18 as being within an area of shallow flooding that reaches northeast from Highland Park to Darlington Ave. along the original floodplain of Tributary ELB.3A. It is likely that this shallow flooding should include one or two homes on the east side of Darlington Ave., as well. The installation of curbing along some streets and the extension of storm sewers north and east of Darlington Ave. to E. 33rd St. could help resolve some of the flooding issues that result from overland flow. However, as cautioned in the *Joe Creek East and West Branches Master Drainage Plan, Final Report*, rainfall events similar to that of 1984 are certain to cause flooding along Joe Creek and in RLA #18.

Homeowners are encouraged to maintain flood insurance. The City of Tulsa is a Community Rating System (CRS) Class II Community, and all homeowners qualify for up to a 40% discount on their flood insurance premiums. Homeowners are also

encouraged to undertake individual mitigation measures to reduce their risk of overland flooding. The City of Tulsa is ready to assist in this effort with advice.