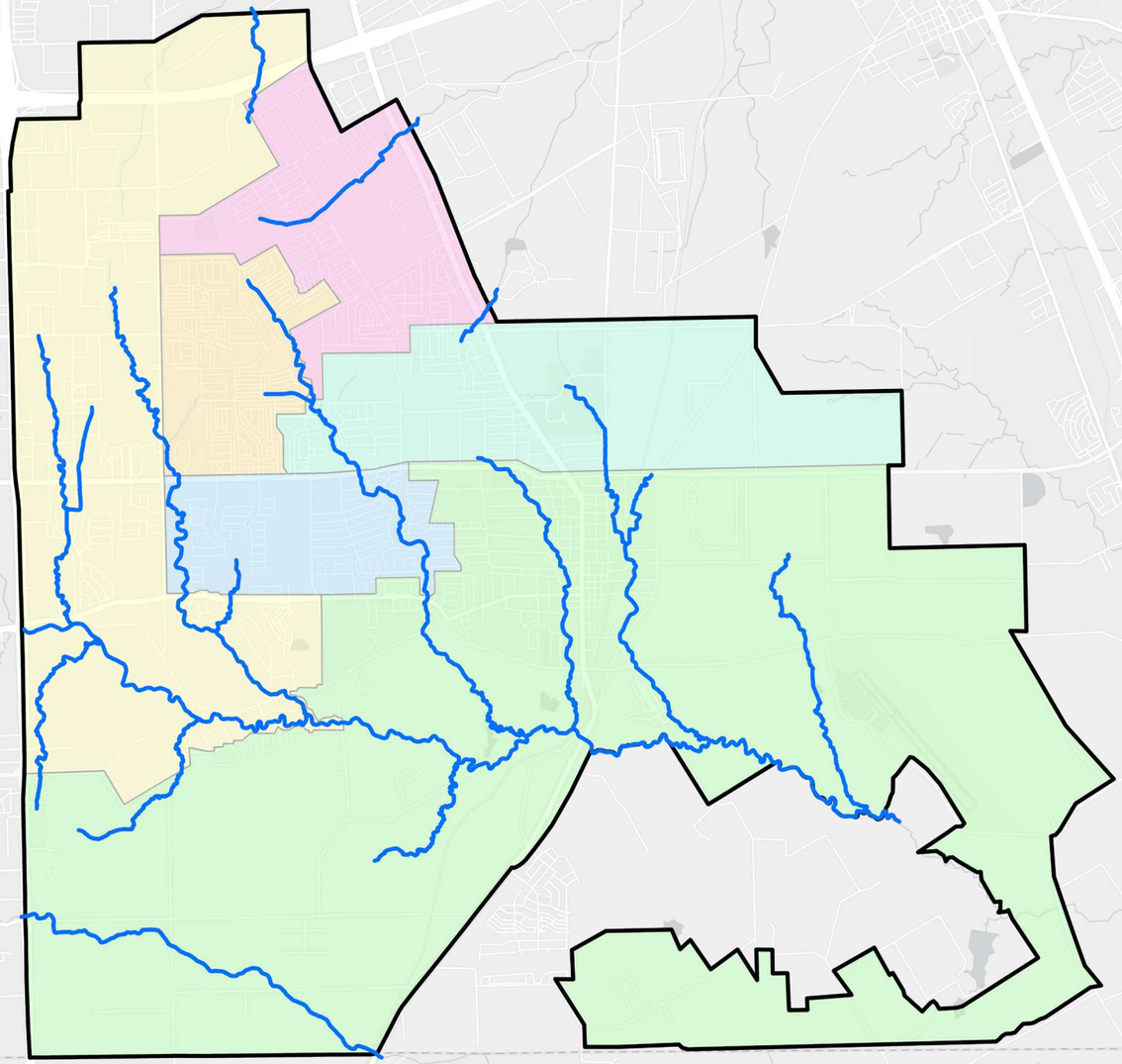
CITY OF LANCASTER

Stormwater Master Plan Update

Adopted October 23, 2023



Westwood

ACKNOWLEDMENTS

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CITY STAFF

Opal Mauldin-Jones	City Manager
Cary Neal	Deputy City Manager
Vicki D. Coleman	Director of Development Services
Rifat Alam, PE, PMP, CFM	Director of Public Works
Quang Nguyen, PE, CFM	City Engineer

CONSULTANT TEAM

WESTWOOD PROFESSIONAL SERVICES, INC.

Brian O'Neill, PE, CFM	Senior Director, South Region Public Infrastructure
Ryan Plasse, PE, CFM	Director, Public Infrastructure
Ryan Mortensen, PE, CFM	South Region Service Lead, Water Resources
Oscar Cetina, PE, CFM	Project Manager

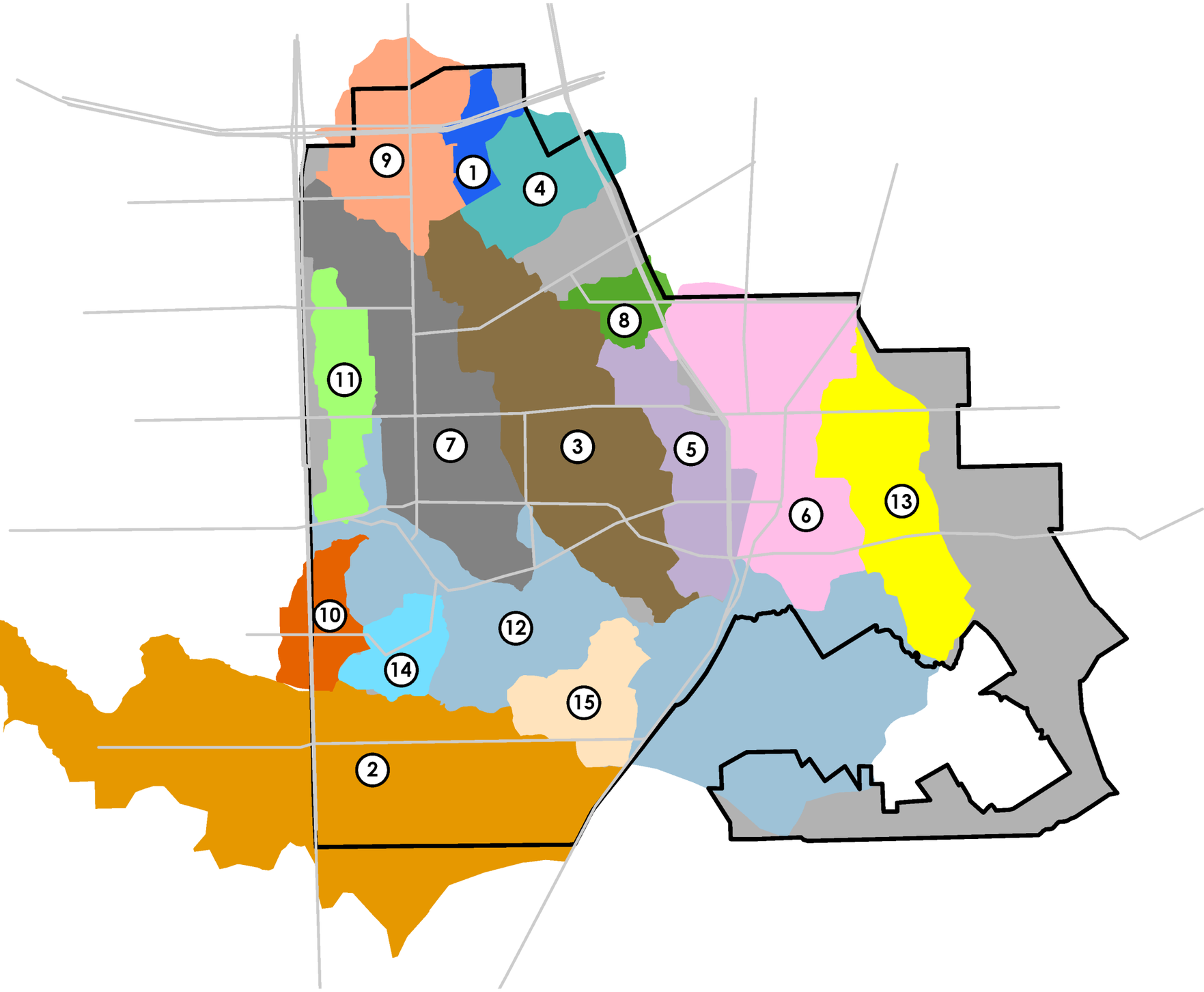
STATE OF TEXAS
RYAN MORTENSEN
102274
LICENSED
PROFESSIONAL ENGINEER
07/19/2024

A MASTER PLAN DESIGNED TO BE IMPLEMENTED

EXECUTIVE SUMMARY

The City of Lancaster previously developed a stormwater master plan in 2007. The original master plan created hydrologic and hydraulic models for fifteen watersheds throughout the City while identifying fifty-four (54) capital improvement projects. This current update to the 2007 stormwater master plan was implemented to incorporate rapid development throughout the watersheds and to develop updated capital improvement projects based on current City needs. The master plan specifically updates watershed landuses, targeted bridge and culvert geometry where known changes have occurred, overbank geometry using available LIDAR data and updated capital projects with an emphasis on project size and constructability. The revised hydraulic models and mapping associated with the updated master plan are for City use only and were not incorporated into an official FEMA letter of map change.

Projects developed as part of this master plan include conceptual solutions for culvert and bridge overtopping, localized street flooding and erosion protection on City infrastructure. Projects were initially prioritized and then presented to City staff. A design charette was used to refine project priority. A total of 23 capital improvement projects were identified at a total estimated construction cost of $23 million dollars.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METHODOLOGY

The methodology to update the hydrologic models involves a series of key steps. First, 2019 LIDAR data is utilized to accurately delineate the drainage areas. This is followed by examining and verifying land use through the analysis of 2019 aerial imagery. A comprehensive impervious cover is then developed citywide using the same aerial imagery. Further, curve numbers are assessed for both existing and fully developed watershed conditions, aiding in the understanding of runoff potential. The process also includes estimating the time of concentration for the existing and fully developed watershed scenarios, which is vital for stormwater management. Lastly, HEC-HMS models are updated to account for various storm events ranging from 1- to 100-years. Detailed hydrologic calculations for each watershed are carried out following this general summary, ensuring a complete understanding of the hydrological behavior across different conditions.

1.0

2.0

3.0

HYDROLOGY

MODELING

Floodplain hydrology was analyzed in this Masterplan using the computer program HEC-HMS , Hydrologic Modeling System, developed by the Hydrologic Engineering Center of the US Army Corps of Engineers (USACE) (Version 4.2.1, March 2017). The existing hydrologic models prepared by Freese & Nichols, dated June 2008 were obtained through the City of Lancaster and is used as a base for the Analysis Updates. Hydrologic parameters were updated in the models based on better available data and improved methodology. The techniques employed and resulting predictions of the computed peak discharges are explained in the subsequent sections.

DRAINAGE AREA VERIFICATION

The 2007 drainage area divides were reviewed for accuracy and updated based on current LIDAR data. Overlaps and holes were identified and corrected as part of the update to hydrologic parameters. The image below shows an example of the overlap and hole identified during review.

SYNTHETIC STORM

The hydrologic model is based on a 24-hour duration storm which uses the Frequency Rainfall Distribution based on nested design intensities centered along storm duration. Rainfall depths used to define the design storm hyetographs were determined from the City of Lancaster Storm Water Design Manual. The table below shows depth used in the rainfall distribution.

RAINFALL DATA

Duration	1-Year Depth (in)	2-Year Depth (in)	5-Year Depth (in)	10-Year Depth (in)	25-Year Depth (in)	50-Year Depth (in)	100-Year Depth (in)
5 MINUTES	0.44	0.51	0.60	0.66	0.77	0.85	0.93
15 MINUTES	0.85	1.00	1.24	1.40	1.63	1.81	2.00
1 HOUR	1.40	1.73	2.24	2.60	3.07	3.45	3.86
2 HOURS	1.66	2.08	2.76	3.22	3.84	4.36	4.90
3 HOURS	1.83	2.28	3.06	3.60	4.32	4.89	5.55
6 HOURS	2.10	2.64	3.60	4.26	5.16	5.88	6.72
12 HOURS	2.40	3.12	4.20	4.92	6.12	6.96	8.04
24 HOURS	2.64	3.60	4.80	5.76	7.20	8.40	9.60

LOSS RATES

Loss rates and initial abstractions were determined from the Curve Number method outlined in US Department of Agriculture, Technical Release No. 55 (TR-55), Urban Hydrology for Small Watersheds. Hydrologic soil types were determined from the USDA-NRCS Soil Survey Division's 2020 Soil Map for Dallas County, Texas. The relevant Lancaster watersheds consist of hydrologic soil Type A B, C and D. Type A soils are the most pervious and consist of more coarse grain materials like sands. Type D soils are least pervious, have lower porosity and consist of mostly clays.

Composite Curve Numbers for each sub-basin were computed using hydrologic soil types only. Existing impervious areas were delineated and used to determine an existing weighted impervious percentage for each sub-basin. The City's Future Land Use was used to determine approximate impervious percentages in undeveloped areas for Fully Developed conditions.

Table 2-2a Runoff curve numbers for urban areas 1/

Cover description — Cover type and hydrologic condition	Average percent impervious area 2/	Curve numbers for hydrologic soil group — A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) 3/:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) 4/		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

IMPERVIOUS PERCENTAGES CHART FROM TR-55 PAGE 2-5

LAG TIME

Times of concentration were determined for each sub-basin from the method outlined in Chapter 3 of TR-55. Flow paths for each sub-basin were developed for components of Overland, Shallow Concentrated, and Channel flows. Overland flow distances were limited to 100-feet. The shallow concentrated flow components use a standard K-factor for paved and unpaved conditions. Similarly, K-factors were developed for typical hydraulic conditions such as gutter flow, full pipe flow uniform channel flow. Natural channel velocities were determined using a steady-state hydraulic model with an approximate 2-year storm profile to simulate bank full conditions when hydraulic model data was available. Basin lag times were developed by multiplying the time of concentration by 0.6. Velocities were limited to about 15 fps.

To calculate Time of Concentration for ultimate conditions, the same existing condition flowpath shapes were used. In reality, these flowpaths would likely change if future development occured in the vicinity. Because the exact future watershed modifications cannot be precisely predicted, future development was simulated in the times of concentration by reducing the overland and shallow times by 25%.

UNIT HYDROGRAPH AND ROUTING

The Soil Conservation Service (SCS) Dimensionless Unit Hydrograph Method was used to produce synthetic hydrographs for the given 24-hour storms. The hydrograph parameters used for each subbasin were based on the sub-basin Lag Time and the composite Curve Numbers (discussed above). Hydrographs from each subbasin were routed to combination points using the Modified Puls Routing Method. The Modified Puls routing method simulates the effects of valley storage within each stream. A steady-state hydraulic model was used to develop a discharge-storage relationship for a suite of flows at each routing reach in the model.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n 1/
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses 2/	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: 3/	
Light underbrush	0.40
Dense underbrush	0.80

1 The n values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

$$K = 1.49 r^{2/3} n^{-1}$$

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007 (nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \quad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

Manning's equation is:

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \quad \text{[eq. 3-4]}$$

where:

V = average velocity (ft/s)
r = hydraulic radius (ft) and is equal to a/p_w
a = cross sectional flow area (ft^2)
p_w = wetted perimeter (ft)
s = slope of the hydraulic grade line (channel slope, ft/ft)
n = Manning's roughness coefficient for open channel flow.

TIME OF CONCENTRATION CALCULATIONS FROM TR-55 PAGE 3-3 & 3-4

METHODOLOGY

1.0

Updating the hydraulic models involves a structured process with multiple phases. This begins with modifying the cross-section geometry based on 2019 LIDAR data, which ensures accuracy in hydraulic analysis. Next, flow calculations are adjusted to align with the hydrologic results, providing a cohesive integration between hydrologic and hydraulic modeling. A significant step is redefining the floodplain maps for 100-year existing and fully developed watershed conditions, leading to better flood risk management. Finally, individual erosion hazard maps are created for each stream, addressing erosion risks in a targeted manner. Further hydraulic calculations for each watershed are elaborated upon following the general summary, providing detailed insights into the hydraulic characteristics of the system.

2.0

3.0

HYDRAULICS

MODELING

The streams analyzed in this Masterplan were analyzed using the computer program HEC-RAS , River Analysis System, developed by the Hydrologic Engineering Center of the USACE (Version 5.0.7, March 2019). The existing hydraulic models prepared by Freese & Nichols, dated June 2008 were obtained through the City of Lancaster and used as a base for the Analysis Update. The hydraulic models use the peak discharges as computed in the respective hydrologic models to determine the floodplain inundation limits throughout the streams. The hydraulic results were compared for all studied streams to identify potential hydraulic impacts of the existing and fully developed floodplains.

CROSS SECTION UPDATE

Cross sectional geometry within the hydraulic models were updated throughout the City. The geometry updated included targeted survey data for structures where known changes had occurred and updates to the overbanks using 2009 LIDAR data. The image below shows cross sectional overlays demonstrating the typical changes hydraulic geometry.

HYDRAULIC COEFFICIENTS

Within the hydraulic models, contraction and expansion coefficients were set to 0.3 and 0.5, respectively, for cross-sections located upstream and downstream of sudden geometry changes. Normal contraction and expansion coefficients of 0.1 and 0.3 were used for all remaining crosssections. Manning's' roughness coefficients were not changed from the original Freese and Nichols model except where significant discrepancies with aerial imagery were apparent. Where alterations were made to the original modeling done by Freese and Nichols, manning's roughness coefficients were selected from Table 5-6 of Ven te Chow's Open Channel Hydraulics. In general, the roughness coefficients range from 0.015 to 0.07. Table 1 describes the different roughness values used in the hydraulic model throughout the overbank areas.

DOWNSTREAM BOUNDARY CONDITIONS

The downstream boundary conditions for the Existing and Fully Developed Condition Models were unmodified from Freese and Nichols' original hydraulic model. The original model utilizes a Known Water Surface Elevation boundary condition for it's streams. The Known Water Surface Elevation for each stream is provided in each stream's respective "Hydraulics" section of this Master Plan.

BOUNDARY SENSITIVITY ANALYSIS

Sensitivity analyses were performed with each hydraulic analysis to ensure the starting cross-sections were placed far enough downstream to eliminate fluctuations in the computed water-surface elevations at culverts and bridges. The starting Water-Surface Elevations (WSELs) can be raised or lowered to varying degrees before any changes in the 100-year profile are observed at the nearest culvert or bridge.

METHODOLOGY

1.0

2.0

3.0

The strategy for developing capital improvement projects is a comprehensive process that encompasses several essential steps. It starts with identifying areas prone to flooding and other potential issues, laying the groundwork for targeted interventions. Then, preliminary solutions for each identified problem are created, providing a blueprint for subsequent development. The projects are then evaluated and presented to stakeholders for prioritization, ensuring that resources are allocated to the most critical areas. This is followed by revising and updating the capital improvement project list based on staff input and recommendations, reflecting the collective wisdom of the team. Lastly, the OPCC (Opinion of Probable Construction Cost) is developed for each project, offering an accurate assessment of the total expected costs. Conceptual project sheets and OPCCs are provided subsequent to the general summary, offering a complete package for implementing the capital improvement projects.

PROJECT DEVELOPMENT

FLOOD PLAIN OVERLAYS

The methodology integrates floodplain data with specific community elements, such as parks and trails, thoroughfare planning, and utilities master planning. The floodplain boundaries are evaluated and aligned with existing and planned parks and trails, enhancing the integration of these recreational areas while minimizing flood damage. The analysis of the floodplain's impact on major roads leads to the design of measures that mitigate disruptions, ensuring a smooth alignment with the existing and future transportation network. Moreover, a comprehensive assessment of floodplain interactions with utility networks is performed to ensure resilience to flood events. These proactive measures not only protect critical services but also foster a wider strategy for flood management within the community.

CAPACITY ANALYSIS

A critical aspect of the stormwater master plan is assessing the existing stormwater system's ability to handle various storm conditions. This process begins with simulating stormwater flows through advanced modeling techniques to identify potential system constraints and bottlenecks. The analysis provides a clear understanding of the areas where the system may cause flooding during significant rain events. This information is used to define hydraulic structures which need to be increased in size.

ROADWAY OVERTOPPING

The methodology for addressing roadway overtopping begins with the identification of roads and intersections prone to overtopping during flood events. This information is crucial to prioritize areas needing immediate attention. Subsequent steps include designing and implementing engineering solutions, such as raising road levels or installing appropriate drainage systems, to prevent or minimize overtopping. These measures not only safeguard the roadways but also ensure uninterrupted transportation during adverse weather conditions, enhancing the overall safety and resilience of the community's infrastructure.

EROSION HOT SPOTS

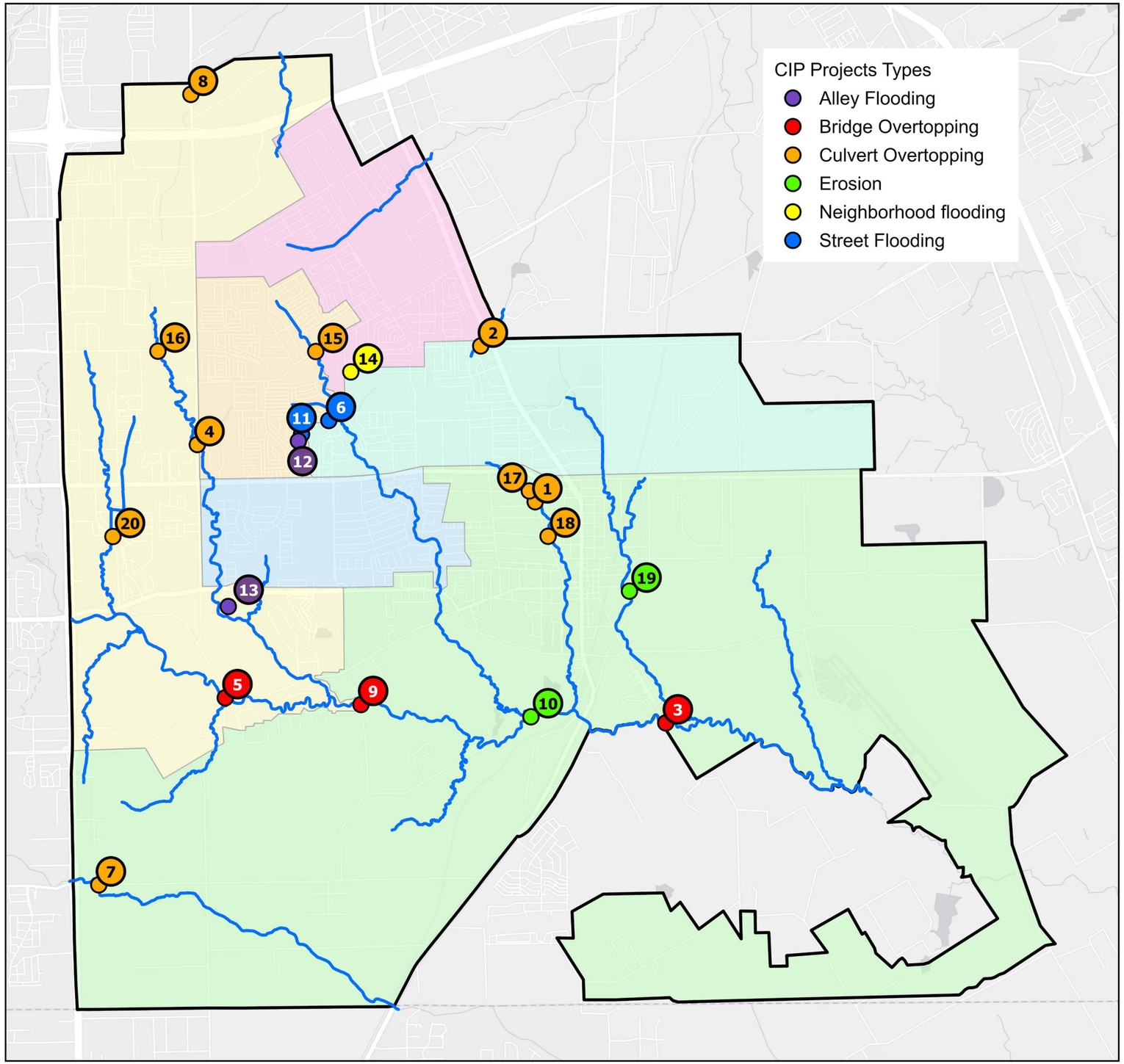
In an effort to identify significant erosion potential, high shear-stress and velocity maps are developed for each stream. This approach enables pinpointing areas that are particularly susceptible to erosion, which can threaten city infrastructure. The resulting mapping can be used as an integral part of the stormwater management strategy, contributing to long-term environmental stability.

PROJECT IDENTIFICATION

This phase is centered on determining the capital improvement projects needed to address identified issues. An initial needs analysis compiles a list of essential projects, followed by feasibility studies to evaluate the practicality and cost-effectiveness of each project. Known problem areas are also specifically identified and prioritized to ensure urgent needs are addressed promptly. This methodical approach ensures projects are not only identified but also evaluated in detail, leading to a plan that is both responsive to current challenges and strategically aligned with long-term goals.

PRIORITIZATION

The prioritization phase plays a vital role in determining the order of implementation for the identified projects. The ranking process is then carried out, taking into consideration factors such as urgency, impact, and alignment with community objectives. Importantly, community members and stakeholders were engaged throughout this process, ensuring the prioritization reflects community needs and values. This inclusive approach fosters greater acceptance and support for the stormwater master plan, positioning it as a community-driven initiative.



PROJECT IDENTIFICATION

RANK	PROJECT DESCRIPTION
1	North Elm Street Culvert Improvements
2	Wintergreen Road Culvert Improvements
3	Nokomis Road Bridge Improvements
4	North Houston School Road Culvert Improvements
5	South Houston School Road Bridge Improvements
6	North Blue Grove Road Storm Improvements
7	Bear Creek Road Bridge Improvements
8	North Houston School Road Culvert Improvements
9	South Blue Grove Road Bridge Improvements
10	Country View Bridge & Erosion Improvements
11	Willow Brook Lane Storm Improvements
12	Willow Brook Street (Alley) Storm Improvements
13	Mill Creek Road Storm Improvements
14	Bayport Drive Ditch Improvements
15	Wintergreen Road Culvert Improvements (Deep)
16	Wintergreen Road Culvert Improvements (Mill)
17	Rea Avenue - Upgrade Halls Branch Crossing
18	6th Street Culvert Improvements
19	East Main Street Erosion Mitigation
20	Rolling Hills Place Culvert Improvements

NORTH ELM STREET CULVERT IMPROVEMENTS

PRIORITY: 1

BUDGET: $610,000

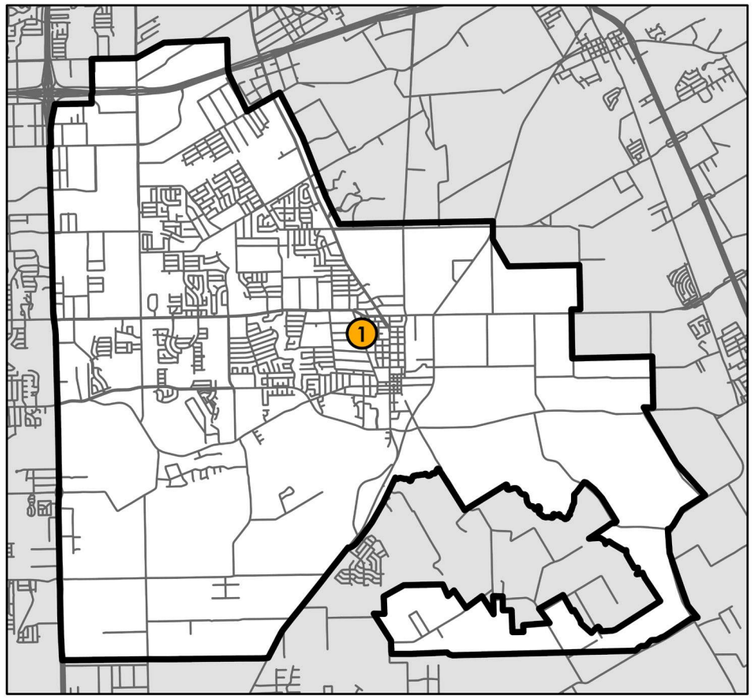
WATERSHED: HALLS BRANCH

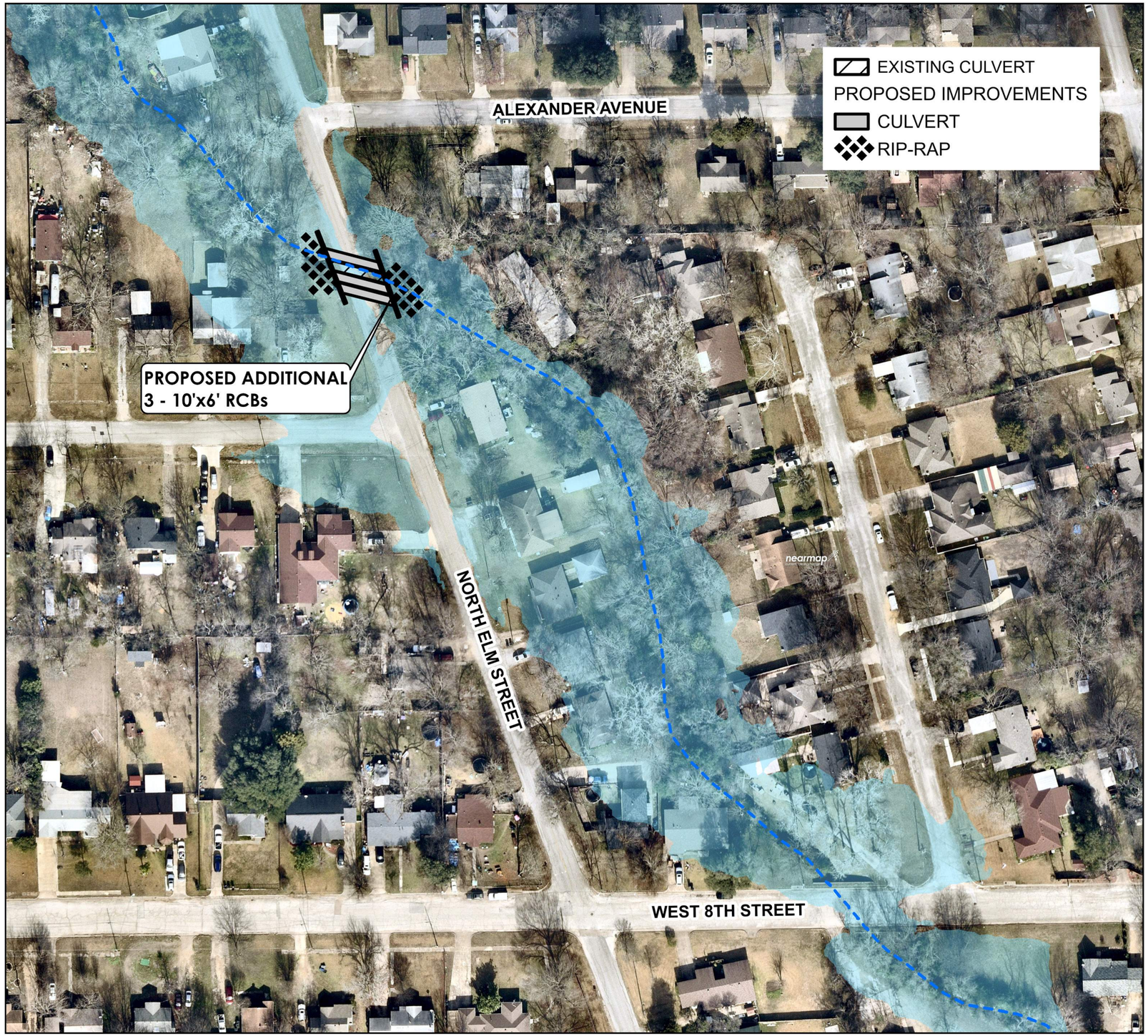
COUNCIL DISTRICT: 1

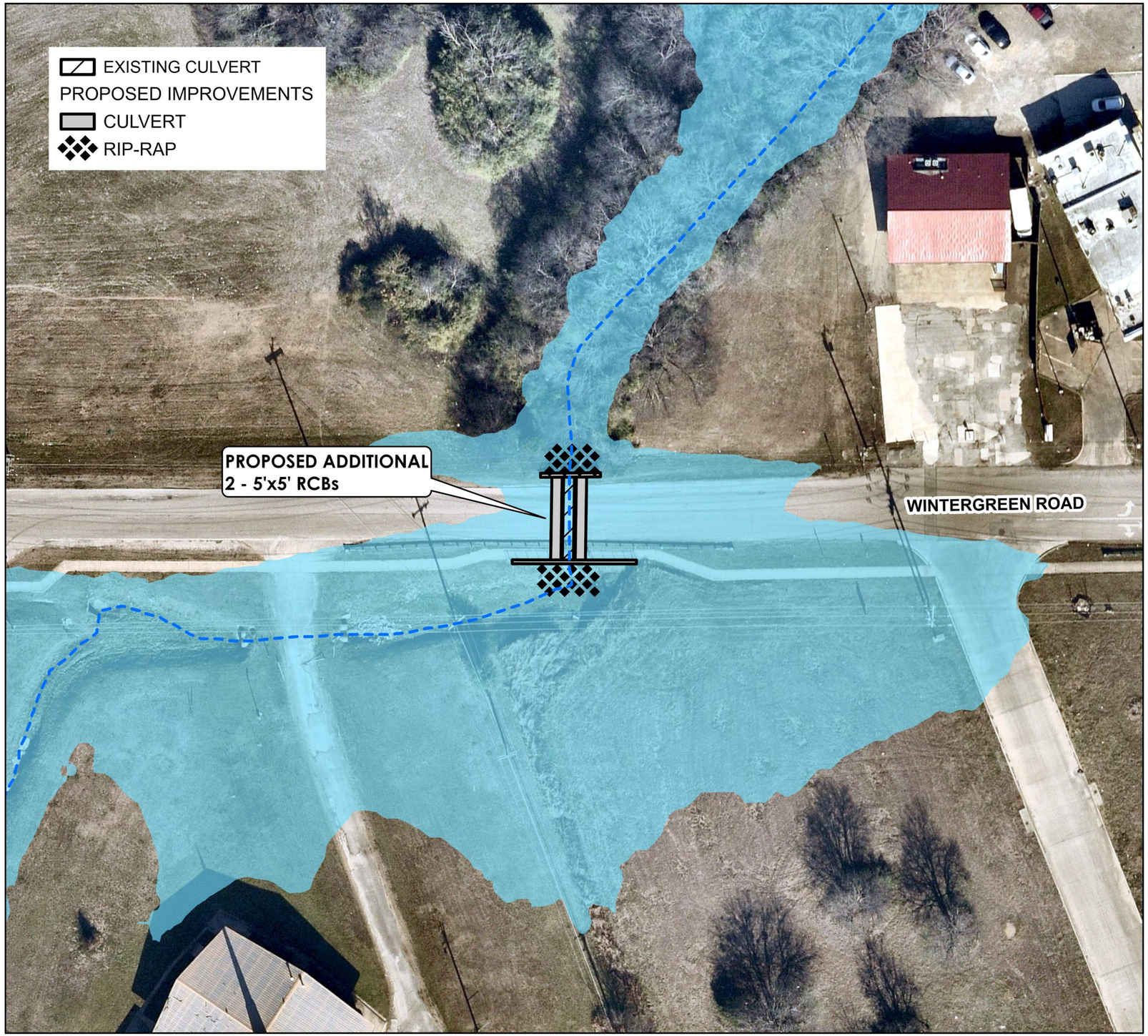
Project description

Existing culverts under North Elm Street at Halls Branch Branch are undersized and overtop during a 1-year storm event.

Proposed improvements include adding three (3)additional 10'x6' RCBs to the existing 10'x5' RCB to convey the flow.







WINTERGREEN ROAD CULVERT IMPROVEMENTS

PRIORITY: 2

BUDGET: $520,000

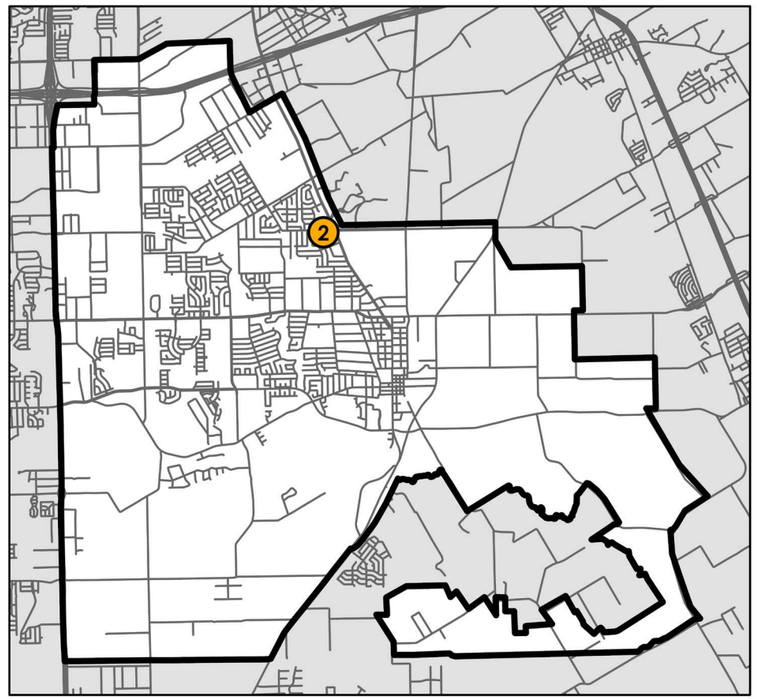
WATERSHED: NEWTON CREEK

COUNCIL DISTRICT: 3

Project description

Existing culverts under Wintergreen Road at Newton Branch are undersized and overtop during a 1-year storm event.

Proposed improvements include adding two (2) additional 5'x5' RCBs to the existing 4'x5' RCB



NOKOMIS ROAD BRIDGE IMPROVEMENTS

PRIORITY: 3

BUDGET: $3,950,000

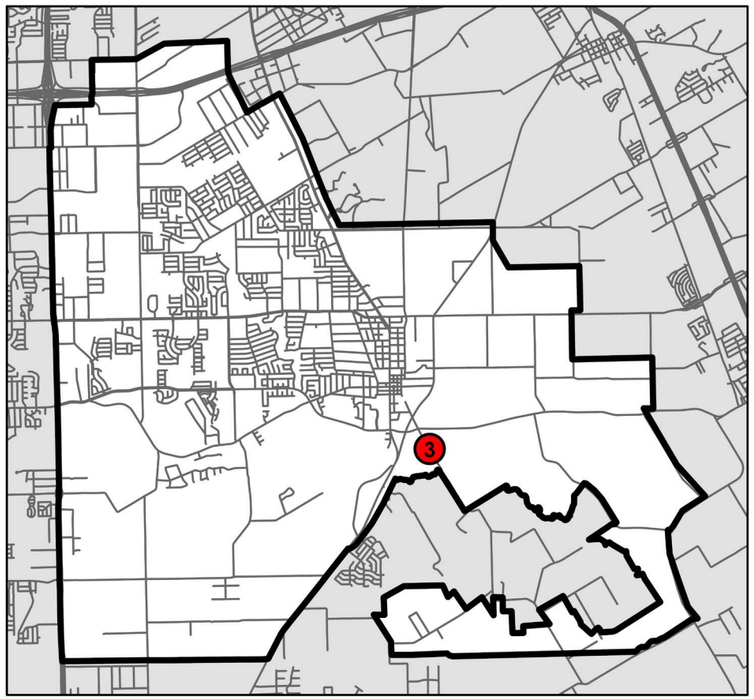
WATERSHED: TEN MILE CREEK

COUNCIL DISTRICT: 2

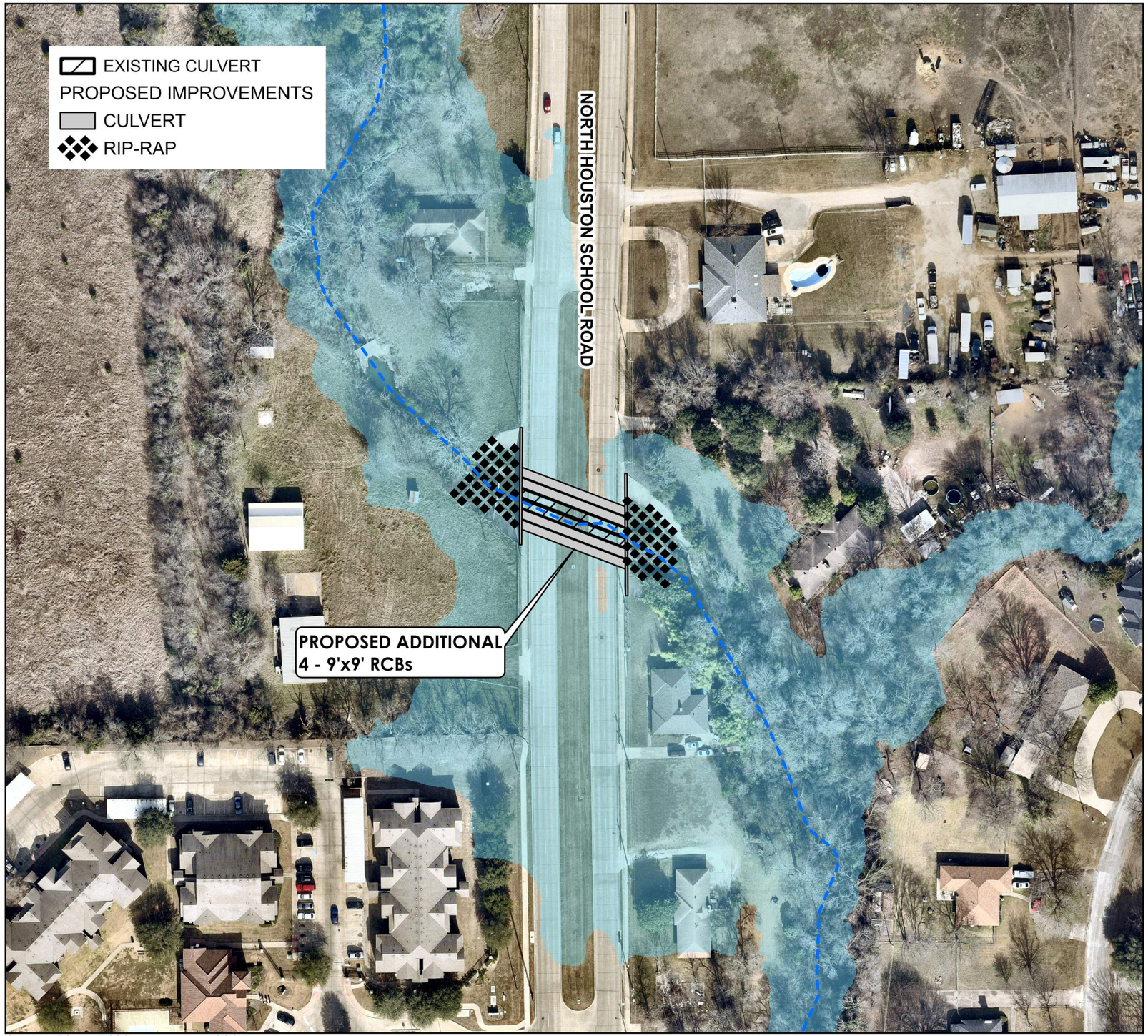
Project description

Existing bridge under Nokomis Road at Ten Mile Creek is undersized and overtop during a 1-year storm event.

Proposed improvements include upsizing the bridge crossing from 100-foot span to 450-foot span to accommodate the frequent storm events.







NORTH HOUSTON SCHOOL ROAD CULVERT IMPROVEMENTS

PRIORITY: 4

BUDGET: $1,540,000

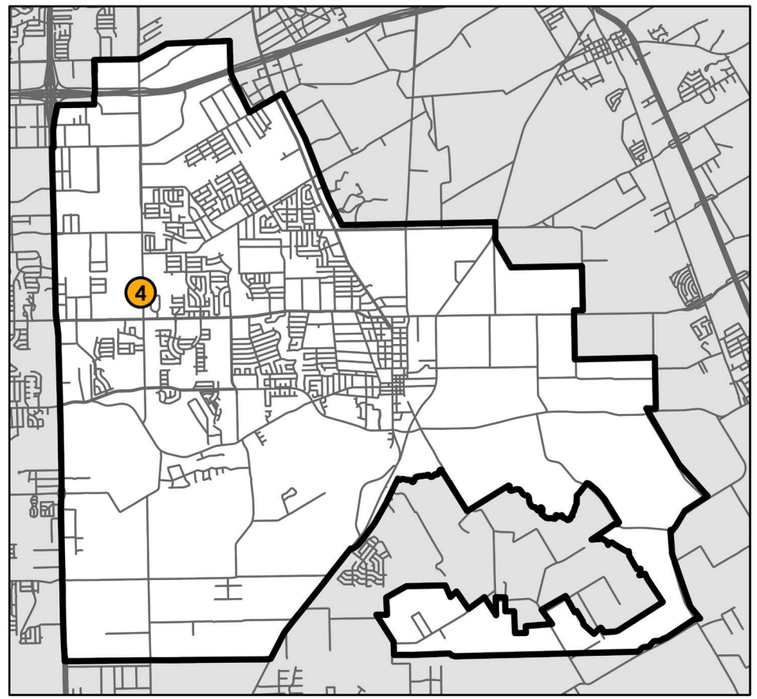
WATERSHED: MILL CREEK

COUNCIL DISTRICT: 2 & 4

Project description

Existing culverts under North Houston School Road at Mill Creek are undersized and overtop during a 5-year storm event.

Proposed improvements include adding four (4) additional 9'x9' RCBs to the existing 2 - 9'x9' RCBs.



SOUTH HOUSTON SCHOOL ROAD BRIDGE IMPROVEMENTS

PRIORITY: 5

BUDGET: $3,390,000

WATERSHED: TEN MILE CREEK

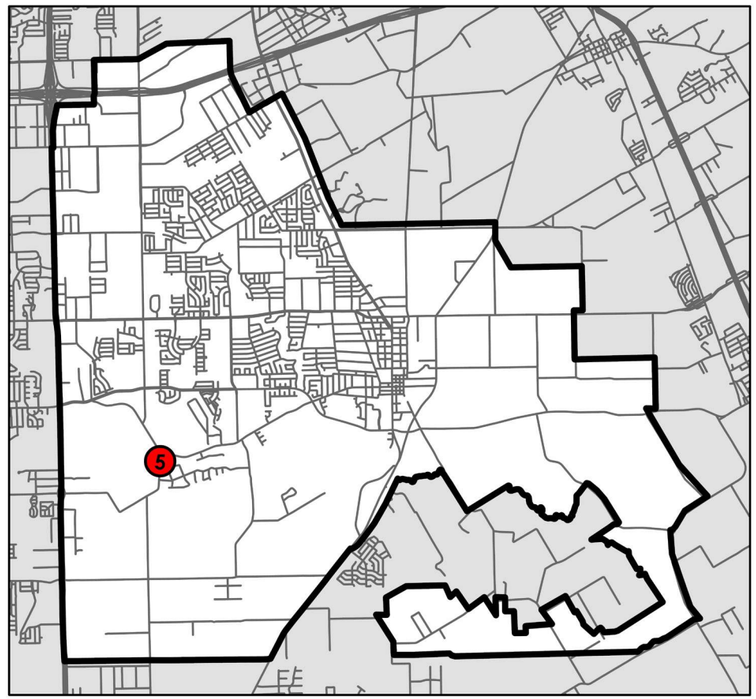
COUNCIL DISTRICT: 2

Project description

Existing bridge under South Houston School Road at Ten Mile Creek is undersized and overtop during a 5-year storm event.

Proposed improvements include upsizing the bridge crossing from 200-foot span to 300-foot span to accommodate the frequent storm events.

A proposed alternative for the 100-year storm event was considered, but would require elevating the roadway over 6 feet and constructing a 1,200 feet long bridge at a cost of approximately $14,000,000.





NORTH BLUE GROVE ROAD STORM IMPROVEMENTS

PRIORITY: 6

BUDGET: $1,040,000

WATERSHED: DEEP BRANCH

COUNCIL DISTRICT: 3 & 4

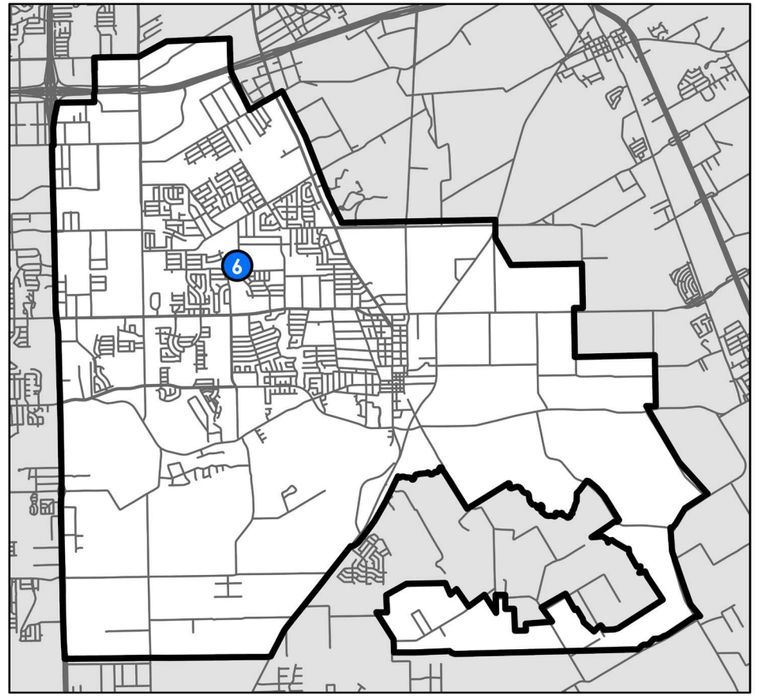
Project description

Existing storm drainage system in North Blue Grove Road is undersized and exceeds capacity during a 2-year storm event.

Proposed improvements include adding additional inlets and upsizing the main trunk line.

*further investigation of existing storm system capacity and required improvements will be necessary during the final design process





BEAR CREEK ROAD CULVERT IMPROVEMENTS

PRIORITY: 7

BUDGET: $1,070,000

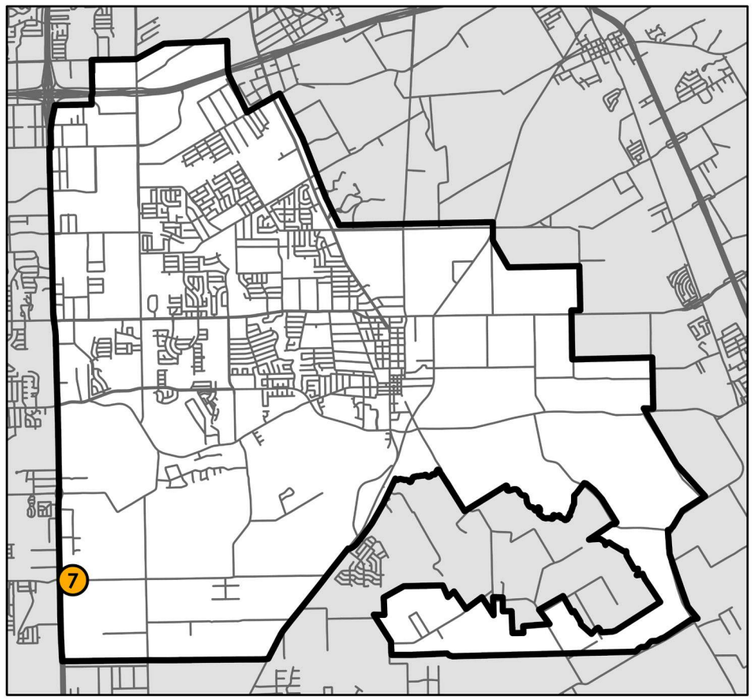
WATERSHED: BEAR CREEK

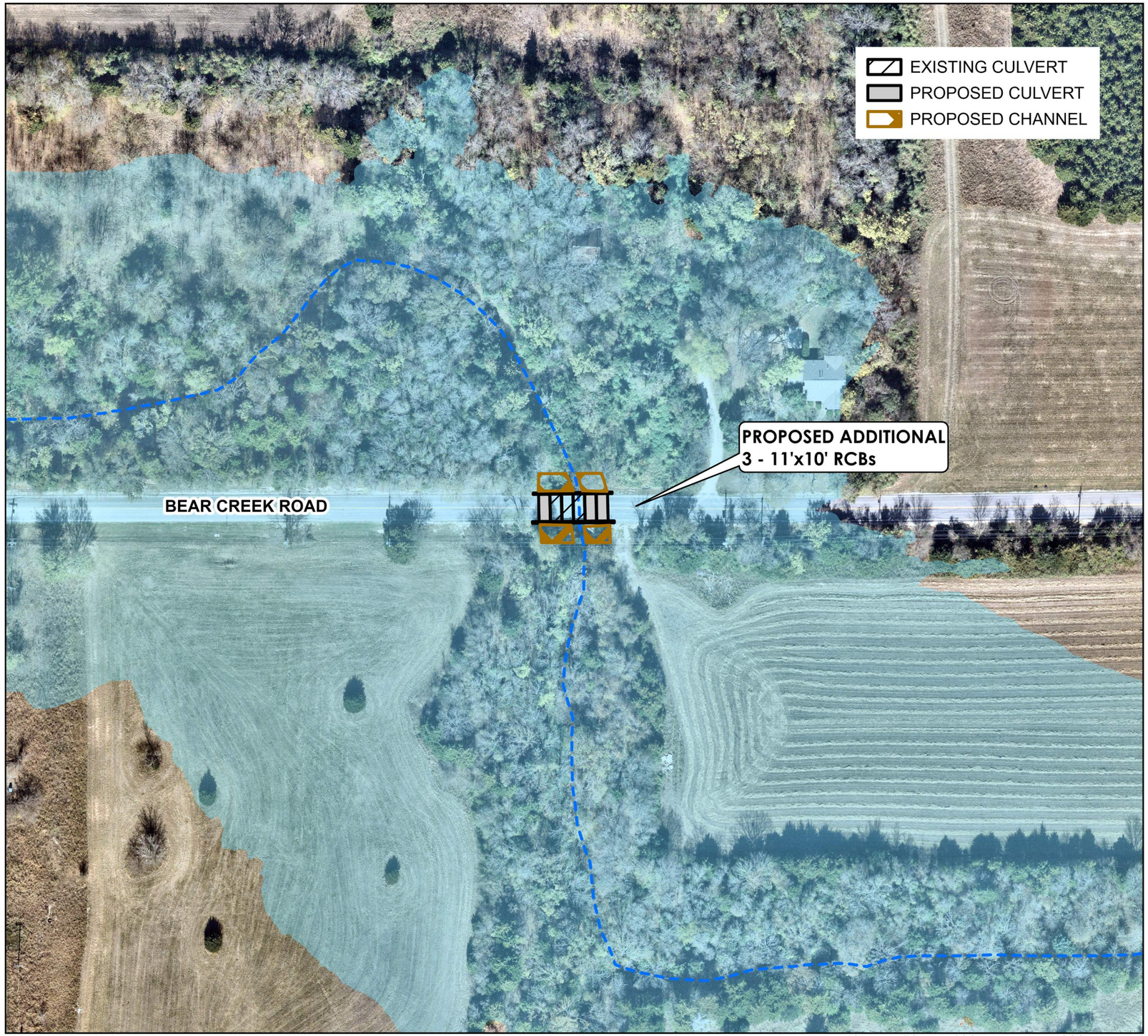
COUNCIL DISTRICT: 1

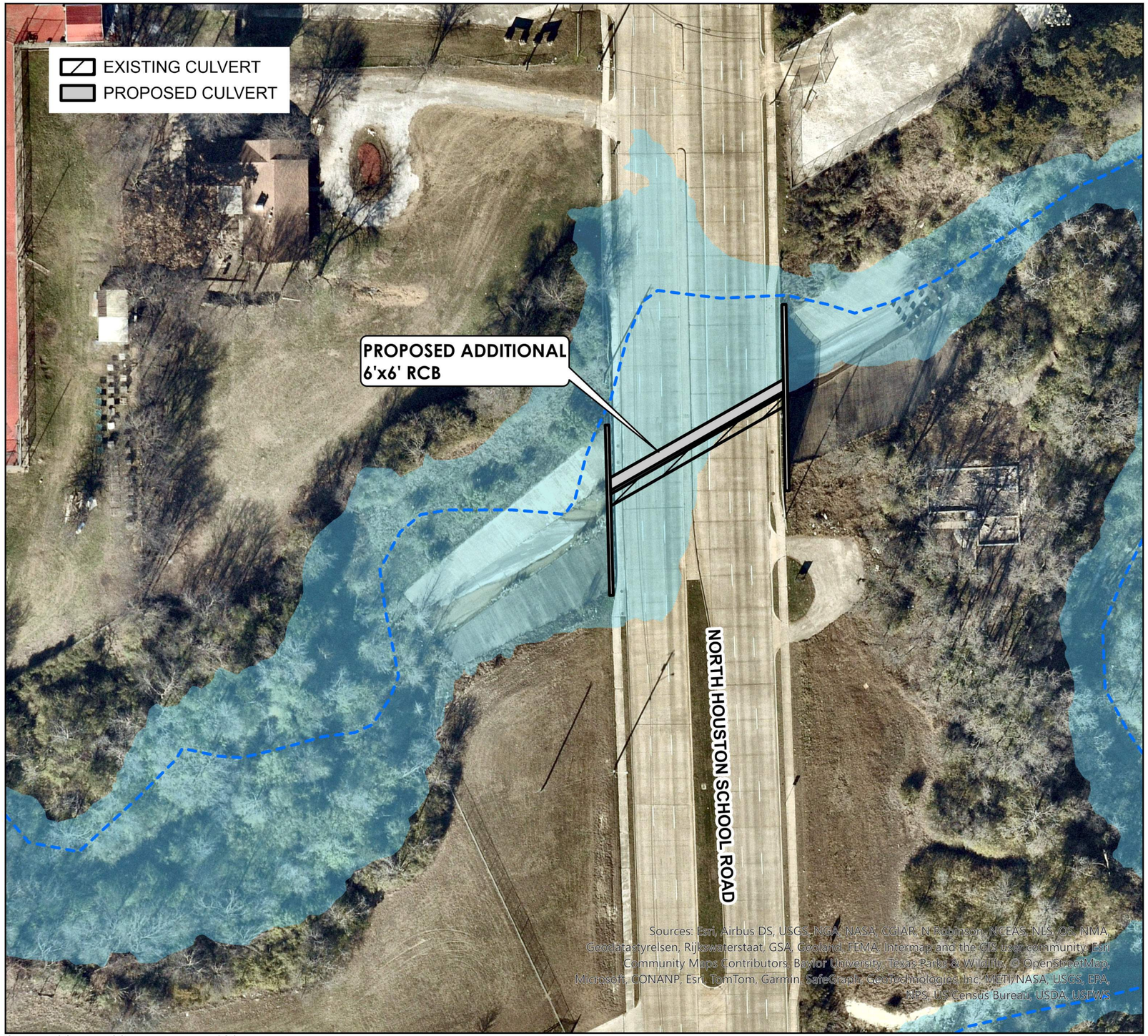
Project description

Existing culverts under Bear Creek Road at Bear Creek are undersized and overtop during a 10-year storm event.

Proposed improvements include adding three (3) additional 11'x10' RCBs to the existing 2 - 11'x10' RCBs.







Lancaster

NORTH HOUSTON SCHOOL ROAD CULVERT IMPROVEMENT

PRIORITY: 8
BUDGET: $650,000

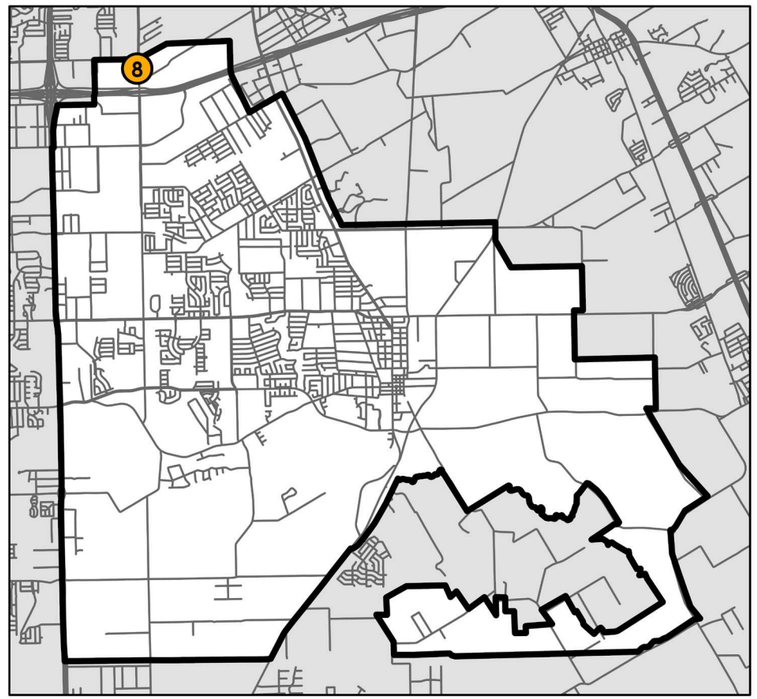
WATERSHED: RUNYON SPRINGS BRANCH

COUNCIL DISTRICT: 2

Project description

Existing culvert under North Houston School Road at Runyon Springs Branch are undersized and overtop during a 10-year storm event.

Proposed improvements include adding one (1) additional 6'x6' RCB to the existing 5'x6.5' RCB.



SOUTH BLUE GROVE ROAD BRIDGE IMPROVEMENTS

PRIORITY: 9
BUDGET: $1,330,000

WATERSHED: TEN MILE CREEK

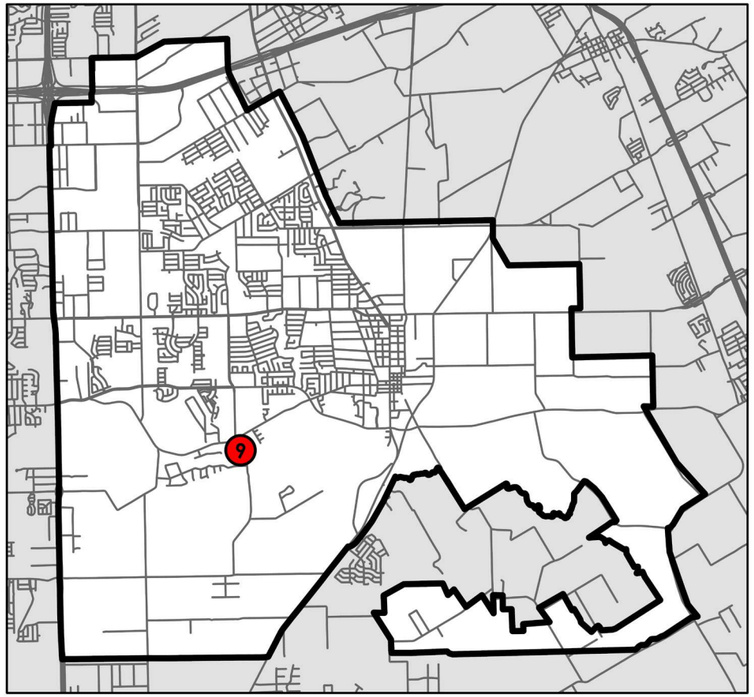
COUNCIL DISTRICT: 2

Project description

Existing bridge under South Blue Grove Road at Ten Mile Creek is undersized and overtop during a 2-year storm event.

Proposed improvements include grading in the vicinity of the bridge crossing and elevating approximately 500 feet of roadway to accommodate the 2-year storm event.

A proposed alternative for the 100-year storm event was considered, but would require elevating the roadway over 10 feet and constructing a 1,200 feet long bridge at a cost of approximately $14,000,000.







COUNTRY VIEW BRIDGE & EROSION IMPROVEMENTS

PRIORITY: 10

BUDGET: $670,000

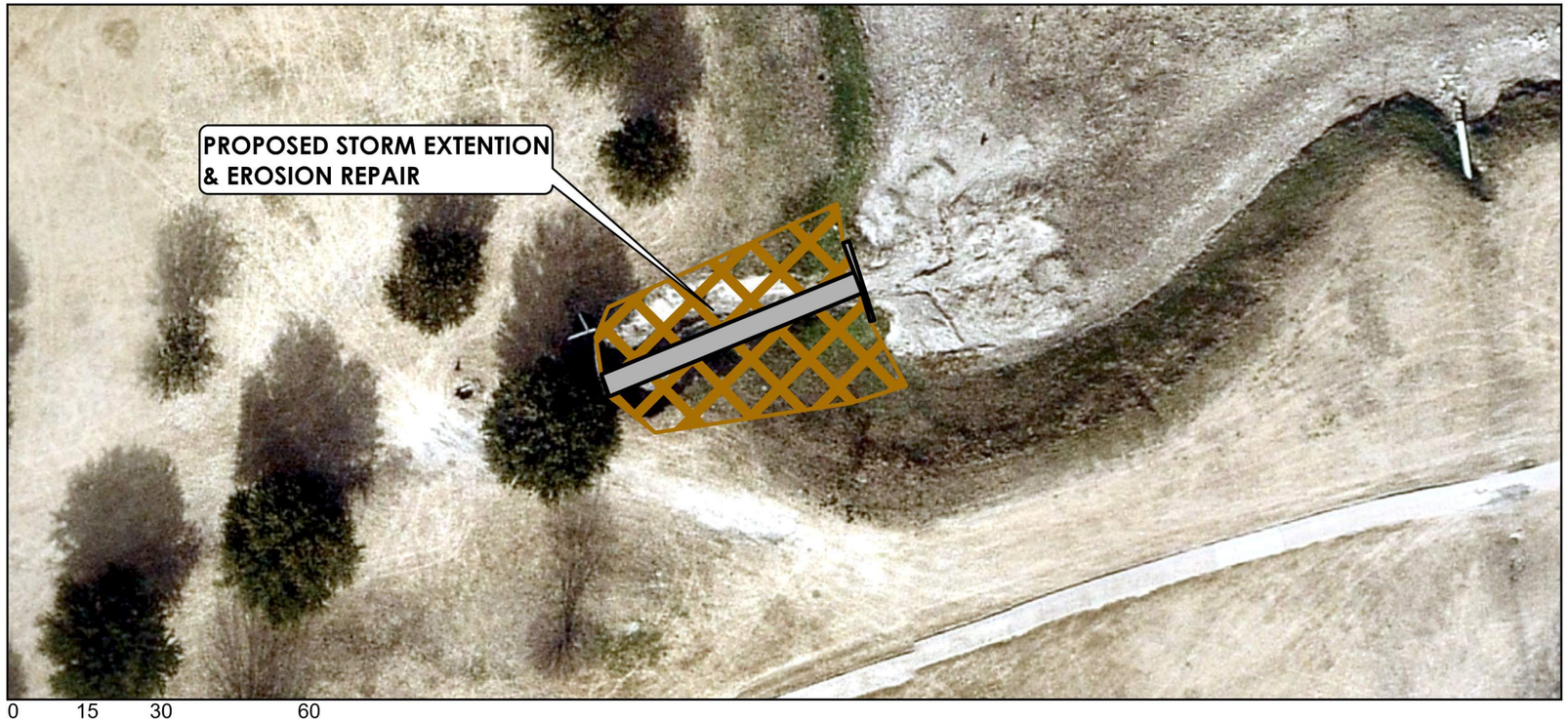
WATERSHED: TEN MILE CREEK

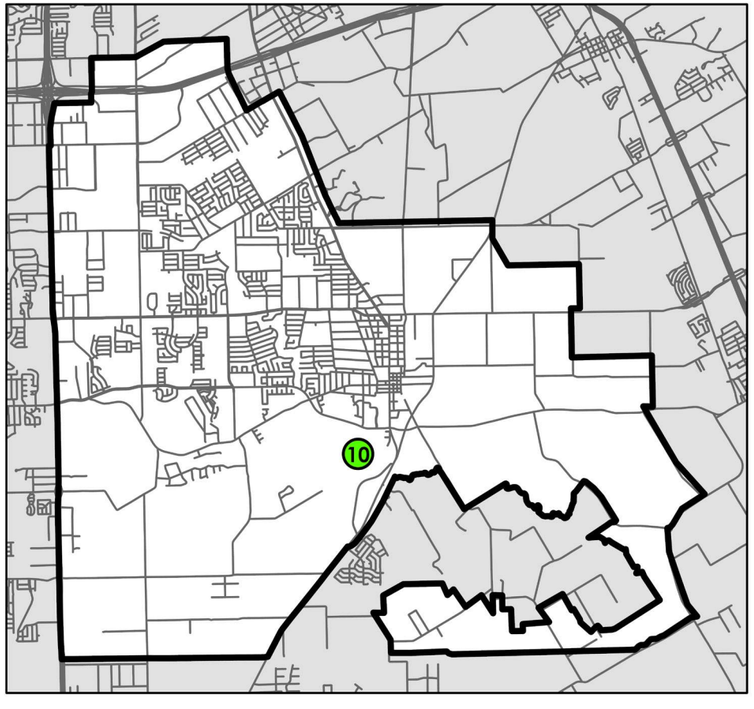
COUNCIL DISTRICT: 1

Project description

Existing golf cart bridge is deteriorating and stream channel is eroding the abutments. Also, a storm pipe has failed and eroded a corner of the existing pond.

Proposed improvements include a bridge replacement with armored abutments. Also, extension of the storm pipe and headwall with slope stabilization.





WILLOWBROOK STREET STORM IMPROVEMENTS

PRIORITY: 11

BUDGET: $1,530,000

WATERSHED: DEEP BRANCH

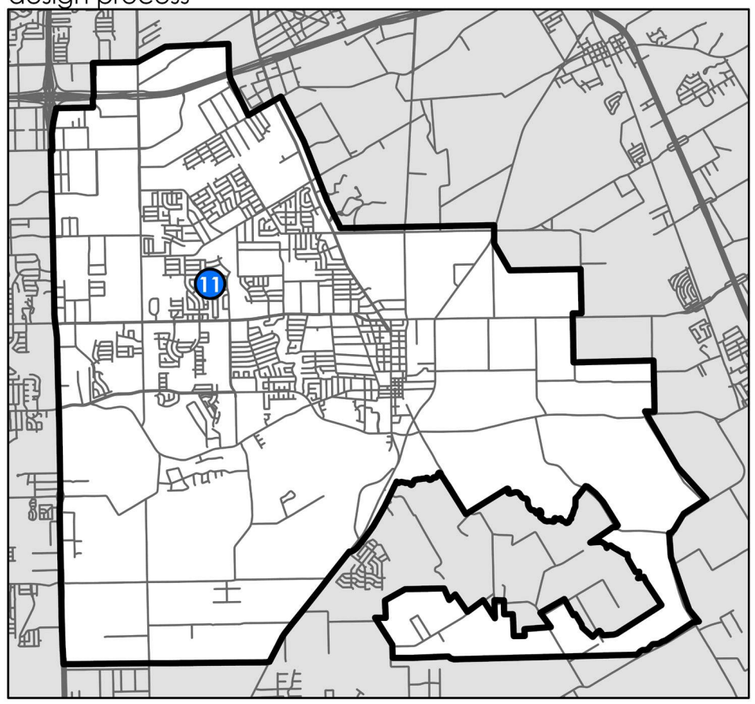
COUNCIL DISTRICT: 4

Project description

Existing 1500-1600 block of Willowbrook Street does not have a storm drainage system. Street capacity is exceeded in a 2-year storm event.

Proposed improvements include extending the storm improvements from Project 6 to collect the runoff along Willowbrook Street and Rockbrook Street.

*further investigation of existing storm system capacity and required improvements will be necessary during the final design process





WILLOWBROOK ALLEY STORM IMPROVEMENTS

PRIORITY: 12

BUDGET: $550,000

WATERSHED: DEEP BRANCH

COUNCIL DISTRICT: 4

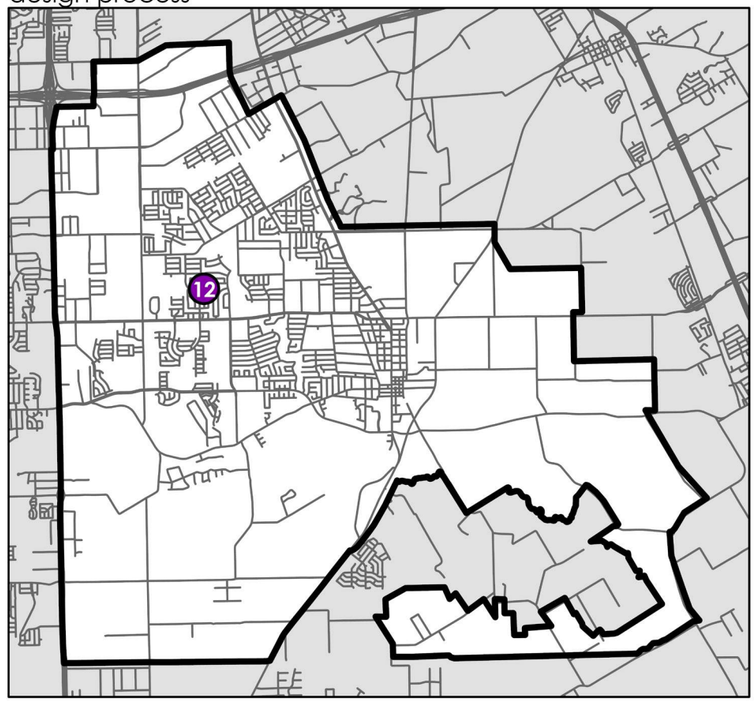


Project description

Existing alley behind 1539 Willowbrook Street does not have a storm drainage system. Alley capacity is exceeded in a 2-year storm event.

Proposed improvements include extending the storm improvements from Project 11 to collect the runoff along the alley between Willowbrook Street and Warwick Drive.

*further investigation of existing storm system capacity and required improvements will be necessary during the final design process



MILL CREEK ALLEY STORM IMPROVEMENTS

PRIORITY: 13

BUDGET: $300,000

WATERSHED: MILL CREEK

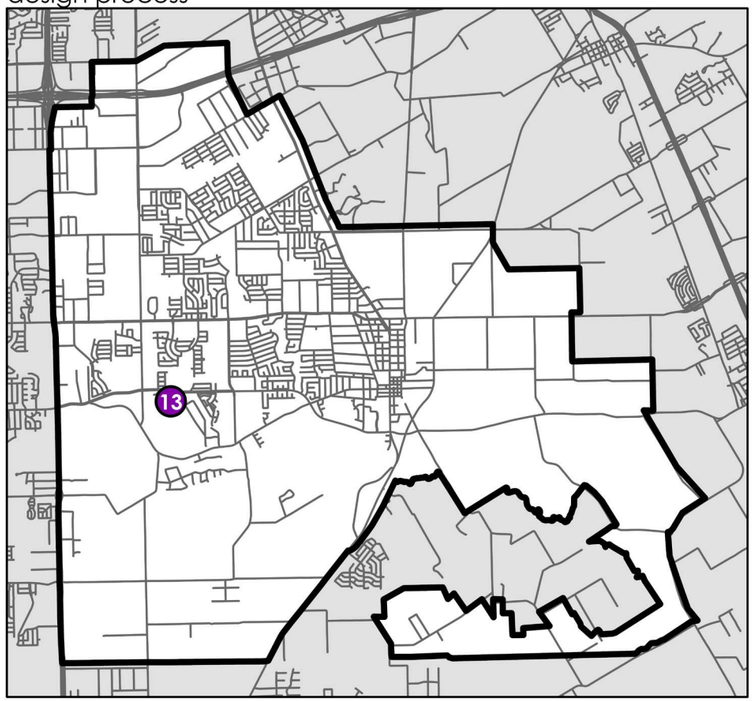
COUNCIL DISTRICT: 2

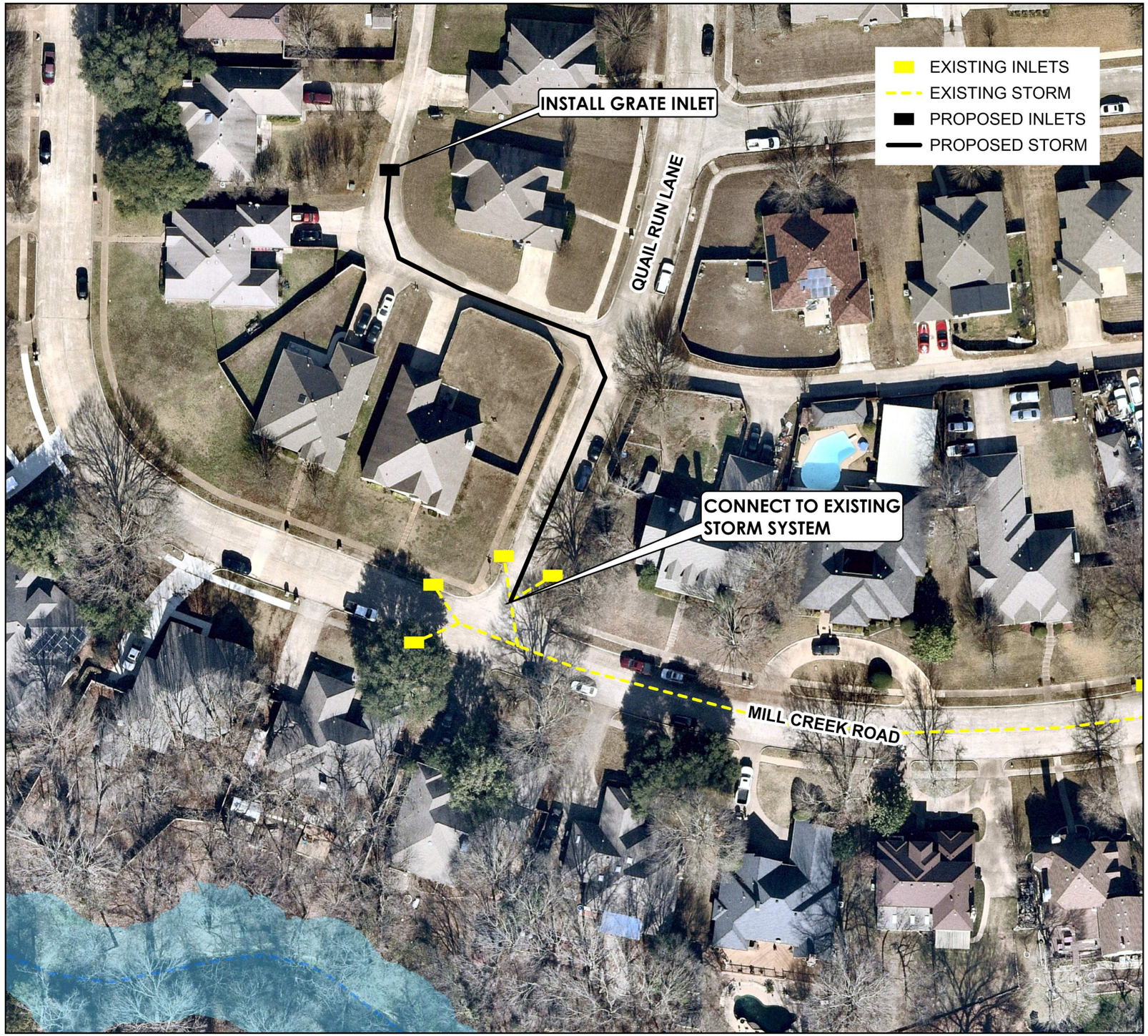
Project description

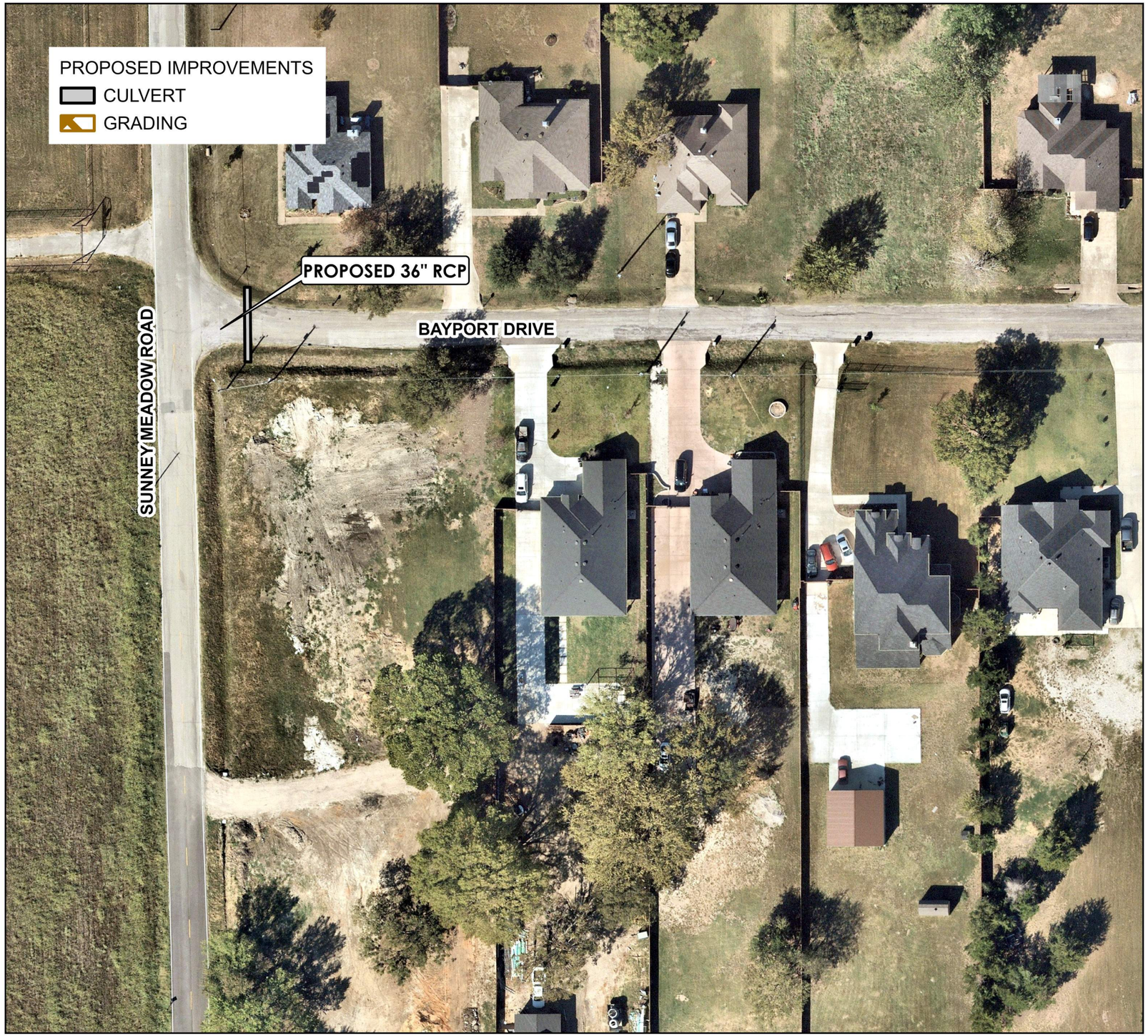
Existing alley behind 807 Mill Creek Road does not have a storm drainage system. Alley capacity is exceeded in a 2-year storm event.

Proposed improvements include extending the storm drainage system from the intersection of Mill Cree Road and Quail Run Lane to collect the runoff along the alley.

*further investigation of existing storm system capacity and required improvements will be necessary during the final design process







BAYPORT DRIVE DITCH IMPROVEMENTS

PRIORITY: 14

BUDGET: $240,000

WATERSHED: DEEP BRANCH

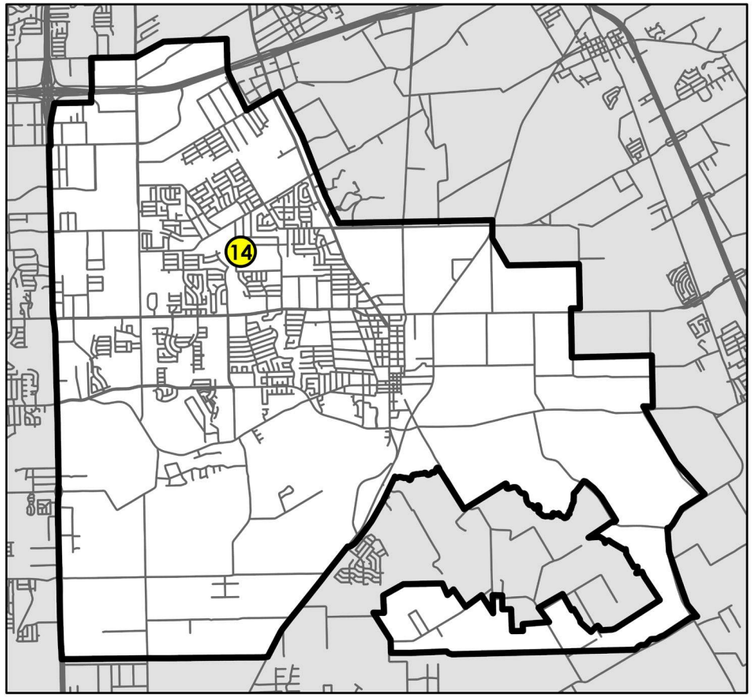
COUNCIL DISTRICT: 3

Project description

Existing roadside ditch on south side of Bayport drive is under capacity. Water overflows towards the houses located at 1102, 1106, and 1110 Bayport Drive.

Proposed improvements include ditch improvements along with necessary culvert improvements.

*further investigation of existing storm system capacity and required improvements will be necessary during the final design process



WINTERGREEN ROAD CULVERT IMPROVEMENTS

PRIORITY: 15

BUDGET: $540,000

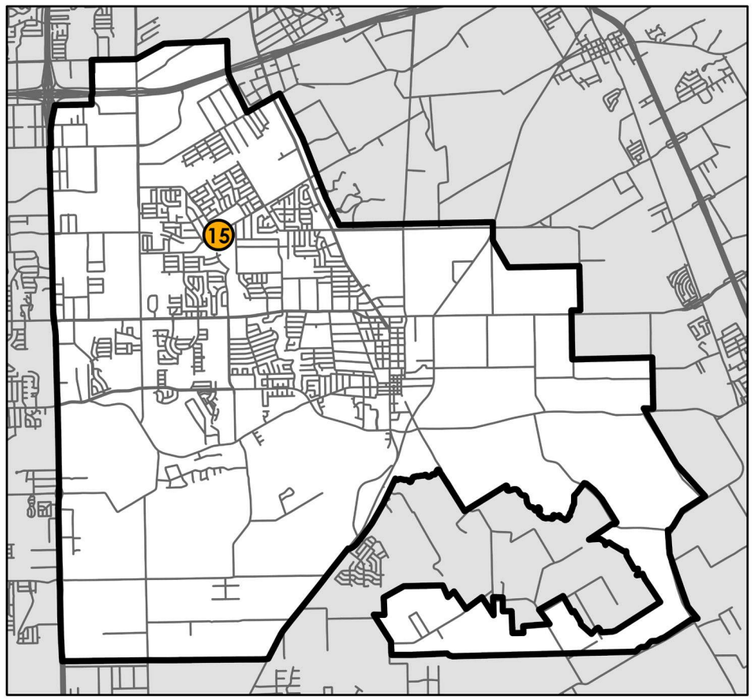
WATERSHED: DEEP BRANCH

COUNCIL DISTRICT: 4 & 6

Project description

Existing culvert under Wintergreen Road along Deep Branch is undersized and exceeds capacity during a 25-year storm event.

Proposed improvements include adding an additional 10'x7' RCB to the existing 2 - 10'x7' RCBs.





WINTERGREEN ROAD CULVERT IMPROVEMENTS

PRIORITY: 16

BUDGET: $730,000

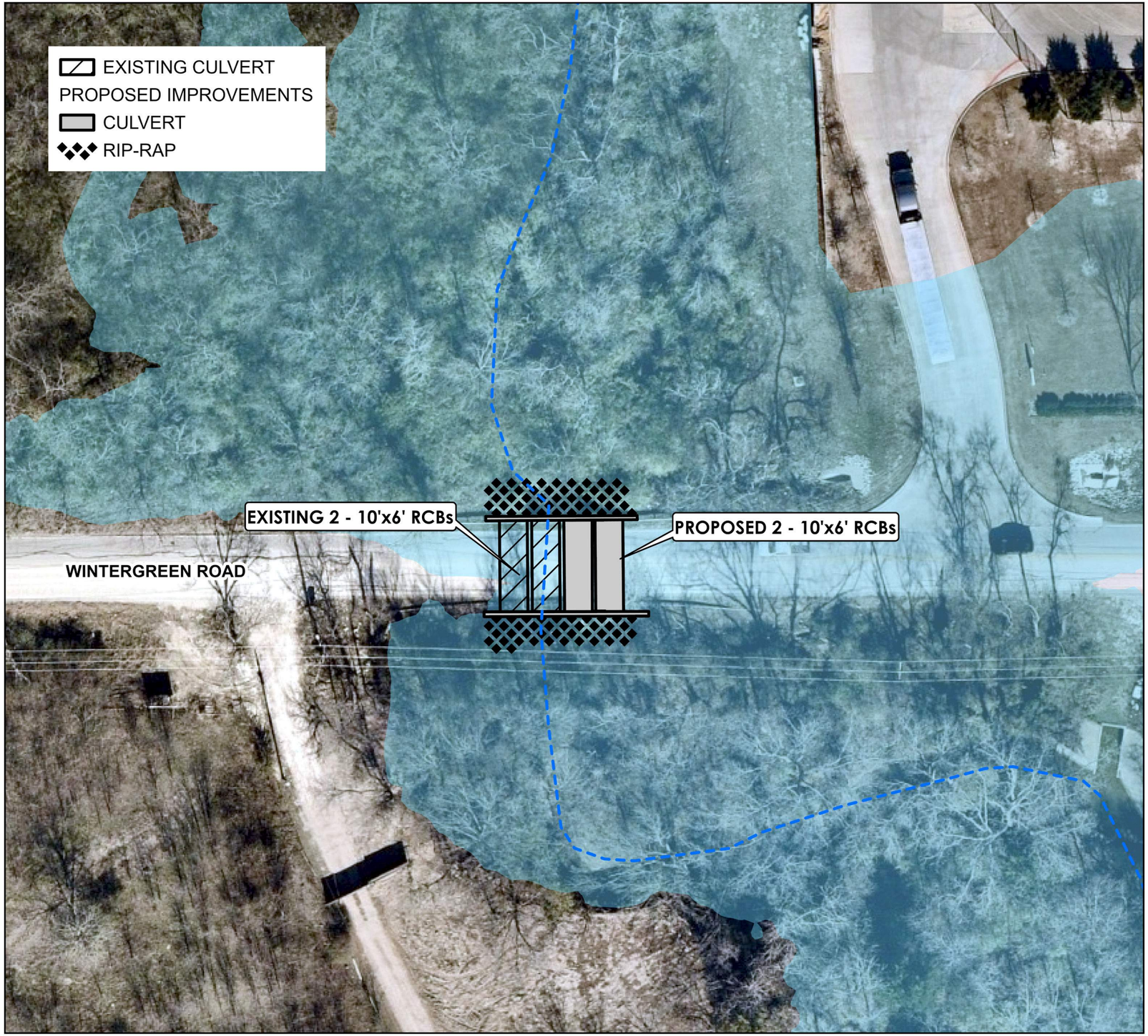
WATERSHED: MILL CREEK

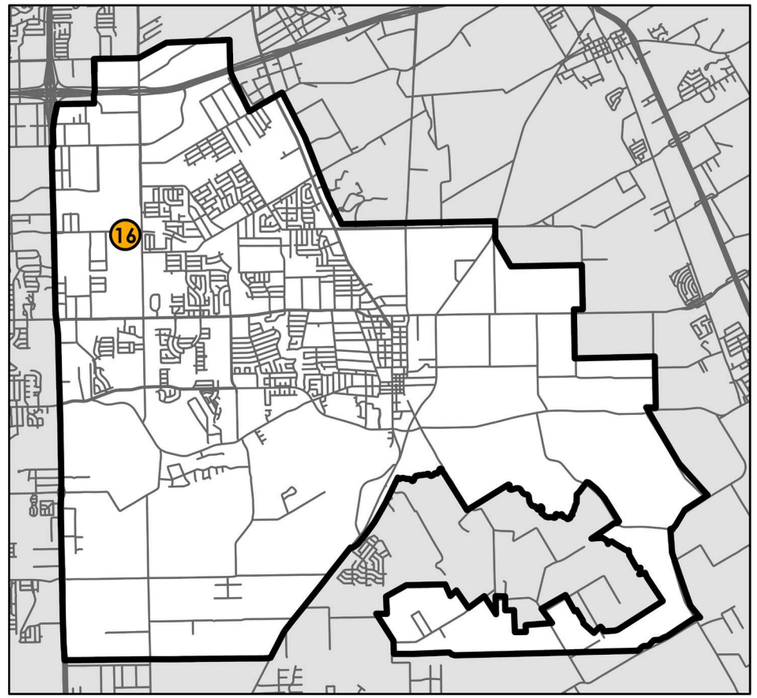
COUNCIL DISTRICT: 2

Project description

Existing roadside ditch on south side of Bayport drive is under capacity. Water overflows towards the houses located at 1102, 1106, and 1110 Bayport Drive.

Proposed improvements include ditch improvements along with necessary culvert improvements.





REA AVENUE CULVERT IMPROVEMENTS

PRIORITY: 17

BUDGET: $900,000

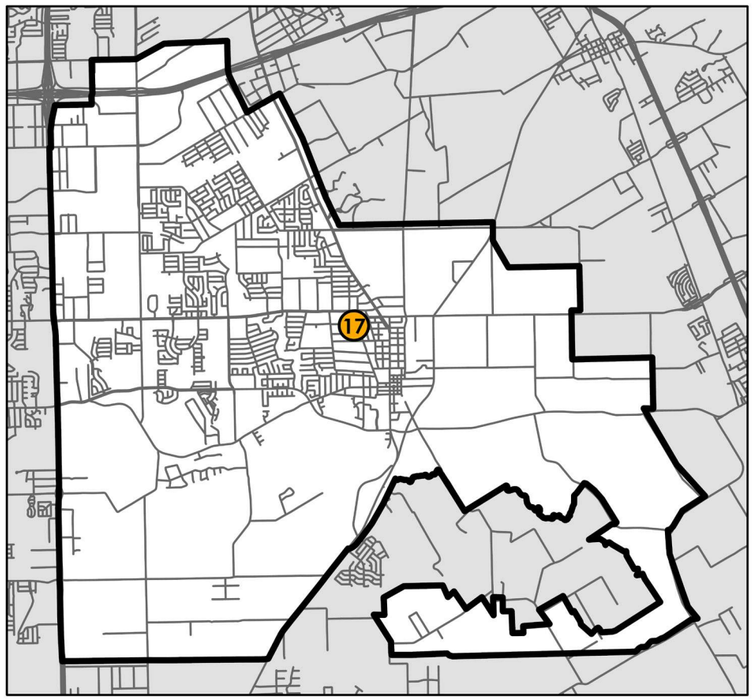
WATERSHED: HALLS BRANCH

COUNCIL DISTRICT: 1

Project description

Existing culvert under Rea Avenue along Halls Branch is undersized and exceeds capacity during a 2-year storm event.

Proposed improvements include adding additional 2-12'x6' RCBs to the existing 10'x5.2' RCB.





WEST 6TH STREET CULVERT IMPROVEMENTS

PRIORITY: 18

BUDGET: $900,000

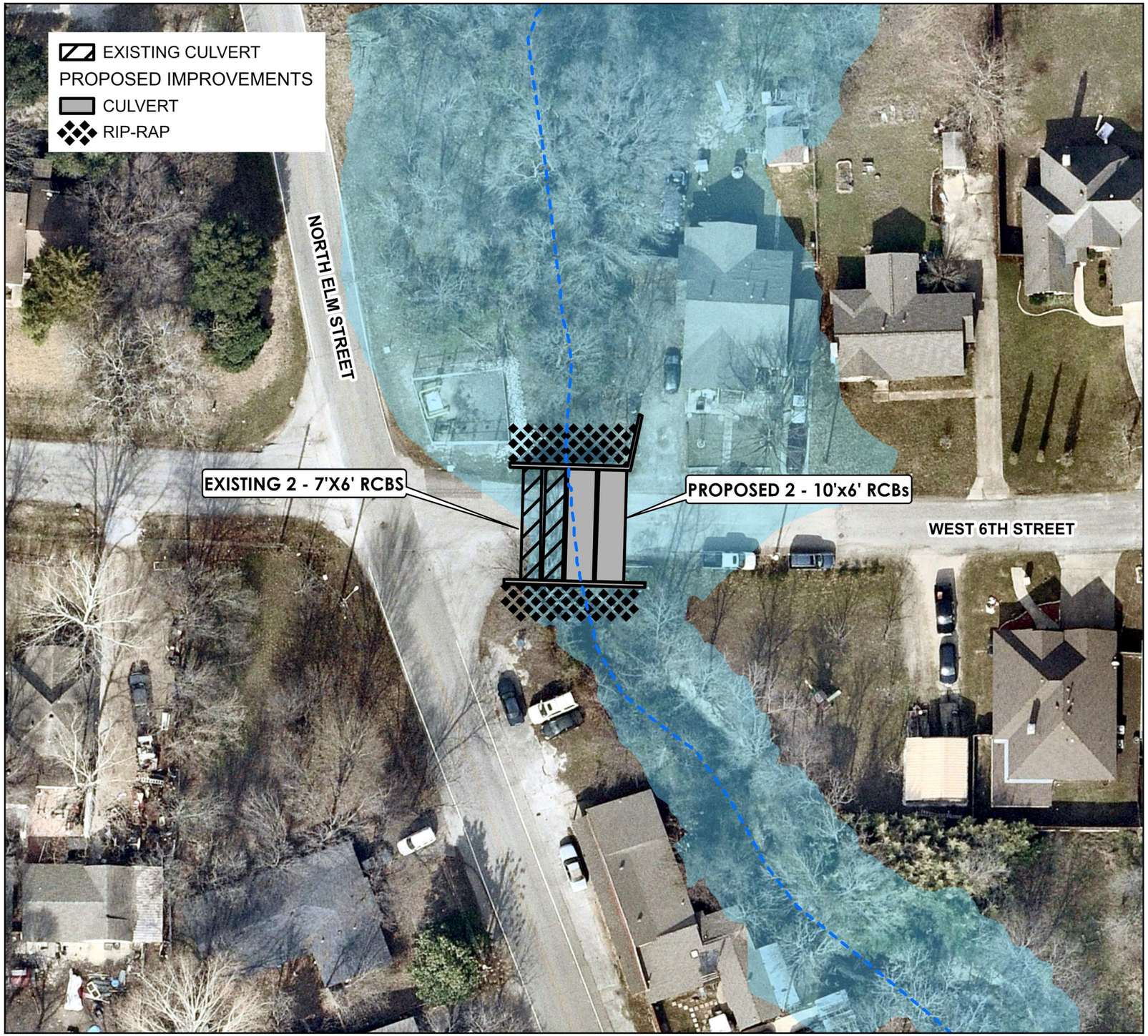
WATERSHED: HALLS BRANCH

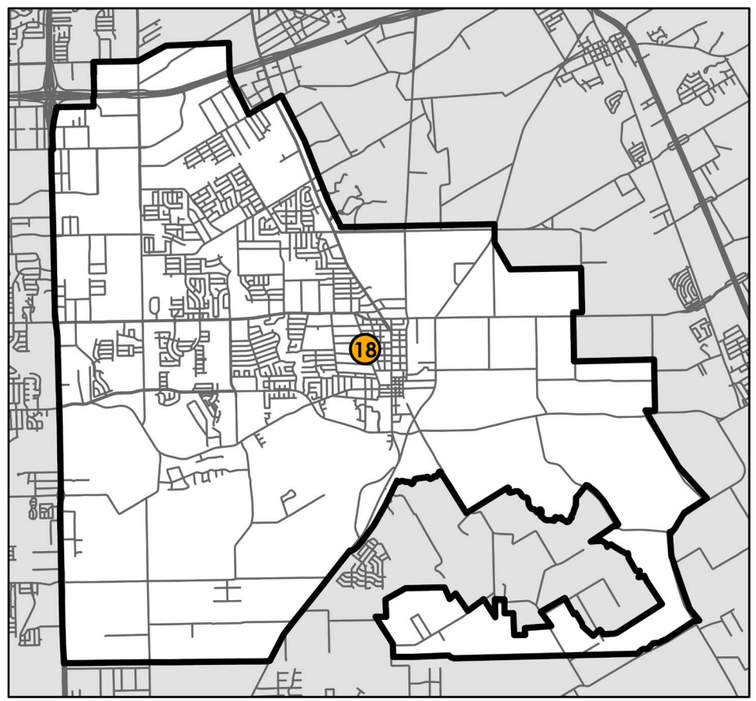
COUNCIL DISTRICT: 1

Project description

Existing culvert under West 6th Street along Halls Branch is undersized and exceeds capacity during a 2-year storm event.

Proposed improvements include adding additional 2-10'x6' RCBs to the existing 2 - 7'x6' RCBs.





EAST MAIN STREET EROSION MITIGATION

PRIORITY: 19

BUDGET: $1,460,000

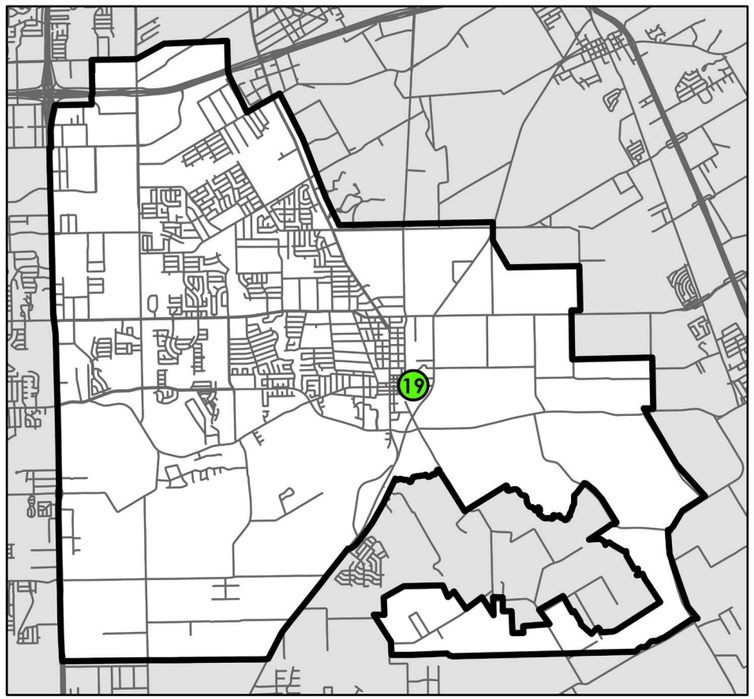
WATERSHED: KELLER BRANCH

COUNCIL DISTRICT: 1

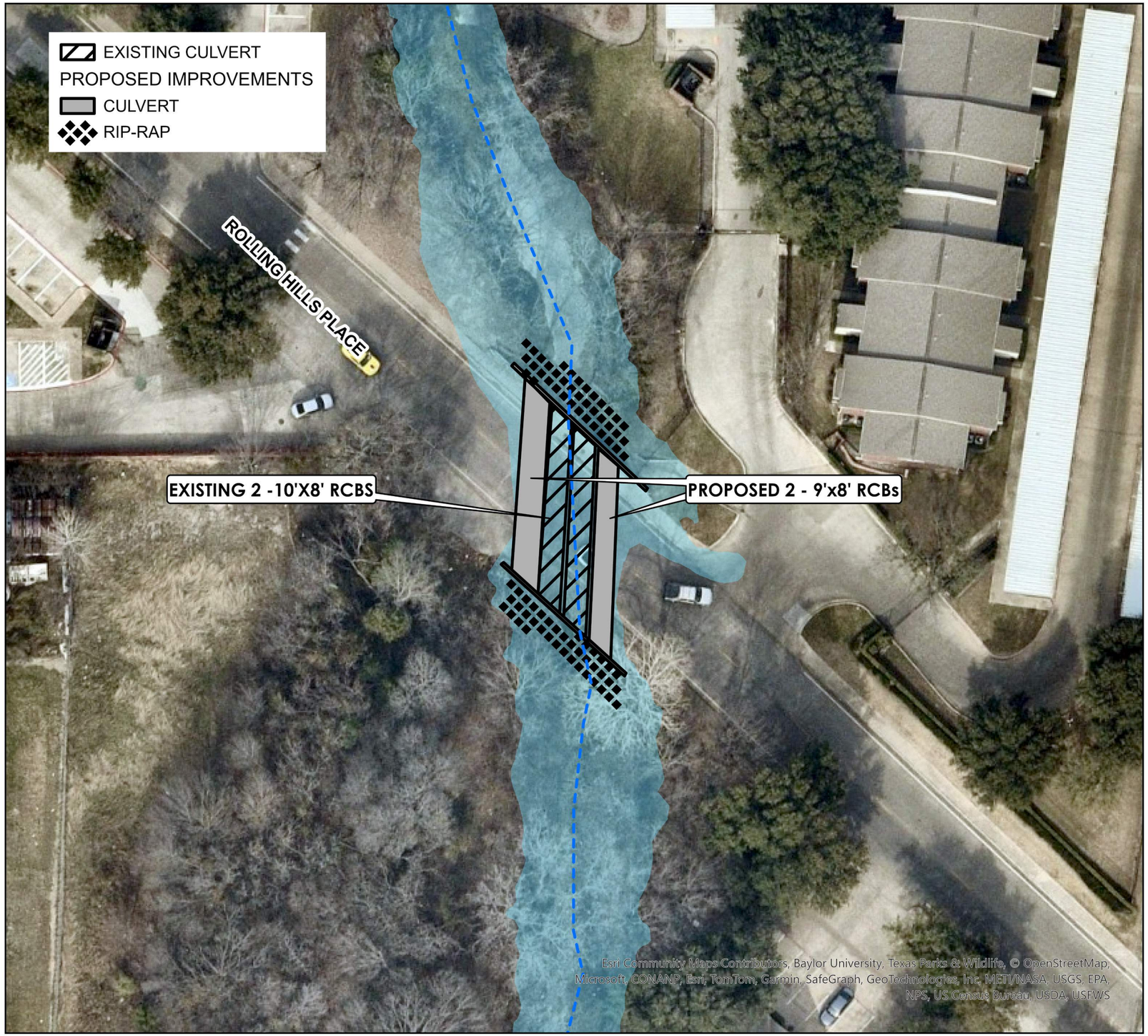
Project description

The City's Community Development Building and Animal Shelter located at 700 East Main Street are experiencing erosion and pavement failure along Keller Branch.

Proposed improvements include a 12-15 foot gabion wall along the eastern bank of Keller Branch. Also, pavement repair of failed areas with a toe wall to prevent future undermining.







ROLLING HILL PLACE CULVERT IMPROVEMENTS

PRIORITY: 20

BUDGET: 1,000,000

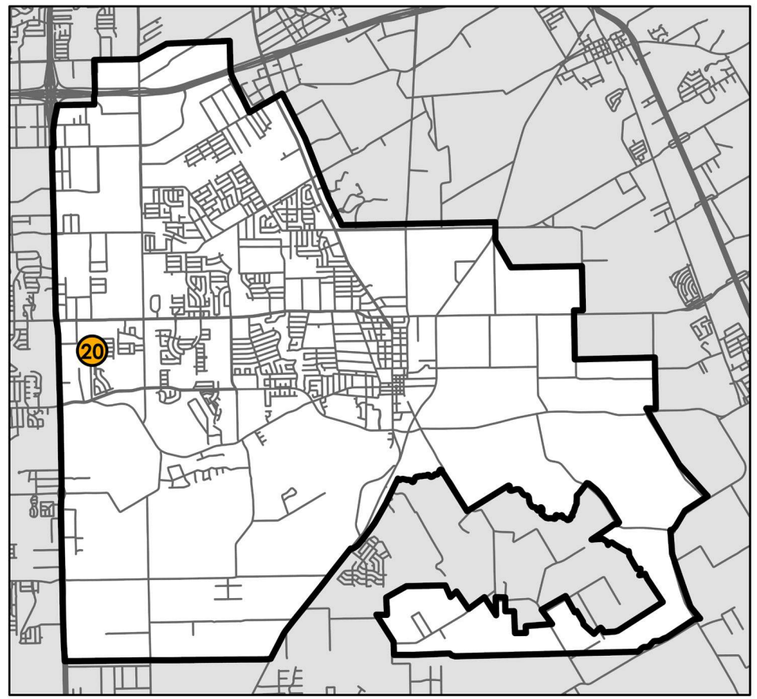
WATERSHED: TRIBUTARY 3A6

COUNCIL DISTRICT: 2

Project description

Existing culvert under Rolling Hills Place along Tributary 3A6 is undersized and exceeds capacity during a 10-year storm event.

Proposed improvements include adding additional 2-9'x8' RCBs to the existing 2 - 10'x8' RCBs.



Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 1: North Elm Street Culvert Improvements

Halls Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Downstream Channel Improvements				
Mobilization	LS	1	$ 60,000.00	$ 60,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Project Signs	EA	1	750.00	750.00
PP5-Xtreme Turf Reinforcement Erosion Control Matt	SY	2,500	70.00	175,000.00
Hydromulching and Seeding	SY	3,000	5.00	15,000.00
Utility Relocations	EA	1	10,000.00	10,000.00
Channel Excavation	CY	3,200	30.00	96,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			SUBTOTAL CHANNEL	
Culvert Improvements				
Mobilization	LS	1	$ 40,000.00	$ 40,000.00
Care of Water	LS	1	$ 10,000.00	$ 10,000.00
Traffic Control	MO	6	7,000.00	42,000.00
Temporary Erosion (SWPPP)	LS	1	5,000.00	5,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Existing Roadway Pavement	SY	200	25.00	5,000.00
8" Concrete Pavement	SY	200	130.00	26,000.00
Landscaping	SY	150	20.00	3,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
10'x6' Reinforced Concrete Box Culvert	LF	165	1,100.00	181,500.00
Trench Safety	LF	330	2.00	660.00
Headwall	EA	2	25,000.00	50,000.00
Rock Rip-rap	SY	300	200.00	60,000.00
			SUBTOTAL CULVERT	450,910.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 450,910.00
			CONTINGENCY (25%)	$ 112,727.50
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 564,000.00**
			DESIGN SERVICES (20%)	$ 113,000.00
			TOTAL PROJECT COST	**$ 680,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 2: Wintergreen Road Culvert Improvements

Newton Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 65,000.00	$ 65,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	4	7,000.00	28,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	1	3,500.00	3,500.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY	60	5.00	300.00
Remove Existing Roadway Pavement	SY	400	25.00	10,000.00
8" Concrete Pavement	SY	400	130.00	52,000.00
6" Concrete Curb and Gutter	LF	120	20.00	2,400.00
Landscaping	SY	300	20.00	6,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	250	30.00	7,500.00
5'x5' Reinforced Concrete Box Culvert	LF	100	850.00	85,000.00
Trench Safety	LF	100	2.00	200.00
Headwall	EA	2	15,000.00	30,000.00
Rock Rip-rap	SY	100	200.00	20,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 365,650.00
			CONTINGENCY (25%)	$ 91,412.50
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 457,000.00**
			DESIGN SERVICES (20%)	$ 91,000.00
			TOTAL PROJECT COST	**$ 550,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 3: Nokomis Road Bridge Improvements

Ten Mile Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 200,000.00	$ 200,000.00
Care of Water	LS	1	$ 20,000.00	$ 20,000.00
Traffic Control	MO	12	7,000.00	84,000.00
Temporary Erosion (SWPPP)	LS	1	20,000.00	20,000.00
Preparing ROW	STA	5	3,500.00	17,500.00
Project Signs	EA	2	750.00	1,500.00
Remove Concrete Sidewalk	SY	60	5.00	300.00
Remove Existing Roadway Pavement	SY	1,300	40.00	52,000.00
8" Concrete Pavement	SY	600	130.00	78,000.00
Landscaping	SY	300	20.00	6,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	10,000	30.00	300,000.00
Bridge	SF	14,000	150.00	2,100,000.00
Rock Rip-rap	SY	500	200.00	100,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 3,009,300.00
			CONTINGENCY (25%)	$ 752,325.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 3,762,000.00**
			DESIGN SERVICES (20%)	$ 752,000.00
			TOTAL PROJECT COST	**$ 4,510,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 4: North Houston School Road Mill Creek Culvert Improvements

Mill Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 100,000.00	$ 100,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	12	7,000.00	84,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY	100	5.00	500.00
Remove Existing Roadway Pavement	SY	700	25.00	17,500.00
Remove 6" Concrete Curb and Gutter	LF	500	10.00	5,000.00
4" Concrete Sidewalk	SY	100	48.00	4,800.00
8" Concrete Pavement	SY	700	130.00	91,000.00
6" Concrete Curb and Gutter	LF	500	20.00	10,000.00
Landscaping	SY	450	20.00	9,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	200	30.00	6,000.00
9'x9' Reinforced Concrete Box Culvert	LF	440	1,100.00	484,000.00
Trench Safety	LF	220	2.00	440.00
Headwall	EA	2	60,000.00	120,000.00
Rock Rip-rap	SY	300	200.00	60,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 1,054,990.00
			CONTINGENCY (25%)	$ 263,747.50
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,319,000.00**
			DESIGN SERVICES (20%)	$ 264,000.00
			TOTAL PROJECT COST	**$ 1,580,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 5: South Houston School Road Bridge Improvements

Ten Mile Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 200,000.00	$ 200,000.00
Care of Water	LS	1	$ 20,000.00	$ 20,000.00
Traffic Control	MO	12	7,000.00	84,000.00
Temporary Erosion (SWPPP)	LS	1	20,000.00	20,000.00
Preparing ROW	STA	5	3,500.00	17,500.00
Project Signs	EA	2	750.00	1,500.00
Remove Concrete Sidewalk	SY	60	5.00	300.00
Remove Existing Roadway Pavement	SY	1,300	40.00	52,000.00
8" Concrete Pavement	SY	600	130.00	78,000.00
Landscaping	SY	300	20.00	6,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	10,000	30.00	300,000.00
Bridge	SF	9,000	150.00	1,350,000.00
Rock Rip-rap	SY	500	200.00	100,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 2,259,300.00
			CONTINGENCY (25%)	$ 564,825.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,824,000.00**
			DESIGN SERVICES (20%)	$ 565,000.00
			TOTAL PROJECT COST	**$ 3,390,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 6: North Blue Grove Road Storm Improvements

Deep Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 60,000.00	$ 60,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	5	3,500.00	17,500.00
Project Signs	EA	2	750.00	1,500.00
Remove Existing Roadway Pavement	SY	800	25.00	20,000.00
Remove 6" Concrete Curb and Gutter	LF	240	10.00	2,400.00
8" Concrete Pavement	SY	800	130.00	104,000.00
6" Concrete Curb and Gutter	LF	240	20.00	4,800.00
Landscaping	SY	120	20.00	2,400.00
Utility Relocations	EA	4	10,000.00	40,000.00
18" Reinforced Concrete Pipe Class III	LF	250	$ 150.00	$ 37,500.00
48" Reinforced Concrete Pipe Class III	LF	325	350.00	113,750.00
60" Reinforced Concrete Pipe Class III	LF	300	450.00	135,000.00
20' Combination Inlet	EA	8	9,500.00	76,000.00
Trench Safety	LF	875	2.00	1,750.00
6' Junction Box	EA	2	6,000.00	12,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 694,600.00
			CONTINGENCY (25%)	$ 173,650.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 868,000.00**
			DESIGN SERVICES (20%)	$ 174,000.00
			TOTAL PROJECT COST	**$ 1,040,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 7: Bear Creek Road Culvert Improvements

Bear Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 75,000.00	$ 75,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	12	7,000.00	84,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	550	25.00	13,750.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
4" Concrete Sidewalk	SY		48.00	-
8" Concrete Pavement	SY	550	130.00	71,500.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	900	20.00	18,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	500	30.00	15,000.00
11'x10' Reinforced Concrete Box Culvert	LF	120	1,500.00	180,000.00
Trench Safety	LF	220	2.00	440.00
Headwall	EA	2	50,000.00	100,000.00
Rock Rip-rap	SY	400	200.00	80,000.00
Tree Removal	EA	20	1,000.00	20,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 710,440.00
			CONTINGENCY (25%)	$ 177,610.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 888,000.00**
			DESIGN SERVICES (20%)	$ 178,000.00
			TOTAL PROJECT COST	**$ 1,070,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 8: North Houston School Road Runyon Springs Branch Culvert Improvements

Runyon Springs Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 60,000.00	$ 60,000.00
Care of Water	LS	1	$ 10,000.00	$ 10,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	275	25.00	6,875.00
Remove 6" Concrete Curb and Gutter	LF	80	10.00	800.00
4" Concrete Sidewalk	SY		48.00	-
8" Concrete Pavement	SY	275	130.00	35,750.00
6" Concrete Curb and Gutter	LF	80	20.00	1,600.00
Landscaping	SY		20.00	-
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	50	30.00	1,500.00
6'x6' Reinforced Concrete Box Culvert	LF	120	650.00	78,000.00
Reinforced Concrete Aprol	SY	600	75.00	45,000.00
Trench Safety	LF	120	2.00	240.00
Headwall	EA	2	50,000.00	100,000.00
Rock Rip-rap	SY		200.00	-
Tree Removal	EA		1,000.00	-
			OPINION OF PROBABLE CONSTRUCTION COST	$ 433,515.00
			CONTINGENCY (25%)	$ 108,378.75
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 542,000.00**
			DESIGN SERVICES (20%)	$ 108,000.00
			TOTAL PROJECT COST	**$ 650,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 9 South Blue Grove Road Bridge Improvements

Ten Mile Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 100,000.00	$ 100,000.00
Care of Water	LS	1	$ 20,000.00	$ 20,000.00
Traffic Control	MO	12	7,000.00	84,000.00
Temporary Erosion (SWPPP)	LS	1	20,000.00	20,000.00
Preparing ROW	STA	5	3,500.00	17,500.00
Project Signs	EA	2	750.00	1,500.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	1,400	40.00	56,000.00
8" Concrete Pavement	SY	1,400	130.00	182,000.00
Landscaping	SY	1,100	20.00	22,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
PP5-Xtreme Turf Reinforcement Erosion Control Matt	SY	3,000	70.00	210,000.00
Hydromulching and Seeding	SY	3,000	5.00	15,000.00
Channel Excavation	CY	2,500	30.00	75,000.00
Bridge	SF		150.00	-
Rock Rip-rap	SY	500	200.00	100,000.00
Tree Removal	EA	20	1,000.00	20,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 943,000.00
			CONTINGENCY (25%)	$ 235,750.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,179,000.00**
			DESIGN SERVICES (20%)	$ 236,000.00
			TOTAL PROJECT COST	**$ 1,420,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 10: Country View Bridge & Erosion Improvements

Ten Mile Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Bridge Improvements				
Mobilization	LS	1	$ 40,000.00	$ 40,000.00
Care of Water	LS	1	$ 20,000.00	$ 20,000.00
Temporary Erosion (SWPPP)	LS	1	5,000.00	5,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Existing Bridge	EA	1	25,000.00	25,000.00
Remove Existing Cart Path	SY	100	40.00	4,000.00
6" Concrete Pavement	SY	100	100.00	10,000.00
Landscaping	SY	200	20.00	4,000.00
Grading	CY	500	30.00	15,000.00
PP5-Xtreme Turf Reinforcement Erosion Control Matt	SY	600	70.00	42,000.00
Hydromulching and Seeding	SY	600	5.00	3,000.00
Bridge	SF	800	125.00	100,000.00
Bridge Abutment	EA	2	35,000.00	70,000.00
Rock Rip-rap	SY	75	200.00	15,000.00
Tree Removal	EA	3	1,000.00	3,000.00
		SUBTOTAL BRIDGE		363,750.00
Erosion Improvements				
Mobilization	LS	1	$ 15,000.00	$ 15,000.00
Care of Water	LS	1	$ 5,000.00	$ 5,000.00
Temporary Erosion (SWPPP)	LS	1	5,000.00	5,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Landscaping	SY	400	20.00	8,000.00
36" Reinforced Concrete Pipe Class III	LF	60	240.00	14,400.00
Headwall	EA	1	10,000.00	10,000.00
Grading	CY	700	30.00	21,000.00
		SUBTOTAL EROSION		$ 86,150.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 449,900.00
			CONTINGENCY (25%)	$ 112,475.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 562,000.00**
			DESIGN SERVICES (20%)	$ 112,000.00
			TOTAL PROJECT COST	**$ 670,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 11:Willowbrook Street Storm Improvements

Deep Branch

PK No.: 4689-20.356

Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 100,000.00	$ 100,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	5	3,500.00	17,500.00
Project Signs	EA	2	750.00	1,500.00
Remove Existing Roadway Pavement	SY	1,550	25.00	38,750.00
Remove 6" Concrete Curb and Gutter	LF	240	10.00	2,400.00
8" Concrete Pavement	SY	1,550	130.00	201,500.00
6" Concrete Curb and Gutter	LF	240	20.00	4,800.00
Landscaping	SY	500	20.00	10,000.00
Utility Relocations	EA	4	10,000.00	40,000.00
18" Reinforced Concrete Pipe Class III	LF	120	$ 150.00	$ 18,000.00
36" Reinforced Concrete Pipe Class III	LF	700	240.00	168,000.00
42" Reinforced Concrete Pipe Class III	LF	1,050	300.00	315,000.00
20' Combination Inlet	EA	8	9,500.00	76,000.00
Trench Safety	LF	1,800	2.00	3,600.00
6' Junction Box	EA	3	6,000.00	18,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 1,081,050.00
			CONTINGENCY (25%)	$ 270,262.50
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,351,000.00**
			DESIGN SERVICES (20%)	$ 270,000.00
			TOTAL PROJECT COST	**$ 1,620,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 12: Willowbrook Alley Storm Improvements

Deep Branch

PK No.: 4689-20.356

Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 40,000.00	$ 40,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	7	3,500.00	24,500.00
Project Signs	EA	2	750.00	1,500.00
Remove Existing Roadway Pavement	SY	625	25.00	15,625.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
8" Concrete Pavement	SY	625	130.00	81,250.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
18" Reinforced Concrete Pipe Class III	LF	350	$ 150.00	$ 52,500.00
24" Reinforced Concrete Pipe Class III	LF	350	175.00	61,250.00
42" Reinforced Concrete Pipe Class III	LF		300.00	-
Grate Inlet	EA	3	6,000.00	18,000.00
Trench Safety	LF	700	2.00	1,400.00
6' Junction Box	EA	1	6,000.00	6,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 393,025.00
			CONTINGENCY (25%)	$ 98,256.25
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 491,000.00**
			DESIGN SERVICES (20%)	$ 98,000.00
			TOTAL PROJECT COST	**$ 590,000.00**

Lancaster

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 13: Mill Creek Alley Storm Improvements

Mill Creek

PK No.: 4689-20.356

Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 40,000.00	$ 40,000.00
Traffic Control	MO	4	7,000.00	28,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	3	3,500.00	10,500.00
Project Signs	EA	1	750.00	750.00
Remove Existing Roadway Pavement	SY	300	25.00	7,500.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
8" Concrete Pavement	SY	300	130.00	39,000.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	1	10,000.00	10,000.00
18" Reinforced Concrete Pipe Class III	LF	325	$ 150.00	$ 48,750.00
24" Reinforced Concrete Pipe Class III	LF		175.00	-
42" Reinforced Concrete Pipe Class III	LF		300.00	-
Grate Inlet	EA	1	6,000.00	6,000.00
Trench Safety	LF	325	2.00	650.00
6' Junction Box	EA	1	6,000.00	6,000.00
OPINION OF PROBABLE CONSTRUCTION COST				$ 212,150.00
CONTINGENCY (25%)				$ 53,037.50
TOTAL OPINION OF PROBABLE CONSTRUCTION COST				**$ 265,000.00**
DESIGN SERVICES (20%)				$ 53,000.00
TOTAL PROJECT COST				**$ 320,000.00**

Lancaster

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 14: Bayport Drive Culvert Improvements

Deep Branch

PK No.: 4689-20.356

Date: 7/15/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 30,000.00	$ 30,000.00
Care of Water	LS	1	$ 10,000.00	$ 10,000.00
Traffic Control	MO	4	7,000.00	28,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Existing Roadway Pavement	SY	60	25.00	1,500.00
8" Concrete Pavement	SY	150	130.00	19,500.00
Landscaping	SY	500	20.00	10,000.00
Protect Utility Poles	EA	2	1,500.00	3,000.00
Channel Excavation (assumed 2 CY/FT)	CY	50	30.00	1,500.00
36" Reinforced Concrete Pipe	LF	60	240.00	14,400.00
Headwall	EA	2	5,000.00	10,000.00
Trench Safety	LF	60	2.00	120.00
Rock Rip-rap	SY	30	200.00	6,000.00
Tree Removal	EA	0	1,000.00	-
OPINION OF PROBABLE CONSTRUCTION COST				$ 151,770.00
CONTINGENCY (25%)				$ 37,942.50
TOTAL OPINION OF PROBABLE CONSTRUCTION COST				**$ 190,000.00**
DESIGN SERVICES (20%)				$ 38,000.00
TOTAL PROJECT COST				**$ 230,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 15: Wintergreen Road Culvert Improvements

Deep Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 50,000.00	$ 50,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	250	25.00	6,250.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
4" Concrete Sidewalk	SY		48.00	-
8" Concrete Pavement	SY	250	130.00	32,500.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	200	30.00	6,000.00
10'x7' Reinforced Concrete Box Culvert	LF	40	1,200.00	48,000.00
Trench Safety	LF	40	2.00	80.00
Headwall	EA	2	40,000.00	80,000.00
Rock Rip-rap	SY	100	200.00	20,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 366,580.00
			CONTINGENCY (25%)	$ 91,645.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 458,000.00**
			DESIGN SERVICES (20%)	$ 92,000.00
			TOTAL PROJECT COST	**$ 550,000.00**

Lancaster

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 16: Wintergreen Road Culvert Improvements

Mill Creek

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 50,000.00	$ 50,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	250	25.00	6,250.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
4" Concrete Sidewalk	SY		48.00	-
8" Concrete Pavement	SY	250	130.00	32,500.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	200	30.00	6,000.00
10'x6' Reinforced Concrete Box Culvert	LF	40	1,100.00	44,000.00
Trench Safety	LF	40	2.00	80.00
Headwall	EA	2	40,000.00	80,000.00
Rock Rip-rap	SY	125	200.00	25,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 367,580.00
			CONTINGENCY (25%)	$ 91,895.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 459,000.00**
			DESIGN SERVICES (20%)	$ 92,000.00
			TOTAL PROJECT COST	**$ 550,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 17: Rea Avenue Culvert Improvements

Halls Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 50,000.00	$ 50,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	250	25.00	6,250.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
4" Concrete Sidewalk	SY		48.00	-
8" Concrete Pavement	SY	250	130.00	32,500.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	400	30.00	12,000.00
12'x6' Reinforced Concrete Box Culvert	LF	80	1,300.00	104,000.00
Trench Safety	LF	80	2.00	160.00
Headwall	EA	2	50,000.00	100,000.00
Rock Rip-rap	SY	150	200.00	30,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 458,660.00
			CONTINGENCY (25%)	$ 114,665.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 573,000.00**
			DESIGN SERVICES (20%)	$ 115,000.00
			TOTAL PROJECT COST	**$ 690,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 18: West 6th Street Culvert Improvements

Halls Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 60,000.00	$ 60,000.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	8	7,000.00	56,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY		5.00	-
Remove Existing Roadway Pavement	SY	250	25.00	6,250.00
Remove 6" Concrete Curb and Gutter	LF		10.00	-
4" Concrete Sidewalk	SY		48.00	-
8" Concrete Pavement	SY	250	130.00	32,500.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	400	30.00	12,000.00
10'x6' Reinforced Concrete Box Culvert	LF	90	1,100.00	99,000.00
Trench Safety	LF	90	2.00	180.00
Headwall	EA	2	50,000.00	100,000.00
Rock Rip-rap	SY	200	200.00	40,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 473,680.00
			CONTINGENCY (25%)	$ 118,420.00
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 592,000.00**
			DESIGN SERVICES (20%)	$ 118,000.00
			TOTAL PROJECT COST	**$ 710,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 19: 700 East Main Street Erosion Mitigation

Keller Branch

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 8,500.00	$ 8,500.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Temporary Erosion (SWPPP)	LS	1	$ 10,000.00	$ 10,000.00
Preparing ROW	STA	7	$ 3,500.00	$ 24,500.00
Project Signs	EA	1	$ 750.00	$ 750.00
Remove Existing Roadway Pavement	SY	850	$ 25.00	$ 21,250.00
Gabion Channel Bank Tied-Back Retaining Wall	CY	850	$ 350.00	$ 297,500.00
Reinforced Concrete Gabion Tie-Back Beam	CY	85	$ 650.00	$ 55,250.00
Gabion Rock Anchor	LF	2,500	$ 90.00	$ 225,000.00
8" Concrete Pavement	SY	850	$ 130.00	$ 110,500.00
Concrete Toe Wall	CY	25	$ 600.00	$ 15,000.00
Landscaping	SY	2,000	$ 20.00	$ 40,000.00
Utility Relocations	EA		$ 10,000.00	$ -
Channel Excavation	CY	600	$ 30.00	$ 18,000.00
Trench Safety	LF		$ 2.00	$ -
Headwall	EA		$ 50,000.00	$ -
Rock Rip-rap	SY	550	$ 200.00	$ 110,000.00
Tree Removal	EA	20	$ 1,000.00	$ 20,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 971,250.00
			CONTINGENCY (25%)	$ 242,812.50
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,214,000.00**
			DESIGN SERVICES (20%)	$ 243,000.00
			TOTAL PROJECT COST	**$ 1,460,000.00**

Westwood

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Project 20: Rolling Hill Place Culvert Improvements

Tributary 3A6

PK No.: 4689-20.356
Date: 4/12/2024

Item Description	Unit	Estimated Quantity	Unit Cost	Total Cost
Mobilization	LS	1	$ 8,500.00	$ 8,500.00
Care of Water	LS	1	$ 15,000.00	$ 15,000.00
Traffic Control	MO	10	7,000.00	70,000.00
Temporary Erosion (SWPPP)	LS	1	10,000.00	10,000.00
Preparing ROW	STA	2	3,500.00	7,000.00
Project Signs	EA	1	750.00	750.00
Remove Concrete Sidewalk	SY	125	5.00	625.00
Remove Existing Roadway Pavement	SY	400	25.00	10,000.00
Remove 6" Concrete Curb and Gutter	LF	200	10.00	2,000.00
4" Concrete Sidewalk	SY	125	48.00	6,000.00
8" Concrete Pavement	SY	400	130.00	52,000.00
6" Concrete Curb and Gutter	LF		20.00	-
Landscaping	SY	250	20.00	5,000.00
Utility Relocations	EA	2	10,000.00	20,000.00
Channel Excavation	CY	400	30.00	12,000.00
10'x8' Reinforced Concrete Box Culvert	LF	150	1,300.00	195,000.00
Trench Safety	LF	300	2.00	600.00
Headwall	EA	2	50,000.00	100,000.00
Rock Rip-rap	SY	200	200.00	40,000.00
Tree Removal	EA	10	1,000.00	10,000.00
			OPINION OF PROBABLE CONSTRUCTION COST	$ 564,475.00
			CONTINGENCY (25%)	$ 141,118.75
			TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 706,000.00**
			DESIGN SERVICES (20%)	$ 141,000.00
			TOTAL PROJECT COST	**$ 850,000.00**

BARNEY BRANCH

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

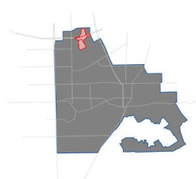
TOTAL DRAINAGE AREA

0.42 SM

*

STREAM LENGTH

0.19 MI



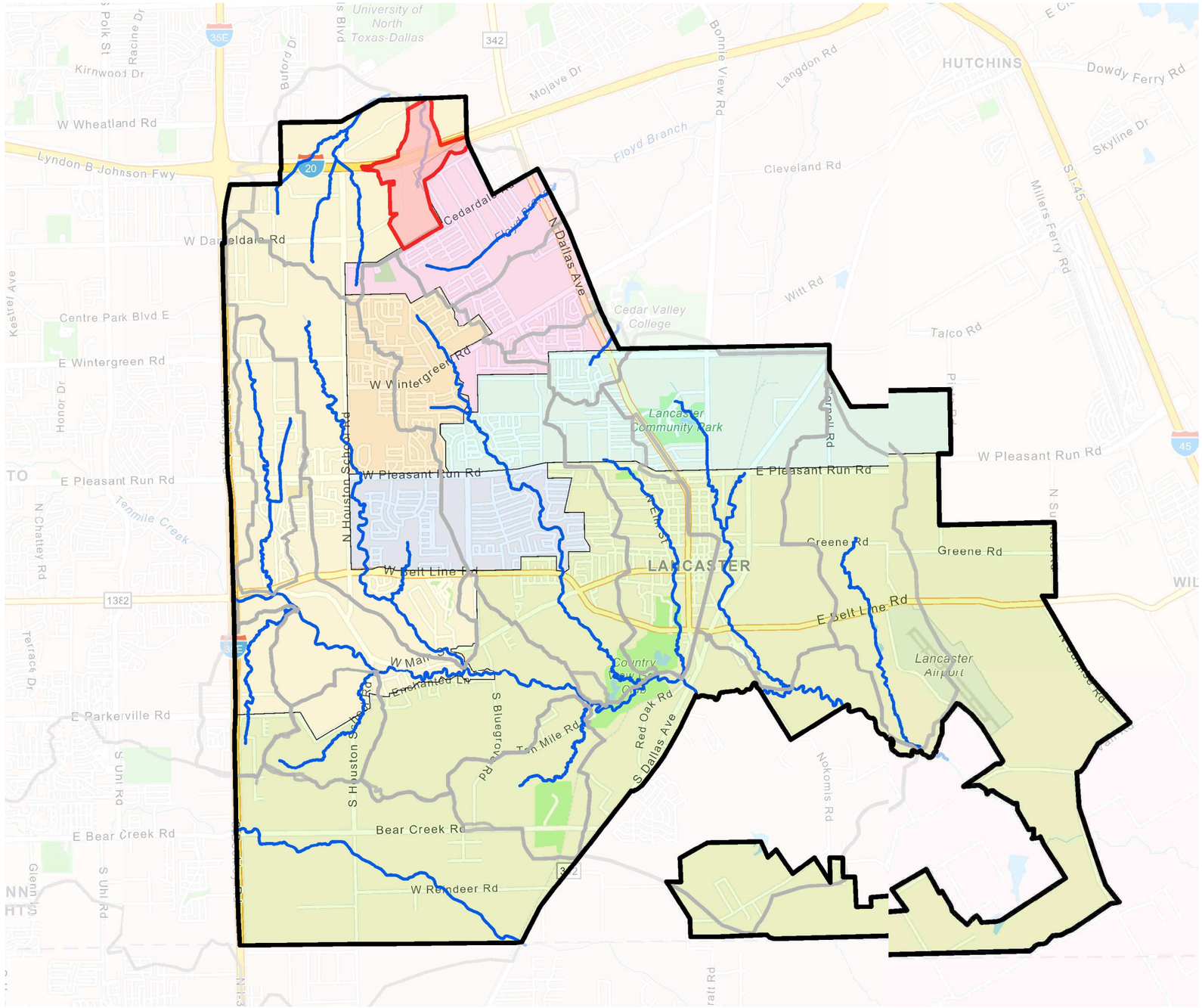
- BARNEY
- STREAM CENTERLINE

COUNCIL DISTRICT

- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

BARNEY BRANCH WATERSHED

Situated in the north-central part of Lancaster, east of North Houston School Road, Barney Branch encompasses 0.40 square miles at the City's edge. Starting near the Prologis Park Development detention pond, it extends north of Interstate 20 for about a mile. Primarily, it consists of vegetated landscapes and commercial spaces.



WATERSHED NO. 1

BARNEY BRANCH

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WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

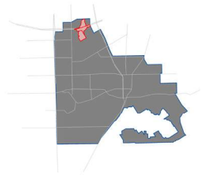
TOTAL DRAINAGE AREA

0.42 SM

*

STREAM LENGTH

0.19 MI



1.1 DRAINAGE AREA MAP

The drainage area divides for the watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into three (3) sub-basins. Sub-basins are designated BB1 through BB3. The total watershed drainage area is 267.0 acres (0.42 square-miles). Almost the entire drainage area is within the Lancaster City Limits. Figure 2, shown below, provides an overview of the drainage sub-basin layout for Barney Branch with in the City of Lancaster.

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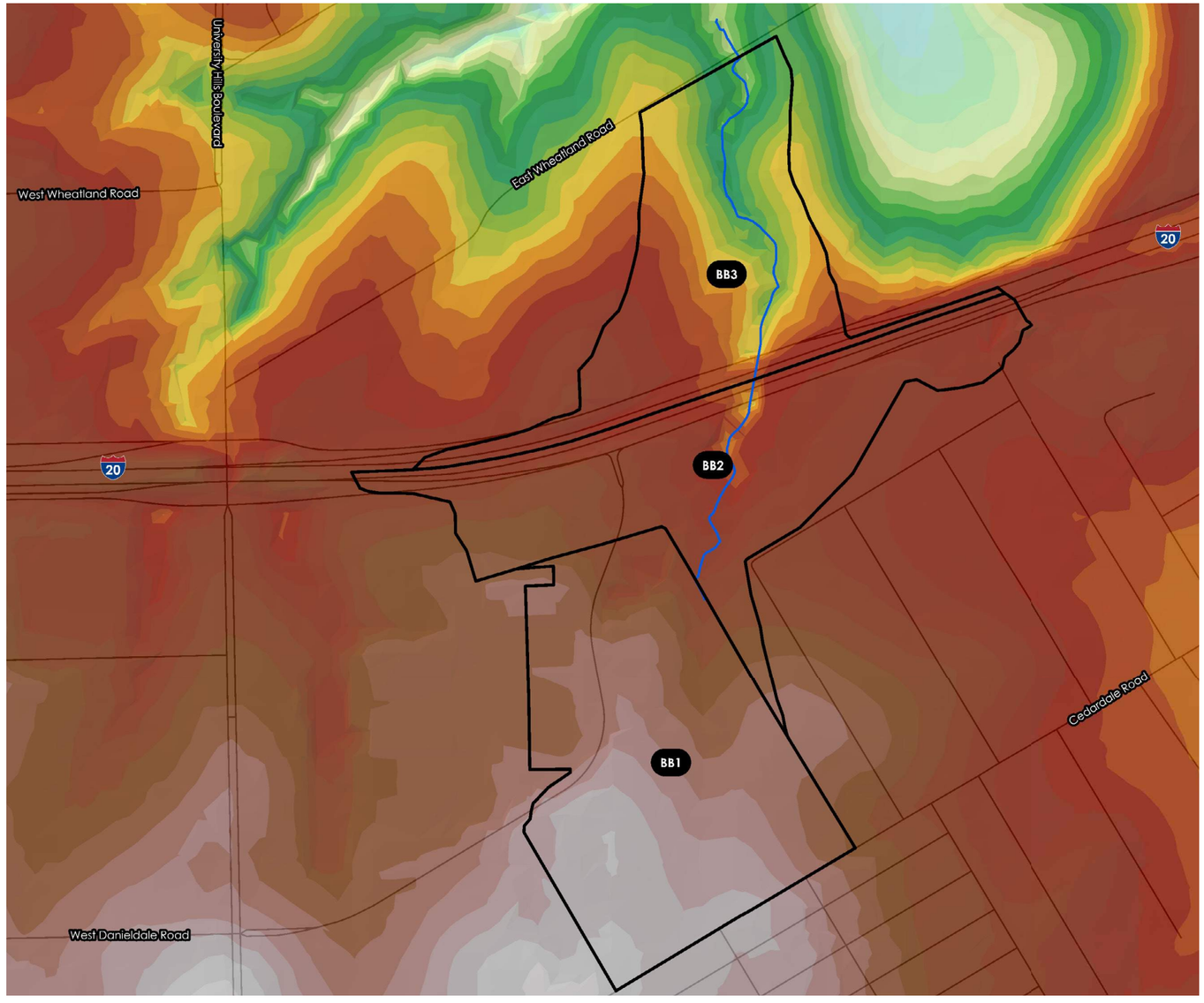


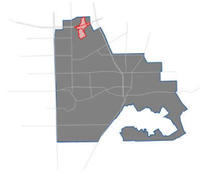
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
BB1	0.1672	84	78.1	79.3	32.8	19.68	27.05	16.23
BB2	0.1324	84	19.3	60.6	32.95	19.77	27.40	16.44
BB3	0.1176	82.2	11.8	69.2	36.13	21.68	28.61	17.16

WATERSHED NO.
1

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
0.42 SM
*
STREAM LENGTH
0.19 MI



1.2 TIME OF CONCENTRATION

The Times of Concentration for Barney Branch were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Barney Branch is thick with vegetation. South of Interstate 20, the stream runs from a detention pond outfall adjacent to an industrial warehouse. Sub-basin BB3 is relatively undeveloped, resulting in a longer Time of Concentration. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

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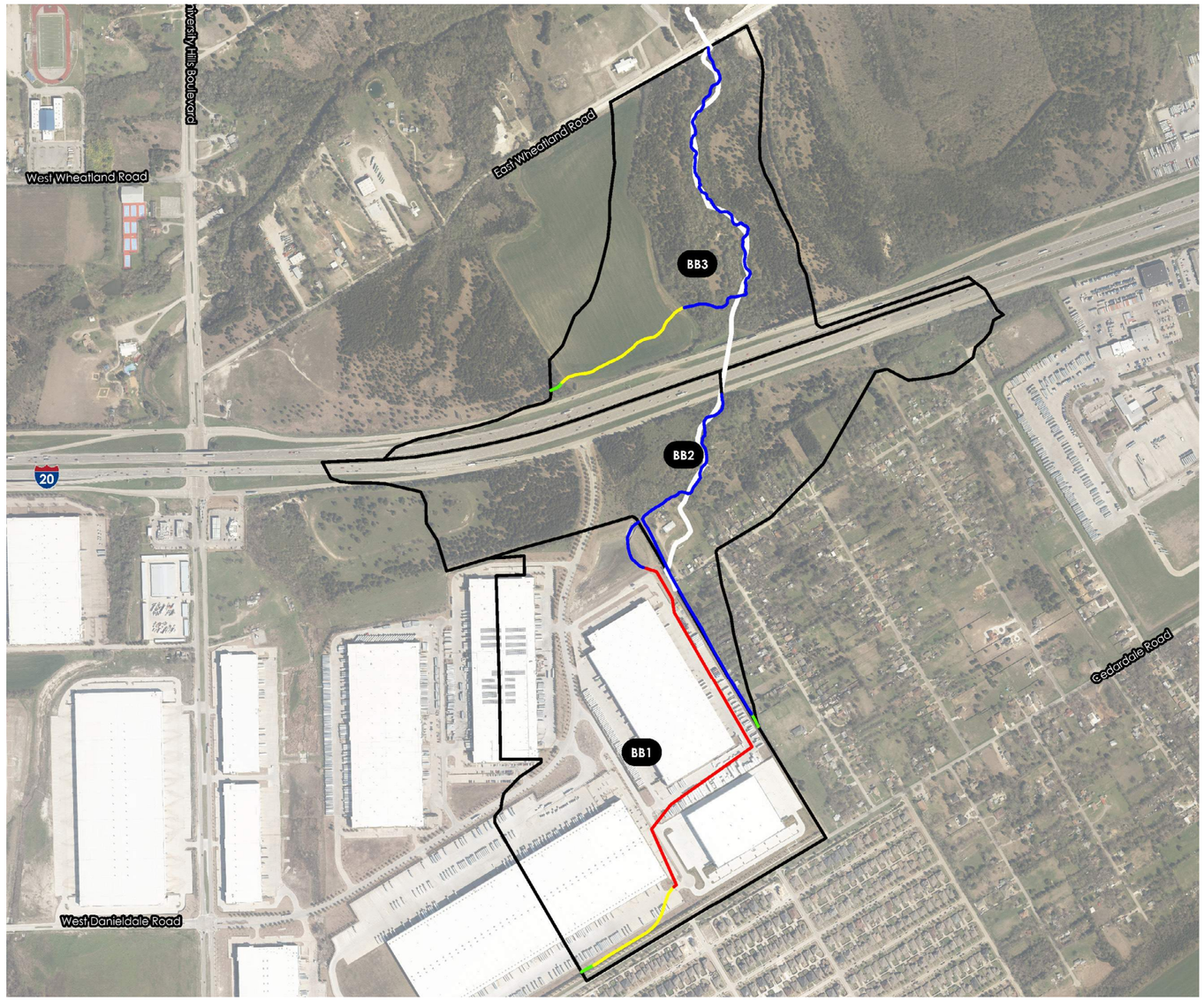


TIME OF CONCENTRATION REPORT

BB1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVER LAND	GRS-DENSE	100	1.48	0.24	0	0.1	14.4
SHALLOW	PAVED	241	0.5	0	20.3	1.4	2.8
SHALLOW	UNPAVED	583	1.06	0	16.1	1.7	5.86
PIPE	18" RCP	454	0.68	0.014	55.2	4.6	1.66
PIPE	24" RCP	923	0.8	0.014	66.87	6	2.57
PIPE	27" RCP	1518	0.71	0.014	72.33	6.1	4.15
CHANNEL	NATRL TRAP (B=10, Y=6, SS=3:1)	397	0.5	0.05	69.56	4.8	1.36
		4,216					**32.81**
							27.05

BB2

OVERLAND	GRS-DENSE	100	0.5	0.24	0	0.1	22.22
CHANNEL	NATRL TRAP (B=0, Y=2, SS=3:1)	1585	1.61	0.05	28.69	3.6	7.26
CHANNEL	NATRL TRAP (B=6, Y=4, SS=3:1)	1235	2.26	0.05	51.79	7.8	2.64
BOX	10X5 RCB	166	0.05	0.014	149.21	3.3	0.83
		3,086					**19.77**
							27.40

BB3

OVERLAND	GRS-DENSE	100	0.5	0.24	0	0.1	22.22
SHALLOW	UNPAVED	1046	1.87	0	16.1	2.2	7.92
CHANNEL	NATRL TRAP (B=6, Y=4, SS=3:1)	2657	2.03	0.05	51.79	7.4	6
		3,803					**36.14**
							28.61

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

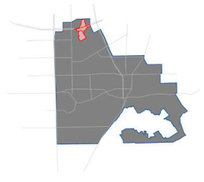
TOTAL DRAINAGE AREA

0.42 SM

*

STREAM LENGTH

0.19 MI



1.3 SOILS MAP

Barney Branch watershed has two different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type B, which is more permeable than soil type D is found within sub-basins BB-3. Hydrologic soil groups A and C are not present in the Barney Branch watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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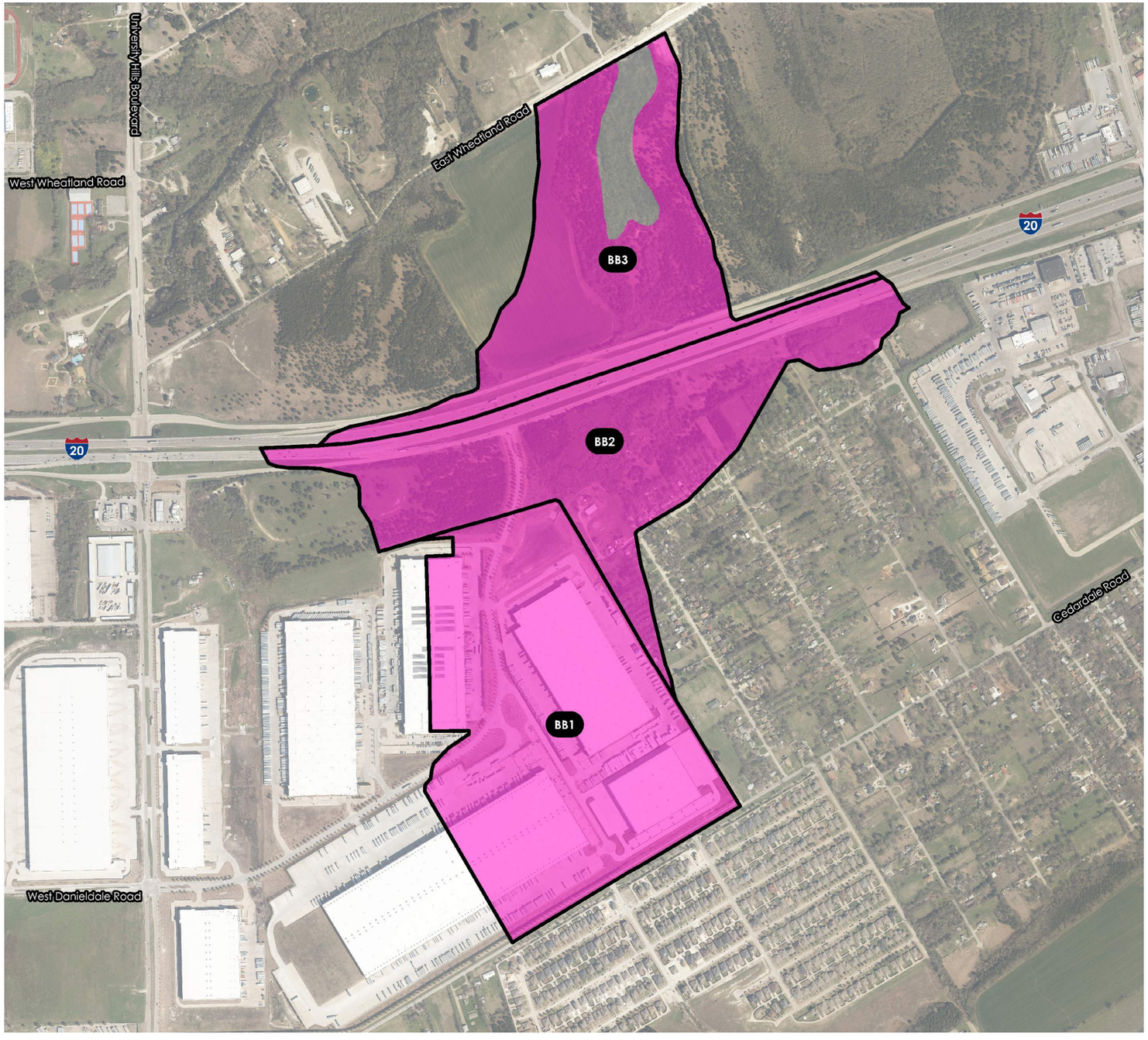


PERVIOUS CURVE NUMBER REPORT

BB1			
SOIL TYPE	**CURVE NUMBER**	**SHAPE AREA (ACRES)**	**AREA WEIGHTED CN**
D	84	107.0	84.0
		107.0	**84.0**

BB2			
D	84	84.7	84.0
		84.7	**84.0**

BB3			
B	69	9.2	8.5
D	84	66.0	73.7
		75.2	**82.2**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

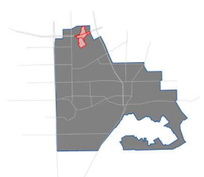
TOTAL DRAINAGE AREA

0.42 SM

*

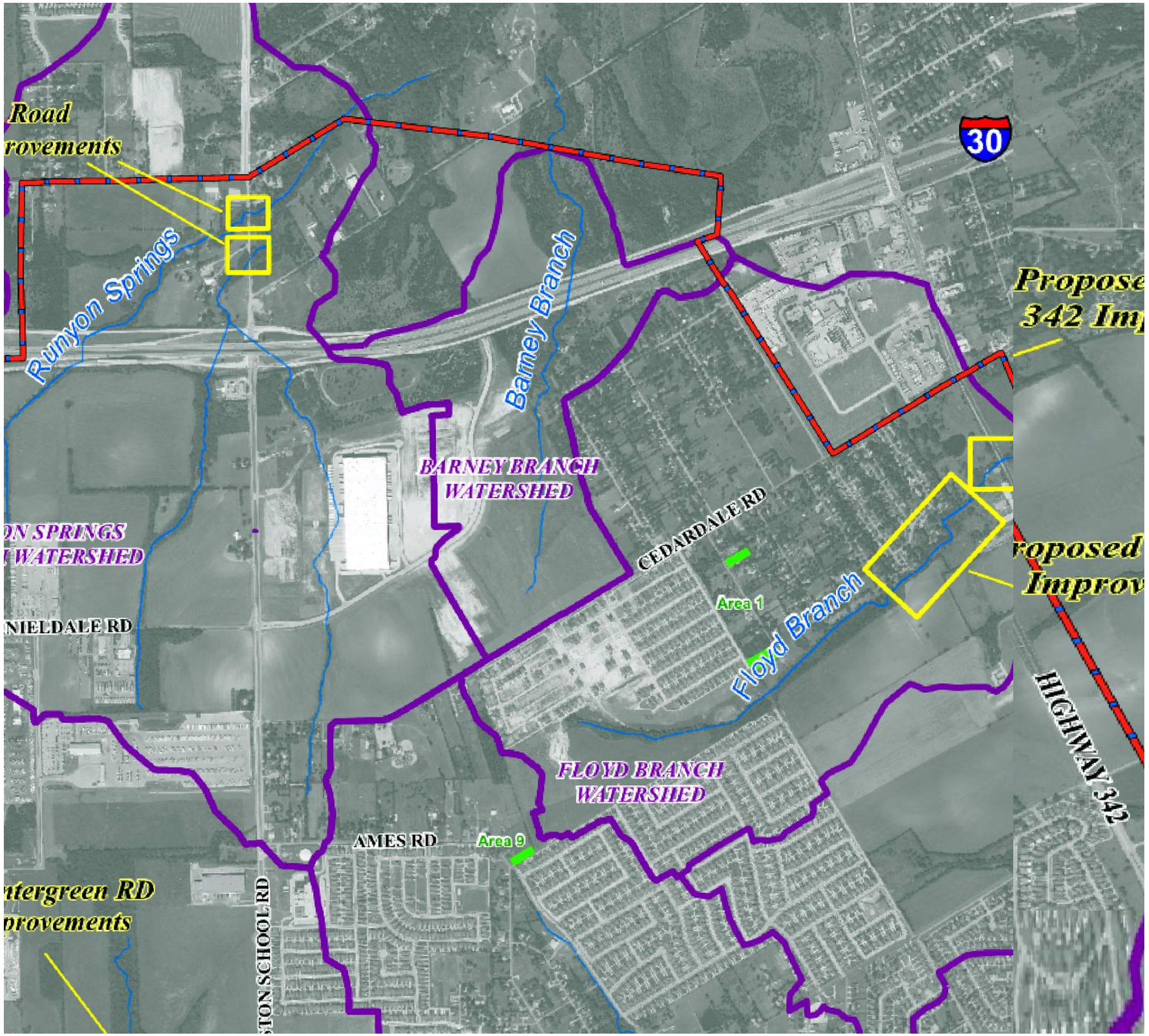
STREAM LENGTH

0.19 MI



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows significant development since 2007 within the Barney Branch watershed. New development consists mostly of large industrial warehouses. Specifically, this new development is located in sub-basins BB-1. The locations of new development are highlighted in red.



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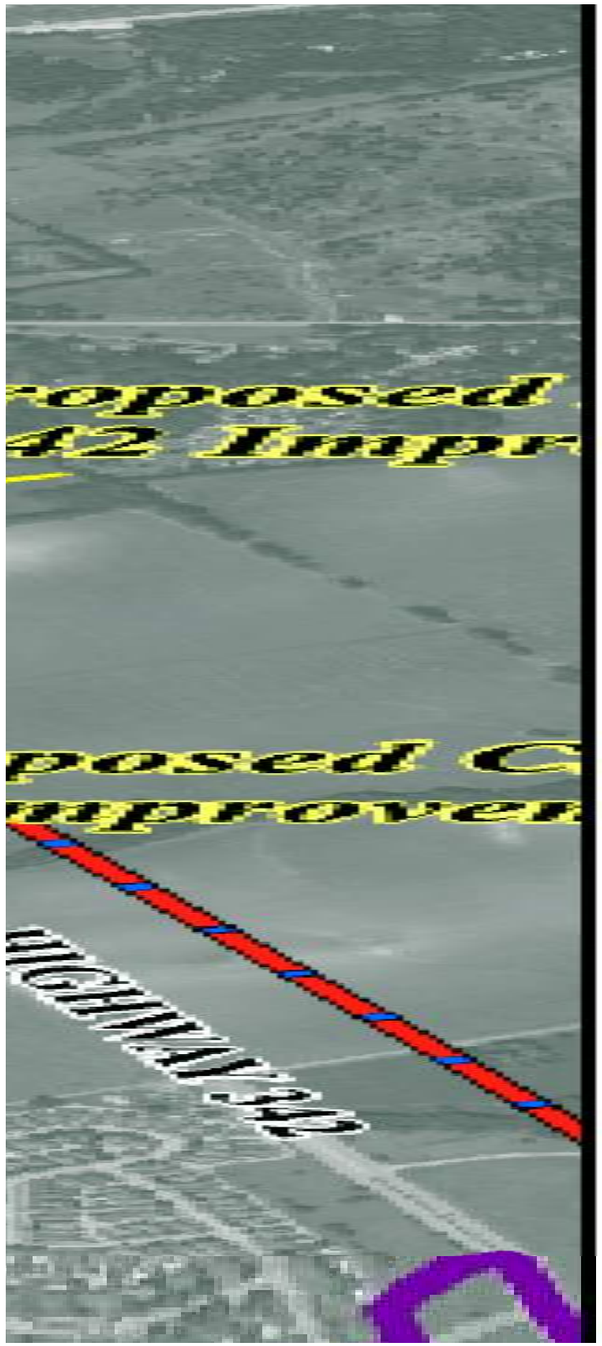
2007





N

N.T.S.

2019

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

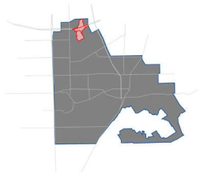
TOTAL DRAINAGE AREA

0.42 SM

*

STREAM LENGTH

0.19 MI



1.5 IMPERVIOUS AREA

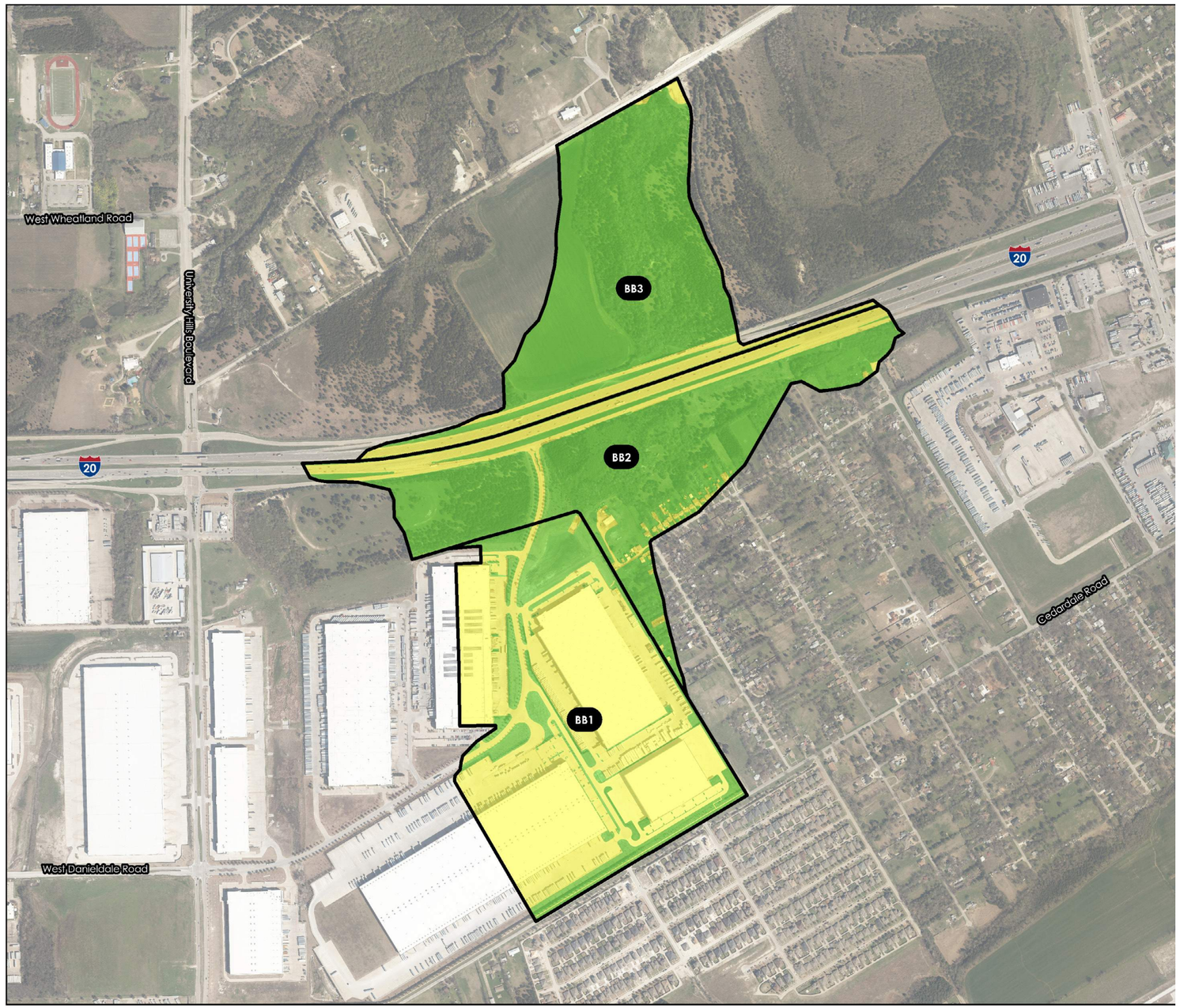
Impervious areas for the Barney Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located South of Interstate 20, where a relatively large number of industrial developments are located.

IMPERVIOUS

OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

BB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	83.6	78.1
OPEN SPACE	0	23.4	0.0
		107.0	**78.1**

BB2

IMPERVIOUS	100	16.3	19.3
OPEN SPACE	0	68.4	0.0
		84.7	**19.3**

BB3

IMPERVIOUS	100	8.9	11.8
OPEN SPACE	0	66.3	0.0
		75.2	**11.8**

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

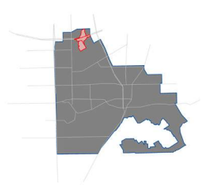
TOTAL DRAINAGE AREA

0.42 SM

*

STREAM LENGTH

0.19 MI



1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The future land use within the watershed consist of mostly Industrial, Residential and Mixed Use zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020. The studied portion of Runyon Springs Branch is primarily a natural channel with a total of three (3) culverts/bridges.

- IMPERVIOUS
- OPEN SPACE
- COMMERCIAL CORRIDOR
- LOGISTICS & DISTRIBUTION
- MIXED USE
- R - RURAL LIVING
- R - URBAN NEIGHBORHOOD
- RESIDENTIAL LOW DENSITY
- RESIDENTIAL MED DENSITY
- SURBURBAN MIXED USE CENTER
- VILLAGE CENTER
- UNIVERSITE RESEARCH CENTER

N

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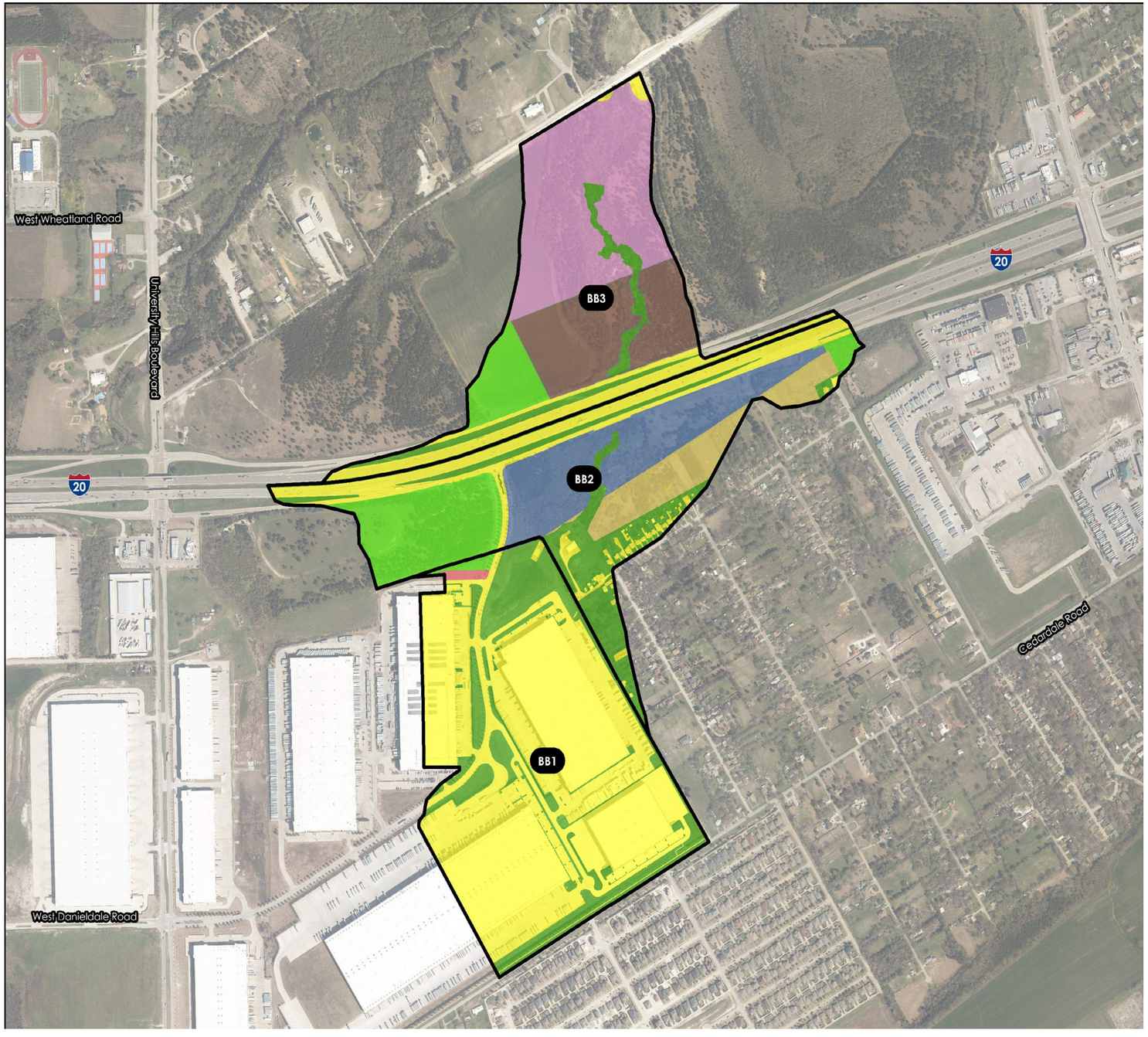


ULTIMATE PERCENT IMPERVIOUS REPORT

BB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	83.6	78.1
COMMERCIAL CORRIDOR	85	0.9	0.7
LOGISTICS & DISTRIBUTION	72	0.6	0.4
MIXED USE	85	0.1	0.1
OPEN SPACE	0	21.8	0.0
		107.0	**79.3**

BB2

IMPERVIOUS	100	16.3	19.3
COMMERCIAL CORRIDOR	85	16.2	16.2
MIXED USE	85	22.3	22.3
R - RURAL LIVING	12	11.5	1.6
OPEN SPACE	0	17.3	0.0
COMMERCIAL CORRIDOR	85	1.1	1.1
		84.7	**60.6**

BB3

IMPERVIOUS	100	8.9	11.8
OPEN SPACE	0	7.9	0.0
VILLAGE CENTER	85	0.0	0.0
R - URBAN NEIGHBORHOOD	65	32.5	28.1
UNIVERSITE RESEARCH CENTER	85	19.1	21.6
COMMERCIAL CORRIDOR	85	6.8	7.7
		75.2	**69.2**

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

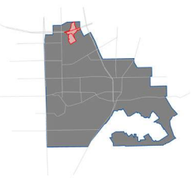
TOTAL DRAINAGE AREA

0.42 SM

*

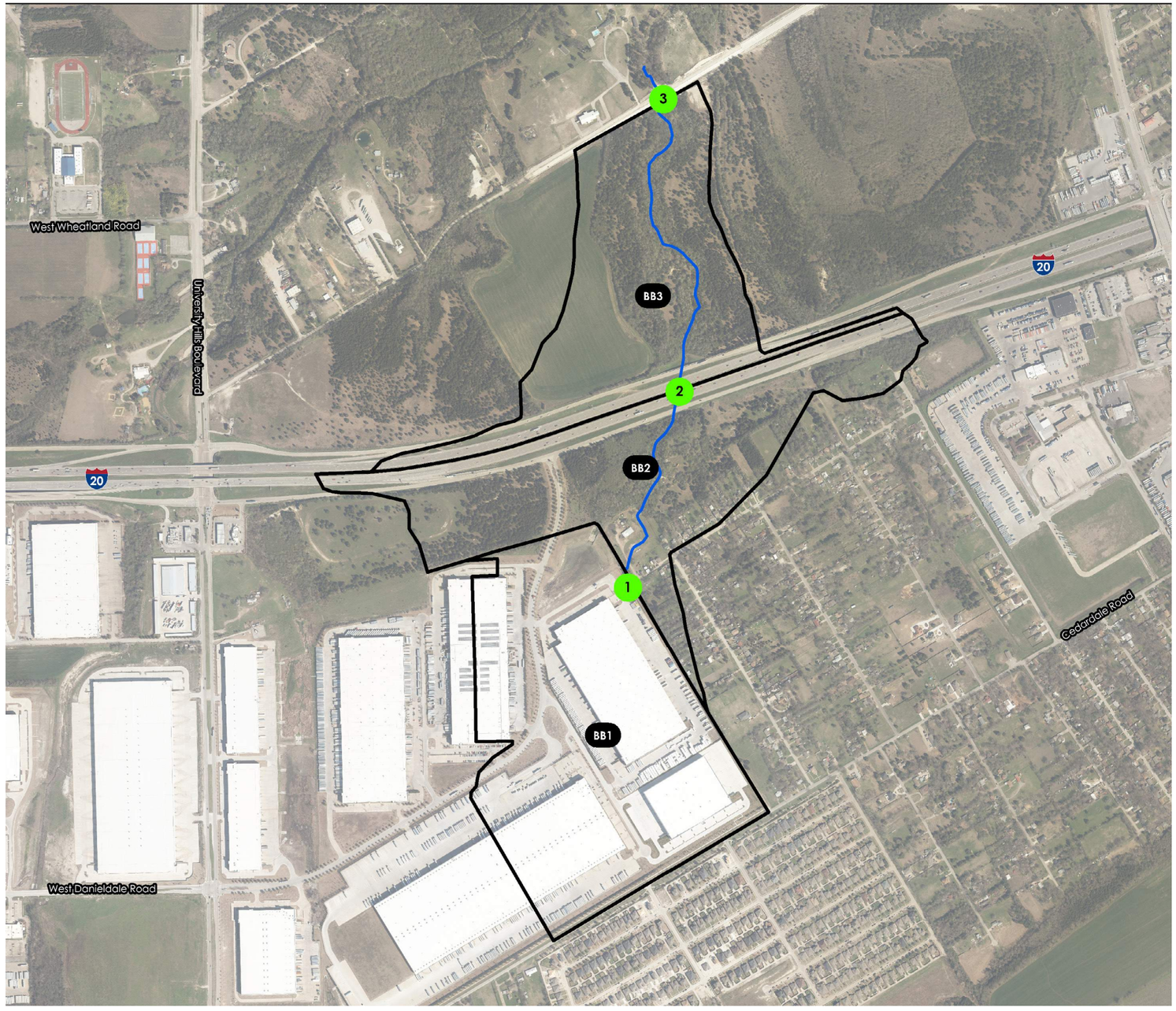
STREAM LENGTH

0.19 MI



1.7 RESULTS

The flow was analyzed at three locations for Barney Branch. Flow location 1 was used to establish flows at the upstream end of the stream. Location 2 determines the peak discharge experienced by the Interstate Highway 20 culvert. Location 3, at Wheatland Road was used to establish a downstream conditions for the stream which is relatively small.



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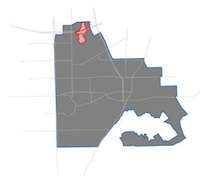
Flow Analysis Locations					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	BB1	Main	4350.8	0.17	420
2	BB1, BB2	Main	3150.757	0.30	800
3	BB1, BB2, BB3	Main	1578.334	0.42	1200

WATERSHED NO.
1

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
0.42 SM
*
STREAM LENGTH
0.19 MI



2.1 SITE ASSESSMENT

Barney Branch is located in the North region of the City of Lancaster. It flows from South to North for approximately 1,000 feet before leaving the city limits. This assessment analyzes the hydrologic and hydraulic characteristics of Barney Branch within the limits of the City of Lancaster, roughly bound by properties at Lyle street (upstream end) and Interstate Highway 20 (downstream end). The channel slope averages around 1.6-1.7%. Barney Branch itself is generally in a natural state with very few man-made alterations, with the exception of the road crossing at the downstream end of the analysis and the properties at the upstream end. Except at these two locations, the channel and overbanks are heavily wooded and generally inaccessable. There is a total of one (1) crossing analyzed throughout the watershed.



Looking at the upstream end of the Interstate Highway 20 culvert. The retaining wall associated with the highway is very large and is not anticipated to overtop.



Looking at the face of the upstream culvert at Interstate Highway 20. The boxes appear to be in adequate conditon. Culverts are expected to fully convey the 100-year peak discharges.



Looking upstream of the Inetsrate Highway 20 culvert crossing for Newton branch. There is slight ponding and there is significant vegetation in and around the channel itself.

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

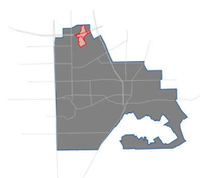
TOTAL DRAINAGE AREA

0.42 SM

*

STREAM LENGTH

0.19 MI



2.2 FLOODPLAIN MAPPING

The Barney Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Barney Branch is comprised of one stream, one reach, eleven (11) cross sections, and one (1) hydraulic structures. The studied stream is 3,044 feet (0.58 miles) long. In general the stream flows though a heavily wooded area and the floodplain is contained within the channel.

The floodplain sheets for Barney Branch display two different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space.



STREAM CENTERLINE
BARNEY VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN

N

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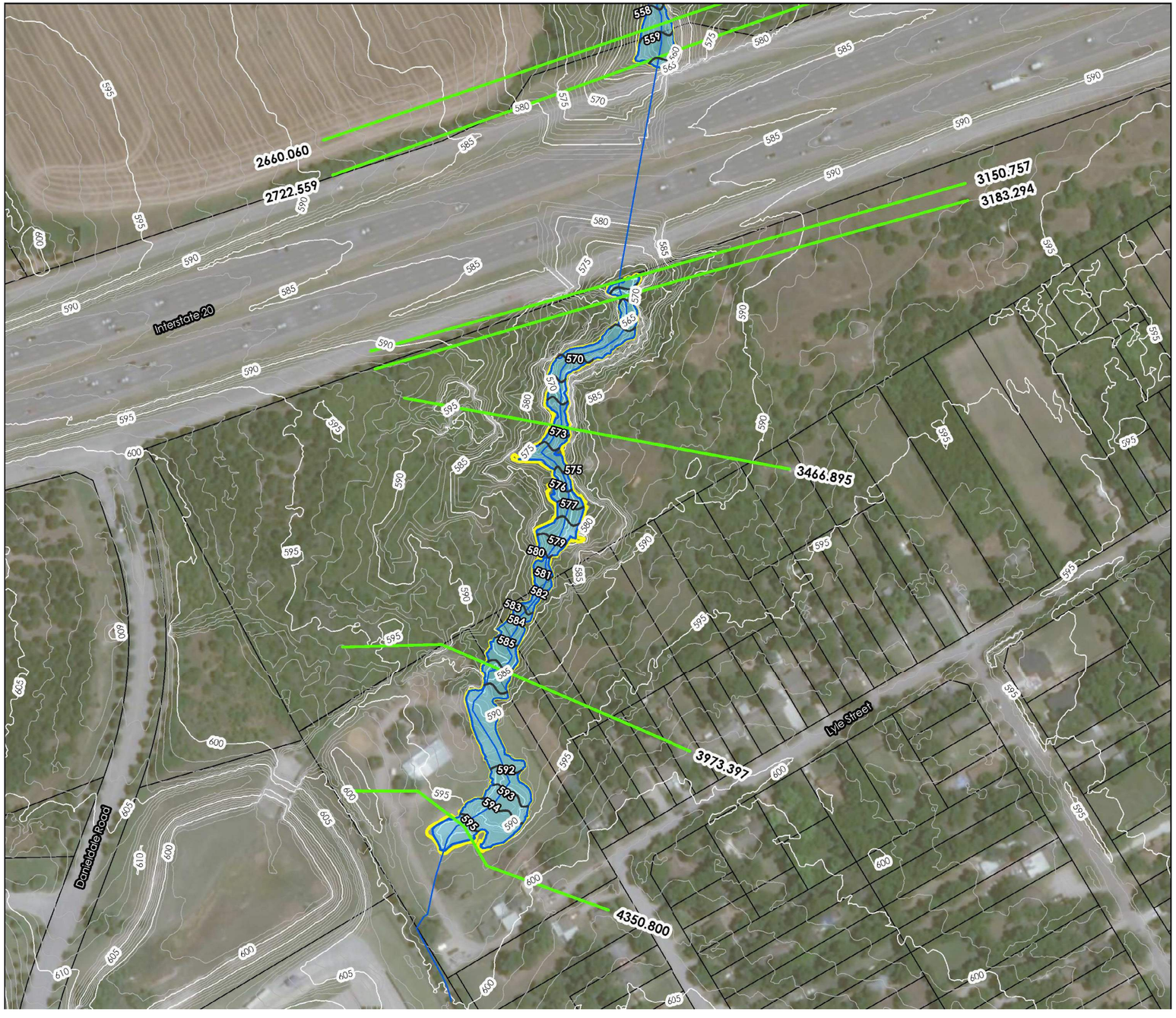
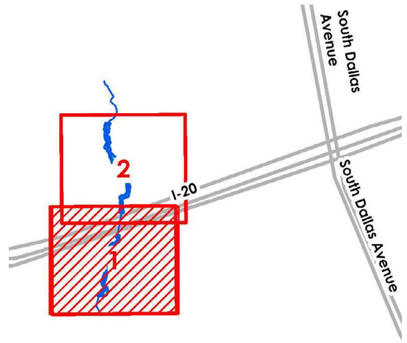
FLOODPLAIN: SHEET 1





N

0 100 200
Feet

- BARNEY CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- BARNEY BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.

1

COUNCIL DISTRICTS

2 AND 6

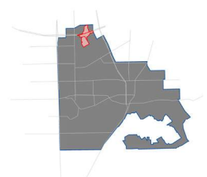
TOTAL DRAINAGE AREA

0.42 SM

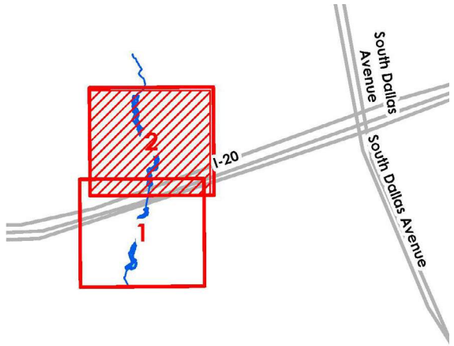
*

STREAM LENGTH

0.19 MI



FLOODPLAIN: SHEET 2



N

0 100 200 Feet

- BARNEY CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- 500 BARNEY BASE FLOW ELEVATIONS
- PARCEL

0

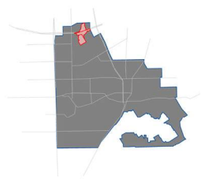


BARNEY BRANCH

WATERSHED NO.
1

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
0.42 SM
*
STREAM LENGTH
0.19 MI



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	593.42	593.63	3.64	2.71
3973.397	584.70	584.55	2.60	3.71
3466.895	570.49	571.29	4.48	1.67
3183.294	564.83	565.43	2.04	6.29
3150.757	563.47	563.76	5.80	6.42
3010.396	I-20			
2722.559	557.58	557.87	5.09	5.91
2660.060	556.67	556.94	3.48	3.87
2312.631	549.03	549.31	5.52	5.98
1578.334	541.88	542.49	1.77	2.03
1267.228	540.54	540.95	4.22	4.91
930.5661	535.77	536.08	3.33	3.83

2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	594.54	594.76	5.14	4.53
3973.397	585.58	585.45	4.27	5.24
3466.895	571.73	572.41	6.38	4.38
3183.294	565.80	566.11	4.81	7.52
3150.757	564.32	564.45	7.57	7.78
3010.396	I-20			
2722.559	558.38	558.48	7.43	7.78
2660.060	557.44	557.55	4.50	4.61
2312.631	549.83	549.93	6.76	6.97
1578.334	543.06	543.41	2.33	2.50
1267.228	541.35	541.59	5.66	6.11
930.5661	536.41	536.59	4.31	4.61

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	594.08	594.23	3.93	3.48
3973.397	585.13	584.98	3.56	4.71
3466.895	571.14	571.78	5.05	3.08
3183.294	565.17	565.67	3.77	6.79
3150.757	563.76	563.99	6.42	7.03
3010.396	I-20			
2722.559	557.87	558.11	5.91	6.59
2660.060	556.94	557.17	3.87	4.14
2312.631	549.31	549.54	5.98	6.37
1578.334	542.44	542.86	2.00	2.22
1267.228	540.91	541.21	4.85	5.40
930.5661	536.05	536.28	3.78	4.15

2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	594.76	595.02	5.79	5.00
3973.397	585.82	585.65	4.59	5.60
3466.895	572.02	572.83	7.08	4.66
3183.294	566.37	566.56	4.70	8.19
3150.757	564.76	564.94	8.31	8.43
3010.396	I-20			
2722.559	558.84	558.98	8.11	8.33
2660.060	557.79	557.90	4.93	5.08
2312.631	550.21	550.34	7.29	7.44
1578.334	543.62	543.92	2.60	2.75
1267.228	541.75	541.97	6.36	6.66
930.5661	536.71	536.89	4.79	4.98

2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	595.01	595.47	6.27	4.77
3973.397	586.03	585.88	5.00	6.06
3466.895	572.36	573.41	7.51	4.71
3183.294	567.04	567.23	4.51	9.08
3150.757	565.37	565.66	8.74	9.21
3010.396	I-20			
2722.559	559.38	559.70	8.72	9.07
2660.060	558.18	558.42	5.44	5.72
2312.631	550.66	550.91	7.81	8.09
1578.334	544.26	544.65	2.90	3.08
1267.228	542.21	542.49	7.01	7.43
930.5661	537.07	537.31	5.25	5.49

2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	595.48	595.70	5.91	5.23
3973.397	586.29	586.12	5.46	6.51
3466.895	572.78	573.85	7.97	5.13
3183.294	567.85	567.74	4.39	9.17
3150.757	565.92	566.91	9.56	7.63
3010.396	I-20			
2722.559	559.93	560.09	9.48	9.69
2660.060	558.60	558.73	5.96	6.09
2312.631	551.13	551.26	8.31	8.46
1578.334	545.03	545.38	3.25	3.41
1267.228	542.74	542.97	7.86	8.25
930.5661	537.52	537.71	5.78	6.06

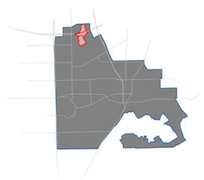
2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4350.800	595.30	595.60	5.94	4.98
3973.397	586.17	585.99	5.23	6.34
3466.895	572.57	573.68	7.77	4.85
3183.294	567.47	567.62	4.46	9.01
3150.757	565.66	566.31	9.21	8.50
3010.396	I-20			
2722.559	559.70	559.96	9.07	9.51
2660.060	558.42	558.63	5.72	5.97
2312.631	550.91	551.15	8.09	8.37
1578.334	544.67	545.03	3.09	3.25
1267.228	542.50	542.74	7.46	7.86
930.5661	537.32	537.52	5.51	5.78

WATERSHED NO.
1

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
0.42 SM
*
STREAM LENGTH
0.19 MI



3.1 RISK IDENTIFICATION

Three risk areas were identified in this study. The risks are all instances of potential erosion in the stream channel. The areas identified are locations of high shear stress and potentially erosive channel velocities (>8 fps). Although, erosion is likely, it is expected to be inconsequential. All potential erosion locations are located in undeveloped, wooded areas. No structures are located within the Barney Branch floodplain and no bridges or culverts are expected to over-top. The following map shows the shear stresses associated with the Unnamed Tributary 3 floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	River Station 1267	Potential Erosion Hot Spot	1-Year	Private	Very Low
2	River Station 2312	Potential Erosion Hot Spot	1-Year	Private	Very Low
3	River Station 3183	Potential Erosion Hot Spot	1-Year	Private	Very Low



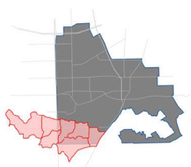
WATERSHED NO. 1 BARNEY BRANCH

BEAR CREEK

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1

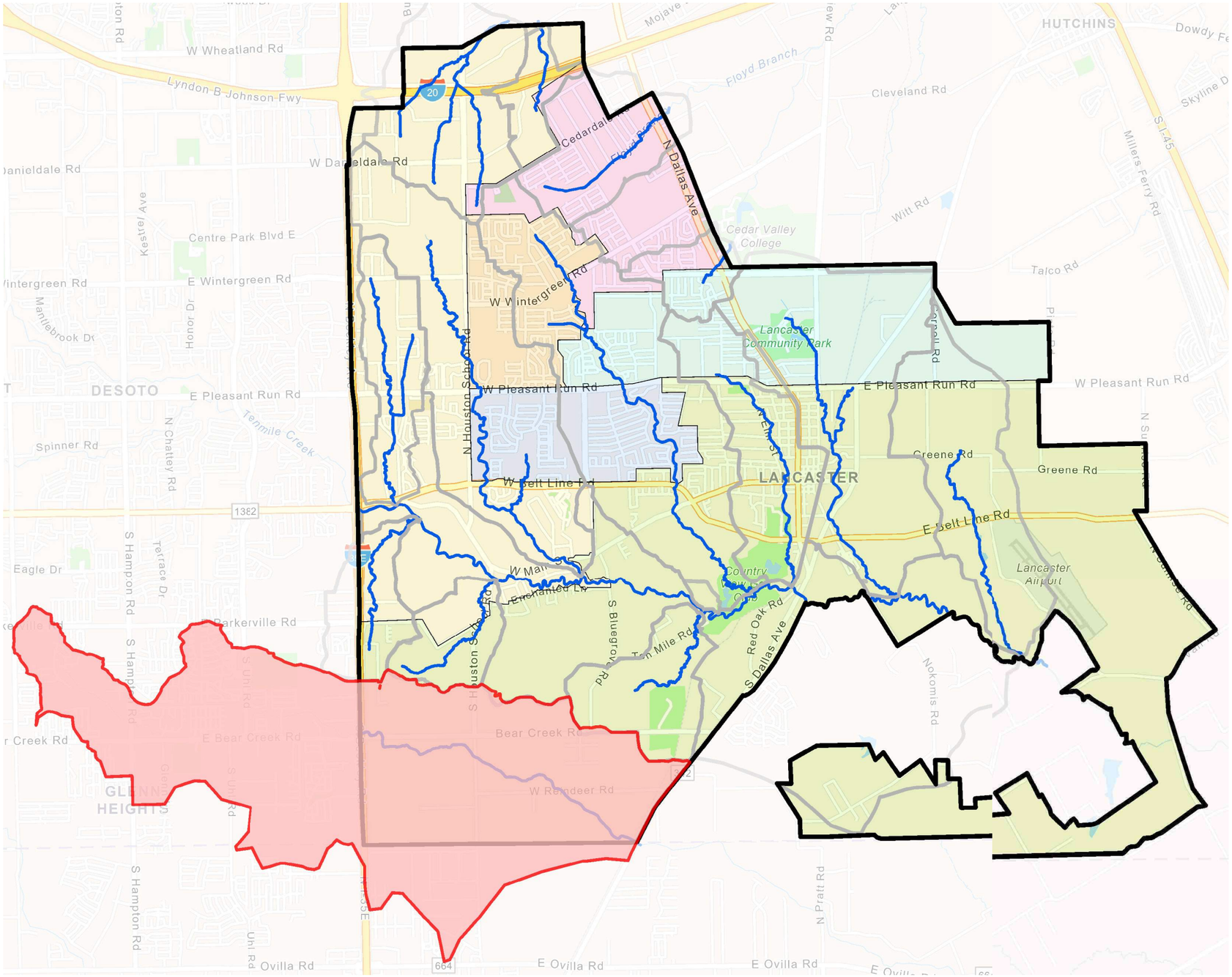


- BEAR CREEK
- STREAM CENTERLINE

COUNCIL DISTRICT
- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

BEAR CREEK WATERSHED

Located in the city's southwest corner, Bear Creek covers around 7.70 square miles. Originating east of Interstate 35E, it winds south and then southeast for roughly 3 miles. Half of its expanse lies in the City of DeSoto, with undeveloped, residential, and commercial areas. Within Lancaster, it's mostly undeveloped with pockets of residential zones.



WATERSHED NO. 2

BEAR CREEK

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WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



1.1 DRAINAGE AREA MAP

The drainage area divides for the Bear Creek watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into seven (7) sub-basins. Sub-basins are designated BCA1, BCB1, and BC1 through BC6. The total watershed drainage area is 4970.9 acres (7.77 square-miles). Approximately 3.17 square-miles of drainage area is located within the City of Lancaster itself.

N

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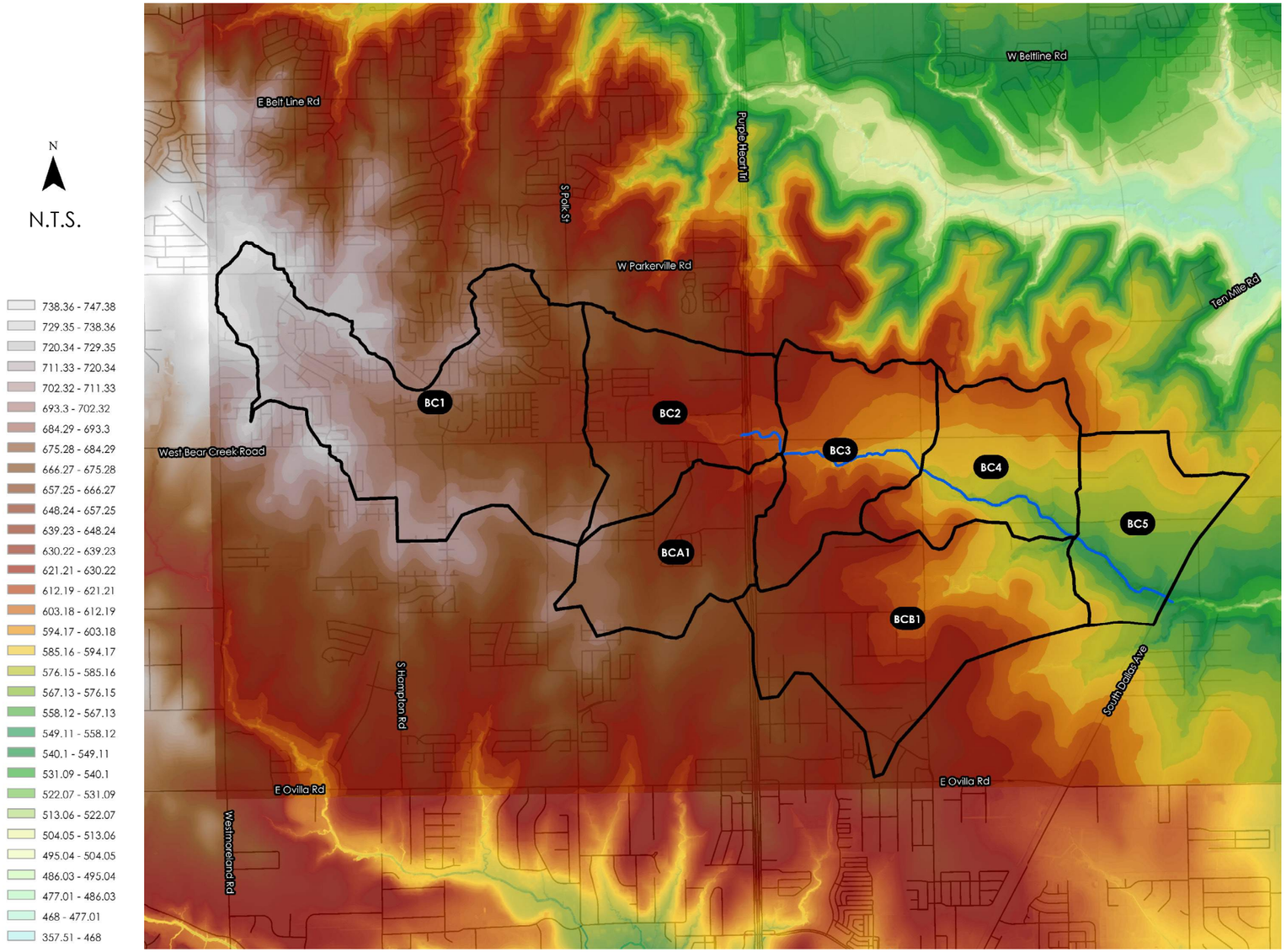


HYDROLOGIC PARAMEETRS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
BCBA1	0.7742	83.9	17.2	42.8	53.9	32.36	34.97	20.98
BCBB1	1.5434	84	9.6	28.1	70.5	42.32	40.19	24.11
BCB1	2.0716	84	28.9	50.1	38.7	23.19	29.70	17.82
BCB2	0.9527	84	20.1	47	46.2	27.71	34.94	20.96
BCB3	0.8881	83.7	4.4	42.2	35.1	21.07	36.84	22.10
BCB4	0.8252	81.5	2.8	29.8	41.6	24.93	48.79	29.28
BCB5	0.7119	82.4	6.2	33.3	41.2	24.7	66.49	39.89

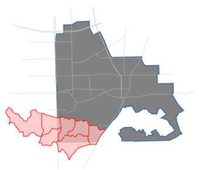
WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*

STREAM LENGTH
2.95 MI
*

PROJECTS IDENTIFIED
1



1.2 TIME OF CONCENTRATION

The Times of Concentration for Bear Creek were traced using the 2009 LiDAR data. and verified with the 2019 aerial imagery. Where possible. flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Bear Creek is thick with vegetation, with the exception of the upstream-most portions of the reaches in sub-basin BC1. Because the land east of Intersate 35 is less developed, the Times of Concentration are generally longer than those on the west side of the highway. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

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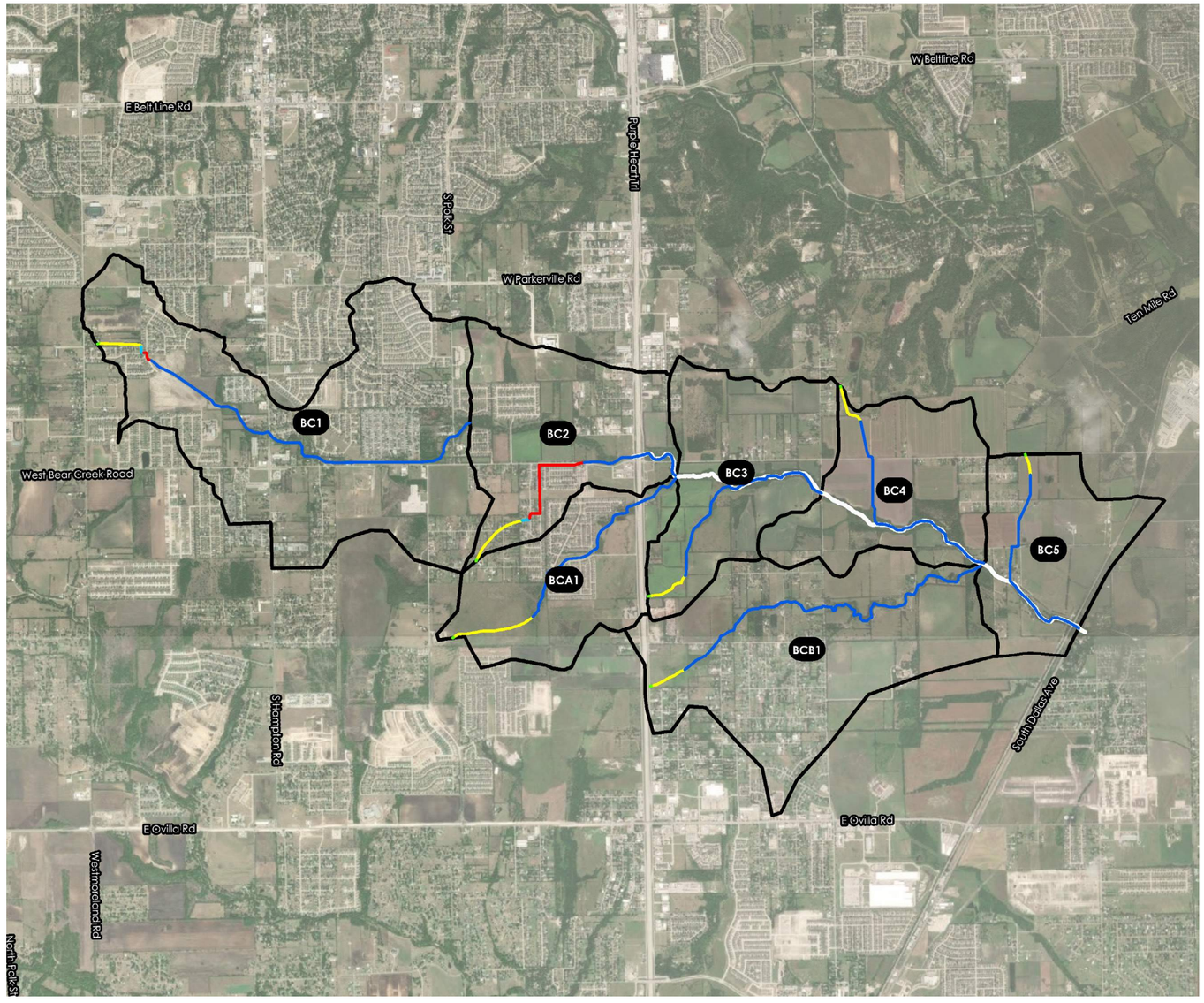


TIME OF CONCENTRATION REPORT

BC1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	3.66	0.240	0.00	0.2	10.57
SHALLOW	UNPAVED	1,187	8.75	0.000	16.10	4.8	4.15
GUTTER	G-20	246	5.44	0.018	24.18	5.6	0.73
PIPE	36" RCP	382	3.07	0.014	87.62	15.4	0.41
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	6,324	5.94	0.050	28.69	7.0	15.07
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	4,714	5.78	0.050	42.29	10.2	7.72
		12,952					**38.65**
							34.97

BC2

OVERLAND	GRS-DENSE	100	1.08	0.240	0.00	0.1	17.19
SHALLOW	UNPAVED	1,751	7.07	0.000	16.10	4.3	6.82
GUTTER	G-12	251	5.2	0.018	23.64	5.4	0.78
PIPE	36" RCP	3,111	0.9	0.014	87.62	8.3	6.24
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,324	0.75	0.050	42.29	3.7	15.16
		8,538					**46.19**
							40.19

BC3

OVERLAND	GRS-DENSE	100	1.91	0.240	0.00	0.1	13.70
SHALLOW	UNPAVED	1,213	2.49	0.000	16.10	2.5	7.96
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,907	4.35	0.050	28.69	6.0	8.09
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,309	5.92	0.050	42.29	10.3	5.36
		7,529					**35.11**
							29.70

BC4

OVERLAND	GRS-DENSE	100	1.22	0.240	0.00	0.1	16.39
SHALLOW	UNPAVED	1,179	1.47	0.000	16.10	2.0	10.07
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,061	4.07	0.050	28.69	5.8	8.81
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,782	5.63	0.050	42.29	10.0	6.28
		8,123					**41.55**
							34.94

BC5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.44	0.240	0.00	0.1	12.42
SHALLOW	UNPAVED	522	1.22	0.000	16.10	1.8	4.90
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,206	2.22	0.050	28.69	4.3	12.51
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,753	0.91	0.050	42.29	4.0	11.35
		6,581					**41.17**
							36.84

BCA1

OVERLAND	GRS-DENSE	100	6.08	0.240	0.00	0.2	8.63
SHALLOW	UNPAVED	2,342	4.11	0.000	16.10	3.3	11.96
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,601	0.93	0.050	28.69	2.8	15.65
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,825	0.73	0.050	42.29	3.6	17.70
		8,868					**53.94**
							48.79

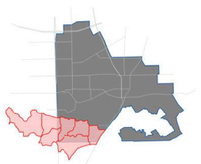
BCB1

OVERLAND	GRS-DENSE	100	3.5	0.240	0.00	0.2	10.75
SHALLOW	UNPAVED	1,008	3.67	0.000	16.10	3.1	5.45
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,126	0.92	0.050	28.69	2.8	18.90
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	8,246	0.84	0.050	42.29	3.9	35.44
		12,480					**70.54**
							66.49

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



1.3 SOILS MAP

Runyon Springs Branch watershed has three different hydrologic soils groups present within it's boundaries: types B, C, and D. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type C, which is more permeable and less prevalent than soil type D is present in all sub-basins except BC1. Soil group B is present in BC3, BC4, BC5 and BCB1. Hydrologic soil groups A is not present in the Bear Creek watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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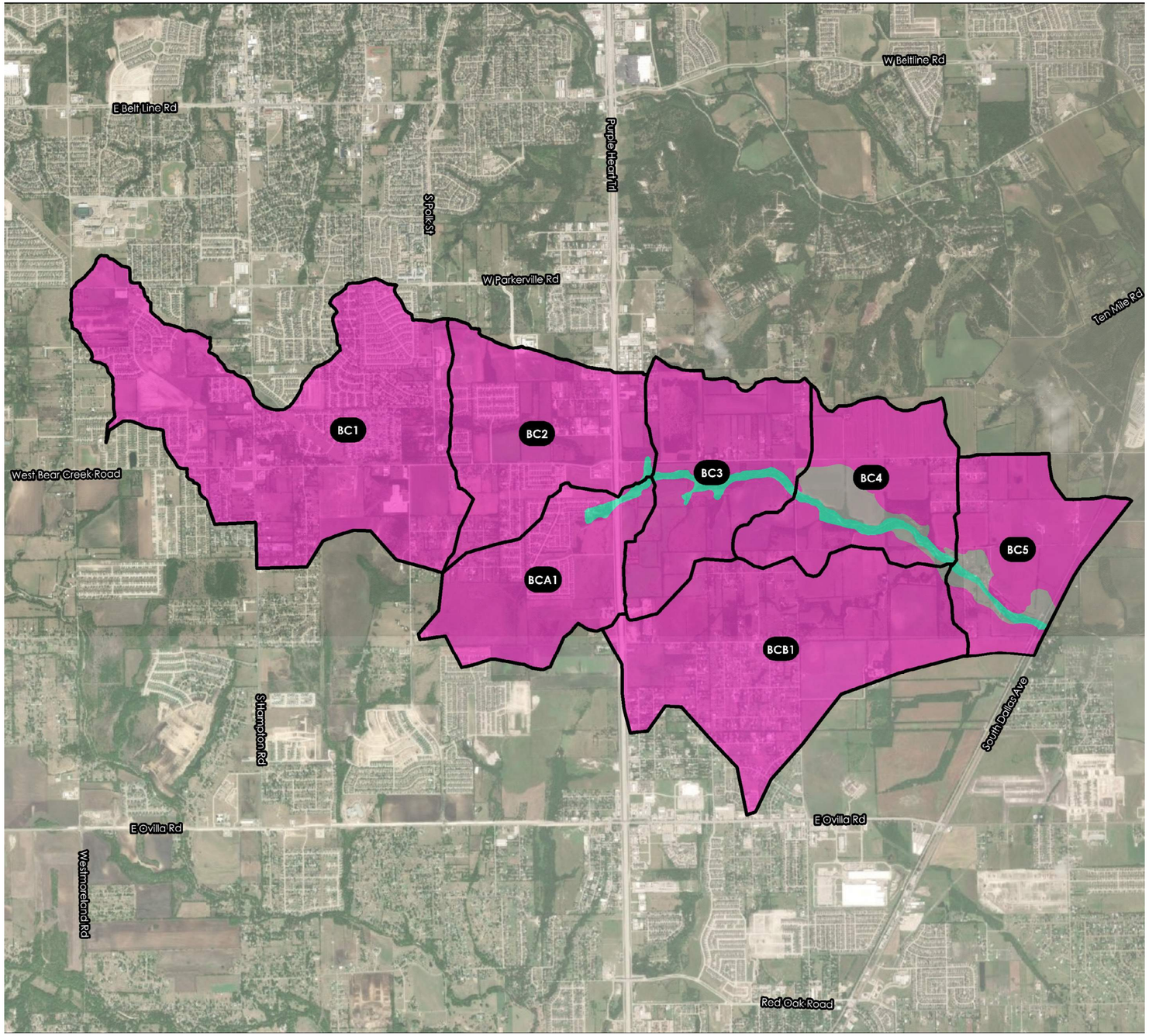


PERVIOUS CURVE NUMBER REPORT

BC1			
SOIL TYPE	**CURVE NUMBER**	**SHAPE AREA (AREA)**	**AREA WEIGHTED CN**
D	84	1325.8	84.0
		1325.8	**84.0**

BC2			
C	79	3.5	0.5
D	84	606.2	83.5
		57.0	**84.0**

BC3			
B	69	1.2	0.1
C	79	30.5	4.2
D	84	536.7	79.3
		568.4	**83.7**

BC4			
B	69	76.6	10.0
C	79	33.1	5.0
D	84	418.4	66.5
		528.1	**81.5**

BC5			
B	69	43.8	6.6
C	79	15.9	2.8
D	84	395.9	73.0
		455.6	**82.4**

BCA1			
C	79	14.9	2.4
D	84	480.6	81.5
		495.5	**83.9**

BCB1			
B	69	2.6	0.2
C	79	0.3	0.0
D	84	984.9	83.8
		987.8	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.
2

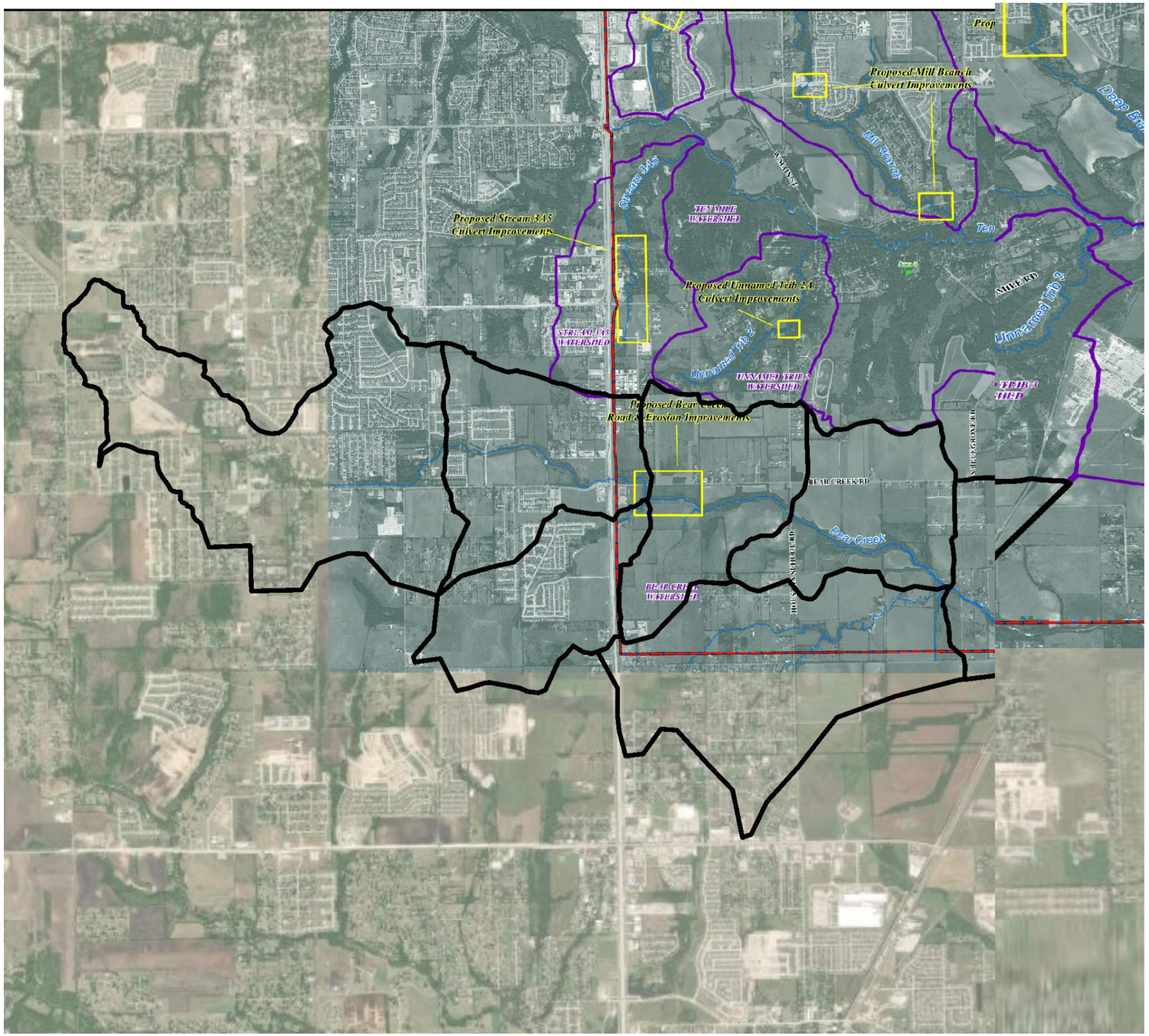
COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows little new development since 2007 within the Bear Creek watershed. New developments appear to be commercial. Only two sifgnificant additions are rpesent in the watershed: one in BC2 and one in BC5.



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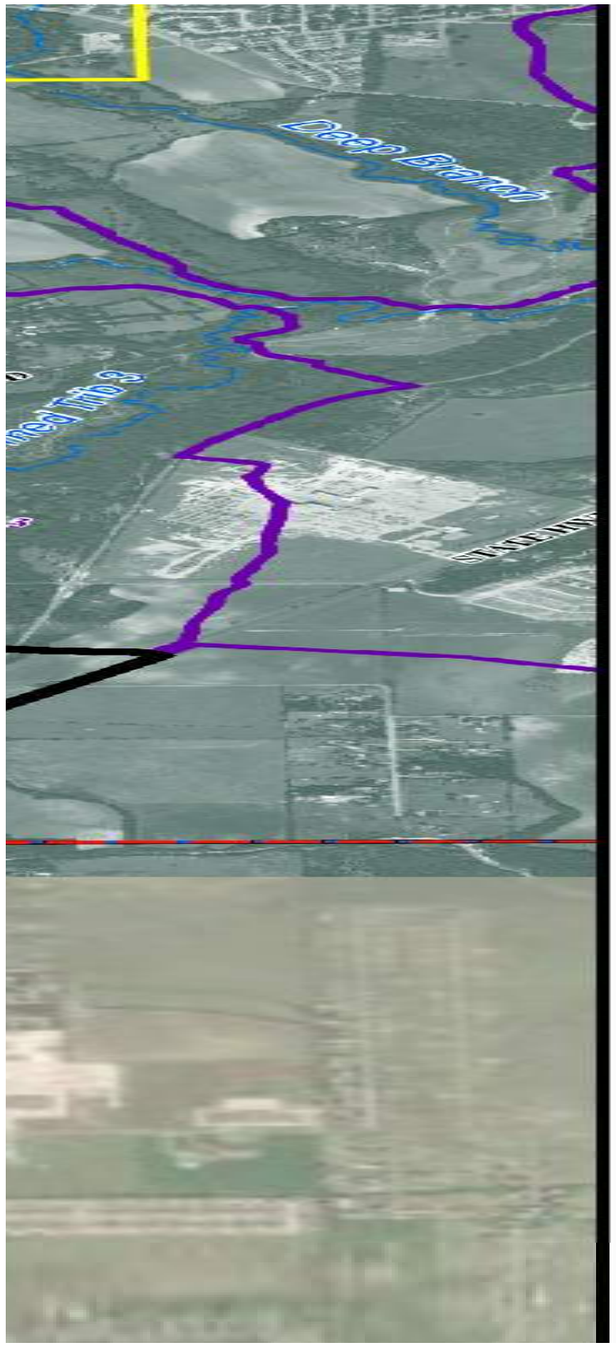
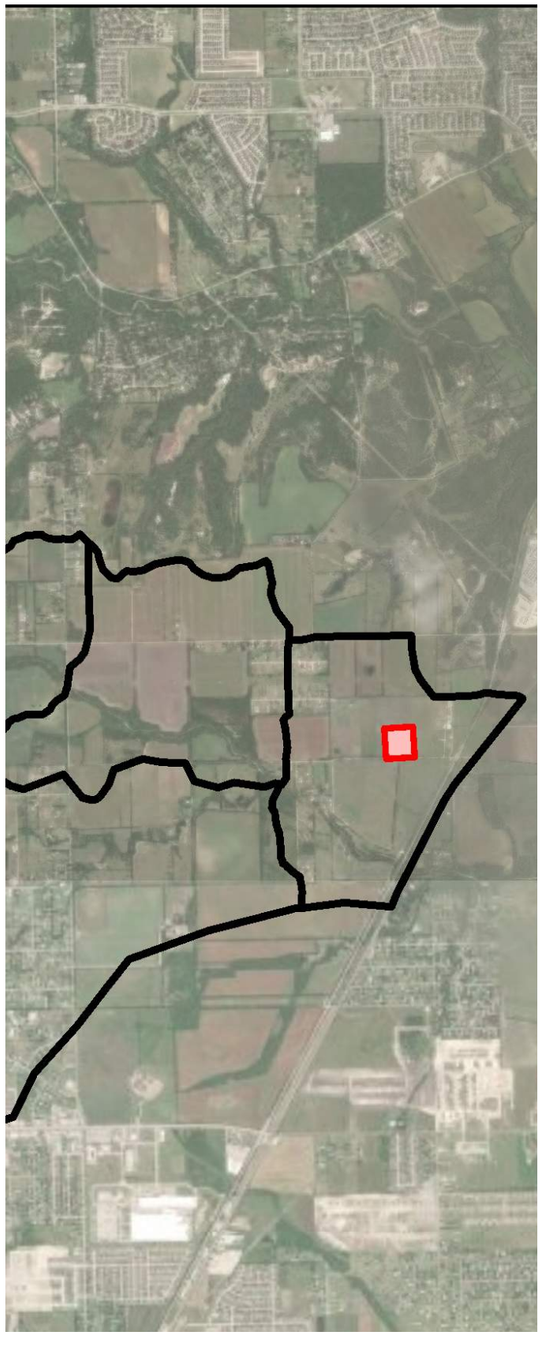
N.T.S.

2007





N

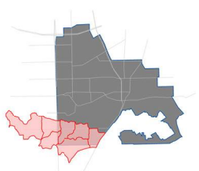
N.T.S.

2019

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



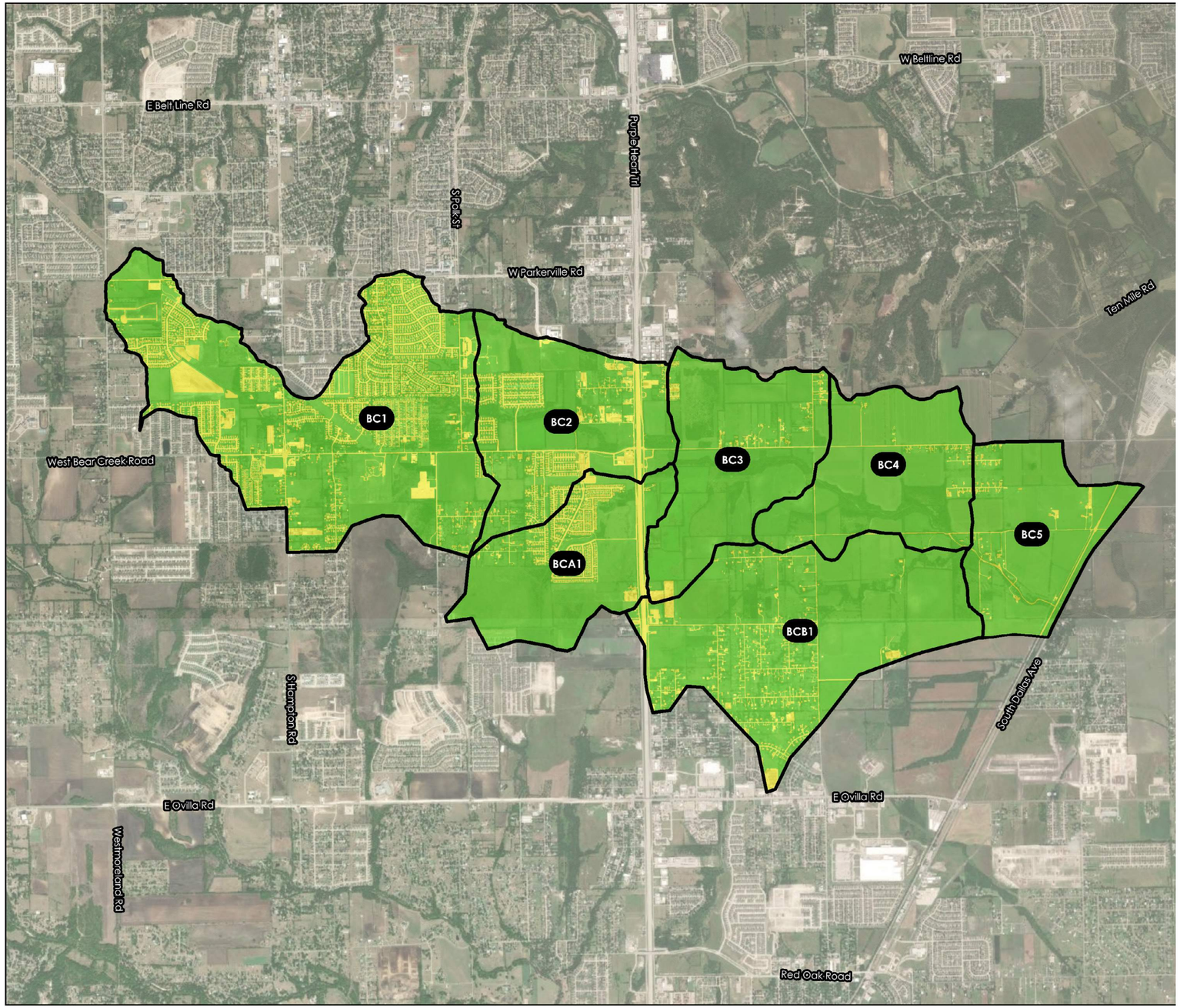
1.5 IMPERVIOUS AREA

Impervious areas for the Bear Creek watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Bear Creek has a relatively low impervious percent. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located West of Interstate 35, where a relatively large number of residential developments are located. The Interstate 35 corridor also has significant commercial devlopment.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

BC1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	383.2	28.9
OPEN SPACE (FAIR CONDITION)	0	942.6	0.0
		1325.8	**28.9**

BC2

IMPERVIOUS	100	122.7	20.1
OPEN SPACE (FAIR CONDITION)	0	487.1	0.0
		609.8	**20.1**

BC3

IMPERVIOUS	100	24.9	4.4
OPEN SPACE (FAIR CONDITION)	0	543.5	0.0
		568.4	**4.4**

BC4

IMPERVIOUS	100	14.6	2.8
OPEN SPACE (FAIR CONDITION)	0	513.5	0.0
		528.1	**2.8**

BC5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	28.4	6.2
OPEN SPACE (FAIR CONDITION)	0	427.2	0.0
		455.6	**6.2**

BCA1

IMPERVIOUS	100	85.1	17.2
OPEN SPACE (FAIR CONDITION)	0	410.4	0.0
		495.5	**17.2**

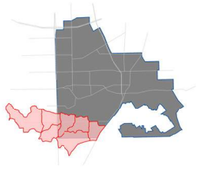
BCB1

IMPERVIOUS	100	95.1	9.6
OPEN SPACE (FAIR CONDITION)	0	892.7	0.0
		987.8	**9.6**

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



1.6 FUTURE LAND USE MAP

The majority of the watershed is located outside City of Lancaster. The existing land use within the watershed is mostly Residential and Commercial. A majority of the undeveloped land tracts are zoned for suburban neighborhood, particularly east of Interstae 35. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- COMMERCIAL CORRIDOR
- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD

N

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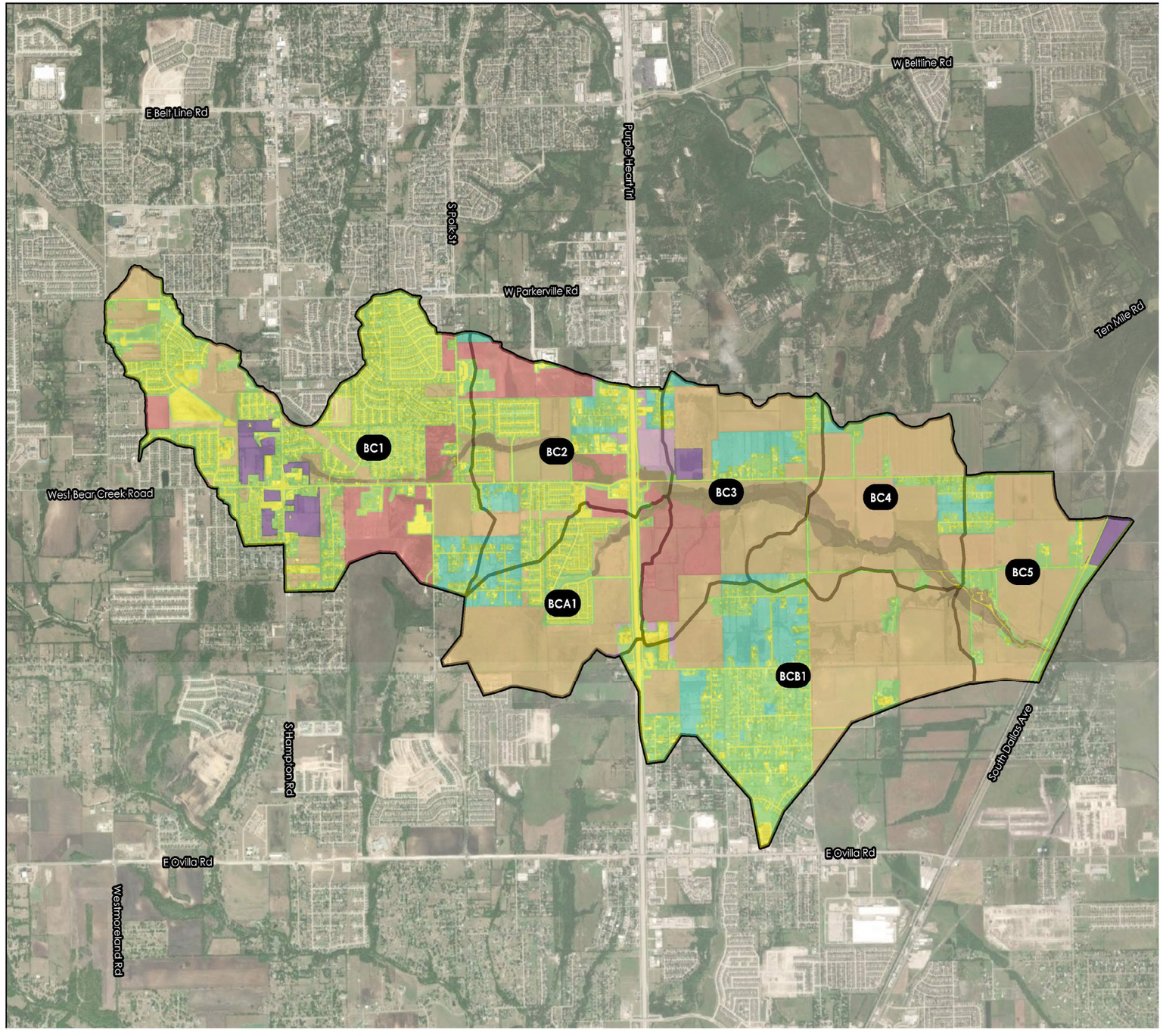


ULTIMATE PERCENT IMPERVIOUS REPORT

BC1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	383.2	28.9
OPEN SPACE (FAIR CONDITION)	0	440.8	0.0
FLOODPLAIN	0	17.6	0.0
R - SURBURBAN NEIGHBORHOOD	38	238.2	6.8
R - RURAL LIVING	12	24.5	0.2
COMMERCIAL NODE	85	68.0	4.4
MIXED USE	85	153.5	9.8
R - SURBURBAN NEIGHBORHOOD	38	0.0	0.0
		1325.8	**50.1**

BC2

IMPERVIOUS	100	122.6	20.1
OPEN SPACE (FAIR CONDITION)	0	159.8	0.0
FLOODPLAIN	0	37.0	0.0
R - SURBURBAN NEIGHBORHOOD	38	97.5	6.1
R - RURAL LIVING	12	50.6	1.0
COMMERCIAL CORRIDOR	85	29.6	4.1
MIXED USE	85	112.6	15.7
R-URBAN NEIGHBORHOOD	65	430,534	11.3
		609.7	**47.0**

BC3

IMPERVIOUS	100	24.9	4.4
OPEN SPACE (FAIR CONDITION)	0	50.3	0.0
FLOODPLAIN	0	59.8	0.0
R - SURBURBAN NEIGHBORHOOD	38	239.0	16.0
R - RURAL LIVING	12	56.6	1.2
COMMERCIAL CORRIDOR	85	10.7	1.6
COMMERCIAL NODE	85	16.0	2.4
MIXED USE	85	111.2	16.6
		568.4	**42.2**

BC4

IMPERVIOUS	100	14.6	2.8
OPEN SPACE (FAIR CONDITION)	0	63.9	0.0
FLOODPLAIN	0	61.8	0.0
R - SURBURBAN NEIGHBORHOOD	38	369.7	26.6
R - RURAL LIVING	12	18.0	0.4
		528.1	**29.8**

BC5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	28.4	6.2
OPEN SPACE (FAIR CONDITION)	0	94.5	0.0
FLOODPLAIN	0	21.1	0.0
R - SURBURBAN NEIGHBORHOOD	38	287.0	23.9
R - RURAL LIVING	12	9.3	0.2
COMMERCIAL NODE	85	15.2	2.8
		455.6	**33.3**

BCA1

IMPERVIOUS	100	85.1	17.2
OPEN SPACE (FAIR CONDITION)	0	90.6	0.0
FLOODPLAIN	0	11.5	0.0
R - SURBURBAN NEIGHBORHOOD	38	258.4	19.8
R - RURAL LIVING	12	18.8	0.5
COMMERCIAL CORRIDOR	85	1.8	0.3
MIXED USE	85	29.4	5.0
		495.5	**42.8**

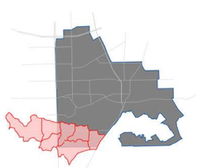
BCB1

IMPERVIOUS	100	95.1	9.6
OPEN SPACE (FAIR CONDITION)	0	337.2	0.0
FLOODPLAIN	0	2.8	0.0
R - SURBURBAN NEIGHBORHOOD	38	441.1	17.0
R - RURAL LIVING	12	109.6	1.3
COMMERCIAL CORRIDOR	85	2.0	0.2
		987.8	**28.1**

WATERSHED NO.
2

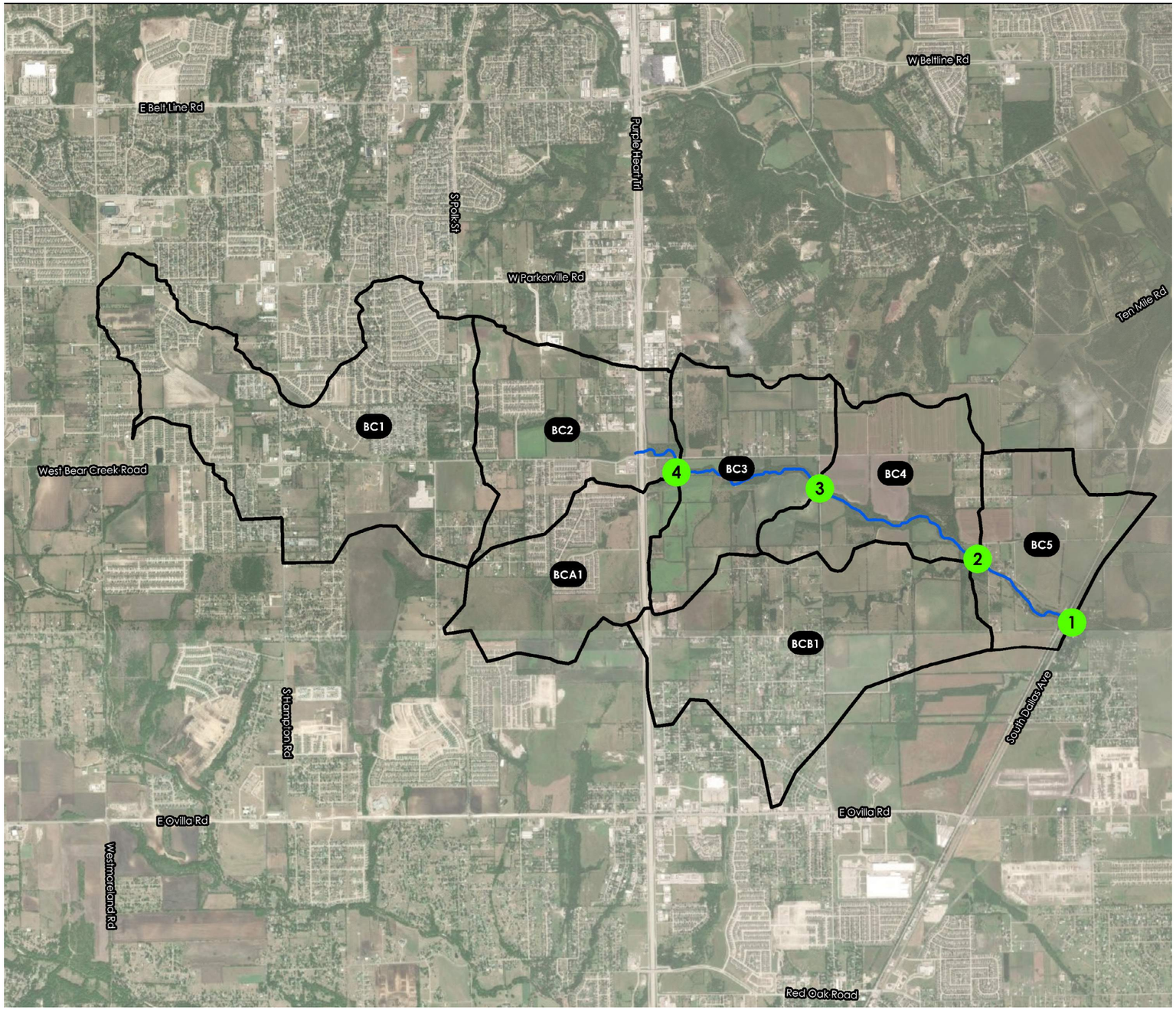
COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



1.7 RESULTS

The flow was analyzed at four locations for Bear Creek. Flow location 4 was used to establish flows at the upstream end of the stream and also to determine the peak discharge going to Bear Creek Road. Locations 1, 2 and 3 were also used to determine flows at major raodways.



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FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	BC1-BC5, BCA1, BCB1	Main	2114	7.77	15400
2	BC1-BC4, BCA1, BCB1	Main	3521	7.06	14800
3	BC1-BC3, BCA1	Main	9413	4.69	12000
4	BC1, BC2, BCA1	Main	14214	3.80	10800

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
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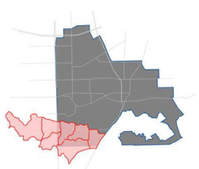
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



2.1 SITE ASSESSMENT

Bear Creek is located in the South portion of the City of Lancaster. It flows from West to East for approximately 2.95 miles before leaving the city limits. This assessment analyzes the hydrologic and hydraulic characteristics of Bear Creek within the limits of the City of Lancaster, roughly bound by Interstate Highway 35 East (upstream end) and South Dallas Avenue (downstream end). The channel slope averages around 0.45-0.5%. Bear Creek itself is generally in a natural state with very few man-made alterations, with the exception of the road crossings throughout the watershed. Except at these road crossings, heavy vegetation is observed on the channel overbanks. The main channel is relatively wide and is free of vegetation. There are a total of seven (7) crossings throughout the watershed.



Looking upstream of the South Houston School Road bridge. Area has a clean channel with vegetated overbanks. The channel further upstream is heavily wooded. Side slope erosion easily visible on the left.



Looking upstream towards the South Dallas Avenue bridge. The stream channel appears to be relatively clean with shrubs and small trees growing on the overbanks.



Looking downstream of South Dallas Avenue bridge. Side slope erosion shown on the far side of the Creek.

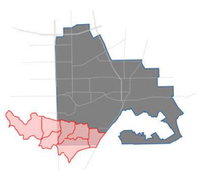


Looking downstream of closed Reindeer Road bridge. The channel further downstream has heavy vegetation on the overbanks, but the channel is wide and clean.

WATERSHED NO.
2

COUNCIL DISTRICT
1

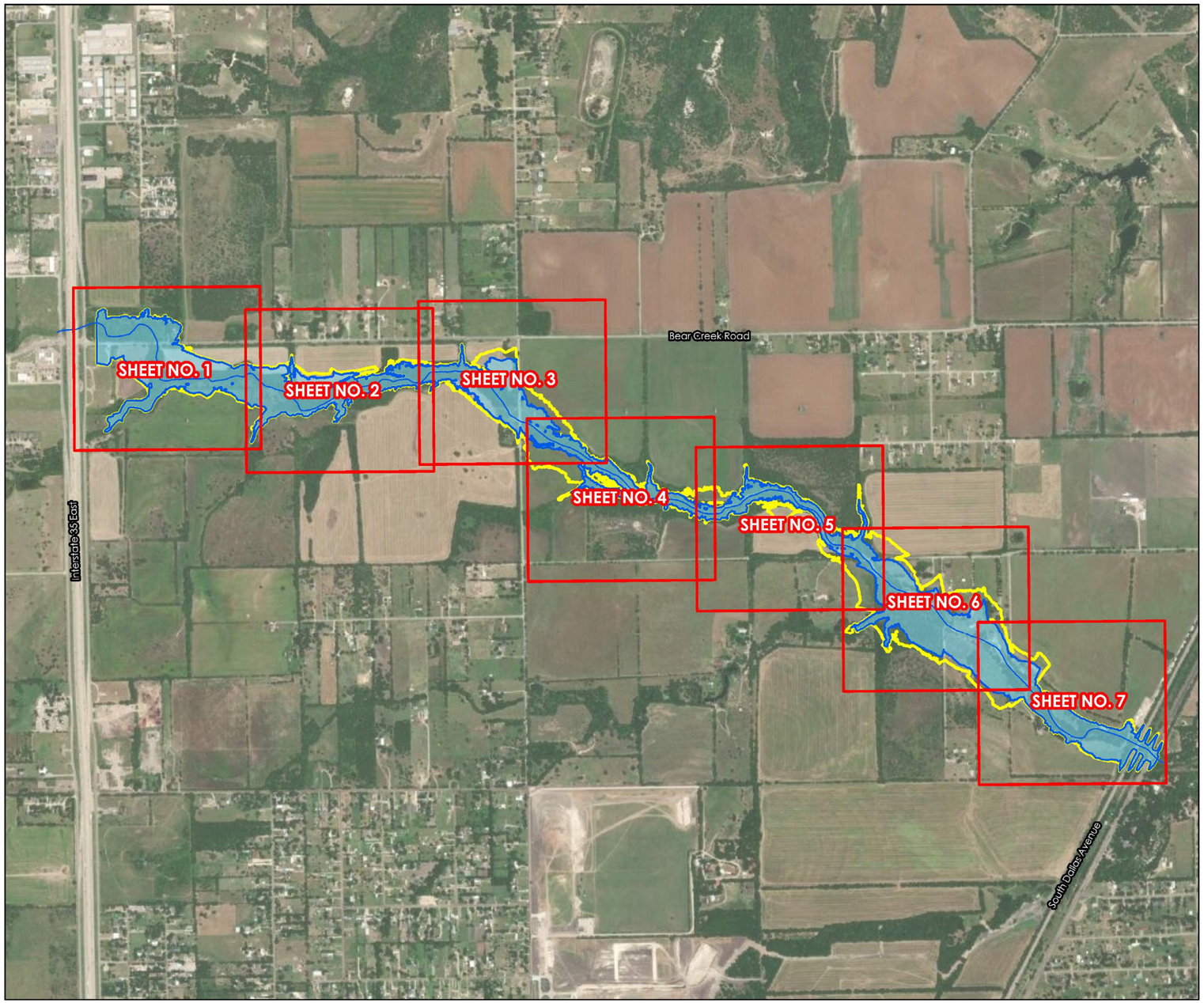
TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



2.2 FLOODPLAIN MAPPING

The Bear Creek stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Bear Creek is comprised of one stream, one reach, fourty-one (41) cross sections, and seven (7) hydraulic structures. The studied stream is 15,600 feet (2.95 miles) long. The floodplains tend to exceed the channel capacity and extend into the overbanks except at a few locations.

The floodplain sheets for Bear Creek display two different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space.



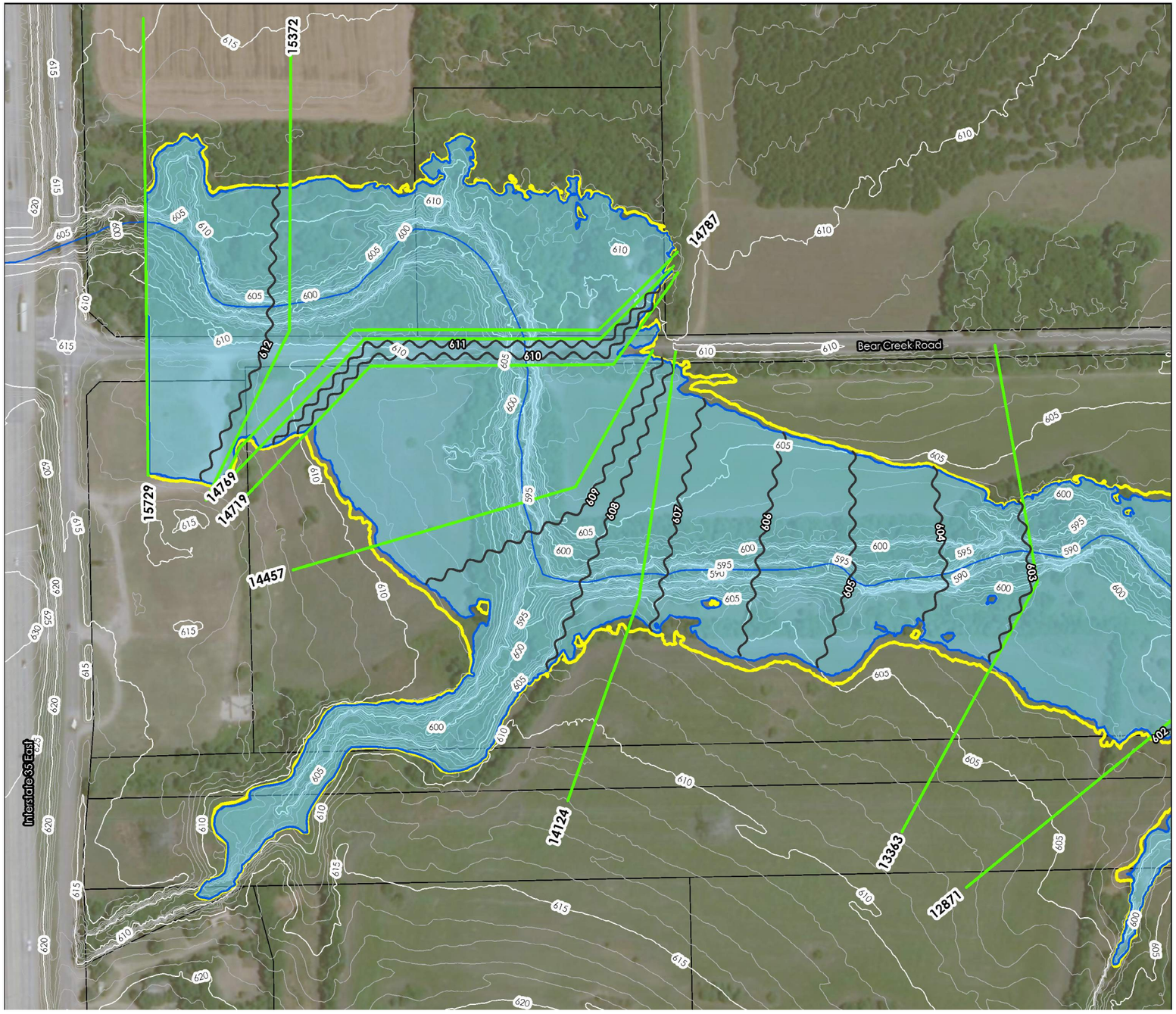
STREAM CENTERLINE
BEAR VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
PARCEL

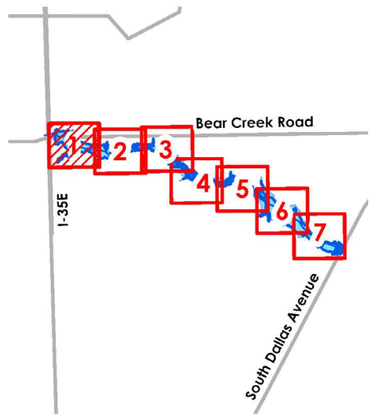
N

N.T.S.

N

FLOODPLAIN: SHEET 1





N

0 100 200

Feet

- AR CROSS SECTIONS
- REAM CENTERLINE
- ISTING 100-YEAR FLOODPLAIN
- MATE 100-YEAR FLOODPLAIN
- AR MAJOR CONTOURS
- AR MINOR CONTOURS
- AR BASE FLOW ELEVATIONS
- RCEL

WATERSHED NO.

2

COUNCIL DISTRICT

1

TOTAL DRAINAGE AREA

7.77 SM

*

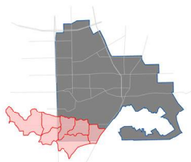
STREAM LENGTH

2.95 MI

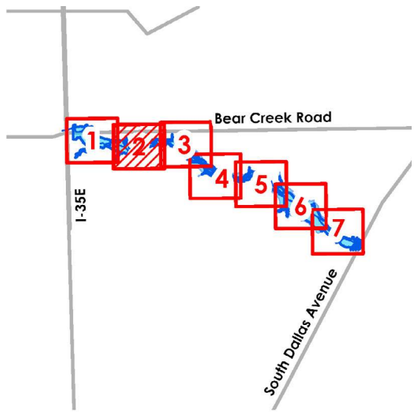
*

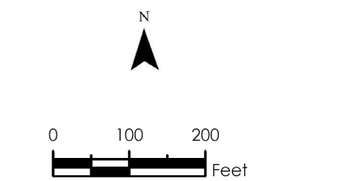
PROJECTS IDENTIFIED

1



FLOODPLAIN: SHEET 2





BEAR CROSS SECTIONS

STREAM CENTERLINE

EXISTING 100-YEAR FLOODPLAIN

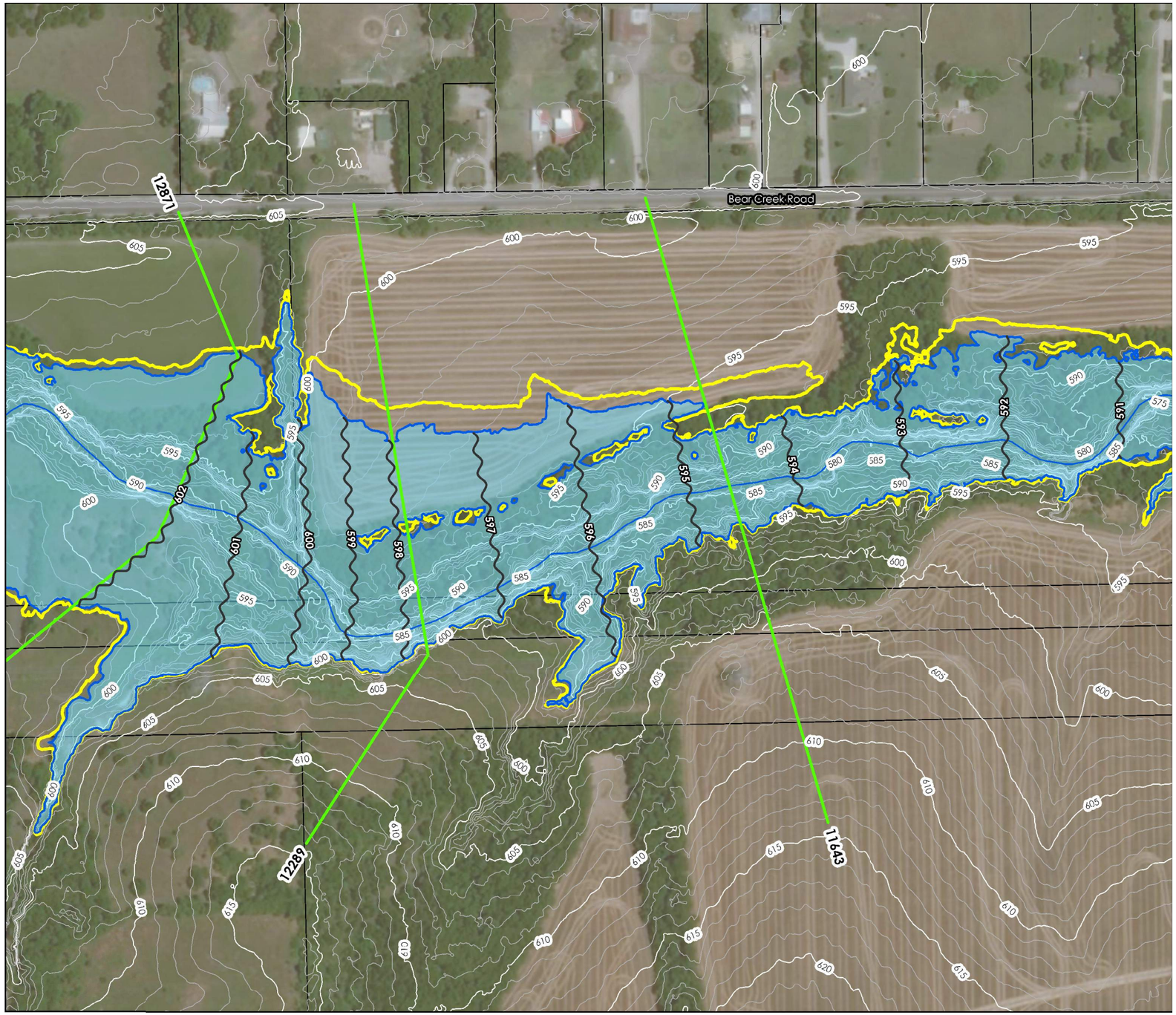
ULTIMATE 100-YEAR FLOODPLAIN

LIDAR MAJOR CONTOURS

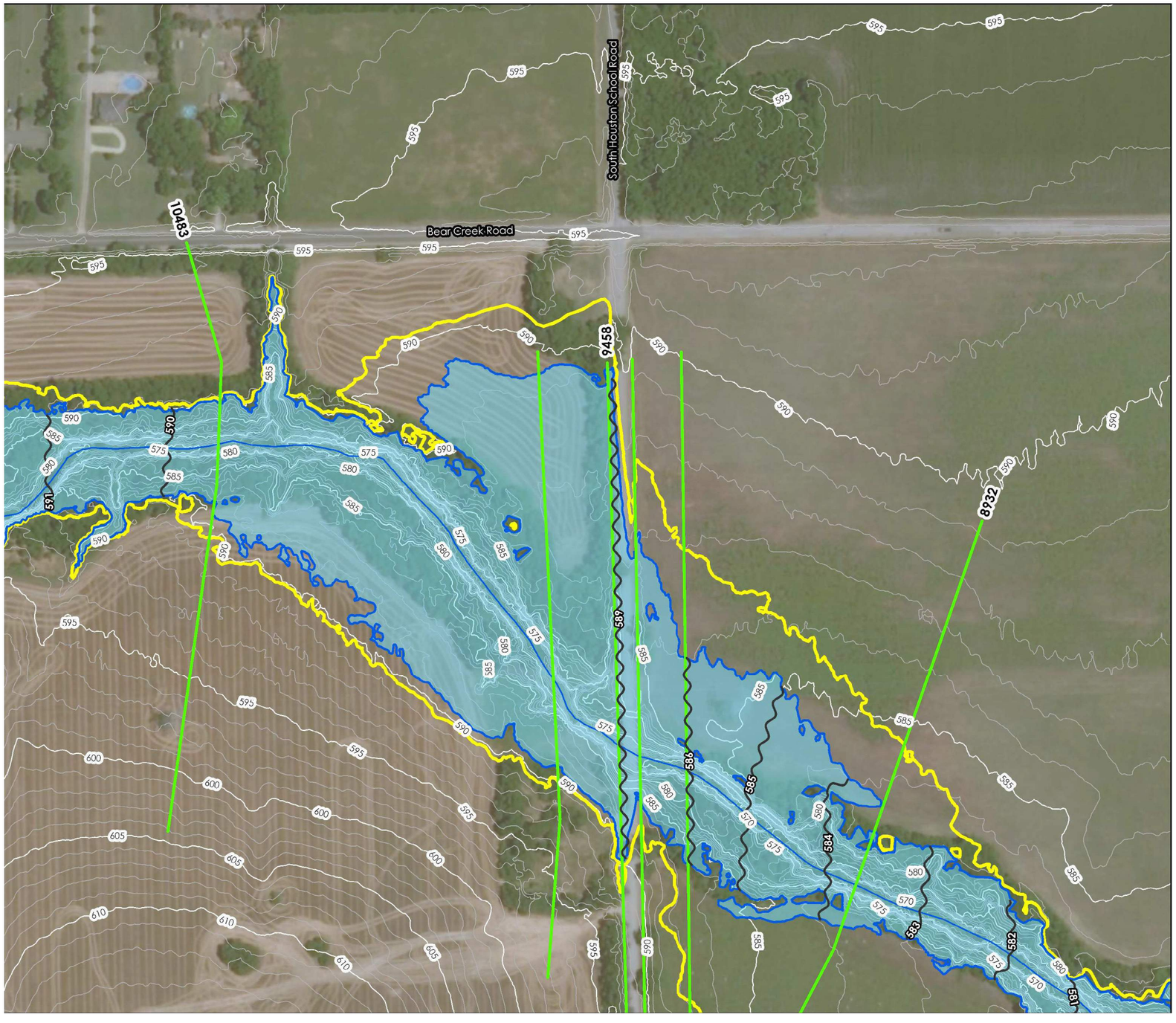
LIDAR MINOR CONTOURS

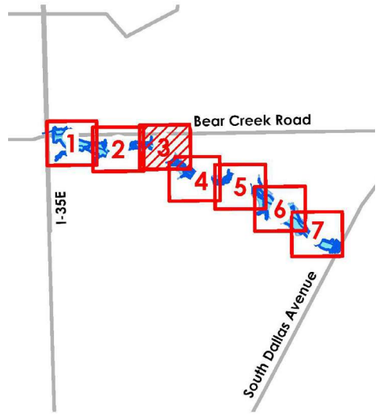
BEAR BASE FLOW ELEVATIONS

PARCEL



FLOODPLAIN: SHEET 3





N

0 100 200

Feet

R CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

R MAJOR CONTOURS

R MINOR CONTOURS

R BASE FLOW ELEVATIONS

CEL

WATERSHED NO.

2

COUNCIL DISTRICT

1

TOTAL DRAINAGE AREA

7.77 SM

*

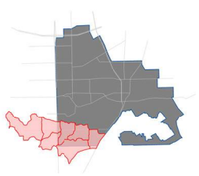
STREAM LENGTH

2.95 MI

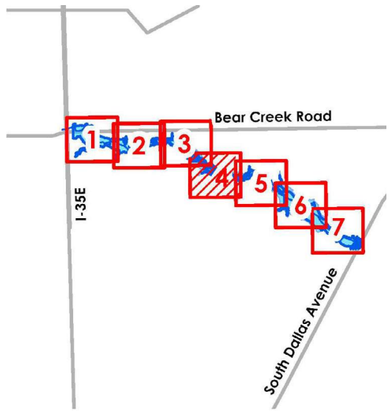
*

PROJECTS IDENTIFIED

1



FLOODPLAIN: SHEET 4

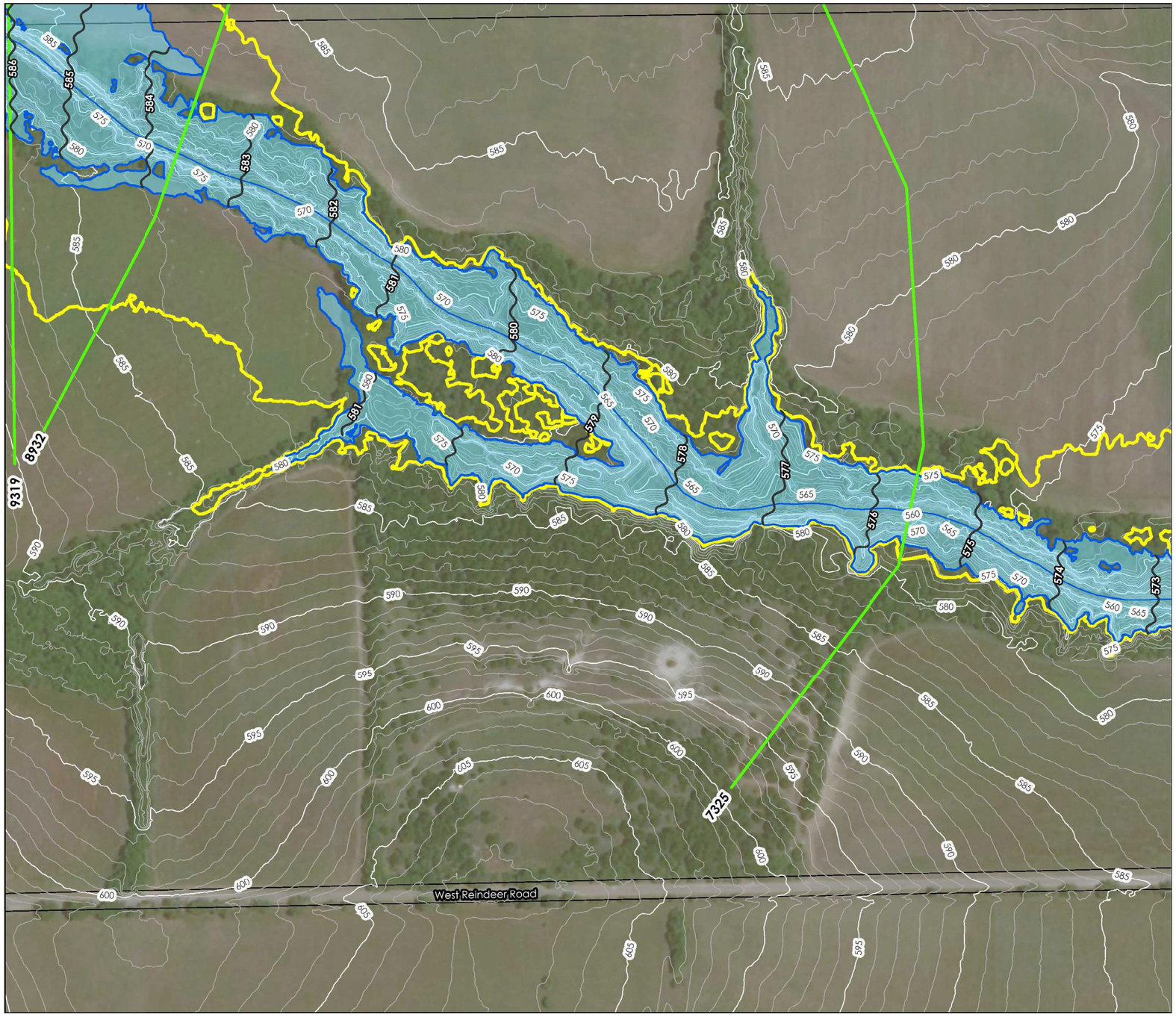


N

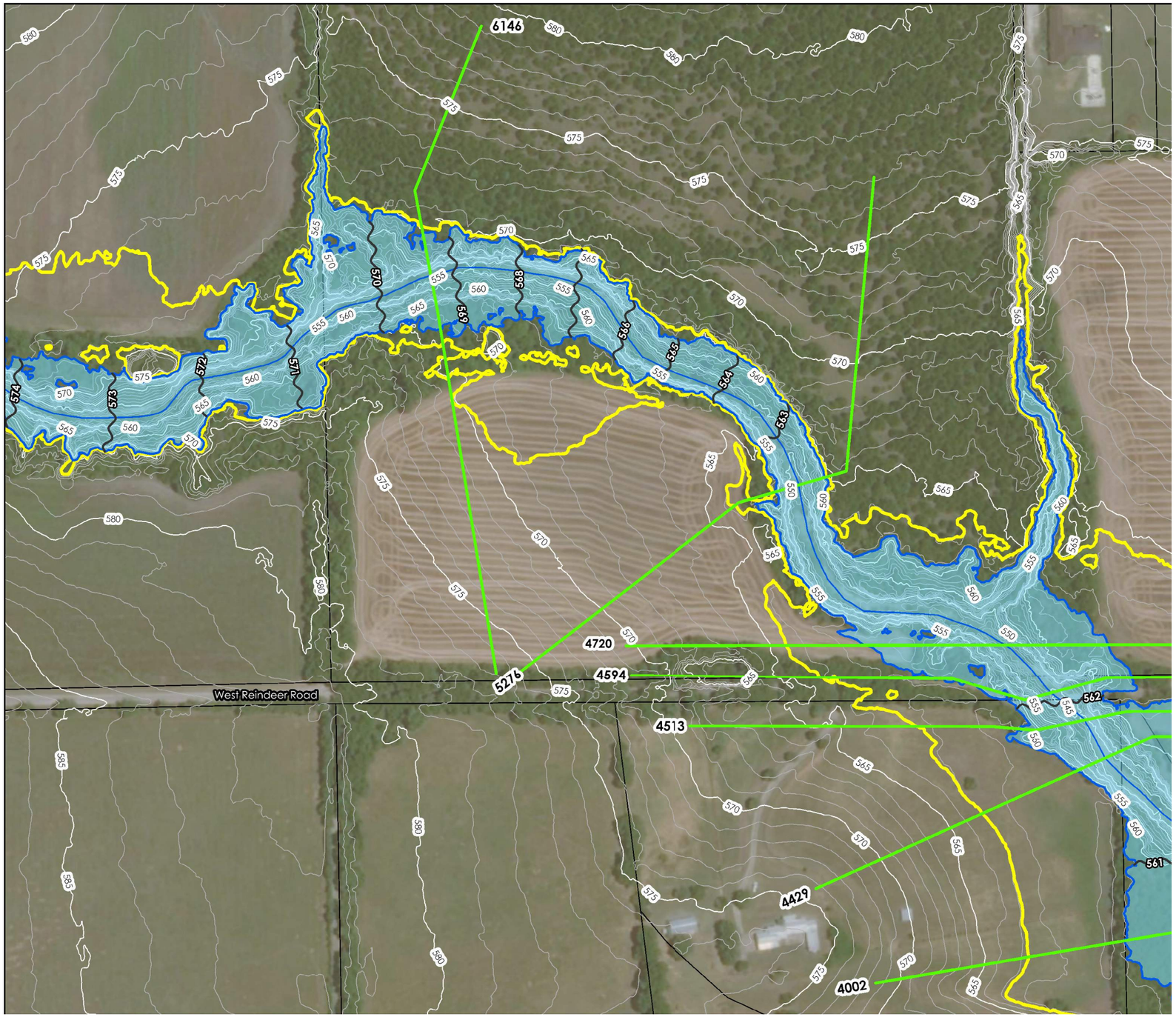
0 100 200 Feet

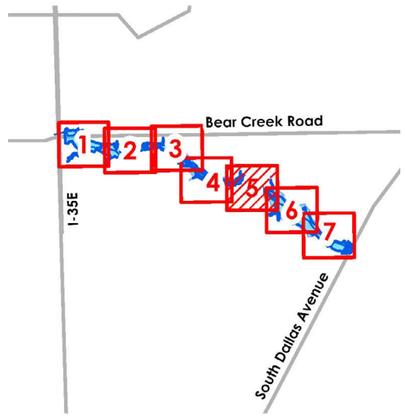
BEAR CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
BEAR BASE FLOW ELEVATIONS
PARCEL

0



FLOODPLAIN: SHEET 5





N

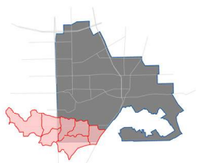
0 100 200
Feet

R CROSS SECTIONS
AM CENTERLINE
STING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
R BASE FLOW ELEVATIONS
CEL

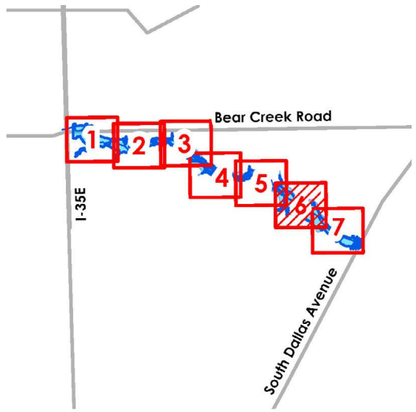
WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



FLOODPLAIN: SHEET 6

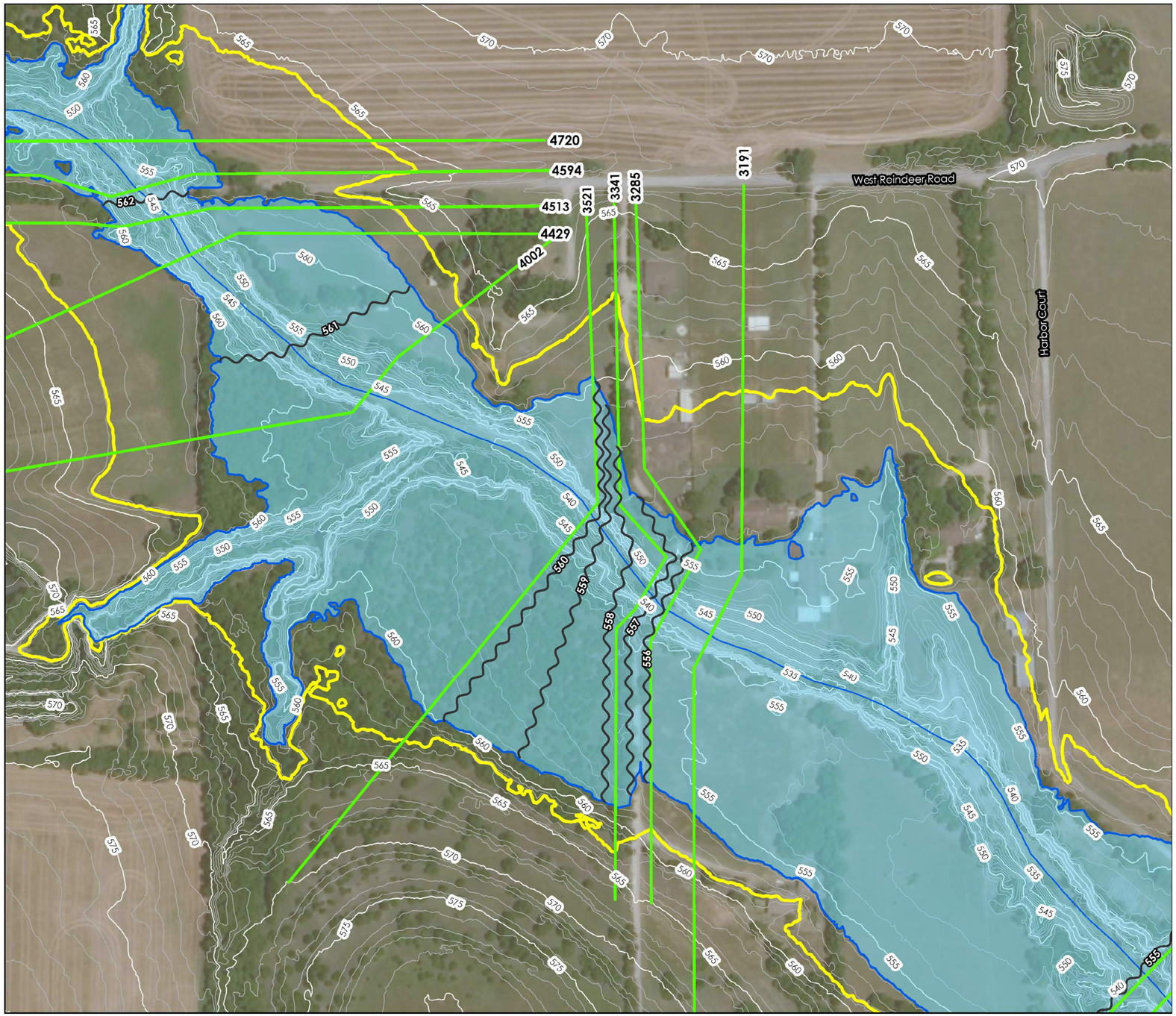


N

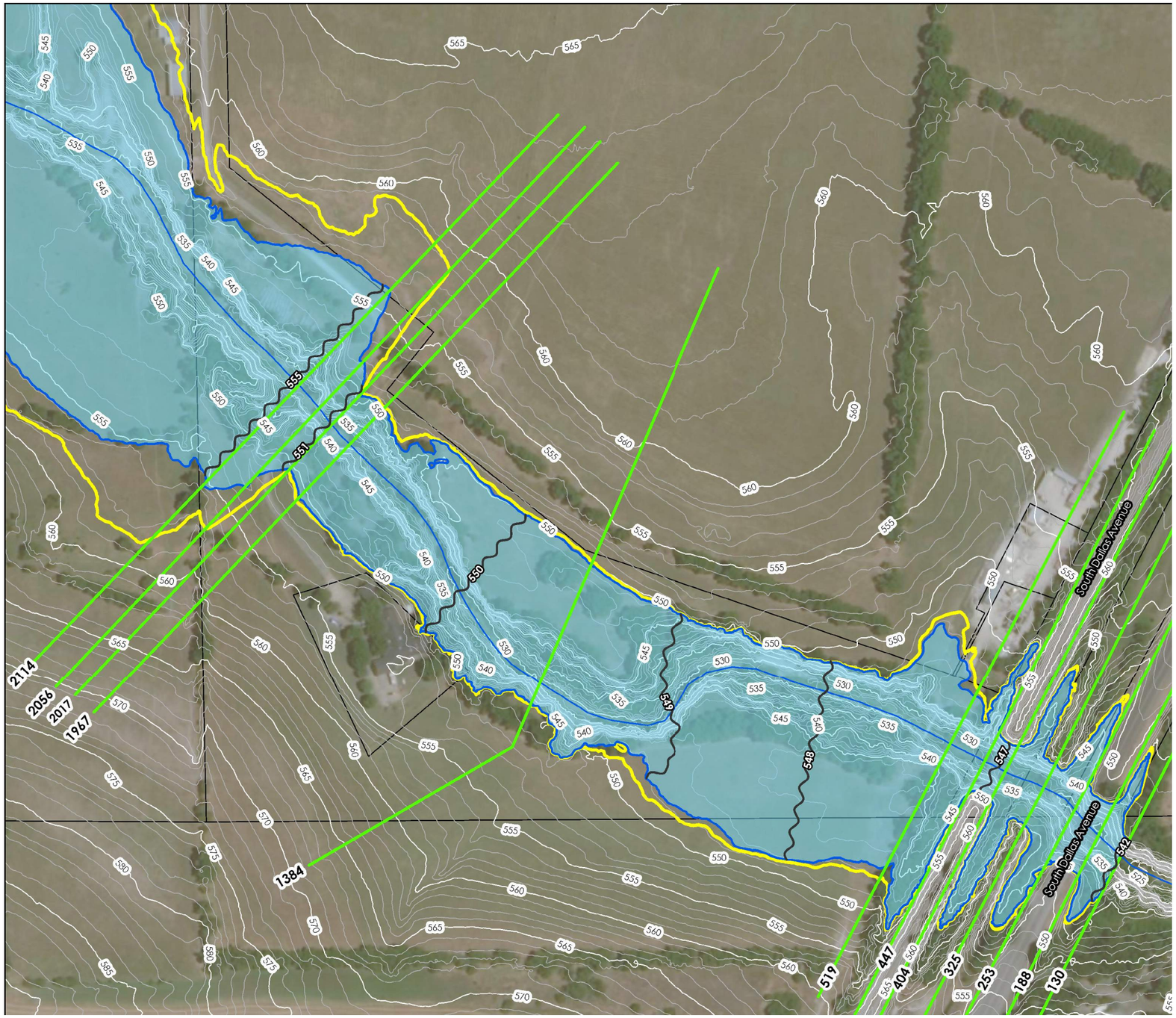
0 100 200
Feet

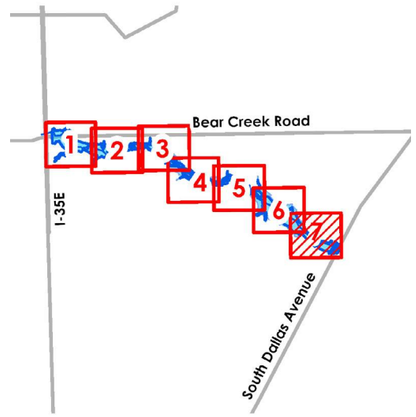
BEAR CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
BEAR BASE FLOW ELEVATIONS
PARCEL

0



FLOODPLAIN: SHEET 7





N

0 100 200
Feet

R CROSS SECTIONS
EAM CENTERLINE
STING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
R BASE FLOW ELEVATIONS
CEL

WATERSHED NO.
2

COUNCIL DISTRICT
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TOTAL DRAINAGE AREA
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STREAM LENGTH
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PROJECTS IDENTIFIED
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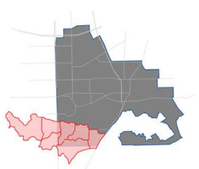


2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	607.91	608.58	4.96	5.28
15372	606.90	607.56	4.94	5.30
14787	603.90	605.07	7.21	6.46
14769	603.83	604.81	6.87	7.12
14747	**Bridge Crossing**			
14719	603.70	604.46	6.12	6.86
14457	603.58	604.39	3.11	3.38
14124	602.40	603.04	6.95	7.69
13363	598.55	599.20	7.89	8.27
12871	596.87	597.53	5.35	5.84
12289	593.32	593.88	8.59	9.06
11643	590.18	590.95	5.72	6.06
10483	580.86	581.85	12.67	12.95
9640	580.58	581.95	3.41	3.47
9458	580.29	581.74	4.11	3.88
9432	**South Houston School Road**			
9413	580.11	581.58	4.22	4.36
9319	579.31	580.81	6.83	6.89
8932	577.42	578.68	7.51	8.02
7325	567.91	569.30	8.53	8.60
6146	562.54	563.71	6.92	7.72
5276	555.37	556.58	11.78	12.06
4720	554.06	555.39	5.04	5.33
4594	553.96	555.28	3.96	4.31
4559	**Reindeer Road**			
4513	552.80	553.93	7.62	8.29
4429	552.55	553.71	6.56	7.04
4002	549.84	550.85	8.58	9.38
3521	547.77	549.05	7.03	7.08
3341	546.42	547.56	8.88	9.47
3307	**Private Crossing**			
3285	545.77	546.85	7.43	7.99
3191	545.10	546.25	8.38	8.71
2114	544.33	545.64	3.13	3.23

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	542.76	543.79	9.15	9.91
2043	**Private Crossing**			
2017	542.40	543.30	7.40	8.27
1967	542.28	543.20	7.01	7.68
1384	539.76	540.92	7.69	7.83
519	537.06	538.47	6.47	6.78
447	536.80	538.25	6.77	6.97
424	**Railroad**			
404	536.58	538.00	6.03	6.47
325	535.96	537.34	7.63	8.10
253	535.99	537.41	5.69	5.87
219	**Lancaster Hutchins Road**			
188	535.79	537.19	4.70	5.09
130	533.30	534.41	11.79	12.52

2.3 HYDRAULIC RESULTS: 2-YEAR

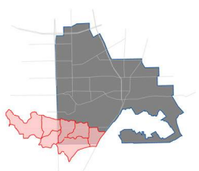
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	608.87	609.46	5.45	5.69
15372	607.84	608.44	5.49	5.73
14787	605.71	606.73	6.02	5.59
14769	605.33	606.20	7.17	7.41
14747	Bridge Crossing			
14719	604.88	605.51	7.13	7.79
14457	604.84	605.52	3.45	3.67
14124	603.39	603.92	8.12	8.77
13363	599.59	600.20	8.46	8.77
12871	597.92	598.53	6.11	6.52
12289	594.22	594.75	9.31	9.72
11643	591.42	592.09	6.22	6.51
10483	582.38	583.67	13.16	12.11
9640	582.27	583.37	3.74	3.85
9458	582.05	583.18	4.14	4.13
9432	Bridge Crossing			
9413	581.86	582.87	4.40	4.85
9319	581.12	582.14	6.79	7.06
8932	578.89	579.92	8.16	8.72
7325	569.57	570.70	8.61	8.89
6146	563.98	565.21	7.83	8.43
5276	556.79	557.64	12.17	13.15
4720	555.68	556.85	5.34	5.62
4594	555.57	556.74	4.36	4.73
4559	Bridge Crossing			
4513	554.23	555.31	8.28	8.66
4429	554.00	555.07	7.05	7.51
4002	551.64	552.38	8.54	9.54
3521	550.04	550.90	7.20	7.32
3341	548.41	549.15	9.99	10.45
3307	Bridge Crossing			
3285	547.64	548.33	8.49	8.94
3191	547.09	547.83	9.04	9.30
2114	546.61	547.47	3.30	3.35

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	544.57	545.27	10.39	10.80
2043	Bridge Crossing			
2017	543.98	544.60	8.85	9.33
1967	543.90	544.53	8.13	8.48
1384	541.79	542.56	7.91	7.99
519	539.48	540.31	7.03	7.28
447	539.29	540.15	7.09	7.25
424	Bridge Crossing			
404	539.02	539.85	6.77	7.07
325	538.34	539.15	8.40	8.69
253	538.44	539.28	5.96	6.07
219	Bridge Crossing			
188	538.20	539.02	5.37	5.64
130	535.31	536.28	12.85	12.67

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	610.13	610.74	5.86	5.93
15372	609.19	609.93	5.83	5.79
14787	607.82	608.97	5.28	4.82
14769	607.16	608.20	7.65	7.69
14747	**Bridge Crossing**			
14719	606.14	606.74	8.53	9.14
14457	606.23	606.92	3.88	3.98
14124	604.42	604.94	9.57	10.23
13363	601.17	601.51	8.60	9.19
12871	599.59	600.00	6.11	6.28
12289	595.35	595.84	10.07	10.33
11643	592.78	592.98	6.80	7.46
10483	584.34	585.50	12.37	11.16
9640	583.91	585.21	4.27	4.18
9458	583.69	585.04	4.54	4.36
9432	**South Houston School Road**			
9413	583.22	584.36	5.02	5.55
9319	582.49	583.64	7.19	7.61
8932	580.25	581.29	8.98	9.74
7325	571.12	572.53	8.98	9.14
6146	565.62	567.01	8.69	9.38
5276	557.98	559.21	13.39	13.82
4720	557.32	558.58	5.69	6.06
4594	557.21	558.46	4.82	5.22
4559	**Reindeer Road**			
4513	555.86	557.00	8.52	9.02
4429	555.66	556.76	7.46	8.14
4002	553.91	554.85	8.06	8.96
3521	552.57	553.63	7.55	7.72
3341	550.63	551.55	11.19	11.66
3307	**Private Crossing**			
3285	549.81	550.67	9.57	10.04
3191	549.48	550.36	9.49	9.81
2114	549.29	550.27	3.47	3.53

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	546.80	547.72	11.48	11.66
2043	**Private Crossing**			
2017	545.88	546.55	10.34	10.88
1967	545.86	546.57	9.21	9.61
1384	544.13	544.95	8.21	8.39
519	541.94	542.77	7.87	8.23
447	541.81	542.64	7.66	7.92
424	**Railroad**			
404	541.45	542.23	7.77	8.17
325	540.69	541.44	9.35	9.74
253	540.88	541.68	6.32	6.49
219	**Lancaster Hutchins Road**			
188	540.55	541.33	6.22	6.48
130	537.75	538.32	13.00	13.51

2.3 HYDRAULIC RESULTS: 10-YEAR

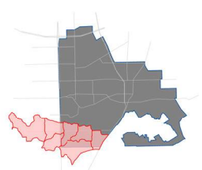
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	611.07	611.52	5.82	5.97
15372	610.40	610.91	5.50	5.51
14787	609.73	610.41	4.31	4.02
14769	608.94	610.33	7.42	4.91
14747	**Bridge Crossing**			
14719	607.34	607.86	7.10	7.16
14457	607.26	607.81	3.92	3.95
14124	605.21	605.67	10.54	10.95
13363	601.68	601.97	9.50	10.08
12871	600.23	600.61	6.33	6.47
12289	596.01	596.49	10.62	10.82
11643	593.31	593.28	7.51	8.41
10483	585.53	587.07	11.82	10.19
9640	585.17	586.53	4.47	4.29
9458	584.98	586.35	4.68	4.50
9432	**South Houston School Road**			
9413	584.20	585.34	5.47	5.95
9319	583.48	584.60	7.55	7.97
8932	581.14	582.22	9.64	10.21
7325	572.33	573.72	9.12	9.23
6146	566.81	568.14	9.29	9.91
5276	559.02	560.12	13.80	14.27
4720	558.53	559.68	5.91	6.25
4594	558.42	559.56	5.08	5.51
4559	**Reindeer Road**			
4513	557.13	558.20	8.55	8.98
4429	556.92	557.96	7.72	8.42
4002	555.52	556.36	7.92	8.83
3521	554.30	555.22	7.80	7.96
3341	552.19	553.04	11.83	12.15
3307	**Private Crossing**			
3285	551.39	552.32	10.10	10.27
3191	551.10	552.06	9.78	9.85
2114	551.04	552.05	3.57	3.65

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	548.43	549.39	11.79	11.97
2043	**Private Crossing**			
2017	547.09	547.89	11.29	11.80
1967	547.13	547.97	9.91	10.27
1384	545.61	546.57	8.51	8.64
519	543.43	544.37	8.49	8.83
447	543.32	544.27	8.09	8.31
424	**Railroad**			
404	542.84	543.70	8.47	8.85
325	542.02	542.82	10.06	10.47
253	542.29	543.14	6.63	6.84
219	**Lancaster Hutchins Road**			
188	541.93	542.76	6.68	6.95
130	538.77	539.36	13.90	14.46

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	611.85	612.13	6.09	6.31
15372	611.25	611.52	5.62	5.84
14787	610.82	611.12	3.93	3.96
14769	610.76	611.08	4.76	4.72
14747	**Bridge Crossing**			
14719	608.34	608.68	7.03	7.09
14457	608.31	608.64	3.88	4.01
14124	606.13	606.51	11.28	11.37
13363	602.23	602.46	10.68	11.14
12871	601.01	601.34	6.56	6.64
12289	596.81	597.16	11.27	11.55
11643	593.72	593.86	8.65	9.20
10483	587.43	588.40	10.66	10.05
9640	586.84	588.09	4.56	4.30
9458	586.64	587.93	4.83	4.60
9432	**South Houston School Road**			
9413	585.38	586.40	5.96	6.24
9319	584.64	585.57	7.99	8.47
8932	582.26	583.10	10.22	10.86
7325	573.77	574.95	9.25	9.45
6146	568.03	569.26	10.10	10.49
5276	560.36	561.16	13.84	14.69
4720	560.01	561.00	6.02	6.33
4594	559.90	560.87	5.35	5.77
4559	**Reindeer Road**			
4513	558.78	559.66	8.33	8.83
4429	558.57	559.40	7.91	8.63
4002	557.45	558.08	7.82	8.74
3521	556.26	557.01	8.20	8.35
3341	553.89	554.52	12.71	13.10
3307	**Private Crossing**			
3285	553.23	553.88	10.68	10.97
3191	553.00	553.66	10.13	10.40
2114	553.07	553.78	3.73	3.79

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	550.36	550.99	12.15	12.37
2043	**Private Crossing**			
2017	548.72	549.27	12.32	12.70
1967	548.84	549.41	10.65	10.98
1384	547.58	548.23	8.77	8.94
519	545.32	545.99	9.19	9.43
447	545.24	545.92	8.52	8.69
424	**Railroad**			
404	544.59	545.21	9.21	9.47
325	543.68	544.33	10.81	10.99
253	544.03	544.69	7.06	7.21
219	**Lancaster Hutchins Road**			
188	543.63	544.27	7.22	7.40
130	539.98	540.44	15.04	15.46

2.3 HYDRAULIC RESULTS: 50-YEAR

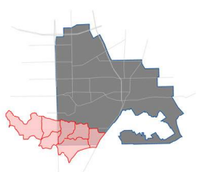
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	612.23	612.43	6.36	6.70
15372	611.63	611.83	5.88	6.06
14787	611.25	611.46	3.93	3.98
14769	611.22	611.43	4.66	4.70
14747	**Bridge Crossing**			
14719	608.92	609.22	6.80	6.83
14457	608.88	609.17	3.93	3.99
14124	606.76	607.16	11.47	11.40
13363	602.63	602.83	11.42	11.91
12871	601.57	601.84	6.70	6.84
12289	597.34	597.71	11.81	11.89
11643	594.19	594.28	9.24	9.87
10483	588.40	589.57	10.63	9.78
9640	588.03	589.48	4.57	4.07
9458	587.84	589.40	4.92	4.17
9432	**South Houston School Road**			
9413	586.11	587.23	6.20	6.37
9319	585.33	586.38	8.32	8.66
8932	582.86	584.04	10.74	10.99
7325	574.72	575.99	9.30	9.48
6146	568.89	570.05	10.48	10.93
5276	561.19	561.82	13.99	15.39
4720	561.07	562.09	6.00	6.34
4594	560.96	561.96	5.47	5.96
4559	**Reindeer Road**			
4513	559.97	560.76	8.11	8.83
4429	559.75	560.49	7.95	8.84
4002	558.75	559.26	7.78	8.83
3521	557.59	558.48	8.39	7.99
3341	555.02	556.05	13.33	12.90
3307	**Private Crossing**			
3285	554.39	555.03	11.13	11.08
3191	554.18	554.81	10.55	10.56
2114	554.36	555.07	3.85	3.83

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	551.45	552.34	12.66	12.35
2043	**Private Crossing**			
2017	549.72	550.08	13.03	13.34
1967	549.89	550.28	11.22	11.43
1384	548.78	549.23	9.05	9.12
519	546.56	547.06	9.60	9.69
447	546.49	546.98	8.84	8.97
424	**Railroad**			
404	545.73	546.17	9.70	9.89
325	544.87	545.32	11.16	11.32
253	545.25	545.72	7.35	7.47
219	**Lancaster Hutchins Road**			
188	544.81	545.26	7.57	7.71
130	540.82	541.15	15.81	16.09

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 100-YEAR

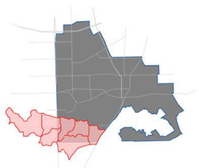
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
15729	612.56	612.74	6.76	6.92
15372	611.94	612.10	6.20	6.39
14787	611.58	611.72	4.02	4.15
14769	611.55	611.70	4.73	4.84
14747	**Bridge Crossing**			
14719	609.45	609.67	6.62	6.63
14457	609.39	609.60	3.97	4.08
14124	607.42	607.75	11.43	11.32
13363	602.96	603.15	12.24	12.63
12871	602.03	602.20	6.91	7.11
12289	597.89	598.27	12.06	11.91
11643	594.60	594.83	9.89	10.25
10483	589.48	590.23	10.40	10.12
9640	589.35	590.28	4.36	4.04
9458	589.26	590.22	4.49	4.06
9432	**South Houston School Road**			
9413	586.87	587.78	6.30	6.57
9319	586.01	586.89	8.60	8.95
8932	583.59	584.54	10.97	11.23
7325	575.65	576.79	9.31	9.47
6146	569.40	570.14	11.13	12.01
5276	562.10	563.63	13.92	13.63
4720	562.42	564.52	5.70	4.88
4594	562.31	564.35	5.42	5.15
4559	**Reindeer Road**			
4513	561.47	563.17	7.59	6.76
4429	561.31	563.04	7.53	6.84
4002	560.72	562.76	6.92	5.96
3521	560.25	562.60	6.72	4.95
3341	558.06	562.52	11.90	5.44
3307	**Private Crossing**			
3285	555.88	558.48	11.01	7.93
3191	555.75	558.48	10.20	6.89
2114	556.00	558.41	3.75	3.21

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2056	553.08	557.82	12.65	7.15
2043	**Private Crossing**			
2017	550.44	550.66	13.73	13.96
1967	550.68	550.91	11.69	11.89
1384	549.70	549.97	9.23	9.30
519	547.62	547.96	9.73	9.72
447	547.52	547.85	9.11	9.19
424	**Railroad**			
404	546.66	546.95	10.11	10.24
325	545.82	546.12	11.50	11.61
253	546.24	546.55	7.61	7.70
219	**Lancaster Hutchins Road**			
188	545.77	546.06	7.87	7.97
130	541.52	541.75	16.41	16.57

WATERSHED NO.
2

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
7.77 SM
*
STREAM LENGTH
2.95 MI
*
PROJECTS IDENTIFIED
1

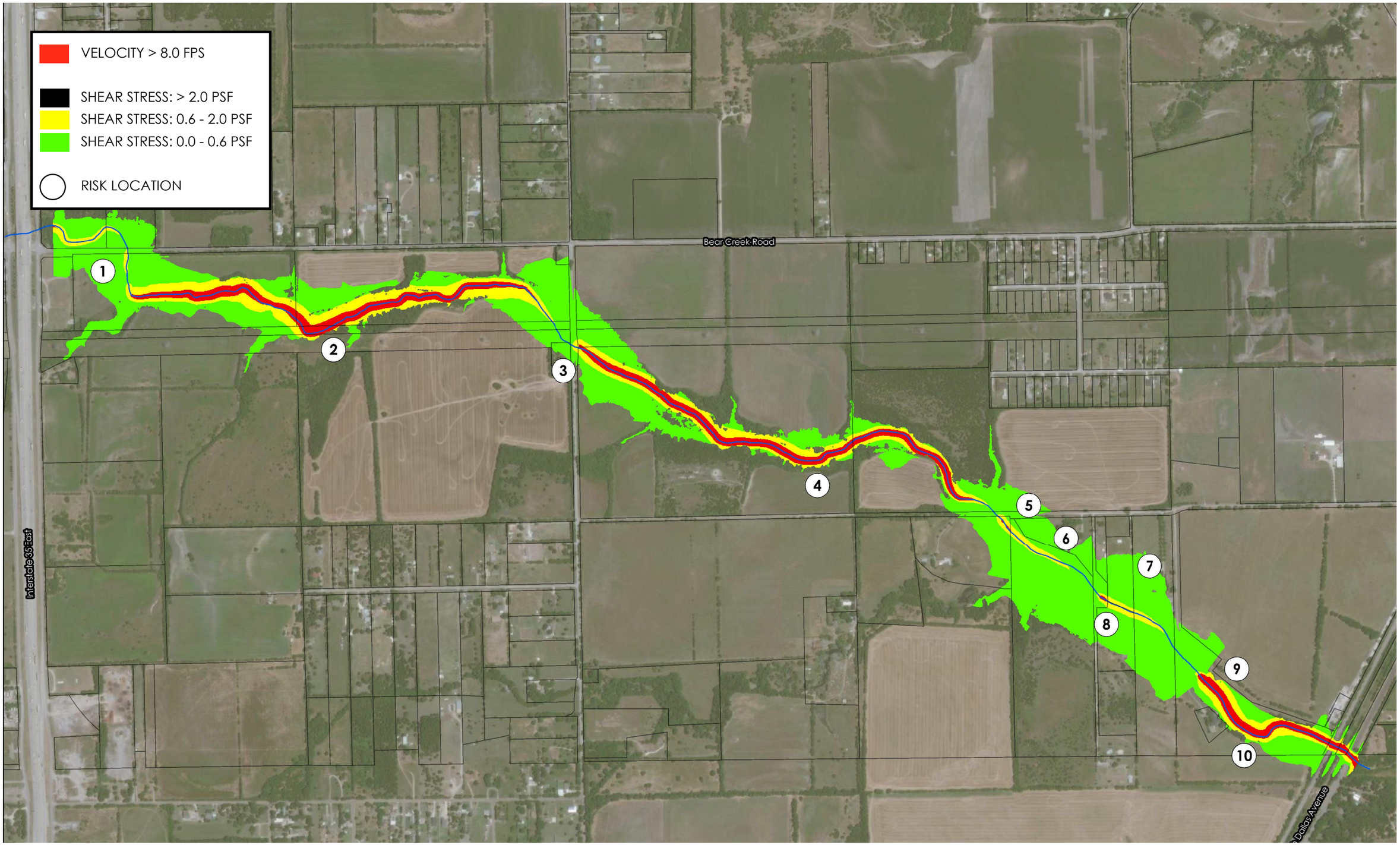


3.1 RISK IDENTIFICATION

Ten risk areas were identified in this study. The risks include five over-topping Bridges, two flooding structures and three locations of erosive velocities. The flooded structures are residential buildings along Reindeer Road that flood in the 50-year event. The bridges are generally low traffic areas with the exception of Bear Creek Road and South Houston School Road, which over-top in the 10-year event and the 50-year event, respectively. The three areas where erosion is likely are all located in areas with very little development. The following map shows the shear stresses associated with the Bear Creek floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Bear Creek Road	Over-topping Bridge	10-Year	Public	High
2	River Station 13363	Potential Erosion Hot Spot	1-Year	Private	Very Low
3	South Houston School Road	Over-topping Bridge	50-Year	Public	Medium
4	River Station 6146	Potential Erosion Hot Spot	1-Year	Private	Very Low
5	Private Property on Reindeer Road	Flooded Structures	50-Year	Private	Low
6	Private Property on Reindeer Road	Flooded Structures	50-Year	Private	Low
7	Reindeer Road	Over-topping Bridge	100-Year	Public	Medium
8	Private Crossing	Over-topping Bridge	100-Year	Private	Very Low
9	Private Crossing	Over-topping Bridge	50-Year	Private	Low
10	River Station 1967	Potential Erosion Hot Spot	1-Year	Private	Very Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
Bear Creek Road
Interstate 35 East
Dallas Avenue
1
2
3
4
5
6
7
8
9
10

DEEP BRANCH

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

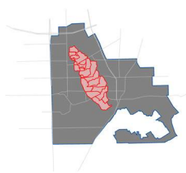
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



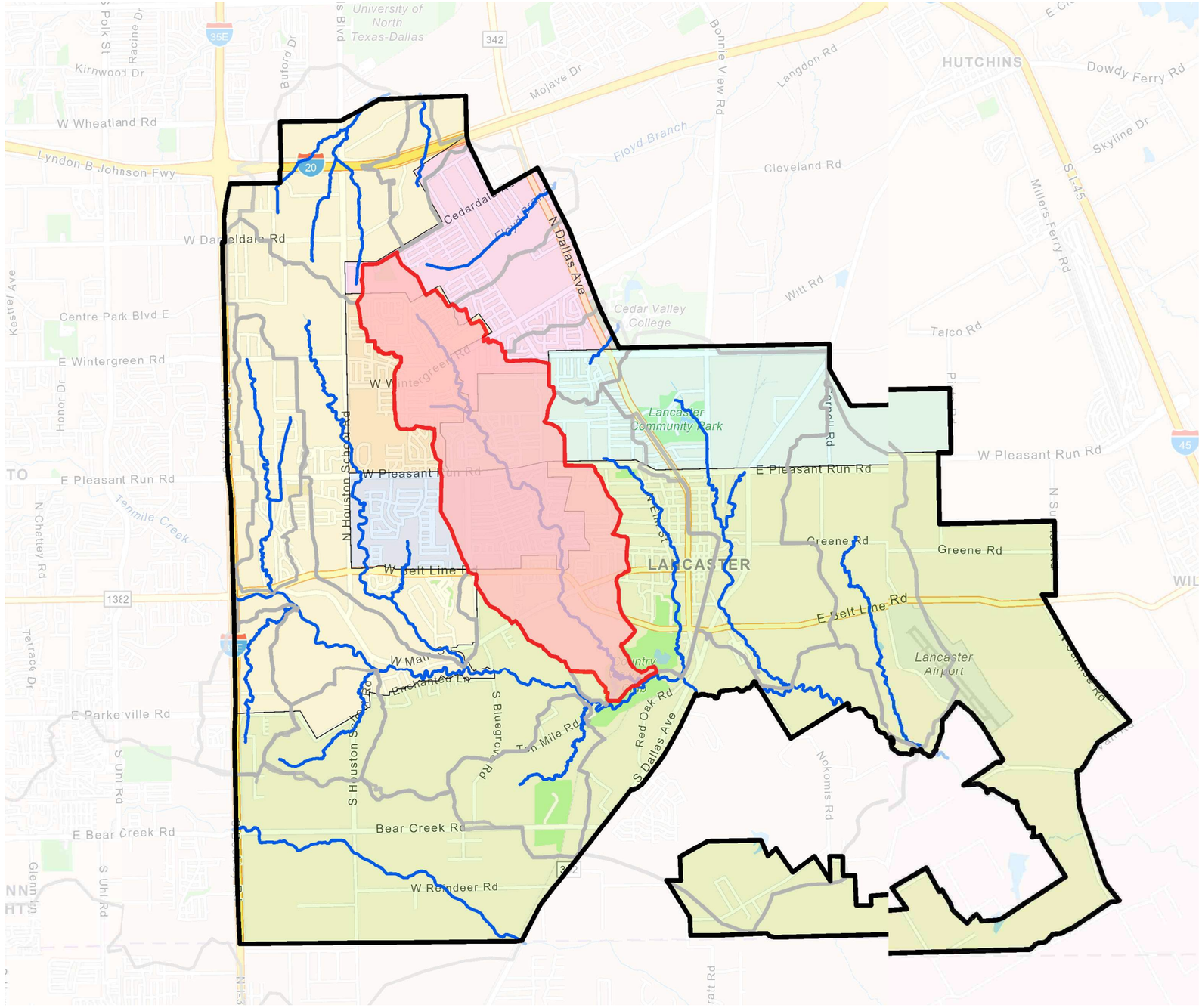
- DEEP BRANCH
- STREAM CENTERLINE

COUNCIL DISTRICT

- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

DEEP BRANCH WATERSHED

Centered between the Halls Branch and Mill Creek watersheds, Deep Branch spans approximately 3.48 square miles. Originating from a storm drain outfall, it runs southeast to Ten Mile Creek for about 4.50 miles. Primarily residential, it also offers open spaces intended for future residential projects.



WATERSHED NO. 3

DEEP BRANCH

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WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



1.1 DRAINAGE AREA MAP

The drainage area divides for the watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into twenty-four (24) sub-basins. Sub-basins are designated DB1 through DB20. The total watershed drainage area is 2493.35 acres (3.90 square-miles). All of the drainage area is located within the Lancaster City Limits.

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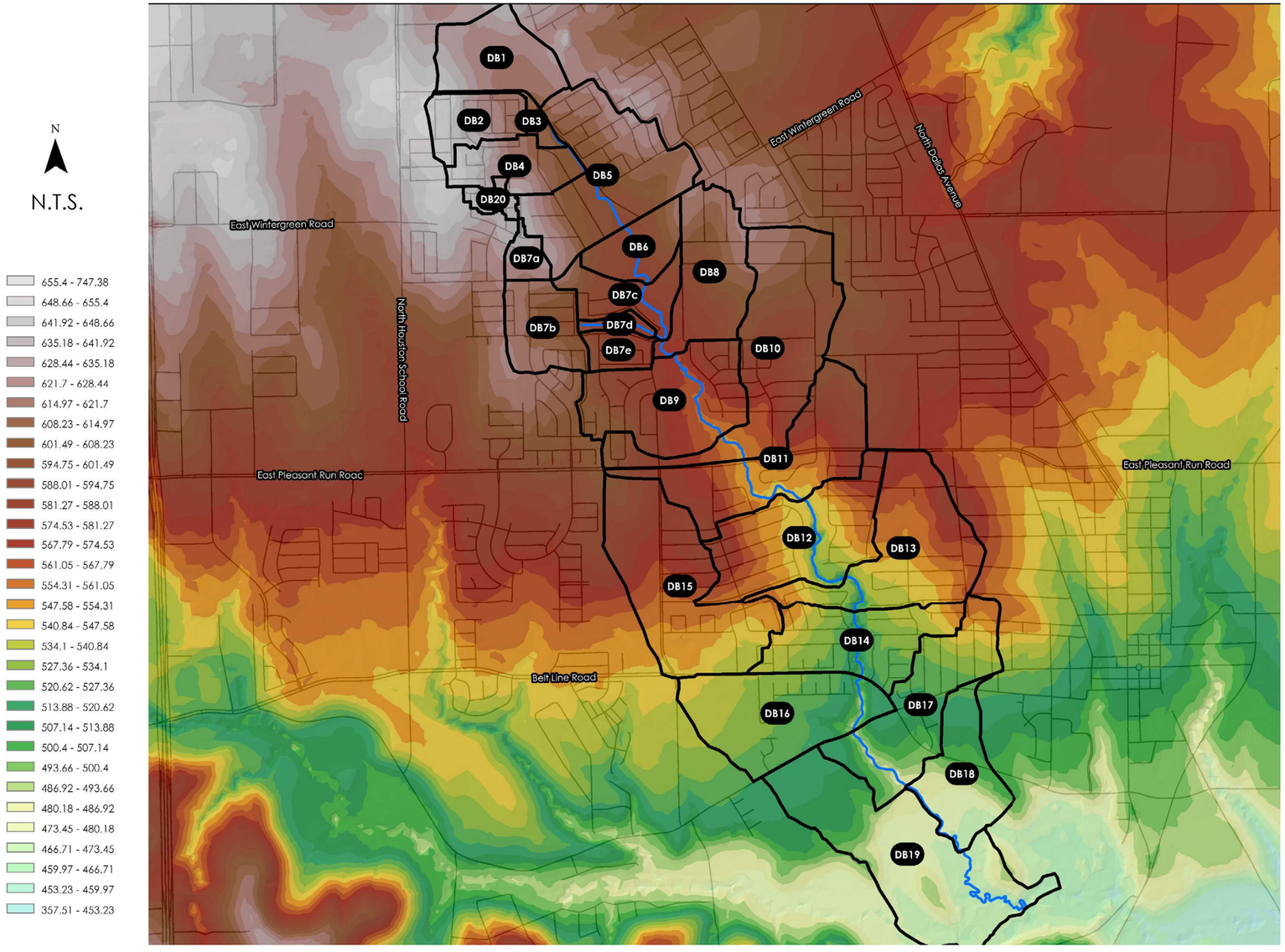


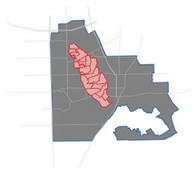
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
DB1	0.1361	84	8.8	27.4	26.32	15.79	20.85	12.51
DB2	0.0813	84	55.5	56.7	12.70	7.62	10.62	6.37
DB3	0.0189	84	20.9	24.2	20.22	12.13	15.90	9.54
DB4	0.0926	84	35.8	41	21.95	13.17	18.15	10.89
DB5	0.2763	84	34.5	38	26.02	15.61	20.48	12.29
DB6	0.0801	84	3.6	31.4	17.85	10.71	14.52	8.71
DB7a	0.0292	84	15.7	40.1	17.58	10.55	13.60	8.16
DB7b	0.1044	84	49.3	52.5	25.98	15.59	20.70	12.42
DB7c	0.0835	84	23.8	41	22.17	13.3	17.83	10.7
DB7d	0.0171	84	24.1	24.1	10.28	6.17	10.00	6
DB7e	0.0402	84	49.8	49.8	22.07	13.24	17.58	10.55
DB8	0.1683	84	14.4	30.8	24.45	14.67	20.42	12.25
DB9	0.224	84	45.8	52.4	22.75	13.65	18.88	11.33
DB10	0.3196	83.7	31.2	42.3	47.18	28.31	39.18	23.51
DB11	0.2399	82.6	48.5	60.5	30.42	18.25	24.50	14.7
DB12	0.2421	82.3	47.2	47.2	40.85	24.51	32.50	19.5
DB13	0.2599	80.9	50.7	56.1	25.55	15.33	20.22	12.13
DB14	0.1842	83.1	50.1	50.8	27.20	16.32	22.65	13.59
DB15	0.312	84	34.9	45.9	37.62	22.57	31.60	18.96
DB16	0.2365	83.5	28.6	47.2	45.72	27.43	36.33	21.8
DB17	0.2173	82.3	28.3	42	32.08	19.25	27.50	16.5
DB18	0.139	79.5	4.9	26	31.05	18.63	24.83	14.9
DB19	0.3716	81.1	2	18.4	47.87	28.72	39.97	23.98
DB20	0.0218	84	51.2	52.8	17.92	10.75	14.15	8.49

WATERSHED NO.
3

COUNCIL DISTRICTS
1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA
3.90 SM
*
STREAM LENGTH
4.72 MI
*
PROJECTS IDENTIFIED
5



1.2 TIME OF CONCENTRATION

The Times of Concentration for Deep Branch were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Deep Branch flows through both developed and undeveloped sub-basins. Developed sub-basins result in shorter Times on Concentration than those undeveloped. Similarly, smaller sub-basins like DB20 and DB7a-7e have reduced Times of Concentration. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

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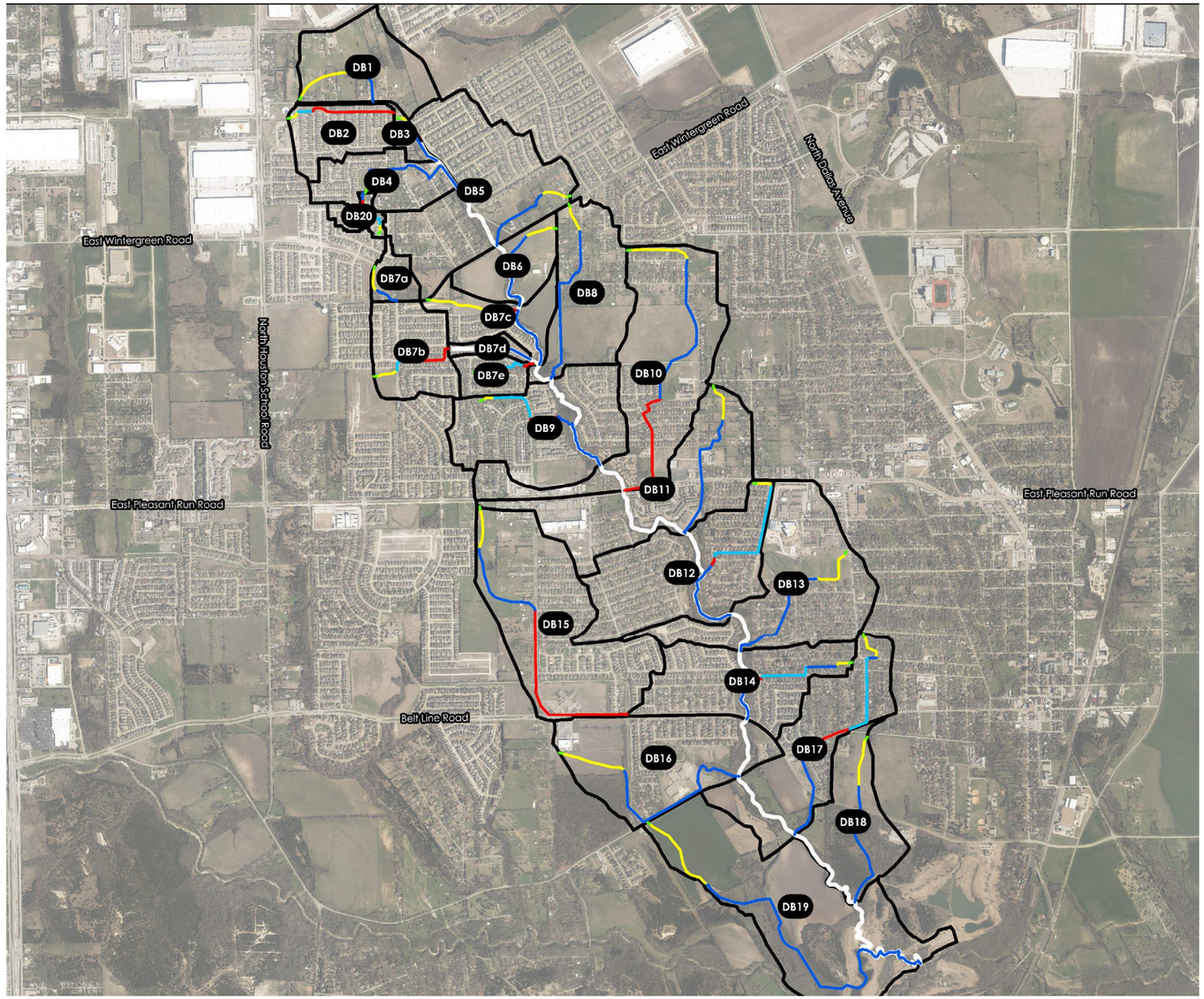


TIME OF CONCENTRATION REPORT

DB1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.59	0.240	0.00	0.1	14.74
SHALLOW	UNPAVED	1,107	2.58	0.000	16.10	2.6	7.13
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	933	1.49	0.050	28.69	3.5	4.44
		2,140					**26.31**
							20.84

DB2

OVERLAND	GRS-DENSE	100	7.78	0.240	0.00	0.2	7.82
SHALLOW	PAVED	106	3.18	0.000	20.30	3.6	0.49
SHALLOW	UNPAVED	61	1.35	0.000	16.10	1.9	0.54
GUTTER	G-20	289	1.12	0.018	24.18	2.6	1.89
PIPE	36" RCP	1,673	2.6	0.014	87.62	14.1	1.97
		2,229					**12.70**
							6.37

DB3

OVERLAND	GRS-DENSE	100	1.2	0.240	0.00	0.1	16.53
SHALLOW	UNPAVED	133	3.83	0.000	16.10	3.2	0.70
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	996	3.76	0.050	28.69	5.6	2.98
		1,229					**20.21**
							15.90

DB4

OVERLAND	GRS-DENSE	100	4.14	0.240	0.00	0.2	10.06
SHALLOW	UNPAVED	350	0.5	0.000	16.10	1.1	5.12
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,234	3.67	0.050	28.69	5.5	6.77
		2,684					**21.95**
							18.16

DB5

OVERLAND	GRS-DENSE	100	0.86	0.240	0.00	0.1	18.89
SHALLOW	UNPAVED	507	2.63	0.000	16.10	2.6	3.24
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,469	4.81	0.050	28.69	6.3	3.89
		2,079					**26.02**
							20.49

DB6

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	4.01	0.240	0.00	0.2	10.19
SHALLOW	UNPAVED	551	3.31	0.000	16.10	2.9	3.14
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	548	1.72	0.050	28.69	3.8	2.43
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,250	5.55	0.050	42.29	10.0	2.09
		2,450					**17.85**
							14.52

DB7a

OVERLAND	GRS-DENSE	100	2.35	0.240	0.00	0.1	12.62
SHALLOW	UNPAVED	417	1.69	0.000	16.10	2.1	3.32
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	482	2.87	0.050	28.69	4.9	1.65
		999					**17.59**
							13.61

DB7b

OVERLAND	GRS-DENSE	100	0.89	0.240	0.00	0.1	18.60
SHALLOW	UNPAVED	390	2.52	0.000	16.10	2.6	2.54
GUTTER	G-20	670	1.59	0.018	24.18	3.0	3.66
PIPE	36" RCP	705	1.29	0.014	87.62	10.0	1.18
		1,865					**25.98**
							20.70

DB7c

OVERLAND	GRS-DENSE	100	3.37	0.240	0.00	0.2	10.91
SHALLOW	UNPAVED	1,095	3.1	0.000	16.10	2.8	6.44
GUTTER	ALLEY-10	384	0.55	0.018	39.51	2.9	2.19
PIPE	36" RCP	420	2.48	0.014	87.62	13.8	0.51
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,315	5.98	0.050	42.29	10.3	2.12
		3,314					**22.17**
							17.83

DB7d

OVERLAND	GRS-DENSE	100	5.95	0.240	0.00	0.2	8.70
SHALLOW	UNPAVED	112	4.21	0.000	16.10	3.3	0.57
CHANNEL	"CONCR. TRAP (B=4,Y=3,SS=1:1)"	844	1.41	0.018	116.76	13.9	1.02
		1,056					**10.28**
							7.96

TIME OF CONCENTRATION REPORT - CONTINUED

DB7e

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
SHALLOW	UNPAVED	130	3.68	0.000	16.10	3.1	0.70
GUTTER	ALLEY-10	663	1.49	0.018	39.51	4.8	2.29
GUTTER	G-20	208	0.87	0.018	24.18	2.3	1.53
PIPE	36" RCP	208	2.23	0.014	87.62	13.1	0.26
PIPE	36" RCP	208	2.23	0.014	87.62	13.1	0.26
		1,309					**22.07**
							17.58

DB8

OVERLAND	GRS-DENSE	100	2.31	0.240	0.00	0.1	12.70
SHALLOW	UNPAVED	499	2.27	0.000	16.10	2.4	3.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,910	5.04	0.050	28.69	6.4	7.53
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	454	5.22	0.050	42.29	9.7	0.78
		3,963					**24.45**
							20.42

DB9

OVERLAND	GRS-DENSE	100	1.78	0.24	0	0.1	14.11
SHALLOW	UNPAVED	197	2.24	0	16.1	2.4	1.36
GUTTER	ALLEY-10	625	2	0.018	39.51	5.6	1.87
GUTTER	G-20	402	1.23	0.018	24.18	2.7	2.5
PIPE	36" RCP	586	4.47	0.014	87.62	15.5	0.53
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1453	5.75	0.05	42.29	10.1	2.39
		3,364					**22.75**
							18.88

DB10

OVERLAND	GRS-DENSE	100	0.58	0.240	0.00	0.1	22.07
SHALLOW	UNPAVED	1,200	1.55	0.000	16.10	2.0	9.99
PIPE	36" RCP	2,663	1.53	0.014	87.62	10.8	4.10
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,137	2.72	0.050	28.69	4.7	11.04
		4,639					**47.19**
							39.18

DB11

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.88	0.240	0.00	0.1	18.67
SHALLOW	UNPAVED	695	2.07	0.000	16.10	2.3	5.00
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,656	5.34	0.050	28.69	6.6	6.67
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	41	5.64	0.050	42.29	10.0	0.07
		4,548					**30.41**
							24.49

DB12

OVERLAND	GRS-DENSE	100	0.45	0.240	0.00	0.1	24.36
SHALLOW	UNPAVED	295	1.97	0.000	16.10	2.3	2.18
GUTTER	ALLEY-10	964	2.53	0.018	39.51	6.3	2.56
GUTTER	G-20	1,346	1.14	0.018	24.18	2.6	8.70
PIPE	36" RCP	171	2.01	0.014	87.62	12.4	0.23
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,727	5.79	0.050	42.29	10.2	2.83
		4,602					**38.56**
							32.50

DB13

OVERLAND	GRS-DENSE	100	1.58	0.240	0.00	0.1	14.78
SHALLOW	UNPAVED	957	2.3	0.000	16.10	2.4	6.54
PIPE	36" RCP	308	2.67	0.014	87.62	14.3	0.36
CHANNEL	"CONCR. TRAP (B=4,Y=3,SS=1:1)"	1,282	1.58	0.018	116.76	14.7	1.46
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	471	2.72	0.050	28.69	4.7	1.66
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	451	5.5	0.050	42.29	9.9	0.76
		3,568					**25.55**
							20.22

DB14

OVERLAND	GRS-DENSE	100	1.2	0.240	0.00	0.1	16.52
SHALLOW	UNPAVED	262	2.64	0.000	16.10	2.6	1.67
GUTTER	G-20	1,112	1.89	0.018	24.18	3.3	5.57
PIPE	36" RCP	157	5.66	0.014	87.62	15.9	0.13
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	556	3.6	0.050	28.69	5.4	1.70
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	979	5.75	0.050	42.29	10.1	1.61
		3,166					**27.20**
							22.65

DB15

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.85	0.240	0.00	0.1	18.91
SHALLOW	UNPAVED	764	2.35	0.000	16.10	2.5	5.16
PIPE	36" RCP	3,762	2.61	0.014	87.62	14.1	4.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,915	1.49	0.050	28.69	3.5	9.10
		6,541					**37.61**
							31.59

DB16

OVERLAND	GRS-DENSE	100	0.57	0.240	0.00	0.1	22.22
SHALLOW	UNPAVED	1,260	0.73	0.000	16.10	1.4	15.29
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,946	6.38	0.050	28.69	7.2	6.78
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	874	5.84	0.050	42.29	10.2	1.42
		5,180					**45.71**
							36.33

DB17

OVERLAND	GRS-DENSE	100	1.55	0.240	0.00	0.1	14.89
SHALLOW	UNPAVED	519	2.39	0.000	16.10	2.5	3.48
GUTTER	G-20	1,743	1.97	0.018	24.18	3.4	8.55
PIPE	36" RCP	1,051	1.37	0.014	87.62	10.3	1.71
CHANNEL	"CONCR. TRAP (B=4,Y=3,SS=1:1)"	866	1.04	0.018	116.76	11.9	1.21
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	129	2.09	0.050	28.69	4.1	0.52
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,030	5.5	0.050	42.29	9.9	1.73
		5,438					**32.09**
							27.50

DB18

OVERLAND	GRS-DENSE	100	1.09	0.240	0.00	0.1	17.15
SHALLOW	UNPAVED	930	1.55	0.000	16.10	2.0	7.73
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,891	4.8	0.050	28.69	6.3	5.02
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	679	5.32	0.050	42.29	9.8	1.16
		3,600					**31.05**
							24.83

DB19

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.89	0.240	0.00	0.1	11.60
SHALLOW	UNPAVED	1,717	0.79	0.000	16.10	1.4	19.95
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	4,146	4.24	0.050	28.69	5.9	11.70
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,655	5.15	0.050	42.29	9.6	4.61
		8,619					**47.86**
							39.97

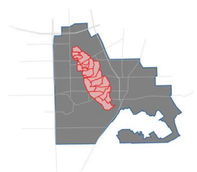
DB20

OVERLAND	GRS-DENSE	100	1.86	0.240	0.00	0.1	13.85
SHALLOW	UNPAVED	109	0.86	0.000	16.10	1.5	1.21
GUTTER	ALLEY-10	460	1.07	0.018	39.51	4.1	1.87
PIPE	36" RCP	380	2.33	0.014	87.62	13.4	0.47
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	127	2.1	0.050	28.69	4.2	0.51
		1,174					**17.91**
							14.15

WATERSHED NO.
3

COUNCIL DISTRICTS
1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA
3.90 SM
*
STREAM LENGTH
4.72 MI
*
PROJECTS IDENTIFIED
5



1.3 SOILS MAP

Deep Branch watershed has multiple hydrologic soil groups present within it's boundaries. Hydrologic soil groups B, C, and D are present in the Halls Branch watershed. The majority of the watershed consists of type D Soil (least permeable). Hydrologic soils group D is present in each sub-basin. Soil group C is present mostly in southern and eastern sub-basins. Type B soil is located only in sub-basins DB18 and DB19 near the downstream (south) end of the watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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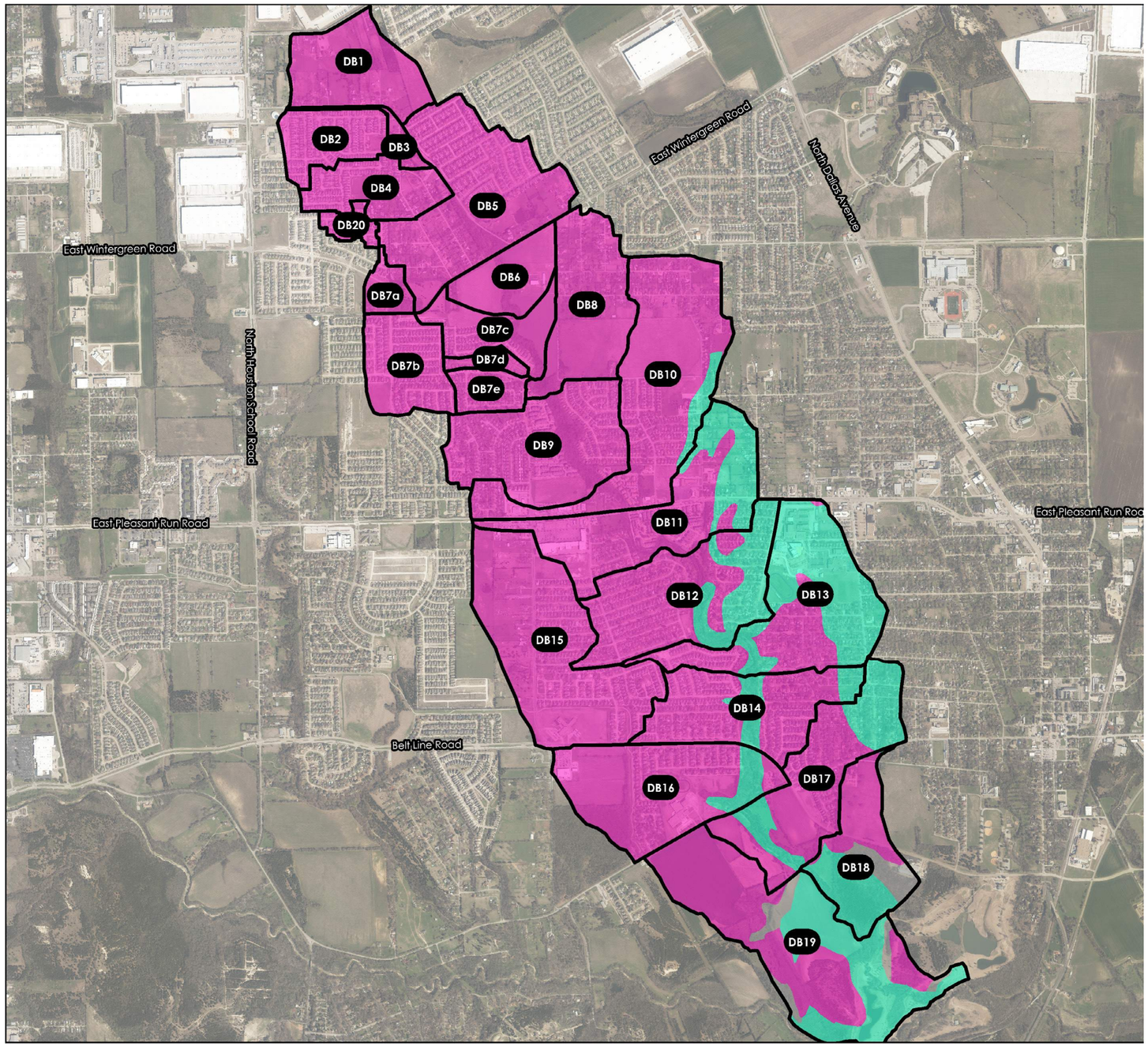


PERVIOUS CURVE NUMBER REPORT

DB1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	87.1	84.0
		87.1	**84.0**

DB2

D	84	52.1	84.0
		52.1	**84.0**

DB3

D	84	12.1	84.0
		12.1	**84.0**

DB4

D	84	59.2	84.0
		59.2	**84.0**

DB5

D	84	176.8	84.0
		176.8	**84.0**

DB6

D	84	51.3	84.0
		51.3	**84.0**

DB7a

D	84	18.7	84.0
		18.7	**84.0**

DB7b

D	84	66.8	84.0
		66.8	**84.0**

DB7c

D	84	53.4	84.0
		53.4	**84.0**

DB7d

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	10.9	84.0
		10.9	**84.0**

DB7e

D	84	25.7	84.0
		25.7	**84.0**

DB8

D	84	107.7	84.0
		107.7	**84.0**

DB9

D	84	143.4	84.0
		143.4	**84.0**

DB10

C	79	12.3	4.8
D	84	192.2	78.9
		204.5	**83.7**

DB11

C	79	43.4	22.3
D	84	110.1	60.2
		153.5	**82.6**

DB12

C	79	50.1	25.6
D	84	104.7	56.8
		154.8	**82.3**

DB13

C	79	104.7	49.7
D	84	61.7	31.1
		166.4	**80.9**

DB14

C	79	20.7	13.9
D	84	97.2	69.2
		117.9	**83.1**

DB15

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	199.7	84.0
		199.7	**84.0**

DB16

C	79	14.4	7.5
D	84	136.9	76.0
		151.4	**83.5**

DB17

B	69	0.0	0.0
C	79	48.3	27.5
D	84	90.7	54.8
		139.1	**82.3**

DB18

B	69	14.3	11.1
C	79	37.3	33.1
D	84	37.4	35.3
		88.9	**79.5**

DB19

B	69	17.4	5.1
C	79	87.0	28.9
D	84	133.4	47.1
		237.8	**81.1**

DB20

D	84	52.1	84.0
		52.1	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

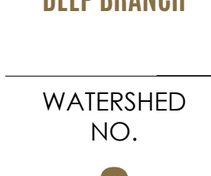
STREAM LENGTH

4.72 MI

*

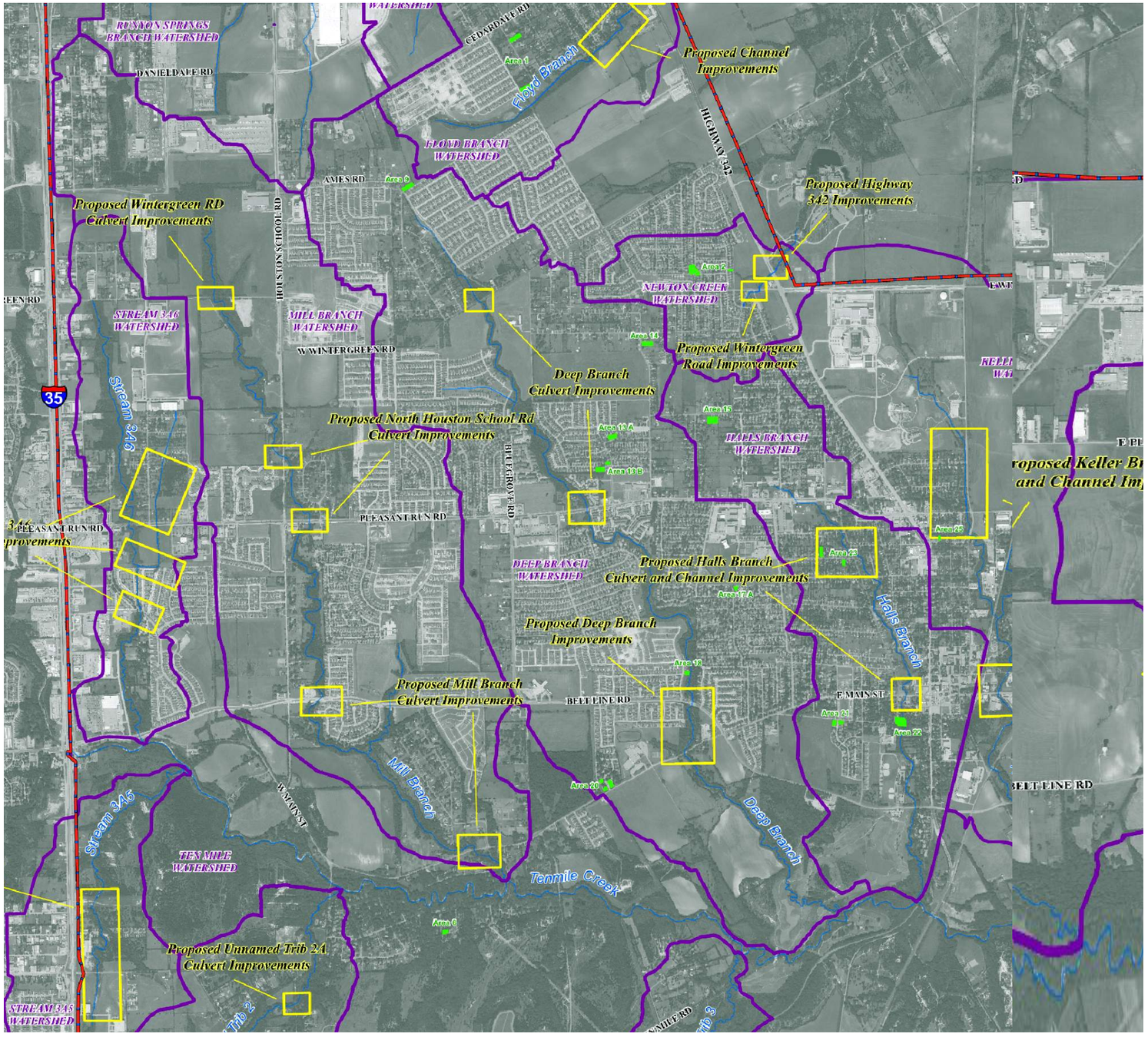
PROJECTS IDENTIFIED

5



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows only one new development since 2007 within the Deep Branch watershed. The new commercial development is located in DB16. The rest of the watershed has seen no major development.



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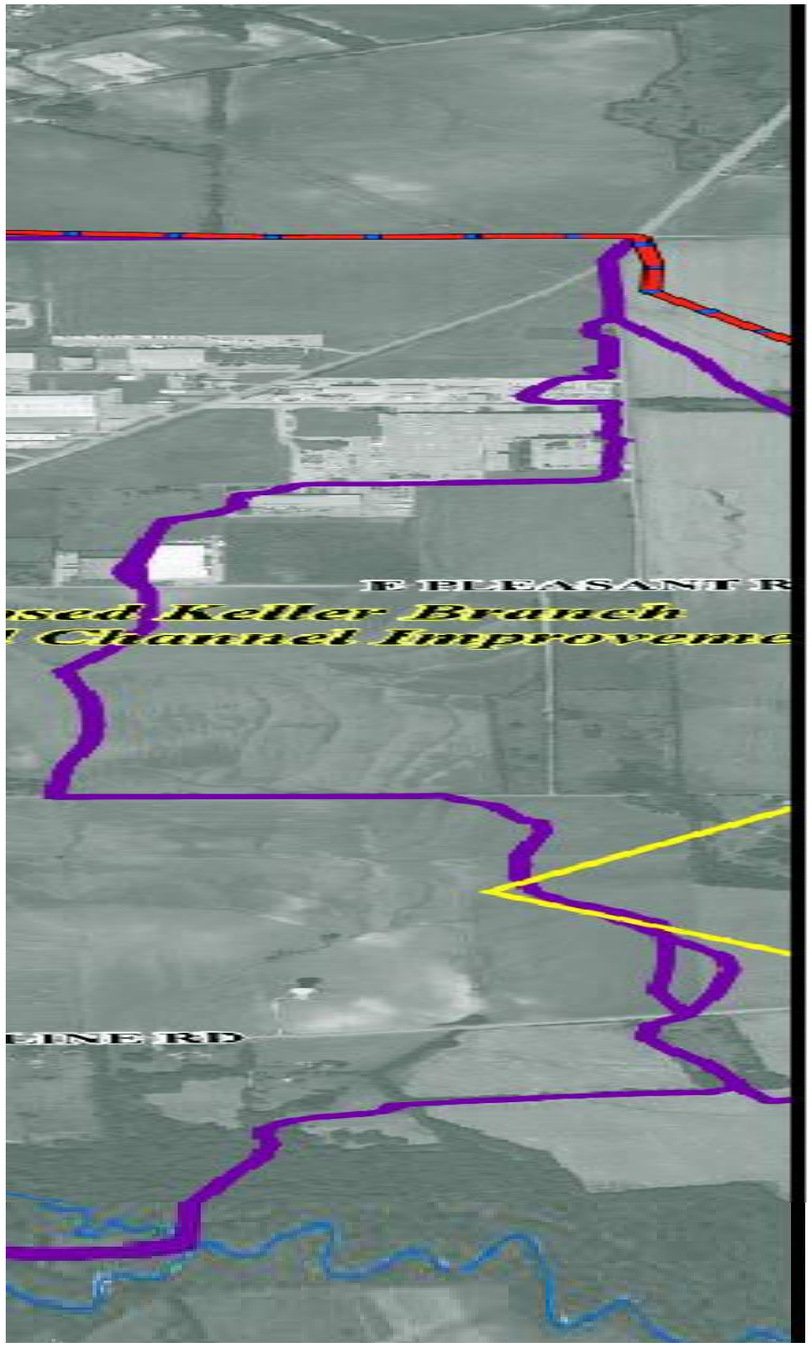
N.T.S.

2007





N

N.T.S.

2019

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

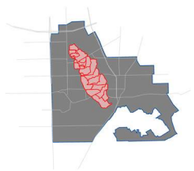
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



1.5 IMPERVIOUS AREA

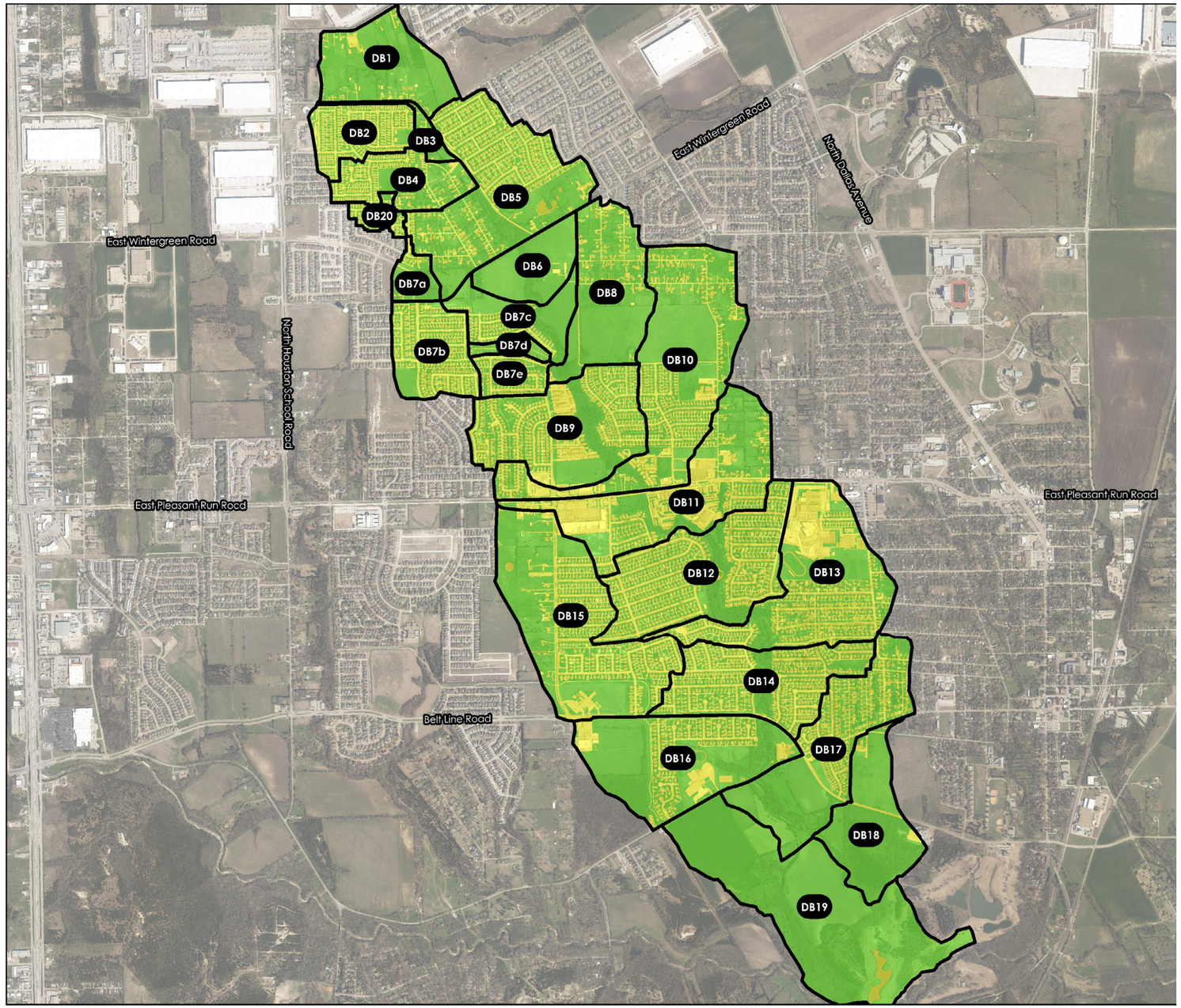
Impervious areas for the Deep Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods and a few commercial developments. Sub-basins DB1, DB6, DB8, DB10, and DB15 through DB19 have the largest amount of open area available for future development.

IMPERVIOUS

OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING IMPERVIOUS REPORT

DB1

LANDUSE	IMPERVIOUS PERCENT	SHAPE AREA (AREA)	WIEGHTED IMPERVIOUS %
OPEN SPACE (FAIR CONDITION)	0	79.4	0.0
IMPERVIOUS	100	7.7	8.8
		309.3	**84.0**

DB2

OPEN SPACE (FAIR CONDITION)	0	23.2	0.0
IMPERVIOUS	100	28.9	55.5
		52.1	**55.5**

DB3

OPEN SPACE (FAIR CONDITION)	0	9.6	0.0
IMPERVIOUS	100	2.5	20.9
		12.1	**20.9**

DB4

OPEN SPACE (FAIR CONDITION)	0	38.0	0.0
IMPERVIOUS	100	21.2	35.8
		59.2	**35.8**

DB5

OPEN SPACE (FAIR CONDITION)	0	115.7	0.0
IMPERVIOUS	100	61.1	34.5
		176.8	**34.5**

DB6

OPEN SPACE (FAIR CONDITION)	0	49.4	0.0
IMPERVIOUS	100	1.8	3.6
		51.3	**3.6**

DB7a

LANDUSE	IMPERVIOUS PERCENT	SHAPE AREA (AREA)	WIEGHTED IMPERVIOUS %
OPEN SPACE (FAIR CONDITION)	0	15.8	0.0
IMPERVIOUS	100	2.9	15.7
		18.7	**15.7**

DB7b

OPEN SPACE (FAIR CONDITION)	0	33.9	0.0
IMPERVIOUS	100	33.0	49.3
		66.8	**49.3**

DB7c

OPEN SPACE (FAIR CONDITION)	0	40.7	0.0
IMPERVIOUS	100	12.7	23.8
		53.4	**23.8**

DB7d

OPEN SPACE (FAIR CONDITION)	0	8.3	0.0
IMPERVIOUS	100	2.6	24.1
		10.9	**24.1**

DB7e

OPEN SPACE (FAIR CONDITION)	0	12.9	0.0
IMPERVIOUS	100	12.8	49.8
		25.7	**49.8**

DB8

OPEN SPACE (FAIR CONDITION)	0	92.2	0.0
IMPERVIOUS	100	15.5	14.4
		107.7	**14.4**

EXISTING IMPERVIOUS REPORT - CONTINUED

DB9

LANDUSE	IMPERVIOUS PERCENT	SHAPE AREA (AREA)	WIEGHTED IMPERVIOUS %
OPEN SPACE (FAIR CONDITION)	0	77.7	0.0
IMPERVIOUS	100	65.7	45.8
		143.4	**45.8**

DB10

OPEN SPACE (FAIR CONDITION)	0	140.8	0.0
IMPERVIOUS	100	63.8	31.2
		204.5	**31.2**

DB11

OPEN SPACE (FAIR CONDITION)	0	79.1	0.0
IMPERVIOUS	100	74.5	48.5
		153.5	**48.5**

DB12

OPEN SPACE (FAIR CONDITION)	0	81.8	0.0
IMPERVIOUS	100	73.1	47.2
		154.9	**47.2**

DB13

OPEN SPACE (FAIR CONDITION)	0	81.9	0.0
IMPERVIOUS	100	84.4	50.7
		166.4	**50.7**

DB14

OPEN SPACE (FAIR CONDITION)	0	58.8	0.0
IMPERVIOUS	100	59.1	50.1
		117.9	**50.1**

DB15

LANDUSE	IMPERVIOUS PERCENT	SHAPE AREA (AREA)	WIEGHTED IMPERVIOUS %
OPEN SPACE (FAIR CONDITION)	0	130.0	0.0
IMPERVIOUS	100	69.7	34.9
		199.7	**34.9**

DB16

OPEN SPACE (FAIR CONDITION)	0	108.1	0.0
IMPERVIOUS	100	43.3	28.6
		151.4	**28.6**

DB17

OPEN SPACE (FAIR CONDITION)	0	99.6	0.0
IMPERVIOUS	100	39.4	28.3
		139.1	**28.3**

DB18

OPEN SPACE (FAIR CONDITION)	0	84.6	0.0
IMPERVIOUS	100	4.4	4.9
		88.9	**4.9**

DB19

OPEN SPACE (FAIR CONDITION)	0	233.0	0.0
IMPERVIOUS	100	4.8	2.0
		237.8	**2.0**

DB20

OPEN SPACE (FAIR CONDITION)	0	6.8	0.0
IMPERVIOUS	100	7.1	51.2
		13.9	**51.2**

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

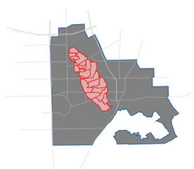
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



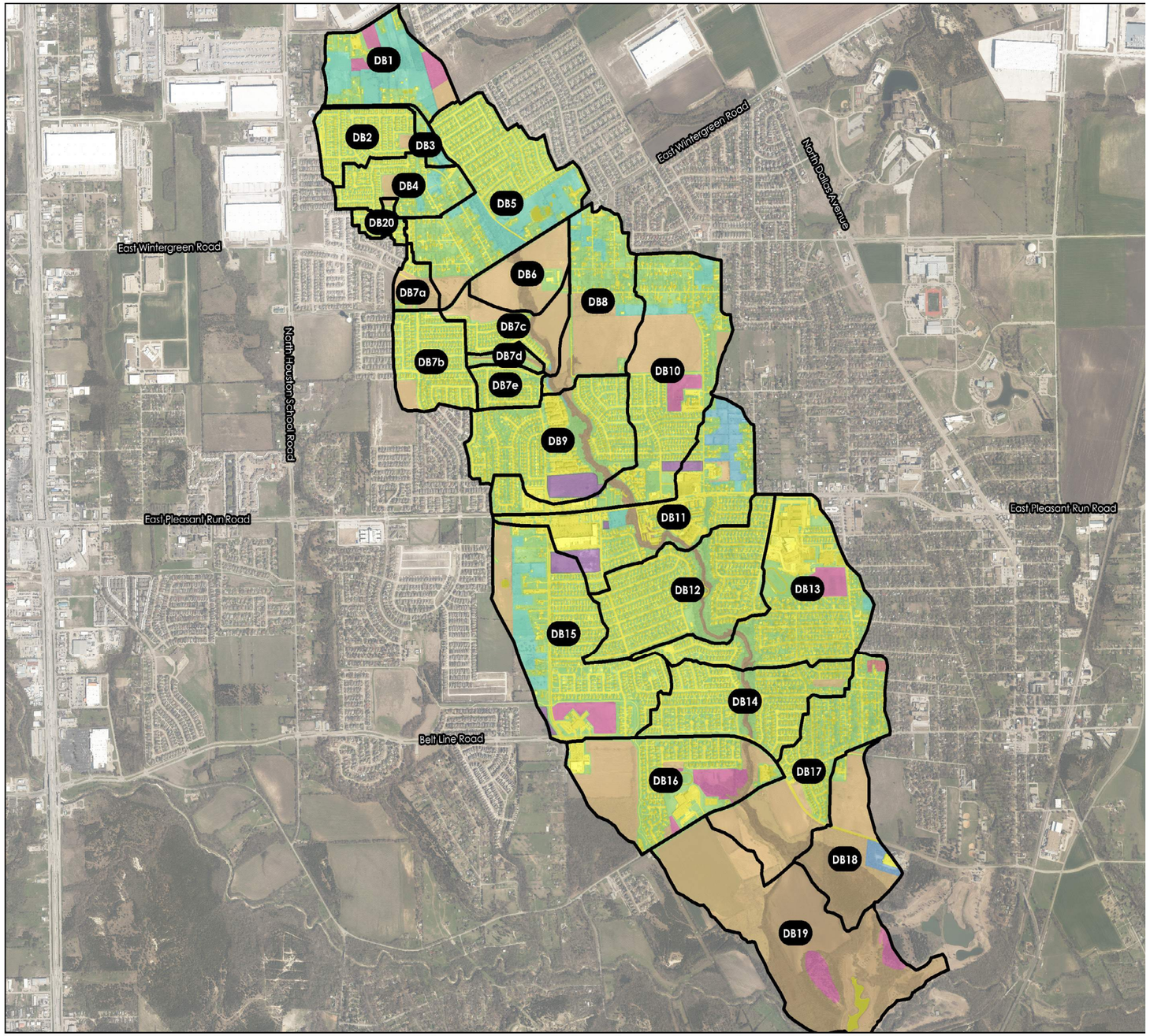
1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The open land within the watershed consist of mostly suburban residential zoning based on the provided City zoning data. The zoning is consistent with the majority existing land use within the watershed. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- R - URBAN NEIGHBORHOOD

N

N.T.S.



ULTIMATE PERCENT IMPERVIOUS REPORT

DB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	19.1	0.0
IMPERVIOUS	100	7.7	8.8
PUBLIC & SEMI-PUBLIC	72	12.9	10.7
R - SURBURBAN NEIGHBORHOOD	38	4.5	2.0
R - RURAL LIVING	12	42.9	5.9
		87.1	**27.4**

DB2

OPEN SPACE (FAIR CONDITION)	0	21.5	0.0
IMPERVIOUS	100	28.9	55.5
R - SURBURBAN NEIGHBORHOOD	38	1.7	1.2
		204.5	**42.3**

DB3

OPEN SPACE (FAIR CONDITION)	0	6.2	0.0
IMPERVIOUS	100	2.5	20.9
R - RURAL LIVING	12	3.3	3.3
		153.5	**60.5**

DB4

OPEN SPACE (FAIR CONDITION)	0	26.9	0.0
IMPERVIOUS	100	21.2	35.8
R - SURBURBAN NEIGHBORHOOD	38	6.7	4.3
R - RURAL LIVING	12	4.4	0.9
		154.9	**47.2**

DB5

OPEN SPACE (FAIR CONDITION)	0	78.6	0.0
IMPERVIOUS	100	61.1	34.5
R - SURBURBAN NEIGHBORHOOD	38	6.6	1.4
R - RURAL LIVING	12	30.6	2.1
		176.8	**38.0**

DB6

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	6.0	0.0
OPEN SPACE (FAIR CONDITION)	0	5.9	0.0
IMPERVIOUS	100	1.8	3.6
R - SURBURBAN NEIGHBORHOOD	38	37.5	27.8
		51.3	**31.4**

DB7a

OPEN SPACE (FAIR CONDITION)	0	3.8	0.0
IMPERVIOUS	100	2.9	15.7
R - SURBURBAN NEIGHBORHOOD	38	12.0	24.4
		18.7	**40.1**

DB7b

OPEN SPACE (FAIR CONDITION)	0	28.3	0.0
IMPERVIOUS	100	33.0	49.3
R - SURBURBAN NEIGHBORHOOD	38	5.6	3.2
		66.8	**52.5**

DB7c

FLOODPLAIN	0	3.6	0.0
OPEN SPACE (FAIR CONDITION)	0	12.9	0.0
IMPERVIOUS	100	12.7	23.8
R - SURBURBAN NEIGHBORHOOD	38	24.0	17.1
R - URBAN NEIGHBORHOOD	65	0.1	0.2
		53.4	**41.0**

DB7d

FLOODPLAIN	0	1.9	0.0
OPEN SPACE (FAIR CONDITION)	0	6.4	0.0
IMPERVIOUS	100	2.6	24.1
		10.9	**24.1**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

DB7e

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	12.9	0.0
IMPERVIOUS	100	12.8	49.8
R - URBAN NEIGHBORHOOD	65	0.0	0.0
		25.7	**49.8**

DB8

FLOODPLAIN	0	2.8	0.0
OPEN SPACE (FAIR CONDITION)	0	36.8	0.0
IMPERVIOUS	100	15.5	14.4
R - SURBURBAN NEIGHBORHOOD	38	43.2	15.3
R - RURAL LIVING	12	9.0	1.0
R - URBAN NEIGHBORHOOD	65	0.2	0.1
		107.7	**30.8**

DB9

FLOODPLAIN	0	7.0	0.0
OPEN SPACE (FAIR CONDITION)	0	59.4	0.0
IMPERVIOUS	100	65.7	45.8
R - SURBURBAN NEIGHBORHOOD	38	0.4	0.1
COMMERCIAL NODE	85	10.8	6.4
R - URBAN NEIGHBORHOOD	65	0.1	0.1
		143.4	**52.4**

DB10

FLOODPLAIN	0	2.9	0.0
OPEN SPACE (FAIR CONDITION)	0	81.0	0.0
IMPERVIOUS	100	63.8	31.2
PUBLIC & SEMI-PUBLIC	72	7.7	2.7
R - SURBURBAN NEIGHBORHOOD	38	37.6	7.0
COMMERCIAL NODE	85	2.0	0.8
R - RURAL LIVING	12	9.6	0.6
R - URBAN NEIGHBORHOOD	65	0.0	0.0
		204.5	**42.3**

DB11

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	6.2	0.0
OPEN SPACE (FAIR CONDITION)	0	42.7	0.0
IMPERVIOUS	100	74.3	48.4
R - SURBURBAN NEIGHBORHOOD	38	2.5	0.6
COMMERCIAL NODE	85	7.4	4.1
R - RURAL LIVING	12	3.7	0.3
R - URBAN NEIGHBORHOOD	65	16.8	7.1
		153.5	**60.5**

DB12

FLOODPLAIN	0	4.6	0.0
OPEN SPACE (FAIR CONDITION)	0	77.2	0.0
IMPERVIOUS	100	73.1	47.2
		154.9	**47.2**

DB13

FLOODPLAIN	0	2.4	0.0
OPEN SPACE (FAIR CONDITION)	0	66.0	0.0
IMPERVIOUS	100	84.4	50.7
PUBLIC & SEMI-PUBLIC	72	12.1	5.2
R - SURBURBAN NEIGHBORHOOD	38	0.3	0.1
R - RURAL LIVING	12	1.2	0.1
		166.4	**56.1**

DB14

FLOODPLAIN	0	3.2	0.0
OPEN SPACE (FAIR CONDITION)	0	53.5	0.0
IMPERVIOUS	100	59.1	50.1
R - SURBURBAN NEIGHBORHOOD	38	2.1	0.7
		117.9	**50.8**

DB15

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	75.1	0.0
IMPERVIOUS	100	69.7	34.9
PUBLIC & SEMI-PUBLIC	72	11.6	4.2
R - SURBURBAN NEIGHBORHOOD	38	15.5	3.0
COMMERCIAL NODE	85	6.1	2.6
R - RURAL LIVING	12	21.7	1.3
		199.7	**45.9**

DB16

FLOODPLAIN	0	4.0	0.0
OPEN SPACE (FAIR CONDITION)	0	42.3	0.0
IMPERVIOUS	100	43.3	28.6
PUBLIC & SEMI-PUBLIC	72	13.7	6.5
R - SURBURBAN NEIGHBORHOOD	38	48.2	12.1
		151.4	**47.2**

DB17

FLOODPLAIN	0	10.5	0.0
OPEN SPACE (FAIR CONDITION)	0	41.3	0.0
IMPERVIOUS	100	39.3	28.3
MIXED USE	85	1.9	1.2
R - SURBURBAN NEIGHBORHOOD	38	46.1	12.6
		139.1	**42.0**

DB18

FLOODPLAIN	0	37.7	0.0
OPEN SPACE (FAIR CONDITION)	0	2.7	0.0
IMPERVIOUS	100	4.3	4.8
R - SURBURBAN NEIGHBORHOOD	38	38.1	16.3
LOGISTICS & DISTRIBUTION	72	6.1	5.0
		88.9	**26.0**

DB19

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	141.1	0.0
OPEN SPACE (FAIR CONDITION)	0	1.3	0.0
IMPERVIOUS	100	4.8	2.0
PUBLIC & SEMI-PUBLIC	72	13.6	4.1
R - SURBURBAN NEIGHBORHOOD	38	77.0	12.3
		237.8	**18.4**

DB20

OPEN SPACE (FAIR CONDITION)	0	6.2	0.0
IMPERVIOUS	100	7.1	51.2
R - SURBURBAN NEIGHBORHOOD	38	0.6	1.5
		13.9	**52.8**

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

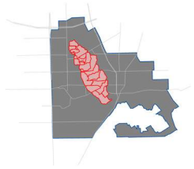
STREAM LENGTH

4.72 MI

*

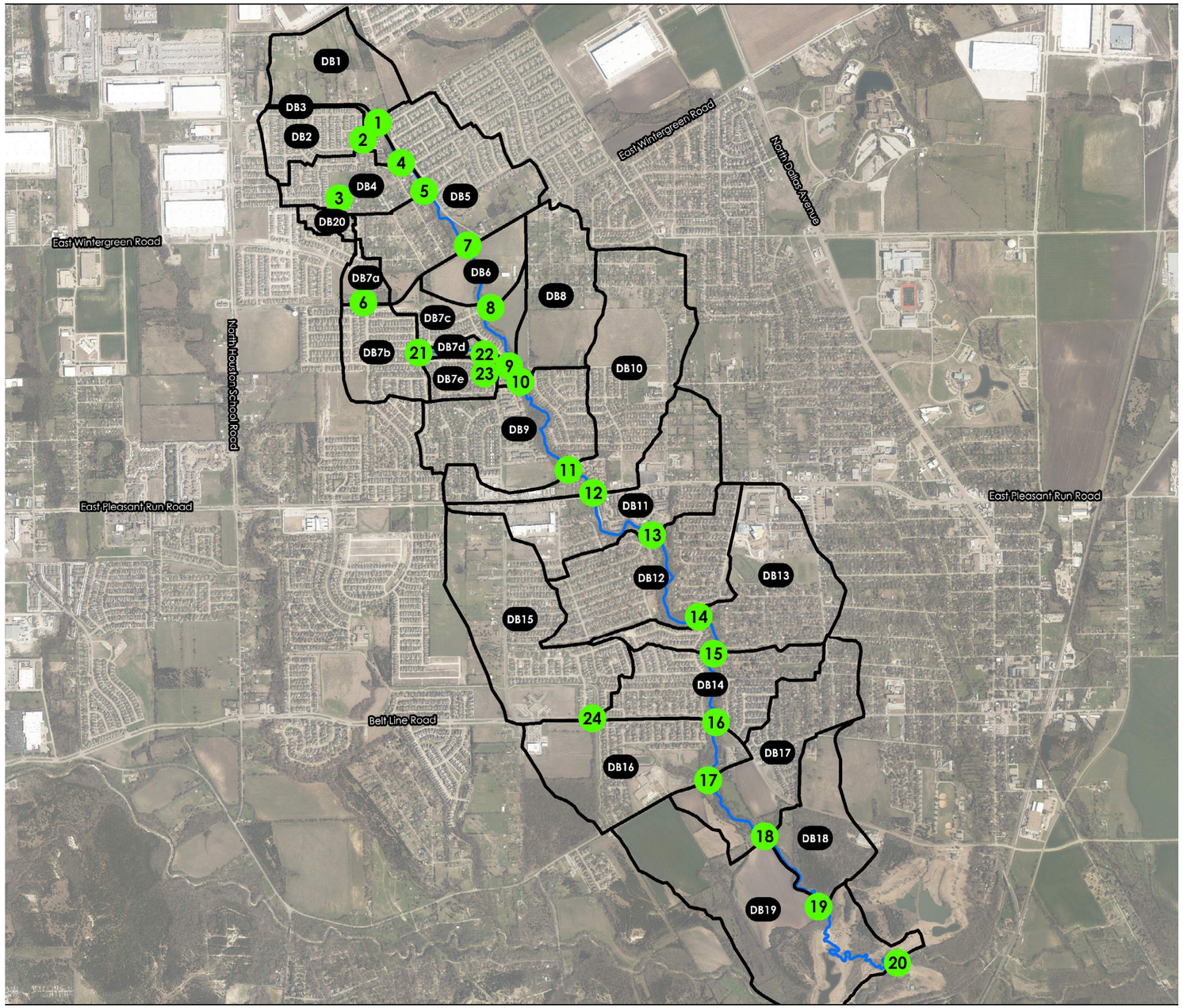
PROJECTS IDENTIFIED

5



1.7 RESULTS

The flow was analyzed at twenty-four locations for Deep Branch. Flow location 7 was used to establish flows at the upstream end of the stream and also to determine the peak discharge going to Wintergreen Road. Locations 8-12 and 16-17 were also used to determine flows at major raod crossings. Location 21 was used for the analysis of the Tributary. Locations 13-15, 19 and 20 are based on the outlet of their respective sub-bains. Hydrology for Locations 1-5, 22, 23 and 24 were analyzed, but not included in the hydraulic model becasue they are not located on the main channel or the tributary.



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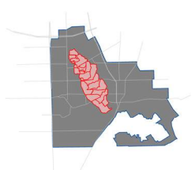
FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ulimate Peak Flow (cfs)
1	DB1	-	-	0.14	550
2	DB2	-	-	0.08	250
3	DB20	-	-	0.02	46
4	DB1, DB2, DB3	-	-	0.24	800
5	DB1-DB4, DB20	-	-	0.35	1150
6	DB7a	-	-	0.03	140
7	DB1-DB5, DB20	DeepBranch	23001	0.63	1850
8	DB1-DB6, DB20	DeepBranch	21281	0.71	1950
9	DB1-DB7e, DB20	DeepBranch	19716	0.98	2700
10	DB1-DB8, DB20	DeepBranch	19119	1.15	3300
11	DB1-DB9, DB20	DeepBranch	16745	1.37	3800
12	DB1-DB10, DB20	DeepBranch	16145	1.69	4700
13	DB1-DB11, DB20	DeepBranch	13825	1.93	5300
14	DB1-DB12, DB20	DeepBranch	11389	2.18	5900
15	DB1-DB13, DB20	DeepBranch	10403	2.44	6500
16	DB1-DB14, DB20	DeepBranch	9189	2.62	6900
17	DB1-DB16, DB20	DeepBranch	7662	3.17	8500
18	DB1-DB17, DB20	DeepBranch	5851	3.39	8900
19	DB1-DB18, DB20	DeepBranch	3594	3.52	8400
20	DB1-DB19, DB20	DeepBranch	568	3.90	8300
21	DB6, DB7b	Trib	1743	0.18	550
22	DB6, DB7b, DB7d	Trib	244	0.20	480
23	DB7e	-	-	0.04	170
24	DB15	-	-	0.31	1050

WATERSHED NO.
3

COUNCIL DISTRICTS
1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA
3.90 SM
*
STREAM LENGTH
4.72 MI
*
PROJECTS IDENTIFIED
5



2.0 HYDRAULICS

2.1 SITE ASSESSMENT

Deep Branch is located in the central region of the City of Lancaster. It flows from North to South for approximately 4.72 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Deep Branch within the limits of the City of Lancaster, roughly bound by Wintergreen Road (upstream end) and the confluence with Ten Mile Creek (downstream end). The channel slope averages around 0.55-0.7%, and for the purposes of this study were divided into two models: one for the main stream of Deep Branch and a second fot the small tributary to Deep Branch. Deep Branch channel is generally in a natural state, but the overbanks have are heavily developed. It should also be noted that the tributary's channel appears to be concrete lined and regularly maintained. There are also a total of four (4) crossings throughout the watershed. Heavy vegetation is observed throughout the watershed.



Looking at the wintergreen road culvert. Area is thick with vegetation. The channel upstream and downstream is heavily wooded. Modeling shows that the structure overtops.



Looking upstream at the Deep Branch Tributary from North Bluegrove Road culvert. The stream channel is concrete lines with well maintained grass on the overbanks.



Looking downstream at the Belt Line Road bridge. This large road crossing is conrete lined and in good condition and not in danger of overtopping.

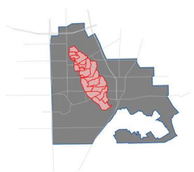


Looking downstream at the Main Street Road bridge. The channel further downstream has heavy vegetation.

WATERSHED NO.
3

COUNCIL DISTRICTS
1, 3, 4, 5 AND 6

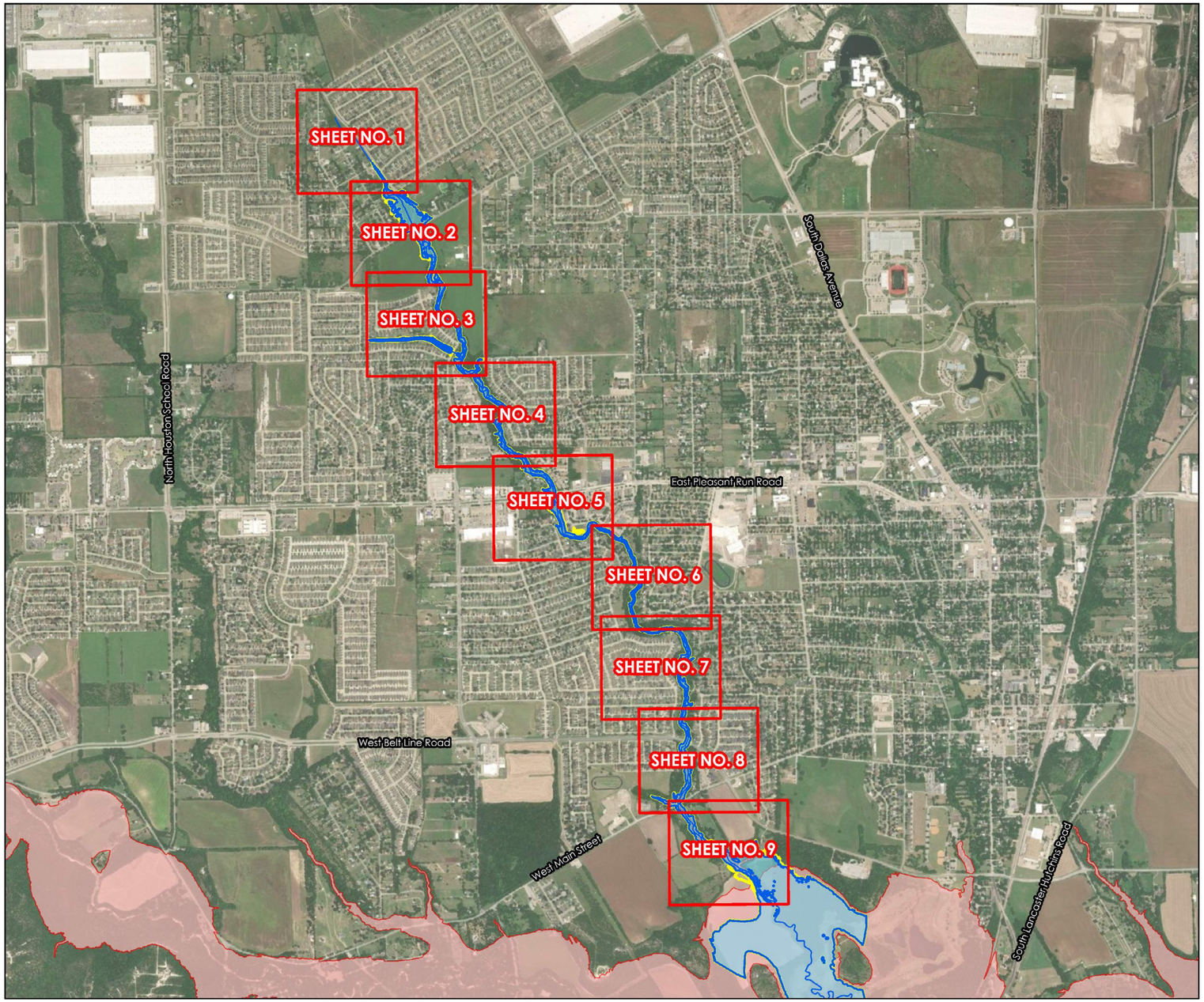
TOTAL DRAINAGE AREA
3.90 SM
*
STREAM LENGTH
4.72 MI
*
PROJECTS IDENTIFIED
5



2.2 FLOODPLAIN MAPPING

The Deep Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Deep Branch is comprised of one stream, one reach, fifty-one (51) cross sections, and four (5) hydraulic structures. The studied stream is 24,900 feet (4.72 miles) long. Near the confluence of the stream with Ten Mile Creek, the Deep Branch floodplain expands dramatically and inundates a large low-lying area.

The floodplain sheets for Deep Branch display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.

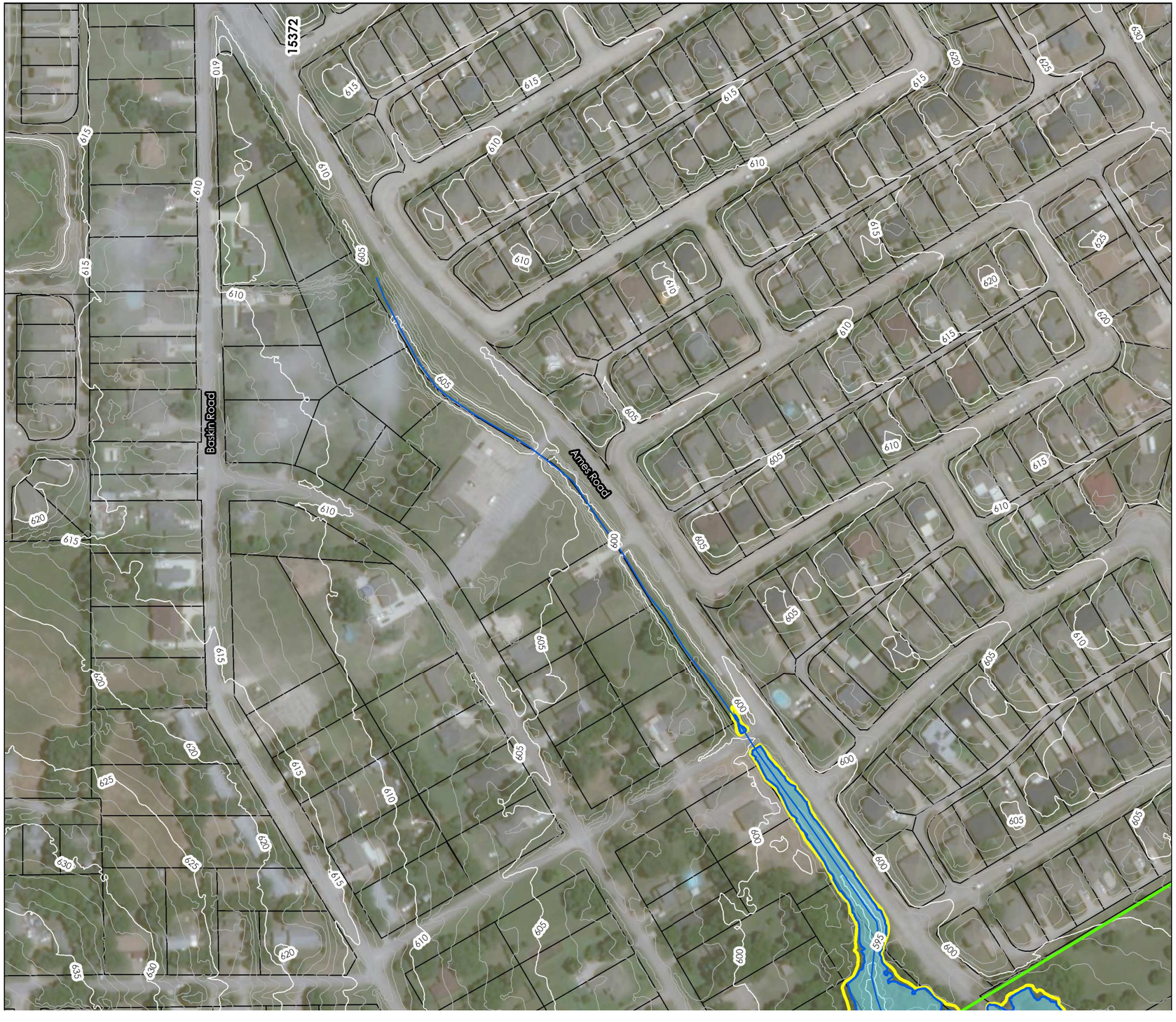


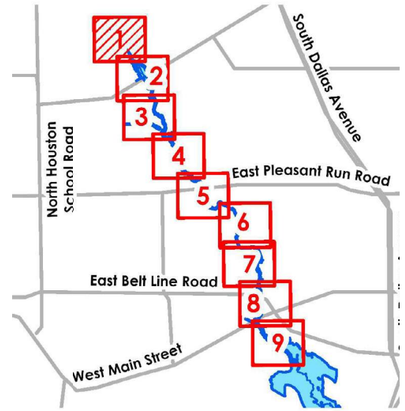
STREAM CENTERLINE
DEEP VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200
Feet

P CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
P BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

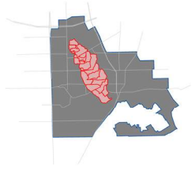
STREAM LENGTH

4.72 MI

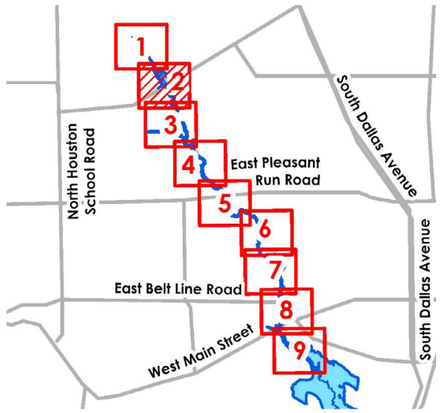
*

PROJECTS IDENTIFIED

5



FLOODPLAIN: SHEET 2



N

0 100 200

Feet

EP CROSS SECTIONS

TREAM CENTERLINE

XISTING 100-YEAR FLOODPLAIN

LTIMATE 100-YEAR FLOODPLAIN

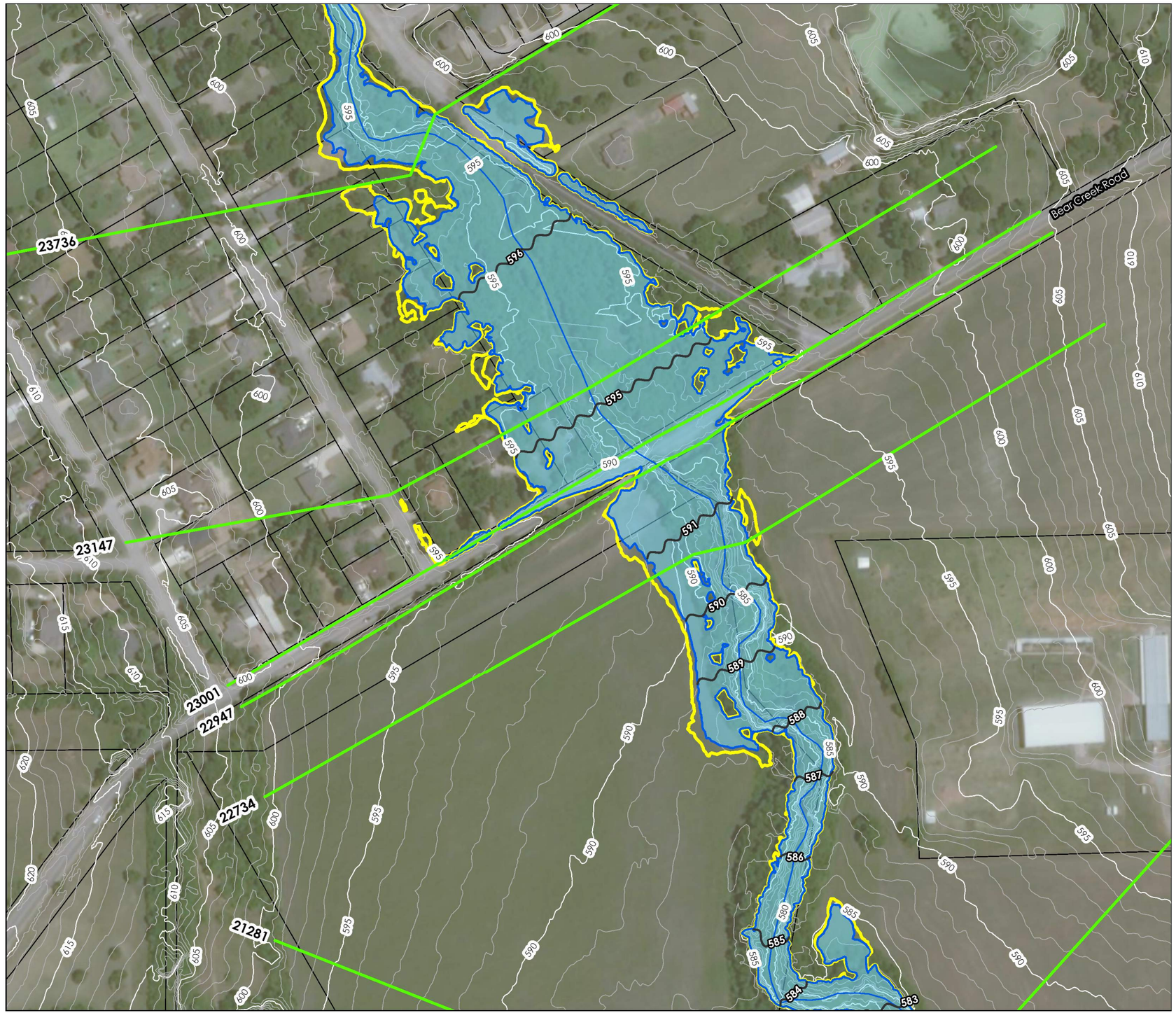
DAR MAJOR CONTOURS

DAR MINOR CONTOURS

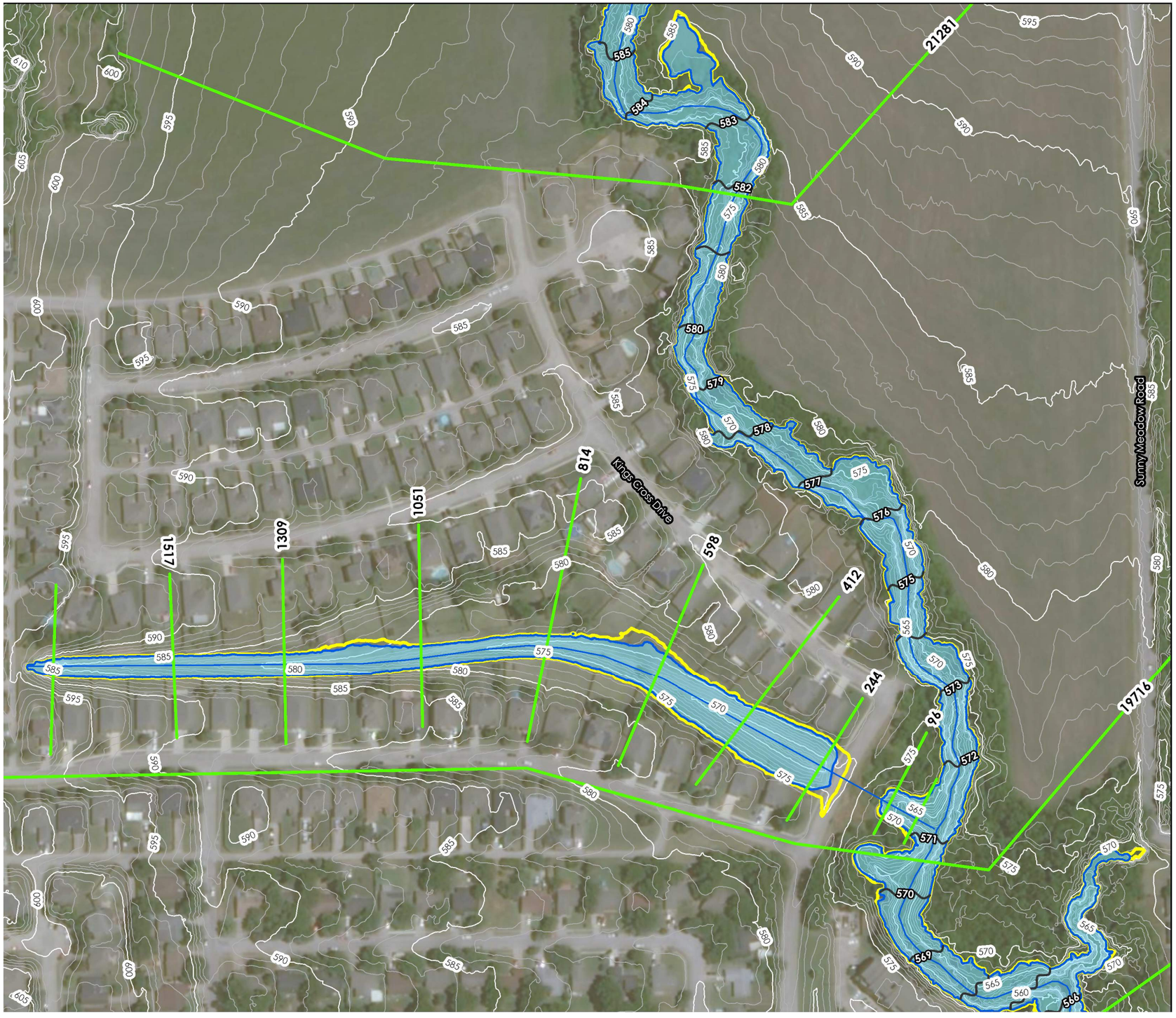
EEP BASE FLOW ELEVATIONS

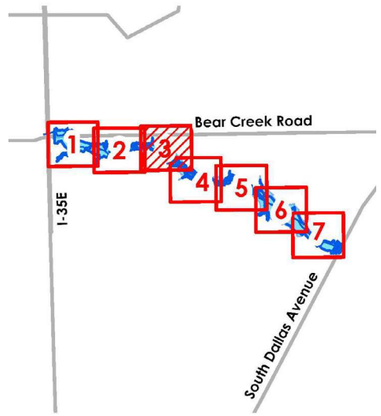
ARCEL

0



FLOODPLAIN: SHEET 3





N

0 100 200 Feet

P CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
P BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

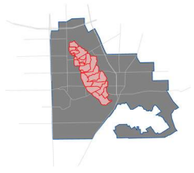
STREAM LENGTH

4.72 MI

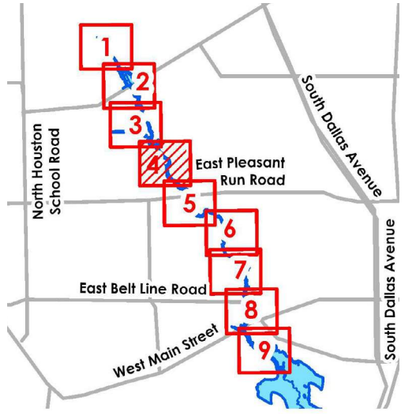
*

PROJECTS IDENTIFIED

5



FLOODPLAIN: SHEET 4



N

0 100 200

Feet

EEP CROSS SECTIONS

TREAM CENTERLINE

ISTING 100-YEAR FLOODPLAIN

TI MATE 100-YEAR FLOODPLAIN

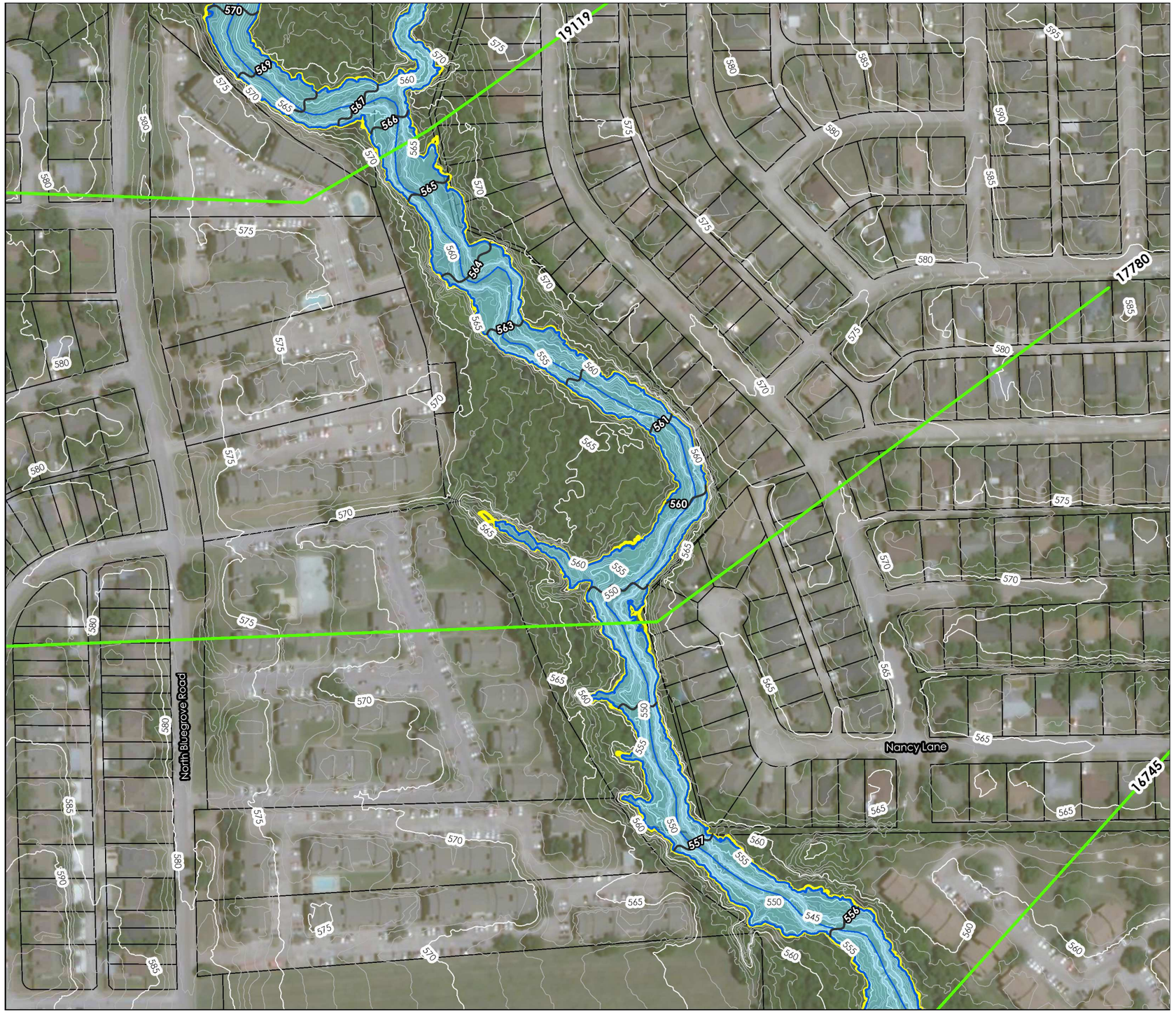
DAR MAJOR CONTOURS

DAR MINOR CONTOURS

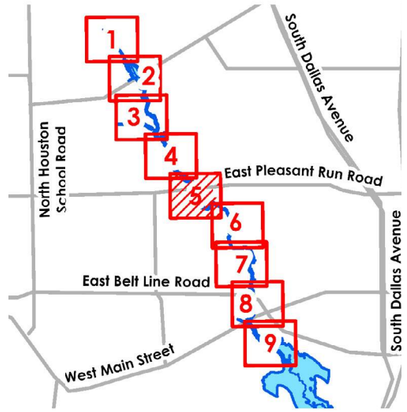
EEP BASE FLOW ELEVATIONS

ARCEL

0



FLOODPLAIN: SHEET 5





N

0 100 200
Feet

P CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
P BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

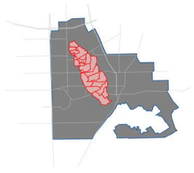
STREAM LENGTH

4.72 MI

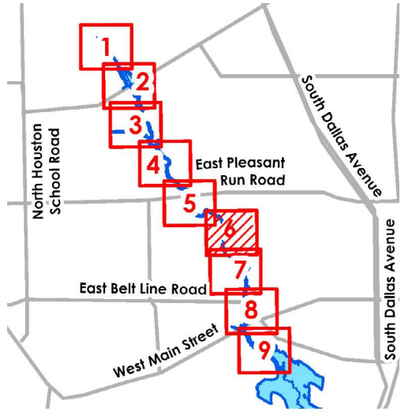
*

PROJECTS IDENTIFIED

5



FLOODPLAIN: SHEET 6



N

0 100 200 Feet

EP CROSS SECTIONS

REAM CENTERLINE

STING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

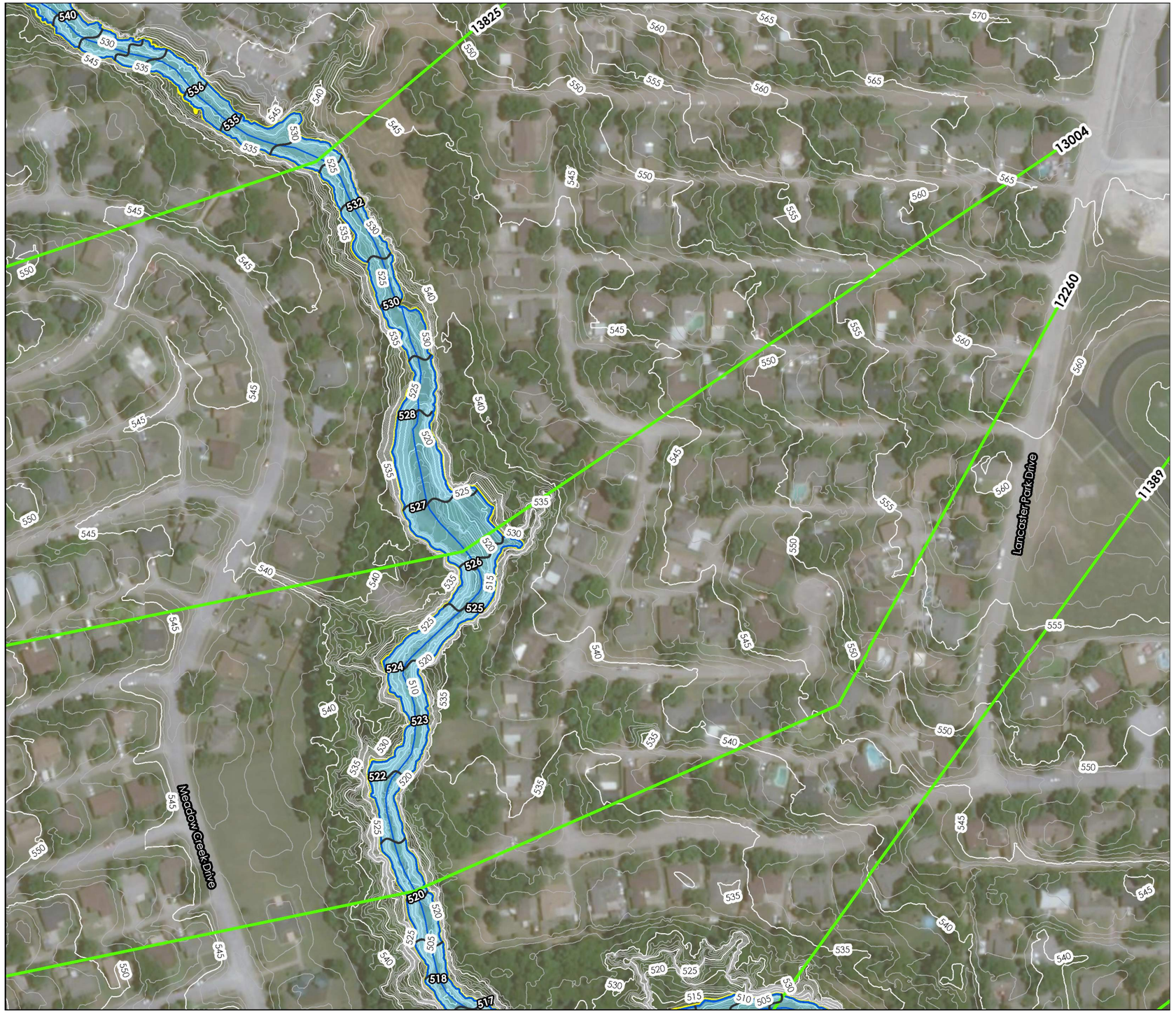
AR MAJOR CONTOURS

AR MINOR CONTOURS

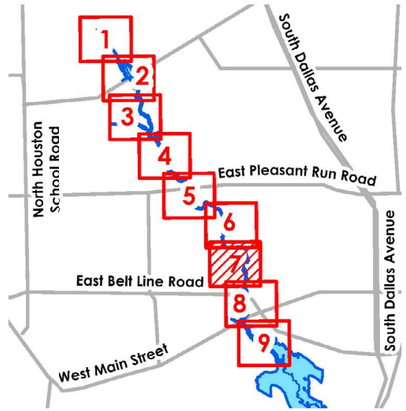
EP BASE FLOW ELEVATIONS

RCEL

0



FLOODPLAIN: SHEET 7



N

0 100 200
Feet

P CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
P BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

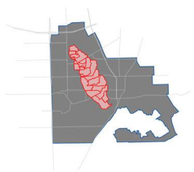
STREAM LENGTH

4.72 MI

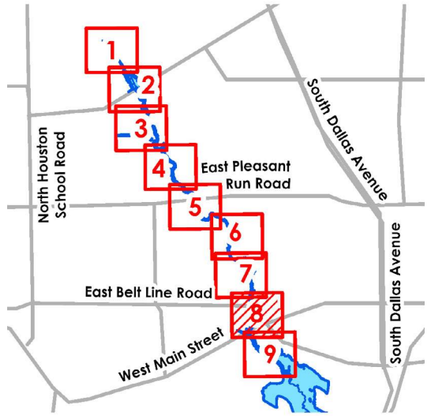
*

PROJECTS IDENTIFIED

5



FLOODPLAIN: SHEET 8



N

0 100 200 Feet

CROSS SECTIONS

STREAM CENTERLINE

EXISTING 100-YEAR FLOODPLAIN

ULTIMATE 100-YEAR FLOODPLAIN

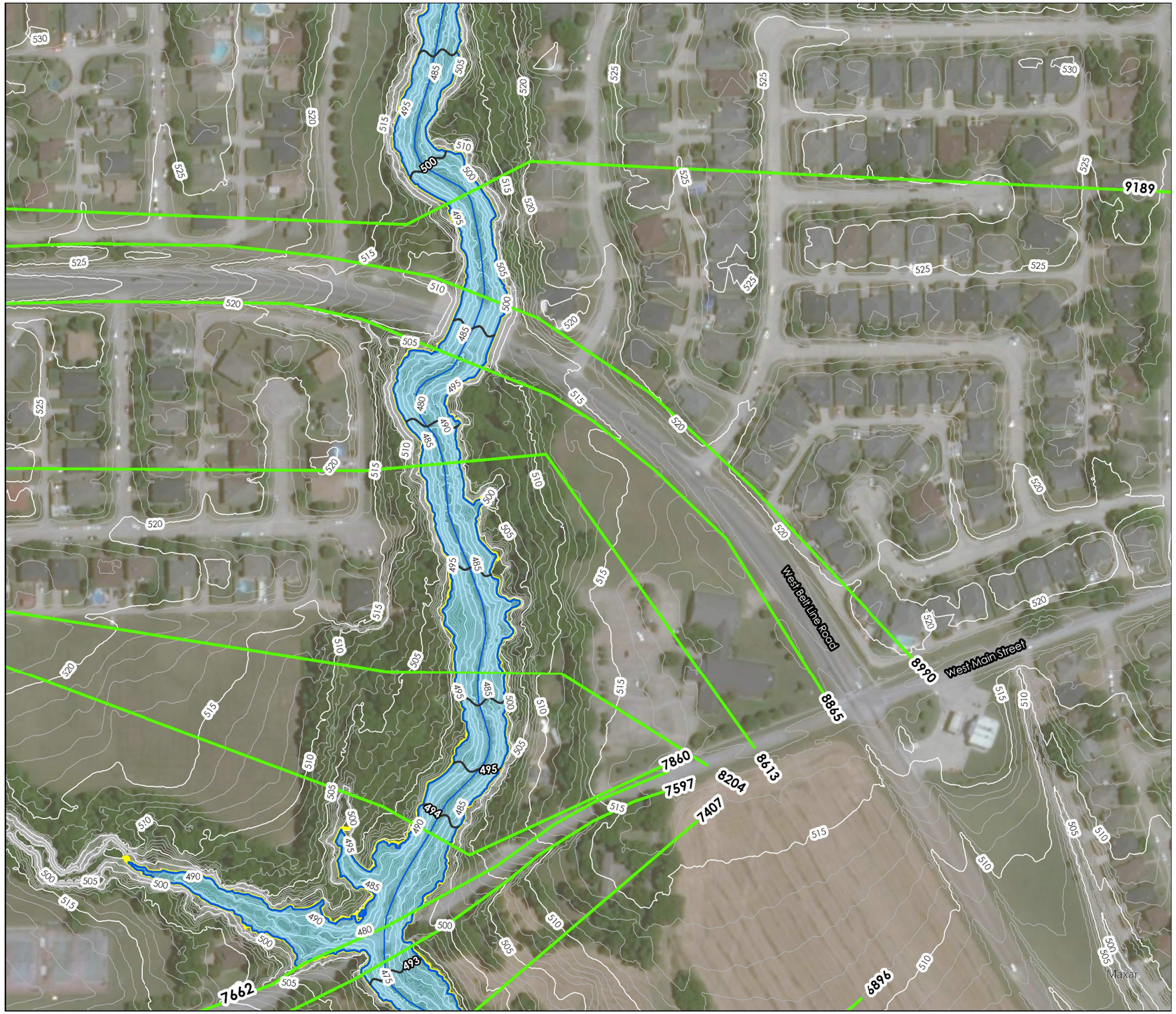
LIDAR MAJOR CONTOURS

LIDAR MINOR CONTOURS

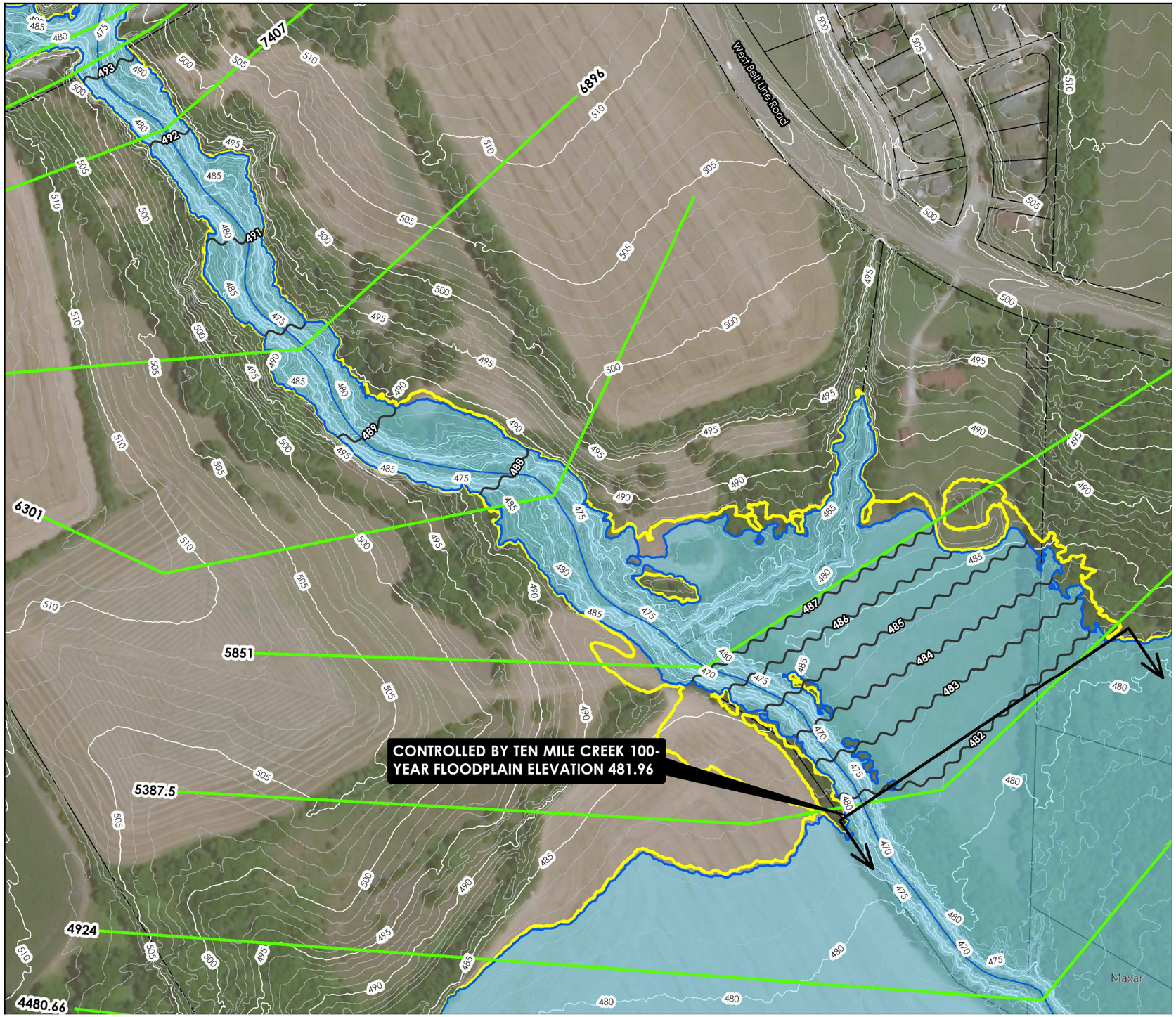
DEEP BASE FLOW ELEVATIONS

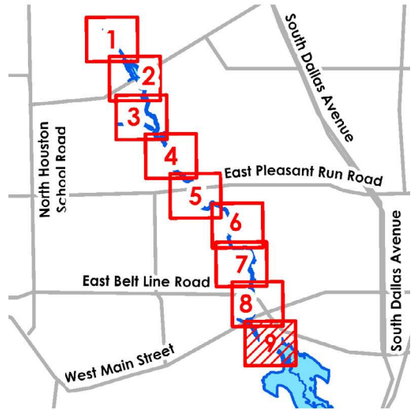
PARCEL

0



FLOODPLAIN: SHEET 9





N

0 100 200
Feet

P CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
P BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

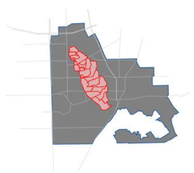
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	595.28	595.43	6.40	6.56
23147	590.56	590.85	2.96	3.04
23001	589.30	589.78	6.19	5.80
22974	**Wintergreen Road**			
22947	589.14	589.37	5.08	5.37
22734	587.58	587.88	4.83	4.82
21281	578.05	578.45	5.03	5.35
19716	565.60	566.04	6.78	6.92
19119	561.10	561.41	5.80	6.24
17780	552.36	552.96	6.14	6.15
16745	548.43	549.03	4.87	5.24
16145	544.51	545.00	8.22	8.58
16042	544.10	544.69	5.33	5.38
15978	**Pleasant Run Road**			
15921	543.24	543.97	4.55	4.47
15703	542.37	543.13	5.37	5.51
15013	539.74	540.41	6.22	6.63
13825	529.10	529.41	9.40	9.80
13004	518.18	518.83	3.60	3.73
12260	514.75	515.25	9.27	9.83
11389	505.69	506.01	7.17	7.55
10912	500.24	500.67	7.97	8.24
10403	496.82	497.37	6.70	6.84
9658	493.21	493.74	6.86	7.15
9189	491.17	491.72	6.55	6.74
8990	490.74	491.30	4.88	5.06
8919	**Belt Line Road**			
8865	490.45	491.00	4.00	4.18
8613	489.66	490.18	5.65	5.86
8204	488.49	489.02	5.26	5.41
7860	485.28	485.91	10.02	10.05
7662	485.76	486.38	2.53	2.65
7625	**West Main Street Road**			
7597	485.05	485.65	5.72	5.86
7407	484.67	485.25	4.94	5.22

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
6896	482.75	483.32	7.07	7.23
6301	480.10	480.71	6.32	6.50
5851	479.06	479.72	4.30	4.36
5387.5	476.75	477.31	7.87	8.35
4924	475.31	475.82	5.26	5.57
4480.66	473.40	473.54	6.95	7.85
4037.33	472.64	472.89	3.84	3.78
3594	472.04	472.32	3.54	3.46
1990	470.68	470.96	2.79	2.86
568	470.68	466.74	0.86	0.96

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	586.24	586.39	5.97	6.27
1517	583.73	583.90	5.88	6.03
1309	581.12	581.30	5.92	6.07
1051	577.97	578.14	5.95	6.10
814	575.19	575.38	6.03	6.11
598	572.66	572.83	5.93	6.11
412	571.33	571.72	2.56	2.46
244	571.31	571.70	1.78	1.87
132	**North Bluegrove Road**			
96	567.67	567.81	5.77	6.14
38	565.38	567.16	5.24	2.09

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	595.64	595.78	6.87	7.00
23147	591.40	591.76	3.07	3.07
23001	590.51	590.97	5.45	5.24
22974	**Wintergreen Road**			
22947	589.77	590.01	5.71	5.94
22734	588.33	588.66	4.87	4.76
21281	578.82	579.09	5.59	5.94
19716	566.53	566.86	7.19	7.19
19119	561.85	562.17	6.66	7.01
17780	553.64	554.21	6.30	6.36
16745	549.76	550.31	5.54	5.82
16145	545.70	546.23	8.92	9.10
16042	545.50	546.11	5.39	5.37
15978	**Pleasant Run Road**			
15921	544.90	545.58	4.43	4.43
15703	544.10	544.79	5.68	5.80
15013	541.31	541.93	7.09	7.42
13825	529.85	530.22	10.40	10.72
13004	519.78	520.51	3.90	4.01
12260	516.10	516.63	10.37	10.93
11389	506.41	506.72	8.30	8.68
10912	501.52	502.03	8.24	8.35
10403	498.55	499.19	7.11	7.26
9658	494.87	495.43	7.74	8.09
9189	492.86	493.43	7.18	7.37
8990	492.46	493.04	5.44	5.61
8919	**Belt Line Road**			
8865	492.12	492.68	4.57	4.75
8613	491.23	491.77	6.31	6.47
8204	490.04	490.60	5.82	5.95
7860	487.10	487.75	10.11	10.12
7662	487.56	488.22	2.84	2.92
7625	**West Main Street Road**			
7597	486.79	487.44	6.09	6.13
7407	486.37	486.99	5.70	5.93

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
6896	484.45	485.05	7.45	7.50
6301	481.67	482.12	6.85	7.07
5851	480.74	481.20	4.50	4.61
5387.5	478.19	478.46	9.10	9.69
4924	476.70	477.16	5.88	5.66
4480.66	473.64	473.61	9.56	10.65
4037.33	473.36	473.52	3.40	3.43
3594	472.99	473.19	2.70	2.54
1990	472.42	472.68	1.83	1.80
568	472.40	472.65	0.81	0.82

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	586.48	586.63	6.49	6.68
1517	583.99	584.14	6.19	6.31
1309	581.39	581.54	6.22	6.32
1051	578.24	578.40	6.23	6.29
814	575.48	575.63	6.28	6.37
598	572.93	573.08	6.22	6.37
412	571.97	572.32	2.43	2.39
244	571.95	572.31	1.93	2.01
132	**North Bluegrove Road**			
96	567.89	568.01	6.35	6.68
38	565.59	568.14	5.79	1.91

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

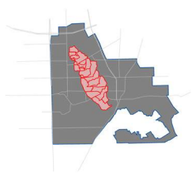
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	596.06	596.21	7.41	7.60
23147	592.66	593.13	2.88	2.75
23001	591.95	592.49	5.01	4.96
22974	**Wintergreen Road**			
22947	590.48	590.85	6.48	6.49
22734	589.09	589.46	5.04	4.92
21281	579.77	579.97	5.95	6.10
19716	567.57	567.87	7.69	7.76
19119	562.78	563.18	7.54	7.73
17780	555.19	555.65	6.52	6.72
16745	551.25	551.77	6.22	6.27
16145	547.33	547.93	9.12	9.20
16042	547.33	547.98	5.21	5.21
15978	**Pleasant Run Road**			
15921	546.92	547.60	4.32	4.34
15703	546.19	546.88	5.78	5.79
15013	543.23	543.76	7.63	7.88
13825	530.77	531.04	11.34	11.59
13004	521.71	522.22	4.12	4.19
12260	517.53	517.91	11.68	12.06
11389	507.28	507.52	9.40	9.68
10912	503.06	503.50	8.42	8.48
10403	500.50	501.04	7.50	7.61
9658	496.82	497.33	8.52	8.75
9189	494.83	495.33	7.91	8.09
8990	494.45	494.96	6.02	6.14
8919	**Belt Line Road**			
8865	494.04	494.53	5.21	5.36
8613	493.09	493.56	6.93	7.09
8204	491.95	492.42	6.33	6.47
7860	489.12	489.59	10.48	10.59
7662	489.64	490.13	3.16	3.24
7625	**West Main Street Road**			
7597	488.83	489.30	6.38	6.44
7407	488.28	488.70	6.60	6.82

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
6896	486.31	486.73	7.79	7.88
6301	483.42	483.89	7.22	7.15
5851	482.56	483.03	4.86	4.93
5387.5	479.51	479.86	10.80	11.15
4924	476.80	476.86	8.18	8.70
4480.66	475.59	475.86	6.11	5.76
4037.33	475.66	475.90	1.41	1.38
3594	475.63	475.87	1.02	1.03
1990	475.55	475.79	1.00	1.02
568	475.54	475.78	0.63	0.65

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	586.80	586.93	6.98	7.12
1517	584.29	584.41	6.56	6.69
1309	581.70	581.82	6.56	6.65
1051	578.55	578.67	6.56	6.69
814	575.80	575.92	6.56	6.66
598	573.24	573.37	6.58	6.65
412	572.79	573.13	2.35	2.34
244	572.77	573.11	2.11	2.17
132	**North Bluegrove Road**			
96	568.17	569.36	7.04	4.39
38	565.84	569.48	6.42	1.78

2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	596.27	596.40	7.77	7.81
23147	593.41	593.82	2.67	2.51
23001	592.77	593.18	4.95	4.94
22974	**Wintergreen Road**			
22947	590.99	591.17	6.59	6.76
22734	589.61	589.69	4.91	5.14
21281	580.36	580.82	6.15	5.84
19716	568.23	569.39	8.05	6.29
19119	563.40	564.00	8.00	7.96
17780	556.17	556.72	6.68	6.90
16745	552.32	552.94	6.49	6.65
16145	548.47	549.09	9.36	9.62
16042	548.56	549.23	5.25	5.36
15978	**Pleasant Run Road**			
15921	548.19	548.87	4.41	4.53
15703	547.49	548.16	5.85	5.96
15013	544.31	544.88	8.08	8.39
13825	531.34	531.67	11.90	12.18
13004	522.83	523.44	4.26	4.34
12260	518.33	518.72	12.56	13.12
11389	507.85	508.21	10.02	10.30
10912	504.05	504.54	8.58	8.79
10403	501.72	502.27	7.74	7.87
9658	498.06	498.56	8.95	9.22
9189	496.06	496.53	8.30	8.48
8990	495.70	496.18	6.26	6.38
8919	**Belt Line Road**			
8865	495.26	495.73	5.52	5.66
8613	494.27	494.73	7.24	7.39
8204	493.17	493.64	6.54	6.65
7860	490.31	490.76	10.77	10.92
7662	490.87	491.34	3.37	3.46
7625	**West Main Street Road**			
7597	490.04	490.49	6.55	6.66
7407	489.37	489.77	7.14	7.38

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
6896	487.32	487.69	8.09	8.24
6301	484.54	485.09	7.16	7.01
5851	483.70	484.27	5.05	5.14
5387.5	480.33	480.73	11.70	12.14
4924	477.00	477.12	9.30	9.76
4480.66	477.11	477.28	3.29	3.27
4037.33	477.08	477.25	1.06	1.12
3594	477.07	477.24	0.82	0.84
1990	477.02	477.19	0.92	0.96
568	477.01	477.18	0.61	0.64

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	586.97	587.12	7.20	7.39
1517	584.43	584.58	6.84	6.95
1309	581.85	581.99	6.71	6.88
1051	578.71	578.86	6.73	6.84
814	575.95	576.09	6.73	6.90
598	573.40	573.55	6.74	6.85
412	573.24	573.67	2.33	2.32
244	573.22	573.65	2.19	2.26
132	**North Bluegrove Road**			
96	568.31	570.01	7.37	4.14
38	565.97	570.11	6.73	1.82

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

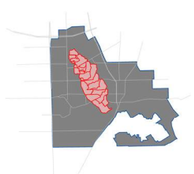
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	596.59	596.69	8.04	8.17
23147	594.53	594.75	2.23	2.21
23001	593.96	594.15	4.90	5.06
22974	**Wintergreen Road**			
22947	591.46	591.61	7.03	7.18
22734	590.00	590.22	5.19	5.10
21281	581.25	581.48	6.00	6.15
19716	569.84	570.11	6.12	6.12
19119	564.33	564.78	8.07	8.01
17780	557.23	557.59	6.95	7.18
16745	553.50	554.06	6.94	6.87
16145	549.64	550.21	9.85	10.14
16042	549.80	550.41	5.47	5.61
15978	**Pleasant Run Road**			
15921	549.45	550.05	4.64	4.79
15703	548.74	549.36	6.06	6.16
15013	545.51	546.08	8.51	8.76
13825	532.13	532.45	12.61	12.82
13004	524.32	524.88	4.46	4.53
12260	519.25	519.55	13.97	14.58
11389	508.67	508.98	10.65	10.82
10912	505.40	505.93	8.78	8.77
10403	503.29	503.88	8.03	8.17
9658	499.64	500.13	9.45	9.74
9189	497.53	498.02	8.84	8.93
8990	497.19	497.68	6.65	6.72
8919	**Belt Line Road**			
8865	496.71	497.20	5.97	6.06
8613	495.65	496.15	7.77	7.84
8204	494.58	495.12	6.92	6.92
7860	491.64	492.16	11.23	11.40
7662	492.26	492.79	3.67	3.79
7625	**West Main Street Road**			
7597	491.36	491.87	6.91	7.06
7407	490.54	490.98	7.88	8.17
6896	488.39	488.80	8.59	8.80
6301	485.92	486.47	7.04	6.98
5851	485.12	485.70	5.28	5.35
5387.5	479.74	480.29	15.65	15.81
4924	480.06	480.19	3.27	3.41
4480.66	480.03	480.17	1.41	1.47
4037.33	480.03	480.16	0.65	0.69
3594	480.02	480.16	0.53	0.55
1990	480.01	480.14	0.75	0.78
568	480.00	480.13	0.56	0.58

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	587.23	587.40	7.55	7.75
1517	584.66	584.83	7.16	7.29
1309	582.07	582.25	7.07	7.18
1051	578.94	579.09	7.03	7.21
814	576.18	576.33	7.06	7.25
598	573.63	574.80	7.01	4.40
412	573.99	574.92	2.31	2.09
244	573.97	574.89	2.31	2.24
132	**North Bluegrove Road**			
96	568.55	570.81	7.93	4.11
38	566.18	570.91	7.20	1.93

2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	596.77	596.89	8.31	8.46
23147	594.94	595.06	2.19	2.27
23001	594.25	594.53	5.23	4.74
22974	**Wintergreen Road**			
22947	591.76	591.91	7.27	7.55
22734	590.43	590.60	4.92	4.95
21281	581.58	581.79	6.32	6.47
19716	570.25	570.55	6.04	5.94
19119	565.05	565.52	7.99	7.97
17780	557.95	558.30	7.19	7.48
16745	554.27	554.74	7.18	7.13
16145	550.41	551.02	10.18	10.06
16042	550.62	551.23	5.64	5.62
15978	**Pleasant Run Road**			
15921	550.22	550.57	4.85	4.98
15703	549.54	549.92	6.18	6.24
15013	546.28	546.63	8.79	8.99
13825	532.65	532.98	13.02	13.25
13004	525.28	525.90	4.58	4.65
12260	519.74	520.01	15.02	15.75
11389	509.31	509.69	10.96	11.10
10912	506.36	506.85	8.89	9.03
10403	504.38	504.89	8.23	8.38
9658	500.75	501.20	9.70	9.94
9189	498.61	499.08	9.15	9.22
8990	498.28	498.76	6.89	6.95
8919	**Belt Line Road**			
8865	497.78	498.26	6.26	6.34
8613	496.67	497.15	8.11	8.20
8204	495.63	496.14	7.14	7.15
7860	492.64	493.13	11.56	11.70
7662	493.30	493.79	3.91	4.02
7625	**West Main Street Road**			
7597	492.34	492.81	7.21	7.36
7407	491.39	491.80	8.45	8.72

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
6896	489.19	489.54	8.98	9.21
6301	487.07	487.44	6.84	6.95
5851	486.30	486.76	5.18	5.10
5387.5	480.77	481.34	15.84	15.83
4924	480.92	481.05	2.90	2.98
4480.66	480.90	481.03	1.28	1.33
4037.33	480.90	481.03	0.64	0.67
3594	480.89	481.02	0.51	0.52
1990	480.88	481.01	0.79	0.81
568	480.87	481.00	0.59	0.60

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	587.40	587.57	7.77	7.92
1517	584.82	584.98	7.36	7.47
1309	582.22	582.37	7.27	7.45
1051	579.09	579.21	7.23	7.48
814	576.32	576.46	7.31	7.51
598	574.80	575.67	4.40	3.61
412	574.92	575.74	2.09	1.97
244	574.89	575.70	2.24	2.22
132	**North Bluegrove Road**			
96	568.73	571.39	8.21	4.04
38	566.32	571.48	7.50	1.95

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

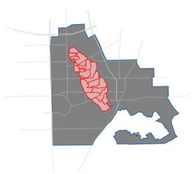
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5



2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23736	596.98	597.12	8.52	8.59
23147	595.12	595.20	2.34	2.43
23001	594.68	594.84	4.43	4.18
22974	**Wintergreen Road**			
22947	591.98	592.13	7.77	8.00
22734	590.72	590.95	4.94	4.79
21281	581.87	581.92	6.68	7.00
19716	570.63	570.81	5.87	5.83
19119	565.59	565.89	8.05	8.18
17780	558.54	558.84	7.40	7.62
16745	555.12	555.61	7.16	7.14
16145	551.44	552.09	9.91	9.56
16042	551.62	552.23	5.61	5.61
15978	**Pleasant Run Road**			
15921	550.80	551.17	5.08	5.22
15703	550.15	550.58	6.29	6.25
15013	546.84	547.15	9.12	9.32
13825	533.15	533.40	13.39	13.57
13004	526.24	526.71	4.68	4.74
12260	520.12	520.45	16.18	16.50
11389	509.94	510.30	11.16	11.27
10912	507.26	507.70	9.00	9.13
10403	505.33	505.80	8.48	8.60
9658	501.69	502.15	10.02	10.17
9189	499.56	500.03	9.38	9.50
8990	499.24	499.72	7.09	7.19
8919	**Belt Line Road**			
8865	498.73	499.19	6.50	6.62
8613	497.57	498.00	8.42	8.57
8204	496.55	496.99	7.33	7.43
7860	493.51	493.93	11.82	11.96
7662	494.19	494.63	4.12	4.22
7625	**West Main Street Road**			
7597	493.18	493.59	7.48	7.62
7407	492.12	492.47	8.93	9.17

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
6896	489.84	490.10	9.37	9.62
6301	487.71	488.03	7.05	7.14
5851	487.09	487.52	5.04	4.91
5387.5	481.71	482.18	15.89	16.02
4924	481.91	482.01	2.38	2.47
4480.66	481.90	481.99	1.14	1.19
4037.33	481.90	481.99	0.62	0.65
3594	481.89	481.98	0.51	0.52
1990	481.88	481.97	0.81	0.84
568	481.87	481.96	0.61	0.63

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1743	587.56	587.78	7.96	8.16
1517	584.97	585.16	7.52	7.73
1309	582.35	582.54	7.51	7.75
1051	579.21	579.39	7.48	7.79
814	576.45	576.64	7.54	7.78
598	575.67	576.14	3.61	3.58
412	575.74	576.21	1.97	2.08
244	575.70	576.16	2.22	2.38
132	**North Bluegrove Road**			
96	568.89	571.88	8.49	4.19
38	566.45	571.98	7.79	2.06

WATERSHED NO.

3

COUNCIL DISTRICTS

1, 3, 4, 5 AND 6

TOTAL DRAINAGE AREA

3.90 SM

*

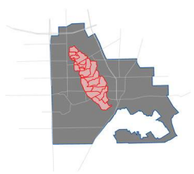
STREAM LENGTH

4.72 MI

*

PROJECTS IDENTIFIED

5

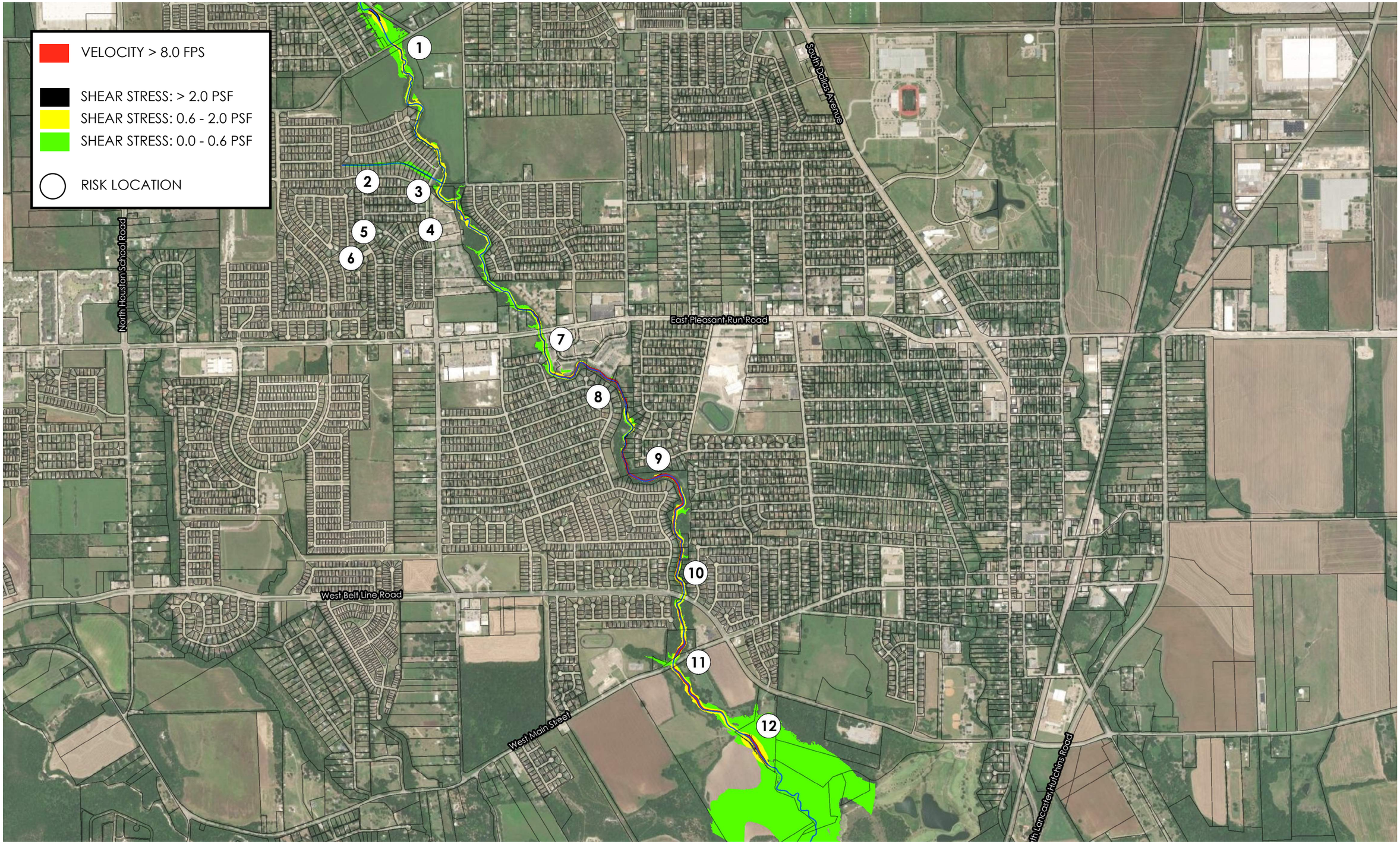


3.1 RISK IDENTIFICATION

Twelve risk areas were identified in this study. The risks include two over-topping Bridges, one flooding structure, three flooded roadways and six locations of erosive velocities. The flooded structure is a multi-family development on Pleasant Run Road. This building is only expected to flood in the 100-eyar event. The Blue Grove Road bridge had very little traffic, but Wintergreen road, which is expected to over-top in the 25-year event has significant traffic. There are also reports of roadway flooding in the N Bluegrove Road area. The six areas where erosion is likely are all located in areas with heavy development. However, based on the direction of channel flow, the potential erosion is unlikely to pose an immediate threat. The following map shows the shear stresses associated with the Deep Branch floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Wintergreen Road	Over-topping Bridge	25-Year	Public	High
2	River Station 3139	Potential Erosion Hot Spot	1-Year	Private	Very Low
3	North Blue Grove Road	Over-topping Bridge	100-Year	Public	Low
4	1600-1800 Block of N Blue Grove Road	Flooded Roads	-	Public	Medium
5	1500-1600 Block of Willow Brook Lane	Flooded Roads	-	Public	Medium
6	1539 Willowbrook (Alley)	Flooded Roads	-	Public	Medium
7	Multifamily Development on Pleasant Run Road	Flooded Structure	100-Year	Private	Low
8	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Low
9	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Low
10	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Low
11	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Low
12	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
1
2
3
4
5
6
7
8
9
10
11
12
North Houston School Road
East Pleasant Run Road
South Dallas Avenue
West Belt Line Road
West Main Street
th Lancaster Hutchins Road

FLOYD BRANCH

WATERSHED NO.

4

COUNCIL DISTRICT

6

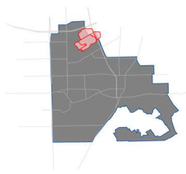
TOTAL DRAINAGE AREA

1.19 SM

*

STREAM LENGTH

0.98 MI



FLOYD

STREAM CENTERLINE

COUNCIL DISTRICT

DISTRICT 1

DISTRICT 2

DISTRICT 3

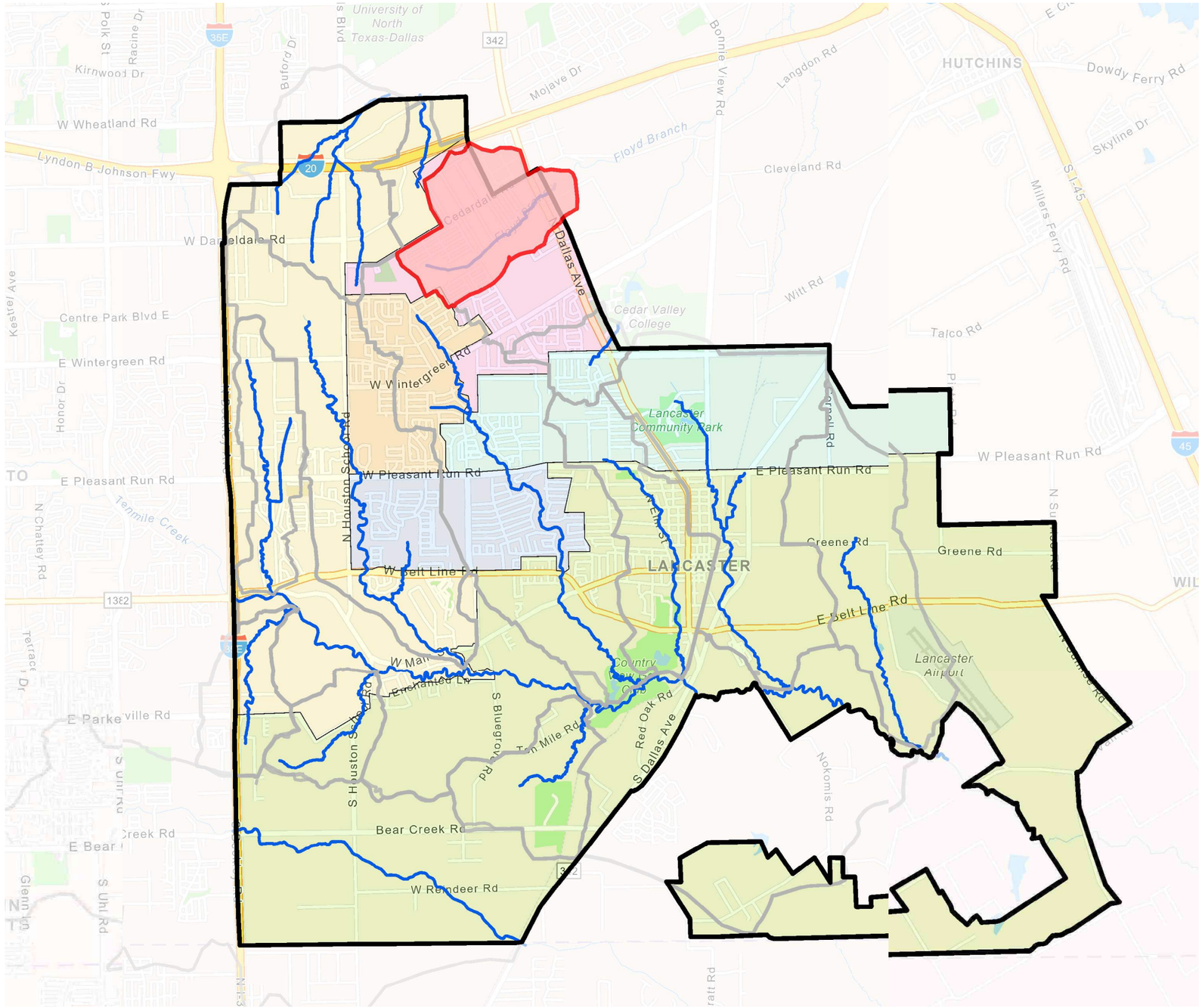
DISTRICT 4

DISTRICT 5

DISTRICT 6

FLOYD BRANCH WATERSHED

In the city's northeast, Floyd Branch spans 1.11 square miles. The stream, starting near the Boardwalk development, extends east for 0.90 miles. Featuring residential, commercial, and undeveloped pasture lands, it's poised for future residential expansion.



WATERSHED NO. 4

FLOYD BRANCH

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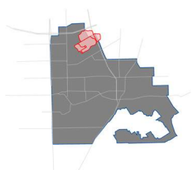
1.0 HYDROLOGY

WATERSHED NO.
4

COUNCIL DISTRICT
6

TOTAL DRAINAGE AREA
1.19 SM
*
STREAM LENGTH
0.98 MI



1.1 DRAINAGE AREA MAP

The drainage area divides for the watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into five (5) sub-basins. Sub-basins are designated FB1 through FB5. The total watershed drainage area is 761.67 acres (1.19 square-miles). 0.99 square miles of the drainage area is located within the Lancaster City Limits. Figure 2, shown below, provides an overview of the drainage sub-basin layout for Floyd Branch with in the City of Lancaster.

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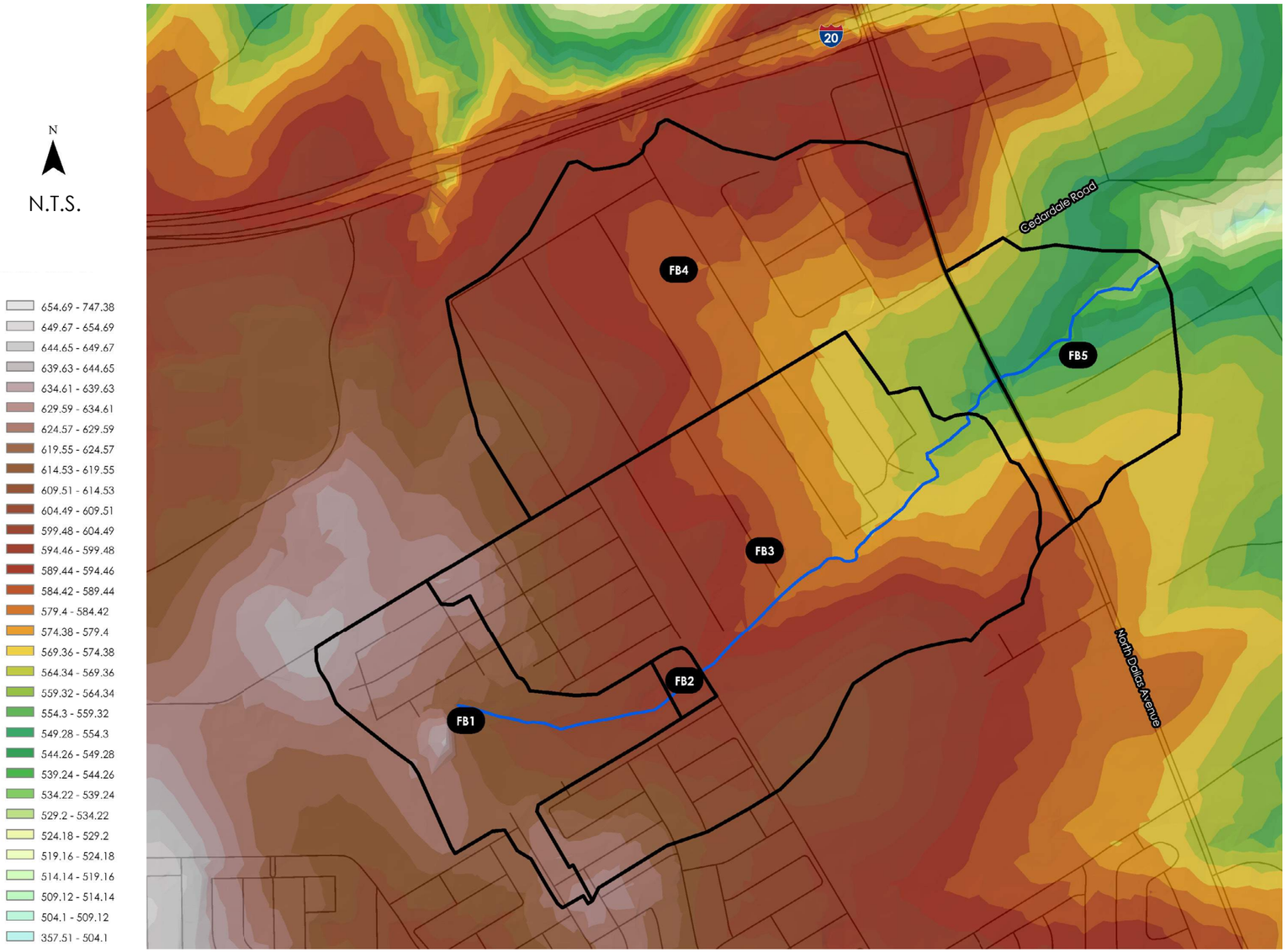


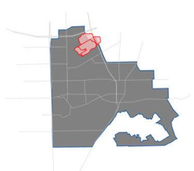
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
FB1	0.151	84	22.9	46.8	32.10	19.26	24.48	14.69
FB2	0.0075	84	7.1	31.8	15.55	9.33	11.78	7.07
FB3	0.5066	84	23.7	46.7	38.73	23.24	30.54	18.32
FB4	0.3976	84	33.1	51.3	33.60	20.16	28.41	17.04
FB5	0.1274	83.4	33	66.1	17.35	10.41	13.54	8.12

WATERSHED NO.
4

COUNCIL DISTRICT
6

TOTAL DRAINAGE AREA
1.19 SM
*
STREAM LENGTH
0.98 MI



1.2 TIME OF CONCENTRATION

The Times of Concentration for Barney Branch were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Floyd Branch flows through residential developments. This development typically reduces the Times of Concentration. Sub-basin FB2 is particularly small, which greatly reduces its Time of Concentration. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

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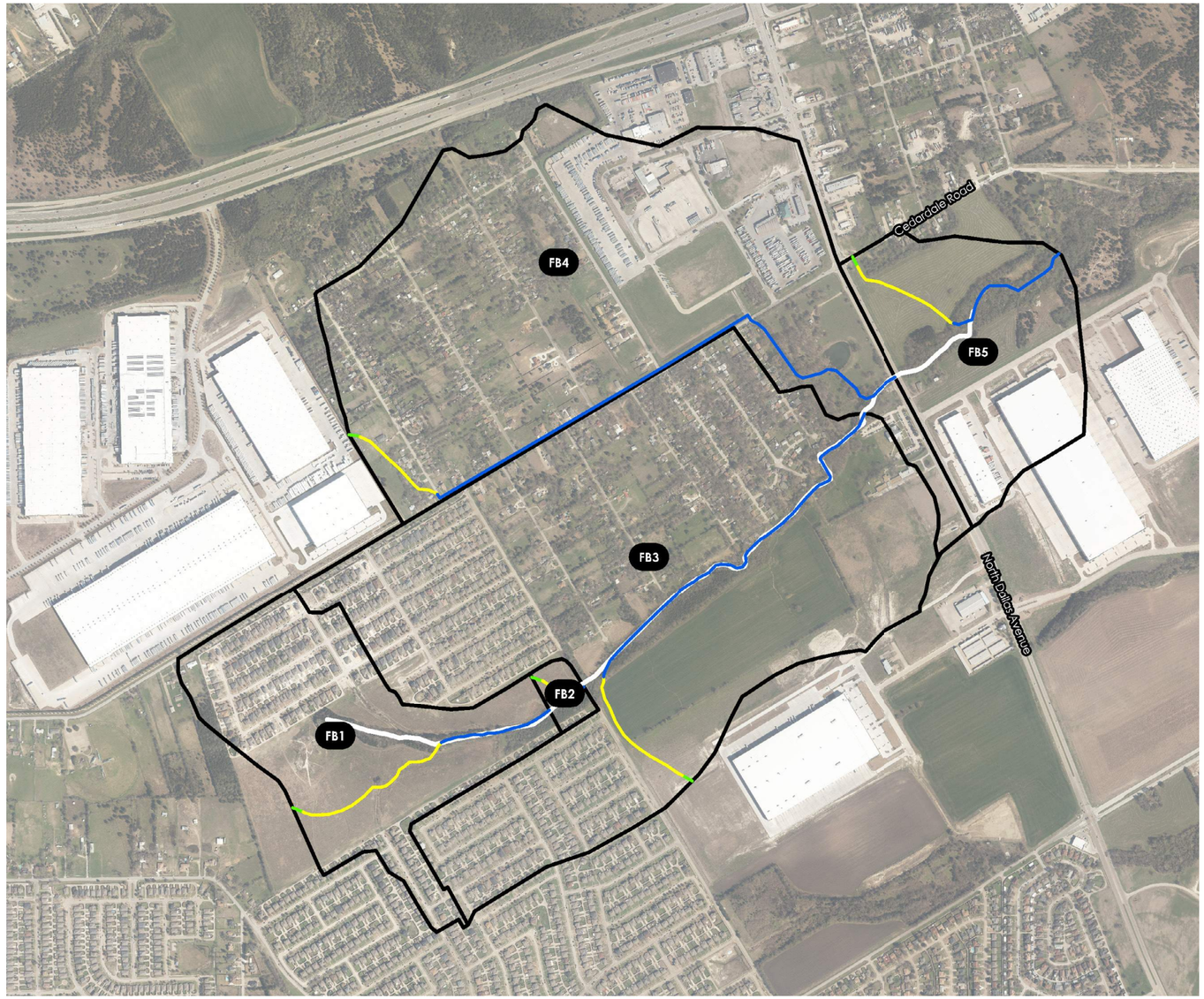


TIME OF CONCENTRATION REPORT

FB1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.81	0.240	0.00	0.1	19.29
SHALLOW	UNPAVED	1,472	1.86	0.000	16.10	2.2	11.17
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,017	5.99	0.050	42.29	10.4	1.64
		2,589					**32.09**
							24.48

FB2

OVERLAND	GRS-DENSE	100	1.71	0.240	0.00	0.1	14.33
SHALLOW	UNPAVED	172	5.72	0.000	16.10	3.8	0.74
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	244	4.09	0.050	42.29	8.6	0.48
		516					**15.55**
							11.78

FB3

OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	23.42
SHALLOW	UNPAVED	1,192	1.74	0.000	16.10	2.1	9.35
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,580	5.61	0.050	42.29	10.0	5.96
		4,872					**38.73**
							30.54

FB4

OVERLAND	GRS-DENSE	100	1.44	0.240	0.00	0.1	15.33
SHALLOW	UNPAVED	875	2.76	0.000	16.10	2.7	5.45
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,197	3.56	0.050	28.69	5.4	9.84
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,764	5.45	0.050	42.29	9.9	2.98
		5,935					**33.60**
							28.41

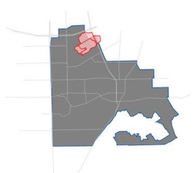
FB5

OVERLAND	GRS-DENSE	100	5.9	0.240	0.00	0.2	8.73
SHALLOW	UNPAVED	1,021	2.64	0.000	16.10	2.6	6.51
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,281	5.72	0.050	42.29	10.1	2.11
		2,403					**17.35**
							13.54

WATERSHED NO.
4

COUNCIL DISTRICT
6

TOTAL DRAINAGE AREA
1.19 SM
*
STREAM LENGTH
0.98 MI



1.3 SOILS MAP

Floyd Branch watershed has two different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type B, which is more permeable than soil type D is found within sub-basins FB-5 Hydrologic soil groups A and C are not present in the Floyd Branch watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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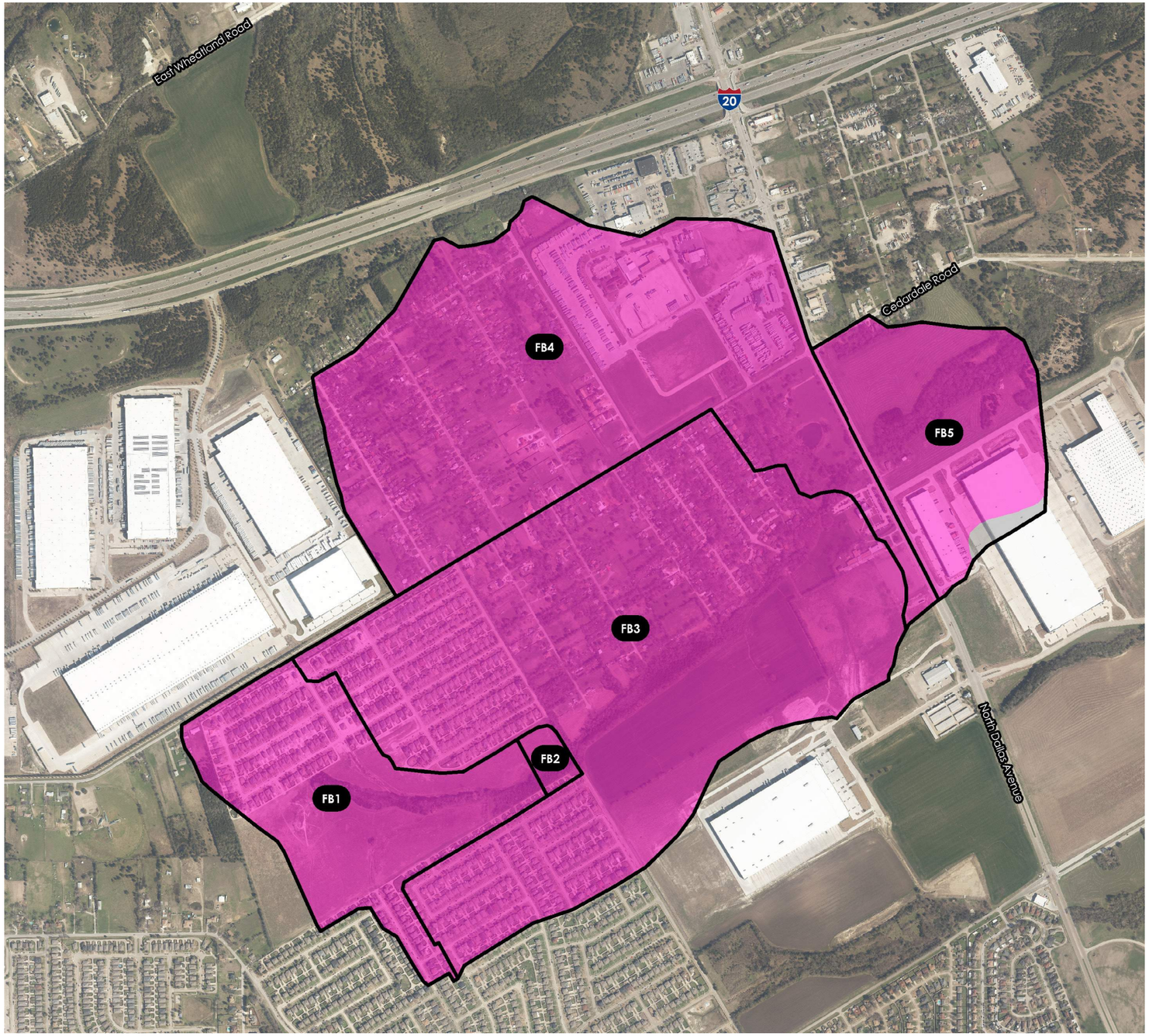


PERVIOUS CURVE NUMBER REPORT

FB1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	96.7	84.0
		96.7	**84.0**

FB2

D	84	4.8	84.0
		4.8	**84.0**

FB3

D	84	324.2	55.6
		324.2	**82.3**

FB4

D	84	254.4	81.7
		254.4	**83.9**

FB5

B	69	3.1	2.6
D	84	78.5	80.8
		81.6	**83.4**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

4

COUNCIL DISTRICT

6

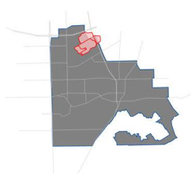
TOTAL DRAINAGE AREA

1.19 SM

*

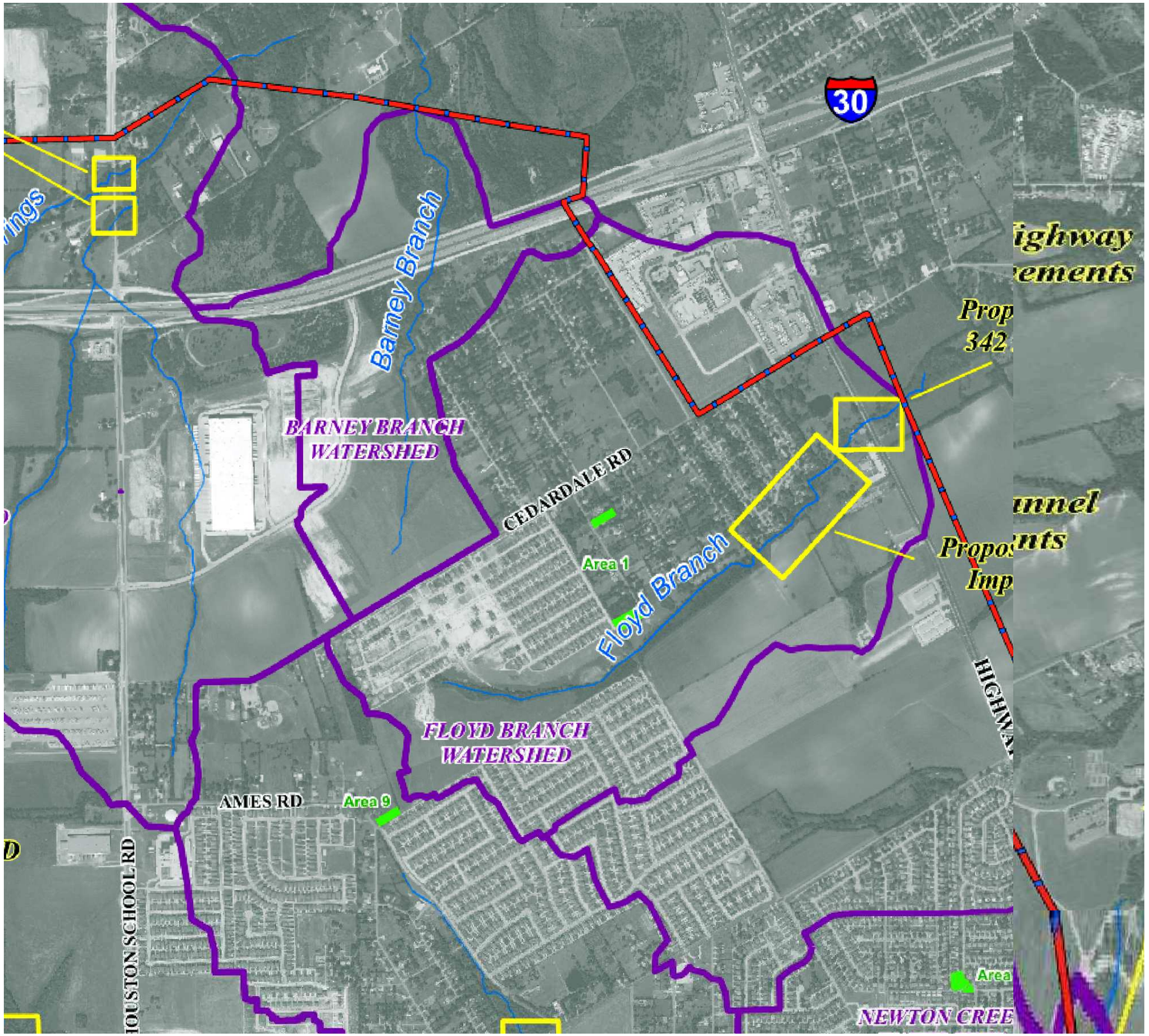
STREAM LENGTH

0.98 MI



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows significant development since 2007 within the Floyd Branch watershed. New development consists mostly of large industrial warehouses. Specifically, this new development is located in sub-basins FB-3 and FB-5. The locations of new development are highlighted in red.



N

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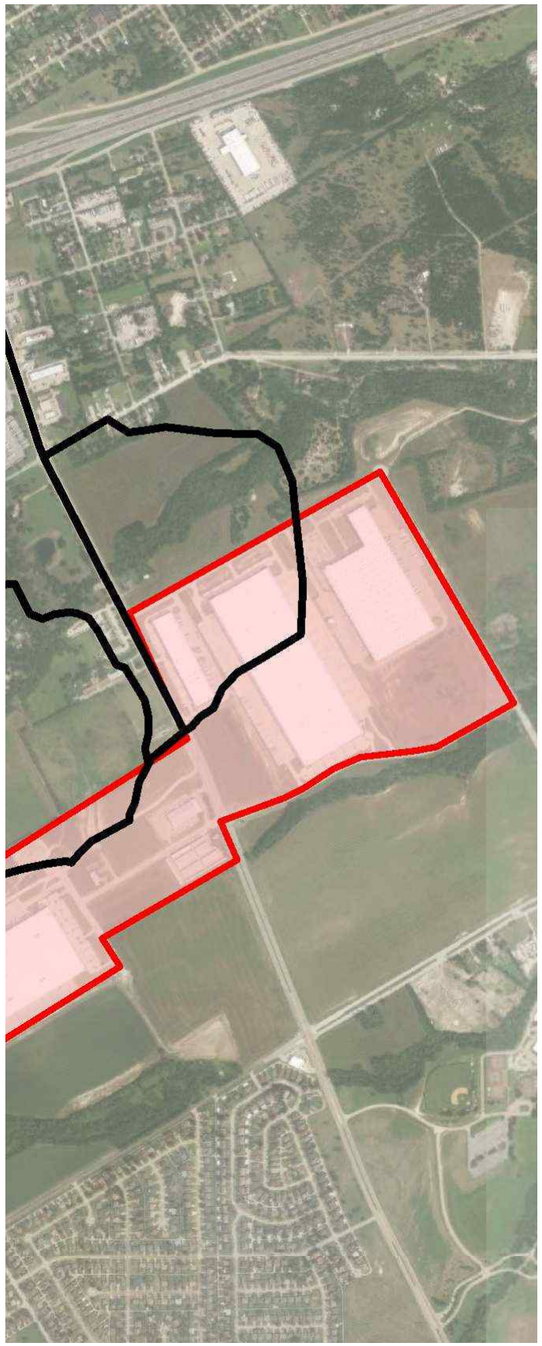
2007





N

N.T.S.

2019

WATERSHED NO.

4

COUNCIL DISTRICT

6

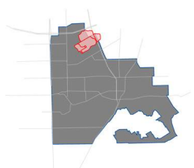
TOTAL DRAINAGE AREA

1.19 SM

*

STREAM LENGTH

0.98 MI



1.5 IMPERVIOUS AREA

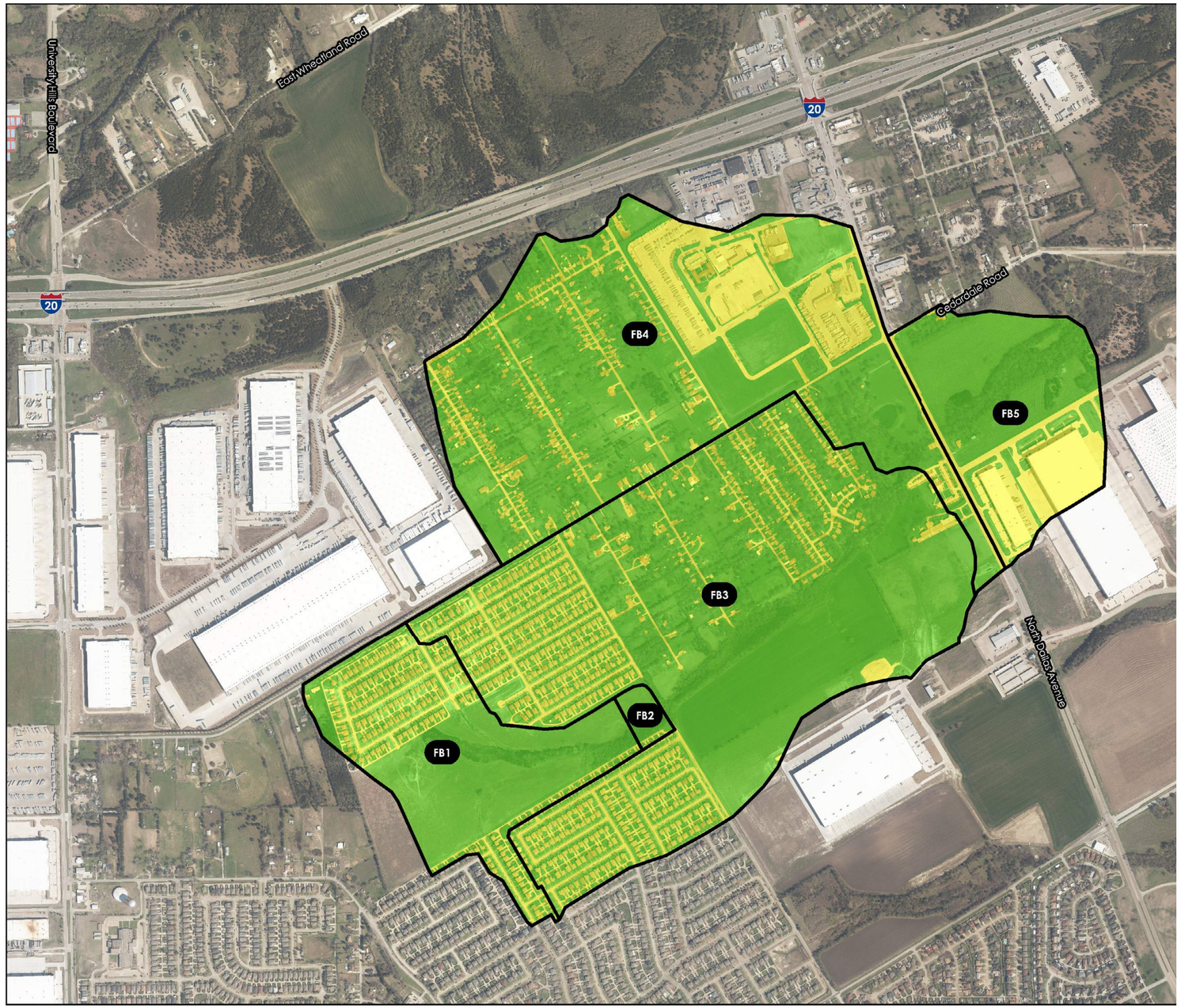
Impervious areas for the Floyd Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods in Basins FB-1 through FB4 and industrial developments located in Basins FB4 and FB5.

IMPERVIOUS

OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

FB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	22.1	22.9
OPEN SPACE	0	74.6	0.0
		96.7	**22.9**

FB2

IMPERVIOUS	100	0.3	7.1
OPEN SPACE	0	4.5	0.0
		4.8	**7.1**

FB3

IMPERVIOUS	100	76.8	23.7
OPEN SPACE	0	247.4	0.0
		324.2	**23.7**

FB4

IMPERVIOUS	100	73.2	33.1
OPEN SPACE	0	181.2	0.0
		254.4	**33.1**

FB5

IMPERVIOUS	100	26.9	33.0
OPEN SPACE	0	54.7	0.0
		81.6	**33.0**

WATERSHED NO.

4

COUNCIL DISTRICT

6

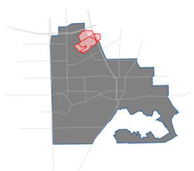
TOTAL DRAINAGE AREA

1.19 SM

*

STREAM LENGTH

0.98 MI



1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The future land use within the watershed consist of mostly Industrial, Residential and Mixed Use zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020. This basin has a large amount of open area that will likely be developed in the future, particularly in Basin FB3 and FB5.

- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- R - URBAN NEIGHBORHOOD

N

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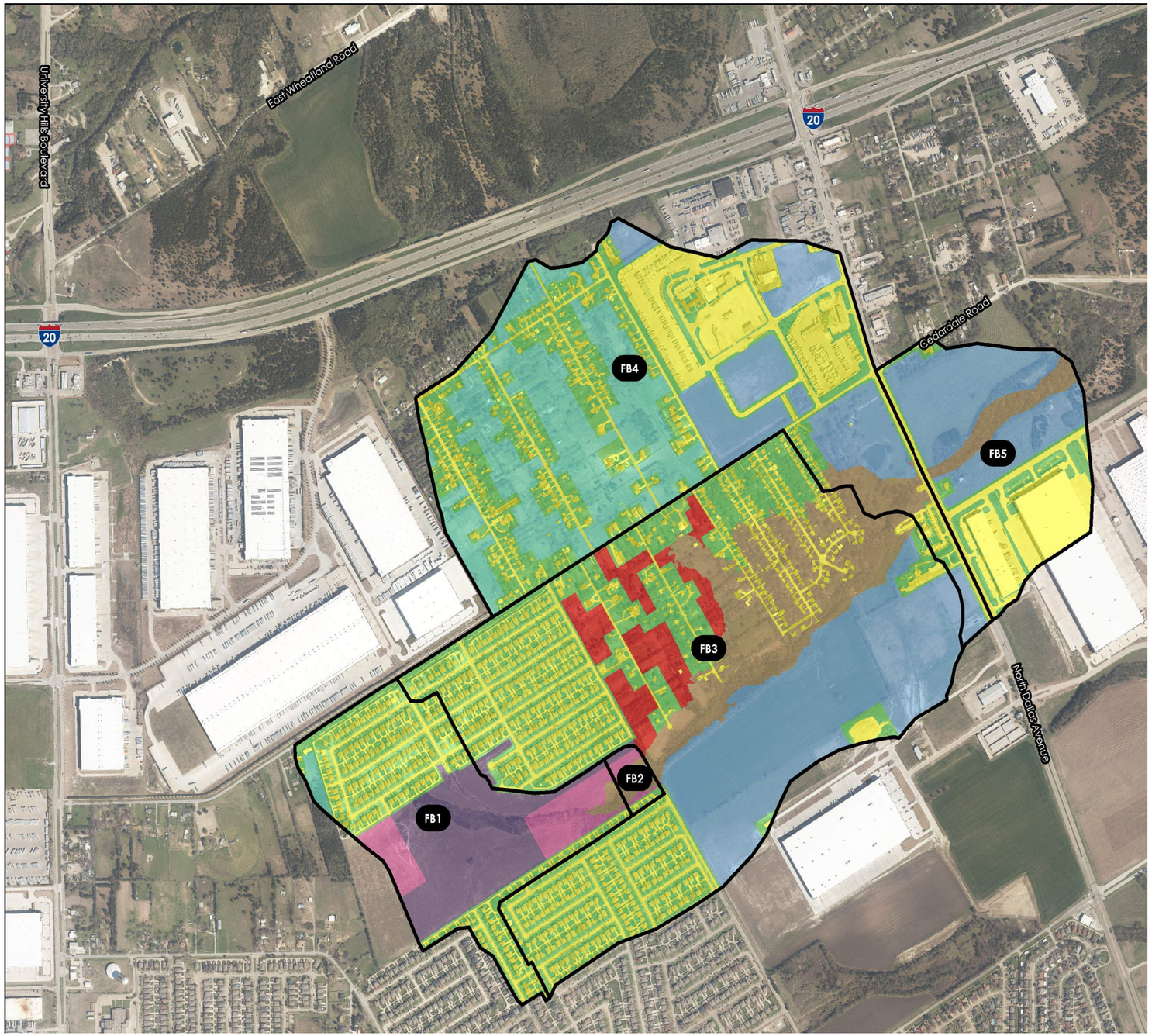


ULTIMATE PERCENT IMPERVIOUS REPORT

FB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	22.1	22.9
FLOODPLAIN	0	1.3	0.0
OPEN SPACE (FAIR CONDITION)	0	23.3	0.0
PUBLIC & SEMI-PUBLIC	72	13.6	10.1
R - SURBURBAN NEIGHBORHOOD	38	34.6	13.6
R - RURAL LIVING	12	1.7	0.2
		96.7	**46.8**

FB2

IMPERVIOUS	100	0.3	7.1
FLOODPLAIN	0	2.2	0.0
OPEN SPACE (FAIR CONDITION)	0	0.4	0.0
PUBLIC & SEMI-PUBLIC	72	1.4	20.7
R - SURBURBAN NEIGHBORHOOD	38	0.5	3.9
R - URBAN NEIGHBORHOOD	65	0.0	0.0
		4.8	**31.8**

FB3

IMPERVIOUS	100	76.8	23.7
FLOODPLAIN	0	51.2	0.0
OPEN SPACE (FAIR CONDITION)	0	89.7	0.0
LOGISTICS & DISTRIBUTION	72	82.2	18.3
PUBLIC & SEMI-PUBLIC	72	0.0	0.0
R - SURBURBAN NEIGHBORHOOD	38	1.6	0.2
R - URBAN NEIGHBORHOOD	65	22.7	4.5
		324.2	**46.7**

FB4

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	73.2	33.1
FLOODPLAIN	0	7.0	0.0
OPEN SPACE (FAIR CONDITION)	0	61.9	0.0
LOGISTICS & DISTRIBUTION	72	44.7	14.5
R - RURAL LIVING	12	67.7	3.7
		254.4	**51.3**

FB5

IMPERVIOUS	100	26.9	33.0
FLOODPLAIN	0	7.4	0.0
OPEN SPACE (FAIR CONDITION)	0	9.7	0.0
LOGISTICS & DISTRIBUTION	72	37.5	33.1
		81.6	**66.1**

WATERSHED NO.

4

COUNCIL DISTRICT

6

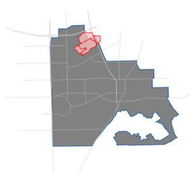
TOTAL DRAINAGE AREA

1.19 SM

*

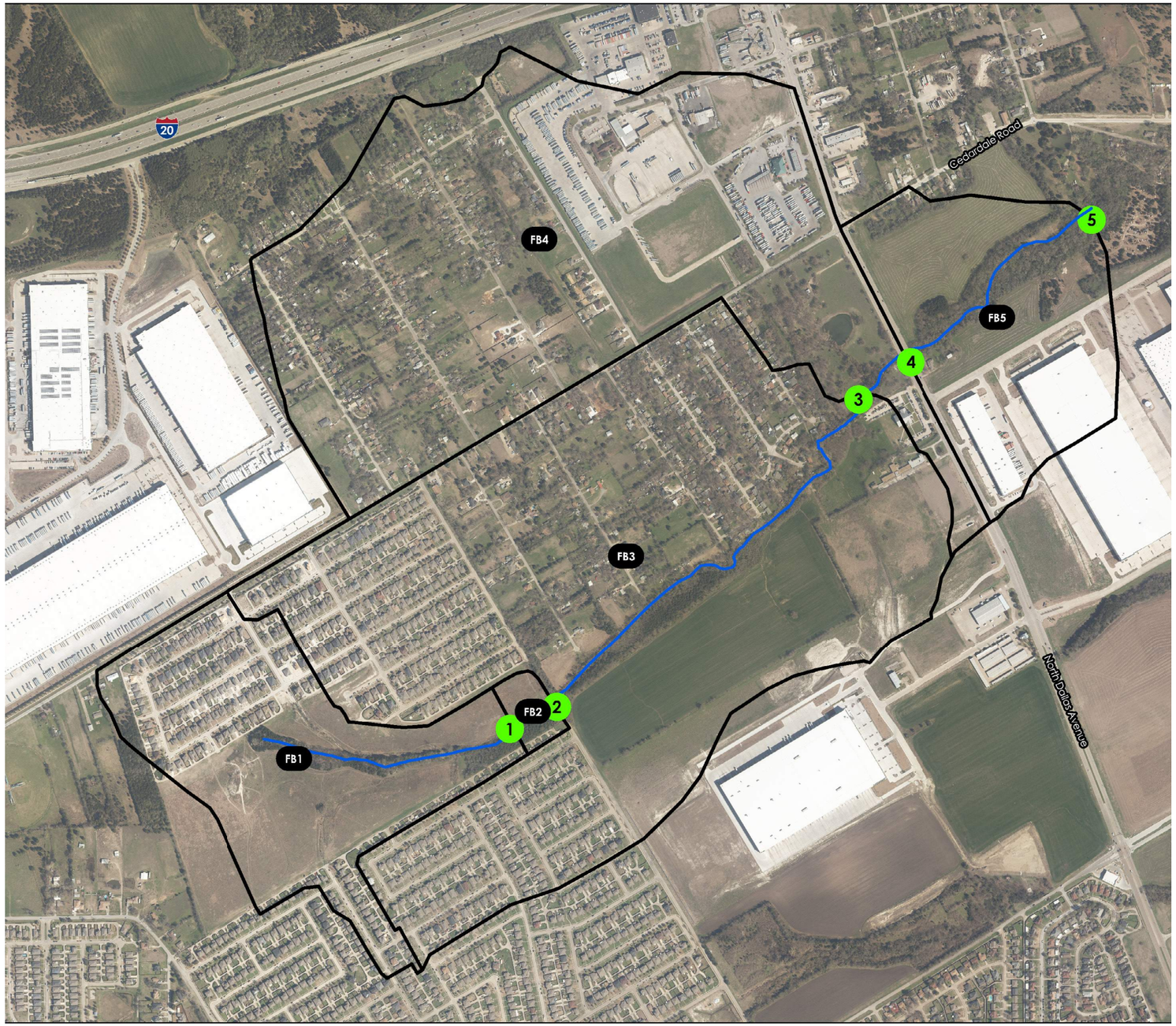
STREAM LENGTH

0.98 MI



1.7 RESULTS

The flow was analyzed at five locations for Floyd Branch. Flow locations 1 and 2 were used to establish flows at the upstream end of the stream. Two were used in this case because of a series of detention ponds in that area. Location 4 was used to determine flows at North Dallas Avenue. Location 3 was included because of the location of its respective sub-basin. Location 5 was used to establish downstream conditions for the stream which is relatively small.



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FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	FB1	-	-	0.15	490
2	FB-1-FB2	Main	5196.092	0.16	300
3	FB-1-FB3	Main	3049.888	0.67	1850
4	FB-1-FB4	Main	1082.463	1.06	3200
5	FB-1-FB5	Main	864.6813	1.19	3500

WATERSHED NO.
4

COUNCIL DISTRICT
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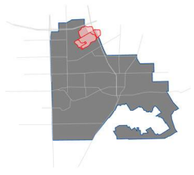
TOTAL DRAINAGE AREA
1.19 SM
*
STREAM LENGTH
0.98 MI



2.1 SITE ASSESSMENT

Floyd Branch is located in the North region of the City of Lancaster. It flows from Southwest to Northeast for approximately 0.98 miles before leaving the city limits. This assessment analyzes the hydrologic and hydraulic characteristics of Floyd Branch within the limits of the City of Lancaster, roughly bound by a location approximately 4,200 feet upstream of Highway 342 (upstream end) and a location approximately 520 feet downstream of Highway 342 (downstream end). The channel slope averages around 0.9-1.2%. Floyd Branch itself is has a number of road crossings, but no concrete lined channels within the City. Except at the road crossings, heavy vegetation is observed. There is a total of one (1) crossing throughout the studied watershed.



Looking Downstream of the Highway 342 Culvert. Is rocky with heavy vegetation. The channel downstream is heavily wooded.



Looking at the downstream edge of the Highway 342 Culvert. Is rocky with heavy vegetation. The channel downstream is heavily wooded.



Looking at the downstream face of the Highway 342 Culvert. Culvert itself appears to be in good condition. Overtopping is anticipated in higher flow storm events however.



Looking upstream of Highway 342 culvert. The upstream portion of the channel is a little cleaner, but still rocky. Upstream channel is still heavily wooded.

WATERSHED NO.
4

COUNCIL DISTRICT
6

TOTAL DRAINAGE AREA
1.19 SM
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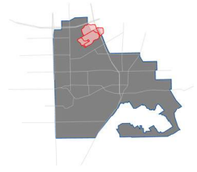
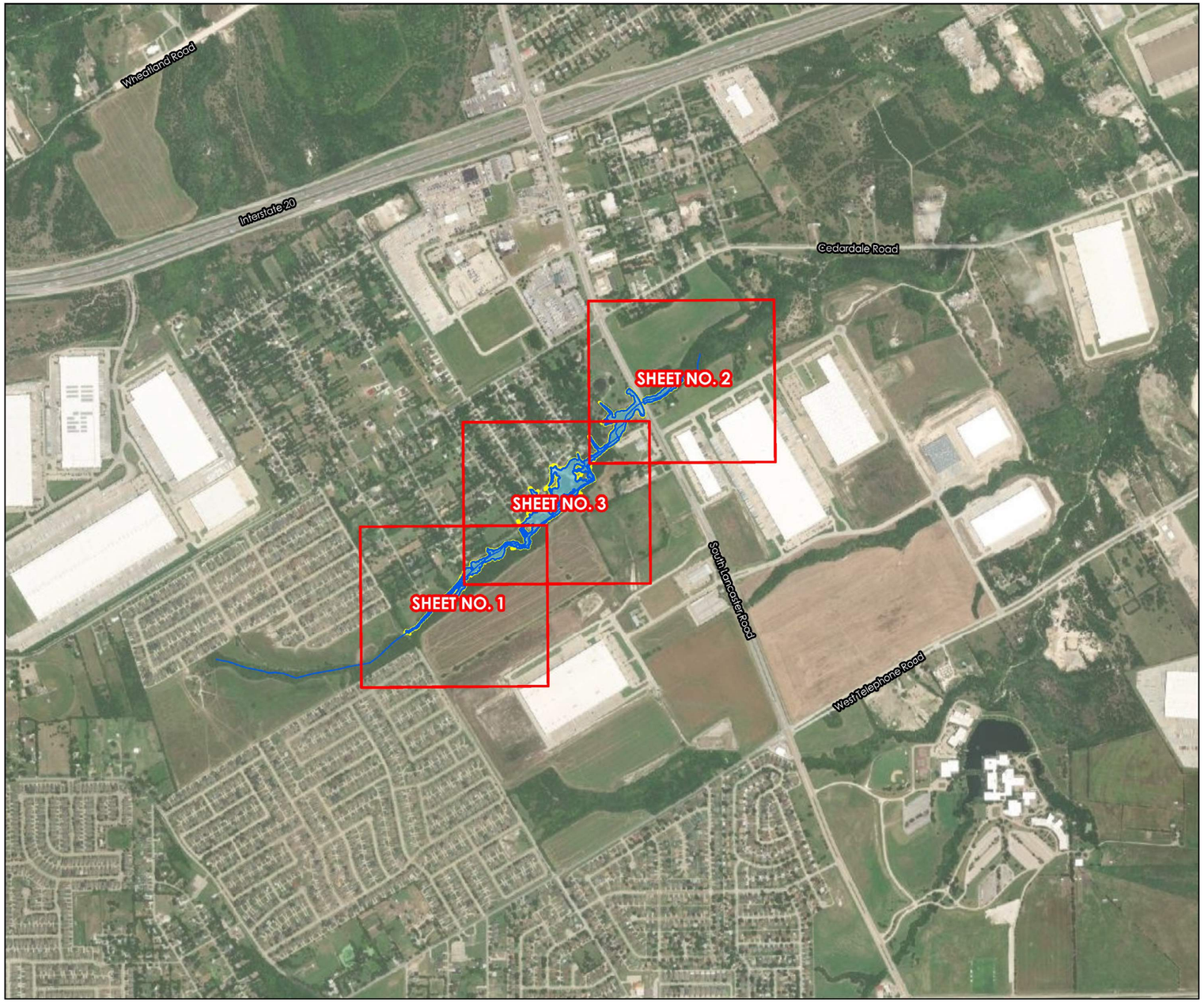
STREAM LENGTH
0.98 MI



2.2 FLOODPLAIN MAPPING

The Floyd Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Floyd Branch is comprised of one stream, one reach, thirteen (13) cross sections, and one (1) hydraulic structure. The studied stream is 5,196 feet (0.98 miles) long. Floyd Branch floodplain is mostly contained within the channel esxcept for a few locations.

The floodplain sheets for Floyd Branch display two different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space.



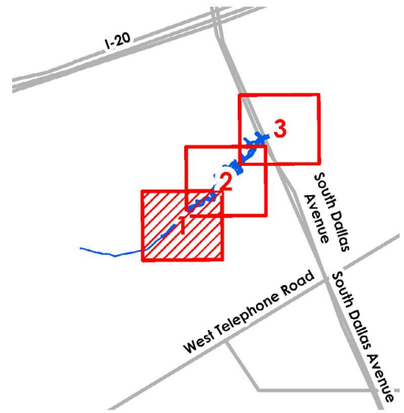
STREAM CENTERLINE
FLOYD VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200
Feet

- FLOYD CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- FLOYD BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.

4

COUNCIL DISTRICT

6

TOTAL DRAINAGE AREA

1.19 SM

*

STREAM LENGTH

0.98 MI

FLOODPLAIN: SHEET 2

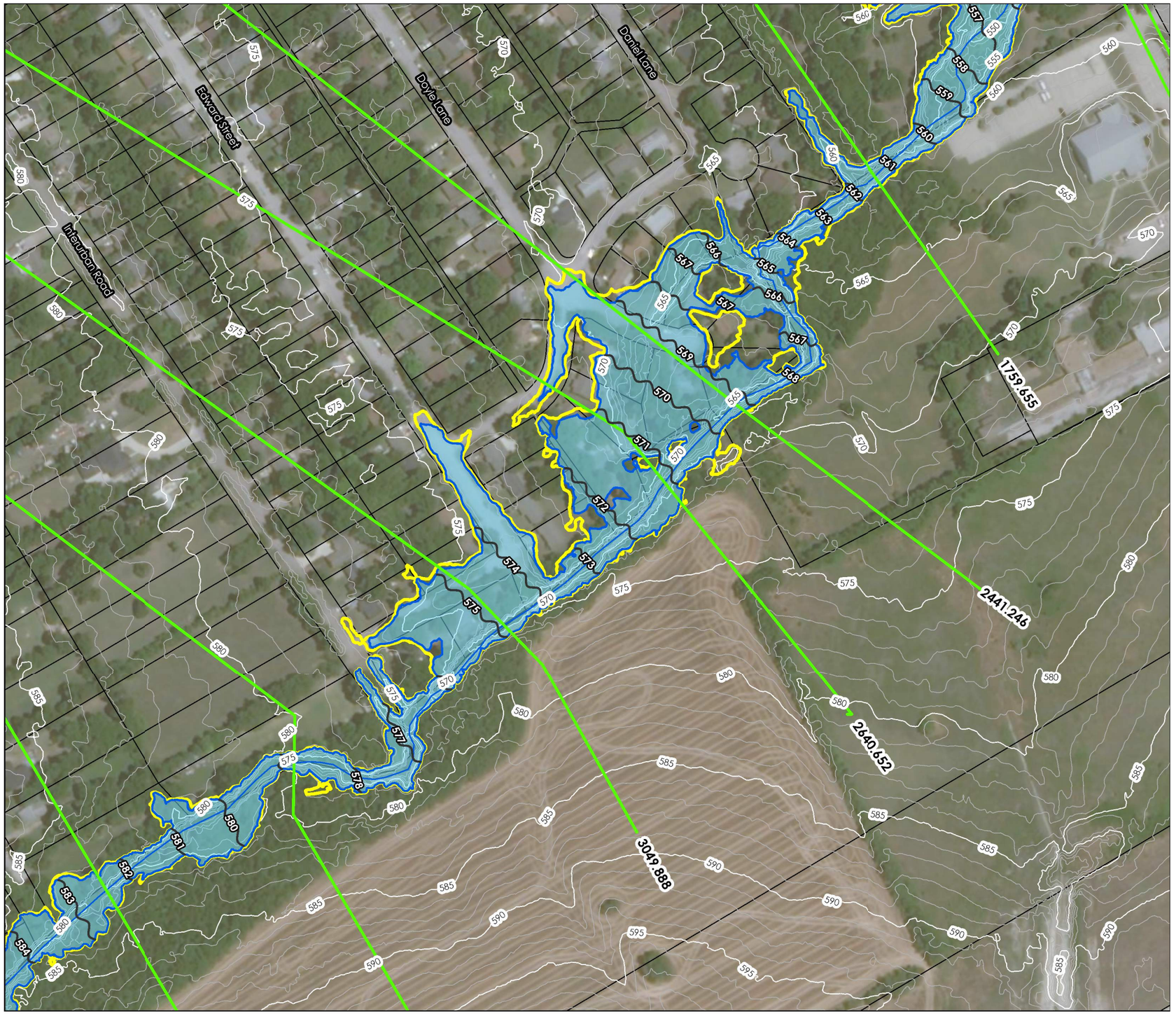


N

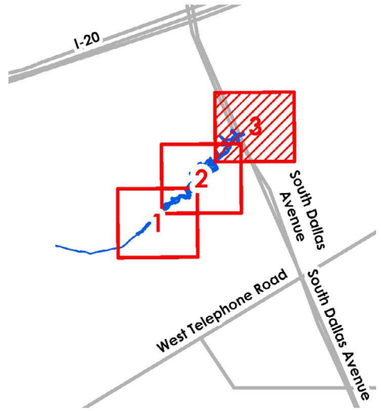
0 100 200 Feet

- FLOYD CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- 500 FLOYD BASE FLOW ELEVATIONS
- PARCEL

0



FLOODPLAIN: SHEET 3



N

0 100 200
Feet

- FLOYD CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- FLOYD BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.
4

COUNCIL DISTRICT
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TOTAL DRAINAGE AREA
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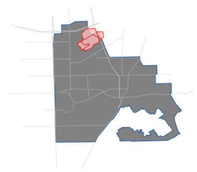
*
STREAM LENGTH
0.98 MI



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	590.09	590.27	5.92	6.26
4480.986	584.54	584.77	3.14	3.41
4061.875	581.80	581.93	4.53	4.55
3625.438	577.07	577.67	2.07	1.92
3049.888	572.30	573.34	8.28	6.99
2640.652	569.50	569.84	4.55	4.79
2441.246	567.74	568.17	6.38	6.43
1759.655	558.70	559.20	7.73	8.45
1082.463	547.55	548.97	6.34	5.40
1047.765	547.21	548.33	7.07	7.48
989.9426	**Highway 342**			
915.2001	546.26	546.94	4.16	4.80
864.6813	545.46	546.02	7.13	7.88
423.6754	541.52	542.09	7.37	7.83

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	590.27	590.34	6.26	6.38
4480.986	584.77	584.86	3.41	3.52
4061.875	581.93	581.98	4.55	4.61
3625.438	577.67	578.01	1.92	1.80
3049.888	573.34	573.94	6.99	5.45
2640.652	569.84	570.12	4.79	4.91
2441.246	568.17	568.38	6.43	6.85
1759.655	559.20	559.58	8.45	8.97
1082.463	549.35	550.54	5.25	4.89
1047.765	548.65	549.67	7.60	7.97
989.9426	**Highway 342**			
915.2001	546.96	547.48	5.12	5.74
864.6813	546.07	546.51	7.95	8.56
423.6754	542.14	542.55	7.87	8.29

2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	590.55	590.67	6.73	6.94
4480.986	585.11	585.26	3.82	3.99
4061.875	582.09	582.16	4.78	4.87
3625.438	578.09	578.31	2.14	2.21
3049.888	574.05	574.21	5.39	5.66
2640.652	570.18	570.49	5.21	4.94
2441.246	568.59	568.74	6.51	7.01
1759.655	559.79	560.16	9.15	9.64
1082.463	551.40	552.56	4.71	4.54
1047.765	550.42	551.40	8.24	8.70
989.9426	**Highway 342**			
915.2001	547.81	548.37	6.23	6.82
864.6813	546.80	547.29	8.97	9.52
423.6754	542.82	543.22	8.59	9.16

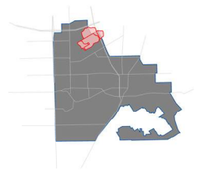
2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	590.79	590.84	7.14	7.24
4480.986	585.40	585.46	4.16	4.24
4061.875	582.22	582.26	4.95	4.97
3625.438	578.35	578.50	2.42	2.40
3049.888	574.21	574.42	5.66	5.80
2640.652	570.49	570.69	4.94	5.32
2441.246	568.74	569.02	7.01	6.40
1759.655	560.16	560.59	9.64	9.99
1082.463	552.42	552.93	4.74	5.13
1047.765	552.47	552.99	3.49	3.79
989.9426	**Highway 342**			
915.2001	548.28	548.62	7.02	7.92
864.6813	547.27	547.63	9.49	10.05
423.6754	543.20	543.53	9.13	9.60

WATERSHED NO.
4

COUNCIL DISTRICT
6

TOTAL DRAINAGE AREA
1.19 SM
*
STREAM LENGTH
0.98 MI



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	590.96	591.01	7.38	7.46
4480.986	585.58	585.65	4.41	4.47
4061.875	582.32	582.35	4.99	5.05
3625.438	578.55	578.66	2.59	2.59
3049.888	574.45	574.68	5.82	5.85
2640.652	570.71	570.91	5.39	5.80
2441.246	569.07	569.34	6.29	5.91
1759.655	560.66	561.10	10.02	10.29
1082.463	553.02	553.33	5.22	5.72
1047.765	553.08	553.41	3.86	4.23
989.9426	**Highway 342**			
915.2001	548.81	549.20	8.00	8.78
864.6813	547.76	548.16	10.25	10.84
423.6754	543.65	544.01	9.77	10.26

2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	591.07	591.12	7.54	7.62
4480.986	585.70	585.77	4.55	4.58
4061.875	582.38	582.40	5.01	5.09
3625.438	578.66	578.85	2.70	2.63
3049.888	574.65	574.89	5.84	5.80
2640.652	570.88	571.07	5.77	6.02
2441.246	569.31	569.57	5.89	5.47
1759.655	561.04	561.48	10.28	10.46
1082.463	553.33	553.55	5.70	6.18
1047.765	553.41	553.65	4.22	4.57
989.9426	**Highway 342**			
915.2001	549.15	549.65	8.80	9.34
864.6813	548.13	548.54	10.79	11.41
423.6754	543.98	544.36	10.22	10.72

2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5196.092	591.17	591.31	7.70	7.90
4480.986	585.83	585.97	4.64	4.86
4061.875	582.42	582.50	5.14	5.23
3625.438	578.83	579.03	2.74	2.86
3049.888	574.87	575.04	5.76	5.93
2640.652	571.03	571.21	5.98	6.32
2441.246	569.52	569.77	5.63	5.42
1759.655	561.39	561.83	10.47	10.61
1082.463	553.56	553.69	6.21	6.91
1047.765	553.66	553.82	4.59	5.07
989.9426	**Highway 342**			
915.2001	549.46	549.58	9.61	10.76
864.6813	548.48	548.81	11.33	11.81
423.6754	544.31	544.62	10.66	11.04

WATERSHED NO.

4

COUNCIL DISTRICT

6

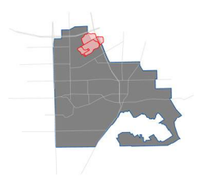
TOTAL DRAINAGE AREA

1.19 SM

*

STREAM LENGTH

0.98 MI

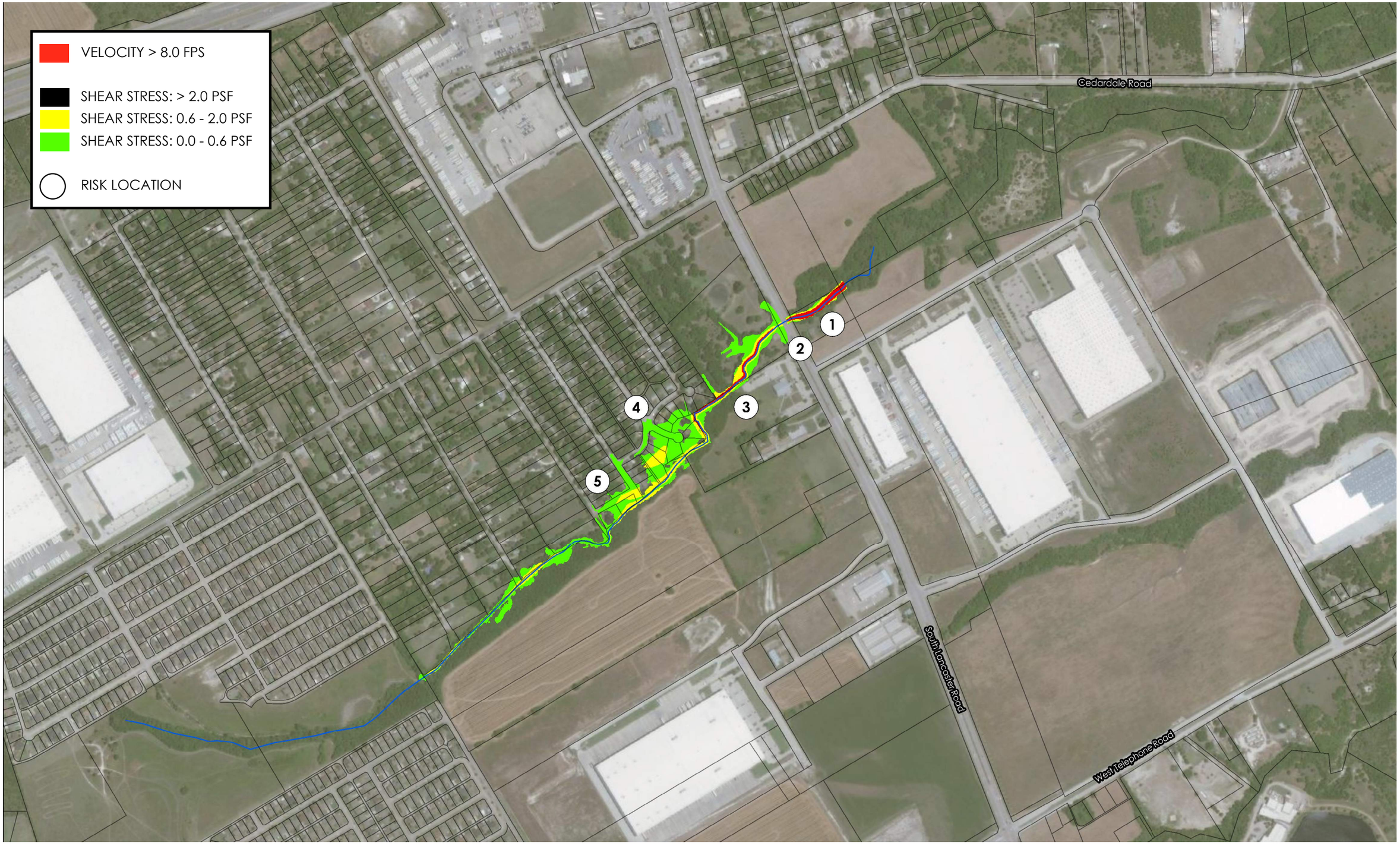


3.1 RISK IDENTIFICATION

Five risk areas were identified in this study. The risks include one over-topping Bridge, two areas of flooding structures and two locations of erosive velocities. The flooded structures are single family residential neighborhoods that are shown in the model to be flooding in the 2-year storm event. Many buildings are within the Floyd Branch Floodplain here. The South Lancaster Road bridge is anticipated to over-top in the 5-year event. This is a high traffic bridge. The two areas where erosion is likely are located away from major development. The potential erosion is unlikely to have any impact on existing structures. The following map shows the shear stresses associated with the Floyd Branch floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	River Station 3139	Potential Erosion Hot Spot	1-Year	Private	Very Low
2	South Lancaster Road	Over-topping Bridge	5-Year	Public	Very High
3	River Station 3139	Potential Erosion Hot Spot	1-Year	Private	Very Low
4	Houses on Taylor Street & Doyle Lane	Flooded Structures	2-Year	Private	Very High
5	Houses on Taylor Street & Edward Street	Flooded Structures	2-Year	Private	Very High

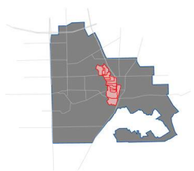

VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
1
2
3
4
5
Cedardale Road
South Lancaster Road
West Telephone Road

HALLS BRANCH

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

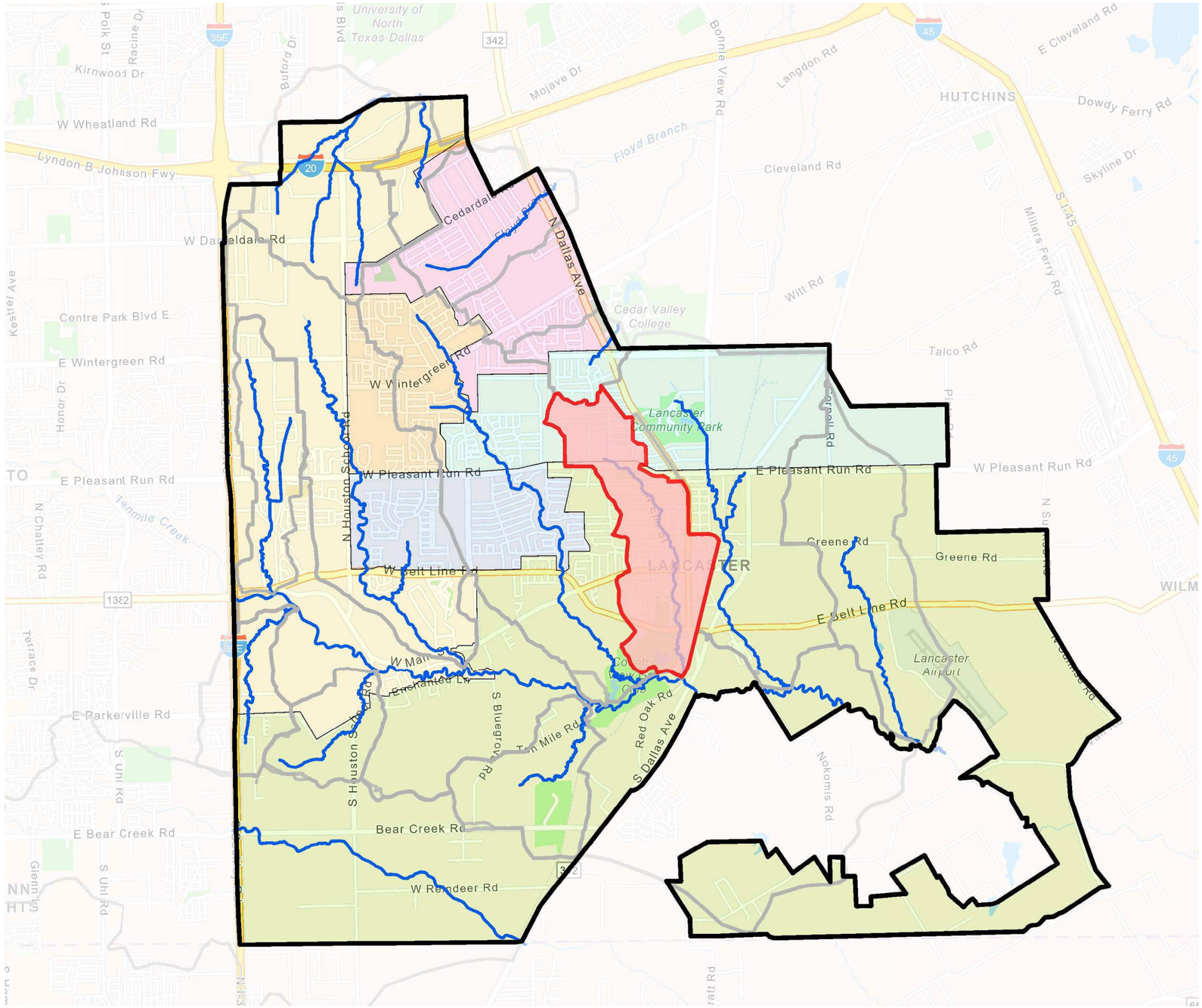
TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



HALLS BRANCH
STREAM CENTERLINE
COUNCIL DISTRICT
DISTRICT 1
DISTRICT 2
DISTRICT 3
DISTRICT 4
DISTRICT 5
DISTRICT 6

HALLS BRANCH WATERSHED

Located centrally and spanning 1.50 square miles, this watershed starts near Dewberry Boulevard, flowing south to join Ten Mile Creek after about 2.42 miles. It's a mix of open spaces, including a golf course, with some regions zoned for medium-density housing.



WATERSHED NO. 5

HALLS BRANCH

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WATERSHED NO.

5

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

1.47 SM

*

STREAM LENGTH

2.43 MI

*

PROJECTS IDENTIFIED

3



1.1 DRAINAGE AREA MAP

The drainage area divides for the watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into fourteen (14) sub-basins. Sub-basins are designated HB1 through HB14. The total watershed drainage area is 941.46 acres (1.47 square-miles). All of the drainage area is located within the Lancaster City Limits.

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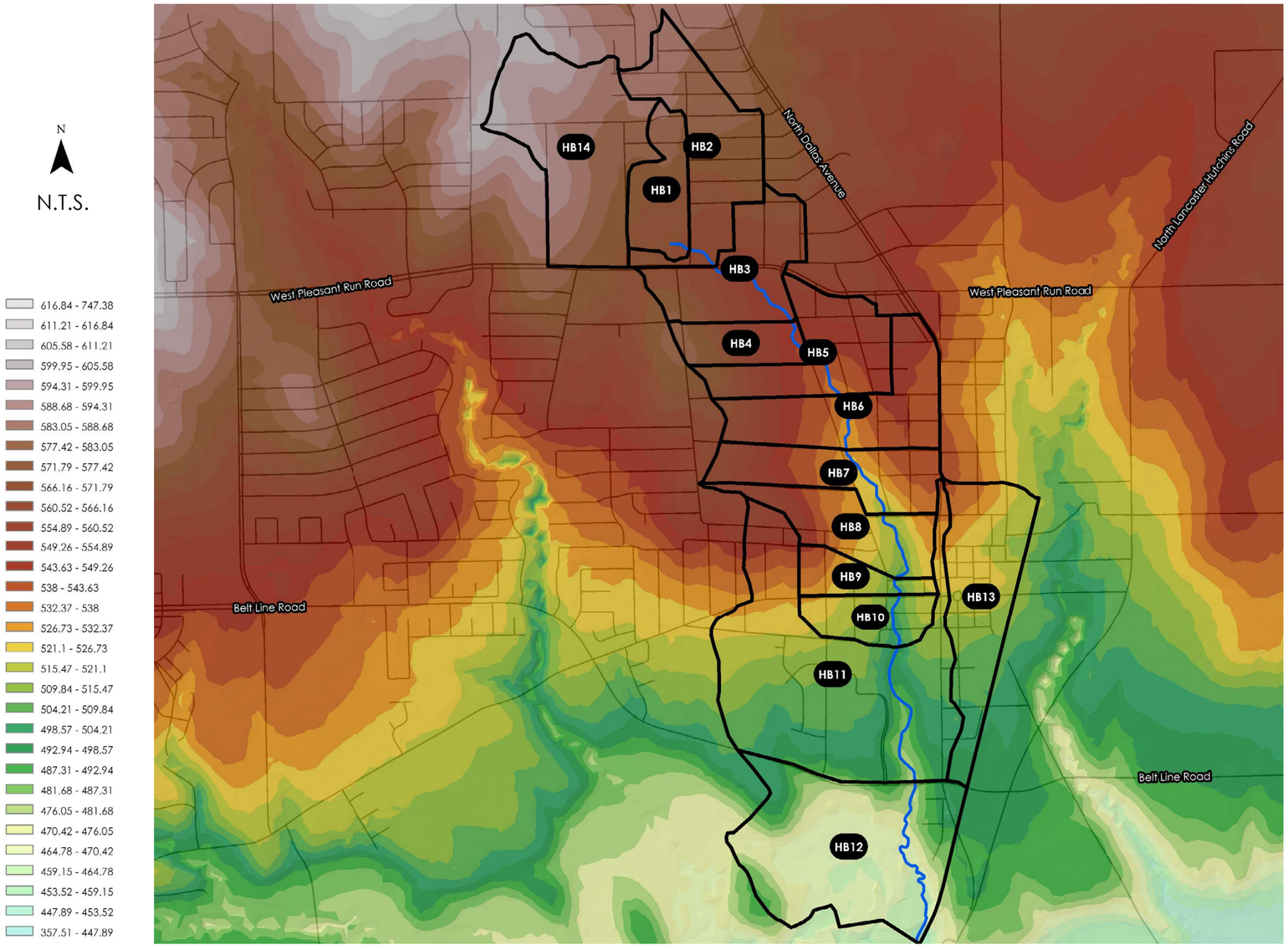

HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
HB1	0.0518	84	32.5	50.5	20.93	12.56	16.50	9.9
HB2	0.1116	84	52.3	52.3	31.93	19.16	27.35	16.41
HB3	0.089	82.9	53.9	58.1	18.42	11.05	14.17	8.5
HB4	0.0383	81.7	26.8	28.6	21.20	12.72	16.83	10.1
HB5	0.0866	83.3	36.1	36.1	24.85	14.91	19.88	11.93
HB6	0.1025	81	37.9	38.8	22.78	13.67	17.65	10.59
HB7	0.0776	77.4	28	29.4	26.20	15.72	20.50	12.3
HB8	0.0705	75.8	28.7	36.5	26.17	15.7	21.30	12.78
HB9	0.0299	77.8	37.9	38.6	17.43	10.46	13.40	8.04
HB10	0.0419	75	40.5	41.9	14.72	8.83	11.48	6.89
HB11	0.2848	76.3	27.3	42	31.87	19.12	26.52	15.91
HB12	0.2074	75.3	19.1	24.3	22.77	13.66	18.63	11.18
HB13	0.115	76	47.1	55.4	33.22	19.93	28.68	17.21
HB14	0.1643	82.3	21.2	40.9	24.63	14.78	21.32	12.79

WATERSHED NO.

5

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

1.47 SM

*

STREAM LENGTH

2.43 MI

*

PROJECTS IDENTIFIED

3



1.2 TIME OF CONCENTRATION

The Times of Concentration for Halls Branch were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Halls Branch flows though residential areas and significant development. This development results in shorter Times of Concentration. Larger sub-basins like HB11 and HB 12 have longer Times of Concentration. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

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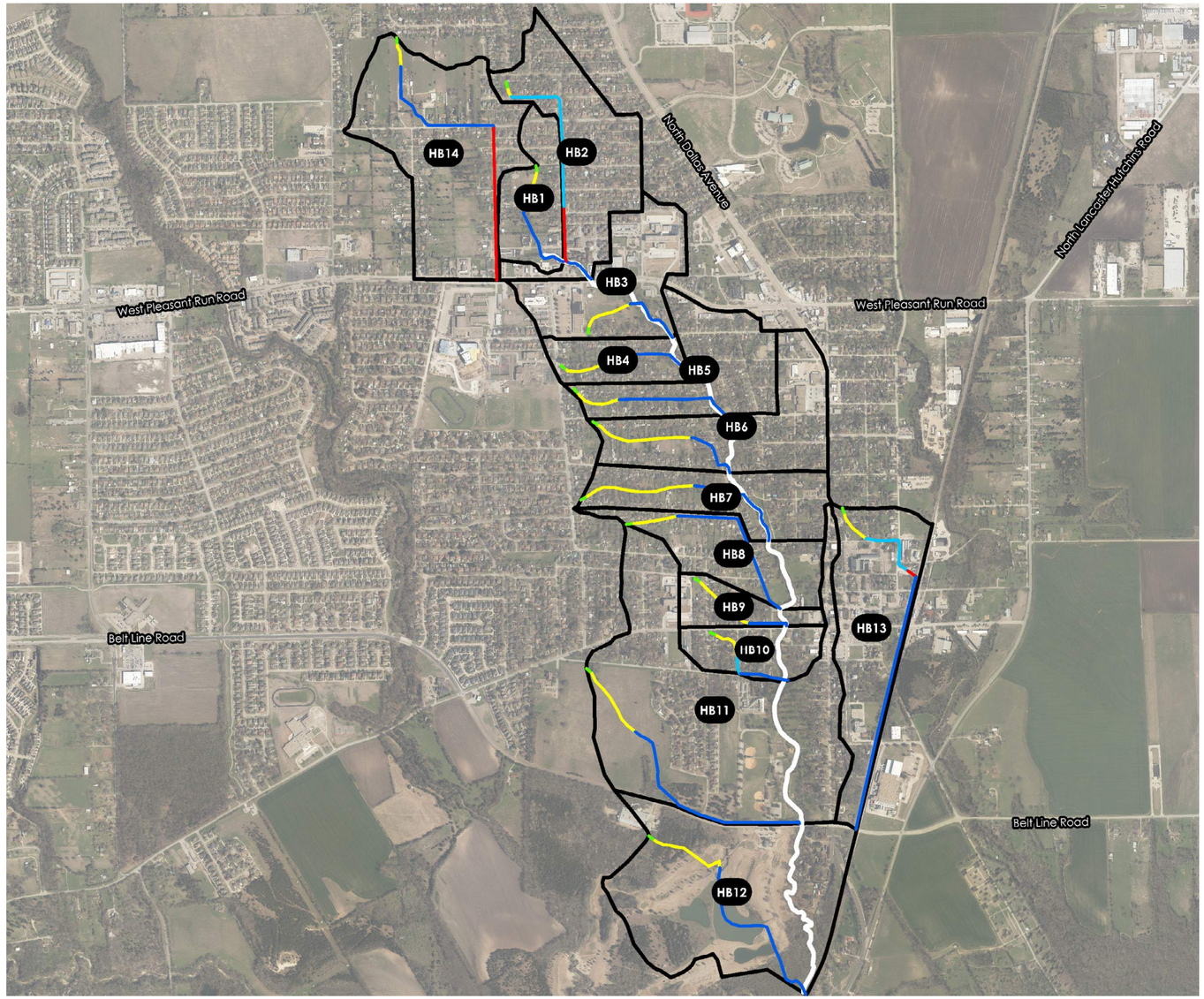


TIME OF CONCENTRATION REPORT

HB1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.83	0.240	0.00	0.1	13.95
SHALLOW	UNPAVED	333	1.04	0.000	16.10	1.6	3.39
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,174	3.59	0.050	28.69	5.4	3.60
		1,607					**20.94**
							16.61

HB2

OVERLAND	GRS-DENSE	100	1.02	0.240	0.00	0.1	17.60
SHALLOW	UNPAVED	102	2.03	0.000	16.10	2.3	0.74
GUTTER	G-20	2,107	1.44	0.018	24.18	2.9	12.09
PIPE	36" RCP	730	2.26	0.014	87.62	13.2	0.92
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	393	7.25	0.050	42.29	11.4	0.58
		3,432					**31.93**
							27.35

HB3

OVERLAND	GRS-DENSE	100	2.5	0.240	0.00	0.1	12.31
SHALLOW	UNPAVED	639	1.97	0.000	16.10	2.3	4.72
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	808	5.2	0.050	42.29	9.6	1.40
		1,547					**18.42**
							14.16

HB4

OVERLAND	GRS-DENSE	100	1.73	0.240	0.00	0.1	14.26
SHALLOW	UNPAVED	555	3.19	0.000	16.10	2.9	3.22
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	774	2.23	0.050	28.69	4.3	3.01
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	407	5.1	0.050	42.29	9.5	0.71
		1,835					**21.20**
							16.83

HB5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.25	0.240	0.00	0.1	16.25
SHALLOW	UNPAVED	589	2.82	0.000	16.10	2.7	3.63
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,129	2.28	0.050	28.69	4.3	4.35
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	390	5.94	0.050	42.29	10.3	0.63
		2,208					**24.85**
							19.88

HB6

OVERLAND	GRS-DENSE	100	2.58	0.240	0.00	0.1	12.15
SHALLOW	UNPAVED	1,286	2.52	0.000	16.10	2.6	8.39
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	572	3.11	0.050	28.69	5.1	1.88
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	218	5.95	0.050	42.29	10.3	0.35
		2,177					**22.78**
							17.65

HB7

OVERLAND	GRS-DENSE	100	2.12	0.240	0.00	0.1	13.14
SHALLOW	UNPAVED	1,462	2.45	0.000	16.10	2.5	9.68
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	466	2.78	0.050	28.69	4.8	1.63
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,014	5.12	0.050	42.29	9.6	1.77
		3,042					**26.21**
							20.51

HB8

OVERLAND	GRS-DENSE	100	1.42	0.240	0.00	0.1	15.43
SHALLOW	UNPAVED	586	2.27	0.000	16.10	2.4	4.02
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,136	3.43	0.050	28.69	5.3	6.70
		2,823					**26.16**
							21.30

TIME OF CONCENTRATION REPORT - CONTINUED

HB9

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	3.05	0.240	0.00	0.1	11.37
SHALLOW	UNPAVED	849	3.38	0.000	16.10	3.0	4.78
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	492	5.34	0.050	28.69	6.6	1.24
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	33	5.05	0.050	42.29	9.5	0.06
		1,474					**17.44**
							13.40

HB10

OVERLAND	GRS-DENSE	100	4.07	0.240	0.00	0.2	10.13
SHALLOW	UNPAVED	450	2.84	0.000	16.10	2.7	2.76
GUTTER	G-20	252	5.4	0.018	24.18	5.6	0.75
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	640	5.48	0.050	42.29	9.9	1.08
		1,441					**14.71**
							11.49

HB11

OVERLAND	GRS-DENSE	100	2.32	0.240	0.00	0.1	12.67
SHALLOW	UNPAVED	974	1.32	0.000	16.10	1.9	8.76
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,603	2.3	0.050	28.69	4.4	9.97
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	268	4.93	0.050	42.29	9.4	0.48
		3,944					**31.87**
							26.51

HB12

OVERLAND	GRS-DENSE	100	3.43	0.240	0.00	0.2	10.84
SHALLOW	UNPAVED	1,054	3.62	0.000	16.10	3.1	5.74
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,656	3.14	0.050	28.69	5.1	5.43
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	722	13.92	0.050	42.29	15.8	0.76
		3,531					**22.77**
							18.63

HB13

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.45	0.240	0.00	0.1	15.31
SHALLOW	UNPAVED	434	2.49	0.000	16.10	2.5	2.84
GUTTER	G-20	905	1.83	0.018	24.18	3.3	4.61
PIPE	36" RCP	133	6.26	0.014	87.62	15.9	0.10
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,449	3.75	0.050	28.69	5.6	10.35
		5,021					**33.22**
							28.68

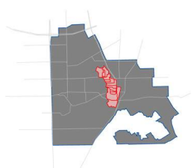
HB14

OVERLAND	GRS-DENSE	100	3.69	0.240	0.00	0.2	10.53
SHALLOW	UNPAVED	292	1.19	0.000	16.10	1.8	2.76
PIPE	36" RCP	2,040	0.85	0.014	87.62	8.1	4.20
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,810	2.17	0.050	28.69	4.2	7.14
		4,242					**24.64**
							21.32

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



1.3 SOILS MAP

Hallas Branch watershed has multiple hydrologic soil groups present within it's boundaries. Hydrologic soil groups B, C, and D (least permeable) are present in the Halls Branch watershed. The soil types are present in relatively equal amounts. Soil Group B is most common in the southern half of the watershed. Group C is generally well distributed around the overall watershed. Soil group D is most prevalent in the northeastern part of the watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

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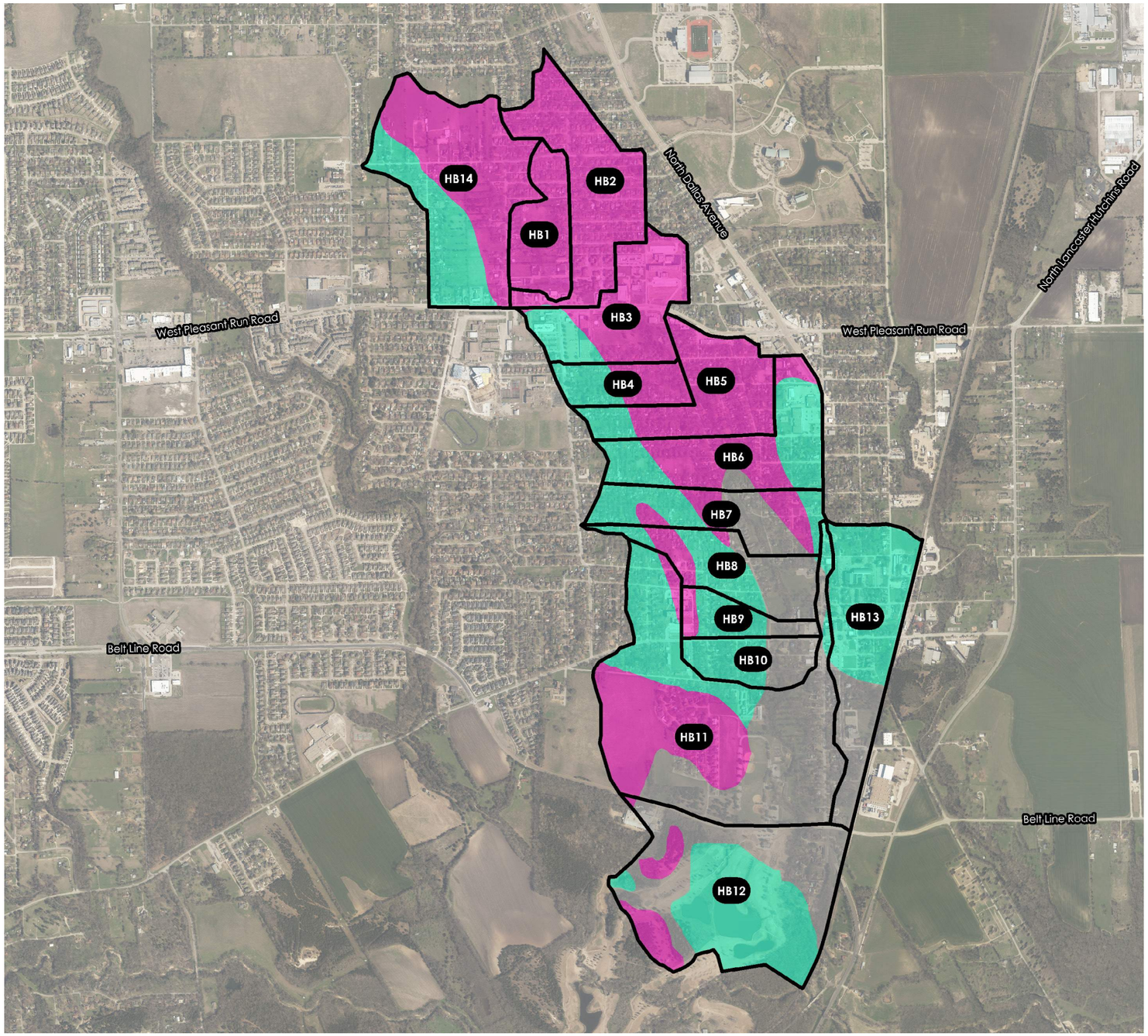


PERVIOUS CURVE NUMBER REPORT

HB1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	33.2	84.0
		33.2	**84.0**

HB2

C	79	0.2	0.2
D	84	71.2	83.8
		71.4	**84.0**

HB3

C	79	12.1	16.8
D	84	44.8	66.1
		56.9	**82.9**

HB4

C	79	11.2	36.1
D	84	13.3	45.6
		24.5	**81.7**

HB5

C	79	7.2	10.3
D	84	48.2	73.0
		55.4	**83.3**

HB6

B	69	2.6	2.7
C	79	31.9	38.5
D	84	31.1	39.8
		65.6	**81.0**

HB7

B	69	15.2	21.1
C	79	19.9	31.7
D	84	14.6	24.7
		49.7	**77.4**

HB8

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
B	69	18.3	28.0
C	79	19.5	34.1
D	84	7.3	13.6
		45.1	**75.8**

HB9

B	69	3.9	14.2
C	79	11.7	48.4
D	84	3.5	15.2
		19.1	**77.8**

HB10

B	69	10.8	27.9
C	79	16.0	47.1
		26.8	**75.0**

HB11

B	69	79.3	30.0
C	79	41.6	18.0
D	84	61.4	28.3
		182.2	**76.3**

HB12

B	69	55.9	29.1
C	79	62.6	37.2
D	84	14.2	9.0
		132.7	**75.3**

HB13

B	69	22.0	20.6
C	79	51.6	55.4
		73.6	**76.0**

HB14

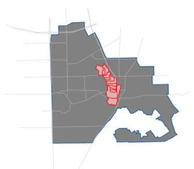
C	79	36.5	27.4
D	84	68.6	54.8
		105.2	**82.3**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.
5

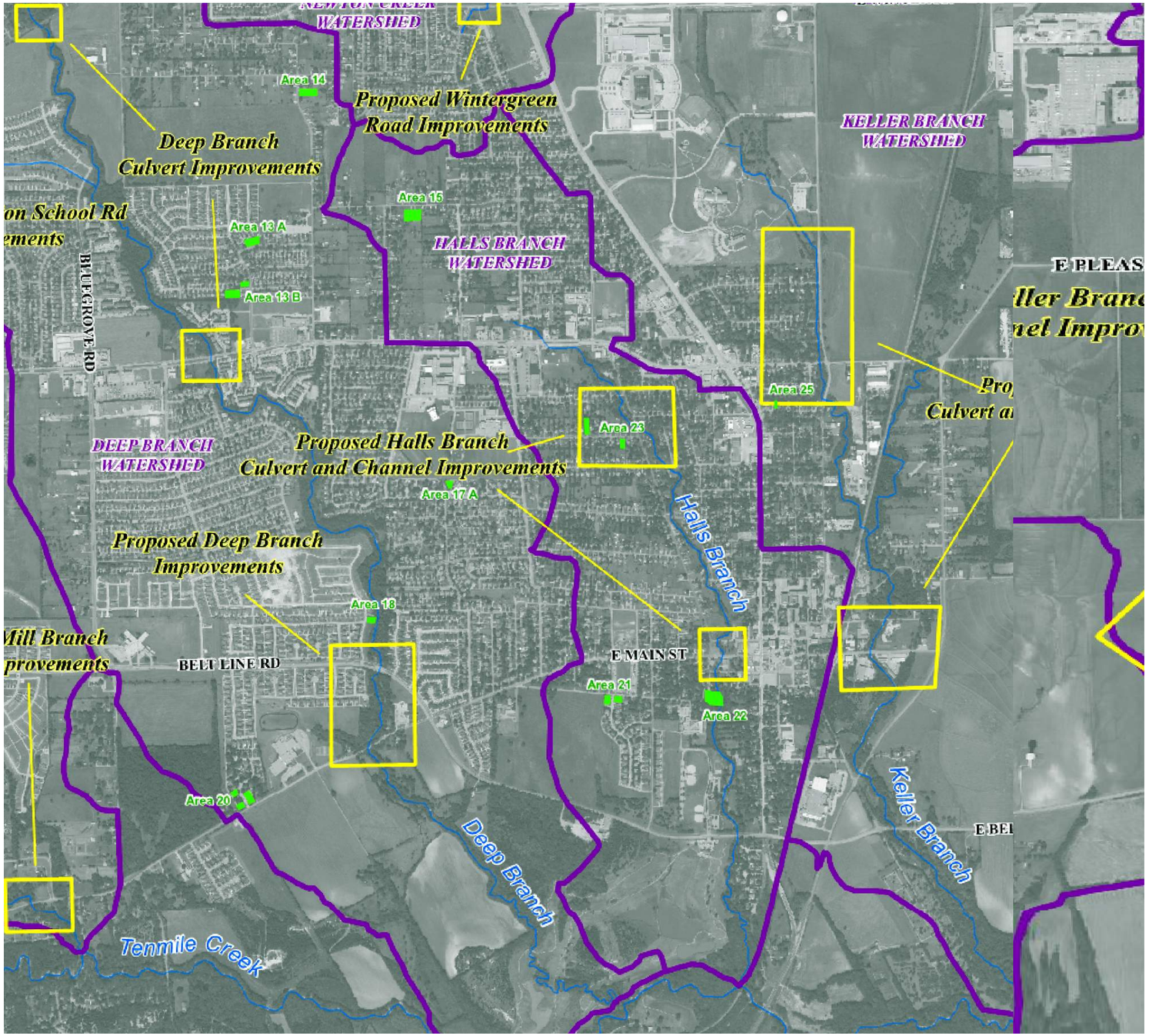
COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows only one new development since 2007 within the Halls Branch watershed. The new commercial development is located in HB3. The rest of the watershed has seen no major development.



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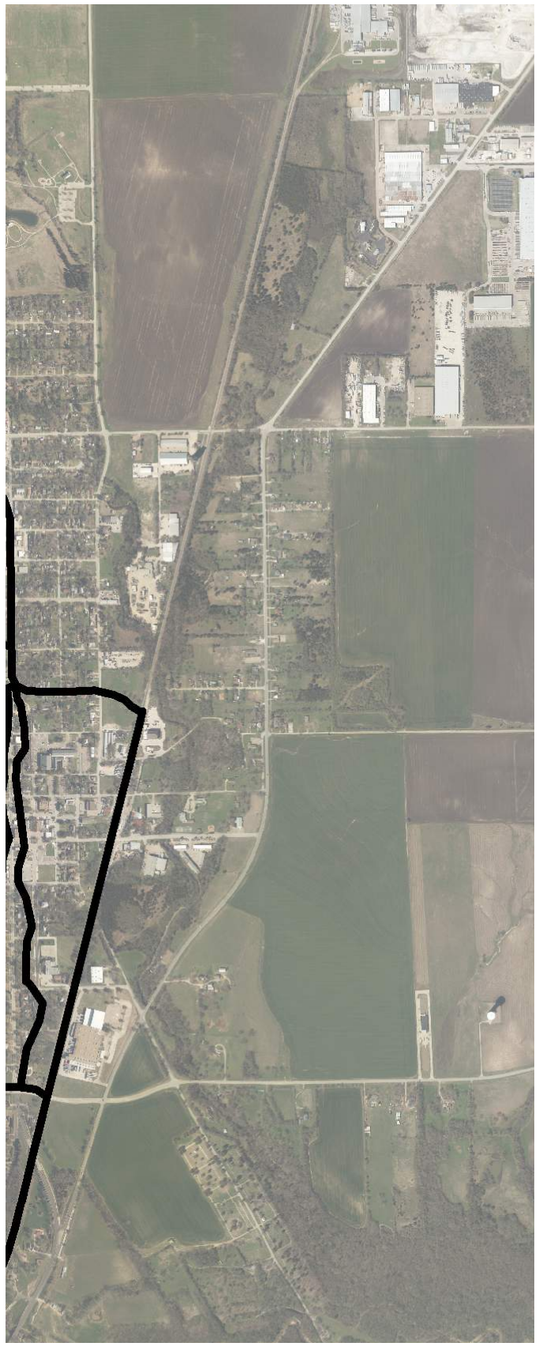
2007





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2019

WATERSHED NO.

5

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

1.47 SM

*

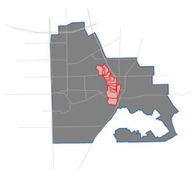
STREAM LENGTH

2.43 MI

*

PROJECTS IDENTIFIED

3



1.5 IMPERVIOUS AREA

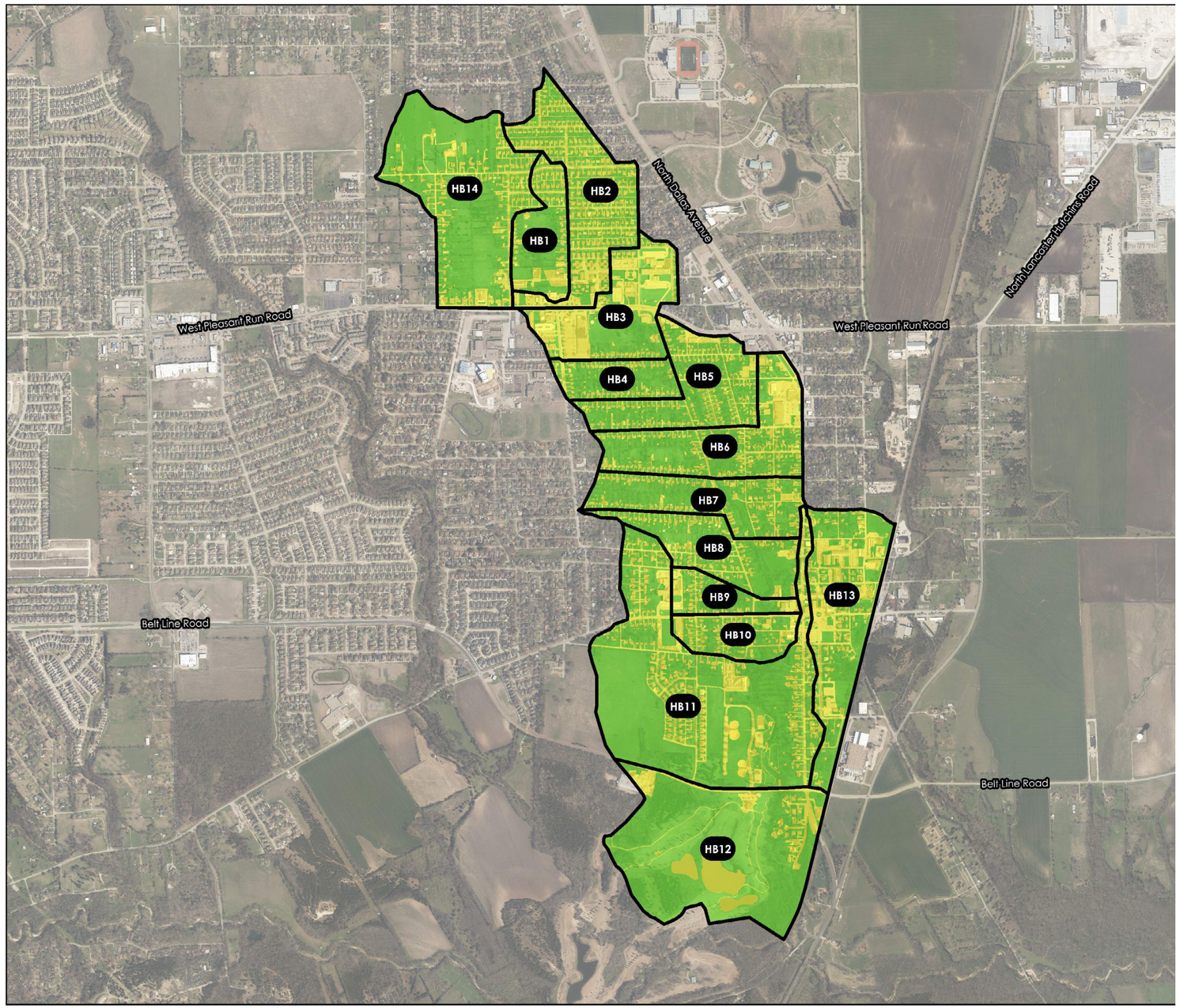
Impervious areas for the Halls Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods and a few commercial developments. Generally, the residential areas, while developed, have relatively low impervious percentages. Sub-basins HB11 and HB12 have the largest amount of open area available for future development.

IMPERVIOUS

OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

HB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	10.8	32.5
OPEN SPACE	0	22.4	0.0
		33.2	**32.5**

HB2

IMPERVIOUS	100	37.3	52.3
OPEN SPACE	0	34.1	0.0
		71.4	**52.3**

HB3

IMPERVIOUS	100	30.7	53.9
OPEN SPACE	0	26.2	0.0
		56.9	**53.9**

HB4

IMPERVIOUS	100	6.6	26.8
OPEN SPACE	0	18.0	0.0
		24.5	**26.8**

HB5

IMPERVIOUS	100	20.0	36.1
OPEN SPACE	0	35.4	0.0
		55.4	**36.1**

HB6

IMPERVIOUS	100	24.9	37.9
OPEN SPACE	0	40.7	0.0
		65.6	**37.9**

HB7

IMPERVIOUS	100	13.9	28.0
OPEN SPACE	0	35.8	0.0
		49.7	**28.0**

HB8

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	12.9	28.7
OPEN SPACE	0	32.2	0.0
		45.1	**28.7**

HB9

IMPERVIOUS	100	7.3	37.9
OPEN SPACE	0	11.9	0.0
		19.1	**37.9**

HB10

IMPERVIOUS	100	10.9	40.5
OPEN SPACE	0	15.9	0.0
		26.8	**40.5**

HB11

IMPERVIOUS	100	49.7	27.3
OPEN SPACE	0	132.6	0.0
		182.2	**27.3**

HB12

IMPERVIOUS	100	25.3	19.1
OPEN SPACE	0	107.4	0.0
		132.7	**19.1**

HB13

IMPERVIOUS	100	34.7	47.1
OPEN SPACE	0	38.9	0.0
		73.6	**47.1**

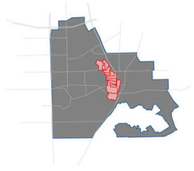
HB14

IMPERVIOUS	100	22.3	21.2
OPEN SPACE	0	82.8	0.0
		105.2	**21.2**

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The open land within the watershed consist of mostly suburban and urban residential zoning based on the provided City zoning data. The zoning is consistent with the majority existing land use within the watershed. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- R - URBAN NEIGHBORHOOD
- COMMERCIAL CORRIDOR

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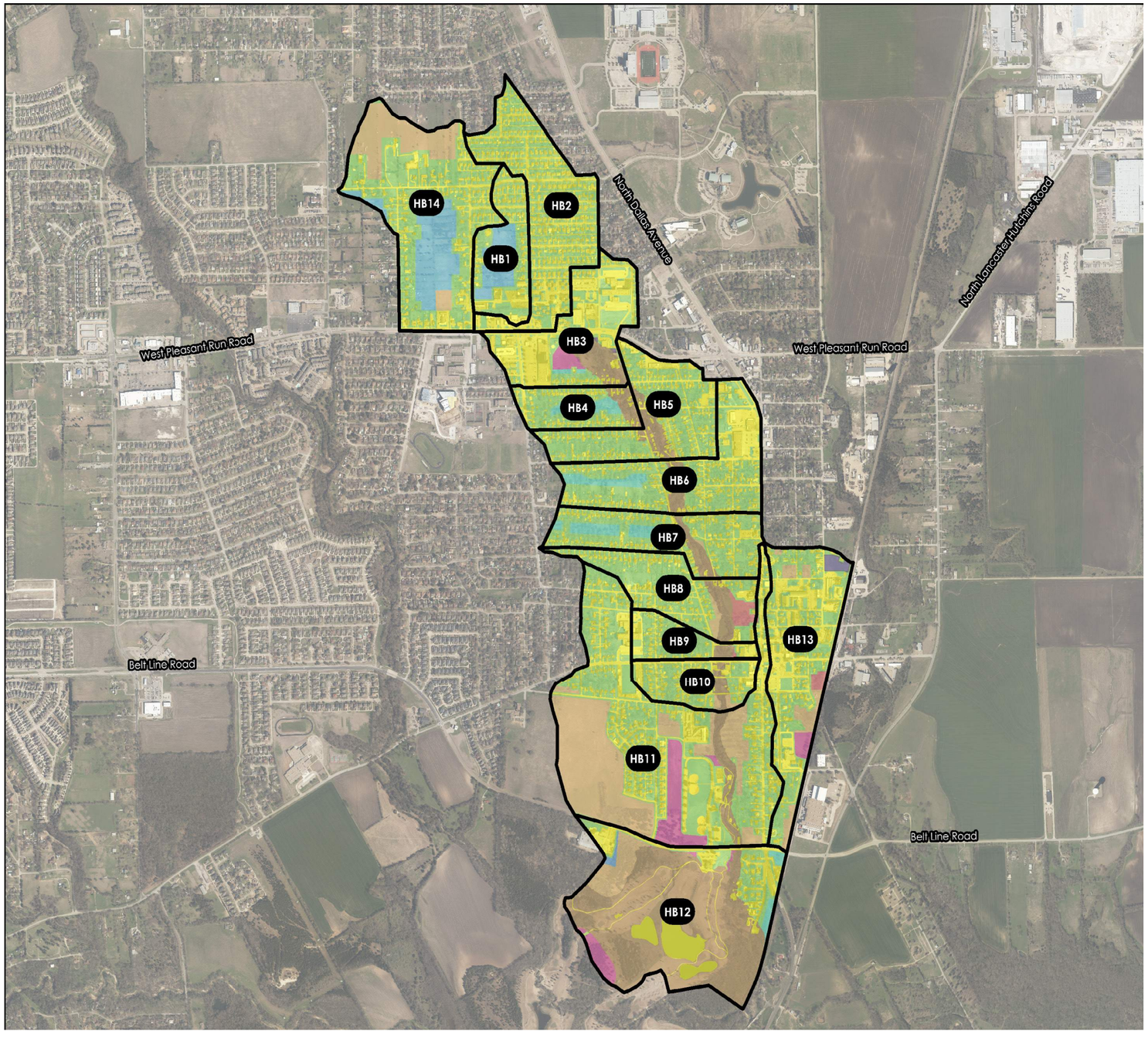


ULTIMATE PERCENT IMPERVIOUS REPORT

HB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	10.8	32.5
OPEN SPACE (FAIR CONDITION)	0	13.2	0.0
R - URBAN NEIGHBORHOOD	65	9.2	17.9
		33.2	**50.5**

HB2

IMPERVIOUS	100	37.3	52.3
OPEN SPACE (FAIR CONDITION)	0	34.1	0.0
		71.4	**52.3**

HB3

IMPERVIOUS	100	30.7	53.9
FLOODPLAIN	0	7.5	0.0
OPEN SPACE (FAIR CONDITION)	0	14.9	0.0
PUBLIC & SEMI-PUBLIC	72	3.0	3.8
R - SURBURBAN NEIGHBORHOOD	38	0.1	0.0
R - RURAL LIVING	12	0.6	0.1
COMMERCIAL NODE	85	0.1	0.2
		56.9	**58.1**

HB4

IMPERVIOUS	100	6.6	26.8
FLOODPLAIN	0	2.9	0.0
OPEN SPACE (FAIR CONDITION)	0	11.3	0.0
R - RURAL LIVING	12	3.8	1.8
		24.5	**28.6**

HB5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	20.0	36.1
FLOODPLAIN	0	4.6	0.0
OPEN SPACE (FAIR CONDITION)	0	30.8	0.0
		55.4	**36.1**

HB6

IMPERVIOUS	100	24.9	37.9
FLOODPLAIN	0	3.8	0.0
OPEN SPACE (FAIR CONDITION)	0	32.9	0.0
R - SURBURBAN NEIGHBORHOOD	38	0.4	0.2
R - RURAL LIVING	12	3.7	0.7
		65.6	**38.8**

HB7

IMPERVIOUS	100	13.9	28.0
FLOODPLAIN	0	3.7	0.0
OPEN SPACE (FAIR CONDITION)	0	26.5	0.0
R - SURBURBAN NEIGHBORHOOD	38	0.2	0.1
R - RURAL LIVING	12	5.4	1.3
		49.7	**29.4**

HB8

IMPERVIOUS	100	12.9	28.7
FLOODPLAIN	0	4.6	0.0
OPEN SPACE (FAIR CONDITION)	0	22.7	0.0
TOWN CENTER	72	0.0	0.0
MIXED USE	85	3.6	6.8
R - SURBURBAN NEIGHBORHOOD	38	1.3	1.1
		45.1	**36.5**

ULTIMATE PERCENT IMPERVIOUS REPORT

HB9

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	7.3	37.9
FLOODPLAIN	0	1.3	0.0
OPEN SPACE (FAIR CONDITION)	0	10.4	0.0
MIXED USE	85	0.2	0.7
R - SURBURBAN NEIGHBORHOOD	38	0.0	0.0
		19.1	**38.6**

HB10

IMPERVIOUS	100	10.9	40.5
FLOODPLAIN	0	2.3	0.0
OPEN SPACE (FAIR CONDITION)	0	12.6	0.0
R - SURBURBAN NEIGHBORHOOD	38	1.0	1.4
		26.8	**41.9**

HB11

IMPERVIOUS	100	49.7	27.3
FLOODPLAIN	0	6.4	0.0
OPEN SPACE (FAIR CONDITION)	0	64.7	0.0
PUBLIC & SEMI-PUBLIC	72	10.2	4.0
MIXED USE	85	0.1	0.1
R - SURBURBAN NEIGHBORHOOD	38	51.2	10.7
		182.2	**42.0**

HB12

IMPERVIOUS	100	25.3	19.1
FLOODPLAIN	0	83.3	0.0
OPEN SPACE (FAIR CONDITION)	0	8.8	0.0
PUBLIC & SEMI-PUBLIC	72	4.2	2.3
LOGISTICS & DISTRIBUTION	72	0.8	0.5
R - SURBURBAN NEIGHBORHOOD	38	8.1	2.3
R - RURAL LIVING	12	2.1	0.2
		132.7	**24.3**

HB13

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	34.7	47.1
FLOODPLAIN	0	0.0	0.0
OPEN SPACE (FAIR CONDITION)	0	28.1	0.0
PUBLIC & SEMI-PUBLIC	72	2.0	2.0
MIXED USE	85	1.2	1.4
R - SURBURBAN NEIGHBORHOOD	38	6.1	3.1
COMMERCIAL CORRIDOR	85	1.5	1.8
		73.6	**55.4**

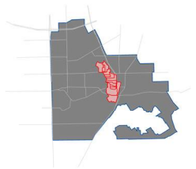
HB14

IMPERVIOUS	100	22.3	21.2
OPEN SPACE (FAIR CONDITION)	0	42.9	0.0
R - SURBURBAN NEIGHBORHOOD	38	19.6	7.1
R - URBAN NEIGHBORHOOD	65	20.3	12.6
		105.2	**40.9**

WATERSHED NO.
5

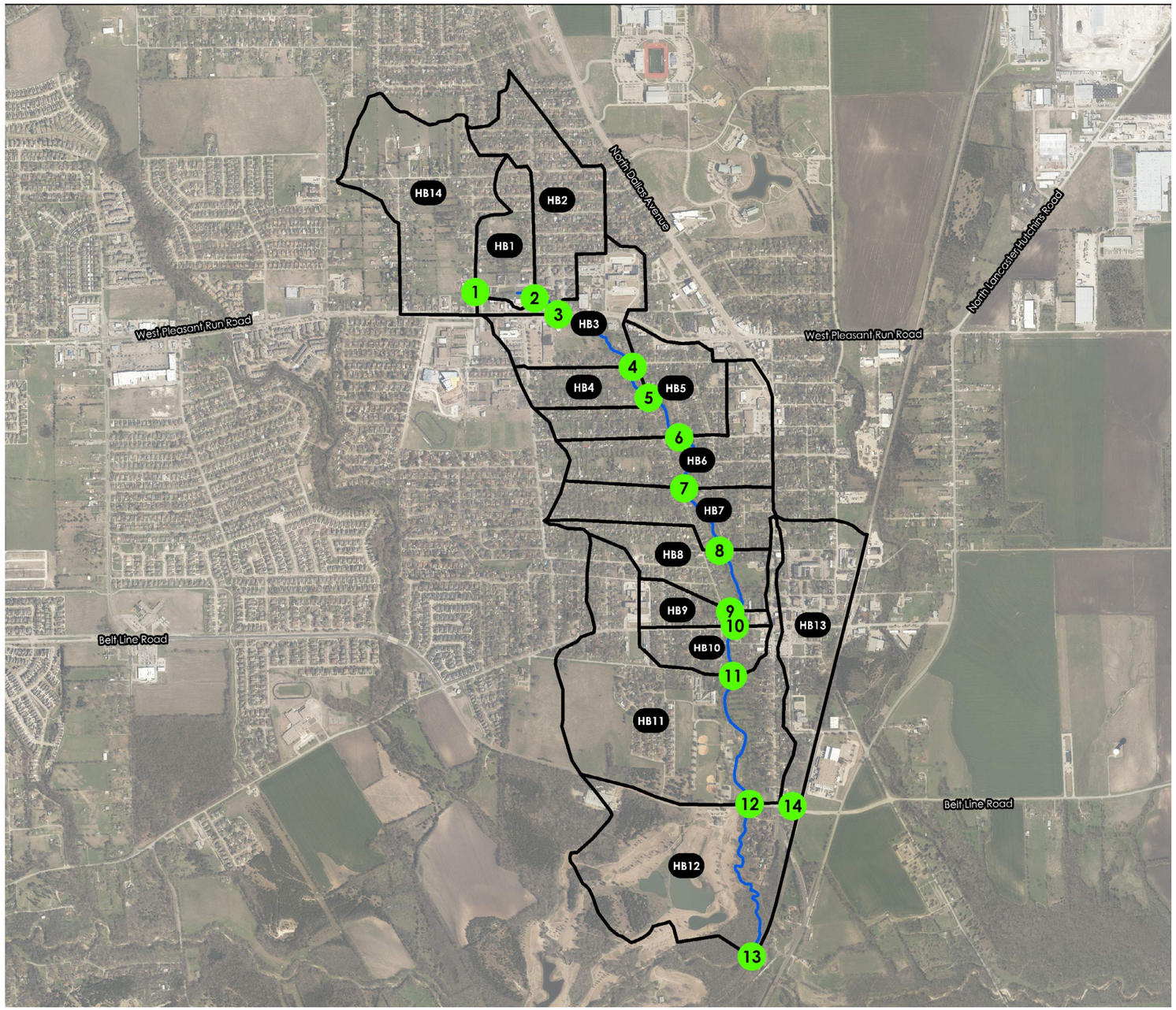
COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



1.7 RESULTS

The flow was analyzed at fourteen locations for Halls Branch. Flow location 2 was used to establish flows at the upstream end of the stream. Locations 3 through 12 were used to determine flows at major road crossings. Location 13 and 14 were included because of the location of their respective sub-basin. Locations 1 and 14 were not located on the studied stream, so were not used directly in the hydraulic modeling.



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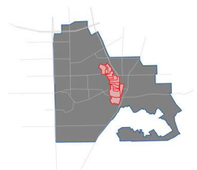
FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	HB14	HB	12374	0.1643	650
2	HB1, HB14	HB	12259	0.2161	220
3	HB1, HB2, HB14	HB	11830	0.3277	1250
4	HB1-HB3, HB14	HB	10569	0.4167	1400
5	HB1-HB4, HB14	HB	9997	0.455	1500
6	HB1-HB5, HB14	HB	9205	0.5416	1700
7	HB1-HB6, HB14	HB	8240	0.6441	2000
8	HB1-HB7, HB14	HB	7130	0.7217	2200
9	HB1-HB8, HB14	HB	5978	0.7922	2400
10	HB1-HB9, HB14	HB	5772	0.8221	2500
11	HB1-HB10, HB14	HB	5068	0.864	2500
12	HB1-HB11, HB14	HB	2824	1.1488	3000
13	HB1-HB14	HB	178	1.3562	3300
14	HB13	-	-	1.4712	390

2.0 HYDRAULICS

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3

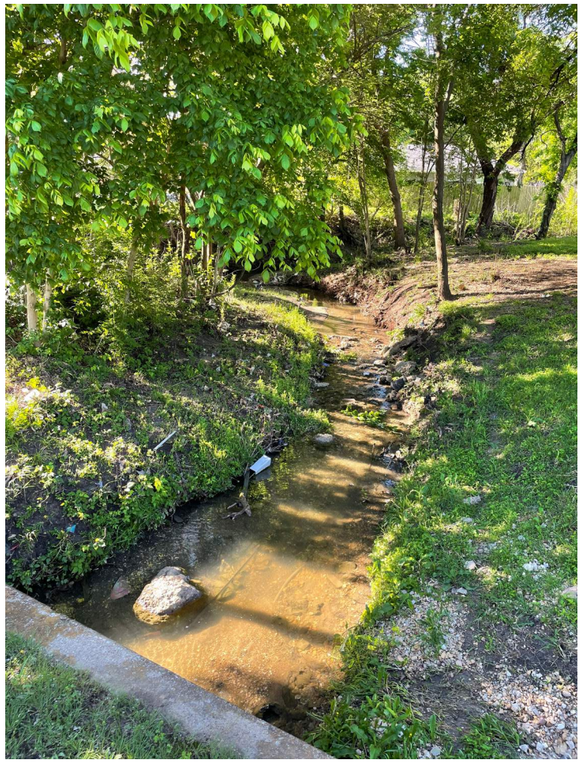


2.1 SITE ASSESSMENT

Halls Branch is located in the Central part of the City of Lancaster. It flows from North to South for approximately 2.43 miles before flowing into Ten Mile Creek. This assessment analyzes the hydraulic characteristics of Halls Branch within the limits of the City of Lancaster, roughly bound by Dewberry Boulevard (upstream end) and the confluence with Ten Mile Creek located 600 feet upstream of South Dallas Avenue (downstream end). The channel slope averages around 0.6-1.0%, and for the purposes of this study the channel was analyzed as a single reach. Halls Branch channel itself is generally in a natural state with very few man-made alterations, with the exception of the road crossings throughout the watershed and the relatively urbanized overbanks. Except at the road crossings, heavy vegetation is observed in and immediately around the channel, especially near the confluence with Ten Mile Creek. There are a total of eleven (11) crossings throughout the watershed.



Looking south at the Pleasant Run culvert outfall. The channel is not concrete-lined, though it appears well maintained.



Looking downstream of 8th Street culvert outfall. The stream channel appears to have a relatively clean channel with some rocks and shrubs. The overbanks have a number of trees.



Looking upstream of the West Cedar Road culvert toward a pedestrian bridge. The channel and overbanks are generally well maintained and clear of major vegetation. There are a few trees on the overbanks.



Looking at the upstream face of the Belt Line Road culvert. The channel is very wide. There is little vegetation and the bottom is generally clean. However there is significant sediment buildup in the right two boxes, and this buildup has begun to establish vegetation growth.

WATERSHED NO.

5

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

1.47 SM

*

STREAM LENGTH

2.43 MI

*

PROJECTS IDENTIFIED

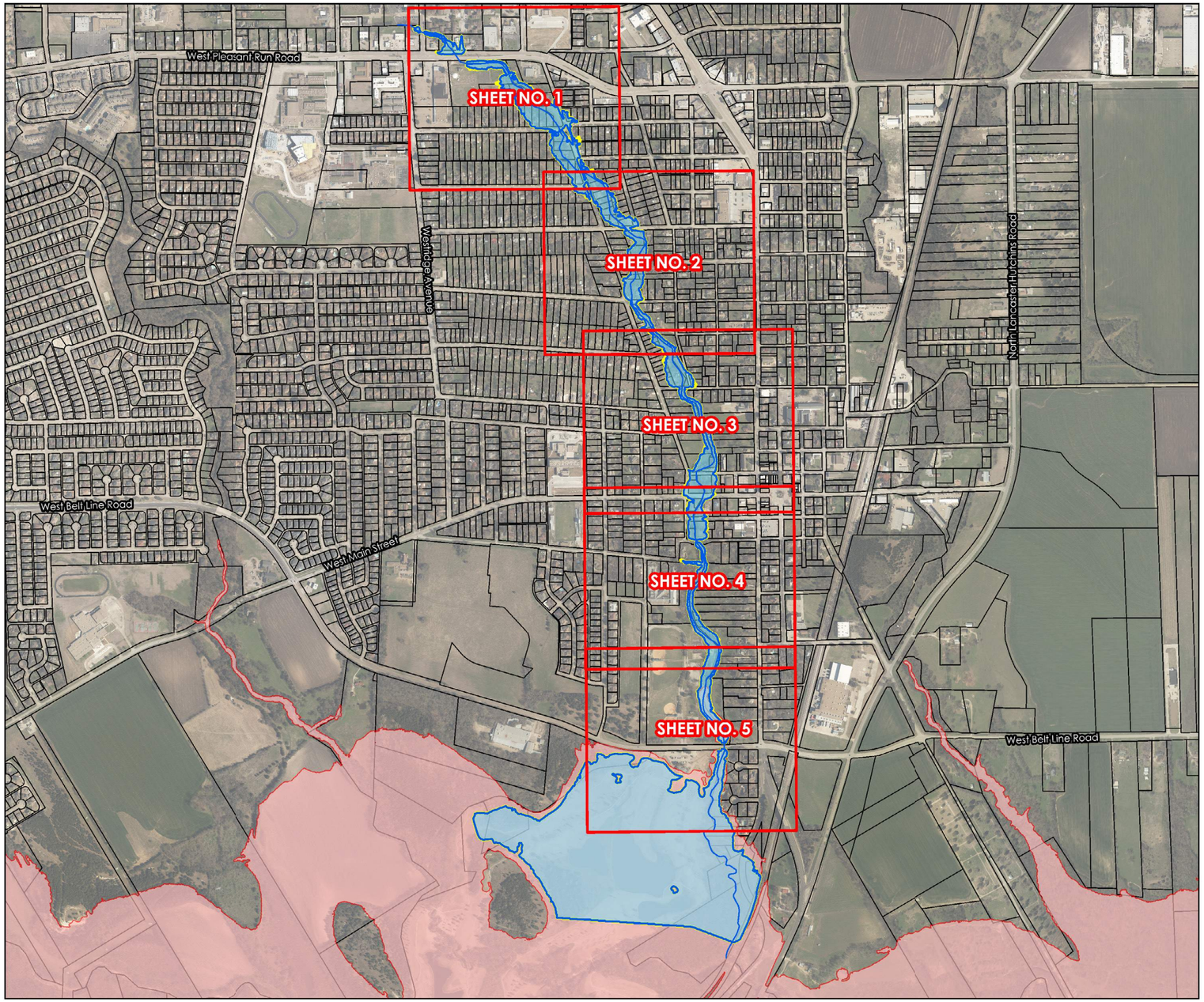
3



2.2 FLOODPLAIN MAPPING

The Halls Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Halls Branch is comprised of one stream, one reach, seventy-three (73) cross sections, and eleven (11) hydraulic structures. The studied stream is 12,808 feet (2.43 miles) long. Near the confluence of the stream with Ten Mile Creek, the Halls Branch floodplain expands dramatically and inundates a large low-lying area.

The floodplain sheets for Halls Branch display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.

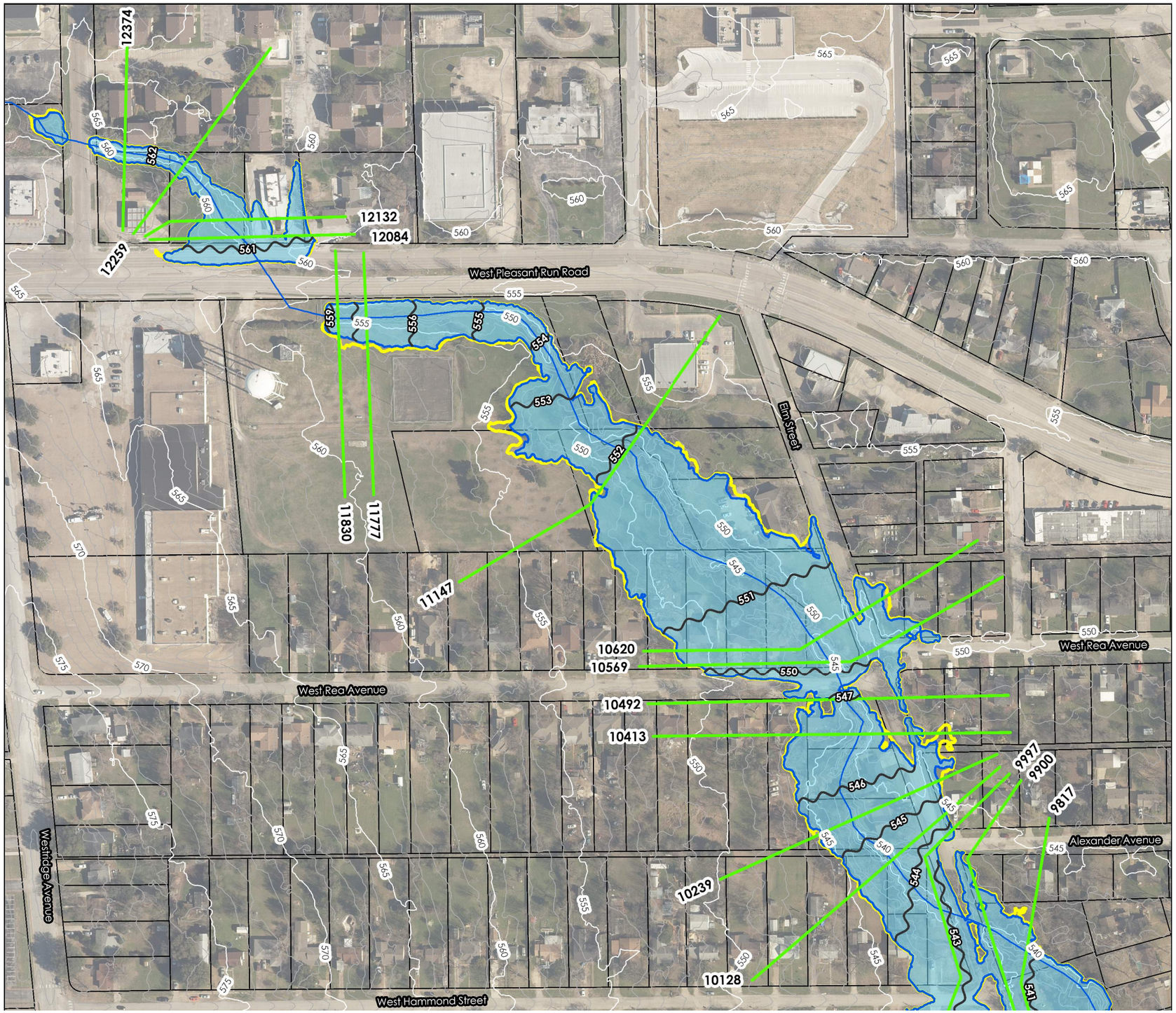


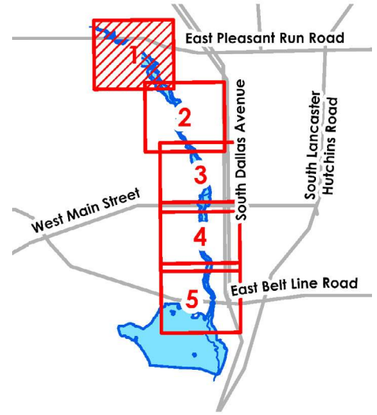
STREAM CENTERLINE
HALLS VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN
PARCEL

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200 Feet

- HALLS CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- HALLS BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.

5

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

1.47 SM

*

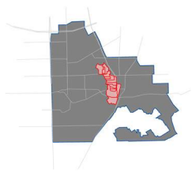
STREAM LENGTH

2.43 MI

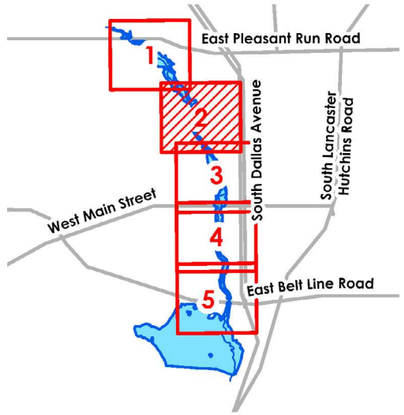
*

PROJECTS IDENTIFIED

3



FLOODPLAIN: SHEET 2

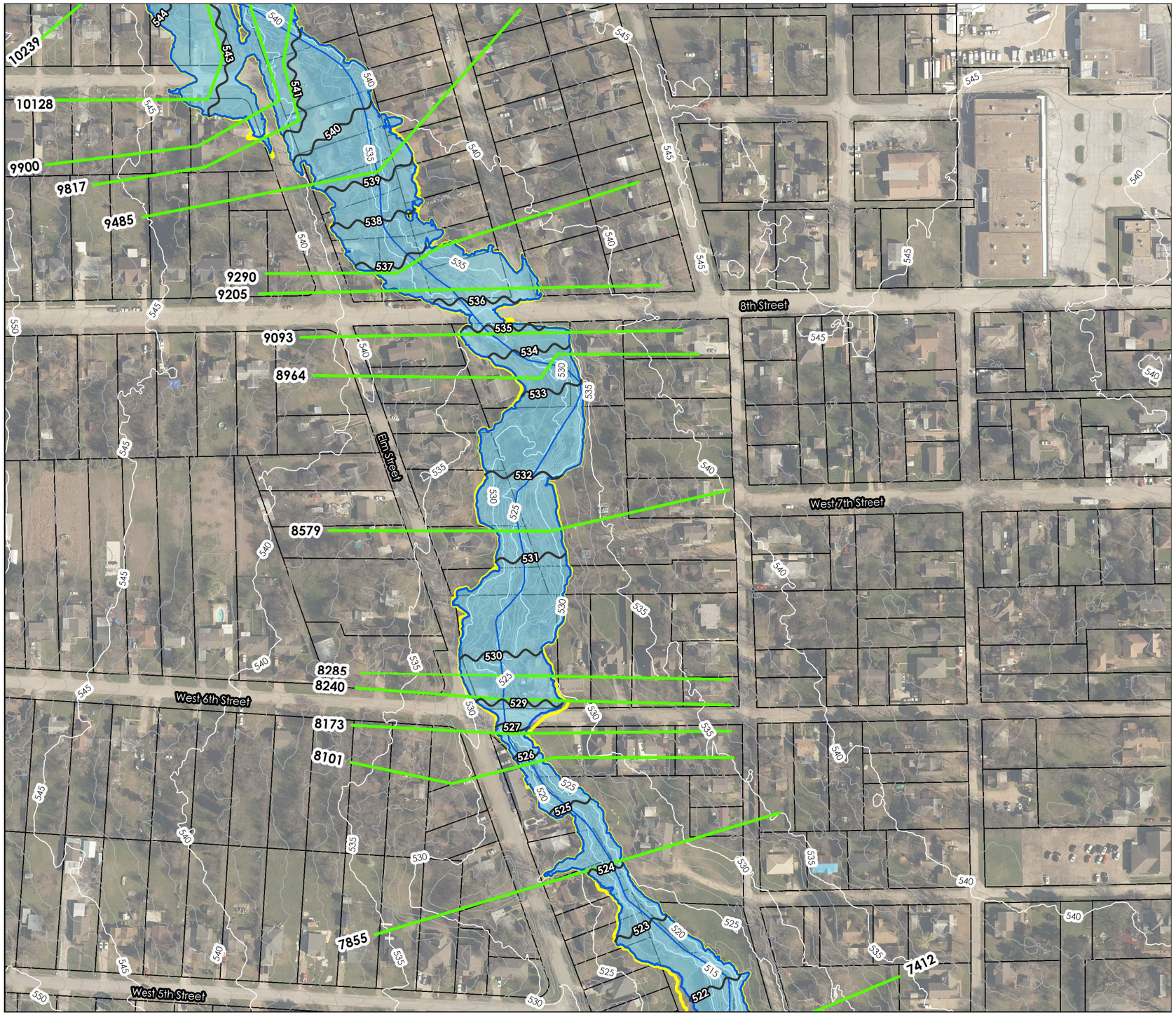


N

0 100 200 Feet

- HALLS CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- 500 HALLS BASE FLOW ELEVATIONS
- PARCEL

0



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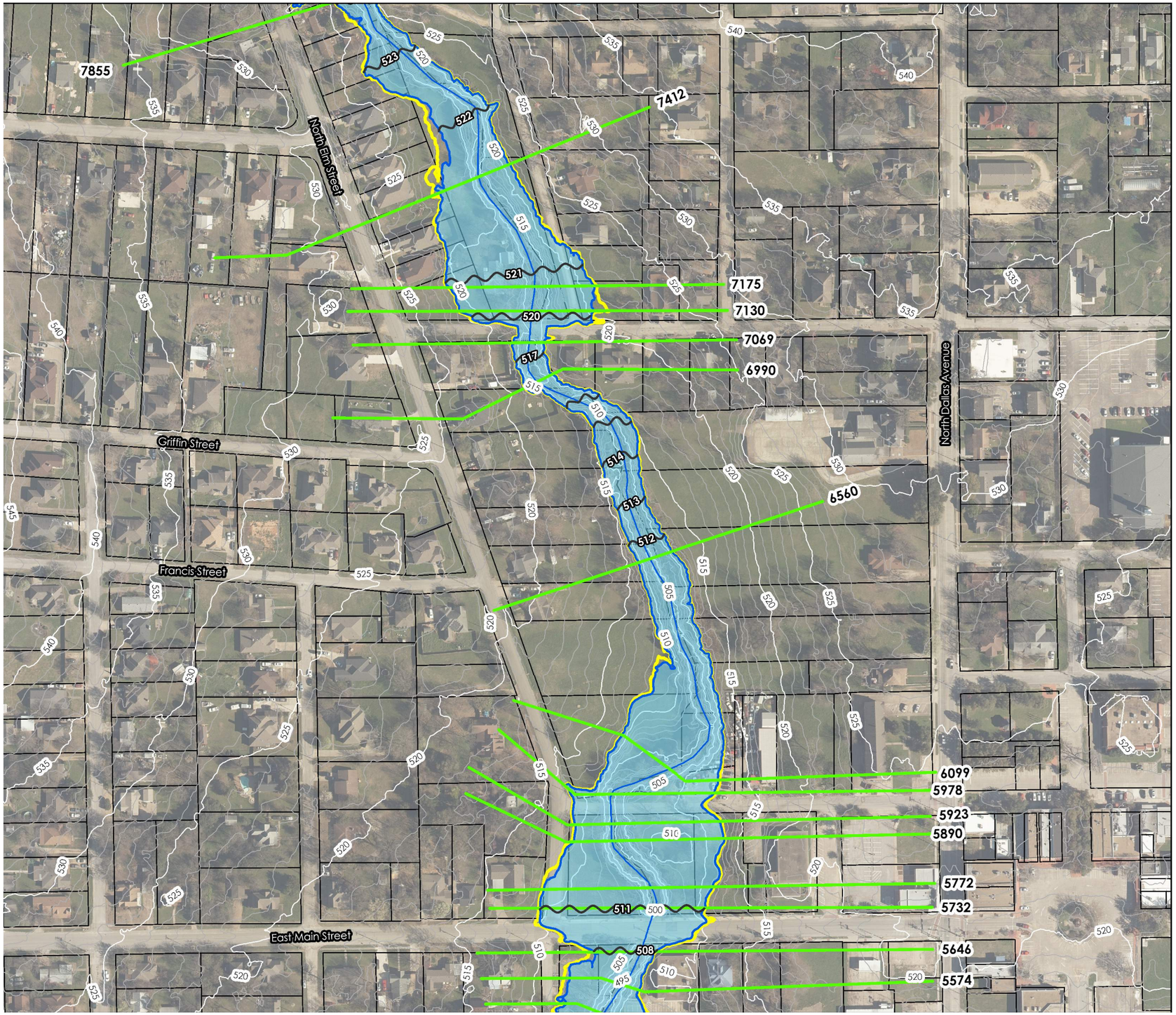
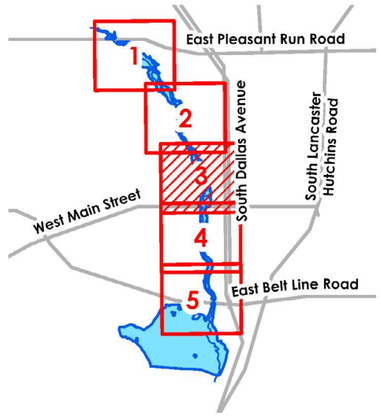




N

0 100 200
Feet

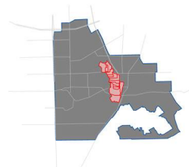
- HALLS CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- HALLS BASE FLOW ELEVATIONS
- PARCEL

2.0 HYDRAULICS

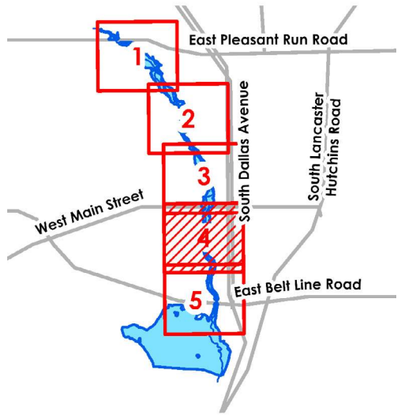
WATERSHED NO.
5

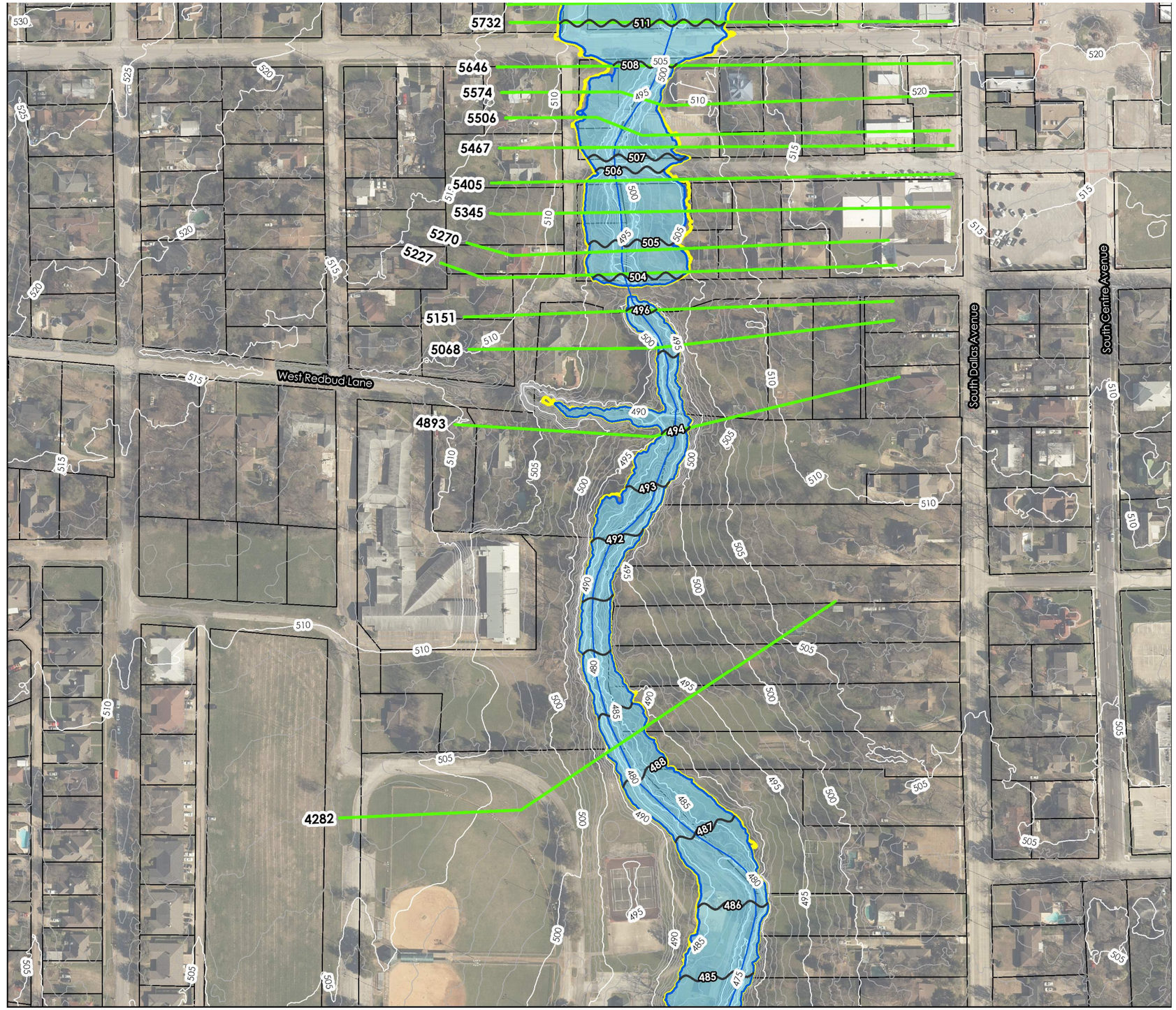
COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



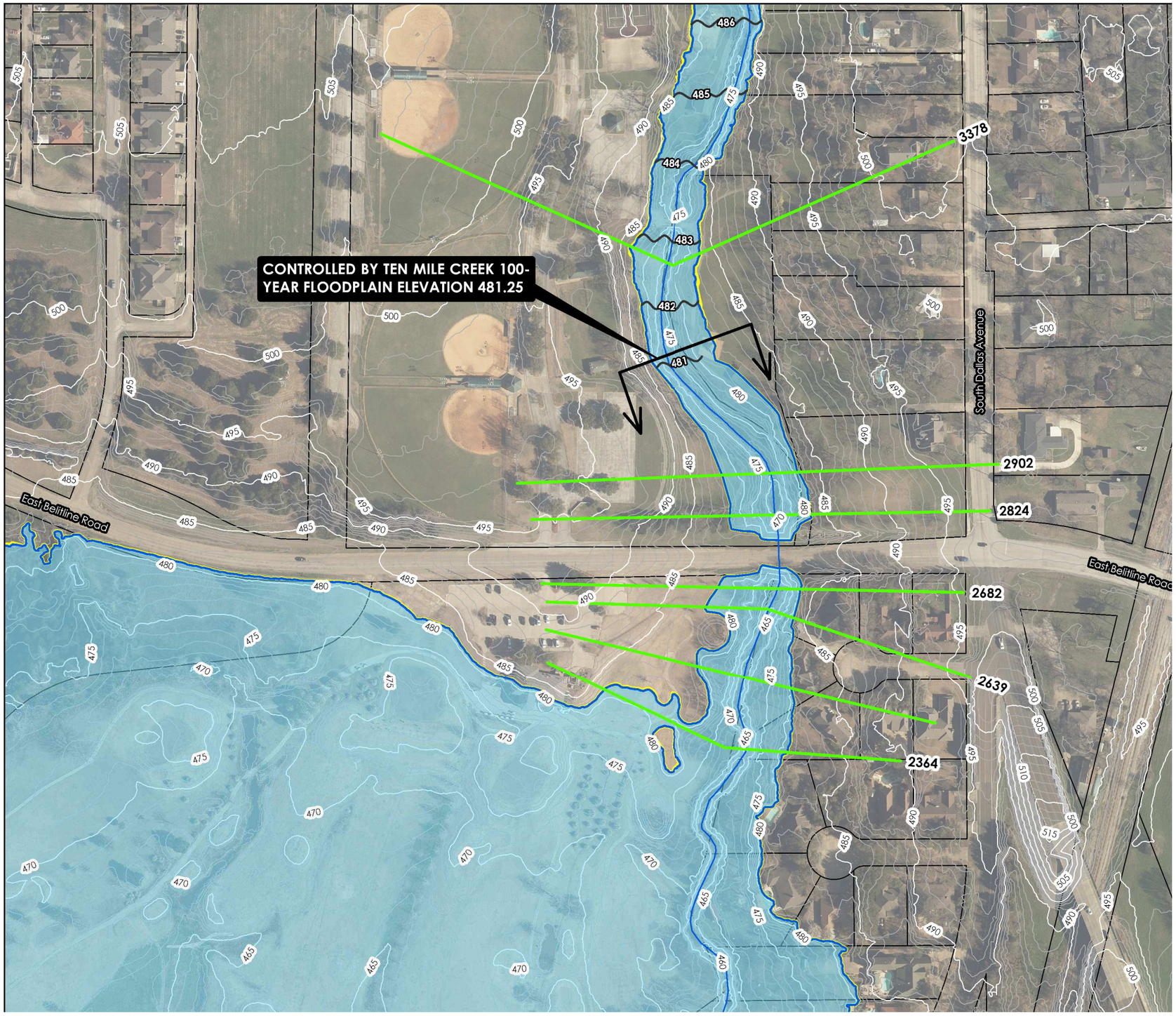
FLOODPLAIN: SHEET 4

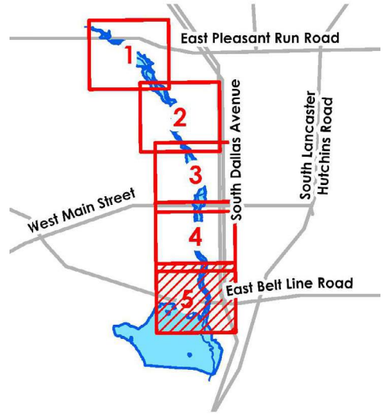




HALLS CROSS SECTION
STREAM CENTERLINE
ULTIMATE 100-YEAR FL
EXISTING 100-YEAR FLC
LIDAR MAJOR CONTC
LIDAR MINOR CONTO
500 HALLS BASE FLOW ELE
PARCEL

FLOODPLAIN: SHEET 5





N

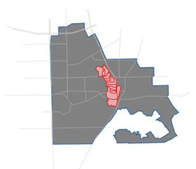
0 100 200 Feet

- HALLS CROSS SECTIONS
- STREAM CENTERLINE
- ULTIMATE 100-YEAR FLOODPLAIN
- EXISTING 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- HALLS BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	561.04	561.30	6.12	6.31
12259	558.90	558.87	3.68	4.61
12132	557.51	557.86	2.82	2.37
12084	557.25	557.62	2.66	2.66
12009	**PLEASANT RUN ROAD**			
11830	554.51	554.76	3.24	3.49
11777	554.16	554.41	4.38	4.54
11147	550.33	550.39	3.34	3.61
10620	546.98	547.92	4.45	3.63
10569	546.91	547.88	2.86	2.35
10530	**REA AVENUE**			
10492	545.16	545.38	4.49	4.76
10413	544.89	545.08	3.71	3.90
10239	543.74	544.05	4.65	4.33
10128	542.65	543.29	4.58	3.98
9997	542.54	542.82	2.60	2.45
9949	**N. ELM STREET**			
9900	540.24	540.36	3.93	4.29
9817	540.01	540.16	3.42	3.36
9485	537.01	536.95	5.94	6.88
9290	534.06	534.46	5.61	5.16
9205	533.47	534.13	4.26	3.59
9151	**8TH STREET**			
9093	532.54	532.68	3.83	4.05
8964	531.58	531.70	5.15	5.35
8579	528.40	528.55	4.28	4.29
8285	525.95	526.26	5.69	5.56
8240	525.76	526.06	5.22	5.32
8207	**6TH STREET**			
8173	523.18	523.33	6.91	7.08
8101	522.59	522.76	5.62	5.69
7855	520.93	521.15	4.77	4.78
7412	517.27	517.44	5.81	5.92
7175	515.43	515.77	4.95	4.73
7130	515.37	515.70	3.91	4.02

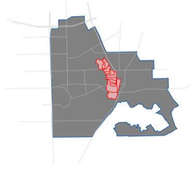
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	513.86	514.08	5.65	5.72
6990	513.46	513.72	4.72	4.73
6560	508.88	509.04	7.17	7.58
6099	505.78	506.32	3.00	2.67
5978	505.24	505.78	4.39	4.60
5954	**W. 1ST STREET**			
5923	502.78	502.97	6.61	7.26
5890	501.87	502.13	8.24	8.48
5772	501.34	501.83	4.20	4.20
5732	500.96	501.43	5.40	5.50
5688	**W. MAIN STREET**			
5646	499.72	500.15	8.93	9.08
5574	499.47	499.96	5.39	5.44
5506	499.31	499.81	4.47	4.57
5467	499.21	499.72	4.27	4.34
5433	**W. CEDAR STREET**			
5405	498.58	498.98	5.72	6.05
5345	498.52	498.95	3.89	3.95
5270	496.51	496.83	10.26	10.63
5227	496.61	497.14	3.96	4.07
5192	**W. REDBUD LANE**			
5151	491.65	491.87	4.30	4.66
5068	491.01	491.23	5.82	6.02
4893	489.70	489.97	5.91	5.96
4282	484.75	485.13	5.87	5.99
3378	479.22	479.57	4.73	4.77
2902	474.28	474.55	8.62	8.93
2824	472.11	472.37	8.25	8.49
2740	**BELT LINE ROAD**			
2682	472.31	472.87	3.40	3.37
2639	472.20	472.75	3.56	3.58
2503	470.20	470.63	5.28	5.56
2364	469.61	469.97	5.33	5.75
2229	469.30	469.60	4.29	4.66

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	469.04	469.30	3.87	4.26
1969	469.08	469.38	1.91	1.82
1825	469.08	469.38	0.80	0.76
1578	469.07	469.37	0.55	0.57
1451	469.07	469.37	0.33	0.32
1225	469.07	469.37	0.13	0.13
1077	469.07	469.37	0.13	0.14
855	469.07	469.37	0.21	0.21
767	469.07	469.37	0.19	0.20
623	469.07	469.37	0.17	0.18
471	469.07	469.37	0.16	0.17
348	469.07	469.37	0.15	0.15
274	469.07	469.37	0.15	0.16
178	469.07	469.37	0.17	0.17

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	561.41	561.61	6.46	6.71
12259	558.90	558.90	4.95	5.72
12132	558.08	558.38	2.11	1.84
12084	557.85	558.20	2.59	2.46
12009	**PLEASANT RUN ROAD**			
11830	554.89	555.18	3.90	4.13
11777	554.42	554.75	5.28	5.29
11147	550.76	550.77	3.27	3.67
10620	548.72	549.40	3.09	2.59
10569	548.68	549.37	2.17	2.06
10530	**REA AVENUE**			
10492	545.71	545.91	5.05	5.38
10413	545.40	545.58	4.00	4.14
10239	544.29	544.44	4.53	4.67
10128	543.44	543.55	4.48	4.82
9997	543.06	543.18	2.36	2.41
9949	**N. ELM STREET**			
9900	540.52	540.64	4.94	5.42
9817	540.34	540.47	3.42	3.45
9485	537.20	537.39	7.07	7.21
9290	534.90	535.27	5.28	5.32
9205	534.66	535.07	3.63	3.67
9151	**8TH STREET**			
9093	532.97	533.20	4.50	4.83
8964	531.89	531.97	5.88	6.48
8579	529.10	529.35	4.07	3.96
8285	527.36	527.76	5.04	4.87
8240	527.09	527.46	5.35	5.38
8207	**6TH STREET**			
8173	523.78	523.94	7.71	8.00
8101	523.23	523.39	6.07	6.27
7855	521.64	521.78	5.00	5.05
7412	517.90	518.03	6.16	6.24
7175	516.31	516.61	4.88	4.72
7130	516.20	516.48	4.63	4.73

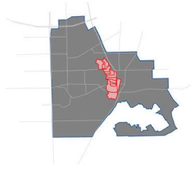
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	514.52	514.68	6.28	6.41
6990	514.14	514.31	5.20	5.28
6560	509.30	509.42	7.91	8.09
6099	507.07	507.46	2.40	2.30
5978	506.52	506.90	4.87	5.00
5954	**W. 1ST STREET**			
5923	503.14	503.38	8.33	8.53
5890	502.77	503.11	7.80	7.49
5772	502.64	503.00	4.19	4.17
5732	502.23	502.58	5.68	5.73
5688	**W. MAIN STREET**			
5646	500.86	501.14	9.30	9.41
5574	500.76	501.07	5.54	5.59
5506	500.63	500.94	4.72	4.79
5467	500.55	500.86	4.45	4.51
5433	**W. CEDAR STREET**			
5405	499.59	499.80	6.62	6.88
5345	499.61	499.84	4.06	4.13
5270	497.51	497.85	10.67	10.40
5227	498.02	498.38	4.26	4.33
5192	**W. REDBUD LANE**			
5151	492.46	492.78	5.00	5.06
5068	491.75	492.02	6.53	6.79
4893	490.48	490.73	6.38	6.61
4282	485.53	485.70	6.36	6.53
3378	479.96	480.14	4.97	5.04
2902	474.94	475.10	9.31	9.51
2824	472.77	473.32	8.90	7.64
2740	**BELT LINE ROAD**			
2682	473.65	473.90	3.56	3.42
2639	473.55	473.80	3.82	3.68
2503	471.93	472.21	6.50	5.29
2364	471.47	471.72	7.54	5.43
2229	471.26	471.51	6.88	4.20

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	471.19	471.48	2.83	2.71
1969	471.24	471.52	0.72	0.68
1825	471.24	471.52	0.38	0.37
1578	471.24	471.52	0.35	0.34
1451	471.24	471.52	0.23	0.23
1225	471.24	471.52	0.12	0.12
1077	471.24	471.52	0.12	0.13
855	471.24	471.52	0.18	0.19
767	471.24	471.52	0.17	0.18
623	471.24	471.52	0.16	0.17
471	471.24	471.52	0.15	0.16
348	471.24	471.52	0.14	0.15
274	471.24	471.52	0.14	0.15
178	471.24	471.52	0.15	0.16

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	561.77	561.94	7.05	7.45
12259	559.02	559.15	6.02	6.33
12132	558.88	558.93	1.50	1.71
12084	558.75	558.75	2.24	2.65
12009	**PLEASANT RUN ROAD**			
11830	555.63	555.86	4.36	4.81
11777	555.05	555.34	5.92	5.98
11147	551.10	551.13	3.72	4.04
10620	549.51	550.02	3.04	2.60
10569	549.47	549.97	2.49	2.48
10530	**REA AVENUE**			
10492	546.21	546.35	6.17	6.58
10413	545.86	545.99	4.53	4.70
10239	544.69	544.84	4.90	4.99
10128	543.68	543.77	5.39	5.73
9997	543.26	543.32	2.72	2.88
9949	**N/ ELM STREET**			
9900	540.75	540.81	6.29	6.86
9817	540.61	540.70	3.70	3.86
9485	538.03	538.16	5.86	5.80
9290	535.82	535.93	5.20	5.34
9205	535.44	535.55	3.86	3.91
9151	**8TH STREET**			
9093	533.51	533.61	5.31	5.54
8964	532.13	532.24	7.19	7.28
8579	530.02	530.17	3.89	3.98
8285	528.65	528.80	4.70	4.82
8240	528.23	528.40	5.37	5.43
8207	**6TH STREET**			
8173	524.48	524.62	8.93	9.33
8101	523.97	524.10	6.83	7.14
7855	522.13	522.20	5.89	6.04
7412	519.22	519.50	5.48	5.30
7175	518.72	519.02	3.42	3.32
7130	518.42	518.69	4.80	4.88

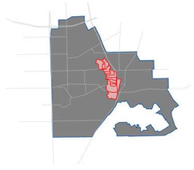
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	515.27	515.41	7.25	7.35
6990	514.90	515.06	5.90	5.94
6560	509.75	509.89	8.64	8.82
6099	508.62	509.20	2.10	1.99
5978	508.01	508.60	5.35	5.39
5954	**W. 1ST STREET**			
5923	504.44	504.94	8.36	8.20
5890	504.44	505.00	6.22	5.86
5772	504.33	504.91	4.09	3.94
5732	503.88	504.47	5.91	5.79
5688	**W. MAIN STREET**			
5646	502.27	502.66	9.32	9.15
5574	502.22	502.63	5.72	5.66
5506	502.09	502.51	4.97	4.93
5467	502.02	502.45	4.73	4.73
5433	**W. CEDAR STREET**			
5405	500.57	500.82	7.80	8.02
5345	500.70	500.98	4.32	4.33
5270	499.44	499.88	8.40	7.89
5227	499.68	500.06	4.60	4.68
5192	**W. REDBUD LANE**			
5151	493.36	493.48	5.79	6.05
5068	492.60	492.74	7.26	7.38
4893	491.40	491.55	6.77	6.82
4282	486.40	486.54	6.92	7.03
3378	480.81	480.96	5.22	5.26
2902	475.73	475.87	10.00	10.11
2824	475.70	475.96	5.06	5.06
2740	**BELT LINE ROAD**			
2682	475.75	476.00	3.15	3.21
2639	475.69	475.93	3.40	3.46
2503	474.96	475.21	4.28	4.32
2364	474.83	475.10	3.50	3.51
2229	474.82	475.09	2.61	2.60

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	474.86	475.13	1.03	1.02
1969	474.86	475.13	0.29	0.29
1825	474.86	475.13	0.20	0.20
1578	474.86	475.13	0.20	0.20
1451	474.86	475.13	0.16	0.16
1225	474.86	475.13	0.10	0.10
1077	474.86	475.13	0.10	0.10
855	474.86	475.13	0.15	0.15
767	474.86	475.13	0.15	0.15
623	474.86	475.13	0.14	0.14
471	474.86	475.13	0.13	0.13
348	474.86	475.13	0.12	0.13
274	474.86	475.13	0.12	0.12
178	474.86	475.13	0.13	0.13

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	561.96	562.13	7.56	7.87
12259	559.16	560.14	6.32	3.95
12132	559.06	560.19	1.57	1.01
12084	558.92	560.11	2.47	1.88
12009	**PLEASANT RUN ROAD**			
11830	556.01	556.16	4.78	5.13
11777	555.47	555.63	6.07	6.23
11147	551.18	551.26	4.15	4.27
10620	550.18	550.39	2.52	2.42
10569	550.11	550.30	2.54	2.63
10530	**REA AVENUE**			
10492	546.41	546.50	6.84	7.20
10413	546.05	546.16	4.81	4.91
10239	544.93	545.11	5.03	5.08
10128	543.82	543.91	5.94	6.35
9997	543.35	543.49	3.00	3.02
9949	**N. ELM STREET**			
9900	540.86	540.91	7.20	7.94
9817	540.78	540.86	3.85	4.07
9485	538.39	538.49	5.60	5.52
9290	535.99	536.07	5.78	5.86
9205	535.46	535.55	4.55	4.57
9151	**8TH STREET**			
9093	533.76	533.81	5.93	6.14
8964	532.41	532.53	7.44	7.42
8579	530.36	530.50	4.11	4.22
8285	528.99	529.12	4.98	5.12
8240	528.60	528.72	5.57	5.73
8207	**6TH STREET**			
8173	524.85	525.21	9.75	9.18
8101	524.37	524.55	7.33	7.54
7855	522.47	522.66	6.32	6.44
7412	520.13	520.39	5.06	5.11
7175	519.82	520.12	3.10	3.07
7130	519.43	519.66	5.12	5.19

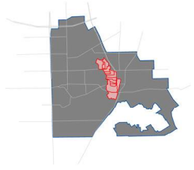
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	515.70	515.89	7.84	8.14
6990	515.35	515.55	6.27	6.46
6560	510.14	510.28	9.01	9.16
6099	509.90	510.38	1.94	1.90
5978	509.50	510.11	4.14	3.50
5954	**W. 1ST STREET**			
5923	506.84	507.98	6.71	4.25
5890	506.96	507.95	4.39	3.95
5772	506.89	507.89	3.31	3.00
5732	506.52	507.53	5.22	5.00
5688	**W. MAIN STREET**			
5646	503.87	504.48	8.47	8.19
5574	503.89	504.52	5.25	5.02
5506	503.80	504.45	4.58	4.39
5467	503.74	504.37	4.59	4.53
5433	**W. CEDAR STREET**			
5405	501.48	501.77	8.45	8.65
5345	501.70	502.03	4.22	4.16
5270	500.87	501.32	6.94	6.58
5227	500.95	501.36	4.85	4.93
5192	**W. REDBUD LANE**			
5151	493.98	494.10	6.41	6.68
5068	493.16	493.29	7.88	8.02
4893	491.87	491.99	7.38	7.50
4282	487.06	487.24	6.94	6.98
3378	481.04	481.22	5.86	5.81
2902	476.97	477.20	8.40	8.32
2824	477.05	477.27	4.70	4.76
2740	**BELT LINE ROAD**			
2682	476.98	477.17	3.19	3.28
2639	476.92	477.11	3.43	3.52
2503	476.40	476.59	3.97	4.05
2364	476.34	476.53	3.18	3.24
2229	476.35	476.53	2.26	2.29

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	476.38	476.57	0.88	0.89
1969	476.38	476.57	0.25	0.26
1825	476.38	476.57	0.18	0.19
1578	476.38	476.57	0.18	0.19
1451	476.38	476.57	0.15	0.16
1225	476.38	476.57	0.11	0.11
1077	476.38	476.57	0.10	0.11
855	476.38	476.57	0.14	0.15
767	476.38	476.57	0.15	0.15
623	476.38	476.57	0.14	0.14
471	476.38	476.57	0.13	0.13
348	476.38	476.57	0.13	0.13
274	476.38	476.57	0.12	0.13
178	476.38	476.57	0.13	0.14

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	562.24	562.44	7.99	8.24
12259	560.95	561.28	2.84	2.71
12132	560.98	561.31	0.78	0.77
12084	560.95	561.29	1.25	1.14
12009	**PLEASANT RUN ROAD**			
11830	556.46	556.89	5.27	5.16
11777	555.89	556.29	6.49	6.41
11147	551.43	551.58	4.37	4.48
10620	550.56	550.67	2.49	2.60
10569	550.44	550.52	2.86	3.05
10530	**REA AVENUE**			
10492	546.61	546.70	7.86	8.52
10413	546.25	546.33	5.26	5.60
10239	545.22	545.33	5.11	5.13
10128	543.99	544.04	6.63	6.88
9997	543.57	543.59	3.10	3.26
9949	**N. ELM STREET**			
9900	540.96	540.98	8.48	9.02
9817	540.99	541.04	4.04	4.17
9485	538.88	539.00	5.15	5.11
9290	536.35	536.46	6.02	6.02
9205	535.82	535.90	4.66	4.75
9151	**8TH STREET**			
9093	534.05	534.13	6.78	7.02
8964	532.76	532.85	7.83	7.96
8579	530.75	530.83	4.46	4.55
8285	529.36	529.46	5.36	5.42
8240	528.95	529.07	5.98	5.98
8207	**6TH STREET**			
8173	525.57	525.73	9.46	9.51
8101	524.89	525.05	7.93	8.01
7855	523.06	523.25	6.62	6.71
7412	520.67	520.79	5.47	5.66
7175	520.42	520.53	3.23	3.32
7130	520.02	520.15	5.03	5.05

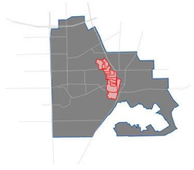
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	516.13	516.26	8.91	9.26
6990	515.74	515.86	7.08	7.34
6560	510.86	510.99	8.67	8.68
6099	511.18	511.29	1.90	1.94
5978	511.00	511.12	3.00	3.01
5954	**W. 1ST STREET**			
5923	510.27	510.52	2.92	2.86
5890	510.22	510.46	3.06	3.05
5772	510.21	510.46	2.33	2.35
5732	509.93	510.22	4.28	4.10
5688	**W. MAIN STREET**			
5646	506.69	507.09	6.05	5.92
5574	506.65	507.03	4.23	4.20
5506	506.61	506.99	3.64	3.63
5467	506.53	506.94	3.82	3.71
5433	**W. CEDAR STREET**			
5405	503.51	504.16	4.38	4.00
5345	503.46	504.11	3.68	3.46
5270	503.13	503.89	5.05	4.48
5227	503.07	503.68	4.93	4.92
5192	**W. REDBUD LANE**			
5151	494.63	494.91	7.29	7.44
5068	493.79	494.09	8.53	8.63
4893	492.47	492.80	7.89	7.86
4282	487.68	487.87	7.30	7.49
3378	481.55	481.74	6.11	6.17
2902	480.05	480.26	4.84	4.96
2824	480.02	480.23	3.82	4.01
2740	**BELT LINE ROAD**			
2682	479.63	479.76	2.90	3.07
2639	479.60	479.74	3.07	3.24
2503	479.42	479.53	2.89	3.04
2364	479.41	479.52	2.29	2.42
2229	479.43	479.55	1.21	1.27

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	479.44	479.56	0.65	0.69
1969	479.44	479.56	0.19	0.20
1825	479.44	479.56	0.15	0.16
1578	479.44	479.56	0.15	0.16
1451	479.44	479.56	0.13	0.14
1225	479.44	479.56	0.10	0.10
1077	479.44	479.56	0.10	0.10
855	479.44	479.56	0.12	0.13
767	479.44	479.56	0.13	0.13
623	479.44	479.56	0.12	0.12
471	479.44	479.56	0.12	0.12
348	479.44	479.56	0.12	0.12
274	479.44	479.56	0.12	0.12
178	479.44	479.56	0.12	0.13

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	562.47	562.77	8.28	8.48
12259	561.31	561.38	2.67	2.88
12132	561.34	561.40	0.77	0.83
12084	561.31	561.38	1.12	1.19
12009	**PLEASANT RUN ROAD**			
11830	557.08	557.22	5.17	5.49
11777	556.44	556.58	6.52	6.71
11147	551.67	551.78	4.55	4.62
10620	550.74	550.81	2.68	2.77
10569	550.58	550.63	3.18	3.33
10530	**REA AVENUE**			
10492	546.77	546.83	8.96	9.48
10413	546.41	546.47	5.75	5.96
10239	545.48	545.60	5.12	5.11
10128	544.13	544.20	7.26	7.55
9997	543.66	543.75	3.43	3.49
9949	**N. ELM STREET**			
9900	540.99	540.99	9.89	10.64
9817	541.15	541.23	4.29	4.39
9485	539.11	539.17	5.24	5.36
9290	536.58	536.70	6.15	6.12
9205	536.04	536.26	4.83	4.56
9151	**8TH STREET**			
9093	534.25	534.60	7.45	4.39
8964	533.03	533.13	8.11	8.23
8579	531.03	531.13	4.75	4.87
8285	529.59	529.69	5.72	5.80
8240	529.01	529.14	6.76	6.77
8207	**6TH STREET**			
8173	526.03	526.20	9.68	9.72
8101	525.30	525.45	8.37	8.52
7855	523.52	523.72	6.83	6.86
7412	520.96	521.06	5.92	6.08
7175	520.71	520.81	3.44	3.52
7130	520.35	520.47	5.02	5.03

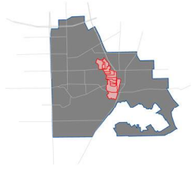
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	516.58	516.70	9.53	9.84
6990	516.24	516.37	7.36	7.56
6560	511.17	511.28	9.26	9.32
6099	511.53	511.65	2.10	2.14
5978	511.35	511.47	3.15	3.17
5954	**W. 1ST STREET**			
5923	510.85	511.06	2.98	2.96
5890	510.78	510.99	3.25	3.27
5772	510.78	510.98	2.46	2.54
5732	510.58	510.80	4.01	4.00
5688	**W. MAIN STREET**			
5646	507.48	507.70	6.10	6.29
5574	507.41	507.62	4.37	4.52
5506	507.37	507.58	3.80	3.96
5467	507.33	507.54	3.83	3.95
5433	**W. CEDAR STREET**			
5405	504.65	504.88	3.99	4.07
5345	504.60	504.84	3.53	3.64
5270	504.42	504.66	4.40	4.47
5227	504.23	504.48	4.81	4.86
5192	**W. REDBUD LANE**			
5151	495.37	495.59	7.80	8.18
5068	494.52	494.75	9.01	9.25
4893	493.27	493.55	7.99	8.04
4282	487.99	488.19	7.94	8.19
3378	482.13	482.39	5.97	6.00
2902	481.09	481.36	4.55	4.67
2824	481.04	481.30	4.01	4.23
2740	**BELT LINE ROAD**			
2682	480.44	480.58	2.82	3.00
2639	480.38	480.51	3.27	3.49
2503	480.20	480.32	2.95	3.13
2364	480.19	480.31	2.41	2.56
2229	480.22	480.34	1.23	1.30

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	480.23	480.35	0.68	0.72
1969	480.23	480.35	0.20	0.22
1825	480.23	480.35	0.16	0.17
1578	480.23	480.35	0.16	0.17
1451	480.23	480.35	0.14	0.15
1225	480.23	480.35	0.11	0.11
1077	480.23	480.35	0.10	0.11
855	480.23	480.35	0.13	0.14
767	480.23	480.35	0.13	0.14
623	480.23	480.35	0.13	0.13
471	480.23	480.35	0.13	0.13
348	480.23	480.35	0.12	0.13
274	480.23	480.35	0.12	0.13
178	480.23	480.35	0.13	0.14

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3



2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12374	562.68	562.92	8.39	8.61
12259	561.37	561.37	3.03	3.17
12132	561.40	561.40	0.87	0.91
12084	561.38	561.38	1.25	1.32
12009	**PLEASANT RUN ROAD**			
11830	557.46	557.67	5.29	5.51
11777	556.73	556.89	6.89	7.12
11147	551.90	552.04	4.68	4.73
10620	550.88	550.94	2.88	3.03
10569	550.69	550.73	3.48	3.72
10530	**REA AVENUE**			
10492	546.88	546.93	10.07	10.82
10413	546.56	546.65	6.15	6.37
10239	545.70	545.80	5.20	5.29
10128	544.29	544.37	7.72	7.94
9997	543.83	543.83	3.60	3.79
9949	**N. ELM STREET**			
9900	541.61	541.69	4.69	4.79
9817	541.34	541.41	4.43	4.58
9485	539.28	539.33	5.52	5.59
9290	536.83	536.88	6.22	6.30
9205	536.44	536.48	4.56	4.62
9151	**8TH STREET**			
9093	534.77	534.83	4.48	4.54
8964	533.30	533.40	8.38	8.34
8579	531.29	531.39	5.05	5.17
8285	529.85	529.95	5.96	6.05
8240	529.34	529.52	6.80	6.67
8207	**6TH STREET**			
8173	526.49	526.74	9.75	9.58
8101	525.71	525.94	8.75	8.77
7855	524.04	524.22	6.93	7.06
7412	521.23	521.35	6.33	6.51
7175	520.97	521.09	3.67	3.77
7130	520.64	520.75	5.09	5.21

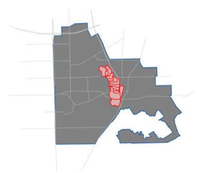
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7096	**4TH STREET**			
7069	517.08	517.32	10.05	10.27
6990	516.83	517.11	7.47	7.50
6560	511.40	511.49	10.12	10.53
6099	511.86	512.00	2.32	2.41
5978	511.67	511.81	3.34	3.43
5954	**W. 1ST STREET**			
5923	511.31	511.51	3.14	3.19
5890	511.23	511.42	3.49	3.56
5772	511.23	511.42	2.65	2.76
5732	511.05	511.25	4.02	4.07
5688	**W. MAIN STREET**			
5646	507.97	508.17	6.54	6.80
5574	507.91	508.10	4.71	4.91
5506	507.86	508.06	4.16	4.36
5467	507.82	508.02	4.10	4.26
5433	**W. CEDAR STREET**			
5405	505.19	505.43	4.20	4.32
5345	505.15	505.38	3.78	3.91
5270	504.96	505.19	4.61	4.76
5227	504.80	505.04	4.94	5.04
5192	**W. REDBUD LANE**			
5151	496.00	496.26	8.57	9.00
5068	495.16	495.42	9.58	9.92
4893	494.08	494.34	7.99	8.20
4282	488.21	488.26	9.01	9.30
3378	483.11	483.28	5.41	5.40
2902	482.42	482.60	4.22	4.26
2824	482.33	482.50	4.23	4.36
2740	**BELT LINE ROAD**			
2682	481.39	481.47	2.99	3.10
2639	481.32	481.39	3.55	3.68
2503	481.16	481.22	3.01	3.12
2364	481.15	481.21	2.54	2.62
2229	481.18	481.24	1.27	1.31

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2093	481.19	481.25	0.72	0.74
1969	481.19	481.25	0.22	0.23
1825	481.19	481.25	0.17	0.18
1578	481.19	481.25	0.17	0.18
1451	481.19	481.25	0.15	0.16
1225	481.19	481.25	0.11	0.12
1077	481.19	481.25	0.11	0.12
855	481.19	481.25	0.14	0.15
767	481.19	481.25	0.14	0.15
623	481.19	481.25	0.14	0.15
471	481.19	481.25	0.13	0.14
348	481.19	481.25	0.13	0.14
274	481.19	481.25	0.13	0.14
178	481.19	481.25	0.14	0.15

WATERSHED NO.
5

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
1.47 SM
*
STREAM LENGTH
2.43 MI
*
PROJECTS IDENTIFIED
3

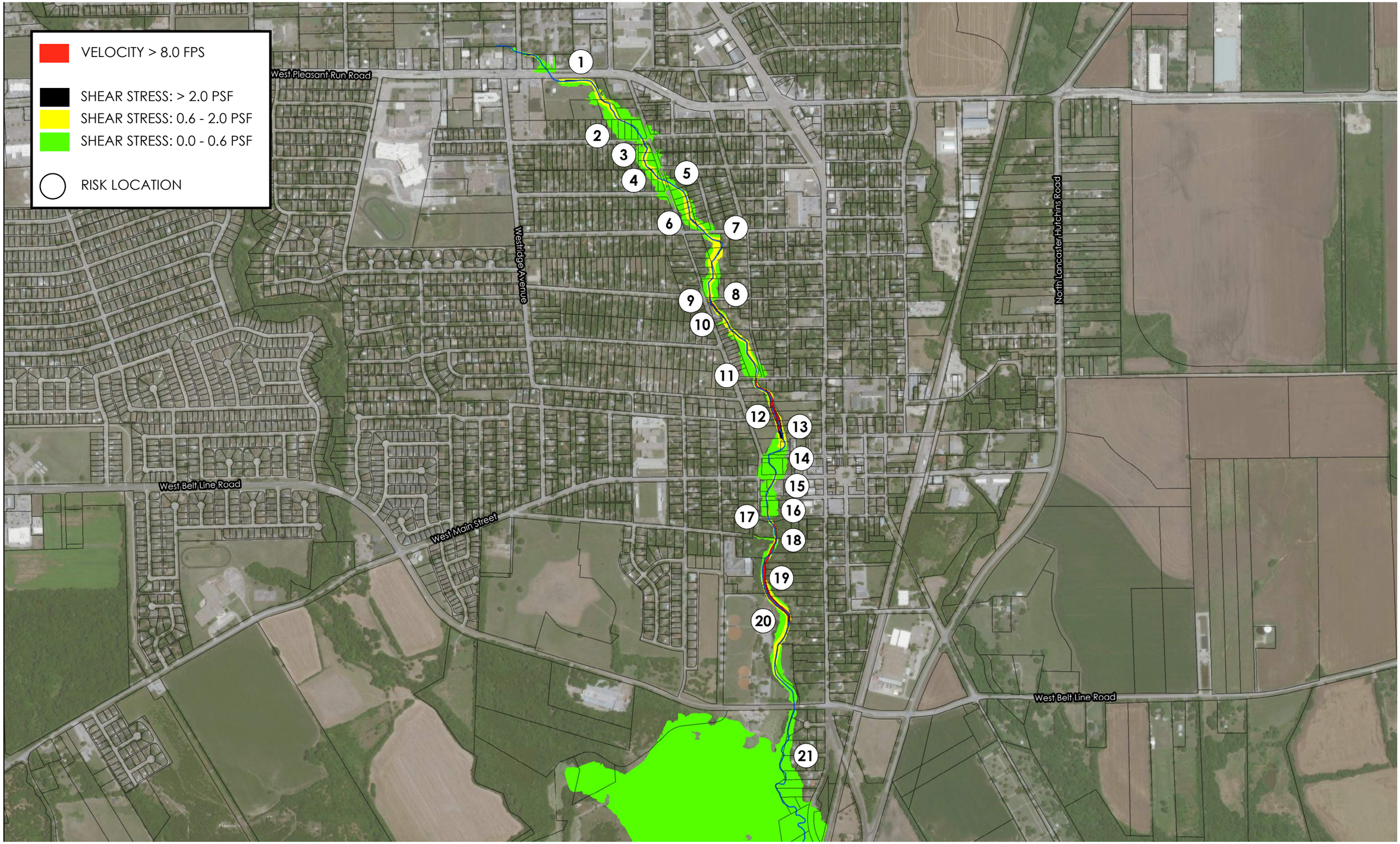


3.1 RISK IDENTIFICATION

Twenty-one risk areas were identified in this study. The risks include ten over-topping bridges, eight areas of flooding structures and three locations of erosive velocities. The areas with flooded structures are all single family residential neighborhoods with one exception of a park building near the downstream end of the stream. The houses between 8th and 4th street are expected to experience the most flooding with flooding beginning in the 2-year event. Of the over-topping bridges, North Elm Street is the least adequate, with the model showing flooding in the 1-year storm. North Elm Street and Pleasant Run Road are the bridges that experience the most traffic. Other roads in this watershed do over-top, but lighter traffic is anticipated on them. The three areas where erosion is likely are located around major development. However, current stream flow direction shows relatively little immediate threat to existing structures. The following map shows the shear stresses associated with the Halls Branch floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Pleasant Run Road	Over-topping Bridge	25-Year	Public	High
2	Houses between Rea Avenue & Pleasant Run Road	Flooded Structures	25-Year	Private	Medium
3	Rea Avenue	Over-topping Bridge	2-Year	Public	High
4	Houses between Rea Avenue & Hammond Street	Flooded Structures	25-Year	Private	Medium
5	North Elm Street	Over-topping Bridge	1-Year	Public	Very High
6	Houses between Alexander Avenue & 8th Street	Flooded Structures	25-Year	Private	Medium
7	8th Street	Over-topping Bridge	5-Year	Public	High
8	Houses between 8th Street & 6th Street	Flooded Structures	2-Year	Private	High
9	6th Street	Over-topping Bridge	2-Year	Public	Very High
10	River Station 8964	Potential Erosion Hot Spot	1-Year	Private	Low
11	Houses between 6th Street & 4th Street	Flooded Structures	2-Year	Private	High
12	River Station 8101	Potential Erosion Hot Spot	1-Year	Private	Low
13	4th Street	Over-topping Bridge	10-Year	Public	High
14	1st Street	Over-topping Bridge	5-Year	Public	High
15	Main Street	Over-topping Bridge	25-Year	Public	High
16	Cedar Street	Over-topping Bridge	25-Year	Public	High
17	Houses between Cedar Street & Redbud Lane	Flooded Structures	2-Year	Private	High
18	Redbud Lane	Over-topping Bridge	25-Year	Public	High
19	River Station 5068	Potential Erosion Hot Spot	1-Year	Private	Low
20	Park Buildings	Flooded Structures	2-Year	Public	Medium
21	Houses on Palmer Circle	Flooded Structures	100-Year	Private	Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
West Pleasant Run Road
Westridge Avenue
North Lancaster Hutchins Road
West Belt Line Road
West Main Street
West Belt Line Road
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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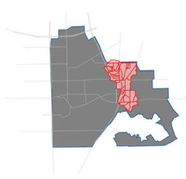
21

KELLER BRANCH

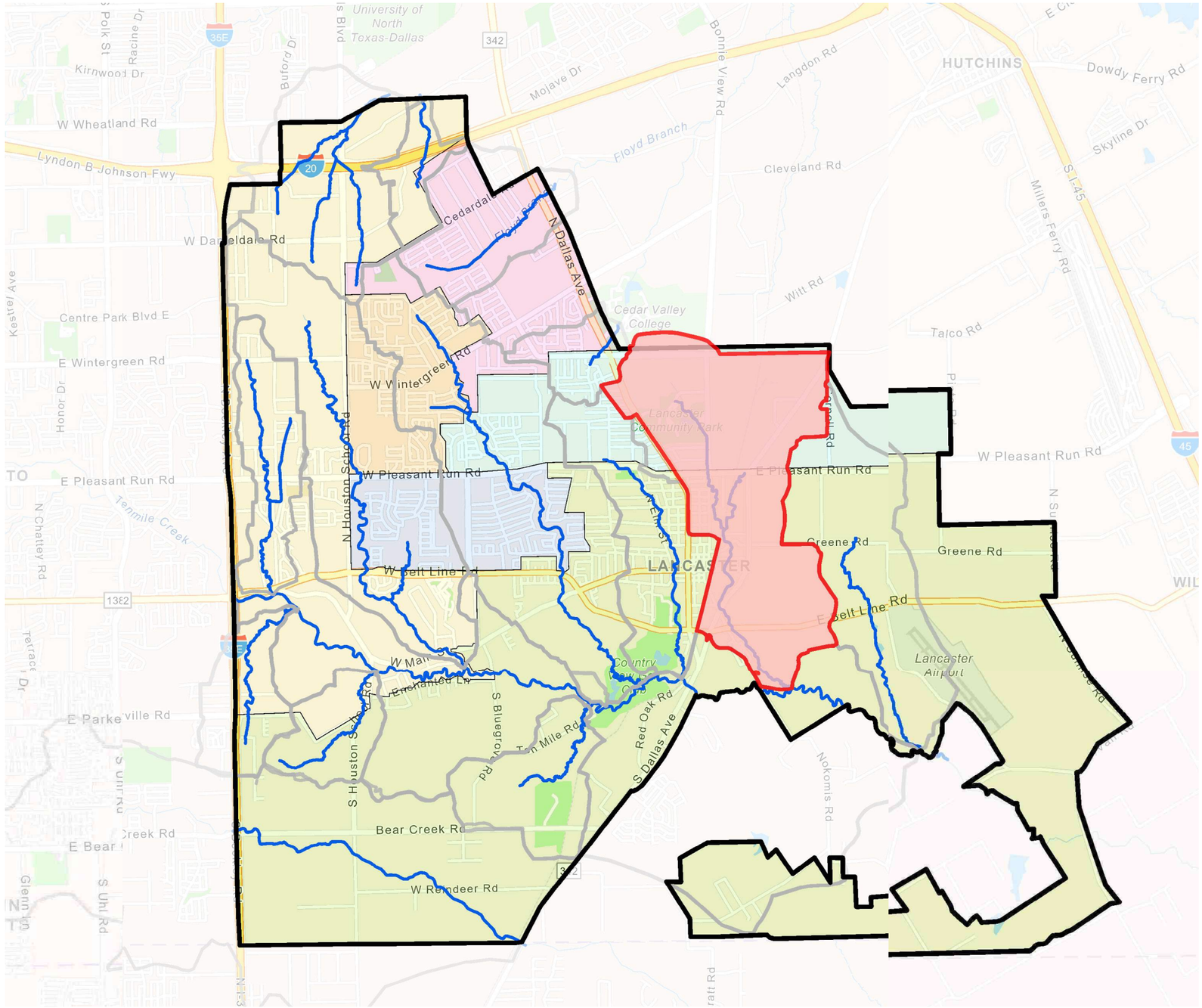
WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



KELLER BRANCH
STREAM CENTERLINE
COUNCIL DISTRICT
DISTRICT 1
DISTRICT 2
DISTRICT 3
DISTRICT 4
DISTRICT 5
DISTRICT 6



KELLER CREEK WATERSHED

Occupying the city's west, Keller Creek drains around 3.84 square miles. Starting in Lancaster Community Park, it flows southeast, joining Ten Mile Creek after 0.66 miles. It combines developed areas with zones planned for residential and light industrial use.

WATERSHED NO. 6

KELLER BRANCH

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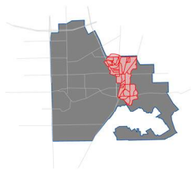
1.0 HYDROLOGY

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



1.1 DRAINAGE AREA MAP

The drainage area divides for the Keller Branch watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into thiry-five (35) sub-basins. Sub-basins are designated KB1 through KB35. The total watershed drainage area is 2062.5 acres (3.22 square-miles). The entirety of the drainage area is located within the City of Lancaster itself.

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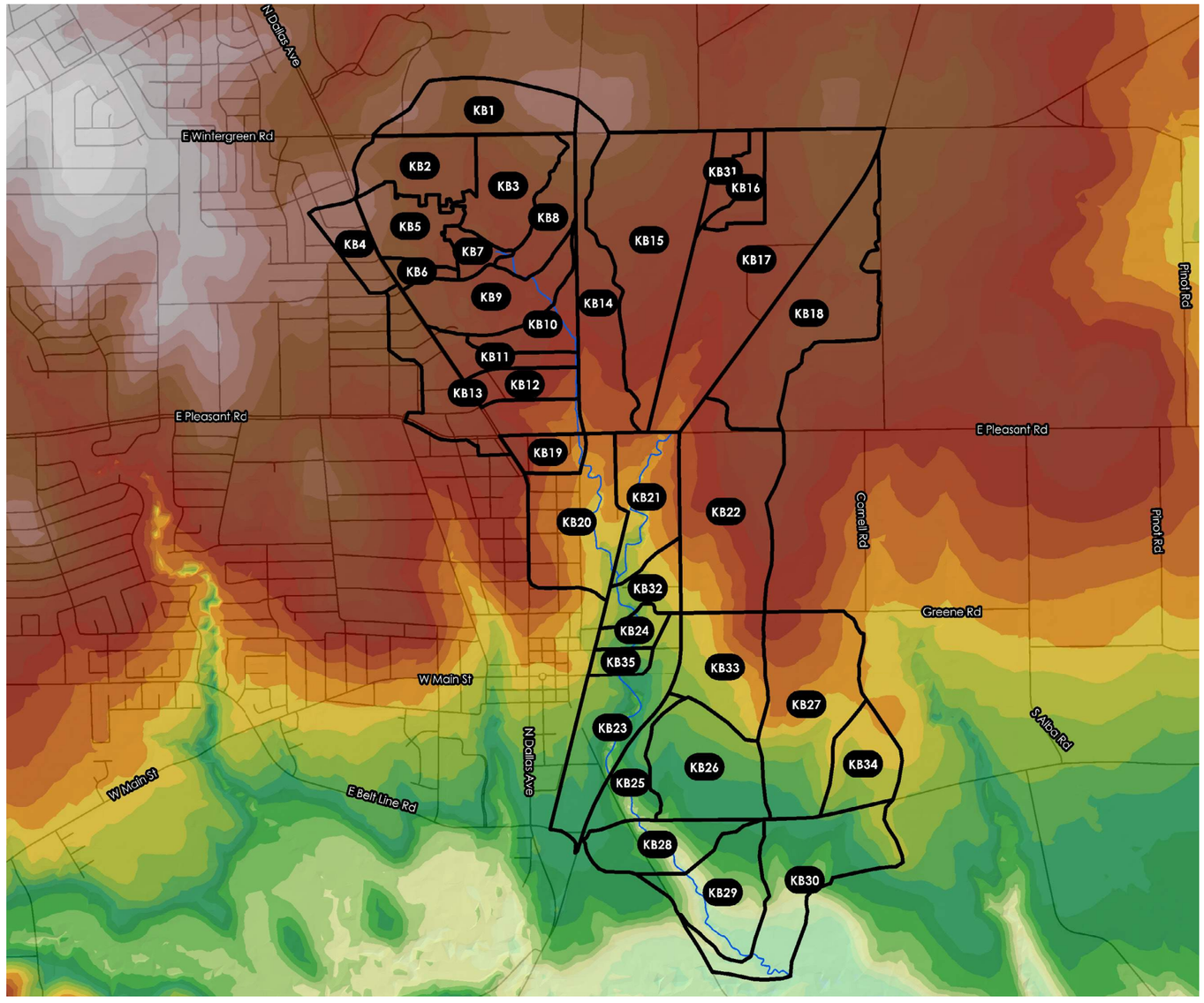


617.48 - 747.38
611.57 - 617.48
605.66 - 611.57
599.75 - 605.66
593.84 - 599.75
587.93 - 593.84
582.03 - 587.93
576.12 - 582.03
570.21 - 576.12
564.3 - 570.21
558.39 - 564.3
552.48 - 558.39
546.57 - 552.48
540.66 - 546.57
534.75 - 540.66
528.84 - 534.75
522.93 - 528.84
517.02 - 522.93
511.11 - 517.02
505.2 - 511.11
499.29 - 505.2
493.38 - 499.29
487.47 - 493.38
481.56 - 487.47
475.65 - 481.56
469.74 - 475.65
463.83 - 469.74
457.92 - 463.83
452.01 - 457.92
446.1 - 452.01
440.19 - 446.1
357.51 - 440.19

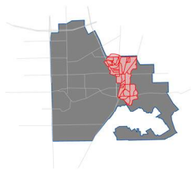
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
KB1	0.0983	84	5.9	70.5	28.68	17.21	22.42	13.45
KB2	0.0775	84	46.2	73.3	25.75	15.45	21.57	12.94
KB3	0.0925	84	8.7	46.2	26.82	16.09	22.22	13.33
KB4	0.04	84	41.5	50.6	26.67	16	21.07	12.64
KB5	0.065	84	37	54.9	25.92	15.55	20.88	12.53
KB6	0.0144	84	13.6	63.3	13.18	7.91	10.35	6.21
KB7	0.0198	84	29.6	30.1	22.80	13.68	17.27	10.36
KB8	0.051	84	8.9	48	29.53	17.72	23.68	14.21
KB9	0.0936	84	27.9	43.7	31.63	18.98	21.38	12.83
KB10	0.0444	83.2	15.5	37.1	24.97	14.98	19.85	11.91
KB11	0.0334	83.8	31	33.1	27.93	16.76	22.53	13.52
KB12	0.0383	83.4	24.9	24.9	23.15	13.89	18.88	11.33
KB13	0.1197	83.4	52.1	52.4	21.37	12.82	17.45	10.47
KB14	0.1242	83.5	3.6	62.3	28.15	16.89	22.67	13.6
KB15	0.2412	84	1.7	70.6	46.55	27.93	38.45	23.07
KB16	0.0334	84	41.3	41.3	28.42	17.05	24.02	14.41
KB17	0.2948	84	45.3	73.7	50.33	30.2	42.37	25.42
KB18	0.1945	84	39.7	71.6	48.45	29.07	40.98	24.59
KB19	0.0312	83	47.7	47.7	17.33	10.4	13.20	7.92
KB20	0.131	80.1	38.6	41.2	24.93	14.96	20.30	12.18
KB21	0.0892	82.5	17.7	22.5	14.92	8.95	12.42	7.45
KB22	0.2027	84	6.1	47.7	42.48	25.49	35.20	21.12
KB23	0.1198	75.1	31	61	20.45	12.27	16.65	9.99
KB24	0.0228	80.5	10.9	21.9	14.57	8.74	11.30	6.78
KB25	0.0497	69.9	9.5	25.2	24.43	14.66	19.58	11.75
KB26	0.1273	81.6	1	1	26.22	15.73	21.30	12.78
KB27	0.1905	83.4	2.9	65.6	37.43	22.46	31.20	18.72
KB28	0.0725	70.5	7.5	14.3	32.77	19.66	25.42	15.25
KB29	0.1013	73	2.9	8.8	22.33	13.4	17.72	10.63
KB30	0.1539	75.5	2.3	9.6	33.33	20	26.78	16.07
KB31	0.0272	84	35.6	35.6	26.22	15.73	21.98	13.19
KB32	0.0417	82.2	23.6	27.8	19.95	11.97	15.58	9.35
KB33	0.1034	84	1.5	1.8	33.25	19.95	27.08	16.25
KB34	0.0651	83.6	1	71	32.70	19.62	26.10	15.66
KB35	0.0174	79.8	42.8	42.8	16.43	9.86	12.45	7.47

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



1.2 TIME OF CONCENTRATION

The Times of Concentration for Keller Branch were traced using the 2009 LiDAR data. and verified with the 2019 aerial imagery. Where possible. flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Keller Branch flows through a series of residential areas. The heavy development and small size of many sub-basins on the west side of the watershed contribute to relatively low times of concentration. The east side of the watershed has generally longer times for the opposite reasons. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

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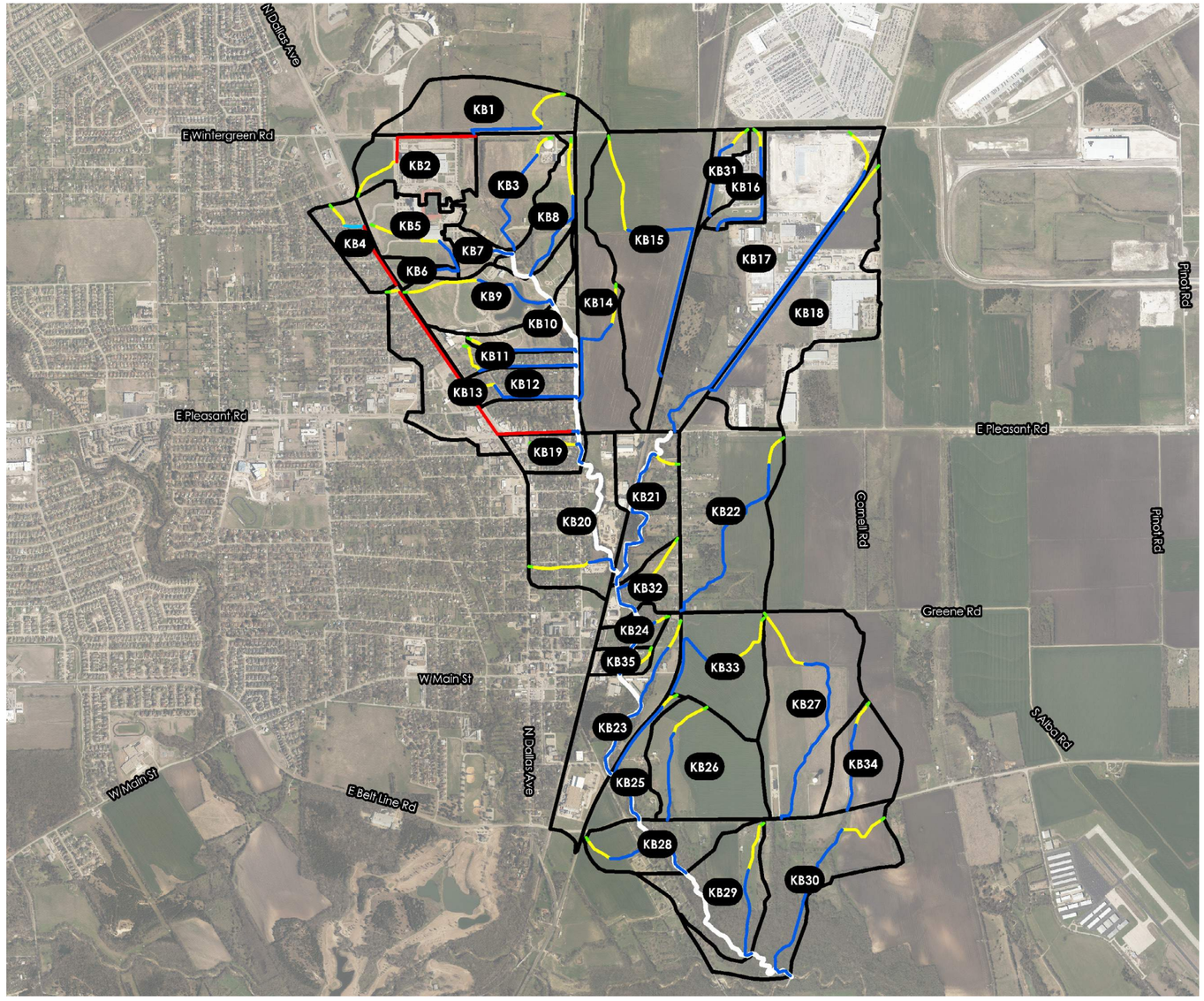


TIME OF CONCENTRATION REPORT

KB1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.67	0.240	0.00	0.1	14.47
SHALLOW	UNPAVED	890	0.76	0.000	16.10	1.4	10.58
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,331	4.56	0.050	28.69	6.1	3.62
		2,321					**28.68**
							22.42

KB2

OVERLAND	GRS-DENSE	100	1.2	0.240	0.00	0.1	16.49
SHALLOW	PAVED	65	3.65	0.000	20.30	3.9	0.28
SHALLOW	UNPAVED	816	1.84	0.000	16.10	2.2	6.23
PIPE	36" RCP	1,810	1.57	0.014	87.62	11.0	2.75
		2,791					**25.76**
							21.57

KB3

OVERLAND	GRS-DENSE	100	1.26	0.240	0.00	0.1	16.21
SHALLOW	UNPAVED	353	2.71	0.000	16.10	2.6	2.22
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,610	1.46	0.050	28.69	3.5	7.75
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	419	6.58	0.050	42.29	10.8	0.64
		2,482					**26.82**
							22.21

KB4

OVERLAND	GRS-DENSE	100	0.77	0.240	0.00	0.1	19.72
SHALLOW	UNPAVED	351	1.78	0.000	16.10	2.2	2.72
GUTTER	G-12	355	1.21	0.018	23.64	2.6	2.28
PIPE	36" RCP	1,177	1.32	0.014	87.62	10.1	1.94
		1,983					**26.67**
							21.06

KB5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.49	0.240	0.00	0.1	15.12
SHALLOW	PAVED	826	1.87	0.000	20.30	2.8	4.96
SHALLOW	UNPAVED	417	1.54	0.000	16.10	2.0	3.48
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	610	2.28	0.050	28.69	4.3	2.35
		1,954					**25.91**
							20.89

KB6

OVERLAND	GRS-DENSE	100	5.1	0.240	0.00	0.2	9.25
SHALLOW	UNPAVED	272	1.85	0.000	16.10	2.2	2.07
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	747	5.44	0.050	28.69	6.7	1.86
		1,119					**13.18**
							10.35

KB7

OVERLAND	GRS-DENSE	100	0.83	0.240	0.00	0.1	19.09
SHALLOW	UNPAVED	392	1.77	0.000	16.10	2.1	3.05
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	453	7.29	0.050	42.29	11.4	0.66
		945					**22.80**
							17.27

KB8

OVERLAND	GRS-DENSE	100	1.74	0.240	0.00	0.1	14.23
SHALLOW	UNPAVED	924	1.09	0.000	16.10	1.7	9.15
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	896	1.68	0.050	28.69	3.7	4.01
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	805	2.21	0.050	42.29	6.3	2.14
		2,725					**29.53**
							23.69

KB9

OVERLAND	GRS-DENSE	100	1.39	0.240	0.00	0.1	15.55
SHALLOW	UNPAVED	1,244	1.49	0.000	16.10	2.0	10.55
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	637	1.43	0.050	28.69	3.4	3.10
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	908	2.15	0.050	42.29	6.2	2.44
		2,889					**31.64**
							21.39

TIME OF CONCENTRATION REPORT - CONTINUED

KB10

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.19	0.240	0.00	0.1	16.55
SHALLOW	UNPAVED	659	2.97	0.000	16.10	2.8	3.96
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,220	2.52	0.050	28.69	4.6	4.46
		1,979					**24.97**
							19.84

KB11

OVERLAND	GRS-DENSE	100	1	0.240	0.00	0.1	17.73
SHALLOW	UNPAVED	485	1.69	0.000	16.10	2.1	3.87
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,748	2.56	0.050	28.69	4.6	6.34
		2,333					**27.94**
							22.54

KB12

OVERLAND	GRS-DENSE	100	1.43	0.240	0.00	0.1	15.41
SHALLOW	UNPAVED	273	2.86	0.000	16.10	2.7	1.67
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,497	2.13	0.050	28.69	4.2	5.96
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	72	5.97	0.050	42.29	10.3	0.12
		1,942					**23.15**
							18.88

KB13

OVERLAND	GRS-DENSE	100	1.57	0.240	0.00	0.1	14.81
SHALLOW	UNPAVED	150	3.57	0.000	16.10	3.0	0.82
PIPE	36" RCP	4,372	2.32	0.014	87.62	13.4	5.46
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	133	7.77	0.050	28.69	8.0	0.28
		4,756					**21.36**
							17.45

KB14

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.38	0.240	0.00	0.1	15.59
SHALLOW	UNPAVED	620	1.02	0.000	16.10	1.6	6.34
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	663	1.36	0.050	28.69	3.3	3.30
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,118	2.3	0.050	42.29	6.4	2.91
		2,502					**28.15**
							22.67

KB15

OVERLAND	GRS-DENSE	100	1.17	0.240	0.00	0.1	16.69
SHALLOW	UNPAVED	1,642	1.17	0.000	16.10	1.7	15.71
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,153	0.82	0.050	28.69	2.6	7.41
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,697	2.49	0.050	42.29	6.7	6.74
		5,591					**46.55**
							38.45

KB16

OVERLAND	GRS-DENSE	100	2.26	0.240	0.00	0.1	12.82
SHALLOW	UNPAVED	273	0.35	0.000	16.10	1.0	4.78
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,087	0.58	0.050	42.29	3.2	10.82
		2,460					**28.42**
							24.02

KB17

OVERLAND	GRS-DENSE	100	0.59	0.240	0.00	0.1	21.95
SHALLOW	UNPAVED	719	0.57	0.000	16.10	1.2	9.90
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	4,670	2.69	0.050	28.69	4.7	16.54
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,270	6.57	0.050	42.29	10.8	1.95
		6,760					**50.33**
							42.37

KB18

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.24	0.240	0.00	0.1	16.31
SHALLOW	UNPAVED	930	0.51	0.000	16.10	1.1	13.50
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,968	1.53	0.050	28.69	3.5	18.64
		4,999					**48.44**
							40.99

KB19

OVERLAND	GRS-DENSE	100	2.85	0.240	0.00	0.1	11.68
SHALLOW	UNPAVED	738	2.45	0.000	16.10	2.5	4.88
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	448	5.04	0.050	42.29	9.5	0.79
		1,286					**17.34**
							13.20

KB20

OVERLAND	GRS-DENSE	100	1.02	0.240	0.00	0.1	17.60
SHALLOW	PAVED	179	2.48	0.000	20.30	3.2	0.93
SHALLOW	UNPAVED	814	2.61	0.000	16.10	2.6	5.21
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	378	6.86	0.050	28.69	7.5	0.84
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	199	5.05	0.050	42.29	9.5	0.35
		1,670					**24.93**
							20.30

KB21

OVERLAND	GRS-DENSE	100	7.29	0.240	0.00	0.2	8.02
SHALLOW	UNPAVED	366	3.67	0.000	16.10	3.1	1.98
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,045	5.93	0.050	42.29	10.3	4.93
		3,510					**14.92**
							12.42

KB22

OVERLAND	GRS-DENSE	100	0.51	0.240	0.00	0.1	23.25
SHALLOW	UNPAVED	484	0.72	0.000	16.10	1.4	5.89
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,300	1.51	0.050	28.69	3.5	10.86
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,138	3.26	0.050	42.29	7.6	2.49
		4,022					**42.48**
							35.20

KB23

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.65	0.240	0.00	0.1	12.02
SHALLOW	UNPAVED	442	2.07	0.000	16.10	2.3	3.18
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	581	3.3	0.050	28.69	5.2	1.86
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,061	5.75	0.050	42.29	10.1	3.39
		3,184					**20.45**
							16.65

KB24

OVERLAND	GRS-DENSE	100	2.58	0.240	0.00	0.1	12.15
SHALLOW	UNPAVED	171	3.93	0.000	16.10	3.2	0.89
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	390	5.76	0.050	28.69	6.9	0.95
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	345	5.64	0.050	42.29	10.0	0.57
		1,006					**14.56**
							11.30

KB25

OVERLAND	GRS-DENSE	100	1.15	0.240	0.00	0.1	16.82
SHALLOW	UNPAVED	247	1.01	0.000	16.10	1.6	2.54
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,471	6.33	0.050	28.69	7.2	3.40
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	978	5.29	0.050	42.29	9.7	1.68
		2,795					**24.43**
							19.59

KB26

OVERLAND	GRS-DENSE	100	2.15	0.240	0.00	0.1	13.06
SHALLOW	UNPAVED	675	1.13	0.000	16.10	1.7	6.58
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,180	1.34	0.050	28.69	3.3	5.91
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	385	5.32	0.050	42.29	9.8	0.66
		2,339					**26.21**
							21.30

KB27

OVERLAND	GRS-DENSE	100	1.28	0.240	0.00	0.1	16.11
SHALLOW	UNPAVED	1,100	1.66	0.000	16.10	2.1	8.83
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,465	2.59	0.050	28.69	4.6	12.50
		4,665					**37.43**
							31.20

TIME OF CONCENTRATION REPORT - CONTINUED

KB28

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.51	0.240	0.00	0.1	23.20
SHALLOW	UNPAVED	477	0.63	0.000	16.10	1.3	6.21
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	975	5.47	0.050	28.69	6.7	2.42
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	706	8.74	0.050	42.29	12.5	0.94
		2,257					**32.77**
							25.42

KB29

OVERLAND	GRS-DENSE	100	2.66	0.240	0.00	0.1	12.01
SHALLOW	UNPAVED	803	1.67	0.000	16.10	2.1	6.44
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,515	5.72	0.050	28.69	6.9	3.68
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	122	5.48	0.050	42.29	9.9	0.21
		2,540					**22.33**
							17.72

KB30

OVERLAND	GRS-DENSE	100	0.65	0.240	0.00	0.1	21.09
SHALLOW	UNPAVED	846	2.88	0.000	16.10	2.7	5.16
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,912	6.72	0.050	28.69	7.4	6.52
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	338	5.56	0.050	42.29	10.0	0.56
		4,196					**33.34**
							26.78

KB31

OVERLAND	GRS-DENSE	100	2.02	0.240	0.00	0.1	13.39
SHALLOW	UNPAVED	295	0.74	0.000	16.10	1.4	3.55
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,417	0.79	0.050	28.69	2.5	9.27
		1,812					**26.21**
							21.98

KB32

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.59	0.240	0.00	0.1	12.14
SHALLOW	UNPAVED	698	1.84	0.000	16.10	2.2	5.32
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	663	6.51	0.050	28.69	7.3	1.51
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	584	5.54	0.050	42.29	10.0	0.98
		2,045					**19.95**
							15.59

KB33

OVERLAND	GRS-DENSE	100	0.97	0.240	0.00	0.1	18.00
SHALLOW	UNPAVED	935	2.13	0.000	16.10	2.4	6.63
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,283	1.88	0.050	28.69	3.9	5.44
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,004	1.56	0.050	42.29	5.3	3.17
		3,322					**33.24**
							27.08

KB34

OVERLAND	GRS-DENSE	100	0.59	0.240	0.00	0.1	21.89
SHALLOW	UNPAVED	366	0.69	0.000	16.10	1.3	4.56
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,230	1.5	0.050	28.69	3.5	5.83
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	299	7.83	0.050	42.29	11.8	0.42
		1,995					**32.71**
							26.10

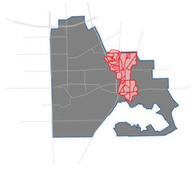
KB35

OVERLAND	GRS-DENSE	100	2.33	0.240	0.00	0.1	12.66
SHALLOW	UNPAVED	506	2.49	0.000	16.10	2.5	3.32
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	138	5.43	0.050	28.69	6.7	0.34
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	67	5.3	0.050	42.29	9.7	0.12
		811					**16.44**
							12.45

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



1.3 SOILS MAP

Keller Branch watershed has three different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type C, which is more permeable than soil type D is found within many of the west sub-basins. Soil group B (more permeable than C) is primarily found in the souther sub-basins. Hydrologic soil groups A is not present in the Keller Branch watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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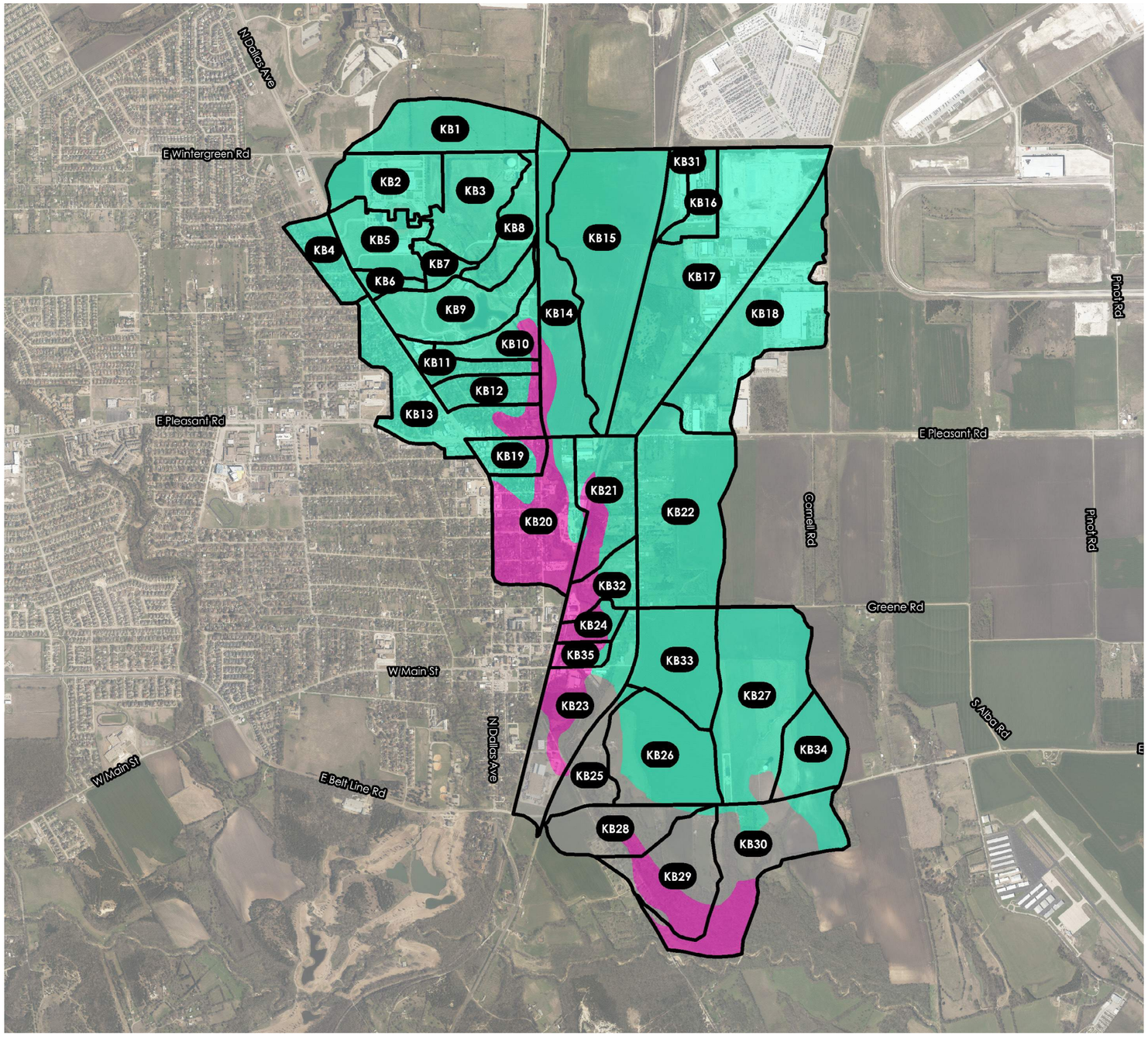


PERVIOUS CURVE NUMBER REPORT

KB1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	62.9	84.0
		62.9	**84.0**

KB2

D	84	49.6	84.0
		49.6	**84.0**

KB3

D	84	59.2	84.0
		59.2	**84.0**

KB4

D	84	25.6	84.0
		25.6	**84.0**

KB5

D	84	41.6	84.0
		41.6	**84.0**

KB6

D	84	9.2	84.0
		9.2	**84.0**

KB7

D	84	12.7	84.0
		12.7	**84.0**

KB8

D	84	32.6	84.0
		32.6	**84.0**

KB9

D	84	59.9	84.0
		59.9	**84.0**

KB10

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
C	79	4.6	12.8
D	84	23.8	70.4
		28.4	**83.2**

KB11

C	79	1.0	3.7
D	84	20.4	80.1
		21.4	**83.8**

KB12

C	79	2.8	8.9
D	84	21.7	74.5
		24.5	**83.4**

KB13

C	79	9.5	9.8
D	84	67.1	73.6
		76.6	**83.4**

KB14

C	79	8.4	8.4
D	84	71.0	75.1
		79.5	**83.5**

KB15

D	84	154.4	84.0
		154.4	**84.0**

KB16

D	84	21.4	84.0
		21.4	**84.0**

KB17

D	84	188.7	84.0
		188.7	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

PERVIOUS CURVE NUMBER REPORT - CONTINUED

KB18

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	124.5	84.0
		124.5	**84.0**

KB19

C	79	4.2	16.5
D	84	15.8	66.5
		20.0	**83.0**

KB20

C	79	65.2	61.4
D	84	18.7	18.7
		83.9	**80.1**

KB21

C	79	17.1	23.7
D	84	40.0	58.8
		57.1	**82.5**

KB22

D	84	129.7	84.0
		129.7	**84.0**

KB23

B	69	37.8	34.1
C	79	23.3	24.0
D	84	15.5	17.0
		76.7	**75.1**

KB24

C	79	10.1	54.7
D	84	4.5	25.8
		14.6	**80.5**

KB25

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
B	69	29.8	64.6
C	79	0.3	0.8
D	84	1.7	4.5
		31.8	**69.9**

KB26

B	69	13.0	11.0
D	84	68.4	70.6
		81.4	**81.6**

KB27

B	69	5.2	2.9
D	84	116.8	80.4
		121.9	**83.4**

KB28

B	69	40.2	59.8
C	79	4.5	7.7
D	84	1.6	3.0
		46.4	**70.5**

KB29

B	69	39.2	41.7
C	79	24.5	29.9
D	84	1.1	1.5
		64.8	**73.0**

KB30

B	69	46.3	32.5
C	79	28.1	22.5
D	84	24.0	20.5
		98.5	**75.5**

KB31			
SOIL TYPE	**CURVE NUMBER**	**SHAPE AREA (AREA)**	**AREA WEIGHTED CN**
D	84	17.4	84.0
		17.4	**84.0**

KB32			
C	79	9.8	29.0
D	84	16.9	53.1
		26.7	**82.2**

KB33			
D	84	66.2	84.0
		66.2	**84.0**

KB34			
B	69	1.2	1.9
D	84	40.5	81.6
		41.6	**83.6**

KB35			
C	79	9.2	65.7
D	84	1.9	14.2
		11.1	**79.8**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

6

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

3.22 SM

*

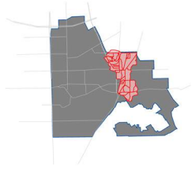
STREAM LENGTH

3.22 MI

*

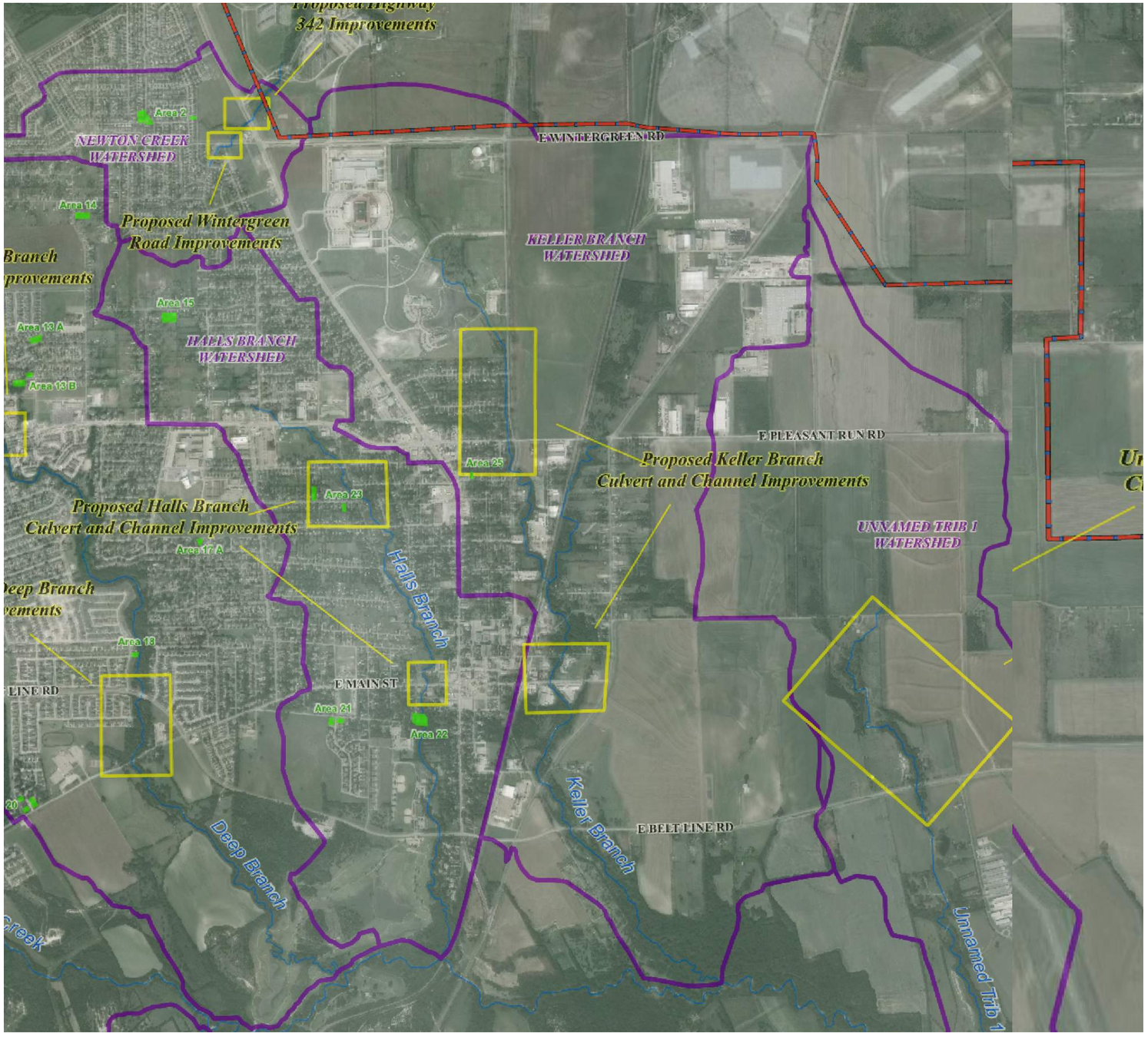
PROJECTS IDENTIFIED

1



1.4 AERIAL COMPARISON

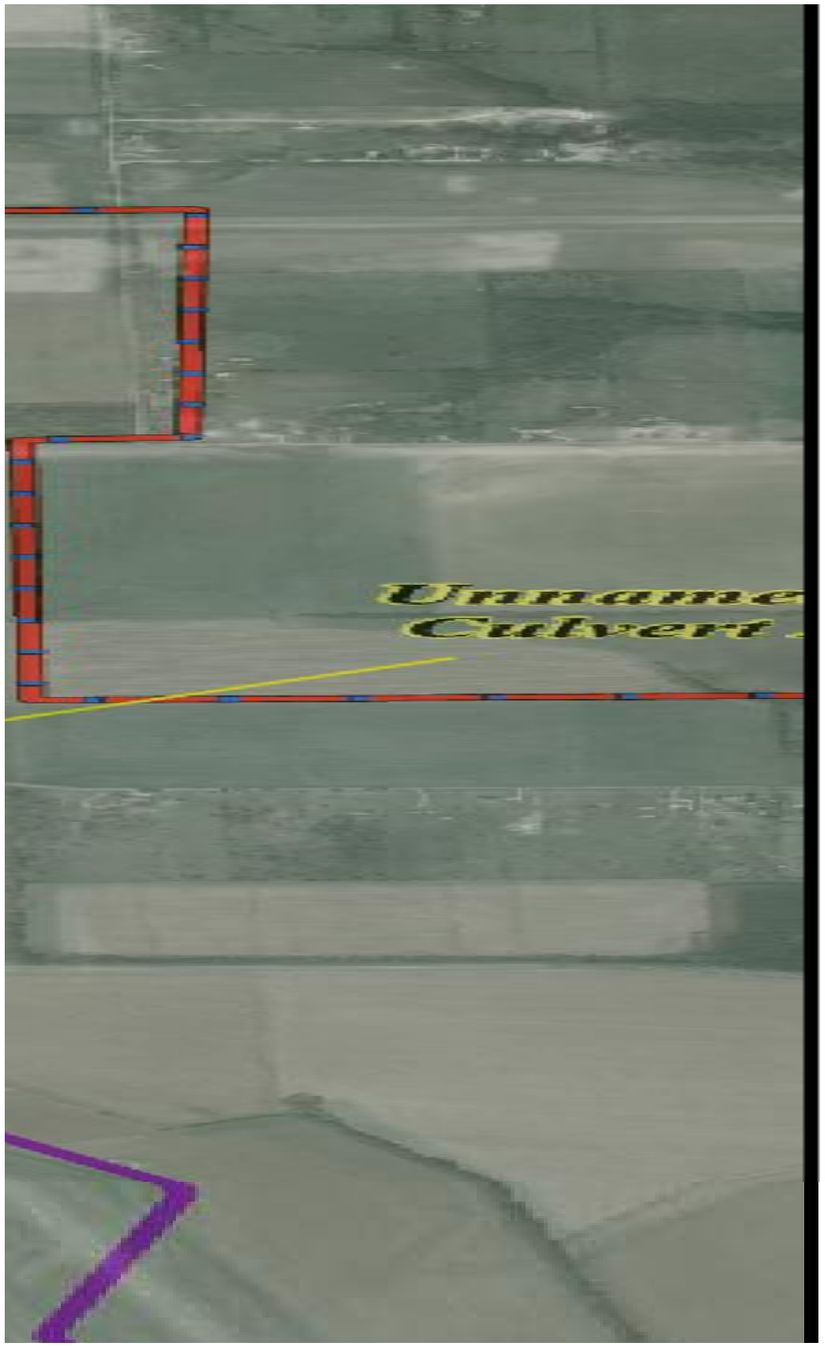
Aerial photography from 2019 shows only one significant development since 2007 within the Keller Branch watershed. New development consists of large parking areas. Specifically, this new development is located in sub-basins KB17 and KB18. The locations of new development are highlighted in red.



N

N.T.S.

2007





N

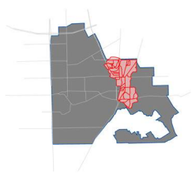
N.T.S.

2019

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



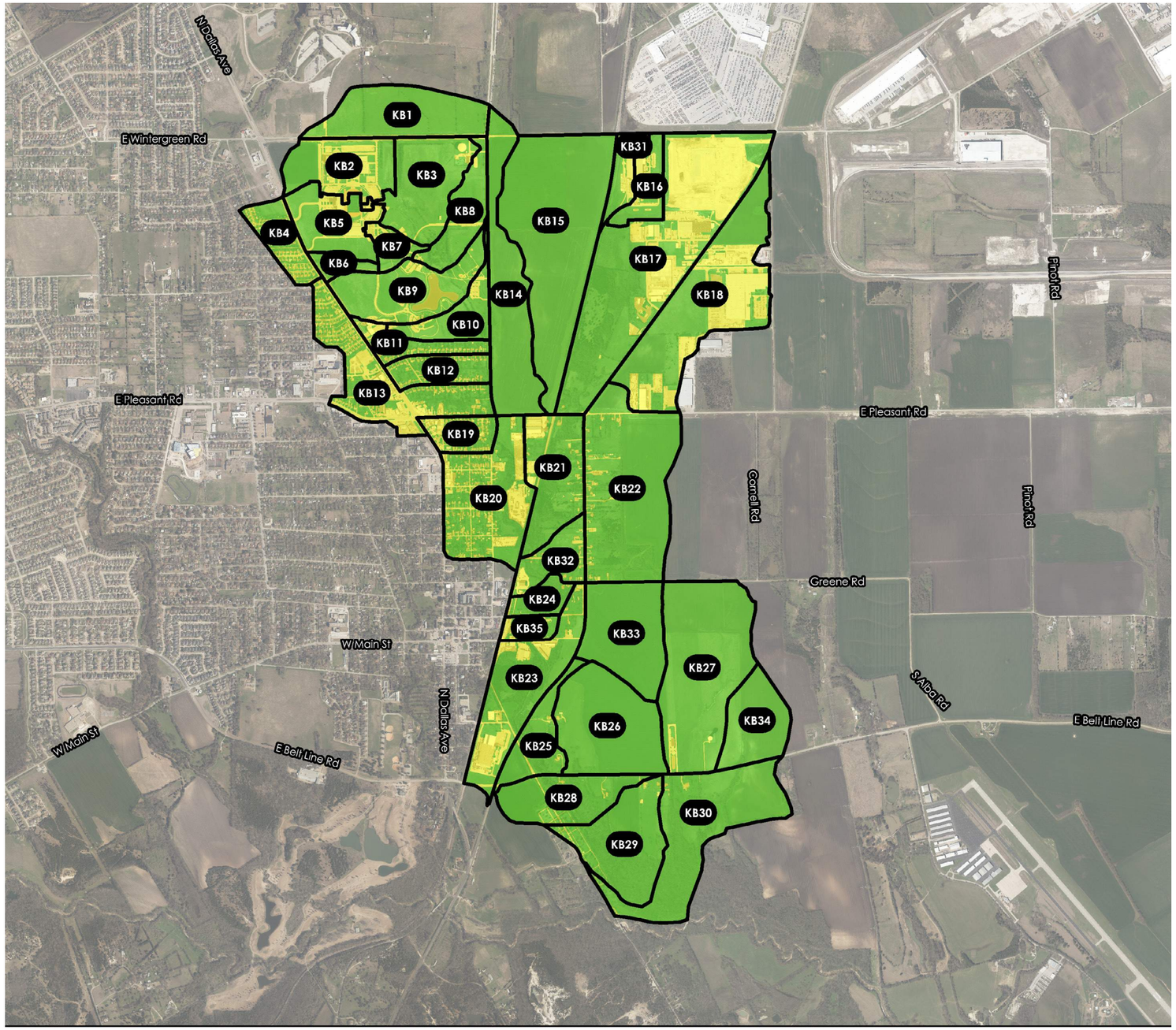
1.5 IMPERVIOUS AREA

Impervious areas for the Keller Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located on the west half of the watershed where residential neighborhoods are prevalent and the industrial developments in the northeast corner of the watershed.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

KB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	59.2	0.0
IMPERVIOUS	100	3.7	5.9
		62.9	**5.9**

KB2

OPEN SPACE (FAIR CONDITION)	0	26.7	0.0
IMPERVIOUS	100	22.9	46.2
		49.6	**46.2**

KB3

OPEN SPACE (FAIR CONDITION)	0	54.0	0.0
IMPERVIOUS	100	5.2	8.7
		59.2	**8.7**

KB4

OPEN SPACE (FAIR CONDITION)	0	15.0	0.0
IMPERVIOUS	100	10.6	41.5
		25.6	**41.5**

KB5

OPEN SPACE (FAIR CONDITION)	0	26.2	0.0
IMPERVIOUS	100	15.4	37.0
		41.6	**37.0**

KB6

OPEN SPACE (FAIR CONDITION)	0	8.0	0.0
IMPERVIOUS	100	1.2	13.6
		9.2	**13.6**

KB7

OPEN SPACE (FAIR CONDITION)	0	8.9	0.0
IMPERVIOUS	100	3.8	29.6
		12.7	**29.6**

KB8

OPEN SPACE (FAIR CONDITION)	0	29.7	0.0
IMPERVIOUS	100	2.9	8.9
		32.6	**8.9**

KB9

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	43.2	0.0
IMPERVIOUS	100	16.7	27.9
		59.9	**27.9**

KB10

OPEN SPACE (FAIR CONDITION)	0	24.0	0.0
IMPERVIOUS	100	4.4	15.5
		28.4	**15.5**

KB11

OPEN SPACE (FAIR CONDITION)	0	14.8	0.0
IMPERVIOUS	100	6.6	31.0
		21.4	**31.0**

KB12

OPEN SPACE (FAIR CONDITION)	0	18.4	0.0
IMPERVIOUS	100	6.1	24.9
		24.5	**24.9**

KB13

OPEN SPACE (FAIR CONDITION)	0	36.7	0.0
IMPERVIOUS	100	39.9	52.1
		76.6	**52.1**

KB14

OPEN SPACE (FAIR CONDITION)	0	76.6	0.0
IMPERVIOUS	100	2.9	3.6
		79.5	**3.6**

KB15

OPEN SPACE (FAIR CONDITION)	0	151.7	0.0
IMPERVIOUS	100	2.7	1.7
		154.4	**1.7**

KB16

OPEN SPACE (FAIR CONDITION)	0	12.5	0.0
IMPERVIOUS	100	8.8	41.3
		21.4	**41.3**

EXISTING PERCENT IMPERVIOUS REPORT - CONTINUED

KB17

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	103.2	0.0
IMPERVIOUS	100	85.5	45.3
		188.7	**45.3**

KB18

OPEN SPACE (FAIR CONDITION)	0	75.0	0.0
IMPERVIOUS	100	49.5	39.7
		124.5	**39.7**

KB19

OPEN SPACE (FAIR CONDITION)	0	10.4	0.0
IMPERVIOUS	100	9.5	47.7
		20.0	**47.7**

KB20

OPEN SPACE (FAIR CONDITION)	0	51.5	0.0
IMPERVIOUS	100	32.4	38.6
		83.9	**38.6**

KB21

OPEN SPACE (FAIR CONDITION)	0	47.0	0.0
IMPERVIOUS	100	10.1	17.7
		57.1	**17.7**

KB22

OPEN SPACE (FAIR CONDITION)	0	121.8	0.0
IMPERVIOUS	100	7.9	6.1
		129.7	**6.1**

KB23

OPEN SPACE (FAIR CONDITION)	0	52.9	0.0
IMPERVIOUS	100	23.7	31.0
		76.7	**31.0**

KB24

OPEN SPACE (FAIR CONDITION)	0	13.0	0.0
IMPERVIOUS	100	1.6	10.9
		14.6	**10.9**

KB25

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	28.8	0.0
IMPERVIOUS	100	3.0	9.5
		31.8	**9.5**

KB26

OPEN SPACE (FAIR CONDITION)	0	80.6	0.0
IMPERVIOUS	100	0.8	1.0
		81.4	**1.0**

KB27

OPEN SPACE (FAIR CONDITION)	0	118.4	0.0
IMPERVIOUS	100	3.5	2.9
		121.9	**2.9**

KB28

OPEN SPACE (FAIR CONDITION)	0	42.9	0.0
IMPERVIOUS	100	3.5	7.5
		46.4	**7.5**

KB29

OPEN SPACE (FAIR CONDITION)	0	63.0	0.0
IMPERVIOUS	100	1.8	2.9
		64.8	**2.9**

KB30

OPEN SPACE (FAIR CONDITION)	0	96.2	0.0
IMPERVIOUS	100	2.2	2.3
		98.5	**2.3**

KB31

OPEN SPACE (FAIR CONDITION)	0	11.2	0.0
IMPERVIOUS	100	6.2	35.6
		17.4	**35.6**

KB32

OPEN SPACE (FAIR CONDITION)	0	20.4	0.0
IMPERVIOUS	100	6.3	23.6
		26.7	**23.6**

KB33

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	65.2	0.0
IMPERVIOUS	100	1.0	1.5
		66.2	**1.5**

KB34

OPEN SPACE (FAIR CONDITION)	0	41.2	0.0
IMPERVIOUS	100	0.4	1.0
		41.6	**1.0**

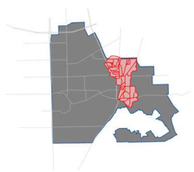
KB35

OPEN SPACE (FAIR CONDITION)	0	6.4	0.0
IMPERVIOUS	100	4.8	42.8
		11.1	**42.8**

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



1.0 HYDROLOGY

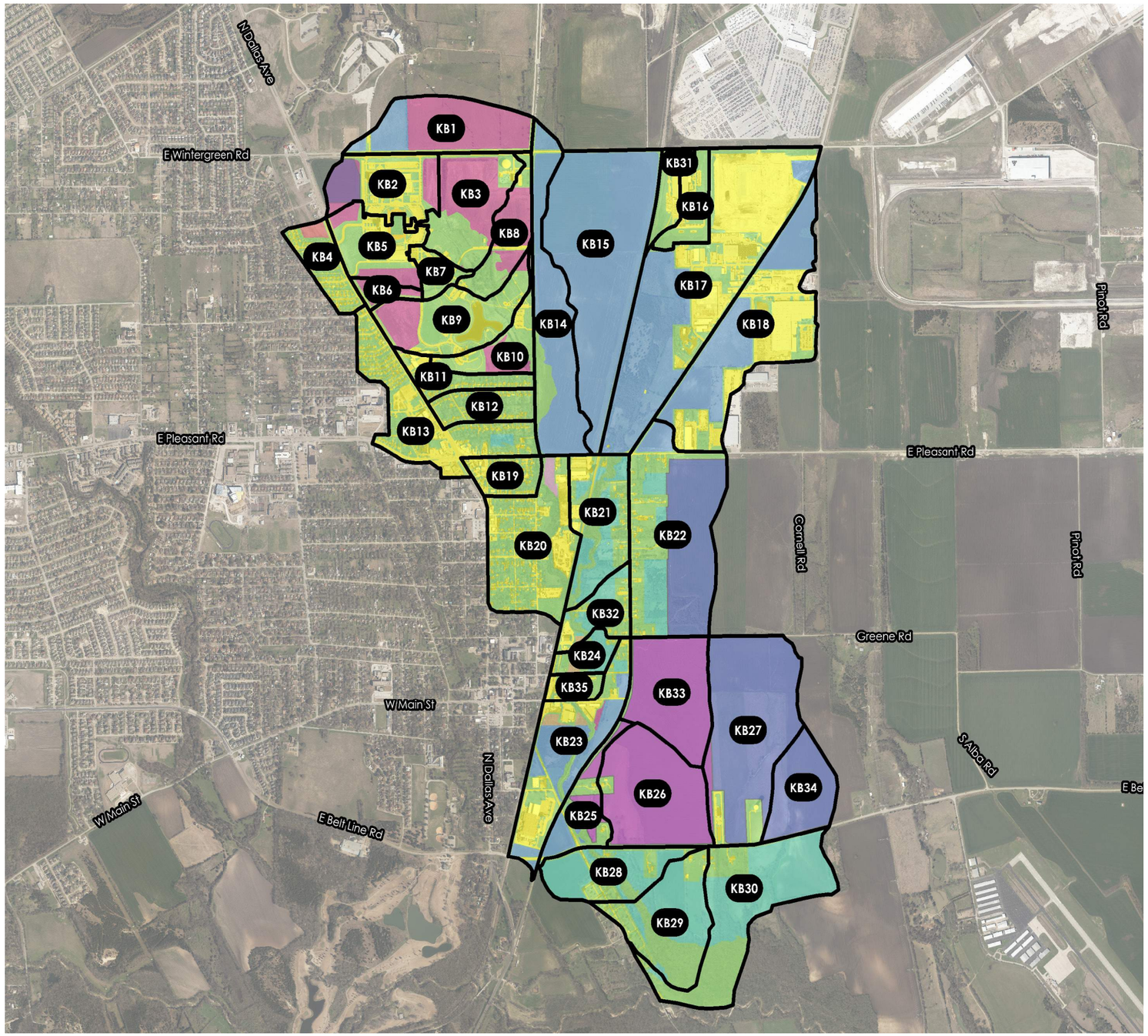
1.6 FUTURE LAND USE MAP

The majority of the watershed is located within City of Lancaster. The undeveloped land use within the watershed consist of mostly Industrial, Commercial and Avaition, with some unused areas for Rural Living. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- COMMERCIAL CORRIDOR
- R - URBAN NEIGHBORHOOD
- SURBURBAN MIXED USE CENTER
- PRIVATE OPEN SPACES
- AVIATION

N

N.T.S.



ULTIMATE PERCENT IMPERVIOUS REPORT

KB1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	2.8	0.0
IMPERVIOUS AREAS	100	3.7	5.9
LOGISTICS & DISTRIBUTION	72	12.7	14.6
PUBLIC & SEMI-PUBLIC	72	43.7	50.0
		62.9	**70.5**

KB2

OPEN SPACE (FAIR CONDITION)	0	9.7	0.0
IMPERVIOUS AREAS	100	22.9	46.2
COMMERCIAL NODE	85	9.7	16.6
PUBLIC & SEMI-PUBLIC	72	7.3	10.6
		49.6	**73.3**

KB3

OPEN SPACE (FAIR CONDITION)	0	23.3	0.0
IMPERVIOUS AREAS	100	5.2	8.7
PUBLIC & SEMI-PUBLIC	72	30.8	37.4
		59.2	**46.2**

KB4

IMPERVIOUS	100	1,335,698	32.7
LOGISTICS & DISTRIBUTION	72	1,563,408	27.6
MIXED-USE	85	11,661	0.2
OPEN SPACE	0	1,068,800	0.0
SUBURBAN MIXED-USE CENTER	85	101,528	2.1
		4,081,094	**62.7**

KB5

OPEN SPACE (FAIR CONDITION)	0	15.9	0.0
IMPERVIOUS AREAS	100	15.4	37.0
COMMERCIAL NODE	85	0.1	0.1
PUBLIC & SEMI-PUBLIC	72	10.3	17.8
		41.6	**54.9**

KB6

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	1.6	0.0
IMPERVIOUS AREAS	100	1.2	13.6
PUBLIC & SEMI-PUBLIC	72	6.4	49.7
		9.2	**63.3**

KB7

OPEN SPACE (FAIR CONDITION)	0	8.8	0.0
IMPERVIOUS AREAS	100	3.8	29.6
PUBLIC & SEMI-PUBLIC	72	0.1	0.5
		12.7	**30.1**

KB8

OPEN SPACE (FAIR CONDITION)	0	12.0	0.0
IMPERVIOUS AREAS	100	2.9	8.9
PUBLIC & SEMI-PUBLIC	72	17.7	39.1
		32.6	**48.0**

KB9

OPEN SPACE (FAIR CONDITION)	0	30.0	0.0
IMPERVIOUS AREAS	100	16.7	27.9
PUBLIC & SEMI-PUBLIC	72	13.2	15.8
		59.9	**43.7**

KB10

OPEN SPACE (FAIR CONDITION)	0	15.5	0.0
IMPERVIOUS AREAS	100	4.4	15.5
PUBLIC & SEMI-PUBLIC	72	8.5	21.5
		28.4	**37.1**

KB11

OPEN SPACE (FAIR CONDITION)	0	12.6	0.0
IMPERVIOUS AREAS	100	6.6	31.0
R - RURAL LIVING	12	1.9	1.1
PUBLIC & SEMI-PUBLIC	72	0.3	1.0
		21.4	**33.1**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

KB12

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	18.4	0.0
IMPERVIOUS AREAS	100	6.1	24.9
		24.5	**24.9**

KB13

OPEN SPACE (FAIR CONDITION)	0	34.7	0.0
IMPERVIOUS AREAS	100	39.9	52.1
R - RURAL LIVING	12	2.0	0.3
		76.6	**52.4**

KB14

OPEN SPACE (FAIR CONDITION)	0	11.9	0.0
IMPERVIOUS AREAS	100	2.9	3.6
LOGISTICS & DISTRIBUTION	72	64.7	58.6
		79.5	**62.3**

KB15

OPEN SPACE (FAIR CONDITION)	0	4.0	0.0
IMPERVIOUS AREAS	100	2.7	1.7
LOGISTICS & DISTRIBUTION	72	147.6	68.9
		154.4	**70.6**

KB16

OPEN SPACE (FAIR CONDITION)	0	12.5	0.0
IMPERVIOUS AREAS	100	8.8	41.3
		21.4	**41.3**

KB17

OPEN SPACE (FAIR CONDITION)	0	28.4	0.0
IMPERVIOUS AREAS	100	85.3	45.2
LOGISTICS & DISTRIBUTION	72	74.6	28.5
		188.4	**73.7**

KB18

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	20.0	0.0
IMPERVIOUS AREAS	100	49.5	39.7
LOGISTICS & DISTRIBUTION	72	55.1	31.8
		124.5	**71.6**

KB19

OPEN SPACE (FAIR CONDITION)	0	10.4	0.0
IMPERVIOUS AREAS	100	9.5	47.7
		20.0	**47.7**

KB20

OPEN SPACE (FAIR CONDITION)	0	48.9	0.0
IMPERVIOUS AREAS	100	32.4	38.6
COMMERCIAL CORRIDOR	85	2.6	2.6
		83.9	**41.2**

KB21

OPEN SPACE (FAIR CONDITION)	0	24.4	0.0
IMPERVIOUS AREAS	100	10.1	17.7
R - RURAL LIVING	12	22.5	4.7
COMMERCIAL CORRIDOR	85	0.0	0.1
		57.1	**22.5**

KB22

OPEN SPACE (FAIR CONDITION)	0	31.1	0.0
IMPERVIOUS AREAS	100	7.9	6.1
LOGISTICS & DISTRIBUTION	72	6.1	3.4
R - RURAL LIVING	12	18.8	1.7
AVIATION	72	65.7	36.5
		129.7	**47.7**

KB23

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	18.8	0.0
IMPERVIOUS AREAS	100	23.7	31.0
LOGISTICS & DISTRIBUTION	72	29.8	28.0
R - RURAL LIVING	12	1.4	0.2
R - SURBURBAN NEIGHBORHOOD	38	2.2	1.1
PUBLIC & SEMI-PUBLIC	72	0.8	0.7
		76.7	**61.0**

KB24

OPEN SPACE (FAIR CONDITION)	0	5.0	0.0
IMPERVIOUS AREAS	100	1.6	10.9
R - RURAL LIVING	12	5.6	4.6
R - SURBURBAN NEIGHBORHOOD	38	2.5	6.4
		14.6	**21.9**

KB25

OPEN SPACE (FAIR CONDITION)	0	11.4	0.0
IMPERVIOUS AREAS	100	3.0	9.5
LOGISTICS & DISTRIBUTION	72	6.9	15.6
R - RURAL LIVING	12	0.2	0.1
PRIVATE OPEN SPACES	0	10.4	0.0
		31.8	**25.2**

KB26

OPEN SPACE (FAIR CONDITION)	0	3.4	0.0
IMPERVIOUS AREAS	100	0.8	1.0
PRIVATE OPEN SPACES	0	77.2	0.0
		81.4	**1.0**

KB27

OPEN SPACE (FAIR CONDITION)	0	8.0	0.0
IMPERVIOUS AREAS	100	3.5	2.9
AVIATION	72	106.1	62.7
PRIVATE OPEN SPACES	0	4.3	0.0
		121.9	**65.6**

KB28

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	16.7	0.0
IMPERVIOUS AREAS	100	3.5	7.5
R - RURAL LIVING	12	26.3	6.8
		46.4	**14.3**

KB29

OPEN SPACE (FAIR CONDITION)	0	31.1	0.0
IMPERVIOUS AREAS	100	1.8	2.9
R - RURAL LIVING	12	31.9	5.9
		64.8	**8.8**

KB30

OPEN SPACE (FAIR CONDITION)	0	36.3	0.0
IMPERVIOUS AREAS	100	2.2	2.3
R - RURAL LIVING	12	59.9	7.3
		98.5	**9.6**

KB31

OPEN SPACE (FAIR CONDITION)	0	11.2	0.0
IMPERVIOUS AREAS	100	6.2	35.6
		17.4	**35.6**

KB32

OPEN SPACE (FAIR CONDITION)	0	12.1	0.0
IMPERVIOUS AREAS	100	6.3	23.6
R - RURAL LIVING	12	7.8	3.5
R - SURBURBAN NEIGHBORHOOD	38	0.5	0.7
		26.7	**27.8**

KB33

OPEN SPACE (FAIR CONDITION)	0	1.6	0.0
IMPERVIOUS AREAS	100	1.0	1.5
AVIATION	72	0.2	0.2
PRIVATE OPEN SPACES	0	63.3	0.0
		66.2	**1.8**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

KB34

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	0.7	0.0
IMPERVIOUS AREAS	100	0.4	1.0
AVIATION	72	40.5	70.0
		41.6	**71.0**

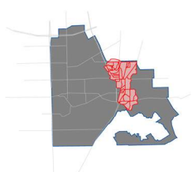
KB35

OPEN SPACE (FAIR CONDITION)	0	6.4	0.0
IMPERVIOUS AREAS	100	4.8	42.8
		11.1	**42.8**

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



1.7 RESULTS

The flow was analyzed at nineteen locations for Keller Branch. Flow location 18 was used to establish flows at the upstream end of the stream. Flow location 19 was used to establish flows at the upstream end of the tributary. Location 9 was included to analyze the peak discharges at the confluence between the main reach and the tributary. All other flow change locations excecpt for 1, 2, 3 and 16 were used to determien peak flows at road crossings. The remaining locations were intermediate sub-basins along the channel.



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FLOW ANALYSIS LOCATIONS

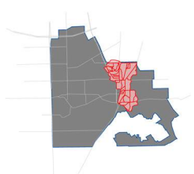
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Peak Flow (cfs)
1	KB1-KB35	Lower Reach	155	3.22	6000
2	KB1-KB26, KB28, KB29, KB31-KB33, KB35	Lower Reach	1039	2.81	5500
3	KB1-KB26, KB28, KB31-KB33, KB35	Lower Reach	4008	2.71	5600
4	KB1-KB25, KB31-KB33, KB35	Lower Reach	4641	2.64	5300
5	KB1-KB24, KB31, KB32, KB35	Lower Reach	5691	2.36	5000
6	KB1-KB22, KB24, KB31, KB32, KB35	Lower Reach	7868	2.24	4900
7	KB1-KB22, KB24, KB31, KB32	Lower Reach	8390	2.22	4800
8	KB1-KB22, KB31, KB32	Lower Reach	9057	2.20	4900
9	KB1-KB21, KB31	Lower Reach	9391	1.95	4200
10	KB1-KB14, KB19, KB20	Upper Reach	10052	1.07	2000
11	KB1-KB14, KB19	Upper Reach	12637	0.94	1900
12	KB1-KB14	Upper Reach	13242	0.91	1800
13	KB1-KB12	Upper Reach	13858	0.67	1400
14	KB1-KB11	Upper Reach	14467	0.63	1350
15	KB1-KB10	Upper Reach	15151	0.60	1300
16	KB1-KB9	Upper Reach	15845	0.55	1300
17	KB1-KB8	Upper Reach	16124	0.46	1200
18	KB1-KB7	Upper Reach	17236	0.41	1100
19	KB16-KB18, KB31	Tributary	3510	0.55	1650

2.0 HYDRAULICS

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.1 SITE ASSESSMENT

Keller Branch is located in the East half of the City of Lancaster. It flows from North to South for approximately 3.22 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Keller Branch within the limits of the City of Lancaster, roughly bound by Veteran's Memorial Parkway (upstream end) and its confluence with Ten Mile Creek (downstream end). The channel slope averages around 0.4-0.8%, and for the purposes of this study were divided into three separate reaches. Keller Branch channel is generally in a natural state, but because the stream winds through a heavily developed area, much of the overbanks have roadways and other structures. There are also a total of eleven (11) crossings throughout the watershed.



Looking upstream at the Veteran's Memorial Parkway culvert. The culvert appears to be in good condition. The area downstream of the culvert has heavy vegetation. Modeling shows this culvert has capacity for all storm events analyzed.



Looking downstream of 2nd Street culvert. The stream channel appears to be very rocky, with limited channel vegetation. Overbanks appear heavily vegetated.



Looking downstream towards the Lancaster Hutchins Road bridge. The large structure is not anticipated to overtop in any of the analyzed storm events. Channel bottom is wide and fairly clean.

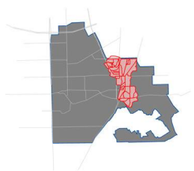


Looking downstream of Belt Line Road culvert. The channel further downstream has heavy vegetation. Also bridge appears slightly damaged.

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

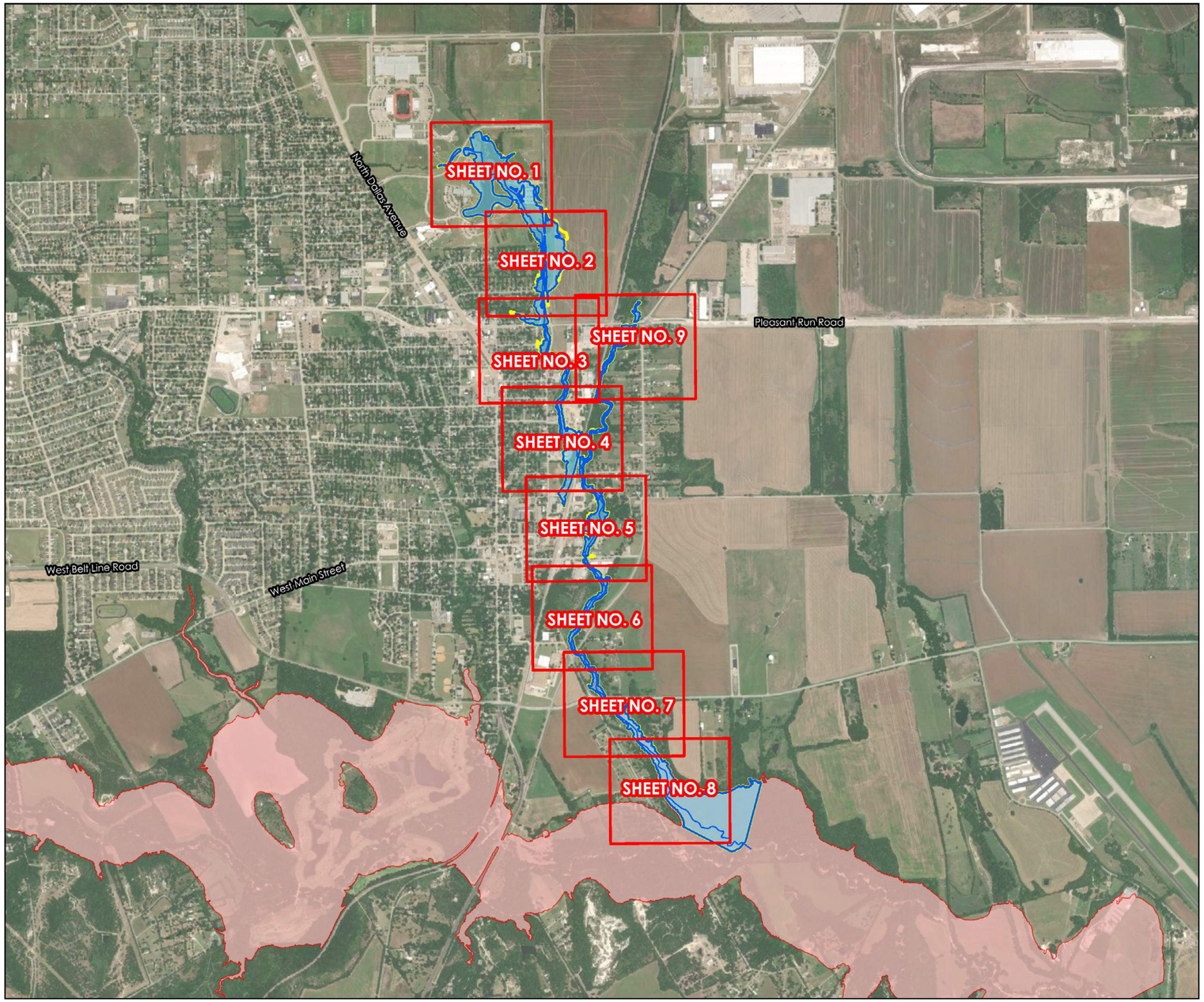
TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.2 FLOODPLAIN MAPPING

The Keller Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Keller Branch is comprised of one stream with two reaches and one tributary comprised of one reach. Tjhere are a total of ninety-two (92) cross sections, and eleven (11) hydraulic structures. The studied stream is 17,015 feet (3.22 miles) long. Near the confluence of the stream with Ten Mile Creek, the Keller Branch floodplain expands dramatically and inundates a large low-lying area.

The floodplain sheets for Keller Branch display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.



STREAM CENTERLINE
KELLER VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

N

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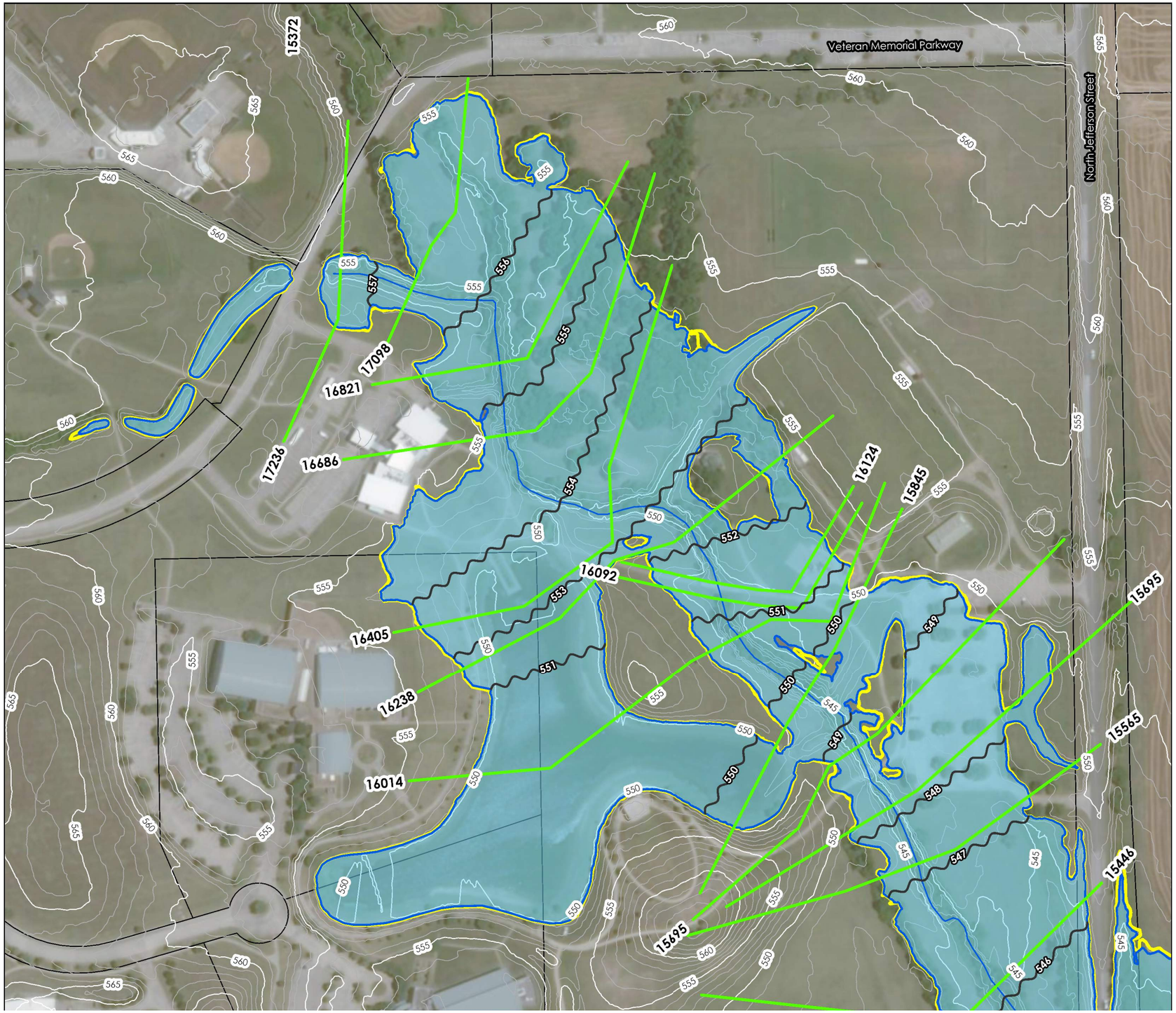
FLOODPLAIN: SHEET 1





N

0 100 200 Feet

ER CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
ER BASE FLOW ELEVATIONS
CEL

KELLER BRANCH

2.0 HYDRAULICS

WATERSHED NO.

6

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

3.22 SM

*

STREAM LENGTH

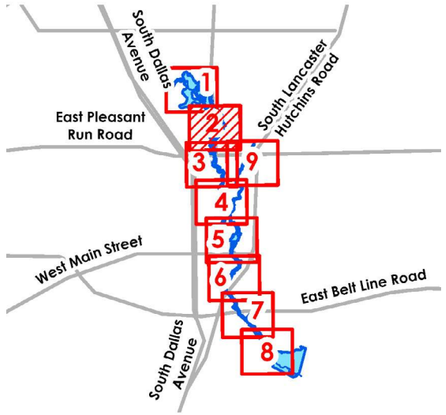
3.22 MI

*

PROJECTS IDENTIFIED

1

FLOODPLAIN: SHEET 2



N

0 100 200

Feet

ELLER CROSS SECTIONS

TREAM CENTERLINE

KISTING 100-YEAR FLOODPLAIN

LTIMATE 100-YEAR FLOODPLAIN

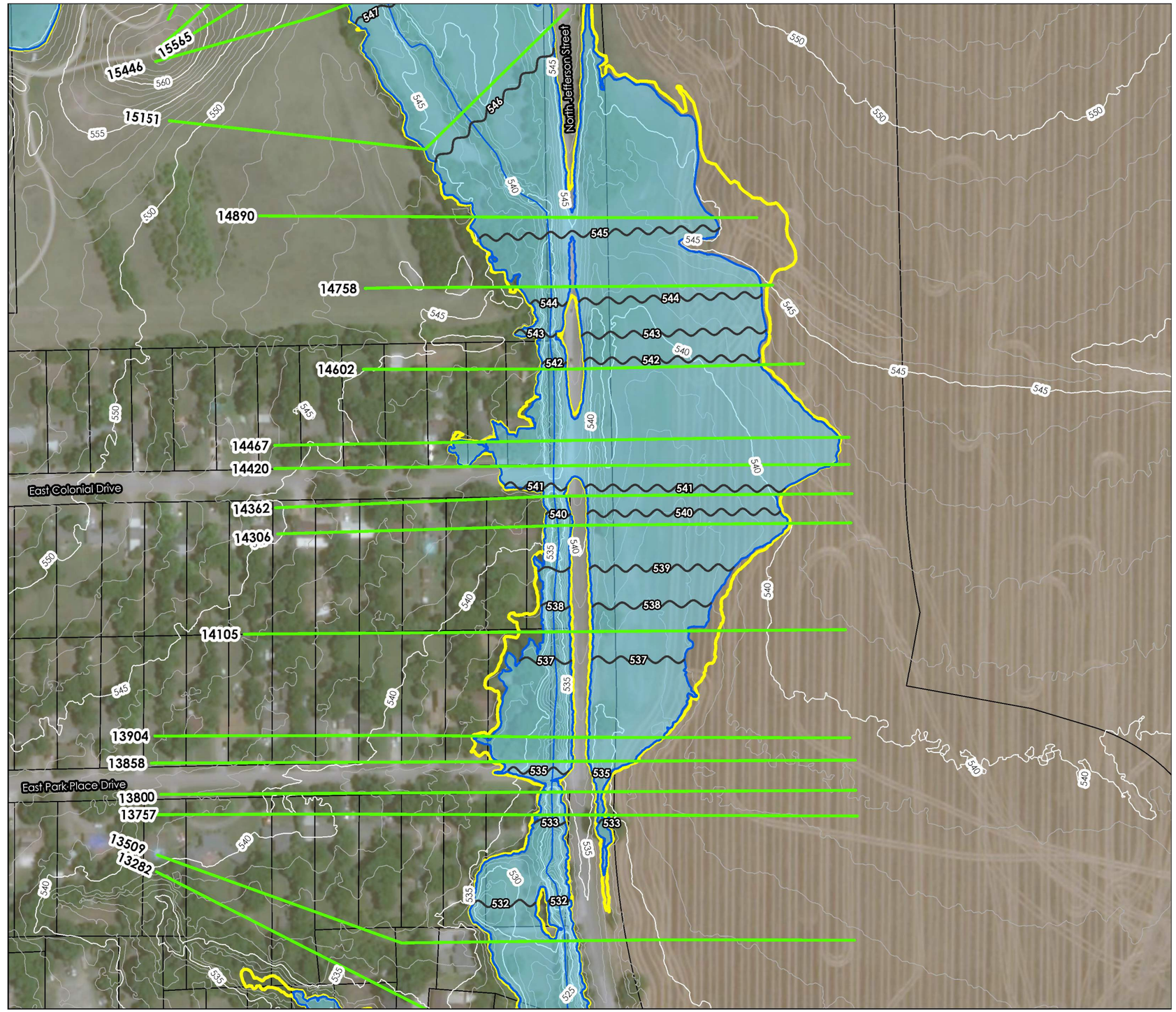
DAR MAJOR CONTOURS

DAR MINOR CONTOURS

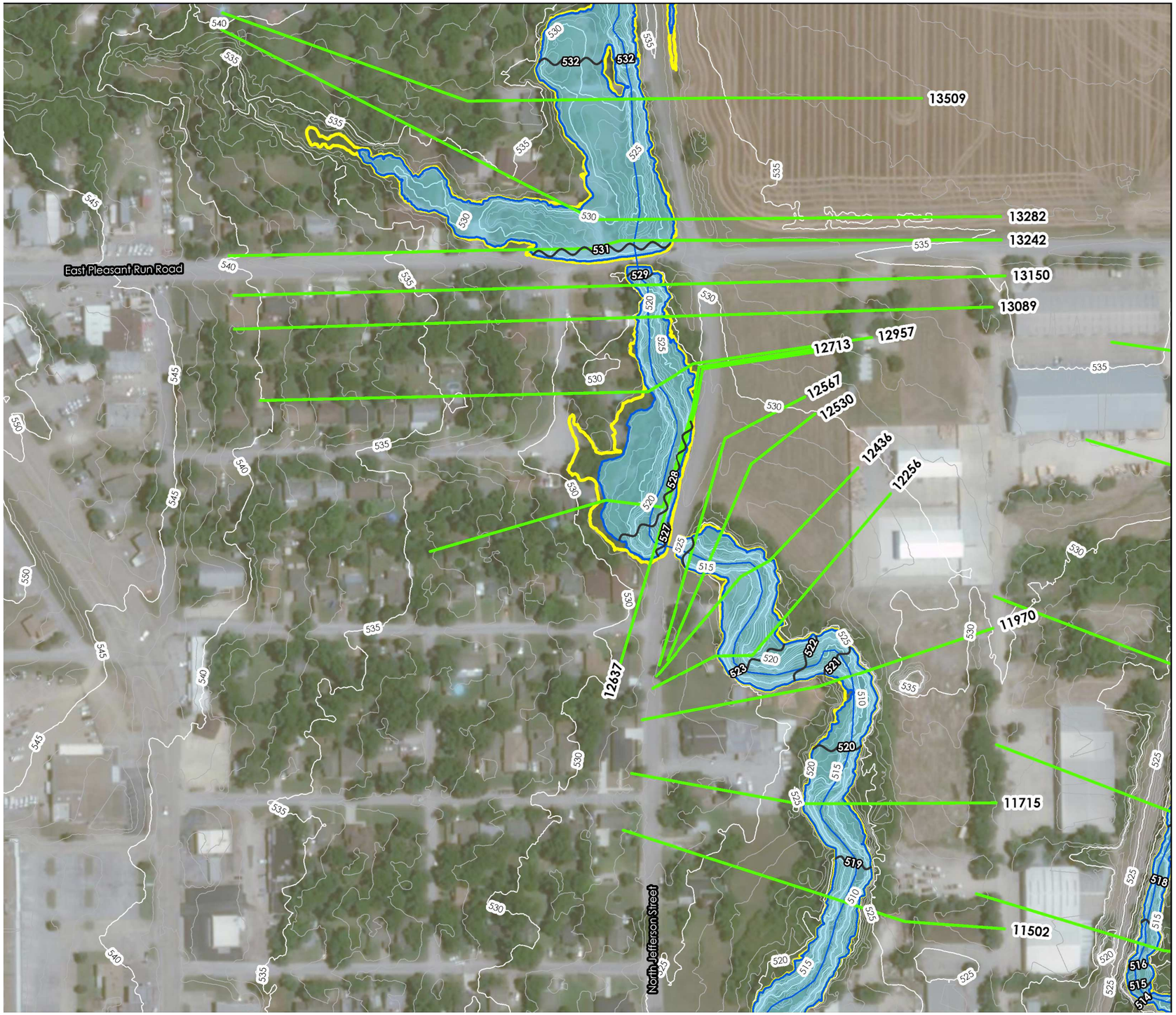
ELLER BASE FLOW ELEVATIONS

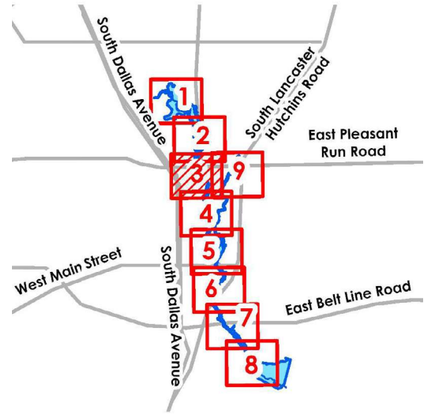
ARCEL

0



FLOODPLAIN: SHEET 3





N

0 100 200

Feet

ER CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
ER BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

6

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

3.22 SM

*

STREAM LENGTH

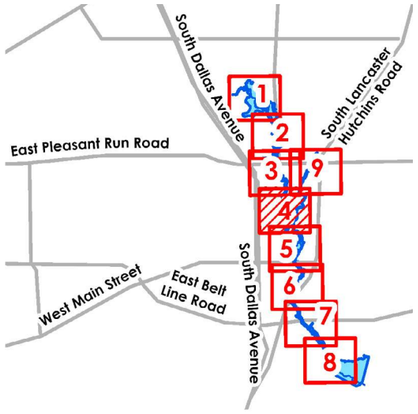
3.22 MI

*

PROJECTS IDENTIFIED

1

FLOODPLAIN: SHEET 4



N

0 100 200

Feet

ELLER CROSS SECTIONS

TREAM CENTERLINE

CISTING 100-YEAR FLOODPLAIN

LTIMATE 100-YEAR FLOODPLAIN

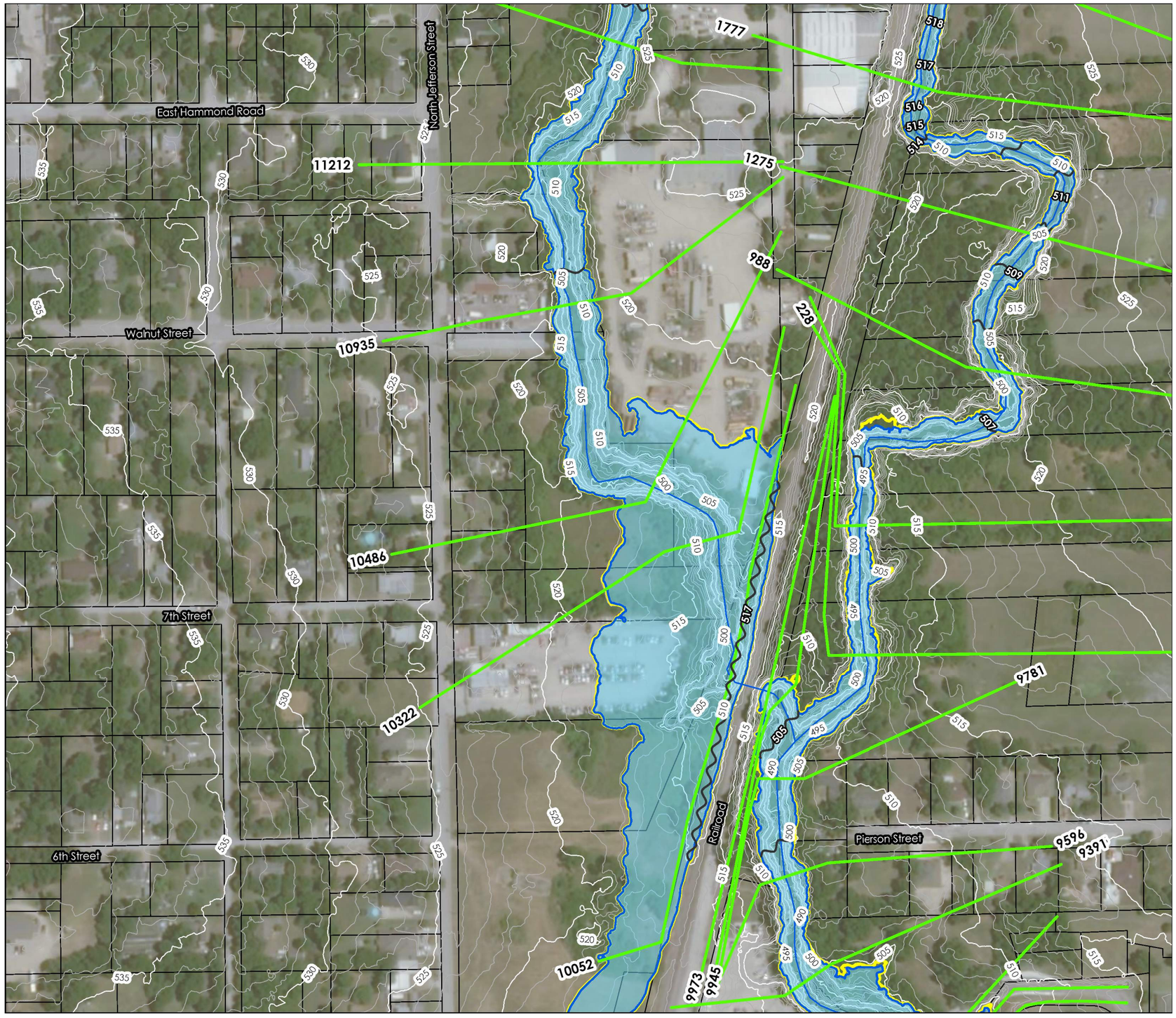
DAR MAJOR CONTOURS

DAR MINOR CONTOURS

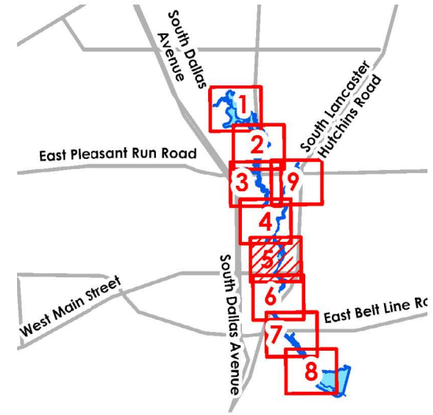
ELLER BASE FLOW ELEVATIONS

ARCEL

0



FLOODPLAIN: SHEET 5



N

0 100 200

Feet

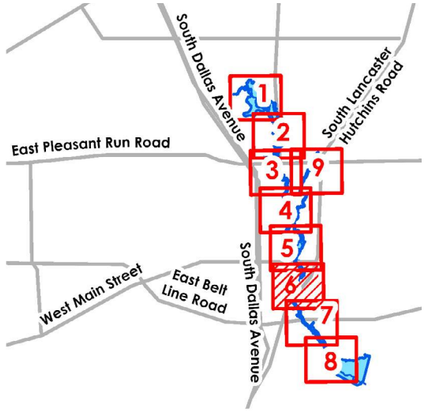
ER CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
ER BASE FLOW ELEVATIONS
CEL

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1

FLOODPLAIN: SHEET 6



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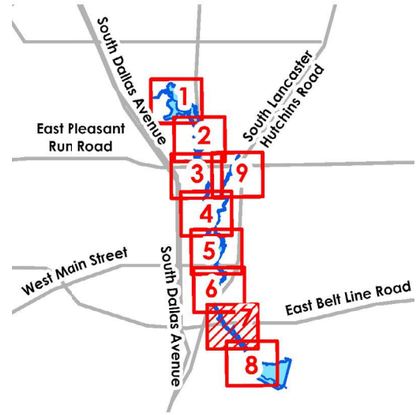
0 100 200
Feet

LER CROSS SECTIONS
REAM CENTERLINE
ISTING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
AR MAJOR CONTOURS
AR MINOR CONTOURS
LER BASE FLOW ELEVATIONS
RCEL

0



FLOODPLAIN: SHEET 7



N

0 100 200 Feet

- KELLER CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- KELLER BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.

6

COUNCIL DISTRICTS

1 AND 3

TOTAL DRAINAGE AREA

3.22 SM

*

STREAM LENGTH

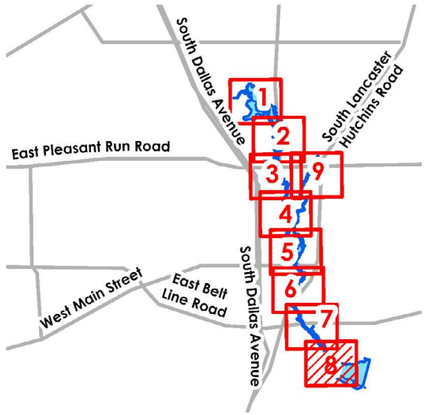
3.22 MI

*

PROJECTS IDENTIFIED

1

FLOODPLAIN: SHEET 8



ELLER CROSS SECTIONS

TREAM CENTERLINE

<ISTING 100-YEAR FLOODPLAIN

LTIMATE 100-YEAR FLOODPLAIN

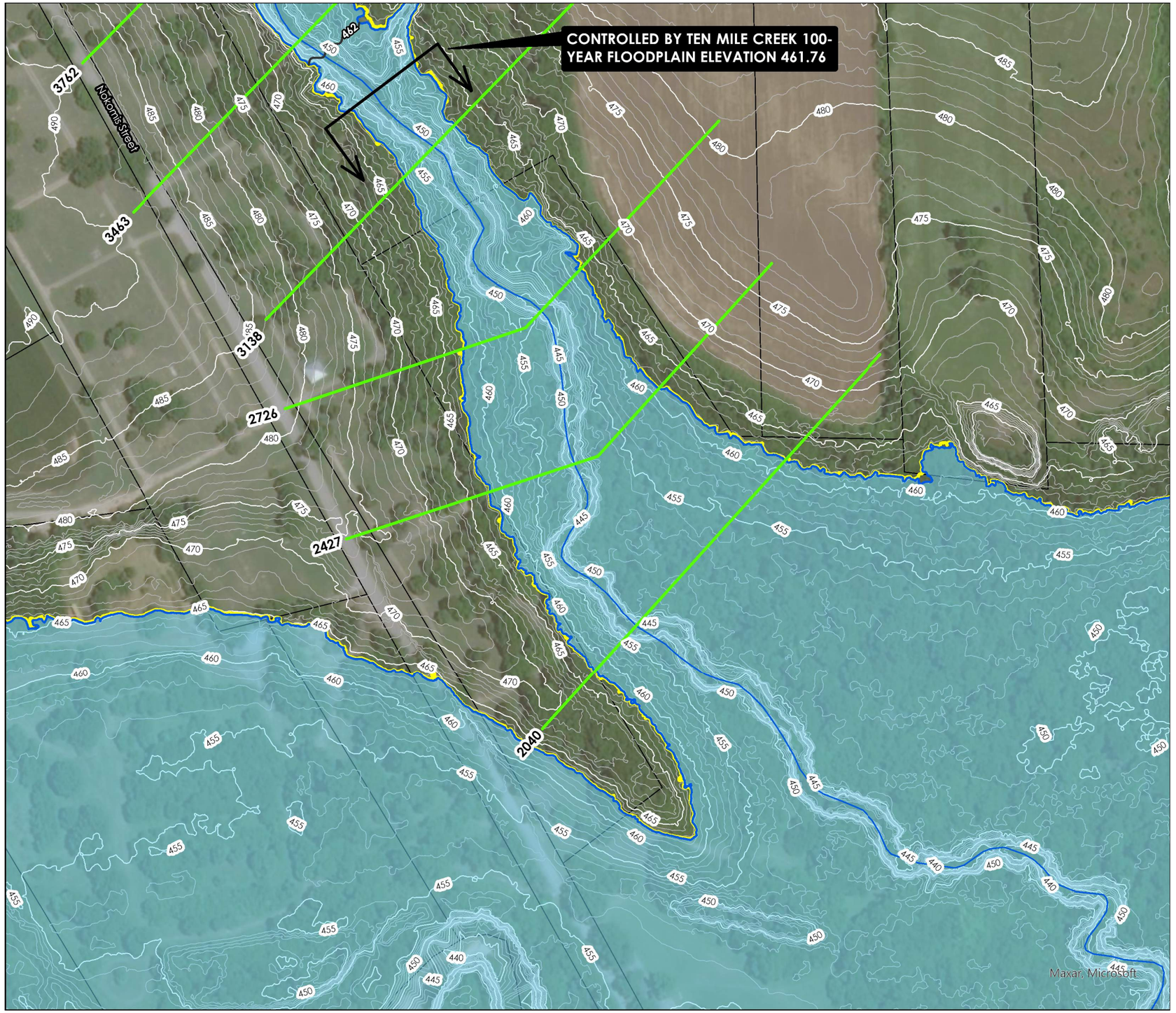
DAR MAJOR CONTOURS

DAR MINOR CONTOURS

ELLER BASE FLOW ELEVATIONS

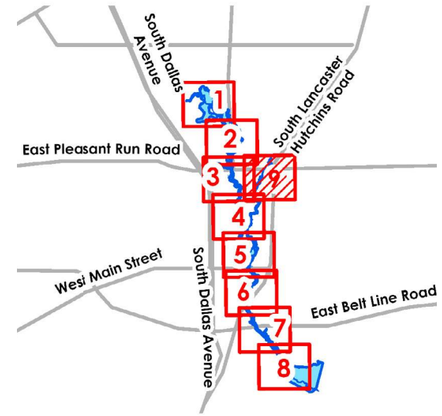
ARCEL

0



FLOODPLAIN: SHEET 9





N

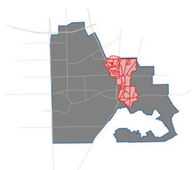
0 100 200
Feet

ER CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
ER BASE FLOW ELEVATIONS
CEL

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	556.16	556.41	3.48	4.08
17098	555.74	555.98	2.38	2.65
16821	554.35	554.50	3.35	3.65
16686	553.27	553.55	3.74	3.78
16405	551.87	552.26	3.17	3.31
16238	551.12	551.29	3.38	4.02
16124	550.68	550.79	1.98	2.13
16109	Park Crossing			
16092	549.54	549.86	2.63	2.72
16014	548.44	548.75	6.41	6.59
15845	547.76	548.09	3.05	3.33
15695	547.31	547.59	3.18	3.57
15565	546.79	547.06	3.64	3.80
15446	546.07	546.25	4.15	4.56
15151	544.39	544.64	2.88	2.71
14890	542.45	542.78	4.44	4.64
14758	541.52	541.90	4.39	4.61
14602	539.54	539.74	6.61	7.44
14467	537.40	538.42	7.05	5.50
14420	537.33	538.37	4.54	4.03
14392	East Colonial Drive			
14362	536.78	537.40	4.37	4.44
14306	536.55	537.25	4.54	4.42
14105	534.42	534.91	7.86	8.88
13904	532.34	533.58	6.03	4.60
13858	532.29	533.49	4.20	4.21
13829	East Park Place			
13800	531.20	531.94	4.97	5.68
13757	529.79	530.65	9.08	9.09
13509	527.17	527.68	6.92	8.13
13282	525.14	526.14	6.98	6.49
13242	525.30	526.25	3.54	3.88
13200	Pleasant Run Road			
13150	524.07	524.67	5.58	6.23
13089	524.00	524.58	4.03	4.79

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	522.43	523.01	8.65	8.77
12713	521.46	522.31	1.46	1.28
12637	520.95	521.76	4.82	5.15
12600	North Jefferson Street			
12567	518.32	519.24	3.29	3.61
12530	518.22	519.18	3.78	3.77
12436	518.04	519.02	3.90	3.99
12256	518.01	518.98	2.40	2.58
11970	515.79	516.53	9.84	10.55
11715	513.84	514.96	5.56	5.86
11502	511.96	512.62	9.20	10.69
11212	510.59	511.46	6.32	6.70
10935	507.30	508.09	10.34	11.19
10486	505.48	508.24	4.68	4.03
10322	505.37	508.20	3.81	3.14
10052	505.33	508.14	2.93	3.13
10009	Missouri Kansas Texas RR			
9973	497.18	498.24	12.05	13.12
9945	496.67	498.16	4.68	4.79
9781	496.25	497.64	5.48	6.09
9596	495.78	497.18	5.87	6.35
9391	495.39	496.84	5.35	5.44
9102	494.78	496.18	5.35	5.69
9057	494.79	496.19	4.31	4.64
9042	East 3rd Street			
9029	494.67	496.06	4.50	4.91
8964	494.58	495.98	4.00	4.22
8805	494.10	495.55	3.86	3.91
8456	492.59	494.35	4.72	4.48
8390	492.53	494.33	3.67	3.54
8335	East 2nd Street			
8298	487.57	488.16	9.70	11.29
8237	486.95	487.66	9.30	10.08
7922	485.06	486.36	6.06	6.41
7868	484.85	486.17	6.21	6.57

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	483.41	484.65	4.18	4.57
7650	482.75	483.87	6.38	7.08
7410	481.85	483.02	4.98	5.22
7092	479.10	480.10	6.17	6.80
6678	476.06	477.14	4.84	5.18
6283	473.76	474.86	4.85	5.32
5947	470.08	471.20	7.85	8.37
5763	468.54	469.73	5.54	6.03
5691	468.02	469.17	5.62	6.22
5654	North Lancaster Hutchins Road			
5611	467.15	468.23	5.24	5.77
5547	466.99	468.08	3.74	4.20
5357	466.01	466.99	5.16	5.74
5048	464.90	465.74	3.64	4.22
4913	464.35	465.19	3.95	4.27
4781	463.80	464.66	3.56	3.93
4641	462.83	463.63	4.97	5.55
4594	East Belt Line Road			
4543	460.35	461.46	5.08	5.37
4469	460.03	461.16	4.19	4.59
4266	459.23	460.30	4.38	4.96
4008	458.14	459.13	4.19	4.41
3762	457.66	458.58	2.67	3.07
3463	456.97	457.82	3.44	3.82
3138	456.35	457.01	2.80	3.37
2726	455.82	456.20	2.81	3.51
2427	455.51	455.73	2.53	3.18
2040	455.43	455.60	1.42	1.82
1679	455.40	455.55	0.87	1.11
1039	455.38	455.53	0.43	0.55
155	455.38	455.52	0.27	0.35

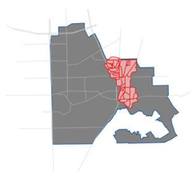
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	527.71	528.09	5.11	5.46
3130	523.36	523.86	7.25	7.46
2686	520.58	521.13	4.72	5.08
2302	518.52	519.11	5.52	5.75
2032	516.21	516.64	6.77	7.50
1777	513.57	514.25	6.95	6.90
1275	507.11	507.30	7.51	8.86
988	503.01	503.58	6.92	6.81
473	500.03	500.66	4.91	5.42
228	497.44	497.91	8.75	9.31
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	556.45	556.61	4.00	4.63
17098	556.04	556.15	2.65	2.94
16821	554.58	554.71	3.67	3.62
16686	553.65	553.89	3.81	3.52
16405	552.39	552.61	3.40	3.60
16238	551.35	551.46	4.29	4.79
16124	550.83	550.90	2.19	2.34
16109	**Park Crossing**			
16092	550.04	550.29	2.65	2.43
16014	548.93	549.20	6.70	6.85
15845	548.26	548.50	3.51	3.80
15695	547.72	547.88	3.81	4.14
15565	547.21	547.40	3.73	3.63
15446	546.32	546.41	4.89	5.35
15151	544.77	544.97	2.63	2.51
14890	542.99	543.32	4.68	4.63
14758	542.12	542.46	4.70	4.83
14602	539.92	540.28	7.77	8.07
14467	538.45	539.20	6.31	6.03
14420	538.39	539.16	4.65	4.63
14392	**East Colonial Drive**			
14362	537.56	538.10	4.89	5.24
14306	537.38	537.93	4.89	5.12
14105	535.00	535.53	8.99	9.33
13904	533.78	534.64	4.47	4.23
13858	533.70	534.54	4.20	4.08
13829	**East Park Place**			
13800	532.02	532.40	5.83	6.76
13757	530.79	531.41	9.04	8.95
13509	527.84	528.20	8.25	9.24
13282	526.36	527.22	6.35	5.78
13242	526.46	527.26	3.95	4.21
13200	**Pleasant Run Road**			
13150	524.99	525.49	5.96	6.38
13089	524.91	525.39	4.69	5.21

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	523.30	523.79	8.96	9.07
12713	522.83	523.70	1.21	1.15
12637	522.25	523.08	5.32	5.54
12600	**North Jefferson Street**			
12567	519.47	520.23	3.99	4.36
12530	519.41	520.20	4.08	4.16
12436	519.21	520.00	4.38	4.56
12256	519.18	519.97	2.86	3.02
11970	516.66	517.21	10.69	11.36
11715	515.16	516.06	5.91	6.15
11502	512.76	513.31	10.92	11.93
11212	511.49	512.87	6.98	6.26
10935	508.61	512.03	10.38	6.58
10486	508.81	512.04	3.91	3.21
10322	508.78	512.04	3.02	2.46
10052	508.71	511.92	3.16	3.17
10009	**Missouri Kansas Texas RR**			
9973	498.44	499.33	13.30	14.08
9945	498.47	499.70	4.78	4.87
9781	497.98	499.17	6.02	6.34
9596	497.49	498.66	6.47	6.84
9391	497.17	498.44	5.43	5.41
9102	496.52	497.85	5.73	5.82
9057	496.54	497.86	4.70	4.87
9042	**East 3rd Street**			
9029	496.39	497.69	5.00	5.27
8964	496.33	497.65	4.25	4.32
8805	495.91	497.30	3.90	3.88
8456	494.78	496.41	4.43	4.23
8390	494.76	496.39	3.54	3.56
8335	**East 2nd Street**			
8298	488.23	488.94	11.85	12.75
8237	487.75	488.33	10.17	10.69
7922	486.53	487.63	6.44	6.61
7868	486.35	487.42	6.62	6.94

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	484.81	485.73	4.62	4.95
7650	484.02	484.83	7.15	7.73
7410	483.21	484.14	5.20	5.30
7092	480.29	481.25	6.92	7.36
6678	477.36	478.37	5.23	5.47
6283	475.08	476.14	5.40	5.74
5947	471.42	472.41	8.47	9.00
5763	469.98	471.01	6.10	6.56
5691	469.43	470.40	6.30	6.88
5654	North Lancaster Hutchins Road			
5611	468.49	469.28	5.82	6.50
5547	468.34	469.13	4.24	4.77
5357	467.23	467.94	5.89	6.32
5048	465.96	466.57	4.36	4.77
4913	465.40	466.01	4.35	4.59
4781	464.87	465.48	4.03	4.33
4641	463.83	464.33	5.69	6.23
4594	East Belt Line Road			
4543	461.76	462.55	5.42	5.69
4469	461.48	462.26	4.66	4.99
4266	460.62	461.32	5.07	5.55
4008	459.51	460.28	4.28	4.42
3762	459.00	459.74	3.07	3.38
3463	458.32	459.01	3.67	3.94
3138	457.62	458.19	3.23	3.65
2726	456.91	457.24	3.37	3.90
2427	456.56	456.75	2.82	3.37
2040	456.47	456.62	1.65	1.99
1679	456.44	456.57	0.96	1.17
1039	456.42	456.56	0.48	0.57
155	456.42	456.55	0.30	0.36

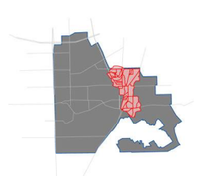
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	528.15	528.51	5.52	5.81
3130	523.94	524.41	7.50	7.64
2686	521.21	521.73	5.14	5.44
2302	519.20	519.76	5.79	5.94
2032	516.72	517.19	7.58	8.10
1777	514.32	514.76	6.98	7.42
1275	507.37	507.77	8.94	9.43
988	503.67	504.22	6.78	6.80
473	500.68	501.16	5.59	6.18
228	498.18	499.66	8.75	6.87
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	556.74	556.89	4.68	5.53
17098	556.26	556.35	3.18	3.44
16821	554.84	554.92	3.60	3.61
16686	554.09	554.21	3.54	3.59
16405	552.87	553.03	3.79	3.93
16238	551.52	551.64	5.58	5.80
16124	551.04	551.04	2.29	2.57
16109	**Park Crossing**			
16092	550.50	550.58	2.42	2.53
16014	549.67	549.82	6.10	5.96
15845	548.74	548.87	4.15	4.33
15695	548.05	548.13	4.39	4.51
15565	547.63	547.64	3.40	3.68
15446	546.52	546.69	6.02	5.37
15151	545.15	545.35	2.39	2.25
14890	543.61	543.92	4.64	4.69
14758	542.67	542.80	5.24	5.92
14602	540.44	541.06	8.28	7.28
14467	539.59	540.72	5.93	5.04
14420	539.56	540.71	4.62	4.03
14392	**East Colonial Drive**			
14362	538.33	538.75	5.45	5.64
14306	538.17	538.61	5.28	5.33
14105	535.78	536.24	9.36	9.45
13904	534.87	535.20	4.31	4.55
13858	534.76	535.07	4.17	4.50
13829	**East Park Place**			
13800	532.53	532.77	7.19	8.12
13757	531.72	532.16	8.72	8.87
13509	528.40	528.76	9.80	10.33
13282	527.72	528.42	5.53	5.23
13242	527.73	528.41	4.36	4.56
13200	**Pleasant Run Road**			
13150	525.87	526.26	6.43	6.76
13089	525.78	526.16	5.37	5.77

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	524.12	524.44	9.33	9.62
12713	524.42	525.21	1.12	1.10
12637	523.78	524.54	5.67	5.77
12600	**North Jefferson Street**			
12567	520.76	521.53	4.71	4.94
12530	520.75	521.54	4.29	4.23
12436	520.53	521.32	4.77	4.70
12256	520.51	521.30	3.16	3.14
11970	517.65	518.26	11.66	12.18
11715	517.26	518.26	5.75	5.92
11502	516.34	517.44	7.48	7.39
11212	516.37	517.49	3.85	3.93
10935	516.12	517.21	4.22	4.44
10486	516.12	517.20	2.39	2.59
10322	516.12	517.22	1.83	1.95
10052	516.00	517.06	2.93	3.11
10009	**Missouri Kansas Texas RR**			
9973	499.94	500.88	14.64	15.34
9945	500.51	501.87	4.96	4.94
9781	499.96	501.33	6.55	6.53
9596	499.47	500.89	6.99	6.94
9391	499.31	500.82	5.36	5.11
9102	498.77	500.37	5.81	5.57
9057	498.78	500.39	4.92	4.82
9042	**East 3rd Street**			
9029	498.60	500.19	5.40	5.38
8964	498.57	500.19	4.32	4.08
8805	498.26	499.95	3.82	3.61
8456	497.49	499.37	4.13	3.75
8390	497.47	499.34	3.60	3.56
8335	**East 2nd Street**			
8298	489.39	490.06	13.34	14.09
8237	489.08	490.09	10.05	9.40
7922	488.42	489.49	6.69	6.75
7868	488.17	489.18	7.16	7.46

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	486.29	487.09	5.23	5.54
7650	485.26	485.95	8.27	8.79
7410	484.57	485.34	5.58	5.74
7092	481.65	482.52	7.56	7.80
6678	478.85	479.84	5.56	5.61
6283	476.63	477.61	5.88	6.03
5947	472.90	473.77	9.16	9.58
5763	471.58	472.47	6.66	7.02
5691	470.99	471.84	6.96	7.41
5654	North Lancaster Hutchins Road			
5611	469.93	470.68	6.51	7.00
5547	469.80	470.57	4.78	5.15
5357	468.56	469.26	6.65	6.99
5048	467.12	467.75	5.10	5.44
4913	466.56	467.22	4.76	4.92
4781	466.04	466.70	4.57	4.80
4641	464.85	465.47	6.58	6.91
4594	East Belt Line Road			
4543	463.24	463.94	5.92	6.24
4469	462.95	463.64	5.26	5.61
4266	461.95	462.51	5.93	6.48
4008	461.00	461.56	4.46	4.65
3762	460.48	461.02	3.55	3.83
3463	459.79	460.28	3.96	4.21
3138	459.03	459.42	3.72	4.06
2726	458.30	458.56	3.61	4.04
2427	458.00	458.19	2.95	3.37
2040	457.92	458.08	1.76	2.01
1679	457.89	458.05	1.02	1.17
1039	457.88	458.04	0.50	0.57
155	457.88	458.03	0.31	0.35

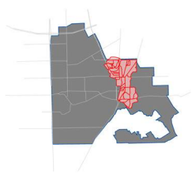
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	528.71	529.06	5.99	6.39
3130	524.70	525.22	7.65	7.73
2686	522.02	522.55	5.63	6.01
2302	520.07	520.67	6.02	6.19
2032	517.45	517.95	8.39	8.96
1777	515.00	515.48	7.67	8.14
1275	508.00	508.45	9.69	10.18
988	504.51	505.25	6.87	6.71
473	501.64	502.72	6.25	6.25
228	500.59	502.00	6.08	5.50
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	556.88	556.99	5.30	6.06
17098	556.35	556.44	3.40	3.57
16821	554.96	555.05	3.61	3.63
16686	554.29	554.42	3.58	3.60
16405	553.14	553.37	4.01	4.03
16238	551.69	551.68	6.05	6.93
16124	551.07	551.20	2.65	2.55
16109	**Park Crossing**			
16092	550.60	550.68	2.68	2.88
16014	549.99	550.20	5.38	4.87
15845	548.98	549.16	4.46	4.72
15695	548.18	548.29	4.63	4.81
15565	547.71	547.83	3.65	3.64
15446	546.70	546.74	5.71	6.24
15151	545.37	545.50	2.24	2.25
14890	543.95	544.18	4.69	4.73
14758	542.82	542.98	5.95	6.31
14602	541.38	541.62	6.70	6.72
14467	541.06	541.26	4.84	5.04
14420	541.04	541.24	3.90	4.07
14392	**East Colonial Drive**			
14362	538.77	539.12	5.86	5.94
14306	538.61	538.99	5.56	5.49
14105	536.24	536.54	9.45	9.71
13904	535.18	535.52	4.59	4.60
13858	535.05	535.36	4.53	4.65
13829	**East Park Place**			
13800	532.73	532.93	8.19	8.95
13757	532.23	532.58	8.66	8.82
13509	528.84	529.41	10.40	10.40
13282	528.56	529.33	5.18	4.89
13242	528.54	529.28	4.60	4.80
13200	**Pleasant Run Road**			
13150	526.39	526.75	6.73	7.13
13089	526.29	526.63	5.77	6.22

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	524.59	525.87	9.59	7.08
12713	525.49	526.36	1.10	1.08
12637	524.82	525.67	5.80	5.90
12600	**North Jefferson Street**			
12567	521.62	522.37	5.14	5.45
12530	521.64	522.42	4.36	4.34
12436	521.40	522.23	4.85	4.60
12256	521.38	522.20	3.26	3.23
11970	518.31	518.95	12.23	12.76
11715	518.34	518.92	5.95	6.49
11502	517.51	517.86	7.42	8.33
11212	517.56	517.92	3.96	4.47
10935	517.28	517.55	4.48	5.15
10486	517.27	517.53	2.62	3.04
10322	517.28	517.55	1.96	2.25
10052	517.14	517.41	3.07	3.27
10009	**Missouri Kansas Texas RR**			
9973	500.96	501.92	15.42	16.20
9945	501.97	503.21	4.95	4.94
9781	501.39	502.66	6.71	6.63
9596	500.98	502.32	6.91	6.71
9391	500.92	502.30	5.08	4.85
9102	500.47	501.94	5.54	5.24
9057	500.49	501.94	4.80	4.67
9042	**East 3rd Street**			
9029	500.29	501.74	5.36	5.31
8964	500.29	501.77	4.06	3.81
8805	500.06	501.59	3.59	3.43
8456	499.48	501.13	3.71	3.21
8390	499.45	501.06	3.55	3.30
8335	**East 2nd Street**			
8298	490.10	490.66	14.11	14.75
8237	490.16	491.31	9.36	8.77
7922	489.56	490.74	6.76	6.78
7868	489.25	490.35	7.48	7.79

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	487.13	487.91	5.57	5.94
7650	485.97	486.57	8.86	9.54
7410	485.35	485.98	5.79	6.13
7092	482.52	483.13	7.80	8.07
6678	479.84	480.68	5.61	5.56
6283	477.61	478.50	6.03	5.93
5947	473.79	474.50	9.55	9.83
5763	472.51	473.25	6.99	7.19
5691	471.88	472.59	7.36	7.65
5654	North Lancaster Hutchins Road			
5611	470.77	471.45	6.92	7.20
5547	470.65	471.35	5.09	5.30
5357	469.34	470.00	7.02	7.29
5048	467.83	468.43	5.47	5.76
4913	467.30	467.93	4.93	5.06
4781	466.79	467.43	4.81	5.00
4641	465.56	466.17	6.92	7.19
4594	East Belt Line Road			
4543	464.08	464.71	6.20	6.51
4469	463.80	464.40	5.58	5.93
4266	462.70	463.16	6.42	6.97
4008	461.82	462.28	4.61	4.80
3762	461.29	461.72	3.82	4.06
3463	460.60	460.98	4.13	4.37
3138	459.81	460.10	3.97	4.27
2726	459.09	459.28	3.78	4.11
2427	458.82	458.96	3.05	3.35
2040	458.74	458.87	1.83	2.02
1679	458.71	458.84	1.06	1.17
1039	458.70	458.83	0.52	0.58
155	458.70	458.82	0.33	0.36

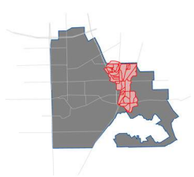
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	529.02	529.36	6.34	6.68
3130	525.16	525.62	7.72	7.83
2686	522.48	523.10	5.97	6.12
2302	520.59	521.32	6.18	5.96
2032	517.89	518.35	8.90	9.42
1777	515.43	515.86	8.09	8.50
1275	508.40	508.81	10.12	10.56
988	505.18	505.88	6.69	6.49
473	502.78	503.88	6.05	5.97
228	502.15	503.40	5.24	4.96
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	557.03	557.13	6.01	6.75
17098	556.47	556.55	3.65	3.82
16821	555.11	555.17	3.64	3.67
16686	554.48	554.52	3.68	3.86
16405	553.51	553.62	3.96	3.85
16238	551.77	551.89	7.15	7.23
16124	551.24	551.24	2.65	2.91
16109	**Park Crossing**			
16092	550.74	550.81	2.99	3.18
16014	550.37	550.48	4.22	3.93
15845	549.29	549.39	4.90	5.02
15695	548.37	548.44	4.87	4.94
15565	547.87	547.93	3.83	3.89
15446	546.88	546.95	5.93	5.99
15151	545.62	545.71	2.27	2.28
14890	544.40	544.55	4.71	4.64
14758	543.26	543.47	6.36	6.32
14602	542.13	541.81	6.47	7.83
14467	541.75	542.43	5.13	0.98
14420	541.72	542.09	4.16	4.10
14392	**East Colonial Drive**			
14362	539.29	539.65	6.59	6.67
14306	539.14	539.53	6.06	5.93
14105	536.70	537.03	9.74	9.97
13904	535.66	535.93	4.61	4.77
13858	535.50	535.76	4.70	4.87
13829	**East Park Place**			
13800	533.05	533.23	9.22	10.10
13757	532.71	532.77	8.95	10.03
13509	529.66	530.70	10.32	8.49
13282	529.64	530.50	4.75	4.24
13242	529.56	530.28	4.88	5.07
13200	**Pleasant Run Road**			
13150	527.10	527.57	6.96	7.16
13089	526.99	527.47	6.12	6.32

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	526.46	527.13	6.38	5.75
12713	526.84	527.44	1.08	1.07
12637	526.14	526.72	5.96	6.04
12600	**North Jefferson Street**			
12567	522.56	523.11	5.76	5.93
12530	522.61	523.19	4.51	4.41
12436	522.42	523.04	4.74	4.44
12256	522.39	523.02	3.37	3.29
11970	519.10	519.55	12.86	13.33
11715	519.00	519.44	6.65	7.05
11502	517.87	518.12	8.64	9.36
11212	517.93	518.21	4.64	5.04
10935	517.52	517.71	5.36	5.92
10486	517.51	517.69	3.16	3.50
10322	517.53	517.72	2.35	2.59
10052	517.37	517.57	3.45	3.58
10009	**Missouri Kansas Texas RR**			
9973	502.13	502.83	16.38	17.09
9945	503.75	504.55	4.72	4.73
9781	503.16	503.88	6.72	7.06
9596	502.78	503.42	6.94	7.44
9391	502.77	503.43	5.00	5.35
9102	502.39	503.01	5.40	5.78
9057	502.40	503.01	4.87	5.30
9042	**East 3rd Street**			
9029	502.17	502.72	5.56	6.10
8964	502.21	502.78	3.93	4.24
8805	502.02	502.56	3.57	3.89
8456	501.58	502.09	3.22	3.39
8390	501.52	502.03	3.29	3.44
8335	**East 2nd Street**			
8298	491.06	493.06	15.18	13.70
8237	491.87	493.96	8.36	6.71
7922	491.31	493.56	6.67	5.87
7868	490.89	493.08	7.81	7.41

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	488.26	489.02	6.05	6.40
7650	486.89	487.47	9.68	10.32
7410	486.36	486.96	6.12	6.45
7092	483.56	484.06	8.18	8.52
6678	481.14	481.69	5.59	5.75
6283	478.96	479.61	5.94	5.99
5947	474.91	475.56	10.06	10.37
5763	473.69	474.43	7.35	7.51
5691	473.00	473.72	7.88	8.13
5654	North Lancaster Hutchins Road			
5611	471.82	472.53	7.45	7.66
5547	471.72	472.45	5.48	5.64
5357	470.35	471.03	7.44	7.73
5048	468.79	469.48	5.89	6.16
4913	468.32	469.05	5.09	5.21
4781	467.84	468.56	5.06	5.23
4641	466.59	467.29	7.22	7.42
4594	East Belt Line Road			
4543	465.22	465.88	6.50	6.79
4469	464.92	465.57	5.96	6.32
4266	463.75	464.25	6.97	7.52
4008	462.99	463.47	4.71	5.01
3762	462.50	462.93	4.04	4.38
3463	461.87	462.22	4.16	4.51
3138	461.16	461.41	4.03	4.45
2726	460.67	460.83	3.46	3.77
2427	460.50	460.64	2.77	3.03
2040	460.45	460.58	1.71	1.88
1679	460.43	460.55	1.02	1.14
1039	460.42	460.54	0.49	0.53
155	460.42	460.54	0.30	0.32

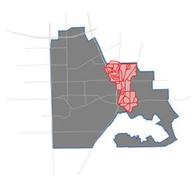
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	529.42	529.68	6.72	7.08
3130	525.71	526.21	7.80	7.66
2686	523.18	523.62	6.18	6.46
2302	521.40	521.88	5.97	5.98
2032	518.42	518.83	9.51	9.98
1777	515.93	516.32	8.57	8.94
1275	508.89	509.27	10.62	10.98
988	506.10	506.75	6.31	6.21
473	504.34	505.12	5.71	5.87
228	503.95	504.76	4.64	4.68
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	557.15	557.29	6.45	6.81
17098	556.58	556.68	3.84	4.05
16821	555.22	555.31	3.68	3.74
16686	554.54	554.64	4.03	4.14
16405	553.70	553.76	3.75	3.95
16238	552.00	552.46	7.29	6.05
16124	551.29	551.38	2.95	3.03
16109	**Park Crossing**			
16092	550.87	550.94	3.22	3.41
16014	550.56	550.66	3.81	3.68
15845	549.50	549.59	5.06	5.16
15695	548.49	548.57	5.09	5.10
15565	548.00	548.05	3.90	4.04
15446	546.97	547.05	6.26	6.26
15151	545.82	545.96	2.30	2.33
14890	544.75	544.99	4.57	4.42
14758	543.62	543.95	6.57	6.49
14602	541.96	541.95	7.97	8.97
14467	542.60	542.77	0.99	1.06
14420	542.24	542.33	4.23	4.64
14392	**East Colonial Drive**			
14362	539.66	540.04	7.12	6.70
14306	539.53	539.83	6.35	6.58
14105	537.03	537.26	9.97	10.23
13904	535.93	536.15	4.76	4.86
13858	535.77	535.99	4.86	4.97
13829	**East Park Place**			
13800	533.23	533.50	10.10	10.46
13757	532.77	533.04	10.03	10.17
13509	530.74	531.69	8.43	6.39
13282	530.54	531.56	4.20	3.46
13242	530.32	531.22	5.08	5.18
13200	**Pleasant Run Road**			
13150	527.72	528.26	7.00	7.14
13089	527.63	528.18	6.17	6.25

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	527.32	527.99	5.61	5.20
12713	527.61	528.24	1.07	1.07
12637	526.88	527.48	6.06	6.18
12600	**North Jefferson Street**			
12567	523.14	523.65	6.05	6.29
12530	523.23	523.76	4.49	4.43
12436	523.08	523.65	4.51	4.31
12256	523.05	523.61	3.35	3.39
11970	519.57	520.05	13.35	13.64
11715	519.47	519.87	7.07	7.43
11502	518.15	518.33	9.38	10.12
11212	518.24	518.45	5.05	5.45
10935	517.73	517.84	5.94	6.52
10486	517.72	517.82	3.52	3.87
10322	517.75	517.86	2.59	2.84
10052	517.60	517.70	3.55	3.76
10009	**Missouri Kansas Texas RR**			
9973	502.87	503.53	17.10	17.73
9945	504.59	505.27	4.74	4.77
9781	503.91	504.49	7.07	7.46
9596	503.45	503.98	7.45	7.88
9391	503.46	504.00	5.36	5.66
9102	503.05	503.56	5.78	6.10
9057	503.04	503.54	5.31	5.70
9042	**East 3rd Street**			
9029	502.76	503.14	6.12	6.64
8964	502.82	503.22	4.24	4.55
8805	502.59	502.97	3.90	4.20
8456	502.12	502.48	3.39	3.56
8390	502.07	502.43	3.43	3.60
8335	**East 2nd Street**			
8298	493.21	494.23	13.55	13.71
8237	494.09	495.22	6.64	6.19
7922	493.70	494.84	5.84	5.74
7868	493.21	494.26	7.41	7.65

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	489.12	489.77	6.39	6.69
7650	487.62	488.14	10.23	10.70
7410	487.14	487.70	6.35	6.57
7092	484.24	484.76	8.64	8.91
6678	481.88	482.43	5.81	5.93
6283	479.83	480.44	6.01	6.06
5947	475.76	476.35	10.51	10.84
5763	474.63	475.26	7.62	7.83
5691	473.90	474.48	8.29	8.61
5654	North Lancaster Hutchins Road			
5611	472.64	473.15	7.87	8.22
5547	472.56	473.07	5.79	6.05
5357	471.14	471.62	7.77	7.98
5048	469.60	470.08	6.19	6.38
4913	469.18	469.68	5.21	5.31
4781	468.70	469.20	5.24	5.35
4641	467.43	467.95	7.43	7.54
4594	East Belt Line Road			
4543	466.05	466.53	6.79	6.96
4469	465.73	466.21	6.33	6.56
4266	464.44	464.83	7.52	7.87
4008	463.70	464.07	4.99	5.24
3762	463.17	463.50	4.37	4.65
3463	462.50	462.79	4.44	4.72
3138	461.75	461.95	4.36	4.70
2726	461.25	461.38	3.62	3.89
2427	461.09	461.20	2.89	3.11
2040	461.03	461.14	1.82	1.96
1679	461.01	461.11	1.11	1.20
1039	461.00	461.10	0.52	0.55
155	461.00	461.10	0.31	0.34

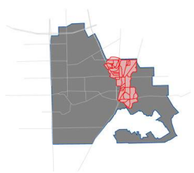
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	529.66	529.84	7.06	7.47
3130	526.18	526.72	7.67	7.34
2686	523.59	524.06	6.45	6.53
2302	521.85	522.27	5.98	6.00
2032	518.80	519.16	9.95	10.37
1777	516.30	516.64	8.92	9.24
1275	509.25	509.59	10.96	11.29
988	506.74	507.35	6.17	6.09
473	505.15	505.82	5.80	5.93
228	504.80	505.49	4.62	4.66
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
17236	557.15	557.39	6.45	7.04
17098	556.58	556.77	3.84	4.17
16821	555.22	555.41	3.68	3.78
16686	554.54	554.72	4.03	4.36
16405	553.70	553.86	3.75	3.94
16238	552.00	552.60	7.29	6.12
16124	551.29	551.46	2.95	3.17
16109	**Park Crossing**			
16092	550.87	551.11	3.22	3.36
16014	550.56	550.84	3.81	3.74
15845	549.50	549.82	5.06	5.27
15695	548.49	548.70	5.09	5.26
15565	548.00	548.21	3.90	4.12
15446	546.97	547.13	6.26	6.79
15151	545.82	546.19	2.30	2.40
14890	544.75	545.36	4.57	4.26
14758	543.62	544.39	6.57	6.60
14602	541.96	542.13	7.97	9.84
14467	542.60	542.94	0.99	1.17
14420	542.24	542.35	4.23	5.40
14392	**East Colonial Drive**			
14362	539.66	540.25	7.12	7.47
14306	539.53	539.96	6.35	7.40
14105	537.03	537.80	9.97	9.78
13904	535.93	536.35	4.76	5.11
13858	535.77	536.17	4.86	5.26
13829	**East Park Place**			
13800	533.23	533.83	10.10	10.84
13757	532.77	533.40	10.03	10.23
13509	530.74	531.95	8.43	6.46
13282	530.54	531.82	4.20	3.60
13242	530.32	531.35	5.08	5.67
13200	**Pleasant Run Road**			
13150	527.72	528.91	7.00	7.16
13089	527.63	528.85	6.17	6.19

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12957	527.32	528.76	5.61	4.71
12713	527.61	528.96	1.07	1.05
12637	526.88	528.47	6.06	5.20
12600	**North Jefferson Street**			
12567	523.14	524.14	6.05	6.48
12530	523.23	524.28	4.49	4.34
12436	523.08	524.20	4.51	4.13
12256	523.05	524.18	3.35	3.31
11970	519.57	520.50	13.35	13.95
11715	519.47	520.28	7.07	7.77
11502	518.15	518.48	9.38	10.94
11212	518.24	518.63	5.05	5.88
10935	517.73	517.88	5.94	7.17
10486	517.72	517.86	3.52	4.26
10322	517.75	517.91	2.59	3.12
10052	517.60	517.73	3.55	4.11
10009	**Missouri Kansas Texas RR**			
9973	502.87	504.22	17.10	18.30
9945	504.59	505.75	4.74	4.87
9781	504.32	504.80	7.66	8.03
9596	503.79	504.28	8.09	8.32
9391	503.80	504.31	5.81	5.98
9102	503.32	503.82	6.31	6.44
9057	503.31	503.81	5.85	6.08
9042	**East 3rd Street**			
9029	502.92	503.30	6.80	7.14
8964	503.00	503.40	4.68	4.86
8805	502.73	503.12	4.33	4.51
8456	502.15	502.56	3.80	3.83
8390	502.08	502.50	3.86	3.88
8335	**East 2nd Street**			
8298	494.42	495.30	13.52	13.56
8237	495.39	496.32	6.09	5.87
7922	495.01	495.96	5.67	5.64
7868	494.44	495.49	7.62	7.14

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7815	East Main Street			
7751	489.83	490.43	6.70	6.98
7650	488.20	488.68	10.70	11.14
7410	487.78	488.29	6.56	6.78
7092	484.83	485.26	8.96	9.24
6678	482.51	483.00	5.95	6.06
6283	480.54	481.11	6.06	6.09
5947	476.47	477.02	10.85	11.12
5763	475.40	476.00	7.82	7.99
5691	474.63	475.19	8.59	8.86
5654	North Lancaster Hutchins Road			
5611	473.34	473.84	8.17	8.44
5547	473.27	473.78	6.00	6.20
5357	471.80	472.28	8.05	8.25
5048	470.27	470.76	6.44	6.63
4913	469.88	470.38	5.33	5.42
4781	469.41	469.92	5.38	5.49
4641	468.18	468.68	7.55	7.67
4594	East Belt Line Road			
4543	466.76	467.21	6.98	7.19
4469	466.44	466.88	6.61	6.87
4266	465.07	465.39	7.93	8.34
4008	464.36	464.69	5.23	5.41
3762	463.81	464.10	4.65	4.86
3463	463.14	463.38	4.66	4.88
3138	462.38	462.56	4.61	4.87
2726	461.88	462.02	3.81	4.02
2427	461.73	461.86	2.94	3.11
2040	461.67	461.79	1.88	2.00
1679	461.65	461.77	1.17	1.24
1039	461.64	461.76	0.54	0.58
155	461.64	461.76	0.33	0.35

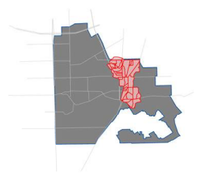
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3510	529.85	530.12	7.49	7.72
3130	526.74	527.11	7.35	7.46
2686	524.08	524.45	6.55	6.77
2302	522.30	522.77	6.00	6.02
2032	519.18	519.57	10.40	10.85
1777	516.66	517.04	9.26	9.61
1275	509.61	509.97	11.31	11.70
988	507.32	507.96	6.17	6.15
473	505.74	506.34	6.04	6.27
228	505.39	505.97	4.77	4.93
38	565.38	567.16	5.24	2.09

WATERSHED NO.
6

COUNCIL DISTRICTS
1 AND 3

TOTAL DRAINAGE AREA
3.22 SM
*
STREAM LENGTH
3.22 MI
*
PROJECTS IDENTIFIED
1

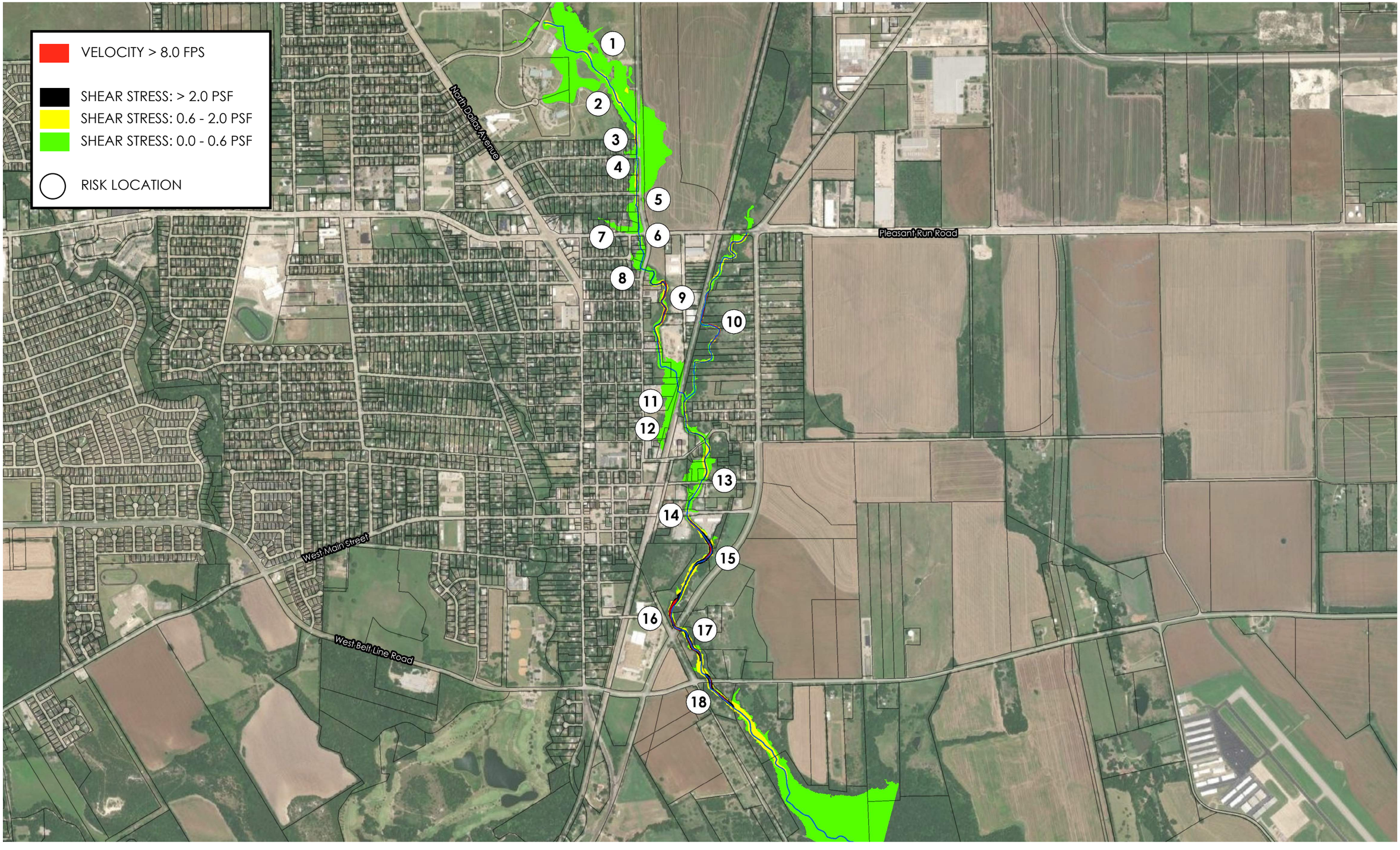


3.1 RISK IDENTIFICATION

Eighteen risk areas were identified in this study. The risks include seven over-topping bridges, five areas of flooding structures and six locations of erosive velocities. The areas with flooded structures include houses, commercial structures and City park and recreation buildings. The houses along North Jefferson Street are expected to experience the most flooding with flooding beginning in the 5-year event. Of the over-topping bridges, Park Place Drive is the least adequate, with the model showing flooding in the 2-year storm. Other roads in this watershed do over-top, but lighter traffic is anticipated on them and/or the flooding frequency is lower than that of Park Place Drive. The six areas where erosion is likely are located away from major development with the exception of the potential erosion area near River Station 11970. River Station 11970 is not expected to pose any immediate threat to nearby structures. The following map shows the shear stresses associated with the Keller Branch floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Park and Recreation Buildings	Flooded Structure	10-Year	Public	Medium
2	Pedestrian Trail Bridge	Over-topping Bridge	1-Year	Public	Very Low
3	Houses Between Colonial Drive & Park Place Drive	Flooded Structure	10-Year	Private	High
4	Colonial Drive	Over-topping Bridge	10-Year	Public	Medium
5	Park Place Drive	Over-topping Bridge	2-Year	Public	High
6	Pleasant Run Road	Over-topping Bridge	50-Year	Public	Medium
7	Houses Between Park Place Drive & Pleasant Run Road	Flooded Structure	10-Year	Private	High
8	Houses Along North Jefferson Street	Flooded Structure	5-Year	Private	High
9	River Station 11970	Potential Erosion Hot Spot	1-Year	Private	Low
10	River Station 2032 (Tributary)	Potential Erosion Hot Spot	1-Year	Private	Very Low
11	Missouri Kansas Texas RR Bridge	Over-topping Bridge	5-Year	Public	Medium
12	Parking Along Railroad	Flooded Structure	5-Year	Private	Low
13	2nd Street	Over-topping Bridge	10-Year	Public	Medium
14	Main Street	Over-topping Bridge	50-Year	Public	Medium
15	River Station 7650	Potential Erosion Hot Spot	1-Year	Private	Very Low
16	River Station 5947	Potential Erosion Hot Spot	1-Year	Private	Very Low
17	River Station 5357	Potential Erosion Hot Spot	1-Year	Private	Very Low
18	River Station 4266	Potential Erosion Hot Spot	1-Year	Private	Very Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
North Dallas Avenue
Pleasant Run Road
West Main Street
West Belt Line Road
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

MILL CREEK

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

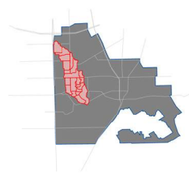
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



MILL BRANCH

STREAM CENTERLINE

COUNCIL DISTRICT

DISTRICT 1

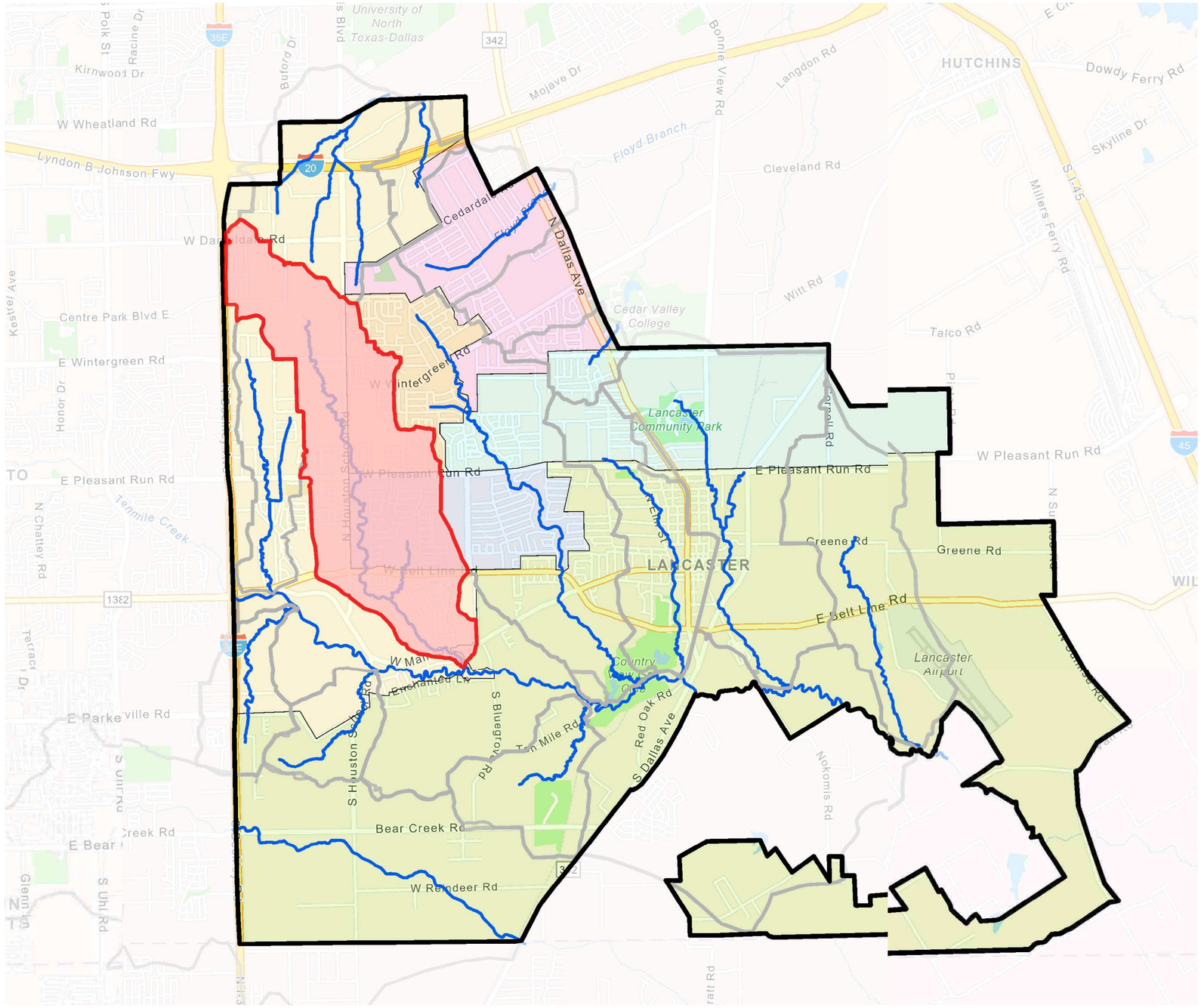
DISTRICT 2

DISTRICT 3

DISTRICT 4

DISTRICT 5

DISTRICT 6



MILL CREEK WATERSHED

In the city's southeast, Mill Creek drains around 3.28 square miles. Flowing south and meandering through residential zones, it joins Ten Mile Creek after 4.4 miles. It's a blend of residential, commercial, and farmland, with some areas zoned for future residential and light industrial use.

WATERSHED NO. 7

MILL CREEK

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WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

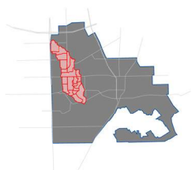
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



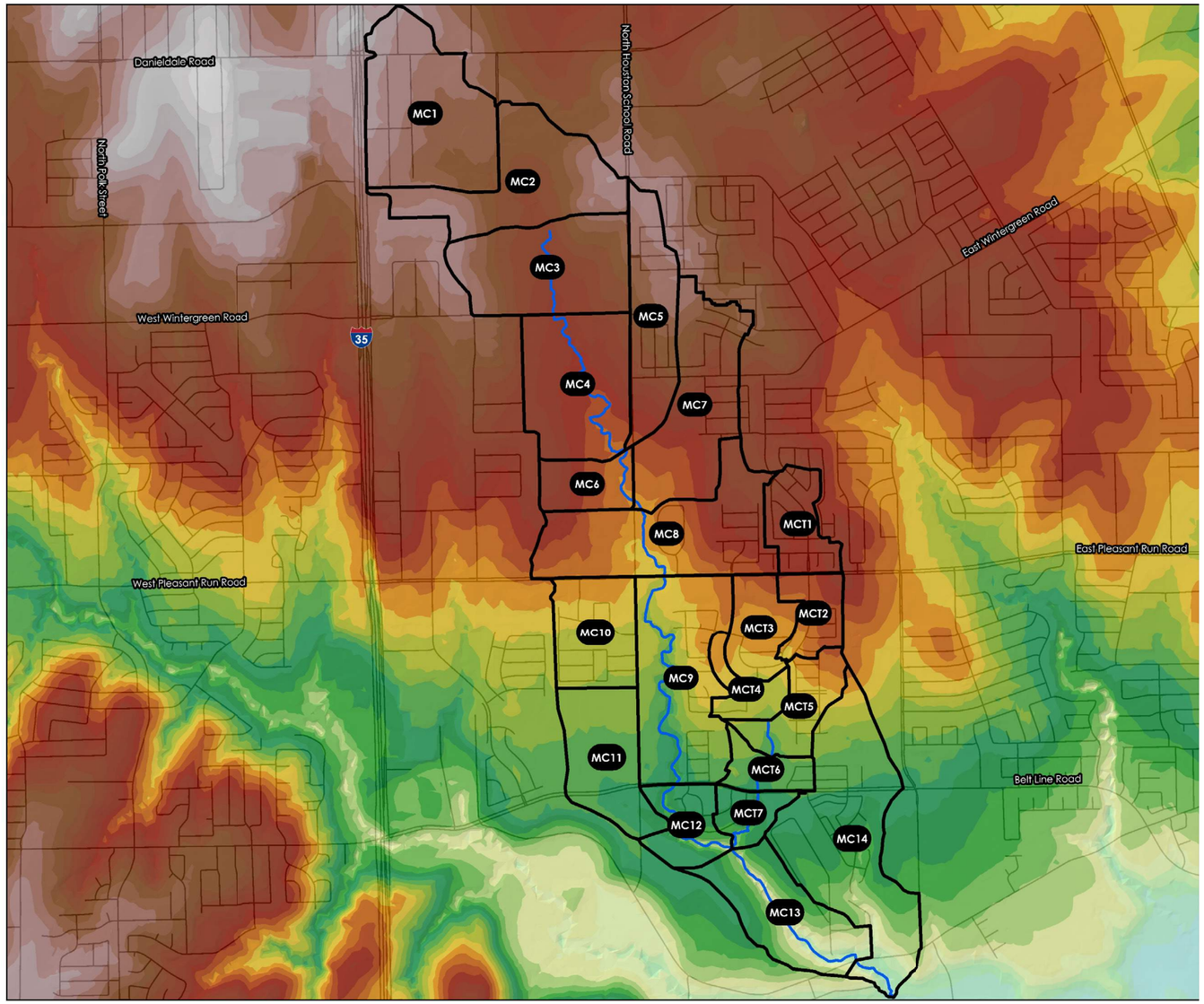
1.1 DRAINAGE AREA MAP

The drainage area divides for the watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into twenty-one (21) sub-basins. Sub-basins are designated MC1 through MC14 and MCT1 through MCT7. The total watershed drainage area is 2092.77 acres (3.27 square-miles). All of the drainage area is located within the Lancaster City Limits.

N

N.T.S.





HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
MC01	0.2742	83.9	49.1	68	30.03	18.02	25.72	15.43
MC02	0.2272	84	66.8	81.5	10.23	6.14	10.00	6
MC03	0.2263	84	52.9	82.4	19.45	11.67	15.65	9.39
MC04	0.2178	84	5.5	63.1	23.63	14.18	19.27	11.56
MC05	0.152	84	40.1	57.5	38.37	23.02	32.68	19.61
MC06	0.0708	84	5	32.8	28.07	16.84	22.08	13.25
MC07	0.2224	84	30.7	41.8	20.18	12.11	16.65	9.99
MC08	0.2699	84	37.3	49.1	34.33	20.6	28.03	16.82
MC09	0.2624	84	34	35.7	21.70	13.02	18.35	11.01
MC10	0.1325	84	39.7	54.1	22.23	13.34	18.15	10.89
MC11	0.1526	83.9	6.7	32.1	43.23	25.94	34.23	20.54
MC12	0.0779	82.4	25.3	28.8	19.87	11.92	15.37	9.22
MC13	0.1685	82.1	6.5	15.4	34.58	20.75	27.20	16.32
MC14	0.3409	83.5	23.7	33.2	32.40	19.44	27.23	16.34
MCT1	0.0855	84	57.1	57.1	15.23	9.14	12.55	7.53
MCT2	0.0654	84	36	58.4	27.10	16.26	21.75	13.05
MCT3	0.086	84	37.9	53.9	20.50	12.3	16.43	9.86
MCT4	0.0511	84	40.1	51	20.62	12.37	16.23	9.74
MCT5	0.0874	83.5	32.8	48.9	28.60	17.16	23.40	14.04
MCT6	0.0511	83.2	21.6	44.7	24.27	14.56	18.32	10.99
MCT7	0.048	82.5	31.8	37.8	21.47	12.88	16.90	10.14

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

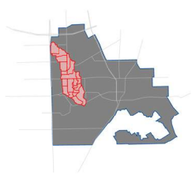
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



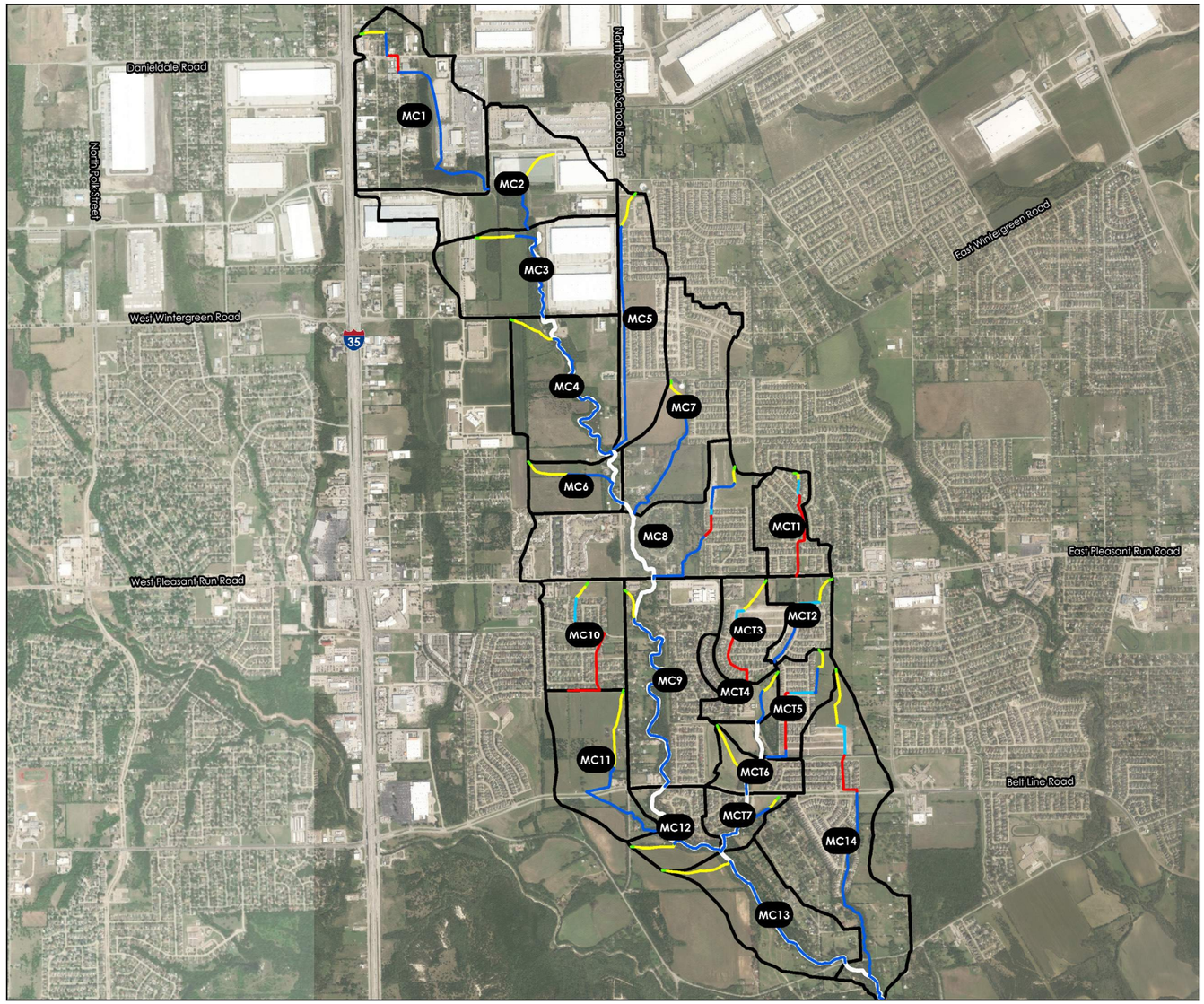
1.2 TIME OF CONCENTRATION

The Times of Concentration for Mill Branch were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Mill Branch runs through well developed residential areas. The residential developments generally shorten the Tiems of Concentration. Smaller sub-basins like MCT1 through MCT7 have even shorter Times of Concentration. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

N.T.S.



TIME OF CONCENTRATION REPORT

MC1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.73	0.240	0.00	0.1	14.27
SHALLOW	UNPAVED	424	2.1	0.000	16.10	2.3	3.03
PIPE	36" RCP	579	1.95	0.014	87.62	12.2	0.79
CHANNEL	"CONCR. TRAP (B=4,Y=3,SS=1:1)"	583	1.87	0.018	116.76	15.9	0.61
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,264	3.63	0.050	28.69	5.5	9.94
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	421	3.04	0.050	28.69	5.0	1.40
		5,372					**30.04**
							25.72

MC2

SHALLOW	UNPAVED	841	1.21	0.000	16.10	1.8	7.91
SHALLOW	UNPAVED	100	1.9	0.000	16.10	2.2	0.75
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	961	5.75	0.050	42.29	10.1	1.58
		1,902					**10.24**
							8.08

MC3

OVERLAND	GRS-DENSE	100	5.01	0.240	0.00	0.2	9.32
SHALLOW	UNPAVED	708	1.56	0.000	16.10	2.0	5.87
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	453	4.09	0.050	28.69	5.8	1.30
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,775	5.57	0.050	42.29	10.0	2.96
		3,036					**19.45**
							15.65

MC4

OVERLAND	GRS-DENSE	100	3.12	0.240	0.00	0.1	11.26
SHALLOW	UNPAVED	875	2.13	0.000	16.10	2.3	6.21
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,739	5.69	0.050	42.29	10.1	6.18
		4,713					**23.64**
							19.27

MC5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.94	0.240	0.00	0.1	18.18
SHALLOW	UNPAVED	652	2.16	0.000	16.10	2.4	4.59
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	4,583	2.91	0.050	28.69	4.9	15.60
		5,335					**38.37**
							32.68

MC6

OVERLAND	GRS-DENSE	100	0.96	0.240	0.00	0.1	18.01
SHALLOW	UNPAVED	805	1.99	0.000	16.10	2.3	5.91
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	856	2.63	0.050	28.69	4.7	3.06
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	639	5.33	0.050	42.29	9.8	1.09
		2,399					**28.07**
							22.09

MC7

OVERLAND	GRS-DENSE	100	2.85	0.240	0.00	0.1	11.67
SHALLOW	UNPAVED	426	3.29	0.000	16.10	2.9	2.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,114	3.97	0.050	28.69	5.7	3.25
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,664	5.38	0.050	42.29	9.8	2.83
		3,305					**20.18**
							16.66

MC8

OVERLAND	GRS-DENSE	100	0.57	0.240	0.00	0.1	22.29
SHALLOW	UNPAVED	245	0.75	0.000	16.10	1.4	2.92
GUTTER	G-20	165	1.87	0.018	24.18	3.3	0.83
PIPE	36" RCP	482	1.52	0.014	87.62	10.8	0.74
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,613	4.72	0.050	28.69	6.2	4.31
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	857	2.37	0.050	28.69	4.4	3.24
		3,462					**34.34**
							28.04

TIME OF CONCENTRATION REPORT - CONTINUED

MC9

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	3.34	0.240	0.00	0.2	10.95
SHALLOW	UNPAVED	563	5.89	0.000	16.10	3.9	2.40
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	4,911	5.39	0.050	42.29	9.8	8.34
		5,574					**21.69**
							18.35

MC10

OVERLAND	GRS-DENSE	100	1.79	0.240	0.00	0.1	14.07
SHALLOW	UNPAVED	286	1.73	0.000	16.10	2.1	2.25
GUTTER	ALLEY-10	502	1.41	0.018	39.51	4.7	1.78
PIPE	36" RCP	2,490	1.32	0.014	87.62	10.1	4.12
		3,378					**22.23**
							18.15

MC11

OVERLAND	GRS-DENSE	100	1.16	0.240	0.00	0.1	16.72
SHALLOW	UNPAVED	1,496	0.64	0.000	16.10	1.3	19.29
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	868	1.62	0.050	28.69	3.7	3.96
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,886	5.21	0.050	42.29	9.7	3.26
		4,351					**43.23**
							34.23

MC12

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.95	0.240	0.00	0.1	13.58
SHALLOW	UNPAVED	816	3.62	0.000	16.10	3.1	4.44
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,068	5.18	0.050	42.29	9.6	1.85
		1,984					**19.87**
							15.37

MC13

OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	23.42
SHALLOW	UNPAVED	1,316	4.93	0.000	16.10	3.6	6.13
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	3,510	5.04	0.050	51.79	11.6	5.03
		4,926					**34.58**
							27.19

MC14

OVERLAND	GRS-DENSE	100	2.15	0.240	0.00	0.1	13.08
SHALLOW	UNPAVED	1,084	2.19	0.000	16.10	2.4	7.58
GUTTER	G-20	714	3.45	0.018	24.18	4.5	2.65
PIPE	36" RCP	1,034	1.9	0.014	87.62	12.1	1.43
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	4,607	5.62	0.050	42.29	10.0	7.66
		7,539					**32.40**
							27.24

MCT1

OVERLAND	GRS-DENSE	100	4.21	0.240	0.00	0.2	9.99
SHALLOW	UNPAVED	117	2.8	0.000	16.10	2.7	0.73
GUTTER	G-20	316	1.54	0.018	24.18	3.0	1.75
PIPE	36" RCP	1,758	1.47	0.014	87.62	10.6	2.76
		2,291					**15.23**
							12.55

MCT2

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.98	0.240	0.00	0.1	17.87
SHALLOW	UNPAVED	484	2.05	0.000	16.10	2.3	3.50
GUTTER	G-20	669	2.65	0.018	24.18	3.9	2.83
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,077	4.65	0.050	28.69	6.2	2.90
		2,331					**27.10**
							21.76

MCT3

OVERLAND	GRS-DENSE	100	2.85	0.240	0.00	0.1	11.68
SHALLOW	UNPAVED	672	2.31	0.000	16.10	2.4	4.57
GUTTER	G-20	697	4.5	0.018	24.18	5.1	2.27
PIPE	36" RCP	1,241	1.43	0.014	87.62	10.5	1.97
		2,709					**20.49**
							16.43

MCT4

OVERLAND	GRS-DENSE	100	1.91	0.240	0.00	0.1	13.69
SHALLOW	UNPAVED	408	1.22	0.000	16.10	1.8	3.82
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	682	1.64	0.050	28.69	3.7	3.09
		1,190					**20.61**
							16.23

MCT5

OVERLAND	GRS-DENSE	100	0.98	0.240	0.00	0.1	17.91
SHALLOW	UNPAVED	370	1.78	0.000	16.10	2.1	2.87
GUTTER	G-12	542	1.78	0.018	23.64	3.2	2.86
PIPE	36" RCP	1,199	1.48	0.014	87.62	10.7	1.87
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	506	7.54	0.050	28.69	7.9	1.07
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	513	2.18	0.050	28.69	4.2	2.02
		3,230					**28.60**
							23.41

MCT6

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.23	0.240	0.00	0.1	16.32
SHALLOW	UNPAVED	1,173	2.64	0.000	16.10	2.6	7.48
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	266	5.06	0.050	42.29	9.5	0.47
		1,539					**24.27**
							18.32

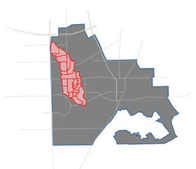
MCT7

OVERLAND	GRS-DENSE	100	1.18	0.24	0	0.1	16.61
SHALLOW	UNPAVED	200	1.52	0	16.1	2.0	1.68
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	577	4.66	0.05	28.69	6.2	1.55
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	927	5.02	0.05	42.29	9.5	1.63
		1804					**21.47**
							16.90

WATERSHED NO.
7

COUNCIL DISTRICTS
1, 2, 4 AND 5

TOTAL DRAINAGE AREA
3.27 SM
*
STREAM LENGTH
5.04 MI
*
PROJECTS IDENTIFIED
3



1.3 SOILS MAP

Mill Branch watershed has multiple hydrologic soil groups present within it's boundaries. Hydrologic soil groups B, C, and D are present in the Mill Branch watershed. The majority of the watershed consists of type D Soil (least permeable). Hydrologic soils group D is present in each sub-basin. Soil group C is present mostly in southern sub-basins MC11, MC12, MC13, MC14, MCT5, MCT6 and MCT7. A very small percentage of type C soil is found in MC1. Type B soil is located only in sub-basin MC14 near the confluence with Ten-Mile Creek.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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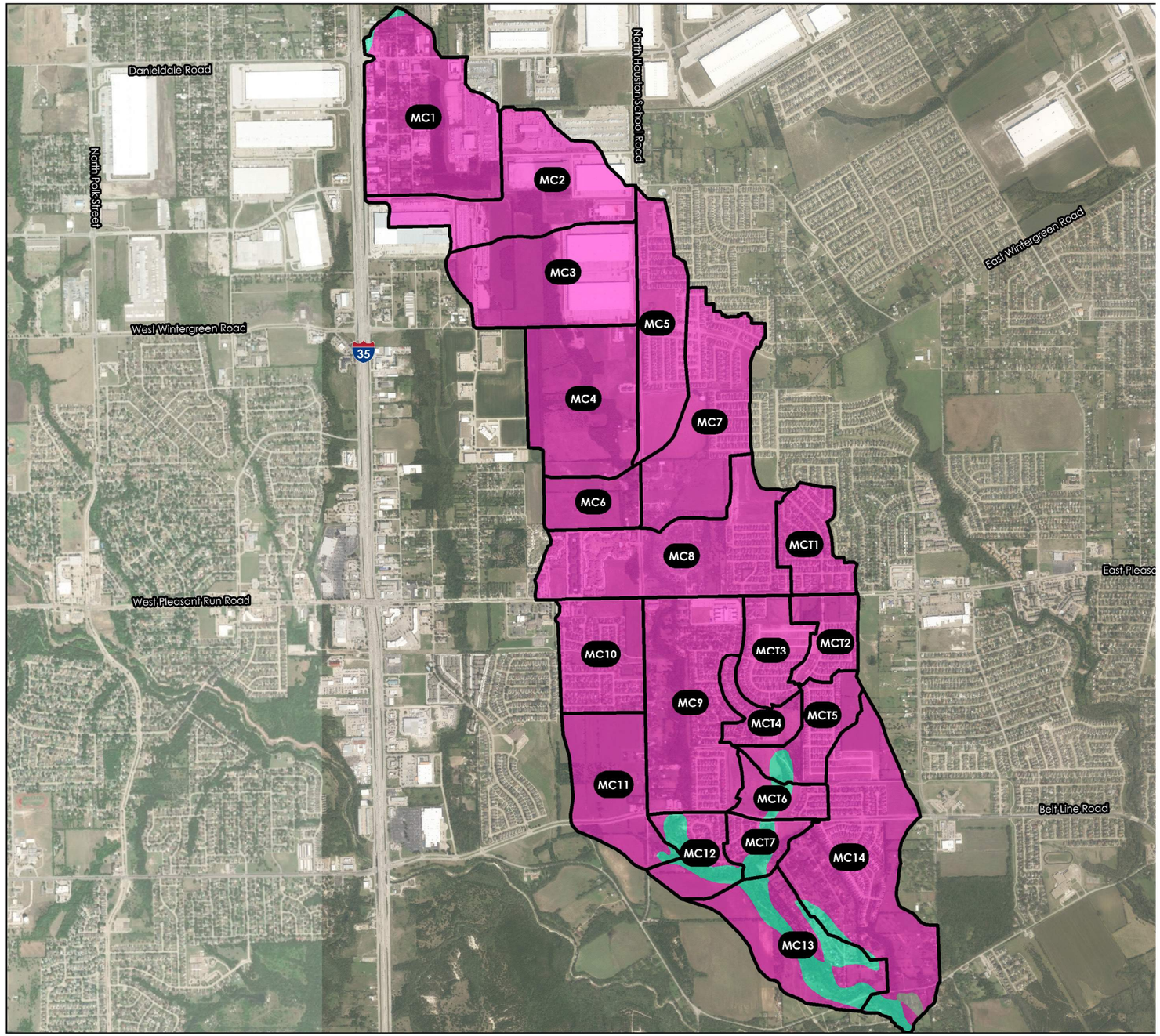


PERVIOUS CURVE NUMBER REPORT

MC1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
C	79	2.4	1.1
D	84	173.1	82.8
		175.5	**83.9**

MC2

D	84	145.4	84.0
		145.4	**84.0**

MC3

D	84	144.8	84.0
		144.8	**84.0**

MC4

D	84	139.4	84.0
		139.4	**84.0**

MC5

D	84	97.3	84.0
		97.3	**84.0**

MC6

D	84	45.3	84.0
		45.3	**84.0**

MC7

D	84	142.3	84.0
		142.3	**84.0**

MC8

D	84	172.7	84.0
		172.7	**84.0**

MC9

C	79	0.0	0.0
D	84	167.9	84.0
		167.9	**84.0**

MC10

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	84.8	84.0
		84.8	**84.0**

MC11

C	79	2.0	1.7
D	84	95.6	82.2
		97.7	**83.9**

MC12

C	79	16.0	25.3
D	84	33.9	57.1
		49.9	**82.4**

MC13

C	79	42.0	30.7
D	84	65.9	51.3
		107.8	**82.1**

MC14

B	69	3.2	1.0
C	79	13.0	4.7
D	84	201.9	77.7
		218.2	**83.5**

MCT1

D	84	54.7	84.0
		54.7	**84.0**

MCT2

D	84	41.8	84.0
		41.8	**84.0**

MCT3

D	84	55.0	84.0
		55.0	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

PERVIOUS CURVE NUMBER REPORT - CONTINUED

MCT4

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	32.7	84.0
		32.7	**84.0**

MCT5

C	79	5.7	8.1
D	84	50.2	75.4
		55.9	**83.5**

MCT6

C	79	5.2	12.6
D	84	27.5	70.6
		32.7	**83.2**

MCT7

C	79	9.5	24.4
D	84	21.2	58.0
		30.7	**82.5**

WATERSHED NO.
7

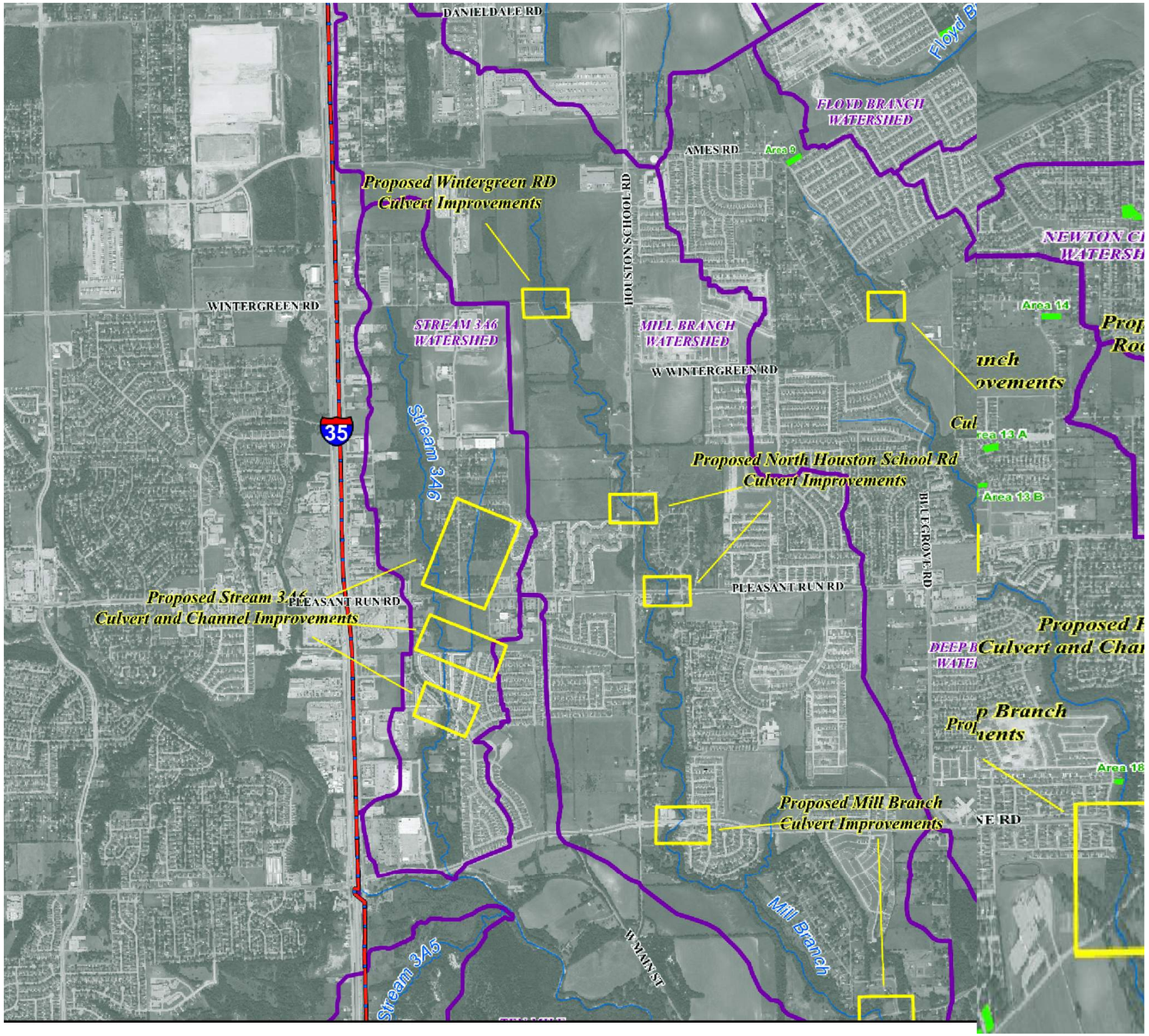
COUNCIL DISTRICTS
1, 2, 4 AND 5

TOTAL DRAINAGE AREA
3.27 SM
*
STREAM LENGTH
5.04 MI
*
PROJECTS IDENTIFIED
3



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows some new development since 2007 within the Mill Branch watershed. A new residential development has been created in north half of the watershed, as well as a few new industrial warehouses and commercial buildings. The southern half of the watershed has seen no major development.



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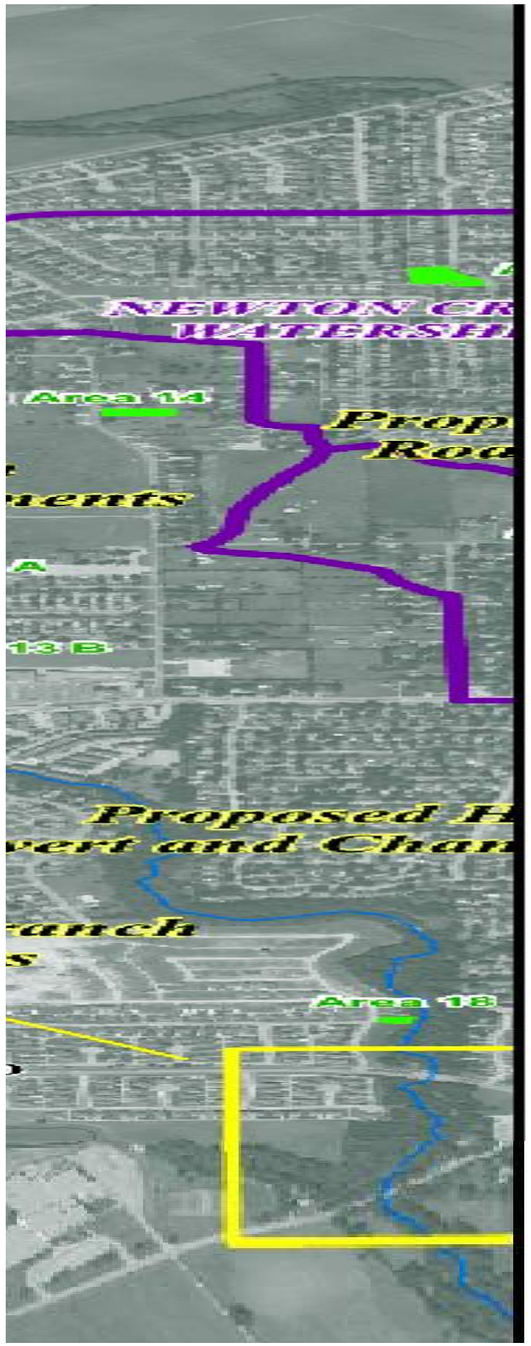
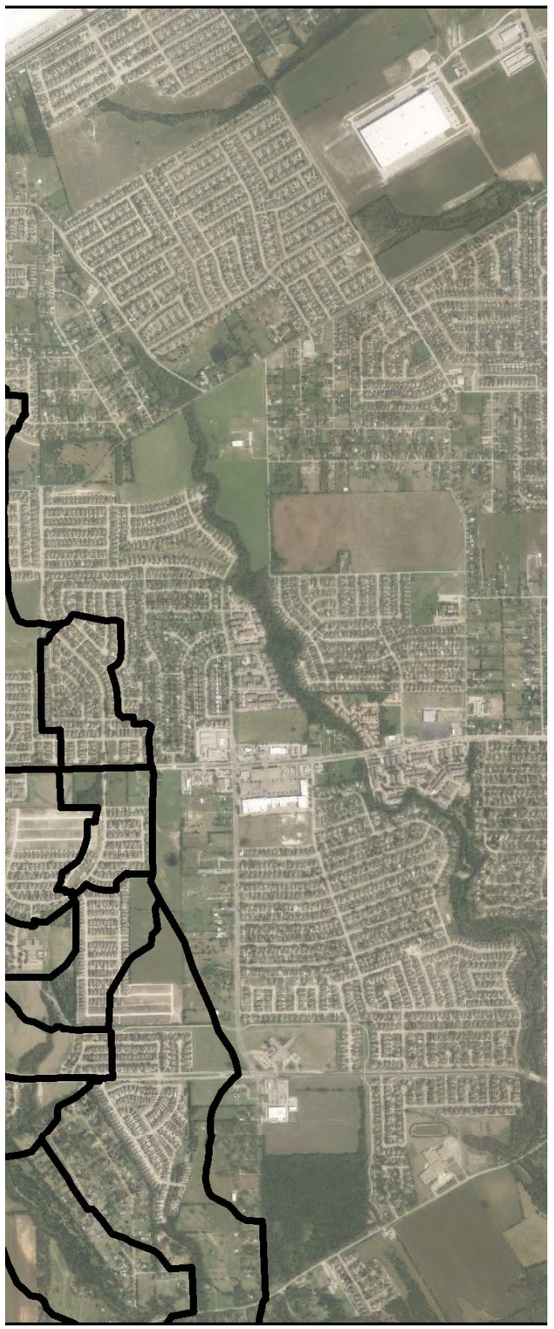
2007





N

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2019

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

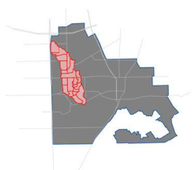
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



1.5 IMPERVIOUS AREA

Impervious areas for the Mill Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods and a few commercial and industrial developments. Sub-basins MC3 through MC7 and MC11 through MC14 have the largest amount of open area available for future development.

IMPERVIOUS

OPEN SPACE (FAIR CONDITIONS)

N

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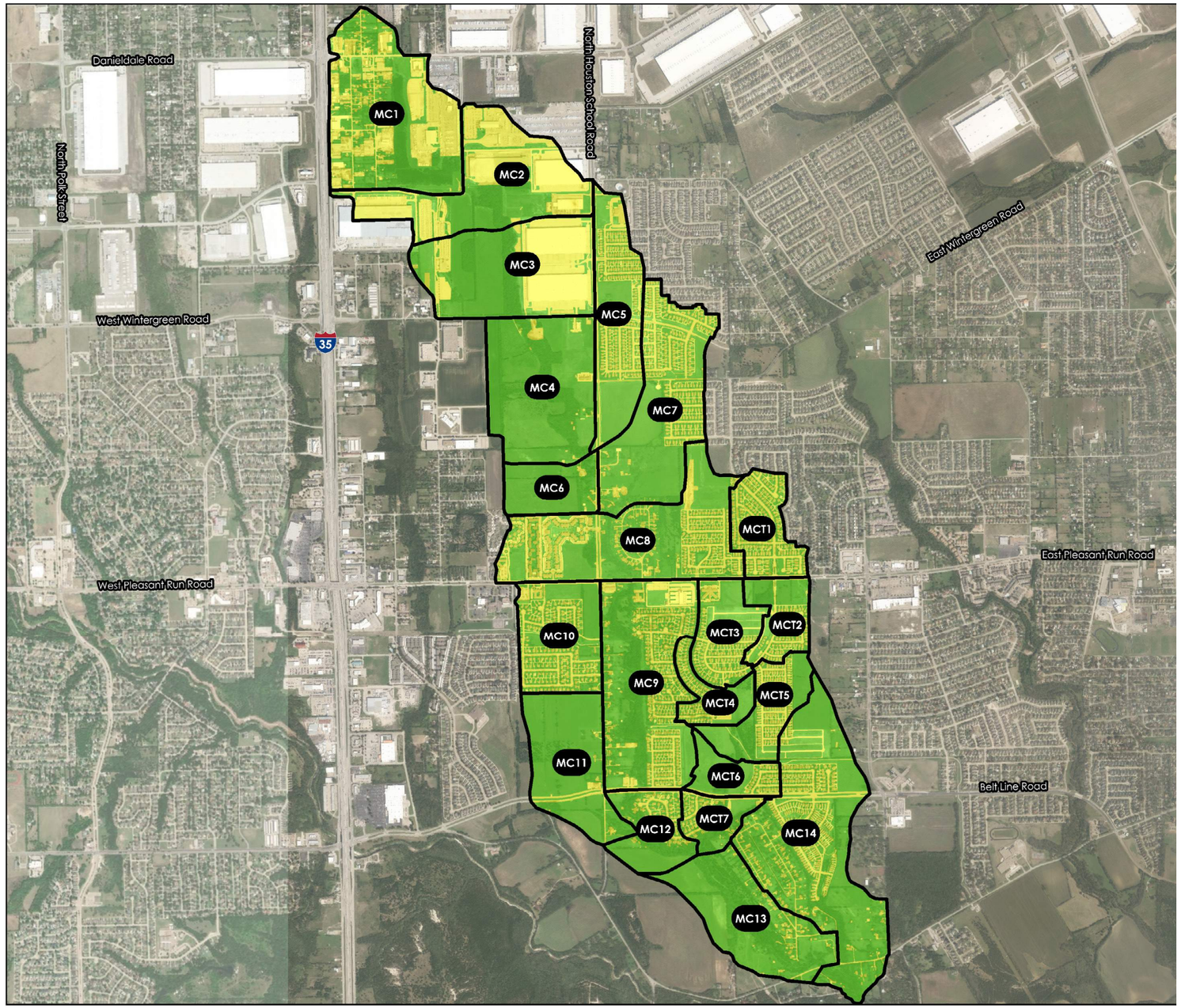


EXISTING PERCENT IMPERVIOUS REPORT

MC1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	89.4	0.0
IMPERVIOUS	100	86.1	49.1
		175.5	**49.1**

MC2

OPEN SPACE (FAIR CONDITION)	0	48.3	0.0
IMPERVIOUS	100	97.1	66.8
		145.4	**66.8**

MC3

OPEN SPACE (FAIR CONDITION)	0	68.2	0.0
IMPERVIOUS	100	76.6	52.9
		144.8	**52.9**

MC4

OPEN SPACE (FAIR CONDITION)	0	131.8	0.0
IMPERVIOUS	100	7.6	5.5
		139.4	**5.5**

MC5

OPEN SPACE (FAIR CONDITION)	0	58.2	0.0
IMPERVIOUS	100	39.0	40.1
		97.3	**40.1**

MC6

OPEN SPACE (FAIR CONDITION)	0	43.0	0.0
IMPERVIOUS	100	2.3	5.0
		45.3	**5.0**

MC7

OPEN SPACE (FAIR CONDITION)	0	98.7	0.0
IMPERVIOUS	100	43.7	30.7
		142.3	**30.7**

MC8

OPEN SPACE (FAIR CONDITION)	0	108.3	0.0
IMPERVIOUS	100	64.5	37.3
		172.7	**37.3**

MC9

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	110.9	0.0
IMPERVIOUS	100	57.1	34.0
		167.9	**34.0**

MC10

OPEN SPACE (FAIR CONDITION)	0	51.1	0.0
IMPERVIOUS	100	33.7	39.7
		84.8	**39.7**

MC11

OPEN SPACE (FAIR CONDITION)	0	91.2	0.0
IMPERVIOUS	100	6.5	6.7
		97.7	**6.7**

MC12

OPEN SPACE (FAIR CONDITION)	0	37.3	0.0
IMPERVIOUS	100	12.6	25.3
		49.9	**25.3**

MC13

OPEN SPACE (FAIR CONDITION)	0	100.8	0.0
IMPERVIOUS	100	7.0	6.5
		107.8	**6.5**

MC14

OPEN SPACE (FAIR CONDITION)	0	166.4	0.0
IMPERVIOUS	100	51.7	23.7
		218.2	**23.7**

MCT1

OPEN SPACE (FAIR CONDITION)	0	23.5	0.0
IMPERVIOUS	100	31.3	57.1
		54.7	**57.1**

MCT2

OPEN SPACE (FAIR CONDITION)	0	26.8	0.0
IMPERVIOUS	100	15.1	36.0
		41.8	**36.0**

EXISTING PERCENT IMPERVIOUS REPORT

MCT3			
LAND USE	**PERCENT IMPERVIOUS**	**SHAPE AREA**	**AREA WEIGHTED PERCENT_IMPERVIOUS**
OPEN SPACE (FAIR CONDITION)	0	34.2	0.0
IMPERVIOUS	100	20.8	37.9
		55.0	**37.9**

MCT4			
OPEN SPACE (FAIR CONDITION)	0	19.6	0.0
IMPERVIOUS	100	13.1	40.1
		32.7	**40.1**

MCT5			
OPEN SPACE (FAIR CONDITION)	0	37.6	0.0
IMPERVIOUS	100	18.4	32.8
		55.9	**32.8**

MCT6			
OPEN SPACE (FAIR CONDITION)	0	25.7	0.0
IMPERVIOUS	100	7.1	21.6
		32.7	**21.6**

MCT7			
OPEN SPACE (FAIR CONDITION)	0	21.0	0.0
IMPERVIOUS	100	9.8	31.8
		30.7	**31.8**

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

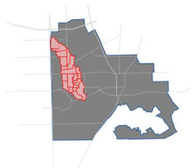
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



1.6 FUTURE LAND USE MAP

Impervious areas for the Mill Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods and a few commercial and industrial developments. Sub-basins MC3 through MC7 and MC11 through MC14 have the largest amount of open area available for future development.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- R - URBAN NEIGHBORHOOD
- SURBURBAN MIXED USE CENTER

N

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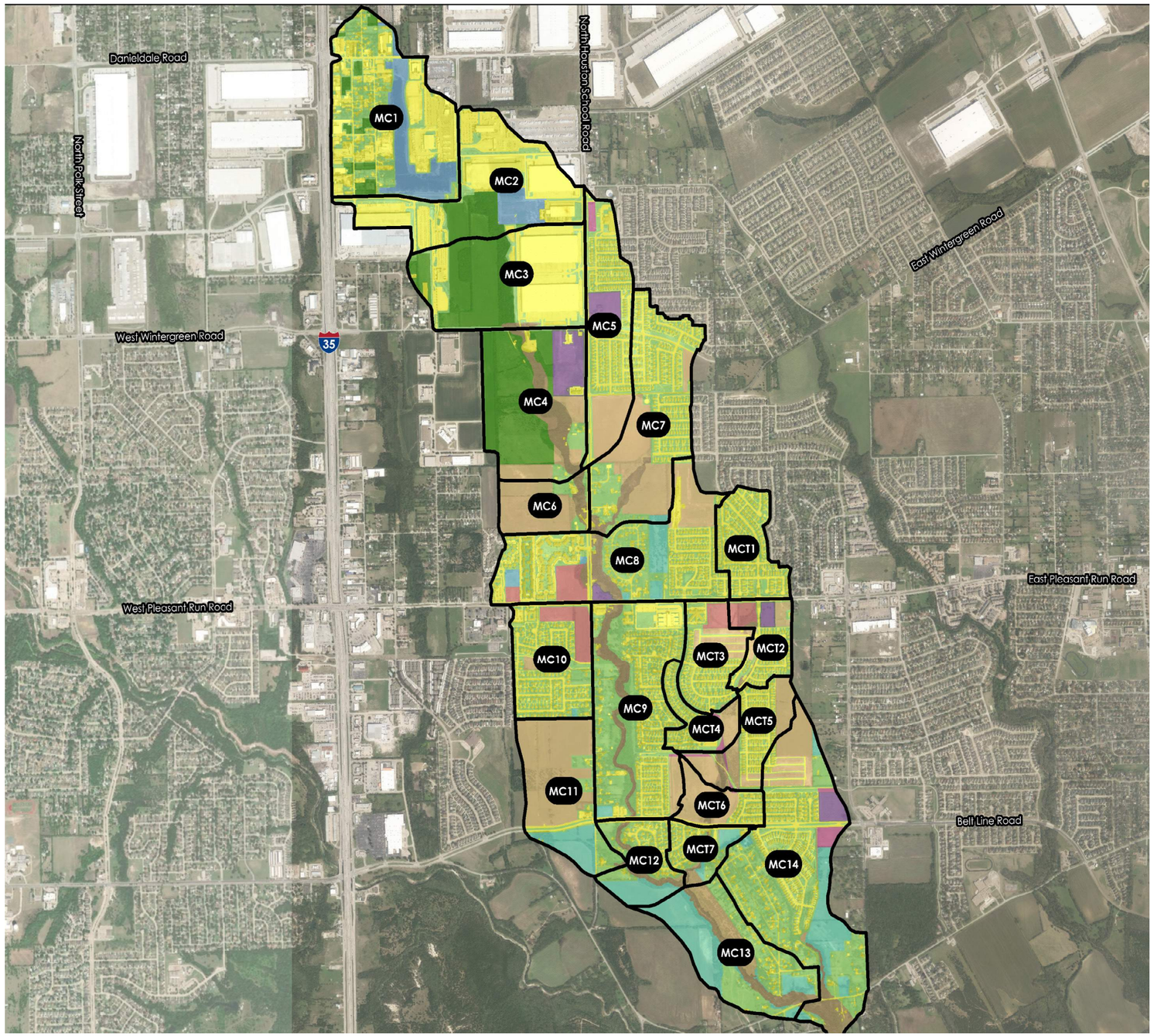


ULTIMATE PERCENT IMPERVIOUS REPORT

MC1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	86.1	49.1
OPEN SPACE (FAIR CONDITION)	0	45.2	0.0
SURBURBAN MIXED USE CENTER	85	10.8	5.2
LOGISTICS & DISTRIBUTION	72	33.5	13.7
		175.5	**68.0**

MC2

IMPERVIOUS	100	90.9	62.5
OPEN SPACE (FAIR CONDITION)	0	20.1	0.0
SURBURBAN MIXED USE CENTER	85	21.8	12.7
LOGISTICS & DISTRIBUTION	72	12.6	6.2
		145.4	**81.5**

MC3

FLOODPLAIN	0	1.5	0.0
IMPERVIOUS	100	69.0	47.7
OPEN SPACE (FAIR CONDITION)	0	15.1	0.0
SURBURBAN MIXED USE CENTER	85	59.2	34.7
		144.8	**82.4**

MC4

FLOODPLAIN	0	19.4	0.0
IMPERVIOUS	100	7.6	5.5
OPEN SPACE (FAIR CONDITION)	0	9.1	0.0
R - SURBURBAN NEIGHBORHOOD	38	15.9	4.3
COMMERCIAL NODE	85	16.5	10.0
SURBURBAN MIXED USE CENTER	85	70.9	43.2
		139.4	**63.1**

MC5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	0.1	0.0
IMPERVIOUS	100	39.0	40.1
OPEN SPACE (FAIR CONDITION)	0	28.4	0.0
R - SURBURBAN NEIGHBORHOOD	38	17.3	6.8
COMMERCIAL NODE	85	10.6	9.2
PUBLIC & SEMI-PUBLIC	72	2.0	1.4
		97.3	**57.5**

MC6

FLOODPLAIN	0	4.6	0.0
IMPERVIOUS	100	2.3	5.0
OPEN SPACE (FAIR CONDITION)	0	5.3	0.0
R - SURBURBAN NEIGHBORHOOD	38	33.1	27.8
		45.3	**32.8**

MC7

FLOODPLAIN	0	7.3	0.0
IMPERVIOUS	100	43.7	30.7
OPEN SPACE (FAIR CONDITION)	0	48.9	0.0
R - RURAL LIVING	12	1.3	0.1
R - SURBURBAN NEIGHBORHOOD	38	41.1	11.0
		142.3	**41.8**

MC8

FLOODPLAIN	0	8.9	0.0
IMPERVIOUS	100	64.5	37.3
OPEN SPACE (FAIR CONDITION)	0	56.5	0.0
R - RURAL LIVING	12	10.7	0.7
R - SURBURBAN NEIGHBORHOOD	38	16.4	3.6
MIXED USE	85	11.0	5.4
COMMERCIAL NODE	85	2.0	1.0
R - URBAN NEIGHBORHOOD	65	2.7	1.0
		172.7	**49.1**
		172.7	**49.1**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

MC9

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	16.7	0.0
IMPERVIOUS	100	57.1	34.0
OPEN SPACE (FAIR CONDITION)	0	85.7	0.0
R - RURAL LIVING	12	1.7	0.1
R - SURBURBAN NEIGHBORHOOD	38	6.5	1.5
PUBLIC & SEMI-PUBLIC	72	0.2	0.1
		167.9	**35.7**

MC10

IMPERVIOUS	100	33.7	39.7
OPEN SPACE (FAIR CONDITION)	0	34.0	0.0
R - RURAL LIVING	12	0.6	0.1
R - SURBURBAN NEIGHBORHOOD	38	4.2	1.9
MIXED USE	85	12.4	12.4
		84.8	**54.1**

MC11

FLOODPLAIN	0	0.4	0.0
IMPERVIOUS	100	6.5	6.7
OPEN SPACE (FAIR CONDITION)	0	14.0	0.0
R - RURAL LIVING	12	16.6	2.0
R - SURBURBAN NEIGHBORHOOD	38	60.1	23.4
		97.7	**32.1**

MC12

FLOODPLAIN	0	5.4	0.0
IMPERVIOUS	100	12.6	25.3
OPEN SPACE (FAIR CONDITION)	0	18.5	0.0
R - RURAL LIVING	12	12.9	3.1
R - SURBURBAN NEIGHBORHOOD	38	0.5	0.4
		49.9	**28.8**

MC13

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	12.7	0.0
IMPERVIOUS	100	7.0	6.5
OPEN SPACE (FAIR CONDITION)	0	37.0	0.0
R - RURAL LIVING	12	37.8	4.2
R - SURBURBAN NEIGHBORHOOD	38	13.3	4.7
		107.8	**15.4**

MC14

FLOODPLAIN	0	12.4	0.0
IMPERVIOUS	100	51.7	23.7
OPEN SPACE (FAIR CONDITION)	0	93.5	0.0
R - RURAL LIVING	12	27.0	1.5
R - SURBURBAN NEIGHBORHOOD	38	22.4	3.9
COMMERCIAL NODE	85	6.7	2.6
PUBLIC & SEMI-PUBLIC	72	4.6	1.5
		218.2	**33.2**

MCT1

IMPERVIOUS	100	31.3	57.1
OPEN SPACE (FAIR CONDITION)	0	23.5	0.0
		54.7	**57.1**

MCT2

FLOODPLAIN	0	1.3	0.0
IMPERVIOUS	100	15.1	36.0
OPEN SPACE (FAIR CONDITION)	0	11.9	0.0
R - SURBURBAN NEIGHBORHOOD	38	4.6	4.2
MIXED USE	85	5.8	11.9
COMMERCIAL NODE	85	3.1	6.4
		41.8	**58.4**

ULTIMATE PERCENT IMPERVIOUS REPORT

MCT3

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	0.3	0.0
IMPERVIOUS	100	20.8	37.9
OPEN SPACE (FAIR CONDITION)	0	17.0	0.0
R - SURBURBAN NEIGHBORHOOD	38	11.6	8.0
MIXED USE	85	5.2	8.0
		55.0	**53.9**

MCT4

FLOODPLAIN	0	0.0	0.0
IMPERVIOUS	100	13.1	40.1
OPEN SPACE (FAIR CONDITION)	0	11.7	0.0
R - SURBURBAN NEIGHBORHOOD	38	6.3	7.3
PUBLIC & SEMI-PUBLIC	72	1.6	3.6
		32.7	**51.0**

MCT5

FLOODPLAIN	0	3.0	0.0
IMPERVIOUS	100	18.4	32.8
OPEN SPACE (FAIR CONDITION)	0	11.9	0.0
R - SURBURBAN NEIGHBORHOOD	38	21.4	14.6
PUBLIC & SEMI-PUBLIC	72	1.2	1.5
		55.9	**48.9**

MCT6

FLOODPLAIN	0	1.7	0.0
IMPERVIOUS	100	7.1	21.6
OPEN SPACE (FAIR CONDITION)	0	4.2	0.0
R - SURBURBAN NEIGHBORHOOD	38	19.6	22.8
PUBLIC & SEMI-PUBLIC	72	0.2	0.3
		32.7	**44.7**

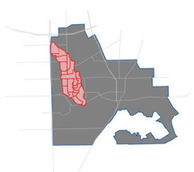
MCT7

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	1.8	0.0
IMPERVIOUS	100	9.8	31.8
OPEN SPACE (FAIR CONDITION)	0	12.3	0.0
R - RURAL LIVING	12	4.0	1.5
R - SURBURBAN NEIGHBORHOOD	38	2.1	2.6
PUBLIC & SEMI-PUBLIC	72	0.8	1.8
		30.7	**37.8**

WATERSHED NO.
7

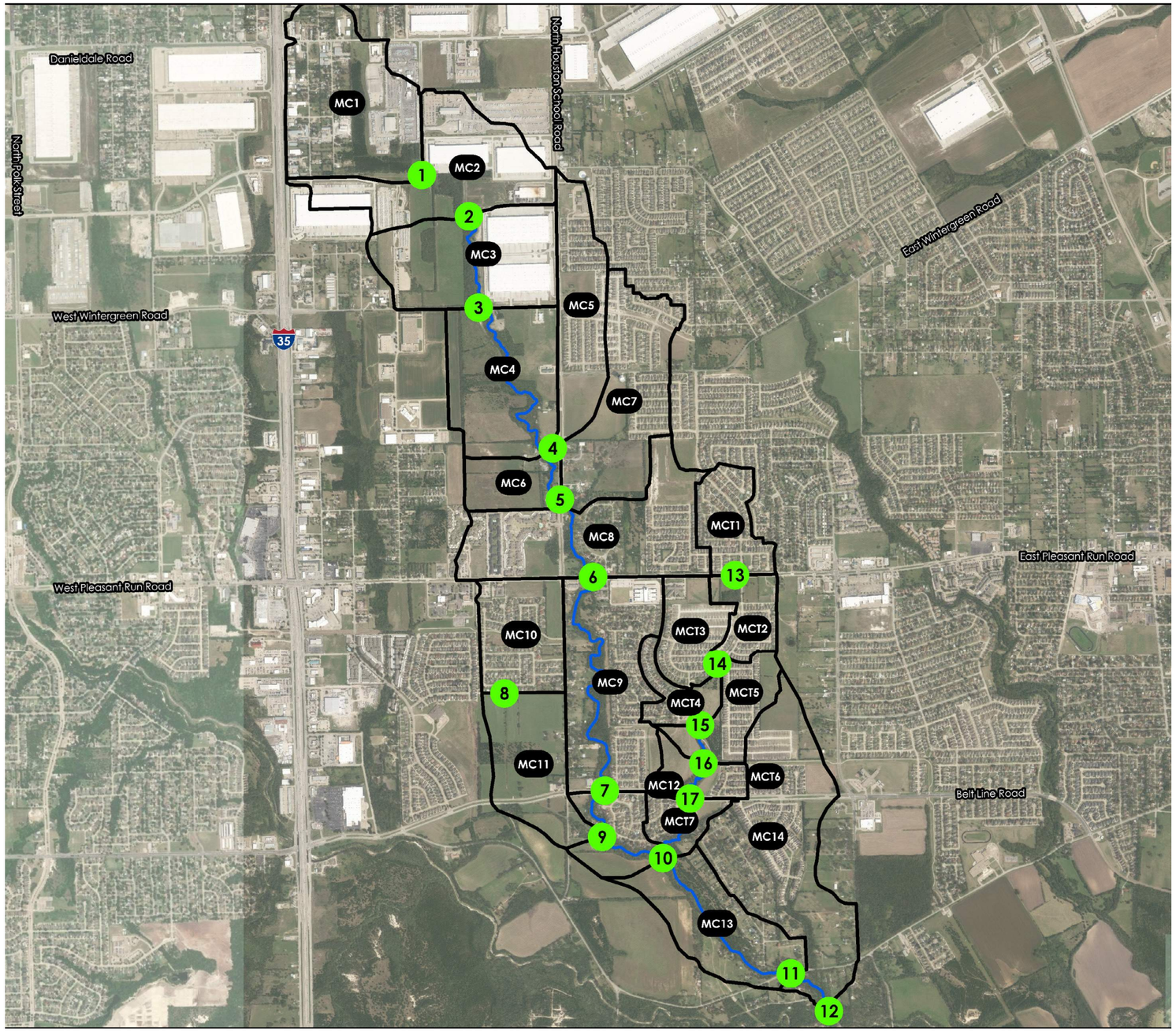
COUNCIL DISTRICTS
1, 2, 4 AND 5

TOTAL DRAINAGE AREA
3.27 SM
*
STREAM LENGTH
5.04 MI
*
PROJECTS IDENTIFIED
3



1.7 RESULTS

The flow was analyzed at eighteen locations for Floyd Branch. Flow location 2 and was used to establish flows at the upstream end of the stream. Likewise, location 16 establishes tributary flows at the top of its reach. Locations 3, 5, 7, 8, 11, 17 and 18 are included to examin flows at roadways. Location 3 was included because of the location of its respective sub-basin. Locations 6, 9 and 10 analyze the impact of additional minor tributaries flowing into the main reach. The other locations are the not directly included in the hydraulic model because the locations are offline of the main channel and tributaries.



N

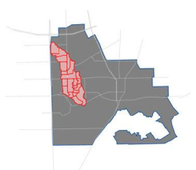
N.T.S.

FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	MC1	-	-	0.27	1000
2	MC1, MC2	MillCreek	23213	0.50	1650
3	MC1-MC3	MillCreek	21413	0.73	2300
4	MC1-MC5	MillCreek	17062	1.10	3000
5	MC1-MC6	MillCreek	15461	1.17	3100
6	MC1-MC7	MillCreek	14927	1.39	3800
7	MC1-MC8	MillCreek	13625	1.66	4500
8	MC1-MC9	MillCreek	7609	1.92	4600
9	MC1-MC11	MillCreek	6349	2.21	5400
10	MC1-MC12, MCT1-MCT7	MillCreek	4592	2.76	6900
11	MC1-MC13, MCT1-MCT7	MillCreek	1229	2.93	7000
12	MC1-MC14, MCT1-MCT7	MillCreek	0	3.27	7800
13	MC10	-	-	0.13	550
14	MCT1	-	-	0.09	400
15	MCT1-MCT3	-	-	0.24	1000
16	MCT1-MCT4	Trib	3377	0.29	1200
17	MCT1-MCT5	Trib	2501	0.38	1550
18	MCT1-MCT6	Trib	1857	0.43	1600

WATERSHED NO.
7

COUNCIL DISTRICTS
1, 2, 4 AND 5

TOTAL DRAINAGE AREA
3.27 SM
*
STREAM LENGTH
5.04 MI
*
PROJECTS IDENTIFIED
3



2.1 SITE ASSESSMENT

Mill Creek is located in the West half of the City of Lancaster. It flows from North to South for approximately 5.04 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Mill Creek within the limits of the City of Lancaster, roughly bound by Wintergreen Road (upstream end) and the stream's confluence with Ten Mile Creek (downstream end). The channel slope averages around 0.5-0.7%. The main stream and the tributary were put into separate hydraulic models. Each model consists of one stream and one reach. Mill Creek is located in a heavily developed area of the city. Because of this, the overbanks for much of the stream include roads and buidlings. The main channels are generally wooded. There are a total of six (6) crossings throughout the watershed.



Looking upstream from Wintergreen Road. The stream at the upstream limit is heavily vegetated.



Looking upstream of North Houston School Road culvert. Upstream of the culvert the stream has heavy vegetation. The main channel aslo appears to have light vegetation, despite the concrete lining near the culvert.



Looking at the downstream Belt Line Street culvert face. The stream in this area is concrete lined and has additional concrete structures in the channel.

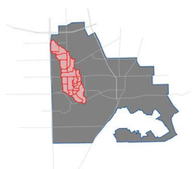


Looking downstream beneath the Main Street bridge. The channel further downstream seems clean with shrubs and trees on the overbanks.

WATERSHED NO.
7

COUNCIL DISTRICTS
1, 2, 4 AND 5

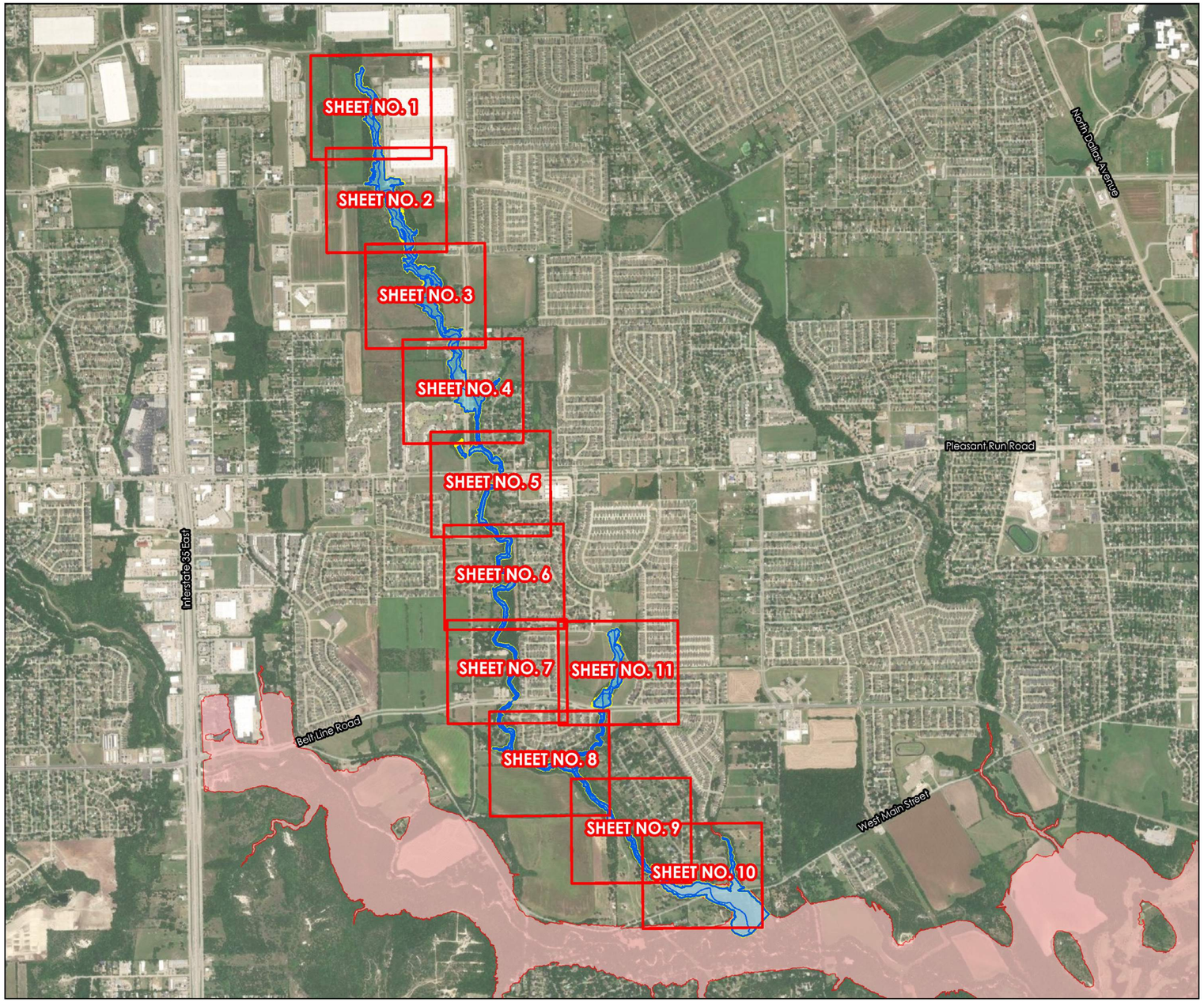
TOTAL DRAINAGE AREA
3.27 SM
*
STREAM LENGTH
5.04 MI
*
PROJECTS IDENTIFIED
3



2.2 FLOODPLAIN MAPPING

The Halls Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Halls Branch is comprised of one two separate models. The first models the main stream and includes one includes stream, one reach, fifty-six (56) cross sections, and five (5) hydraulic structures. The second model is for the Mill Cree tributary and is comprised of one stream, one reach, twenty (20) cross sections and one (1) hydraulic structures. The studied stream is 26,590 feet (5.05 miles) long.

The floodplain sheets for Mill Creek display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.

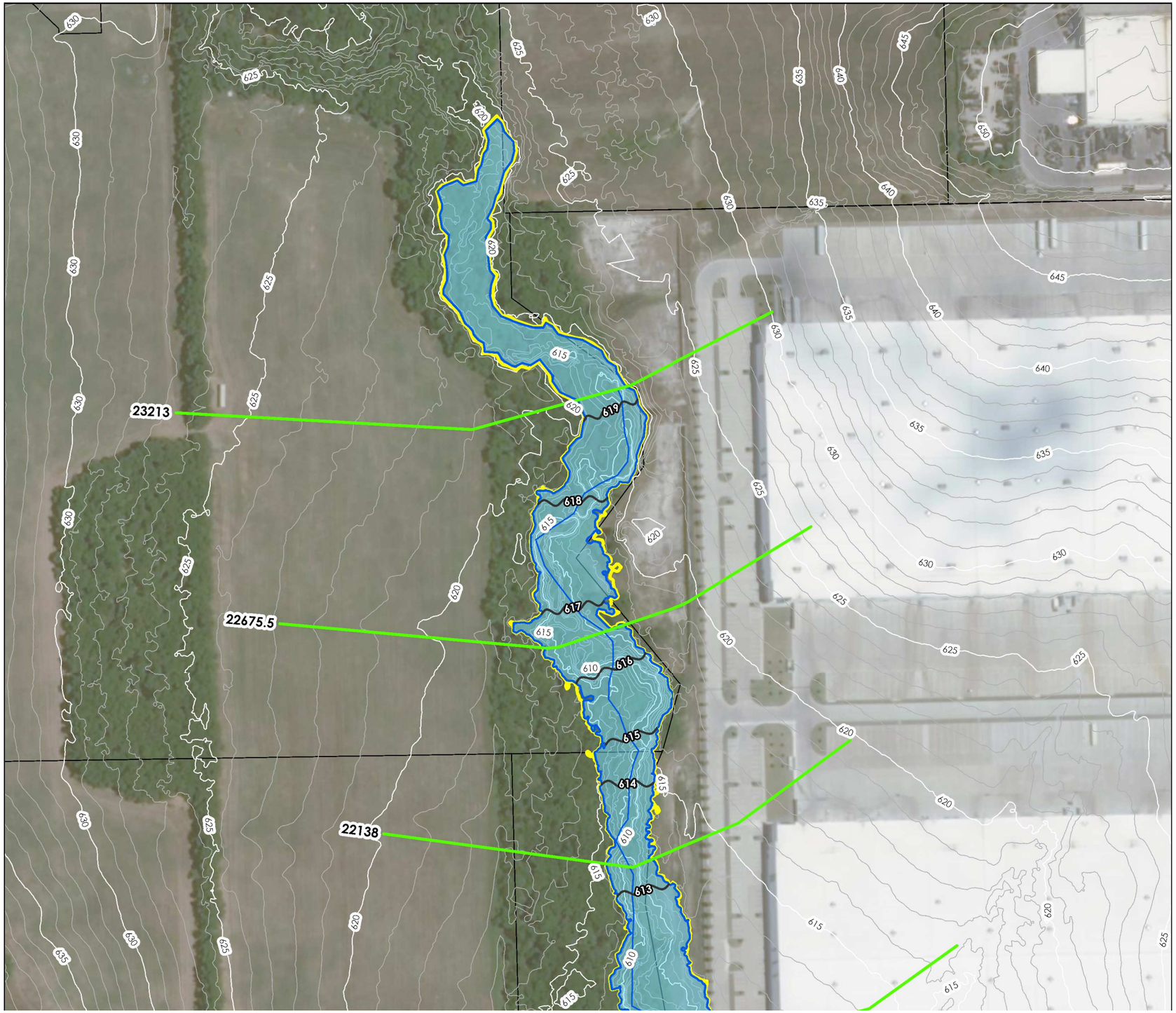


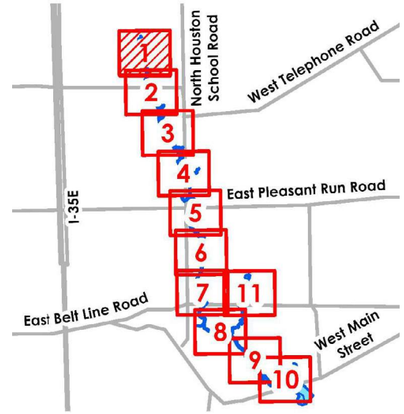
STREAM CENTERLINE
MILL VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200
Feet

CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
BASE FLOW ELEVATIONS
CEL

MILL CREEK

2.0 HYDRAULICS

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

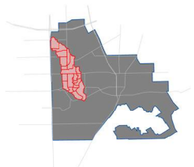
STREAM LENGTH

5.04 MI

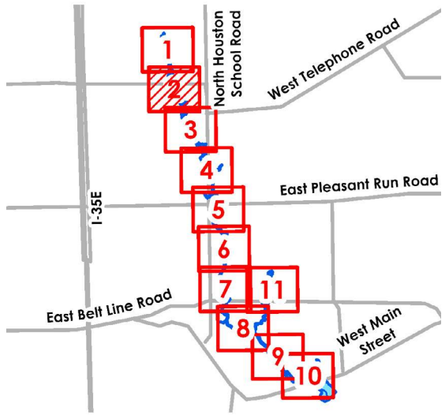
*

PROJECTS IDENTIFIED

3



FLOODPLAIN: SHEET 2



CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

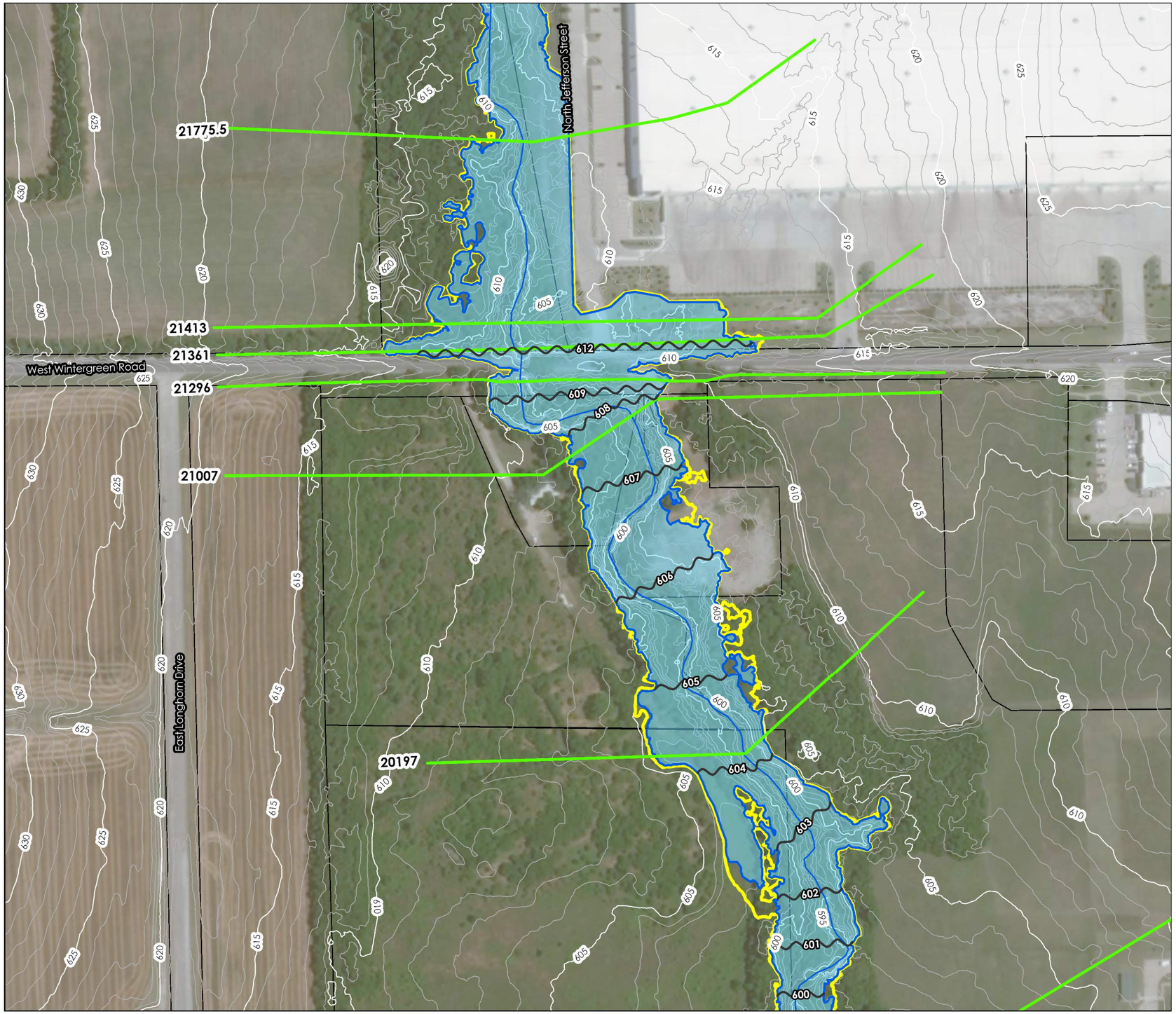
R MAJOR CONTOURS

R MINOR CONTOURS

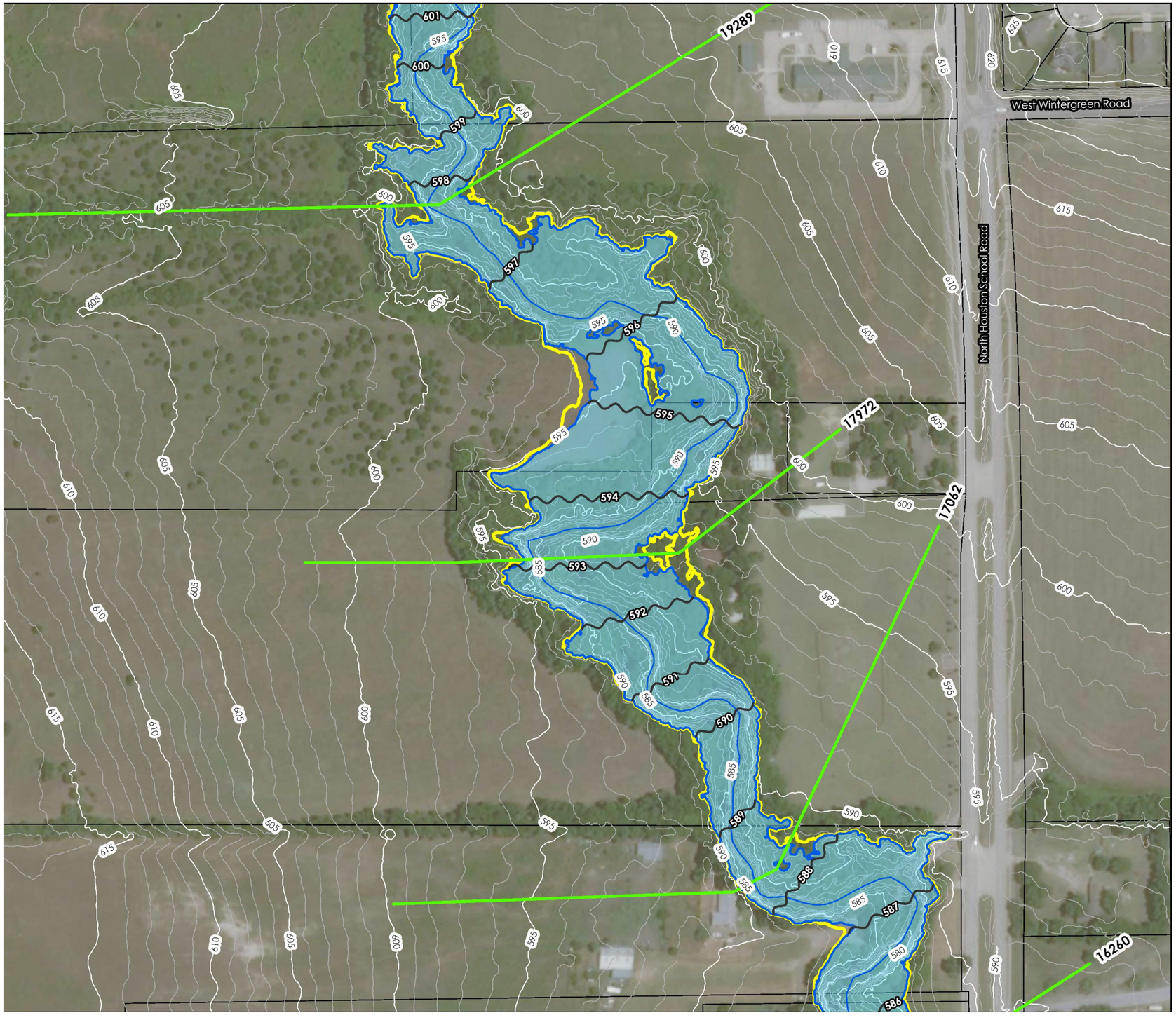
BASE FLOW ELEVATIONS

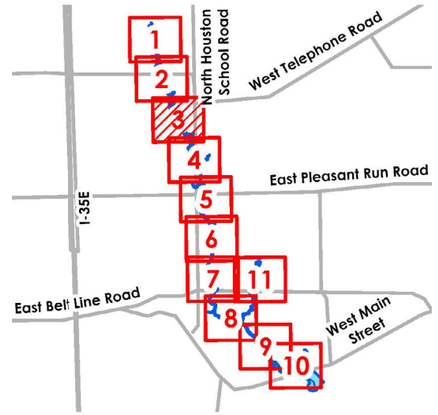
CEL

0



FLOODPLAIN: SHEET 3





N

0 100 200

Feet

CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

STREAM LENGTH

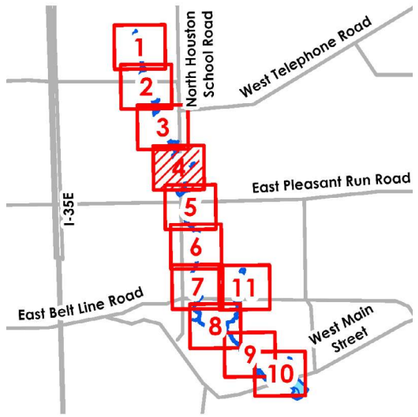
5.04 MI

*

PROJECTS IDENTIFIED

3

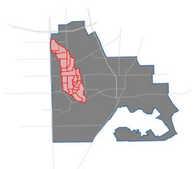
FLOODPLAIN: SHEET 4



N

0 100 200

Feet



CROSS SECTIONS

EAM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

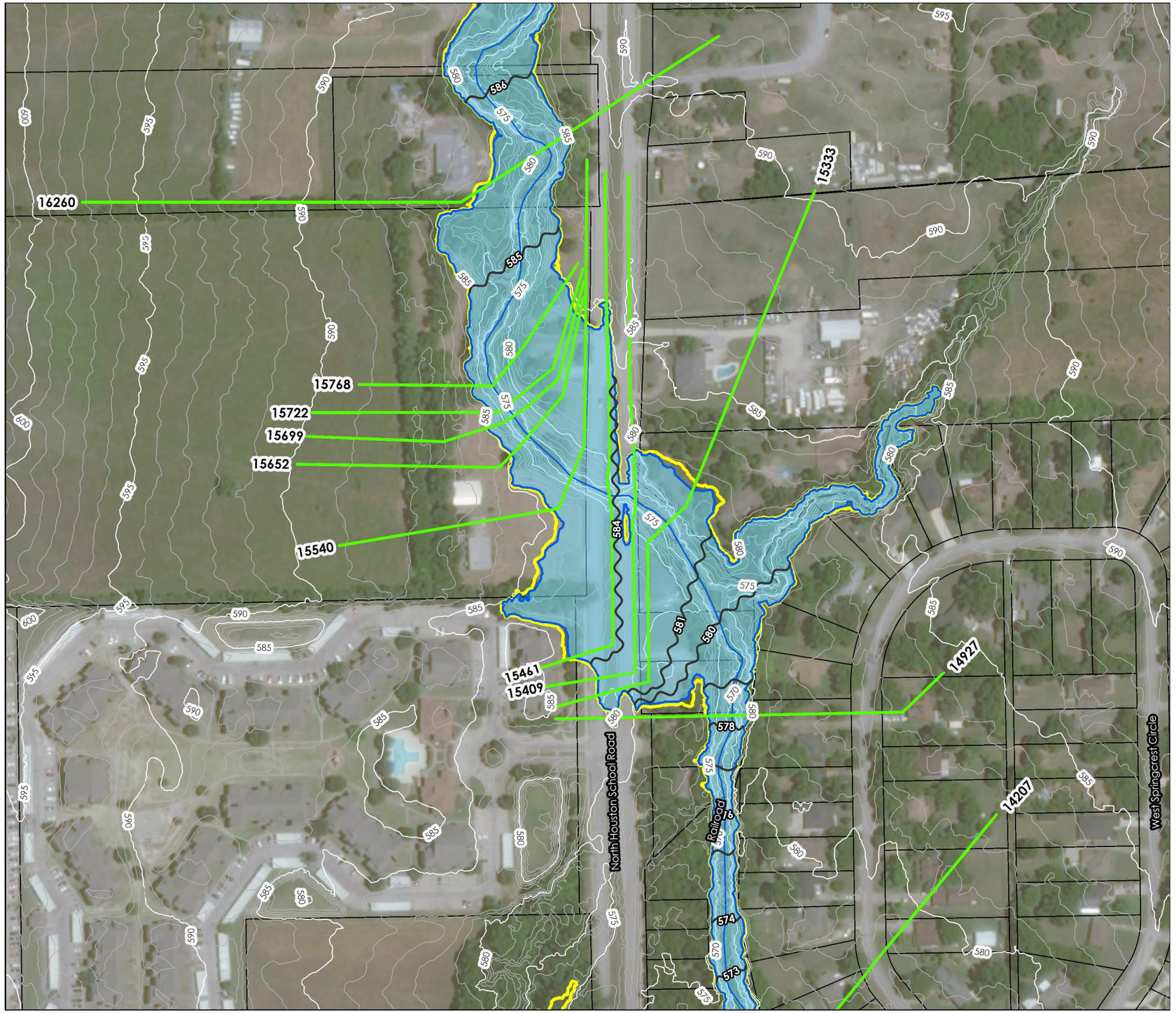
R MAJOR CONTOURS

R MINOR CONTOURS

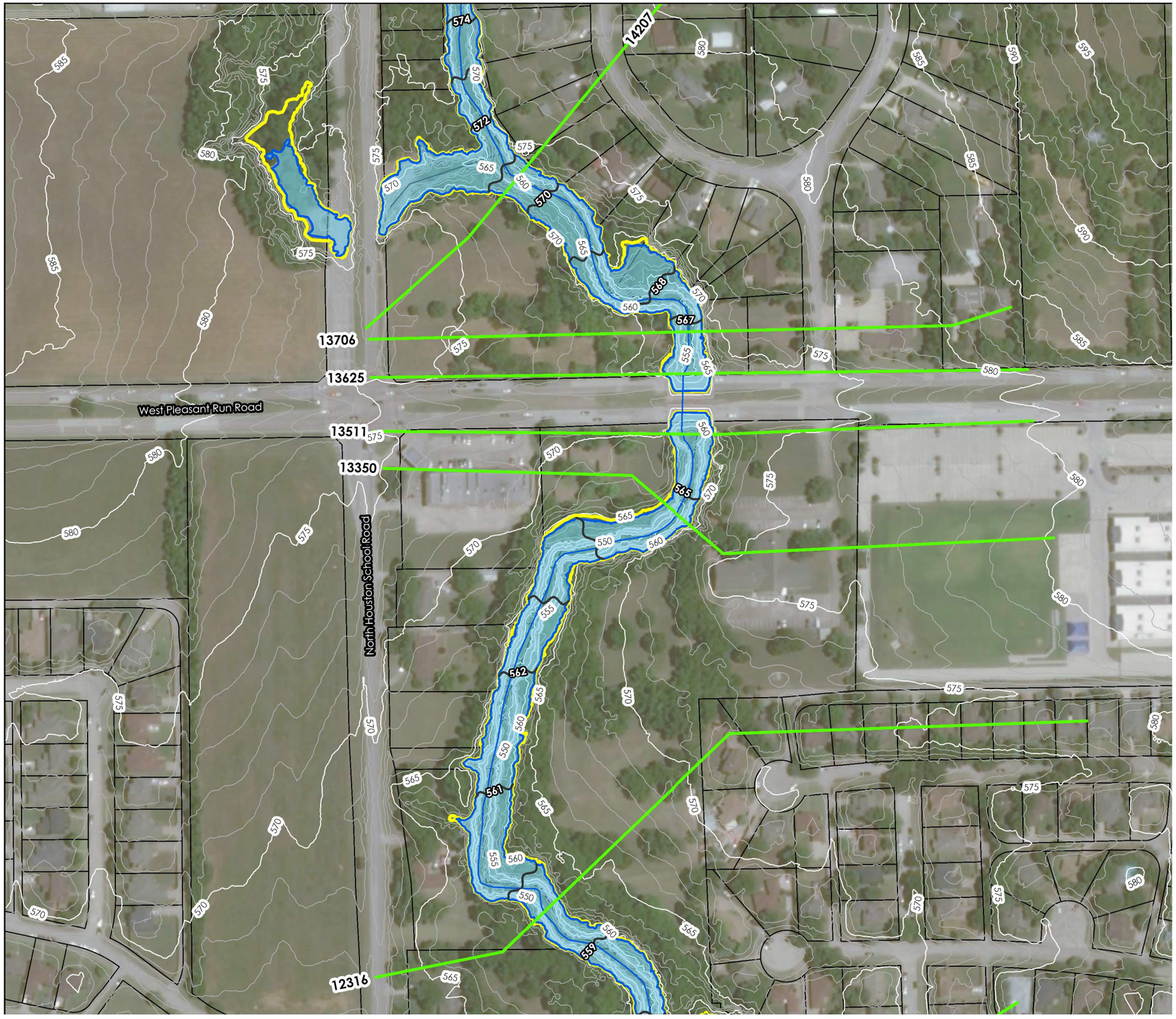
BASE FLOW ELEVATIONS

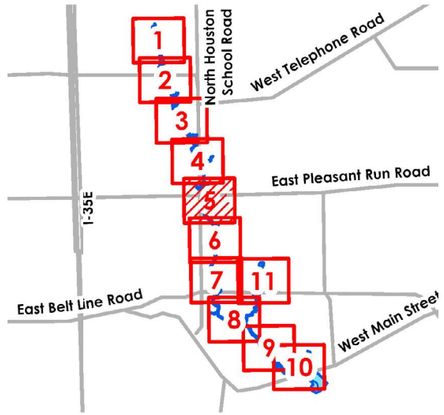
CEL

0



FLOODPLAIN: SHEET 5





N

0 100 200

Feet

CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

R MAJOR CONTOURS

R MINOR CONTOURS

BASE FLOW ELEVATIONS

CEL

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

STREAM LENGTH

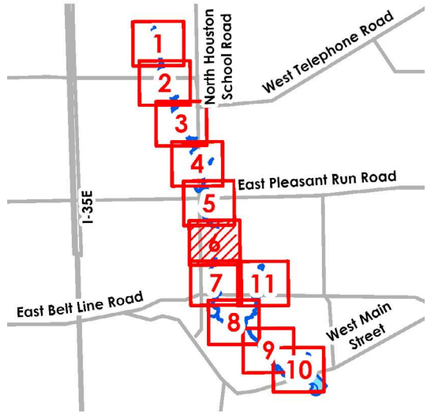
5.04 MI

*

PROJECTS IDENTIFIED

3

FLOODPLAIN: SHEET 6



N

0 100 200

Feet

CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

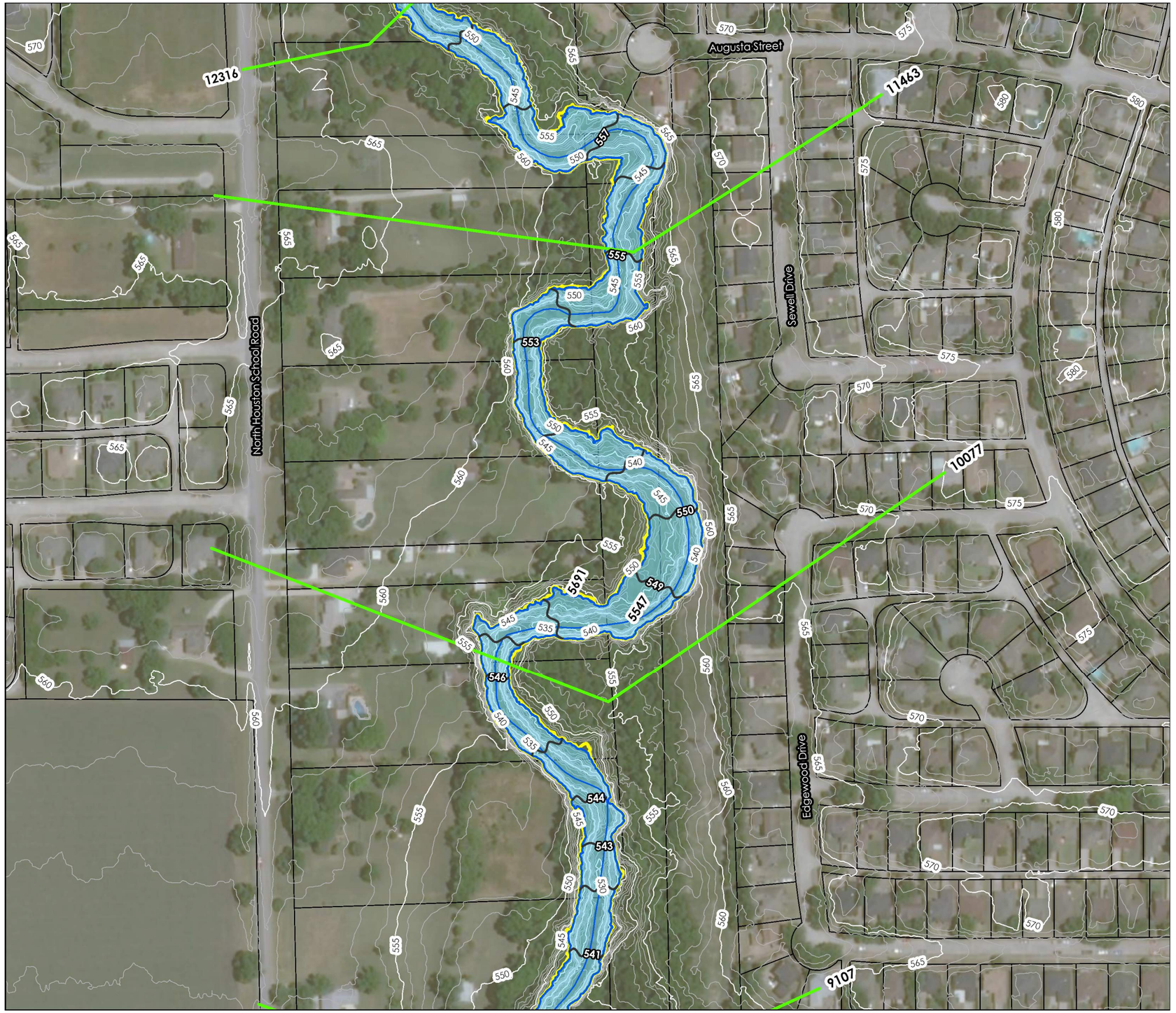
R MAJOR CONTOURS

R MINOR CONTOURS

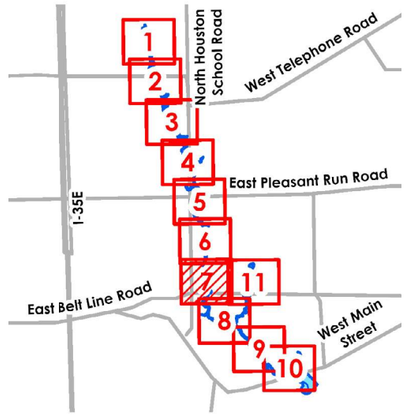
BASE FLOW ELEVATIONS

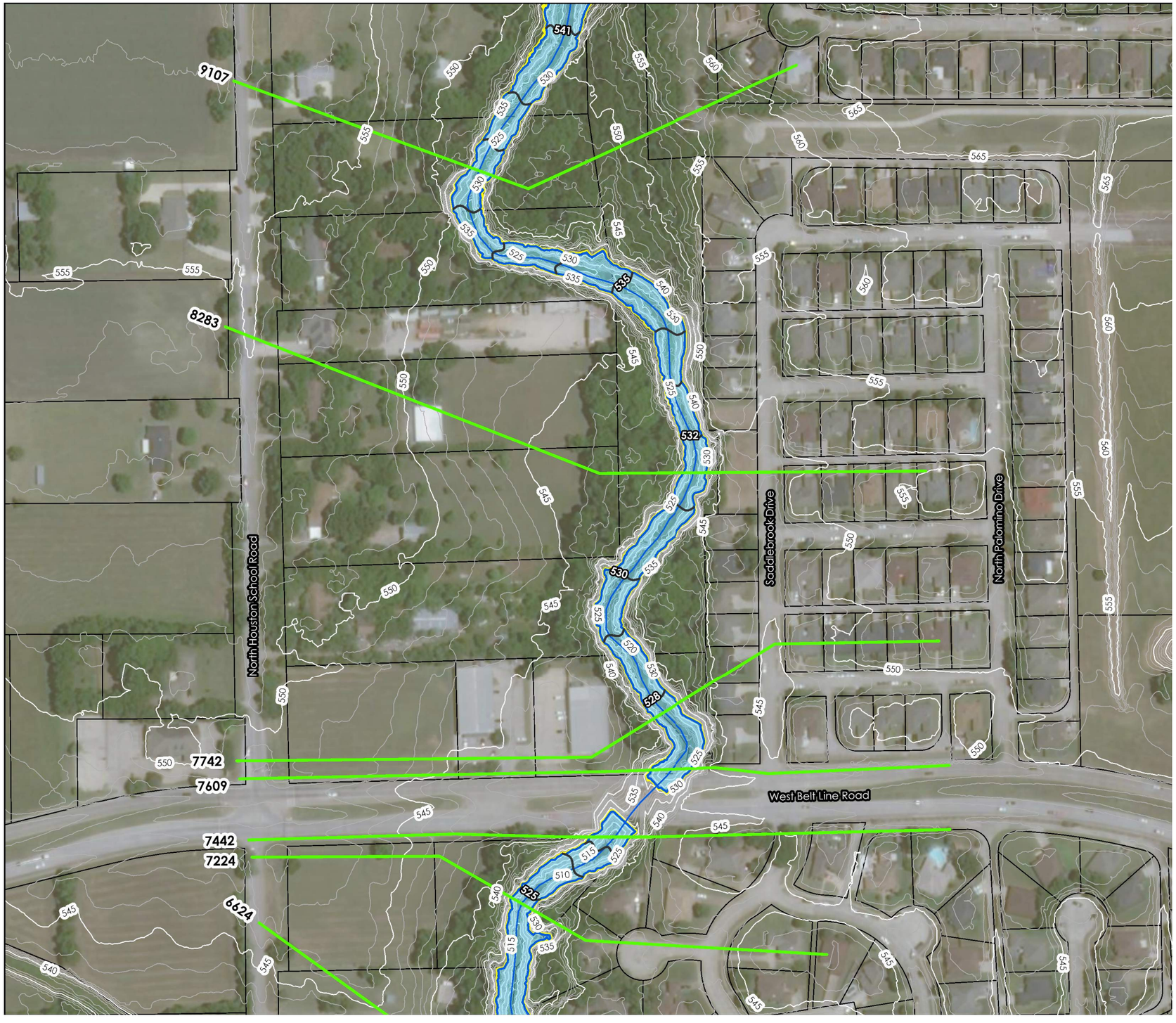
CEL

0



FLOODPLAIN: SHEET 7





N

0 100 200

Feet

CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

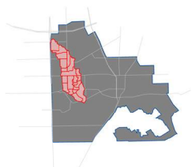
STREAM LENGTH

5.04 MI

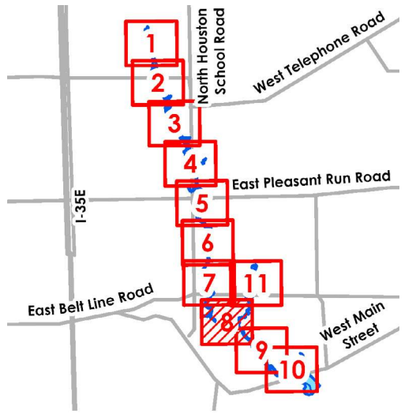
*

PROJECTS IDENTIFIED

3



FLOODPLAIN: SHEET 8



N

0 100 200

Feet

CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

R MAJOR CONTOURS

R MINOR CONTOURS

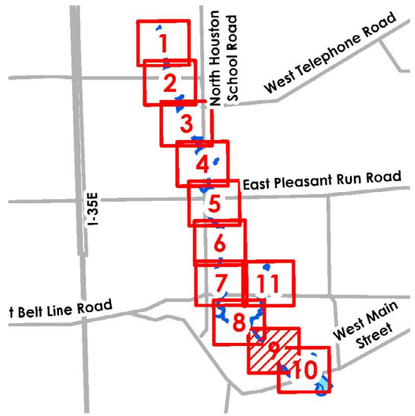
BASE FLOW ELEVATIONS

CEL

0



FLOODPLAIN: SHEET 9





N

0 100 200
Feet

CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

STREAM LENGTH

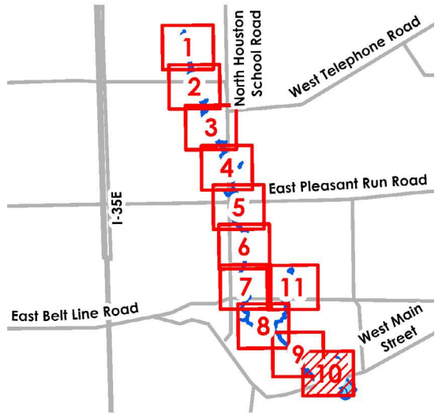
5.04 MI

*

PROJECTS IDENTIFIED

3

FLOODPLAIN: SHEET 10



N

0 100 200

Feet

CROSS SECTIONS

EAM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

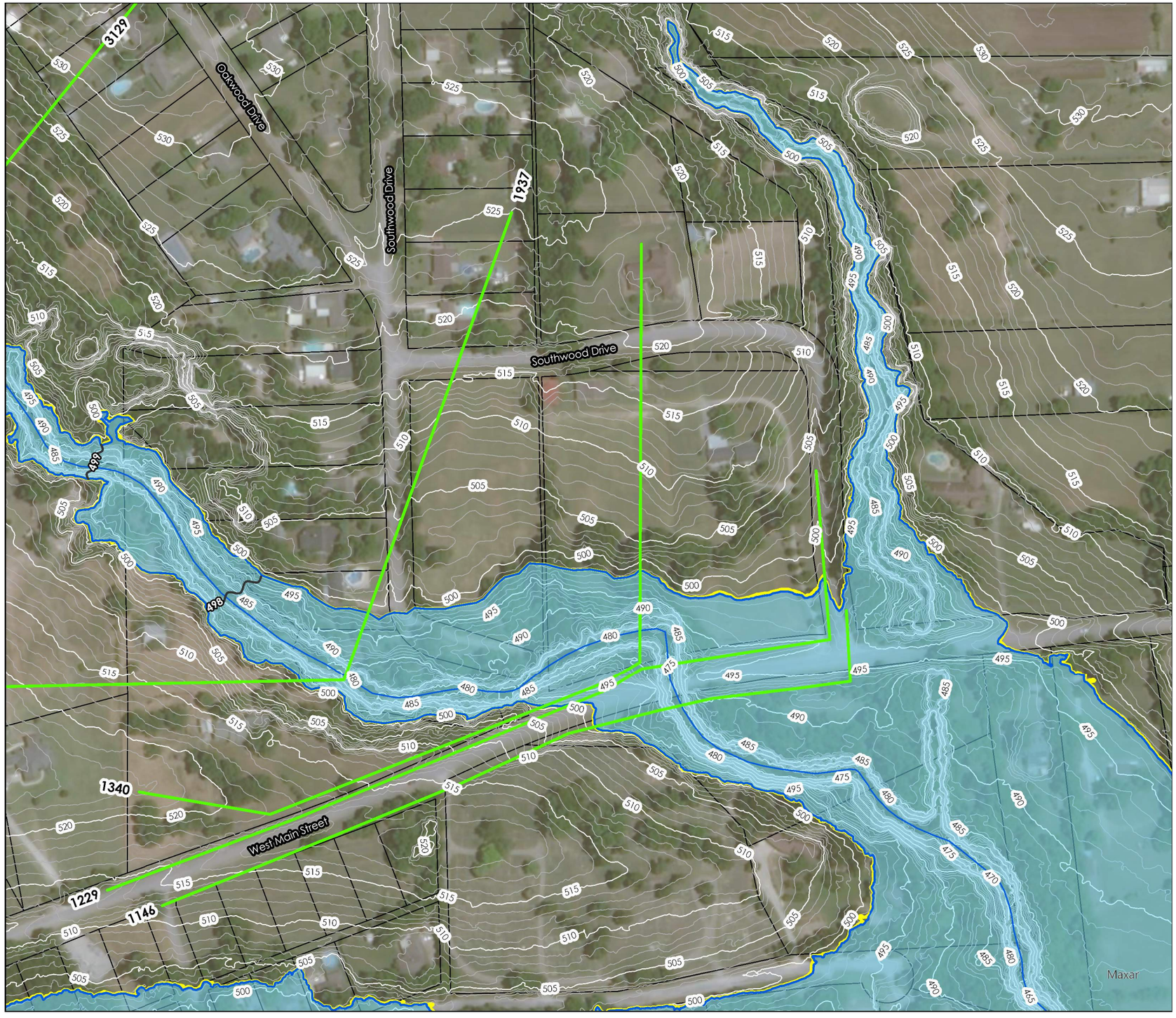
R MAJOR CONTOURS

R MINOR CONTOURS

BASE FLOW ELEVATIONS

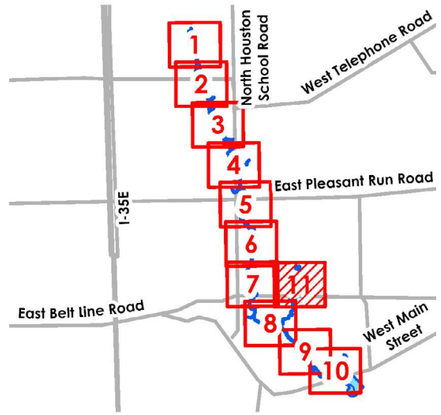
CEL

0



FLOODPLAIN: SHEET 11





N

0 100 200
Feet

CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

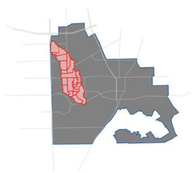
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	617.35	617.54	2.97	3.14
22675.5	614.78	615.01	4.01	4.01
22138	611.02	611.19	4.43	4.78
21775.5	609.36	609.67	3.19	3.15
21413	607.85	608.50	3.57	3.08
21361	607.80	608.43	2.83	2.96
21332	**Wintergreen Road**			
21296	606.70	607.09	4.77	5.10
21007	605.42	605.66	4.13	4.35
20197	601.49	601.86	3.79	3.87
19289	596.04	596.21	5.57	6.15
17972	589.76	590.44	3.71	3.50
17062	585.69	586.24	5.35	5.84
16260	581.22	581.88	4.26	4.07
15768	580.14	581.03	3.59	3.51
15722	579.72	580.69	5.71	5.32
15699	579.79	580.74	4.18	4.08
15652	579.67	580.67	4.39	4.13
15540	579.46	580.56	4.28	3.70
15461	579.35	580.42	3.82	3.96
15438	North Houston School Road			
15409	577.46	578.22	4.27	4.47
15333	577.05	577.83	5.01	5.15
14927	574.40	575.17	6.52	6.82
14207	564.73	565.43	10.28	10.71
13706	561.94	562.59	5.55	6.09
13625	561.96	562.62	3.19	3.51
13596	Pleasant Run Road			
13511	558.46	559.38	3.00	3.20
13350	557.46	558.30	6.67	7.06
12316	553.14	553.89	5.49	5.93
11463	548.90	549.64	6.73	7.10
10077	540.40	541.06	6.54	7.08
9107	531.71	532.36	9.05	9.40
8283	525.41	526.01	6.62	7.11

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	521.39	521.95	7.51	7.89
7609	520.74	521.36	5.51	5.73
7560	Belt Line Road			
7442	520.40	521.02	5.30	5.30
7224	517.30	517.94	10.59	10.59
6624	514.70	515.54	5.20	5.20
6349	511.59	512.63	10.40	10.40
5648	509.58	510.57	4.99	4.99
4592	504.03	504.53	10.00	10.00
4270	498.75	499.21	10.52	10.52
3984	496.83	497.69	6.10	6.11
3629	495.51	496.42	6.06	6.07
3129	492.87	494.04	7.43	7.50
1937	489.56	490.30	5.00	6.89
1340	489.06	489.48	3.34	5.56
1229	489.00	489.39	3.19	4.75
1183	West Main Street			
1146	488.89	489.23	2.95	3.40
962	488.82	489.14	2.64	3.05
475	488.80	489.11	1.48	1.71
0	488.79	489.11	0.92	1.03

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	556.97	557.28	3.73	4.22
3139	553.15	553.68	3.54	4.12
2886	550.99	551.39	3.34	4.01
2691	549.34	549.84	3.84	3.76
2501	547.48	547.92	3.54	4.33
2326	545.28	546.01	4.22	4.18
2143	542.88	543.19	4.13	5.57
1955	538.73	540.33	7.55	5.66
1857	538.31	540.13	3.11	3.03
1788	537.91	539.66	4.24	4.84
1725	**West Belt Line Road**			
1649	534.32	535.10	8.62	10.01
1554	532.45	533.59	2.95	3.38
1389	529.99	531.20	9.17	8.90
1175	527.60	528.65	4.27	4.84
962	523.66	524.55	8.73	9.42
749	520.72	521.84	3.90	4.70
530	519.28	520.20	4.68	5.36
375	516.45	517.20	7.14	8.12
217	511.20	512.20	8.21	8.94
92	507.63	508.77	7.60	8.58

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

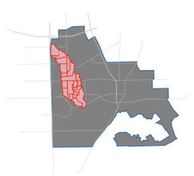
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	617.66	617.84	3.29	3.48
22675.5	615.16	615.37	4.03	4.08
22138	611.33	611.52	4.97	5.27
21775.5	609.82	610.23	3.22	3.08
21413	608.87	609.65	2.88	2.51
21361	608.78	609.51	3.04	3.20
21332	**Wintergreen Road**			
21296	607.26	607.60	5.33	5.81
21007	605.82	606.13	4.44	4.61
20197	602.03	602.39	3.96	4.13
19289	596.41	596.79	6.24	6.46
17972	590.70	591.32	3.53	3.42
17062	586.27	586.26	6.19	7.26
16260	582.15	582.91	3.93	3.51
15768	581.43	582.40	3.37	3.07
15722	581.15	582.20	4.95	4.29
15699	581.19	582.23	3.87	3.45
15652	581.13	582.20	3.87	3.39
15540	581.04	582.14	3.50	3.08
15461	580.88	581.91	4.03	4.17
15438	North Houston School Road			
15409	578.49	578.91	4.59	5.01
15333	578.12	578.56	5.17	5.36
14927	575.50	575.89	6.76	7.03
14207	565.75	566.33	10.61	10.54
13706	562.89	563.34	6.32	6.70
13625	562.93	563.40	3.64	3.86
13596	Pleasant Run Road			
13511	559.79	560.44	3.29	3.43
13350	558.67	559.26	7.23	7.49
12316	554.24	554.78	6.11	6.41
11463	549.90	550.43	7.36	7.61
10077	541.49	541.95	7.14	7.51
9107	532.96	533.43	9.70	9.92
8283	526.56	526.97	7.55	7.89

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	522.47	522.88	8.21	8.44
7609	521.93	522.37	5.92	6.05
7560	Belt Line Road			
7442	521.59	522.03	5.59	5.78
7224	518.57	519.05	10.66	10.73
6624	516.20	516.80	5.48	5.61
6349	513.41	514.14	10.33	10.23
5648	511.41	512.28	5.17	5.25
4592	505.00	505.28	10.74	11.82
4270	499.63	500.26	11.06	11.00
3984	498.56	499.27	6.21	6.43
3629	497.38	498.10	6.13	6.42
3129	495.09	495.76	7.70	7.99
1937	491.66	492.05	4.73	5.00
1340	490.98	491.28	3.08	3.32
1229	490.88	491.15	3.13	3.40
1183	West Main Street			
1146	490.71	490.94	3.41	3.76
962	490.64	490.85	3.05	3.36
475	490.62	490.82	1.79	1.98
0	490.62	490.83	0.95	1.04

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	557.13	557.28	4.04	4.22
3139	553.44	553.68	3.82	4.12
2886	551.19	551.39	3.73	4.01
2691	549.64	549.84	3.68	3.76
2501	547.76	547.92	4.07	4.33
2326	545.74	546.01	4.18	4.18
2143	543.10	543.19	4.99	5.57
1955	539.67	540.33	6.31	5.66
1857	539.45	540.13	3.06	3.03
1788	539.01	539.66	4.62	4.84
1725	**West Belt Line Road**			
1649	534.81	535.10	9.50	10.01
1554	533.26	533.59	3.23	3.38
1389	530.70	531.20	9.54	8.90
1175	528.34	528.65	4.65	4.84
962	524.26	524.55	9.29	9.42
749	521.49	521.84	4.47	4.70
530	519.91	520.20	5.16	5.36
375	516.96	517.20	7.83	8.12
217	511.89	512.20	8.72	8.94
92	508.41	508.77	8.29	8.58

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

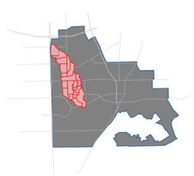
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	618.04	618.23	3.69	3.82
22675.5	615.62	615.80	4.11	4.17
22138	611.82	612.12	5.39	5.33
21775.5	610.91	611.50	2.71	2.46
21413	610.64	611.34	1.99	1.74
21361	610.48	611.22	3.17	2.81
21332	Wintergreen Road			
21296	607.98	608.35	6.05	6.22
21007	606.49	606.73	4.50	4.52
20197	602.75	603.07	4.16	4.23
19289	596.83	596.94	7.24	7.80
17972	591.72	592.01	3.42	3.48
17062	586.27	586.38	8.51	9.24
16260	583.67	584.14	3.27	3.23
15768	583.28	583.79	2.95	2.97
15722	583.13	583.67	3.95	3.83
15699	583.16	583.70	3.17	3.12
15652	583.13	583.67	3.18	3.13
15540	583.11	583.66	2.79	2.67
15461	582.84	583.36	4.30	4.46
15438	North Houston School Road			
15409	579.46	579.87	5.17	5.28
15333	579.10	579.50	5.63	5.80
14927	576.36	576.73	7.39	7.54
14207	567.06	567.56	10.48	10.49
13706	563.92	564.33	7.19	7.54
13625	564.00	564.43	4.13	4.32
13596	Pleasant Run Road			
13511	561.28	561.88	3.61	3.74
13350	560.03	560.58	7.81	8.04
12316	555.50	556.02	6.77	7.03
11463	551.04	551.51	8.03	8.30
10077	542.74	543.28	7.74	7.95
9107	534.44	535.06	10.37	10.64
8283	527.85	528.38	8.61	9.03

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	523.78	524.35	8.87	9.11
7609	523.36	523.97	6.29	6.41
7560	Belt Line Road			
7442	523.02	523.65	6.12	6.28
7224	520.11	520.75	10.86	10.97
6624	518.01	518.65	5.93	6.20
6349	515.50	516.21	10.26	10.28
5648	513.67	514.43	5.60	5.75
4592	505.68	506.20	13.46	13.93
4270	501.26	501.94	10.89	10.88
3984	500.44	501.19	6.65	6.82
3629	499.34	500.10	6.63	6.81
3129	496.84	497.49	8.69	8.95
1937	493.88	494.21	4.39	4.62
1340	493.37	493.64	2.96	3.17
1229	493.29	493.54	3.04	3.28
1183	West Main Street			
1146	493.07	493.27	3.62	3.95
962	493.02	493.22	3.13	3.37
475	493.00	493.19	1.99	2.14
0	493.01	493.21	0.93	0.99

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	557.36	557.49	4.29	4.37
3139	553.80	553.97	4.29	4.54
2886	551.48	551.63	4.15	4.32
2691	549.98	550.12	3.74	3.85
2501	548.09	548.26	4.50	4.60
2326	546.26	546.48	4.25	4.31
2143	543.35	543.59	6.00	6.18
1955	541.05	541.72	5.12	4.75
1857	540.86	541.56	2.96	2.87
1788	540.35	541.01	5.07	5.27
1725	**West Belt Line Road**			
1649	535.42	535.72	10.45	10.90
1554	534.05	534.42	3.61	3.82
1389	531.56	531.91	9.15	9.20
1175	529.10	529.50	5.12	5.34
962	524.95	525.24	9.70	10.06
749	522.37	522.81	5.03	5.28
530	520.63	520.98	5.66	5.93
375	517.58	517.92	8.42	8.63
217	512.68	513.10	9.25	9.51
92	509.31	509.77	8.98	9.31

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

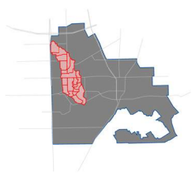
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	618.32	618.47	3.90	4.06
22675.5	615.90	616.11	4.18	4.17
22138	612.22	612.46	5.40	5.45
21775.5	611.60	611.82	2.52	2.59
21413	611.45	611.68	1.73	1.75
21361	611.34	611.59	2.72	2.61
21332	**Wintergreen Road**			
21296	608.42	608.61	6.34	6.69
21007	606.80	607.00	4.54	4.57
20197	603.18	603.46	4.25	4.31
19289	596.97	597.11	8.01	8.44
17972	592.11	592.34	3.49	3.58
17062	586.69	586.99	9.00	9.13
16260	584.40	584.62	3.22	3.37
15768	584.05	584.24	3.00	3.19
15722	583.95	584.14	3.76	3.94
15699	583.97	584.17	3.08	3.24
15652	583.95	584.14	3.12	3.28
15540	583.94	584.13	2.70	2.83
15461	583.58	583.83	4.65	4.53
15438	North Houston School Road			
15409	580.01	580.41	5.62	5.84
15333	579.69	580.11	5.88	6.06
14927	576.81	577.26	7.81	7.94
14207	568.00	568.69	10.05	9.76
13706	564.69	565.10	7.86	8.21
13625	564.81	565.24	4.50	4.68
13596	Pleasant Run Road			
13511	562.43	563.04	3.86	3.99
13350	561.07	561.63	8.25	8.47
12316	556.48	557.11	7.27	7.43
11463	551.97	552.60	8.49	8.54
10077	543.69	544.24	8.24	8.43
9107	535.46	536.07	10.81	11.07
8283	528.73	529.28	9.30	9.70

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	524.71	525.29	9.27	9.49
7609	524.36	524.98	6.50	6.62
7560	Belt Line Road			
7442	524.05	524.67	6.38	6.52
7224	521.22	521.86	10.96	11.09
6624	519.28	519.94	6.20	6.44
6349	516.82	517.52	10.46	10.52
5648	514.95	515.67	6.03	6.20
4592	506.52	507.04	14.19	14.58
4270	502.41	502.97	10.77	10.99
3984	501.72	502.28	6.83	7.11
3629	500.69	501.18	6.80	7.16
3129	498.03	498.35	9.19	9.59
1937	495.32	495.62	4.17	4.30
1340	494.72	494.98	2.97	3.07
1229	494.62	494.86	3.17	3.35
1183	West Main Street			
1146	494.28	494.53	3.89	3.04
962	494.26	494.45	3.14	3.31
475	494.22	494.40	2.14	2.33
0	494.24	494.42	0.97	1.04

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	557.50	557.62	4.38	4.44
3139	554.00	554.16	4.56	4.78
2886	551.63	551.75	4.36	4.52
2691	550.15	550.29	3.83	3.90
2501	548.31	548.46	4.63	4.79
2326	546.54	546.79	4.34	4.38
2143	543.68	544.49	6.20	5.07
1955	541.91	543.39	4.65	3.60
1857	541.77	543.36	2.83	1.96
1788	541.20	542.86	5.33	5.05
1725	**West Belt Line Road**			
1649	535.80	536.14	11.03	11.51
1554	534.47	534.69	3.85	3.98
1389	531.97	532.19	9.19	9.18
1175	529.56	529.80	5.38	5.52
962	525.30	525.50	10.08	10.23
749	522.88	523.14	5.32	5.48
530	521.04	521.26	5.97	6.14
375	517.97	518.19	8.67	8.74
217	513.17	513.43	9.55	9.70
92	509.85	510.13	9.36	9.56

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

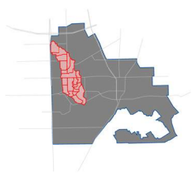
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	618.63	618.78	4.22	4.36
22675.5	616.27	616.43	4.25	4.31
22138	612.64	612.79	5.57	5.70
21775.5	611.98	612.10	2.71	2.84
21413	611.84	611.96	1.79	1.83
21361	611.76	611.89	2.58	2.58
21332	**Wintergreen Road**			
21296	608.76	608.88	7.00	7.30
21007	607.16	607.27	4.61	4.71
20197	603.72	603.94	4.33	4.36
19289	597.17	597.18	8.95	9.53
17972	592.57	592.78	3.61	3.63
17062	587.35	587.83	9.12	8.88
16260	584.82	585.02	3.53	3.74
15768	584.41	584.56	3.38	3.64
15722	584.31	584.45	4.13	4.42
15699	584.34	584.48	3.41	3.66
15652	584.31	584.45	3.46	3.73
15540	584.29	584.44	3.06	3.25
15461	584.03	584.22	4.53	4.47
15438	North Houston School Road			
15409	580.78	581.14	6.23	6.54
15333	580.56	580.99	6.01	5.69
14927	577.54	577.79	8.45	8.77
14207	569.35	569.80	9.55	9.55
13706	565.62	565.94	8.77	9.16
13625	565.80	566.15	4.99	5.20
13596	Pleasant Run Road			
13511	563.93	564.55	4.18	4.29
13350	562.44	563.03	8.77	8.91
12316	557.95	558.46	7.69	7.89
11463	553.51	554.00	8.45	8.52
10077	544.93	545.36	8.82	9.10
9107	536.77	537.19	11.36	11.51
8283	529.90	530.26	10.13	10.38

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	525.95	526.36	9.72	9.84
7609	525.69	526.13	6.72	6.77
7560	Belt Line Road			
7442	525.41	525.86	6.65	6.70
7224	522.67	523.17	11.14	11.14
6624	520.89	521.50	6.56	6.60
6349	518.48	519.09	10.68	10.79
5648	516.61	517.20	6.50	6.67
4592	507.70	508.21	15.00	15.15
4270	503.82	504.36	11.02	11.11
3984	503.20	503.76	7.25	7.40
3629	502.10	502.66	7.32	7.46
3129	498.92	499.28	10.34	10.79
1937	497.05	497.28	3.96	4.17
1340	496.65	496.85	2.64	2.78
1229	496.55	496.74	3.06	3.23
1183	West Main Street			
1146	496.21	496.37	2.65	2.82
962	496.15	496.30	2.94	3.12
475	496.11	496.26	2.20	2.31
0	496.13	496.28	0.96	1.01

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	557.72	557.83	4.51	4.53
3139	554.25	554.38	4.93	5.15
2886	551.84	551.95	4.60	4.73
2691	550.35	550.47	4.02	4.13
2501	548.56	548.76	4.80	4.80
2326	546.79	546.86	4.63	5.09
2143	544.89	545.71	4.46	3.41
1955	544.28	545.39	3.06	2.63
1857	544.29	545.40	1.59	1.34
1788	543.81	544.90	4.88	5.02
1725	**West Belt Line Road**			
1649	536.30	536.66	11.74	12.27
1554	534.91	535.09	4.11	4.21
1389	532.41	532.60	9.18	9.16
1175	530.02	530.21	5.67	5.79
962	525.88	526.05	9.77	9.80
749	523.39	523.61	5.62	5.74
530	521.46	521.63	6.30	6.44
375	518.41	518.59	8.79	8.83
217	513.68	513.90	9.84	9.97
92	510.41	510.64	9.75	9.91

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

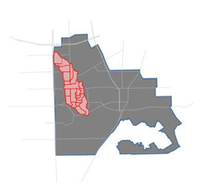
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	618.86	619.01	4.45	4.54
22675.5	616.52	616.65	4.34	4.40
22138	612.89	613.04	5.76	5.82
21775.5	612.18	612.33	2.91	2.97
21413	612.04	612.20	1.85	1.92
21361	611.97	612.13	2.57	2.60
21332	**Wintergreen Road**			
21296	608.94	609.09	7.48	7.94
21007	607.33	607.48	4.76	4.90
20197	604.02	604.26	4.43	4.50
19289	597.30	597.87	9.51	8.57
17972	592.84	593.01	3.70	3.85
17062	587.89	588.14	8.86	8.81
16260	585.06	585.21	3.77	3.87
15768	584.60	584.73	3.67	3.79
15722	584.48	584.62	4.46	4.57
15699	584.51	584.64	3.69	3.79
15652	584.48	584.61	3.76	3.87
15540	584.46	584.58	3.33	3.50
15461	584.24	584.40	4.55	4.49
15438	North Houston School Road			
15409	581.27	581.89	6.62	2.66
15333	581.14	581.39	5.64	5.48
14927	577.85	578.06	9.02	9.35
14207	570.08	570.49	9.40	9.42
13706	566.21	566.65	9.37	9.57
13625	566.44	566.89	5.31	5.42
13596	Pleasant Run Road			
13511	565.00	565.66	4.35	4.42
13350	563.47	564.18	8.99	8.88
12316	558.81	559.26	8.03	8.22
11463	554.33	554.81	8.59	8.62
10077	545.88	546.27	9.04	9.28
9107	537.73	538.05	11.71	11.83
8283	530.74	531.02	10.70	10.88

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	526.88	527.21	10.00	10.06
7609	526.69	527.04	6.84	6.86
7560	Belt Line Road			
7442	526.43	526.79	6.79	6.81
7224	523.72	524.15	11.30	11.26
6624	522.03	522.55	6.81	6.80
6349	519.63	520.14	10.89	10.99
5648	517.75	518.25	6.82	6.96
4592	508.54	509.17	15.49	15.31
4270	504.83	505.38	11.18	11.23
3984	504.26	504.85	7.50	7.58
3629	503.16	503.73	7.55	7.62
3129	499.67	500.06	11.09	11.34
1937	497.99	498.17	4.05	4.22
1340	497.63	497.79	2.64	2.75
1229	497.55	497.71	3.04	3.17
1183	West Main Street			
1146	497.37	497.52	2.63	2.76
962	497.32	497.47	2.89	3.03
475	497.27	497.42	2.25	2.32
0	497.29	497.44	1.05	1.09

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	557.87	558.01	4.56	4.57
3139	554.43	554.59	5.21	5.48
2886	551.99	552.14	4.76	4.90
2691	550.49	550.64	4.21	4.38
2501	548.77	548.93	4.81	4.89
2326	546.87	547.02	5.11	5.32
2143	545.75	546.03	3.39	3.34
1955	545.43	545.73	2.62	2.67
1857	545.45	545.75	1.34	1.37
1788	544.94	545.17	5.05	5.38
1725	**West Belt Line Road**			
1649	536.70	537.04	12.28	12.76
1554	535.16	535.47	4.25	4.40
1389	532.68	532.99	9.16	9.14
1175	530.30	530.55	5.83	6.08
962	526.09	526.39	9.91	9.86
749	523.69	524.03	5.79	5.97
530	521.70	521.97	6.51	6.75
375	518.67	518.95	8.84	8.93
217	513.99	514.35	10.02	10.19
92	510.74	511.11	9.97	10.22

WATERSHED NO.

7

COUNCIL DISTRICTS

1, 2, 4 AND 5

TOTAL DRAINAGE AREA

3.27 SM

*

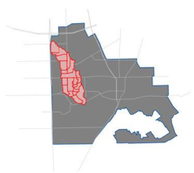
STREAM LENGTH

5.04 MI

*

PROJECTS IDENTIFIED

3



2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
23213	619.11	619.31	4.61	4.73
22675.5	616.76	616.91	4.42	4.53
22138	613.12	613.30	5.94	6.08
21775.5	612.36	612.48	3.10	3.26
21413	612.22	612.34	1.94	2.01
21361	612.15	612.27	2.62	2.66
21332	Wintergreen Road			
21296	609.13	609.15	8.03	8.59
21007	607.50	607.62	4.95	5.08
20197	604.32	604.50	4.49	4.57
19289	597.66	598.01	9.42	8.85
17972	593.12	593.34	3.81	3.89
17062	588.38	588.60	8.75	8.93
16260	585.30	585.46	4.01	4.19
15768	584.77	584.89	3.97	4.20
15722	584.65	584.75	4.81	5.08
15699	584.68	584.79	3.98	4.21
15652	584.64	584.74	4.07	4.31
15540	584.63	584.73	3.59	3.74
15461	584.46	584.59	4.51	4.45
15438	North Houston School Road			
15409	581.96	582.13	2.68	2.69
15333	581.49	581.69	5.42	5.35
14927	578.11	578.30	9.59	9.93
14207	570.77	571.17	9.26	9.29
13706	566.93	567.37	9.70	9.86
13625	567.18	567.64	5.50	5.60
13596	Pleasant Run Road			
13511	566.02	566.58	4.49	4.59
13350	564.55	565.14	8.90	8.85
12316	559.56	560.01	8.33	8.48
11463	555.06	555.50	8.71	8.76
10077	546.75	547.21	9.18	9.31
9107	538.58	539.00	12.02	12.17
8283	531.50	531.88	11.18	11.41

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7742	527.74	528.20	10.21	10.27
7609	527.61	528.09	6.93	6.95
7560	Belt Line Road			
7442	527.37	527.86	6.88	6.90
7224	524.69	525.24	11.43	11.41
6624	523.08	523.72	7.01	7.02
6349	520.67	521.33	11.10	11.15
5648	518.76	519.34	7.12	7.28
4592	509.60	510.02	15.34	15.40
4270	505.87	506.28	11.28	11.45
3984	505.37	505.79	7.64	7.78
3629	504.28	504.69	7.62	7.73
3129	500.46	500.69	11.60	11.91
1937	498.85	499.00	4.11	4.25
1340	498.54	498.67	2.64	2.74
1229	498.48	498.61	3.00	3.10
1183	West Main Street			
1146	498.40	498.52	2.57	2.65
962	498.34	498.47	2.88	2.99
475	498.30	498.42	2.29	2.39
0	498.32	498.44	1.08	1.12

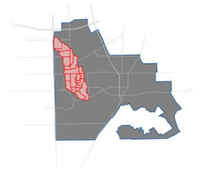
TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3377	558.01	558.11	4.57	4.62
3139	554.59	554.71	5.48	5.70
2886	552.14	552.24	4.90	5.03
2691	550.65	550.80	4.37	4.40
2501	548.94	549.14	4.90	5.00
2326	547.03	547.22	5.34	5.60
2143	546.04	546.27	3.34	3.44
1955	545.75	545.97	2.68	2.87
1857	545.76	545.98	1.38	1.51
1788	545.18	545.56	5.41	4.83
1725	**West Belt Line Road**			
1649	537.08	537.54	12.75	13.32
1554	535.56	536.06	4.45	4.66
1389	533.08	533.57	9.14	9.18
1175	530.63	531.01	6.17	6.59
962	526.51	527.08	9.78	9.47
749	524.14	524.68	6.03	6.31
530	522.05	522.46	6.82	7.23
375	519.04	519.51	8.95	9.03
217	514.46	515.05	10.25	10.52
92	511.23	511.85	10.30	10.66

WATERSHED NO.
7

COUNCIL DISTRICTS
1, 2, 4 AND 5

TOTAL DRAINAGE AREA
3.27 SM
*
STREAM LENGTH
5.04 MI
*
PROJECTS IDENTIFIED
3

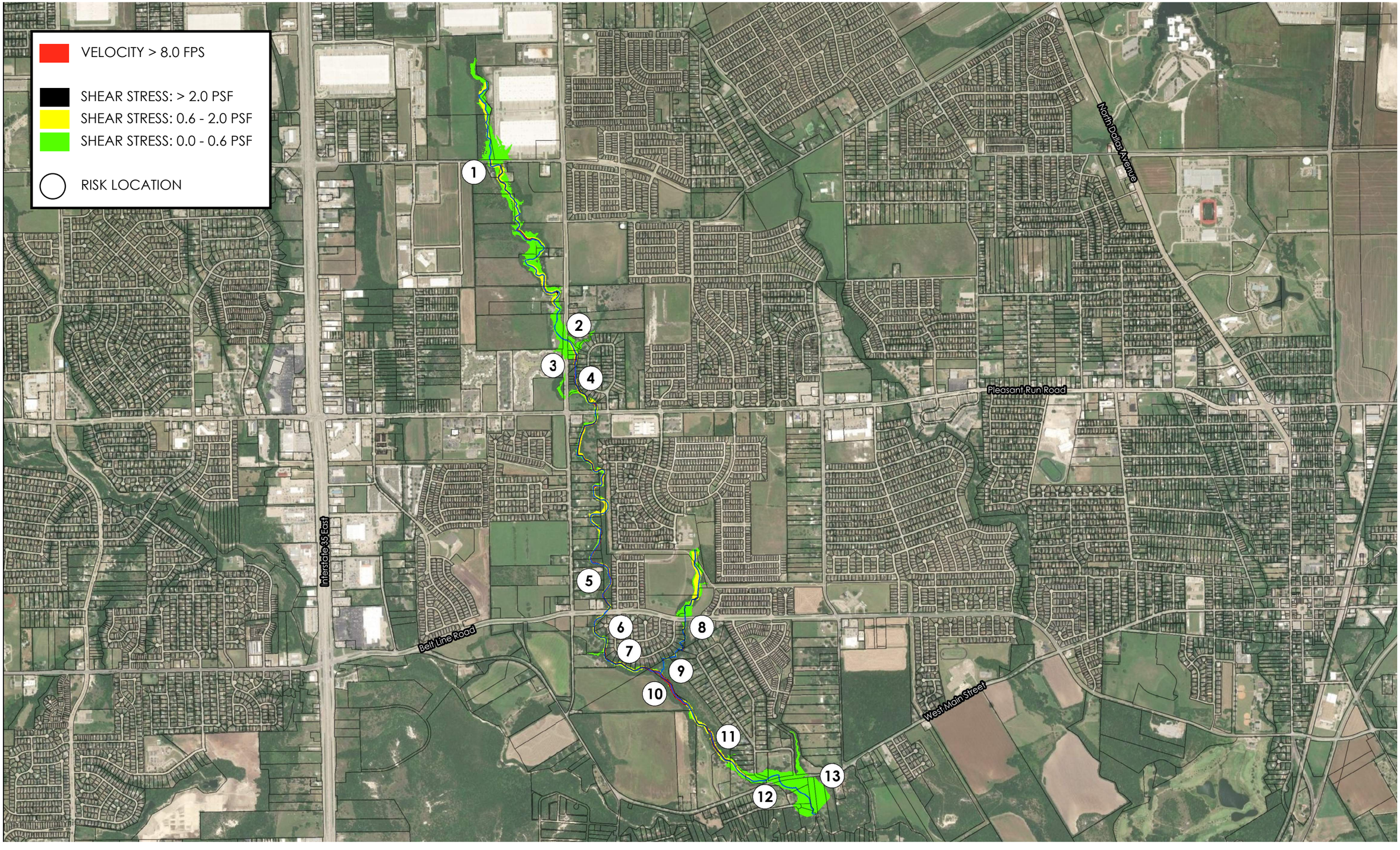


3.1 RISK IDENTIFICATION

Thirteen risk areas were identified in this study. The risks include four over-topping bridges, two areas of flooding structures, one flooded roadway and six locations of erosive velocities. The areas with flooded structures are houses on Main Street and North Houston School Road. All of the over-topping bridges in this watershed are anticipated to be high traffic roads. Wintergreen and North Houston school road see less traffic than Belt Line or Main Street, but are expected to flood more frequently. There are also reports of roadway drainage issues at the Alley of Mill Creek Road. Of the six areas where erosion is likely, two are near enough to existing structures that they may become problematic: River Stations 19289 and 6349. The rest of these areas are lower risk based on their location. The following map shows the shear stresses associated with the Mill Creek floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Wintergreen Road	Over-topping Bridge	5-Year	Public	High
2	Houses and Multi-Family Structure on North Houston School Road	Flooded Structure	10-Year	Private	High
3	North Houston School Road	Over-topping Bridge	5-Year	Public	High
4	River Station 19289	Potential Erosion Hot Spot	1-Year	Private	Medium
5	River Station 8283	Potential Erosion Hot Spot	1-Year	Private	Low
6	807 Mill Creek Road (Alley)	Flooded Roadway	-	Public	Medium
7	River Station 6349	Potential Erosion Hot Spot	1-Year	Private	Medium
8	Belt Line Road (Tributary)	Over-topping Bridge	25-Year	Public	High
9	River Station 375 (Tributary)	Potential Erosion Hot Spot	1-Year	Private	Very Low
10	River Station 4592	Potential Erosion Hot Spot	1-Year	Private	Very Low
11	River Station 3129	Potential Erosion Hot Spot	1-Year	Private	Low
12	West Main Street	Over-topping Bridge	25-Year	Public	High
13	Houses Along Main Street	Flooded Structure	25-Year	Private	Medium


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
1
2
3
4
5
6
7
8
9
10
11
12
13
North Dallas Avenue
Pleasant Run Road
Interstate 35 East
Belt Line Road
West Main Street

NEWTON CREEK

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

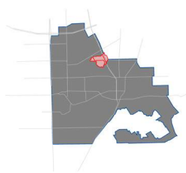
STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



NEWTON CREEK

STREAM CENTERLINE

COUNCIL DISTRICT

DISTRICT 1

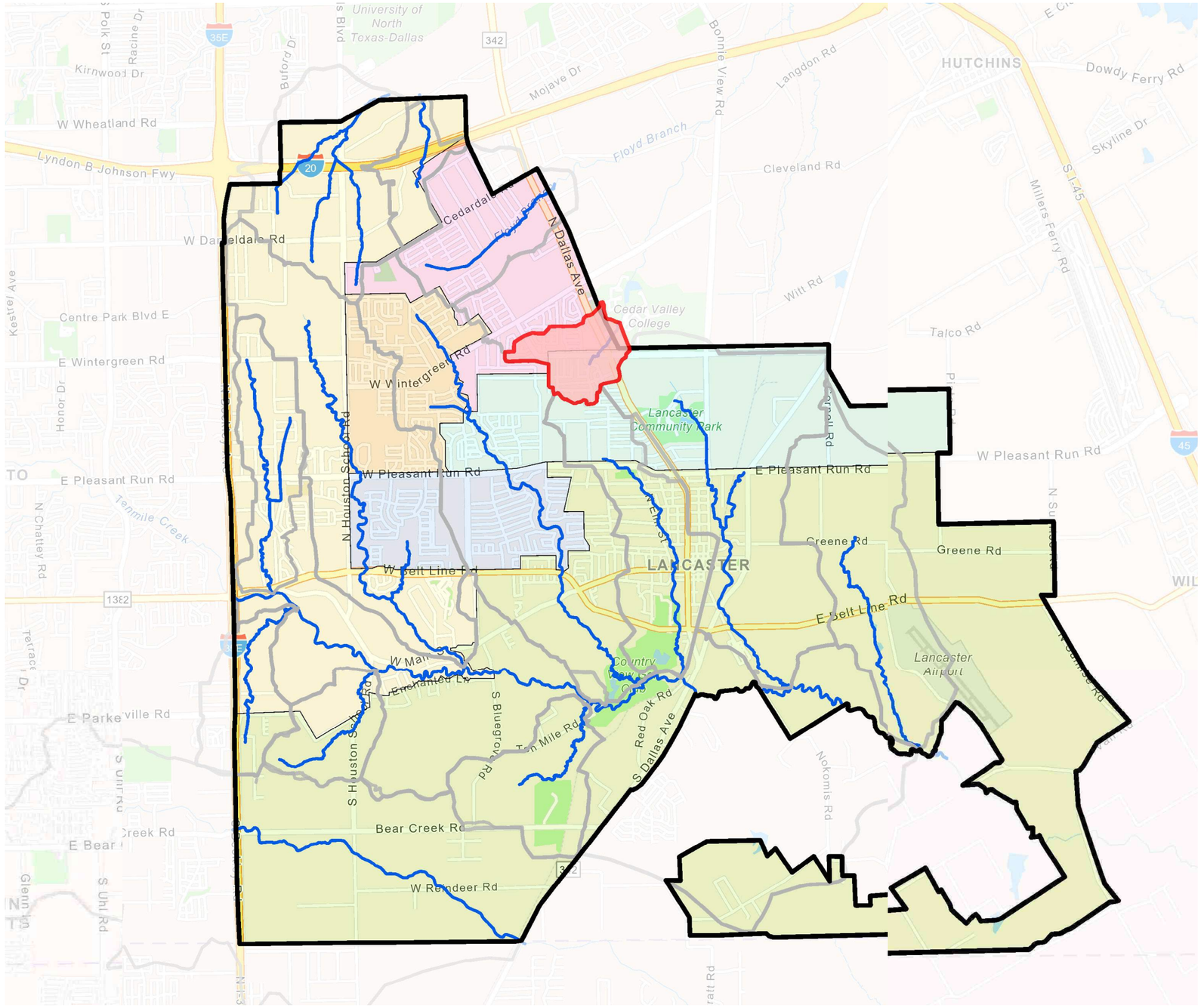
DISTRICT 2

DISTRICT 3

DISTRICT 4

DISTRICT 5

DISTRICT 6



NEWTON CREEK WATERSHED

This northern watershed, adjacent to the city's eastern boundary, measures about 0.43 square miles. Starting from a storm drain outfall, it runs northeast for roughly 0.40 miles. It mainly houses residential zones and open spaces earmarked for future retail.

WATERSHED NO. 8

NEWTON CREEK

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WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

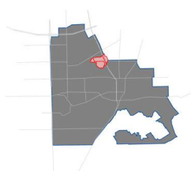
STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



1.1 DRAINAGE AREA MAP

The drainage area divides for the watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into three (3) sub-basins. Sub-basins are designated NC1 through NC3. The total watershed drainage area is 301.84 acres (0.47 square-miles). 0.44 square miles of the drainage area are located within the Lancaster City Limits. Figure 2, shown below, provides an overview of the drainage sub-basin layout for Newton Branch with in the City of Lancaster.

N

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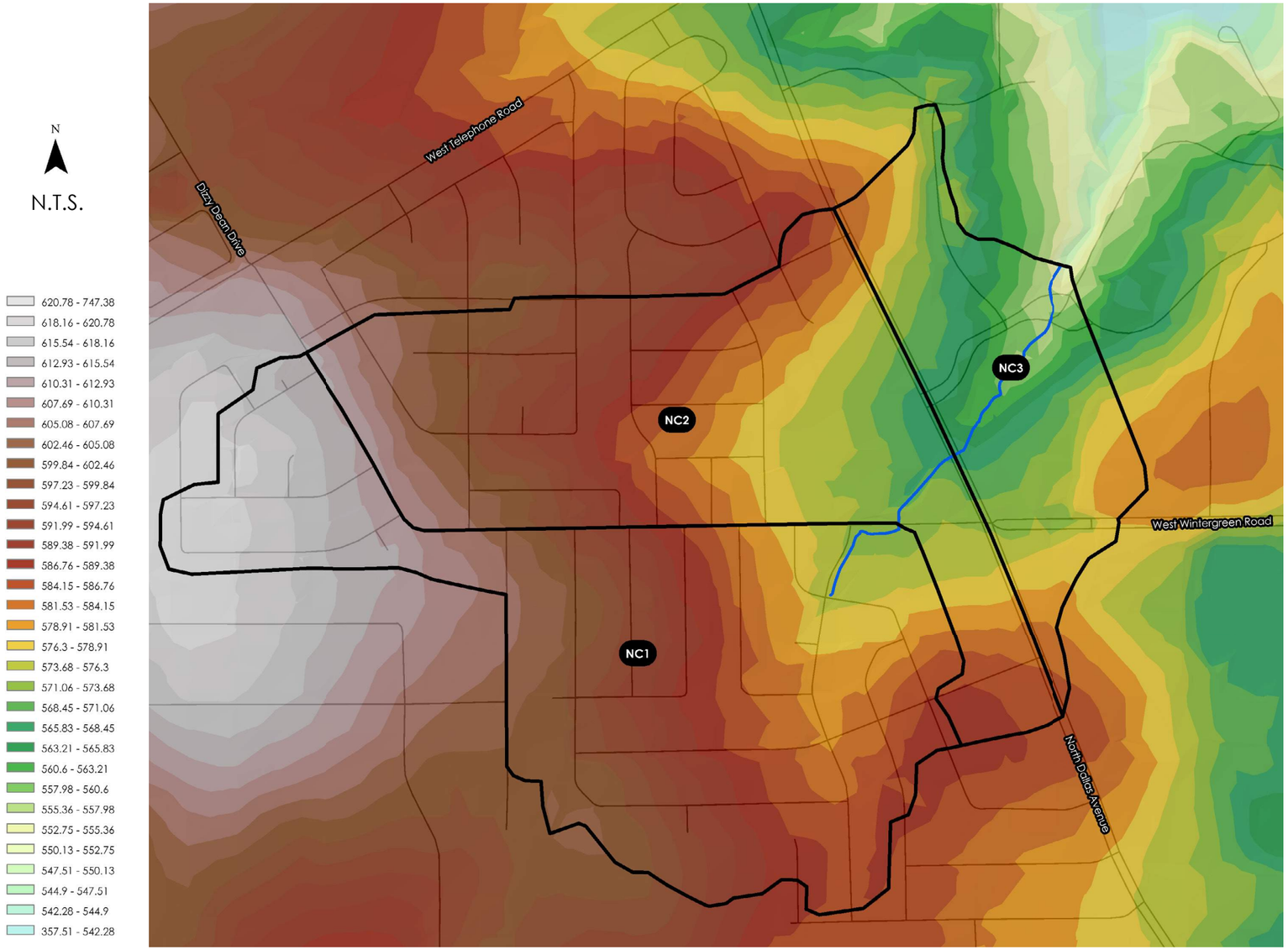

HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
NC1	0.2127	84	35.7	43.2	26.93	16.16	22.12	13.27
NC2	0.177	84	36.8	57.3	19.18	11.51	15.42	9.25
NC3	0.0818	84	12.7	70.4	24.53	14.72	19.14	11.48

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



1.2 TIME OF CONCENTRATION

The Times of Concentration for Newton Branch were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. The stream generally flows through relatively developed areas, resulting in shorter Times of Concentration than other basins of similar sizes. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

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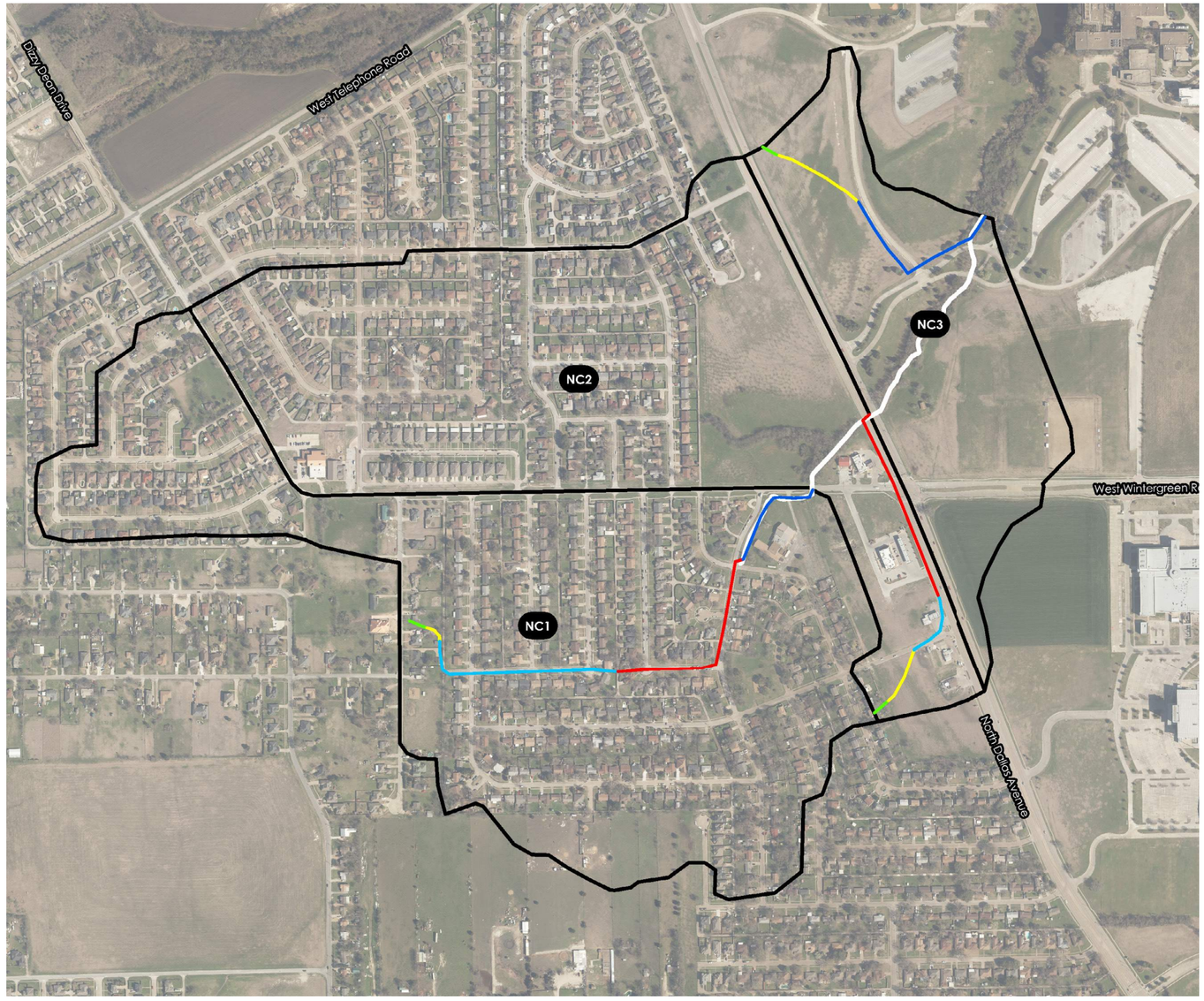


TIME OF CONCENTRATION REPORT

NC1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.94	0.240	0.00	0.1	18.19
SHALLOW	UNPAVED	112	1.15	0.000	16.10	1.7	1.08
GUTTER	G-18	1,105	2.33	0.018	24.09	3.7	5.00
PIPE	36" RCP	1,133	1.95	0.014	87.62	12.2	1.54
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	605	4.53	0.050	42.29	9.0	1.12
		3,056					**26.94**
							22.12

NC2

OVERLAND	GRS-DENSE	100	2.76	0.240	0.00	0.1	11.83
SHALLOW	UNPAVED	313	1.02	0.000	16.10	1.6	3.21
GUTTER	G-25	369	1.04	0.018	24.34	2.5	2.48
PIPE	36" RCP	1,068	1.49	0.014	87.62	10.7	1.67
		1,851					**19.18**
							15.42

NC3

OVERLAND	GRS-DENSE	100	0.87	0.240	0.00	0.1	18.76
SHALLOW	UNPAVED	495	3.35	0.000	16.10	2.9	2.80
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	463	1.74	0.050	28.69	3.8	2.04
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	531	5.08	0.050	42.29	9.5	0.93
		1,590					**24.53**
							19.14

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



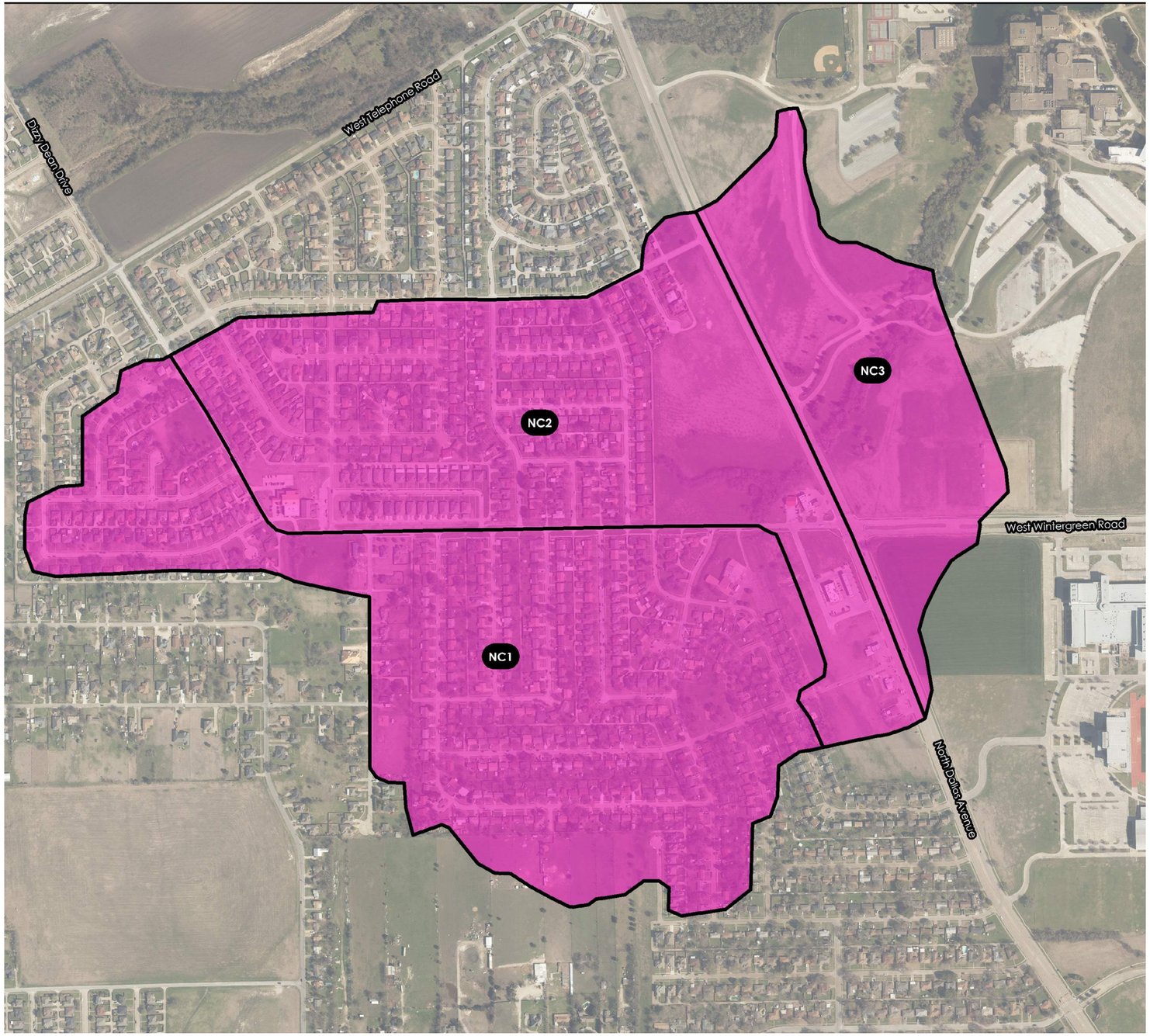
1.3 SOILS MAP

Newton Branch watershed has only hydrologic soil group B present within it's boundaries. Hydrologic soil groups A, B and C are not present in the Newton Branch watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

N.T.S.



PERVIOUS CURVE NUMBER REPORT

RC-A-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	136.2	84.0
		136.2	**84.0**

RC-A-2

D	84	113.3	84.0
		113.3	**84.0**

RC-A-3

D	84	52.4	84.0
		52.4	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

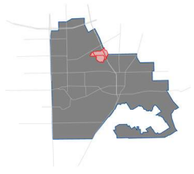
STREAM LENGTH

0.4 MI

*

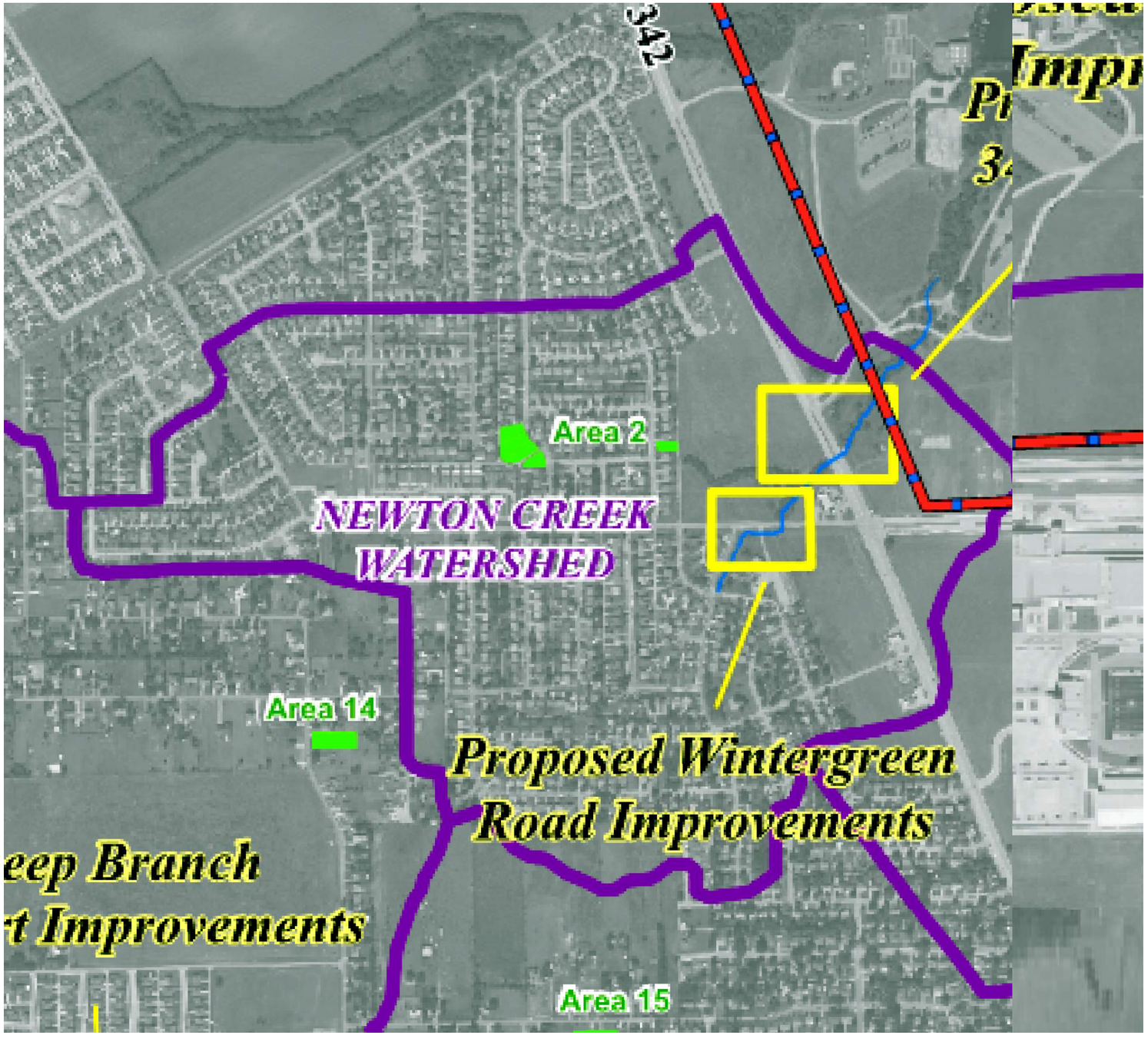
PROJECTS IDENTIFIED

1



1.4 AERIAL COMPARISON

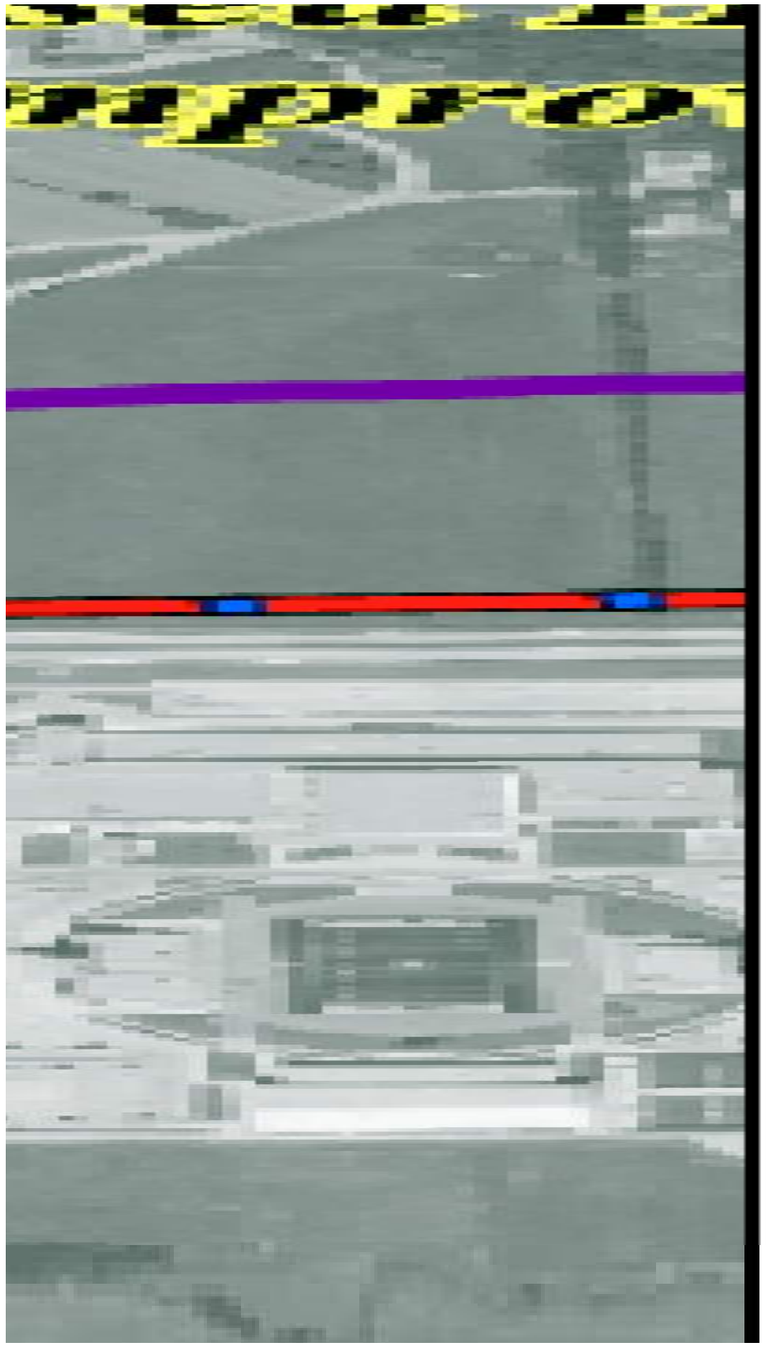
Aerial photography from 2019 shows little new development since 2007 within the Newton Branch watershed. A new commercial/mixed use development has been created in NC2. Some areas in Basins NC2 and NC3 show ground disturbance which may mean new development in the near future.



N

N.T.S.

2007





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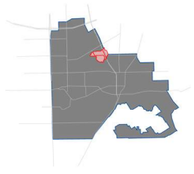
2019

WATERSHED NO.
8

COUNCIL DISTRICTS
3 AND 6

TOTAL DRAINAGE AREA
0.47 SM
*
STREAM LENGTH
0.4 MI
*
PROJECTS IDENTIFIED
1



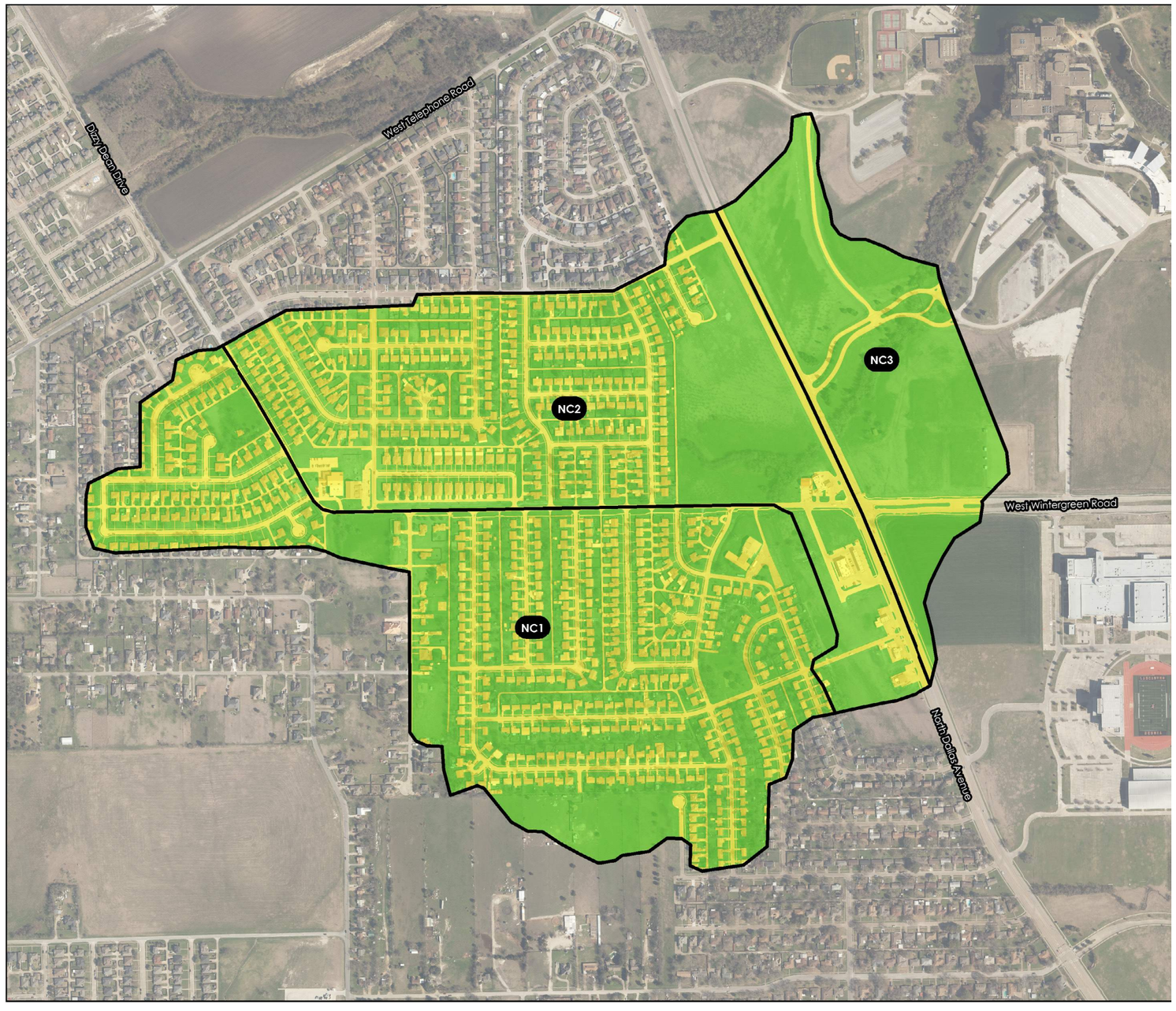
1.5 IMPERVIOUS AREA

Impervious areas for the Newton Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods in Basins NC2 and NC3 and mixed-use developments located in Basins NC1.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

RC-A-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	48.6	35.7
OPEN SPACE	0	87.6	0.0
		136.2	**35.7**

RC-A-2

IMPERVIOUS	100	48.6	35.7
OPEN SPACE	0	87.6	0.0
		136.2	**35.7**

RC-A-3

IMPERVIOUS	100	48.6	35.7
OPEN SPACE	0	87.6	0.0
		136.2	**35.7**

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



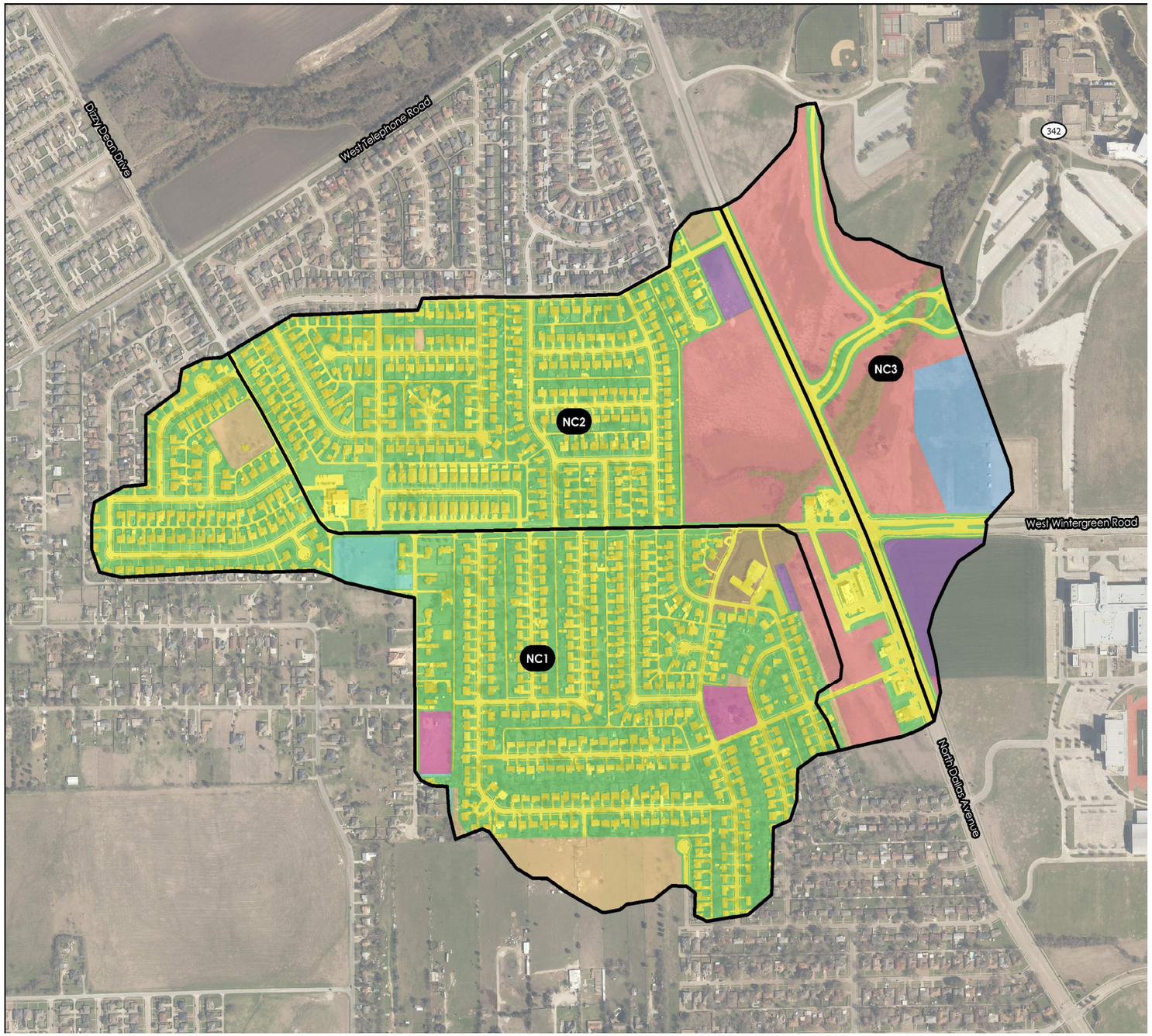
1.6 FUTURE LAND USE MAP

A majority of the watershed is located within City of Lancaster. The future land use within the watershed consist of mostly Industrial, Commercial, Residential and Mixed Use zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020. Sub-basins NC3 and NC2 have a large amount of open area that will likely be developed in the future.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD

N

N.T.S.



ULTIMATE PERCENT IMPERVIOUS REPORT

RC-A-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	50.3	36.9
FLOODPLAIN	0	2.8	0.0
OPEN SPACE (FAIR CONDITION)	0	64.6	0.0
MIXED USE	85	2.0	1.3
COMMERCIAL NODE	85	0.4	0.2
R - SURBURBAN NEIGHBORHOOD	38	10.1	2.8
R - RURAL LIVING	12	2.7	0.2
PUBLIC & SEMI-PUBLIC	72	3.2	1.7
		136.2	**43.2**

RC-A-2

IMPERVIOUS	100	44.2	39.0
FLOODPLAIN	0	1.3	0.0
OPEN SPACE (FAIR CONDITION)	0	42.8	0.0
MIXED USE	85	22.3	16.8
COMMERCIAL NODE	85	1.6	1.2
R - SURBURBAN NEIGHBORHOOD	38	1.1	0.4
		113.3	**57.3**

RC-A-3

IMPERVIOUS	100	6.7	12.7
FLOODPLAIN	0	2.9	0.0
OPEN SPACE (FAIR CONDITION)	0	5.9	0.0
MIXED USE	85	24.2	39.2
COMMERCIAL NODE	85	4.1	6.7
PUBLIC & SEMI-PUBLIC	72	0.1	0.1
LOGISTICS & DISTRIBUTION	72	8.5	11.7
		52.4	**70.4**

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

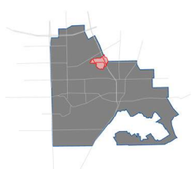
STREAM LENGTH

0.4 MI

*

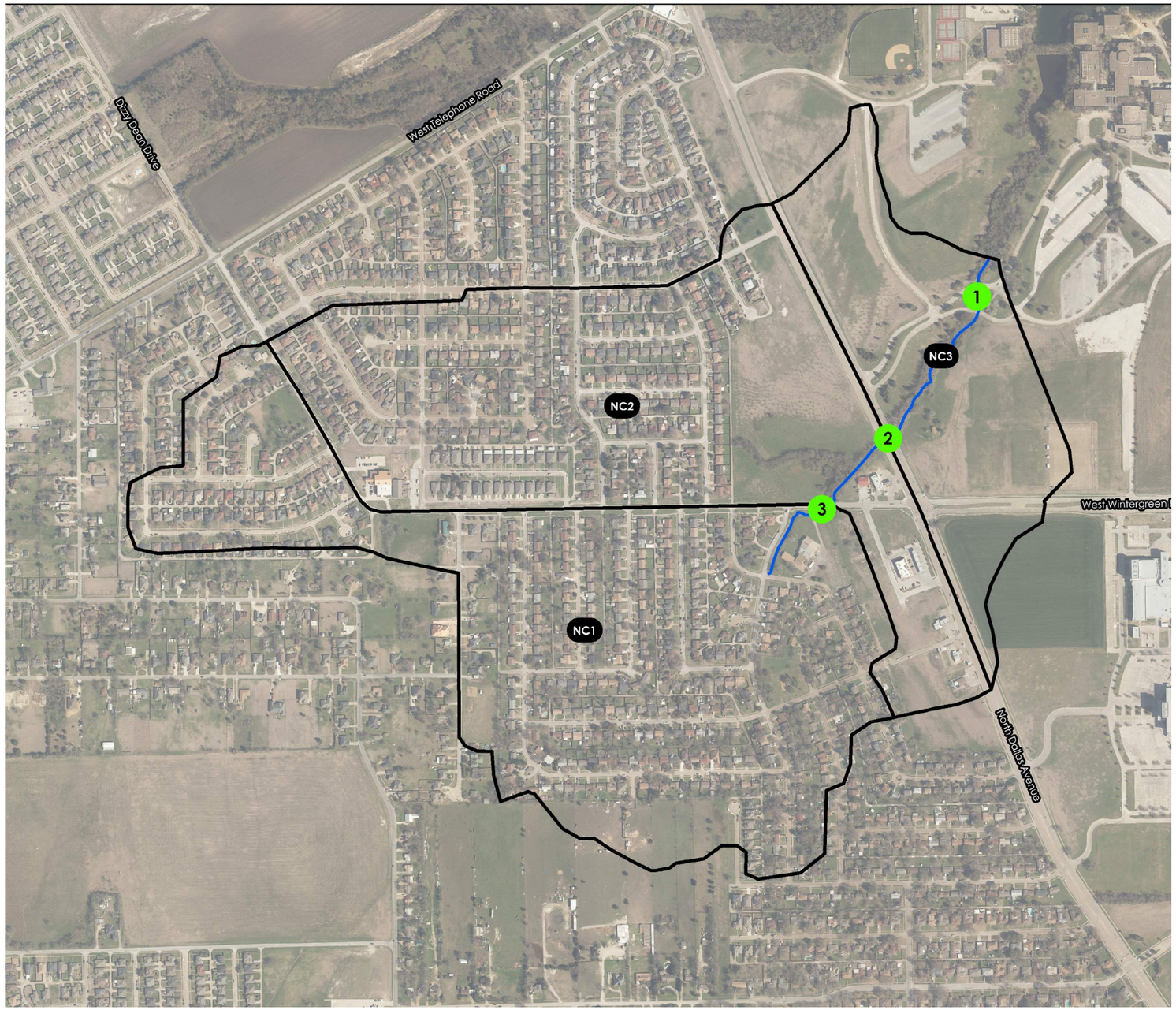
PROJECTS IDENTIFIED

1



1.7 RESULTS

The flow was analyzed at three locations for Floyd Branch. Flow location 1 is used to establish flows at the upstream end of the reach and also determine the flows to Wintergreen Road. Location 2 was included for North Dallas Avenue. Location 1 was meant to establish downstream conditions for the stream which is relatively small.



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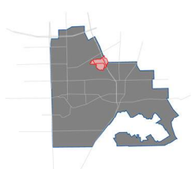
N.T.S.

FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	NC1, NC2, NC3	Main	1983	0.47	850
2	NC1, NC2	Main	1392	0.39	1600
3	NC1	Main	380	0.08	1900

WATERSHED NO.
8

COUNCIL DISTRICTS
3 AND 6

TOTAL DRAINAGE AREA
0.47 SM
*
STREAM LENGTH
0.4 MI
*
PROJECTS IDENTIFIED
1



2.1 SITE ASSESSMENT

Newton Creek is located in the North part of the City of Lancaster. It flows from West to East for approximately 0.4 miles before leaving the city limits. This assessment analyzes the hydrologic and hydraulic characteristics of Newton Creek within the limits of the City of Lancaster, roughly bound by Rutgers Drive (upstream end) and 0.18 miles downstream of Dallas Avenue (downstream end). The channel slope averages around 1.0-1.1%. Newton Creek itself is generally in a natural state with very few man-made alterations, with the exception of the road crossings throughout the watershed. Except at these road crossings, and the area upstream of Wintergreen Road, heavy vegetation is observed. There are a total of two (2) crossings throughout the analyzed watershed.



Looking upstream Along Wintergreen Road. Area is vegetated, but grass is well maintained. The channel upstream runs along Wintergreen Road through a residential area.



Looking at upstream Wintergreen Road culvert face. More vegetation in this area. The culvert is anticipated to overtop in most flooding events.



Looking at downstream Wintergreen Road culvert face. Downstream of this location, the stream runs through heavy veegation. Newton Creek Channel bottom is relatively clean.

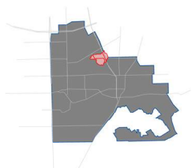


Looking downstream of undersized North Dallas Avenue culvert. The channel further downstream has heavy vegetation, though it appears rip-rap has been installed for approximately 30 feet of channel.

WATERSHED NO.
8

COUNCIL DISTRICTS
3 AND 6

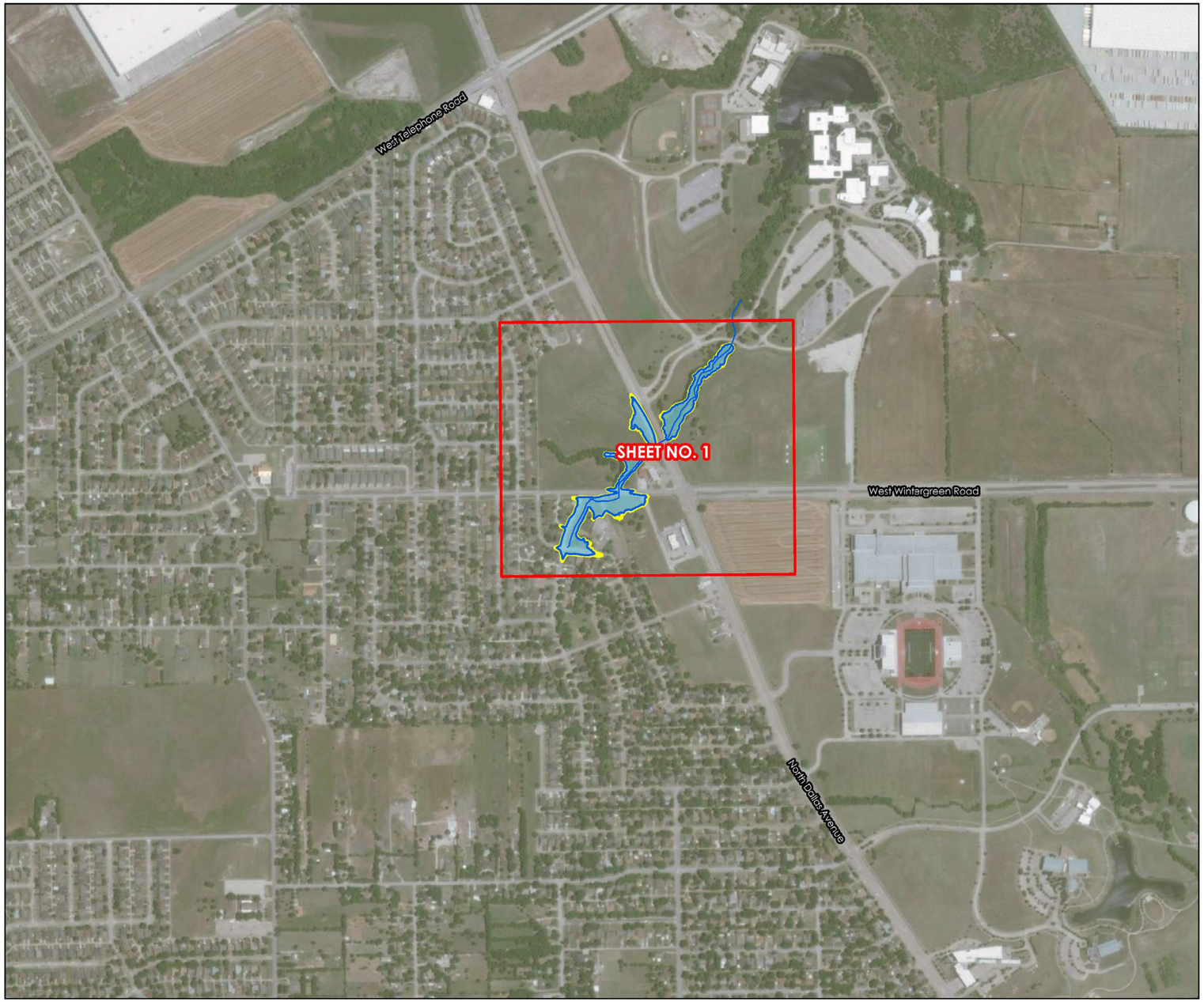
TOTAL DRAINAGE AREA
0.47 SM
*
STREAM LENGTH
0.4 MI
*
PROJECTS IDENTIFIED
1



2.2 FLOODPLAIN MAPPING

The Newton Creek stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Newton Creek is comprised of one stream, one reach, sixteen (16) cross sections, and two (2) hydraulic structures. The studied stream is approximately 950 feet (0.18 miles) long. The floodplain tends to escape the channel upstream of North Dallas Avenue.

The floodplain sheets for Newton Creek display two different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space.



STREAM CENTERLINE
NEWTON VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN

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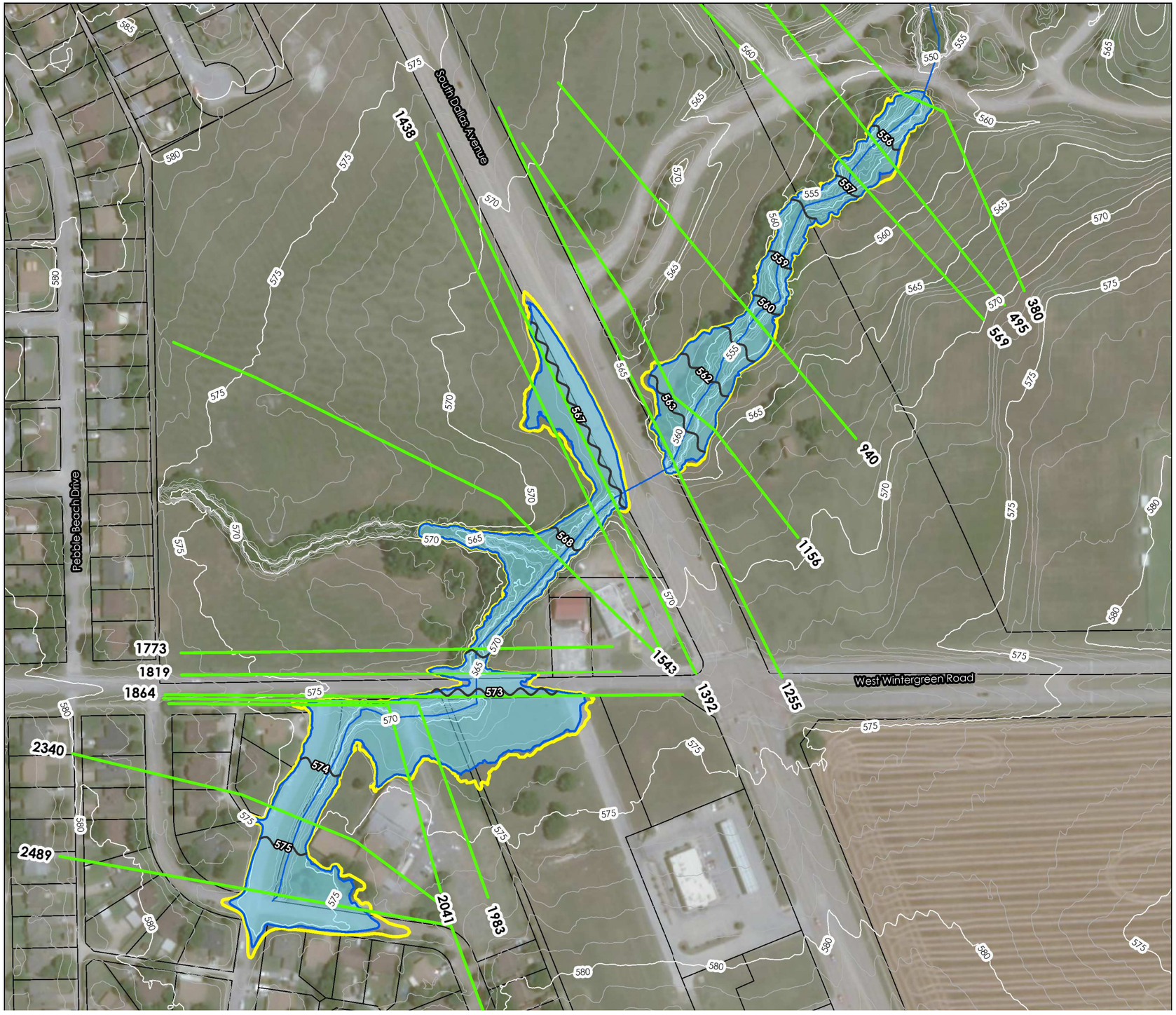
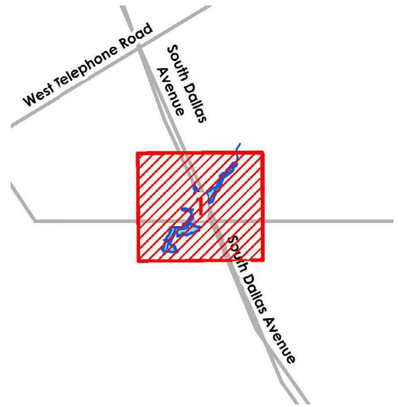
N.T.S.

FLOODPLAIN: SHEET 1





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0 100 200
Feet

- NEWTON CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- NEWTON BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	574.35	574.49	3.14	3.19
2340	572.91	573.05	6.62	6.78
2041	572.23	572.40	1.88	1.90
1983	572.18	572.36	1.81	1.85
1864	572.15	572.32	1.21	1.25
1846	Wintergreen Road			
1819	567.46	567.79	11.04	11.48
1773	566.10	567.27	3.77	2.61
1543	565.36	566.94	4.21	3.00

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	565.26	566.82	3.34	3.07
1392	564.97	566.47	4.72	4.91
1339	Dallas Avenue			
1255	561.97	562.46	4.83	5.38
1156	560.39	560.92	8.54	8.70
940	557.75	558.19	5.34	5.89
569	554.74	555.04	6.98	7.43
495	553.51	554.00	5.92	6.23
380	552.29	552.86	7.33	7.32

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	574.64	574.79	3.25	3.25
2340	573.22	573.39	6.92	7.05
2041	572.54	572.56	2.00	2.22
1983	572.48	572.49	1.99	2.25
1864	572.45	572.45	1.35	1.53
1846	Wintergreen Road			
1819	568.20	568.59	12.05	12.57
1773	567.32	567.62	2.96	3.03
1543	566.98	567.22	3.07	3.45

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	566.85	567.03	3.16	3.72
1392	566.48	566.44	5.09	6.27
1339	Dallas Avenue			
1255	562.55	562.61	5.44	6.58
1156	561.03	561.83	8.68	7.53
940	558.28	558.73	5.97	6.51
569	555.08	555.39	7.58	8.02
495	554.08	554.54	6.31	6.70
380	552.94	553.35	7.42	7.86

2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	575.01	575.11	3.20	3.32
2340	573.64	574.03	7.24	6.25
2041	572.87	572.98	2.18	2.36
1983	572.80	572.90	2.30	2.46
1864	572.77	572.86	1.56	1.66
1846	Wintergreen Road			
1819	571.03	571.08	5.70	6.10
1773	567.77	568.01	3.49	3.64
1543	567.36	567.51	3.63	4.02

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	567.13	567.21	4.00	4.58
1392	566.40	567.09	6.94	4.59
1339	**Dallas Avenue**			
1255	562.59	562.79	7.28	8.09
1156	561.99	562.37	7.48	7.28
940	558.89	559.32	6.73	7.12
569	555.52	555.81	8.15	8.54
495	554.72	555.13	6.84	7.14
380	553.51	553.88	8.02	8.40

2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	575.17	575.29	3.37	3.44
2340	574.11	574.25	6.24	6.33
2041	573.03	573.14	2.40	2.50
1983	572.95	573.04	2.55	2.73
1864	572.91	573.00	1.72	1.83
1846	Wintergreen Road			
1819	571.20	571.23	5.84	6.35
1773	568.01	568.26	3.87	4.04
1543	567.52	567.70	4.06	4.42

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	567.21	567.30	4.64	5.25
1392	567.06	567.18	4.76	4.84
1339	**Dallas Avenue**			
1255	562.77	562.87	8.22	9.27
1156	562.36	562.54	7.26	7.47
940	559.29	559.59	7.12	7.49
569	555.79	556.05	8.53	8.75
495	555.11	555.46	7.12	7.31
380	553.86	554.16	8.38	8.68

WATERSHED NO.

8

COUNCIL DISTRICTS

3 AND 6

TOTAL DRAINAGE AREA

0.47 SM

*

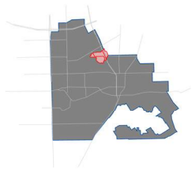
STREAM LENGTH

0.4 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	575.36	575.47	3.47	3.53
2340	574.32	574.42	6.42	6.54
2041	573.17	573.23	2.63	2.76
1983	573.06	573.11	2.88	3.09
1864	573.02	573.06	1.94	2.10
1846	Wintergreen Road			
1819	571.39	571.40	5.90	6.47
1773	568.38	568.61	4.20	4.35
1543	567.81	567.98	4.51	4.84

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	567.38	567.44	5.44	6.05
1392	567.32	567.37	4.48	4.86
1339	Dallas Avenue			
1255	562.90	562.95	9.74	10.82
1156	562.61	562.77	7.58	7.84
940	559.71	559.93	7.66	8.18
569	556.16	556.44	8.82	8.96
495	555.62	556.06	7.34	7.25
380	554.30	554.65	8.76	8.92

2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	575.51	575.66	3.55	3.65
2340	574.45	574.57	6.60	6.78
2041	573.27	573.36	2.76	2.91
1983	573.15	573.22	3.11	3.35
1864	573.10	573.15	2.10	2.28
1846	Wintergreen Road			
1819	571.40	571.64	6.66	6.11
1773	568.62	568.83	4.47	4.74
1543	567.99	568.15	4.86	5.16

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	567.44	567.46	6.10	6.74
1392	567.37	567.40	4.90	5.29
1339	Dallas Avenue			
1255	562.95	563.04	10.91	11.86
1156	562.78	562.92	7.85	8.16
940	559.94	560.15	8.23	8.75
569	556.46	556.83	8.94	8.76
495	556.08	556.46	7.24	7.20
380	554.66	554.97	8.93	9.14

2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2489	575.66	575.81	3.65	3.67
2340	574.57	574.70	6.78	6.99
2041	573.36	573.48	2.91	3.03
1983	573.22	573.32	3.35	3.58
1864	573.15	573.25	2.28	2.43
1846	Wintergreen Road			
1819	571.64	571.72	6.11	6.43
1773	568.87	569.16	4.69	4.96
1543	568.18	568.43	5.18	5.46

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1438	567.49	567.55	6.80	7.54
1392	567.47	567.64	4.95	4.70
1339	Dallas Avenue			
1255	563.09	563.45	11.91	12.40
1156	562.92	563.05	8.16	8.50
940	560.15	560.35	8.75	9.24
569	556.83	557.14	8.76	8.75
495	556.46	556.80	7.20	7.18
380	554.97	555.26	9.14	9.35

WATERSHED NO.
8

COUNCIL DISTRICTS
3 AND 6

TOTAL DRAINAGE AREA
0.47 SM
*

STREAM LENGTH
0.4 MI
*

PROJECTS IDENTIFIED
1



3.1 RISK IDENTIFICATION

Five risk areas were identified in this study. The risks include two over-topping bridges, two flooded roadway and one location of erosive velocities. No structures are located within the floodplain mapped for Newton Creek. Within the watershed, two road intersections have had flooding issues previously: the Telephone Road/ North Dallas Avenue intersection and the Wintergreen Road/North Dallas Avenue intersection. Both Wintergreen Road and North Dallas Avenue are high traffic roads with crossings at Newton Creek that over-top. The North Dallas Avenue crossing is estimated to experience some flooding in the 2-year event, and the Wintergreen Road crossing is estimated to over-top in the 2-year event. The potential erosion area is located away from major development, east of North Dallas Avenue. The following map shows the shear stresses associated with the Newton Creek floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Telephone Road & North Dallas Avenue	Flooded Roadway	-	Public	Medium
2	River Station 940	Potential Erosion Hot Spot	1-Year	Private	Low
3	North Dallas Avenue	Over-topping Bridge	2-Year	Public	Very High
4	Wintergreen Road & North Dallas Avenue	Flooded Roadway	-	Public	Medium
5	Wintergreen Road	Over-topping Bridge	1-Year	Public	High


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
1
2
3
4
5
West Telephone Road
West Wintergreen Road
North Dallas Avenue

RUNYON SPRINGS BRANCH

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

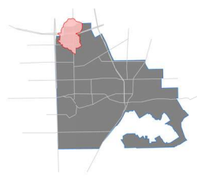
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



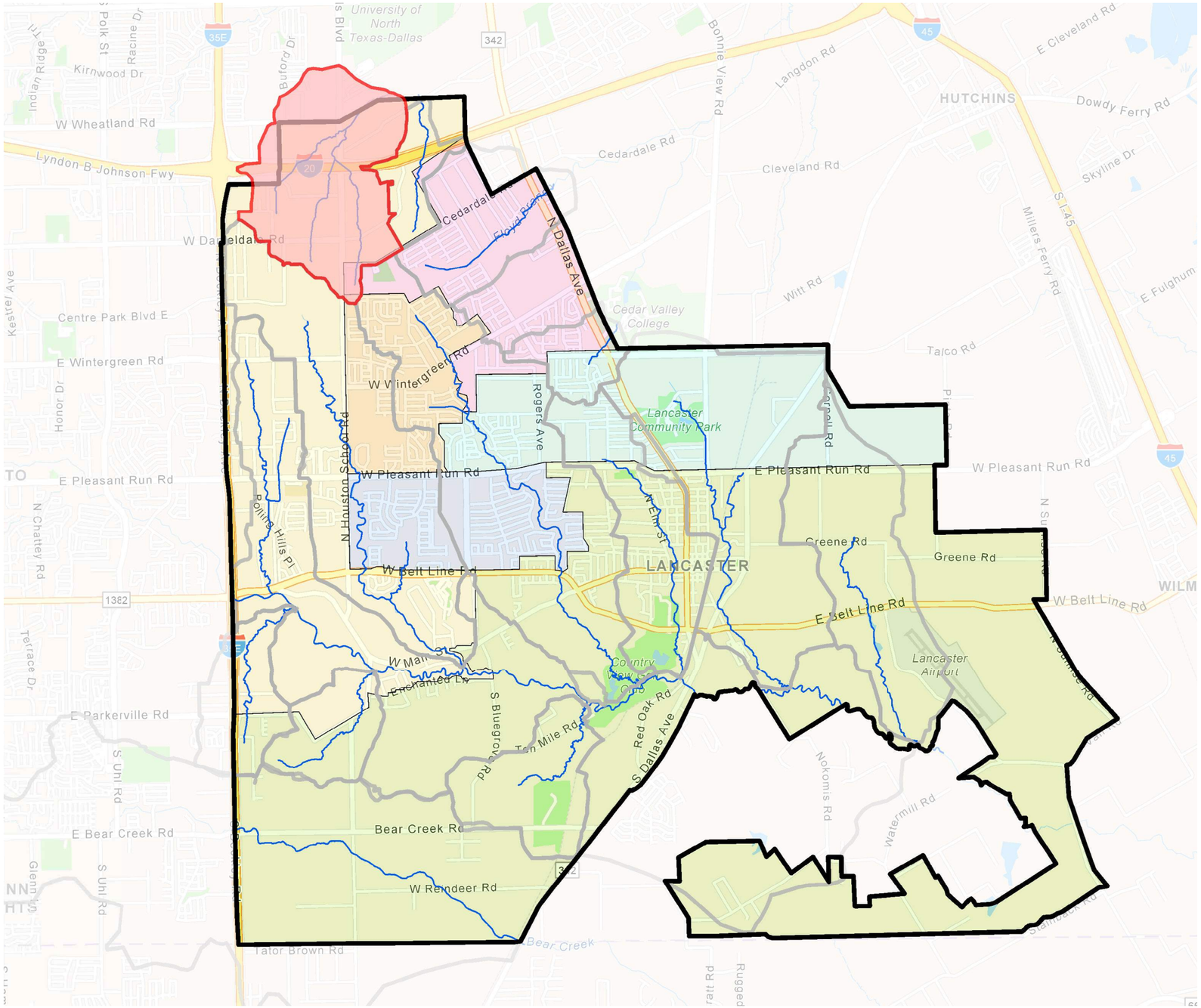
RUNYON SPRINGS BRANCH
WATERSHED
STREAM CENTERLINE

COUNCIL DISTRICT
- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

N

RUNYON SPRINGS BRANCH WATERSHED

Occupying the northwest region, this watershed spreads across 1.59 square miles. It features two tributaries merging near North Houston School Road, open spaces, the Prologis Park development, and some residential areas. Notably, it holds potential for mixed-use and commercial development in certain zones.



WATERSHED NO. 9

RUNYON SPRINGS BRANCH

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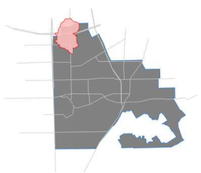
RUNYON SPRINGS BRANCH

WATERSHED NO.
9

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.1 DRAINAGE AREA MAP

The drainage area divides for the Runyon Springs Branch watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into eight (8) sub-basins. Sub-basins are designated RC-A 1 through RC-C3. The total watershed drainage area is 1172.9 acres (1.83 square-miles). Approximately 1 .44 square-miles of drainage area is located within the City of Lancaster itself.

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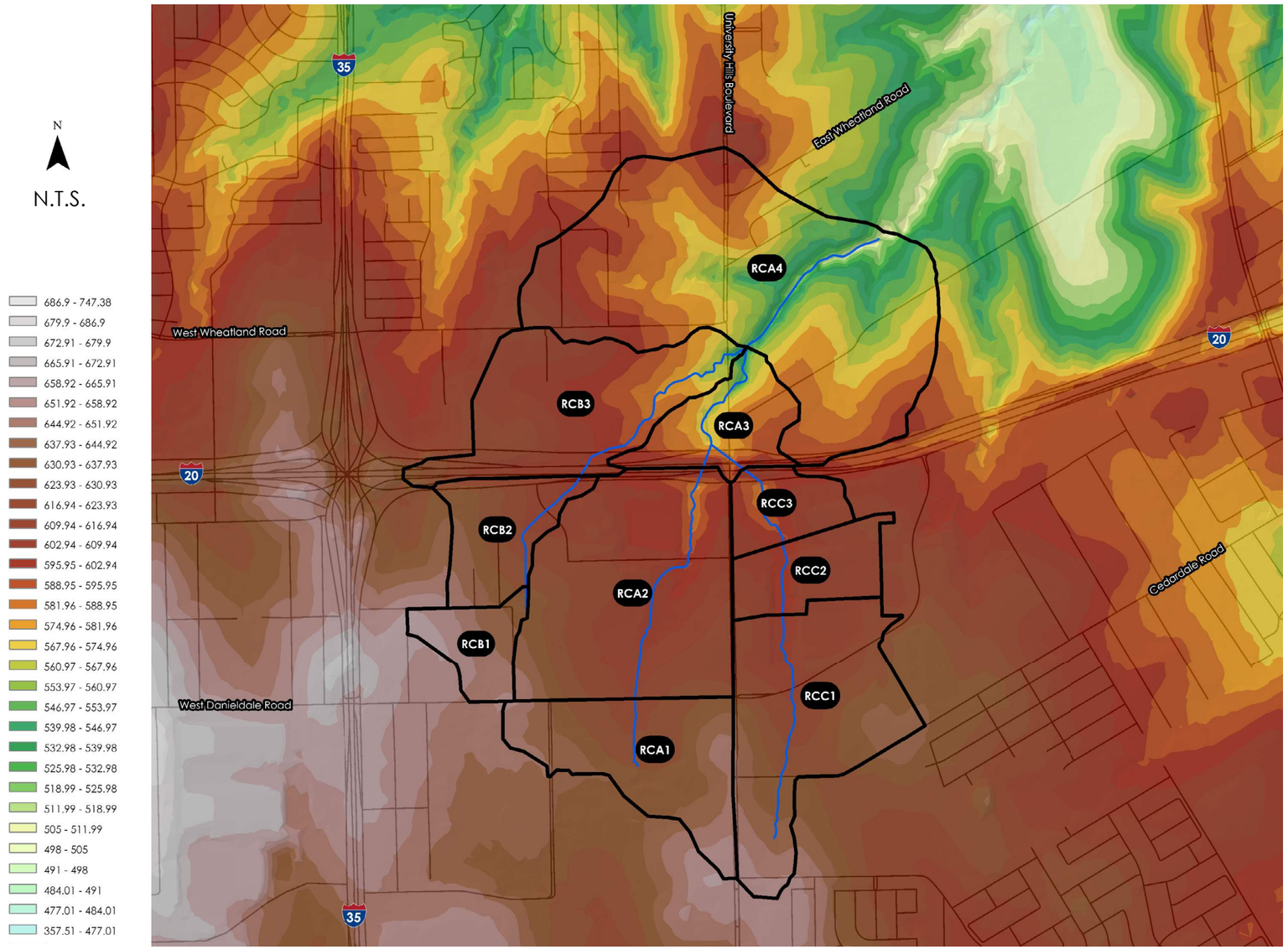


HYDROLOGIC PARAMETERS REPORT

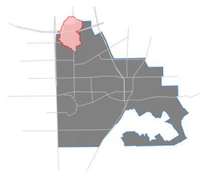
BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
RCA1	0.1649	84	49.7	70.9	15.82	9.49	5.15	8.58
RCA2	0.3184	84	68.5	72.2	37.17	22.3	10.46	17.43
RCA3	0.0890	84	25.1	59.1	30.43	18.26	8.80	14.66
RCA4	0.5275	82.3	14.1	66.1	41.60	24.96	12.73	21.21
RCB1	0.0560	83.6	36.4	71.1	36.38	21.83	10.48	17.47
RCB2	0.0904	84	30.4	57.5	24.28	14.57	6.79	11.31
RCB3	0.2113	83.4	15.1	65.5	34.42	20.65	10.59	17.65
RCC1	0.2417	84	62.4	63.5	23.77	14.26	7.39	12.32
RCC2	0.0765	84	70	76.1	10.10	6.06	3.60	6
RCC3	0.0570	84	15	70.1	22.10	13.26	6.45	10.75

RUNYON SPRINGS BRANCH

WATERSHED NO.
9

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.2 TIME OF CONCENTRATION

The Times of Concentration for Runyon Springs Branch were traced using the 2009 LiDAR data. and verified with the 2019 aerial imagery. Where possible. flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Runyon Springs Branch is thick with vegetation, with the exception of the upstream-most portions of the reaches. South of Interstate 20, the streams run between industrial warehouses. North of Interstate 20, the area is mostly open space, resulting in generally shorter Times of Concentration upstream. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

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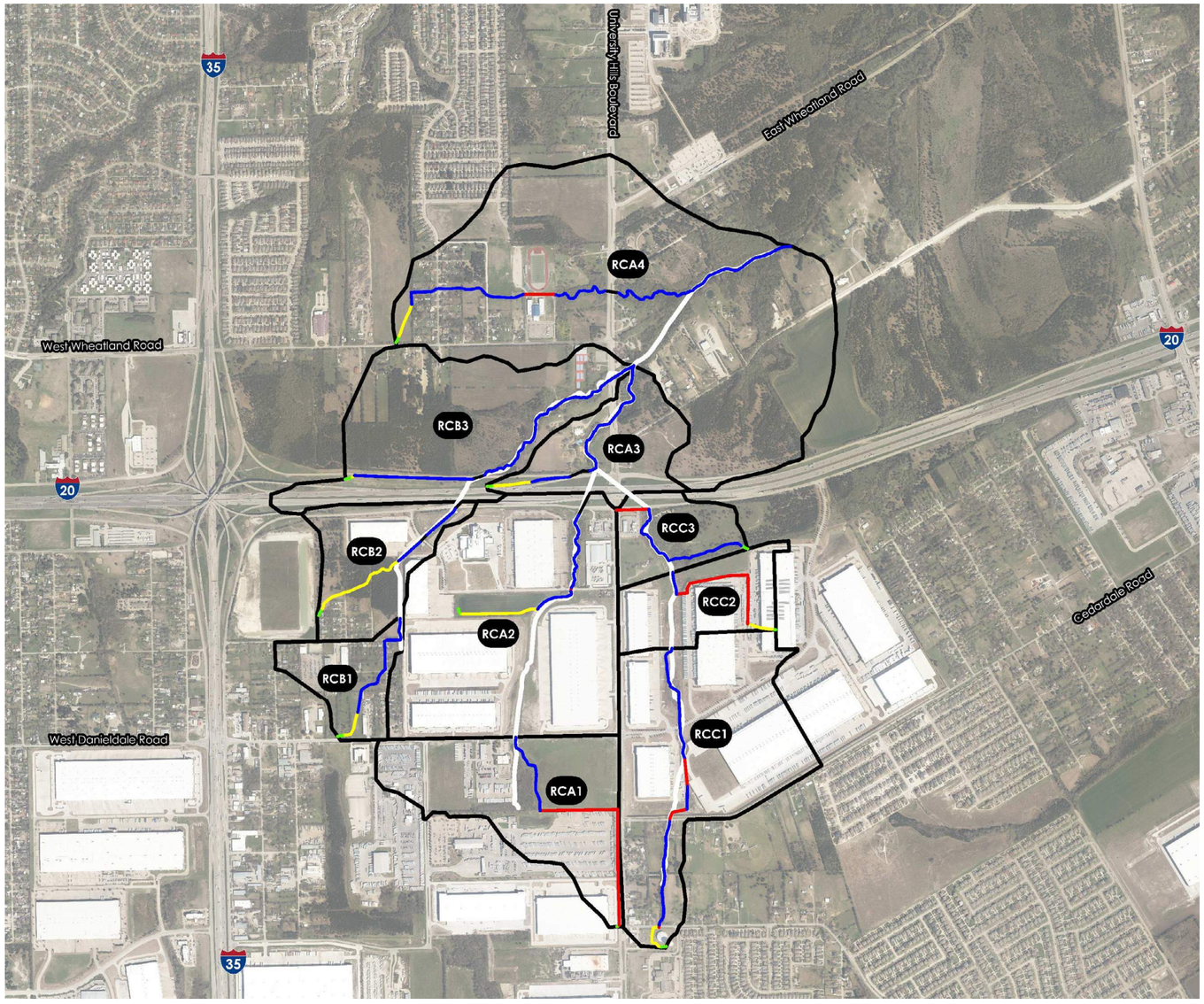


TIME OF CONCENTRATION REPORT

RC-A-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	38	2.22	0.240	0.00	0.1	6.01
PIPE	24" RCP	2,580	1.10	0.014	66.87	7.0	6.13
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	1131	0.98	0.050	51.79	5.1	3.68
		3,749					**15.81**
							14.31

RC-A-2

OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	23.42
SHALLOW	24" RCP	1019	1.37	0	16.1	1.9	9
PIPE	36" RCP	53	1.80	0.014	87.62	11.8	0.08
CHANNEL	"CONCR. TRAP (B=6,Y=4,SS=3:1)"	440	1.00	0.018	143.86	14.4	1.38
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	1,083	1.88	0.050	51.79	7.1	2.54
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	115	1.14	0.050	51.79	5.5	0.35
BOX	10X5 RCB	338	0.50	0.014	149.21	10.6	0.38
		3146					**37.16**
							29.06

RC-A-3

OVERLAND	GRS-DENSE	100	0.85	0.240	0.00	0.1	18.95
SHALLOW	UNPAVED	502	1.06	0.000	16.10	1.7	5.05
CHANNEL	NATRL PARA (B=10,Y=1)	501	1.63	0.035	27.68	3.5	2.36
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	1,891	2.65	0.050	51.79	8.4	3.74
BOX	10X5 RCB	292	4.92	0.014	149.21	14.7	0.33
		3,286					**30.43**
							24.43

RC-A-4

OVERLAND	GRS-DENSE	100	0.63	0.240	0.00	0.1	21.36
SHALLOW	UNPAVED	454	1.68	0.000	16.10	2.1	3.62
PIPE	36" RCP	439	1.97	0.014	87.62	12.3	0.60
CHANNEL	NATRL PARA (B=10,Y=1)	1,725	1.94	0.035	27.68	3.9	7.46
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	2,719	1.82	0.050	51.79	7.0	6.49
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	815	1.97	0.050	51.79	7.3	1.87
BOX	10X5 RCB	186	2.06	0.014	149.21	14.4	0.21
		6,437					**41.6**
							35.36

RC-B-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.50	0.240	0.00	0.1	23.42
SHALLOW	UNPAVED	384	0.50	0.000	16.10	1.1	5.61
PIPE	24" RCP	34	0.50	0.014	66.87	4.7	0.12
CHANNEL	NATRL PARA (B=40,Y=1)	766	1.34	0.035	31.04	3.6	3.56
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	375	0.94	0.050	28.69	2.8	2.24
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	179	2.65	0.050	28.69	4.7	0.64
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	294	1.47	0.050	51.79	6.3	0.78
		2132					**36.38**
							29.12

RC-B-2

OVERLAND	GRS-DENSE	100	2.21	0.240	0.00	0.1	12.93
SHALLOW	UNPAVED	1291	2.29	0.000	16.10	2.4	8.83
CHANNEL	CONCR. TRAP (B=6,Y=4,SS=3:1)	381	3.41	0.18	144.28	14.7	0.43
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	512	0.85	0.050	51.79	4.8	1.79
BOX	10X5 RCB	138	3.30	0.014	149.21	14.1	0.16
BOX	10X5 RCB	131	2.22	0.014	149.21	14.2	0.15
		2553					**24.29**
							18.85

RC-B-3

OVERLAND	GRS-DENSE	100	0.76	0.240	0.00	0.1	19.81
SHALLOW	UNPAVED	34	3.08	0.000	16.10	2.8	0.20
CHANNEL	"CONCR. TRAP (B=6,Y=4,SS=1:1)"	348	6.14	0.018	144.28	14.8	0.39
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,574	1.16	0.050	28.69	3.1	8.49
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	2,217	2.03	0.050	51.79	7.4	5.01
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	192	3.92	0.050	51.79	10.3	0.31
BOX	10X5 RCB	173	1.99	0.014	149.21	14	0.2
		4,639					**34.42**
							29.42

TIME OF CONCENTRATION REPORT - CONTINUED

RC-C-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	7.63	0.240	0.00	0.2	7.88
SHALLOW	UNPAVED	382	0.61	0.000	16.10	1.3	5.06
PIPE	36" RCP	32	0.50	0.014	87.62	6.2	0.09
PIPE	36" RCP	328	0.80	0.014	87.62	7.8	0.70
PIPE	36" RCP	391	1.34	0.014	87.62	10.1	0.64
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	1,595	1.10	0.050	51.79	5.4	4.89
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	1,419	1.50	0.050	51.79	6.3	3.73
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	302	1.56	0.050	51.79	6.5	0.78
		4,548					**23.76**
							20.53

RC-C-2

OVERLAND	PAVEMENT	50	0.50	0.011	0.00	0.7	1.14
SHALLOW	PAVED	339	0.68	0.000	20.30	1.7	3.37
PIPE	24" RCP	1,718	0.75	0.014	66.87	5.8	4.94
CHANNEL	NATRL TRAP (B=6, Y=4, SS=3:1)	295	2.20	0.050	51.79	7.7	0.64
		2,401					**10.10**
							8.97

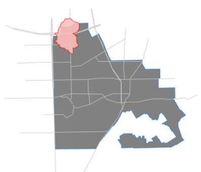
RC-C-3

OVERLAND	GRS-DENSE	100	1.28	0.240	0.00	0.1	16.08
PIPE	36" RCP	436	1.74	0.014	87.62	11.6	0.63
CHANNEL	CONCR, TRAP (B=6, Y=4, SS=3:1)	925	0.65	0.018	143.86	11.6	1.33
CHANNEL	NATRL PARA (B=20, Y=1)	1,020	1.98	0.035	29.81	4.2	4.05
		2,481					**22.10**
							17.92

WATERSHED NO.
9

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.3 SOILS MAP

Runyon Springs Branch watershed has two different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type C, which is more permeable than soil type D is found within sub-basins RC-A3, RC-BI and RC-B2. Hydrologic soil groups A and B are not present in the Runyon Springs Branch watershed.

Hydrologic Soil Group C
Hydrologic Soil Group D

N

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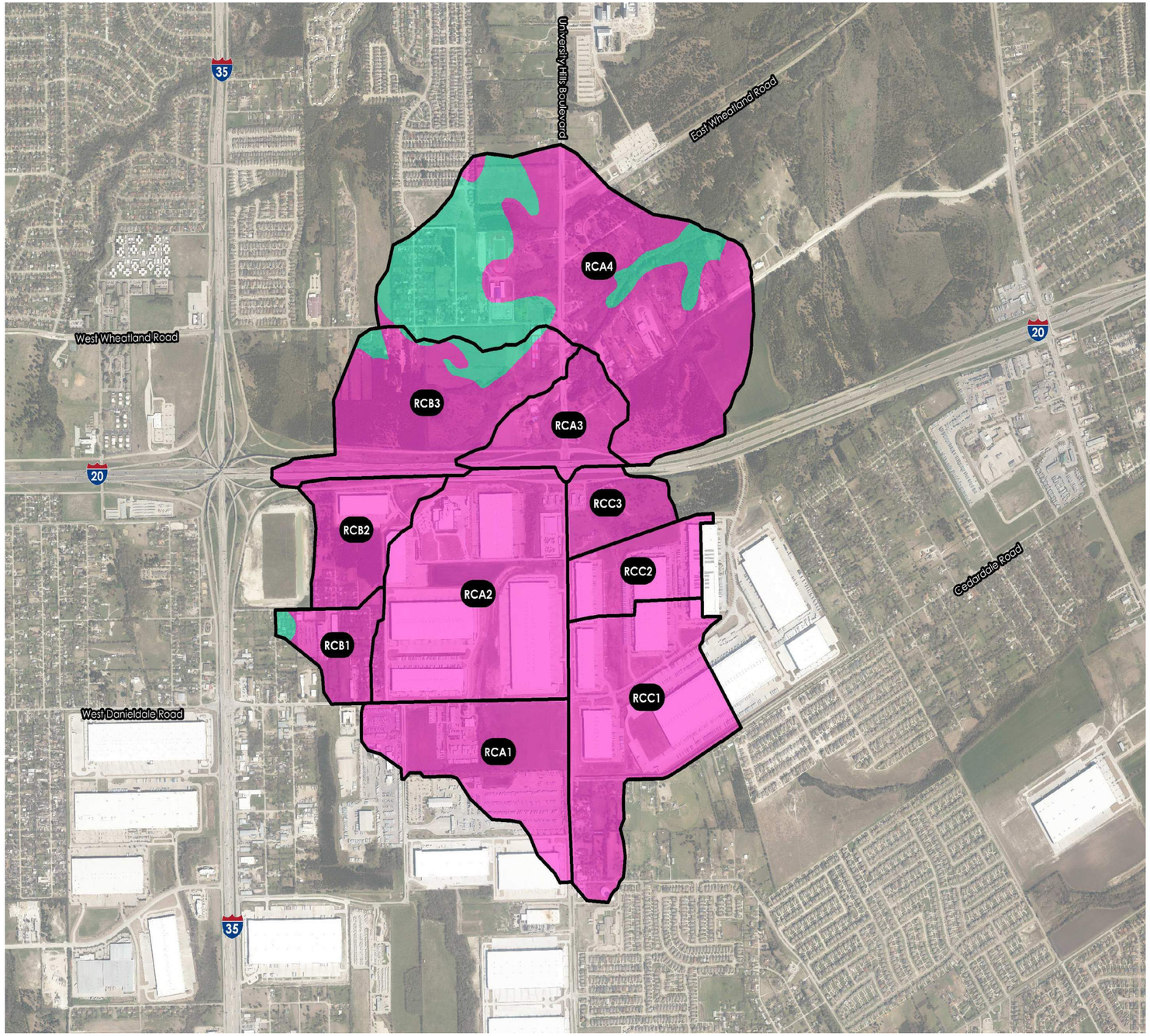


PERVIOUS CURVE NUMBER REPORT

RC-A-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	105.5	84.0
		105.5	**84.0**

RC-A-2

D	84	203.7	84.0
		203.7	**84.0**

RC-A-3

D	84	57.0	84.0
		57.0	**84.0**

RC-A-4

C	79	114.1	26.7
D	84	223.5	55.6
		337.6	**82.3**

RC-B-1

C	79	2.6	5.6
D	84	33.3	78.0
		35.9	**83.6**

RC-B-2

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	57.8	84.0
		57.8	**84.0**

RC-B-3

C	79	16.4	9.6
D	84	118.9	73.8
		135.2	**83.4**

RC-C-2

D	84	154.7	84.0
		154.7	**84.0**

RC-C-2

D	84	49.0	84.0
		49.0	**84.0**

RC-C-3

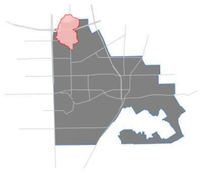
D	84	36.5	84.0
		36.5	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.
9

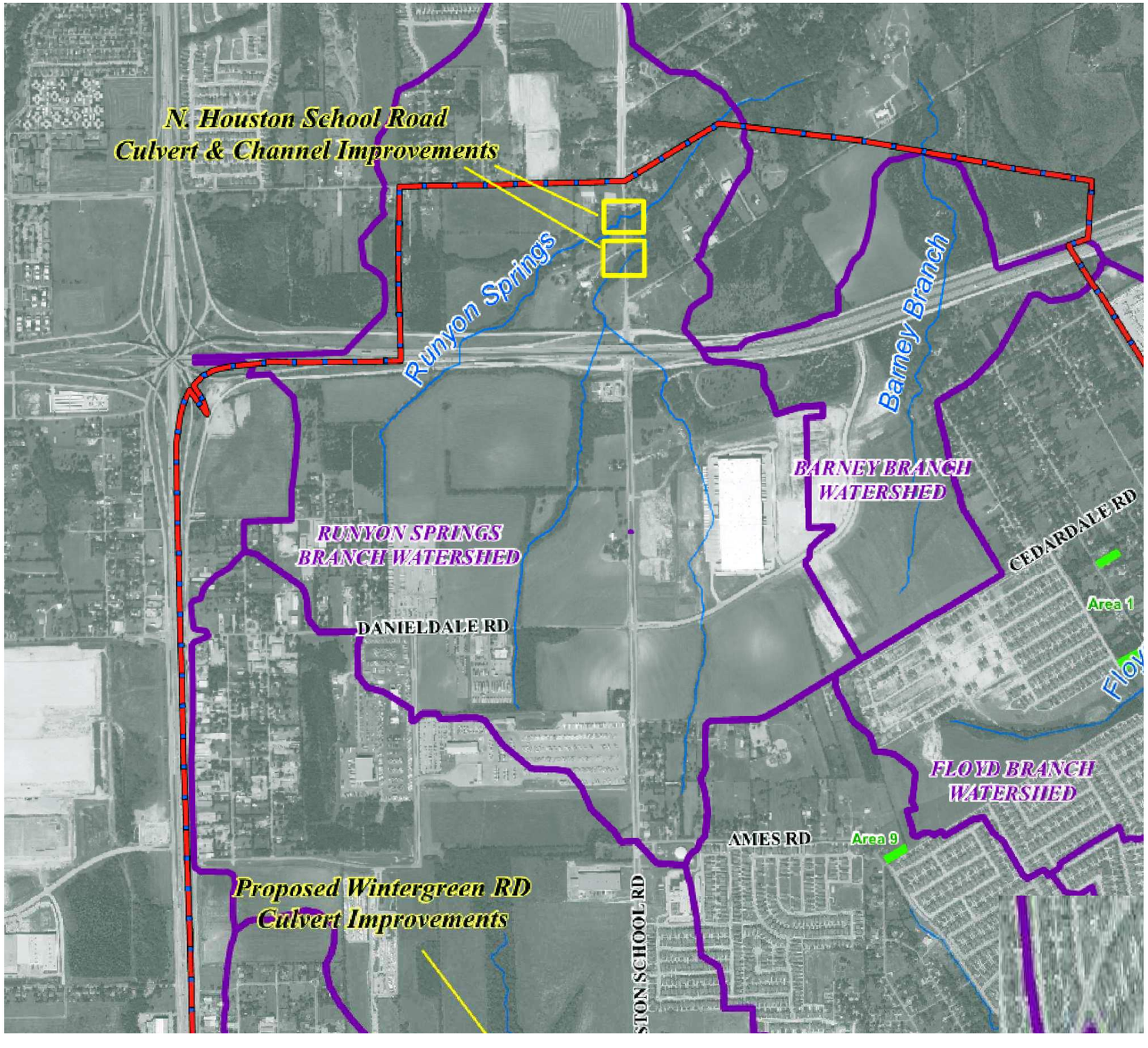
COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows significant development since 2007 within the Runyon Springs Branch watershed. New development consists mostly of large industrial warehouses. Specifically, this new development is located in sub-basins A-0 I, B-0 I, C-0 I and C-02. The locations of new development are highlighted in red.



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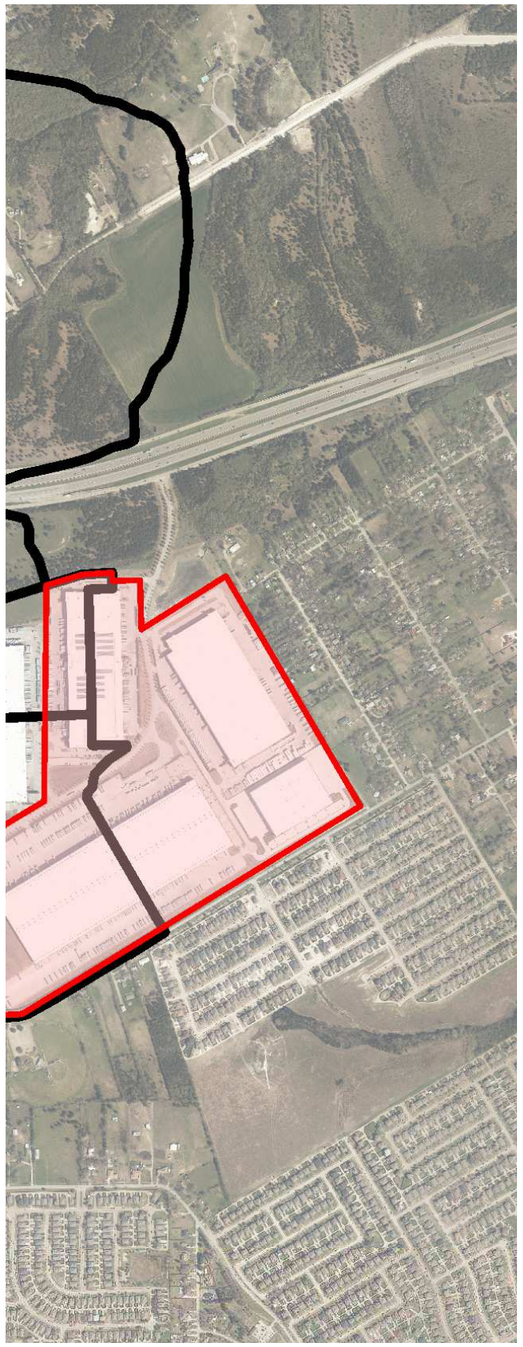
2007





N

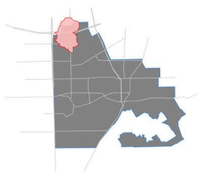
N.T.S.

2019

WATERSHED NO.
9

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.5 IMPERVIOUS AREA

Impervious areas for the Runyon Springs Branch watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located South of Interstate 20, where a relatively large number of industrial developments are located.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

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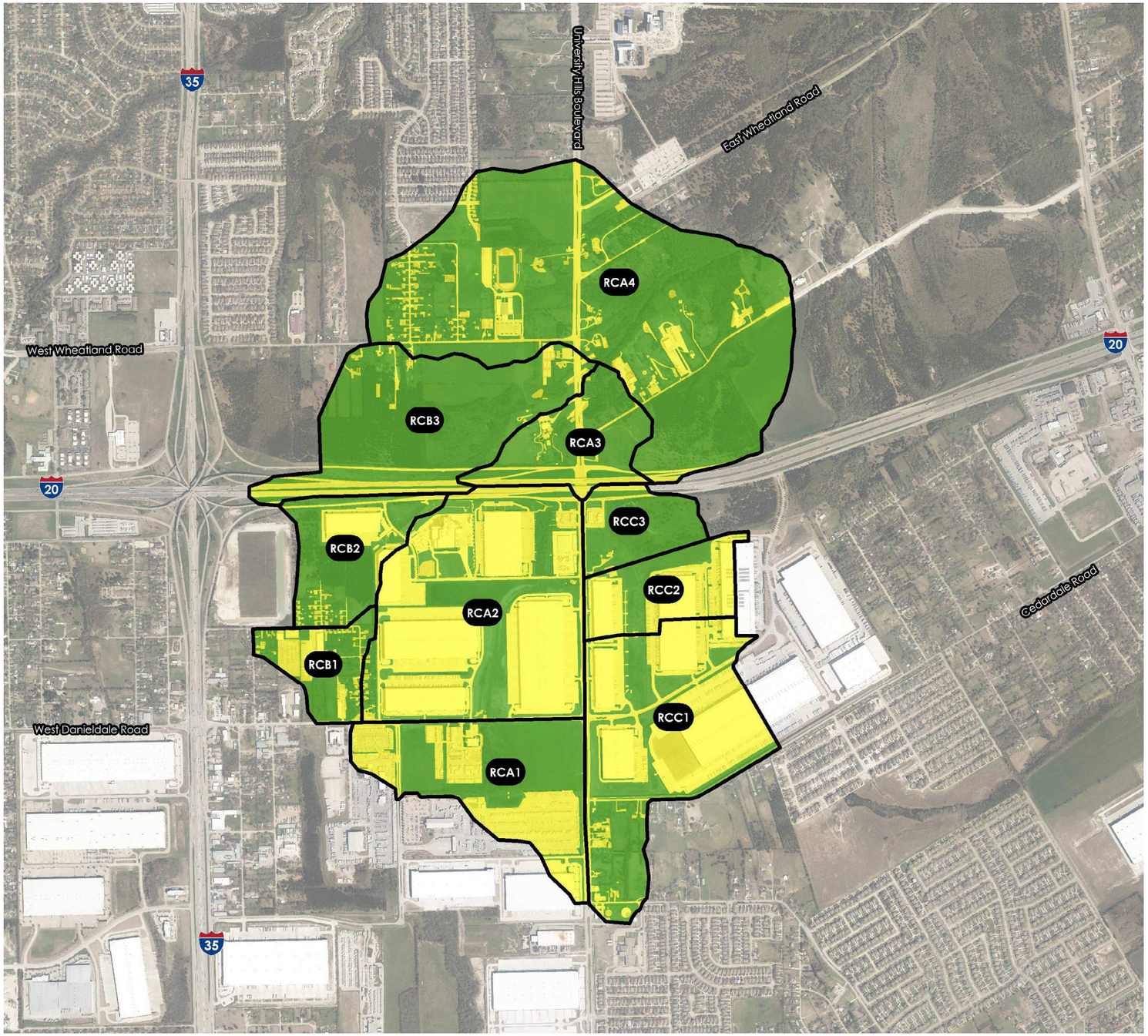


EXISTING PERCENT IMPERVIOUS REPORT

RC-A-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	52.5	49.7
OPEN SPACE (FAIR CONDITION)	0	53.1	0.0
		105.5	**49.7**

RC-A-2

IMPERVIOUS	100	139.6	68.5
OPEN SPACE (FAIR CONDITION)	0	64.2	0.0
		203.7	**68.5**

RC-A-3

IMPERVIOUS	100	14.3	25.1
OPEN SPACE (FAIR CONDITION)	0	42.7	0.0
		57.0	**25.1**

RC-A-4

IMPERVIOUS	100	47.6	14.1
OPEN SPACE (FAIR CONDITION)	0	290.0	0.0
		337.6	**14.1**

RC-B-1

IMPERVIOUS	100	13.1	36.4
OPEN SPACE (FAIR CONDITION)	0	22.8	0.0
		35.9	**36.4**

RC-B-2

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	17.6	30.4
OPEN SPACE (FAIR CONDITION)	0	40.2	0.0
		57.8	**30.4**

RC-B-3

IMPERVIOUS	100	20.4	15.1
OPEN SPACE (FAIR CONDITION)	0	114.8	0.0
		135.2	**15.1**

RC-C-1

IMPERVIOUS	100	96.6	62.4
OPEN SPACE (FAIR CONDITION)	0	58.1	0.0
		154.7	**62.4**

RC-C-2

IMPERVIOUS	100	34.3	70.0
OPEN SPACE (FAIR CONDITION)	0	14.7	0.0
		49.0	**70.0**

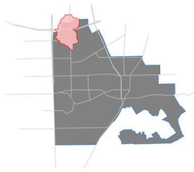
RC-C-3

IMPERVIOUS	100	5.5	15.0
OPEN SPACE (FAIR CONDITION)	0	31.0	0.0
		36.5	**15.0**

WATERSHED NO.
9

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.6 FUTURE LAND USE MAP

The majority of the watershed is located within City of Lancaster. The existing land use within the watershed consist of mostly Industrial. The undeveloped protions of the watershed have Residential and Mixed Use zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- IMPERVIOUS
- OPEN SPACE
- MIXED USE
- LOGISTICS & DISTRIBUTION
- MIXED-USE
- R - RURAL LIVING
- R - URBAN NEIGHBORHOOD
- RESIDENTIAL LOW DENSITY
- RESIDENTIAL MED DENSITY
- SUBURBAN MIXED-USE CENTER
- VILLAGE CENTER

N

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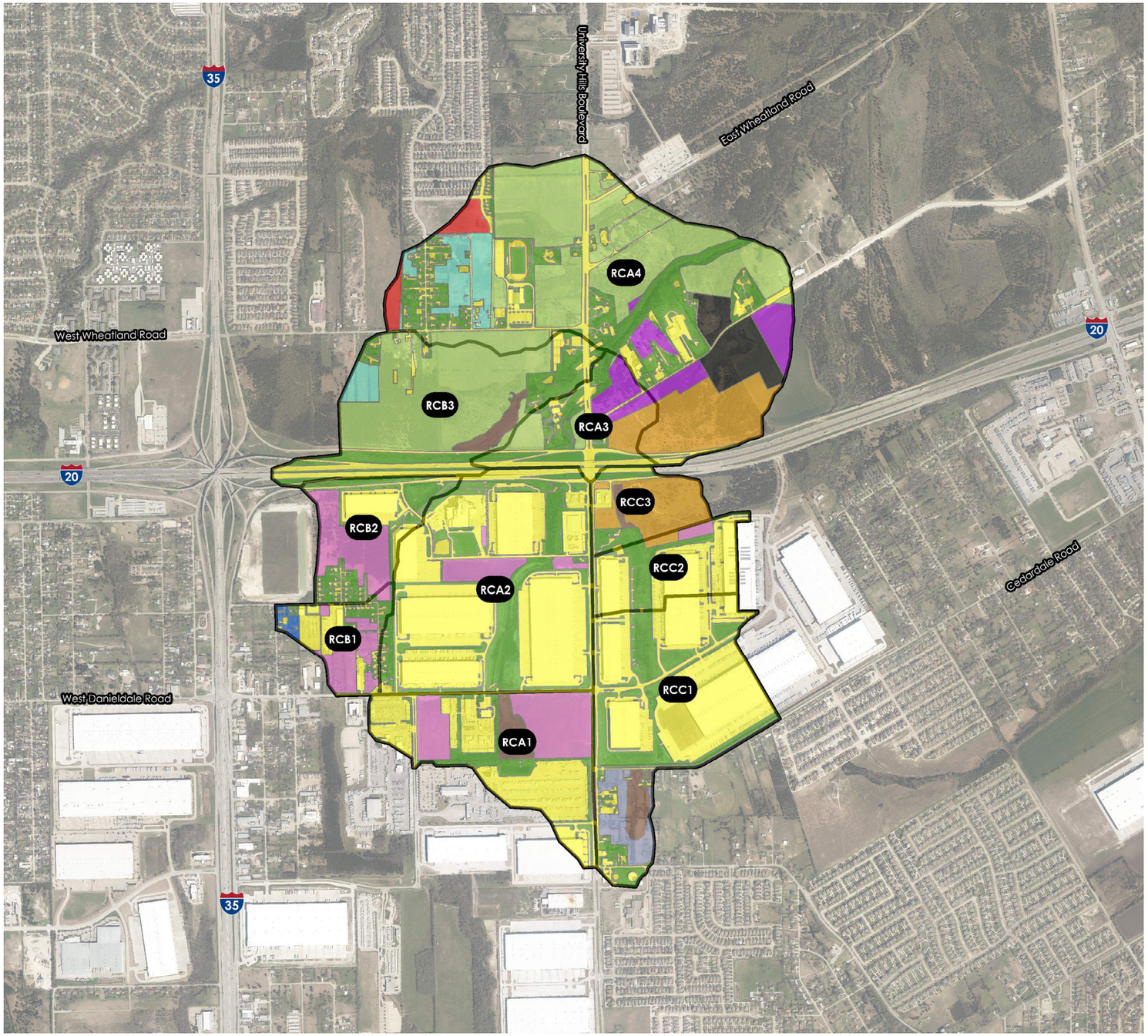


ULTIMATE PERCENT IMPERVIOUS REPORT

RC-A-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	52.5	49.7
FLOODPLAIN	0	7.5	0.0
OPEN SPACE (FAIR CONDITION)	0	14.5	0.0
LOGISTICS & DISTRIBUTION	72	31.0	21.2
		105.5	**70.9**

RC-A-2

IMPERVIOUS	100	139.6	68.5
FLOODPLAIN	0	0.0	0.0
OPEN SPACE (FAIR CONDITION)	0	53.8	0.0
LOGISTICS & DISTRIBUTION	72	10.3	3.7
		203.7	**72.2**

RC-A-3

IMPERVIOUS	100	14.3	25.1
FLOODPLAIN	0	0.1	0.0
OPEN SPACE (FAIR CONDITION)	0	17.5	0.0
MIXED USE	85	7.5	11.1
R - URBAN NEIGHBORHOOD	65	9.9	11.3
COMMERCIAL CORRIDOR	85	7.8	11.6
		57.0	**59.1**

RC-A-4

IMPERVIOUS	100	47.6	14.1
OPEN SPACE (FAIR CONDITION)	0	59.8	0.0
MIXED USE	85	124.5	31.3
R - URBAN NEIGHBORHOOD	65	18.6	3.6
VILLAGE CENTER	85	23.9	6.0
COMMERCIAL CORRIDOR	85	34.9	8.8
RESIDENTIAL LOW DENSITY	25	19.5	1.4
RESIDENTIAL MED DENSITY	30	8.7	0.8
		337.6	**66.1**

RC-B-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	13.1	36.4
OPEN SPACE (FAIR CONDITION)	0	6.0	0.0
SURBURBAN MIXED USE CENTER	85	2.3	5.5
LOGISTICS & DISTRIBUTION	72	14.5	29.1
		35.9	**71.1**

RC-B-2

IMPERVIOUS	100	17.6	30.4
OPEN SPACE (FAIR CONDITION)	0	18.6	0.0
LOGISTICS & DISTRIBUTION	72	21.4	26.6
MIXED USE	85	0.3	0.4
		57.8	**57.5**

RC-B-3

IMPERVIOUS	100	20.4	15.1
FLOODPLAIN	0	5.7	0.0
OPEN SPACE (FAIR CONDITION)	0	24.8	0.0
MIXED USE	85	78.5	49.4
RESIDENTIAL LOW DENSITY	25	5.8	1.1
RESIDENTIAL MED DENSITY	30	0.0	0.0
		135.2	**65.5**

RC-C-1

IMPERVIOUS	100	96.6	62.4
FLOODPLAIN	0	6.4	0.0
OPEN SPACE (FAIR CONDITION)	0	39.5	0.0
LOGISTICS & DISTRIBUTION	72	0.3	0.1
R - RURAL LIVING	12	12.0	0.9
		154.7	**63.5**

ULTIMATE PERCENT IMPERVIOUS REPORT

RC-C-2			
IMPERVIOUS	100	34.3	70.0
OPEN SPACE (FAIR CONDITION)	0	10.9	0.0
COMMERCIAL CORRIDOR	85	1.9	3.2
LOGISTICS & DISTRIBUTION	72	1.9	2.8
		49.0	**76.1**

RC-C-3			
IMPERVIOUS	100	5.5	15.0
FLOODPLAIN	0	1.6	0.0
OPEN SPACE (FAIR CONDITION)	0	5.7	0.0
COMMERCIAL CORRIDOR	85	23.7	55.1
		36.5	**70.1**

RUNYON SPRINGS BRANCH

WATERSHED NO.
9

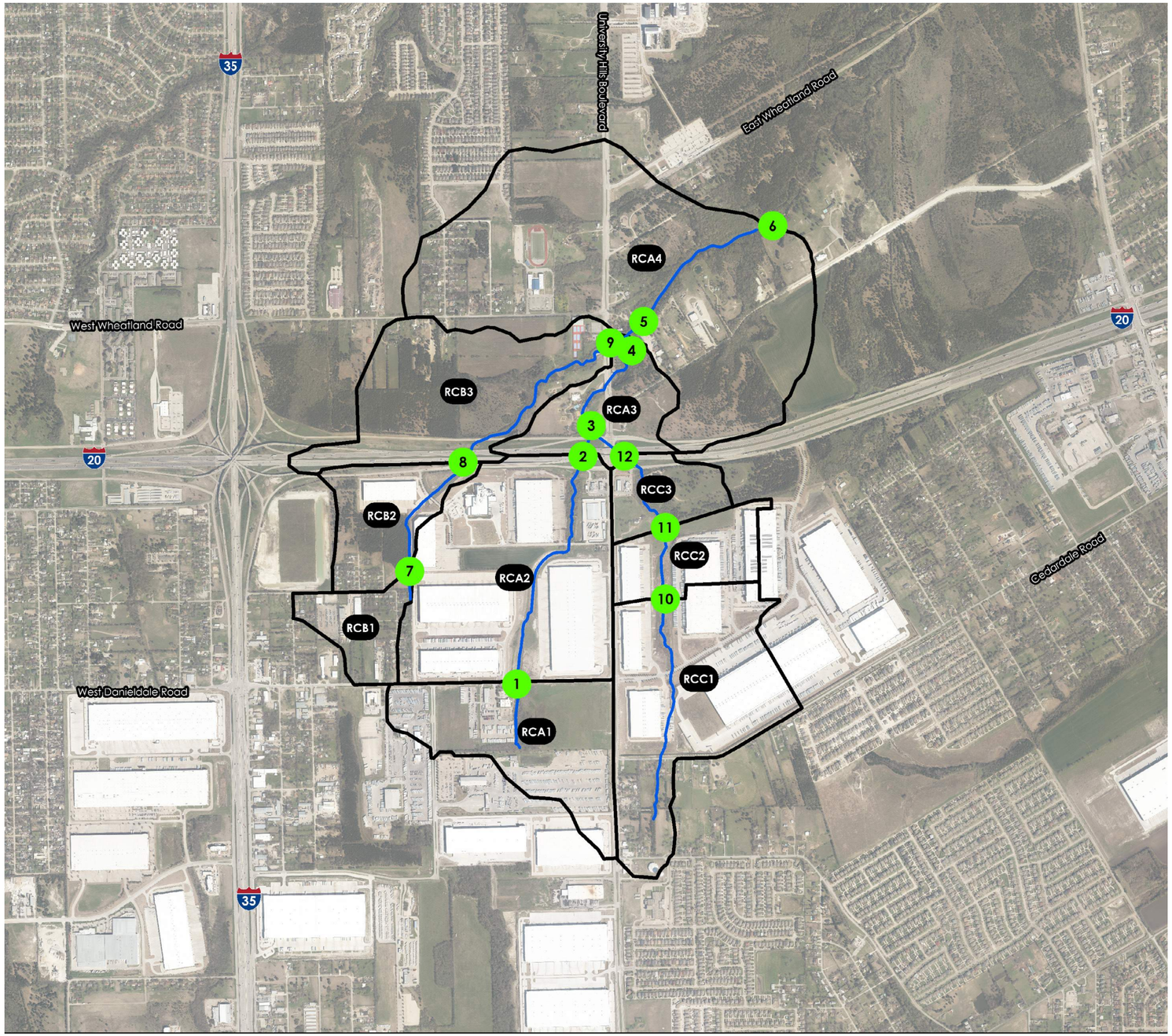
COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1



1.7 RESULTS

The flow was analyzed at nine locations for Runyon Springs Branch. Flow locations 1, 7 and 10 were used to establish flows at the upstream end of the reaches. Flow analysis locations 1, 2, 4, 8, 9 and 12 were used for analysis of road crossings. The remaining locations were chosen to examine the effects at conluences between the different reaches.



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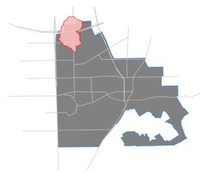
FLOW ANALYSIS LOCATIONS

Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Peak Flow (cfs)
1	RC-A1	RC-A-1	9488	0.16	800
2	RC-A1 & -A2	RC-A-1	7054	0.48	1650
3	RC-A1, -A2, -C1, -C2 & -C3	RC-A-2	4288.435	0.36	1000
4	RC-A1, -A2, -A3, -C1, -C2 & -C3	RC-A-2	3428.097	0.95	2600
5	RC-A1, -A2, -B1, -B2, -B3, -C1, -C2 & -C3	RC-A-3	2353.439	1.31	3600
6	RC-A1, -A2, -A3, -B1, -B2, -B3, -C1, -C2 & -C3	RC-A-3	848.271	1.83	5300
7	RC-B1	RC-B	5304.917	0.06	200
8	RC-B1 & RC-B2	RC-B	3473.717	0.15	550
9	RC-B1, -B2, -B3	RC-B	345.5635	0.36	1000
10	RC-C1	RC-C	2169.601	0.24	1000
11	RC-C1 & RC-C2	RC-C	1443.187	0.32	1000
12	RC-C1, -C2, -C3	RC-C	4.22	0.38	800

WATERSHED NO.
9

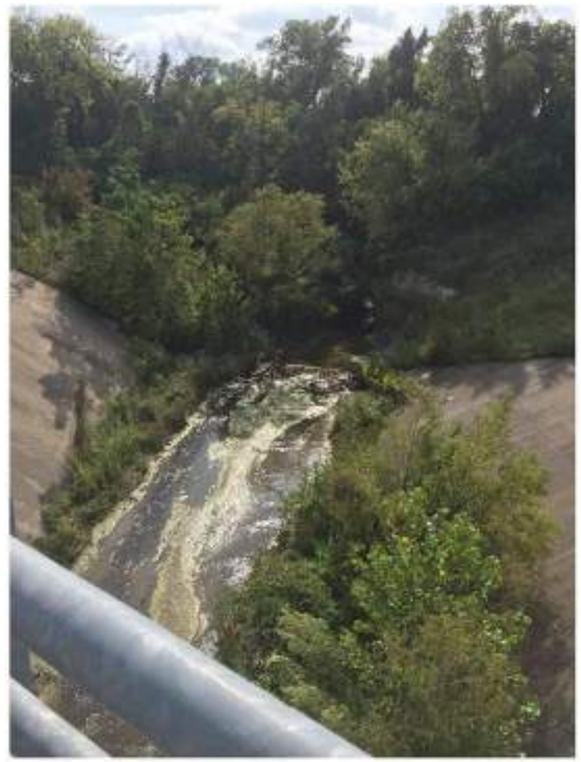
COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1

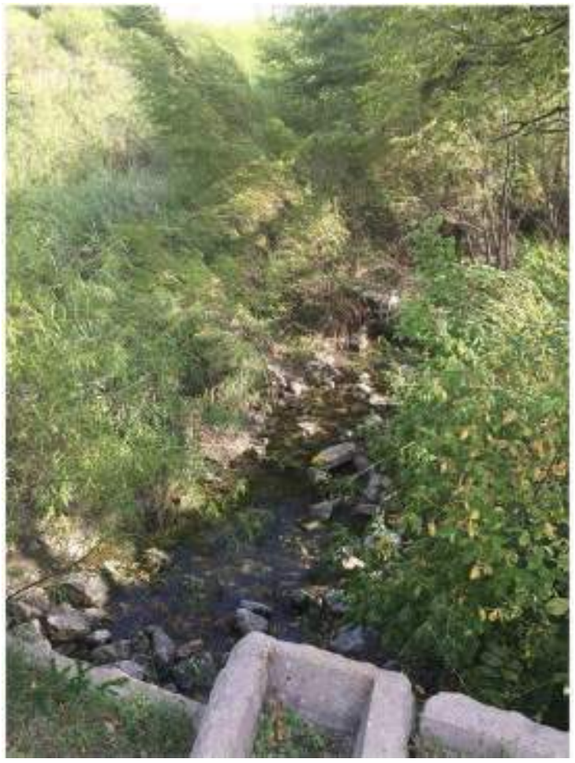


2.1 SITE ASSESSMENT

Runyon Springs Branch is located in the North region of the City of Lancaster. It flows from South to North for approximately 1.35 miles before leaving the city limits. This assessment analyzes the hydrologic and hydraulic characteristics of Runyon Springs Branch within the limits of the City of Lancaster, roughly bound by Danieldale Road (upstream end) and 0.4 miles downstream of University Hills Boulevard (downstream end). The channel slope averages around 1.6-1.7%, and for the purposes of this study were divided into three separate reaches. Runyon Springs Branch itself is generally in a natural state with very few man-made alterations, with the exception of the road crossings throughout the watershed. Except at these road crossings, heavy vegetation is observed. There are a total of seven (7) crossings throughout the watershed.



Looking upstream of University Hills Boulevard Culvert. Area is paved with vegetation beginning to grow on paved area. The channel upstream is heavily wooded.



Looking upstream of South Pointe Drive culvert. The stream channel appears to relatively rocky with shrubs and small trees growing.



Looking upstream of another South Pointe Drive culvert between two industrial structures. Rock check dams are shown. The channel and overbanks are generally well maintained.



Looking downstream of Danieldale Road culvert. The channel further downstream has heavy vegetation.

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

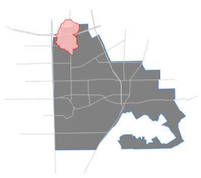
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

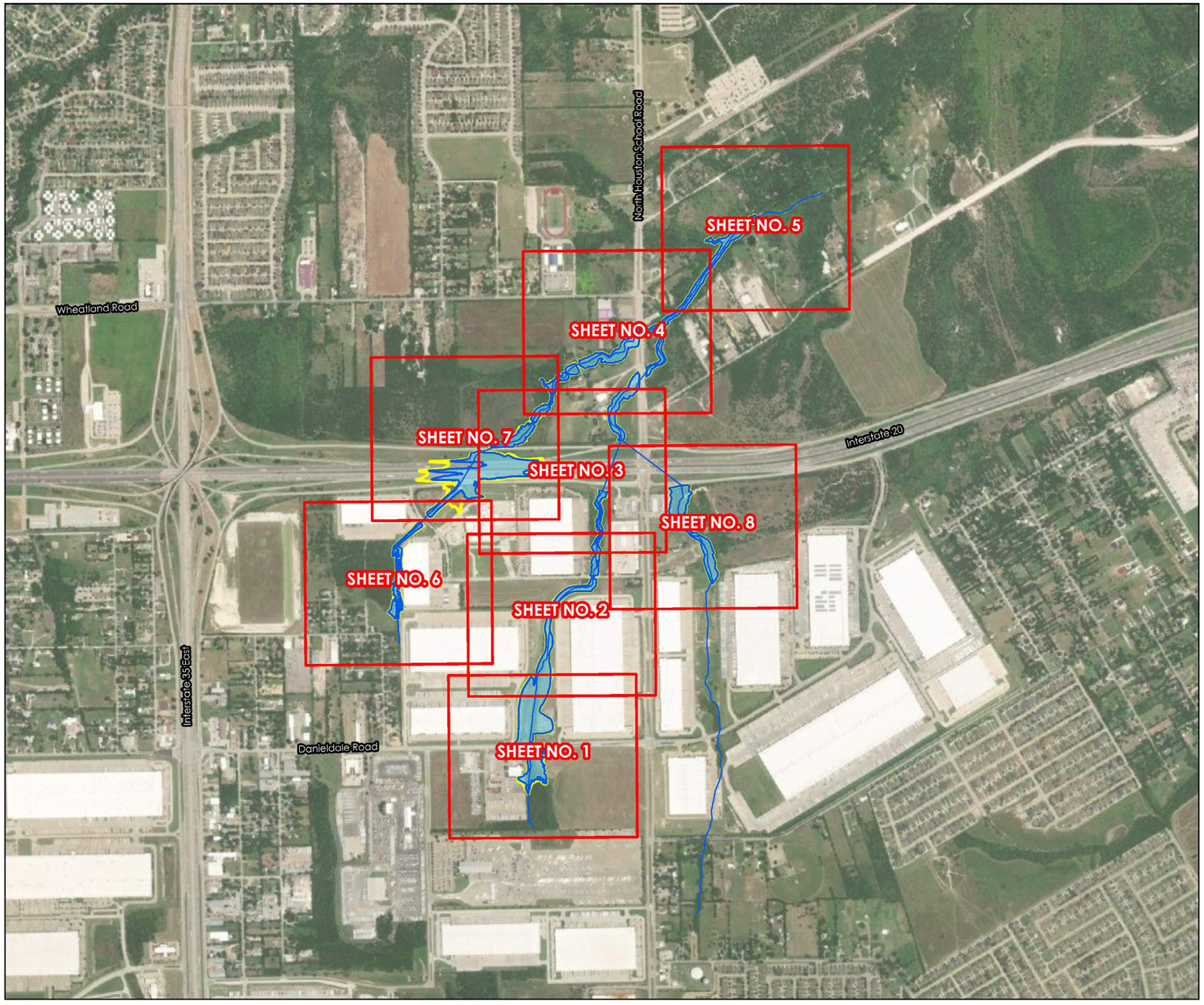
1



2.2 FLOODPLAIN MAPPING

The Halls Branch stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Halls Branch is comprised of one stream, one reach, seventy-three (73) cross sections, and eleven (11) hydraulic structures. The studied stream is 12,808 feet (2.43 miles) long. Near the confluence of the stream with Ten Mile Creek, the Halls Branch floodplain expands dramatically and inundates a large low-lying area.

The floodplain sheets for Halls Branch display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.

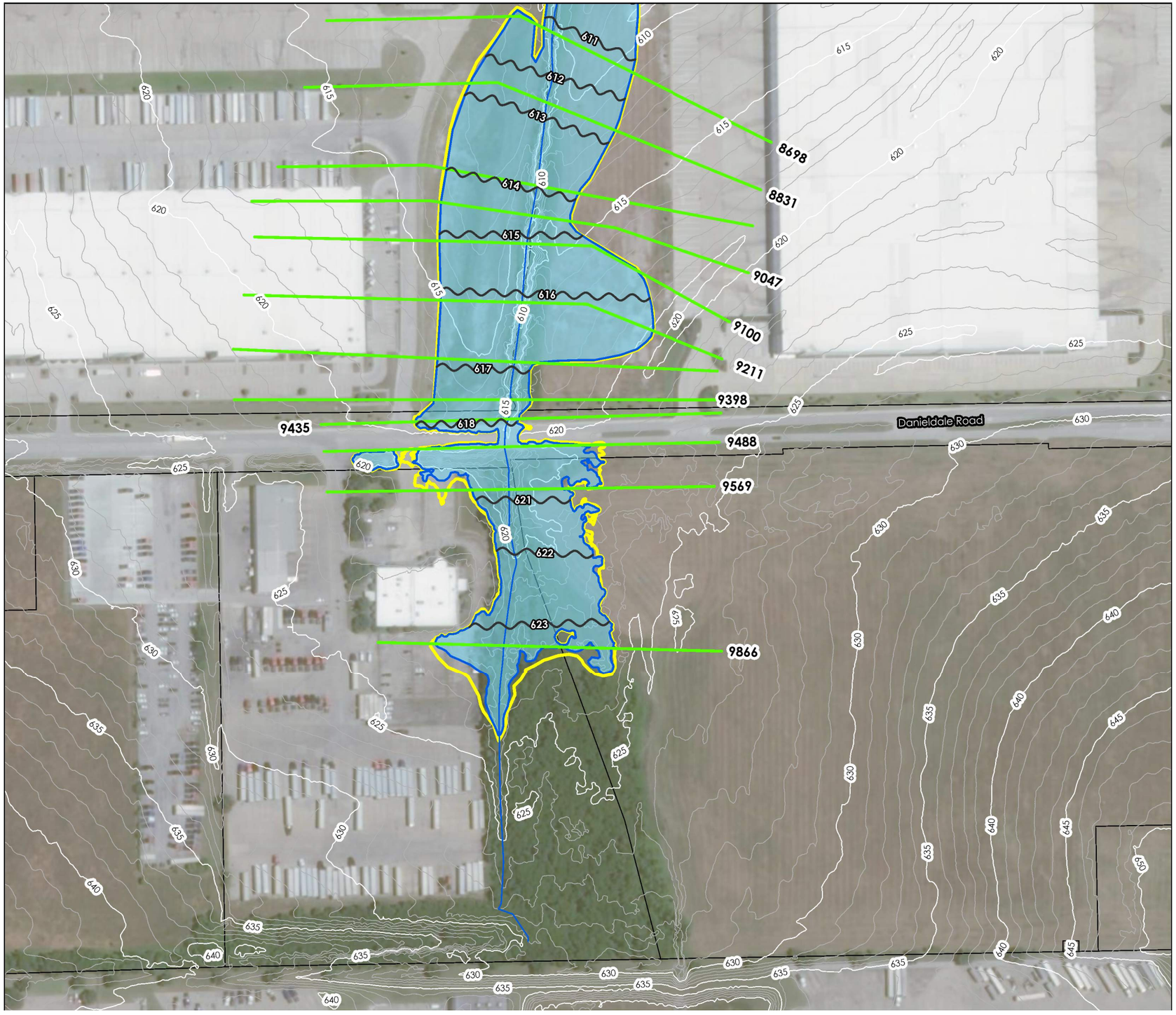


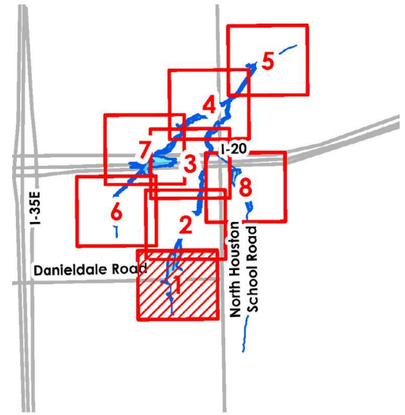
STREAM CENTERLINE
RUNYON VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200
Feet

YON CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
YON BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

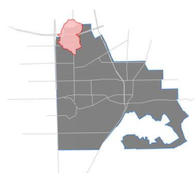
STREAM LENGTH

1.35 MI

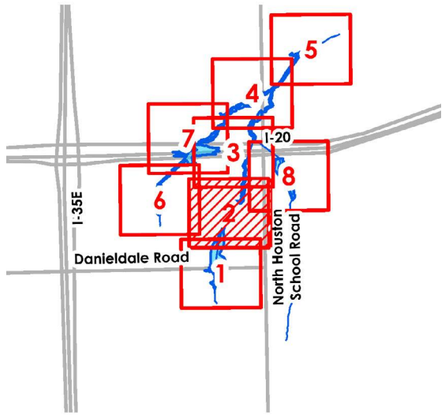
*

PROJECTS IDENTIFIED

1



FLOODPLAIN: SHEET 2



N

0 100 200 Feet

RUNYON CROSS SECTIONS

STREAM CENTERLINE

EXISTING 100-YEAR FLOODPLAIN

ULTIMATE 100-YEAR FLOODPLAIN

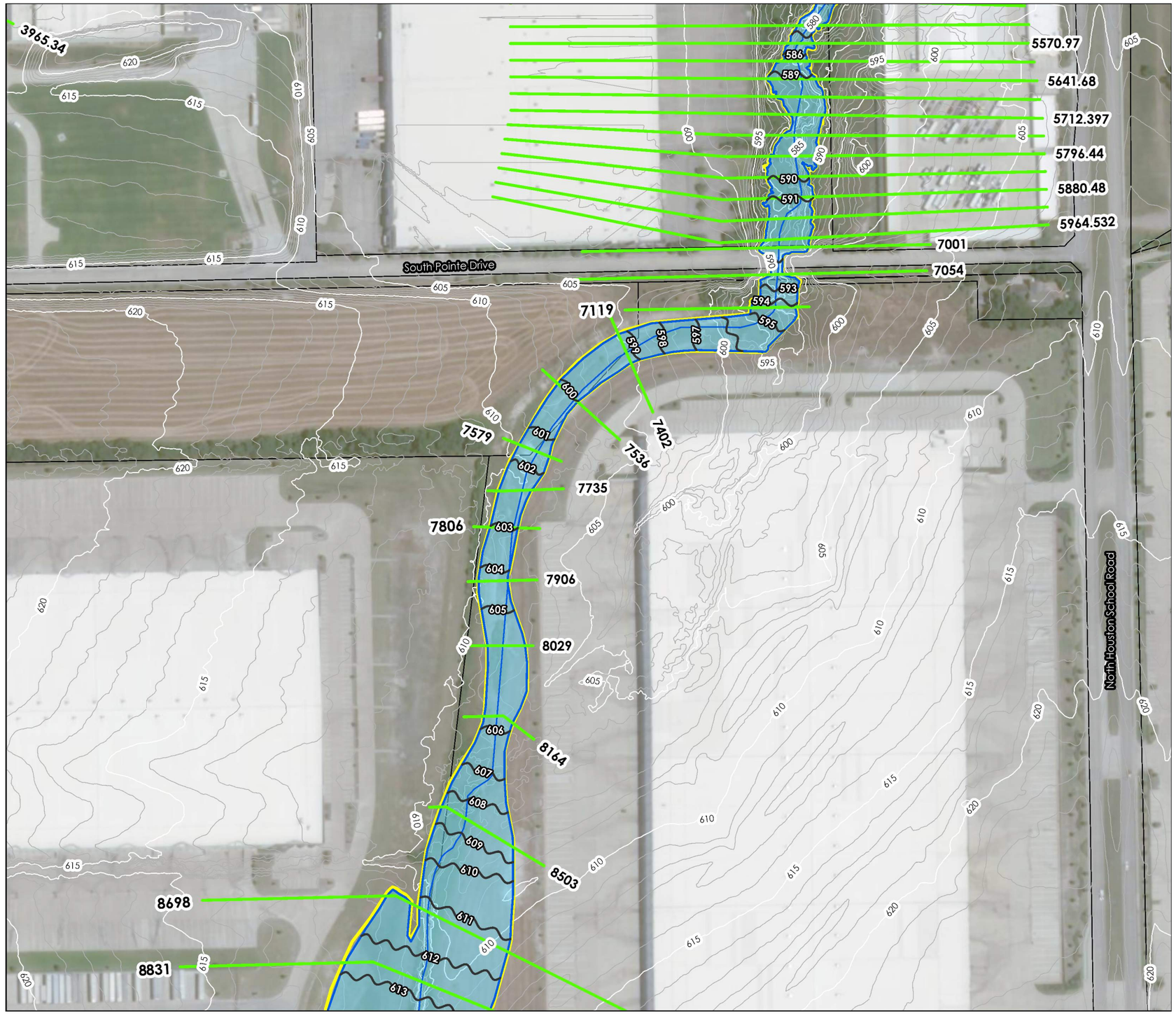
MAJOR CONTOURS

MINOR CONTOURS

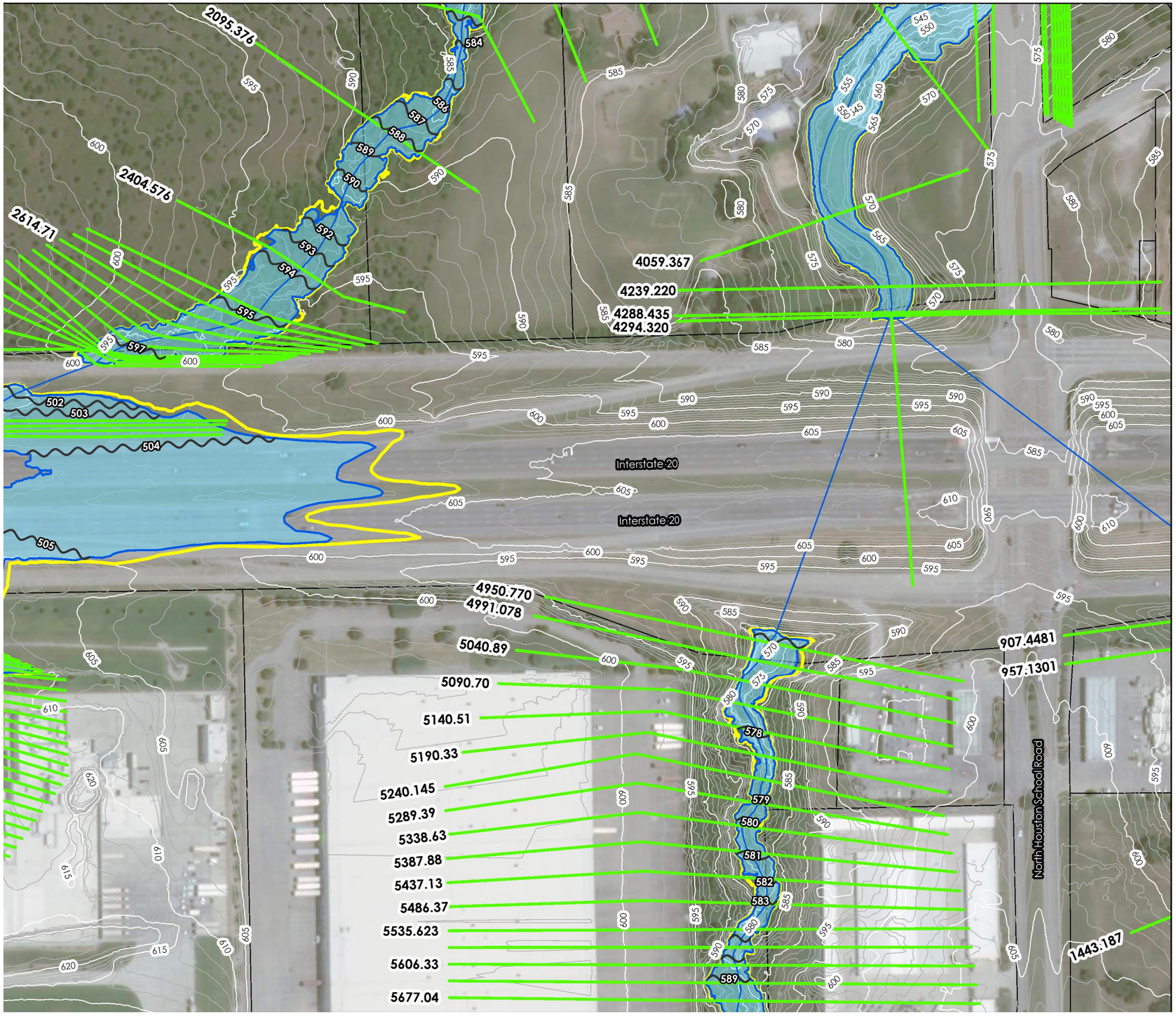
RUNYON BASE FLOW ELEVATIONS

PARCEL

0



FLOODPLAIN: SHEET 3





N

0 100 200
Feet

YON CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
YON BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

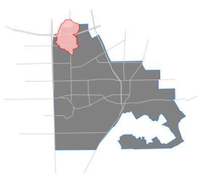
STREAM LENGTH

1.35 MI

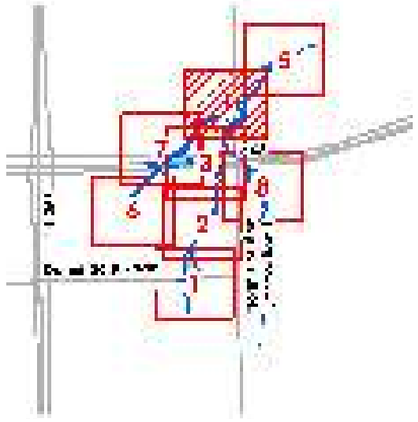
*

PROJECTS IDENTIFIED

1

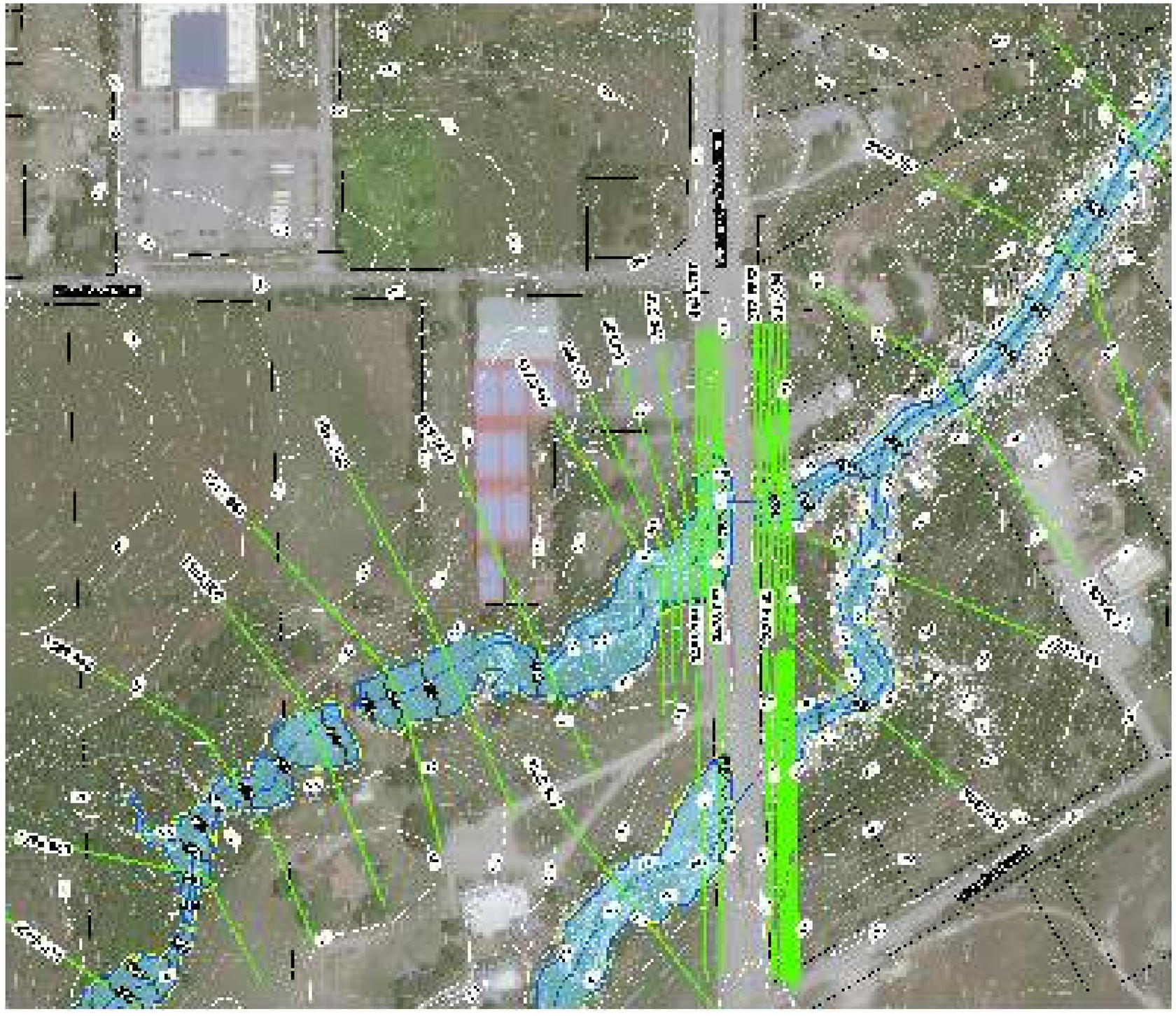


FLOODPLAIN: SHEET 4

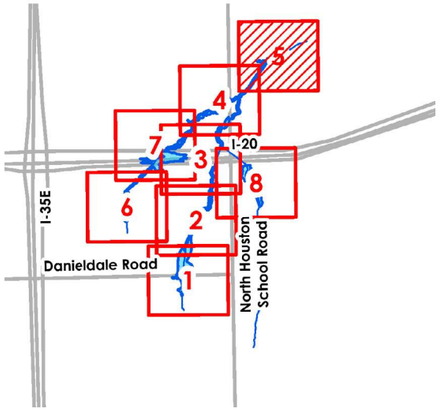


RUNYON CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
5-FOOT MAJOR CONTOURS
1-FOOT MINOR CONTOURS
RUNYON BASE FLOW ELEVATIONS
PARCEL

0



FLOODPLAIN: SHEET 5





N

0 100 200

Feet

YON CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

R MAJOR CONTOURS

R MINOR CONTOURS

YON BASE FLOW ELEVATIONS

CEL

RUNYON SPRINGS BRANCH

2.0 HYDRAULICS

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

STREAM LENGTH

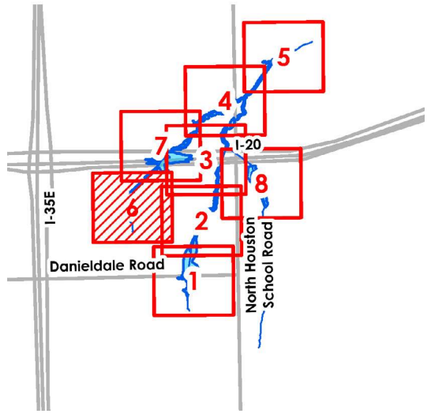
1.35 MI

*

PROJECTS IDENTIFIED

1

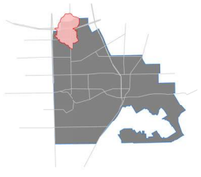
FLOODPLAIN: SHEET 6



N

0 100 200

Feet



RUNYON CROSS SECTIONS

STREAM CENTERLINE

EXISTING 100-YEAR FLOODPLAIN

ULTIMATE 100-YEAR FLOODPLAIN

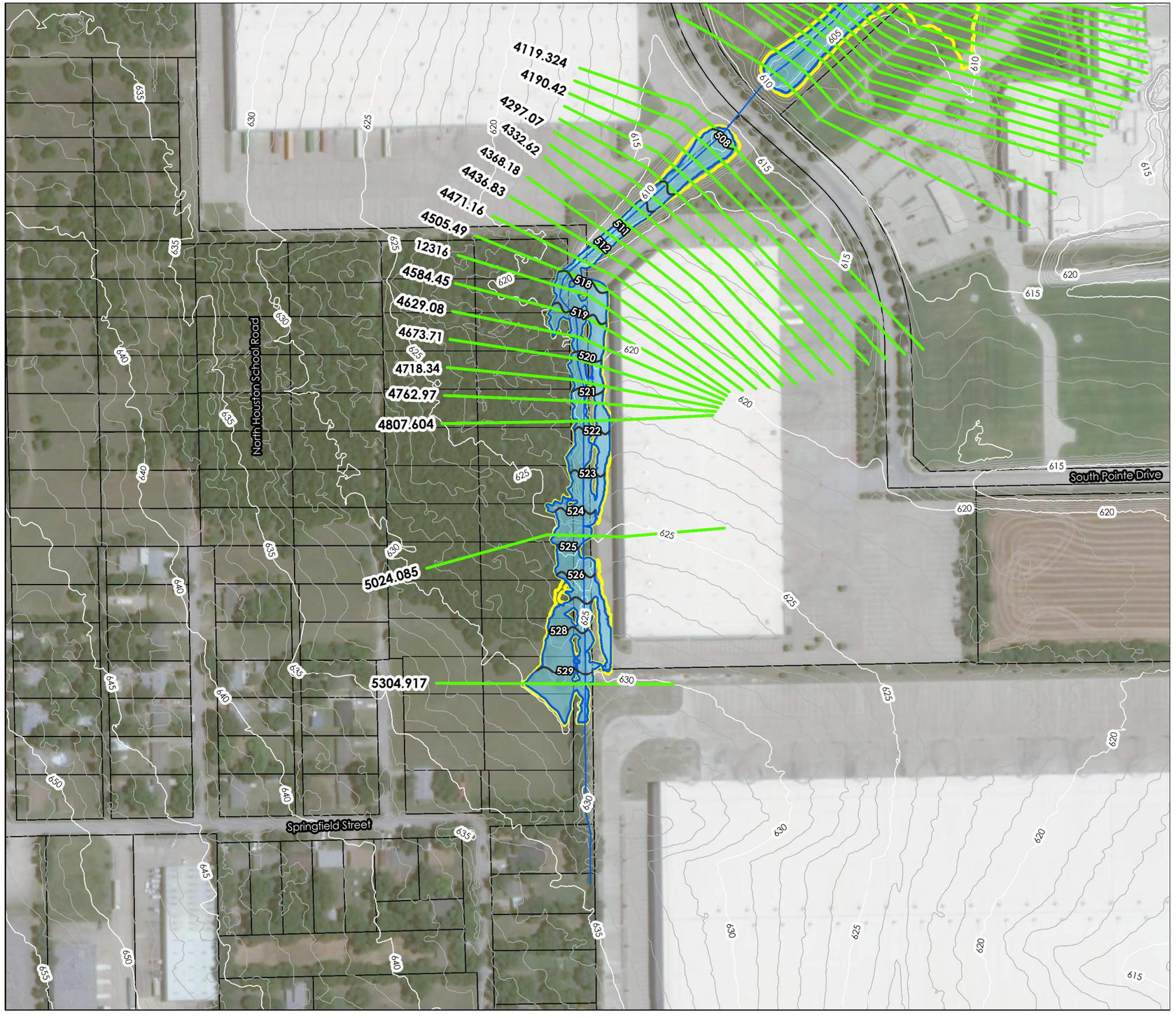
MAJOR MAJOR CONTOURS

MAJOR MINOR CONTOURS

RUNYON BASE FLOW ELEVATIONS

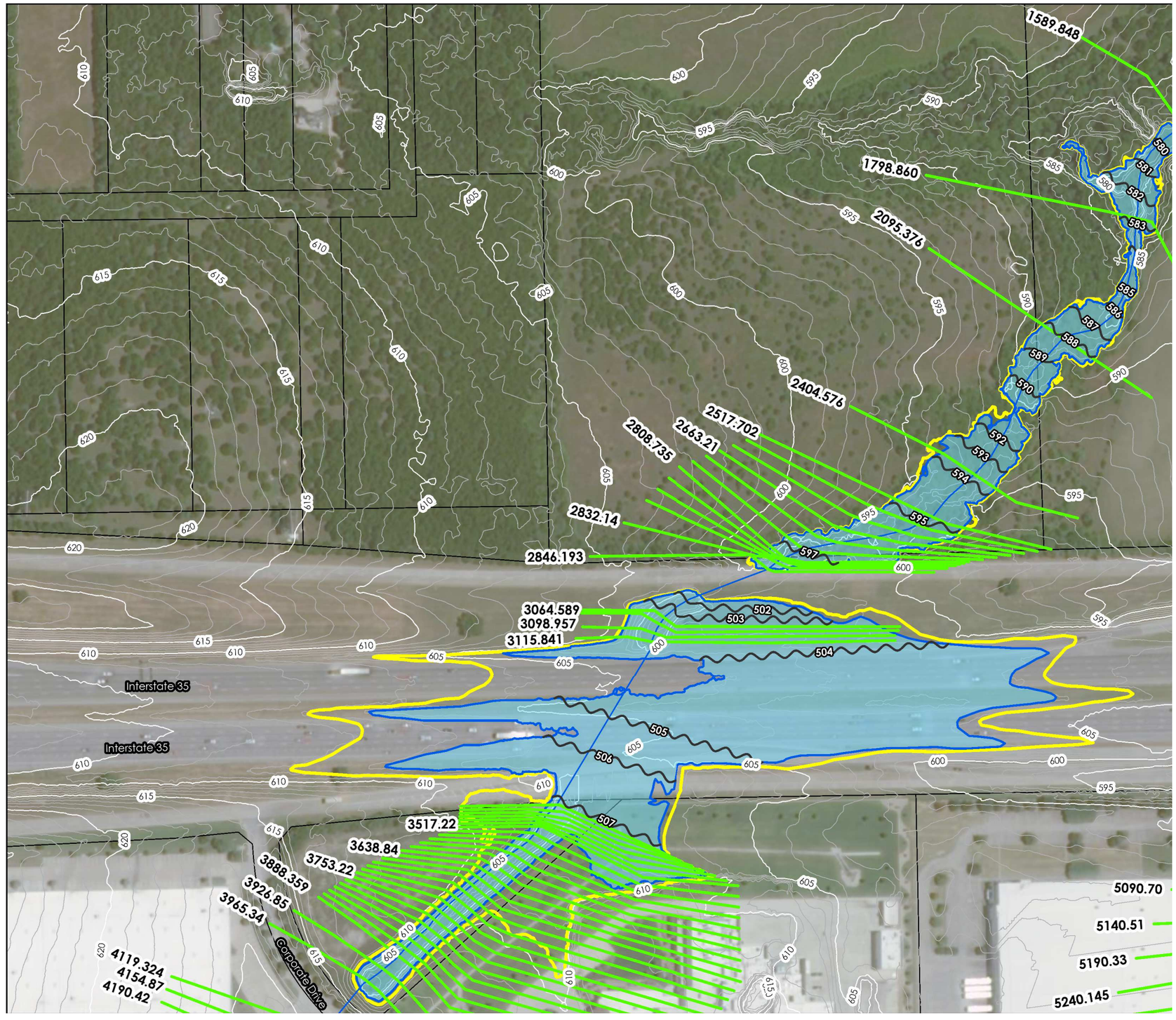
PARCEL

0



FLOODPLAIN: SHEET 7





N

0 100 200

Feet

YON CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
YON BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

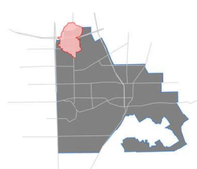
STREAM LENGTH

1.35 MI

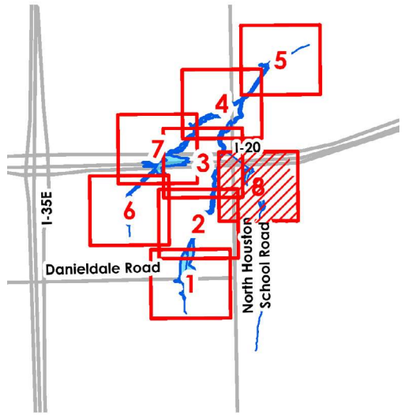
*

PROJECTS IDENTIFIED

1



FLOODPLAIN: SHEET 8



N

0 100 200

Feet

YON CROSS SECTIONS

EAM CENTERLINE

STING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

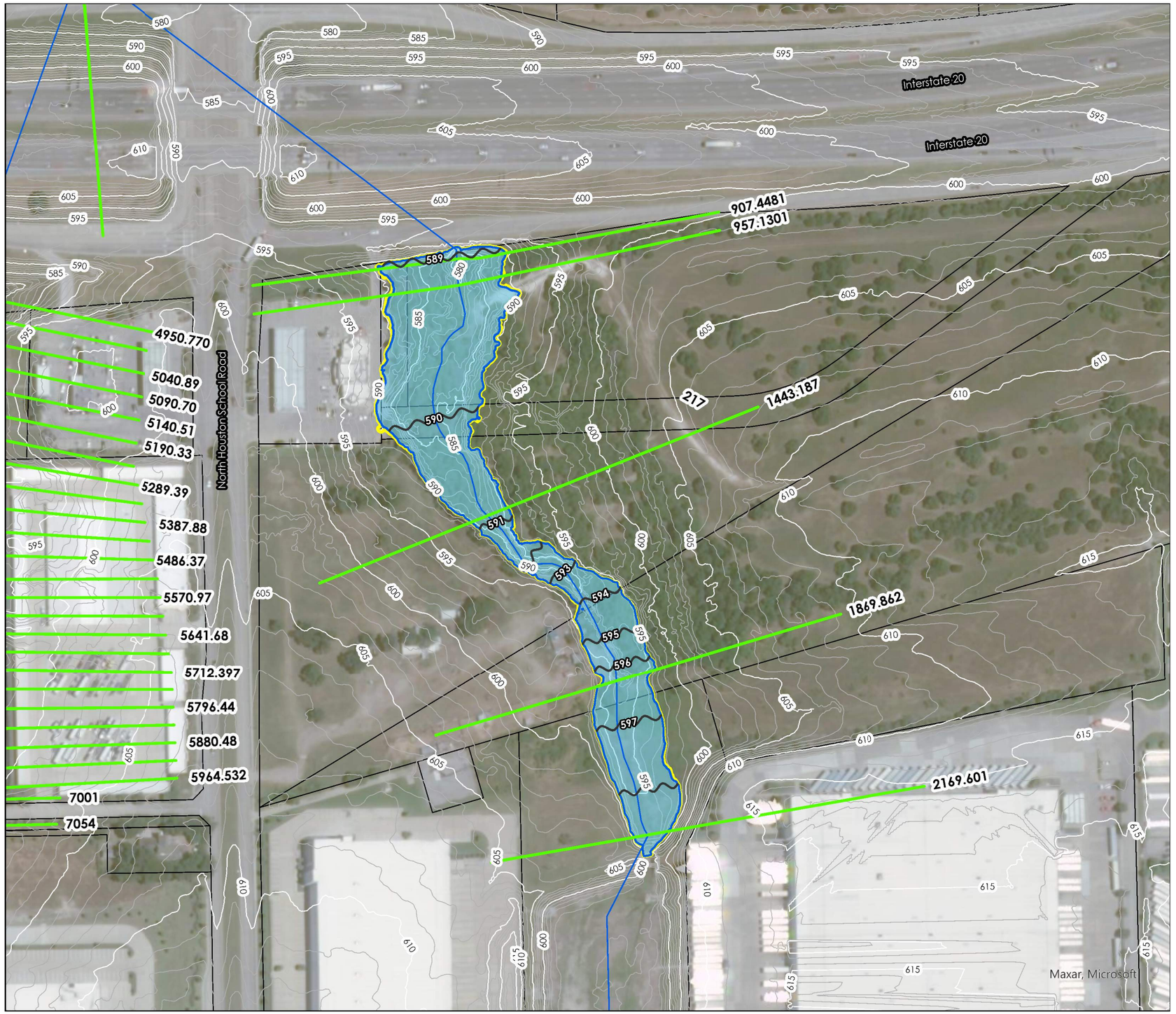
R MAJOR CONTOURS

R MINOR CONTOURS

YON BASE FLOW ELEVATIONS

RCEL

0



WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

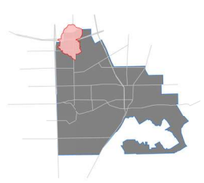
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 1-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	622.49	622.59	4.65	4.86
9569	618.36	618.67	4.14	4.26
9488	616.72	616.95	7.03	7.33
9450	DANIELDALE ROAD			
9435	616.42	616.66	4.41	4.72
9398	616.35	616.59	2.74	3.03
9325	615.93	616.06	3.49	4.02
9211	615.25	615.47	3.10	2.80
9100	614.35	614.57	3.72	4.13
9047	613.84	613.97	2.91	3.23
8989	613.34	613.43	2.32	2.44
8831	611.96	612.08	3.55	3.56
8698	610.54	610.66	4.16	4.37
8503	607.43	607.57	3.95	4.08
8164	604.11	604.37	4.26	4.45
8029	603.43	603.68	2.49	2.66
7906	602.49	602.72	4.18	4.42
7806	601.21	601.48	4.25	4.42
7735	600.71	600.98	3.14	3.31
7579	600.04	600.29	3.52	3.71
7536	598.37	598.60	4.90	5.10
7402	597.40	597.64	2.84	3.03
7119	592.93	593.12	6.26	6.53
7054	590.74	590.95	3.28	3.46
7025	SOUTH POINTE DRIVE			
7001	590.68	590.86	1.74	1.97
5964.532	590.66	590.84	1.76	1.94
5922.51	590.48	590.65	2.82	3.00
5880.48	589.78	590.00	4.99	4.81
5838.46	589.14	589.25	4.08	4.46
5796.44	588.12	588.27	5.06	5.06
5754.41	586.53	586.78	6.53	6.47
5712.397	586.18	586.47	2.74	2.85
5677.04	585.82	586.21	4.16	3.70
5641.68	585.76	586.13	2.69	2.75
5606.33	584.59	584.89	7.95	8.27
5570.97	581.95	582.16	11.28	11.78

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5535.623	580.94	581.12	7.79	8.36
5486.37	581.07	581.40	3.51	3.63
5437.13	579.80	580.07	7.71	8.10
5387.88	579.01	579.26	2.48	2.65
5338.63	578.54	578.79	4.56	4.71
5289.39	577.51	577.71	6.19	6.58
5240.145	576.69	576.90	5.58	5.96
5190.33	576.15	576.37	4.68	5.01
5140.51	575.42	575.71	5.29	5.31
5090.70	575.01	575.33	4.29	4.39
5040.89	573.61	573.89	7.87	8.27
4991.078	572.54	573.18	3.76	3.37
4950.770	572.55	573.16	2.63	2.80
4691.955	INTERSTATE 20			
4294.320	554.33	554.51	52.58	40.45
4288.435	553.46	553.63	69.69	54.45
4239.220	552.92	553.14	24.86	21.55
4059.367	552.20	552.05	5.71	6.44
3662.537	547.05	548.12	9.82	7.58
3495.795	546.42	548.19	3.42	3.13
3428.097	546.03	547.82	4.83	4.68
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	542.24	542.86	9.18	10.12
3264.83	540.63	541.16	11.98	12.94
3244.83	538.65	539.06	13.05	14.33
3234.83	538.17	538.34	11.20	13.50
3224.82	537.36	537.51	10.20	11.81
3214.82	536.10	536.24	9.84	11.00
3204.82	533.70	534.10	12.54	13.12
3194.82	532.67	535.04	12.59	4.87
3190.338	534.39	535.06	4.12	4.36
3047.751	532.08	532.63	8.61	9.42
2741.193	530.64	531.37	3.63	4.24
2353.439	527.10	527.59	9.46	10.00
2003.707	522.94	523.56	6.27	6.64
1752.357	521.23	521.88	6.18	6.56
1276.135	516.94	517.76	7.04	7.56
848.2705	512.65	513.64	7.58	8.30

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	629.81	628.74	7.00	5.09
5024.085	624.65	623.94	3.02	2.38
4807.604	621.92	620.52	6.55	5.69
4762.97	621.07	619.90	3.95	2.36
4718.34	620.69	619.64	4.13	2.61
4673.71	620.05	619.14	4.80	3.38
4629.08	619.57	619.00	3.80	1.79
4584.45	619.11	618.76	3.16	2.18
4539.821	618.45	618.14	2.84	1.84
4505.49	617.80	617.22	4.34	3.88
4471.16	615.11	614.61	9.73	6.70
4436.83	611.76	611.15	9.83	6.80
4402.50	611.51	610.73	5.96	4.07
4368.180	610.76	609.99	6.20	4.43
4332.62	610.31	609.47	4.27	2.74
4297.07	609.76	609.03	5.21	3.54
4261.52	608.99	608.28	5.64	3.97
4225.97	607.84	607.29	6.35	3.96
4190.42	608.03	606.67	2.67	2.81
4154.87	608.01	605.86	1.64	3.81
4119.324	608.00	605.56	1.38	1.18
4000	SOUTH POINTE DRIVE			
3965.34	607.85	605.44	0.95	0.87
3926.85	607.84	605.43	0.86	0.67
3888.359	607.83	605.42	1.05	0.91
3869.05	607.82	605.39	1.23	1.21
3849.74	607.81	605.36	1.31	1.30
3830.44	607.80	605.32	1.38	1.54
3811.14	607.79	605.29	1.35	1.42
3791.83	607.78	605.28	1.32	1.25
3772.53	607.77	605.26	1.22	1.14
3753.22	607.77	605.25	1.19	1.04
3733.92	607.76	605.24	1.17	1.04
3714.61	607.76	605.23	1.18	1.05
3695.311	607.75	605.22	1.16	1.00

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	607.75	605.21	1.13	1.02
3657.67	607.74	605.20	1.09	0.93
3638.84	607.60	605.01	2.97	3.15
3620.02	607.56	604.84	2.88	3.41
3601.20	607.54	604.82	2.63	2.45
3582.38	607.54	604.81	2.36	1.91
3563.56	607.49	604.66	2.63	3.06
3544.74	607.44	604.12	2.78	5.40
3525.926	607.44	603.94	2.21	4.02
3517.22	607.42	603.86	2.38	3.80
3508.52	607.40	603.77	2.47	3.79
3499.82	607.41	603.54	2.15	4.56
3491.12	607.40	603.36	2.07	4.63
3482.41	607.38	603.01	2.25	5.43
3473.717	607.35	602.67	2.57	2.08
3431.93	INTERSTATE 20			
3115.841	603.61	599.78	0.91	2.45
3098.957	603.61	599.79	0.90	1.48
3079.091	603.61	599.76	0.88	1.76
3064.589	603.61	599.54	0.70	3.61
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	598.29	597.14	8.33	4.82
2832.14	597.57	596.81	9.41	5.46
2822.78	597.49	596.21	7.88	6.95
2711.72	595.80	595.04	3.53	2.28
2663.21	595.65	594.87	2.81	1.81
2614.71	595.44	594.69	3.46	2.11
2566.20	595.13	594.35	3.58	2.56
2517.702	594.93	594.12	3.11	2.08
2404.576	593.73	593.03	5.42	3.83
2095.376	588.06	587.56	4.23	2.44
1798.860	582.90	581.43	6.43	5.90
1589.848	579.10	578.02	3.29	2.02
1383.802	577.12	576.60	4.67	2.91
1212.841	573.90	573.37	5.15	3.96

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.83	570.11	8.82	6.10
893.1495	563.15	560.06	2.60	8.63
567.3397	563.21	552.10	0.54	5.51
536.673	563.21	551.74	0.66	3.23
506.007	563.21	551.69	0.62	2.65
475.341	563.21	551.68	0.45	1.92
444.6757	563.21	551.69	0.35	1.24
419.897	563.21	551.68	0.25	1.08
395.119	563.21	551.68	0.21	0.72
370.341	563.21	551.68	0.19	0.42
345.5635	563.21	551.62	0.45	1.83
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	553.73	548.98	15.88	10.50
267.984	541.03	539.47	26.09	18.13
257.984	539.16	538.60	22.50	11.36
247.984	534.28	533.35	23.49	16.22
237.984	533.20	532.31	18.90	10.98
227.984	535.98	532.74	4.17	3.86
217.985	535.99	532.71	3.67	3.27
215.5150	535.95	532.52	3.88	4.40

REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	5.05	597.54	4.82	5.05
1869.862	3.96	594.38	3.92	3.96
1443.187	5.70	589.20	5.66	5.70
957.1301	2.86	582.69	2.95	2.86
907.4481	2.04	582.64	2.02	2.04
612.3994	INTERSTATE 20			
4.220822	10.96	553.99	10.81	10.96

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

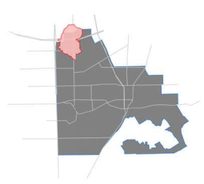
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 2-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	622.65	622.82	4.84	4.35
9569	618.80	619.14	4.26	3.96
9488	617.04	617.21	7.46	7.64
9450	DANIELDALE ROAD			
9435	616.75	616.92	4.85	5.05
9398	616.67	616.82	3.15	3.36
9325	616.10	616.18	4.22	4.56
9211	615.54	615.67	2.71	2.60
9100	614.64	614.75	4.27	4.59
9047	614.02	614.09	3.36	3.54
8989	613.46	613.52	2.49	2.58
8831	612.12	612.20	3.56	3.55
8698	610.69	610.76	4.46	4.64
8503	607.63	607.74	4.10	4.15
8164	604.46	604.63	4.53	4.68
8029	603.77	603.94	2.72	2.85
7906	602.80	602.96	4.53	4.70
7806	601.57	601.75	4.48	4.62
7735	601.07	601.24	3.39	3.53
7579	600.37	600.53	3.79	3.97
7536	598.69	598.85	5.18	5.31
7402	597.72	597.89	3.10	3.23
7119	593.21	593.35	6.53	6.60
7054	591.03	591.18	3.52	3.65
7025	SOUTH POINTE DRIVE			
7001	590.93	591.05	2.06	2.24
5964.532	590.91	591.02	2.02	2.15
5922.51	590.71	590.81	3.08	3.23
5880.48	590.05	590.16	4.88	4.96
5838.46	589.29	589.36	4.59	4.91
5796.44	588.31	588.42	5.16	5.22
5754.41	586.86	587.03	6.49	6.45
5712.397	586.58	586.80	2.89	2.95
5677.04	586.35	586.63	3.55	3.33
5641.68	586.27	586.54	2.77	2.80
5606.33	585.01	585.21	8.38	8.61
5570.97	582.24	582.39	11.97	12.31
5535.623	581.20	581.33	8.56	8.95
5486.37	581.52	581.75	3.68	3.79
5437.13	580.18	580.41	8.21	8.29
5387.88	579.36	579.53	2.72	2.85
5338.63	578.88	579.06	4.76	4.87
5289.39	577.79	577.94	6.72	6.98
5240.145	576.98	577.13	6.10	6.35
5190.33	576.45	576.62	5.14	5.33
5140.51	575.82	576.05	5.30	5.23
5090.70	575.46	575.70	4.43	4.50
5040.89	574.00	574.20	8.40	8.66
4991.078	573.42	573.89	3.26	3.08
4950.770	573.40	573.85	2.86	2.98
4691.955	INTERSTATE 20			
4294.320	554.58	554.71	37.27	32.74
4288.435	553.71	553.84	53.79	50.91
4239.220	553.26	553.43	22.32	22.62
4059.367	552.30	552.62	6.68	6.86
3662.537	548.57	549.78	7.65	6.47
3495.795	548.68	549.83	3.04	2.83
3428.097	548.33	549.51	4.60	4.46
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	543.02	543.42	10.39	10.88
3264.83	541.32	541.67	13.18	13.68
3244.83	539.18	539.43	14.64	15.33
3234.83	538.40	538.52	14.03	15.24
3224.82	537.55	537.63	12.30	13.33
3214.82	536.28	536.36	11.33	12.11
3204.82	534.21	534.43	13.30	13.73
3194.82	535.24	535.69	4.91	4.93
3190.338	535.25	535.70	4.41	4.46
3047.751	532.79	533.19	9.60	9.80
2741.193	531.63	532.30	4.35	4.48
2353.439	527.78	528.21	10.22	10.68
2003.707	523.79	524.33	6.81	7.13
1752.357	521.97	522.60	6.98	7.17
1276.135	517.78	518.62	7.57	8.06
848.2705	513.66	514.60	8.32	9.02

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	628.93	629.14	5.48	5.85
5024.085	624.08	624.22	2.50	2.60
4807.604	620.76	621.04	6.11	6.42
4762.97	620.12	620.35	2.66	2.97
4718.34	619.84	620.05	2.93	3.23
4673.71	619.30	619.47	3.72	4.05
4629.08	619.11	619.21	2.21	2.69
4584.45	618.81	618.89	2.45	2.56
4539.821	618.21	618.25	1.93	2.23
4505.49	617.33	617.52	4.17	3.86
4471.16	614.70	614.72	7.28	9.10
4436.83	611.26	611.42	7.44	7.51
4402.50	610.86	611.01	4.50	4.92
4368.180	610.14	610.29	4.73	5.03
4332.62	609.62	609.78	3.04	3.35
4297.07	609.19	609.33	3.76	4.10
4261.52	608.39	608.52	4.44	4.78
4225.97	607.40	607.50	4.30	4.81
4190.42	606.79	606.85	3.12	3.81
4154.87	605.97	606.19	4.11	3.74
4119.324	605.86	606.20	1.29	1.40
4000	SOUTH POINTE DRIVE			
3965.34	605.74	606.06	0.95	1.02
3926.85	605.73	606.05	0.75	0.84
3888.359	605.71	606.03	1.00	1.09
3869.05	605.69	606.00	1.30	1.39
3849.74	605.66	605.98	1.39	1.48
3830.44	605.62	605.94	1.61	1.68
3811.14	605.60	605.92	1.50	1.59
3791.83	605.58	605.90	1.38	1.49
3772.53	605.56	605.89	1.25	1.35
3753.22	605.55	605.88	1.16	1.28
3733.92	605.54	605.86	1.16	1.27
3714.61	605.53	605.85	1.17	1.28
3695.311	605.52	605.84	1.13	1.24

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	605.51	605.83	1.13	1.23
3657.67	605.50	605.82	1.05	1.16
3638.84	605.28	605.58	3.39	3.63
3620.02	605.12	605.42	3.60	3.82
3601.20	605.10	605.39	2.72	3.01
3582.38	605.08	605.38	2.19	2.48
3563.56	604.92	605.20	3.34	3.62
3544.74	604.34	604.59	5.75	6.07
3525.926	604.17	604.42	4.36	4.71
3517.22	604.09	604.33	4.16	4.54
3508.52	603.99	604.23	4.18	4.58
3499.82	603.75	603.98	4.93	5.30
3491.12	603.56	603.78	5.08	5.44
3482.41	603.21	603.67	5.81	5.08
3473.717	603.20	603.80	2.26	2.45
3431.93	INTERSTATE 20			
3115.841	600.33	600.95	2.16	2.01
3098.957	600.33	600.96	1.43	1.40
3079.091	600.31	600.94	1.68	1.61
3064.589	600.04	600.62	3.90	4.21
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	596.97	597.27	7.27	7.39
2832.14	597.01	597.25	5.79	6.00
2822.78	596.43	596.69	7.23	7.36
2711.72	595.17	595.33	2.55	2.74
2663.21	595.01	595.18	1.97	2.09
2614.71	594.82	594.98	2.31	2.80
2566.20	594.50	594.65	2.73	2.94
2517.702	594.29	594.45	2.19	2.36
2404.576	593.13	593.23	4.30	4.77
2095.376	587.66	587.78	2.67	2.89
1798.860	581.67	581.94	6.24	6.50
1589.848	578.21	578.41	2.24	2.48
1383.802	576.69	576.79	3.21	3.54
1212.841	573.47	573.57	3.96	4.16

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.21	570.33	6.71	7.30
893.1495	560.22	560.38	9.27	10.02
567.3397	553.98	556.62	1.75	0.90
536.673	553.97	556.61	1.51	0.97
506.007	553.96	556.61	1.50	1.00
475.341	553.96	556.61	1.05	0.67
444.6757	553.96	556.61	0.78	0.54
419.897	553.96	556.61	0.66	0.42
395.119	553.96	556.61	0.42	0.28
370.341	553.97	556.61	0.30	0.22
345.5635	553.91	556.56	1.69	1.63
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	549.85	548.00	11.45	26.53
267.984	539.74	540.56	19.72	15.82
257.984	538.72	538.81	13.36	15.82
247.984	533.56	533.74	17.03	18.50
237.984	532.50	532.67	12.25	13.89
227.984	533.15	533.51	4.17	4.63
217.985	533.12	533.49	3.57	3.99
215.5150	532.96	533.32	4.45	4.85

REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	597.67	597.74	5.22	5.33
1869.862	594.53	594.60	4.17	4.26
1443.187	589.32	589.38	5.84	5.93
957.1301	583.38	583.51	2.50	2.42
907.4481	583.33	583.46	2.11	2.13
612.3994	INTERSTATE 20			
4.220822	554.17	554.20	11.61	11.75

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

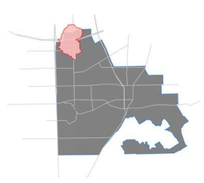
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 5-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	622.92	623.01	4.43	4.42
9569	619.40	619.51	3.80	3.99
9488	617.41	618.82	7.85	4.85
9450	DANIELDALE ROAD			
9435	617.12	617.28	5.25	5.47
9398	617.00	617.15	3.61	3.84
9325	616.28	616.37	4.92	5.22
9211	615.82	615.96	2.51	2.44
9100	614.86	614.95	4.98	5.36
9047	614.17	614.25	3.70	3.80
8989	613.59	613.64	2.69	2.81
8831	612.30	612.38	3.53	3.52
8698	610.85	610.91	4.82	5.05
8503	607.87	607.99	4.21	4.22
8164	604.81	604.99	4.87	5.03
8029	604.14	604.31	3.01	3.15
7906	603.14	603.30	4.91	5.13
7806	601.95	602.13	4.77	4.93
7735	601.43	601.61	3.70	3.85
7579	600.70	600.86	4.18	4.38
7536	599.03	599.20	5.47	5.62
7402	598.08	598.26	3.37	3.51
7119	593.51	593.66	6.70	6.78
7054	591.36	591.54	3.78	3.89
7025	SOUTH POINTE DRIVE			
7001	591.19	591.32	2.45	2.65
5964.532	591.16	591.29	2.31	2.47
5922.51	590.94	591.05	3.41	3.59
5880.48	590.30	590.42	4.97	5.05
5838.46	589.44	589.53	5.26	5.53
5796.44	588.53	588.65	5.31	5.38
5754.41	587.20	587.32	6.45	6.63
5712.397	587.08	587.35	3.00	3.05
5677.04	586.96	587.25	3.09	2.93
5641.68	586.86	587.15	2.80	2.77
5606.33	585.47	585.84	8.82	8.44
5570.97	582.55	582.73	12.72	12.89

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5535.623	581.49	581.63	9.37	9.76
5486.37	582.00	582.22	3.93	4.09
5437.13	580.75	580.96	8.06	8.17
5387.88	579.74	579.94	2.99	3.12
5338.63	579.26	579.45	4.99	5.11
5289.39	578.12	578.28	7.27	7.53
5240.145	577.31	577.48	6.64	6.90
5190.33	576.80	576.99	5.59	5.80
5140.51	576.32	576.57	5.16	5.08
5090.70	575.99	576.26	4.57	4.63
5040.89	574.45	574.68	8.91	9.17
4991.078	574.46	575.02	2.88	2.71
4950.770	574.40	574.92	3.12	3.24
4691.955	INTERSTATE 20			
4294.320	554.87	555.02	28.96	25.79
4288.435	554.04	554.19	46.82	42.69
4239.220	553.73	553.97	22.83	22.09
4059.367	553.83	554.88	5.96	5.26
3662.537	553.17	554.47	3.88	3.48
3495.795	553.20	554.50	1.92	1.72
3428.097	553.01	554.32	3.44	3.30
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	543.83	544.05	11.45	11.74
3264.83	542.05	542.26	14.20	14.44
3244.83	539.70	539.85	16.02	16.37
3234.83	538.68	538.77	16.16	16.61
3224.82	537.72	537.76	14.46	15.08
3214.82	536.44	536.48	12.95	13.40
3204.82	534.66	534.78	14.24	14.49
3194.82	536.21	536.38	4.67	4.72
3190.338	536.21	536.38	4.34	4.40
3047.751	533.71	534.10	9.67	9.31
2741.193	532.85	533.33	4.72	4.68
2353.439	528.63	529.04	11.06	11.42
2003.707	524.82	525.31	7.44	7.73
1752.357	522.86	523.39	7.88	8.14
1276.135	518.88	519.58	8.19	8.51
848.2705	514.89	515.63	9.23	9.73

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	629.17	629.40	5.93	6.39
5024.085	624.25	624.40	2.60	2.72
4807.604	621.08	621.53	6.50	6.07
4762.97	620.39	620.67	3.03	3.35
4718.34	620.09	620.33	3.28	3.58
4673.71	619.50	619.73	4.11	4.32
4629.08	619.22	619.35	2.77	3.27
4584.45	618.90	618.99	2.58	2.74
4539.821	618.26	618.31	2.25	2.59
4505.49	617.54	617.67	3.89	3.85
4471.16	614.74	614.85	9.17	9.85
4436.83	611.44	611.57	7.63	8.31
4402.50	611.03	611.19	4.98	5.44
4368.180	610.32	610.49	5.10	5.47
4332.62	609.81	610.00	3.40	3.73
4297.07	609.35	609.51	4.16	4.54
4261.52	608.54	608.71	4.82	5.15
4225.97	607.51	607.63	4.90	5.47
4190.42	606.84	606.95	4.05	4.63
4154.87	606.30	606.62	3.36	3.01
4119.324	606.30	606.60	1.39	1.58
4000	SOUTH POINTE DRIVE			
3965.34	606.16	606.42	1.01	1.15
3926.85	606.15	606.41	0.83	0.97
3888.359	606.13	606.39	1.08	1.25
3869.05	606.11	606.36	1.36	1.56
3849.74	606.08	606.33	1.45	1.67
3830.44	606.05	606.29	1.64	1.86
3811.14	606.03	606.27	1.55	1.78
3791.83	606.01	606.25	1.46	1.70
3772.53	606.00	606.23	1.33	1.55
3753.22	605.99	606.22	1.26	1.48
3733.92	605.98	606.20	1.25	1.47
3714.61	605.97	606.19	1.26	1.48
3695.311	605.96	606.17	1.22	1.45

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	605.94	606.16	1.21	1.43
3657.67	605.94	606.15	1.15	1.36
3638.84	605.68	605.88	3.72	3.89
3620.02	605.53	605.73	3.90	4.06
3601.20	605.50	605.70	3.12	3.32
3582.38	605.49	605.68	2.59	2.80
3563.56	605.30	605.48	3.73	3.92
3544.74	604.68	604.88	6.17	6.20
3525.926	604.52	604.77	4.80	4.80
3517.22	604.43	604.69	4.64	4.63
3508.52	604.33	604.61	4.67	4.59
3499.82	604.12	604.50	5.23	4.71
3491.12	604.00	604.44	5.06	4.39
3482.41	603.93	604.41	4.61	4.06
3473.717	604.03	604.46	2.52	2.65
3431.93	INTERSTATE 20			
3115.841	601.18	601.64	1.98	1.94
3098.957	601.19	601.65	1.39	1.36
3079.091	601.18	601.63	1.59	1.54
3064.589	600.84	601.25	4.33	4.53
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	597.38	597.61	7.43	7.51
2832.14	597.14	597.25	7.24	7.61
2822.78	596.78	597.04	7.46	7.09
2711.72	595.39	595.50	2.79	2.91
2663.21	595.25	595.34	2.14	2.39
2614.71	595.04	595.13	2.95	3.05
2566.20	594.70	594.80	3.02	3.16
2517.702	594.50	594.60	2.44	2.57
2404.576	593.28	593.36	4.86	5.09
2095.376	587.83	587.89	2.98	3.18
1798.860	582.04	582.26	6.56	6.50
1589.848	578.48	578.63	2.58	2.72
1383.802	576.83	576.90	3.64	3.84
1212.841	573.61	573.67	4.25	4.46

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.38	570.47	7.48	7.79
893.1495	560.44	560.54	10.27	10.73
567.3397	557.44	561.67	0.80	0.42
536.673	557.44	561.66	0.89	0.51
506.007	557.44	561.66	0.92	0.49
475.341	557.44	561.66	0.61	0.35
444.6757	557.44	561.66	0.50	0.28
419.897	557.44	561.66	0.37	0.20
395.119	557.44	561.66	0.26	0.15
370.341	557.44	561.66	0.21	0.14
345.5635	557.39	561.62	1.61	1.46
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	548.13	551.86	26.96	13.88
267.984	540.63	540.41	16.31	23.29
257.984	538.84	538.95	16.32	18.42
247.984	533.79	533.96	18.85	20.36
237.984	532.71	532.88	14.29	15.86
227.984	533.75	534.13	4.45	4.88
217.985	533.74	534.12	3.84	4.22
215.5150	533.62	533.99	4.48	4.86

REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	598.03	598.20	5.34	5.59
1869.862	595.11	595.26	4.38	4.35
1443.187	589.67	589.76	6.42	6.55
957.1301	585.00	585.11	1.65	1.61
907.4481	584.91	585.02	2.31	2.32
612.3994	INTERSTATE 20			
4.220822	554.58	554.61	12.61	12.64

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

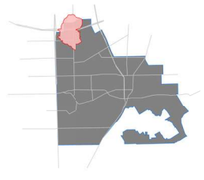
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 10-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	623.01	623.05	4.62	5.20
9569	619.63	620.16	3.84	3.23
9488	618.98	619.56	4.82	4.77
9450	DANIELDALE ROAD			
9435	617.34	617.54	5.57	5.95
9398	617.20	617.40	3.93	4.29
9325	616.41	616.55	5.33	5.69
9211	616.00	616.18	2.43	2.41
9100	614.98	615.10	5.51	6.01
9047	614.28	614.38	3.84	3.97
8989	613.67	613.76	2.85	2.98
8831	612.41	612.54	3.51	3.51
8698	610.94	611.02	5.14	5.47
8503	608.03	608.19	4.21	4.23
8164	605.06	605.31	5.10	5.32
8029	604.38	604.64	3.21	3.42
7906	603.35	603.58	5.22	5.53
7806	602.20	602.43	5.00	5.30
7735	601.68	601.93	3.90	4.13
7579	600.92	601.16	4.46	4.73
7536	599.26	599.49	5.69	5.95
7402	598.32	598.54	3.58	3.83
7119	593.71	593.91	6.82	6.98
7054	591.61	591.71	3.93	4.39
7025	SOUTH POINTE DRIVE			
7001	591.36	591.55	2.73	3.03
5964.532	591.34	591.52	2.53	2.74
5922.51	591.09	591.25	3.66	3.92
5880.48	590.46	590.64	5.07	5.18
5838.46	589.56	589.68	5.64	6.05
5796.44	588.69	588.85	5.38	5.49
5754.41	587.36	587.56	6.71	6.87
5712.397	587.42	587.71	3.09	3.26
5677.04	587.33	587.64	2.93	2.96
5641.68	587.24	587.56	2.77	2.81
5606.33	585.95	586.30	8.39	8.36
5570.97	582.80	583.06	13.00	13.24

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5535.623	581.69	581.89	9.91	10.47
5486.37	582.31	582.61	4.14	4.39
5437.13	581.02	581.33	8.30	8.42
5387.88	580.01	580.31	3.17	3.36
5338.63	579.53	579.81	5.15	5.32
5289.39	578.35	578.59	7.63	7.98
5240.145	577.55	577.80	6.99	7.34
5190.33	577.06	577.34	5.88	6.16
5140.51	576.67	577.03	5.05	5.00
5090.70	576.37	576.74	4.65	4.77
5040.89	574.76	575.55	9.27	8.11
4991.078	575.23	576.06	2.65	2.43
4950.770	575.12	575.91	3.29	3.47
4691.955	INTERSTATE 20			
4294.320	555.09	555.32	24.58	21.25
4288.435	554.29	554.50	41.23	35.62
4239.220	554.17	554.55	22.04	20.52
4059.367	556.57	555.79	4.36	5.44
3662.537	556.36	555.40	2.95	3.70
3495.795	556.39	555.44	1.48	1.83
3428.097	556.23	555.21	3.11	3.70
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	544.35	544.64	12.07	12.45
3264.83	542.53	542.82	14.77	15.10
3244.83	540.04	540.23	16.80	17.25
3234.83	538.89	539.02	17.13	17.64
3224.82	537.82	537.88	15.80	16.55
3214.82	536.54	536.59	13.99	14.60
3204.82	534.93	535.07	14.86	15.27
3194.82	536.63	536.90	4.74	4.76
3190.338	536.63	536.90	4.45	4.49
3047.751	534.40	534.82	9.43	9.27
2741.193	533.53	533.98	4.97	5.08
2353.439	529.18	529.54	11.54	11.83
2003.707	525.47	525.91	7.83	8.05
1752.357	523.43	523.98	8.43	8.51
1276.135	519.61	520.32	8.53	8.84
848.2705	515.66	516.41	9.75	10.22

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	629.33	629.54	6.24	6.66
5024.085	624.35	624.48	2.70	2.84
4807.604	621.29	621.69	6.68	6.17
4762.97	620.58	620.83	3.24	3.54
4718.34	620.25	620.47	3.49	3.76
4673.71	619.65	619.87	4.25	4.46
4629.08	619.31	619.44	3.13	3.48
4584.45	618.97	619.03	2.64	2.88
4539.821	618.29	618.36	2.56	2.66
4505.49	617.65	617.71	3.73	4.09
4471.16	614.80	614.95	9.80	9.70
4436.83	611.53	611.63	8.04	8.90
4402.50	611.13	611.31	5.34	5.63
4368.180	610.44	610.59	5.32	5.74
4332.62	609.94	610.11	3.63	3.93
4297.07	609.46	609.60	4.41	4.78
4261.52	608.65	608.81	5.05	5.33
4225.97	607.59	607.70	5.27	5.78
4190.42	606.90	607.07	4.51	4.72
4154.87	606.56	606.89	2.95	2.72
4119.324	606.54	606.86	1.49	1.64
4000	SOUTH POINTE DRIVE			
3965.34	606.39	606.67	1.07	1.18
3926.85	606.38	606.66	0.90	1.02
3888.359	606.35	606.63	1.16	1.30
3869.05	606.33	606.60	1.45	1.61
3849.74	606.31	606.58	1.55	1.71
3830.44	606.27	606.54	1.73	1.89
3811.14	606.25	606.52	1.65	1.82
3791.83	606.23	606.50	1.57	1.75
3772.53	606.22	606.48	1.42	1.59
3753.22	606.21	606.47	1.37	1.54
3733.92	606.20	606.46	1.35	1.52
3714.61	606.18	606.44	1.36	1.54
3695.311	606.17	606.43	1.33	1.50

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	606.16	606.41	1.31	1.48
3657.67	606.15	606.40	1.25	1.42
3638.84	605.88	606.11	3.89	4.06
3620.02	605.73	605.97	4.06	4.20
3601.20	605.70	605.93	3.32	3.53
3582.38	605.68	605.91	2.80	3.01
3563.56	605.48	605.71	3.92	4.10
3544.74	604.88	605.23	6.20	5.85
3525.926	604.77	605.17	4.80	4.50
3517.22	604.69	605.11	4.63	4.32
3508.52	604.61	605.06	4.59	4.23
3499.82	604.50	605.01	4.71	4.13
3491.12	604.44	604.99	4.39	3.79
3482.41	604.41	604.95	4.06	3.68
3473.717	604.46	604.98	2.65	2.80
3431.93	INTERSTATE 20			
3115.841	601.64	602.10	1.94	1.98
3098.957	601.65	602.11	1.36	1.37
3079.091	601.63	602.09	1.54	1.53
3064.589	601.25	602.00	4.53	2.65
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	597.61	597.87	7.51	7.57
2832.14	597.26	597.36	7.58	8.19
2822.78	597.04	597.23	7.05	7.17
2711.72	595.50	595.60	2.91	3.10
2663.21	595.34	595.44	2.39	2.52
2614.71	595.13	595.24	3.05	3.15
2566.20	594.80	594.90	3.16	3.34
2517.702	594.60	594.71	2.57	2.73
2404.576	593.36	593.47	5.09	5.23
2095.376	587.89	587.94	3.18	3.53
1798.860	582.26	582.51	6.50	6.38
1589.848	578.63	578.78	2.72	2.91
1383.802	576.90	576.97	3.84	4.11
1212.841	573.67	573.74	4.46	4.69

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.47	570.58	7.79	8.16
893.1495	560.54	562.74	10.73	2.33
567.3397	560.60	562.79	0.50	0.42
536.673	560.60	562.79	0.60	0.51
506.007	560.60	562.79	0.59	0.48
475.341	560.60	562.79	0.41	0.35
444.6757	560.60	562.79	0.33	0.27
419.897	560.60	562.79	0.23	0.20
395.119	560.60	562.79	0.18	0.16
370.341	560.60	562.79	0.16	0.14
345.5635	560.55	562.79	1.49	0.37
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	548.46	552.52	29.24	14.59
267.984	540.87	540.63	17.74	24.33
257.984	538.94	539.03	17.77	19.92
247.984	533.93	534.08	19.94	21.48
237.984	532.85	533.00	15.50	16.95
227.984	534.18	534.53	4.55	4.94
217.985	534.17	534.53	3.93	4.28
215.5150	534.07	534.42	4.46	4.80

REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	598.25	598.37	5.45	5.52
1869.862	595.46	595.62	4.51	4.45
1443.187	589.93	590.05	6.78	6.80
957.1301	585.99	586.10	1.36	1.34
907.4481	585.89	585.99	2.43	2.44
612.3994	INTERSTATE 20			
4.220822	554.85	554.87	12.93	13.01

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

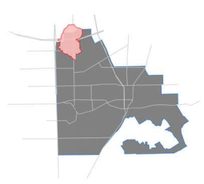
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 25-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	623.07	623.21	5.15	4.65
9569	620.22	620.79	3.16	2.60
9488	619.63	620.25	4.77	4.77
9450	DANIELDALE ROAD			
9435	617.56	617.76	6.00	6.43
9398	617.42	617.61	4.33	4.70
9325	616.56	616.70	5.72	6.10
9211	616.21	616.28	2.40	2.61
9100	615.11	615.34	6.06	5.54
9047	614.39	614.50	3.98	4.09
8989	613.77	613.87	2.99	3.11
8831	612.55	612.67	3.51	3.54
8698	611.03	611.13	5.50	5.78
8503	608.21	608.36	4.23	4.32
8164	605.34	605.59	5.35	5.61
8029	604.68	604.95	3.44	3.65
7906	603.61	603.84	5.57	5.88
7806	602.46	602.69	5.34	5.67
7735	601.96	602.21	4.16	4.41
7579	601.19	601.42	4.76	5.06
7536	599.51	599.73	5.98	6.28
7402	598.57	598.78	3.86	4.14
7119	593.93	594.12	7.01	7.17
7054	591.74	592.03	4.41	4.53
7025	SOUTH POINTE DRIVE			
7001	591.57	591.76	3.07	3.39
5964.532	591.54	591.73	2.77	2.99
5922.51	591.27	591.43	3.95	4.20
5880.48	590.66	590.84	5.19	5.28
5838.46	589.70	589.91	6.07	6.13
5796.44	588.85	588.94	5.58	6.01
5754.41	587.60	587.96	6.79	6.30
5712.397	587.75	588.02	3.28	3.48
5677.04	587.68	587.96	2.96	3.05
5641.68	587.60	587.88	2.81	2.90
5606.33	586.34	586.73	8.36	8.03
5570.97	583.09	583.35	13.26	13.49

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5535.623	581.93	582.15	10.49	10.96
5486.37	582.65	582.96	4.41	4.67
5437.13	581.36	581.65	8.45	8.60
5387.88	580.34	580.65	3.38	3.55
5338.63	579.85	580.14	5.34	5.50
5289.39	578.62	578.88	8.02	8.34
5240.145	577.83	578.14	7.38	7.61
5190.33	577.38	577.76	6.19	6.28
5140.51	577.08	577.57	4.99	4.71
5090.70	576.78	577.32	4.79	4.68
5040.89	575.70	576.83	7.78	5.74
4991.078	576.16	577.04	2.40	2.20
4950.770	576.01	576.84	3.49	3.67
4691.955	INTERSTATE 20			
4294.320	559.19	561.78	8.03	5.83
4288.435	559.38	561.87	6.28	4.68
4239.220	558.86	561.64	7.76	5.60
4059.367	559.10	561.74	3.97	3.33
3662.537	558.98	561.69	2.72	2.26
3495.795	559.00	561.71	1.43	1.19
3428.097	558.80	561.52	3.41	3.22
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	545.26	545.62	13.09	13.52
3264.83	543.40	543.79	15.69	16.03
3244.83	540.58	540.78	18.12	18.66
3234.83	539.28	539.43	18.59	19.18
3224.82	538.01	538.08	17.93	18.76
3214.82	536.70	536.77	15.80	16.54
3204.82	535.33	535.48	16.09	16.62
3194.82	537.46	537.83	4.77	4.76
3190.338	537.46	537.83	4.56	4.59
3047.751	535.49	535.97	9.35	9.28
2741.193	534.60	535.11	5.47	5.61
2353.439	530.01	530.42	12.24	12.60
2003.707	526.47	526.99	8.36	8.58
1752.357	524.31	524.81	9.23	9.51
1276.135	520.68	521.30	8.98	9.21
848.2705	516.78	517.41	10.44	10.81

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	629.54	629.68	6.66	6.84
5024.085	624.48	624.57	2.84	2.93
4807.604	621.69	621.80	6.17	6.40
4762.97	620.83	620.96	3.54	3.73
4718.34	620.47	620.60	3.76	3.93
4673.71	619.87	619.96	4.46	4.65
4629.08	619.44	619.50	3.48	3.67
4584.45	619.03	619.08	2.88	3.00
4539.821	618.36	618.40	2.66	2.79
4505.49	617.71	617.76	4.09	4.17
4471.16	614.95	615.03	9.70	9.80
4436.83	611.63	611.70	8.90	9.37
4402.50	611.31	611.41	5.63	5.79
4368.180	610.59	610.68	5.74	5.98
4332.62	610.11	610.22	3.93	4.11
4297.07	609.60	609.69	4.79	4.99
4261.52	608.81	608.90	5.33	5.51
4225.97	607.70	607.77	5.78	6.06
4190.42	607.10	607.40	4.56	3.86
4154.87	606.96	607.34	2.56	2.18
4119.324	606.94	607.32	1.59	1.55
4000	SOUTH POINTE DRIVE			
3965.34	606.76	607.15	1.13	1.09
3926.85	606.75	607.14	0.98	0.97
3888.359	606.72	607.12	1.25	1.21
3869.05	606.70	607.10	1.53	1.46
3849.74	606.67	607.08	1.63	1.55
3830.44	606.64	607.06	1.79	1.66
3811.14	606.62	607.04	1.73	1.62
3791.83	606.61	607.03	1.66	1.57
3772.53	606.60	607.02	1.51	1.44
3753.22	606.58	607.01	1.47	1.40
3733.92	606.57	607.00	1.44	1.38
3714.61	606.56	606.99	1.46	1.39
3695.311	606.55	606.98	1.43	1.36

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	606.54	606.97	1.40	1.34
3657.67	606.53	606.97	1.35	1.29
3638.84	606.24	606.73	4.05	3.70
3620.02	606.11	606.65	4.16	3.68
3601.20	606.07	606.62	3.53	3.24
3582.38	606.05	606.61	3.03	2.83
3563.56	605.86	606.50	4.03	3.45
3544.74	605.51	606.35	5.26	3.95
3525.926	605.48	606.34	4.05	3.14
3517.22	605.45	606.32	3.89	3.06
3508.52	605.41	606.30	3.82	3.09
3499.82	605.38	606.30	3.61	2.76
3491.12	605.37	606.30	3.31	2.60
3482.41	605.34	606.27	3.33	2.78
3473.717	605.36	606.26	2.76	2.69
3431.93	INTERSTATE 20			
3115.841	602.45	603.34	1.89	1.75
3098.957	602.46	603.36	1.28	0.91
3079.091	602.45	603.36	1.42	0.91
3064.589	602.45	603.36	1.47	0.73
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	597.94	598.13	7.71	8.00
2832.14	597.40	597.49	8.39	8.94
2822.78	597.26	597.41	7.40	7.48
2711.72	595.63	595.72	3.27	3.42
2663.21	595.48	595.57	2.57	2.69
2614.71	595.28	595.36	3.20	3.33
2566.20	594.94	595.04	3.40	3.48
2517.702	594.74	594.84	2.81	2.95
2404.576	593.53	593.65	5.19	5.30
2095.376	587.95	588.00	3.70	4.00
1798.860	582.61	582.77	6.28	6.32
1589.848	578.84	578.97	2.98	3.14
1383.802	577.00	577.07	4.20	4.44
1212.841	573.77	573.83	4.78	4.97

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.62	570.73	8.29	8.57
893.1495	562.73	562.88	2.48	2.63
567.3397	562.79	562.94	0.44	0.50
536.673	562.79	562.94	0.54	0.61
506.007	562.79	562.94	0.51	0.57
475.341	562.79	562.94	0.37	0.41
444.6757	562.79	562.94	0.29	0.33
419.897	562.79	562.94	0.21	0.23
395.119	562.79	562.94	0.17	0.19
370.341	562.79	562.94	0.15	0.17
345.5635	562.79	562.93	0.37	0.41
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	552.52	553.13	14.59	15.27
267.984	540.63	540.83	24.33	25.24
257.984	539.03	539.10	19.92	21.27
247.984	534.08	534.18	21.48	22.51
237.984	533.00	533.10	16.95	17.96
227.984	534.87	535.26	4.41	4.49
217.985	534.87	535.27	3.84	3.92
215.5150	534.81	535.21	4.19	4.23

REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	598.53	598.65	5.65	5.92
1869.862	595.82	595.91	4.60	4.66
1443.187	590.23	590.30	6.98	7.16
957.1301	587.22	587.61	1.14	1.09
907.4481	587.10	587.48	2.58	2.62
612.3994	INTERSTATE 20			
4.220822	559.98	562.19	3.21	2.45

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

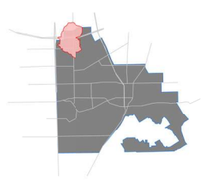
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 50-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	623.20	623.25	4.62	4.71
9569	620.73	620.89	2.65	2.65
9488	620.18	620.70	4.77	2.96
9450	DANIELDALE ROAD			
9435	617.74	617.85	6.38	6.65
9398	617.59	617.71	4.66	4.89
9325	616.68	616.77	6.07	6.29
9211	616.26	616.31	2.62	2.74
9100	615.36	615.45	5.34	5.19
9047	614.48	614.55	4.08	4.15
8989	613.86	613.93	3.10	3.17
8831	612.66	612.74	3.54	3.56
8698	611.12	611.17	5.75	5.93
8503	608.34	608.44	4.31	4.35
8164	605.56	605.72	5.58	5.75
8029	604.92	605.09	3.63	3.76
7906	603.82	603.97	5.85	6.03
7806	602.66	602.81	5.64	5.84
7735	602.18	602.33	4.38	4.54
7579	601.39	601.54	5.03	5.22
7536	599.71	599.84	6.25	6.45
7402	598.76	598.89	4.11	4.29
7119	594.10	594.22	7.15	7.29
7054	592.00	592.18	4.52	4.59
7025	SOUTH POINTE DRIVE			
7001	591.74	591.86	3.35	3.56
5964.532	591.71	591.83	2.97	3.10
5922.51	591.41	591.52	4.18	4.33
5880.48	590.82	590.93	5.27	5.37
5838.46	589.88	589.98	6.13	6.26
5796.44	588.93	589.00	5.98	6.20
5754.41	587.93	588.10	6.31	6.24
5712.397	588.00	588.15	3.45	3.59
5677.04	587.94	588.09	3.03	3.13
5641.68	587.86	588.01	2.88	2.97
5606.33	586.65	586.98	8.24	7.60
5570.97	583.32	583.53	13.45	13.29

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5535.623	582.13	582.27	10.91	11.21
5486.37	582.93	583.12	4.64	4.81
5437.13	581.60	581.78	8.69	8.76
5387.88	580.62	580.81	3.54	3.64
5338.63	580.11	580.30	5.49	5.59
5289.39	578.85	579.02	8.31	8.48
5240.145	578.10	578.35	7.60	7.59
5190.33	577.71	578.04	6.28	6.16
5140.51	577.51	577.93	4.75	4.43
5090.70	577.25	577.70	4.70	4.49
5040.89	576.72	577.35	5.89	5.11
4991.078	576.95	577.51	2.22	2.10
4950.770	576.75	577.29	3.65	3.76
4691.955	INTERSTATE 20			
4294.320	563.63	564.18	4.74	5.06
4288.435	563.67	564.25	4.01	4.05
4239.220	563.54	564.12	4.71	4.72
4059.367	563.60	564.18	3.03	3.11
3662.537	563.57	564.16	2.01	2.05
3495.795	563.59	564.17	1.08	1.13
3428.097	563.59	564.17	0.96	1.01
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	545.98	546.44	13.86	14.30
3264.83	544.13	544.59	16.34	16.73
3244.83	540.97	541.20	19.16	19.80
3234.83	539.58	539.75	19.72	20.33
3224.82	538.16	538.29	19.44	19.84
3214.82	536.83	536.91	17.23	17.99
3204.82	535.64	535.97	16.88	15.80
3194.82	538.16	538.63	4.78	4.76
3190.338	538.16	538.63	4.63	4.66
3047.751	536.29	536.84	9.45	9.41
2741.193	535.38	535.97	5.89	6.04
2353.439	530.60	531.06	12.76	13.17
2003.707	527.23	527.82	8.68	8.91
1752.357	525.04	525.58	9.66	10.01
1276.135	521.57	522.21	9.31	9.54
848.2705	517.68	518.33	10.96	11.32

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	629.68	629.81	6.84	7.00
5024.085	624.57	624.65	2.93	3.02
4807.604	621.80	621.92	6.40	6.55
4762.97	620.96	621.07	3.73	3.95
4718.34	620.60	620.69	3.93	4.13
4673.71	619.96	620.05	4.65	4.80
4629.08	619.50	619.57	3.67	3.80
4584.45	619.08	619.11	3.00	3.16
4539.821	618.40	618.45	2.79	2.84
4505.49	617.76	617.80	4.17	4.34
4471.16	615.03	615.11	9.80	9.73
4436.83	611.70	611.76	9.37	9.83
4402.50	611.41	611.51	5.79	5.96
4368.180	610.68	610.76	5.98	6.20
4332.62	610.22	610.31	4.11	4.27
4297.07	609.69	609.76	4.99	5.21
4261.52	608.90	608.99	5.51	5.64
4225.97	607.77	607.84	6.06	6.35
4190.42	607.40	608.03	3.86	2.67
4154.87	607.34	608.01	2.18	1.64
4119.324	607.32	608.00	1.55	1.38
4000	SOUTH POINTE DRIVE			
3965.34	607.15	607.85	1.09	0.95
3926.85	607.14	607.84	0.97	0.86
3888.359	607.12	607.83	1.21	1.05
3869.05	607.10	607.82	1.46	1.23
3849.74	607.08	607.81	1.55	1.31
3830.44	607.06	607.80	1.66	1.38
3811.14	607.04	607.79	1.62	1.35
3791.83	607.03	607.78	1.57	1.32
3772.53	607.02	607.77	1.44	1.22
3753.22	607.01	607.77	1.40	1.19
3733.92	607.00	607.76	1.38	1.17
3714.61	606.99	607.76	1.39	1.18
3695.311	606.98	607.75	1.36	1.16

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	606.97	607.75	1.34	1.13
3657.67	606.97	607.74	1.29	1.09
3638.84	606.73	607.60	3.70	2.97
3620.02	606.65	607.56	3.68	2.88
3601.20	606.62	607.54	3.24	2.63
3582.38	606.61	607.54	2.83	2.36
3563.56	606.50	607.49	3.45	2.63
3544.74	606.35	607.44	3.95	2.78
3525.926	606.34	607.44	3.14	2.21
3517.22	606.32	607.42	3.06	2.38
3508.52	606.30	607.40	3.09	2.47
3499.82	606.30	607.41	2.76	2.15
3491.12	606.30	607.40	2.60	2.07
3482.41	606.27	607.38	2.78	2.25
3473.717	606.26	607.35	2.69	2.57
3431.93	INTERSTATE 20			
3115.841	603.34	603.61	1.75	0.91
3098.957	603.36	603.61	0.91	0.90
3079.091	603.36	603.61	0.91	0.88
3064.589	603.36	603.61	0.73	0.70
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	598.13	598.29	8.00	8.33
2832.14	597.49	597.57	8.94	9.41
2822.78	597.41	597.49	7.48	7.88
2711.72	595.72	595.80	3.42	3.53
2663.21	595.57	595.65	2.69	2.81
2614.71	595.36	595.44	3.33	3.46
2566.20	595.04	595.13	3.48	3.58
2517.702	594.84	594.93	2.95	3.11
2404.576	593.65	593.73	5.30	5.42
2095.376	588.00	588.06	4.00	4.23
1798.860	582.77	582.90	6.32	6.43
1589.848	578.97	579.10	3.14	3.29
1383.802	577.07	577.12	4.44	4.67
1212.841	573.83	573.90	4.97	5.15

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.73	570.83	8.57	8.82
893.1495	562.88	563.15	2.63	2.60
567.3397	562.94	563.21	0.50	0.54
536.673	562.94	563.21	0.61	0.66
506.007	562.94	563.21	0.57	0.62
475.341	562.94	563.21	0.41	0.45
444.6757	562.94	563.21	0.33	0.35
419.897	562.94	563.21	0.23	0.25
395.119	562.94	563.21	0.19	0.21
370.341	562.94	563.21	0.17	0.19
345.5635	562.93	563.21	0.41	0.45
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	553.13	553.73	15.27	15.88
267.984	540.83	541.03	25.24	26.09
257.984	539.10	539.16	21.27	22.50
247.984	534.18	534.28	22.51	23.49
237.984	533.10	533.20	17.96	18.90
227.984	535.43	535.90	4.29	4.26
217.985	535.43	535.90	3.75	3.75
215.5150	535.39	535.86	4.02	3.97

REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	598.71	598.85	5.90	6.06
1869.862	596.01	596.14	4.76	4.91
1443.187	590.40	590.55	7.26	7.38
957.1301	588.27	588.54	1.01	0.99
907.4481	588.13	588.40	2.70	2.73
612.3994	INTERSTATE 20			
4.220822	563.90	564.49	2.19	2.13

WATERSHED NO.

9

COUNCIL DISTRICTS

2 AND 6

TOTAL DRAINAGE AREA

1.83 SM

*

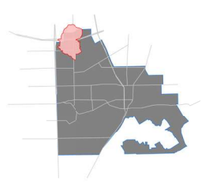
STREAM LENGTH

1.35 MI

*

PROJECTS IDENTIFIED

1



2.3 HYDRAULIC RESULTS: 100-YEAR

REACH A

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9866	623.26	623.32	4.73	4.84
9569	620.91	621.07	2.66	2.76
9488	620.73	620.92	2.92	2.80
9450	DANIELDALE ROAD			
9435	617.87	618.03	6.70	7.10
9398	617.72	617.88	4.93	5.26
9325	616.78	616.90	6.32	6.62
9211	616.34	616.45	2.72	2.81
9100	615.43	615.46	5.43	5.84
9047	614.56	614.65	4.16	4.25
8989	613.94	614.03	3.19	3.29
8831	612.75	612.86	3.56	3.58
8698	611.18	611.25	5.96	6.23
8503	608.46	608.60	4.36	4.40
8164	605.74	605.96	5.78	6.01
8029	605.11	605.35	3.78	3.97
7906	603.99	604.20	6.07	6.33
7806	602.83	603.04	5.87	6.15
7735	602.36	602.58	4.56	4.79
7579	601.56	601.77	5.25	5.50
7536	599.87	600.06	6.48	6.76
7402	598.92	599.11	4.32	4.57
7119	594.24	594.40	7.31	7.52
7054	592.21	592.48	4.60	4.70
7025	SOUTH POINTE DRIVE			
7001	591.88	592.04	3.59	3.88
5964.532	591.85	592.02	3.12	3.31
5922.51	591.54	591.68	4.35	4.56
5880.48	590.94	591.09	5.39	5.54
5838.46	590.00	590.10	6.29	6.62
5796.44	589.01	589.14	6.22	6.37
5754.41	588.12	588.35	6.24	6.21
5712.397	588.17	588.37	3.62	3.83
5677.04	588.11	588.31	3.14	3.28
5641.68	588.03	588.23	2.99	3.13
5606.33	587.01	587.18	7.56	7.73
5570.97	583.57	583.82	13.27	12.96

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5535.623	582.32	582.73	11.11	10.53
5486.37	583.14	583.36	4.84	5.14
5437.13	581.84	582.32	8.66	7.81
5387.88	580.84	581.13	3.66	3.79
5338.63	580.33	580.61	5.61	5.73
5289.39	579.05	579.39	8.50	8.46
5240.145	578.40	578.93	7.58	7.18
5190.33	578.10	578.75	6.13	5.72
5140.51	578.00	578.74	4.38	3.85
5090.70	577.78	578.57	4.45	4.00
5040.89	577.45	578.39	5.01	4.22
4991.078	577.60	578.49	2.08	1.89
4950.770	577.38	578.24	3.78	3.90
4691.955	INTERSTATE 20			
4294.320	564.33	564.62	5.02	5.50
4288.435	564.38	564.70	4.27	4.43
4239.220	564.24	564.55	4.98	5.16
4059.367	564.31	564.62	3.29	3.45
3662.537	564.28	564.60	2.17	2.26
3495.795	564.30	564.62	1.15	1.22
3428.097	564.30	564.62	1.04	1.11
3343.321	UNIVERSITY HILLS BOULEVARD			
3274.831	546.59	547.01	14.45	14.81
3264.83	544.76	545.21	16.84	17.11
3244.83	541.28	541.49	20.00	20.54
3234.83	539.80	539.94	20.56	21.15
3224.82	538.33	538.43	20.07	20.68
3214.82	536.94	537.01	18.23	18.92
3204.82	538.75	539.19	5.64	5.55
3194.82	538.78	539.22	4.77	4.77
3190.338	538.78	539.21	4.68	4.70
3047.751	536.98	537.47	9.49	9.49
2741.193	536.09	536.60	6.16	6.30
2353.439	531.15	531.54	13.25	13.59
2003.707	527.93	528.45	8.95	9.12
1752.357	525.70	526.23	10.05	10.26
1276.135	522.35	522.97	9.58	9.75
848.2705	518.47	519.06	11.39	11.71

REACH B

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5304.917	629.81	629.92	7.00	7.21
5024.085	624.65	624.72	3.02	3.12
4807.604	621.92	622.05	6.55	6.59
4762.97	621.07	621.10	3.95	4.33
4718.34	620.69	620.77	4.13	4.04
4673.71	620.05	620.12	4.80	4.94
4629.08	619.57	619.61	3.80	4.01
4584.45	619.11	619.15	3.16	3.24
4539.821	618.45	618.48	2.84	2.98
4505.49	617.80	617.84	4.34	4.37
4471.16	615.11	615.18	9.73	9.83
4436.83	611.76	611.82	9.83	10.15
4402.50	611.51	611.60	5.96	6.10
4368.180	610.76	610.84	6.20	6.41
4332.62	610.31	610.40	4.27	4.43
4297.07	609.76	609.84	5.21	5.37
4261.52	608.99	609.74	5.64	3.34
4225.97	607.84	609.77	6.35	1.81
4190.42	608.03	609.77	2.67	1.24
4154.87	608.01	609.77	1.64	0.89
4119.324	608.00	609.76	1.38	1.00
4000	SOUTH POINTE DRIVE			
3965.34	607.85	609.60	0.95	0.68
3926.85	607.84	609.60	0.86	0.59
3888.359	607.83	609.59	1.05	0.71
3869.05	607.82	609.59	1.23	0.79
3849.74	607.81	609.59	1.31	0.83
3830.44	607.80	609.58	1.38	0.86
3811.14	607.79	609.58	1.35	0.85
3791.83	607.78	609.58	1.32	0.83
3772.53	607.77	609.58	1.22	0.79
3753.22	607.77	609.58	1.19	0.77
3733.92	607.76	609.57	1.17	0.75
3714.61	607.76	609.57	1.18	0.77
3695.311	607.75	609.57	1.16	0.78

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3676.49	607.75	609.57	1.13	0.73
3657.67	607.74	609.57	1.09	0.67
3638.84	607.60	609.52	2.97	1.78
3620.02	607.56	609.52	2.88	1.60
3601.20	607.54	609.52	2.63	1.37
3582.38	607.54	609.52	2.36	1.14
3563.56	607.49	609.52	2.63	1.05
3544.74	607.44	609.52	2.78	0.94
3525.926	607.44	609.52	2.21	0.77
3517.22	607.42	609.52	2.38	0.74
3508.52	607.40	609.52	2.47	0.84
3499.82	607.41	609.51	2.15	1.00
3491.12	607.40	609.51	2.07	1.18
3482.41	607.38	609.49	2.25	1.43
3473.717	607.35	609.50	2.57	0.76
3431.93	INTERSTATE 20			
3115.841	603.61	603.94	0.91	0.93
3098.957	603.61	603.94	0.90	0.93
3079.091	603.61	603.94	0.88	0.90
3064.589	603.61	603.94	0.70	0.72
2966.713	INTERSTATE FRONTAGE ROAD			
2846.193	598.29	598.58	8.33	8.97
2832.14	597.57	597.72	9.41	10.28
2822.78	597.49	597.60	7.88	8.70
2711.72	595.80	595.96	3.53	3.70
2663.21	595.65	595.80	2.81	3.01
2614.71	595.44	595.60	3.46	3.66
2566.20	595.13	595.30	3.58	3.72
2517.702	594.93	595.11	3.11	3.33
2404.576	593.73	593.87	5.42	5.80
2095.376	588.06	588.18	4.23	4.54
1798.860	582.90	583.10	6.43	6.77
1589.848	579.10	579.33	3.29	3.56
1383.802	577.12	577.23	4.67	5.08
1212.841	573.90	574.02	5.15	5.46

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
1097.132	570.83	571.03	8.82	9.22
893.1495	563.15	563.23	2.60	3.07
567.3397	563.21	563.31	0.54	0.65
536.673	563.21	563.31	0.66	0.79
506.007	563.21	563.31	0.62	0.74
475.341	563.21	563.31	0.45	0.54
444.6757	563.21	563.31	0.35	0.42
419.897	563.21	563.31	0.25	0.31
395.119	563.21	563.31	0.21	0.25
370.341	563.21	563.31	0.19	0.23
345.5635	563.21	563.31	0.45	0.50
310.7735	NORTH HOUSTON SCHOOL ROAD			
277.9838	553.73	554.29	15.88	16.47
267.984	541.03	541.23	26.09	26.86
257.984	539.16	539.23	22.50	23.63
247.984	534.28	534.37	23.49	24.42
237.984	533.20	533.30	18.90	19.79
227.984	535.98	536.41	4.17	4.18
217.985	535.99	536.42	3.67	3.69
215.5150	535.95	536.39	3.88	3.88

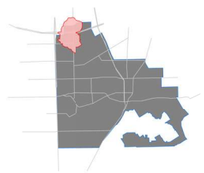
REACH C

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
2169.601	598.88	599.00	6.05	6.32
1869.862	596.19	596.26	5.00	5.12
1443.187	590.60	590.69	7.45	7.56
957.1301	589.26	589.50	0.93	0.90
907.4481	589.10	589.35	2.81	2.81
612.3994	INTERSTATE 20			
4.220822	564.64	564.99	2.33	2.30

WATERSHED NO.
9

COUNCIL DISTRICTS
2 AND 6

TOTAL DRAINAGE AREA
1.83 SM
*
STREAM LENGTH
1.35 MI
*
PROJECTS IDENTIFIED
1

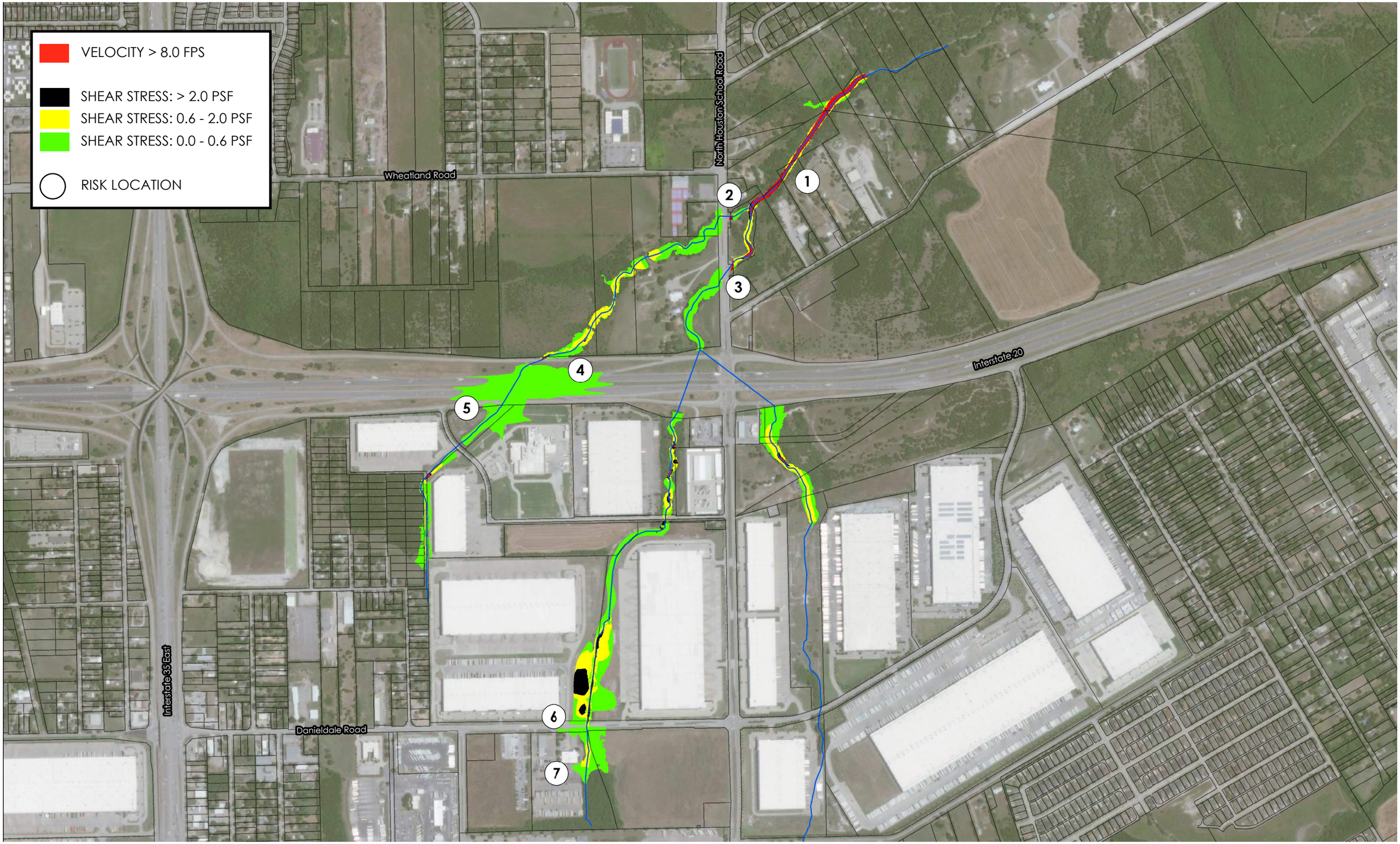


3.1 RISK IDENTIFICATION

Seven risk areas were identified in this study. The risks include five over-topping bridges, one area with flooding structures and one location with erosive velocities. The area with flooded structures is at a commercial development on Danieldale Road. Flooding is anticipated in the 25-year event. Most of the over-topping bridges only experience flooding in larger storm events, however North Houston School Road and Interstate 20 experience heavy traffic and could pose more significant safety risks. The one potential erosion location is relatively far from existing development. The following map shows the shear stresses associated with the Runyon Springs Branch floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	River Station 3234	Potential Erosion Hot Spot	1-Year	Private	Low
2	North Houston School Road (Reach B)	Over-topping Bridge	10-Year	Public	High
3	North Houston School Road (Reach A)	Over-topping Bridge	50-Year	Public	Medium
4	Interstate 20 (Reach B)	Over-topping Bridge	25-Year	Public	High
5	Southe Pointe Drive (Reach B)	Over-topping Bridge	100-Year	Public	Low
6	Danieldale Road (Reach A)	Over-topping Bridge	50-Year	Public	Medium
7	Parking and Commerical Structure on Danieldale Road	Flooded Structure	25-Year	Private	Low



WATERSHED NO. 9 RUNYON SPRINGS BRANCH

STREAM 3A5

WATERSHED NO.

10

COUNCIL DISTRICTS

1 AND 2

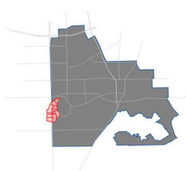
TOTAL DRAINAGE AREA

0.76 SM

*

STREAM LENGTH

1.70 MI



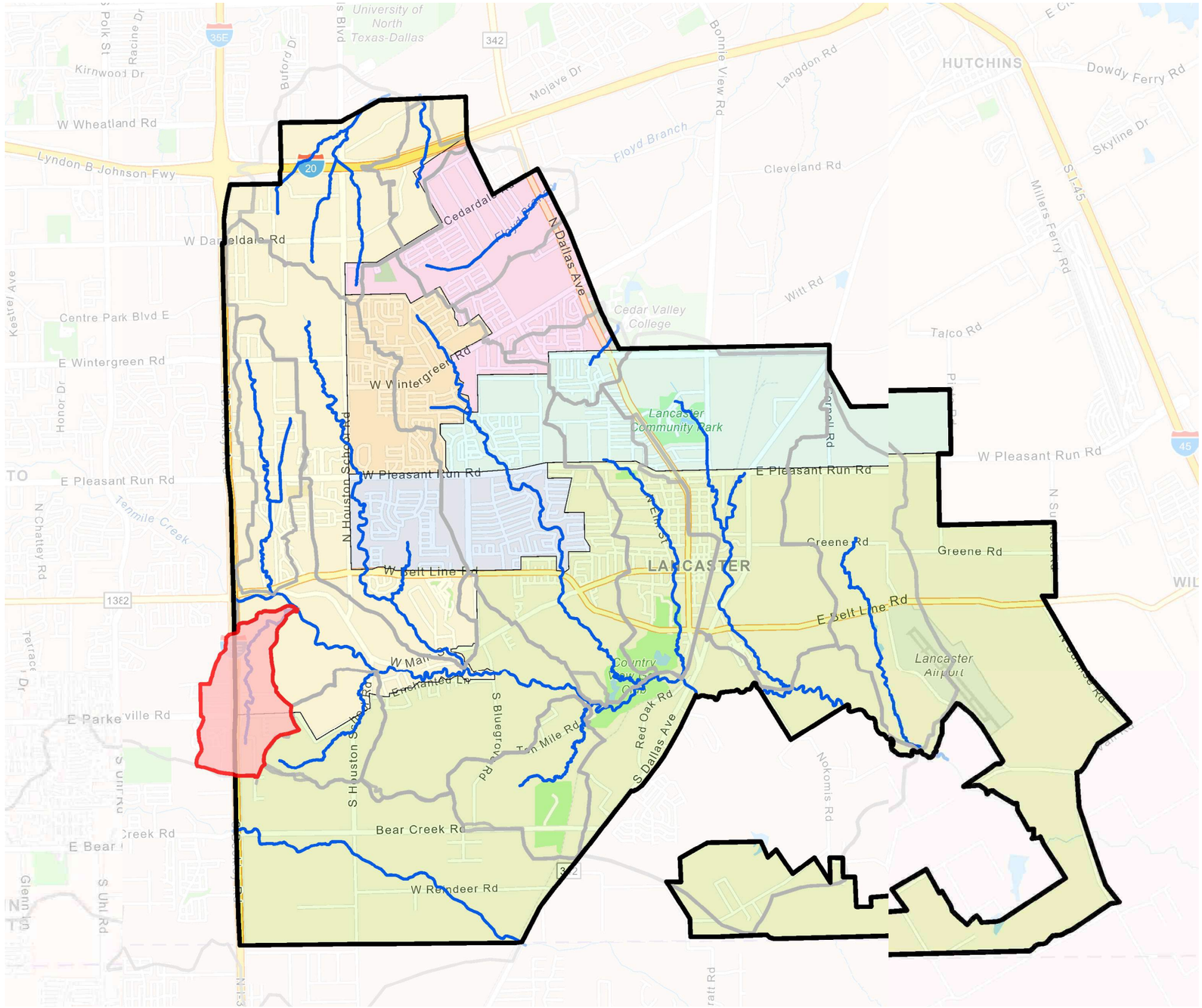
- STREAM 3A5
- STREAM CENTERLINE

COUNCIL DISTRICT

- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

STREAM 3A5 WATERSHED

Situated southwest near Interstate 35, this 0.75-square-mile watershed is largely undeveloped. Starting north, it runs for about 1.75 miles. Conservation efforts will preserve most of its expanse, with some areas earmarked for residential growth.



WATERSHED NO. 10

STREAM 3A5

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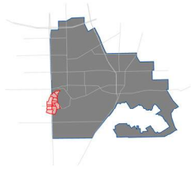
1.0 HYDROLOGY

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI

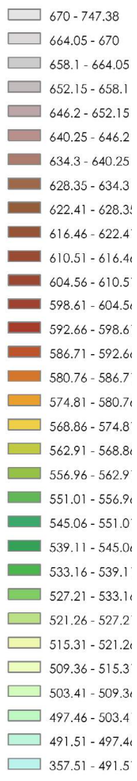


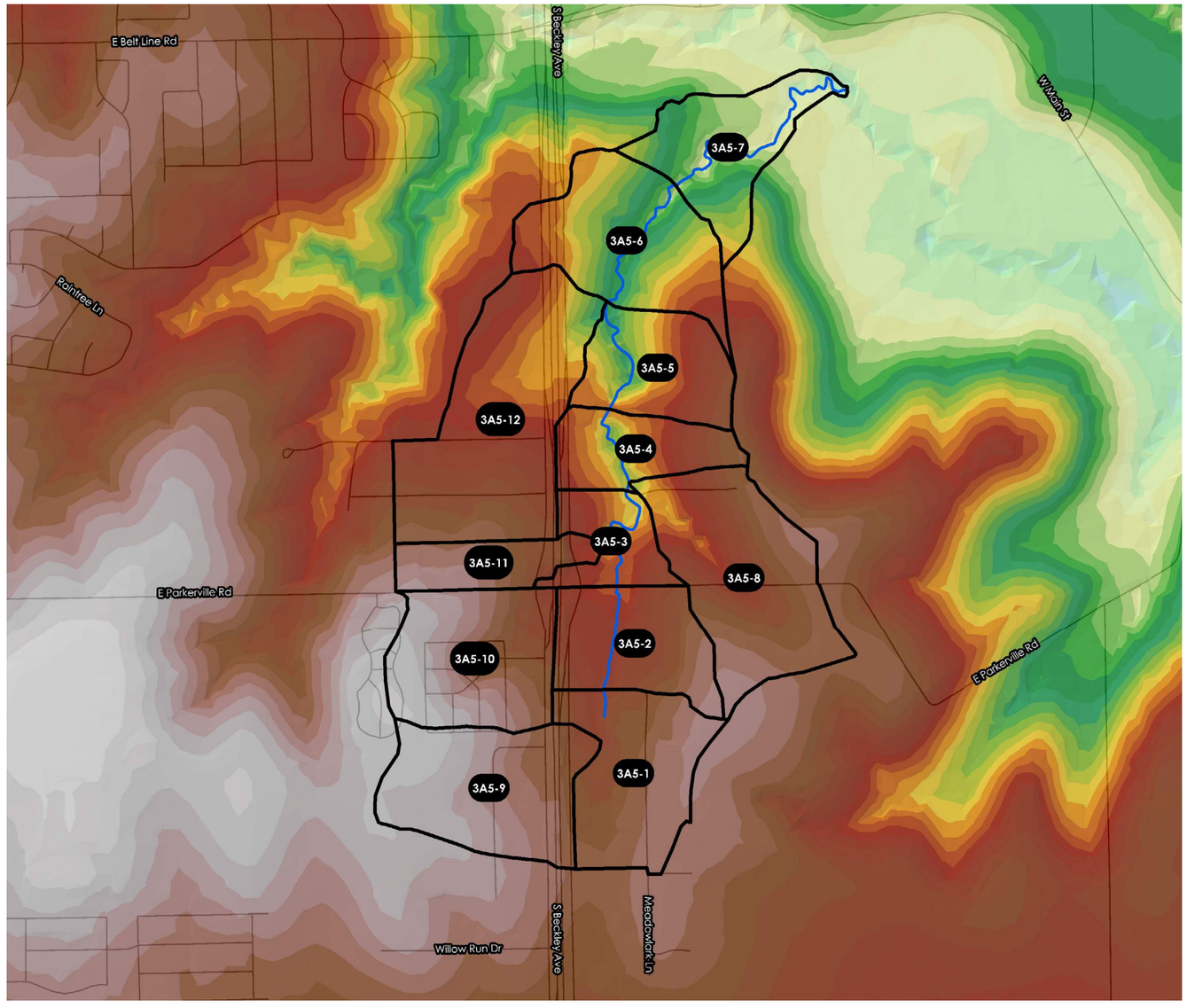
1.1 DRAINAGE AREA MAP

The drainage area divides for the Stream 3A5 watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into twelve (12) sub-basins. Sub-basins are designated 3A5-1 through 3A5-12. The total watershed drainage area is 484.3 acres (0.76 square-miles). Approximately 0.48 square-miles of drainage area is located outside the City of Lancaster limits.

N

N.T.S.





HYDROLOGIC PARAMETERS REPORT

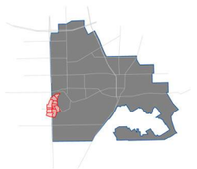
BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
3A5-1	0.0678	83.3	48	63.4	16.40	9.84	13.33	8
3A5-2	0.054	81.5	18	54	25.27	15.16	19.67	11.8
3A5-3	0.0285	80.7	30.1	51	18.67	11.2	14.45	8.67
3A5-4	0.0375	81.4	12.7	38.4	16.62	9.97	12.78	7.67
3A5-5	0.0487	82	0.2	27.8	16.87	10.12	13.25	7.95
3A5-6	0.0782	83.3	6.5	34.8	17.32	10.39	13.68	8.21
3A5-7	0.0552	78.5	0	0.2	15.75	9.45	13.07	7.84
3A5-8	0.0926	82.3	4.7	14.6	32.53	19.52	25.30	15.18
3A5-9	0.0769	83.9	35.3	78.5	23.45	14.07	18.42	11.05
3A5-10	0.0721	84	46.6	50.6	24.17	14.5	19.95	11.97
3A5-11	0.0285	83.8	56.5	66.5	18.43	11.06	14.22	8.53
3A5-12	0.1167	84	39.8	59.1	22.88	13.73	19.40	11.64

1.0 HYDROLOGY

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



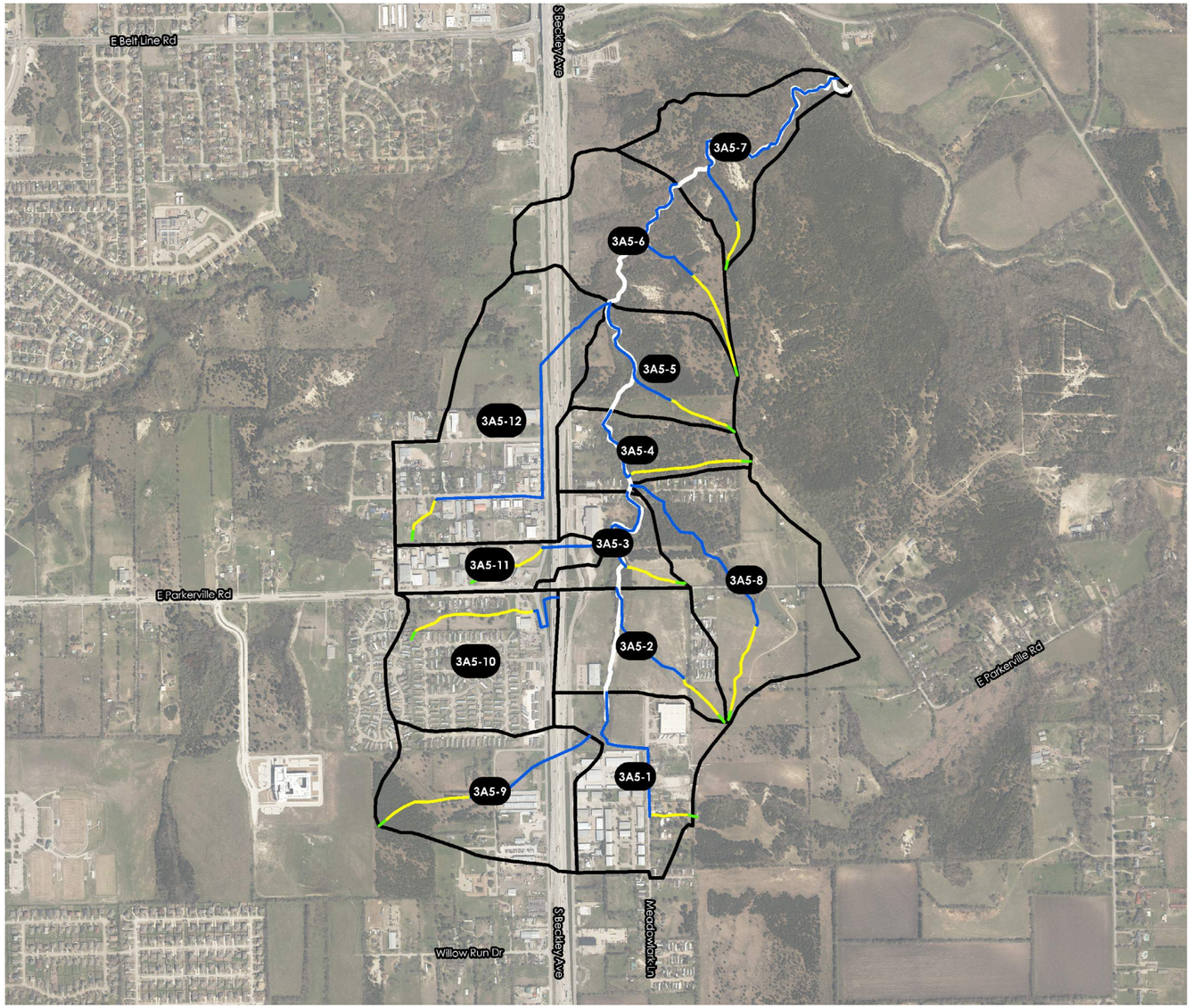
1.2 TIME OF CONCENTRATION

The Times of Concentration for Stream 3A5 were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Stream 3A5 runs through undeveloped wooded areas. The west half of the watershed is fairly well urbanized, which results in lower Times of Concentration there. The basins are all of similar sizes, so variety of times between sub-basins is mostly caused by differences in levels of development. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

N.T.S.



TIME OF CONCENTRATION REPORT

3A5-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	4.61	0.240	0.00	0.2	9.64
SHALLOW	UNPAVED	354	2.01	0.000	16.10	2.3	2.58
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,073	3.34	0.050	28.69	5.2	3.41
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	474	5.96	0.050	42.29	10.3	0.77
		2,001					**16.39**
							13.34

3A5-2

OVERLAND	GRS-DENSE	100	0.74	0.240	0.00	0.1	19.98
SHALLOW	UNPAVED	477	4.13	0.000	16.10	3.3	2.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	771	4.05	0.050	28.69	5.8	2.22
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	386	5.7	0.050	42.29	10.1	0.64
		1,734					**25.27**
							19.67

3A5-3

OVERLAND	GRS-DENSE	100	1.51	0.240	0.00	0.1	15.05
SHALLOW	UNPAVED	486	7.51	0.000	16.10	4.4	1.84
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,067	5.52	0.050	42.29	9.9	1.79
		1,653					**18.67**
							14.45

3A5-4

OVERLAND	GRS-DENSE	100	3.07	0.240	0.00	0.1	11.34
SHALLOW	UNPAVED	1,057	7.5	0.000	16.10	4.4	4.00
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	765	5.51	0.050	42.29	9.9	1.28
		1,923					**16.62**
							12.79

3A5-5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.74	0.240	0.00	0.1	11.86
SHALLOW	UNPAVED	586	5.38	0.000	16.10	3.7	2.62
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	377	5.29	0.050	28.69	6.6	0.95
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	868	5.71	0.050	42.29	10.1	1.43
		1,932					**16.87**
							13.25

3A5-6

OVERLAND	GRS-DENSE	100	4.72	0.240	0.00	0.2	9.55
SHALLOW	UNPAVED	964	3.94	0.000	16.10	3.2	5.03
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	637	5.47	0.050	28.69	6.7	1.58
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	690	5.54	0.050	42.29	10.0	1.16
		2,391					**17.32**
							13.68

3A5-7

OVERLAND	GRS-DENSE	100	5.29	0.240	0.00	0.2	9.12
SHALLOW	UNPAVED	393	6.55	0.000	16.10	4.1	1.59
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	568	5.19	0.050	28.69	6.5	1.45
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,121	5.43	0.050	42.29	9.9	3.59
		3,183					**15.75**
							13.07

3A5-8

OVERLAND	GRS-DENSE	100	0.52	0.240	0.00	0.1	23.15
SHALLOW	UNPAVED	870	2.46	0.000	16.10	2.5	5.74
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	410	5.77	0.050	28.69	6.9	0.99
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,525	5.14	0.050	42.29	9.6	2.65
		2,906					**32.53**
							25.31

TIME OF CONCENTRATION REPORT - CONTINUED

3A5-9

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.88	0.240	0.00	0.1	13.78
SHALLOW	UNPAVED	843	1.88	0.000	16.10	2.2	6.36
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,292	5.14	0.050	28.69	6.5	3.31
		2,236					**23.45**
							18.42

3A5-10

OVERLAND	GRS-DENSE	100	1.26	0.240	0.00	0.1	16.20
SHALLOW	PAVED	193	5.23	0.000	20.30	4.6	0.69
SHALLOW	UNPAVED	977	3.43	0.000	16.10	3.0	5.46
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	641	4.2	0.050	28.69	5.9	1.82
		1,911					**24.17**
							19.95

3A5-11

OVERLAND	GRS-DENSE	100	2.15	0.240	0.00	0.1	13.06
SHALLOW	UNPAVED	678	3.42	0.000	16.10	3.0	3.80
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	607	5.05	0.050	28.69	6.5	1.57
		1,385					**18.43**
							14.22

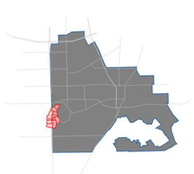
3A5-12

OVERLAND	GRS-DENSE	100	2.68	0.240	0.00	0.1	11.97
SHALLOW	UNPAVED	371	3.81	0.000	16.10	3.1	1.97
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,262	3.04	0.050	28.69	5.0	7.54
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	869	5.87	0.050	42.29	10.2	1.41
		3,602					**22.89**
							19.41

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



1.3 SOILS MAP

Stream 3A5 watershed has three different hydrologic soils groups present within it's boundaries: groups B, C and D. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type C, which is more permeable than soil type D is found within each sub-basins except 3A5-10. Hydrologic soil group B is found in sub-basins 3A5-4 through 3A5-8 and type A (most permeable) is not present.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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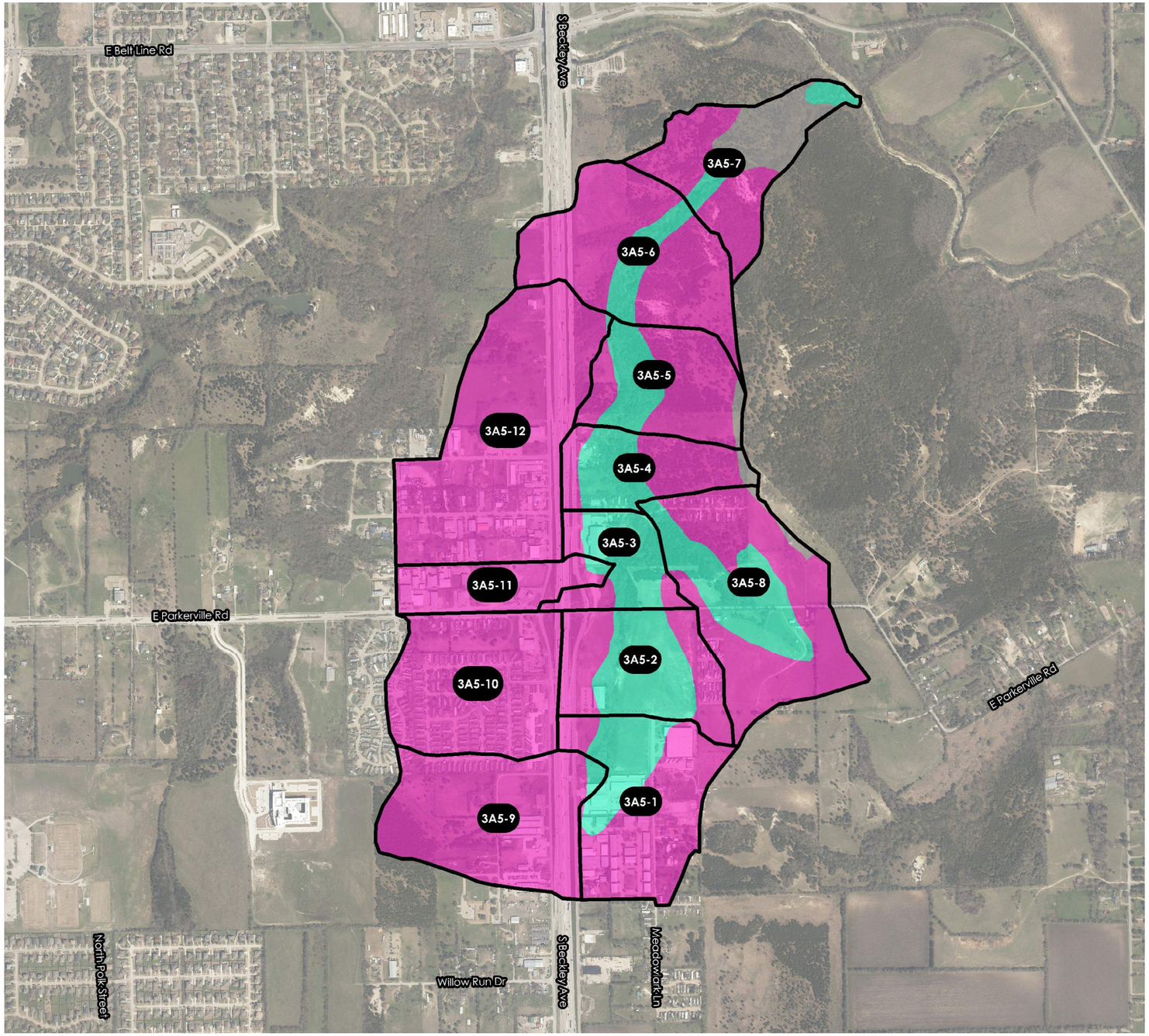


PERVIOUS CURVE NUMBER REPORT

3A5-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
C	79	11.9	21.8
D	84	31.5	61.5
		43.4	**83.3**

3A5-2

C	79	17.4	39.9
D	84	17.1	41.6
		34.5	**81.5**

3A5-3

C	79	12.1	52.3
D	84	6.1	28.3
		18.2	**80.7**

3A5-4

B	69	0.9	2.6
C	79	9.7	32.1
D	84	13.3	46.7
		24.0	**81.4**

3A5-5

B	69	1.2	2.7
C	79	9.0	22.9
D	84	20.9	56.4
		31.2	**82.0**

3A5-6

B	69	0.0	0.1
C	79	7.0	11.0
D	84	43.1	72.2
		50.1	**83.3**

3A5-8

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
B	69	11.6	22.6
C	79	4.4	9.9
D	84	19.4	46.1
		35.4	**78.5**

3A5-7

B	69	1.1	1.3
C	79	19.3	25.8
D	84	38.8	55.2
		59.3	**82.3**

3A5-9

C	79	1.1	1.8
D	84	48.1	82.1
		49.2	**83.9**

3A5-10

D	84	46.2	84.0
		46.2	**84.0**

3A5-11

C	79	0.7	3.0
D	84	17.5	80.8
		18.2	**83.8**

3A5-12

C	79	0.2	0.2
D	84	74.5	83.8
		74.7	**84.0**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

10

COUNCIL DISTRICTS

1 AND 2

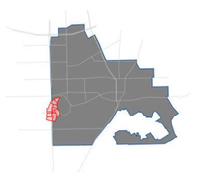
TOTAL DRAINAGE AREA

0.76 SM

*

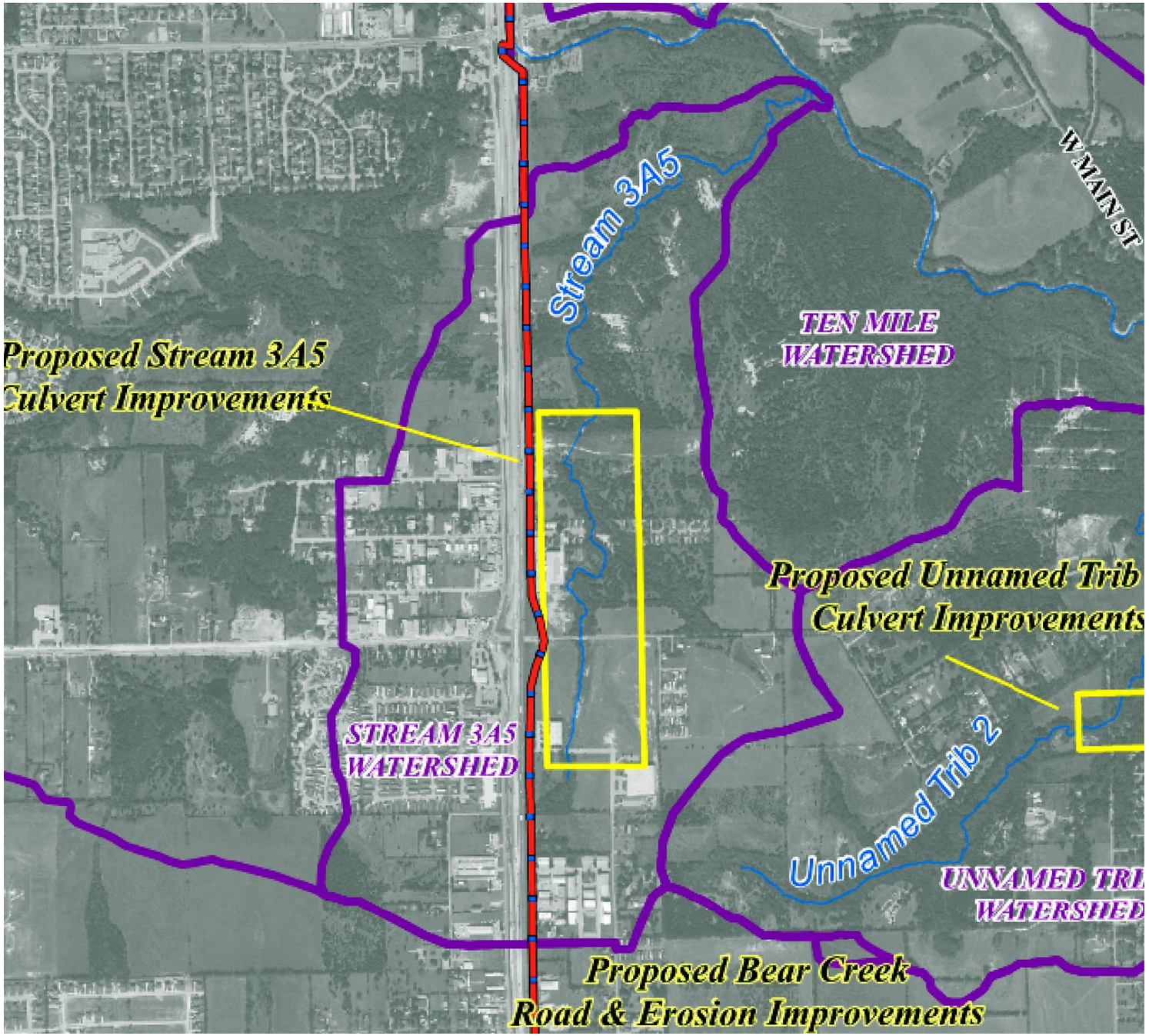
STREAM LENGTH

1.70 MI



1.4 AERIAL COMPARISON

Aerial photography from 2019 a couple significant developments since 2007 within the Stream 3A5 watershed. New development consists of commercial/industrial buildings. Specifically, this new development is located in sub-basins 3A5-1 and 3A5-9. The locations of new development are highlighted in red.



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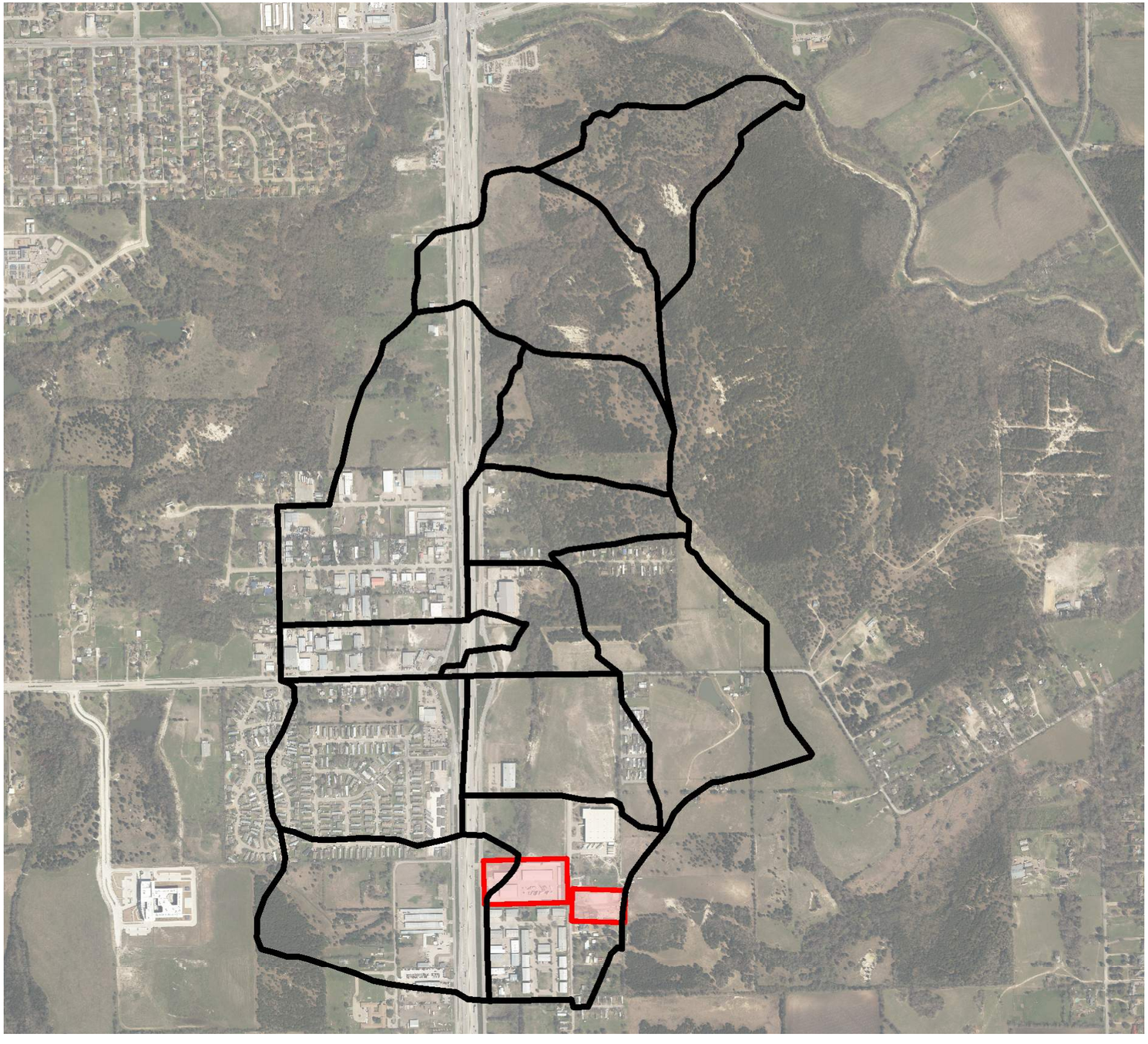
2007



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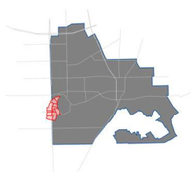
2019

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



1.5 IMPERVIOUS AREA

Impervious areas for the Stream 3A5 watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located around Intersate 35 and the upstream (South) end of the watershed, where a relatively large number of residential and commercial developments are located. Downstream sub-basins have very little if any impervious areas.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

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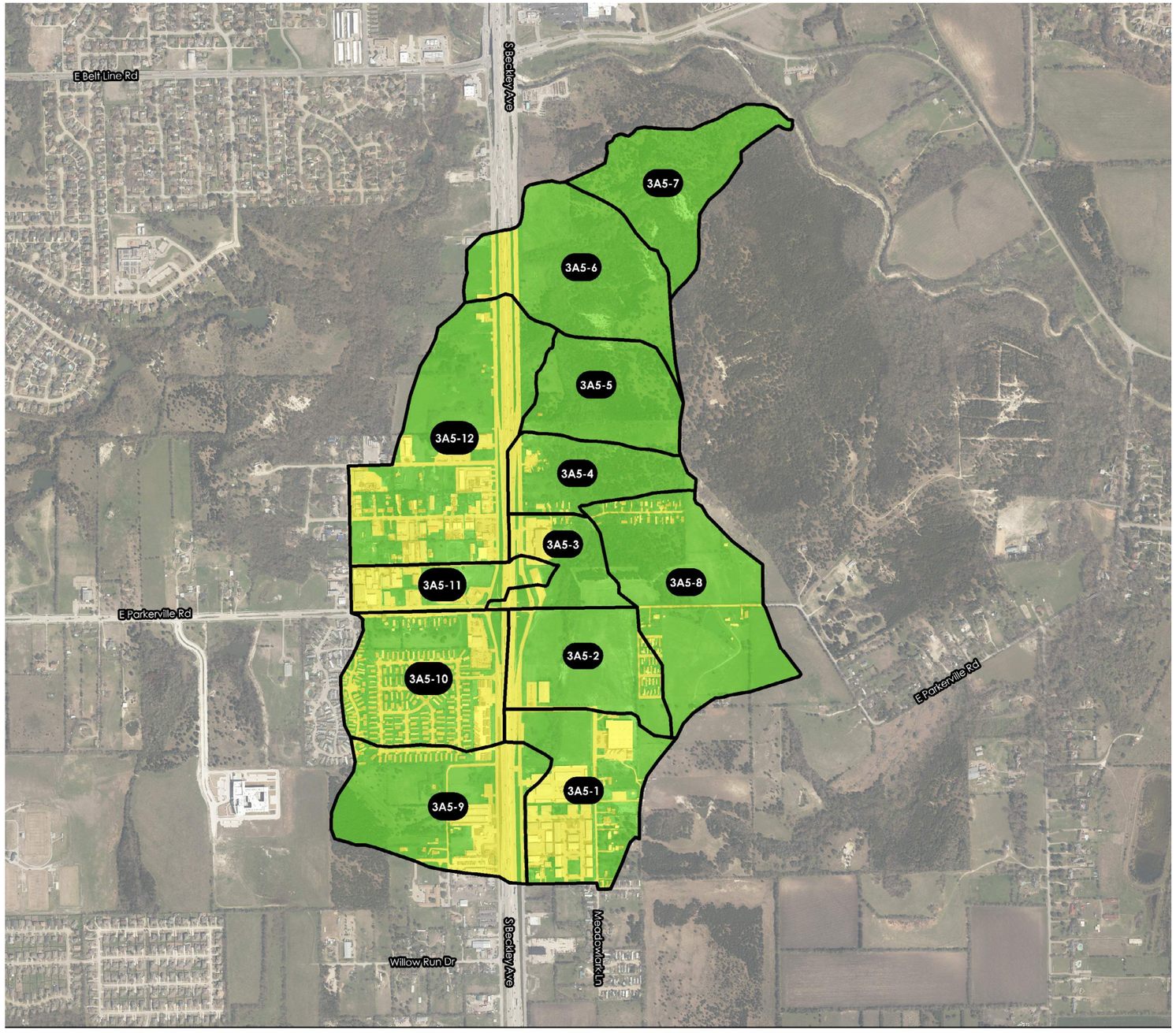


EXISTING PERCENT IMPERVIOUS REPORT

3A5-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	20.7	48.0
OPEN SPACE (FAIR CONDITION)	0	22.7	0.0
		43.4	**48.0**

3A5-2

IMPERVIOUS	100	6.2	18.0
OPEN SPACE (FAIR CONDITION)	0	28.3	0.0
		34.5	**18.0**

3A5-3

IMPERVIOUS	100	5.5	30.1
OPEN SPACE (FAIR CONDITION)	0	12.7	0.0
		18.2	**30.1**

3A5-4

IMPERVIOUS	100	3.0	12.7
OPEN SPACE (FAIR CONDITION)	0	20.9	0.0
		24.0	**12.7**

3A5-5

IMPERVIOUS	100	0.0	0.2
OPEN SPACE (FAIR CONDITION)	0	31.1	0.0
		31.2	**0.2**

3A5-6

IMPERVIOUS	100	3.2	6.5
OPEN SPACE (FAIR CONDITION)	0	46.8	0.0
		50.1	**6.5**

3A5-7

OPEN SPACE (FAIR CONDITION)	0	35.4	0.0
		35.4	**0.0**

3A5-8

IMPERVIOUS	100	2.8	4.7
OPEN SPACE (FAIR CONDITION)	0	56.5	0.0
		59.3	**4.7**

3A5-9

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	17.4	35.3
OPEN SPACE (FAIR CONDITION)	0	31.9	0.0
		49.2	**35.3**

3A5-10

IMPERVIOUS	100	21.5	46.6
OPEN SPACE (FAIR CONDITION)	0	24.6	0.0
		46.2	**46.6**

3A5-11

IMPERVIOUS	100	10.3	56.5
OPEN SPACE (FAIR CONDITION)	0	7.9	0.0
		18.2	**56.5**

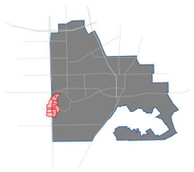
3A5-12

IMPERVIOUS	100	29.7	39.8
OPEN SPACE (FAIR CONDITION)	0	45.0	0.0
		74.7	**39.8**

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



1.6 FUTURE LAND USE MAP

The majority of the watershed is located within City of Lancaster. The existing land use within the watershed consist of mostly Residential and Commercial. The undeveloped areas and set for Residential and Mixed Use zoning based on the provided City zoning data. The aerial imagery generally appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- COMMERCIAL CORRIDOR
- R - URBAN NEIGHBORHOOD
- SURBURBAN MIXED USE CENTER
- PRIVATE OPEN SPACES

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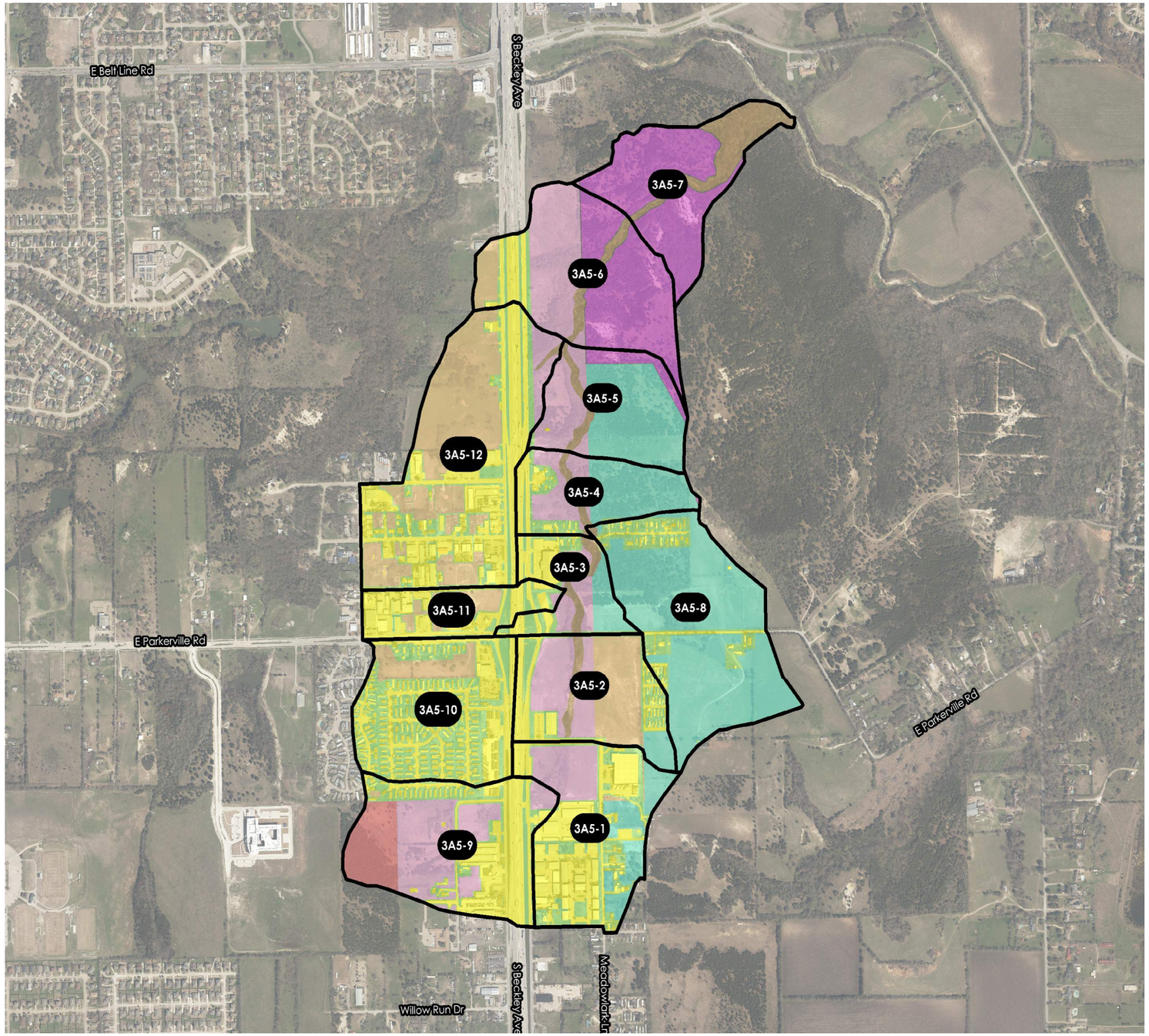


ULTIMATE PERCENT IMPERVIOUS REPORT

3A5-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	20.7	48.0
COMMERCIAL CORRIDOR	85	6.6	13.0
R - RURAL LIVING	12	7.5	2.1
R - SURBURBAN NEIGHBORHOOD	38	0.3	0.3
OPEN SPACE (FAIR CONDITIONS)	0	8.3	0.0
		43.4	**63.4**

3A5-2

IMPERVIOUS	100	6.2	18.0
FLOODPLAIN	0	1.7	0.0
COMMERCIAL CORRIDOR	85	9.5	23.5
R - RURAL LIVING	12	2.3	0.8
R - SURBURBAN NEIGHBORHOOD	38	10.6	11.7
OPEN SPACE (FAIR CONDITIONS)	0	4.2	0.0
		34.5	**54.0**

3A5-3

IMPERVIOUS	100	5.5	30.1
FLOODPLAIN	0	2.3	0.0
COMMERCIAL CORRIDOR	85	4.0	18.5
R - RURAL LIVING	12	3.6	2.4
OPEN SPACE (FAIR CONDITIONS)	0	2.8	0.0
		18.2	**51.0**

3A5-4

IMPERVIOUS	100	3.0	12.7
FLOODPLAIN	0	1.4	0.0
COMMERCIAL CORRIDOR	85	5.7	20.2
PRIVATE OPEN SPACES	0	0.1	0.0
R - RURAL LIVING	12	11.0	5.5
OPEN SPACE (FAIR CONDITIONS)	0	2.7	0.0
		24.0	**38.4**

3A5-5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	0.0	0.2
FLOODPLAIN	0	2.1	0.0
COMMERCIAL CORRIDOR	85	7.6	20.7
PRIVATE OPEN SPACES	0	3.2	0.0
R - RURAL LIVING	12	18.1	6.9
OPEN SPACE (FAIR CONDITIONS)	0	0.2	0.0
		31.2	**27.8**

3A5-6

IMPERVIOUS	100	3.2	6.5
FLOODPLAIN	0	2.7	0.0
COMMERCIAL CORRIDOR	85	15.4	26.1
PRIVATE OPEN SPACES	0	23.8	0.0
R - SURBURBAN NEIGHBORHOOD	38	3.0	2.3
OPEN SPACE (FAIR CONDITIONS)	0	1.9	0.0
		50.1	**34.8**

3A5-7

FLOODPLAIN	0	9.2	0.0
COMMERCIAL CORRIDOR	85	0.1	0.2
PRIVATE OPEN SPACES	0	26.1	0.0
		35.4	**0.2**

3A5-8

IMPERVIOUS	100	2.8	4.7
FLOODPLAIN	0	0.2	0.0
PRIVATE OPEN SPACES	0	0.0	0.0
R - RURAL LIVING	12	48.8	9.9
OPEN SPACE (FAIR CONDITIONS)	0	7.4	0.0
		59.3	**14.6**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

3A5-9

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	17.4	35.3
COMMERCIAL CORRIDOR	85	16.6	28.6
R - SURBURBAN NEIGHBORHOOD	38	0.1	0.1
MIXED USE	85	8.4	14.5
OPEN SPACE (FAIR CONDITIONS)	0	6.8	0.0
		49.2	**78.5**

3A5-10

IMPERVIOUS	100	21.5	46.6
R - SURBURBAN NEIGHBORHOOD	38	4.8	4.0
OPEN SPACE (FAIR CONDITIONS)	0	19.8	0.0
		46.2	**50.6**

3A5-11

IMPERVIOUS	100	10.3	56.5
FLOODPLAIN	0	0.0	0.0
COMMERCIAL CORRIDOR	85	0.2	1.1
R - SURBURBAN NEIGHBORHOOD	38	4.3	9.0
OPEN SPACE (FAIR CONDITIONS)	0	3.4	0.0
		18.2	**66.5**

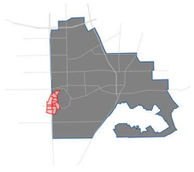
3A5-12

IMPERVIOUS	100	29.7	39.8
FLOODPLAIN	0	0.4	0.0
COMMERCIAL CORRIDOR	85	3.1	3.6
R - SURBURBAN NEIGHBORHOOD	38	31.1	15.8
OPEN SPACE (FAIR CONDITIONS)	0	10.4	0.0
		74.7	**59.1**

WATERSHED NO.
10

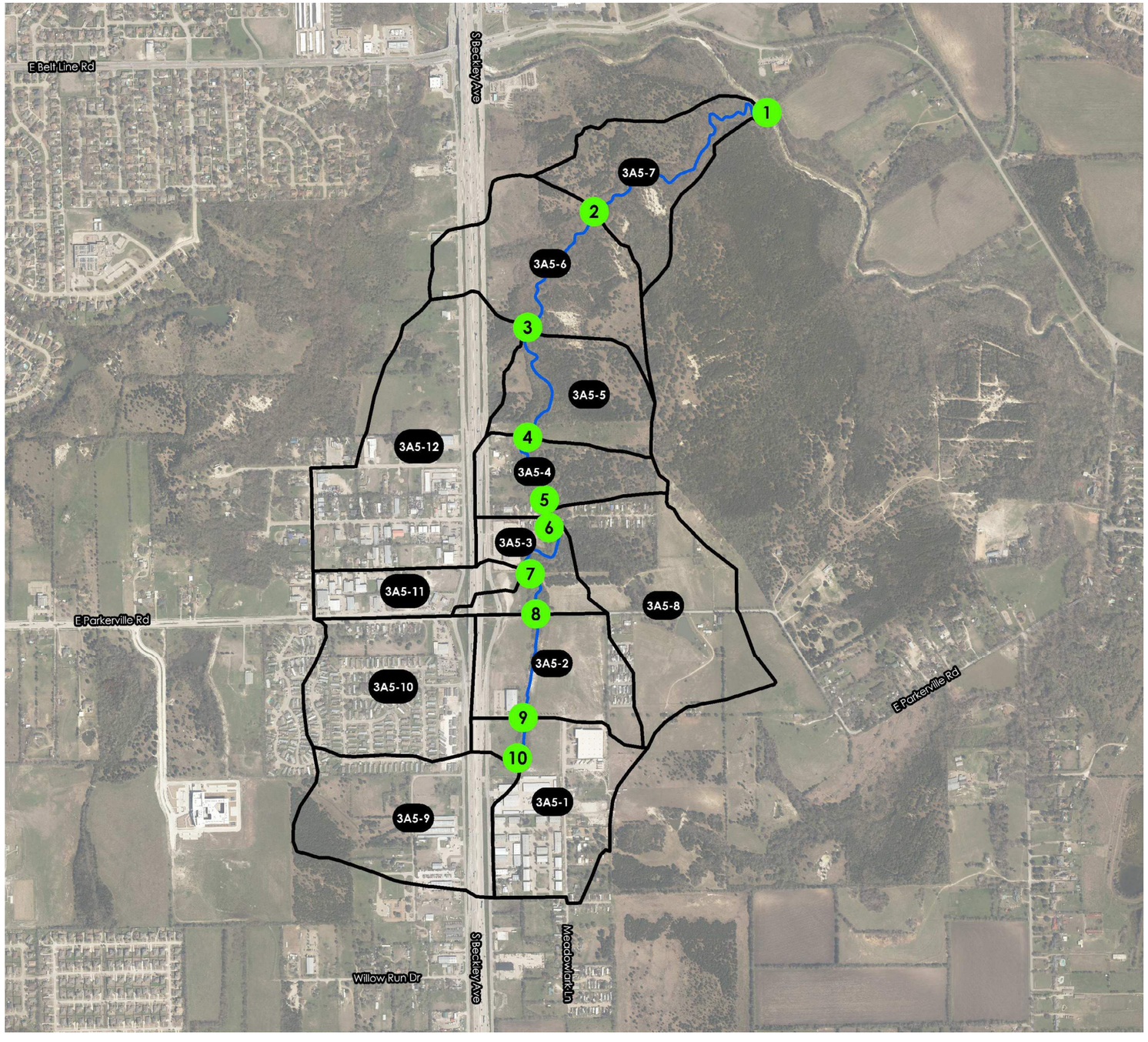
COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



1.7 RESULTS

The flow was analyzed at ten locations for Stream 3A5. Flow location 10 was used to establish flows at the upstream end of the reach. Locations 9, 8, 6 and 4 were used to determine peak discharges going through culverts and bridges. Locations 7 and 5 investigate the effects of minor tributaries flowing into the main channel. Locations 1 and 2 are based on the outlets of their respective drainage areas.



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FLOW ANALYSIS LOCATIONS

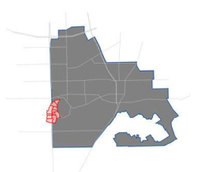
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	3A5-1 - 3A5-12	Main	108.581	0.76	2300
2	3A5-1 - 3A5-6, 3A5-8 - 3A5-12	Main	2617.608	0.70	2300
3	3A5-1 - 3A5-5, 3A5-8 - 3A5-12	Main	4223.485	0.62	2000
4	3A5-1 - 3A5-4, 3A5-8 - 3A5-11	Main	5625.812	0.46	1500
5	3A5-1 - 3A5-3, 3A5-8 - 3A5-11	Main	6357.553	0.42	1650
6	3A5-1 - 3A5-3, 3A5-9 - 3A5-11	Main	6467.985	0.33	1300
7	3A5-1, 3A5-2, 3A5-9 - 3A5-11	Main	7153.324	0.33	1350
8	3A5-1, 3A5-2, 3A5-9	Main	7847.824	0.27	1150
9	3A5-1, 3A5-9	Main	8913.251	0.14	650
10	3A5-9	Main	9090.327	0.08	330

2.0 HYDRAULICS

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



2.1 SITE ASSESSMENT

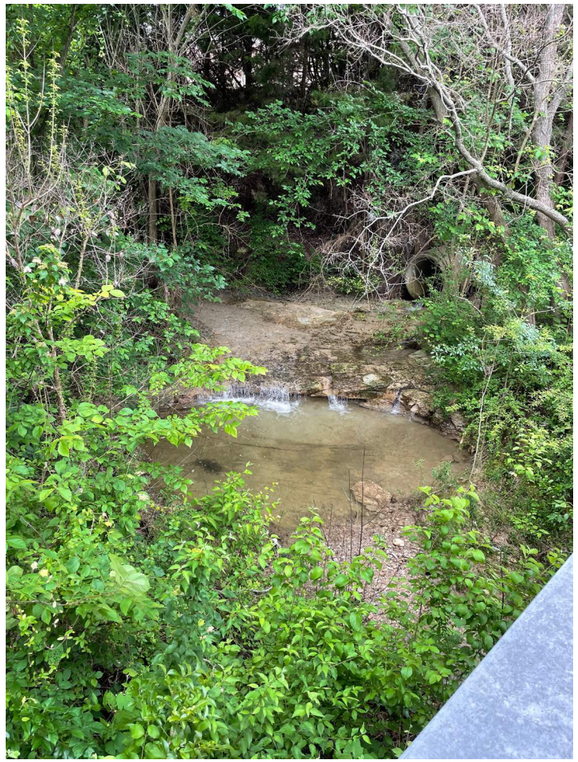
Stream 3A5 is located on the West edge of the City of Lancaster. It flows from South to North for approximately 1.70 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Stream 3A5 within the limits of the City of Lancaster, roughly bound by a location about 200 feet upstream of Meadowlark Lane (upstream end) and the confluence with Ten Mile Creek (downstream end). The channel slope averages around 1.0-1.8%. Stream 3A5 itself is generally in a natural state with very few man-made alterations. There are, however, a few places where the overbanks include nearby structures, and there are four (4) road crossings throughout the watershed. Otherwise the area is heavily wooded - especially near Ten Mile Creek.



Looking downstream of Meadowlark Lane Culvert. Area has heavy vegetation in the main channel with light vegetation on overbanks.



Looking at the upstream face of the Meadowlark Lane culvert. The stream channel appears to be relatively rocky with shrubs and small trees growing. in and around the channel as well. The culvert overtops in heavy flooding events.



Looking upstream of the Parkerville Road Bridge. The upstream area is still very rocky. The vegetation seems to be limited to the overbanks.

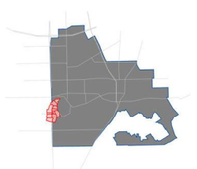


Looking downstream of the Parkerville Road Bridge. This shows similar channel conditions. Parkerville Road Bridge is not anticipated to experience overtopping in any of the studied flood events.

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

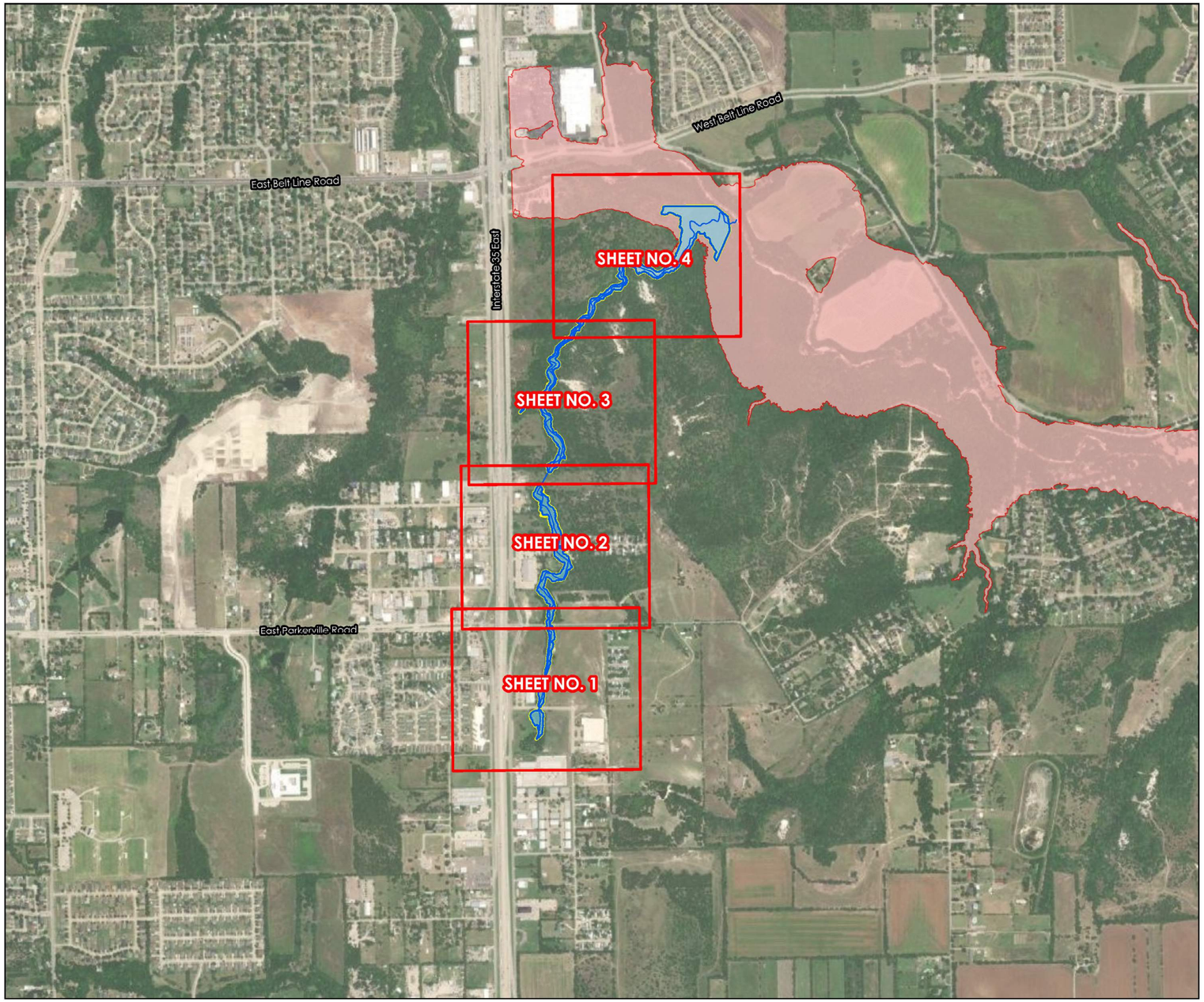
TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



2.2 FLOODPLAIN MAPPING

The Stream 3A5 hydraulics were analyzed with HEC-RAS 5.0.7. The model for Stream 3A5 is comprised of one stream, one reach, fourty-four (44) cross sections, and four (4) hydraulic structures. The studied stream is 8,873 feet (1.70 miles) long. Except near the confluence of the stream with Ten Mile Creek, the Stream 3A5 floodplain remains within the channel.

The floodplain sheets for Stream 3A5 display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.



STREAM CENTERLINE
STREAM 3A5 VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

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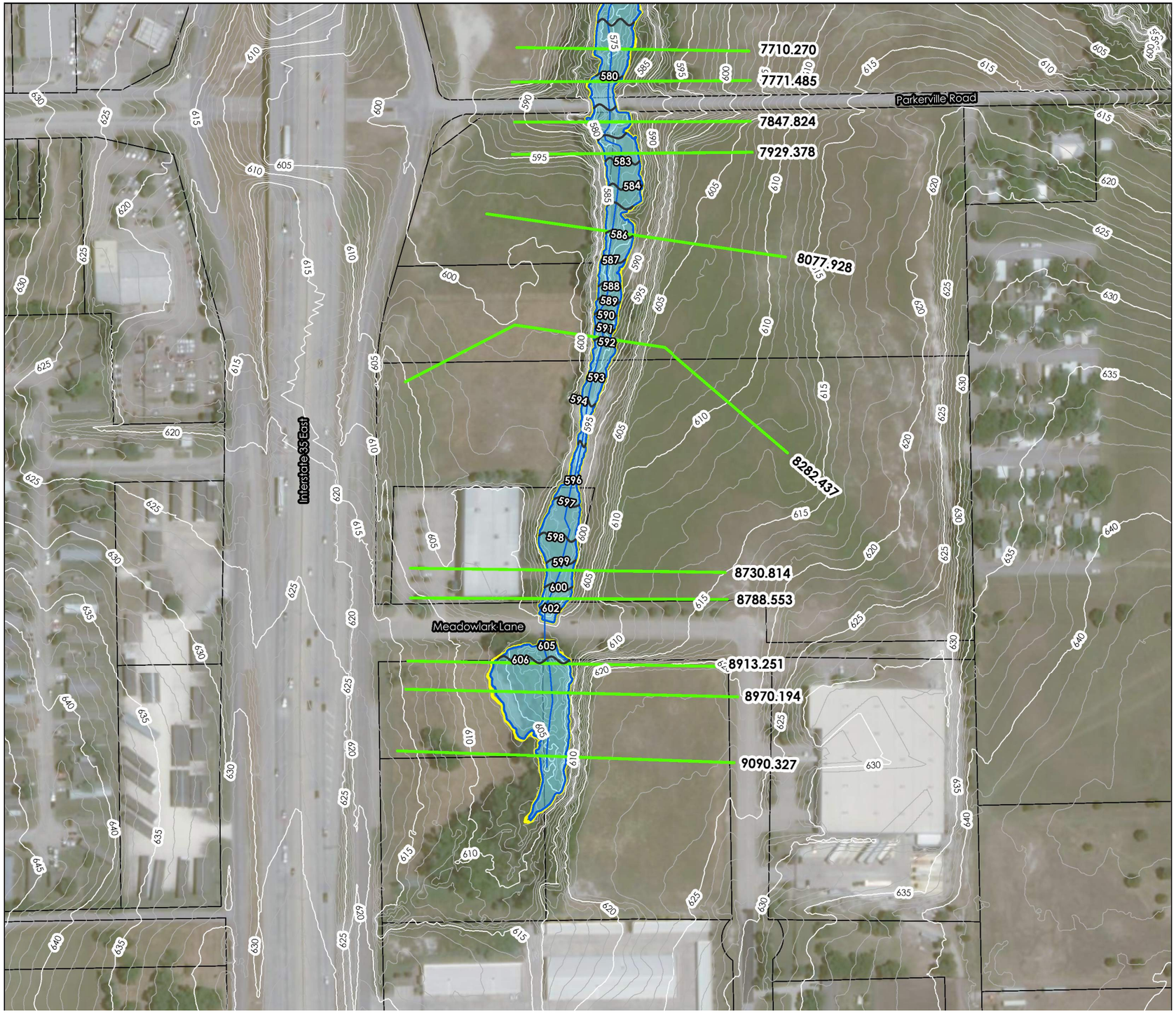
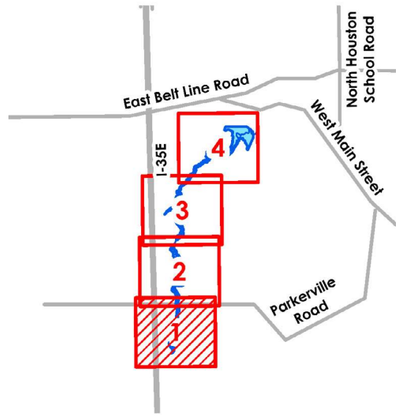
N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200 Feet

STREAM 3A5 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
STREAM 3A5 BASE FLOW ELEVATIONS
PARCEL

STREAM 3A5

2.0 HYDRAULICS

WATERSHED NO.

10

COUNCIL DISTRICTS

1 AND 2

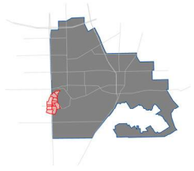
TOTAL DRAINAGE AREA

0.76 SM

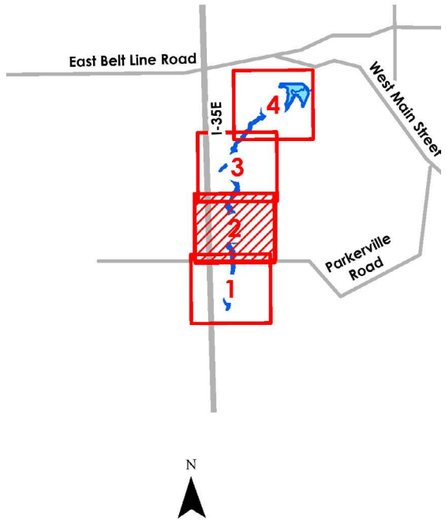
*

STREAM LENGTH

1.70 MI

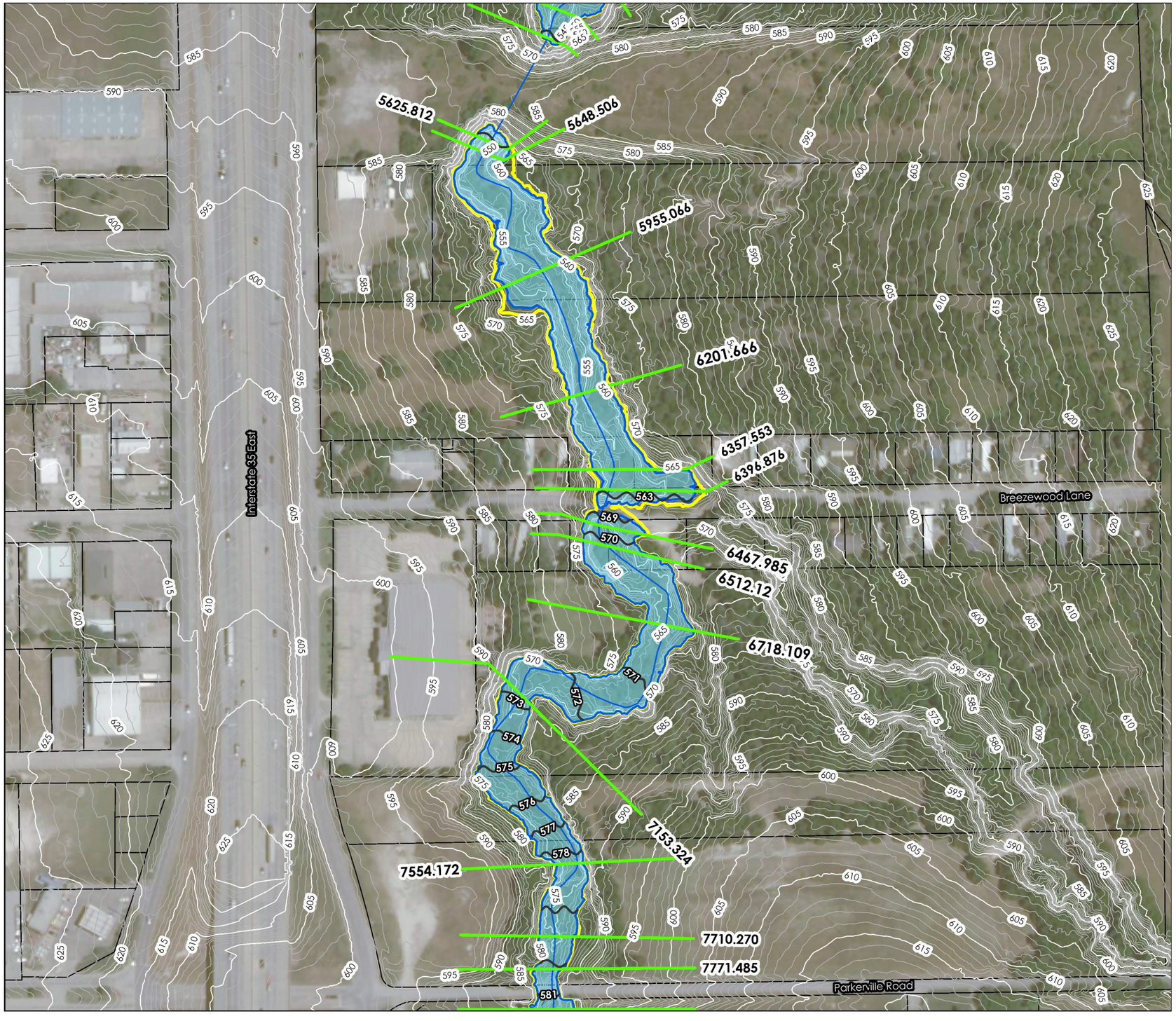


FLOODPLAIN: SHEET 2

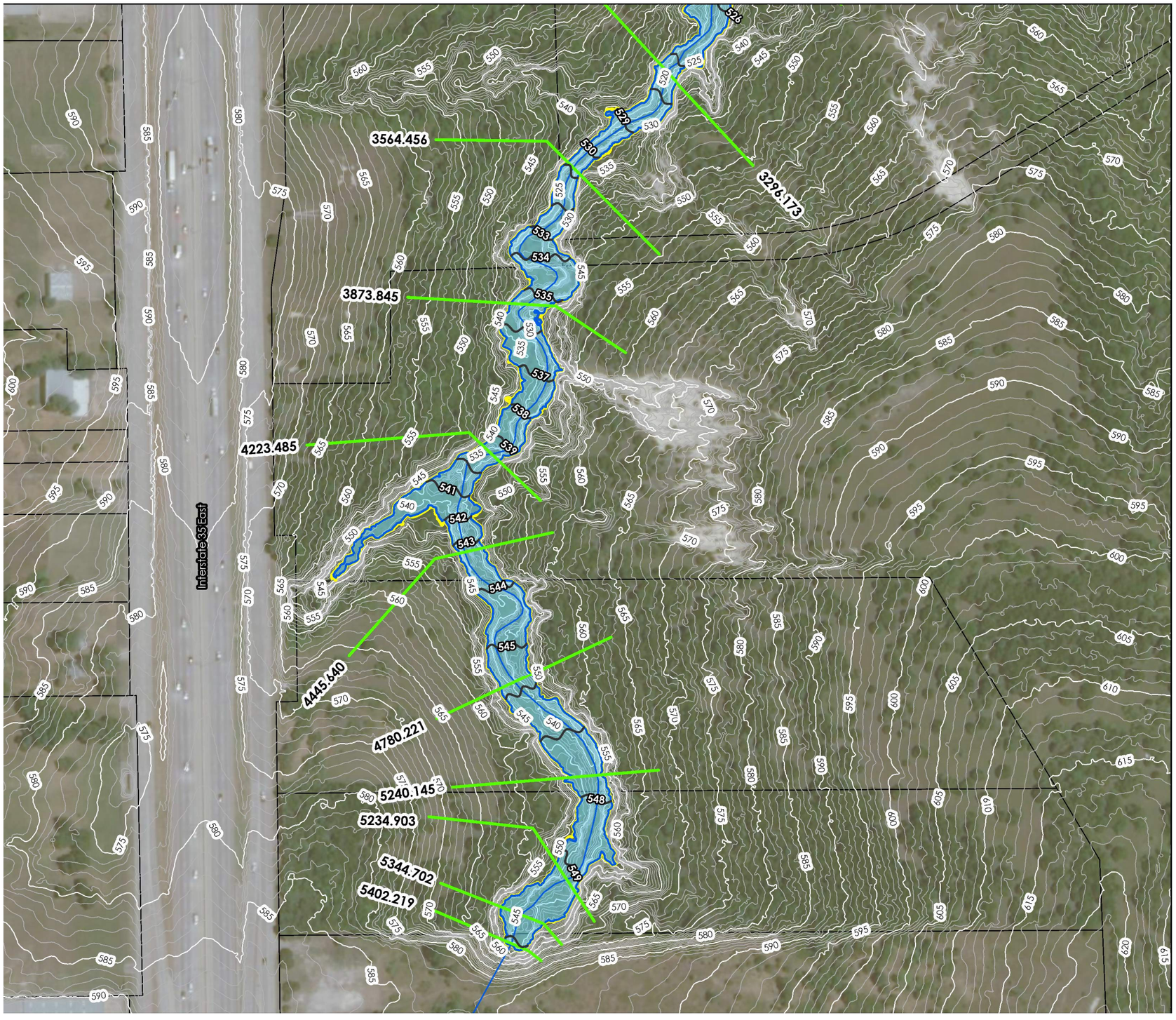


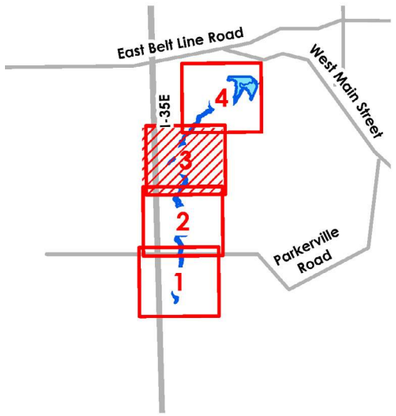
- STREAM 3A5 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- STREAM 3A5 BASE FLOW ELEVATIONS
- PARCEL

0



FLOODPLAIN: SHEET 3





N

0 100 200
Feet

STREAM 3A5 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
STREAM 3A5 BASE FLOW ELEVATIONS
PARCEL

STREAM 3A5

2.0 HYDRAULICS

WATERSHED NO.

10

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

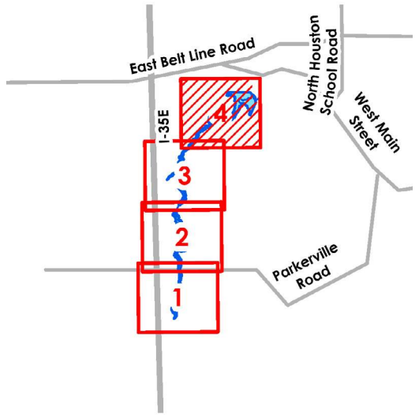
0.76 SM

*

STREAM LENGTH

1.70 MI

FLOODPLAIN: SHEET 4



N

0 100 200 Feet

STREAM 3A5 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
STREAM 3A5 BASE FLOW ELEVATIONS
PARCEL

0

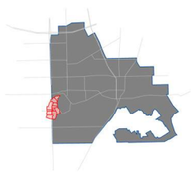




WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	603.78	604.50	2.30	2.68
8970.194	603.73	604.50	0.79	0.78
8913.251	603.68	604.46	1.31	1.27
8853.282	KIRKLAND DRIVE			
8788.553	599.62	599.82	5.63	5.92
8730.814	598.42	598.58	5.07	5.51
8282.437	590.79	590.99	5.85	6.30
8077.928	585.08	585.26	5.37	5.68
7929.378	581.73	581.85	4.72	5.13
7847.824	579.28	579.70	2.43	2.70
7817.758	PARKERVILLE ROAD			
7771.485	578.45	578.70	4.58	5.18
7710.270	577.30	577.70	5.40	5.22
7554.172	576.07	576.46	3.47	3.83
7153.324	571.07	571.34	6.79	7.23
6718.109	568.11	568.49	2.33	2.54
6512.120	568.14	568.50	0.71	0.92
6467.985	568.08	568.43	1.66	2.09
6438.188	BREEZEWOOD LANE			
6396.876	558.20	558.75	8.51	9.43
6357.553	558.16	558.88	2.68	2.81
6201.666	557.60	558.29	3.59	4.04
5955.066	555.75	556.12	5.48	6.23
5648.506	553.35	554.58	4.06	3.59
5625.812	553.35	554.56	2.99	3.15
5532.945	PRIVATE CROSSING			
5402.219	547.52	547.98	8.09	8.56
5344.702	546.75	547.29	3.08	3.24
5234.903	546.48	547.01	2.71	2.99
5021.160	545.21	545.67	5.31	5.61
4780.221	542.88	543.36	4.53	4.89
4445.640	540.33	540.80	4.52	4.97
4223.485	536.45	536.85	8.14	8.63
3873.845	531.23	531.83	4.17	4.38
3564.456	526.74	527.29	9.71	10.36

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	523.71	524.23	5.30	5.86
2973.352	519.66	520.35	7.31	7.46
2617.608	516.76	517.53	5.12	5.55
2364.684	515.89	516.61	4.00	4.45
2086.808	515.16	515.85	3.56	3.91
1741.898	513.31	513.89	5.52	5.88
1489.504	512.59	512.88	3.07	3.83
1210.099	512.48	512.69	1.71	2.23
941.2197	512.46	512.65	0.99	1.30
766.9562	512.45	512.64	0.75	0.98
536.8826	512.44	512.62	0.69	0.89
407.6628	512.44	512.62	0.49	0.64
108.5814	512.44	512.62	0.11	0.14

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	604.50	605.19	2.48	2.62
8970.194	604.50	605.22	0.72	0.70
8913.251	604.46	605.18	1.27	1.26
8853.282	KIRKLAND DRIVE			
8788.553	599.82	600.03	5.92	5.99
8730.814	598.57	598.72	5.56	5.93
8282.437	591.00	591.17	6.25	6.64
8077.928	585.27	585.42	5.64	5.92
7929.378	581.85	581.96	5.09	5.45
7847.824	579.74	580.12	2.73	2.99
7817.758	PARKERVILLE ROAD			
7771.485	578.72	578.97	5.24	5.75
7710.270	577.74	578.08	5.23	5.29
7554.172	576.51	576.91	3.85	4.15
7153.324	571.41	571.71	7.23	7.58
6718.109	568.75	569.10	2.39	2.62
6512.120	568.76	569.11	0.96	1.15
6467.985	568.67	569.00	2.14	2.51
6438.188	BREEZEWOOD LANE			
6396.876	558.91	559.52	9.69	10.11
6357.553	559.12	559.67	2.88	2.99
6201.666	558.51	559.00	4.20	4.41
5955.066	556.26	557.02	6.42	5.49
5648.506	554.86	556.18	3.51	3.33
5625.812	554.84	556.15	3.17	3.39
5532.945	PRIVATE CROSSING			
5402.219	548.05	548.51	8.77	9.49
5344.702	547.40	547.95	3.28	3.48
5234.903	547.12	547.65	3.04	3.37
5021.160	545.78	546.25	5.63	5.97
4780.221	543.44	544.02	4.99	5.25
4445.640	541.01	541.47	4.89	5.48
4223.485	537.14	537.47	8.80	9.28
3873.845	532.20	532.70	4.54	4.79
3564.456	527.68	528.20	10.65	11.10

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	524.49	524.95	6.13	6.53
2973.352	520.70	521.30	7.54	7.63
2617.608	517.95	518.56	5.73	6.07
2364.684	517.01	517.57	4.64	5.04
2086.808	516.26	516.77	4.02	4.35
1741.898	514.73	515.11	5.07	5.43
1489.504	514.22	514.45	3.10	3.64
1210.099	514.07	514.23	1.99	2.39
941.2197	514.05	514.20	1.14	1.38
766.9562	514.04	514.19	0.87	1.05
536.8826	514.03	514.18	0.73	0.86
407.6628	514.03	514.18	0.53	0.64
108.5814	514.03	514.18	0.14	0.17

WATERSHED NO.

10

COUNCIL DISTRICTS

1 AND 2

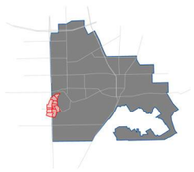
TOTAL DRAINAGE AREA

0.76 SM

*

STREAM LENGTH

1.70 MI



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	605.59	605.92	2.32	2.63
8970.194	605.62	605.96	0.60	0.66
8913.251	605.58	605.92	1.25	1.28
8853.282	KIRKLAND DRIVE			
8788.553	600.11	600.25	6.16	6.39
8730.814	598.78	598.92	6.20	6.48
8282.437	591.29	591.44	6.76	7.11
8077.928	585.51	585.63	6.00	6.33
7929.378	582.04	582.13	5.53	5.84
7847.824	580.27	580.62	3.09	3.33
7817.758	PARKERVILLE ROAD			
7771.485	579.07	579.33	5.92	6.31
7710.270	578.21	578.55	5.31	5.38
7554.172	577.05	577.44	4.27	4.53
7153.324	571.85	572.20	7.57	7.62
6718.109	569.07	569.22	2.88	3.35
6512.120	569.08	569.24	1.14	1.30
6467.985	568.98	569.11	2.49	2.82
6438.188	BREEZEWOOD LANE			
6396.876	559.46	559.89	10.14	10.41
6357.553	559.70	560.01	3.09	3.27
6201.666	558.97	559.22	4.64	4.93
5955.066	557.39	557.88	4.82	4.59
5648.506	556.75	557.32	3.22	3.24
5625.812	556.70	557.26	3.40	3.52
5532.945	PRIVATE CROSSING			
5402.219	548.66	548.88	9.73	10.07
5344.702	548.13	548.38	3.54	3.63
5234.903	547.82	548.07	3.48	3.63
5021.160	546.41	546.63	6.06	6.20
4780.221	544.18	544.43	5.37	5.50
4445.640	541.76	542.10	5.45	5.53
4223.485	537.81	538.07	9.56	9.99
3873.845	533.16	533.62	5.00	5.17
3564.456	528.68	529.08	11.48	11.93

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	525.46	525.82	6.96	7.24
2973.352	521.98	522.44	7.73	7.79
2617.608	519.35	519.81	6.32	6.58
2364.684	518.36	518.75	5.35	5.69
2086.808	517.61	517.94	4.47	4.76
1741.898	516.46	516.68	4.59	4.92
1489.504	516.05	516.18	3.21	3.58
1210.099	515.89	515.98	2.14	2.41
941.2197	515.87	515.95	1.30	1.46
766.9562	515.86	515.94	1.00	1.13
536.8826	515.86	515.94	0.72	0.81
407.6628	515.86	515.94	0.54	0.60
108.5814	515.86	515.94	0.17	0.19

2.3 HYDRAULIC RESULTS: 10-YEAR

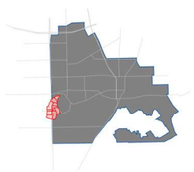
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	605.98	606.16	2.45	2.76
8970.194	606.01	606.20	0.62	0.71
8913.251	605.97	606.16	1.29	1.37
8853.282	KIRKLAND DRIVE			
8788.553	600.27	600.40	6.45	6.66
8730.814	598.95	599.06	6.51	6.78
8282.437	591.47	591.62	7.13	7.41
8077.928	585.67	585.76	6.29	6.61
7929.378	582.17	582.25	5.80	6.10
7847.824	580.56	580.90	3.29	3.54
7817.758	PARKERVILLE ROAD			
7771.485	579.28	579.55	6.25	6.61
7710.270	578.49	578.83	5.36	5.46
7554.172	577.37	577.70	4.48	4.81
7153.324	572.15	572.35	7.55	7.88
6718.109	569.23	569.52	3.22	3.41
6512.120	569.24	569.53	1.30	1.49
6467.985	569.11	569.36	2.82	3.18
6438.188	BREEZEWOOD LANE			
6396.876	559.89	560.41	10.41	10.77
6357.553	560.06	560.56	3.29	3.47
6201.666	559.27	559.79	4.95	5.04
5955.066	558.15	559.06	4.25	3.82
5648.506	557.67	558.71	3.19	3.05
5625.812	557.59	558.62	3.53	3.51
5532.945	PRIVATE CROSSING			
5402.219	548.95	549.22	10.27	10.61
5344.702	548.48	548.77	3.66	3.76
5234.903	548.17	548.44	3.70	3.87
5021.160	546.72	546.97	6.25	6.40
4780.221	544.56	544.86	5.53	5.63
4445.640	542.17	542.53	5.68	5.79
4223.485	538.15	538.44	9.98	10.38
3873.845	533.70	534.16	5.20	5.38
3564.456	529.19	529.65	11.94	12.28

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	525.93	526.37	7.34	7.67
2973.352	522.60	523.18	7.80	7.83
2617.608	520.03	520.57	6.57	6.88
2364.684	519.01	519.45	5.68	6.11
2086.808	518.26	518.62	4.68	5.05
1741.898	517.23	517.46	4.48	4.87
1489.504	516.83	516.98	3.35	3.73
1210.099	516.69	516.80	2.25	2.52
941.2197	516.67	516.78	1.39	1.57
766.9562	516.66	516.77	1.08	1.22
536.8826	516.66	516.77	0.71	0.79
407.6628	516.66	516.77	0.54	0.60
108.5814	516.66	516.77	0.19	0.21

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	606.22	606.35	2.70	2.99
8970.194	606.26	606.40	0.70	0.78
8913.251	606.21	606.35	1.41	1.50
8853.282	**KIRKLAND DRIVE**			
8788.553	600.45	600.55	6.72	6.97
8730.814	599.13	599.23	6.76	7.03
8282.437	591.69	591.82	7.44	7.71
8077.928	585.82	585.92	6.63	6.90
7929.378	582.30	582.38	6.12	6.36
7847.824	580.96	581.29	3.58	3.83
7817.758	**PARKERVILLE ROAD**			
7771.485	579.60	579.87	6.66	6.96
7710.270	578.89	579.23	5.47	5.57
7554.172	577.76	578.12	4.86	5.12
7153.324	572.41	572.66	7.92	8.30
6718.109	569.62	569.82	3.42	3.80
6512.120	569.62	569.84	1.56	1.66
6467.985	569.44	569.64	3.30	3.47
6438.188	**BREEZEWOOD LANE**			
6396.876	560.56	560.82	10.89	11.24
6357.553	560.87	561.53	3.42	3.29
6201.666	560.22	561.07	4.74	4.24
5955.066	559.74	560.81	3.41	3.00
5648.506	559.45	560.59	2.97	2.85
5625.812	559.37	560.50	3.50	3.48
5532.945	**PRIVATE CROSSING**			
5402.219	549.40	549.68	10.85	11.14
5344.702	548.97	549.25	3.83	3.93
5234.903	548.63	548.90	3.98	4.14
5021.160	547.15	547.39	6.49	6.63
4780.221	545.08	545.37	5.69	5.79
4445.640	542.69	543.03	5.99	6.14
4223.485	538.61	538.87	10.45	10.80
3873.845	534.37	534.81	5.46	5.60
3564.456	529.87	530.26	12.40	12.74

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	526.54	526.87	7.79	8.06
2973.352	523.43	523.86	7.79	7.83
2617.608	520.93	521.32	6.81	7.06
2364.684	519.88	520.18	6.05	6.41
2086.808	519.16	519.40	4.87	5.18
1741.898	518.34	518.49	4.25	4.56
1489.504	518.00	518.09	3.43	3.75
1210.099	517.89	517.95	2.33	2.56
941.2197	517.87	517.93	1.49	1.63
766.9562	517.87	517.93	1.13	1.23
536.8826	517.87	517.93	0.66	0.72
407.6628	517.87	517.93	0.51	0.56
108.5814	517.87	517.93	0.20	0.22

2.3 HYDRAULIC RESULTS: 50-YEAR

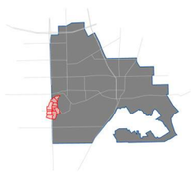
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	606.39	606.50	2.82	3.09
8970.194	606.43	606.55	0.75	0.83
8913.251	606.39	606.50	1.51	1.60
8853.282	KIRKLAND DRIVE			
8788.553	600.59	600.69	6.93	7.16
8730.814	599.28	599.37	6.97	7.21
8282.437	591.86	591.98	7.68	7.95
8077.928	585.95	586.04	6.89	7.11
7929.378	582.42	582.49	6.32	6.58
7847.824	581.24	581.64	3.79	4.09
7817.758	PARKERVILLE ROAD			
7771.485	579.83	580.17	6.92	7.25
7710.270	579.18	579.58	5.56	5.70
7554.172	578.05	578.45	5.11	5.47
7153.324	572.60	572.86	8.21	8.60
6718.109	569.90	570.11	3.58	3.97
6512.120	569.90	570.13	1.69	1.81
6467.985	569.70	569.90	3.52	3.74
6438.188	BREEZEWOOD LANE			
6396.876	560.90	562.36	11.33	9.21
6357.553	561.67	562.88	3.27	2.92
6201.666	561.24	562.63	4.18	3.55
5955.066	560.99	562.51	2.96	2.57
5648.506	560.79	562.36	2.83	2.62
5625.812	560.69	562.25	3.48	3.37
5532.945	PRIVATE CROSSING			
5402.219	549.73	550.04	11.19	11.40
5344.702	549.29	549.57	3.95	4.05
5234.903	548.94	549.21	4.17	4.34
5021.160	547.43	547.67	6.66	6.82
4780.221	545.42	545.72	5.81	5.90
4445.640	543.06	543.40	6.20	6.35
4223.485	538.93	539.19	10.76	11.11
3873.845	534.86	535.30	5.62	5.74
3564.456	530.35	530.73	12.69	13.03

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	526.96	527.45	8.14	8.45
2973.352	524.00	524.70	7.81	7.67
2617.608	521.56	522.12	6.98	7.24
2364.684	520.48	520.84	6.34	6.87
2086.808	519.77	520.02	5.03	5.50
1741.898	519.05	519.16	4.22	4.70
1489.504	518.74	518.79	3.51	3.85
1210.099	518.63	518.66	2.41	2.66
941.2197	518.62	518.65	1.57	1.73
766.9562	518.62	518.65	1.11	1.22
536.8826	518.62	518.65	0.63	0.69
407.6628	518.62	518.65	0.50	0.55
108.5814	518.62	518.65	0.22	0.24

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



2.3 HYDRAULIC RESULTS: 100-YEAR

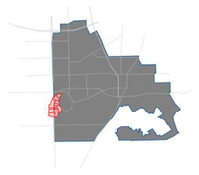
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
9090.327	606.50	606.68	2.99	3.09
8970.194	606.54	606.73	0.81	0.87
8913.251	606.49	606.66	1.64	1.80
8853.282	KIRKLAND DRIVE			
8788.553	600.73	600.90	7.11	7.42
8730.814	599.40	599.59	7.20	7.48
8282.437	592.02	592.23	7.94	8.29
8077.928	586.08	586.25	7.08	7.38
7929.378	582.52	582.66	6.54	6.85
7847.824	581.50	581.86	3.99	4.25
7817.758	PARKERVILLE ROAD			
7771.485	580.05	580.36	7.14	7.40
7710.270	579.45	579.80	5.65	5.79
7554.172	578.32	578.65	5.33	5.68
7153.324	572.78	572.99	8.48	8.78
6718.109	570.13	570.31	3.76	4.06
6512.120	570.13	570.32	1.81	1.90
6467.985	569.91	570.08	3.73	3.89
6438.188	BREEZEWOOD LANE			
6396.876	562.22	563.95	9.45	5.75
6357.553	562.77	564.10	2.96	2.62
6201.666	562.50	563.93	3.61	3.13
5955.066	562.37	563.86	2.61	2.32
5648.506	562.22	563.74	2.64	2.46
5625.812	562.11	563.64	3.38	3.26
5532.945	PRIVATE CROSSING			
5402.219	550.01	550.23	11.40	11.69
5344.702	549.55	549.78	4.04	4.13
5234.903	549.19	549.41	4.33	4.46
5021.160	547.65	547.84	6.81	6.94
4780.221	545.70	545.94	5.90	5.98
4445.640	543.40	543.66	6.30	6.44
4223.485	539.22	539.41	11.07	11.35
3873.845	535.32	535.63	5.76	5.86
3564.456	530.79	531.19	12.95	12.92

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
3296.173	527.39	527.81	8.41	8.68
2973.352	524.67	525.14	7.61	7.69
2617.608	522.20	522.64	7.05	7.28
2364.684	521.02	521.33	6.63	7.09
2086.808	520.31	520.53	5.20	5.60
1741.898	519.64	519.76	4.27	4.65
1489.504	519.35	519.44	3.64	3.87
1210.099	519.25	519.33	2.51	2.67
941.2197	519.25	519.33	1.63	1.73
766.9562	519.25	519.33	1.10	1.17
536.8826	519.25	519.33	0.62	0.66
407.6628	519.25	519.33	0.50	0.53
108.5814	519.25	519.33	0.23	0.24

WATERSHED NO.
10

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.76 SM
*
STREAM LENGTH
1.70 MI



3.1 RISK IDENTIFICATION

Six risk areas were identified in this study. The risks include two over-topping bridges and four locations of erosive velocities. No structures are within the mapped Stream 3A5 floodplain. The two over-topping bridges, Breezewood Lane and Kirkland Drive, are both anticipated to over-top frequently. However, both are low traffic roads. The four areas where erosion is likely are located away from major development with the exception of the potential erosion area near River Station 5735. River Station 5735 may threaten a nearby structure in the future. The following map shows the shear stresses associated with the Stream 3A5 floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Very Low
2	River Station 3139	Potential Erosion Hot Spot	1-Year	Private	Very Low
3	Breezewood Lane	Over-topping Bridge	1-Year	Public	High
4	River Station 5735	Potential Erosion Hot Spot	1-Year	Private	Medium
5	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Low
6	Kirkland Drive (Meadowlark Lane)	Over-topping Bridge	5-Year	Public	Medium



WATERSHED NO. 10 STREAM 3A5

STREAM 3A6

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1

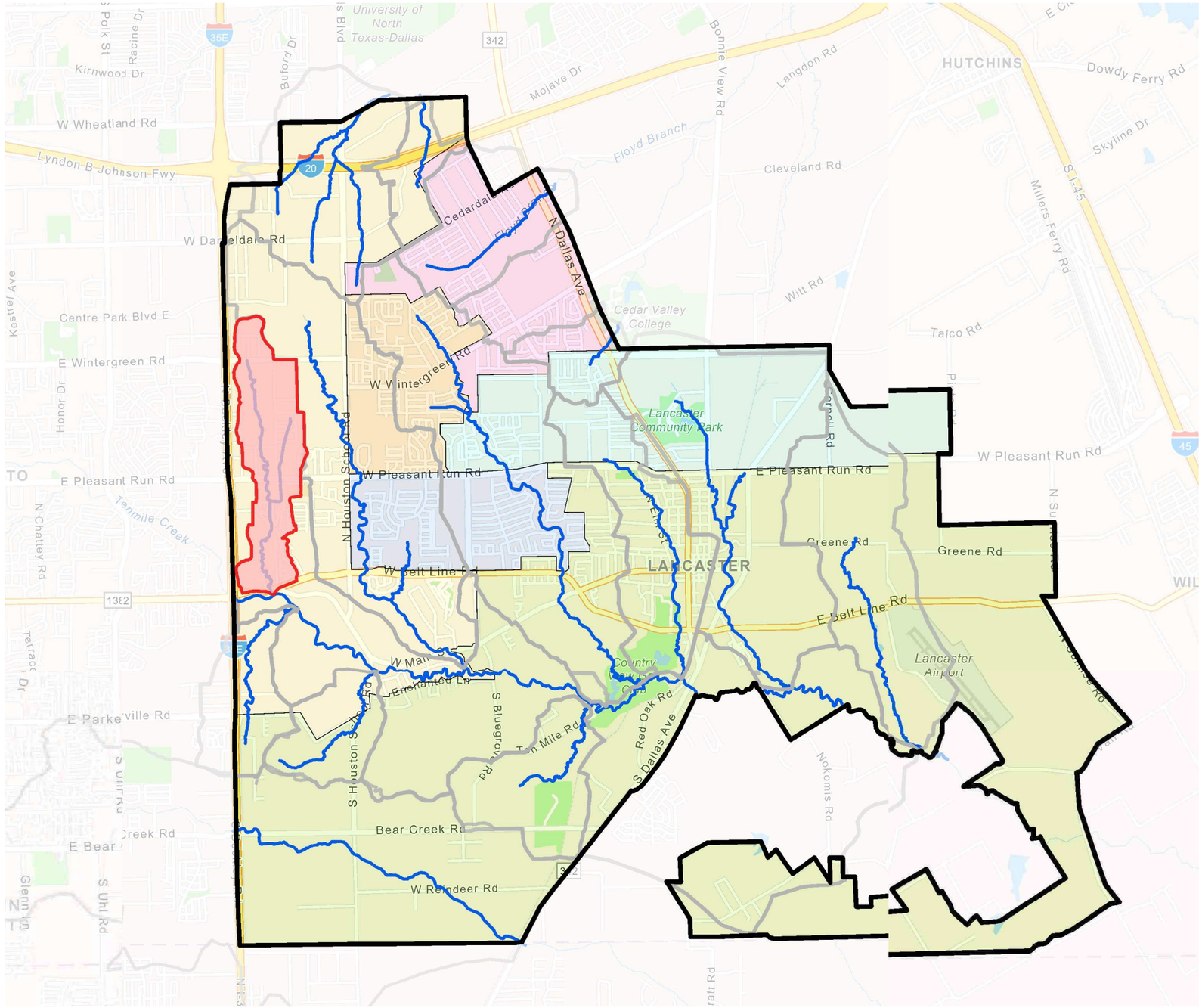


- STREAM 3A6
- STREAM CENTERLINE

COUNCIL DISTRICT
- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

STREAM 3A6 WATERSHED

Located south near Interstate 35, this 0.75-square-mile watershed originates north of West Pleasant Road. As it winds south for about 1.75 miles, it's mainly wooded and open, with pockets of residential and commercial zones.



WATERSHED NO. 11

STREAM 3A6

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WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



1.1 DRAINAGE AREA MAP

The drainage area divides for the Stream 3A6 watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into twelve (12) sub-basins. Sub-basins are designated M1 through M8 and T1 through T4. The total watershed drainage area is 616.42 acres (0.96 square-miles). All of the drainage area is located within the Lancaster City Limits. Figure 2, shown below, provides an overview of the drainage sub-basin layout for Stream 3A6 with in the City of Lancaster.

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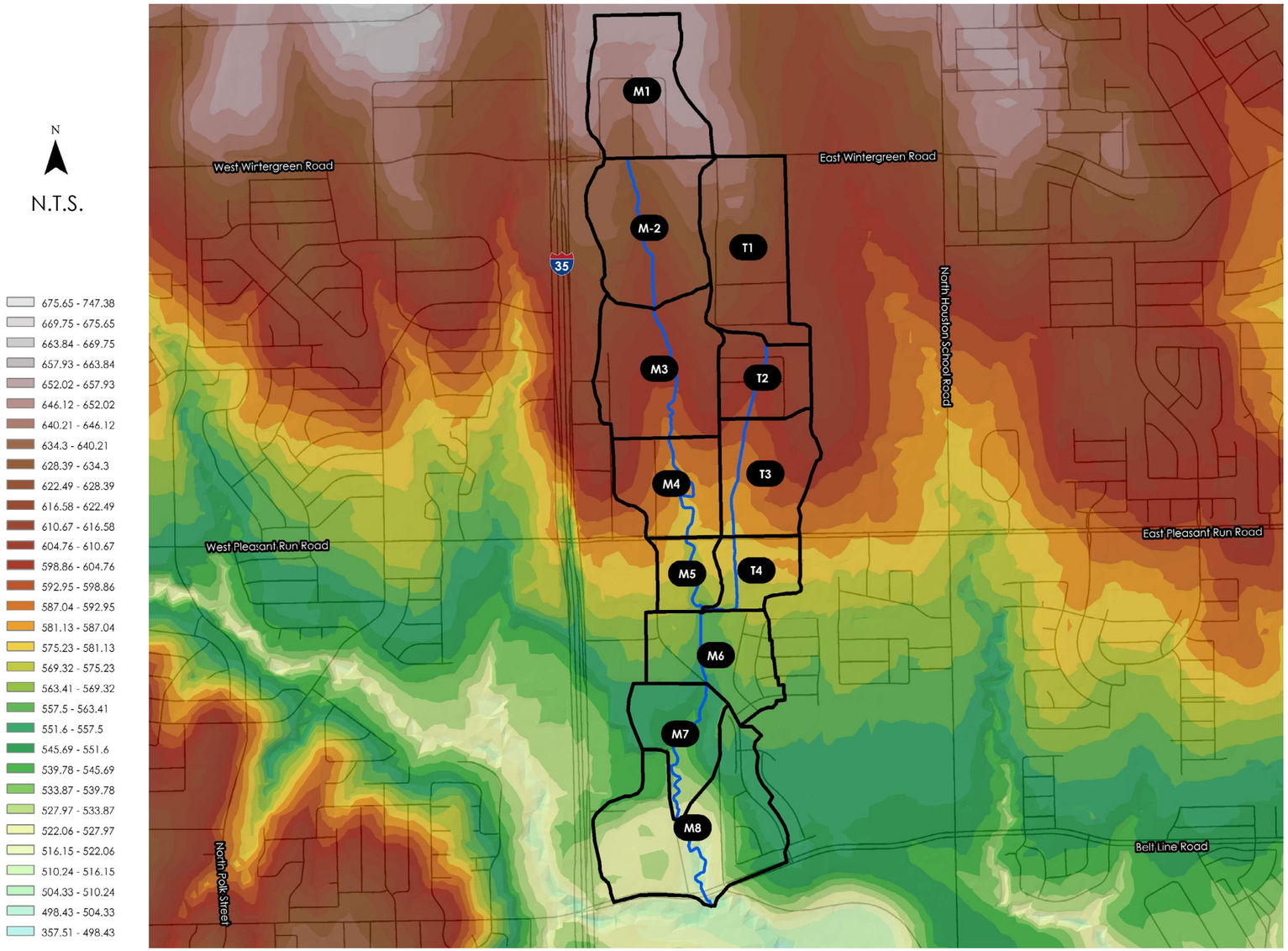


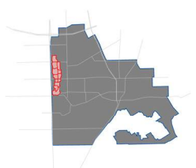
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
M1	0.0973	84	45	77.8	22.40	13.44	17.45	10.47
M2	0.1067	84	14.2	62.9	22.62	13.57	18.43	11.06
M3	0.1126	84	18.9	50.5	25.17	15.1	20.00	12
M4	0.0669	83.9	17.8	44.8	18.08	10.85	14.23	8.54
M5	0.0315	82.1	18.3	61.7	26.00	15.6	19.98	11.99
M6	0.0766	82.8	62.3	63	20.12	12.07	16.78	10.07
M7	0.0571	83.1	43.1	57.8	20.23	12.14	15.65	9.39
M8	0.1477	81	50.6	56.6	15.68	9.41	12.45	7.47
T1	0.1052	84	31.8	76.5	28.53	17.12	23.38	14.03
T2	0.0498	84	22.7	40.5	18.73	11.24	14.75	8.85
T3	0.0734	84	19.8	37.4	17.25	10.35	13.83	8.3
T4	0.0385	83.9	29	60.4	18.55	11.13	14.38	8.63

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



1.2 TIME OF CONCENTRATION

The Times of Concentration for Stream 3A6 were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Stream 3A6 is thick with vegetation, though at times, the channel becomes concrete lined when it runs through developed residential areas. In the undeveloped portions of the stream, the overbanks are slightly wooded. Overall, the heavy development in the watershed results in shorter Times of Concentration. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

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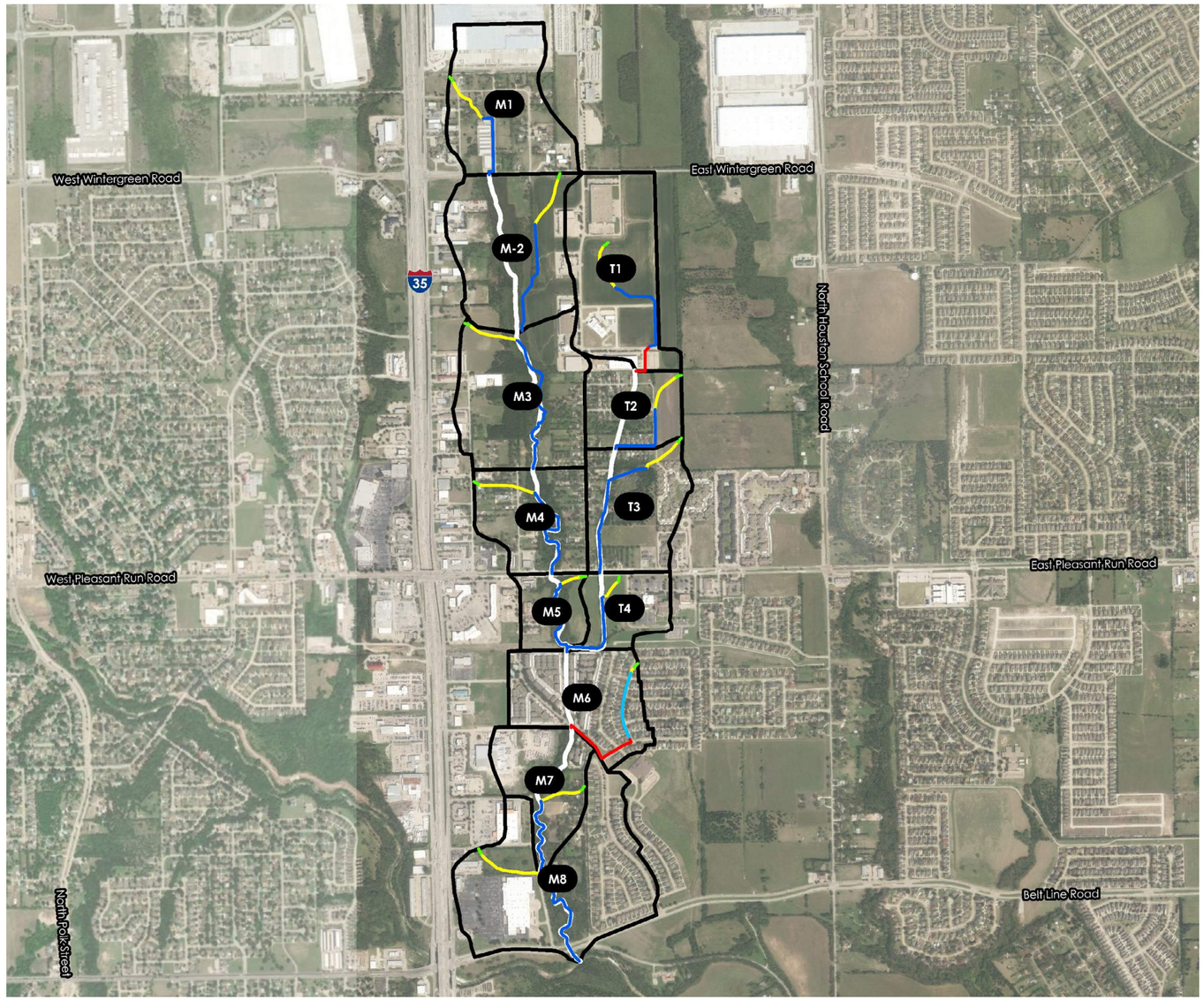


TIME OF CONCENTRATION REPORT

M1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.42	0.240	0.00	0.1	15.44
SHALLOW	UNPAVED	638	2.32	0.000	16.10	2.5	4.34
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	919	4.18	0.050	28.69	5.9	2.61
		1,658					**22.39**
							17.45

M2

OVERLAND	GRS-DENSE	100	3.03	0.240	0.00	0.1	11.40
SHALLOW	UNPAVED	666	1.68	0.000	16.10	2.1	5.32
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,493	2.17	0.050	28.69	4.2	5.89
		2,259					**22.61**
							18.43

M3

OVERLAND	GRS-DENSE	100	1.16	0.240	0.00	0.1	16.73
SHALLOW	UNPAVED	643	2.89	0.000	16.10	2.7	3.92
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,441	5.83	0.050	28.69	6.9	3.47
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	601	5.12	0.050	42.29	9.6	1.05
		2,785					**25.16**
							20.00

M4

OVERLAND	GRS-DENSE	100	2.96	0.240	0.00	0.1	11.49
SHALLOW	UNPAVED	737	3.69	0.000	16.10	3.1	3.97
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,562	5.52	0.050	42.29	9.9	2.62
		2,400					**18.09**
							14.23

M5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.52	0.240	0.00	0.1	23.13
SHALLOW	UNPAVED	260	8.73	0.000	16.10	4.8	0.91
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,190	5.73	0.050	42.29	10.1	1.96
		1,550					**26.00**
							19.99

M6

OVERLAND	GRS-DENSE	100	2.24	0.240	0.00	0.1	12.86
SHALLOW	PAVED	61	0.99	0.000	20.30	2.0	0.50
GUTTER	G-20	909	1.45	0.018	24.18	2.9	5.20
PIPE	36" RCP	1,121	1.87	0.014	87.62	12.0	1.56
		2,190					**20.12**
							16.78

M7

OVERLAND	GRS-DENSE	100	1.34	0.240	0.00	0.1	15.80
SHALLOW	UNPAVED	531	4.68	0.000	16.10	3.5	2.54
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,103	5.29	0.050	42.29	9.7	1.89
		1,734					**20.23**
							15.65

M8

OVERLAND	GRS-DENSE	100	4.65	0.240	0.00	0.2	9.60
SHALLOW	UNPAVED	855	7.06	0.000	16.10	4.3	3.33
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,671	5.73	0.050	42.29	10.1	2.75
		2,626					**15.68**
							12.45

TIME OF CONCENTRATION REPORT - CONTINUED

T1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.3	0.240	0.00	0.1	15.97
SHALLOW	UNPAVED	607	1.79	0.000	16.10	2.2	4.69
PIPE	36" RCP	482	1.05	0.014	87.62	9.0	0.89
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,234	1.05	0.050	28.69	2.9	6.98
		2,423					**28.54**
							23.38

T2

OVERLAND	GRS-DENSE	100	2.7	0.240	0.00	0.1	11.93
SHALLOW	UNPAVED	513	1.71	0.000	16.10	2.1	4.06
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,027	4.72	0.050	28.69	6.2	2.75
		1,639					**18.74**
							14.74

T3

OVERLAND	GRS-DENSE	100	3.55	0.240	0.00	0.2	10.70
SHALLOW	UNPAVED	533	3.37	0.000	16.10	3.0	3.01
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	519	4.02	0.050	28.69	5.8	1.50
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,248	5.76	0.050	42.29	10.2	2.05
		2,401					**17.26**
							13.83

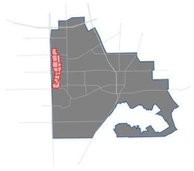
T4

OVERLAND	GRS-DENSE	100	1.74	0.240	0.00	0.1	14.24
SHALLOW	UNPAVED	266	1.32	0.000	16.10	1.9	2.40
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,130	5.43	0.050	42.29	9.9	1.91
		1,496					**18.55**
							14.39

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



1.3 SOILS MAP

Stream 3A6 watershed has multiple hydrologic soil groups present within it's boundaries. Hydrologic soil groups B, C, and D are present in the Stream 3A6 watershed. The majority of the watershed consists of type D Soil (least permeable). Hydrologic soils group D is present in each sub-basin. Soil group C is present in sub-basins T4, M4, M5, M6, M7 and M8. Type B soil is located only in sub-basin M8.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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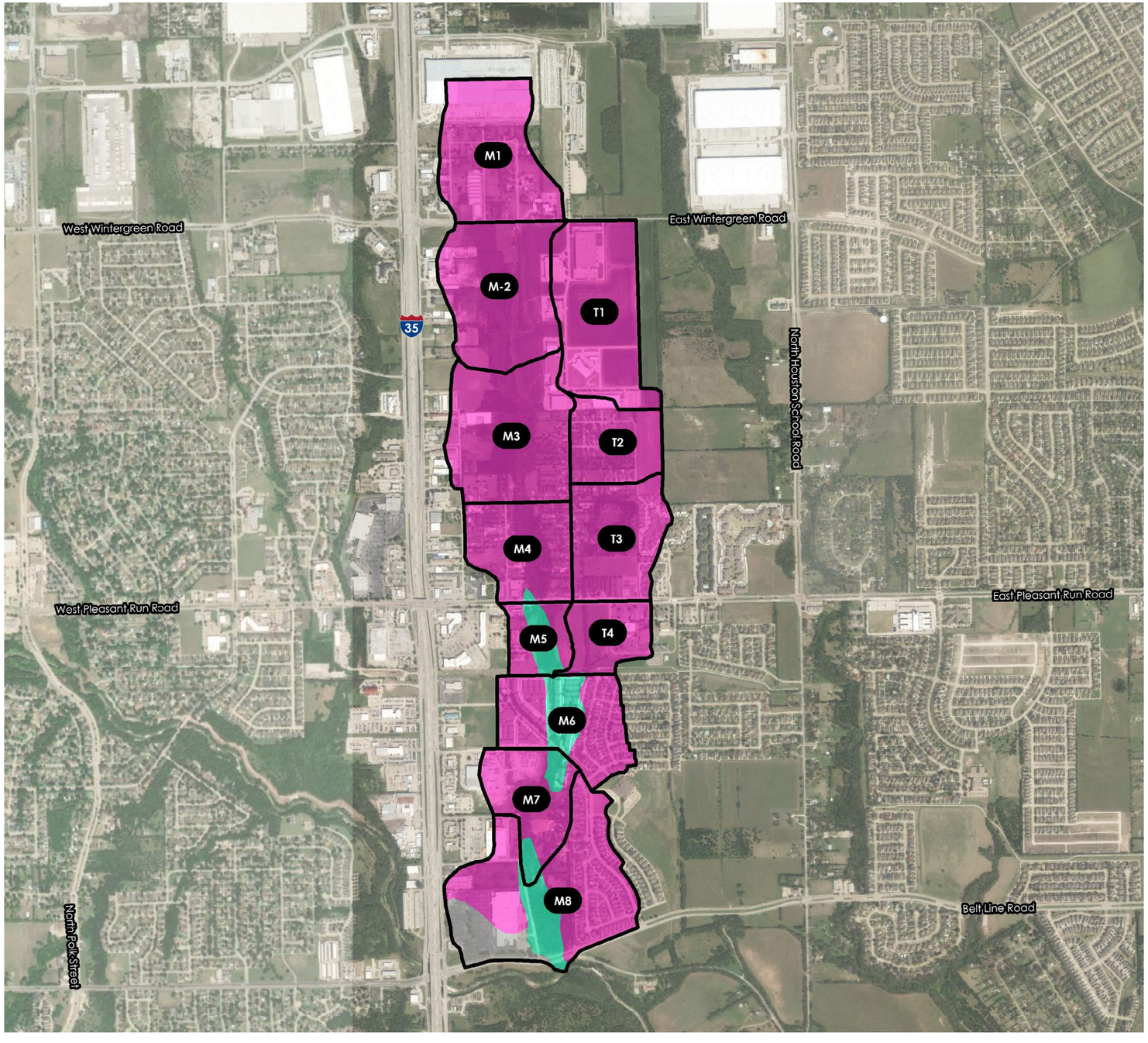


PERVIOUS CURVE NUMBER REPORT

M1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	62.3	84.0
		62.3	**84.0**

M2

D	84	68.3	84.0
		68.3	**84.0**

M3

D	84	72.0	84.0
		72.0	**84.0**

M4

C	79	0.6	1.0
D	84	42.2	82.9
		42.8	**83.9**

M5

C	79	7.6	29.9
D	84	12.5	52.2
		20.1	**82.1**

M6

C	79	11.6	18.7
D	84	37.4	64.1
		49.0	**82.8**

M7

B	69	0.1	0.2
C	79	6.4	13.8
D	84	30.0	69.0
		36.6	**83.1**

M8

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
B	69	15.2	11.1
C	79	12.1	10.1
D	84	67.3	59.8
		94.5	**81.0**

T1

D	84	67.3	84.0
		67.3	**84.0**

T2

D	84	31.9	84.0
		31.9	**84.0**

T3

D	84	47.0	84.0
		47.0	**84.0**

T4

C	79	0.3	0.9
D	84	24.4	83.0
		24.6	**83.9**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

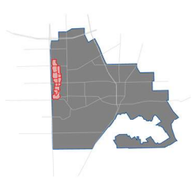
WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*

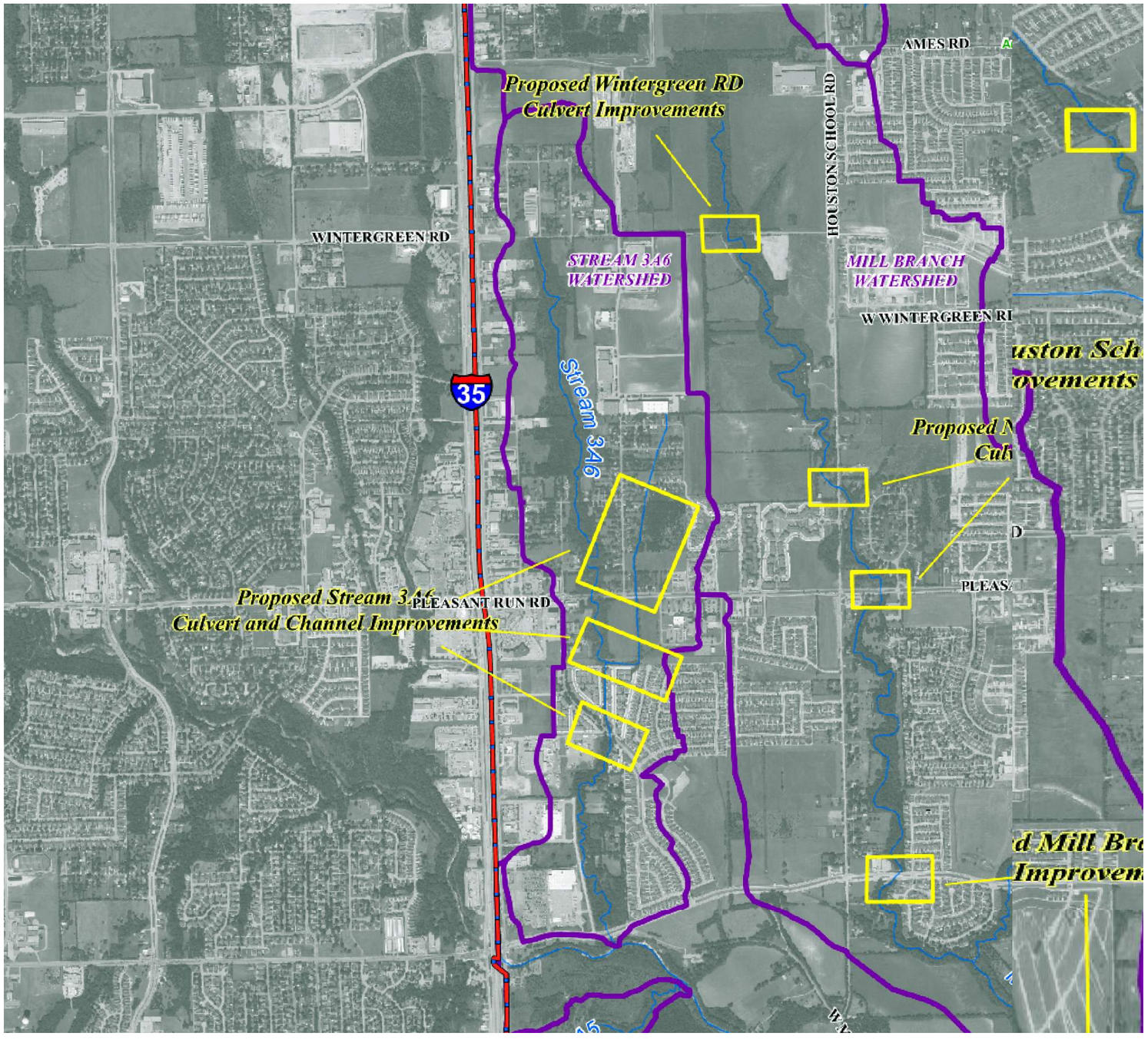
STREAM LENGTH
3.18 MI
*

PROJECTS IDENTIFIED
1

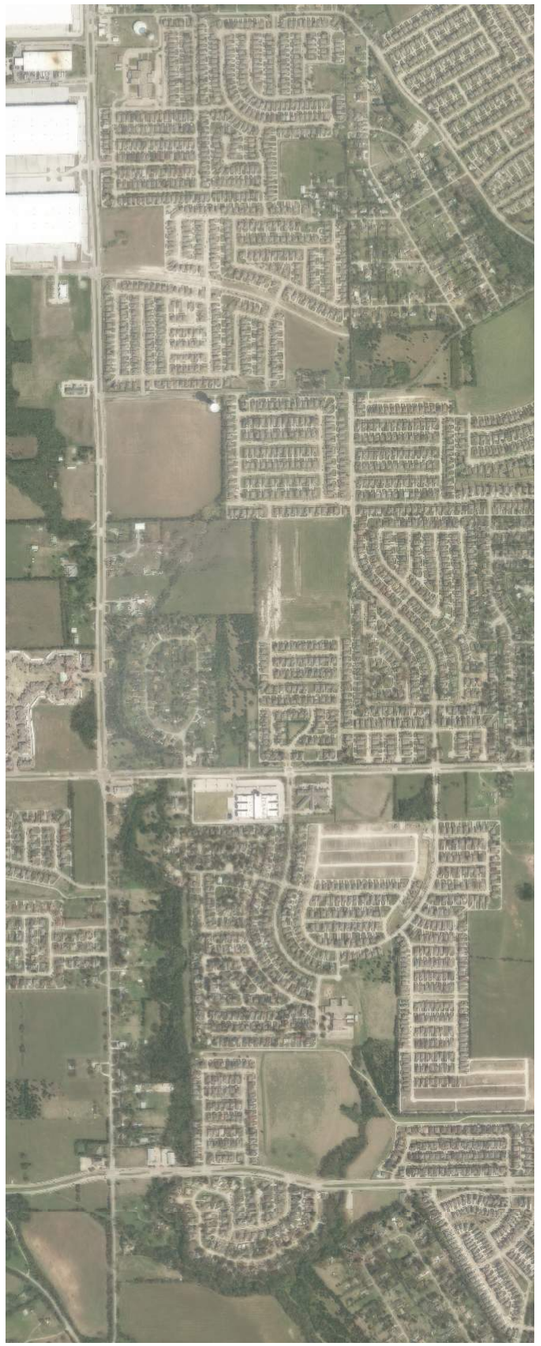


1.4 AERIAL COMPARISON

Aerial photography from 2019 shows little new development since 2007 within the Stream 3A6 watershed. A new commercial development has been created in sub-basin T1 and a new industrial warehouse has been added to the top portion of the M1 sub-basin.







N

N.T.S.

2019

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



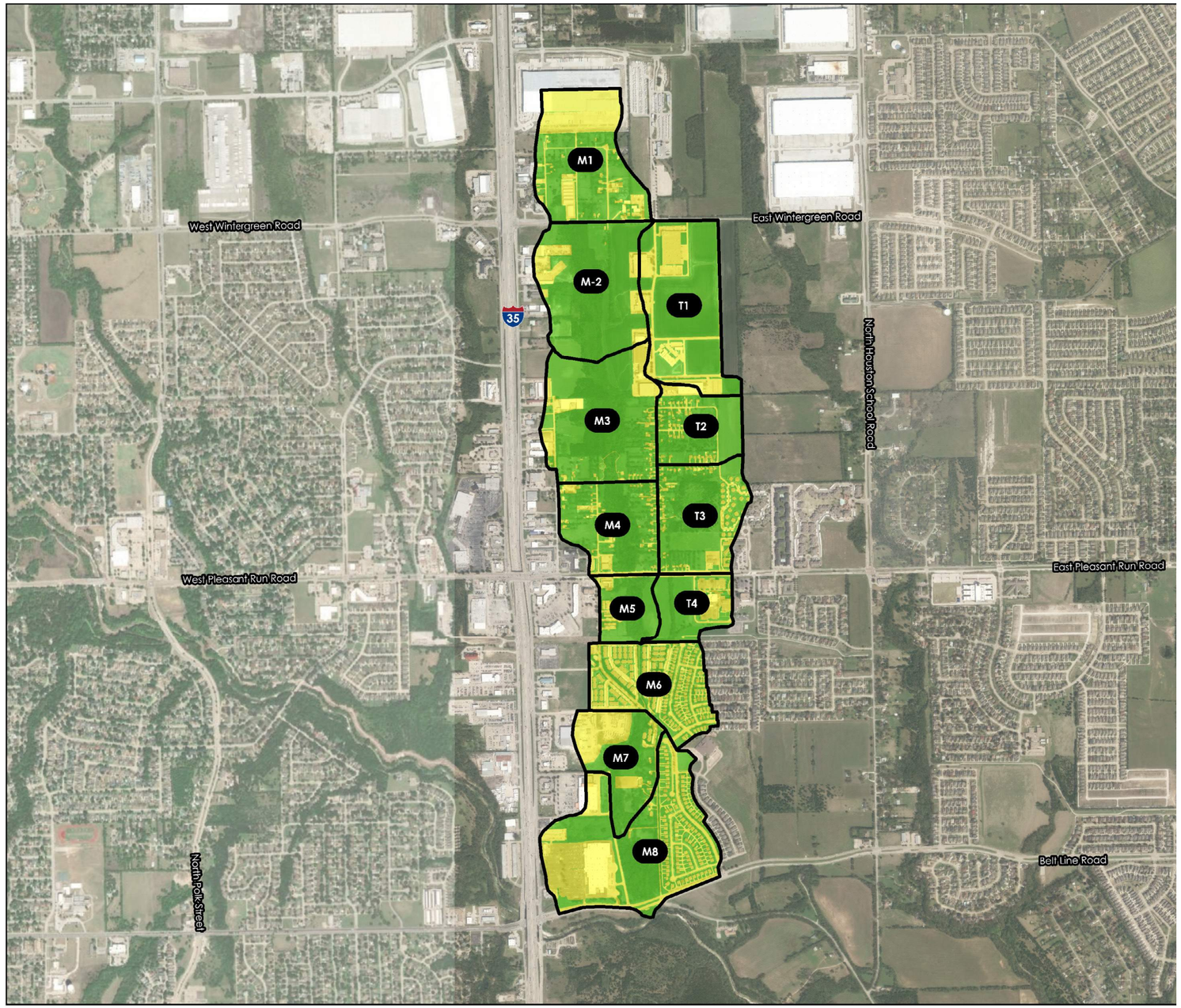
1.5 IMPERVIOUS AREA

Impervious areas for the Stream 3A6 watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are associated with the residential neighborhoods in the east portion of the watershed and commercial developments along the highway in the west portion of the watershed. Sub-basins Main-2, Main-3, Trib-1 and Trib-2 have the largest amount of open area available for future development.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

M1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	28.0	45.0
OPEN SPACE (FAIR CONDITION)	0	34.3	0.0
		62.3	**45.0**

M2

IMPERVIOUS	100	9.7	14.2
OPEN SPACE (FAIR CONDITION)	0	58.6	0.0
		68.3	**14.2**

M3

IMPERVIOUS	100	13.6	18.9
OPEN SPACE (FAIR CONDITION)	0	58.4	0.0
		72.0	**18.9**

M4

IMPERVIOUS	100	7.6	17.8
OPEN SPACE (FAIR CONDITION)	0	35.2	0.0
		42.8	**17.8**

M5

IMPERVIOUS	100	3.7	18.3
OPEN SPACE (FAIR CONDITION)	0	16.4	0.0
		20.1	**18.3**

M6

IMPERVIOUS	100	30.6	62.3
OPEN SPACE (FAIR CONDITION)	0	18.5	0.0
		49.0	**62.3**

M7

IMPERVIOUS	100	15.8	43.1
OPEN SPACE (FAIR CONDITION)	0	20.8	0.0
		36.6	**43.1**

M8

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	47.8	50.6
OPEN SPACE (FAIR CONDITION)	0	46.7	0.0
		94.5	**50.6**

T1

IMPERVIOUS	100	21.4	31.8
OPEN SPACE (FAIR CONDITION)	0	45.9	0.0
		67.3	**31.8**

T2

IMPERVIOUS	100	7.2	22.7
OPEN SPACE (FAIR CONDITION)	0	24.6	0.0
		31.9	**22.7**

T3

IMPERVIOUS	100	9.3	19.8
OPEN SPACE (FAIR CONDITION)	0	37.7	0.0
		47.0	**19.8**

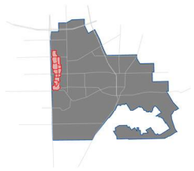
T4

IMPERVIOUS	100	7.1	29.0
OPEN SPACE (FAIR CONDITION)	0	17.5	0.0
		24.6	**29.0**

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The future land use within the watershed consist of mostly Commercial and Residential zoning based on the provided City zoning data with some Industrial in the northernmost sub-basins. The commercial development is generally located along the highway corridor. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- COMMERCIAL CORRIDOR
- R - URBAN NEIGHBORHOOD
- SURBURBAN MIXED USE CENTER

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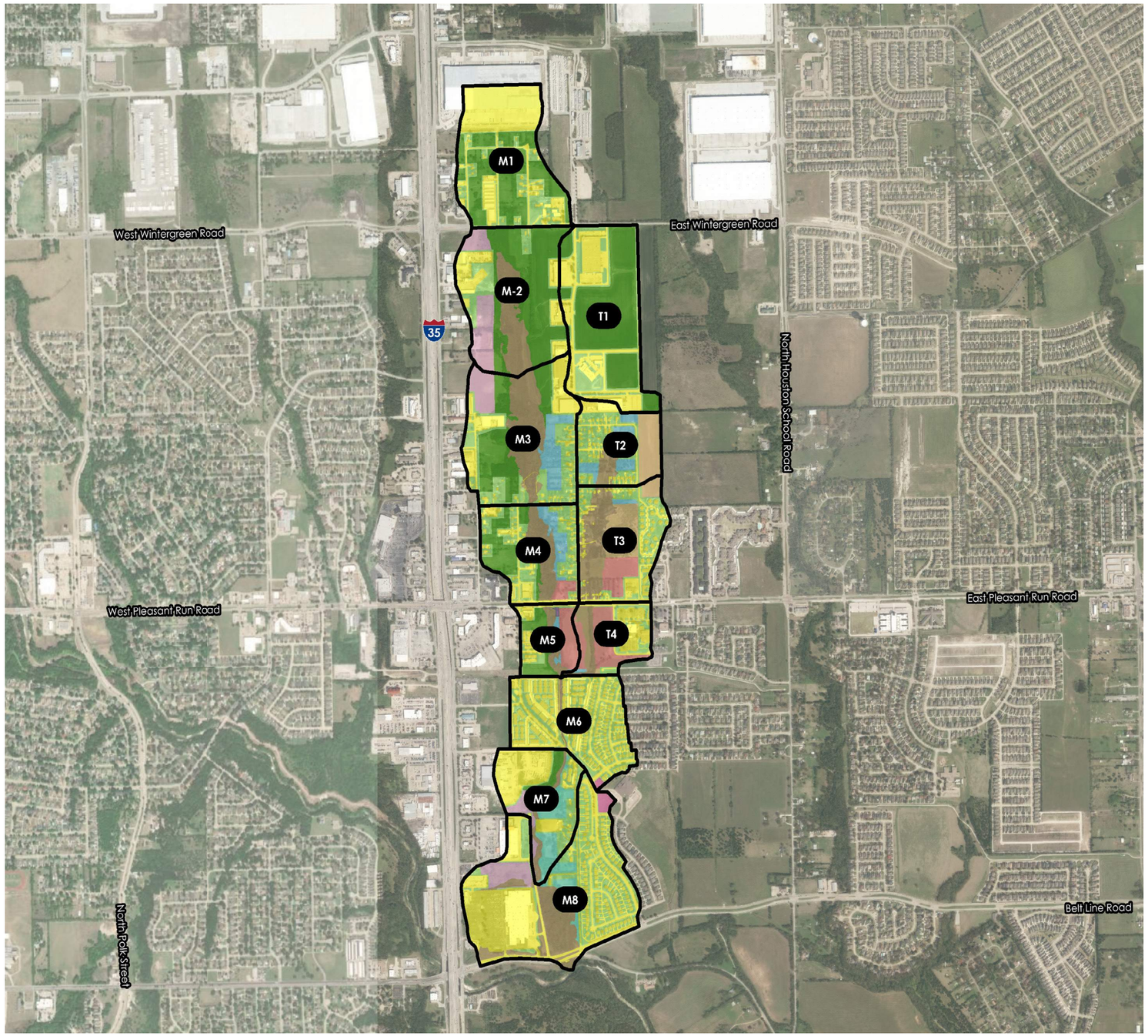


ULTIMATE PERCENT IMPERVIOUS REPORT

M1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	28.1	45.2
OPEN SPACE (FAIR CONDITION)	0	10.2	0.0
SURBURBAN MIXED USE CENTER	85	23.9	32.6
		62.3	**77.8**

M2

IMPERVIOUS	100	9.7	14.2
OPEN SPACE (FAIR CONDITION)	0	7.3	0.0
FLOODPLAIN	0	12.1	0.0
COMMERCIAL CORRIDOR	85	9.6	12.0
SURBURBAN MIXED USE CENTER	85	29.6	36.8
		68.3	**62.9**

M3

IMPERVIOUS	100	13.6	18.9
OPEN SPACE (FAIR CONDITION)	0	14.4	0.0
FLOODPLAIN	0	15.9	0.0
R - URBAN NEIGHBORHOOD	65	6.1	5.5
COMMERCIAL CORRIDOR	85	4.9	5.7
SURBURBAN MIXED USE CENTER	85	17.2	20.3
		58.4	**31.5**

M4

IMPERVIOUS	100	7.6	17.8
OPEN SPACE (FAIR CONDITION)	0	12.8	0.0
FLOODPLAIN	0	7.9	0.0
R - URBAN NEIGHBORHOOD	65	3.8	5.8
MIXED USE	85	1.7	3.4
SURBURBAN MIXED USE CENTER	85	9.0	17.9
		42.8	**44.8**

M5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	3.7	18.3
OPEN SPACE (FAIR CONDITION)	0	2.5	0.0
FLOODPLAIN	0	3.4	0.0
R - URBAN NEIGHBORHOOD	65	1.3	4.1
MIXED USE	85	4.9	20.8
SURBURBAN MIXED USE CENTER	85	4.2	17.9
COMMERCIAL NODE	85	0.1	0.6
		20.1	**61.7**

M6

IMPERVIOUS	100	30.6	62.3
OPEN SPACE (FAIR CONDITION)	0	17.0	0.0
FLOODPLAIN	0	1.1	0.0
R - SURBURBAN NEIGHBORHOOD	38	0.0	0.0
SURBURBAN MIXED USE CENTER	85	0.1	0.1
PUBLIC & SEMI-PUBLIC	72	0.4	0.5
		49.0	**63.0**

M7

IMPERVIOUS	100	15.8	43.1
OPEN SPACE (FAIR CONDITION)	0	5.2	0.0
FLOODPLAIN	0	3.0	0.0
R - RURAL LIVING	12	7.3	2.4
COMMERCIAL CORRIDOR	85	3.1	7.3
SURBURBAN MIXED USE CENTER	85	2.1	5.0
		36.6	**57.8**

M8

IMPERVIOUS	100	48.0	50.7
OPEN SPACE (FAIR CONDITION)	0	21.6	0.0
FLOODPLAIN	0	15.2	0.0
R - RURAL LIVING	12	3.6	0.5
COMMERCIAL CORRIDOR	85	4.9	4.4
PUBLIC & SEMI-PUBLIC	72	1.4	1.0
		94.5	**56.6**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

T1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	21.4	31.8
OPEN SPACE (FAIR CONDITION)	0	10.5	0.0
R - SURBURBAN NEIGHBORHOOD	38	0.0	0.0
SURBURBAN MIXED USE CENTER	85	35.4	44.7
		67.3	**76.5**

T2

IMPERVIOUS	100	7.2	22.7
OPEN SPACE (FAIR CONDITION)	0	9.3	0.0
FLOODPLAIN	0	3.5	0.0
R - URBAN NEIGHBORHOOD	65	4.4	8.9
R - SURBURBAN NEIGHBORHOOD	38	7.4	8.9
		31.9	**40.5**

T3

IMPERVIOUS	100	9.3	19.8
OPEN SPACE (FAIR CONDITION)	0	10.3	0.0
FLOODPLAIN	0	12.2	0.0
R - URBAN NEIGHBORHOOD	65	0.5	0.8
R - SURBURBAN NEIGHBORHOOD	38	9.7	7.9
MIXED USE	85	5.0	9.0
		47.0	**37.4**

T4

IMPERVIOUS	100	7.1	29.0
OPEN SPACE (FAIR CONDITION)	0	4.0	0.0
FLOODPLAIN	0	4.3	0.0
R - URBAN NEIGHBORHOOD	65	0.2	0.6
R - SURBURBAN NEIGHBORHOOD	38	0.1	0.2
MIXED USE	85	8.8	30.5
		24.6	**60.4**

WATERSHED NO.
11

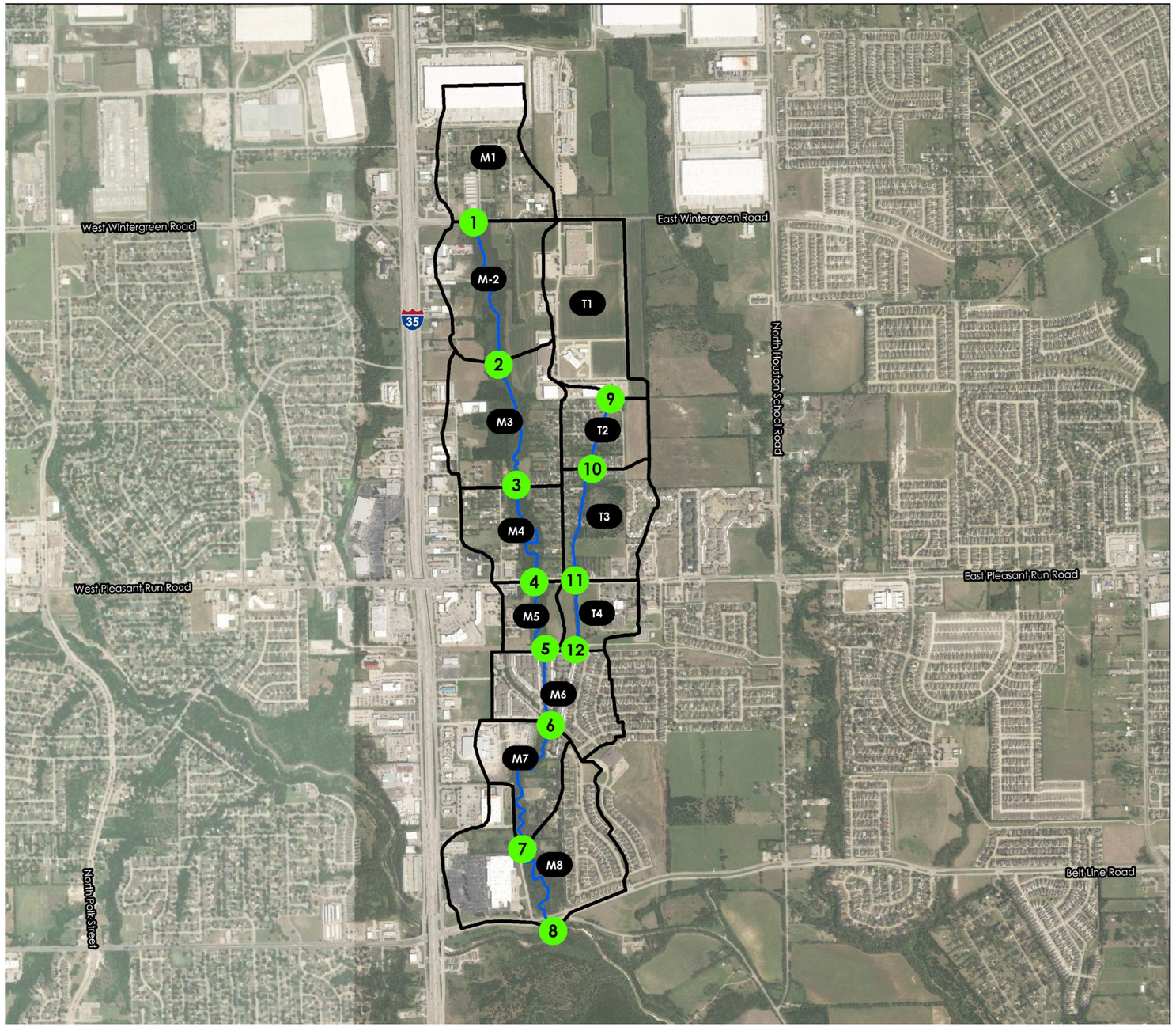
COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



1.7 RESULTS

The flow was analyzed at twelve locations for Stream 3A6 Branch. Flow locations 1 and 9 were used to establish flows at the upstream end of the main channel and tributary respectively. Location 3, 4, 5, 6, 8, 9, 11 and 12 were used to determine flows at major road crossings. Locations 2 and 7 were included because of the location of their respective sub-basins.



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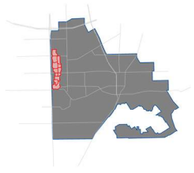
FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	M1	Upper Reach	12753	0.10	420
2	M1, M2	Upper Reach	10406	0.20	800
3	M1-M3	Upper Reach	8443	0.32	1000
4	M1-M4	Upper Reach	6590	0.38	1200
5	M1-M5	Lower Reach	5288	0.68	1950
6	M1-M6, T1-T4	Lower Reach	4299	0.76	2200
7	M1-M7, T1-T4	Lower Reach	1787	0.82	2300
8	M1-M8, T1-T4	Lower Reach	57	0.96	2500
9	T1	Tributary	4237	0.11	410
10	T1, T2	Tributary	3204	0.16	460
11	T1-T3	Tributary	1548	0.23	700
12	T1-T4	Tributary	256	0.27	700

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.1 SITE ASSESSMENT

Stream 3A6 is located on the West edge of the City of Lancaster. It flows from North to South for approximately 3.18 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Stream 3A6 within the limits of the City of Lancaster, roughly bound by Wintergreen Road (upstream end) and the confluence with Ten Mile Creek (downstream end). The channel slope averages around 0.9-1.2%, and for the purposes of this study were divided into a main channel and a tributary. Stream 3A6 itself is generally in a natural state with a few areas of concerte lined channel, however, the overbanks are heavily developed. There are also a total of nine (9) crossings throughout the watershed.



Looking upstream of McKinney Drive towards Pike Drive. Area is grassy but appears to be well maintained within the residential area. Culverts and the rest of the lowlying area is expected to flood in heavier flooding events.



Looking downstream at the channel condition near Rolling Hills multi-family development. Main channel is winding and has vegetation growing in and around the channel.



Looking downstream of Rolling Hills Place culvert. Channel is wide and appears to be concrete lined for some distance downstream. Heavy vegetation on the overbanks.

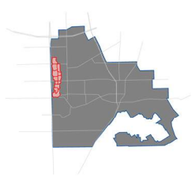


Looking at the downstream face of Rolling Hills multi-family development culvert. The channel is completely concrete lined and parking is present on the overbanks. The 100-year floodplain is expected to be contained, though the culvert is expected to overtop.

WATERSHED NO.
11

COUNCIL DISTRICT
1

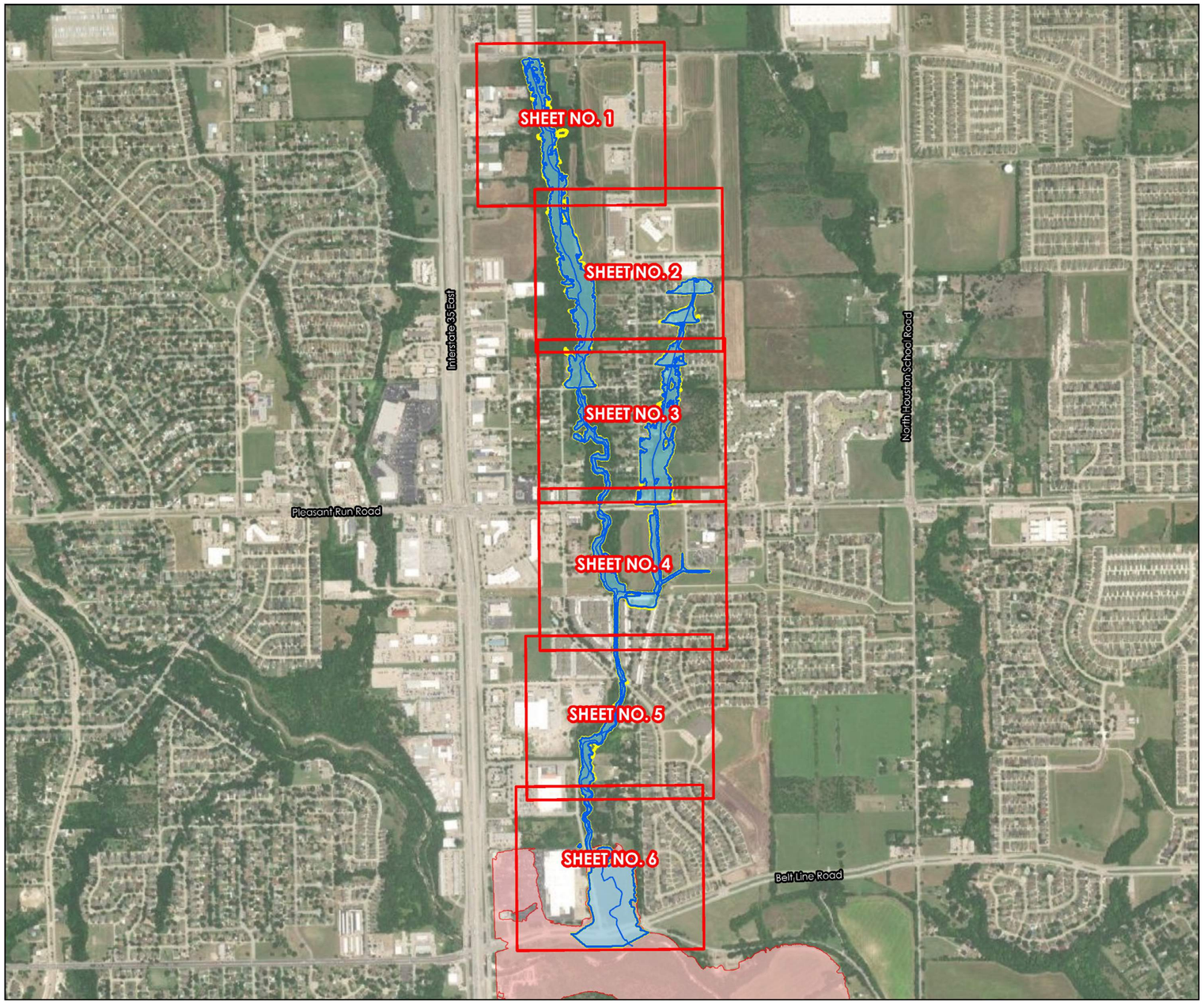
TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.2 FLOODPLAIN MAPPING

The Stream 3A6 hydraulics were analyzed with HEC-RAS 5.0.7. The model for Stream 3A6 is comprised of two streams (main and tributary), three reaches, ninety-nine (99) cross sections, and nine (9) hydraulic structures. The studied stream is 16,782 feet (2.43 miles) long. Near the undeveloped portions of the stream the floodplain extends beyond the channel.

The floodplain sheets for Stream 3A6 display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.

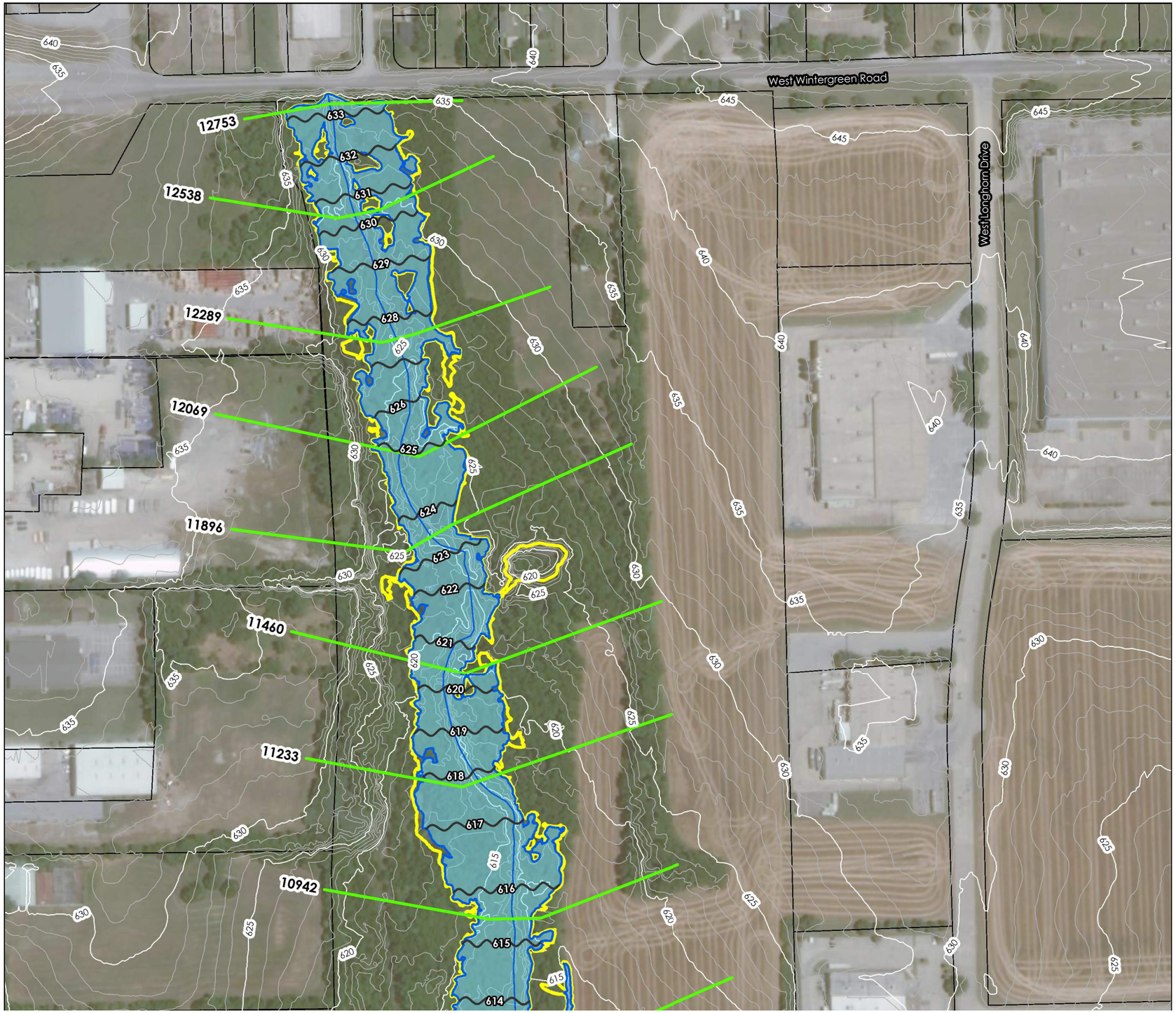


STREAM CENTERLINE
STREAM 3A6 VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200
Feet

- STREAM 3A6 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- MAJOR CONTOURS
- MINOR CONTOURS
- STREAM 3A6 BASE FLOW ELEVATIONS
- PARCEL

STREAM 3A6

2.0 HYDRAULICS

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



FLOODPLAIN: SHEET 2

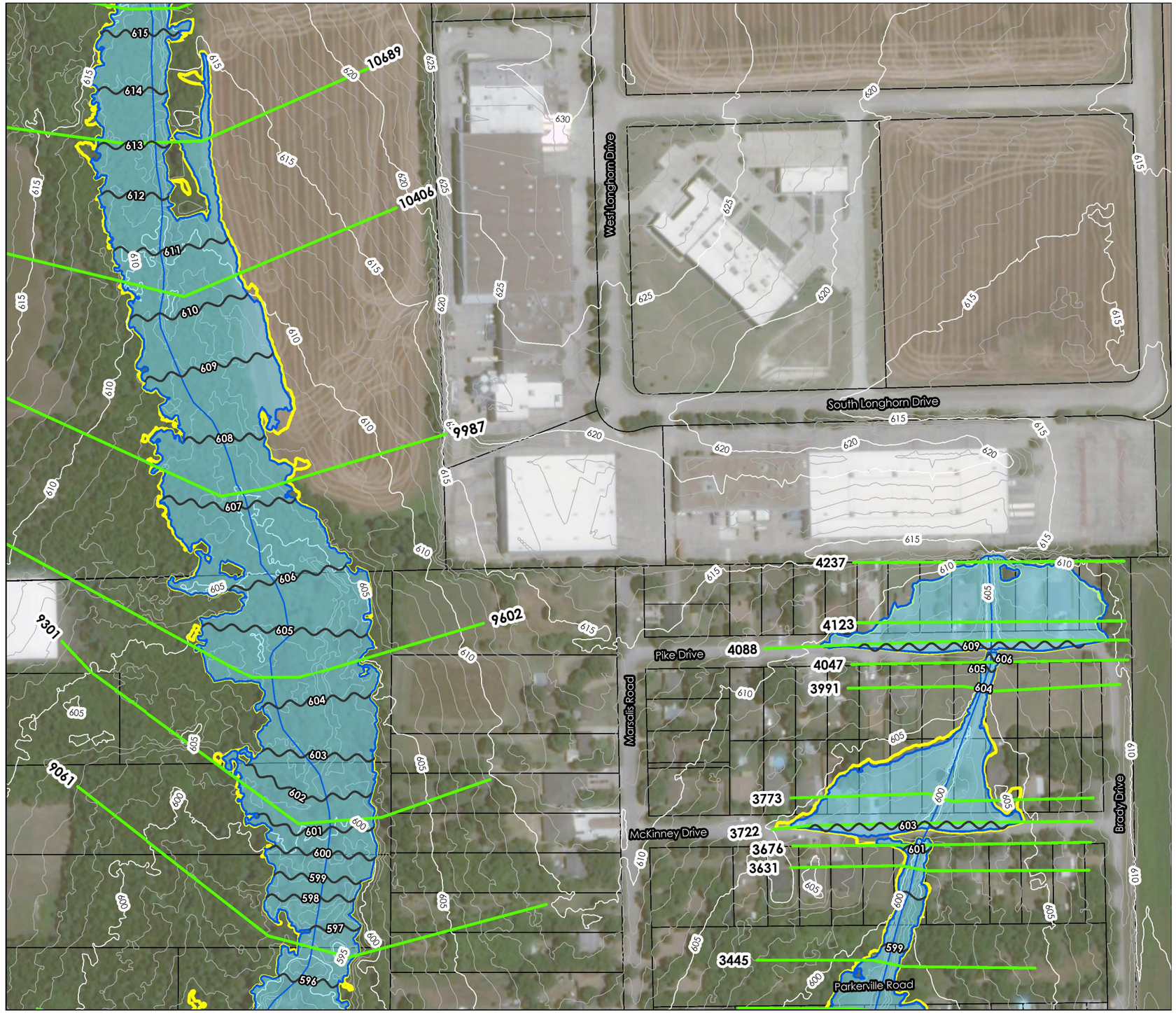


N

0 100 200
Feet

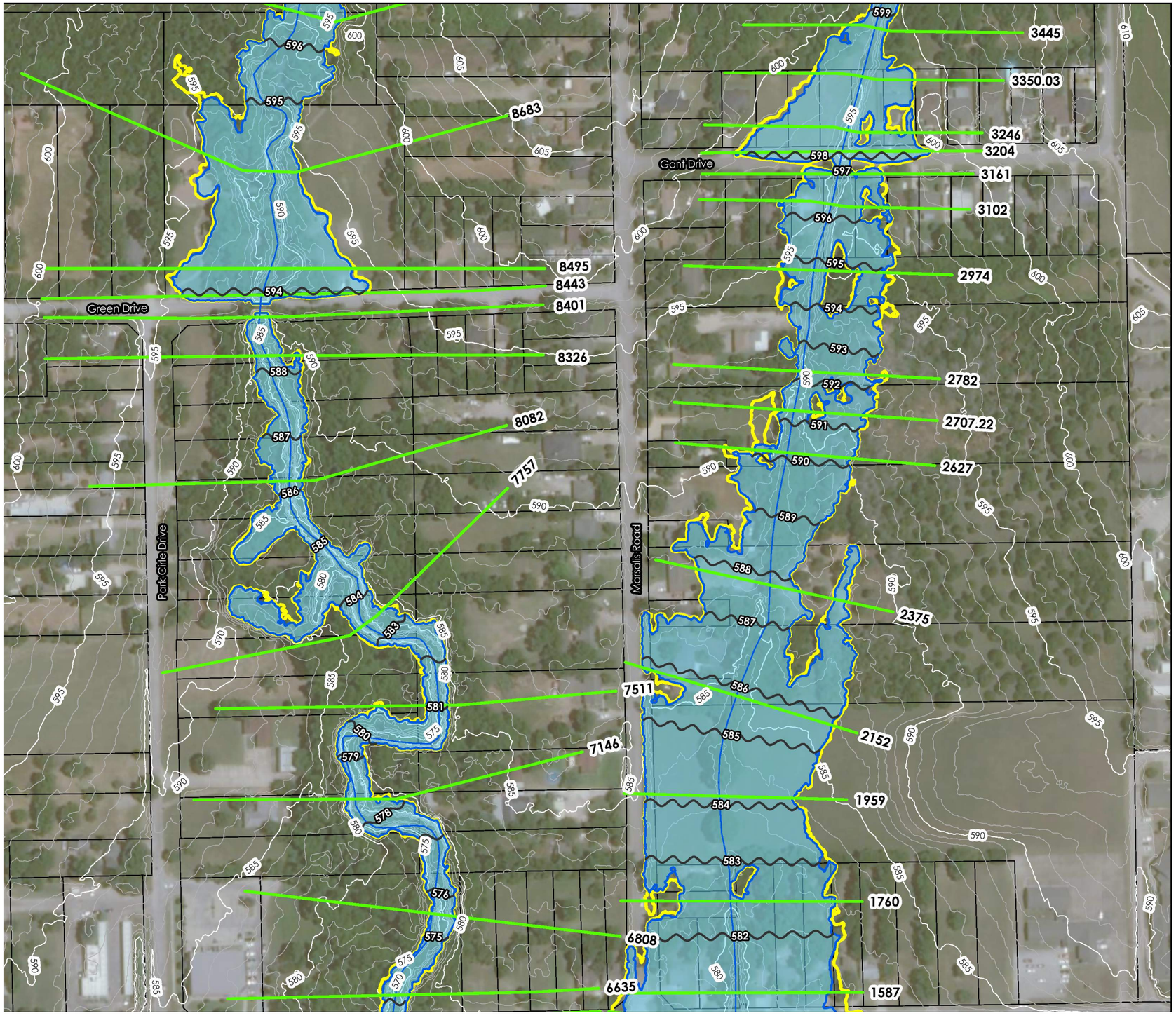
STREAM 3A6 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
STREAM 3A6 BASE FLOW ELEVATIONS
PARCEL

0



FLOODPLAIN: SHEET 3





N

0 100 200 Feet

- STREAM 3A6 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- 500 STREAM 3A6 BASE FLOW ELEVATIONS
- PARCEL

STREAM 3A6

2.0 HYDRAULICS

WATERSHED NO.

11

COUNCIL DISTRICT

1

TOTAL DRAINAGE AREA

0.96 SM

*

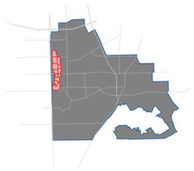
STREAM LENGTH

3.18 MI

*

PROJECTS IDENTIFIED

1



FLOODPLAIN: SHEET 4



N

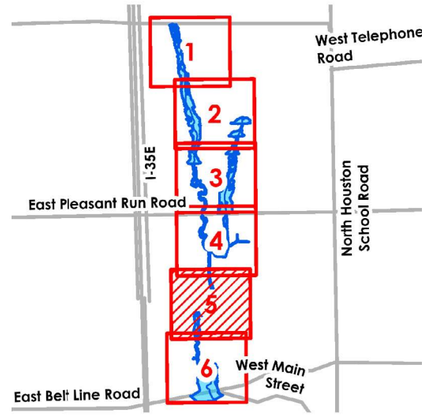
0 100 200 Feet

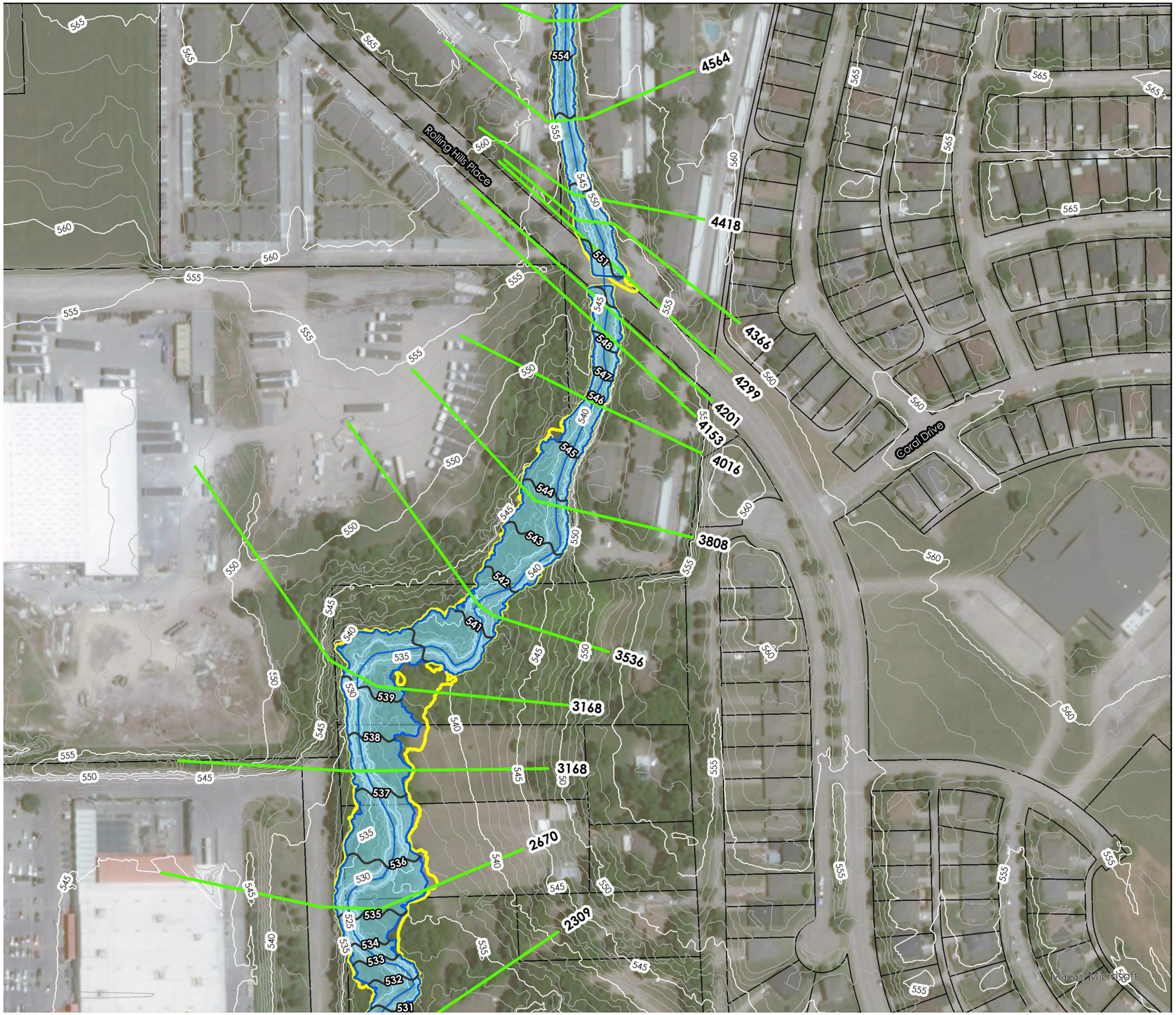
STREAM 3A6 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
STREAM 3A6 BASE FLOW ELEVATIONS
PARCEL

0



FLOODPLAIN: SHEET 5





N

0 100 200
Feet

- STREAM 3A6 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- 500 STREAM 3A6 BASE FLOW ELEVATIONS
- PARCEL

STREAM 3A6

2.0 HYDRAULICS

WATERSHED NO.

11

COUNCIL DISTRICT

1

TOTAL DRAINAGE AREA

0.96 SM

*

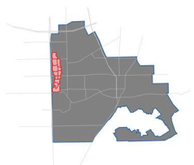
STREAM LENGTH

3.18 MI

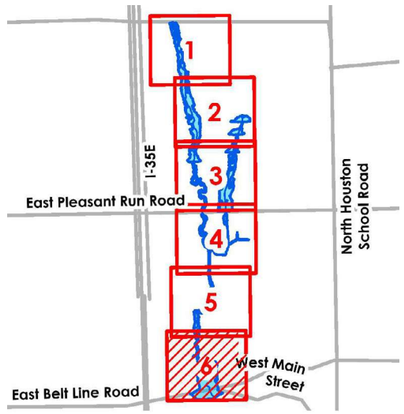
*

PROJECTS IDENTIFIED

1



FLOODPLAIN: SHEET 6



N

0 100 200 Feet

STREAM 3A6 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
STREAM 3A6 BASE FLOW ELEVATIONS
PARCEL

0



WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
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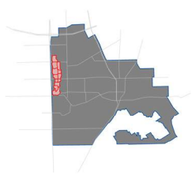


2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	632.28	632.59	3.88	4.21
12538	629.53	629.70	4.79	5.07
12289	626.53	626.79	2.68	3.01
12069	623.95	624.21	5.20	5.63
11896	621.98	622.34	2.24	2.46
11460	618.81	619.19	5.92	6.31
11233	616.42	616.72	3.31	3.66
10942	614.38	614.64	2.97	3.37
10689	612.29	612.41	2.61	3.11
10406	609.67	609.85	2.46	2.63
9987	606.44	606.56	2.33	2.78
9602	603.86	604.10	3.43	3.49
9301	600.68	600.70	3.70	4.75
9061	594.46	595.12	6.91	6.22
8683	589.41	589.47	5.17	6.77
8495	586.28	587.45	7.59	6.00
8443	586.41	587.48	3.79	3.83
8421	**GREEN ROAD**			
8401	585.54	586.15	3.89	4.44
8326	585.45	586.06	2.83	3.22
8082	583.71	584.30	7.77	7.68
7757	580.13	580.80	3.31	3.64
7511	578.00	578.51	7.90	8.50
7146	575.04	575.62	3.83	4.19
6808	573.08	573.61	5.28	5.68
6635	570.57	570.96	7.09	7.66
6590	569.37	569.78	7.26	7.87
6543	**WEST PLEASANT RUN**			
6487	568.79	569.28	6.59	6.85
6370	568.14	568.74	3.78	3.88
6137	566.09	566.47	6.47	7.39
5951	565.57	565.97	2.74	3.04
5701	565.02	565.33	2.54	2.97
5517	563.87	564.07	5.07	5.37
5352	558.82	559.76	6.84	4.08

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	557.86	558.84	6.39	6.20
5268	**ROLLING HILLS APARTMENTS**			
5240	556.45	557.37	5.59	5.42
5159	555.54	556.17	8.29	9.15
4966	553.08	553.72	8.36	9.17
4751	550.96	551.57	8.75	9.50
4564	549.65	550.23	8.51	9.22
4418	547.15	547.68	8.30	9.04
4366	546.48	547.25	7.71	7.35
4299	546.48	547.53	4.57	4.96
4254	**ROLLING HILLS**			
4201	544.67	545.28	6.05	6.82
4153	544.51	545.21	4.59	4.79
4016	543.37	543.92	6.25	7.18
3808	541.38	541.96	6.14	6.11
3536	536.46	537.06	8.69	9.44
3168	533.78	534.67	4.83	5.34
2987	532.57	533.40	6.75	7.22
2670	530.51	531.15	6.09	6.91
2309	527.33	527.80	6.82	7.50
2019	522.28	522.92	8.89	9.37
1787	520.02	520.75	5.16	5.50
1641	519.03	519.89	5.84	5.77
1276	514.95	515.23	7.74	9.07
807	515.56	515.89	0.56	0.68
586	515.55	515.88	0.63	0.79
380	515.54	515.86	0.90	1.14
323	515.52	515.84	1.25	1.62
243	**WEST BELT LINE ROAD**			
149	515.33	515.50	0.34	0.44
57	515.33	515.50	0.32	0.41

TRIBUTARY

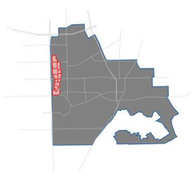
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	607.04	607.81	2.06	1.94
4123	606.97	607.75	1.46	1.41
4088	606.86	607.66	2.74	2.27
4070	**PIKE DRIVE**			
4047	603.29	603.67	3.52	3.88
3991	602.71	602.90	4.75	5.75
3773	602.12	602.67	1.84	1.62
3722	601.99	602.52	2.50	2.83
3703	**MCKINNEY DRIVE**			
3676	599.92	600.17	5.82	6.39
3631	599.00	599.41	3.39	3.67
3445	597.77	597.91	4.13	5.05
3350.03	597.20	597.61	3.10	2.64
3246	596.78	597.31	2.74	2.50
3204	596.75	597.27	2.10	2.32
3182	**GANT DRIVE**			
3161	595.34	595.70	2.60	2.91
3102	594.98	595.32	3.97	4.25
2974	593.63	593.93	4.89	4.67
2782	591.54	591.71	3.14	3.41
2707.22	590.22	590.40	5.05	5.36
2627	589.50	589.64	1.78	1.96
2375	587.37	587.43	3.05	3.25
2152	585.09	585.24	1.90	2.04
1959	583.78	583.84	3.04	3.35
1760	581.75	581.88	2.92	2.92
1587	578.74	579.01	6.22	6.59
1548	577.40	578.00	5.96	4.93
1501	**WEST PLEASANT RUN ROAD**			
1449	576.94	577.17	6.13	6.69
1398	576.18	576.55	4.55	4.80
1295	575.25	575.63	3.71	3.99
1165	574.31	574.65	4.62	4.98
1040	573.59	573.91	3.63	3.81
922	572.14	572.44	4.97	5.15

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	571.40	571.64	3.71	4.08
682	569.86	570.19	5.61	5.43
521	566.86	567.05	6.13	6.95
438	565.61	565.77	5.29	5.63
371	564.23	564.39	2.77	2.92
309	564.07	564.24	2.42	2.46
256	563.47	563.66	5.13	5.20

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	632.58	632.79	4.22	4.61
12538	629.71	629.89	5.05	5.08
12289	626.76	626.99	2.95	3.21
12069	624.18	624.46	5.60	5.64
11896	622.30	622.60	2.43	2.63
11460	619.15	619.46	6.27	6.45
11233	616.69	616.98	3.62	3.79
10942	614.61	614.75	3.32	3.87
10689	612.40	612.58	3.07	3.17
10406	609.83	609.90	2.60	3.11
9987	606.55	606.76	2.73	2.76
9602	604.12	604.17	3.51	4.12
9301	600.71	600.91	4.84	4.38
9061	595.18	595.21	6.21	7.64
8683	589.50	590.31	6.89	5.77
8495	587.57	588.93	5.89	4.54
8443	587.60	588.87	3.83	3.60
8421	**GREEN ROAD**			
8401	586.21	586.69	4.50	5.00
8326	586.12	586.59	3.26	3.62
8082	584.36	584.74	7.66	7.80
7757	580.91	581.62	3.62	3.66
7511	578.60	579.07	8.61	8.91
7146	575.72	576.18	4.27	4.62
6808	573.70	574.08	5.76	6.11
6635	571.04	571.40	7.73	8.06
6590	569.86	570.22	7.97	8.38
6543	**WEST PLEASANT RUN**			
6487	569.37	569.78	6.93	7.13
6370	568.85	569.32	3.90	4.02
6137	566.54	566.81	7.57	8.46
5951	566.04	566.37	3.09	3.31
5701	565.39	565.65	3.05	3.41
5517	564.11	564.32	5.45	5.63
5352	559.74	560.30	4.38	3.49

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	558.84	559.51	6.20	6.10
5268	**ROLLING HILLS APARTMENTS**			
5240	557.37	557.95	5.42	5.50
5159	556.17	556.58	9.15	9.65
4966	553.72	554.14	9.17	9.73
4751	551.65	552.12	9.61	10.17
4564	550.31	550.76	9.32	9.81
4418	547.76	548.18	9.14	9.67
4366	547.45	548.54	7.08	6.10
4299	547.69	548.61	5.02	5.25
4254	**ROLLING HILLS**			
4201	545.37	545.84	6.94	7.54
4153	545.31	545.85	4.83	5.02
4016	543.99	544.31	7.33	8.21
3808	542.02	542.37	6.15	6.38
3536	537.15	537.64	9.53	9.96
3168	534.93	535.67	5.50	5.93
2987	533.64	534.34	7.37	7.76
2670	531.34	531.88	7.15	7.86
2309	527.95	528.40	7.70	8.21
2019	523.11	523.89	9.49	8.86
1787	520.87	521.41	5.76	6.19
1641	519.14	519.78	8.22	8.16
1276	517.32	517.56	5.33	5.97
807	517.60	517.91	0.53	0.61
586	517.59	517.90	0.71	0.81
380	517.57	517.88	1.03	1.18
323	517.54	517.83	1.66	1.94
243	**WEST BELT LINE ROAD**			
149	517.11	517.22	0.43	0.51
57	517.11	517.22	0.31	0.36

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	607.61	608.47	1.98	1.89
4123	607.54	608.46	1.46	1.05
4088	607.39	608.46	3.04	0.68
4070	PIKE DRIVE			
4047	603.58	604.01	3.80	4.19
3991	602.88	603.06	5.44	6.62
3773	602.54	603.18	1.67	1.40
3722	602.39	603.01	2.75	3.10
3703	MCKINNEY DRIVE			
3676	600.12	600.40	6.23	6.84
3631	599.31	599.77	3.60	3.89
3445	597.87	598.03	4.88	5.92
3350.03	597.71	598.02	2.21	2.21
3246	597.44	597.83	2.42	2.15
3204	597.39	597.76	2.37	2.50
3182	GANT DRIVE			
3161	595.78	596.08	2.99	2.58
3102	595.40	595.59	4.32	4.48
2974	593.97	594.08	4.73	4.94
2782	591.75	591.87	3.47	3.63
2707.22	590.44	590.55	5.41	5.60
2627	589.67	589.75	1.99	2.11
2375	587.44	587.49	3.34	3.42
2152	585.28	585.37	2.03	2.07
1959	583.85	583.89	3.48	3.79
1760	581.93	582.03	2.92	2.92
1587	579.11	579.33	6.72	7.00
1548	578.22	578.70	4.70	4.40
1501	WEST PLEASANT RUN ROAD			
1449	577.25	577.46	6.93	7.39
1398	576.68	577.00	4.89	5.06
1295	575.77	576.08	4.09	4.29
1165	574.77	575.05	5.09	5.35
1040	574.04	574.36	3.83	3.78
922	572.53	572.85	5.25	5.06

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	571.72	571.92	4.24	4.54
682	570.31	570.65	5.36	4.94
521	567.11	567.33	7.28	7.68
438	565.83	565.96	5.75	6.07
371	564.44	564.54	2.98	3.11
309	564.29	564.40	2.47	2.51
256	563.72	563.84	5.20	5.24

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	632.89	632.97	4.50	5.03
12538	629.92	630.12	5.10	4.72
12289	627.05	627.23	3.33	3.53
12069	624.57	624.78	5.49	5.38
11896	622.70	622.93	2.70	2.92
11460	619.70	619.89	5.76	5.84
11233	617.08	617.29	3.86	4.06
10942	614.81	614.98	4.04	4.34
10689	612.64	612.74	3.24	3.53
10406	609.92	610.04	3.26	3.40
9987	606.82	606.93	2.79	3.04
9602	604.23	604.41	4.28	4.44
9301	600.97	601.03	4.48	5.06
9061	595.37	595.89	7.84	7.25
8683	590.50	591.07	5.88	5.57
8495	589.13	590.89	4.49	2.45
8443	589.03	590.72	3.88	3.56
8421	**GREEN ROAD**			
8401	586.94	587.42	5.23	5.71
8326	586.85	587.33	3.78	4.10
8082	584.90	585.25	7.98	8.24
7757	581.95	582.50	3.64	3.70
7511	579.36	579.86	9.08	9.38
7146	576.46	576.97	4.84	5.23
6808	574.31	574.71	6.36	6.85
6635	571.62	572.03	8.27	8.58
6590	570.81	571.83	7.42	6.54
6543	**WEST PLEASANT RUN**			
6487	570.03	570.48	7.29	7.63
6370	569.62	570.14	4.09	4.26
6137	566.99	567.45	8.98	9.41
5951	566.57	566.93	3.46	3.70
5701	565.78	566.06	3.68	4.11
5517	564.43	564.57	5.69	6.11
5352	560.81	561.39	2.89	2.59

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	560.08	560.68	6.11	6.18
5268	**ROLLING HILLS APARTMENTS**			
5240	558.44	558.94	5.61	5.76
5159	556.94	557.32	10.06	10.46
4966	554.49	554.87	10.18	10.63
4751	552.49	552.96	10.60	11.11
4564	551.12	551.57	10.18	10.62
4418	548.82	549.98	9.15	7.95
4366	549.32	550.32	5.76	5.42
4299	549.33	550.23	5.49	5.77
4254	**ROLLING HILLS**			
4201	546.22	546.70	8.03	8.62
4153	546.28	546.83	5.17	5.33
4016	544.54	544.84	8.97	9.85
3808	542.67	542.99	6.51	6.81
3536	538.05	538.75	10.18	9.81
3168	536.20	536.85	6.22	6.54
2987	534.84	535.48	8.02	8.28
2670	532.32	532.87	8.28	8.70
2309	528.66	528.99	8.75	9.37
2019	524.17	524.50	9.16	9.58
1787	521.79	522.17	6.50	6.98
1641	520.87	521.16	6.56	7.11
1276	520.21	520.50	3.48	3.65
807	520.32	520.62	0.51	0.59
586	520.32	520.61	0.72	0.79
380	520.31	520.60	1.00	1.08
323	520.24	520.54	2.10	2.19
243	**WEST BELT LINE ROAD**			
149	519.30	519.41	0.50	0.56
57	519.30	519.41	0.29	0.33

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	608.65	609.23	1.86	1.82
4123	608.65	609.24	0.94	0.68
4088	608.65	609.24	0.58	0.44
4070	**PIKE DRIVE**			
4047	604.09	604.36	4.27	4.61
3991	603.13	603.49	6.71	6.66
3773	603.31	603.80	1.34	1.10
3722	603.13	603.68	3.16	2.67
3703	**MCKINNEY DRIVE**			
3676	600.46	600.66	6.91	7.31
3631	599.84	600.12	3.97	4.20
3445	598.17	598.43	5.64	5.58
3350.03	598.22	598.52	1.97	1.91
3246	598.09	598.43	1.98	1.81
3204	598.00	598.40	2.57	1.82
3182	**GANT DRIVE**			
3161	596.29	596.42	2.50	2.73
3102	595.91	596.03	3.90	4.08
2974	594.15	594.31	5.01	5.10
2782	591.93	592.03	3.75	4.04
2707.22	590.64	590.82	5.61	5.49
2627	589.81	589.90	2.18	2.33
2375	587.51	587.56	3.55	3.63
2152	585.44	585.51	2.03	2.12
1959	583.93	583.95	4.09	4.36
1760	582.13	582.22	2.96	2.94
1587	579.54	579.73	7.19	7.38
1548	579.15	579.57	4.24	4.08
1501	**WEST PLEASANT RUN ROAD**			
1449	577.65	577.86	7.83	8.11
1398	577.30	577.62	5.17	5.14
1295	576.38	576.68	4.41	4.40
1165	575.27	575.41	5.64	6.05
1040	574.57	574.71	4.03	4.22
922	573.07	573.21	5.12	5.28

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	572.10	572.31	4.92	4.99
682	570.87	570.82	4.94	5.86
521	567.63	568.06	7.86	7.05
438	566.08	566.19	6.42	6.64
371	564.65	564.74	3.27	3.39
309	564.51	564.59	2.59	2.65
256	563.97	564.03	5.26	5.53

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	632.97	633.05	5.03	5.43
12538	630.12	630.24	4.72	4.65
12289	627.20	627.46	3.53	3.69
12069	624.77	624.95	5.31	5.62
11896	622.90	623.19	2.90	3.20
11460	619.87	620.08	5.81	6.12
11233	617.27	617.60	4.04	4.14
10942	614.96	615.28	4.31	4.33
10689	612.73	612.89	3.49	3.83
10406	610.02	610.18	3.38	3.58
9987	606.92	607.06	3.01	3.31
9602	604.40	604.50	4.42	4.66
9301	601.02	601.11	5.02	5.29
9061	595.85	596.17	7.29	7.12
8683	590.96	593.58	5.76	2.29
8495	590.73	593.57	2.56	1.22
8443	590.56	593.47	3.58	2.55
8421	**GREEN ROAD**			
8401	587.38	587.84	5.67	6.08
8326	587.28	587.74	4.07	4.31
8082	585.22	585.53	8.20	8.40
7757	582.41	582.86	3.76	3.86
7511	579.76	580.22	9.30	9.38
7146	576.87	577.37	5.15	5.38
6808	574.62	574.79	6.75	7.58
6635	571.95	572.52	8.51	7.98
6590	571.64	572.43	6.63	6.38
6543	**WEST PLEASANT RUN**			
6487	570.38	570.82	7.56	7.75
6370	570.04	570.52	4.23	4.28
6137	567.36	567.74	9.32	9.69
5951	566.86	567.16	3.65	3.86
5701	566.01	566.22	4.02	4.43
5517	564.54	564.68	6.06	6.27
5352	561.53	562.01	2.29	2.19

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	560.82	561.26	6.21	6.46
5268	**ROLLING HILLS APARTMENTS**			
5240	559.06	559.52	5.80	5.96
5159	557.41	557.77	10.56	10.87
4966	554.97	555.32	10.74	11.13
4751	553.03	553.39	11.18	11.57
4564	551.63	551.97	10.68	11.02
4418	550.14	550.97	7.83	7.31
4366	550.46	551.23	5.38	5.20
4299	550.36	551.05	5.81	6.05
4254	**ROLLING HILLS**			
4201	546.76	547.13	8.71	9.17
4153	546.91	547.33	5.36	5.50
4016	544.90	545.25	9.95	10.31
3808	543.04	543.11	6.85	7.52
3536	538.86	539.64	9.70	8.72
3168	536.95	537.88	6.59	6.26
2987	535.57	536.78	8.31	7.26
2670	532.96	534.41	8.74	6.56
2309	529.03	529.28	9.46	9.97
2019	524.55	524.80	9.63	9.96
1787	522.31	522.55	6.92	7.38
1641	521.49	521.67	6.57	7.00
1276	521.07	521.20	3.32	3.55
807	521.16	521.31	0.58	0.63
586	521.16	521.30	0.78	0.85
380	521.15	521.29	1.04	1.12
323	521.10	521.24	1.90	2.00
243	**WEST BELT LINE ROAD**			
149	520.40	520.53	0.52	0.56
57	520.40	520.53	0.29	0.32

TRIBUTARY

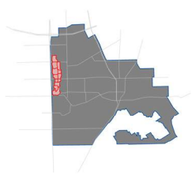
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	609.16	609.38	1.78	2.02
4123	609.18	609.40	0.69	0.71
4088	609.18	609.40	0.43	0.45
4070	**PIKE DRIVE**			
4047	604.29	604.61	4.53	4.91
3991	603.39	603.78	6.72	6.76
3773	603.68	604.16	1.15	0.98
3722	603.49	604.13	3.31	1.53
3703	**MCKINNEY DRIVE**			
3676	600.60	600.87	7.24	7.55
3631	600.00	600.47	4.24	4.12
3445	598.44	598.46	5.29	6.33
3350.03	598.53	598.63	1.83	2.07
3246	598.43	598.53	1.81	1.90
3204	598.40	598.51	1.82	1.76
3182	**GANT DRIVE**			
3161	596.42	596.50	2.73	2.91
3102	596.03	596.10	4.08	4.21
2974	594.31	594.42	5.10	5.15
2782	592.03	592.09	4.04	4.27
2707.22	590.82	590.93	5.49	5.44
2627	589.90	589.97	2.33	2.38
2375	587.56	587.60	3.63	3.74
2152	585.52	585.57	2.10	2.15
1959	583.96	583.99	4.40	4.56
1760	582.24	582.32	2.95	2.92
1587	579.78	579.99	7.35	7.29
1548	579.65	580.04	4.04	3.90
1501	**WEST PLEASANT RUN ROAD**			
1449	577.94	578.13	8.04	8.32
1398	577.70	577.91	5.09	5.20
1295	576.73	576.93	4.41	4.50
1165	575.46	575.58	6.06	6.43
1040	574.76	574.88	4.29	4.47
922	573.26	573.39	5.32	5.42

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	572.37	572.51	5.06	5.25
682	570.85	570.94	5.99	6.22
521	568.14	568.34	7.05	6.97
438	566.23	566.29	6.74	7.13
371	564.76	564.83	3.46	3.56
309	564.61	564.68	2.70	2.78
256	564.06	564.11	5.44	5.62

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	633.09	633.22	5.45	5.49
12538	630.25	630.30	4.74	4.95
12289	627.44	627.62	3.62	3.89
12069	624.91	625.10	5.64	5.70
11896	623.15	623.43	3.15	3.39
11460	620.04	620.27	6.10	6.12
11233	617.56	617.82	4.11	4.26
10942	615.23	615.44	4.33	4.54
10689	612.87	613.00	3.74	4.07
10406	610.14	610.28	3.61	3.78
9987	607.05	607.19	3.22	3.49
9602	604.53	604.63	4.71	4.94
9301	601.13	601.24	5.38	5.63
9061	596.25	596.48	7.08	7.10
8683	593.74	594.04	2.27	2.38
8495	593.73	594.02	1.22	1.31
8443	593.64	593.95	2.45	2.45
8421	**GREEN ROAD**			
8401	587.95	588.28	6.18	6.70
8326	587.86	588.18	4.36	4.67
8082	585.60	586.00	8.47	8.25
7757	582.96	583.29	3.91	4.11
7511	580.32	580.68	9.40	9.42
7146	577.49	577.92	5.41	5.54
6808	574.80	574.95	7.85	8.51
6635	572.70	573.39	7.72	6.94
6590	572.59	573.24	6.36	6.31
6543	**WEST PLEASANT RUN**			
6487	570.89	571.17	7.85	8.23
6370	570.61	570.95	4.31	4.43
6137	567.83	568.18	9.77	9.96
5951	567.23	567.48	3.90	4.06
5701	566.26	566.45	4.51	4.83
5517	564.70	564.82	6.38	6.62
5352	562.29	562.59	2.03	2.07

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	561.48	561.70	6.71	7.08
5268	**ROLLING HILLS APARTMENTS**			
5240	559.82	560.19	6.06	6.18
5159	558.00	558.28	11.09	11.35
4966	555.56	555.84	11.37	11.67
4751	553.66	554.00	11.82	12.12
4564	552.21	552.52	11.27	11.56
4418	551.36	551.62	7.31	7.67
4366	551.62	551.89	5.26	5.54
4299	551.38	551.66	6.35	6.49
4254	**ROLLING HILLS**			
4201	547.40	548.32	9.51	5.16
4153	547.65	548.06	5.59	5.68
4016	545.45	545.61	10.70	11.42
3808	543.44	543.62	7.16	7.39
3536	539.99	540.65	8.64	7.97
3168	538.12	538.56	6.41	6.54
2987	536.93	537.16	7.52	7.98
2670	534.59	534.89	6.54	6.49
2309	529.43	529.67	10.29	10.83
2019	524.96	525.25	10.16	10.41
1787	522.82	522.93	7.47	8.15
1641	522.48	522.59	5.42	5.77
1276	522.18	522.23	3.02	3.25
807	522.25	522.32	0.61	0.66
586	522.24	522.31	0.81	0.88
380	522.23	522.30	1.05	1.14
323	522.21	522.27	1.58	1.70
243	**WEST BELT LINE ROAD**			
149	522.17	522.23	0.50	0.54
57	522.17	522.23	0.28	0.30

TRIBUTARY

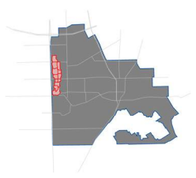
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	609.38	609.49	2.02	2.28
4123	609.40	609.52	0.71	0.77
4088	609.40	609.52	0.45	0.49
4070	**PIKE DRIVE**			
4047	604.61	604.92	4.91	5.24
3991	603.78	603.90	6.76	7.55
3773	604.16	604.41	0.98	0.99
3722	604.13	604.39	1.53	1.30
3703	**MCKINNEY DRIVE**			
3676	600.87	601.21	7.55	6.40
3631	600.41	600.67	4.24	4.42
3445	598.55	598.63	5.95	6.60
3350.03	598.69	598.76	1.97	2.23
3246	598.60	598.66	1.93	2.03
3204	598.58	598.64	1.71	1.72
3182	**GANT DRIVE**			
3161	596.55	596.61	3.03	3.19
3102	596.14	596.19	4.31	4.46
2974	594.49	594.59	5.17	5.14
2782	592.12	592.19	4.42	4.57
2707.22	591.00	591.10	5.39	5.32
2627	590.01	590.06	2.41	2.48
2375	587.62	587.64	3.82	3.93
2152	585.61	585.63	2.14	2.24
1959	584.00	584.09	4.78	4.61
1760	582.37	582.38	2.90	3.34
1587	580.10	580.92	7.29	5.31
1548	580.27	580.95	3.84	3.65
1501	**WEST PLEASANT RUN ROAD**			
1449	578.22	578.44	8.57	9.21
1398	578.01	578.25	5.30	5.52
1295	577.01	577.27	4.61	4.67
1165	575.70	575.81	6.45	7.15
1040	575.02	575.14	4.66	4.83
922	573.54	573.69	5.52	5.61

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	572.60	572.70	5.59	5.89
682	571.09	571.20	6.19	6.30
521	568.50	568.64	7.05	7.17
438	566.47	566.57	7.05	7.26
371	564.91	564.99	3.66	3.75
309	564.76	564.83	2.88	2.96
256	564.16	564.20	5.78	6.06

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	633.22	633.30	5.49	5.67
12538	630.30	630.35	4.95	5.16
12289	627.55	627.70	3.82	3.97
12069	625.05	625.15	5.63	5.84
11896	623.34	623.54	3.32	3.48
11460	620.22	620.34	6.00	6.24
11233	617.74	617.93	4.21	4.26
10942	615.37	615.51	4.49	4.67
10689	612.97	613.08	3.94	4.13
10406	610.22	610.31	3.75	3.95
9987	607.15	607.27	3.38	3.52
9602	604.61	604.70	4.91	5.15
9301	601.22	601.32	5.59	5.73
9061	596.44	596.64	7.12	7.18
8683	593.99	594.12	2.36	2.59
8495	593.98	594.10	1.30	1.44
8443	593.90	594.01	2.45	2.66
8421	**GREEN ROAD**			
8401	588.23	588.52	6.61	7.12
8326	588.13	588.43	4.62	4.92
8082	585.93	586.21	8.28	8.33
7757	583.28	583.54	4.03	4.29
7511	580.68	580.94	9.42	9.49
7146	577.92	578.27	5.54	5.58
6808	574.95	575.14	8.51	8.82
6635	573.39	573.92	6.94	6.46
6590	573.24	573.74	6.31	6.32
6543	**WEST PLEASANT RUN**			
6487	571.17	571.39	8.23	8.55
6370	570.95	571.21	4.43	4.53
6137	568.18	568.46	9.96	10.04
5951	567.48	567.69	4.06	4.16
5701	566.45	566.57	4.83	5.11
5517	564.82	564.91	6.62	6.74
5352	562.71	562.95	1.99	2.03

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	561.78	561.90	7.26	7.72
5268	**ROLLING HILLS APARTMENTS**			
5240	560.35	560.71	6.21	6.32
5159	558.37	558.62	11.55	11.82
4966	555.96	556.23	11.78	12.05
4751	554.09	554.46	12.21	12.54
4564	552.61	552.95	11.64	11.95
4418	551.69	551.91	7.77	8.24
4366	551.97	552.23	5.61	5.94
4299	551.76	552.08	6.44	6.46
4254	**ROLLING HILLS**			
4201	548.44	548.90	5.16	5.16
4153	548.18	548.63	5.71	5.81
4016	545.67	545.94	11.57	12.10
3808	543.64	543.87	7.52	7.65
3536	540.87	541.25	7.69	7.71
3168	538.72	539.03	6.52	6.49
2987	537.22	537.33	8.12	8.47
2670	534.97	535.16	6.50	6.47
2309	529.77	529.94	10.93	11.28
2019	525.31	525.50	10.57	10.76
1787	523.27	523.29	7.83	8.39
1641	523.38	523.45	4.15	4.33
1276	523.22	523.27	2.57	2.69
807	523.26	523.32	0.62	0.66
586	523.25	523.31	0.82	0.87
380	523.25	523.30	1.04	1.11
323	523.23	523.29	1.35	1.41
243	**WEST BELT LINE ROAD**			
149	523.23	523.29	0.50	0.53
57	523.23	523.29	0.28	0.30

TRIBUTARY

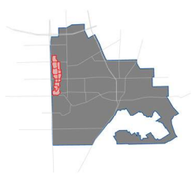
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	609.45	609.55	2.24	2.51
4123	609.48	609.59	0.77	0.83
4088	609.48	609.59	0.49	0.52
4070	**PIKE DRIVE**			
4047	604.86	605.20	5.18	5.40
3991	603.89	603.89	7.37	8.51
3773	604.36	604.53	0.98	1.02
3722	604.35	604.51	1.33	1.27
3703	**MCKINNEY DRIVE**			
3676	601.05	601.40	6.95	6.19
3631	600.63	600.69	4.36	4.90
3445	598.60	598.88	6.55	6.14
3350.03	598.79	598.77	2.13	2.49
3246	598.69	598.63	2.06	2.37
3204	598.67	598.60	1.73	2.08
3182	**GANT DRIVE**			
3161	596.63	596.70	3.25	3.47
3102	596.21	596.28	4.48	4.59
2974	594.62	594.71	5.17	5.22
2782	592.23	592.29	4.53	4.72
2707.22	591.11	591.20	5.40	5.44
2627	590.08	590.14	2.50	2.59
2375	587.65	587.69	3.96	4.11
2152	585.65	585.68	2.25	2.37
1959	584.06	584.13	4.78	4.65
1760	582.38	582.41	3.19	3.44
1587	580.68	581.33	5.85	4.64
1548	580.75	581.31	3.72	3.44
1501	**WEST PLEASANT RUN ROAD**			
1449	578.38	578.58	9.07	9.54
1398	578.19	578.38	5.48	5.64
1295	577.19	577.41	4.71	4.74
1165	575.83	575.90	6.80	7.41
1040	575.17	575.24	4.85	4.97
922	573.70	573.78	5.64	5.73

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	572.72	572.77	5.92	6.11
682	571.21	571.28	6.33	6.40
521	568.64	568.71	7.28	7.38
438	566.58	566.63	7.30	7.49
371	565.00	565.05	3.76	3.84
309	564.84	564.88	2.97	3.06
256	564.21	564.25	6.08	6.00

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1



2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
12753	633.30	633.35	5.67	6.01
12538	630.35	630.46	5.16	4.97
12289	627.68	627.82	3.96	4.19
12069	625.14	625.26	5.80	5.95
11896	623.52	623.75	3.46	3.65
11460	620.33	620.49	6.21	6.30
11233	617.91	618.10	4.26	4.37
10942	615.50	615.67	4.64	4.77
10689	613.06	613.17	4.13	4.37
10406	610.30	610.42	3.90	4.09
9987	607.25	607.36	3.53	3.73
9602	604.69	604.72	5.09	5.29
9301	601.30	601.36	5.75	5.72
9061	596.62	596.69	7.11	7.30
8683	594.09	594.20	2.55	2.65
8495	594.08	594.18	1.42	1.48
8443	593.99	594.09	2.63	2.69
8421	**GREEN ROAD**			
8401	588.48	588.65	7.04	7.30
8326	588.38	588.56	4.87	5.01
8082	586.17	586.29	8.30	8.46
7757	583.57	583.84	4.17	4.17
7511	580.99	581.26	9.49	9.69
7146	578.34	578.68	5.58	5.68
6808	575.18	575.52	8.84	8.85
6635	574.03	574.73	6.38	5.84
6590	573.84	574.47	6.32	6.36
6543	**WEST PLEASANT RUN**			
6487	571.43	571.83	8.61	8.69
6370	571.26	571.68	4.55	4.53
6137	568.51	568.82	10.06	10.25
5951	567.73	567.96	4.18	4.32
5701	566.60	566.75	5.16	5.49
5517	564.93	565.03	6.75	6.94
5352	563.02	563.28	2.02	2.10

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
5288	561.94	562.06	7.84	8.33
5268	**ROLLING HILLS APARTMENTS**			
5240	560.80	561.18	6.35	6.46
5159	558.69	558.97	11.89	12.16
4966	556.31	556.60	12.12	12.40
4751	554.48	554.81	12.56	12.85
4564	552.97	553.28	11.97	12.24
4418	551.92	552.05	8.27	8.80
4366	552.24	552.43	5.96	6.30
4299	552.09	552.31	6.47	6.64
4254	**ROLLING HILLS**			
4201	548.93	549.34	5.16	5.19
4153	548.65	549.05	5.82	5.92
4016	545.95	546.24	12.14	12.48
3808	543.87	544.10	7.70	7.75
3536	541.32	541.52	7.60	7.89
3168	539.15	539.47	6.53	6.51
2987	537.38	537.53	8.70	9.23
2670	535.25	535.51	6.46	6.46
2309	530.02	530.30	11.50	11.93
2019	525.61	525.90	10.84	11.09
1787	523.90	523.90	7.74	8.56
1641	524.21	524.30	3.32	3.55
1276	524.14	524.23	2.06	2.15
807	524.16	524.25	0.63	0.67
586	524.15	524.24	0.82	0.87
380	524.14	524.23	1.04	1.11
323	524.14	524.23	1.17	1.23
243	**WEST BELT LINE ROAD**			
149	524.13	524.23	0.50	0.54
57	524.13	524.23	0.29	0.30

TRIBUTARY

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
4237	609.48	609.43	2.50	2.89
4123	609.52	609.48	0.84	0.98
4088	609.52	609.48	0.53	0.62
4070	**PIKE DRIVE**			
4047	605.15	605.39	5.34	5.68
3991	603.85	604.09	8.44	8.63
3773	604.50	604.62	1.01	1.06
3722	604.48	604.61	1.28	1.29
3703	**MCKINNEY DRIVE**			
3676	601.37	601.57	6.16	6.00
3631	600.67	600.79	4.81	5.19
3445	598.85	598.99	6.13	6.25
3350.03	598.81	598.97	2.35	2.41
3246	598.68	598.85	2.35	2.32
3204	598.66	598.84	1.99	1.80
3182	**GANT DRIVE**			
3161	596.71	596.81	3.53	3.76
3102	596.30	596.33	4.60	5.01
2974	594.73	594.88	5.25	5.02
2782	592.31	592.31	4.74	5.28
2707.22	591.22	591.41	5.50	4.90
2627	590.16	590.22	2.62	2.74
2375	587.70	587.75	4.11	4.26
2152	585.69	585.77	2.41	2.38
1959	584.13	584.17	4.65	5.08
1760	582.41	582.52	3.44	3.42
1587	581.33	581.70	4.64	4.30
1548	581.31	581.75	3.44	2.70
1501	**WEST PLEASANT RUN ROAD**			
1449	578.58	578.89	9.54	10.02
1398	578.38	578.58	5.64	5.91
1295	577.39	577.57	4.77	5.08
1165	575.93	576.18	7.29	7.38
1040	575.28	575.33	5.03	5.11
922	573.82	573.88	5.77	5.84

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
813	572.80	572.84	6.20	6.33
682	571.31	571.36	6.43	6.47
521	568.74	568.77	7.48	7.64
438	566.67	566.72	7.50	7.55
371	565.07	565.11	3.88	3.87
309	564.90	564.95	3.09	3.07
256	564.27	564.69	6.04	3.50

WATERSHED NO.
11

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
0.96 SM
*
STREAM LENGTH
3.18 MI
*
PROJECTS IDENTIFIED
1

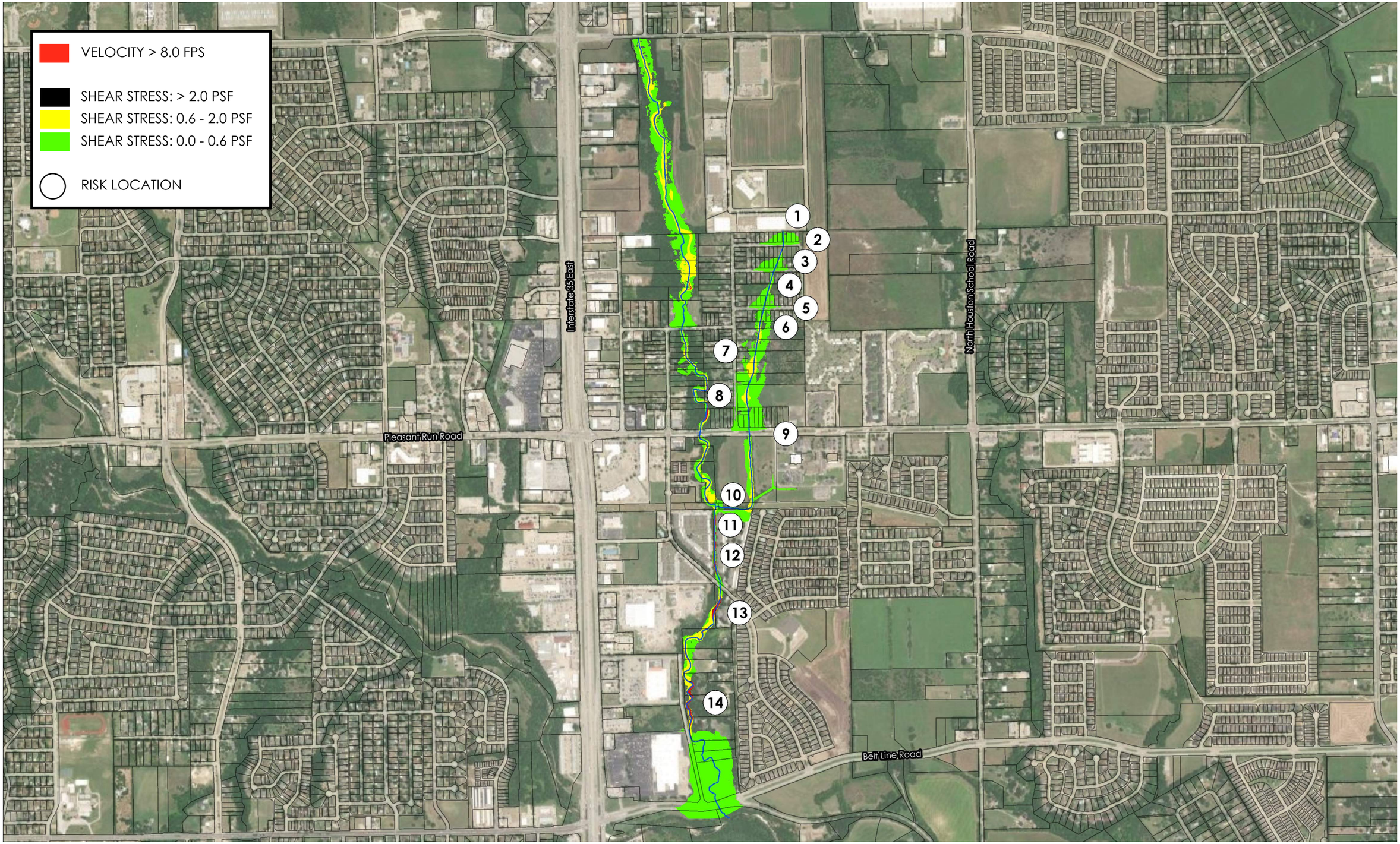


3.1 RISK IDENTIFICATION

Fourteen risk areas were identified in this study. The risks include six over-topping bridges, seven areas of flooding structures and two locations of erosive velocities. All the flooded structures in this watershed are residential buildings. The houses north of Pleasant Run Road are particularly prone to flooding. The over-topping bridges north of Pleasant Run are also the most flood prone, though they are less trafficked. The Rolling Hills Place crossing is a heavier traffic area that also experiences flooding relatively frequently (10-year storm event). The two areas where erosion is likely are located away within a developed part of the city, but currently do not pose any risk to structures. The following map shows the shear stresses associated with the Stream 3A6 floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Houses North of Pike Drive	Flooded Structure	1-Year	Private	High
2	Pike Drive	Over-topping Bridge	5-Year	Public	High
3	McKinney Drive	Over-topping Bridge	5-Year	Public	High
4	Houses Between Pike Drive and McKinney Drive	Flooded Structure	1-Year	Private	High
5	Gant Drive	Over-topping Bridge	5-Year	Public	High
6	Houses Between McKinney Drive and Gant Drive	Flooded Structure	5-Year	Private	High
7	Houses Between Gant Drive and Pleasant Run Road	Flooded Structure	25-Year	Private	Medium
8	Houses along Marsalis Road	Flooded Structure	25-Year	Private	Medium
9	Pleasant Run Road	Over-topping Bridge	50-Year	Public	Medium
10	Private Road Crossing (Multi-Family Dveelopment)	Over-topping Bridge	10-Year	Private	Low
11	Multi-Family Structure	Flooded Structure	100-Year	Private	Low
12	Rolling Hills Place	Over-topping Bridge	10-Year	Public	High
13	River Station 4016	Potential Erosion Hot Spot	1-Year	Private	Low
14	River Station 2309	Potential Erosion Hot Spot	1-Year	Private	Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
Interstate 35 East
North Houston School Road
Pleasant Run Road
Belt Line Road
1
2
3
4
5
6
7
8
9
10
11
12
13
14

TEN MILE CREEK

WATERSHED NO.

12

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

7.25 SM

*

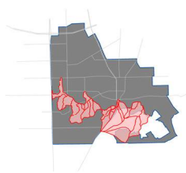
STREAM LENGTH

5.42 MI

*

PROJECTS IDENTIFIED

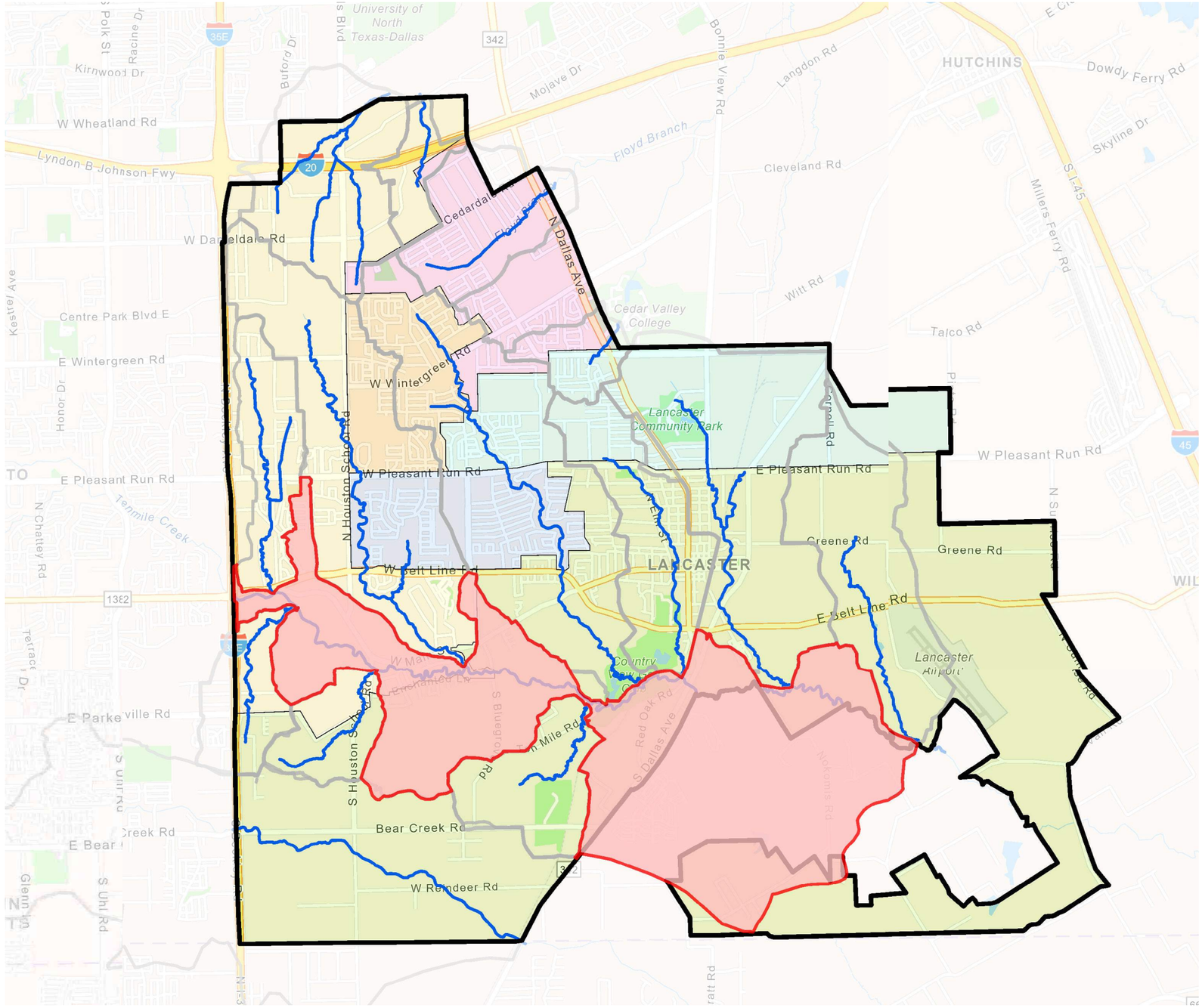
4



- TEN MILE CREEK
- STREAM CENTERLINE

COUNCIL DISTRICT

- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6



TEN MILE CREEK WATERSHED

Located south near Interstate 35, this 0.75-square-mile watershed originates north of West Pleasant Road. As it winds south for about 1.75 miles, it's mainly wooded and open, with pockets of residential and commercial zones.

WATERSHED NO. 12

TEN MILE CREEK

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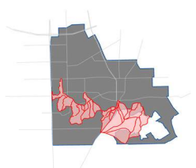
WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.1 DRAINAGE AREA MAP

The drainage area divides for the Ten Mile Creek watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into twenty-six (26) sub-basins. Sub-basins are designated TM1 through TM26. The total watershed drainage area is 4639.2 acres (7.25 square-miles). Approximately 2.60 square-miles of drainage area is located outside the City of Lancaster itself.

N

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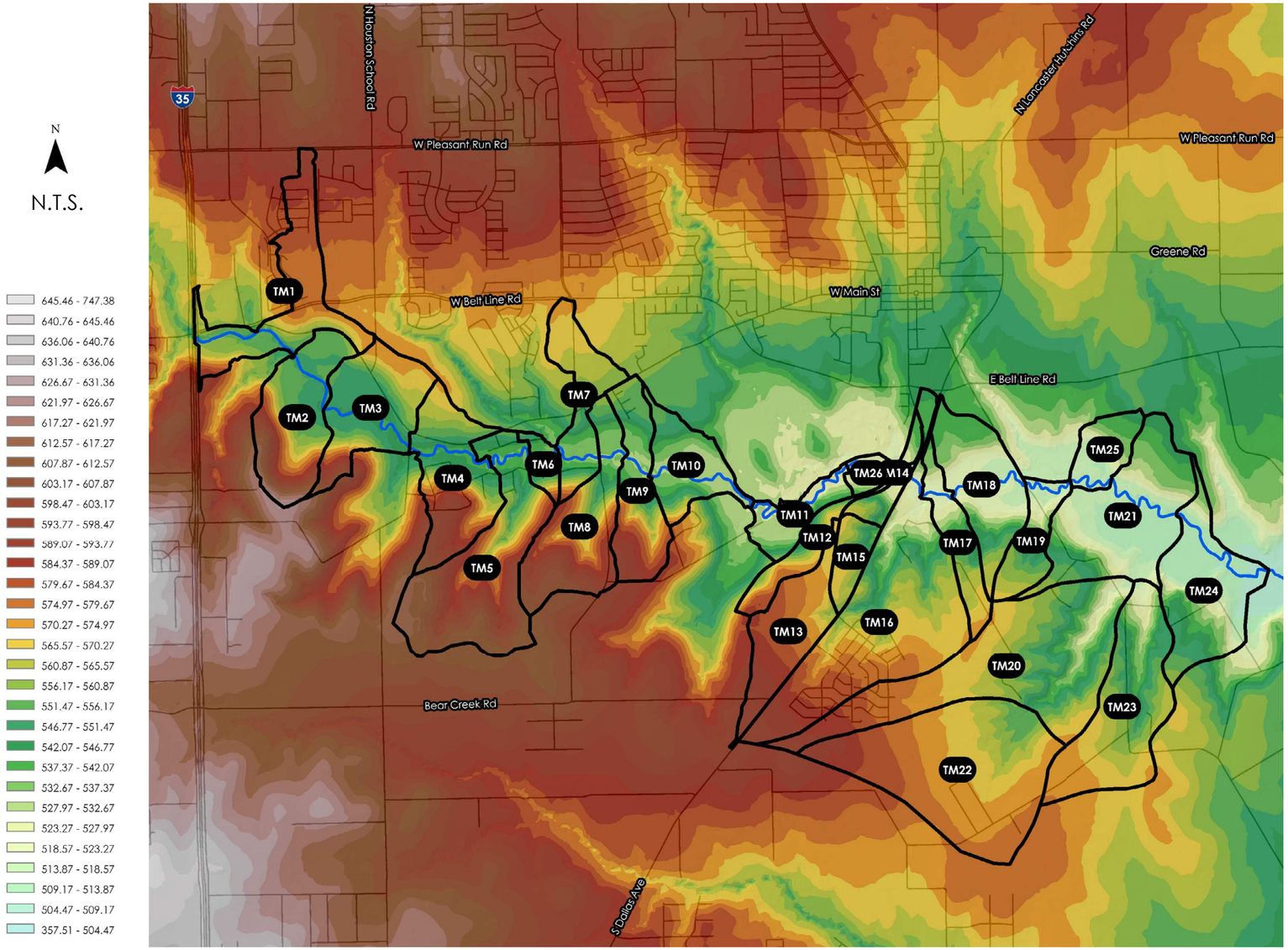


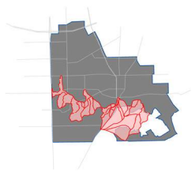
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
TM1	0.3186	81.6	22.3	33.8	16.90	10.14	13.40	8.04
TM2	0.3026	79.5	0.7	0.8	17.93	10.76	14.00	8.4
TM3	0.2935	82.6	1.8	5.3	23.88	14.33	19.58	11.75
TM4	0.3023	81.7	9.6	14.8	22.55	13.53	18.22	10.93
TM5	0.4862	82.4	2.2	15.5	24.15	14.49	20.05	12.03
TM6	0.0482	78.2	10.9	14.7	21.73	13.04	16.57	9.94
TM7	0.1942	80.9	7.8	25.5	41.35	24.81	32.33	19.4
TM8	0.3124	81.8	2.4	12.1	42.48	25.49	33.78	20.27
TM9	0.2291	80.7	4.5	15.8	25.65	15.39	20.23	12.14
TM10	0.184	76.7	0.3	11.7	36.57	21.94	28.98	17.39
TM11	0.1101	79.2	3.5	13	23.45	14.07	18.85	11.31
TM12	0.1267	80.2	5.3	37.3	21.87	13.12	18.95	11.37
TM13	0.2378	84	27.4	58.7	35.97	21.58	28.97	17.38
TM14	0.0655	78.4	12.1	41.9	15.95	9.57	12.67	7.6
TM15	0.0813	84	5.8	34.9	16.13	9.68	13.28	7.97
TM16	0.6987	83.6	27.2	49.8	58.30	34.98	49.10	29.46
TM17	0.1342	81.4	1.8	21.6	38.70	23.22	31.85	19.11
TM18	0.2715	77.2	0.9	14.3	30.02	18.01	24.40	14.64
TM19	0.1279	82.5	3.2	28.2	24.65	14.79	21.17	12.7
TM20	0.6825	83.8	9.5	43.6	59.40	35.64	53.87	32.32
TM21	0.449	78.2	2.8	11.1	40.70	24.42	35.28	21.17
TM22	0.6823	84	3.4	44.7	34.93	20.96	29.55	17.73
TM23	0.4151	84	4.7	33.8	49.78	29.87	41.80	25.08
TM24	0.3375	81.3	2	20.6	24.23	14.54	20.92	12.55
TM25	0.1088	76.6	0	6.5	22.83	13.7	17.32	10.39
TM26	0.0452	80.2	2.6	3.1	11.07	6.64	10.00	6

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.2 TIME OF CONCENTRATION

The Times of Concentration for Ten Mile Creek were traced using the 2009 LiDAR data. and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Ten Mile Creek runs through wooded undeveloped land. Given the large amount of open space, Times of Concentration tend to be longer. There are considerable differences in sub-basin sizes, so some small basins see smaller Times of Concentration than larger basins. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

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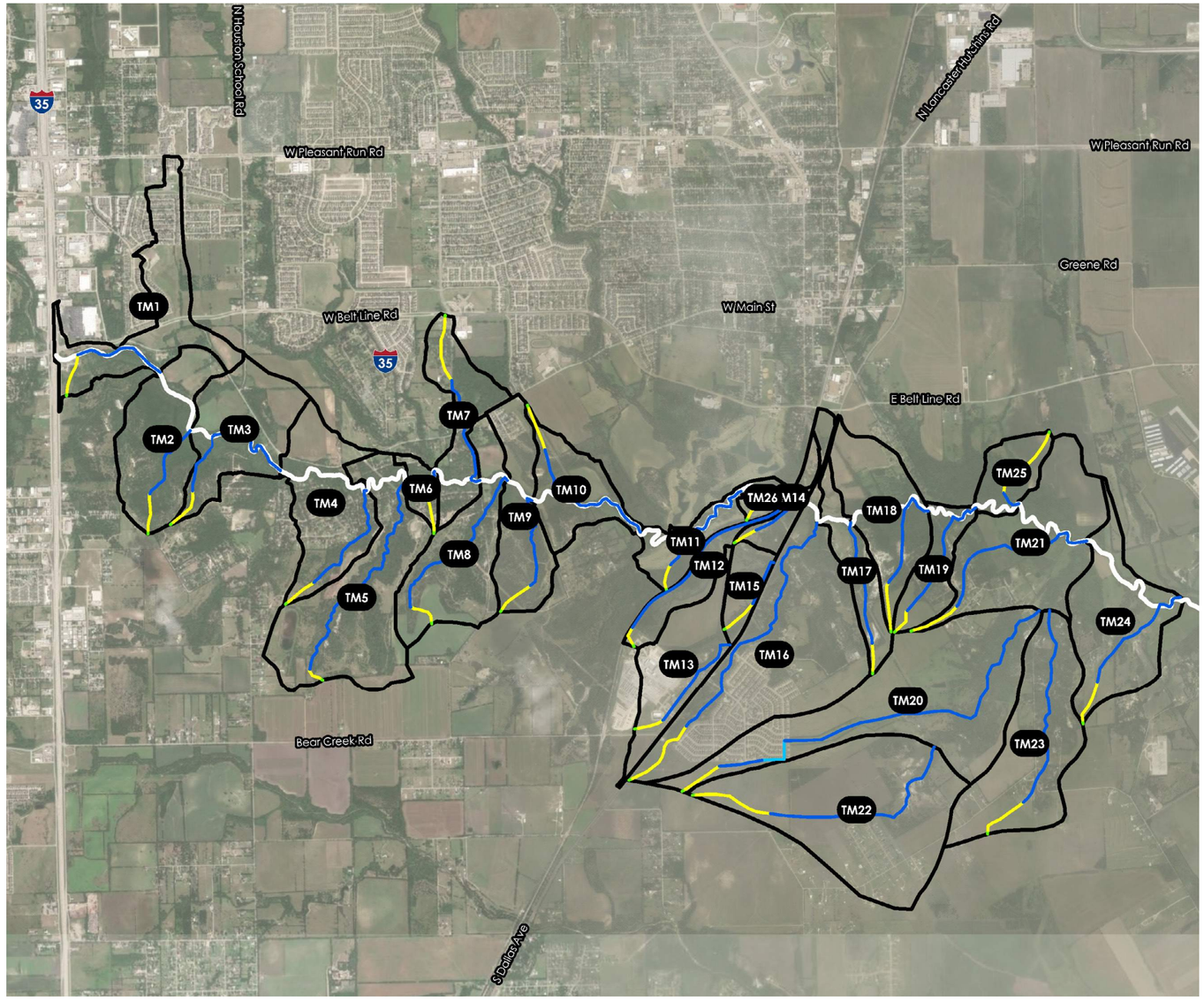


TIME OF CONCENTRATION REPORT

TM1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	3.5	0.240	0.00	0.2	10.76
SHALLOW	UNPAVED	1,056	11.16	0.000	16.10	5.4	3.27
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,573	12.45	0.050	42.29	14.9	2.87
		3,729					**16.90**
							13.39

TM2

OVERLAND	GRS-DENSE	100	2.44	0.240	0.00	0.1	12.43
SHALLOW	UNPAVED	991	9.6	0.000	16.10	5.0	3.31
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,186	15.53	0.050	42.29	16.7	2.19
		3,277					**17.93**
							14.00

TM3

OVERLAND	GRS-DENSE	100	2.2	0.240	0.00	0.1	12.96
SHALLOW	UNPAVED	1,078	6.82	0.000	16.10	4.2	4.27
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,594	7.65	0.050	28.69	7.9	3.35
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,723	10.49	0.050	42.29	13.7	3.31
		5,495					**23.89**
							19.58

TM4

OVERLAND	GRS-DENSE	100	2.46	0.240	0.00	0.1	12.38
SHALLOW	UNPAVED	860	3.2	0.000	16.10	2.9	4.98
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,180	13.51	0.050	28.69	10.5	5.02
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	190	20.83	0.050	42.29	19.3	0.16
		4,330					**22.55**
							18.21

TM5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.67	0.240	0.00	0.1	14.47
SHALLOW	UNPAVED	404	4.77	0.000	16.10	3.5	1.91
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,301	20.47	0.050	28.69	13.0	4.24
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,496	15.23	0.050	42.29	16.5	3.53
		7,301					**24.15**
							20.06

TM6

OVERLAND	GRS-DENSE	100	1.05	0.240	0.00	0.1	17.43
SHALLOW	UNPAVED	899	8.43	0.000	16.10	4.7	3.20
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	276	6.45	0.050	28.69	7.3	0.63
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	506	18.39	0.050	42.29	18.1	0.47
		1,781					**21.73**
							16.57

TM7

OVERLAND	GRS-DENSE	100	0.66	0.240	0.00	0.1	20.94
SHALLOW	UNPAVED	1,737	1.41	0.000	16.10	1.9	15.16
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,876	11.74	0.050	28.69	9.8	4.87
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	360	13.79	0.050	42.29	15.7	0.38
		5,074					**41.35**
							32.33

TM8

OVERLAND	GRS-DENSE	100	0.26	0.240	0.00	0.1	30.34
SHALLOW	UNPAVED	723	2.8	0.000	16.10	2.7	4.47
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	4,760	13.46	0.050	28.69	10.5	7.54
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	113	10.26	0.050	42.29	13.5	0.14
		5,696					**42.48**
							33.78

TIME OF CONCENTRATION REPORT - CONTINUED

TM9

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.28	0.240	0.00	0.1	16.09
SHALLOW	UNPAVED	981	3.4	0.000	16.10	3.0	5.51
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,662	15.94	0.050	28.69	11.5	3.87
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	152	11.59	0.050	42.29	14.4	0.18
		3,895					**25.64**
							20.24

TM10

OVERLAND	GRS-DENSE	100	1.21	0.240	0.00	0.1	16.45
SHALLOW	UNPAVED	1,193	0.79	0.000	16.10	1.4	13.92
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,245	5.02	0.050	28.69	6.4	3.23
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,888	14.6	0.050	42.29	16.2	2.98
		5,426					**36.57**
							28.98

TM11

OVERLAND	GRS-DENSE	100	1.05	0.240	0.00	0.1	17.43
SHALLOW	UNPAVED	899	8.43	0.000	16.10	4.7	3.20
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	276	6.45	0.050	28.69	7.3	0.63
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	506	18.39	0.050	42.29	18.1	0.47
		1,781					**21.73**
							18.85

TM12

OVERLAND	GRS-DENSE	100	4.34	0.240	0.00	0.2	9.87
SHALLOW	UNPAVED	489	8.34	0.000	16.10	4.6	1.75
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	5,911	12	0.050	28.69	9.9	9.91
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	214	6.9	0.050	42.29	11.1	0.32
		6,715					**21.86**
							18.96

TM13

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.68	0.240	0.00	0.1	20.73
SHALLOW	UNPAVED	706	1.02	0.000	16.10	1.6	7.23
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,607	3.87	0.050	28.69	5.6	7.69
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	308	15.88	0.050	42.29	16.9	0.30
		3,721					**35.96**
							28.97

TM14

OVERLAND	GRS-DENSE	100	3.96	0.240	0.00	0.2	10.23
SHALLOW	UNPAVED	588	4.2	0.000	16.10	3.3	2.97
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,431	11.32	0.050	28.69	9.7	2.47
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	198	7.58	0.050	42.29	11.6	0.28
		2,317					**15.96**
							12.66

TM15

OVERLAND	GRS-DENSE	100	11.35	0.240	0.00	0.2	6.72
SHALLOW	UNPAVED	945	4.35	0.000	16.10	3.4	4.69
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,301	2.56	0.050	28.69	4.6	4.72
		2,346					**16.13**
							13.28

TM16

OVERLAND	GRS-DENSE	100	0.82	0.240	0.00	0.1	19.21
SHALLOW	UNPAVED	2,158	1.62	0.000	16.10	2.1	17.53
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,351	8.14	0.050	28.69	8.2	4.79
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	5,073	1.42	0.050	42.29	5.0	16.76
		9,682					**58.29**
							49.11

TM17

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.48	0.240	0.00	0.1	23.85
SHALLOW	UNPAVED	722	4.51	0.000	16.10	3.4	3.52
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,760	1.74	0.050	28.69	3.8	7.76
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,624	3.22	0.050	42.29	7.6	3.57
		4,207					**38.69**
							31.85

TM18

OVERLAND	GRS-DENSE	100	2.37	0.240	0.00	0.1	12.56
SHALLOW	UNPAVED	1,244	1.69	0.000	16.10	2.1	9.89
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,108	3.39	0.050	28.69	5.3	6.65
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	933	16.45	0.050	42.29	17.2	0.91
		4,385					**30.02**
							24.41

TM19

OVERLAND	GRS-DENSE	100	4.75	0.240	0.00	0.2	9.52
SHALLOW	UNPAVED	628	2.18	0.000	16.10	2.4	4.40
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	419	3.92	0.050	28.69	5.7	1.23
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,422	2.02	0.050	42.29	6.0	9.50
		4,569					**24.65**
							21.17

TM20

OVERLAND	GRS-DENSE	100	1.02	0.240	0.00	0.1	17.61
SHALLOW	UNPAVED	1,112	6.5	0.000	16.10	4.1	4.52
GUTTER	G-20	1,110	4.51	0.018	24.18	5.1	3.60
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,161	3.15	0.050	28.69	5.1	3.80
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,259	3.72	0.050	28.69	5.5	9.81
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	5,720	1.26	0.050	42.29	4.8	20.06
		12,462					**59.40**
							53.87

TM21

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.9	0.240	0.00	0.1	11.60
SHALLOW	UNPAVED	1,329	1.86	0.000	16.10	2.2	10.10
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	4,063	1.72	0.050	28.69	3.8	17.97
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	986	14.28	0.050	42.29	16.0	1.03
		6,478					**40.71**
							35.29

TM22

OVERLAND	GRS-DENSE	100	4.87	0.240	0.00	0.2	9.42
SHALLOW	UNPAVED	2,124	3.31	0.000	16.10	2.9	12.10
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,343	3.49	0.050	28.69	5.4	10.40
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,398	9.82	0.050	42.29	13.3	3.01
		7,965					**34.93**
							29.55

TM23

OVERLAND	GRS-DENSE	100	0.43	0.240	0.00	0.1	24.87
SHALLOW	UNPAVED	1,263	3.43	0.000	16.10	3.0	7.06
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	325	6.03	0.050	28.69	7.0	0.77
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	5,273	1.48	0.050	42.29	5.1	17.07
		6,962					**49.78**
							41.80

TM24

OVERLAND	GRS-DENSE	100	5.85	0.240	0.00	0.2	8.76
SHALLOW	UNPAVED	1,151	6.82	0.000	16.10	4.2	4.56
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,796	2.54	0.050	28.69	4.6	10.20
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	743	16.52	0.050	42.29	17.2	0.72
		4,790					**24.24**
							20.91

TIME OF CONCENTRATION REPORT - CONTINUED

TM25

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	2.68	0.240	0.00	0.1	11.97
SHALLOW	UNPAVED	2,010	4.26	0.000	16.10	3.3	10.07
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	308	15.27	0.050	28.69	11.2	0.46
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	276	10.92	0.050	42.29	14.0	0.33
		2,694					**22.83**
							17.32

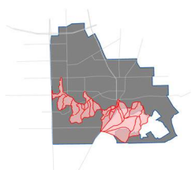
TM26

OVERLAND	GRS-DENSE	100	13.01	0.240	0.00	0.3	6.36
SHALLOW	UNPAVED	907	5.01	0.000	16.10	3.6	4.19
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	556	18.13	0.050	42.29	15.0	0.51
		1,562					**11.07**
							8.43

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.3 SOILS MAP

Ten Mile Creek watershed has four different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil types C and B, which are more permeable than soil type D, are found within most sub-basins and especially near the stream centerline. Hydrologic soil group A (most pervious) is onyl present in a small area between sub-basins TM9 and TM10.

- Hydrologic Soil Group A
- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

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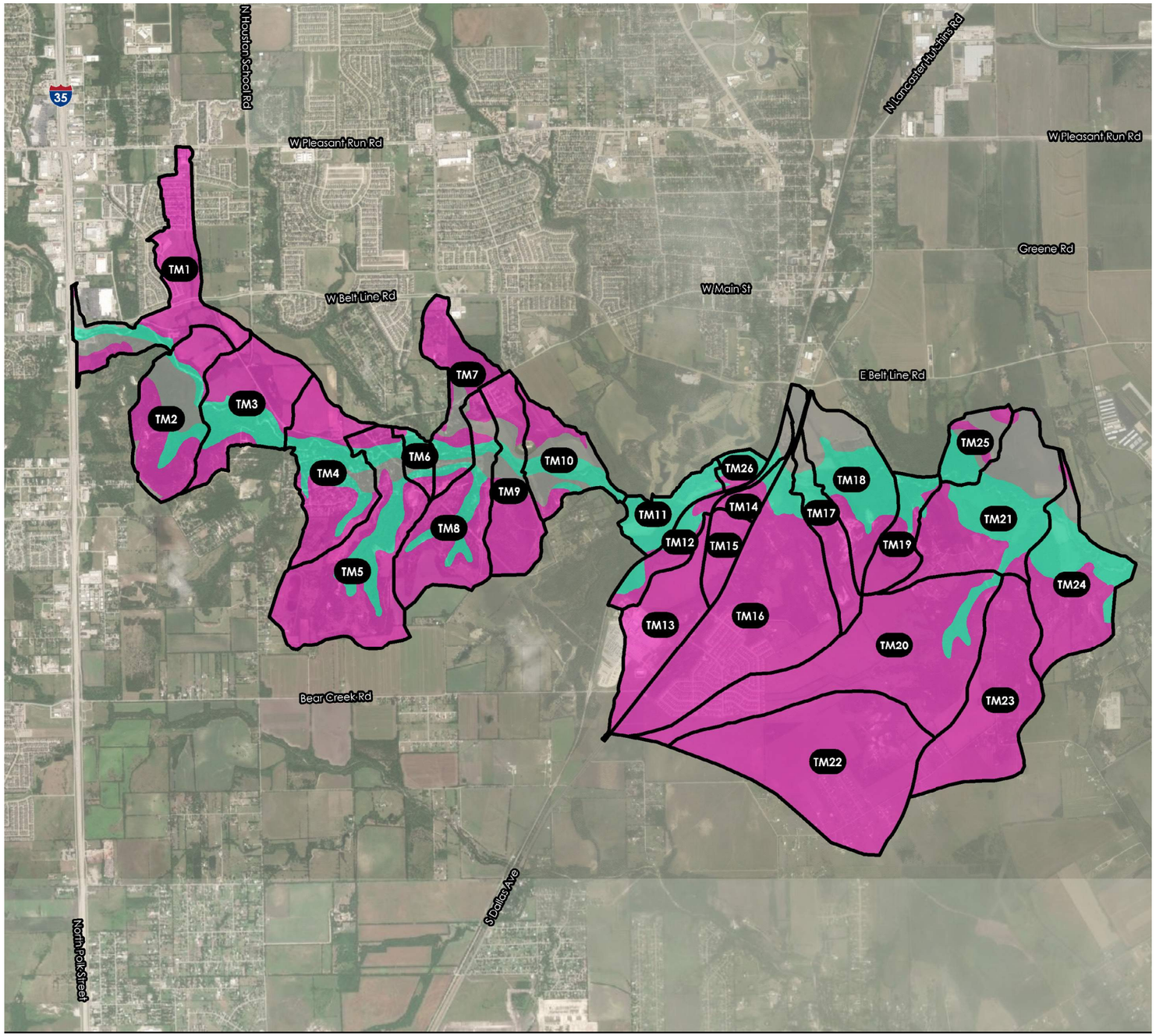


PERVIOUS CURVE NUMBER REPORT

TM1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
B	69	25.5	8.6
D	84	158.7	65.4
C	79	19.6	7.6
		203.8	**81.6**

TM2

B	69	49.6	17.7
C	79	26.0	10.6
D	84	118.1	51.2
		193.7	**79.5**

TM3

B	69	0.1	0.0
C	79	53.3	22.4
D	84	134.4	60.1
		187.8	**82.6**

TM4

B	69	9.4	3.3
C	79	59.4	24.2
D	84	124.8	54.2
		193.5	**81.7**

TM5

B	69	9.4	2.1
C	79	71.3	18.1
D	84	230.4	62.2
		311.2	**82.4**

TM6

B	69	6.3	14.0
C	79	16.9	43.4
D	84	7.6	20.8
		30.8	**78.2**

TM7

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
B	69	20.5	11.4
C	79	16.3	10.4
D	84	87.4	59.1
		124.3	**80.9**

TM8

B	69	15.8	5.5
C	79	38.5	15.2
D	84	145.5	61.2
		199.9	**81.8**

TM9

A	49	2.0	0.7
B	69	25.1	11.8
C	79	7.4	4.0
D	84	112.1	64.2
		146.6	**80.7**

TM10

A	49	2.5	1.1
C	79	39.2	26.3
D	84	37.9	27.1
B	69	38.1	22.3
		117.7	**76.7**

TM11

C	79	71.2	76.4
D	84	2.4	2.8
		73.6	**79.2**

TM12

B	69	9.6	8.2
C	79	32.3	31.5
D	84	39.1	40.6
		81.0	**80.2**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

PERVIOUS CURVE NUMBER REPORT - CONTINUED

TM13

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
C	79	0.0	0.0
D	84	152.2	84.0
		152.2	**84.0**

TM14

B	69	13.9	22.9
C	79	5.6	10.5
D	84	22.5	45.0
		42.0	**78.4**

TM15

D	84	52.0	84.0
		52.0	**84.0**

TM16

B	69	4.8	0.8
C	79	21.5	3.9
D	84	411.5	78.9
		437.8	**83.6**

TM17

B	69	8.3	6.6
C	79	20.3	18.6
D	84	57.4	56.1
		85.9	**81.4**

TM18

B	69	50.2	19.9
C	79	84.9	38.6
D	84	38.7	18.7
		173.7	**77.2**

TM19

C	79	25.3	24.4
D	84	56.5	58.0
		81.8	**82.5**

TM20

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
C	79	22.3	3.9
D	84	423.9	79.8
		446.2	**83.8**

TM21

B	69	77.1	18.5
C	79	101.8	28.0
D	84	108.5	31.7
		287.4	**78.2**

TM22

D	84	436.8	84.0
		436.8	**84.0**

TM23

C	79	0.2	0.1
D	84	265.4	83.9
		265.7	**84.0**

TM24

B	69	11.5	3.7
C	79	82.3	30.1
D	84	122.2	47.5
		216.0	**81.3**

TM25

B	69	25.0	24.8
C	79	28.6	32.5
D	84	16.0	19.3
		69.6	**76.6**

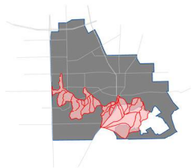
TM23

C	79	20.6	60.2
D	84	6.4	20.0
		27.0	**80.2**

WATERSHED NO.
12

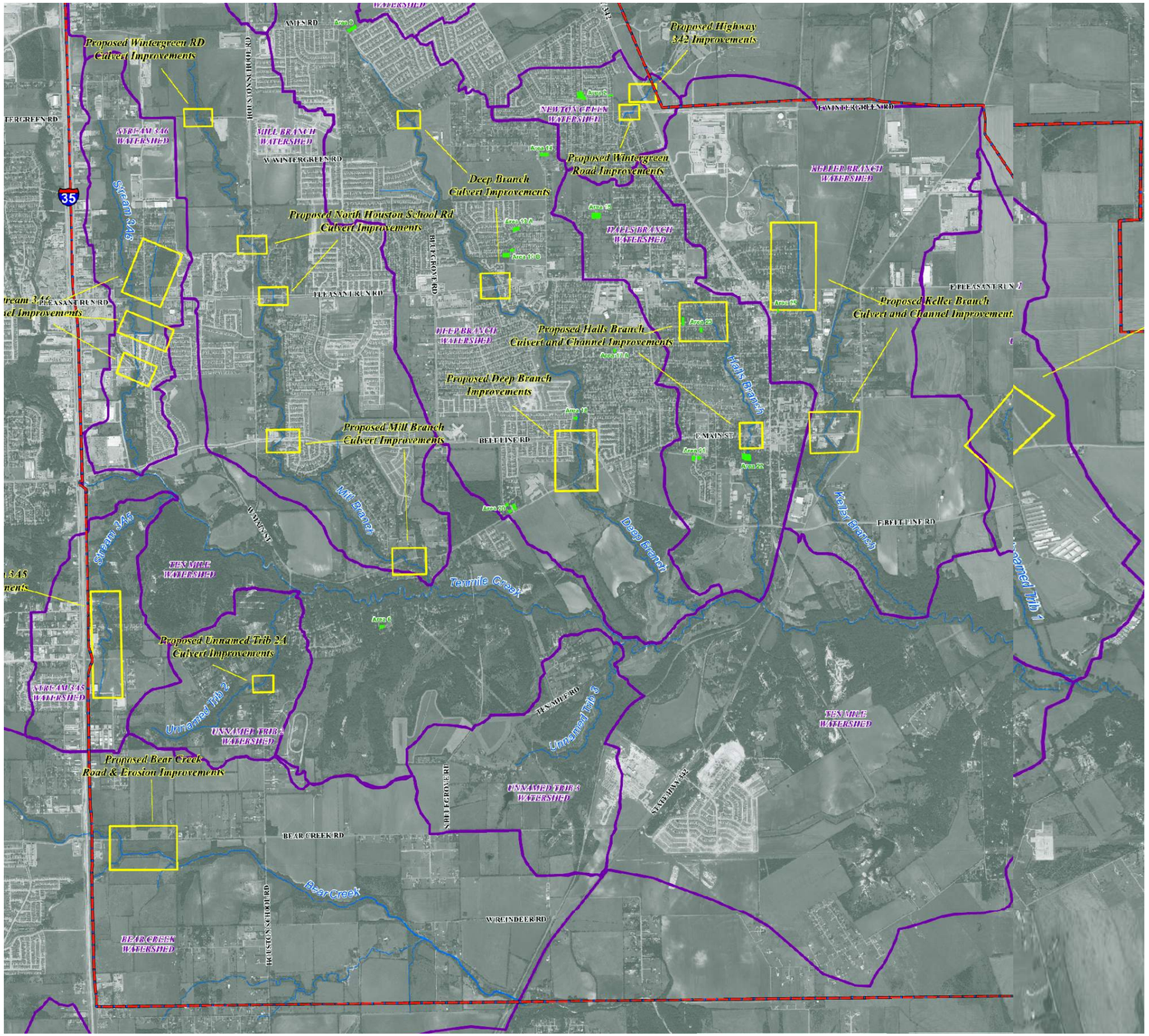
COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows one major development since 2007 within the Ten Mile Creek watershed. The new development appears to be a commercial/ mixed use development. Specifically, this new development is located in sub-basins TM19 and TM21. The locations of new development are highlighted in red.



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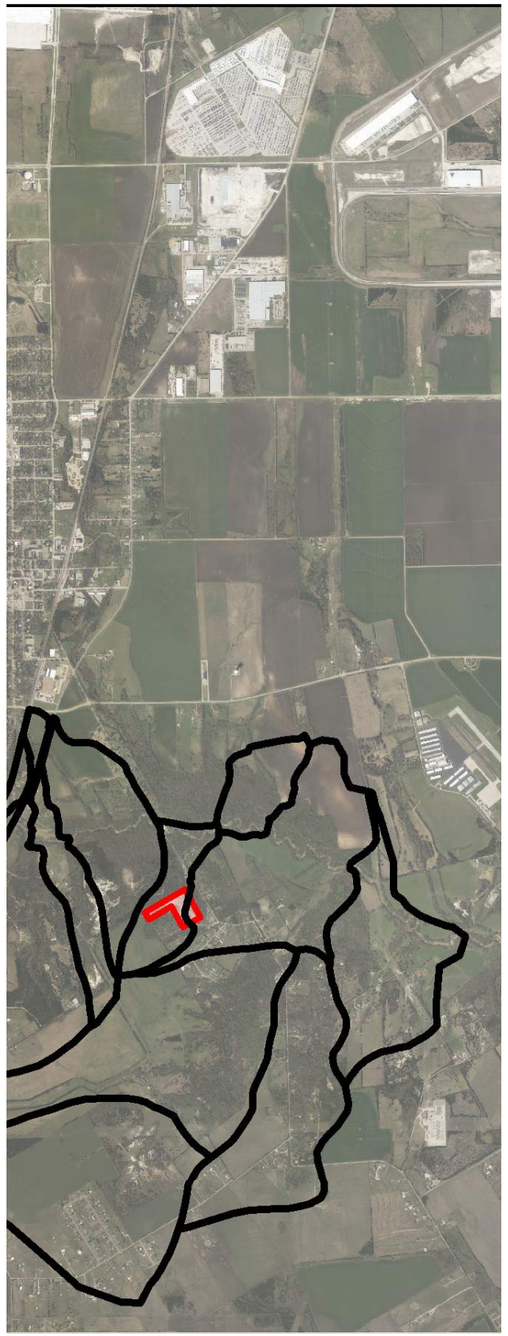
2007





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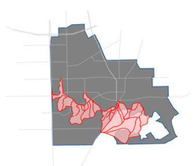
2019

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.5 IMPERVIOUS AREA

Impervious areas for the Ten Mile Creek watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Ten Mile Creek is a fairly undeveloped watershed, so existing impervious percentages are low. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located near the highway, near the middle of sub-basin TM4, and in an area just outside of the City of Lancaster within sub-basins TM12, TM15 and TM20.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

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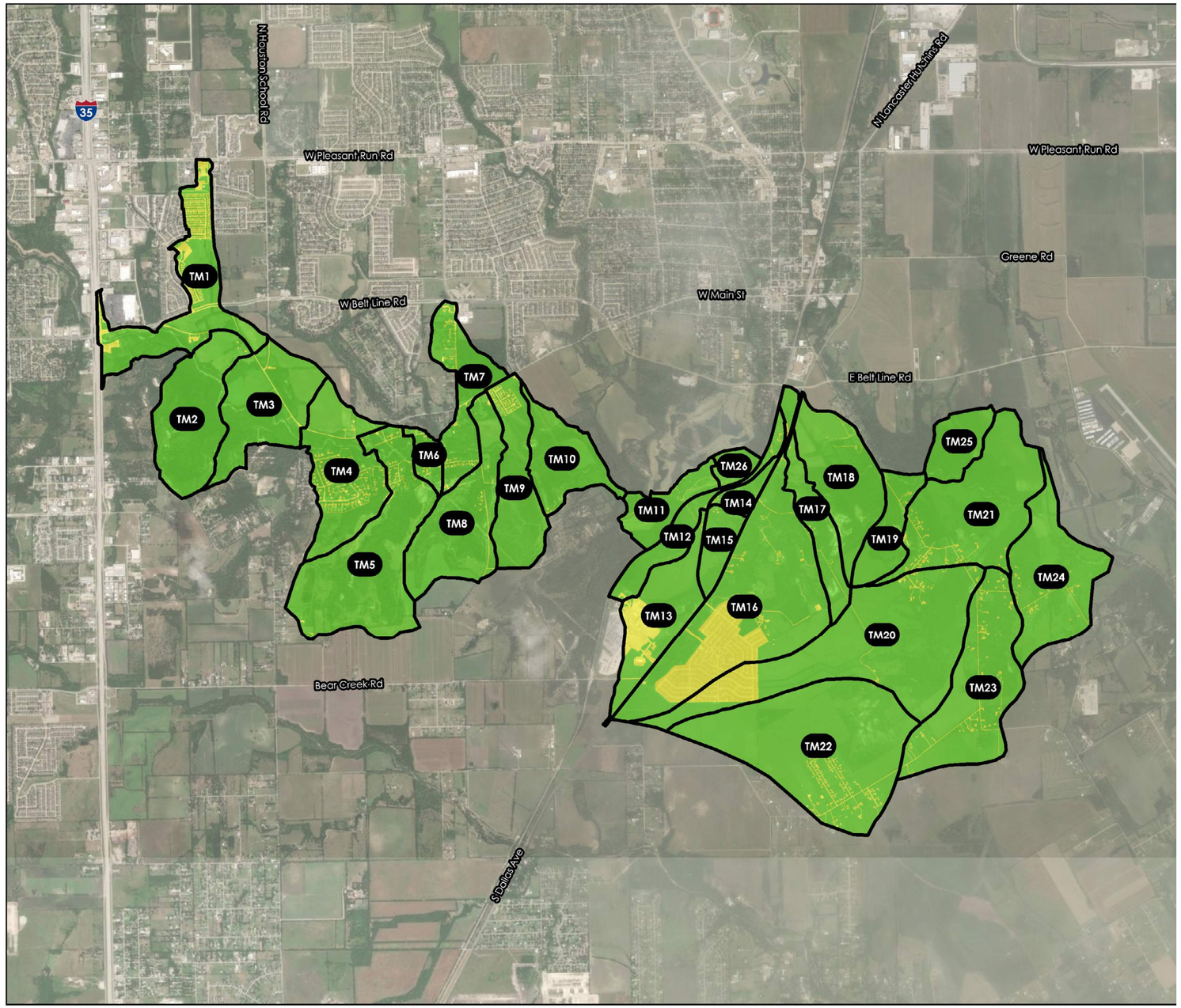


EXISTING PERCENT IMPERVIOUS REPORT

TM1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	45.5	22.3
OPEN SPACE (FAIR CONDITION)	0	158.2	0.0
		203.8	**22.3**

TM2

IMPERVIOUS	100	1.3	0.7
OPEN SPACE (FAIR CONDITION)	0	192.4	0.0
		193.7	**0.7**

TM3

IMPERVIOUS	100	3.4	1.8
OPEN SPACE (FAIR CONDITION)	0	184.4	0.0
		187.8	**1.8**

TM4

IMPERVIOUS	100	18.6	9.6
OPEN SPACE (FAIR CONDITION)	0	174.9	0.0
		193.5	**9.6**

TM5

IMPERVIOUS	100	6.8	2.2
OPEN SPACE (FAIR CONDITION)	0	304.4	0.0
		311.2	**2.2**

TM6

IMPERVIOUS	100	3.4	10.9
OPEN SPACE (FAIR CONDITION)	0	27.5	0.0
		30.8	**10.9**

TM7

IMPERVIOUS	100	9.7	7.8
OPEN SPACE (FAIR CONDITION)	0	114.5	0.0
		124.3	**7.8**

TM8

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	4.7	2.4
OPEN SPACE (FAIR CONDITION)	0	195.1	0.0
		199.9	**2.4**

TM9

IMPERVIOUS	100	6.6	4.5
OPEN SPACE (FAIR CONDITION)	0	140.0	0.0
		146.6	**4.5**

TM10

IMPERVIOUS	100	0.4	0.3
OPEN SPACE (FAIR CONDITION)	0	117.3	0.0
		117.7	**0.3**

TM11

IMPERVIOUS	100	2.6	3.5
OPEN SPACE (FAIR CONDITION)	0	71.0	0.0
		73.6	**3.5**

TM12

IMPERVIOUS	100	4.3	5.3
OPEN SPACE (FAIR CONDITION)	0	76.7	0.0
		81.0	**5.3**

TM13

IMPERVIOUS	100	41.7	27.4
OPEN SPACE (FAIR CONDITION)	0	110.5	0.0
		152.2	**27.4**

TM14

IMPERVIOUS	100	5.1	12.1
OPEN SPACE (FAIR CONDITION)	0	36.9	0.0
		42.0	**12.1**

EXISTING PERCENT IMPERVIOUS REPORT - CONTINUED

TM14

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	5.1	12.1
OPEN SPACE (FAIR CONDITION)	0	36.9	0.0
		42.0	**12.1**

TM15

IMPERVIOUS	100	3.0	5.8
OPEN SPACE (FAIR CONDITION)	0	49.0	0.0
		52.0	**5.8**

TM16

IMPERVIOUS	100	119.1	27.2
OPEN SPACE (FAIR CONDITION)	0	318.7	0.0
		437.8	**27.2**

TM17

IMPERVIOUS	100	1.5	1.8
OPEN SPACE (FAIR CONDITION)	0	84.3	0.0
		85.9	**1.8**

TM18

IMPERVIOUS	100	1.5	0.9
OPEN SPACE (FAIR CONDITION)	0	172.2	0.0
		173.7	**0.9**

TM19

IMPERVIOUS	100	2.6	3.2
OPEN SPACE (FAIR CONDITION)	0	79.2	0.0
		81.8	**3.2**

TM20

IMPERVIOUS	100	42.6	9.5
OPEN SPACE (FAIR CONDITION)	0	403.6	0.0
		446.2	**9.5**

TM21

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	7.9	2.8
OPEN SPACE (FAIR CONDITION)	0	279.4	0.0
		287.4	**2.8**

TM22

IMPERVIOUS	100	14.8	3.4
OPEN SPACE (FAIR CONDITION)	0	422.0	0.0
		436.8	**3.4**

TM23

IMPERVIOUS	100	12.4	4.7
OPEN SPACE (FAIR CONDITION)	0	253.3	0.0
		265.7	**4.7**

TM24

IMPERVIOUS	100	4.3	2.0
OPEN SPACE (FAIR CONDITION)	0	211.7	0.0
		216.0	**2.0**

TM25

OPEN SPACE (FAIR CONDITION)	0	69.6	0.0
		69.6	**0.0**

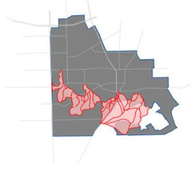
TM26

IMPERVIOUS	100	0.7	2.6
OPEN SPACE (FAIR CONDITION)	0	26.3	0.0
		27.0	**2.6**

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.6 FUTURE LAND USE MAP

The majority of the watershed is located within City of Lancaster. The existing land use within the watershed consist of mostly Industrial. Residential and Mixed Use zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- AVIATION
- COMMERCIAL CORRIDOR
- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- OPEN SPACE (FAIR CONDITION)
- PRIVATE OPEN SPACES
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD

N

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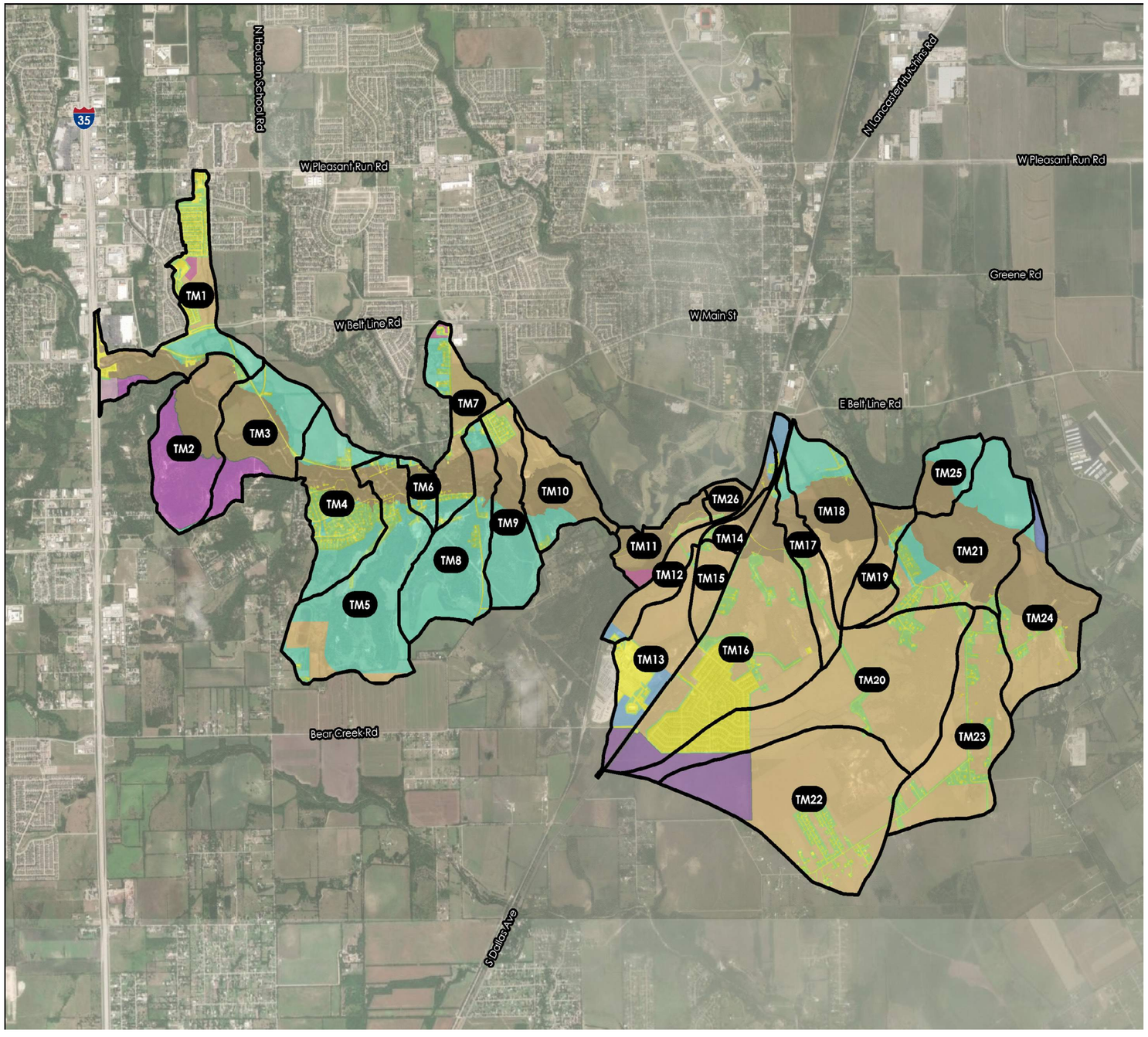


ULTIMATE PERCENT IMPERVIOUS REPORT

TM1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
COMMERCIAL CORRIDOR	85	6.8	2.8
FLOODPLAIN	0	41.3	0.0
IMPERVIOUS	100	45.5	22.3
OPEN SPACE (FAIR CONDITION)	0	37.3	0.0
PRIVATE OPEN SPACES	0	6.9	0.0
PUBLIC & SEMI-PUBLIC	72	3.9	1.4
R - RURAL LIVING	12	33.7	2.0
R - SURBURBAN NEIGHBORHOOD	38	28.4	5.3
		203.8	**33.8**

TM2

FLOODPLAIN	0	77.9	0.0
IMPERVIOUS	100	1.3	0.7
OPEN SPACE (FAIR CONDITION)	0	4.4	0.0
PRIVATE OPEN SPACES	0	107.7	0.0
R - RURAL LIVING	12	2.4	0.1
		193.7	**0.8**

TM3

FLOODPLAIN	0	90.3	0.0
IMPERVIOUS	100	3.4	1.8
OPEN SPACE (FAIR CONDITION)	0	4.6	0.0
PRIVATE OPEN SPACES	0	35.2	0.0
R - RURAL LIVING	12	54.4	3.5
		187.8	**5.3**

TM4

FLOODPLAIN	0	34.6	0.0
IMPERVIOUS	100	18.6	9.6
OPEN SPACE (FAIR CONDITION)	0	57.5	0.0
R - RURAL LIVING	12	82.7	5.1
		193.5	**14.8**

TM5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	27.3	0.0
IMPERVIOUS	100	6.8	2.2
OPEN SPACE (FAIR CONDITION)	0	15.1	0.0
R - RURAL LIVING	12	223.2	8.6
R - SURBURBAN NEIGHBORHOOD	38	38.8	4.7
		311.2	**15.5**

TM6

FLOODPLAIN	0	14.5	0.0
IMPERVIOUS	100	3.4	10.9
OPEN SPACE (FAIR CONDITION)	0	3.4	0.0
R - RURAL LIVING	12	9.6	3.7
		30.8	**14.7**

TM7

FLOODPLAIN	0	25.8	0.0
IMPERVIOUS	100	9.7	7.8
OPEN SPACE (FAIR CONDITION)	0	16.4	0.0
PUBLIC & SEMI-PUBLIC	72	2.5	1.4
R - RURAL LIVING	12	24.7	2.4
R - SURBURBAN NEIGHBORHOOD	38	45.2	13.8
		124.3	**25.5**

TM8

FLOODPLAIN	0	22.2	0.0
IMPERVIOUS	100	4.7	2.4
OPEN SPACE (FAIR CONDITION)	0	10.3	0.0
R - RURAL LIVING	12	162.6	9.8
		199.9	**12.1**

TM9

FLOODPLAIN	0	27.4	0.0
IMPERVIOUS	100	6.6	4.5
OPEN SPACE (FAIR CONDITION)	0	10.6	0.0
R - RURAL LIVING	12	85.5	7.0
R - SURBURBAN NEIGHBORHOOD	38	16.5	4.3
		146.6	**15.8**

ULTIMATE PERCENT IMPERVIOUS REPORT - CONTINUED

TM10

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	65.7	0.0
IMPERVIOUS	100	0.4	0.3
OPEN SPACE (FAIR CONDITION)	0	2.5	0.0
R - RURAL LIVING	12	20.4	2.1
R - SURBURBAN NEIGHBORHOOD	38	28.8	9.3
		117.7	**11.7**

TM11

FLOODPLAIN	0	55.2	0.0
IMPERVIOUS	100	2.6	3.5
OPEN SPACE (FAIR CONDITION)	0	3.7	0.0
PUBLIC & SEMI-PUBLIC	72	7.1	7.0
R - SURBURBAN NEIGHBORHOOD	38	4.9	2.5
		73.6	**13.0**

TM12

FLOODPLAIN	0	7.7	0.0
IMPERVIOUS	100	4.3	5.3
LOGISTICS & DISTRIBUTION	72	8.1	7.2
OPEN SPACE (FAIR CONDITION)	0	7.8	0.0
R - RURAL LIVING	12	0.2	0.0
R - SURBURBAN NEIGHBORHOOD	38	52.9	24.8
		81.0	**37.3**

TM13

COMMERCIAL NODE	85	9.3	5.2
IMPERVIOUS	100	41.7	27.4
LOGISTICS & DISTRIBUTION	72	18.5	8.8
OPEN SPACE (FAIR CONDITION)	0	12.9	0.0
R - RURAL LIVING	12	0.2	0.0
R - SURBURBAN NEIGHBORHOOD	38	69.7	17.4
		152.2	**58.7**

TM14

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	8.3	0.0
IMPERVIOUS	100	5.1	12.1
LOGISTICS & DISTRIBUTION	72	9.5	16.3
OPEN SPACE (FAIR CONDITION)	0	4.2	0.0
R - SURBURBAN NEIGHBORHOOD	38	15.0	13.6
		42.0	**41.9**

TM15

IMPERVIOUS	100	3.0	5.8
OPEN SPACE (FAIR CONDITION)	0	9.1	0.0
R - SURBURBAN NEIGHBORHOOD	38	39.9	29.2
		52.0	**34.9**

TM16

FLOODPLAIN	0	31.9	0.0
IMPERVIOUS	100	119.1	27.2
OPEN SPACE (FAIR CONDITION)	0	57.5	0.0
R - RURAL LIVING	12	0.9	0.0
R - SURBURBAN NEIGHBORHOOD	38	203.1	17.6
		437.8	**49.8**

TM17

FLOODPLAIN	0	20.4	0.0
IMPERVIOUS	100	1.5	1.8
OPEN SPACE (FAIR CONDITION)	0	15.3	0.0
R - RURAL LIVING	12	5.6	0.8
R - SURBURBAN NEIGHBORHOOD	38	43.0	19.0
		85.9	**21.6**

TM18

FLOODPLAIN	0	75.3	0.0
IMPERVIOUS	100	1.5	0.9
OPEN SPACE (FAIR CONDITION)	0	4.7	0.0
R - RURAL LIVING	12	45.2	3.1
R - SURBURBAN NEIGHBORHOOD	38	47.0	10.3
		173.7	**14.3**

TM19

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
FLOODPLAIN	0	19.6	0.0
IMPERVIOUS	100	2.6	3.2
OPEN SPACE (FAIR CONDITION)	0	4.3	0.0
R - RURAL LIVING	12	2.4	0.3
R - SURBURBAN NEIGHBORHOOD	38	52.9	24.6
		81.8	**28.2**

TM20

COMMERCIAL NODE	85	23.5	4.5
IMPERVIOUS	100	42.6	9.5
OPEN SPACE (FAIR CONDITION)	0	33.1	0.0
R - SURBURBAN NEIGHBORHOOD	38	346.9	29.5
		446.2	**43.6**

TM21

FLOODPLAIN	0	124.9	0.0
IMPERVIOUS	100	7.9	2.8
OPEN SPACE (FAIR CONDITION)	0	26.4	0.0
R - RURAL LIVING	12	95.1	4.0
R - SURBURBAN NEIGHBORHOOD	38	33.0	4.4
		287.4	**11.1**

TM22

COMMERCIAL NODE	85	70.1	13.6
IMPERVIOUS	100	14.8	3.4
OPEN SPACE (FAIR CONDITION)	0	33.8	0.0
R - SURBURBAN NEIGHBORHOOD	38	318.1	27.7
		436.8	**44.7**

TM23

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	12.4	4.7
OPEN SPACE (FAIR CONDITION)	0	49.6	0.0
R - SURBURBAN NEIGHBORHOOD	38	203.6	29.1
		265.6	**33.8**

TM24

AVIATION	72	10.3	3.4
FLOODPLAIN	0	99.6	0.0
IMPERVIOUS	100	4.3	2.0
OPEN SPACE (FAIR CONDITION)	0	13.4	0.0
R - RURAL LIVING	12	2.9	0.2
R - SURBURBAN NEIGHBORHOOD	38	85.4	15.0
		216.0	**20.6**

TM25

FLOODPLAIN	0	32.0	0.0
R - RURAL LIVING	12	37.7	6.5
		69.6	**6.5**

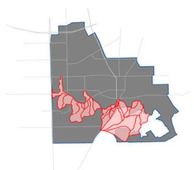
TM26

FLOODPLAIN	0	24.7	0.0
IMPERVIOUS	100	0.7	2.6
OPEN SPACE (FAIR CONDITION)	0	1.3	0.0
R - SURBURBAN NEIGHBORHOOD	38	0.4	0.5
		27.0	**3.1**

WATERSHED NO.
12

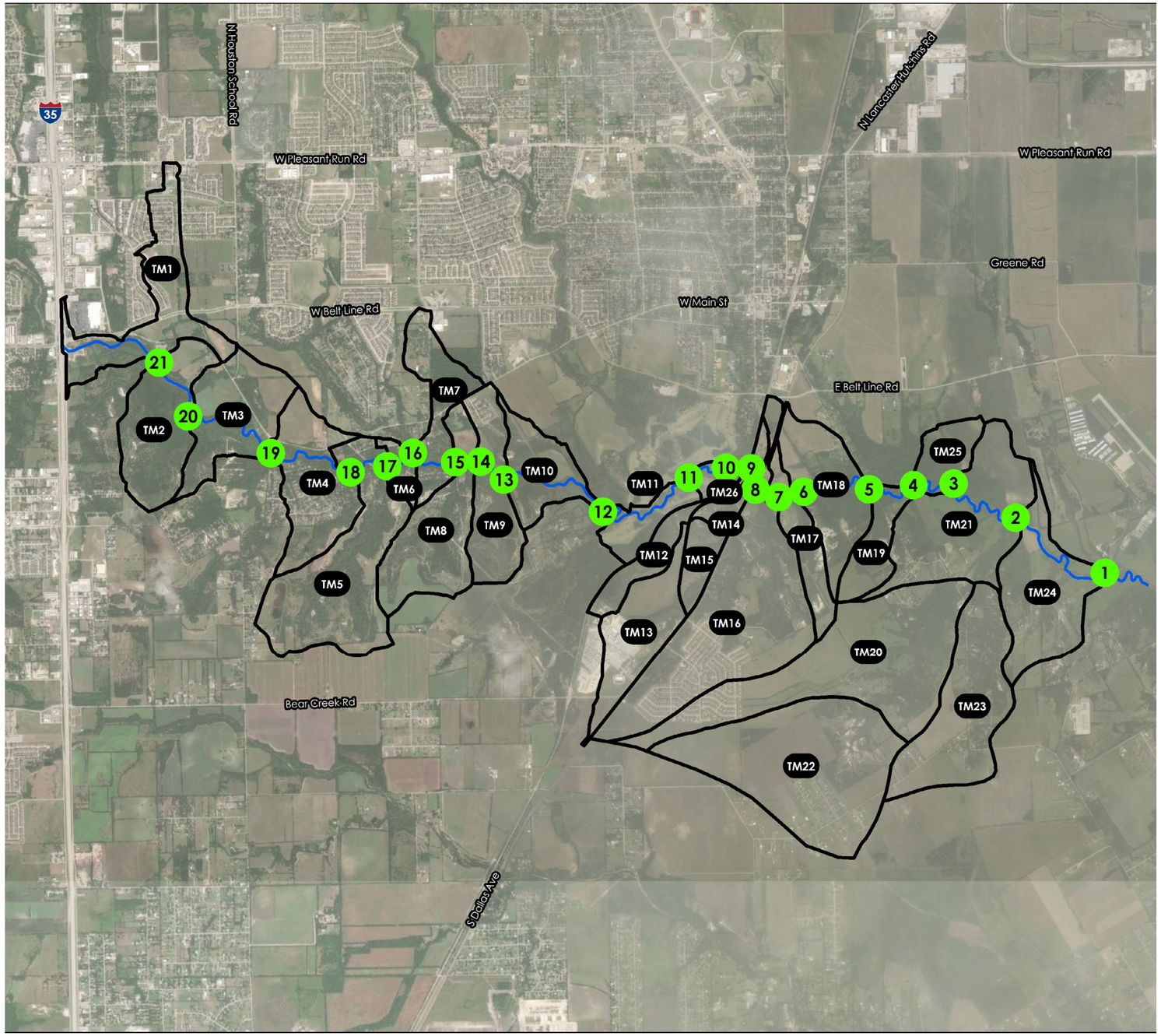
COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



1.7 RESULTS

The flow was analyzed at twenty-one locations for Ten Mile Creek. Flow location 21 was used to establish flows at the upstream end of the model. A majority of the flow analysis locations are based on the original sub-basin locations and confluences with other major streams. Analysis locations for major roads include 19, 15, 10, 9, 8 and 5.



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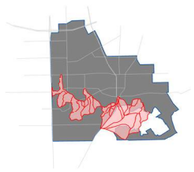
FLOW ANALYSIS LOCATIONS

Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	TM1-TM26, Mill, Deep, 3A5, 3A6, Halls, Keller, Unnamed Trib 1, Unnamed Trib 2, Unnamed Trib 3	Main	84	61.50	64000
2	TM1-TM23, TM25, TM26, Mill, Deep, 3A5, 3A6, Halls, Keller, Unnamed Trib 2, Unnamed Trib 3	Main	6316	59.15	61000
3	TM1-TM19, TM25, TM26, Mill, Deep, 3A5, 3A6, Halls, Keller, Unnamed Trib 2, Unnamed Trib 3	Main	9056	56.92	60000
4	TM1-TM19, TM26, Mill, Deep, 3A5, 3A6, Halls, Keller, Unnamed Trib 2, Unnamed Trib 3	Main	10445	56.81	60000
5	TM1-TM18, TM26, Mill, Deep, 3A5, 3A6, Halls, Unnamed Trib 2, Unnamed Trib 3	Main	12749	53.89	57000
6	TM1-TM17, TM26, Mill, Deep, 3A5, 3A6, Halls, Unnamed Trib 2, Unnamed Trib 3	Main	15528	53.62	57000
7	TM1-TM16, TM26, Mill, Deep, 3A5, 3A6, Halls, Unnamed Trib 2, Unnamed Trib 3	Main	16255	53.49	57000
8	TM1-TM12, TM14, TM26, Mill, Deep, 3A5, 3A6, Halls, Unnamed Trib 2, Unnamed Trib 3	Main	17323	52.47	56000
9	TM1-TM12, TM26, Mill, Deep, 3A5, 3A6, Halls, Unnamed Trib 2, Unnamed Trib 3	Main	17656	52.40	56000
10	TM1-TM11, TM26, Mill, Deep, 3A5, 3A6, Halls, Unnamed Trib 2, Unnamed Trib 3	Main	17936	52.28	56000
11	TM1-TM11, Mill, Deep, 3A5, 3A6, Unnamed Trib 2, Unnamed Trib 3	Main	20415	50.68	57000
12	TM1-TM10, Mill, 3A5, 3A6, Unnamed Trib 2, Unnamed Trib 3	Main	23926	46.73	54000
13	TM1-TM9, Mill, 3A5, 3A6, Unnamed Trib 2	Main	27692	45.54	54000
14	TM1-TM8, Mill, 3A5, 3A6, Unnamed Trib 2	Main	28618	45.31	54000
15	TM1-TM7, Mill, 3A5, 3A6, Unnamed Trib 2	Main	29569	45.00	53000
16	TM1-TM6, Mill, 3A5, 3A6, Unnamed Trib 2	Main	31032	44.80	53000
17	TM1-TM5, 3A5, 3A6, Unnamed Trib 2	Main	32249	41.48	45000
18	TM1-TM4, 3A5, 3A6, Unnamed Trib 2	Main	34402	41.00	44500
19	TM1-TM3, 3A5, 3A6	Main	37400	40.05	43000
20	TM1, TM2, 3A5, 3A6	Main	40607	39.76	43500
21	TM1, 3A5, 3A6	Main	43026	39.46	43500

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



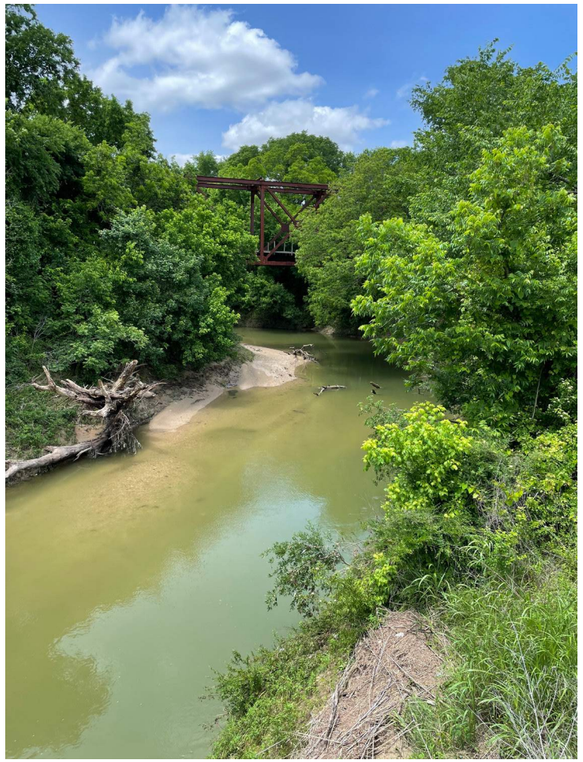
2.0 HYDRAULICS

2.1 SITE ASSESSMENT

Ten Mile Creek is located in the Southern half of the City of Lancaster. It flows from West to East for approximately 5.42 miles before leaving the city limits. This assessment analyzes the hydrologic and hydraulic characteristics of Ten Mile Creek within the limits of the City of Lancaster, roughly bound by Interstate Highway 35 East (upstream end) and South Dallas Avenue (downstream end). The channel slope averages around 0.1-0.3%. Ten Mile Creek itself is generally in a natural state. There is very little development near the stream, and the surrounding area is heavily wooded. There are a total of six (6) crossings throughout the watershed.



Looking at the Bluegrove Road Bridge. Channel has significant vegetation on the overbanks and some light vegetation within the channel itself. The Bridge appears to be in good condition, though it is anticipated to overtop in most storm events.



Looking upstream of the Old Red Oak Road bridge towards the railroad bridge. The stream channel appears to be clean with shrubs and trees growing on the overbanks.



Looking downstream of Old Red Oak Road bridge toward the South Dallas Avenue bridge. Again, the stream channel appears to be wide and deep with shrubs and trees growing on the overbanks.

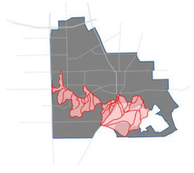


Looking upstream towards Nokomis Road bridge. The channel is very large at this location and has concrete blocks armoring the channel side slopes. The channel itself has some debris, but is overall free of vegeation.

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

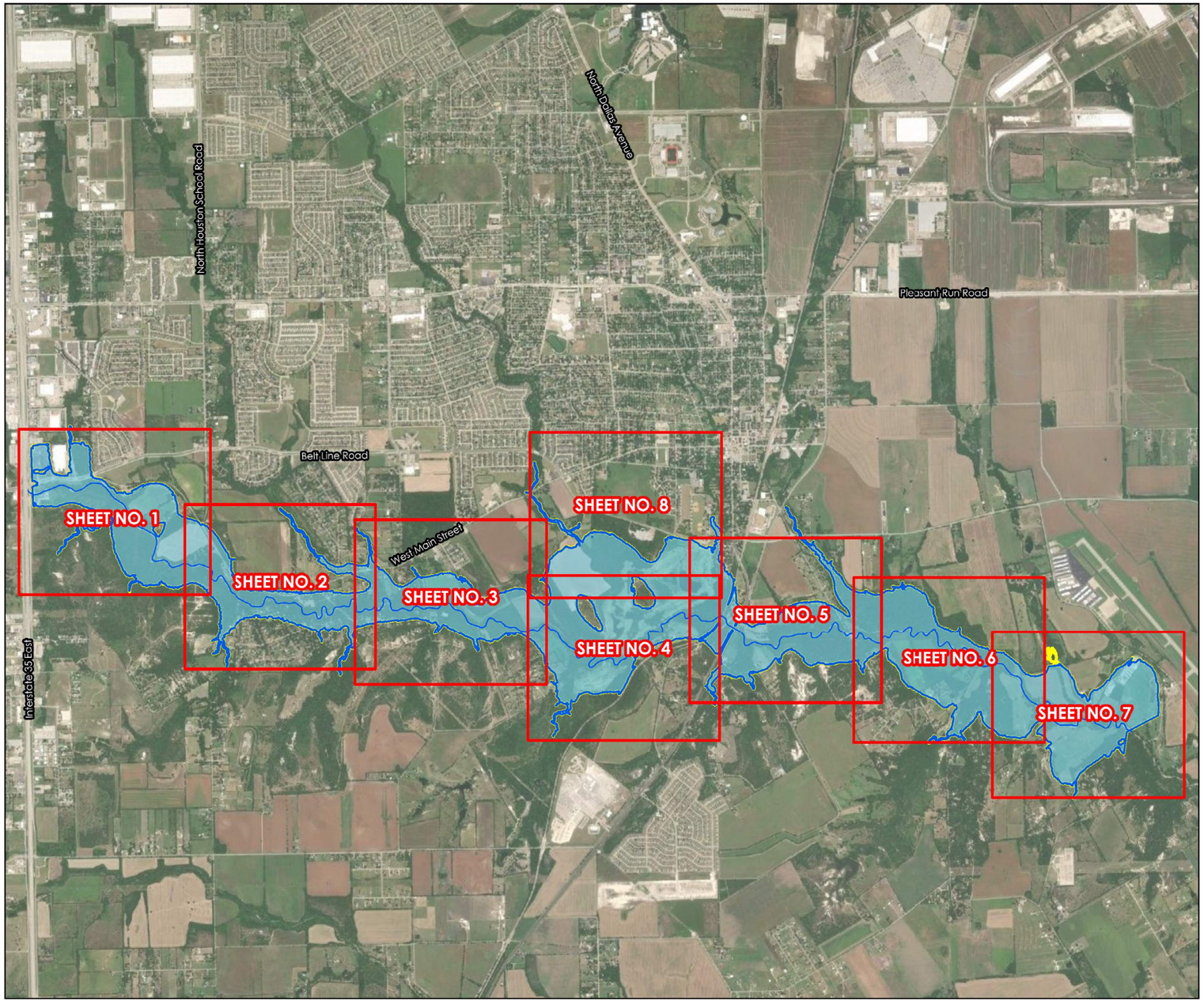
TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.2 FLOODPLAIN MAPPING

The Ten Mile Creek stream hydraulics were analyzed with HEC-RAS 5.0.7. The model for Ten Mile Creek is comprised of one stream, one reach, one hundred and nineteen (119) cross sections, and six (6) hydraulic structures. The studied stream is 45,687 feet (8.65 miles) long. The Ten Mile Creek floodplain is extensive and is not contained within the channel.

The floodplain sheets for Ten Mile Creek display two different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space.

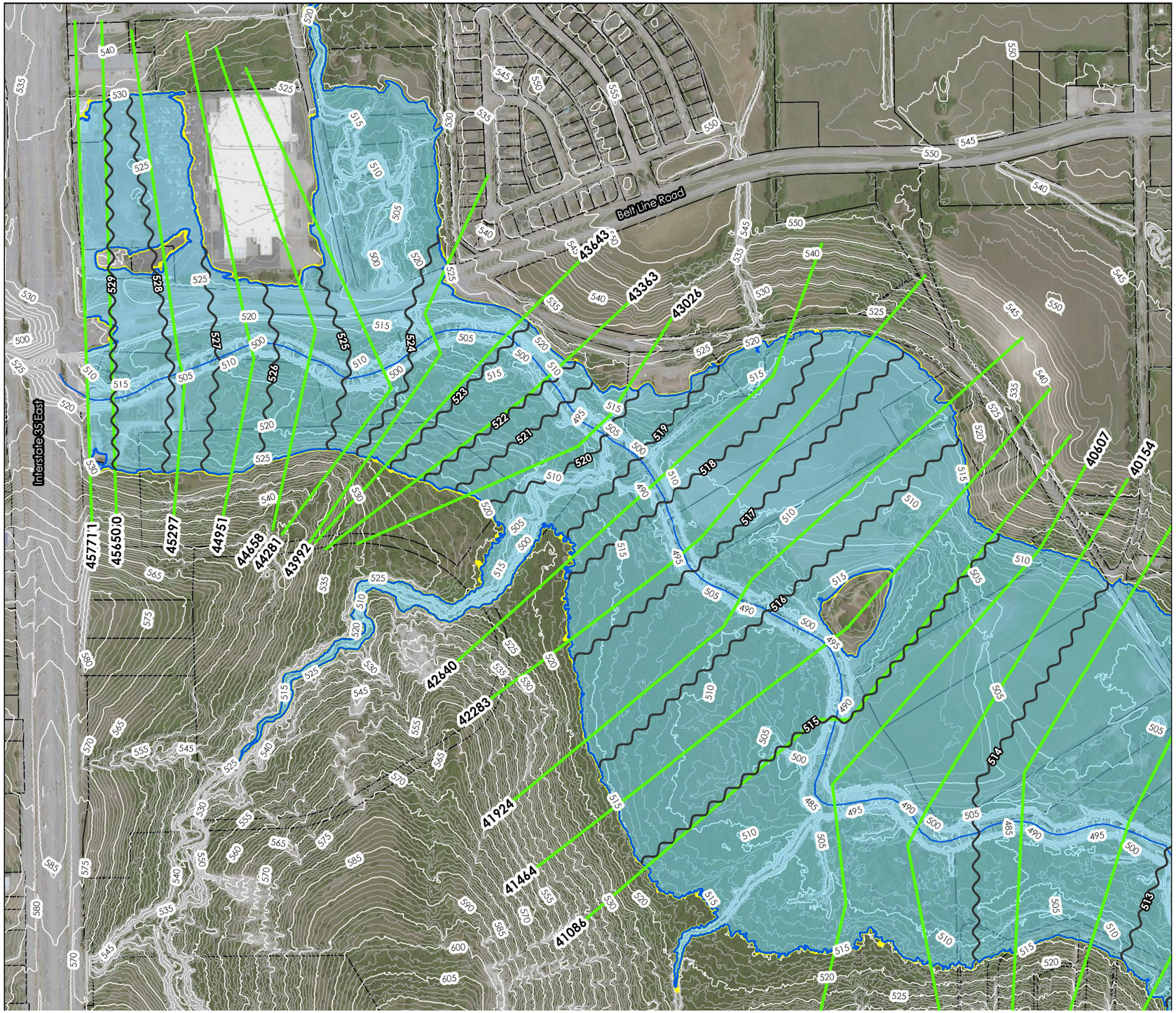


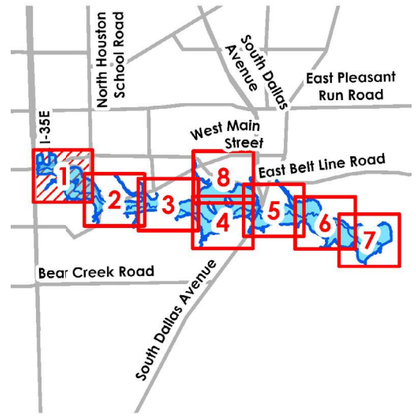
STREAM CENTERLINE
TEN MILE VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 250 500

Feet

MILE CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

R MAJOR CONTOURS

R MINOR CONTOURS

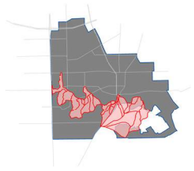
MILE BASE FLOW ELEVATIONS

CEL

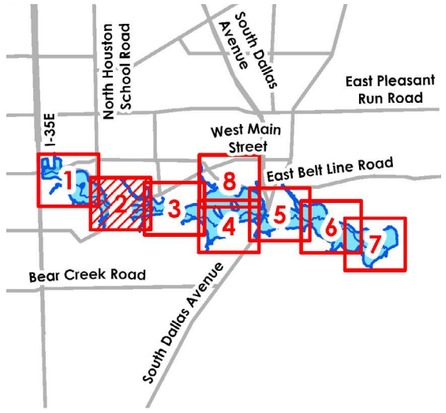
WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



FLOODPLAIN: SHEET 2

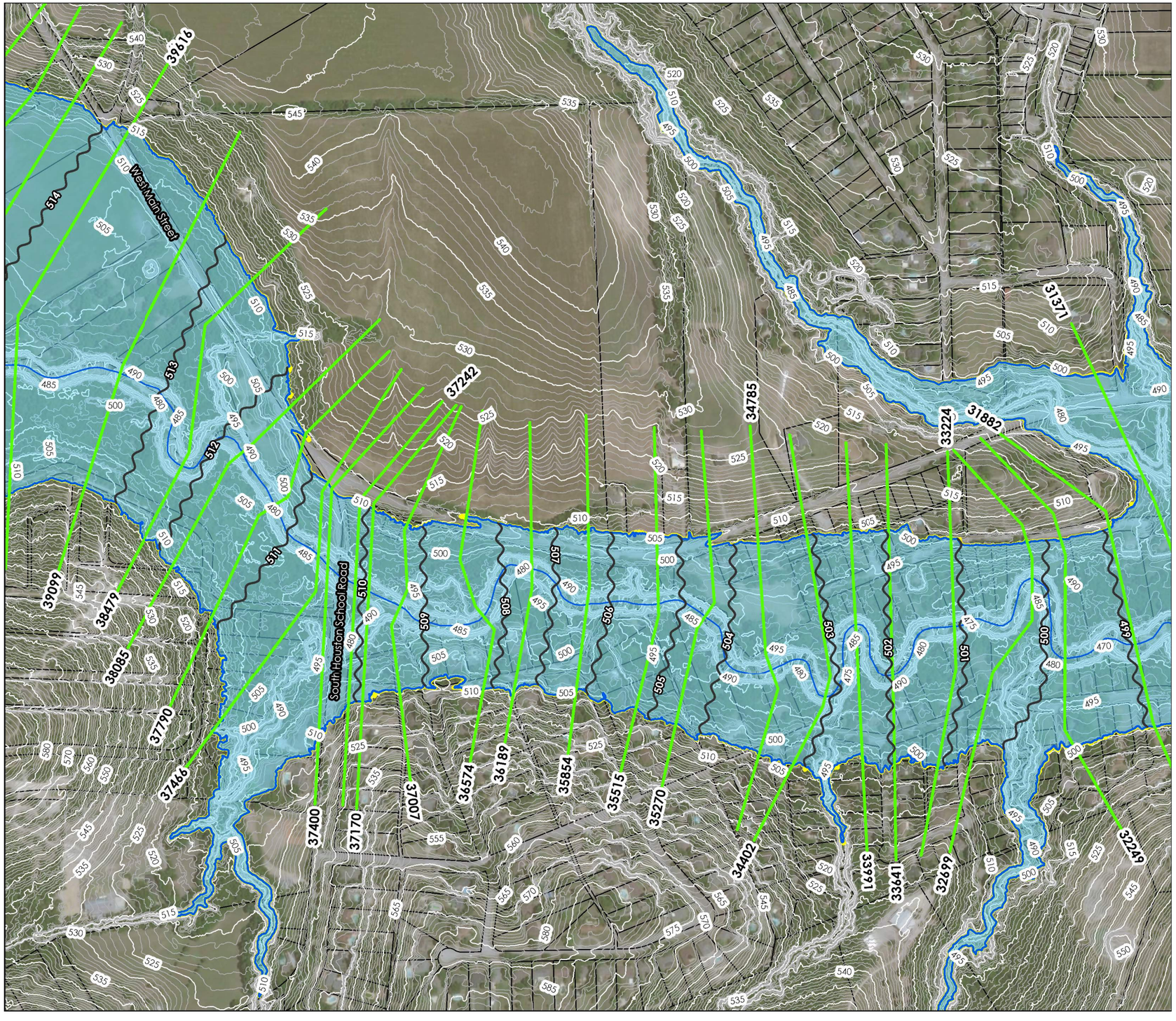


N

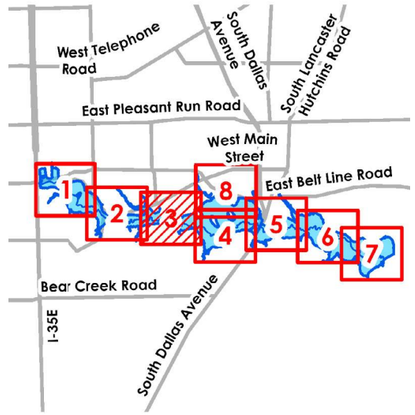
0 250 500
Feet

MILE CROSS SECTIONS
EAM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
MILE BASE FLOW ELEVATIONS
CEL

0



FLOODPLAIN: SHEET 3



N

0 250 500

Feet

- TEN MILE CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- TEN MILE BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.

12

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

7.25 SM

*

STREAM LENGTH

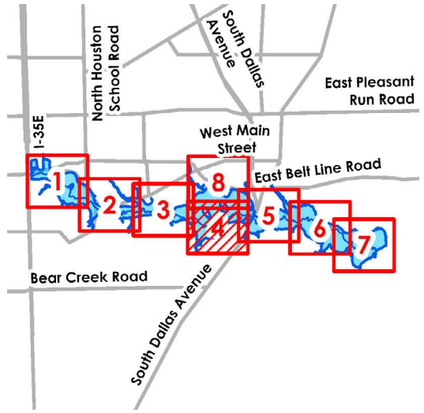
5.42 MI

*

PROJECTS IDENTIFIED

4

FLOODPLAIN: SHEET 4



N

0 250 500 Feet

MILE CROSS SECTIONS

REAM CENTERLINE

STING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

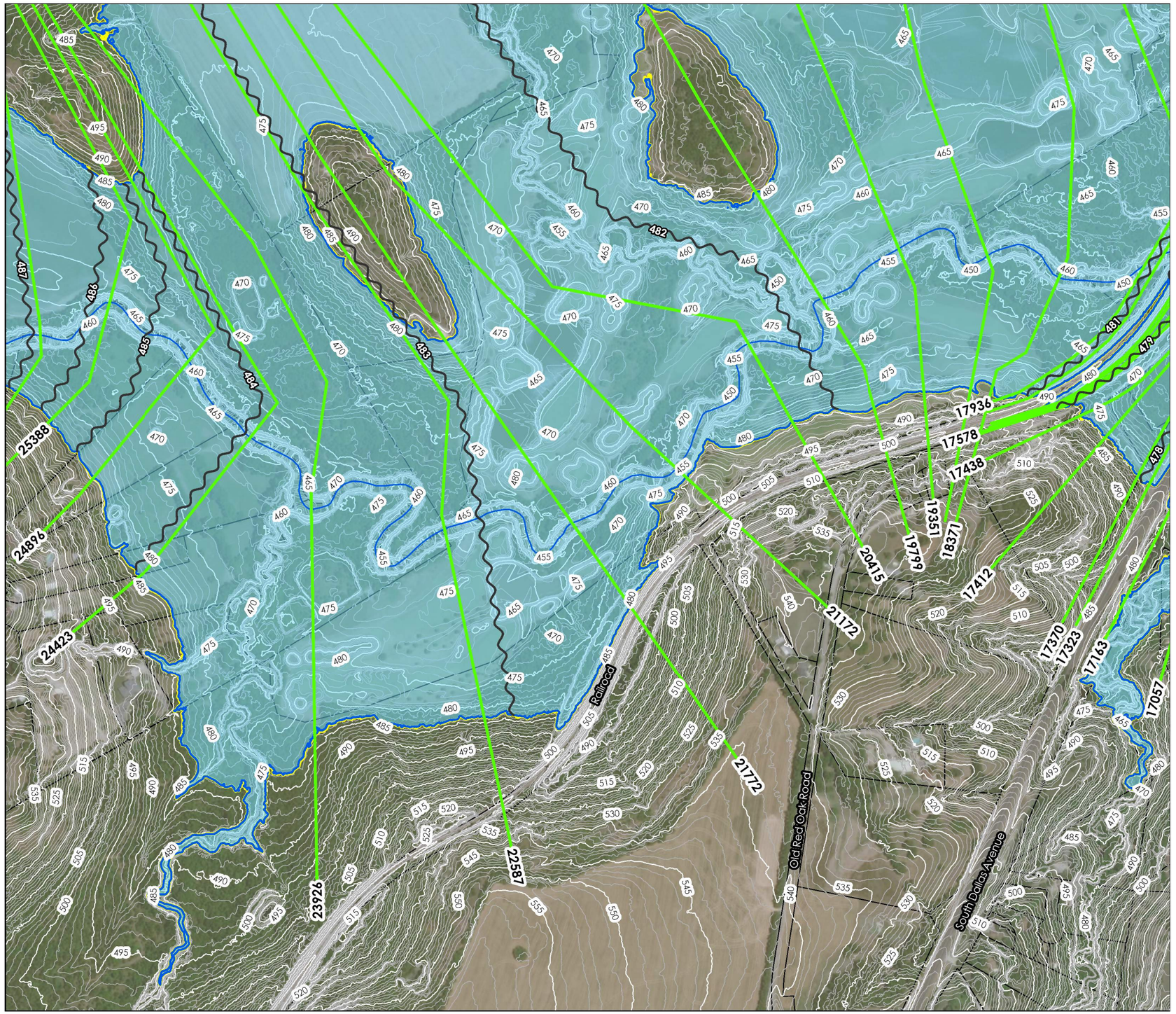
R MAJOR CONTOURS

R MINOR CONTOURS

MILE BASE FLOW ELEVATIONS

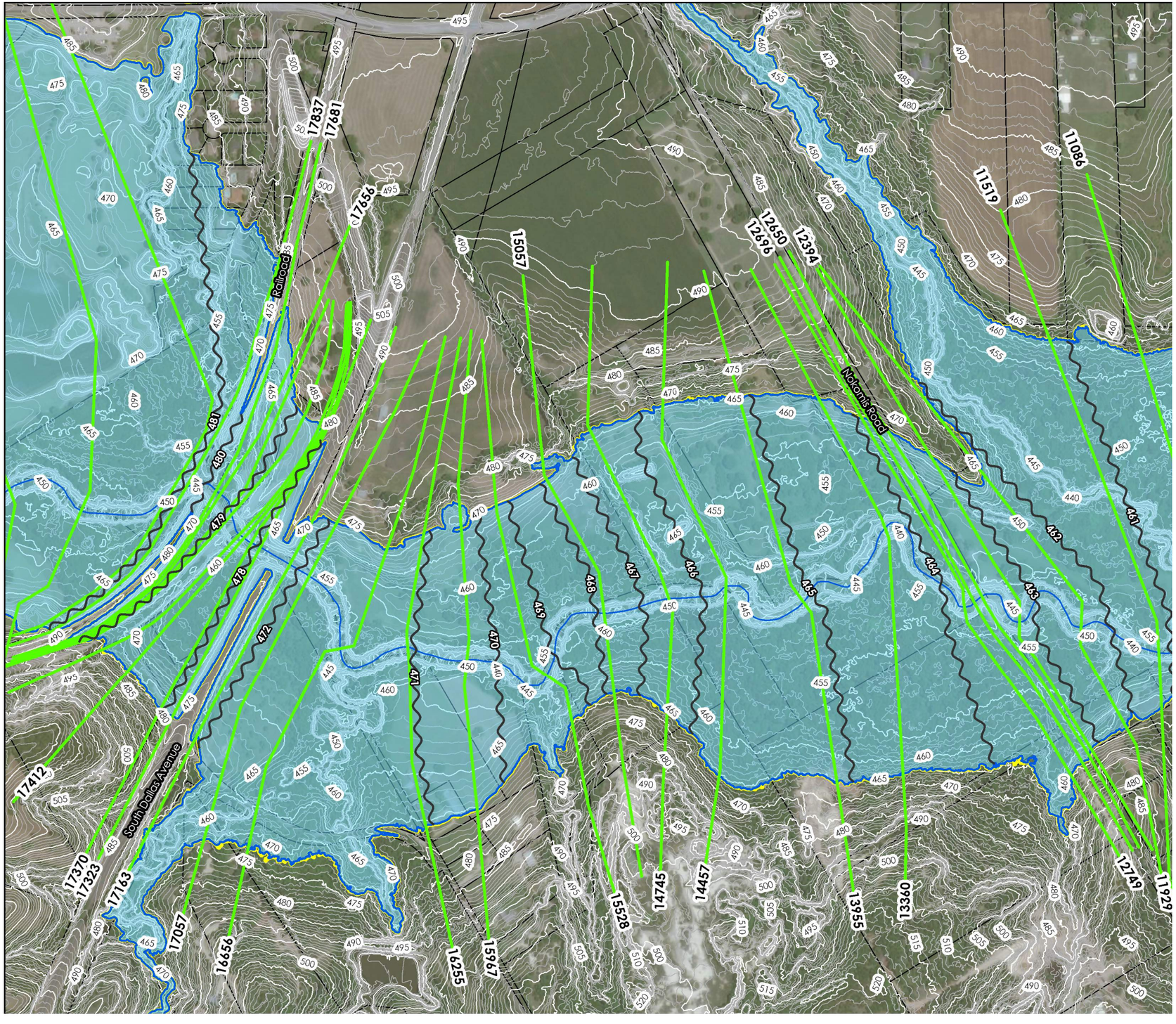
CEL

0



FLOODPLAIN: SHEET 5





N

0 250 500

Feet

MILE CROSS SECTIONS

AM CENTERLINE

TING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

R MAJOR CONTOURS

R MINOR CONTOURS

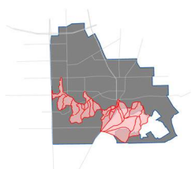
MILE BASE FLOW ELEVATIONS

CEL

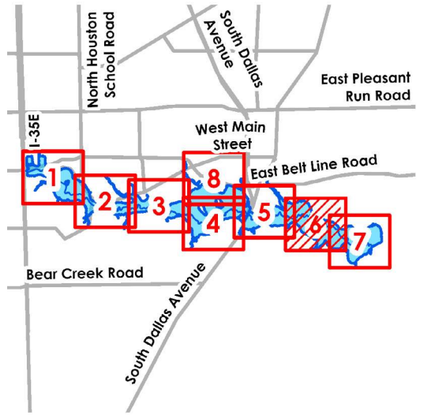
WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



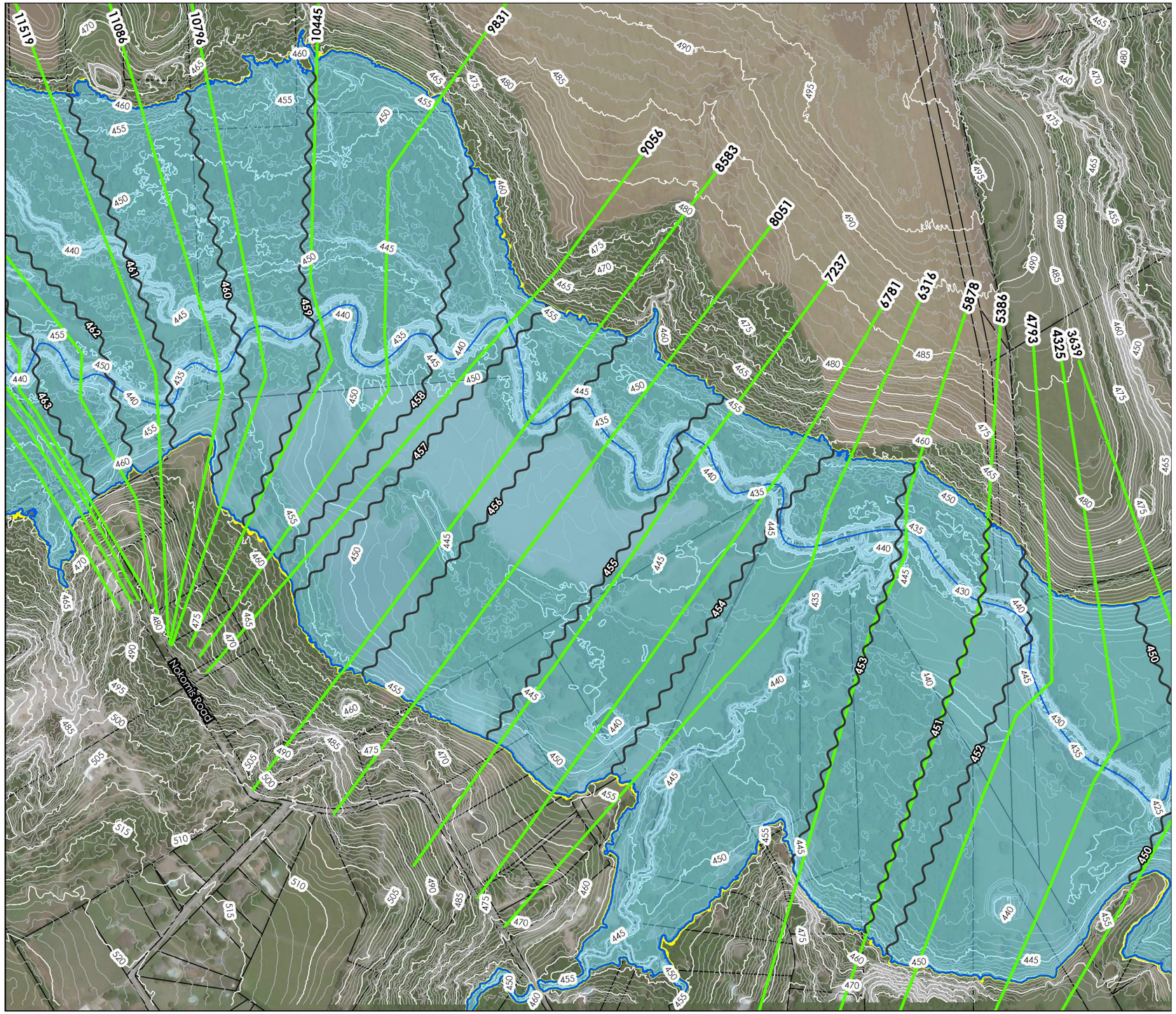
FLOODPLAIN: SHEET 6



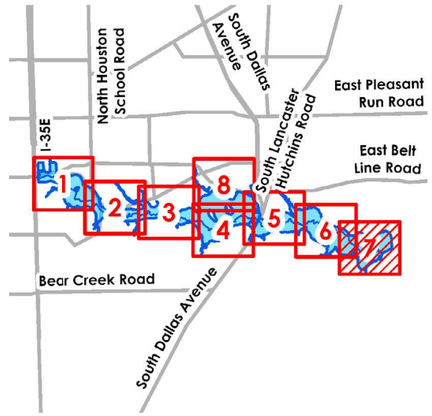
N

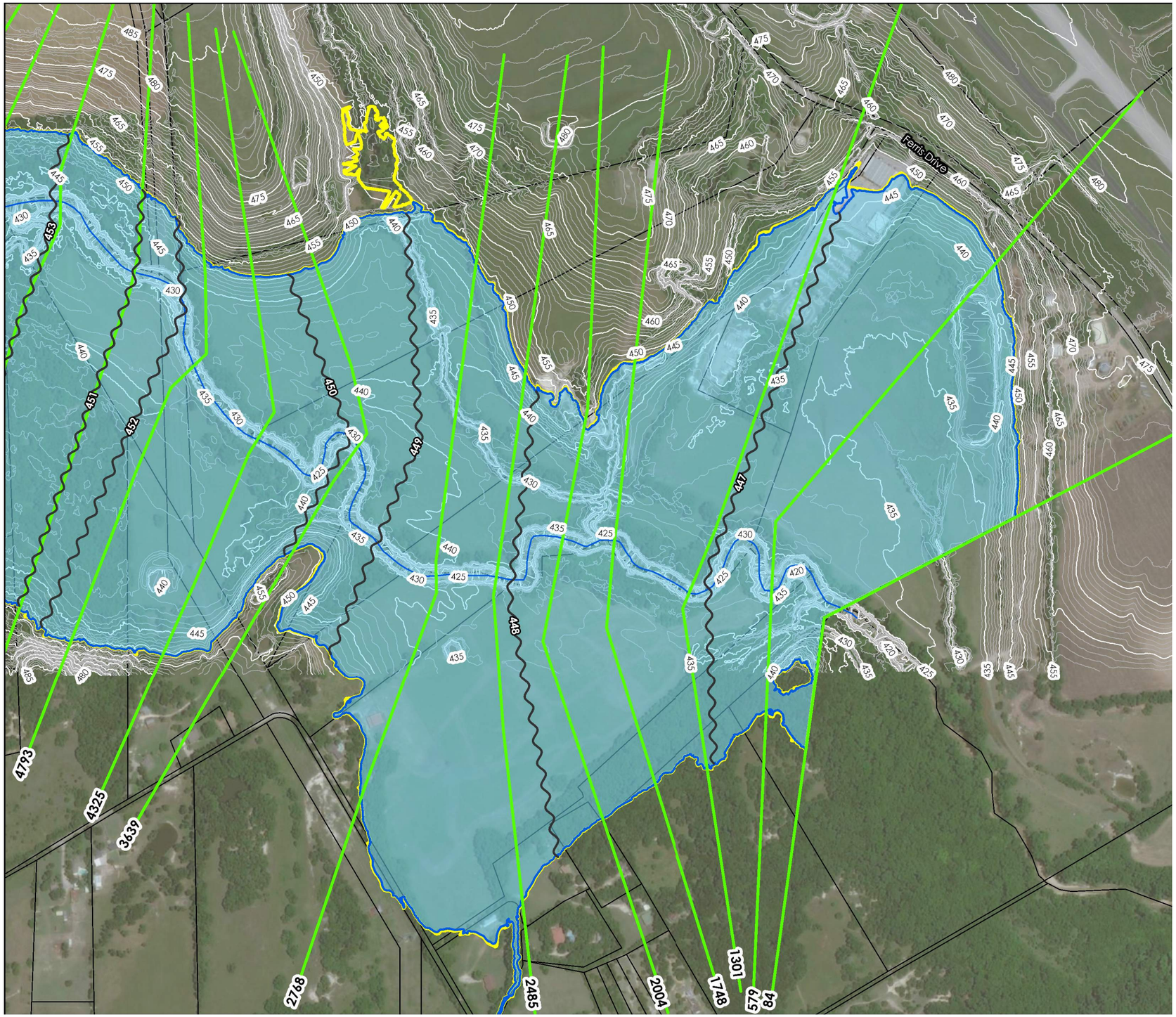
0 250 500
Feet

MILE CROSS SECTIONS
REAM CENTERLINE
STING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
AR MAJOR CONTOURS
AR MINOR CONTOURS
MILE BASE FLOW ELEVATIONS
RCEL



FLOODPLAIN: SHEET 7





N

0 250 500
Feet

MILE CROSS SECTIONS
AM CENTERLINE
TING 100-YEAR FLOODPLAIN
MATE 100-YEAR FLOODPLAIN
R MAJOR CONTOURS
R MINOR CONTOURS
MILE BASE FLOW ELEVATIONS
CEL

WATERSHED NO.

12

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

7.25 SM

*

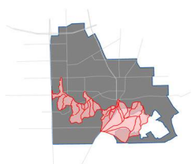
STREAM LENGTH

5.42 MI

*

PROJECTS IDENTIFIED

4



FLOODPLAIN: SHEET 8



N

0 250 500

Feet

MILE CROSS SECTIONS

EAM CENTERLINE

STING 100-YEAR FLOODPLAIN

MATE 100-YEAR FLOODPLAIN

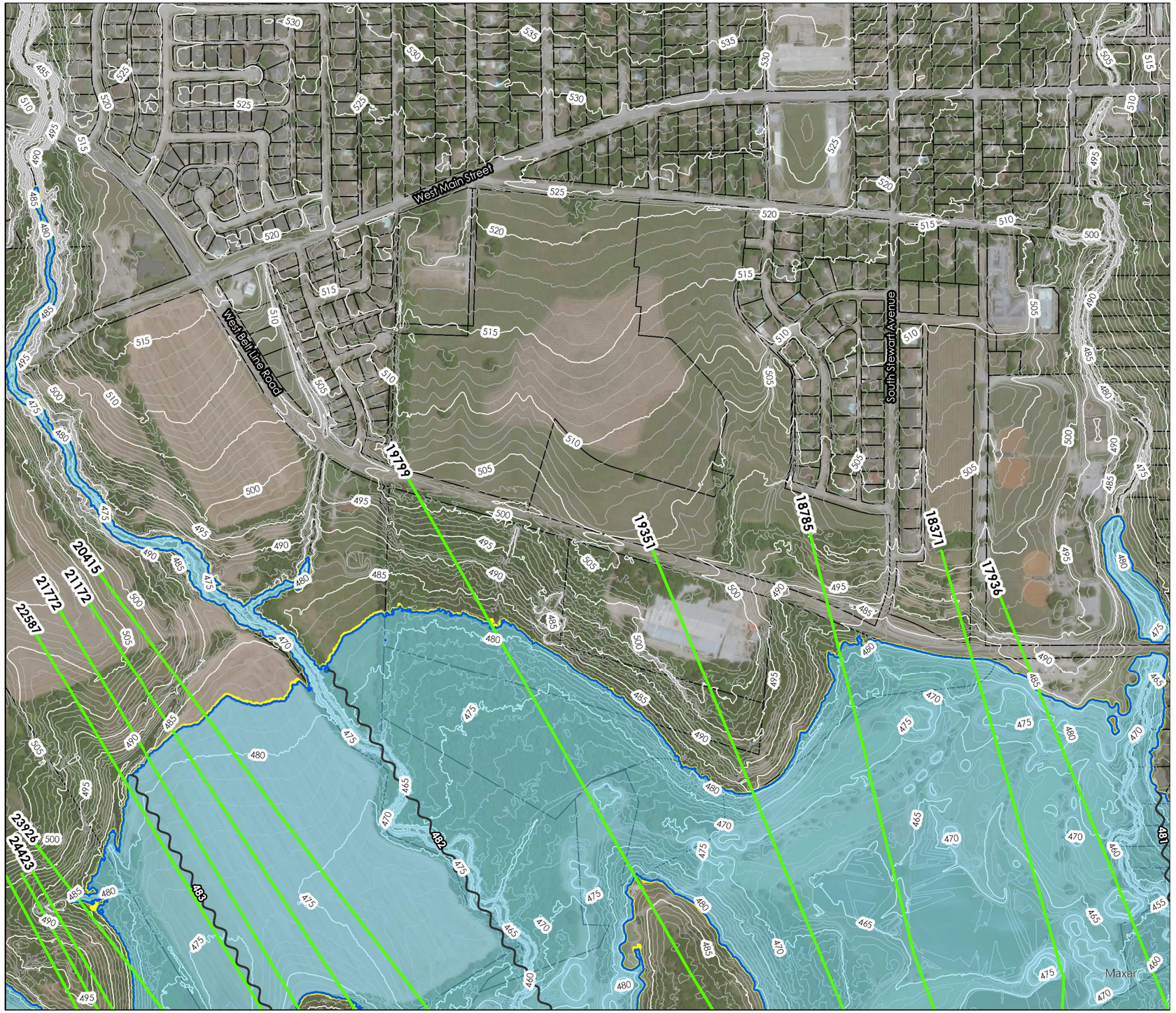
AR MAJOR CONTOURS

AR MINOR CONTOURS

MILE BASE FLOW ELEVATIONS

RCEL

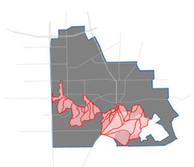
0



WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	518.80	518.88	2.34	2.33
45650	518.47	518.55	4.39	4.36
45297	517.82	517.92	4.40	4.36
44951	516.96	517.09	5.04	4.98
44658	516.31	516.45	4.57	4.50
44281	515.75	515.92	3.68	3.61
43992	515.15	515.32	4.49	4.51
43643	514.48	514.65	4.36	4.38
43363	513.81	513.99	4.66	4.67
43026	513.08	513.26	4.44	4.47
42640	511.96	512.13	5.51	5.57
42283	510.74	510.93	5.58	5.60
41924	509.99	510.16	4.35	4.43
41464	508.82	509.00	5.36	5.35
41086	508.08	508.28	4.05	4.03
40607	507.20	507.39	4.08	4.14
40154	506.59	506.77	3.60	3.67
39616	505.49	505.67	5.09	5.15
39099	503.82	504.09	5.47	5.29
38479	502.29	502.60	4.42	4.42
38085	501.33	501.63	5.11	5.17
37790	500.44	500.72	5.92	5.97
37466	499.96	500.23	4.38	4.41
37400	499.94	500.22	3.35	3.39
37320	**HOUSTON SCHOOL ROAD**			
37242	499.59	499.85	4.18	4.25
37170	499.60	499.86	3.15	3.17
37007	499.25	499.50	4.46	4.53
36574	498.70	498.95	4.62	4.69
36189	498.17	498.42	4.87	4.93
35854	497.48	497.73	5.38	5.43
35515	495.81	496.11	7.63	7.59
35270	494.68	494.99	7.06	7.11
34785	493.50	493.78	5.26	5.33
34402	493.17	493.45	4.03	4.07

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	492.36	492.66	5.76	5.74
33641	491.95	492.25	4.27	4.33
33224	490.95	491.25	5.93	5.93
32699	490.36	490.67	3.98	3.99
32249	489.52	489.83	5.57	5.63
31882	489.38	489.69	3.21	3.23
31371	488.79	489.11	4.58	4.66
31032	488.30	488.62	4.91	4.97
30417	487.31	487.61	5.01	5.14
30003	486.77	487.07	4.53	4.60
29625	486.44	486.74	4.11	4.19
29569	486.08	486.35	5.32	5.47
29522	**BLUEGROVE ROAD**			
29463	485.63	485.88	5.16	5.34
29402	485.56	485.82	4.80	4.83
29152	485.15	485.41	4.09	4.09
28618	484.55	484.82	3.23	3.24
28329	484.09	484.36	4.25	4.31
27968	483.50	483.76	4.34	4.42
27692	482.94	483.20	4.72	4.82
27195	482.16	482.40	4.29	4.43
26860	481.65	481.87	4.48	4.60
26476	481.07	481.28	4.45	4.53
26166	480.39	480.61	4.30	4.28
25793	479.78	480.01	4.11	4.14
25388	478.99	479.20	4.67	4.80
24896	477.78	477.96	5.90	6.03
24423	475.67	475.86	6.47	6.54
23926	474.77	474.95	3.60	3.64
22587	472.69	472.93	5.38	5.36
21772	472.22	472.46	2.68	2.74
21172	471.92	472.16	2.48	2.49
20415	471.34	471.61	4.08	4.06
19799	470.17	470.42	4.35	4.47
19351	469.69	469.94	3.15	3.16

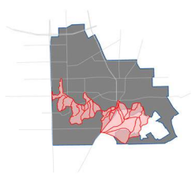
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	469.32	469.59	2.61	2.55
18371	468.95	469.25	2.29	2.26
17936	468.85	469.15	1.38	1.38
17837	468.73	469.02	2.71	2.78
17742	**RAILROAD**			
17681	468.59	468.87	2.03	2.09
17656	468.60	468.88	1.47	1.49
17578	468.57	468.85	1.83	1.83
17542	467.87	468.12	5.99	6.14
17492	**OLD RED OAK ROAD**			
17438	466.72	466.92	5.86	6.03
17412	466.87	467.07	3.06	3.09
17370	466.71	466.92	3.60	3.60
17323	466.06	466.23	5.86	6.03
17247	**HIGHWAY 342**			
17163	466.02	466.19	5.90	6.06
17057	465.85	466.02	3.70	3.76
16656	464.97	465.15	3.63	3.63
16255	464.04	464.22	4.35	4.40
15967	463.43	463.61	4.43	4.46
15528	462.49	462.67	4.80	4.88
15057	461.45	461.63	5.29	5.34
14745	460.00	460.17	6.86	6.98
14457	459.46	459.62	4.10	4.18
13955	458.87	459.02	3.77	3.81
13360	458.19	458.34	4.13	4.18
12749	457.47	457.62	3.75	3.79
12696	457.29	457.43	4.29	4.33
12671	**NOKOMIS ROAD**			
12650	457.09	457.24	3.79	3.84
12394	456.70	456.85	4.60	4.65
11929	455.95	456.10	4.21	4.27
11519	455.15	455.29	3.72	3.77
11086	454.30	454.44	4.09	4.16
10796	453.68	453.82	4.50	4.57

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	452.92	453.05	4.68	4.71
9831	452.32	452.45	3.31	3.35
9056	450.97	451.12	5.51	5.48
8583	450.17	450.31	3.96	4.00
8051	449.52	449.67	4.07	4.06
7237	448.48	448.61	4.25	4.38
6781	448.07	448.20	2.94	2.99
6316	447.47	447.60	3.76	3.79
5878	446.68	446.81	3.32	3.34
5386	446.09	446.22	2.50	2.53
4793	445.59	445.72	2.84	2.88
4325	445.02	445.15	3.15	3.19
3639	443.93	444.04	4.67	4.74
2768	441.91	442.03	3.98	4.00
2485	441.22	441.35	3.47	3.46
2004	440.52	440.68	4.18	4.12
1748	439.77	439.95	5.12	5.14
1301	439.14	439.34	3.29	3.26
579	438.80	439.01	2.49	2.51
84	438.32	438.52	3.52	3.57

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	520.94	520.99	2.79	2.78
45650	520.54	520.60	5.02	5.01
45297	519.82	519.88	5.05	5.03
44951	518.85	518.93	5.77	5.74
44658	518.11	518.20	5.30	5.27
44281	517.53	517.64	4.12	4.07
43992	516.92	517.04	4.90	4.89
43643	516.24	516.37	4.76	4.74
43363	515.58	515.73	4.94	4.91
43026	514.75	514.92	5.09	5.07
42640	513.46	513.60	6.34	6.44
42283	512.12	512.24	6.24	6.34
41924	511.22	511.32	5.03	5.07
41464	510.05	510.15	5.53	5.57
41086	509.35	509.44	4.12	4.14
40607	508.39	508.49	4.61	4.65
40154	507.77	507.87	3.85	3.88
39616	506.75	506.85	5.31	5.32
39099	505.50	505.62	4.87	4.84
38479	504.36	504.52	4.42	4.40
38085	503.29	503.45	5.83	5.85
37790	502.46	502.64	6.29	6.29
37466	501.99	502.19	4.72	4.71
37400	501.96	502.15	3.85	3.89
37320	HOUSTON SCHOOL ROAD			
37242	501.61	501.78	3.49	3.51
37170	501.54	501.69	3.61	3.76
37007	501.14	501.29	5.03	5.09
36574	500.54	500.68	5.27	5.33
36189	499.97	500.10	5.48	5.55
35854	499.22	499.35	6.04	6.10
35515	497.88	498.03	7.48	7.47
35270	496.79	496.96	7.32	7.31
34785	495.45	495.64	5.88	5.89
34402	495.09	495.29	4.54	4.55

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	494.32	494.53	6.01	5.99
33641	493.87	494.09	4.88	4.89
33224	492.89	493.14	6.21	6.19
32699	492.31	492.54	4.41	4.46
32249	491.38	491.63	6.16	6.17
31882	491.21	491.44	3.68	3.72
31371	490.62	490.83	5.00	5.06
31032	490.16	490.37	5.26	5.31
30417	489.19	489.41	5.43	5.50
30003	488.70	488.92	4.83	4.87
29625	488.38	488.60	4.46	4.49
29569	488.00	488.23	5.69	5.67
29522	BLUEGROVE ROAD			
29463	487.13	487.31	5.13	5.17
29402	487.03	487.21	4.98	5.00
29152	486.60	486.78	4.38	4.42
28618	485.97	486.14	3.58	3.64
28329	485.50	485.67	4.56	4.60
27968	484.91	485.08	4.70	4.74
27692	484.31	484.48	5.24	5.30
27195	483.41	483.57	5.00	5.08
26860	482.84	482.99	5.03	5.11
26476	482.22	482.36	4.87	4.92
26166	481.54	481.68	4.31	4.34
25793	480.98	481.12	4.32	4.37
25388	480.07	480.19	5.36	5.45
24896	478.63	478.72	6.81	6.93
24423	476.75	476.88	6.33	6.26
23926	475.83	475.96	3.74	3.74
22587	474.19	474.39	5.15	5.08
21772	473.74	473.95	2.97	2.99
21172	473.46	473.68	2.50	2.49
20415	473.03	473.27	3.87	3.84
19799	471.92	472.17	4.72	4.75
19351	471.55	471.81	3.02	2.98

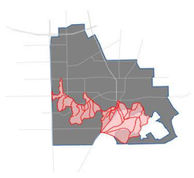
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	471.33	471.61	2.14	2.12
18371	471.12	471.40	1.94	1.91
17936	471.04	471.32	1.39	1.39
17837	470.87	471.15	3.19	3.26
17742	RAILROAD			
17681	470.67	470.94	2.46	2.52
17656	470.70	470.97	1.56	1.58
17578	470.67	470.94	1.86	1.87
17542	469.68	469.91	7.08	7.22
17492	OLD RED OAK ROAD			
17438	468.05	468.22	7.18	7.35
17412	468.31	468.49	3.32	3.35
17370	468.17	468.34	3.70	3.72
17323	467.16	467.29	7.22	7.40
17247	HIGHWAY 342			
17163	467.10	467.22	7.22	7.40
17057	466.98	467.11	3.99	4.03
16656	466.17	466.31	3.66	3.66
16255	465.24	465.38	4.71	4.75
15967	464.63	464.77	4.69	4.73
15528	463.70	463.83	5.24	5.29
15057	462.67	462.80	5.63	5.70
14745	461.13	461.25	7.69	7.75
14457	460.52	460.64	4.69	4.73
13955	459.90	460.02	4.08	4.11
13360	459.21	459.33	4.46	4.49
12749	458.48	458.60	4.04	4.06
12696	458.29	458.42	4.56	4.56
12671	NOKOMIS ROAD			
12650	458.13	458.25	4.10	4.12
12394	457.75	457.88	4.89	4.91
11929	457.00	457.13	4.62	4.65
11519	456.19	456.32	3.92	3.95
11086	455.37	455.51	4.39	4.40
10796	454.69	454.82	5.10	5.18

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	453.90	454.04	4.91	4.92
9831	453.30	453.45	3.63	3.67
9056	452.00	452.15	5.68	5.72
8583	451.14	451.29	4.35	4.41
8051	450.50	450.64	4.25	4.28
7237	449.50	449.65	4.57	4.60
6781	449.06	449.20	3.27	3.31
6316	448.44	448.58	3.98	4.02
5878	447.68	447.83	3.48	3.51
5386	447.08	447.23	2.74	2.77
4793	446.56	446.71	3.16	3.20
4325	445.95	446.09	3.43	3.47
3639	444.79	444.91	5.22	5.30
2768	442.78	442.92	4.14	4.14
2485	442.15	442.30	3.52	3.52
2004	441.56	441.73	4.15	4.13
1748	440.91	441.08	5.14	5.21
1301	440.37	440.55	3.18	3.18
579	440.08	440.26	2.63	2.64
84	439.57	439.74	3.82	3.86

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	523.87	523.95	3.54	3.56
45650	523.36	523.44	6.06	6.07
45297	522.45	522.53	6.18	6.20
44951	521.25	521.33	7.01	7.03
44658	520.37	520.46	6.43	6.42
44281	519.72	519.83	4.88	4.87
43992	519.11	519.22	5.47	5.49
43643	518.43	518.53	5.27	5.29
43363	517.69	517.80	5.66	5.69
43026	516.61	516.70	6.34	6.42
42640	515.27	515.33	6.98	7.06
42283	513.70	513.78	7.23	7.20
41924	512.75	512.83	5.44	5.46
41464	511.48	511.55	6.14	6.17
41086	510.77	510.84	4.37	4.38
40607	509.98	510.06	4.64	4.65
40154	509.44	509.52	3.92	3.94
39616	508.75	508.84	4.78	4.79
39099	507.90	508.00	4.44	4.43
38479	507.15	507.25	4.35	4.34
38085	506.25	506.37	6.02	6.03
37790	505.67	505.78	6.18	6.19
37466	505.34	505.46	4.62	4.62
37400	505.16	505.26	4.69	4.77
37320	HOUSTON SCHOOL ROAD			
37242	504.23	504.35	4.16	4.18
37170	504.14	504.26	4.39	4.42
37007	503.68	503.80	5.89	5.89
36574	502.99	503.10	6.29	6.33
36189	502.17	502.28	6.90	6.96
35854	501.23	501.34	7.44	7.49
35515	500.08	500.19	7.90	7.93
35270	499.14	499.25	7.70	7.72
34785	497.94	498.06	6.42	6.45
34402	497.58	497.69	5.20	5.23

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	496.87	496.99	6.46	6.48
33641	496.39	496.51	5.66	5.70
33224	495.51	495.65	6.62	6.57
32699	494.86	495.02	5.28	5.26
32249	493.95	494.14	6.78	6.69
31882	493.68	493.88	4.50	4.46
31371	493.01	493.21	5.85	5.92
31032	492.59	492.78	5.71	5.76
30417	491.61	491.79	6.13	6.22
30003	491.12	491.29	5.41	5.50
29625	490.79	490.96	5.04	5.12
29569	490.59	490.76	5.49	5.52
29522	BLUEGROVE ROAD			
29463	489.29	489.44	5.56	5.65
29402	489.20	489.35	5.16	5.23
29152	488.78	488.92	4.76	4.78
28618	488.09	488.24	4.13	4.17
28329	487.60	487.75	5.19	5.20
27968	486.99	487.14	5.25	5.25
27692	486.29	486.42	6.08	6.27
27195	485.23	485.34	5.99	6.05
26860	484.58	484.69	5.85	5.89
26476	483.89	483.99	5.48	5.52
26166	483.18	483.28	4.64	4.66
25793	482.64	482.73	4.76	4.79
25388	481.58	481.67	6.31	6.36
24896	479.81	479.91	8.10	8.12
24423	478.56	478.73	5.42	5.29
23926	477.85	478.05	3.54	3.52
22587	476.97	477.21	4.22	4.19
21772	476.60	476.84	3.30	3.37
21172	476.36	476.60	2.64	2.63
20415	476.06	476.30	3.62	3.62
19799	475.16	475.41	4.92	4.95
19351	474.97	475.23	2.54	2.52

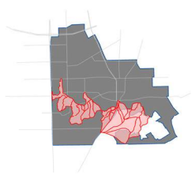
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	474.87	475.13	1.78	1.77
18371	474.75	475.02	1.62	1.61
17936	474.70	474.97	1.33	1.34
17837	474.45	474.71	3.85	3.93
17742	RAILROAD			
17681	474.18	474.43	3.06	3.13
17656	474.22	474.48	1.64	1.65
17578	474.20	474.46	1.82	1.82
17542	472.55	473.32	9.55	8.34
17492	OLD RED OAK ROAD			
17438	470.61	470.82	3.80	3.82
17412	470.57	470.78	3.65	3.66
17370	470.43	470.65	3.91	3.92
17323	468.69	468.84	9.43	9.60
17247	HIGHWAY 342			
17163	468.56	468.70	9.36	9.54
17057	468.62	468.78	4.36	4.36
16656	467.89	468.06	3.67	3.69
16255	466.97	467.13	5.21	5.27
15967	466.32	466.49	5.24	5.28
15528	465.33	465.49	5.90	5.97
15057	464.20	464.35	6.47	6.56
14745	462.61	462.75	8.47	8.53
14457	461.99	462.14	5.19	5.22
13955	461.35	461.49	4.52	4.56
13360	460.64	460.79	4.89	4.93
12749	459.91	460.06	4.47	4.51
12696	459.74	459.89	4.80	4.83
12671	NOKOMIS ROAD			
12650	459.61	459.76	4.45	4.48
12394	459.24	459.40	5.29	5.33
11929	458.46	458.61	5.19	5.24
11519	457.64	457.79	4.26	4.28
11086	456.81	456.96	4.87	4.91
10796	456.06	456.22	5.83	5.89

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	455.28	455.43	5.19	5.22
9831	454.69	454.85	3.99	4.03
9056	453.43	453.59	6.01	6.05
8583	452.57	452.72	4.79	4.84
8051	451.94	452.09	4.48	4.52
7237	451.01	451.17	4.88	4.91
6781	450.54	450.70	3.68	3.72
6316	449.90	450.05	4.36	4.39
5878	449.17	449.33	3.75	3.78
5386	448.56	448.72	3.12	3.15
4793	448.01	448.16	3.59	3.62
4325	447.34	447.49	3.85	3.89
3639	446.07	446.22	5.95	6.00
2768	444.26	444.45	4.16	4.14
2485	443.73	443.95	3.52	3.48
2004	443.28	443.52	4.07	4.02
1748	442.77	443.03	5.07	5.06
1301	442.32	442.59	3.15	3.16
579	442.05	442.32	2.93	2.96
84	441.49	441.76	4.24	4.30

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	525.39	525.55	3.99	4.05
45650	524.83	524.98	6.59	6.66
45297	523.85	524.00	6.73	6.79
44951	522.51	522.65	7.73	7.80
44658	521.58	521.72	6.99	7.04
44281	520.82	520.95	5.58	5.60
43992	520.21	520.35	5.79	5.82
43643	519.51	519.65	5.58	5.61
43363	518.71	518.84	6.15	6.19
43026	517.45	517.57	7.11	7.18
42640	516.02	516.13	7.40	7.48
42283	514.55	514.62	7.12	7.26
41924	513.55	513.61	5.71	5.72
41464	512.29	512.35	6.25	6.26
41086	511.62	511.68	4.40	4.41
40607	510.93	511.00	4.52	4.52
40154	510.46	510.52	3.88	3.88
39616	509.89	509.97	4.56	4.56
39099	509.14	509.23	4.47	4.44
38479	508.47	508.57	4.39	4.37
38085	507.62	507.73	6.23	6.20
37790	507.06	507.18	6.38	6.33
37466	506.75	506.88	4.76	4.72
37400	506.47	506.61	5.21	5.18
37320	**HOUSTON SCHOOL ROAD**			
37242	505.58	505.74	4.49	4.46
37170	505.45	505.63	4.92	4.87
37007	504.96	505.11	6.37	6.47
36574	504.23	504.38	6.80	6.87
36189	503.32	503.46	7.57	7.65
35854	502.36	502.50	7.95	8.02
35515	501.25	501.39	8.21	8.23
35270	500.35	500.50	7.95	7.99
34785	499.21	499.35	6.71	6.75
34402	498.84	498.98	5.54	5.58

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	498.16	498.30	6.71	6.80
33641	497.67	497.80	6.09	6.15
33224	496.80	496.95	6.91	6.88
32699	496.13	496.29	5.76	5.75
32249	495.22	495.42	7.12	7.06
31882	494.91	495.10	4.94	4.93
31371	494.24	494.42	6.22	6.31
31032	493.82	494.00	6.00	6.08
30417	492.77	492.93	6.63	6.76
30003	492.24	492.39	5.93	6.01
29625	491.88	492.03	5.52	5.60
29569	491.73	491.87	5.63	5.67
29522	**BLUEGROVE ROAD**			
29463	490.62	490.78	5.75	5.80
29402	490.53	490.69	5.29	5.32
29152	490.12	490.29	4.92	4.90
28618	489.39	489.57	4.58	4.57
28329	488.89	489.07	5.47	5.53
27968	488.29	488.46	5.50	5.56
27692	487.51	487.67	6.72	6.80
27195	486.30	486.46	6.73	6.79
26860	485.62	485.77	6.27	6.32
26476	484.89	485.04	5.84	5.90
26166	484.16	484.31	4.83	4.87
25793	483.62	483.76	5.04	5.08
25388	482.49	482.62	6.83	6.91
24896	480.64	480.76	8.59	8.64
24423	479.65	479.80	5.12	5.11
23926	479.05	479.21	3.41	3.40
22587	478.36	478.53	4.03	4.02
21772	478.00	478.18	3.57	3.60
21172	477.78	477.95	2.60	2.61
20415	477.52	477.69	3.62	3.63
19799	476.64	476.82	5.17	5.18
19351	476.50	476.69	2.47	2.46

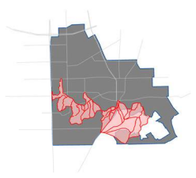
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	476.41	476.60	1.79	1.78
18371	476.30	476.50	1.67	1.66
17936	476.25	476.45	1.39	1.40
17837	475.93	476.11	4.36	4.43
17742	RAILROAD			
17681	475.63	475.80	1.52	1.53
17656	475.61	475.78	1.78	1.80
17578	475.58	475.75	1.96	1.97
17542	474.95	475.15	6.90	6.77
17492	OLD RED OAK ROAD			
17438	471.97	472.15	3.95	3.95
17412	471.93	472.11	3.82	3.82
17370	471.80	471.98	3.99	3.99
17323	469.52	469.63	10.76	10.91
17247	HIGHWAY 342			
17163	469.32	469.42	10.67	10.83
17057	469.53	469.65	4.52	4.54
16656	468.82	468.94	3.79	3.80
16255	467.88	468.00	5.49	5.53
15967	467.23	467.35	5.45	5.48
15528	466.20	466.32	6.29	6.35
15057	465.00	465.10	6.97	7.04
14745	463.47	463.58	8.64	8.66
14457	462.84	462.95	5.44	5.47
13955	462.19	462.30	4.77	4.79
13360	461.47	461.58	5.12	5.15
12749	460.74	460.85	4.73	4.74
12696	460.58	460.70	4.96	4.97
12671	NOKOMIS ROAD			
12650	460.46	460.58	4.66	4.68
12394	460.09	460.21	5.52	5.54
11929	459.29	459.41	5.51	5.54
11519	458.45	458.58	4.46	4.47
11086	457.61	457.75	5.16	5.17
10796	456.86	457.00	6.12	6.14

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	456.08	456.22	5.33	5.42
9831	455.50	455.63	4.21	4.24
9056	454.24	454.37	6.23	6.29
8583	453.37	453.50	5.00	5.05
8051	452.74	452.86	4.64	4.68
7237	451.85	451.96	5.05	5.07
6781	451.37	451.49	3.88	3.91
6316	450.71	450.83	4.55	4.57
5878	450.00	450.11	3.91	3.93
5386	449.38	449.50	3.32	3.35
4793	448.81	448.93	3.80	3.83
4325	448.12	448.24	4.06	4.09
3639	446.82	446.93	6.27	6.31
2768	445.12	445.26	4.19	4.18
2485	444.64	444.79	3.54	3.53
2004	444.23	444.39	4.12	4.11
1748	443.76	443.93	5.04	5.04
1301	443.35	443.52	3.19	3.20
579	443.09	443.26	3.04	3.05
84	442.51	442.68	4.47	4.50

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	527.63	527.64	4.81	4.81
45650	526.98	526.99	7.55	7.55
45297	525.89	525.90	7.75	7.74
44951	524.39	524.41	8.76	8.72
44658	523.39	523.43	7.77	7.73
44281	522.63	522.68	6.00	5.95
43992	521.96	522.02	6.42	6.43
43643	521.21	521.27	6.18	6.19
43363	520.30	520.36	6.92	6.93
43026	518.74	518.80	8.37	8.37
42640	517.16	517.22	8.05	8.08
42283	515.80	515.88	7.04	7.01
41924	514.90	514.99	5.70	5.68
41464	513.74	513.85	6.30	6.28
41086	513.15	513.26	4.31	4.31
40607	512.62	512.74	4.29	4.26
40154	512.23	512.37	3.77	3.75
39616	511.79	511.93	4.35	4.39
39099	511.12	511.25	4.63	4.68
38479	510.52	510.65	4.60	4.63
38085	509.67	509.79	6.67	6.73
37790	509.04	509.15	7.13	7.20
37466	508.74	508.84	5.20	5.27
37400	508.37	508.47	5.93	6.00
37320	HOUSTON SCHOOL ROAD			
37242	507.72	507.82	5.18	5.25
37170	507.60	507.69	5.49	5.55
37007	507.04	507.12	7.17	7.24
36574	506.25	506.34	7.64	7.67
36189	505.27	505.36	8.42	8.45
35854	504.21	504.30	8.91	8.94
35515	503.21	503.30	8.49	8.50
35270	502.32	502.43	8.50	8.49
34785	501.25	501.36	7.17	7.17
34402	500.87	500.99	6.08	6.08

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	500.21	500.35	7.20	7.18
33641	499.68	499.82	6.81	6.80
33224	498.84	498.98	7.41	7.43
32699	498.16	498.31	6.42	6.42
32249	497.22	497.38	7.80	7.80
31882	496.82	496.98	5.76	5.78
31371	496.13	496.28	6.89	6.96
31032	495.70	495.85	6.50	6.56
30417	494.57	494.70	7.40	7.50
30003	493.96	494.09	6.75	6.78
29625	493.55	493.68	6.31	6.34
29569	493.43	493.57	6.01	6.01
29522	BLUEGROVE ROAD			
29463	492.52	492.67	6.18	6.17
29402	492.44	492.60	5.51	5.50
29152	492.05	492.21	5.22	5.21
28618	491.25	491.42	5.17	5.17
28329	490.73	490.90	5.98	6.01
27968	490.07	490.24	6.08	6.14
27692	489.23	489.39	7.43	7.49
27195	487.98	488.13	7.38	7.44
26860	487.27	487.42	6.82	6.87
26476	486.50	486.65	6.38	6.43
26166	485.75	485.89	5.17	5.20
25793	485.21	485.35	5.47	5.51
25388	484.01	484.13	7.48	7.58
24896	482.53	482.66	8.13	8.14
24423	481.98	482.12	4.41	4.42
23926	481.58	481.72	3.12	3.12
22587	481.11	481.25	3.75	3.76
21772	480.83	480.97	3.52	3.55
21172	480.66	480.80	2.50	2.51
20415	480.46	480.60	3.46	3.49
19799	479.68	479.81	5.47	5.51
19351	479.60	479.73	2.41	2.42

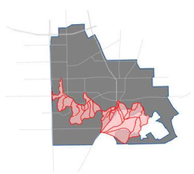
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	479.53	479.66	1.79	1.81
18371	479.45	479.58	1.67	1.68
17936	479.40	479.53	1.58	1.59
17837	478.90	479.01	5.39	5.47
17742	RAILROAD			
17681	478.16	478.25	1.76	1.79
17656	478.14	478.22	2.04	2.07
17578	478.11	478.19	2.23	2.25
17542	477.73	477.80	5.89	5.92
17492	OLD RED OAK ROAD			
17438	477.37	477.44	3.26	3.30
17412	477.35	477.42	3.13	3.17
17370	477.29	477.37	3.19	3.23
17323	476.37	476.44	8.47	8.52
17247	HIGHWAY 342			
17163	470.67	470.74	13.51	13.68
17057	471.36	471.45	4.69	4.70
16656	470.68	470.78	4.03	4.02
16255	469.70	469.82	6.05	6.03
15967	469.04	469.16	5.86	5.89
15528	467.94	468.05	7.08	7.13
15057	466.60	466.70	7.95	8.02
14745	465.19	465.30	8.93	8.95
14457	464.59	464.70	5.84	5.86
13955	463.94	464.05	5.17	5.19
13360	463.20	463.31	5.65	5.67
12749	462.50	462.62	4.98	4.99
12696	462.36	462.47	5.19	5.21
12671	NOKOMIS ROAD			
12650	462.25	462.36	5.04	5.06
12394	461.88	461.99	5.94	5.96
11929	461.02	461.14	6.23	6.27
11519	460.17	460.29	4.83	4.85
11086	459.32	459.44	5.69	5.72
10796	458.55	458.67	6.74	6.78

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	457.78	457.90	5.67	5.69
9831	457.21	457.33	4.63	4.67
9056	455.96	456.07	6.57	6.62
8583	455.12	455.22	5.40	5.45
8051	454.50	454.59	4.97	5.02
7237	453.64	453.73	5.38	5.39
6781	453.15	453.24	4.30	4.31
6316	452.46	452.56	5.01	5.03
5878	451.77	451.86	4.24	4.25
5386	451.14	451.24	3.71	3.72
4793	450.55	450.65	4.24	4.25
4325	449.83	449.94	4.45	4.45
3639	448.51	448.63	6.79	6.78
2768	447.05	447.23	4.28	4.22
2485	446.64	446.84	3.62	3.57
2004	446.27	446.49	4.28	4.22
1748	445.88	446.10	5.03	5.05
1301	445.52	445.74	3.30	3.32
579	445.28	445.51	3.23	3.26
84	444.67	444.89	4.91	4.96

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	528.80	528.88	5.34	5.38
45650	528.10	528.17	8.15	8.20
45297	526.89	526.96	8.45	8.50
44951	525.45	525.52	8.96	8.98
44658	524.44	524.50	8.07	8.10
44281	523.70	523.76	6.20	6.23
43992	523.00	523.06	6.74	6.76
43643	522.21	522.27	6.55	6.57
43363	521.24	521.30	7.36	7.39
43026	519.54	519.58	9.04	9.08
42640	517.85	517.88	8.53	8.55
42283	516.59	516.63	6.89	6.89
41924	515.76	515.80	5.67	5.66
41464	514.67	514.72	6.24	6.23
41086	514.13	514.19	4.26	4.25
40607	513.66	513.73	4.19	4.18
40154	513.32	513.39	3.73	3.72
39616	512.90	512.97	4.46	4.44
39099	512.24	512.32	4.78	4.78
38479	511.67	511.74	4.73	4.73
38085	510.79	510.87	7.05	7.05
37790	510.13	510.20	7.54	7.58
37466	509.79	509.87	5.60	5.61
37400	509.40	509.47	6.37	6.39
37320	HOUSTON SCHOOL ROAD			
37242	508.95	509.04	5.56	5.57
37170	508.81	508.90	5.91	5.94
37007	508.20	508.29	7.72	7.71
36574	507.39	507.48	8.10	8.13
36189	506.38	506.47	8.91	8.94
35854	505.31	505.40	9.32	9.35
35515	504.33	504.42	8.76	8.79
35270	503.49	503.59	8.70	8.72
34785	502.46	502.56	7.42	7.44
34402	502.08	502.18	6.38	6.40

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	501.46	501.56	7.40	7.41
33641	500.91	501.01	7.15	7.17
33224	500.04	500.16	7.83	7.79
32699	499.39	499.51	6.74	6.72
32249	498.42	498.56	8.20	8.17
31882	497.97	498.12	6.23	6.22
31371	497.29	497.44	7.21	7.25
31032	496.87	497.01	6.77	6.80
30417	495.68	495.82	7.87	7.92
30003	495.04	495.17	7.21	7.29
29625	494.59	494.72	6.79	6.87
29569	494.48	494.61	6.18	6.23
29522	BLUEGROVE ROAD			
29463	493.64	493.76	6.49	6.56
29402	493.56	493.68	5.68	5.73
29152	493.17	493.29	5.40	5.45
28618	492.35	492.46	5.45	5.50
28329	491.83	491.95	6.19	6.21
27968	491.15	491.26	6.44	6.48
27692	490.25	490.36	7.87	7.92
27195	488.98	489.08	7.79	7.82
26860	488.25	488.36	7.16	7.19
26476	487.45	487.55	6.73	6.76
26166	486.66	486.77	5.45	5.47
25793	486.11	486.21	5.76	5.78
25388	484.84	484.94	7.95	7.98
24896	483.44	483.56	8.14	8.11
24423	482.93	483.07	4.49	4.48
23926	482.54	482.67	3.20	3.21
22587	482.06	482.20	3.96	3.98
21772	481.75	481.89	3.76	3.79
21172	481.57	481.71	2.66	2.68
20415	481.36	481.49	3.70	3.73
19799	480.53	480.65	5.78	5.82
19351	480.45	480.57	2.51	2.53

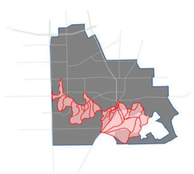
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	480.38	480.50	1.88	1.89
18371	480.29	480.41	1.75	1.77
17936	480.23	480.36	1.69	1.69
17837	479.65	479.76	5.83	5.89
17742	RAILROAD			
17681	478.70	478.78	1.90	1.92
17656	478.67	478.75	2.20	2.22
17578	478.64	478.72	2.40	2.43
17542	478.24	478.31	6.06	6.09
17492	OLD RED OAK ROAD			
17438	477.87	477.94	3.48	3.51
17412	477.85	477.92	3.35	3.38
17370	477.79	477.86	3.40	3.43
17323	476.85	476.92	8.73	8.76
17247	HIGHWAY 342			
17163	471.06	471.08	14.62	14.80
17057	471.96	472.02	4.76	4.78
16656	471.29	471.35	4.12	4.13
16255	470.31	470.36	6.20	6.22
15967	469.64	469.69	5.99	6.00
15528	468.52	468.57	7.33	7.35
15057	467.13	467.17	8.29	8.32
14745	465.76	465.81	9.02	9.02
14457	465.17	465.22	5.95	5.95
13955	464.52	464.58	5.30	5.30
13360	463.79	463.85	5.79	5.79
12749	463.10	463.17	5.07	5.05
12696	462.95	463.02	5.28	5.27
12671	NOKOMIS ROAD			
12650	462.84	462.92	5.17	5.16
12394	462.47	462.55	6.07	6.06
11929	461.60	461.69	6.46	6.44
11519	460.74	460.85	4.98	4.95
11086	459.88	460.01	5.87	5.82
10796	459.13	459.26	6.86	6.88

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	458.37	458.51	5.77	5.78
9831	457.81	457.95	4.73	4.75
9056	456.58	456.73	6.65	6.65
8583	455.75	455.91	5.50	5.53
8051	455.15	455.31	5.01	5.01
7237	454.31	454.47	5.50	5.52
6781	453.81	453.98	4.45	4.49
6316	453.12	453.28	5.18	5.24
5878	452.43	452.58	4.36	4.39
5386	451.80	451.96	3.84	3.87
4793	451.21	451.36	4.38	4.42
4325	450.49	450.64	4.58	4.62
3639	449.16	449.31	6.95	6.99
2768	447.84	448.01	4.21	4.20
2485	447.46	447.64	3.64	3.65
2004	447.11	447.29	4.30	4.32
1748	446.73	446.92	5.08	5.09
1301	446.38	446.57	3.37	3.38
579	446.15	446.34	3.33	3.36
84	445.52	445.71	5.08	5.12

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4



2.3 HYDRAULIC RESULTS: 100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
45771	529.78	529.86	5.83	5.88
45650	529.02	529.11	8.73	8.77
45297	527.80	527.88	8.81	8.83
44951	526.39	526.48	9.15	9.15
44658	525.35	525.45	8.39	8.41
44281	524.63	524.73	6.36	6.35
43992	523.88	523.98	7.09	7.12
43643	523.07	523.17	6.88	6.91
43363	522.05	522.15	7.72	7.76
43026	520.21	520.29	9.66	9.72
42640	518.45	518.52	8.85	8.90
42283	517.28	517.35	6.76	6.78
41924	516.52	516.59	5.60	5.62
41464	515.51	515.57	6.15	6.17
41086	515.00	515.07	4.22	4.24
40607	514.58	514.64	4.14	4.16
40154	514.26	514.32	3.74	3.77
39616	513.86	513.92	4.46	4.50
39099	513.23	513.29	4.86	4.85
38479	512.67	512.73	4.87	4.86
38085	511.78	511.85	7.27	7.25
37790	511.08	511.16	7.93	7.91
37466	510.75	510.84	5.82	5.79
37400	510.31	510.40	6.75	6.72
37320	HOUSTON SCHOOL ROAD			
37242	510.04	510.16	5.88	5.85
37170	509.87	509.99	6.40	6.36
37007	509.23	509.35	8.14	8.16
36574	508.40	508.52	8.49	8.54
36189	507.38	507.50	9.27	9.32
35854	506.30	506.42	9.69	9.73
35515	505.32	505.43	9.10	9.13
35270	504.52	504.63	8.92	8.96
34785	503.50	503.61	7.69	7.72
34402	503.10	503.21	6.75	6.81

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
33991	502.48	502.59	7.66	7.70
33641	501.94	502.04	7.44	7.48
33224	501.09	501.21	8.01	7.99
32699	500.44	500.55	7.03	7.10
32249	499.46	499.58	8.52	8.51
31882	498.98	499.10	6.60	6.61
31371	498.32	498.44	7.44	7.49
31032	497.90	498.01	7.00	7.05
30417	496.66	496.76	8.27	8.35
30003	495.99	496.09	7.61	7.63
29625	495.53	495.63	7.17	7.19
29569	495.43	495.53	6.34	6.34
29522	BLUEGROVE ROAD			
29463	494.63	494.74	6.66	6.66
29402	494.56	494.66	5.85	5.85
29152	494.17	494.27	5.59	5.63
28618	493.34	493.43	5.66	5.70
28329	492.82	492.92	6.36	6.38
27968	492.11	492.21	6.76	6.79
27692	491.16	491.25	8.33	8.37
27195	489.89	489.98	8.04	8.06
26860	489.15	489.24	7.42	7.45
26476	488.32	488.41	7.05	7.08
26166	487.52	487.61	5.66	5.68
25793	486.97	487.05	5.98	6.00
25388	485.67	485.75	8.27	8.29
24896	484.37	484.46	8.04	8.03
24423	483.91	484.01	4.49	4.49
23926	483.54	483.64	3.24	3.24
22587	483.08	483.18	4.03	4.04
21772	482.77	482.87	3.90	3.92
21172	482.59	482.69	2.77	2.78
20415	482.36	482.46	3.85	3.87
19799	481.53	481.61	5.92	6.02
19351	481.46	481.54	2.54	2.58

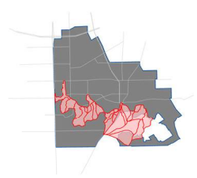
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
18785	481.39	481.47	1.90	1.93
18371	481.30	481.38	1.78	1.81
17936	481.25	481.33	1.78	1.80
17837	480.55	480.60	6.38	6.50
17742	RAILROAD			
17681	479.35	479.45	2.07	2.09
17656	479.32	479.42	2.38	2.40
17578	479.28	479.38	2.64	2.67
17542	478.85	478.95	6.35	6.38
17492	OLD RED OAK ROAD			
17438	478.46	478.55	3.76	3.81
17412	478.44	478.53	3.63	3.67
17370	478.37	478.46	3.66	3.70
17323	477.42	477.51	9.06	9.09
17247	HIGHWAY 342			
17163	471.51	471.60	16.03	16.22
17057	472.73	472.87	4.83	4.82
16656	472.06	472.20	4.27	4.30
16255	471.06	471.19	6.40	6.44
15967	470.39	470.52	6.17	6.20
15528	469.23	469.36	7.66	7.72
15057	467.77	467.89	8.70	8.77
14745	466.46	466.59	9.13	9.15
14457	465.88	466.01	6.10	6.14
13955	465.23	465.35	5.48	5.51
13360	464.49	464.62	5.96	6.00
12749	463.80	463.93	5.25	5.28
12696	463.65	463.78	5.42	5.45
12671	NOKOMIS ROAD			
12650	463.55	463.68	5.34	5.37
12394	463.17	463.30	6.27	6.31
11929	462.26	462.38	6.82	6.87
11519	461.36	461.48	5.22	5.26
11086	460.45	460.56	6.19	6.25
10796	459.72	459.83	6.96	6.97

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
10445	458.96	459.07	5.97	6.00
9831	458.39	458.50	4.86	4.88
9056	457.15	457.26	6.79	6.81
8583	456.33	456.44	5.67	5.70
8051	455.71	455.82	5.15	5.17
7237	454.88	455.00	5.58	5.59
6781	454.39	454.50	4.58	4.60
6316	453.68	453.79	5.39	5.41
5878	452.98	453.10	4.47	4.48
5386	452.35	452.47	3.95	3.97
4793	451.75	451.88	4.50	4.52
4325	451.02	451.15	4.70	4.70
3639	449.70	449.84	7.09	7.08
2768	448.45	448.64	4.18	4.13
2485	448.09	448.29	3.69	3.66
2004	447.75	447.96	4.36	4.32
1748	447.38	447.59	5.12	5.14
1301	447.03	447.25	3.48	3.49
579	446.80	447.01	3.42	3.44
84	446.16	446.37	5.21	5.25

WATERSHED NO.
12

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
7.25 SM
*
STREAM LENGTH
5.42 MI
*
PROJECTS IDENTIFIED
4

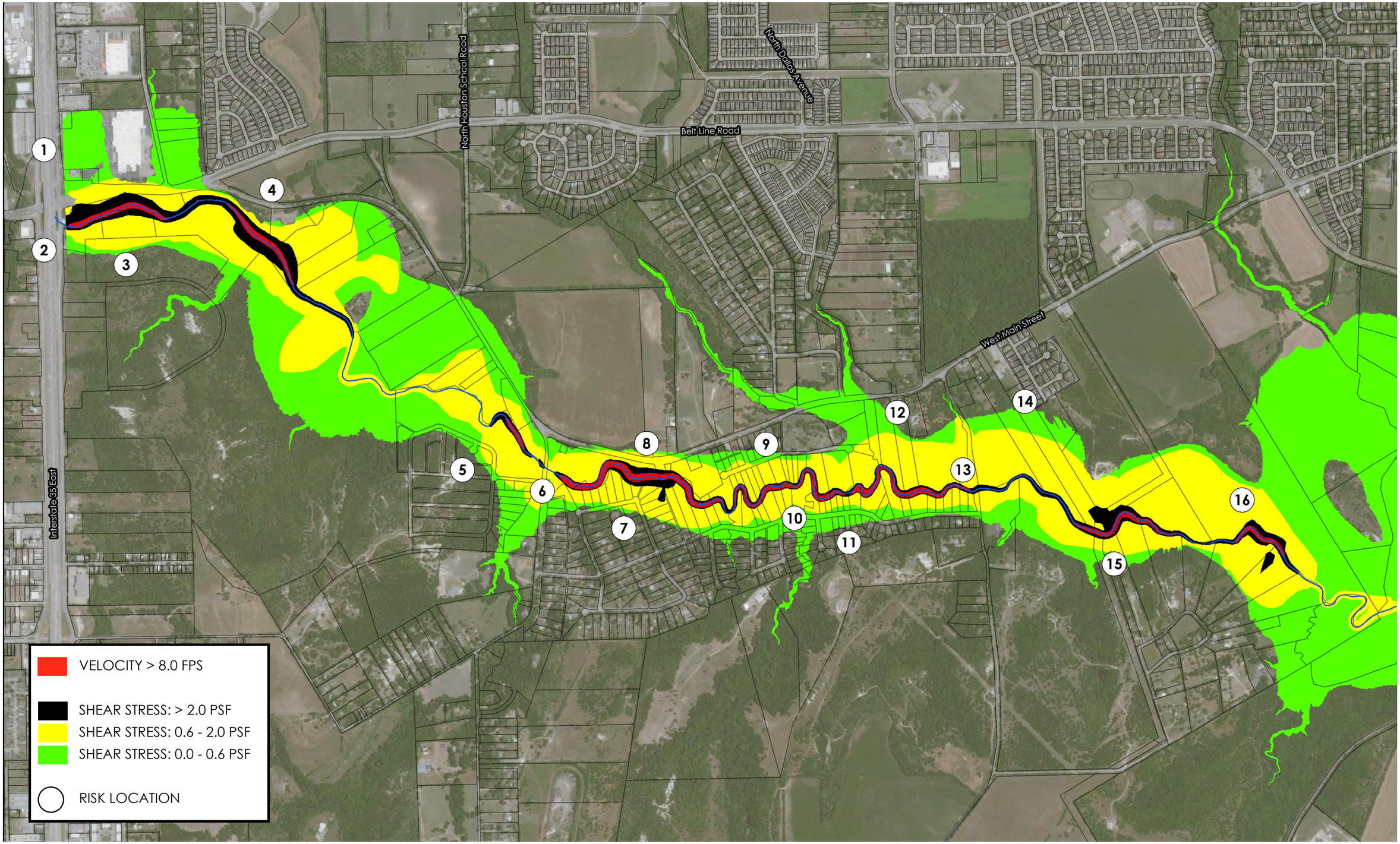


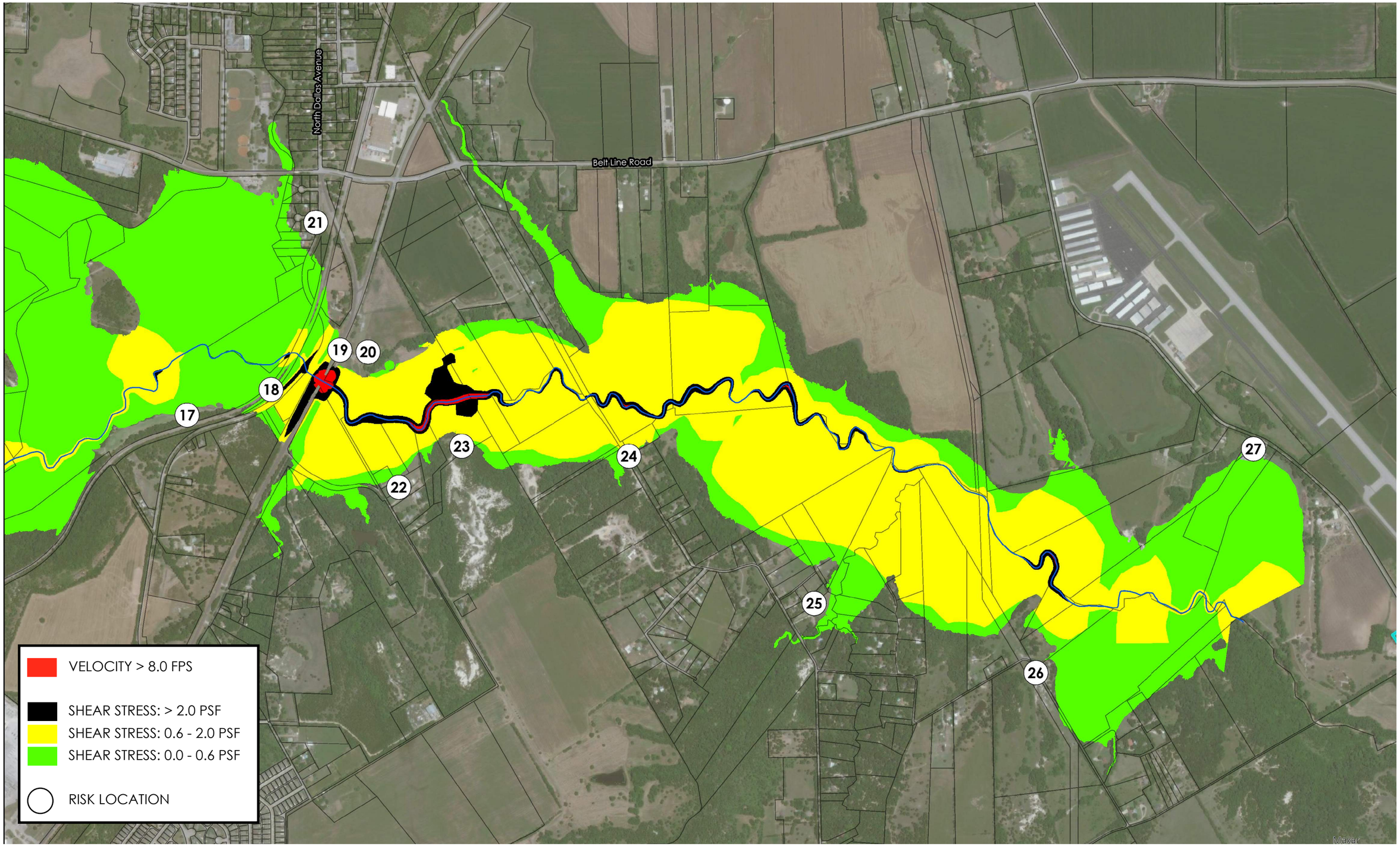
3.1 RISK IDENTIFICATION

Twenty-seven risk areas were identified in this study. The risks include six over-topping bridges, fourteen areas with flooding structures and seven locations of erosive velocities. The areas with flooded structures are mostly neighborhoods. Near Interstate Highway 35, there are a few commercial buildings that experience flooding, but the vast majority of inundated structures are houses which modeling shows flooding in the 5- and 10-year stom events. All of the overtopping bridges in the analysis of Ten Mile Creek have high flooding frequency and/or heavy traffic, which is why they all have a high priority. The seven areas where erosion is likely are located away from major development and in heavily wooded areas. No significant erosion risks are anticipated. The following map shows the shear stresses associated with the Ten Mile Creek floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Commerical Buildings (North of Belt Line)	Flooded Structure	10-Year	Private	Medium
2	Commerical Buildings (South of Belt Line)	Flooded Structure	5-Year	Private	Medium
3	River Station 44951	Potential Erosion Hot Spot	1-Year	Private	Very Low
4	River Station 43026	Potential Erosion Hot Spot	1-Year	Private	Very Low
5	Houses Near Creek	Flooded Structure	10-Year	Private	Medium
6	South Houston School Road	Over-topping Bridge	5-Year	Public	High
7	Houses on Enchanted Lane	Flooded Structure	5-Year	Private	Medium
8	River Station 35854	Potential Erosion Hot Spot	1-Year	Private	Very Low
9	Houses on Riverway Lane	Flooded Structure	5-Year	Private	Medium
10	Enchanted Lane (Headwalls)	Over-topping Culvert	-	Public	Medium
11	Houses Near Enchanted Lane & Bluegrove Road	Flooded Structure	5-Year	Private	Medium
12	Houses on Main Street	Flooded Structure	5-Year	Private	Medium
13	South Blue Grove Road	Over-topping Bridge	2-Year	Public	High
14	Houses on Big Sandy Lane	Flooded Structure	5-Year	Private	Medium
15	River Station 27692	Potential Erosion Hot Spot	1-Year	Private	Very Low
16	River Station 25388	Potential Erosion Hot Spot	1-Year	Private	Very Low
17	Houses Near Old Red Oak Road	Flooded Structure	5-Year	Private	Medium
18	Old Red Oak Road	Over-topping Bridge	5-Year	Public	Medium
19	Highway 342	Over-topping Bridge	25-Year	Public	High
20	River Station 17163	Potential Erosion Hot Spot	1-Year	Private	Very Low
21	Houses Near South Dallas Avenue	Flooded Structure	5-Year	Private	Medium
22	Houses on Moreland Road	Flooded Structure	5-Year	Private	Medium
23	River Station 14745	Potential Erosion Hot Spot	1-Year	Private	Very Low
24	Nokomis Road	Over-topping Bridge	1-Year	Public	High
25	Houses on Unnamed Road	Flooded Structure	5-Year	Private	Medium
26	Houses on Wilson Road	Flooded Structure	5-Year	Private	Medium
27	Industrial Building on Ferris Road	Flooded Structure	100-Year	Private	Low


North Houston School Road
North Dallas Avenue
Belt Line Road
West Main Street
Interstate 35 East
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION


North Dallas Avenue
Belt Line Road
21
19
20
18
17
23
24
27
22
25
26
VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
Maxar

UNNAMED TRIBUTARY 1

WATERSHED NO.

13

COUNCIL DISTRICT

1

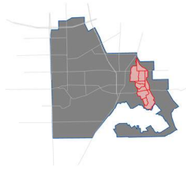
TOTAL DRAINAGE AREA

2.01 SM

*

STREAM LENGTH

2.20 MI



UNNAMED TRIB 1

STREAM CENTERLINE

COUNCIL DISTRICT

DISTRICT 1

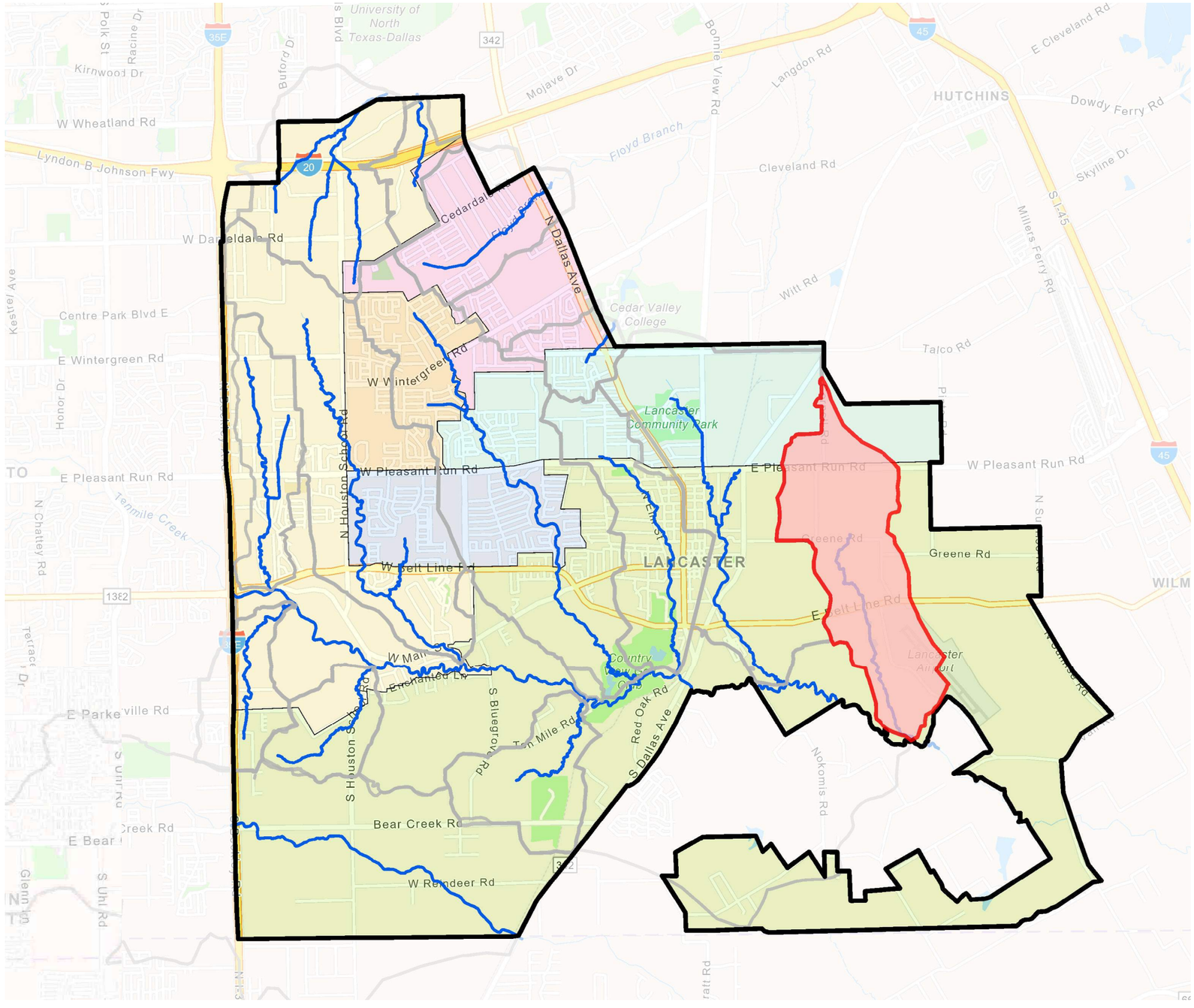
DISTRICT 2

DISTRICT 3

DISTRICT 4

DISTRICT 5

DISTRICT 6



UNNAMED TRIBUTARY 1 WATERSHED

Unnamed Tributary 1 is located along the eastern boundary of the City and the watershed is approximately 2.01 square miles at the confluence with Ten Mile Creek. The stream begins north of East Belt Line Road adjacent to open farmland. The stream flows south from a culvert outfall towards Ten Mile Creek located 2.70 miles downstream. The watershed consists of open areas including wooded spaces as well as some residential development. These undeveloped areas are projected to be office areas as well as medium residential area.

WATERSHED NO. 13

UNNAMED TRIBUTARY 1

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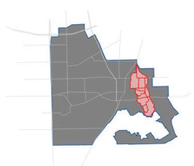
UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



1.0 HYDROLOGY

1.1 DRAINAGE AREA MAP

The drainage area divides for the Unnamed Tributary 1 watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into ten (10) sub-basins. Sub-basins are designated UT1-1 through UT1-10. The total watershed drainage area is 1287.9 acres (2.01 square-miles). Approximately 1 .44 square-miles of drainage area is located within the City of Lancaster itself.

N

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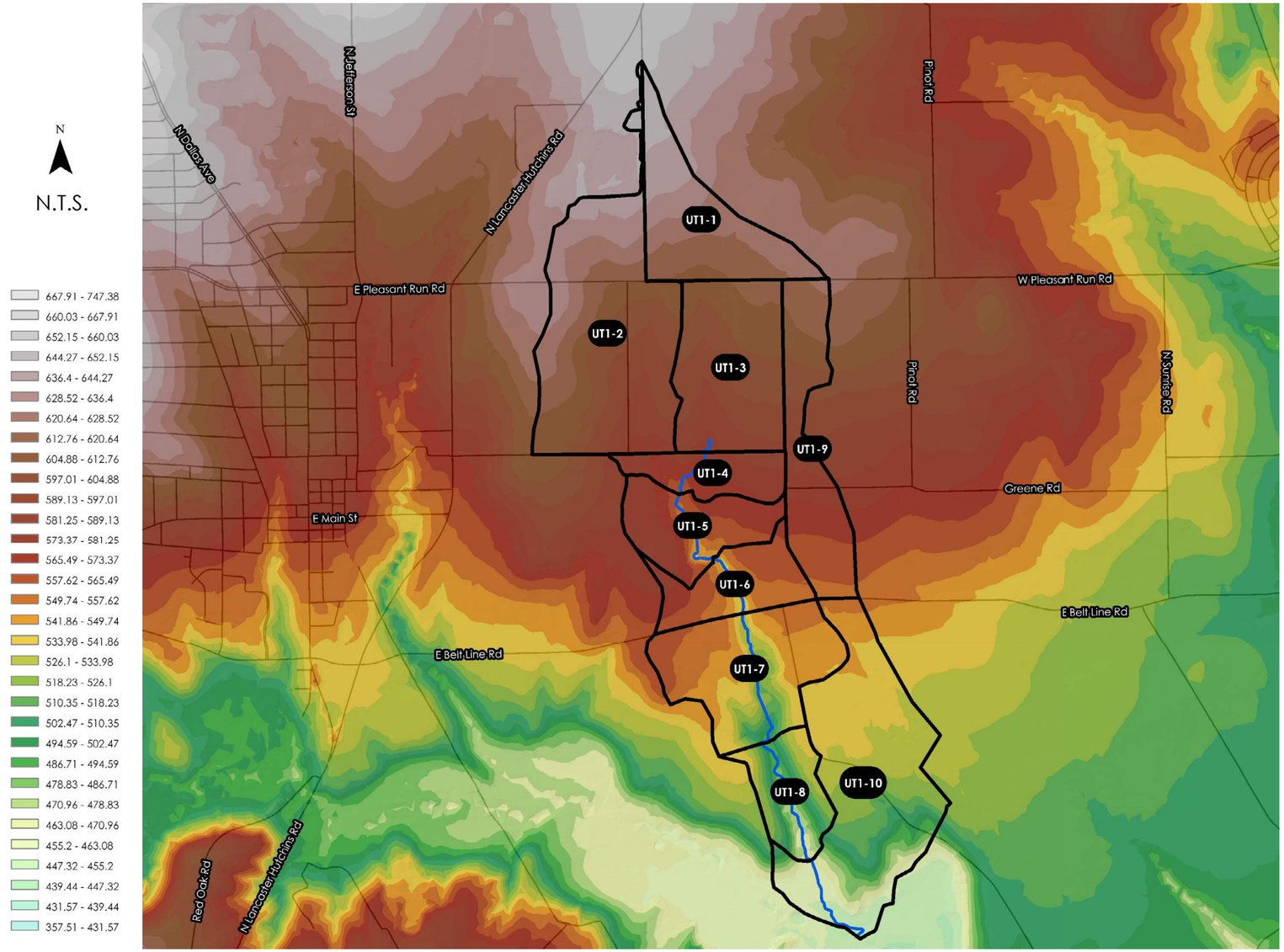


HYDROLOGIC PARAMETERS REPORT

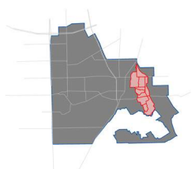
BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
UT1-1	0.1854	84	2.5	69.3	50.88	30.53	40.55	24.33
UT1-2	0.3927	84	8.1	69.4	39.18	23.51	31.27	18.76
UT1-3	0.2231	84	1	70	33.07	19.84	27.53	16.52
UT1-4	0.0811	84	3.7	58.3	34.73	20.84	30.13	18.08
UT1-5	0.1262	84	1	66.5	27.18	16.31	22.58	13.55
UT1-6	0.1101	84	4.7	53.1	41.30	24.78	31.50	18.9
UT1-7	0.2344	79.3	9.7	38.2	28.93	17.36	22.12	13.27
UT1-8	0.0978	72.9	4.4	58.2	23.67	14.2	18.73	11.24
UT1-9	0.1762	84	2.8	71.1	48.83	29.3	41.22	24.73
UT1-10	0.3854	76.8	20.8	50.4	42.33	25.4	35.68	21.41

1.0 HYDROLOGY

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



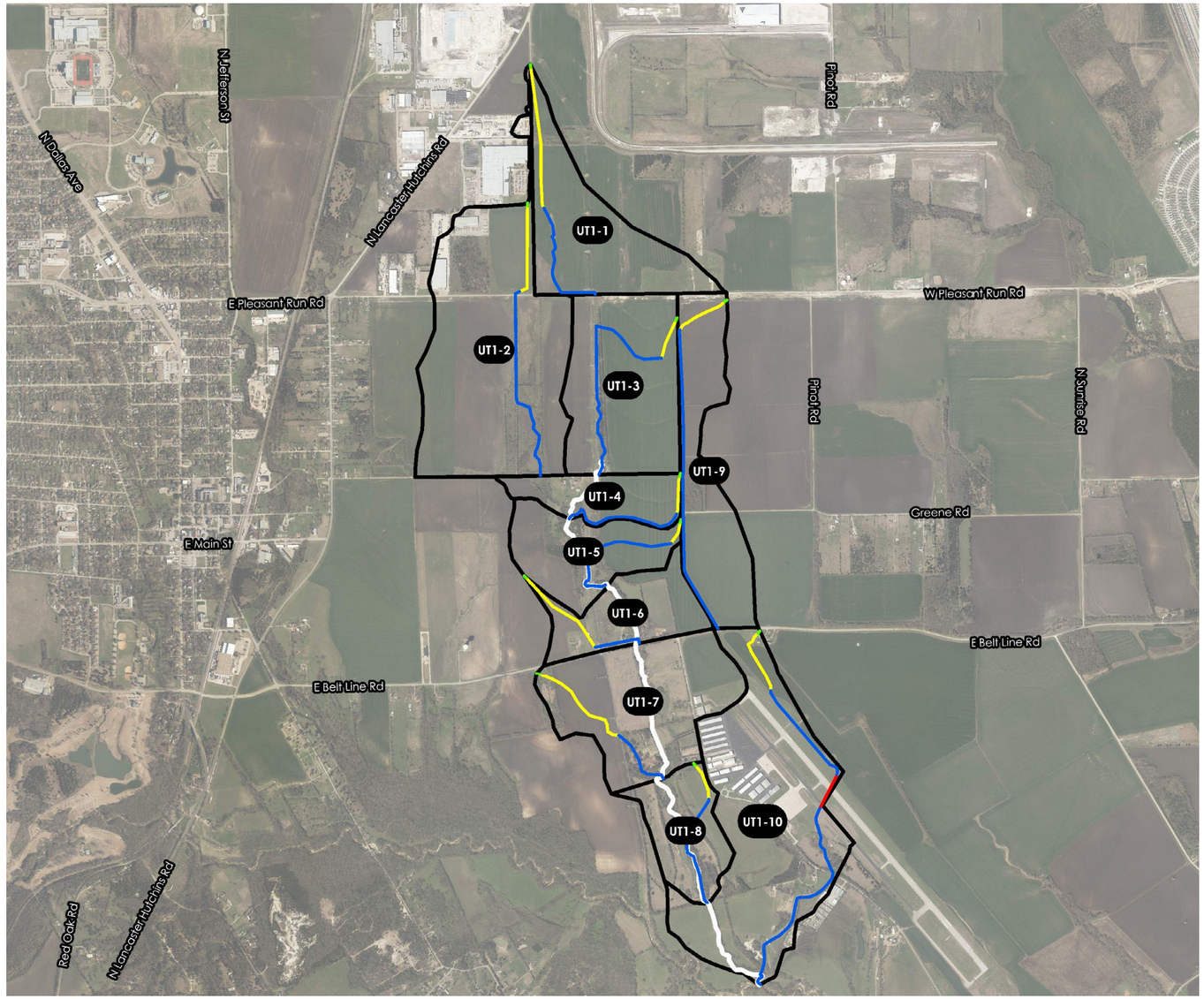
1.2 TIME OF CONCENTRATION

The Times of Concentration for Unnamed Tributary 1 were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Runyon Springs Branch runs through largely undeveloped land. Due to the minimal development, Time of Concentration tend to be larger. Sub-basins UT1-4 and UT1-8 are particularly small, however, which results in relatively short times. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

N.T.S.



TIME OF CONCENTRATION REPORT

UT1-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.73	0.240	0.00	0.1	20.15
SHALLOW	UNPAVED	2,457	1.45	0.000	16.10	1.9	21.16
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,612	1.45	0.050	28.69	3.5	7.78
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	630	1.92	0.050	42.29	5.9	1.79
		4,799					**50.88**
							40.55

UT1-2

OVERLAND	GRS-DENSE	100	1.12	0.240	0.00	0.1	16.96
SHALLOW	UNPAVED	1,554	1.19	0.000	16.10	1.8	14.74
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,543	3.47	0.050	42.29	7.9	7.49
		5,197					**39.19**
							31.27

UT1-3

OVERLAND	GRS-DENSE	100	1.48	0.240	0.00	0.1	15.17
SHALLOW	UNPAVED	667	0.98	0.000	16.10	1.6	6.96
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,407	1.28	0.050	28.69	3.2	7.23
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,712	8.33	0.050	42.29	12.2	3.70
		4,886					**33.06**
							27.53

UT1-4

OVERLAND	GRS-DENSE	100	2.64	0.240	0.00	0.1	12.03
SHALLOW	UNPAVED	620	1.01	0.000	16.10	1.6	6.40
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,908	0.5	0.050	28.69	2.0	15.68
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	355	4.83	0.050	42.29	9.3	0.64
		2,984					**34.74**
							30.13

UT1-5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.64	0.240	0.00	0.1	14.56
SHALLOW	UNPAVED	360	0.95	0.000	16.10	1.6	3.83
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,549	1.46	0.050	28.69	3.5	7.43
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	958	7.71	0.050	42.29	11.7	1.36
		2,967					**27.18**
							22.58

UT1-6

OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	23.43
SHALLOW	UNPAVED	1,709	1.26	0.000	16.10	1.8	15.79
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	855	5.67	0.050	28.69	6.8	2.09
		2,664					**41.30**
							31.50

UT1-7

OVERLAND	GRS-DENSE	100	1.66	0.240	0.00	0.1	14.50
SHALLOW	UNPAVED	1,850	2.27	0.000	16.10	2.4	12.73
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,210	7.85	0.050	42.29	11.9	1.70
		3,160					**28.93**
							22.12

UT1-8

OVERLAND	GRS-DENSE	100	3.41	0.240	0.00	0.2	10.87
SHALLOW	UNPAVED	606	0.5	0.000	16.10	1.1	8.88
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	727	7.07	0.050	28.69	7.6	1.59
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,690	8.12	0.050	42.29	12.1	2.34
		3,123					**23.67**
							18.73

TIME OF CONCENTRATION REPORT

UT1-9

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	23.42
SHALLOW	UNPAVED	900	1.74	0.000	16.10	2.1	7.05
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	3,301	1.81	0.050	28.69	3.9	14.26
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,134	4.24	0.050	42.29	8.7	4.09
		6,434					**48.83**
							41.21

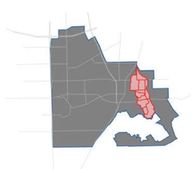
UT1-10

OVERLAND	GRS-DENSE	100	1.5	0.240	0.00	0.1	15.10
SHALLOW	UNPAVED	1,158	1.08	0.000	16.10	1.7	11.52
PIPE	36" RCP	674	2.42	0.014	87.62	13.6	0.82
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,933	1.33	0.050	28.69	3.3	9.72
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,941	9.05	0.050	42.29	12.7	5.16
		7,805					**42.33**
							35.68

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



1.0 HYDROLOGY

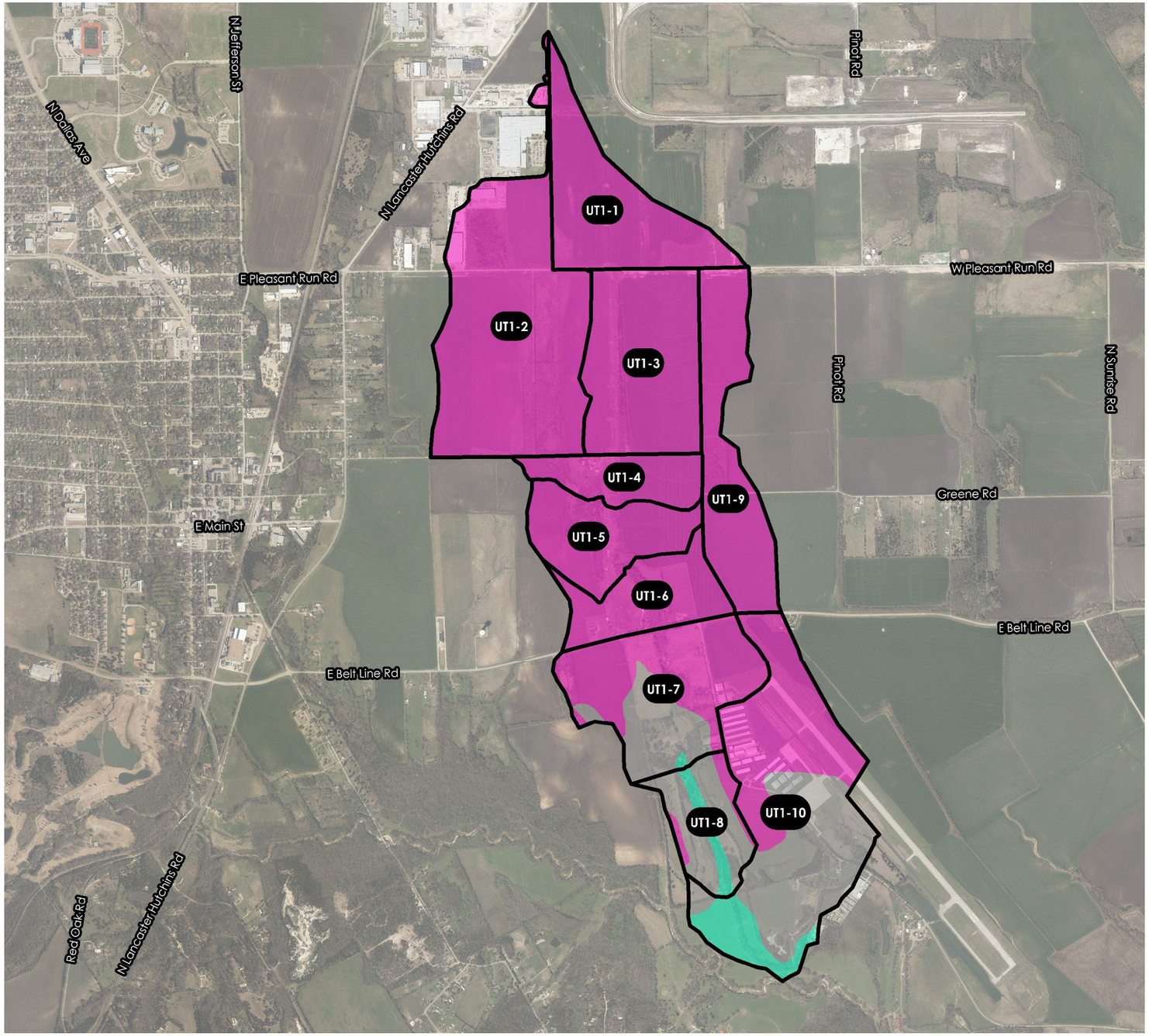
1.3 SOILS MAP

Unnamed Tributary 1 watershed has three different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil types B and C, which are more permeable than soil type D are found within sub-basins UT1-7, UT1-8 and UT1-10. Hydrologic soil groups A is not present in the Unnamed Tributary 1 watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

N.T.S.



PERVIOUS CURVE NUMBER REPORT

UT1-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	118.6	84.0
		118.6	**84.0**

UT1-2

D	84	251.4	84.0
		251.4	**84.0**

UT1-3

D	84	142.8	84.0
		142.8	**84.0**

UT1-4

D	84	51.9	84.0
		51.9	**84.0**

UT1-5

D	84	80.7	84.0
		80.7	**84.0**

UT1-6

D	84	70.4	84.0
		70.4	**84.0**

UT1-7

B	69	47.2	21.7
C	79	1.0	0.5
D	84	101.9	57.0
		150.0	**79.3**

UT1-8

B	69	42.3	46.7
C	79	11.5	14.6
D	84	8.7	11.7
		62.6	**72.9**

UT1-9

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	112.8	84.0
		112.8	**84.0**

UT1-10

B	69	109.1	30.5
C	79	29.4	9.4
D	84	108.2	36.8
		246.7	**76.8**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

13

COUNCIL DISTRICT

1

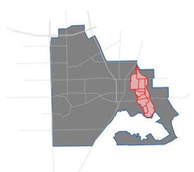
TOTAL DRAINAGE AREA

2.01 SM

*

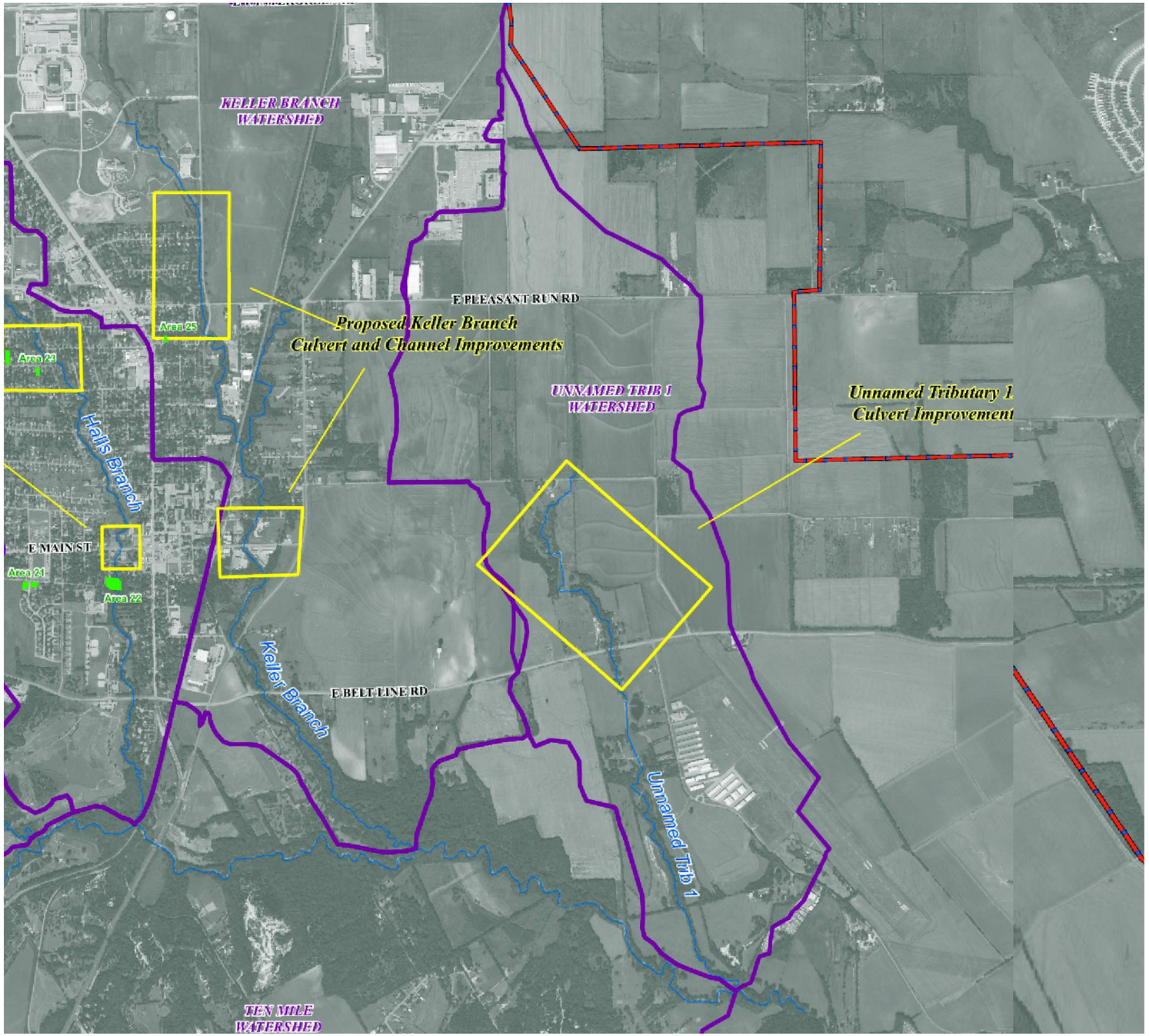
STREAM LENGTH

2.20 MI



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows one significant development since 2007 within the Unnamed Tributary 1 watershed. The new development consists aviation runways. Specifically, this new development is located in sub-basin UT1-10. The locations of new development are highlighted in red.

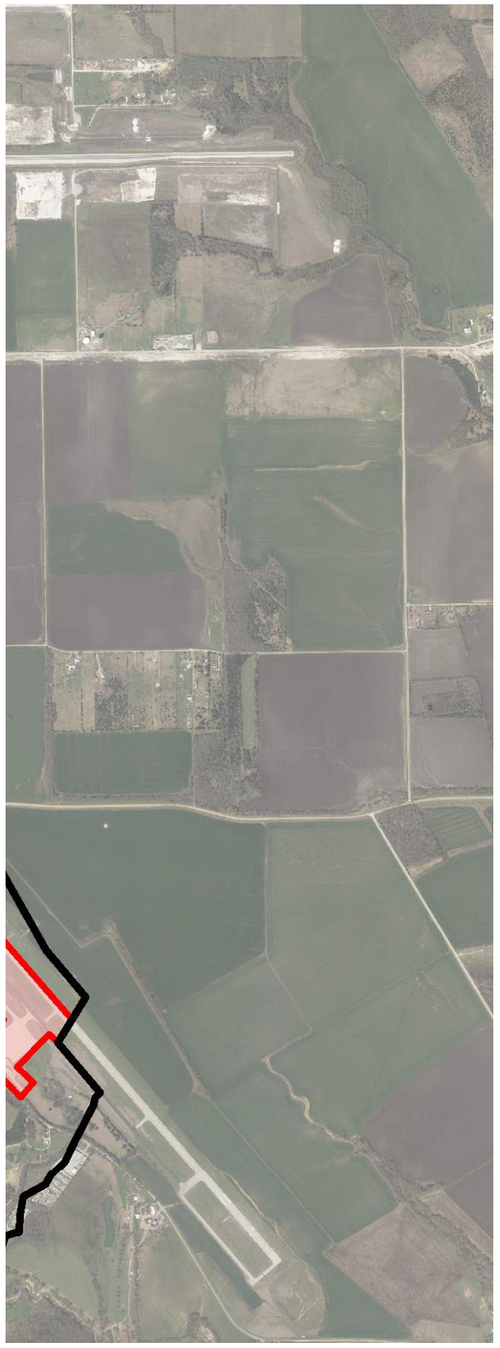


N

N.T.S.

2007





N

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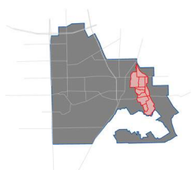
2019

UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



1.5 IMPERVIOUS AREA

Impervious areas for the Unnamed Tributary 1 watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed is located in sub-basins UT1-7 and UT1-10 where aviaitoon development is located.

IMPERVIOUS
OPEN SPACE (FAIR CONDITIONS)

N

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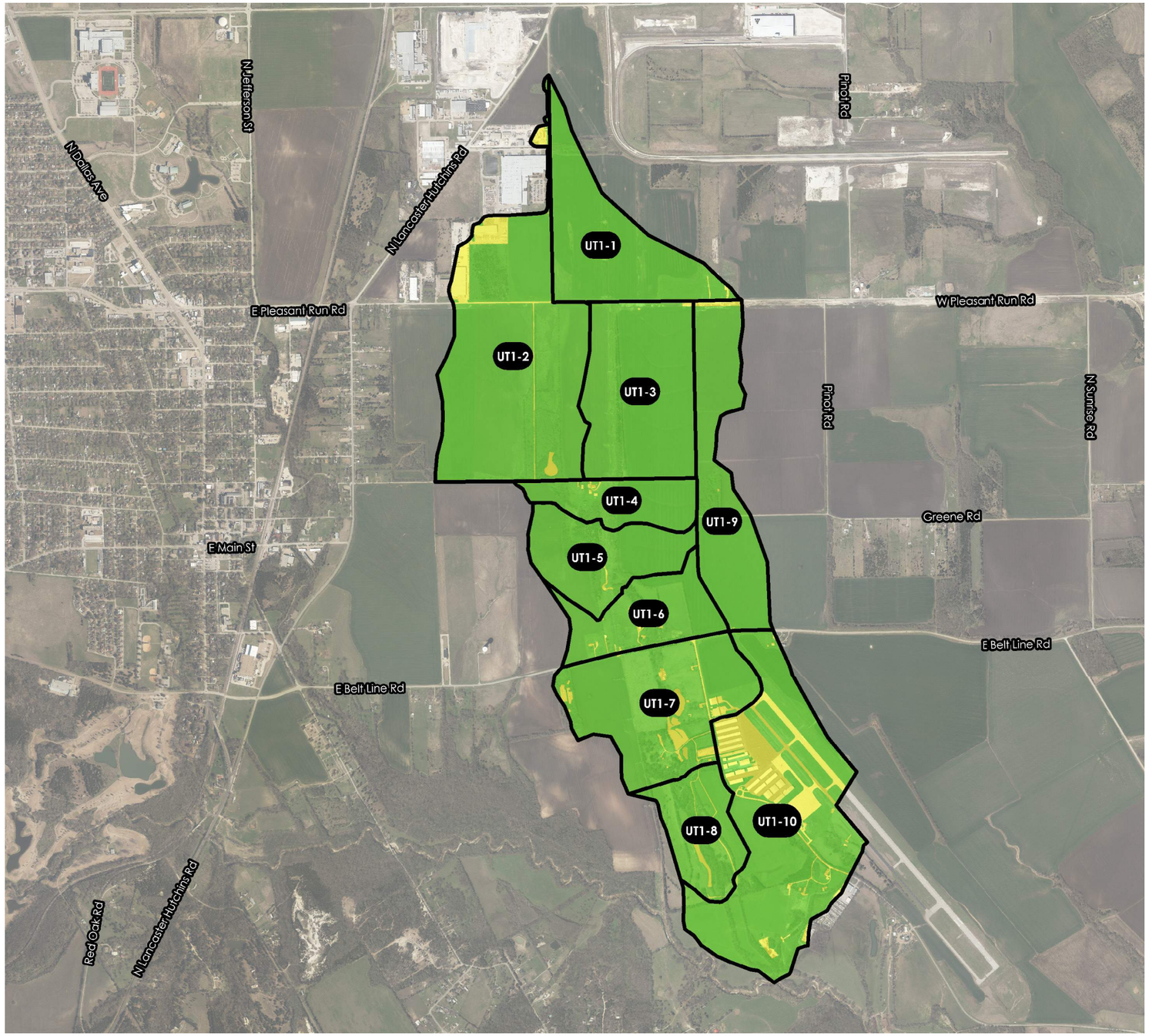


EXISTING PERCENT IMPERVIOUS REPORT

UT1-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	3.0	2.5
OPEN SPACE (FAIR CONDITION)	0	115.6	0.0
		118.6	**2.5**

UT1-2

IMPERVIOUS	100	20.3	8.1
OPEN SPACE (FAIR CONDITION)	0	231.1	0.0
		251.4	**8.1**

UT1-3

IMPERVIOUS	100	1.4	1.0
OPEN SPACE (FAIR CONDITION)	0	141.3	0.0
		142.8	**1.0**

UT1-4

IMPERVIOUS	100	1.9	3.7
OPEN SPACE (FAIR CONDITION)	0	50.0	0.0
		51.9	**3.7**

UT1-5

IMPERVIOUS	100	0.8	1.0
OPEN SPACE (FAIR CONDITION)	0	80.0	0.0
		80.7	**1.0**

UT1-6

IMPERVIOUS	100	3.3	4.7
OPEN SPACE (FAIR CONDITION)	0	67.1	0.0
		70.4	**4.7**

UT1-7

IMPERVIOUS	100	14.6	9.7
OPEN SPACE (FAIR CONDITION)	0	135.4	0.0
		150.0	**9.7**

UT1-8

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	2.8	4.4
OPEN SPACE (FAIR CONDITION)	0	59.8	0.0
		62.6	**4.4**

UT1-9

IMPERVIOUS	100	3.2	2.8
OPEN SPACE (FAIR CONDITION)	0	109.6	0.0
		112.8	**2.8**

UT1-10

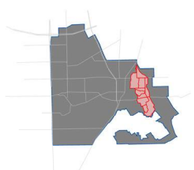
IMPERVIOUS	100	3.0	2.5
OPEN SPACE (FAIR CONDITION)	0	115.6	0.0
		118.6	**2.5**

UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The existing land use within the watershed consist of mostly Industrial and Aviation zoning based on the provided City zoning data. Almost the whole watershed is zoned for Avaiation. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- AVIATION
- COMMERCIAL CORRIDOR
- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- OPEN SPACE (FAIR CONDITION)
- PRIVATE OPEN SPACES
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD

N

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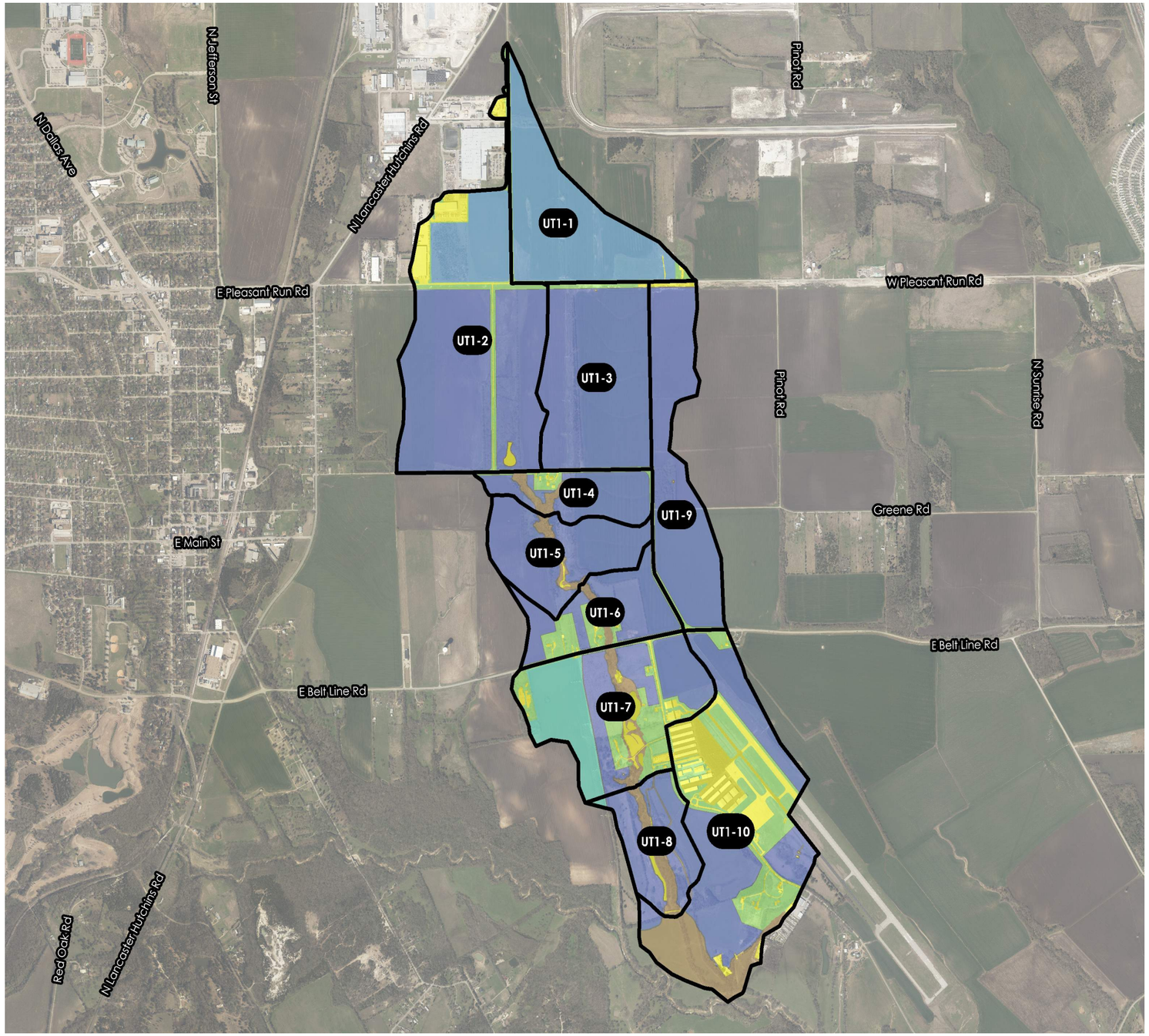


ULTIMATE PERCENT IMPERVIOUS REPORT

UT1-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS AREAS	100	3.0	2.5
LOGISTICS & DISTRIBUTION	72	110.0	66.8
OPEN SPACE (FAIR CONDITION)	0	5.6	0.0
		118.6	**69.3**

UT1-2

IMPERVIOUS AREAS	100	20.3	8.1
AVIATION	72	171.7	49.2
LOGISTICS & DISTRIBUTION	72	42.3	12.1
OPEN SPACE (FAIR CONDITION)	0	17.1	0.0
		251.4	**69.4**

UT1-3

IMPERVIOUS AREAS	100	1.4	1.0
AVIATION	72	136.9	69.0
OPEN SPACE (FAIR CONDITION)	0	4.5	0.0
		142.8	**70.0**

UT1-4

IMPERVIOUS AREAS	100	1.9	3.7
FLOODPLAIN	0	5.5	0.0
AVIATION	72	39.3	54.5
OPEN SPACE (FAIR CONDITION)	0	5.2	0.0
		51.9	**58.3**

UT1-5

IMPERVIOUS AREAS	100	0.8	1.0
FLOODPLAIN	0	6.1	0.0
AVIATION	72	73.5	65.5
OPEN SPACE (FAIR CONDITION)	0	0.3	0.0
		80.7	**66.5**

UT1-6

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS AREAS	100	3.3	4.7
FLOODPLAIN	0	3.8	0.0
AVIATION	72	47.3	48.4
OPEN SPACE (FAIR CONDITION)	0	16.0	0.0
		70.4	**53.1**

UT1-7

IMPERVIOUS AREAS	100	14.6	9.7
FLOODPLAIN	0	10.2	0.0
R - RURAL LIVING	12	42.2	3.4
AVIATION	72	52.2	25.1
OPEN SPACE (FAIR CONDITION)	0	30.8	0.0
		150.0	**38.2**

UT1-8

IMPERVIOUS AREAS	100	2.8	4.4
FLOODPLAIN	0	11.0	0.0
R - RURAL LIVING	12	0.9	0.2
AVIATION	72	46.5	53.6
OPEN SPACE (FAIR CONDITION)	0	1.3	0.0
		62.6	**58.2**

UT1-9

IMPERVIOUS AREAS	100	3.2	2.8
AVIATION	72	106.9	68.2
OPEN SPACE (FAIR CONDITION)	0	2.7	0.0
		112.8	**71.1**

UT1-10

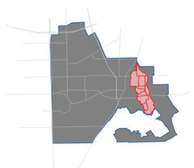
IMPERVIOUS AREAS	100	51.2	20.8
FLOODPLAIN	0	35.9	0.0
AVIATION	72	101.6	29.7
OPEN SPACE (FAIR CONDITION)	0	57.9	0.0
		246.7	**50.4**

UNNAMED TRIBUTARY 1

WATERSHED NO.
13

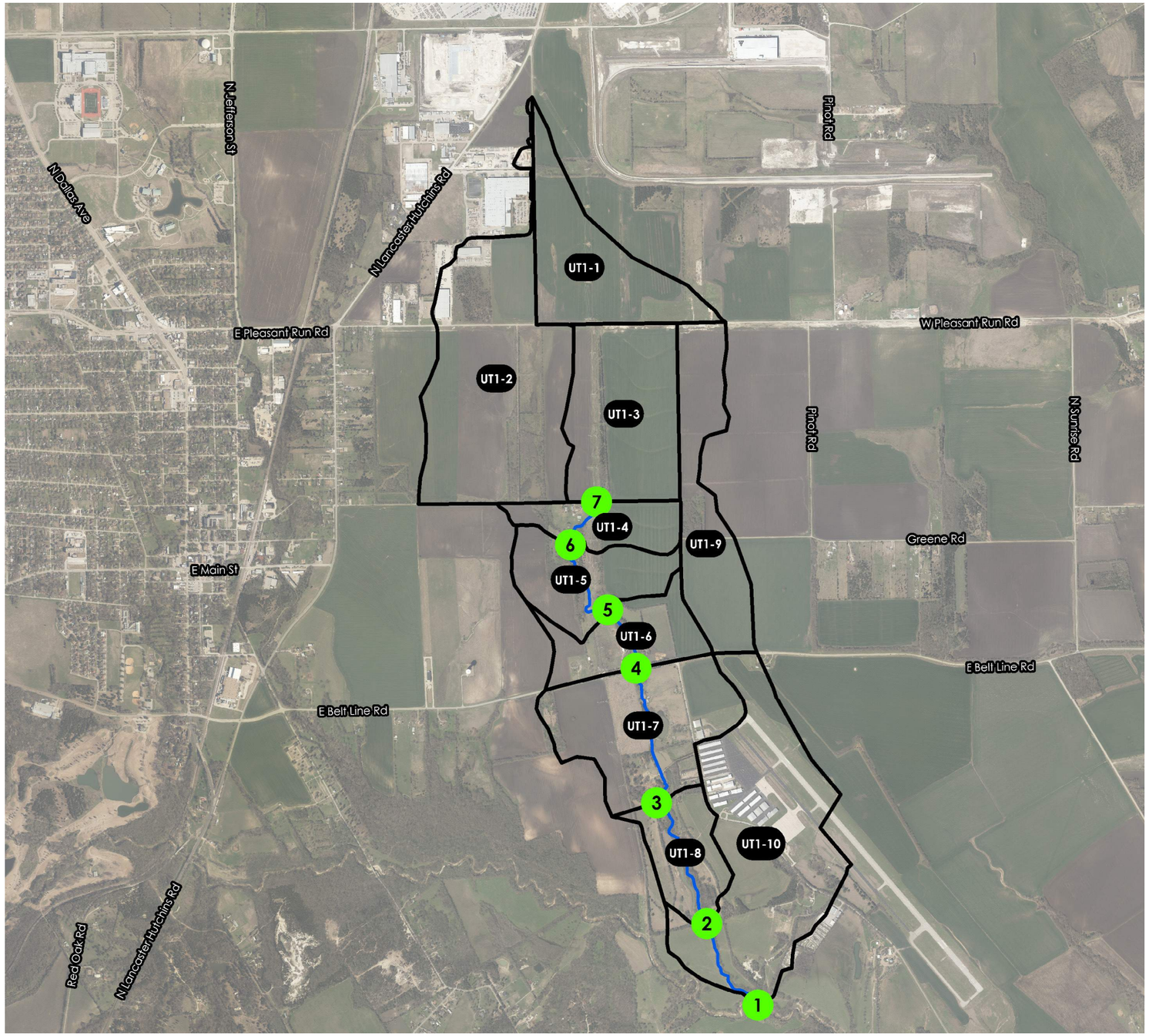
COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



1.7 RESULTS

The flow was analyzed at seven locations for Unnamed Tributary 1. Flow locations 7 established a flow at the upstream end of the reach and also serves to detemine flows for culverts at Greene Road. Location 4 determines peak discharges at Belt Line Road. The Remaining locations are based on natural sub-basin outlet locations.



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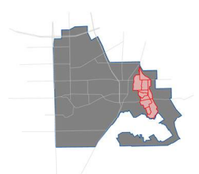
FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Peak Flow (cfs)
1	UT1-1 - UT1-10	Main	210.128	2.01	4800
2	UT1-1 - UT1-8	Main	2018.327	1.45	3700
3	UT1-1 - UT1-7	Main	5909.452	1.35	3600
4	UT1-1 - UT1-6	Main	7398.043	1.12	3300
5	UT1-1 - UT1-5	Main	8447.014	1.01	3000
6	UT1-1 - UT1-4	Main	11184.99	0.88	2800
7	UT1-1, UT1-3	Main	11849.42	0.41	1200

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



2.0 HYDRAULICS

2.1 SITE ASSESSMENT

Unnamed Tributary 1 is located in the East part of the City of Lancaster. It flows from North to South for approximately 2.20 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Unnamed Tributary 1 within the limits of the City of Lancaster, roughly bound by Greene Road (upstream end) and the confluence with Ten Mile Creek (downstream end). The channel slope averages around 0.6-0.8%, and for the purposes of this study was kept as a single reach. Unnamed Tributary 1 has relatively little in the way of urbanization. The only urbanization being the road crossings throughout the watershed. Except at these road crossings, heavy vegetation is observed. There are a total of two (2) crossings throughout the watershed.



Looking downstream of Greene Road. The stream is full of shrub growth and has many trees on the overbanks. This level of vegetation is fairly consistent throughout the Unnamed Tributary 1 reach.



Looking at the downstream face of the Belt Line Road Bridge. The bridge appears to be in adequate condition and modeling shows this bridge to be safe from overtopping in the analyzed storm events.



Looking downstream of the Belt Line Road bridge. The channel appears to be relatively clear with a few shrubs. Trees and other shrubs are much more prevalent on the overbanks.



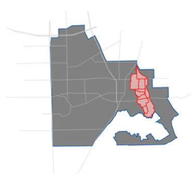
Looking upstream of Belt Line Road culvert. There is a small hydraulic structure futher upstream. The upstream side of the channel is rockier than the downstream, but level of vegetation appears the same.

UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

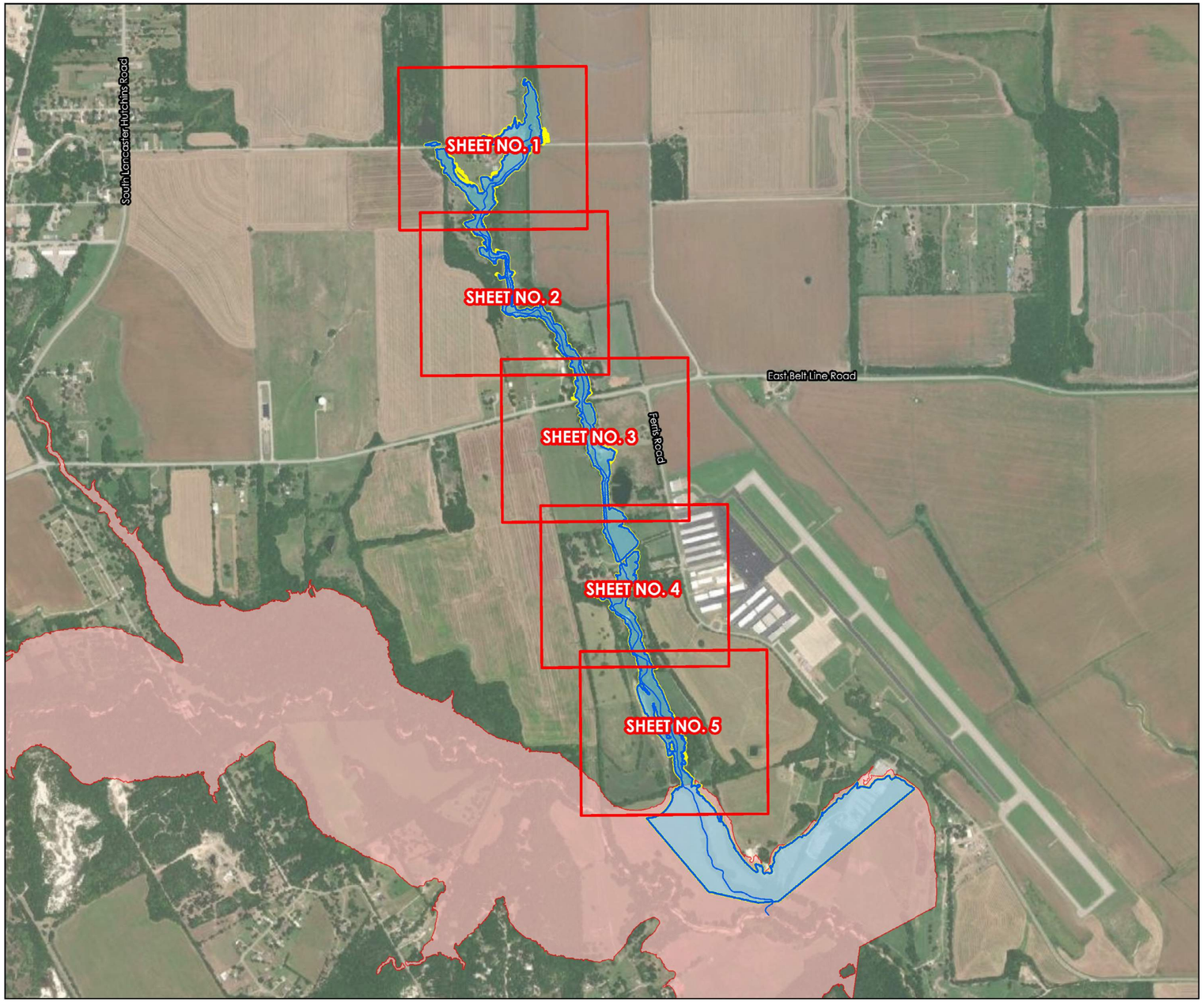
TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



2.2 FLOODPLAIN MAPPING

The Unnamed Tributary 1 stream hydraulics were analyzed with HEC-RAS 5.0.7. The model is comprised of one stream, one reach, eighteen (18) cross sections, and two (2) hydraulic structures. The studied stream is 11,640 feet (2.20 miles) long. Near the confluence of the stream with Ten Mile Creek, the Halls Branch floodplain expands dramatically and inundates a large low-lying area.

The floodplain sheets for Unnamed Tributary 1 display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.



STREAM CENTERLINE
UNNAMED TRIB 1 VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

N

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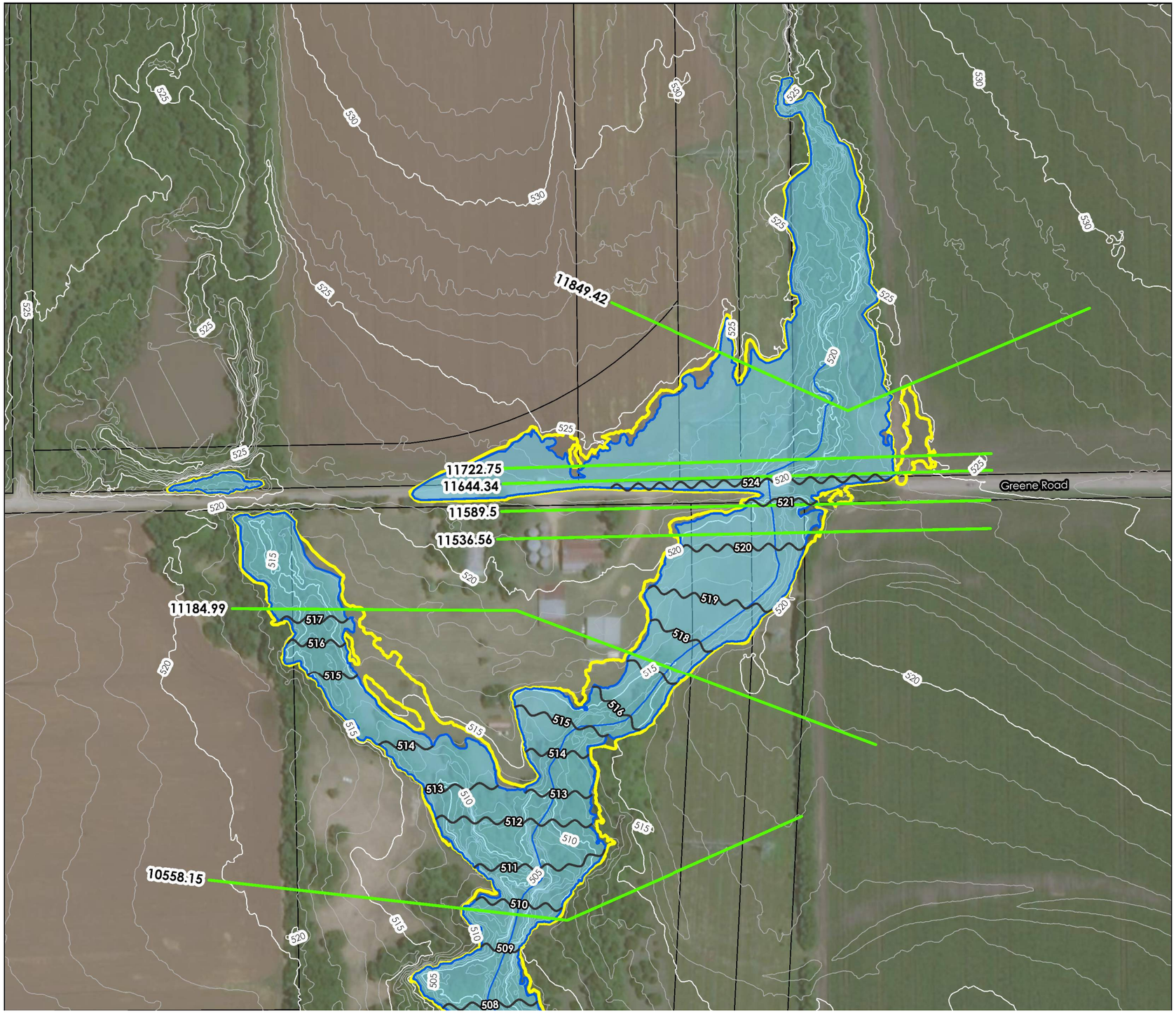
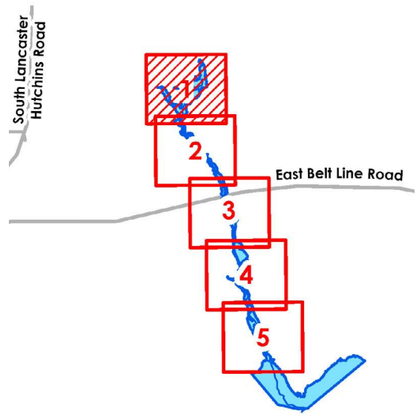
FLOODPLAIN: SHEET 1





N

0 100 200
Feet

UNNAMED TRIB 1 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
UNNAMED TRIB 1 BASE FLOW ELEVATIONS
PARCEL

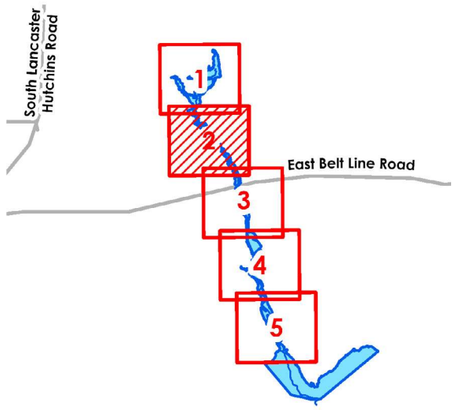
UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI

FLOODPLAIN: SHEET 2



N

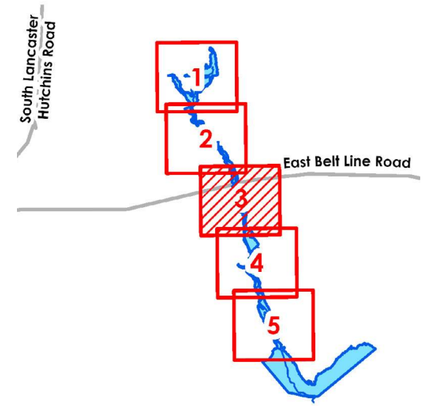
0 100 200
Feet

UNNAMED TRIB 1 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
UNNAMED TRIB 1 BASE FLOW ELEVATIONS
PARCEL



FLOODPLAIN: SHEET 3





N

0 100 200
Feet

- UNNAMED TRIB 1 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- 500 UNNAMED TRIB 1 BASE FLOW ELEVATIONS
- PARCEL

UNNAMED TRIBUTARY 1

2.0 HYDRAULICS

WATERSHED NO.

13

FLOODPLAIN: SHEET 4

COUNCIL DISTRICT

1

TOTAL DRAINAGE AREA

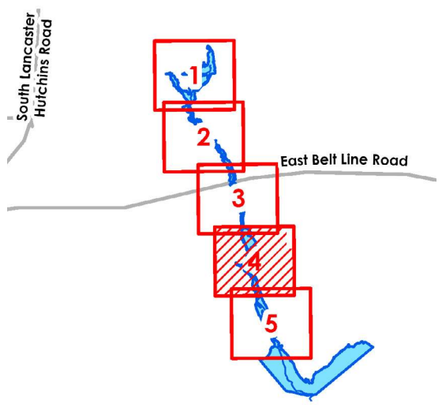
2.01 SM

*

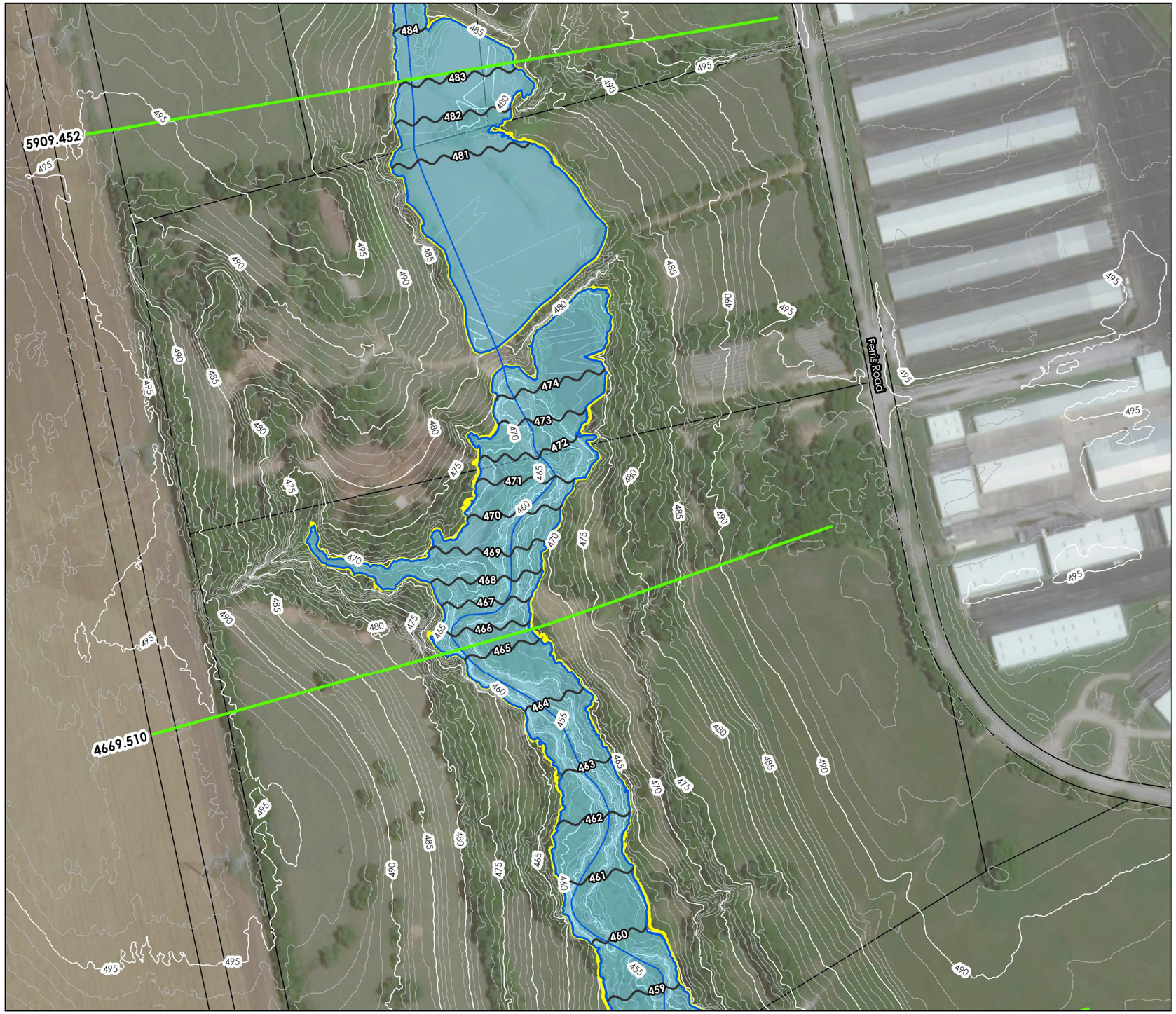
STREAM LENGTH

2.20 MI



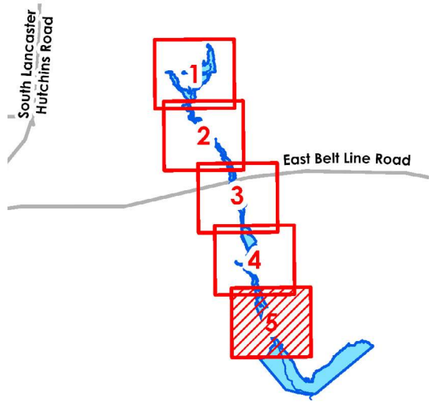


- UNNAMED TRIB 1 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- UNNAMED TRIB 1 BASE FLOW ELEVATIONS
- PARCEL



FLOODPLAIN: SHEET 5





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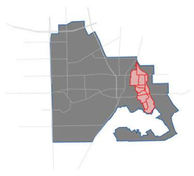
0 100 200
Feet

UNNAMED TRIB 1 CROSS SECTIONS
STREAM CENTERLINE
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
LIDAR MAJOR CONTOURS
LIDAR MINOR CONTOURS
UNNAMED TRIB 1 BASE FLOW ELEVATIONS
PARCEL

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	520.98	521.42	5.12	5.65
11722.75	519.72	521.43	1.21	1.08
11644.34	519.59	521.27	2.41	2.86
11618.05	GREENE ROAD			
11589.5	519.17	519.72	1.74	2.27
11536.56	518.96	519.45	2.88	3.63
11184.99	515.98	516.35	4.75	5.47
10558.15	506.71	507.89	5.12	5.98
9511.532	495.84	496.97	8.47	9.80
8447.014	491.18	492.50	3.42	4.24
7453.683	489.23	490.66	3.35	3.66
7398.043	489.11	490.45	3.39	4.27
7378.414	EAST BELT LINE ROAD			
7352.480	488.41	489.10	5.91	8.30
7293.613	488.37	489.29	2.89	3.33
6680.413	486.75	487.66	3.07	3.75
5909.452	482.18	482.49	4.58	5.53
4669.510	460.84	461.91	5.49	6.98
3449.065	452.40	455.11	6.04	3.99
2018.327	442.46	442.83	5.94	9.80
1445.931	442.77	442.87	0.70	1.23
210.1283	442.77	442.88	0.04	0.08

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	521.25	522.50	5.53	3.08
11722.75	520.74	522.56	1.15	0.95
11644.34	520.58	522.39	2.75	2.90
11618.05	GREENE ROAD			
11589.5	519.56	519.91	2.05	2.57
11536.56	519.29	519.63	3.41	3.86
11184.99	516.22	516.51	5.24	5.78
10558.15	507.51	508.38	5.68	6.37
9511.532	496.57	497.52	9.37	10.38
8447.014	492.12	493.29	3.99	4.62
7453.683	490.24	491.45	3.58	3.74
7398.043	490.05	491.21	4.06	4.56
7378.414	EAST BELT LINE ROAD			
7352.480	488.91	489.36	7.63	9.77
7293.613	489.02	489.71	3.22	3.63
6680.413	487.39	488.02	3.61	4.15
5909.452	482.40	482.64	5.25	6.04
4669.510	461.81	463.08	6.43	6.36
3449.065	454.87	455.22	4.00	5.01
2018.327	442.87	444.19	8.73	7.78
1445.931	443.63	443.76	0.75	1.00
210.1283	443.63	443.76	0.06	0.09

2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	522.38	524.25	3.26	1.93
11722.75	522.44	524.27	0.97	0.81
11644.34	522.27	524.14	2.90	2.66
11618.05	GREENE ROAD			
11589.5	519.89	520.19	2.54	3.13
11536.56	519.62	519.93	3.84	4.21
11184.99	516.50	516.80	5.76	6.25
10558.15	508.30	508.95	6.29	6.70
9511.532	497.41	498.20	10.31	11.06
8447.014	493.24	494.27	4.52	4.88
7453.683	491.43	492.51	3.74	3.82
7398.043	491.19	492.22	4.56	4.90
7378.414	EAST BELT LINE ROAD			
7352.480	489.35	489.95	9.72	10.91
7293.613	489.70	490.25	3.62	4.03
6680.413	488.01	488.45	4.14	4.65
5909.452	482.64	482.87	6.03	6.62
4669.510	463.99	464.27	4.54	5.12
3449.065	454.96	455.44	5.84	5.97
2018.327	444.67	444.88	6.49	7.37
1445.931	445.01	445.18	0.66	0.80
210.1283	445.01	445.18	0.07	0.10

2.3 HYDRAULIC RESULTS: 10-YEAR

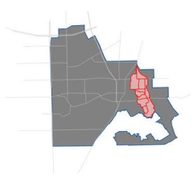
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	523.81	524.45	1.98	2.03
11722.75	523.83	524.47	0.79	0.87
11644.34	523.67	524.37	2.86	2.47
11618.05	GREENE ROAD			
11589.5	520.06	520.30	2.86	3.40
11536.56	519.79	520.05	4.06	4.33
11184.99	516.67	516.94	6.02	6.40
10558.15	508.74	509.30	6.58	6.91
9511.532	497.94	498.72	10.82	11.55
8447.014	493.92	494.85	4.76	4.97
7453.683	492.18	493.21	3.79	3.87
7398.043	491.91	492.88	4.79	5.15
7378.414	EAST BELT LINE ROAD			
7352.480	489.72	490.47	10.70	11.35
7293.613	490.08	490.61	3.90	4.31
6680.413	488.31	488.74	4.52	5.01
5909.452	482.81	483.04	6.36	6.92
4669.510	464.59	464.97	4.38	4.75
3449.065	454.82	455.13	7.79	8.30
2018.327	445.71	445.78	4.37	5.40
1445.931	445.81	445.94	0.64	0.80
210.1283	445.81	445.94	0.08	0.10

UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	524.37	524.65	1.96	2.24
11722.75	524.39	524.67	0.83	0.96
11644.34	524.28	524.60	2.53	2.36
11618.05	GREENE ROAD			
11589.5	520.25	520.43	3.26	3.78
11536.56	519.99	520.23	4.26	4.47
11184.99	516.87	517.13	6.36	6.56
10558.15	509.20	509.63	6.85	7.20
9511.532	498.58	499.49	11.40	11.46
8447.014	494.75	495.56	5.01	5.33
7453.683	493.08	493.94	3.86	3.92
7398.043	492.76	493.57	5.10	5.39
7378.414	EAST BELT LINE ROAD			
7352.480	490.37	491.02	11.26	11.74
7293.613	490.54	490.94	4.25	4.65
6680.413	488.69	489.01	4.94	5.30
5909.452	483.01	483.22	6.88	7.30
4669.510	464.99	465.37	4.77	5.08
3449.065	455.15	455.45	8.29	8.76
2018.327	447.60	447.74	2.56	2.95
1445.931	447.62	447.77	0.54	0.63
210.1283	447.62	447.77	0.09	0.11

2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	524.53	524.67	2.13	2.45
11722.75	524.55	524.69	0.92	1.05
11644.34	524.46	524.61	2.47	2.60
11618.05	GREENE ROAD			
11589.5	520.36	520.53	3.58	4.01
11536.56	520.14	520.33	4.39	4.57
11184.99	517.02	517.26	6.53	6.62
10558.15	509.49	509.93	7.04	7.28
9511.532	499.07	499.92	11.72	11.74
8447.014	495.32	496.08	5.21	5.43
7453.683	493.73	494.60	3.91	3.95
7398.043	493.37	494.19	5.33	5.62
7378.414	EAST BELT LINE ROAD			
7352.480	490.86	491.53	11.63	12.06
7293.613	490.85	491.24	4.55	4.97
6680.413	488.94	489.27	5.22	5.57
5909.452	483.17	483.39	7.19	7.65
4669.510	465.32	465.66	5.04	5.31
3449.065	455.40	455.69	8.70	9.09
2018.327	448.32	448.48	2.41	2.69
1445.931	448.34	448.50	0.56	0.63
210.1283	448.34	448.50	0.10	0.11

2.3 HYDRAULIC RESULTS:
100-YEAR

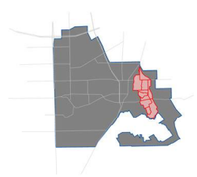
CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
11849.42	524.66	524.80	2.33	2.64
11722.75	524.68	524.83	0.99	1.14
11644.34	524.60	524.75	2.46	2.60
11618.05	GREENE ROAD			
11589.5	520.47	520.68	3.88	4.29
11536.56	520.27	520.48	4.52	4.74
11184.99	517.19	517.42	6.58	6.75
10558.15	509.76	510.19	7.25	7.42
9511.532	499.71	500.38	11.50	11.82
8447.014	495.87	496.44	5.35	5.66
7453.683	494.33	495.05	3.94	3.98
7398.043	493.93	494.61	5.52	5.79
7378.414	EAST BELT LINE ROAD			
7352.480	491.33	491.91	11.90	12.21
7293.613	491.12	491.45	4.84	5.20
6680.413	489.16	489.45	5.45	5.74
5909.452	483.32	483.50	7.50	7.95
4669.510	465.63	465.94	5.29	5.53
3449.065	455.66	455.92	9.03	9.38
2018.327	448.90	449.06	2.38	2.65
1445.931	448.92	449.08	0.58	0.66
210.1283	448.92	449.08	0.11	0.12

UNNAMED TRIBUTARY 1

WATERSHED NO.
13

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
2.01 SM
*
STREAM LENGTH
2.20 MI



3.1 RISK IDENTIFICATION

Four risk areas were identified in this study. The risks include one over-topping bridge, one flooded structures and two locations of erosive velocities. The flooded structure within the Unnamed Tributary 3 floodplain is an industrial building located near the confluence with Ten Mile Creek. Flooding of this structure is only anticipated in the 100-year storm event. The over-topping bridge is located at the Greene Road crossing at the upstream end of the creek. Modeling shows over-topping in the 5-year storm event. This road has very little traffic. The two areas where erosion is likely are located away from major development. The following map shows the shear stresses associated with the Unnamed Tributary 1 floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Greene Road	Over-topping Bridge	5-Year	Public	Low
2	River Station 9511	Potential Erosion Hot Spot	1-Year	Private	Very Low
3	River Station 3449	Potential Erosion Hot Spot	1-Year	Private	Very Low
4	Industrial Structure along Ferris Road	Flooded Structure	100-Year	Private	Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
1
2
3
4
East Belt Line Road
Ferris Road

UNNAMED TRIBUTARY 2

WATERSHED NO.

14

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

0.65 SM

*

STREAM LENGTH

1.5 MI



UNNAMED TRIB 2

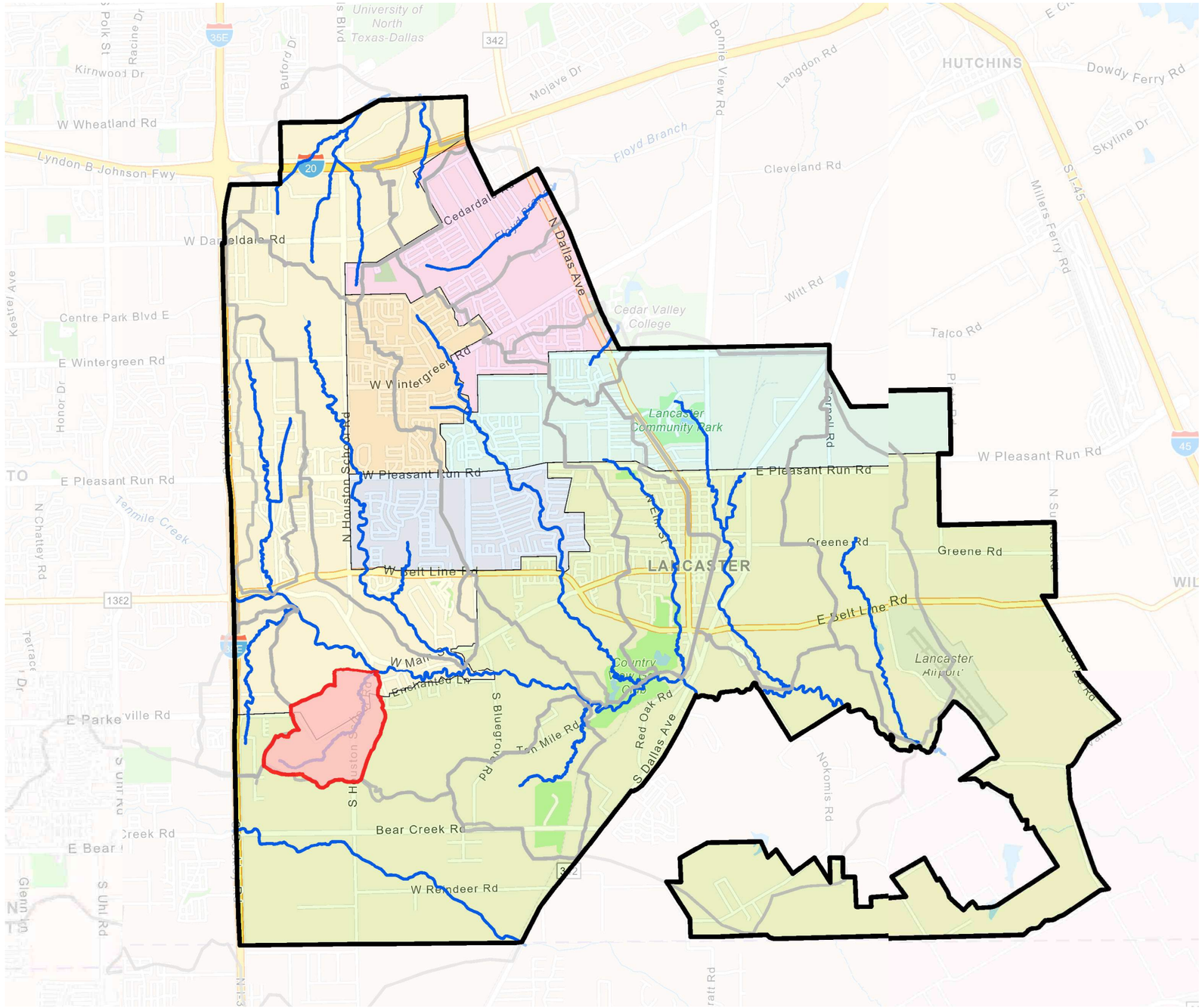
STREAM CENTERLINE

COUNCIL DISTRICT

- DISTRICT 1
- DISTRICT 2
- DISTRICT 3
- DISTRICT 4
- DISTRICT 5
- DISTRICT 6

UNNAMED TRIBUTARY 2 WATERSHED

Unnamed Tributary 2 is located in the southwestern portion of the City east of Interstate 35 and south of Ten Mile Creek with a watershed of approximately 0.65 square miles. The creek begins south of an existing wooded and open grassland area. It continues flowing in a northeasterly direction until its confluence with Ten Mile Creek approximately 1.5 miles downstream. The watershed is uniformly mixed with residential, wooded and open areas. The open areas are zoned as medium family residential.



WATERSHED NO. 14

UNNAMED TRIBUARY 2

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1.0 HYDROLOGY

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



1.1 DRAINAGE AREA MAP

The drainage area divides for the Unnamed Tributary 2 watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into eight (8) sub-basins. Sub-basins are designated UT2-1 through UT2-8. The total watershed drainage area is 416.9 acres (0.65 square-miles). The drainage area is located within the City of Lancaster itself.

N

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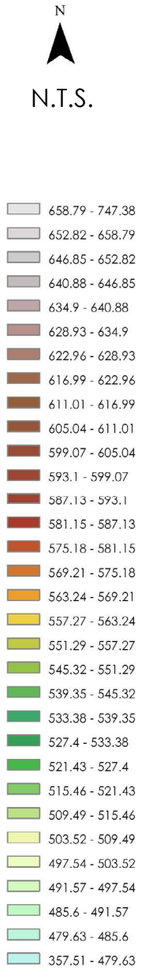

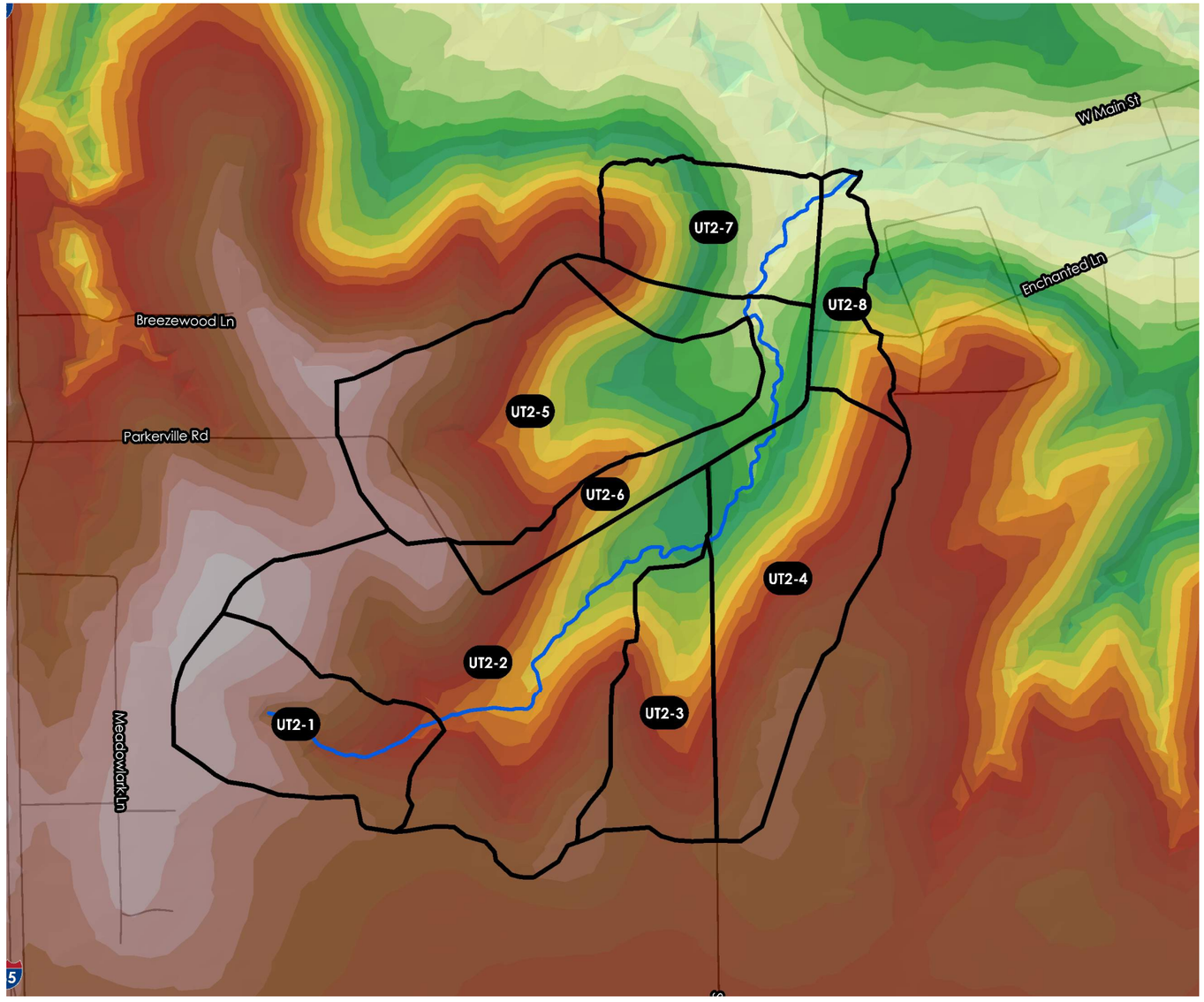

HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
UT2-1	0.065	88.2	0	5.3	22.82	13.69	17.77	10.66
UT2-2	0.168	84.5	1.3	15.7	61.33	36.8	28.03	16.82
UT2-3	0.0521	83.6	6.4	6.1	25.40	15.24	19.78	11.87
UT2-4	0.1026	80.2	9.3	9.9	30.10	18.06	22.10	13.26
UT2-5	0.1339	83	3.5	10.5	23.05	13.83	18.63	11.18
UT2-6	0.0517	82.1	8.8	4.9	17.22	10.33	13.25	7.95
UT2-7	0.0521	81.6	3.7	1.2	14.52	8.71	11.58	6.95
UT2-8	0.026	82.3	27.2	4.5	18.52	11.11	14.85	8.91

UNNAMED TRIBUTARY 2

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



1.2 TIME OF CONCENTRATION

The Times of Concentration for Unnamed Tributary 2 were traced using the 2009 LiDAR data. and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Unnamed Tributary 2 runs through lightly developed wooded areas, resulting in relatively high times of concentration for the given sub-basin areas. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

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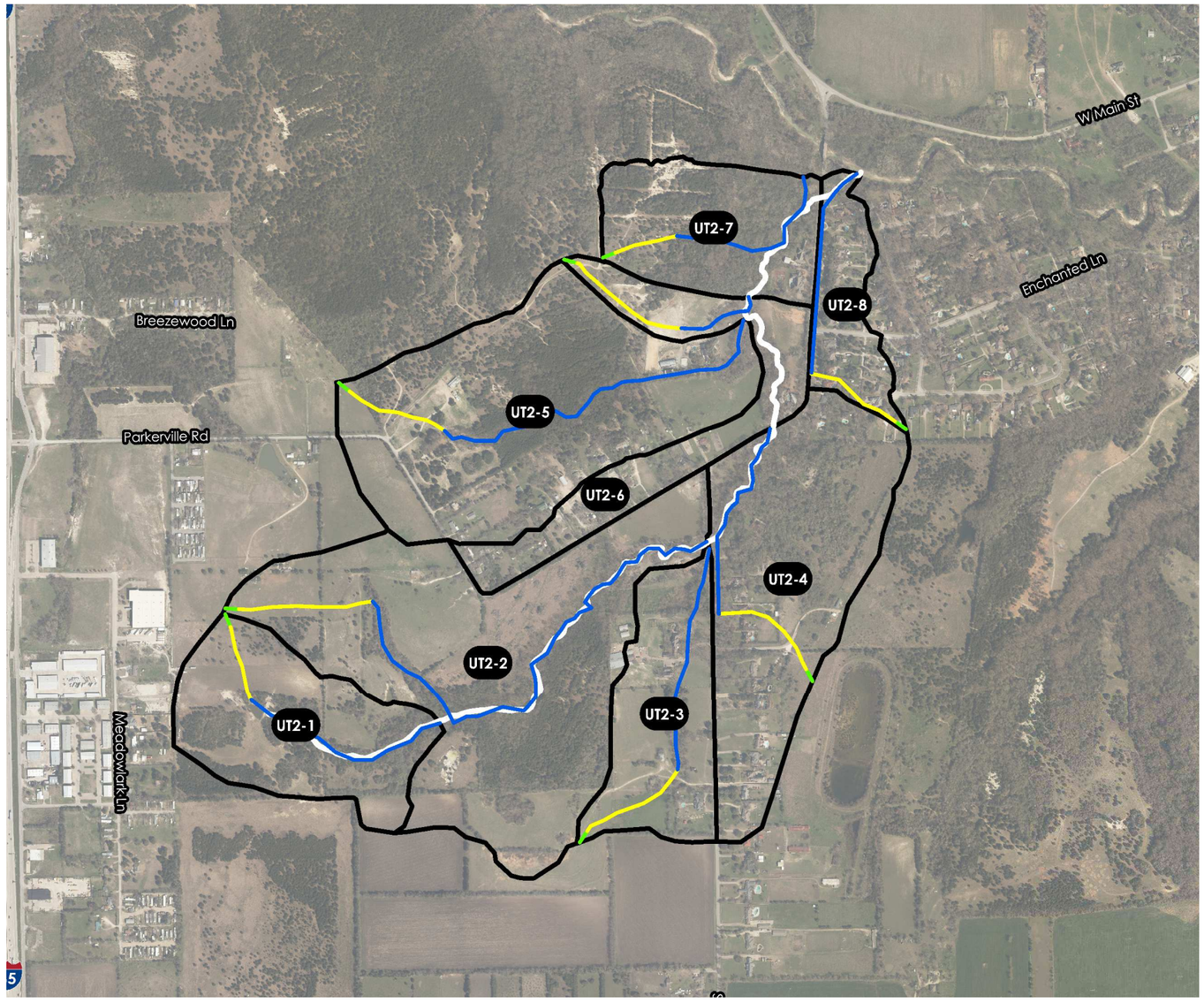

TIME OF CONCENTRATION REPORT

UT2-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.18	0.240	0.00	0.1	16.60
SHALLOW	UNPAVED	568	2.71	0.000	16.10	2.6	3.58
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,596	5.7	0.050	42.29	10.1	2.64
		2,264					**22.81**
							17.77

UT2-2

OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	22.06
SHALLOW	UNPAVED	991	3.75	0.000	16.10	3.1	5.30
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,145	5.96	0.050	28.69	7.0	2.72
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,754	5.1	0.050	42.29	9.6	4.80
		4,990					**34.88**
							19.78

UT2-3

OVERLAND	GRS-DENSE	100	0.91	0.240	0.00	0.1	18.45
SHALLOW	UNPAVED	828	4.54	0.000	16.10	3.4	4.02
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,680	5.11	0.050	42.29	9.6	2.93
		2,608					**25.40**
							19.78

UT2-4

OVERLAND	GRS-DENSE	100	0.5	0.240	0.00	0.1	22.06
SHALLOW	UNPAVED	847	7.15	0.000	16.10	4.3	3.28
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	576	5.25	0.050	28.69	6.6	1.46
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	957	5.33	0.050	42.29	9.8	1.63
		2,481					**28.43**
							22.09

UT2-5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	1.77	0.240	0.00	0.1	14.12
SHALLOW	UNPAVED	773	4.94	0.000	16.10	3.6	3.60
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,096	5.56	0.050	28.69	6.8	2.70
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,603	5.74	0.050	42.29	10.1	2.64
		3,572					**23.06**
							18.63

UT2-6

OVERLAND	GRS-DENSE	100	2.44	0.240	0.00	0.1	12.42
SHALLOW	UNPAVED	935	7.81	0.000	16.10	4.5	3.46
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	269	5.08	0.050	28.69	6.5	0.69
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	368	5.12	0.050	42.29	9.6	0.64
		1,672					**17.22**
							13.25

UT2-7

OVERLAND	GRS-DENSE	100	3.95	0.240	0.00	0.2	10.25
SHALLOW	UNPAVED	470	10.16	0.000	16.10	5.1	1.53
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	598	5.94	0.050	28.69	7.0	1.42
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	760	5.18	0.050	42.29	9.6	1.31
		1,927					**14.52**
							11.58

UT2-8

OVERLAND	GRS-DENSE	100	2.69	0.24	0	0.1	11.94
SHALLOW	UNPAVED	734	7.52	0	16.1	4.4	2.77
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1225	4.86	0.05	28.69	6.3	3.23
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	345	5.55	0.05	42.29	10.0	0.58
		2404					**18.52**
							14.84

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



1.3 SOILS MAP

Unnamed Tributary 2 watershed has three different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil types B and C, which are more permeable than soil type D are found within most sub-basins at the downstream (North) end of the watershed. Hydrologic soil groups A is not present in the Unnamed Tributary 2 watershed.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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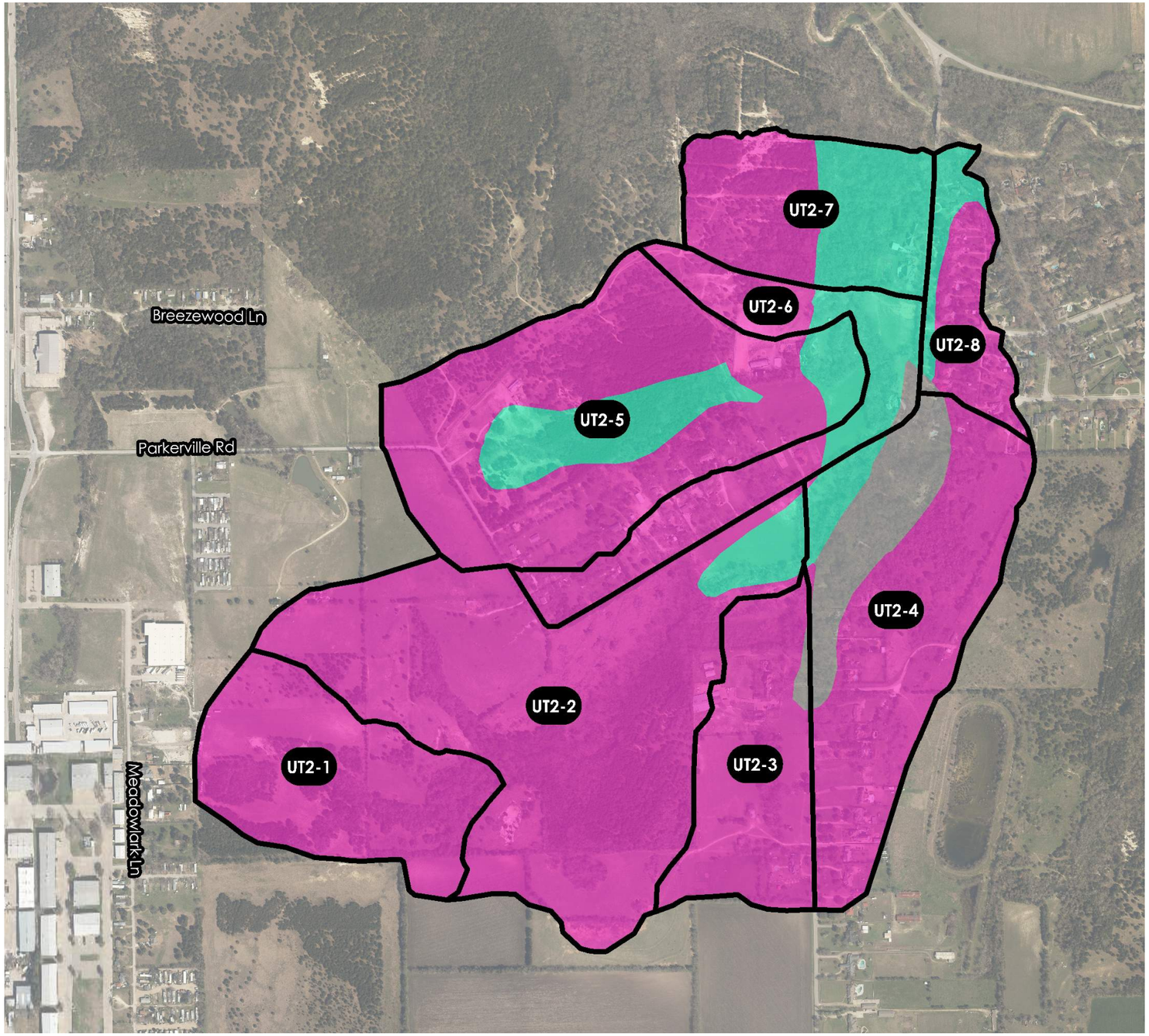


PERVIOUS CURVE NUMBER REPORT

UT2-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	41.6	88.2
		41.6	**88.2**

UT2-2

C	79	5.6	4.2
D	84	100.6	80.3
		106.2	**84.5**

UT2-3

B	69	0.9	1.8
C	79	0.0	0.0
D	84	32.4	81.8
		33.3	**83.6**

UT2-4

B	69	15.1	15.8
C	79	4.0	4.9
D	84	46.6	59.5
		65.7	**80.2**

UT2-5

C	79	19.7	18.2
D	84	66.0	64.8
		85.7	**83.0**

UT2-6

B	69	0.9	1.9
C	79	9.6	23.0
D	84	22.5	57.2
		33.1	**82.1**

UT2-7

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
C	79	15.9	37.7
D	84	17.4	43.9
		33.3	**81.6**

UT2-8

B	69	0.3	1.1
C	79	4.9	23.3
D	84	11.5	57.8
		16.6	**82.3**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.

14

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

0.65 SM

*

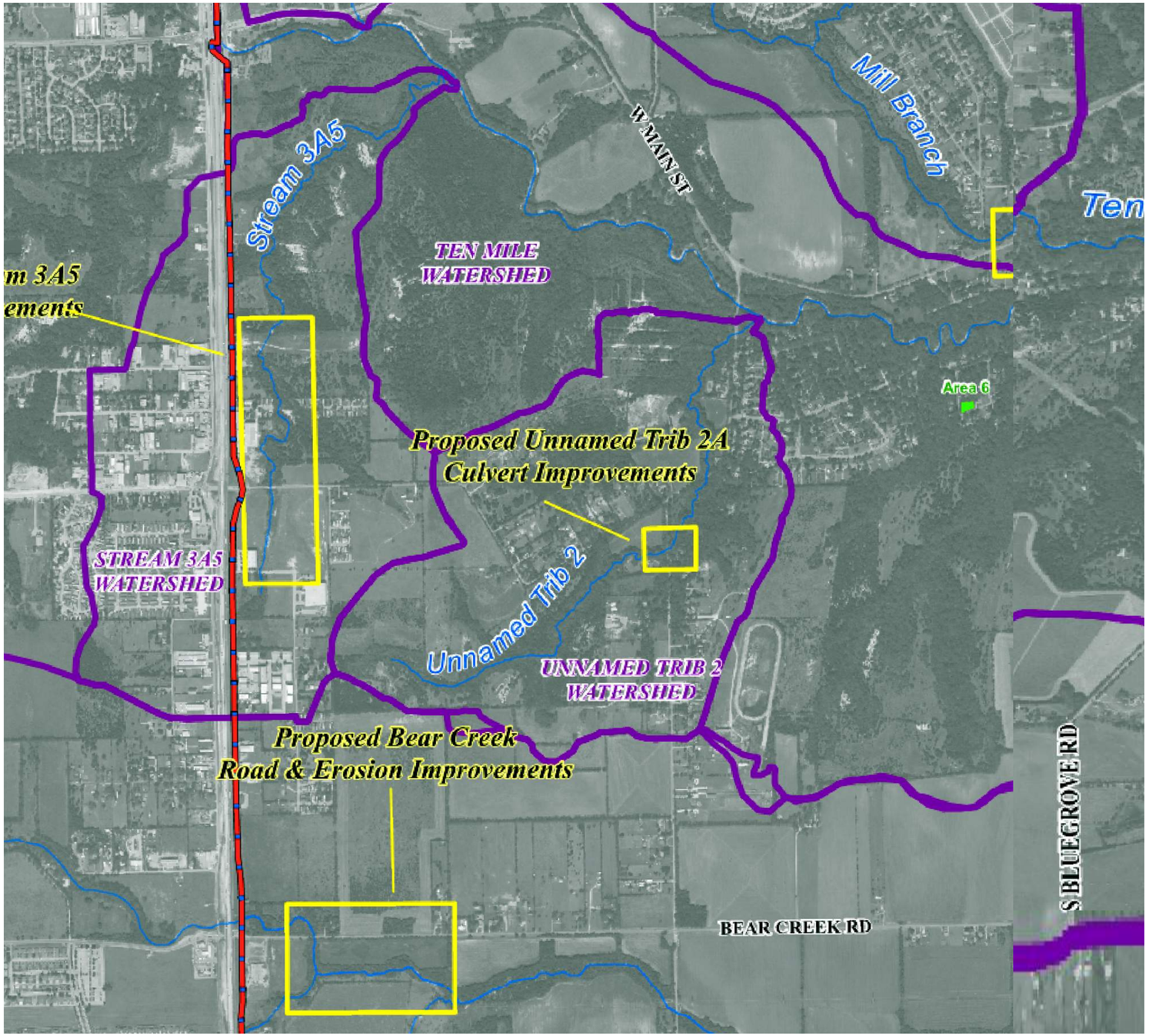
STREAM LENGTH

1.5 MI



1.4 AERIAL COMPARISON

Aerial photography from 2019 shows no new development since 2007 within the Unnamed Tributary 2 watershed.



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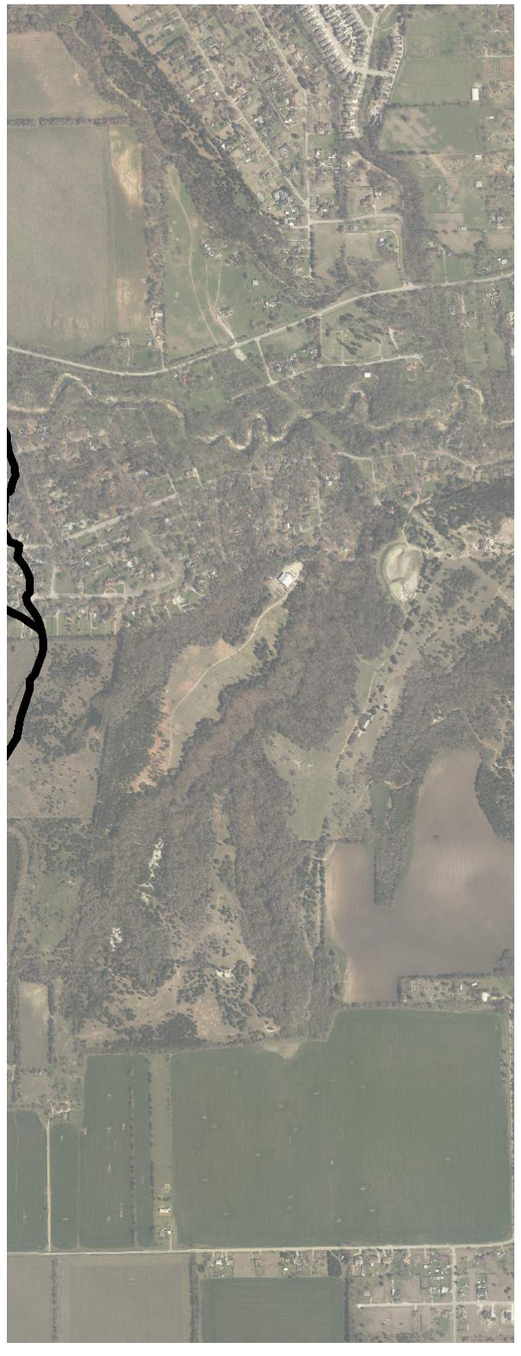
N.T.S.

2007





N

N.T.S.

2019

WATERSHED NO.

14

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

0.65 SM

*

STREAM LENGTH

1.5 MI



1.5 IMPERVIOUS AREA

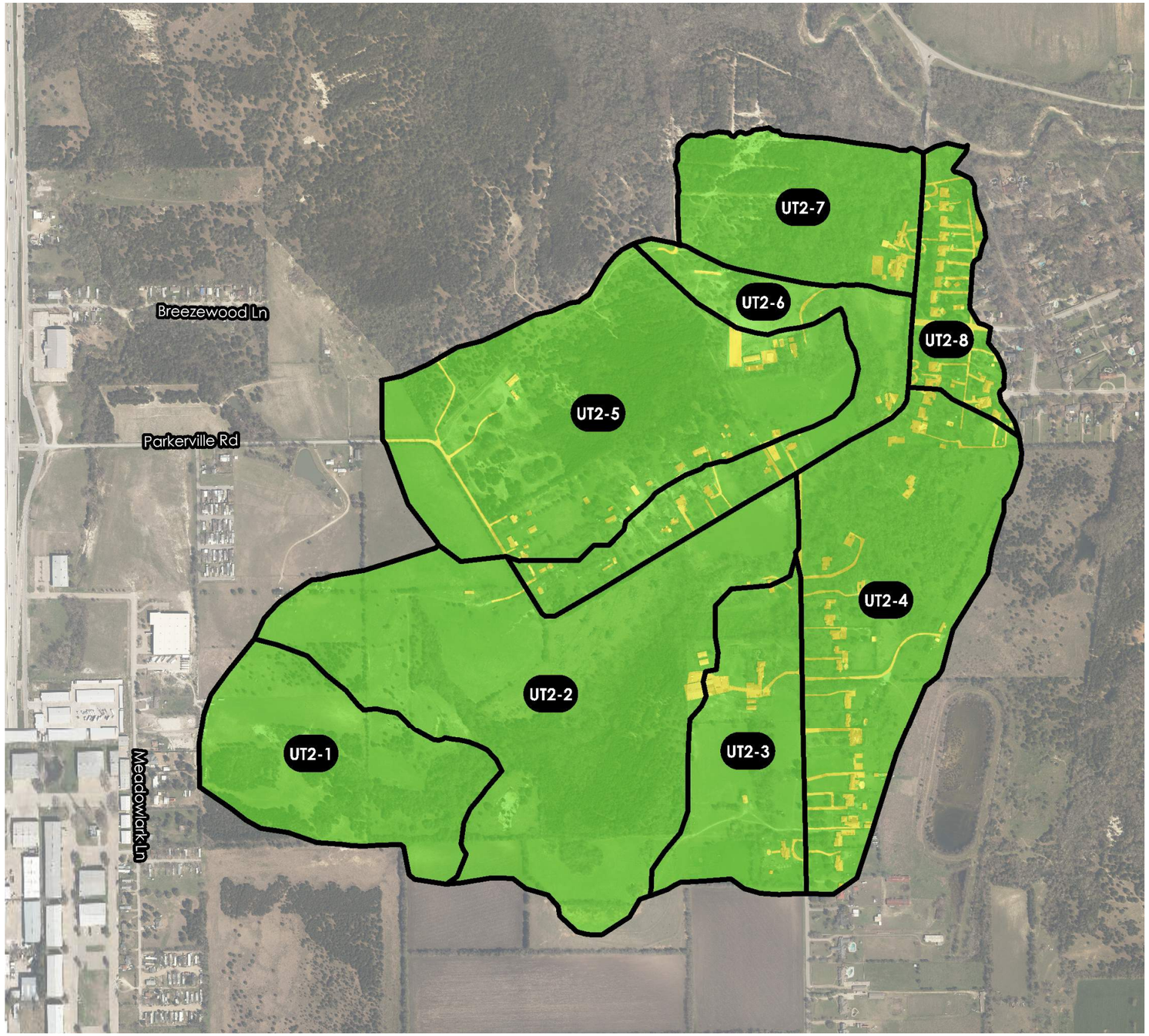
Impervious areas for the Unnamed Tributary 2 watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed are located in residential neighborhoods. These neighborhoods are spread out and have little impervious area.

IMPERVIOUS

OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

UT2-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
OPEN SPACE (FAIR CONDITION)	0	41.6	0.0
		41.6	**0.0**

UT2-2

IMPERVIOUS	100	1.3	1.3
OPEN SPACE (FAIR CONDITION)	0	104.9	0.0
		106.2	**1.3**

UT2-3

IMPERVIOUS	100	2.1	6.4
OPEN SPACE (FAIR CONDITION)	0	31.2	0.0
		33.3	**6.4**

UT2-4

IMPERVIOUS	100	6.1	9.3
OPEN SPACE (FAIR CONDITION)	0	59.5	0.0
		65.7	**9.3**

UT2-5

IMPERVIOUS	100	3.0	3.5
OPEN SPACE (FAIR CONDITION)	0	82.8	0.0
		85.7	**3.5**

UT2-6

IMPERVIOUS	100	2.9	8.8
OPEN SPACE (FAIR CONDITION)	0	30.2	0.0
		33.1	**8.8**

UT2-7

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	1.2	3.7
OPEN SPACE (FAIR CONDITION)	0	32.1	0.0
		33.3	**3.7**

UT2-8

IMPERVIOUS	100	4.5	27.2
OPEN SPACE (FAIR CONDITION)	0	12.1	0.0
		16.6	**27.2**

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



1.6 FUTURE LAND USE MAP

The majority of the watershed is located within City of Lancaster. The existing land use within the watershed consist of mostly Rural Living and Suburban zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- COMMERCIAL CORRIDOR
- R - URBAN NEIGHBORHOOD
- SURBURBAN MIXED USE CENTER
- PRIVATE OPEN SPACES

N

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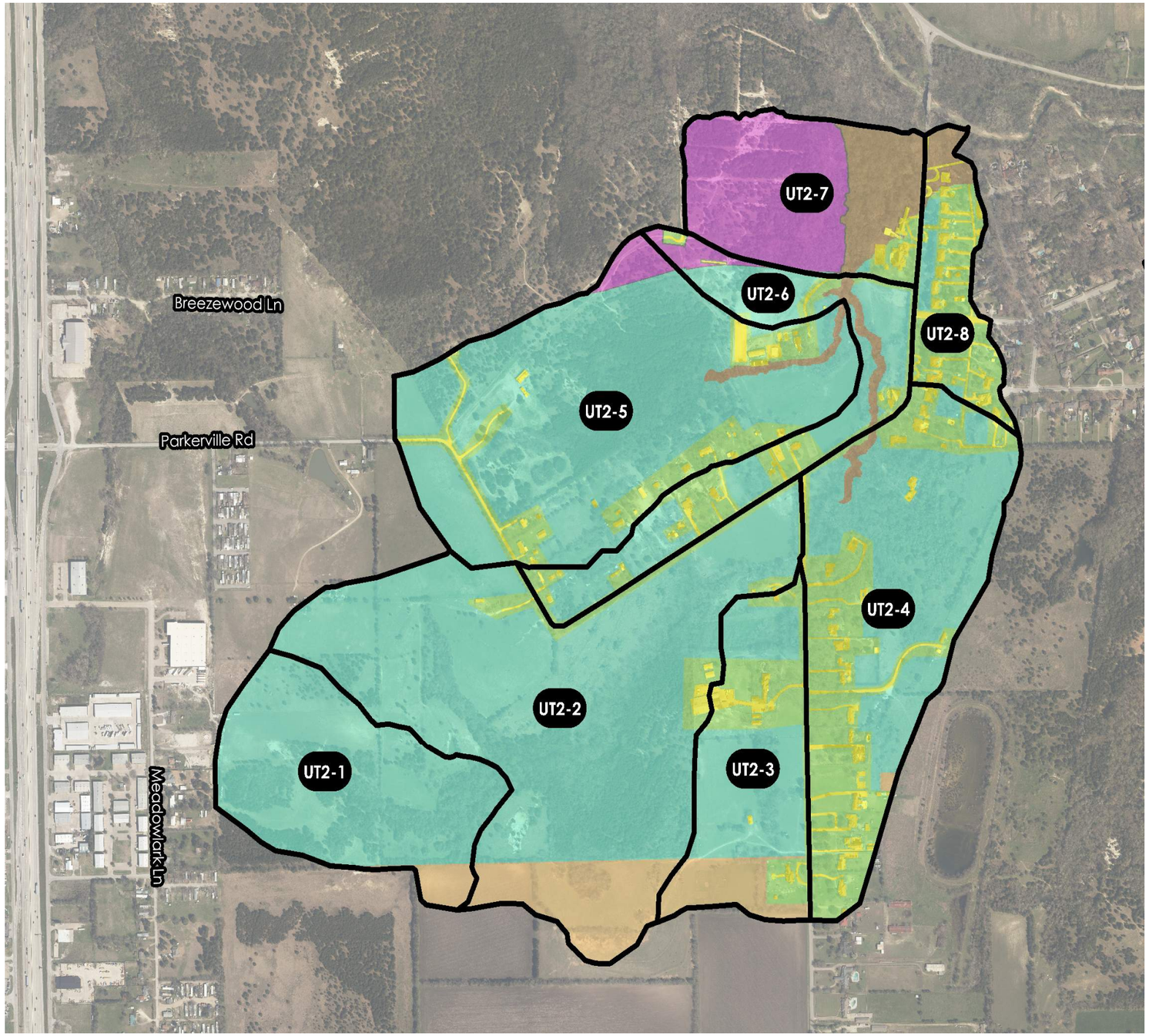


ULTIMATE PERCENT IMPERVIOUS REPORT

UT2-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
R - SURBURBAN NEIGHBORHOOD	38	2.4	0.9
R - RURAL LIVING	12	39.2	11.3
		41.6	**12.2**

UT2-2

IMPERVIOUS AREAS	100	1.3	1.3
OPEN SPACE (FAIR CONDITION)	0	5.3	0.0
R - SURBURBAN NEIGHBORHOOD	38	12.7	4.6
R - RURAL LIVING	12	86.9	9.9
		106.2	**15.7**

UT2-3

IMPERVIOUS AREAS	100	2.1	6.4
OPEN SPACE (FAIR CONDITION)	0	7.7	0.0
R - SURBURBAN NEIGHBORHOOD	38	5.8	6.6
R - RURAL LIVING	12	17.6	6.3
		33.3	**19.3**

UT2-4

IMPERVIOUS AREAS	100	6.1	9.3
OPEN SPACE (FAIR CONDITION)	0	23.8	0.0
FLOODPLAIN	0	0.8	0.0
R - SURBURBAN NEIGHBORHOOD	38	0.3	0.1
R - RURAL LIVING	12	34.6	3.9
		65.7	**13.3**

UT2-5

IMPERVIOUS AREAS	100	3.0	3.5
OPEN SPACE (FAIR CONDITION)	0	11.5	0.0
FLOODPLAIN	0	1.4	0.0
PRIVATE OPEN SPACES	0	2.3	0.0
R - RURAL LIVING	12	67.5	9.5
		85.7	**13.0**

UT2-6

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS AREAS	100	2.9	8.8
OPEN SPACE (FAIR CONDITION)	0	8.3	0.0
FLOODPLAIN	0	1.6	0.0
PRIVATE OPEN SPACES	0	2.0	0.0
R - RURAL LIVING	12	18.4	6.7
		33.1	**15.5**

UT2-7

IMPERVIOUS AREAS	100	1.2	3.7
OPEN SPACE (FAIR CONDITION)	0	1.4	0.0
FLOODPLAIN	0	8.4	0.0
PRIVATE OPEN SPACES	0	22.1	0.0
R - RURAL LIVING	12	0.2	0.1
		33.3	**3.8**

UT2-8

IMPERVIOUS AREAS	100	4.5	27.1
OPEN SPACE (FAIR CONDITION)	0	8.7	0.0
FLOODPLAIN	0	2.0	0.0
R - RURAL LIVING	12	1.4	1.0
		16.6	**4.5**

WATERSHED NO.

14

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

0.65 SM

*

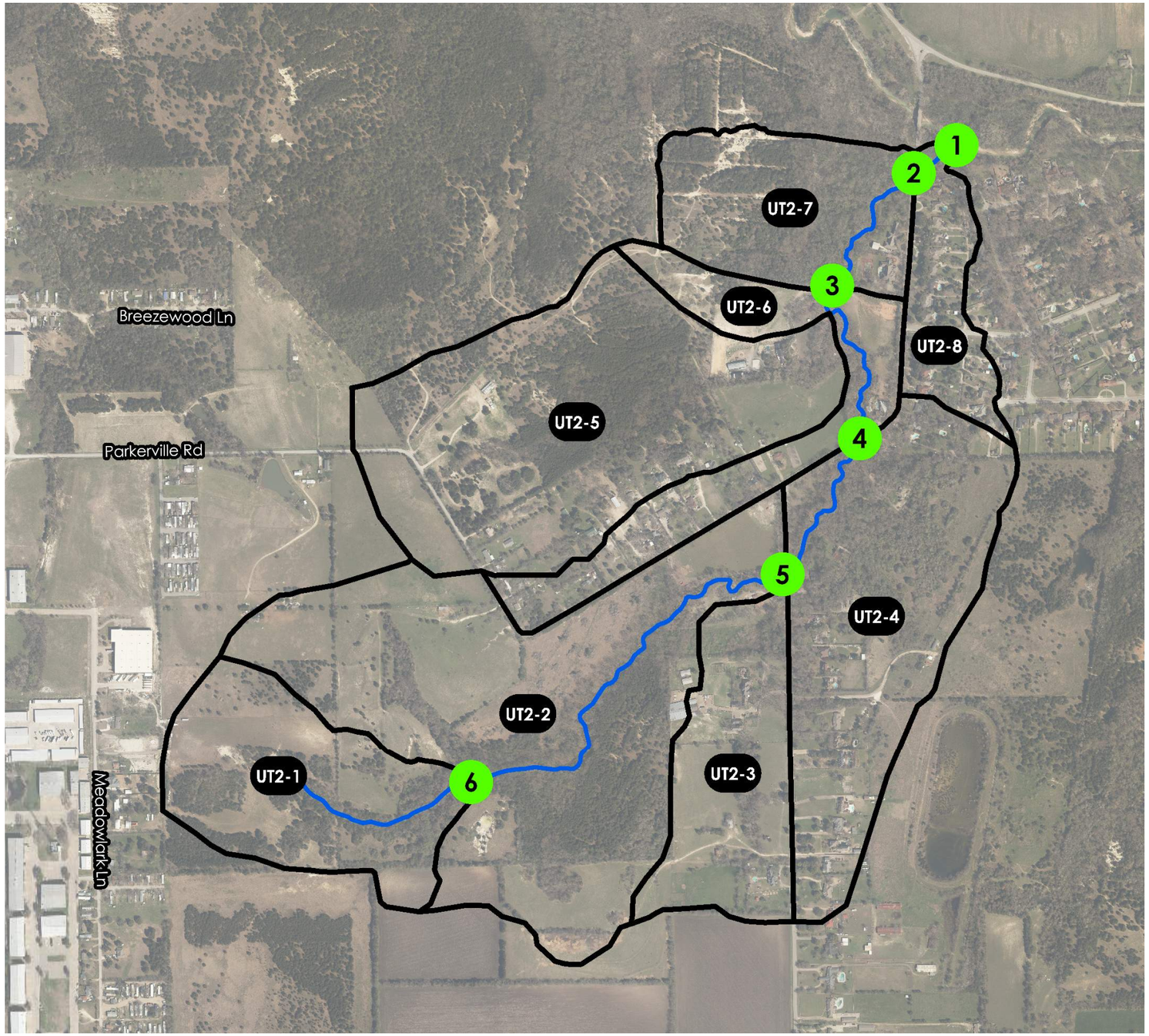
STREAM LENGTH

1.5 MI



1.7 RESULTS

The flow was analyzed at six locations for Unnamed Tributary 2. Flow location 6 is used to establish flows at the upstream end of the stream. Locations 2, 4 and 5 were chosen to analyze road crossings. Locations 5, 3, and 1 are based on the natural breaks of their respective sub-basins.



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FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Ultimate Peak Flow (cfs)
1	UT2-1 - UT2-8	Main	90	0.65	1900
2	UT2-1 - UT2-7	Main	407	0.63	1850
3	UT2-1 - UT2-6	Main	1436	0.57	1850
4	UT2-1 - UT2-4	Main	2614	0.39	1300
5	UT2-1 - UT2-3	Main	3740	0.29	950
6	UT2-1	Main	6595	0.07	270

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



2.0 HYDRAULICS

2.1 SITE ASSESSMENT

Unnamed Tributary 2 is located in the Southeast part of the City of Lancaster. It flows from South to North for approximately 1.50 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Unnamed Tributary 2 within the limits of the City of Lancaster, roughly bound by a location 0.8 miles upstream of South Houston School Road (upstream end) and the confluence with Ten Mile Creek (downstream end). The channel slope averages around 1.2-1.8%. Unnamed Tributary 2 itself has a large amount of trees and shrubs in and around the channel, even in the more developed areas of the watershed. Very little of the channel is accessbile due to the significant amount vegetation. There are a total of four (4) crossings throughout the watershed.



Looking at the South Houston School Road bridge. Heavy vegetation is visible. Modeling shows this bridge is safe from flooding in all studied storm events.



Looking under the South Houston School Road bridge. Fewer shrubs found in the channel, though it does appear rockier than the overbanks.

WATERSHED NO.

14

COUNCIL DISTRICTS

1 AND 2

TOTAL DRAINAGE AREA

0.65 SM

*

STREAM LENGTH

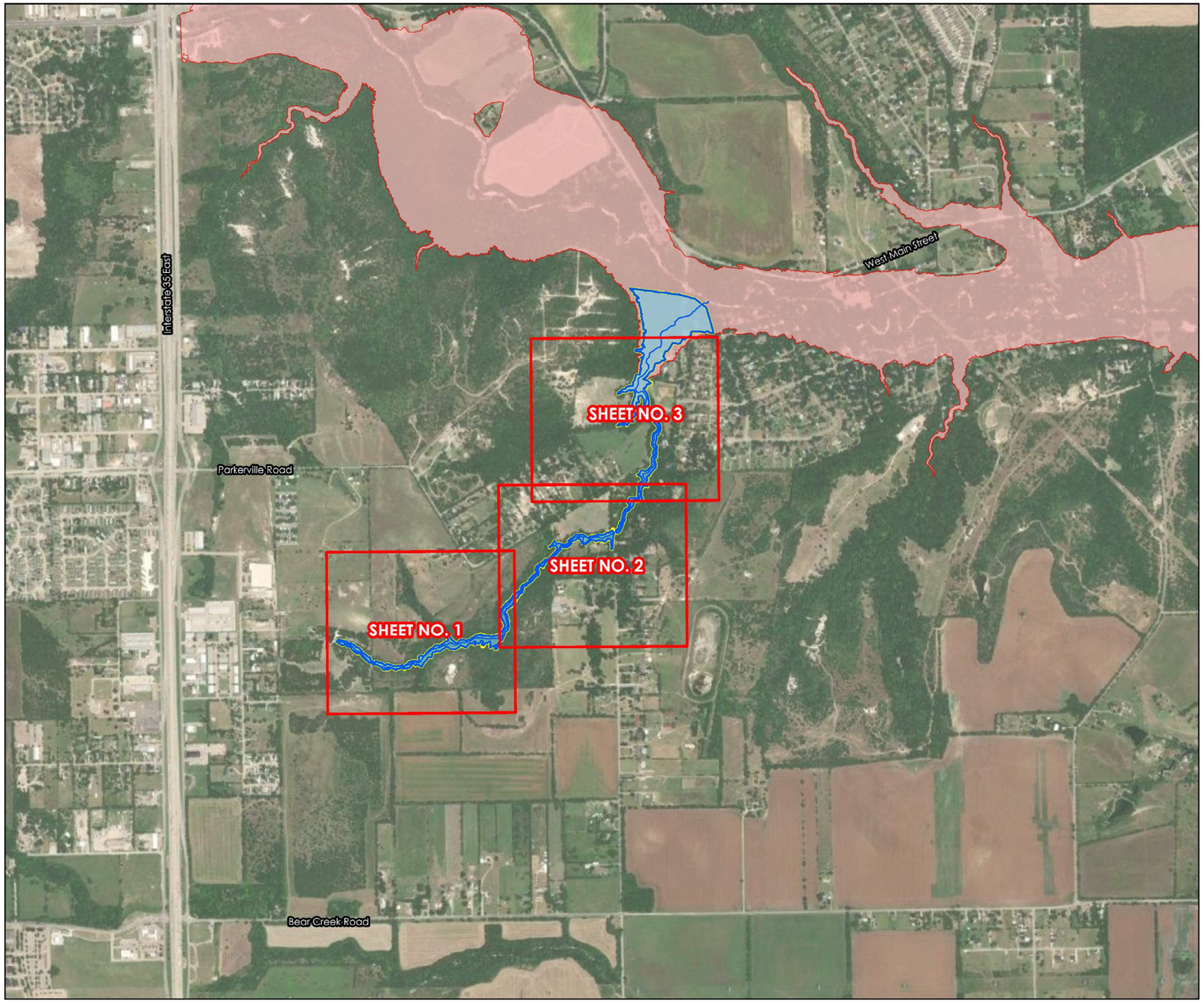
1.5 MI



2.2 FLOODPLAIN MAPPING

The Unnamed Tributary 2 stream hydraulics were analyzed with HEC-RAS 5.0.7. The model is comprised of one stream, one reach, thirty (30) cross sections, and four (4) hydraulic structures. The studied stream is 7,925 feet (1.50 miles) long. Near the confluence of the stream with Ten Mile Creek, the floodplain expands significantly. The rest of the stream's 100-year floodplain, however, is contained within the channel.

The floodplain sheets for Halls Branch display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.

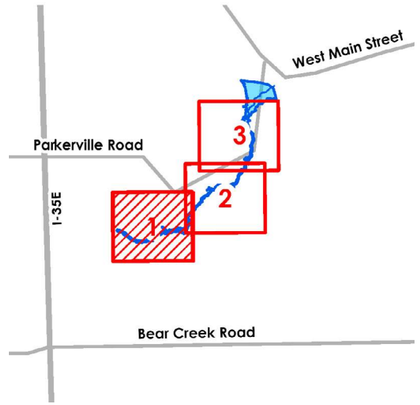


STREAM CENTERLINE
UNNAMED TRIB 2 VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1



N

0 100 200
Feet

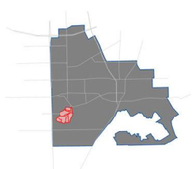
- UNNAMED TRIB 2 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- UNNAMED TRIB 2 BASE FLOW ELEVATIONS
- PARCEL

UNNAMED TRIBUTARY 2

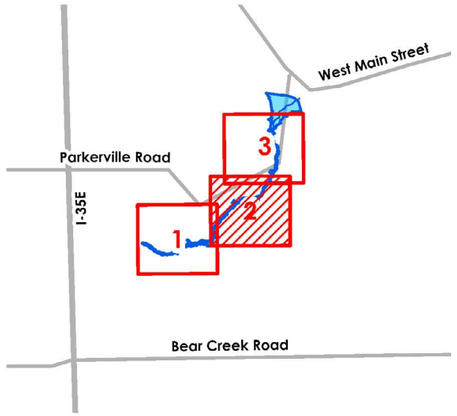
WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



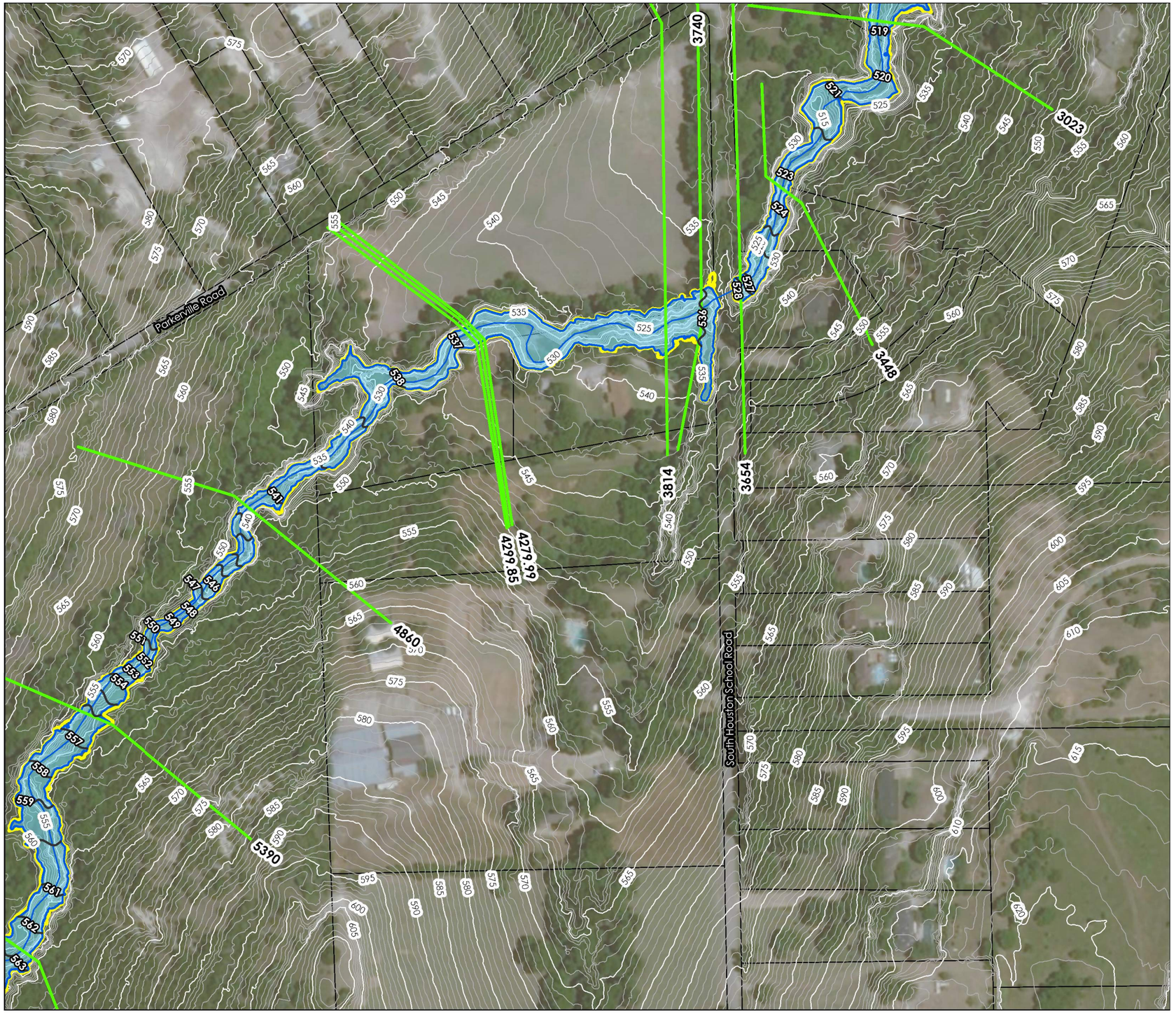
FLOODPLAIN: SHEET 2



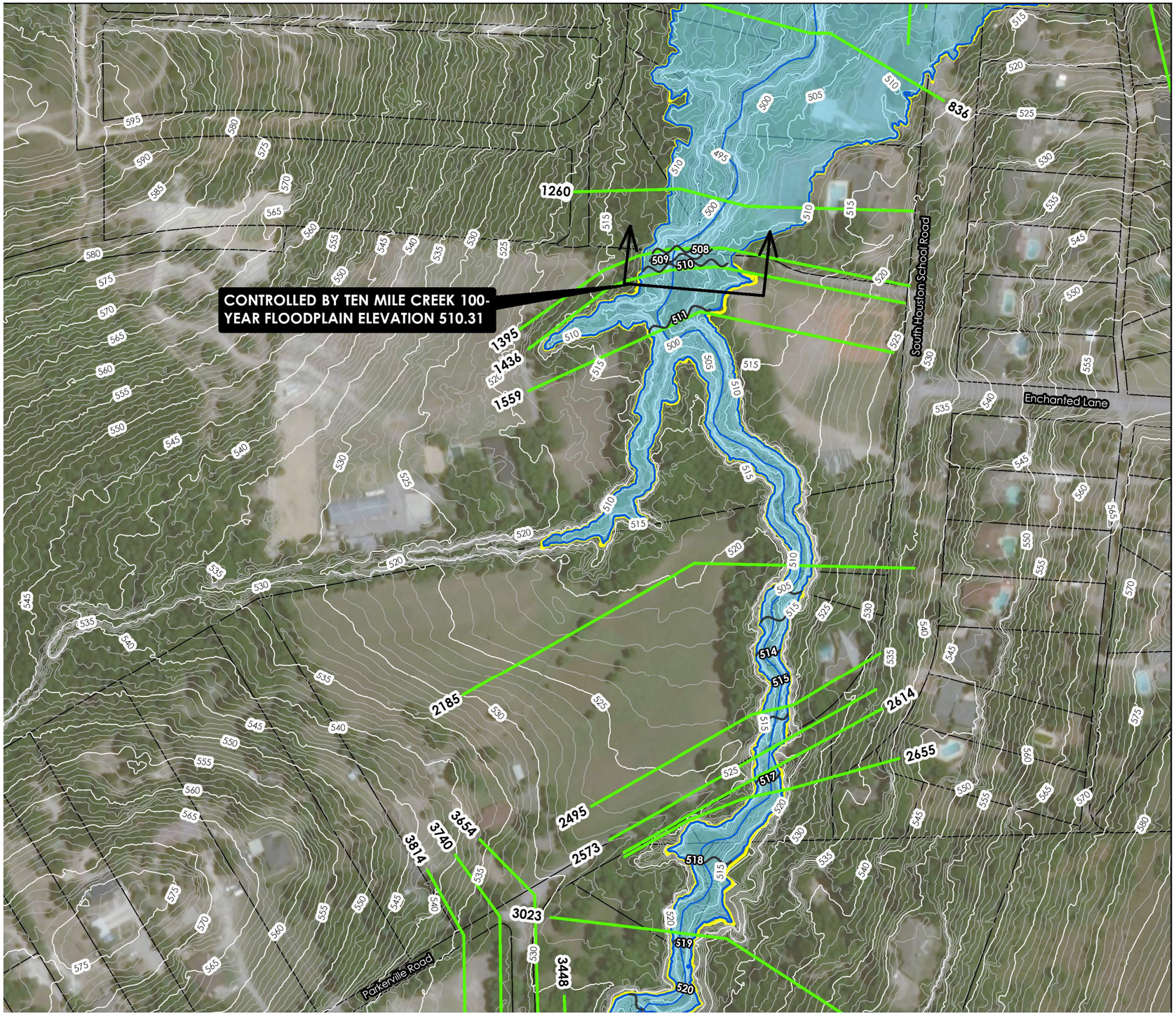
N

0 100 200
Feet

- UNNAMED TRIB 2 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- UNNAMED TRIB 2 BASE FLOW ELEVATIONS
- PARCEL



FLOODPLAIN: SHEET 3





N

0 100 200 Feet

- UNNAMED TRIB 2 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- UNNAMED TRIB 2 BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	613.77	613.86	2.77	2.98
7484	596.54	596.64	4.61	4.82
6986	579.80	580.17	1.83	1.69
6595	573.00	573.44	5.77	6.30
5917	559.94	561.06	3.64	3.26
5390	553.24	553.54	4.44	6.13
4860	538.82	540.11	7.21	6.08
4299.85	531.05	531.50	3.44	4.66
4290	530.88	531.08	4.11	6.09
4279.99	530.91	531.17	2.76	4.11
3814	525.38	527.47	6.87	4.29
3740	525.41	527.43	2.11	2.09
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	523.67	524.46	4.26	5.23
3448	520.17	520.80	6.96	7.63
3023	515.42	516.16	3.17	3.62
2655	514.44	514.97	1.90	2.38
2614	514.02	514.43	4.05	4.71
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	512.69	513.02	3.48	3.70
2495	510.61	510.86	6.79	7.21
2185	508.85	509.06	2.36	2.80
1559	508.84	509.06	0.45	0.55
1436	508.82	509.02	0.98	1.11
1421	PRIVATE CROSSING			
1395	500.34	500.67	2.29	2.61
1260	500.01	500.30	2.92	3.16
836	499.88	500.14	0.78	0.88
524	499.87	500.13	0.34	0.40
407	499.81	500.06	1.80	1.97
358	SOUTH HOUSTON SCHOOL ROAD			
298	499.79	500.06	0.18	0.20
205	499.79	500.06	0.18	0.20
90	499.79	500.06	0.19	0.21

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	613.93	614.05	3.16	3.42
7484	596.72	596.84	4.96	5.25
6986	580.18	580.58	1.95	1.87
6595	573.37	573.78	6.18	6.70
5917	560.94	561.52	3.20	3.59
5390	553.46	554.11	5.93	6.45
4860	539.94	540.59	6.06	6.92
4299.85	531.38	532.28	4.51	4.90
4290	530.99	531.93	5.84	6.05
4279.99	531.08	532.01	3.91	4.39
3814	527.47	530.85	4.29	2.54
3740	527.43	530.82	2.09	1.80
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	524.46	525.25	5.23	6.30
3448	520.80	521.49	7.63	8.19
3023	516.16	516.91	3.62	4.03
2655	514.97	515.54	2.38	2.87
2614	514.43	514.89	4.71	5.32
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	513.34	514.09	4.15	4.75
2495	511.53	512.76	6.53	6.22
2185	509.34	509.82	3.39	4.73
1559	509.33	509.77	0.69	1.01
1436	509.28	509.70	1.29	1.70
1421	PRIVATE CROSSING			
1395	502.05	502.30	2.57	3.04
1260	501.90	502.11	2.05	2.33
836	501.83	502.02	0.71	0.83
524	501.83	502.01	0.38	0.45
407	501.81	501.99	1.00	1.12
358	SOUTH HOUSTON SCHOOL ROAD			
298	501.81	501.99	0.18	0.21
205	501.81	501.99	0.19	0.22
90	501.81	501.99	0.19	0.22

2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	614.14	614.19	3.63	3.72
7484	596.95	597.00	5.41	5.51
6986	580.62	580.97	2.14	1.87
6595	573.72	574.18	6.63	7.04
5917	561.37	561.91	3.64	4.17
5390	554.14	555.12	6.00	5.98
4860	540.33	540.67	7.25	9.34
4299.85	532.32	536.36	4.56	2.45
4290	532.05	536.32	5.48	2.75
4279.99	532.11	536.33	4.02	2.32
3814	531.14	536.13	2.44	1.36
3740	531.11	536.11	1.77	1.46
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	525.30	526.14	6.37	7.53
3448	521.54	522.26	8.23	8.89
3023	516.96	517.73	4.06	4.47
2655	515.57	516.16	2.90	3.39
2614	514.92	515.36	5.37	6.10
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	514.30	515.10	4.86	5.15
2495	513.02	513.98	6.26	6.38
2185	509.99	510.41	4.98	6.15
1559	509.93	510.31	1.08	1.40
1436	509.86	510.20	1.76	2.12
1421	PRIVATE CROSSING			
1395	504.78	504.90	0.69	0.74
1260	504.74	504.86	1.19	1.26
836	504.73	504.84	0.53	0.56
524	504.72	504.84	0.26	0.28
407	504.72	504.84	0.39	0.42
358	SOUTH HOUSTON SCHOOL ROAD			
298	504.72	504.83	0.14	0.14
205	504.72	504.83	0.15	0.15
90	504.72	504.83	0.14	0.15

2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	614.24	614.32	3.82	3.98
7484	597.04	597.13	5.60	5.76
6986	580.85	581.22	2.14	1.96
6595	573.96	574.40	6.87	7.34
5917	561.61	562.32	4.01	4.22
5390	554.77	555.51	5.73	6.25
4860	540.34	541.05	8.91	9.81
4299.85	534.57	536.66	3.03	2.78
4290	534.49	536.61	3.43	3.13
4279.99	534.51	536.62	2.77	2.64
3814	534.19	536.38	1.66	1.50
3740	534.17	536.34	1.52	1.61
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	525.78	526.56	7.04	8.09
3448	521.96	522.75	8.58	8.76
3023	517.41	518.11	4.30	4.64
2655	515.91	516.56	3.19	3.53
2614	515.16	515.88	5.82	5.82
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	514.93	515.74	5.12	5.26
2495	513.79	514.65	6.35	6.51
2185	510.35	510.72	5.89	6.99
1559	510.26	510.59	1.33	1.64
1436	510.16	510.46	2.03	2.37
1421	PRIVATE CROSSING			
1395	506.09	506.24	0.64	0.67
1260	506.06	506.21	1.01	1.05
836	506.05	506.20	0.47	0.49
524	506.05	506.20	0.22	0.23
407	506.05	506.20	0.14	0.14
358	SOUTH HOUSTON SCHOOL ROAD			
298	506.05	506.20	0.12	0.12
205	506.05	506.20	0.13	0.13
90	506.05	506.20	0.12	0.13

UNNAMED TRIBUTARY 2

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	614.41	614.48	4.12	4.27
7484	597.21	597.29	5.93	6.03
6986	581.16	581.51	2.26	2.09
6595	574.23	574.71	7.10	7.66
5917	561.98	562.79	4.21	4.41
5390	555.20	556.40	6.04	5.56
4860	540.75	541.57	9.43	10.40
4299.85	536.51	536.97	2.48	3.28
4290	536.47	536.89	2.78	3.71
4279.99	536.48	536.91	2.35	3.15
3814	536.26	536.56	1.43	1.84
3740	536.24	536.51	1.55	1.87
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	526.36	527.20	7.80	9.29
3448	522.47	523.34	8.97	9.16
3023	517.93	518.81	4.55	4.94
2655	516.43	517.27	3.41	3.79
2614	515.80	516.64	5.59	5.82
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	515.67	516.56	5.26	5.42
2495	514.58	515.54	6.51	6.70
2185	510.73	511.13	6.86	8.15
1559	510.60	510.95	1.60	1.97
1436	510.48	510.80	2.31	2.70
1421	PRIVATE CROSSING			
1395	508.09	508.19	0.56	0.58
1260	508.07	508.18	0.79	0.82
836	508.07	508.17	0.37	0.38
524	508.07	508.17	0.17	0.18
407	508.07	508.17	0.10	0.11
358	SOUTH HOUSTON SCHOOL ROAD			
298	508.07	508.17	0.10	0.10
205	508.07	508.17	0.10	0.11
90	508.07	508.17	0.10	0.10

2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	614.48	614.60	4.27	4.46
7484	597.29	597.44	6.03	6.00
6986	581.32	581.72	2.29	2.17
6595	574.40	574.88	7.35	7.94
5917	562.32	563.02	4.22	4.59
5390	555.51	556.64	6.25	5.72
4860	541.05	541.89	9.80	10.72
4299.85	536.71	537.20	2.75	3.56
4290	536.66	537.11	3.10	4.03
4279.99	536.67	537.13	2.62	3.43
3814	536.40	536.66	1.61	2.19
3740	536.35	536.60	1.73	2.13
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	526.77	527.79	8.45	10.34
3448	522.94	523.87	8.88	9.52
3023	518.35	519.41	4.71	5.21
2655	516.88	517.81	3.53	4.09
2614	516.31	517.14	5.47	6.16
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	516.22	517.07	5.35	5.52
2495	515.17	516.08	6.63	6.83
2185	510.98	511.38	7.63	8.84
1559	510.83	511.18	1.82	2.19
1436	510.69	511.01	2.53	2.89
1421	PRIVATE CROSSING			
1395	509.22	509.30	0.53	0.56
1260	509.21	509.29	0.71	0.75
836	509.21	509.28	0.33	0.35
524	509.21	509.28	0.16	0.17
407	509.21	509.28	0.09	0.10
358	SOUTH HOUSTON SCHOOL ROAD			
298	509.20	509.28	0.09	0.09
205	509.20	509.28	0.10	0.10
90	509.20	509.28	0.09	0.10

2.3 HYDRAULIC RESULTS:
100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
8015	614.60	614.67	4.46	4.58
7484	597.44	597.51	6.00	6.08
6986	581.50	581.87	2.39	2.20
6595	574.60	575.06	7.51	8.08
5917	562.64	563.24	4.29	4.76
5390	556.24	556.86	5.47	5.85
4860	541.37	542.20	10.16	11.03
4299.85	536.93	537.41	3.04	3.83
4290	536.86	537.30	3.43	4.36
4279.99	536.88	537.33	2.91	3.72
3814	536.54	536.76	1.82	2.43
3740	536.49	536.69	1.86	2.27
3691	SOUTH HOUSTON SCHOOL ROAD			
3654	527.17	528.20	9.23	11.08
3448	523.30	524.19	9.19	9.87
3023	518.80	519.86	4.90	5.33
2655	517.33	518.32	3.70	4.17
2614	516.77	517.71	5.55	6.08
2593	SOUTH HOUSTON SCHOOL ROAD			
2573	516.71	517.66	5.46	5.63
2495	515.70	516.69	6.74	6.97
2185	511.23	511.67	8.32	9.64
1559	511.05	511.43	2.03	2.44
1436	510.89	511.24	2.73	3.11
1421	PRIVATE CROSSING			
1395	510.24	510.37	1.15	1.42
1260	510.21	510.33	1.43	1.76
836	510.20	510.32	0.73	0.90
524	510.20	510.32	0.33	0.40
407	510.20	510.32	0.19	0.24
358	SOUTH HOUSTON SCHOOL ROAD			
298	510.20	510.31	0.20	0.24
205	510.20	510.31	0.21	0.26
90	510.20	510.31	0.20	0.24

UNNAMED TRIBUTARY 2

WATERSHED NO.
14

COUNCIL DISTRICTS
1 AND 2

TOTAL DRAINAGE AREA
0.65 SM
*
STREAM LENGTH
1.5 MI

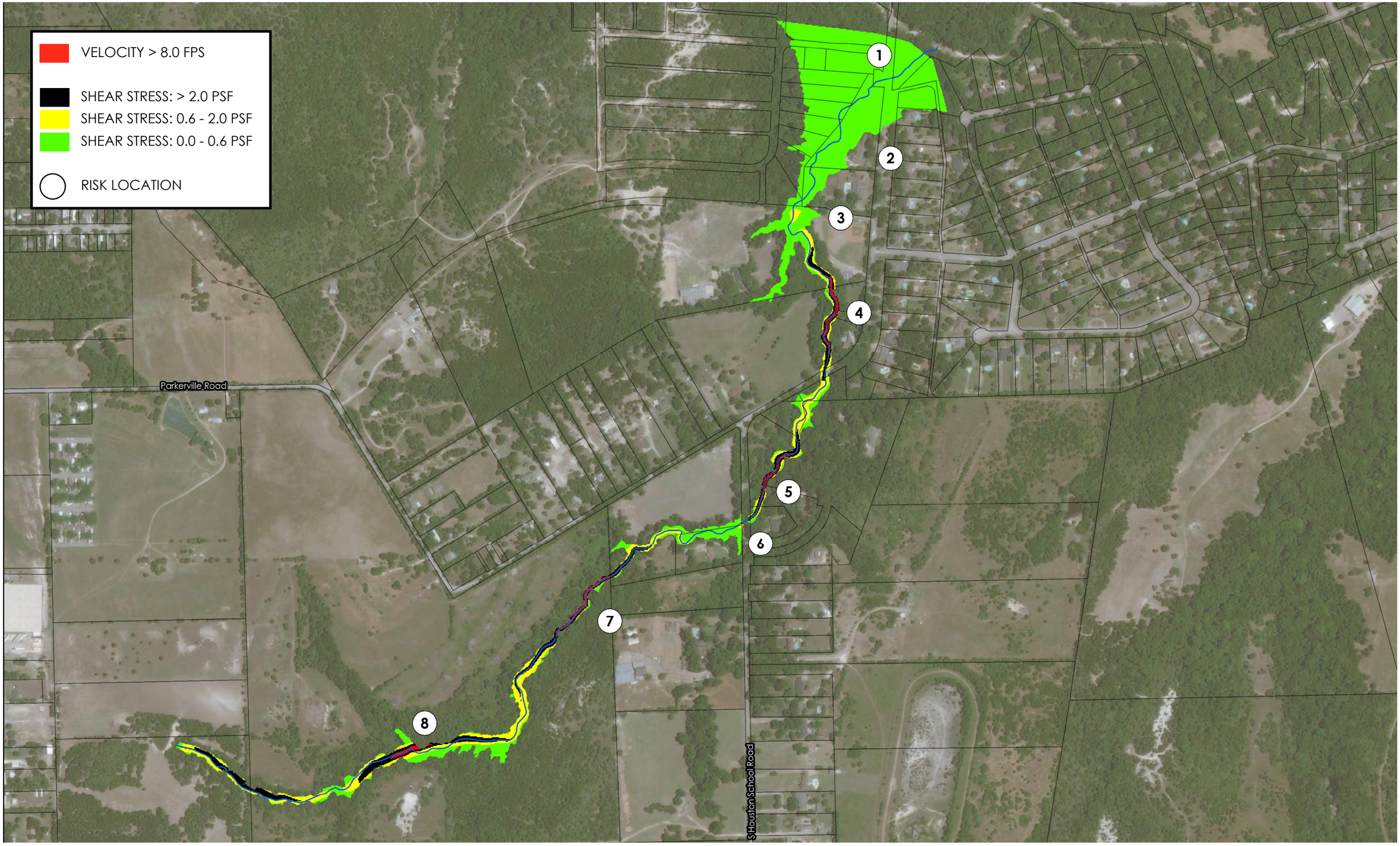


3.1 RISK IDENTIFICATION

Eight risk areas were identified in this study. The risks include three over-topping bridges, one area of flooding structures and four locations of erosive velocities. The area with flooded structures include houses along South Houston School Road near the confluence with Ten Mile Creek. However, flooding here is expected to be infrequent. The over-topping bridges in the watershed experience flooding frequently (1-Year). However, the roads generally have light traffic. The four areas where erosion is likely are heavily wooded and located away from major development. The following map shows the shear stresses associated with the Unnamed Tributary 2 floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	South Houston School Road (River Station 358)	Over-topping Bridge	1-Year	Public	High
2	Houses along South Houston School Road	Flooded Structure	100-Year	Private	Very Low
3	Private Crossing (River Station 1421)	Over-topping Bridge	1-Year	Private	High
4	River Station 5735	Potential Erosion Hot Spot	1-Year	Private	Very Low
5	River Station 5735	Potential Erosion Hot Spot	1-Year	Private	Very Low
6	South Houston School Road (River Station 3691)	Over-topping Bridge	5-Year	Public	Medium
7	River Station 4860	Potential Erosion Hot Spot	1-Year	Private	Very Low
8	River Station 6595	Potential Erosion Hot Spot	1-Year	Private	Very Low

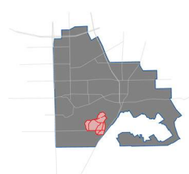

VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
1
2
3
4
5
6
7
8
Parkerville Road
S Houston School Road

UNNAMED TRIBUTARY 3

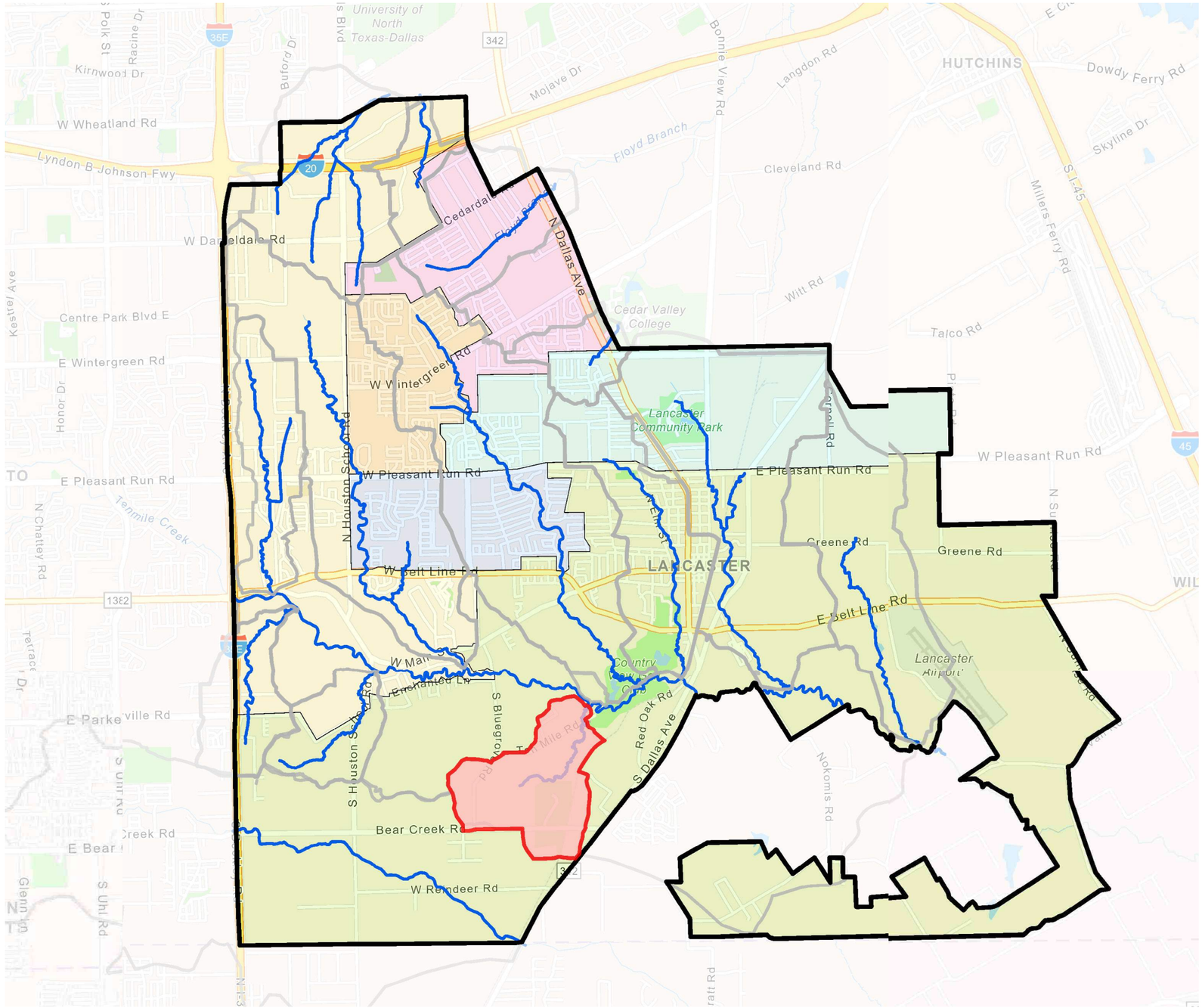
WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



UNNAMED TRIB 3
STREAM CENTERLINE
COUNCIL DISTRICT
DISTRICT 1
DISTRICT 2
DISTRICT 3
DISTRICT 4
DISTRICT 5
DISTRICT 6



UNNAMED TRIBUTARY 3 WATERSHED

Unnamed Tributary 3 is located in the southern portion of the City west of State Highway 342, with a watershed of approximately 1.01 square miles. The creek begins northeast of the intersection of Bear Creek Road. and South Blue Grove Road and flows north until it joins with Ten Mile Creek approximately 1.50 miles downstream. The watershed consists of predominantly wooded and open areas but includes some dense residential. The majority of these undeveloped areas will be developed as medium density residential under the current zoning plan.

WATERSHED NO. 15

UNNAMED TRIBUTARY 3

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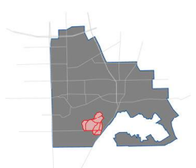
1.0 HYDROLOGY

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



1.1 DRAINAGE AREA MAP

The drainage area divides for the Unnamed Tributary 3 watershed were delineated based on aerial LIDAR data and the original drainage delineation as determined in the June, 4 2008 Freese and Nichols study. The watershed was divided into eight (8) sub-basins. Sub-basins are designated UT3-1 through UT3-8. The total watershed drainage area is 647.4 acres (1.01 square-miles). The whole drainage area is located within the City of Lancaster itself.

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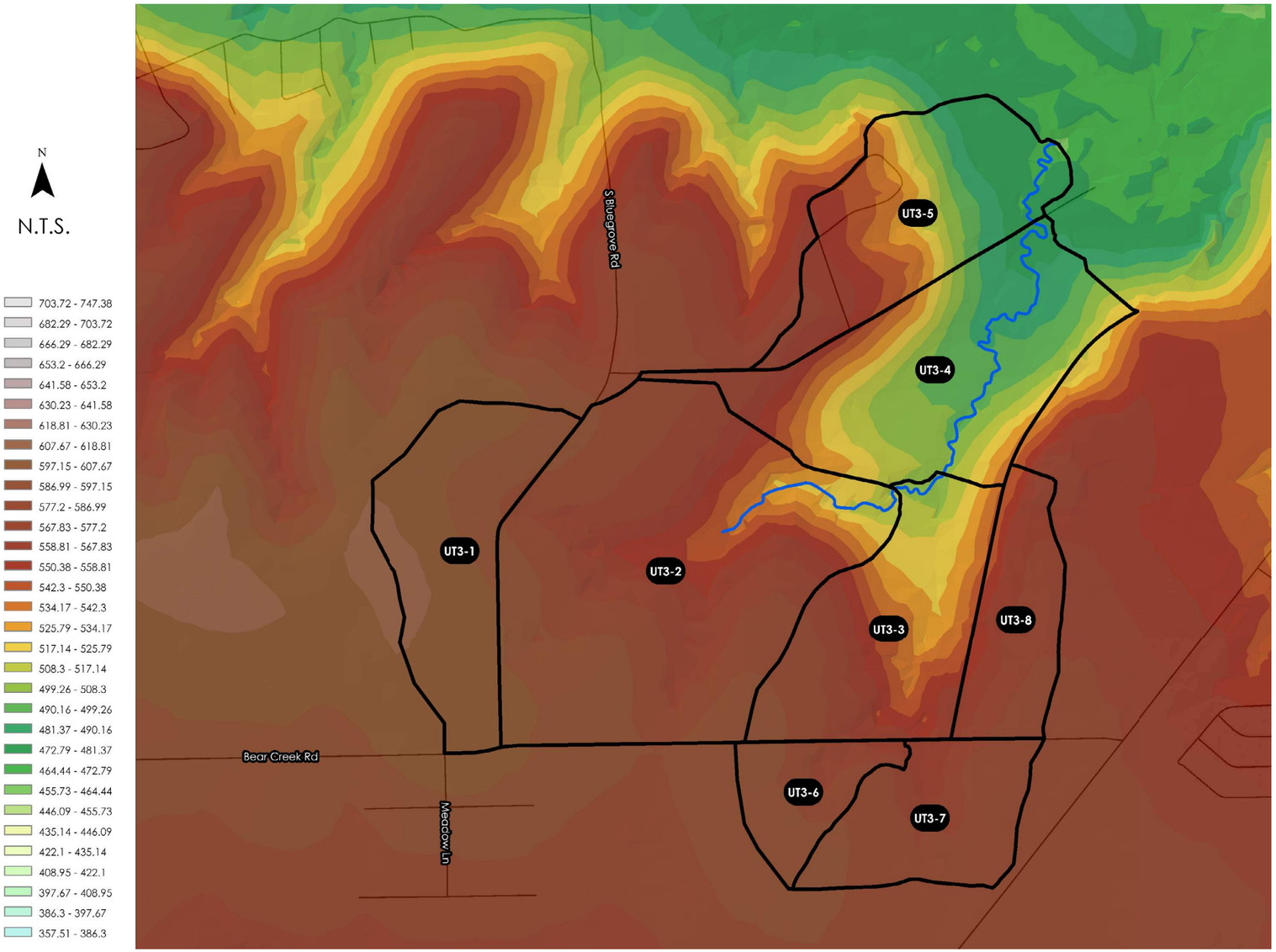


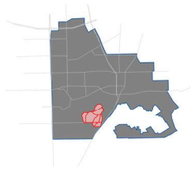
HYDROLOGIC PARAMETERS REPORT

BASIN ID	AREA (acres)	CURVE NUMBER	EXISTING IMPERVIOUS PERCENT	ULTIMATE IMPERVIOUS PERCENT	TIME OF CONCENTRATION (min)	LAG TIME (min)	ULTIMATE TIME OF CONCENTRATION (min)	ULTIMATE LAG TIME (min)
UTrib3-1	0.1138	84	1.8	22.5	34.87	20.92	26.88	16.13
UTrib3-2	0.303	83.4	1	28.4	25.75	15.45	21.55	12.93
UTrib3-3	0.1231	82.5	3.6	53	32.42	19.45	25.55	15.33
UTrib3-4	0.1727	82.1	1.9	59.8	31.43	18.86	25.43	15.26
UTrib3-5	0.1196	81.3	6.2	8.9	19.25	11.55	16.37	9.82
UTrib3-6	0.0413	84	2.1	38.2	21.08	12.65	16.03	9.62
UTrib3-7	0.0762	84	3.2	59.9	24.52	14.71	19.08	11.45
UTrib3-8	0.0618	83.1	64.5	64.5	35.13	21.08	28.33	17

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



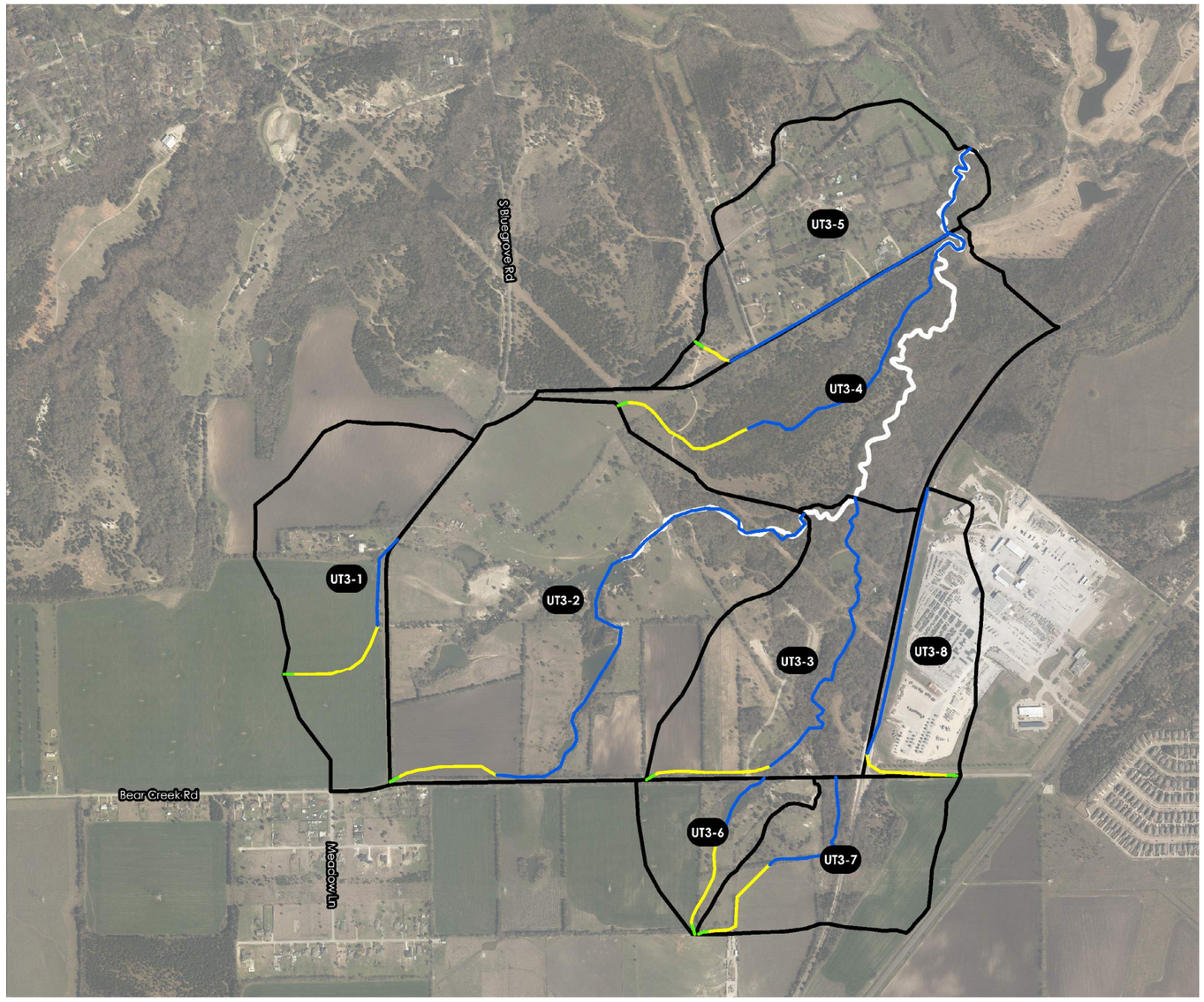
1.2 TIME OF CONCENTRATION

The Times of Concentration for Unnamed Tributary 3 were traced using the 2009 LiDAR data, and verified with the 2019 aerial imagery. Where possible, flow path delineation began at the edge of the sub-basins and on unpaved surfaces. In general, the stream centerline of Unnamed Tributary 3 runs through a lightly developed and heavily wooded area. This results in Times of Concentration that are longer than would be expected of sub-basins of similar sizes. The following tables include the calculated times of concentrations for each sub-basin. Ultimate times of concentration are included for each sub-basin in italics.

- Stream Centerline
- Overland
- Shallow
- Channel
- Gutter
- Pipe

N

N.T.S.



TIME OF CONCENTRATION REPORT

UT3-1

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	0.54	0.240	0.00	0.1	22.79
SHALLOW	UNPAVED	939	1.13	0.000	16.10	1.7	9.13
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	809	2.53	0.050	28.69	4.6	2.95
		1,848					**34.87**
							26.89

UT3-2

OVERLAND	GRS-DENSE	100	6.13	0.240	0.00	0.2	8.60
SHALLOW	UNPAVED	872	1.21	0.000	16.10	1.8	8.21
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	627	3.56	0.050	28.69	5.4	1.93
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	4,203	5.57	0.050	42.29	10.0	7.02
		5,802					**25.75**
							21.55

UT3-3

OVERLAND	GRS-DENSE	100	0.58	0.240	0.00	0.1	22.03
SHALLOW	UNPAVED	1,001	3.61	0.000	16.10	3.1	5.46
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	2,986	5.69	0.050	42.29	10.1	4.93
		4,087					**32.42**
							25.55

UT3-4

OVERLAND	GRS-DENSE	100	0.87	0.240	0.00	0.1	18.75
SHALLOW	UNPAVED	1,223	5.81	0.000	16.10	3.9	5.25
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,322	2.85	0.050	28.69	4.8	4.55
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,715	5.51	0.050	42.29	9.9	2.88
		4,360					**31.43**
							25.43

UT3-5

FLOW TYPE	SURFACE	LENGTH	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min) *ULT TC*
OVERLAND	GRS-DENSE	100	3.88	0.240	0.00	0.2	10.32
SHALLOW	UNPAVED	251	4.16	0.000	16.10	3.3	1.28
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,191	4.45	0.050	28.69	6.1	6.03
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	982	5.68	0.050	42.29	10.1	1.62
		3,525					**19.26**
							16.36

UT3-6

OVERLAND	GRS-DENSE	100	1.71	0.240	0.00	0.1	14.33
SHALLOW	UNPAVED	801	2.01	0.000	16.10	2.3	5.85
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	667	8.63	0.050	42.29	12.4	0.89
		1,568					**21.08**
							16.04

UT3-7

OVERLAND	GRS-DENSE	100	1.9	0.240	0.00	0.1	13.72
SHALLOW	UNPAVED	885	1.3	0.000	16.10	1.8	8.05
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	492	3.96	0.050	28.69	5.7	1.44
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	748	5.02	0.050	42.29	9.5	1.31
		2,225					**24.52**
							19.08

UT3-8

OVERLAND	GRS-DENSE	100	0.55	0.240	0.00	0.1	22.62
SHALLOW	UNPAVED	779	3.1	0.000	16.10	2.8	4.58
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,364	2.99	0.050	28.69	5.0	7.94
		3,243					**35.13**
							28.33

WATERSHED NO.

15

COUNCIL DISTRICT

1

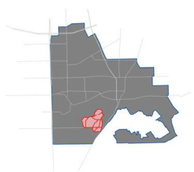
TOTAL DRAINAGE AREA

1.01 SM

*

STREAM LENGTH

1.40 MI



1.3 SOILS MAP

Unnamed Tributary 3 watershed has two different hydrologic soils groups present within it's boundaries. Hydrologic soil type D (least pervious) makes up the majority of the surface soil composition, and can be found in each sub-basin. Hydrologic soil type C, which is more permeable than soil type D is found in all sub-basins except UT3-1, UT3-6 and UT3-7. Hydrologic soil group B is present only in the upstream most (northern most) sub-basin, UT3-5.

- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

N

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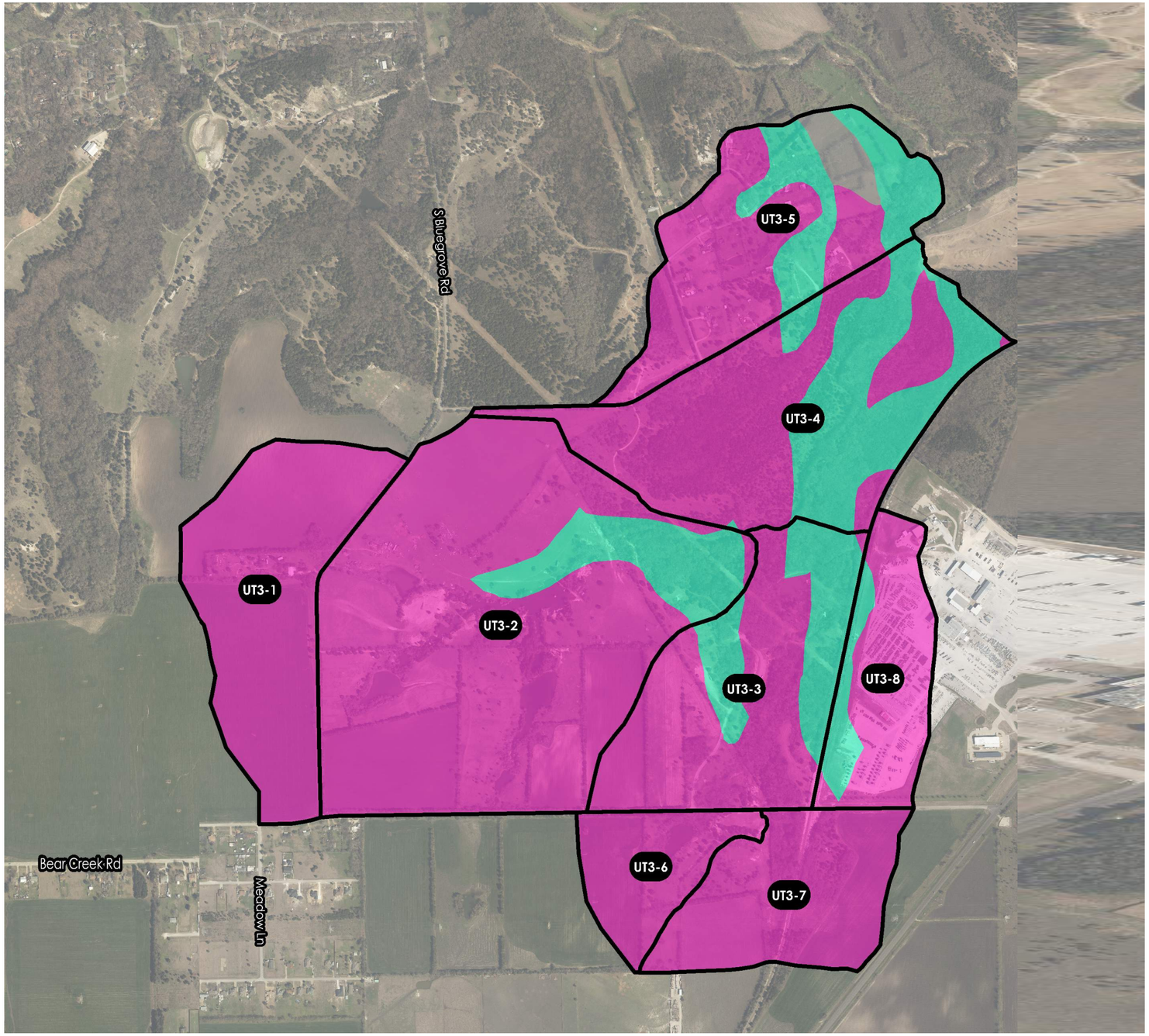


PERVIOUS CURVE NUMBER REPORT

UT2-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	72.8	84.0
		72.8	**84.0**

UT2-2

C	79	23.6	9.6
D	84	170.4	73.8
		193.9	**83.4**

UT2-3

C	79	24.0	24.0
D	84	54.8	58.4
		78.8	**82.5**

UT2-4

C	79	42.7	30.5
D	84	67.9	51.6
		110.5	**82.1**

UT2-5

B	69	5.9	5.4
C	79	23.6	24.4
D	84	47.0	51.5
		76.6	**81.3**

UT2-6

D	84	26.4	84.0
		26.4	**84.0**

UT2-1

SOIL TYPE	CURVE NUMBER	SHAPE AREA (AREA)	AREA WEIGHTED CN
D	84	48.8	84.0
		48.8	**84.0**

UT2-4

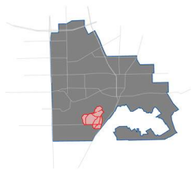
C	79	7.1	14.2
D	84	32.5	68.9
		39.6	**83.1**

PERVIOUS CN CALCULATIONS BASED ON OPEN SPACE FAIR CONDITIONS

WATERSHED NO.
15

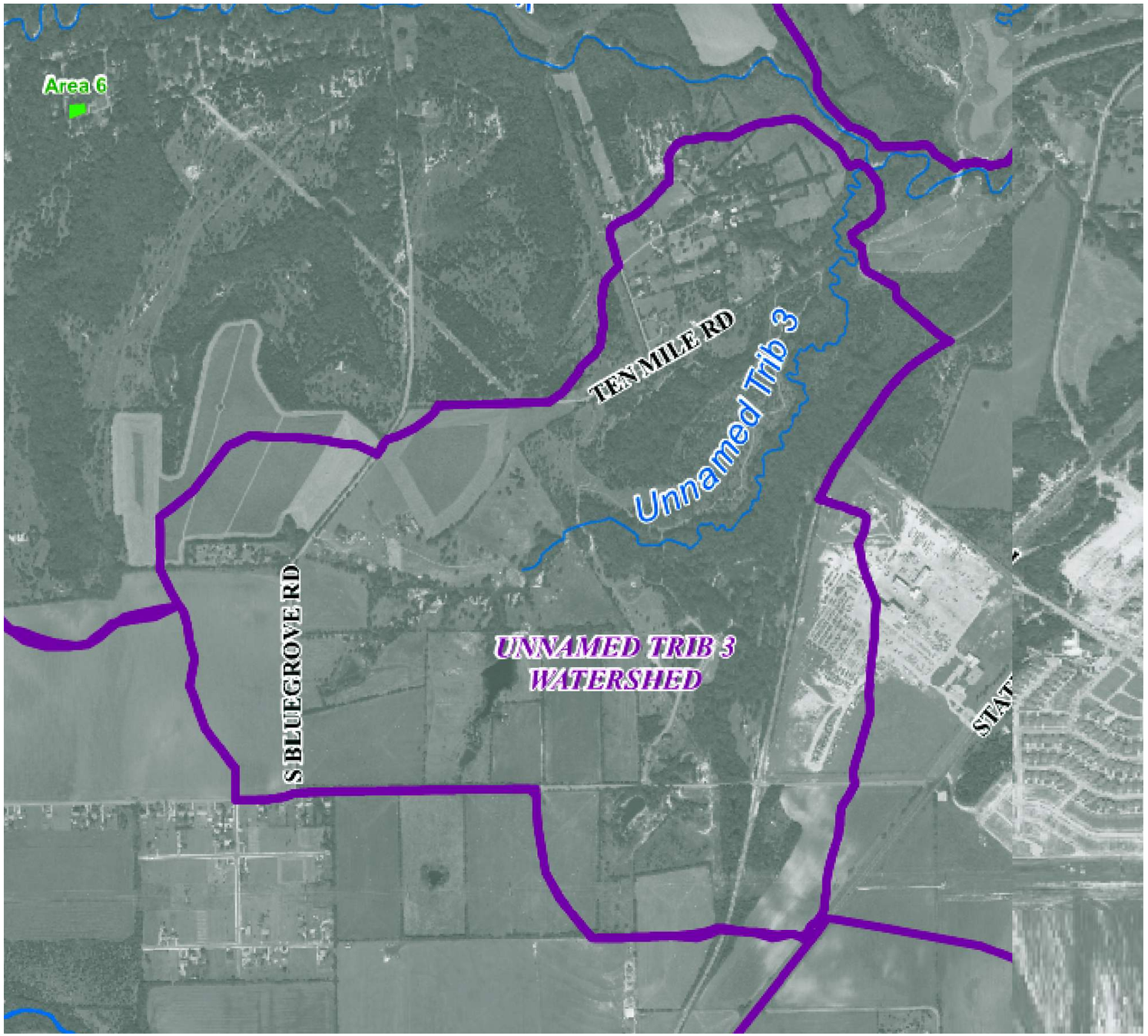
COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



1.4 AERIAL COMPARISON

Aerial photography from 2019 no development since 2007 within the Unnamed Tributary 3 watershed.



N

N.T.S.

2007





N

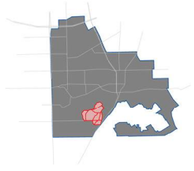
N.T.S.

2019

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



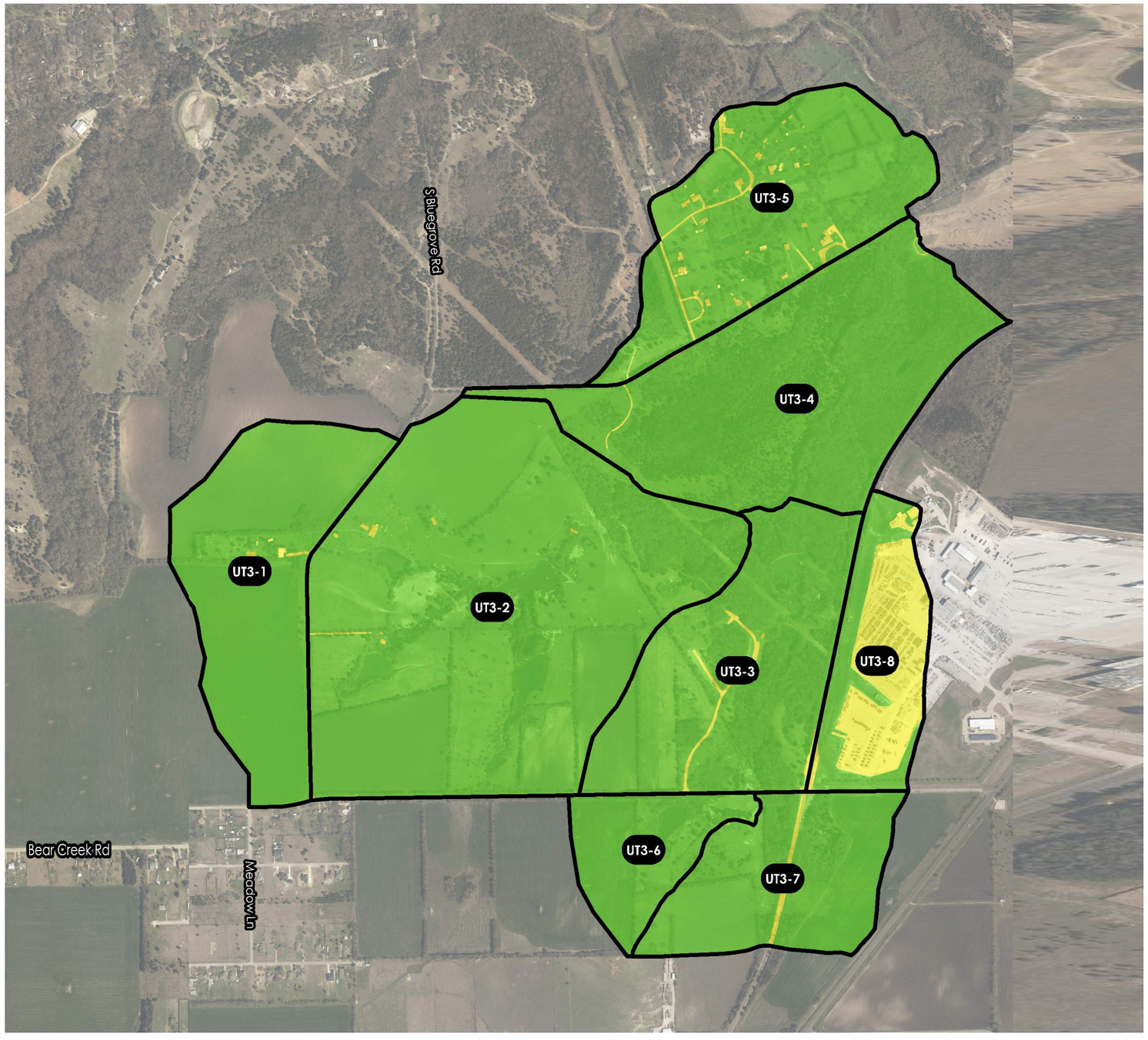
1.5 IMPERVIOUS AREA

Impervious areas for the Unnamed Tributary 3 watershed were delineated based on the 2019 Aerial Imagery. Impervious surfaces for the purpose of this study include roadways, parking and buildings. Based on the aerial imagery delineation, a majority of the impervious areas of the watershed is located in UT3-8 where a relatively large parking area is located. The rest of the watershed has fairly low impervious percentages.

- IMPERVIOUS
- OPEN SPACE (FAIR CONDITIONS)

N

N.T.S.



EXISTING PERCENT IMPERVIOUS REPORT

UT3-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	1.3	1.8
OPEN SPACE (FAIR CONDITION)	0	71.6	0.0
		72.8	**1.8**

UT3-2

IMPERVIOUS	100	2.0	1.0
OPEN SPACE (FAIR CONDITION)	0	191.9	0.0
		193.9	**1.0**

UT3-3

IMPERVIOUS	100	2.9	3.6
OPEN SPACE (FAIR CONDITION)	0	75.9	0.0
		78.8	**3.6**

UT3-4

IMPERVIOUS	100	2.1	1.9
OPEN SPACE (FAIR CONDITION)	0	108.5	0.0
		110.5	**1.9**

UT3-5

IMPERVIOUS	100	4.7	6.2
OPEN SPACE (FAIR CONDITION)	0	71.8	0.0
		76.6	**6.2**

UT3-6

IMPERVIOUS	100	0.6	2.1
OPEN SPACE (FAIR CONDITION)	0	25.9	0.0
		26.4	**2.1**

UT3-7

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS	100	1.5	3.2
OPEN SPACE (FAIR CONDITION)	0	47.3	0.0
		48.8	**3.2**

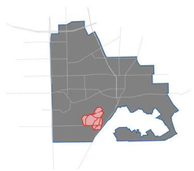
UT3-8

IMPERVIOUS	100	25.5	64.5
OPEN SPACE (FAIR CONDITION)	0	14.0	0.0
		39.6	**64.5**

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



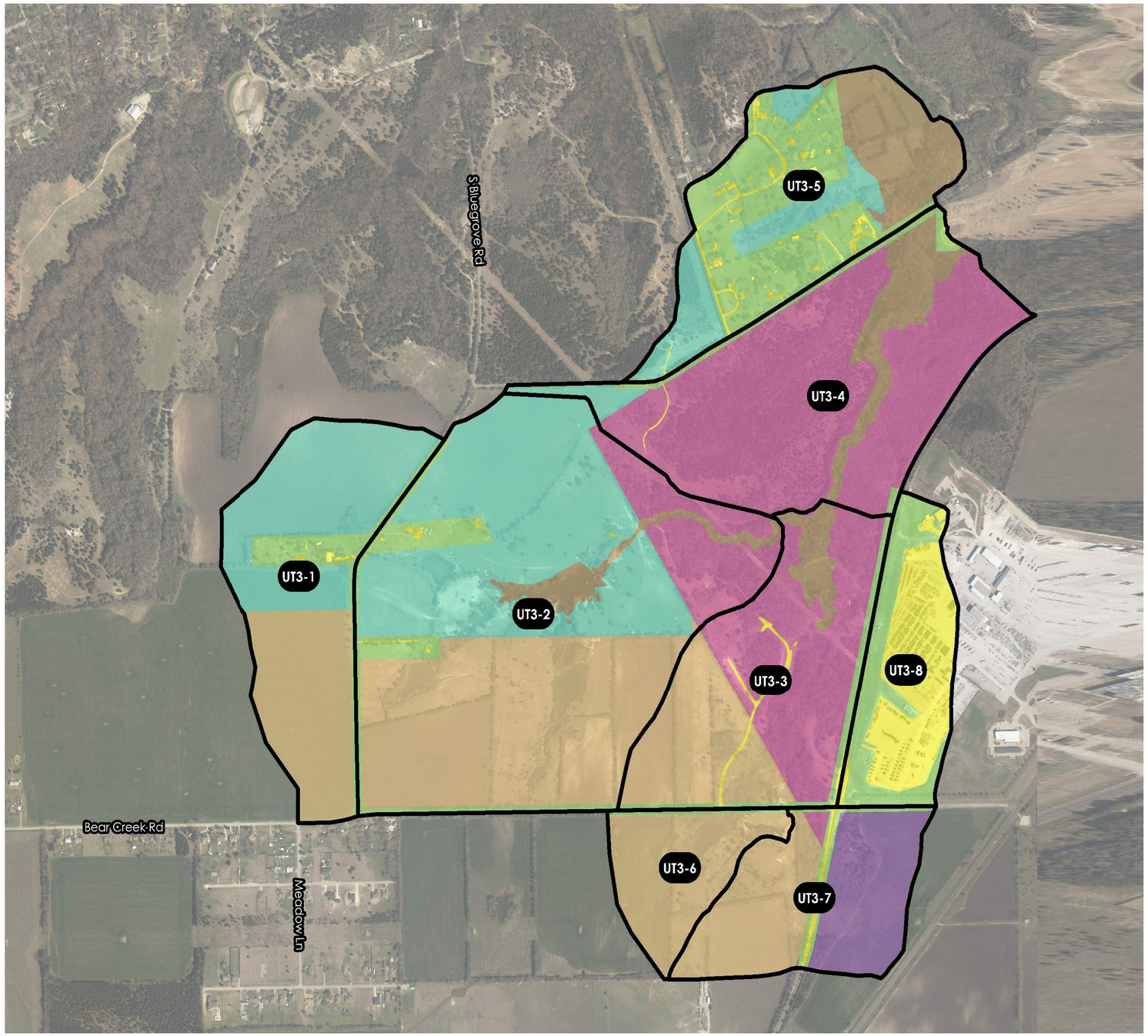
1.6 FUTURE LAND USE MAP

The entirety of the watershed is located within City of Lancaster. The existing land use within the watershed consist of mostly Industrial. and Residential zoning based on the provided City zoning data. The aerial imagery appears to reflect the ultimate land use as described by the City's current future land use maps as of July 29, 2020.

- COMMERCIAL NODE
- FLOODPLAIN
- IMPERVIOUS
- LOGISTICS & DISTRIBUTION
- MIXED USE
- OPEN SPACE (FAIR CONDITION)
- PUBLIC & SEMI-PUBLIC
- R - RURAL LIVING
- R - SURBURBAN NEIGHBORHOOD
- COMMERCIAL CORRIDOR
- R - URBAN NEIGHBORHOOD
- SURBURBAN MIXED USE CENTER
- PRIVATE OPEN SPACES

N

N.T.S.



ULTIMATE PERCENT IMPERVIOUS REPORT

UT3-1

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS AREAS	100	1.3	1.8
R - SURBURBAN NEIGHBORHOOD	38	28.1	14.7
R - RURAL LIVING	12	36.7	6.1
OPEN SPACE (FAIR CONDITION)	0	6.7	0.0
		72.8	**22.5**

UT3-2

IMPERVIOUS AREAS	100	2.0	1.0
R - SURBURBAN NEIGHBORHOOD	38	74.3	14.5
FLOODPLAIN	0	7.1	0.0
R - RURAL LIVING	12	77.8	4.8
PUBLIC & SEMI-PUBLIC	72	21.4	8.0
OPEN SPACE (FAIR CONDITION)	0	11.3	0.0
		193.9	**28.4**

UT3-3

IMPERVIOUS AREAS	100	2.9	3.6
R - SURBURBAN NEIGHBORHOOD	38	25.5	12.3
FLOODPLAIN	0	5.8	0.0
PUBLIC & SEMI-PUBLIC	72	40.5	37.1
OPEN SPACE (FAIR CONDITION)	0	4.1	0.0
		78.8	**53.0**

UT3-4

IMPERVIOUS AREAS	100	2.1	1.9
FLOODPLAIN	0	13.5	0.0
R - RURAL LIVING	12	3.0	0.3
PUBLIC & SEMI-PUBLIC	72	88.4	57.6
OPEN SPACE (FAIR CONDITION)	0	3.5	0.0
		110.5	**59.8**

UT3-5

LAND USE	PERCENT IMPERVIOUS	SHAPE AREA	AREA WEIGHTED PERCENT_IMPERVIOUS
IMPERVIOUS AREAS	100	4.7	6.2
FLOODPLAIN	0	19.3	0.0
R - RURAL LIVING	12	17.3	2.7
OPEN SPACE (FAIR CONDITION)	0	35.2	0.0
		76.6	**8.9**

UT3-6

IMPERVIOUS AREAS	100	0.6	2.1
R - SURBURBAN NEIGHBORHOOD	38	25.1	36.1
OPEN SPACE (FAIR CONDITION)	0	0.8	0.0
		26.4	**38.2**

UT3-7

IMPERVIOUS AREAS	100	1.5	3.2
R - SURBURBAN NEIGHBORHOOD	38	22.0	17.2
COMMERCIAL NODE	85	22.1	38.5
PUBLIC & SEMI-PUBLIC	72	0.7	1.1
OPEN SPACE (FAIR CONDITION)	0	2.4	0.0
		48.8	**59.9**

UT3-8

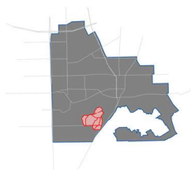
IMPERVIOUS AREAS	100	25.5	64.5
OPEN SPACE (FAIR CONDITION)	0	14.0	0.0
		39.6	**64.5**

UNNAMED TRIBUTARY 3

WATERSHED NO.
15

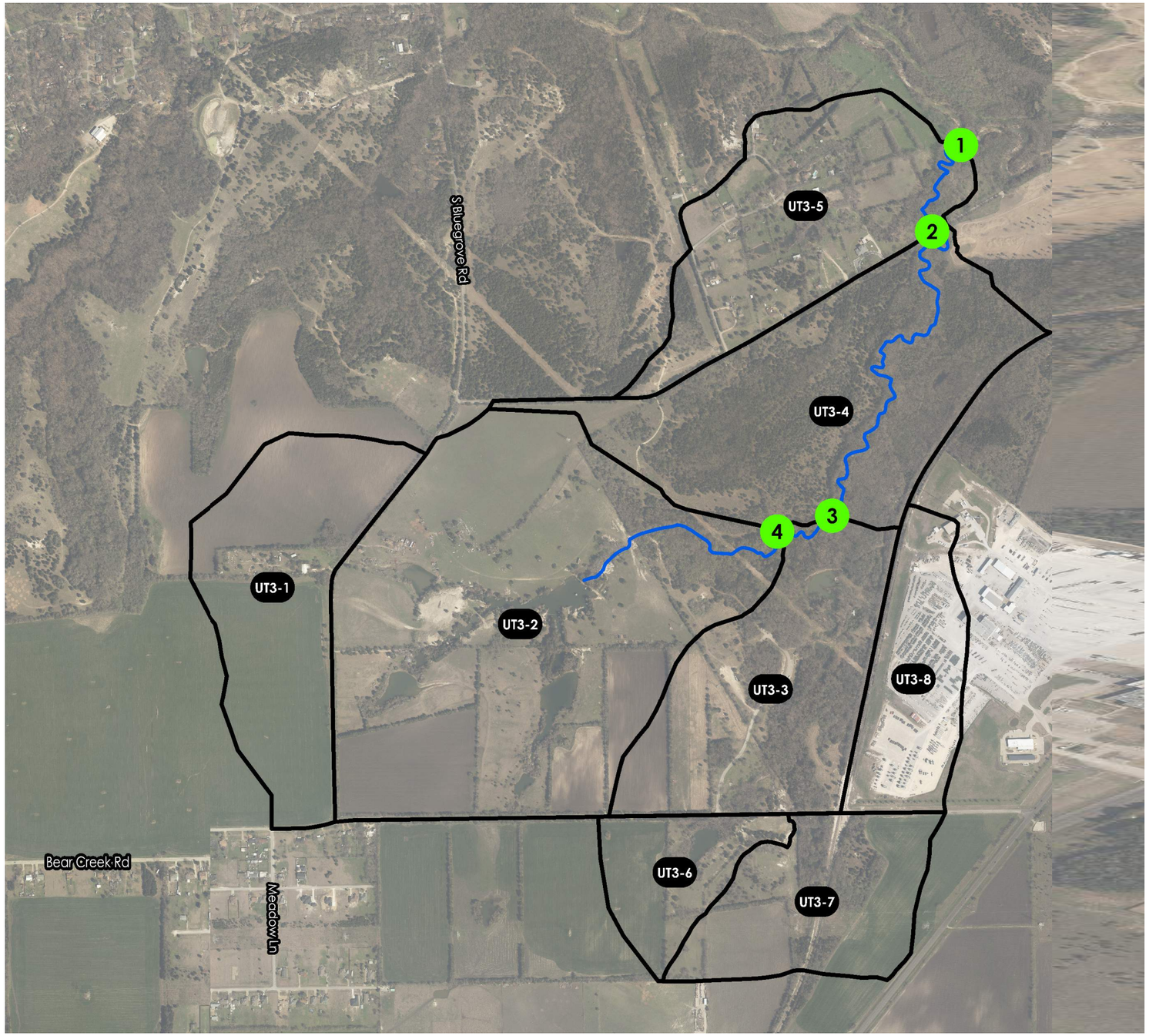
COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



1.7 RESULTS

The flow was analyzed at four locations for Unnamed Tributary 3. Flow locations 4 is used for the upstream flow in te hydraulic model. Locations 1 and 3 were chosen based on the natural breaks of their respective sub-basins. Location 2 was analyzed to consider the potential floding impacts on the Ten Mile Road culvert.



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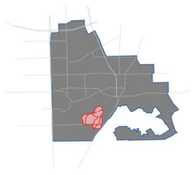
FLOW ANALYSIS LOCATIONS					
Flow Analysis Location	Upstream Basins	Reach	Hydraulic Station	Cumulative Area (sq-mi)	Peak Flow (cfs)
1	UT3-1 - UT3-8	Main	123.46	1.01	2800
2	UT3-1 - UT3-4, UT3-6 - UT3-8	Main	1205.027	0.89	2700
3	UT3-1 - UT3-3, UT3-6 - UT3-8	Main	4961.718	0.72	2400
4	UT3-1, UT3-2	Main	5735.439	0.42	1400

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



2.0 HYDRAULICS

2.1 SITE ASSESSMENT

Unnamed Tributary 3 is located in the South part of the City of Lancaster. It flows from South to North for approximately 1.40 miles before flowing into Ten Mile Creek. This assessment analyzes the hydrologic and hydraulic characteristics of Unnamed Tributary 3 within the limits of the City of Lancaster, roughly bound by a location approximately 1.2 miles upstream of Ten Mile Road (upstream end) and the confluence with Ten Mile Creek (downstream end). The channel slope averages around 0.6-0.8%. Unnamed Tributary 3 is is almost entirely undeveloped, with the exception being the Ten Mile Road culvert. The entire reach is overgrown with trees and shrubs in and around the channel. Access to the stream itself is limited. The Ten Mile Road culvert is the only crossing throughout the watershed.



Looking upstream of Ten Mile Road culvert. Channel is rocky with established vegetation on the overbanks. Ten Mile Road culvert is unable to convey any of the analyzed stom events.

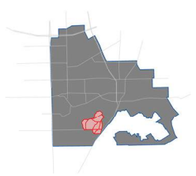


Looking downstream of Ten Mile Road culvert. Again the stream channel appears elatively rocky with shrubs growing within the channel. Heavier vegetation present on the overbanks.

WATERSHED NO.
15

COUNCIL DISTRICT
1

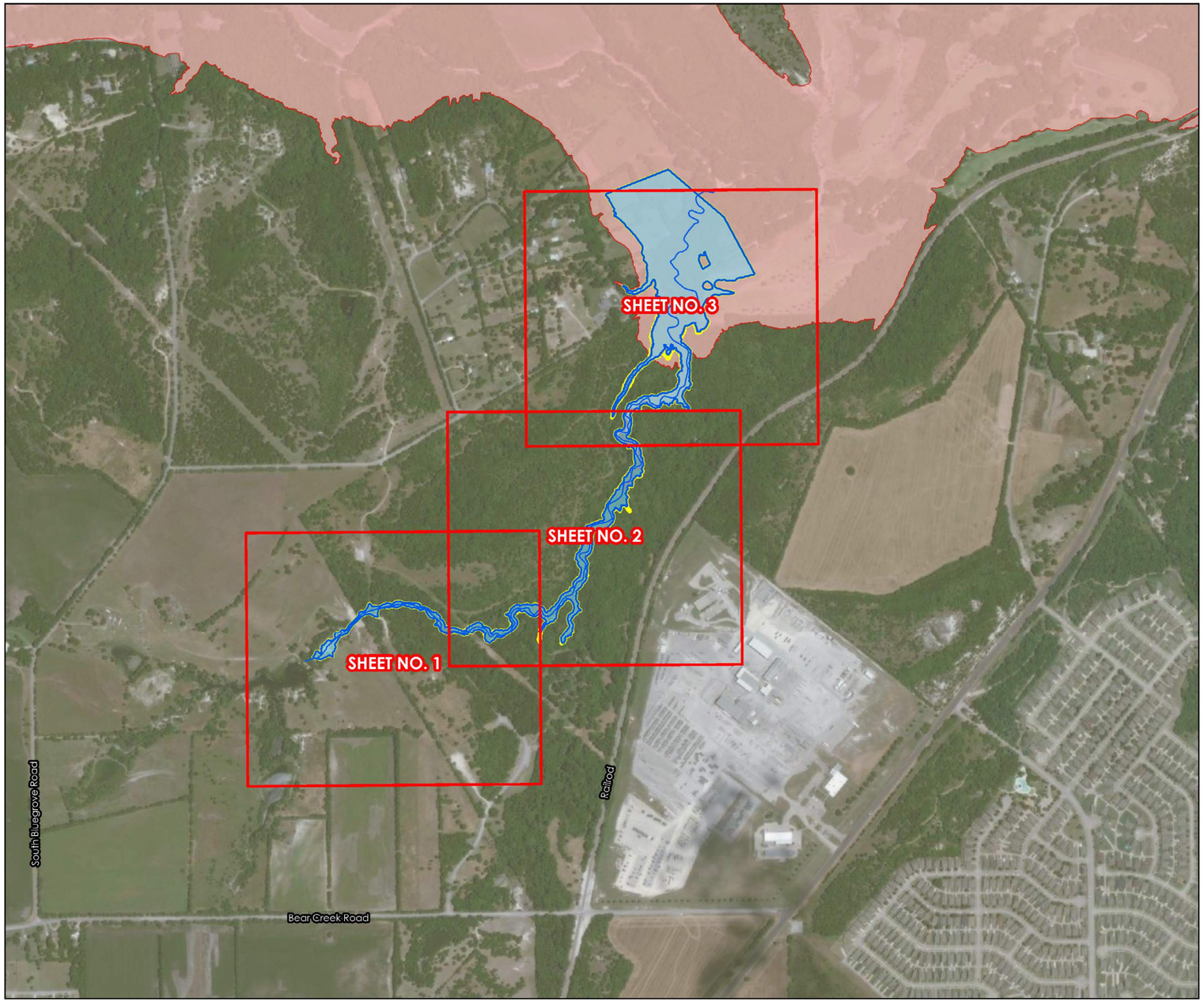
TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



2.2 FLOODPLAIN MAPPING

The Unnamed Tributary 3 hydraulics were analyzed with HEC-RAS 5.0.7. The model is comprised of one stream, one reach, twenty-one (21) cross sections, and one (1) hydraulic structures. The studied stream is 7,400 feet (1.40 miles) long. Near the confluence of the stream with Ten Mile Creek, the oodplain expands dramatically and inundates a large low-lying area. Oustide of this area, the floodplain remains contained within its channel.

The floodplain sheets display three different floodplains. The Existing 100-Year Floodplain (Blue) is based on an existing conditions watershed analysis, or an analysis that looks at the watershed conditions as they are at the time of the analysis (2021). 100-Year indicates that there is a 1% annual chance of the flooding event occurring in a given year. The Ultimate 100-Year Floodplain (Yellow) is determined based on fully developed watershed conditions. The fully developed or ultimate conditions anticipate the watershed having no areas without development except where city zoning maps indicate future open space. Finally, the Ten Mile Creek Floodplain (Red) is the 100-Year floodplain for Ten Mile Creek. Ten Mile Creek is a major creek running through the City of Lancaster and many of the smaller streams flow into Ten Mile Creek. Because of its size relative to the other streams, the backwater of Ten Mile Creek has a higher water surface elevation than those smaller creeks flowing into it, meaning that the Ten Mile Creek backwater is the controlling flood elevation in those areas, particularly near the confluences.



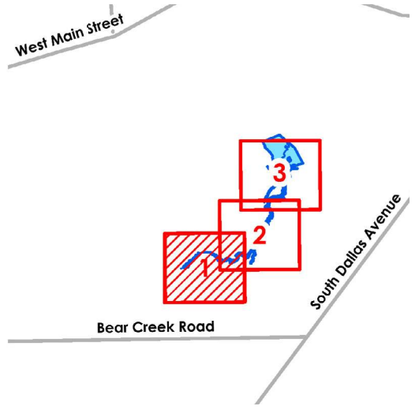
STREAM CENTERLINE
UNNAMED TRIB 3 VIEWPORTS
EXISTING 100-YEAR FLOODPLAIN
ULTIMATE 100-YEAR FLOODPLAIN
TEN MILE FLOODPLAIN

N

N.T.S.

FLOODPLAIN: SHEET 1





N

0 100 200
Feet

- UNNAMED TRIB 3 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- UNNAMED TRIB 3 BASE FLOW ELEVATIONS
- PARCEL

UNNAMED TRIBUTARY 3

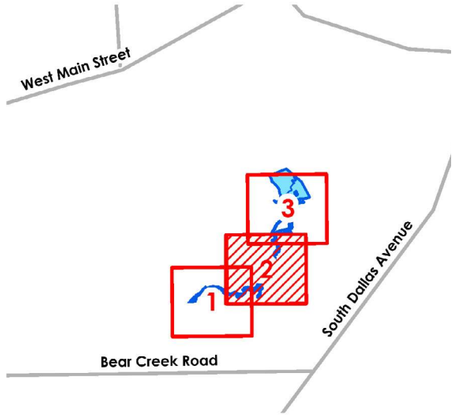
2.0 HYDRAULICS

WATERSHED NO.
15

COUNCIL DISTRICT
1

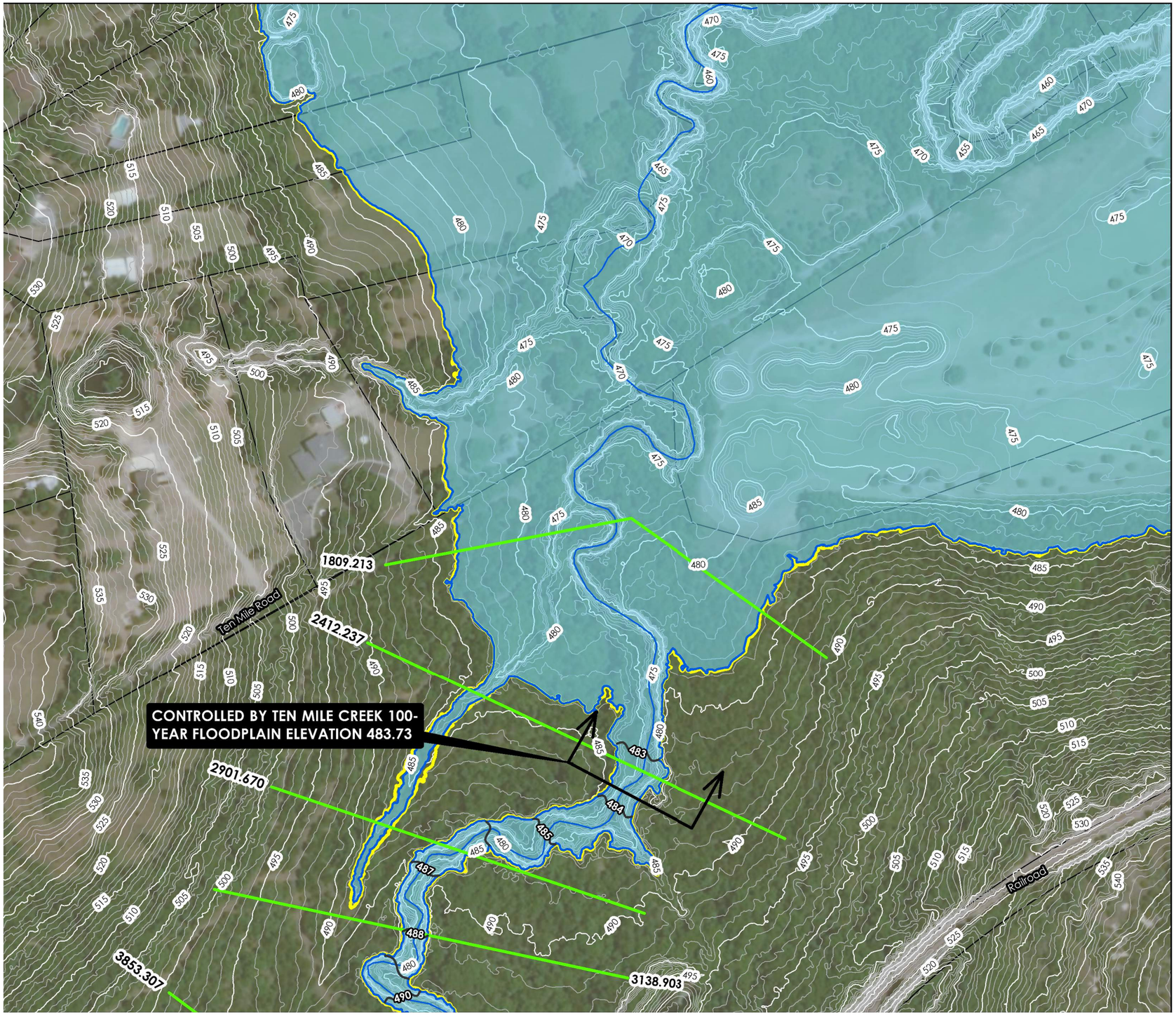
TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI

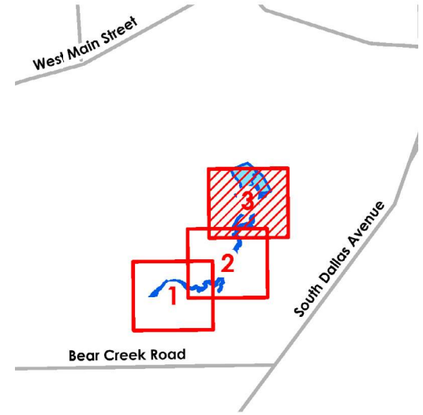
FLOODPLAIN: SHEET 2





FLOODPLAIN: SHEET 3





N

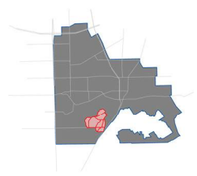
0 100 200 Feet

- UNNAMED TRIB 3 CROSS SECTIONS
- STREAM CENTERLINE
- EXISTING 100-YEAR FLOODPLAIN
- ULTIMATE 100-YEAR FLOODPLAIN
- LIDAR MAJOR CONTOURS
- LIDAR MINOR CONTOURS
- UNNAMED TRIB 3 BASE FLOW ELEVATIONS
- PARCEL

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



2.3 HYDRAULIC RESULTS: 1-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	530.64	530.81	2.79	3.05
7235.567	525.16	525.35	4.94	5.39
6835.259	517.10	517.48	1.44	1.70
6513.180	515.99	516.21	5.28	5.67
6042.757	507.26	507.55	2.11	2.23
5735.439	501.42	501.94	8.39	9.06
4961.718	496.32	497.39	4.39	4.92
4492.545	492.33	493.27	8.19	8.83
4183.783	489.71	490.84	5.57	6.13
3853.307	488.26	489.38	4.62	5.27
3138.903	483.74	484.65	6.50	7.16
2901.670	482.52	483.50	4.39	4.85
2412.237	479.86	481.23	5.10	4.40
1809.213	476.96	477.87	4.13	4.26
1222.562	475.99	476.36	2.10	2.79
1205.027	475.95	476.32	2.58	3.07
1188.018	UNNAMED CROSSING			
1170.131	475.23	475.58	2.45	3.22
1148.584	475.05	475.11	3.63	5.48
851.5899	475.15	475.34	0.57	0.85
562.4075	475.14	475.32	0.63	0.87
123.4598	475.13	475.31	0.45	0.61

2.3 HYDRAULIC RESULTS: 2-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	530.87	530.99	3.11	3.36
7235.567	525.41	525.57	5.53	5.86
6835.259	517.60	517.91	1.78	1.99
6513.180	516.28	516.47	5.78	6.02
6042.757	507.62	507.97	2.30	2.26
5735.439	502.09	502.70	9.16	9.82
4961.718	497.43	498.28	4.94	5.37
4492.545	493.30	494.17	8.84	9.05
4183.783	490.89	491.84	6.15	6.58
3853.307	489.42	490.32	5.29	5.83
3138.903	484.68	485.44	7.18	7.64
2901.670	483.53	484.18	4.88	5.42
2412.237	481.26	481.78	4.41	4.75
1809.213	477.88	478.37	4.30	4.59
1222.562	476.50	476.72	2.69	3.15
1205.027	476.48	476.70	2.82	3.19
1188.018	UNNAMED CROSSING			
1170.131	476.27	476.45	2.46	2.96
1148.584	476.15	476.26	3.38	4.18
851.5899	476.21	476.35	0.71	0.89
562.4075	476.21	476.34	0.63	0.78
123.4598	476.20	476.33	0.45	0.55

2.3 HYDRAULIC RESULTS: 5-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	531.11	531.22	3.57	3.77
7235.567	525.72	525.87	6.13	6.32
6835.259	518.19	518.45	2.18	2.36
6513.180	516.64	516.78	6.28	6.51
6042.757	508.14	508.32	2.45	2.59
5735.439	502.93	503.73	10.04	9.58
4961.718	498.63	499.39	5.54	5.99
4492.545	494.54	495.58	9.08	8.78
4183.783	492.23	493.29	6.75	6.94
3853.307	490.69	491.61	6.04	6.52
3138.903	485.74	486.42	7.85	8.37
2901.670	484.43	485.02	5.64	6.17
2412.237	481.99	482.51	4.90	5.24
1809.213	478.53	478.86	4.78	5.24
1222.562	478.16	478.37	1.89	2.22
1205.027	478.16	478.37	1.80	2.08
1188.018	UNNAMED CROSSING			
1170.131	478.14	478.34	1.67	1.94
1148.584	478.10	478.29	2.23	2.63
851.5899	478.11	478.31	0.68	0.82
562.4075	478.11	478.30	0.51	0.59
123.4598	478.11	478.30	0.36	0.42

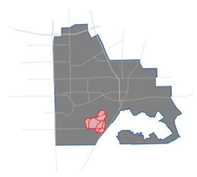
2.3 HYDRAULIC RESULTS: 10-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	531.22	531.35	3.77	4.00
7235.567	525.87	526.05	6.32	6.55
6835.259	518.44	518.75	2.36	2.58
6513.180	516.78	516.97	6.51	6.77
6042.757	508.38	508.64	2.51	2.64
5735.439	503.67	504.34	9.88	9.68
4961.718	499.30	500.12	5.93	6.14
4492.545	495.43	496.83	8.84	7.73
4183.783	493.14	494.38	6.96	6.20
3853.307	491.48	492.28	6.46	6.90
3138.903	486.36	486.97	8.26	8.68
2901.670	485.07	485.62	5.92	6.33
2412.237	481.97	482.35	6.05	6.48
1809.213	479.51	479.70	3.67	4.05
1222.562	479.31	479.45	1.62	1.88
1205.027	479.31	479.45	1.46	1.72
1188.018	UNNAMED CROSSING			
1170.131	479.28	479.44	1.39	1.59
1148.584	479.26	479.41	1.91	2.21
851.5899	479.26	479.41	0.68	0.79
562.4075	479.26	479.41	0.47	0.53
123.4598	479.26	479.41	0.33	0.37

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI



2.3 HYDRAULIC RESULTS: 25-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	531.42	531.54	4.10	4.31
7235.567	526.13	526.29	6.65	6.80
6835.259	518.89	519.16	2.68	2.86
6513.180	517.05	517.20	6.91	7.17
6042.757	508.79	509.07	2.66	2.73
5735.439	504.51	505.12	9.88	9.73
4961.718	500.23	500.90	6.19	6.44
4492.545	496.90	497.30	7.84	8.31
4183.783	494.49	495.17	6.18	6.07
3853.307	492.36	493.07	7.02	7.43
3138.903	487.19	487.73	8.51	8.91
2901.670	486.14	486.72	5.82	6.08
2412.237	481.59	481.77	8.66	9.56
1809.213	481.76	481.92	1.83	2.03
1222.562	481.71	481.87	1.06	1.17
1205.027	481.71	481.87	0.97	1.07
1188.018	UNNAMED CROSSING			
1170.131	481.70	481.84	0.96	1.05
1148.584	481.69	481.83	1.25	1.38
851.5899	481.69	481.83	0.56	0.63
562.4075	481.69	481.83	0.35	0.39
123.4598	481.69	481.83	0.25	0.28

2.3 HYDRAULIC RESULTS: 50-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	531.53	531.66	4.31	4.46
7235.567	526.29	526.48	6.79	6.71
6835.259	519.17	519.41	2.86	3.04
6513.180	517.19	517.35	7.23	7.40
6042.757	509.12	509.39	2.67	2.73
5735.439	505.11	505.65	9.92	9.78
4961.718	500.83	501.49	6.43	6.68
4492.545	497.23	497.77	8.33	8.43
4183.783	495.12	495.83	6.06	5.98
3853.307	493.05	493.77	7.34	7.74
3138.903	487.56	488.12	9.10	9.48
2901.670	486.25	486.91	6.59	6.72
2412.237	482.52	482.50	7.34	8.64
1809.213	482.74	482.84	1.55	1.76
1222.562	482.71	482.79	1.00	1.15
1205.027	482.71	482.79	0.92	1.05
1188.018	UNNAMED CROSSING			
1170.131	482.65	482.79	0.91	1.03
1148.584	482.64	482.78	1.17	1.33
851.5899	482.64	482.78	0.56	0.64
562.4075	482.64	482.78	0.34	0.38
123.4598	482.64	482.78	0.25	0.27

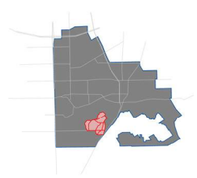
2.3 HYDRAULIC RESULTS:
100-YEAR

CROSS SECTION	WATER SURFACE ELEVATION (ft)		CHANNEL VELOCITY (fps)	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
7522.595	531.66	531.79	4.46	4.66
7235.567	526.48	526.61	6.71	7.00
6835.259	519.41	519.70	3.04	3.23
6513.180	517.35	517.52	7.40	7.67
6042.757	509.48	509.84	2.65	2.69
5735.439	505.62	506.26	10.07	9.94
4961.718	501.34	501.90	6.67	7.04
4492.545	497.61	498.16	8.58	8.56
4183.783	495.72	496.58	5.98	5.78
3853.307	493.67	494.58	7.64	7.81
3138.903	487.94	488.46	9.57	10.02
2901.670	486.38	486.95	7.30	7.55
2412.237	483.46	483.47	6.46	7.47
1809.213	483.67	483.78	1.36	1.54
1222.562	483.65	483.75	0.96	1.06
1205.027	483.65	483.75	0.88	0.98
1188.018	**UNNAMED CROSSING**			
1170.131	483.63	483.74	0.88	0.97
1148.584	483.63	483.73	1.12	1.23
851.5899	483.63	483.73	0.51	0.56
562.4075	483.63	483.73	0.34	0.40
123.4598	483.63	483.73	0.25	0.29

WATERSHED NO.
15

COUNCIL DISTRICT
1

TOTAL DRAINAGE AREA
1.01 SM
*
STREAM LENGTH
1.40 MI

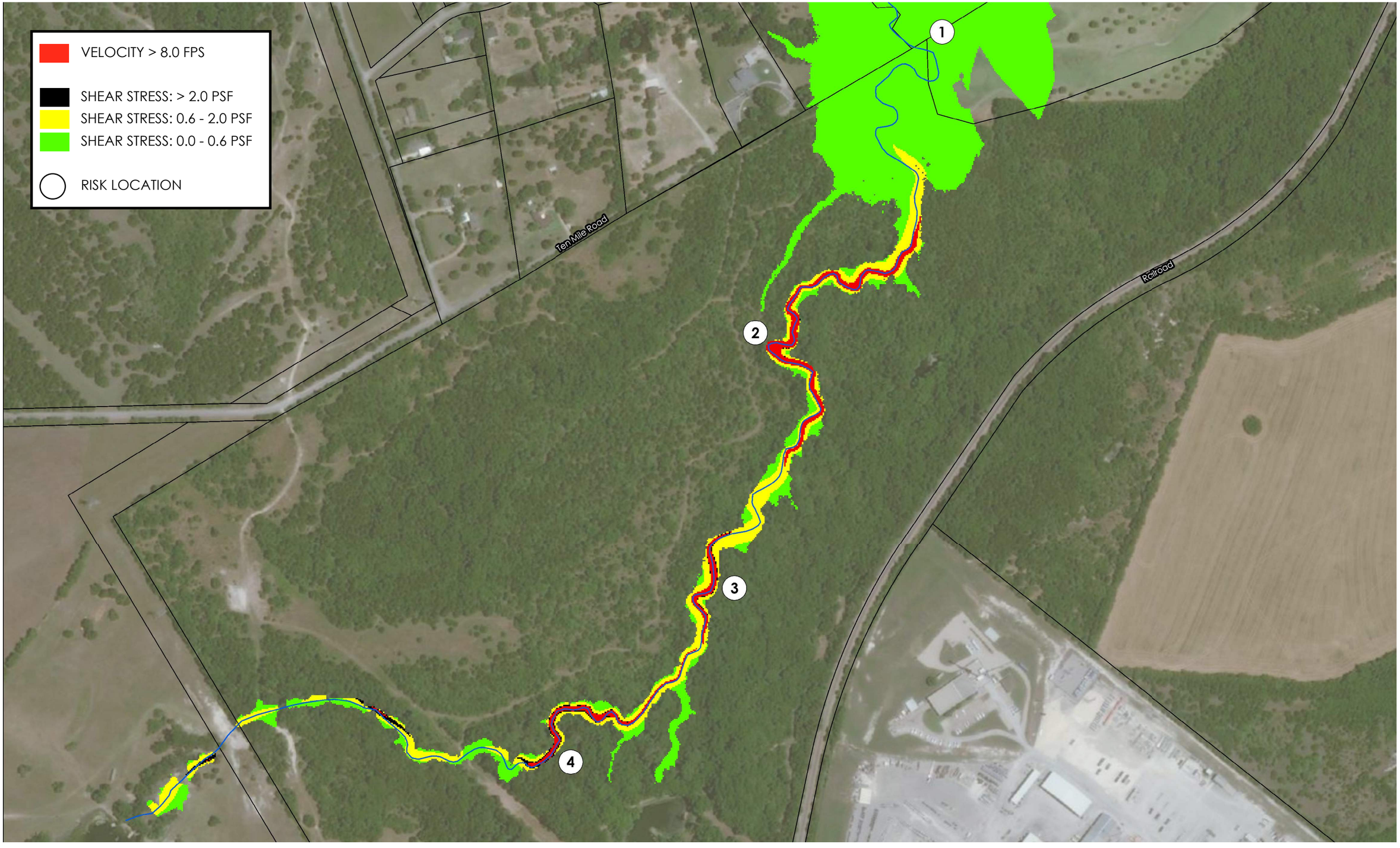


3.1 RISK IDENTIFICATION

Four risk areas were identified in this study. The risks include one over-topping Bridge and three locations of erosive velocities. The Ten Mile Creek bridge which over-tops in all analyzed flooding events is a small bridge which acts as a driveway to a private property. Very little traffic is expected. The three areas where the RAS model shows erosive velocities >8 fps are all located in the undeveloped and heavily wooded areas shown on the map. Erosion is likely, but is expected to be inconsequential. No structures are located within the Unnamed Tributary 3 floodplain. The following map shows the shear stresses associated with the Unnamed Tributary 3 floodplain.

RISK IDENTIFICATION

Risk Map Number	Location	Problem	Frequency	Safety Risk	Priority
1	Ten Mile Road	Over-topping Private Roadway	1-Year	Private	Low
2	River Station 3139	Potential Erosion Hot Spot	1-Year	Private	Very Low
3	River Station 4493	Potential Erosion Hot Spot	1-Year	Private	Very Low
4	River Station 5735	Potential Erosion Hot Spot	1-Year	Private	Very Low


VELOCITY > 8.0 FPS
SHEAR STRESS: > 2.0 PSF
SHEAR STRESS: 0.6 - 2.0 PSF
SHEAR STRESS: 0.0 - 0.6 PSF
RISK LOCATION
Ten Mile Road
Railroad
1
2
3
4

