



**US Army Corps
of Engineers®**

Funded by

New Orleans District

**State of Louisiana Silver Jackets Interagency
Pilot Project Program
W912PS-11-D-0022**

Lafayette Parish Areawide Drainage Plan



May 2017



McBADE
ENGINEERS & CONSULTANTS, LLC

JESCO ENVIRONMENTAL
& Geotechnical Services, Inc.

Table of Contents

Acronyms and Abbreviations.....	3
1.0 Executive Summary.....	5
2.0 Introduction	12
2.1 Background	12
2.2 Objective	13
2.3 Scope of Work.....	13
3.0 Data Collection.....	17
3.1 Previous Drainage Studies and Models	17
3.1.1 Lafayette Parish Master Drainage Plan.....	17
3.1.2 City of Carencro, Lafayette Parish, Louisiana Continuing Authorities Program Section 205 Feasibility Study	18
3.1.3 Additional Studies, Plans and Models.....	19
3.1.4 Recently Completed and Ongoing Projects	21
4.0 Existing Conditions.....	24
4.1 City of Lafayette and Lafayette Parish	24
4.1.1 Drainage System	24
4.1.2 Soil conditions.....	25
4.1.3 Problem Areas.....	37
4.2 City of Broussard	37
4.2.1 Drainage System	37
4.2.2 Problem Areas.....	38
4.3 City of Carencro	38
4.3.1 Drainage System	38
4.3.2 Problem Areas.....	38
4.4 City of Scott.....	39
4.4.1 Drainage System	39
4.4.2 Problem Areas.....	39
4.5 City of Youngsville	39
4.5.1 Drainage System	40
4.5.2 Problem Areas.....	40
5.0 Current Ordinances and Requirements	52

5.1 Detention	52
5.2 Primary Drainage Systems	52
5.3 Enforcement	52
5.4 Maintenance	53
6.0 Alternatives Analysis	54
7.0 Potential Funding Sources	56
7.1 FEMA Pre-Disaster Mitigation (PDM) Grant Program	56
7.2 FEMA Flood Mitigation Assistance (FMA)	56
7.4 USACE Planning Assistance to States (PAS)	57
7.5 USACE Section 219 Environmental Infrastructure Program	57
7.6 USACE Floodplain Management Services (FPMS)	57
7.7 USACE Continuing Authorities Program (CAP) Section 205 Funding.....	58
7.8 NRCS Emergency Watershed Protection Program	59
7.9 Clean Water State Revolving Fund (CWSRF) Assistance.....	59
7.10 LADOTD Transportation Alternative Program (DOTDTAP)	60
7.11 Capital Outlay Program	61
7.12 Bonding	61
7.13 Impact Fees	61
7.14 Permit Fees	62
7.15 Stormwater Utility Fee.....	62
8.0 Recommendations	63
8.1 Proposed Non-Structural Projects and Activities	63
8.1.1 Models and Data Development	63
8.1.2 Ordinance, Regulations and Requirements	64
8.2 Infrastructure Improvement Projects.....	65
8.2.1 Near Term Projects	66
8.2.2 Long Term Projects	67
8.2 Opinions of Probable Construction Costs	67
9.0 Conclusions	70
10.0 References	80

Acronyms and Abbreviations

ADA	American Disabilities Act
BFE	Base Flood Elevations
BMPs	Best Management Practices
CAD	Computer-Aided Design
CAO	Chief Administrative Officer
CAP	Continuing Authorities Program
CIP	Capital improvement projects
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DOTDTAP	LADOTD Transportation Alternative Program
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
FIS	Flood Information Survey
FMA	Flood Mitigation Assistance
FPMS	Floodplain Management Services
GIS	Geographic Information System
HOA	Homeowner's Association
I/I	Infiltration and Inflow
LADOTD	Louisiana Department of Transportation and Development
LCG	Lafayette Consolidated Government
LDEQ	Louisiana Department of Environmental Quality
LOMR	Letter of Map Revision
LUS	Lafayette Utilities System
MPO	Metropolitan Planning Organization
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
PAS	Planning Assistance to States

PE	Professional Engineer
PDM	Pre-Disaster Mitigation
SDWA	Safe Drinking Water Act
SFHA	Special Flood Hazard Area
SWMP	Stormwater Management Program
UDC	Unified Development Code
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture

1.0 Executive Summary

Areas within Lafayette Parish have experienced an increase in the number of rain events resulting in localized flooding, road, school and business closures, home flooding and flooding of City infrastructure. Lafayette Parish has experienced tremendous growth over the previous fifteen years. Currently, the Parish and the cities within the Parish implement the Lafayette Parish Unified Development Code (UDC) and the Louisiana Department of Transportation and Development (LaDOTD) regulations and additional local, state and federal requirements for design of new drainage infrastructure. The Parish and local cities implement limited, routine maintenance of the current infrastructure. However, there isn't an area-wide stormwater management plan for the parish or larger region identifying the "problem areas and choke points" and identifying capital improvement projects to address drainage issues.

Existing drainage systems within the Parish of Lafayette discharging into waterways that are hydrologically dependent on each other require effective communication and participation of City and Parish leaders and the public to maintain drainage and reduce the risk of adversely impacting property within the drainage area as a standard of practice. There has been limited coordination and efforts within the parish to manage stormwater and address drainage issues on a parish-wide, region-wide or watershed basis. With limited funding, communication, and coordination between cities, each city's recommendations are alternatives focused on the local drainage improvements that the community can provide and regulate on their own.

To address drainage issues in the parish, administrations from the Cities of Youngsville, Scott, Broussard, Carencro and Lafayette, as well as the Parish of Lafayette, requested federal assistance to develop an area-wide plan that identifies capital improvement projects and best management practices (BMPs) for stormwater management. Based upon potential federal funding options that are available it was decided that leadership would request funding from the State of Louisiana Silver Jackets Interagency Pilot Project Program. The State of Louisiana Silver Jackets Interagency Pilot Project Program provides communities with opportunities to work with all appropriate State and Federal agencies to develop a comprehensive flood risk management program to reduce flood risk by establishing priorities.

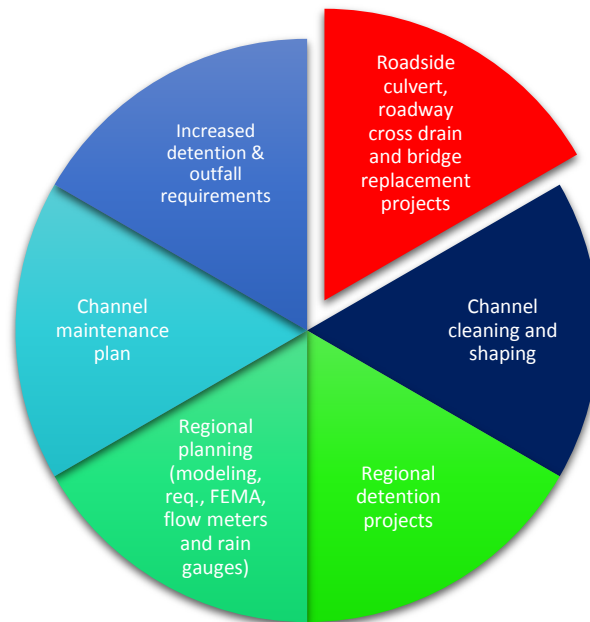
The overall goal of this study and plan should serve as a guideline for the administrations within the parish and the cooperating cities to address stormwater management issues and the design and construction of drainage projects within the parish and the Vermilion-Teche watershed.

The following items were identified from this evaluation to contribute to the drainage issues within Lafayette Parish:

- limited available capacity in receiving streams due to lack of access, authority and maintenance
- limited existing design criteria of detention systems

- increase in impervious area with minimal detention volume requirements
- undersized roadway cross drains and ditch culverts
- lack of maintenance of private drainage systems in developments
- absence of a regional approach to drainage issues
- absence of consistent regional requirements for drainage design, floodplain management and stormwater management

The figure below shows the six (6) categories of projects that were identified and are recommended to address stormwater management within Lafayette Parish. The projects provide the most benefit when performed in concert with a regional cooperation and coordination approach in lieu of the current independent approach.



An approach, similar to that of other states, would be to work regionally specifically within a common watershed because the flow of stormwater is continuous through cities and parishes. Water does not know political boundaries. The majority of the projects identified by each municipality and by the parish are limited in scope to an immediate area within the city limits of that municipality due, in part, to limited joint efforts and coordination between the municipalities within and outside of the Lafayette Parish and limited available funds for the larger projects that would benefit a larger geographic area. A dedicated regional authority, to manage the water resources within the watershed, is recommended as a long-term solution. However, this will require legislation. In the absence of a dedicated authority, the governments within the watershed must commit to a regional approach, work with state and federal agencies in identifying and completing large scale projects, and work to develop ordinances, maintenance plans and minimum standards of practice for the management and design of regional stormwater management.

Consistent with the regional approach, the following projects and activities are recommended to minimize drainage issues within the Parish. Due to the costs of construction, activities associated with the recommendations below, immediate focus must be on updating data and modeling of scenarios to verify size, location, downstream and upstream impacts as well as cost of structural alternatives first before proceeding to design and construction. This is important as many recent suggestions of simply cleaning or upgrading one area could greatly impact areas

downstream outside of the cities and Lafayette Parish affecting neighboring parishes getting significant increases of water. **Table 1** is a summary of the recommended non-structural and structural projects recommended, the areas of benefit, the priority, the potential funding mechanisms and planning level costs.

Understanding there are several projects listed above and there is limited funding within Lafayette Parish and the cooperating cities, it is recommended that as a group they seek funding with the USACE, NRCS, and the LDEQ to accomplish the parish-wide and regional projects and as individual communities pursue mitigation funding with FEMA and NRCS based upon the Great Flood of 2016 and consider general funds, bonds and permit fees to assist in the funding of the smaller local drainage projects. The communities should consider implementing a stormwater utility to fund their individual stormwater projects.

Table 1 Recommended Non-Structural Activities and Structural Projects

Alternative	Beneficial Area	Priority Level	Potential Funding Mechanisms	Planning Level Costs
Develop a model of the Vermilion River that includes updated cross sections and utilizes collected rainfall data for the past 15-20 years	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$500,000
Develop a Vermilion-Teche Watershed model that includes the thirty-three identified channels of the Lafayette Parish Drainage Map	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$750,000
Using the collected rainfall data, develop a watershed rainfall distribution to be used in the design calculations for structural project and the future planning and design for development	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$50,000
Install rain gauges and flow meters along major channels prone to flooding to monitor and collect data for future planning and design	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$350,000
Use the more recent trends of rainstorm events in planning, ordinance development and design regulations for drainage infrastructure	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	N/A
Work with neighboring parishes on a regional watershed approach to look for diversion and/or larger detention systems that provide benefit to the parish and watershed on a much larger scale	Parish and Vermilion-Teche watershed	1	USACE Section 205	N/A
Lafayette parish and surrounding areas within the Vermilion-Tech watershed adopt an ordinance similar to the City of Youngsville requiring 25-year storm event detention on new development with requirements for modeling using recent data, backflow prevention and 25-year event tailwater on receiving streams	Parish and Vermilion-Teche watershed	1	General Fund	N/A
Cities within the parish should include in their permit and inspection process for new development inspection of all site development for conformance with the permit issued	Cities and Parish	1	Permit Fees, General Fund, Stormwater Utility	N/A
Development of a Youngsville Drainage Model	City of Youngsville and unincorporated areas of Lafayette Parish	1	Planning Assistance to States (PAS). USACE FPMS	\$250,000
Enforcement of the drainage ordinances that identify developer maintenance of drainage collection systems until the developments are 70-80%	Cities and Parish	1	Permit Fees, General Fund, Stormwater Utility	N/A
Increased monitoring and enforcement of erosion and sediment control measures on construction sites	Cities and Parish	1	Permit Fees, General Fund, Stormwater Utility	N/A
The development of a routine maintenance plan for channel maintenance within the Parish	Cities and Parish	1	General Fund, Impact Fee, Stormwater Utility	\$1,500,000 annually
Clean channels and laterals within the parish as soon as possible to restore the historical capacity of the water bodies:	Cities and Parish	1	General Fund, FEMA HGMP	
Coulee Ile Des Cannes	City of Scott, City of Lafayette and Unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$500,000
Coulee Mine East	City of Scott, City of Lafayette and Unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$500,000
Cypress Bayou and laterals	City of Broussard and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$750,000
Coulee LaSalle and laterals	City of Youngsville, City of Broussard and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$750,000
Bayou Parc Perdue coulee and laterals	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$650,000
Isaac Verot Coulee	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$650,000

Alternative	Beneficial Area	Priority Level	Potential Funding Mechanisms	Planning Level Costs
Anslem Coulee and laterals	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HMGP	\$350,000
Request USACE assistance with dredge maintenance of the Vermilion River	Parish and Vermilion-Teche watershed	1	USACE Section 219	
Complete the channel regrading projects of Coulee Mine East and Cypress Bayou	City of Scott, City of Broussard, City of Lafayette and unincorporated areas of Lafayette Parish	2	USACE Section 219	\$2,500,000
Replace cross drains at along Hwy 90 at Coulee LaSalle and Cypress Bayou	City of Youngsville, City of Broussard and unincorporated areas of Lafayette Parish	1	LADOTDTAP	\$1,000,000
Replace undersized Larriviere Road coulee and lateral crossings	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP, USACE Section 219,	\$1,250,000
Replace Fortune Road and Bonin Road undersized crossings	City of Youngsville and unincorporated areas of Lafayette Parish	3		\$900,000
Replace Savoy Road and Iberia Street undersized bridges	City of Youngsville	3		\$950,000
Construct regional detention systems at the following locations:				
Along Coulee Ile Des Cannes in Scott	City of Scott, City of Lafayette and unincorporated areas of Lafayette Parish	1	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	
Along Bayou Parc Perdue in Youngsville	City of Youngsville and unincorporated areas of Lafayette Parish	1	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$8,000,000
Along Coulee LaSalle in Youngsville	City of Youngsville, City of Broussard and unincorporated areas of Lafayette Parish	1	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$4,000,000
Along Anslem Coulee/Isaac Verot Coulee in Youngsville	City of Youngsville and unincorporated areas of Lafayette Parish	3	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$2,500,000
Along Cypress Bayou in Broussard	City of Broussard and unincorporated areas of Lafayette Parish	3	USACE Section 205, FEMA HMGP, FEMA PDM	\$2,500,000
Along Indian Bayou in the unincorporated area of Lafayette Parish	Unincorporated areas of Lafayette Parish	3	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$3,500,000

2.0 Introduction

Areas within Lafayette Parish have experienced an increase in the number of rain events resulting in localized flooding, road, school and business closures, home flooding and flooding of City infrastructure. Lafayette Parish has experienced tremendous growth over the previous fifteen years. Currently, the Parish and the cities within the Parish implement the Lafayette Parish Unified Development Code (UDC) and the Louisiana Department of Transportation and Development (LaDOTD) regulations and additional local, state and federal requirements for design of new drainage infrastructure. The Parish and local cities implement limited, routine maintenance of the current infrastructure. However, there isn't an area-wide stormwater management plan for the parish or larger region identifying the "problem areas and choke points" and identifying capital improvement projects to address drainage issues.



To address drainage issues in the parish, administrations from the Cities of Youngsville, Scott, Broussard, Carencro and Lafayette, as well as the Parish of Lafayette, requested federal assistance to develop an area-wide plan that identifies capital improvement projects and best management practices (BMPs) for stormwater management.

2.1 Background

In August of 2014 the City of Youngsville contacted the USACE to inquire about the Planning Assistance to State (PAS) program and other programs that may be available to assist the City of Youngsville and Lafayette Parish in developing a Parish-wide drainage plan to identify the drainage issues and recommend improvements to reduce the flooding.

A meeting was held at the Youngsville City Hall on August 25, 2014 with representatives from the cities of Youngsville, Broussard, Scott, Lafayette, Carencro as well as the USACE and local and state legislative delegates. During that meeting two potential funding programs were discussed, PAS and the State of Louisiana Silver Jackets Interagency Pilot Project Program. Based upon the two different funding programs objectives and requirements it was decided that the State of Louisiana Silver Jackets Interagency Pilot Project Program would be explored for funding for an area-wide drainage plan for Lafayette Parish. The State of Louisiana Silver Jackets Interagency Pilot Project Program provides communities with opportunities to work with all appropriate State and Federal agencies to develop a comprehensive flood risk management program to reduce flood risk by establishing priorities.

In January of 2015, the Lafayette Parish area-wide drainage plan was selected and funded as part of the State of Louisiana Silver Jackets Interagency Pilot Project Program. A follow up meeting was held in June 2016 with representatives from each of the cooperating cities of Youngsville, Scott, Carencro, Broussard as well as the Lafayette Consolidated Government to discuss the plan tasks and objectives.

During the preparation of the draft of this study, a historic flood event occurred so the data collection, analysis, results and recommendations were included the event.

In August of 2016, Lafayette Parish experienced heavy rainfall from Friday August 12 to Sunday August 14 that resulted in flooding that affected more than 9,000 homes within the Parish. The rainfall within the parish reached as high as 28" inches in 30 hours in the City of Youngsville, where more than 600 homes flooded. The event has been identified as a 500-1,000-year storm event.



2.2 Objective

The objective of the project effort is to meet with the individual cooperating Cities' staff, review ordinances, studies and plans for each City and the parish and to develop a plan that includes a prioritized capital improvement plan and best management practices that the parish and cities collectively can use to apply for funding for the projects and as a guide to implement the projects on an area wide/parish wide basis.

2.3 Scope of Work

The following paragraphs outline the plan's scope of work:

➤ ***Project Management and Meetings***

This subtask covers the attendance at meetings with the individual Cities of Youngsville, Broussard, Carencro, Scott and the Lafayette Consolidated Government as well as meetings with the group as a whole to collect stormwater management plan data from staff that includes current and future drainage projects and flooding complaints areas and to provide updates on the progress of the plan. In addition, meetings are anticipated with the USACE for coordination and updates. This subtask also includes the project coordination and the scheduling and attendance of internal project team meetings throughout the project.

➤ ***Data Collection and Review***

Various data collection activities will be performed for the purposes of this plan. The following is a list of the subtasks associated with this effort:

- ***Previous Drainage Studies and Models***

The following previous drainage studies and models will be collected and reviewed:

- FEMA models for the parish
- Drainage studies and/or plans from each City
- City wide models available from each City
- USACE models of the surrounding area

- ***Drainage Issues Identification and Documentation***

The following data will be collected as part of this subtask:

- Available Resident and Business Drainage issues/flooding complaint documentation from each City
- Identification of ponding and flooding areas based upon recent events from interviews with City Staff
- Rainfall accumulation data for recent events
- GIS maps or data from each City as available

- ***Summary of Data Collection and Review***

A summary of the data collection efforts performed will be prepared for inclusion in the stormwater management plan. It will include the following:

- Narrative of the data collection and review efforts
- List of drainage studies, models and reports collected and used as references
- Maps as needed for data identification purposes

➤ ***Plan Formulation***

This subtask includes the development of the areawide stormwater management plan with activities that include:

- ***Identification of Alternatives***

This subtask includes the identifications of up to four (4) alternatives for each City taken from the respective City's plan alternatives to address the current flooding issues in the Lafayette area based upon the data collected in Task 2. The alternatives will include those identified in the drainage studies/plans from each individual City only.

- ***Evaluation of Alternatives and Recommendations***

This subtask includes the evaluations and prioritization of the recommended alternatives using the following criteria:

- The impact of the improvement to decrease in flooding
- Right of way
- Condition of existing infrastructure
- Ability of alternative to address the drainage issues
- Constructability

- Permitting
- Environmental impacts
- Impacts to adjacent property
- Impacts to other infrastructure

- ***Development of Planning Level Opinions of Probable Construction Costs***

This effort associated with this subtask includes the development of Planning Level Opinions of Probable Construction Costs based upon the recommendations of Task 3.2 on an alternative basis.

- ***Potential Funding Sources***

Potential funding sources will be investigated for the design and construction of the recommended alternatives. A narrative describing each potential funding source investigation will be developed for inclusion in the final report.

- ***Review of Drainage Ordinances and Requirements***

This subtask includes the review of:

- City subdivision, land use and drainage ordinance and requirements
- Lafayette Parish subdivision, land use and drainage ordinances and requirements
- LaDOTD Hydraulic requirements
- Other Lafayette Parish drainage ordinances and requirements
- Examples of other drainage ordinance and requirements in more stringent areas, i.e. Florida.

A summary of the review of drainage ordinances and requirements will be developed for inclusion on the final report. The summary will include:

- A narrative describing the existing drainage ordinances and requirements
- A list of the other sources reviewed
- A recommendation of any changes to the existing drainage ordinances and requirements

➤ ***Preparation of Plan***

A report will be developed that will include the following:

- Narratives describing the data collection and review, identification of alternatives, evaluation of alternatives and potential funding sources
- Planning Level Opinions of Probable Construction Costs
- 5 and 10-year Capital Improvement Plans
- Evaluation matrix
- List of references
- Any Field investigation summaries and photographs

A draft report will be developed and submitted to the Cities and USACE for review. After receipt of comments, the final report will be prepared and submitted to the Cities and USACE for approval. One (1) hard copy and one electronic copy in pdf form for the draft and final reports will be submitted to each City and USACE.

Assumptions

The following assumptions are included in the scope of work.

- NO modeling effort of existing models will be performed. Models will be reviewed for planning purposes only.
- Drainage studies and/or plans will be provided by each City.
- The only deliverables provided will be agendas, progress reports, schedules, invoices, minutes and the draft and final reports.

3.0 Data Collection

The following data was collected and reviewed as part of this plan:

- Meetings with cooperating Cities' staff
- Minutes of each City's monthly council meeting for the past three (3) years
- United State Geological Service (USGS) soils data and maps
- Drainage maps
- Federal Emergency Management Assistance (FEMA) maps, HEC-RAS hydrologic and hydraulic models and Geographic Information System (GIS) data
- City Masterplans and comprehensive plans
- Drainage plans and modeling performed within Lafayette Parish for the USACE
- Rainfall data
- Documentation of drainage issues from cooperating cities
- Agency programs which fund drainage and water resources projects
- Aerial photographs
- Topographic maps

3.1 Previous Drainage Studies and Models

After visits with cooperating cities and review of data provided by cities and collected, it was determined that there have been limited drainage studies and models performed within the Lafayette Parish. The two (2) largest completed drainage study and models completed to date are the "*Lafayette Parish Master Drainage Plan*" dated June 2008 prepared for the USACE and the "*City of Carencro, Lafayette Parish, Louisiana, Continuing Authorities Program Section 205 Feasibility Study*" dated 2012 prepared for the USACE. Both studies were performed in response to the heavy rainfall of Tropical Storm Allison in 2001.

3.1.1 Lafayette Parish Master Drainage Plan

The objective of this study and plan was to conduct hydrologic and hydraulic modeling analysis for five project scenarios pre-identified by the Lafayette Parish Consolidated Government(LCG) and other Lafayette Parish stakeholders using the FEMA approved Digital Flood Insurance Rate Map (DFIRM) models as the base models. The models for the "Lafayette Parish Master Drainage Plan" were expanded and focused primarily on the Carencro area, Coulee Fortune North and South (aka Cypress Bayou) and Coulee LaSalle due to the flooding in those areas especially along Hwy 90 where Coulees Fortune North and South and LaSalle cross the highway as well as Coulee Mine and Louisiana Avenue Exit at Interstate 10.

Several alternatives were identified for each of the five (5) areas. The alternatives basically consisted of derivations of the following:

- Channel widening
- Concrete lining of channels
- Adding and/or modifying culverts at cross drains

- Replacing bridge sections
- Adding channels
- Detention

In summary, many of the alternatives had minimal impact on the areas of flooding, some reduced the water levels at the areas of the flooding concern but caused higher water surface profile downstream or upstream. The alternative scenario that provided the most benefit while also not adversely impacting areas upstream or downstream is detention.

The following are other results of importance of the study that play a large role on the current continued flooding experiences of Lafayette Parish

- Many of the roads now used as collectors in the study areas are inundated at hypothetical 10-year storm events in 2001 conditions
- Many of the areas will flood with 31.9 inches of rainfall due to volume of runoff in 2001 conditions
- Concrete lined channels functioned hydraulically superior to vegetative bank channels but did result in increased water surface levels downstream in the vegetative bank channel areas

3.1.2 City of Carencro, Lafayette Parish, Louisiana Continuing Authorities Program Section 205 Feasibility Study

This study was conducted as part of the process of the Section 205 of the Flood Control Act of 1948 as amended which provides the authority to the USACE to plan and construct small flood damage reduction projects that have not already been specifically authorized by congress. The projects are done in cooperation with a non-Federal Sponsor that shares in the cost of the study and project. The goals of the study were to look at alternatives that: 1) reduce flood damages in the Carencro area and 2) do not induce flood damages to other areas within the watershed.

The study included alternatives with 11 structural measures and 6 nonstructural measures. The structural alternatives consisted of:

- Widening or enlarging coulees
- Lining of coulees with gabions or concrete
- Retention/detention basins
- Clearing, grubbing and dressing of Beau Bassin Coulee to remove debris that has accumulated

The nonstructural measures consist of:

- Purchasing properties and relocating or removing structures and using the land as open space
- Elevating structures

The selected preferred alternative from the study consisted of clearing and grubbing the Beau Bassin Coulee and construction of a retention pond.

3.1.3 Additional Studies, Plans and Models

City of Scott Comprehensive Plan

The City of Scott developed a comprehensive plan that identifies a Vision of Scott for 2032. The plan identifies the City's natural systems as a broad range of interconnected systems from the urban canopy to soils and hydrology. The plan identifies that as the City grows it will need to address flood hazards, water and air quality, enforce FEMA regulations and promote smart growth development using best management practices including low impact development strategies. The plan identified the following goals and strategies for the natural systems:

1. Minimize risks from flood hazards
 - a. Work with LCG to create a regional stormwater master plan
 - b. Discourage development in areas located inside of the 100-year flood hazard areas
 - c. Limit risk by enforcing the FEMA National Flood Insurance Program (NFIP) regulations for regulating floodplains and floodways
 - d. Participate in FEMA's community rating system (CRS) program
 - e. Improve the Ile Des Cannes Coulee
 - f. Create regional detention ponds in the floodplain and floodway
2. Develop a stormwater management program
 - a. Adopt standards and incentives that encourage reductions in runoff through the use of Best Management Practices (BMPs)
 - b. Generate a complete inventory of all of the channels, ditches, drainage basins, subsurface drainage network, flow directions, bridges and manholes
 - c. Inventory hydrologic data
 - d. Maintain an active intergovernmental agreement for the maintenance of channel outfalls that are located outside of the City of Scott corporate limits
 - e. Implement a public awareness and stormwater and water quality educational programs
 - f. Create and implement a channel and structure maintenance and inspection plan
3. Provide an interconnected greenway system
 - a. Acquire the property within the FEMA regulatory floodway
 - b. Develop and implement a greenway system
 - c. Acquire easement along the BNSF railroad right of way
4. Preserve and improve tree canopy
 - a. Encourage the preservation of significant trees
 - b. Promote landscaping and tree planting in the public realm
5. Ensure environmental quality
 - a. Promote industries that will maintain a high level of environmental quality standards

- b. Promote alternative transportation options, including bicycling, walking and transit
- 6. Preserve Soils and Topography
 - a. Preserve soils through adoption of compatible land use

City of Youngsville Master Plan

In November of 2015 the City of Youngsville completed a 10-year Master Plan that was adopted by the City Council in February 2016. The plan included more than \$7M in identified drainage improvements. The drainage improvements consisted of:

- Regional detention ponds within the Coulee LaSalle and Bayou Parc Perdue watersheds
- Channel cleaning of Bayou Parc Perdue, Coulee LaSalle, Anslem Coulee, Isaac Verot Coulee and several coulee laterals within the City
- Existing detention pond outfall modifications for Highland Ridge and Copper Meadows subdivisions
- Arterial and collector road cross drain replacement projects for Bonin, Fortune, Détente and South Larriviere roads

Non-structural project initiatives were also identified in the plan. The initiatives that are identified are:

- Drainage maintenance measures
- Install rain gauges and flow meters along Bayou Parc Perdue and Coulee LaSalle
- New best management practices
- Recommendations regarding modification to the drainage requirements and ordinances:
 - provide 25-year detention for all commercial and residential developments
 - Detention pond outfalls to provide for backflow prevention of the receiving stream
 - All hydraulic modeling to account for dynamic tailwater conditions
- The masterplan recommended that the City adopt an ordinance establishing new detention design requirements for residential and commercial developments to accommodate a twenty-five (25) year storm event and receiving stream backwater conditions. This will assist in minimizing additional impacts to the City's limited drainage in storms larger than a five (5) year. On October 13, 2016 the City adopted an ordinance modifying the drainage system requirements for new construction to be designed to provide detention for the 25-year storm event and to account for dynamic tailwater conditions and for the detention system outfalls to provide for backflow prevention.
- To address the large amount of development within the City that does not accommodate storms larger than five (5) years, two regional detention ponds

were recommended in the masterplan. One regional detention system within the Bayou Parc Perdue watershed and one with the Coulee LaSalle watershed. Based upon the results of the Great Flood of 2016 it is recommended to add a third regional detention system within the Isaac Verot Coulee watershed.

- For those existing developments that are experiencing localized flooding in all storm events it is recommended the Homeowner's Association (HOA) review the detention pond outfalls for backwater prevention to allow for the development's drainage collection system to drain.
- A few of the City's bridges are in need of repairs due to erosion of the channel banks near the bridges and pile that have deteriorated. The bridges at Savoy and Iberia Street which cross Bayou Parc Perdue and the bridge at Bonin Road that crosses the lateral that connects Bayou Parc Perdue and Anslem Coulee. The bridges are also in need of being sized and placed at an elevation to provide for conveyance of the 25-year storm event without inundating the road. The three road crossings along South Larriviere Road are in need of replacement as well as there is significant erosion along the roadside due to constant flood inundation at storm events of 10-year and greater. The insufficient capacity of the cross drains was identified in the *Lafayette Drainage Master Plan* performed after Tropical Storm Allison.

LCG and City of Scott Ongoing Models and Reports

The Lafayette Consolidated Government is currently in the process of completing models and reports of the model results of Coulee Mine East and Bayou Carencro. At the time of the writing of this plan the reports were not complete for distribution to include in the recommendations of this report. The City of Scott is also currently working with the Acadiana Planning Organization on the Marais de Cannes Watershed Plan which includes a regional detention pond located along the Ile des Cannes Coulee.

3.1.4 Recently Completed and Ongoing Projects

LCG

LCG is currently completing models and reports for Coulee Mine and Bayou Carencro. Ongoing roadway projects throughout the parish include drainage and outfall improvements. As mentioned in Section 3 Data Collection, a Lafayette Parish Master Drainage Plan was completed in 2001 that focused on Coulee Mine, Beau Bassin, Coulee Fortune North, Coulee Fortune South and Coulee LaSalle. Recent completed projects include:

- widening and regrading of Coulee Fortune South aka Cypress Bayou,
- bridge replacements and channel improvements at multiple locations throughout the parish,
- concrete coulee wall repair at multiple locations throughout the parish,
- erosion protection projects in areas where slope stability is a problem,

- small local drainage improvement projects focused on reducing flood risk,
- widening and increased capacity of multiple phases and laterals of Coulee Ile des Cannes

City of Broussard

The City of Broussard does not currently have a city- wide drainage plan, study or master plan. However, the City has identified areas for drainage improvements and has completed numerous drainage projects within the City. The City of Broussard did not provide any information for this study but based upon review of City public documents available the following information was obtained. The City is continuously working on Cypress Bayou lateral projects as well as cross drain replacements projects to improve drainage. The 2016 Streets and Drainage Fund was budgeted at \$2,711,280. One of the 2016 projects that was approved by resolution to initiate engineering was the drainage improvements near Mon Jardin Subdivision.

The most recent completed projects and the projects identified for 2016 include:

- Heart D Farm Road Drainage Project (emergency drainage project)
- Cypress Bayou Lateral II Project
- Cypress Bayou Lateral 4-D Drainage Improvements Project– located north of Albertson’s Parkway, between Ben Hogan’s subdivision and Southfield subdivision
- Albertson Parkway Drainage Project
- 2016 N. Bernard Drainage Improvements
- 2016 Cypress Bayou Lateral 2-B
- 2016 Cypress Bayou Lateral 2 – Div II
- 2016 Cypress Bayou Lateral 4-D

City of Carencro

During the data collection efforts of this study, the City of Carencro did not provide any information for this study but based upon review of public documents the following information was obtained. As a result of the 2012 rain event that caused a large amount of flooding in Carencro, several projects were recently completed and some are still under construction to mitigate some of the flooding within the City. These projects include:

- Elevating two homes along Fado Street in partnership with GOSHEP
- Richard Street Hazard Mitigation Project – this project consisted of widening and stabilizing the channel side slopes with concrete
- Clearing and grubbing of the Kentwood Street Laterals that discharge to Dan Debaillon Coulee
- Arceneaux Road Project - this project consists of cleaning ditches, outfalls and removing and replacing culverts

- Beau Bassin Detention Pond and channel clearing and grubbing

While the City of Carencro does not currently have a city wide drainage study, plan or a city masterplan, projects have been identified for the future to alleviate flooding in areas. The following is a list of proposed projects:

- Prejean Road maintenance project – this project includes the cleaning of drainage ditches in the vicinity of Pelican Park
- St. Pierre Drainage Project – this project includes cleaning and rehabilitating drainage features along St. Pierre to Interstate 49
- Gloria Switch Drive Culvert Replacement Project – this project includes the replacement of an undersized drainage culvert

At this time, no specific projects have been identified to address the overflowing of Bayou Carencro but based upon the review of the data collected alternatives to address the overflowing of the bayou are needed.

4.0 Existing Conditions

An understanding of the existing drainage system and surrounding land use as well as the planned development of land within the parish is critical to provide viable and sustainable drainage solutions based upon science, engineering, and necessity. Drainage systems are dynamic, consisting of a series of features that are interconnected with parameters fluctuating over time due to changes in the capacity of upstream or downstream drainage infrastructure, development of the surrounding lands within a drainage area, weather events, and tidal effects. Typically, drainage systems include a series of major and minor drainage features that convey stormwater to a downstream water body. Minor changes to upstream or downstream drainage features will inadvertently influence the effectiveness of the overall drainage system.

The existing drainage system including major drainage channels, soil conditions, on-going projects, and existing studies, plans, and projects within the boundaries of Lafayette Parish have been researched and are documented in the following paragraphs separated by individual cities. This information provides the baseline conditions and assists in the identification of the constraints associated with the broad analysis of drainage alternatives.

4.1 *City of Lafayette and Lafayette Parish*

Lafayette Parish located in south central Louisiana with a population estimated at more than 225,000. It is made up of six municipalities, the cities of Lafayette, Broussard, Carencro, Duson, Scott and Youngsville. Until the 1940s the cities' and parish's economy was based primarily upon agriculture. After the 1940s the petroleum and natural gas industries became the dominate industries for the parish. Based upon information from the Lafayette Economic Development Authority (LEDA) the current business base of the parish includes energy services, manufacturing, health care, transportation and distribution, education, information technology, finance, tourism and other service related industries. **Exhibit 1** represents a map of Lafayette Parish along with the city limits of each of the cities within the parish.

4.1.1 Drainage System

Lafayette Parish is located within the Vermilion-Teche Watershed. The Vermilion River, which runs through the Vermilion-Teche Watershed, is approximately 70 miles long and is known as a "tidal river" as the river was formed from tides and natural events originating in Vermilion Bay. As the major waterway of Lafayette Parish, the upstream end of the Vermilion River begins at Bayou Fusilier at a point where flow converges from Bayou Teche. The Vermilion River flows through Lafayette Parish and Vermilion Parish, crosses the Gulf Intracoastal Waterway, and then discharges into Vermilion Bay.

Within the city limits of Lafayette, the primary drainage system is curb and gutter with subsurface drainage with limited detention. Within the unincorporated areas of Lafayette Parish, the primary drainage system is open ditch. New subdivisions and new commercial areas have curb and gutter with subsurface drainage with detention systems. The primary systems drain through a series of thirty-three (33) major bayous and coulees many of which converge

into others and the Vermilion River. Numerous smaller channels referred to as laterals drain into the bayous and coulees, many of them connecting two coulees. Many of these laterals originated as agricultural drainage ditches. The largest channel in Lafayette Parish is the Vermilion River. Some of the larger channels within the parish are Isaac Verot Coulee, Coulee des Poches, Coulee Ile des Cannes, Bayou Carencro, Bayou Beau Bassin, Bayou Parc Purdue, Coulee Mine and Coulee Lasalle. Many of the coulees within the City of Lafayette city limits are concrete lined. The coulees and laterals outside of the City limits are highly vegetated and many channel bottoms are filled with silt. See **Exhibit 2** for the drainage map identifying the thirty-three (33) major bayous and coulees and showing the interconnected laterals for Lafayette Parish. **Exhibit 3** is the existing drainage map for the City of Lafayette. **Exhibits 4a-4e** identifies the FEMA floodplain areas within each City within Lafayette Parish as identified in the most recent Preliminary FIRM maps of December 19, 2014. **Exhibit 5** is a map of the jurisdictional wetland areas within the parish.

4.1.2 Soil conditions

The physical characteristics of Lafayette Parish today are a legacy of the region's geologic history. The entire state of Louisiana is part of the north Gulf Coastal Plain that runs from Southeastern Texas to the tip of Florida. Over thousands of years of glacial and interglacial periods the levels of the seas rose and receded in this area.

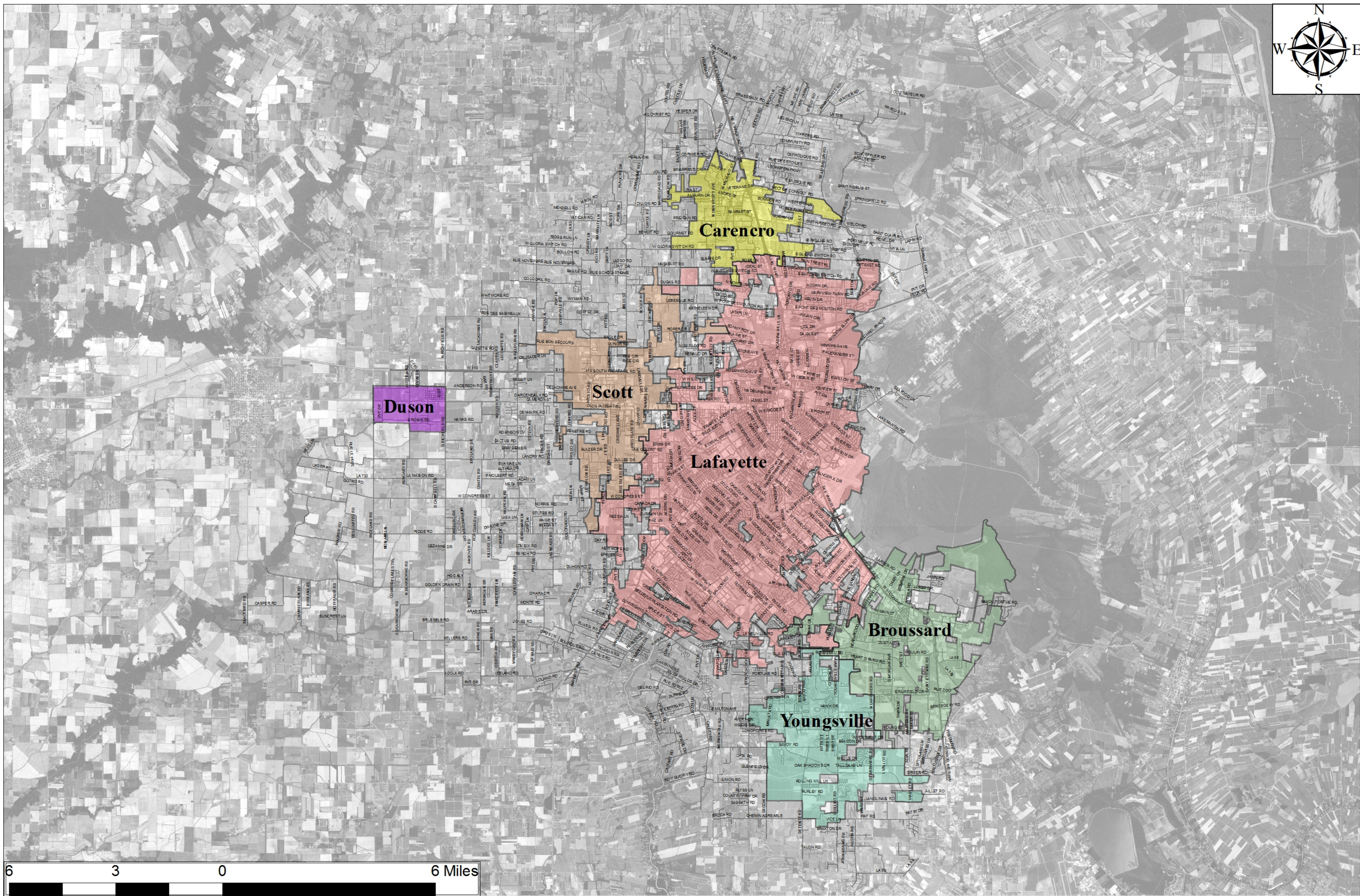
18,000 years ago, during the last ice age melt, water and sediment flowed south from the southern part of the Wisconsin Glaciation, roughly where the Ohio and Missouri Rivers meet at the Mississippi. Rich deposits from the ancient streams helped create the Prairie Complex on this former floodplain.

Lafayette Parish is at the easternmost point of the Prairie Terrace, an area created by deposits of sediment in the former floodplain of the Mississippi River. Soils consisting of clay, sand, and silt were deposited in the area and allowed farmers to benefit from the rich, loose soil deposits. These soil conditions made the parish most suitable as an agricultural based economy. The large amount of floodplains and the soils make the area challenging and costly with regards to drainage and development.





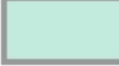

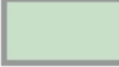
Based on a web survey of the soils in the Lafayette Parish area from the Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture (USDA), the soils within the parish are mostly limited in terms of suitability for use in constructing local roads and streets.

Trenches or excavations for the installation of utilities, open ditches, or other purposes with a maximum depth of 6 feet below ground surface are defined as shallow excavations. The soil performance rating for shallow excavations, as defined by the NRCS regarding soil properties related to the ease of excavating and the resistance to sloughing, is identified as limited in approximately 70% of the Parish area. Equipped with this information, solutions provided in this drainage plan need to include soil prepping and strengthening alternatives as well as

removal and replacement of suitable materials that supports the infrastructure alternatives. See **Exhibit 6** for a Lafayette Parish Soils Map.



Legend

 Scott	 CarenCro
 Duson	 Lafayette
 Youngsville	 Unincorporated Area of Lafayette Parish
 Broussard	

Lafayette Parish Overview

Lafayette Parish Area-wide Drainage Plan

Exhibit 1



McBADE
ENGINEERS & CONSULTANTS, LLC

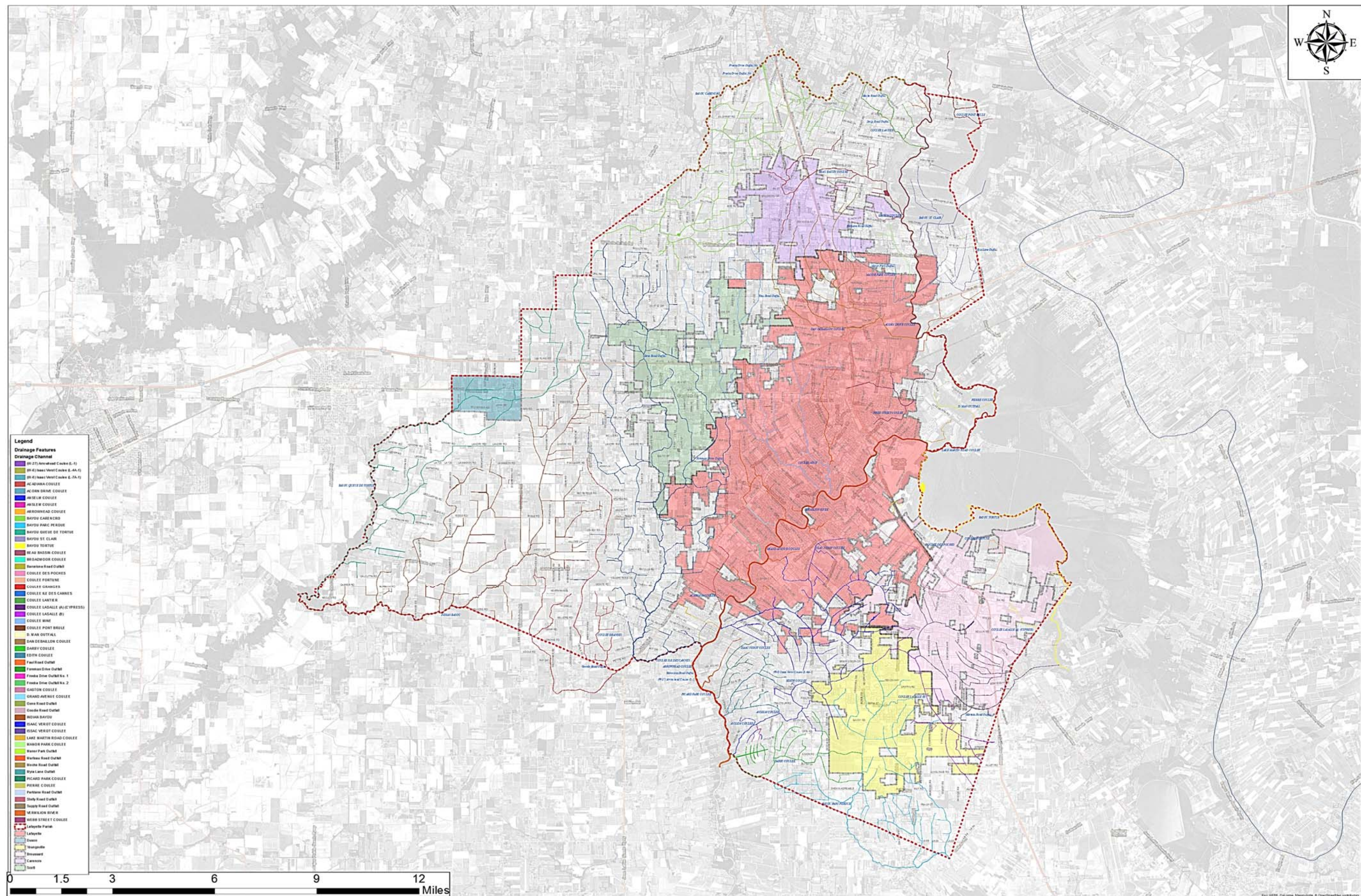


Exhibit 2

Lafayette Parish Drainage Map Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



Insert Exhibit 4a

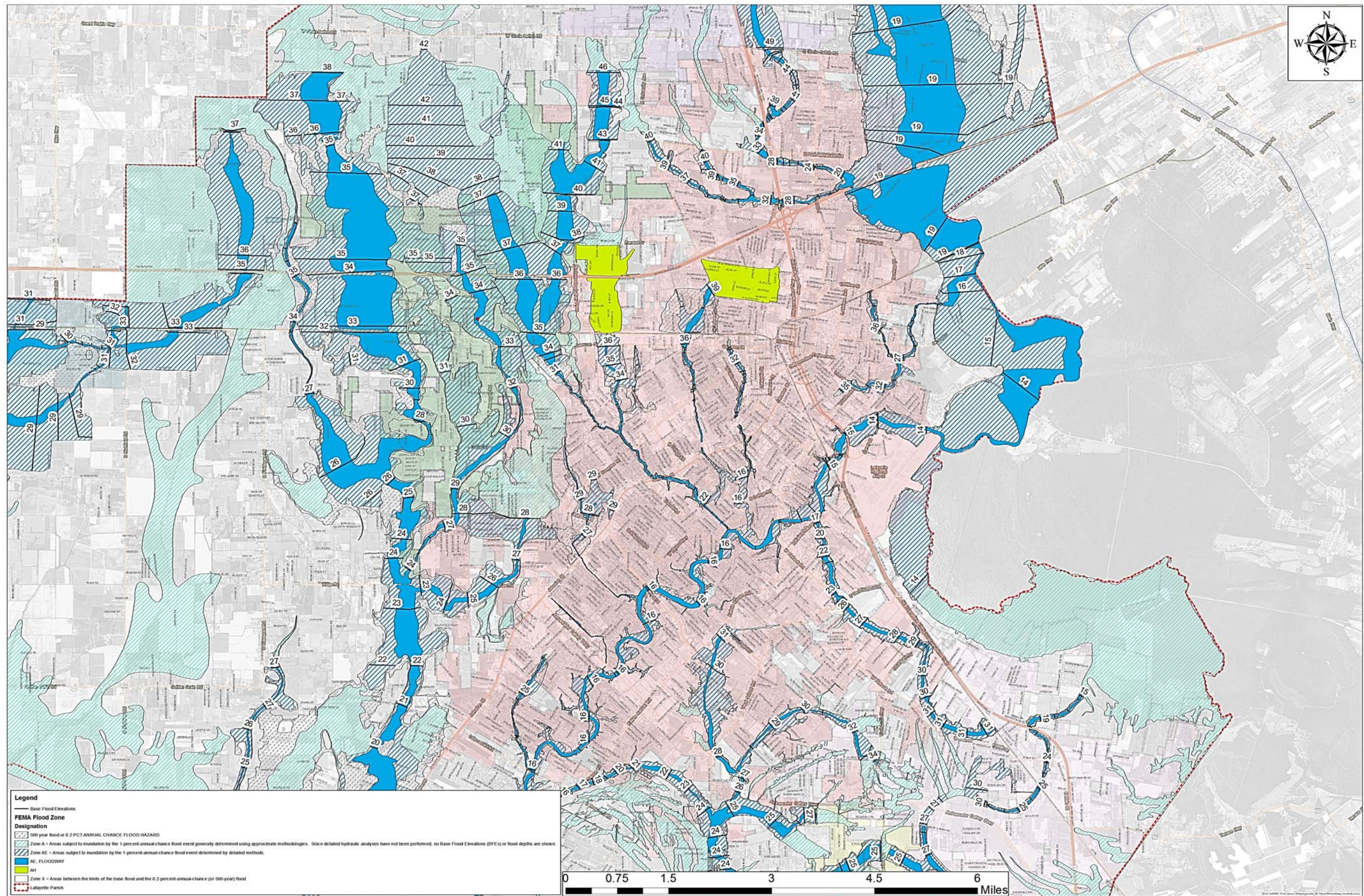


Exhibit 4A

Preliminary FEMA Flood Zone Map for Lafayette, LA

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



McBADE
ENGINEERS & CONSULTANTS, LLC

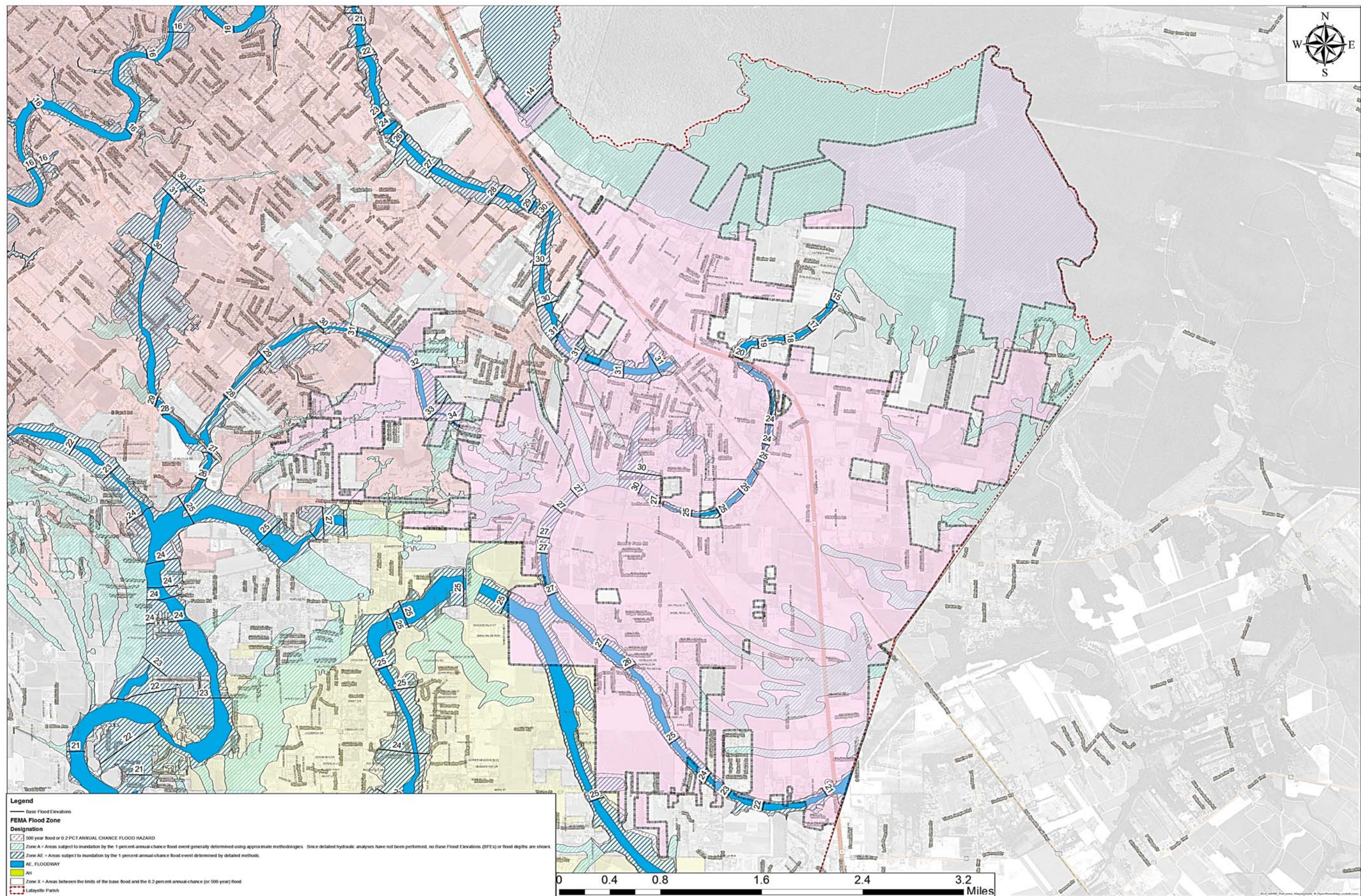


Exhibit 4B

Preliminary FEMA Flood Zone Map for Broussard, LA

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



McBADE
ENGINEERS & CONSULTANTS, LLC

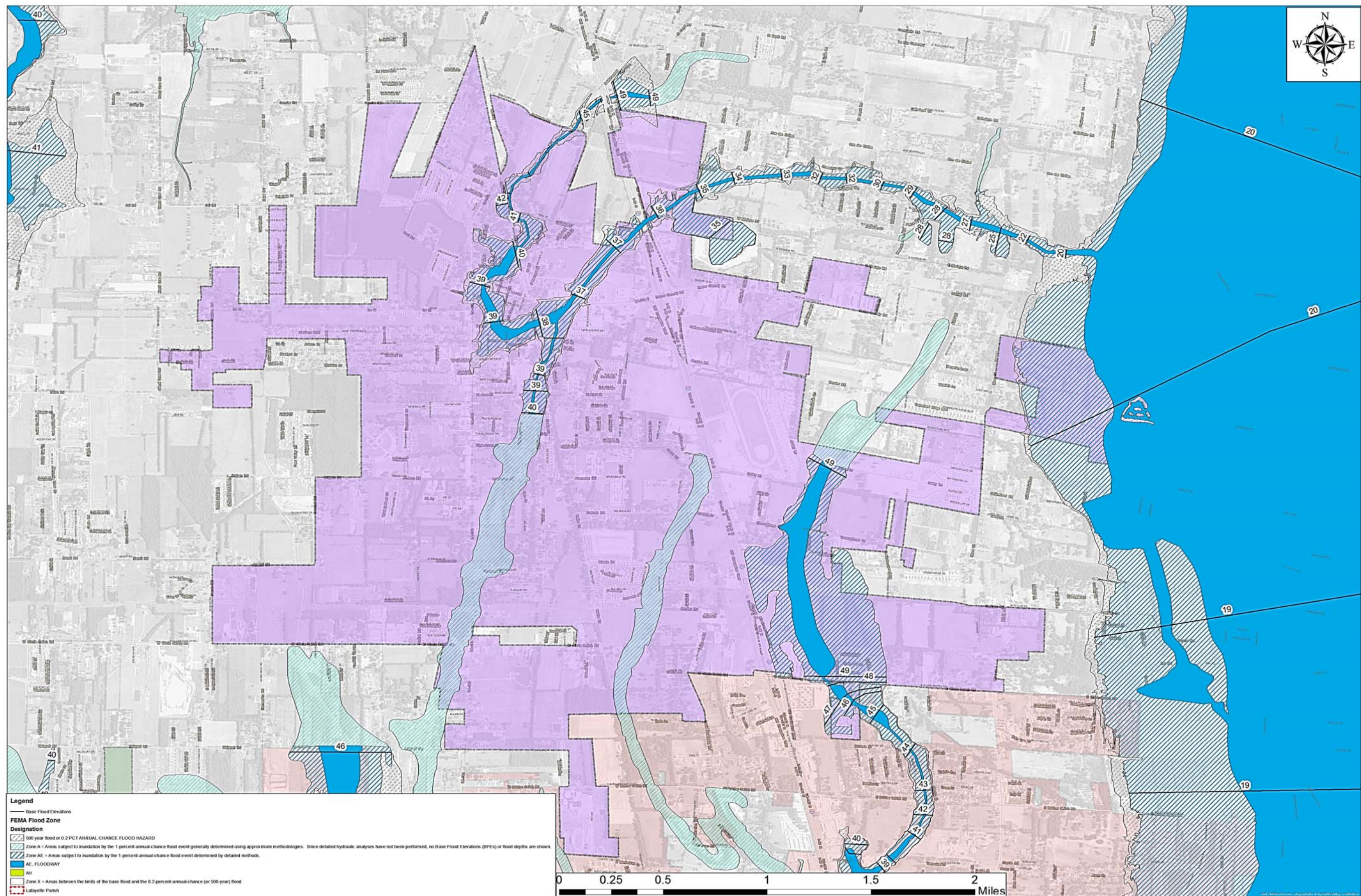


Exhibit 4C

Preliminary FEMA Flood Zone Map for Carencro, LA

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



McBADE
ENGINEERS & CONSULTANTS, LLC

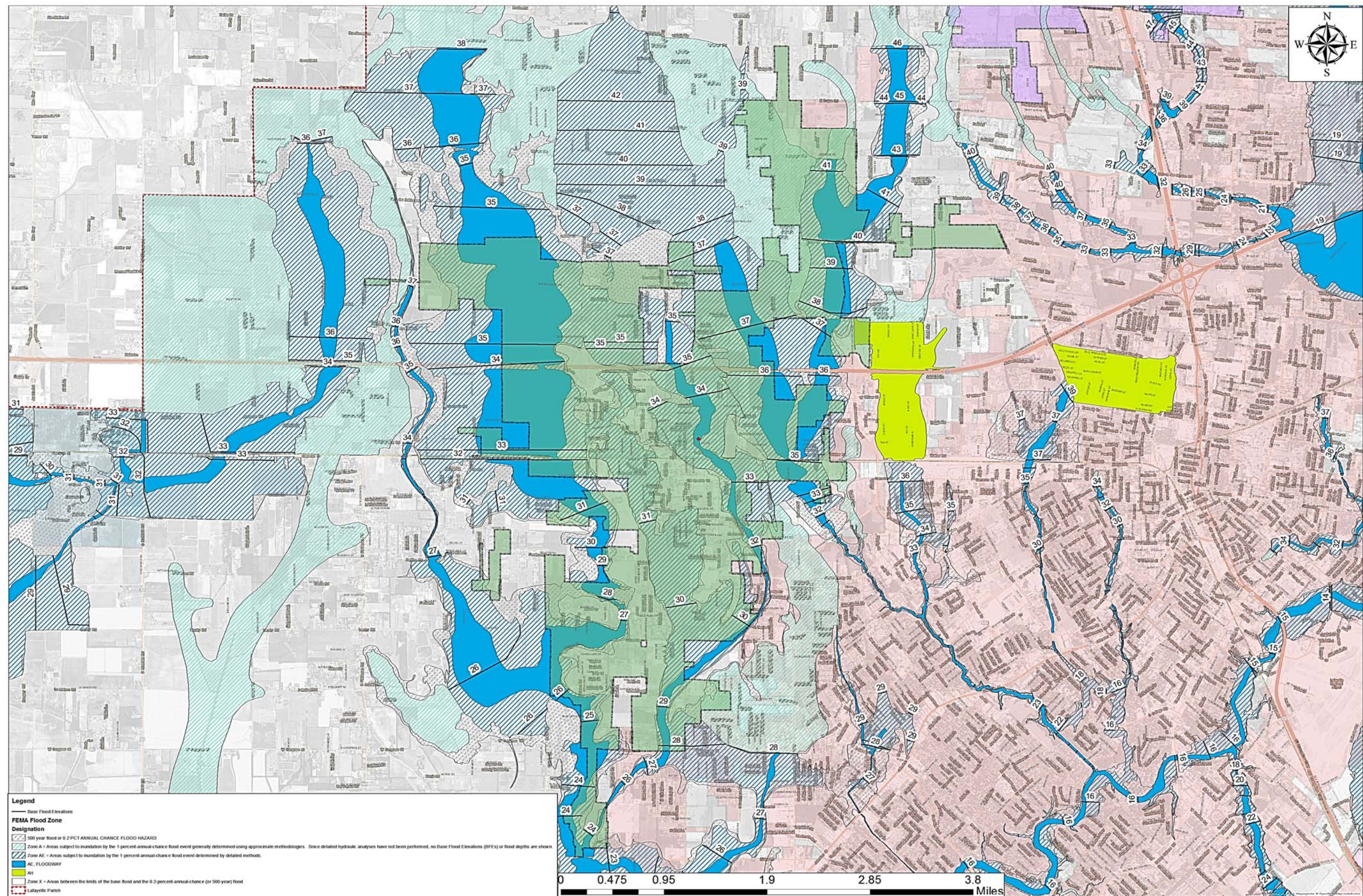


Exhibit 4D

Preliminary FEMA Flood Zone Map for Scott, LA Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



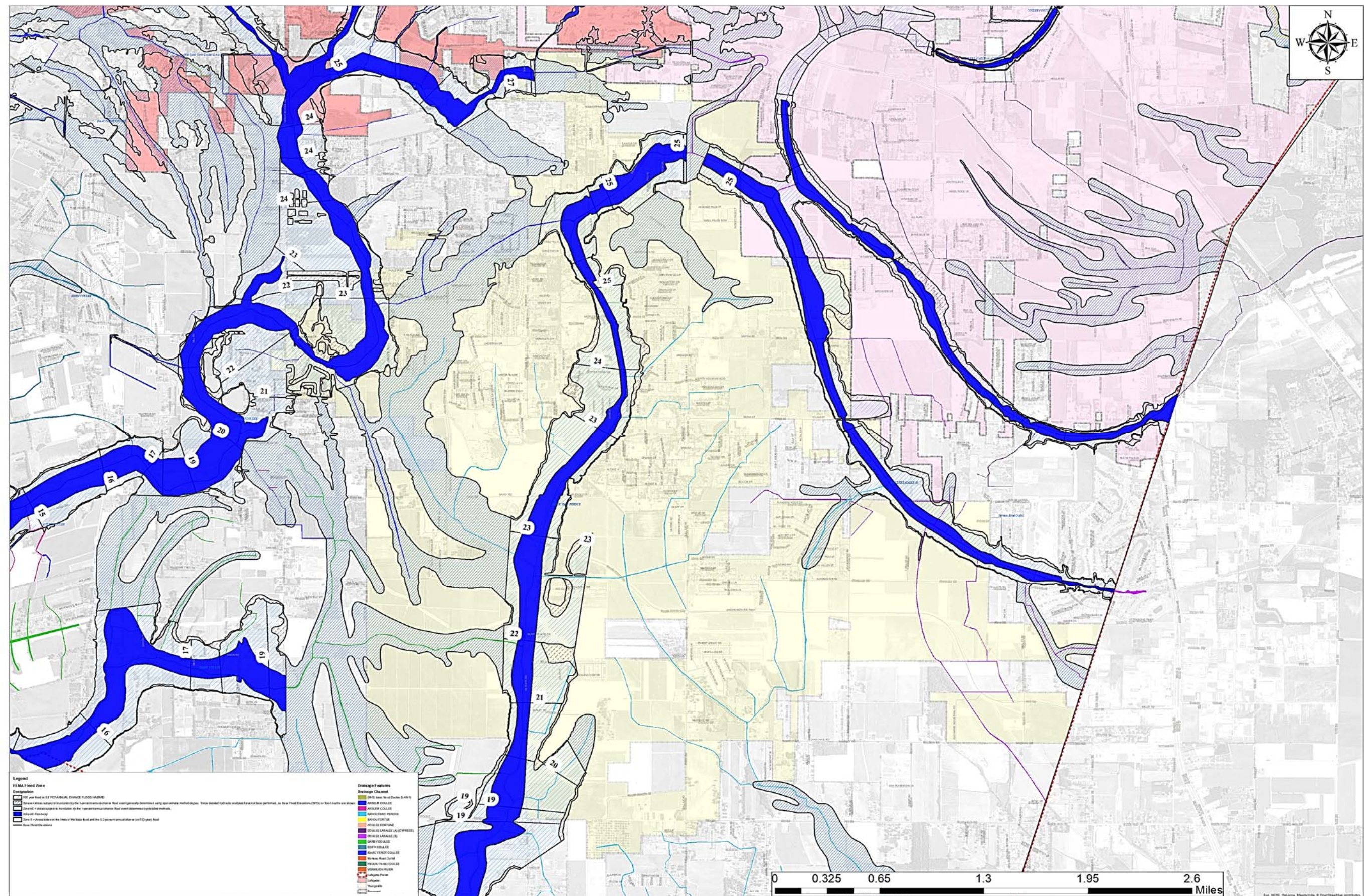


Exhibit 4E



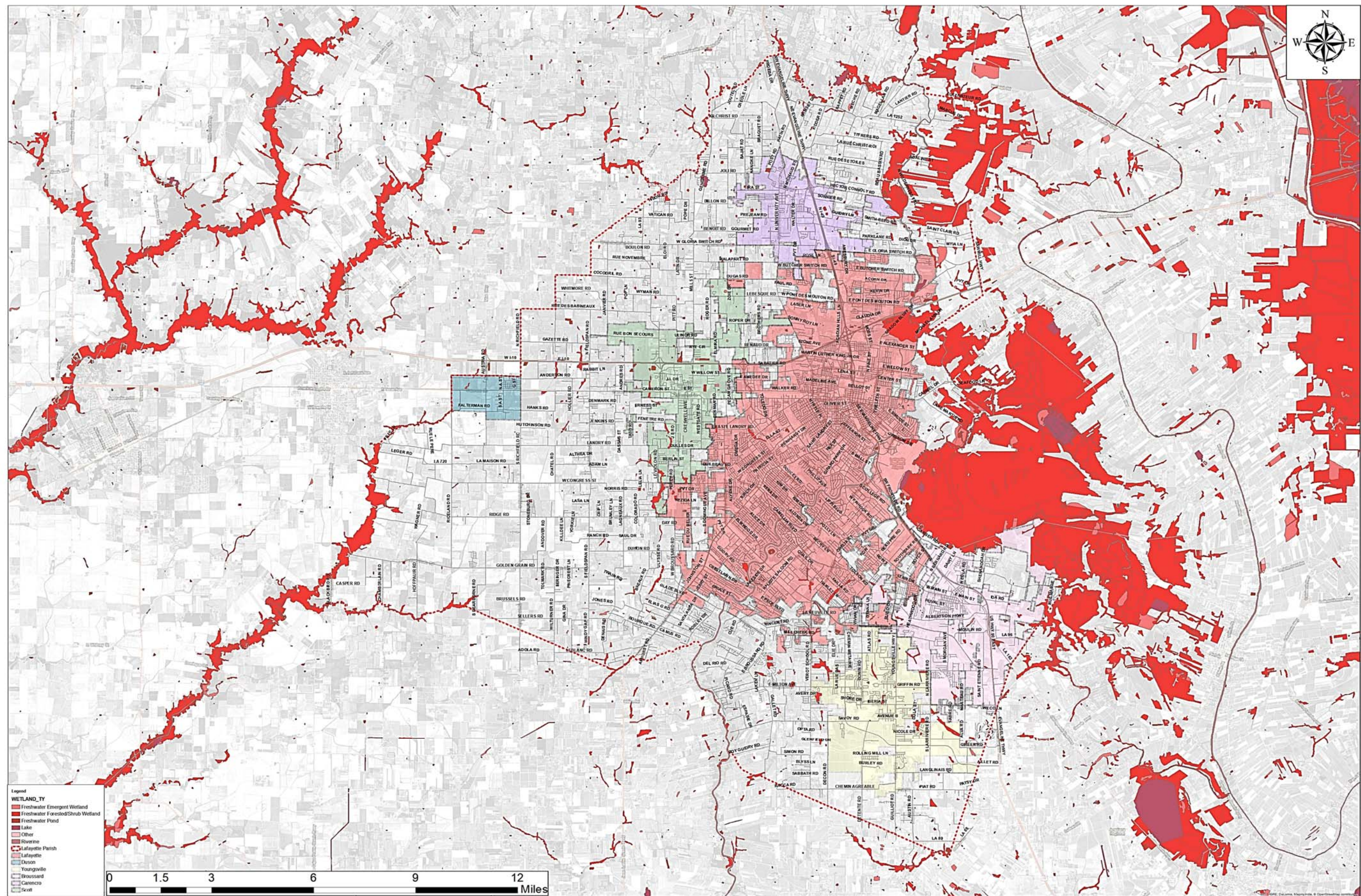


Exhibit 5

Wetland Map of Lafayette Parish Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



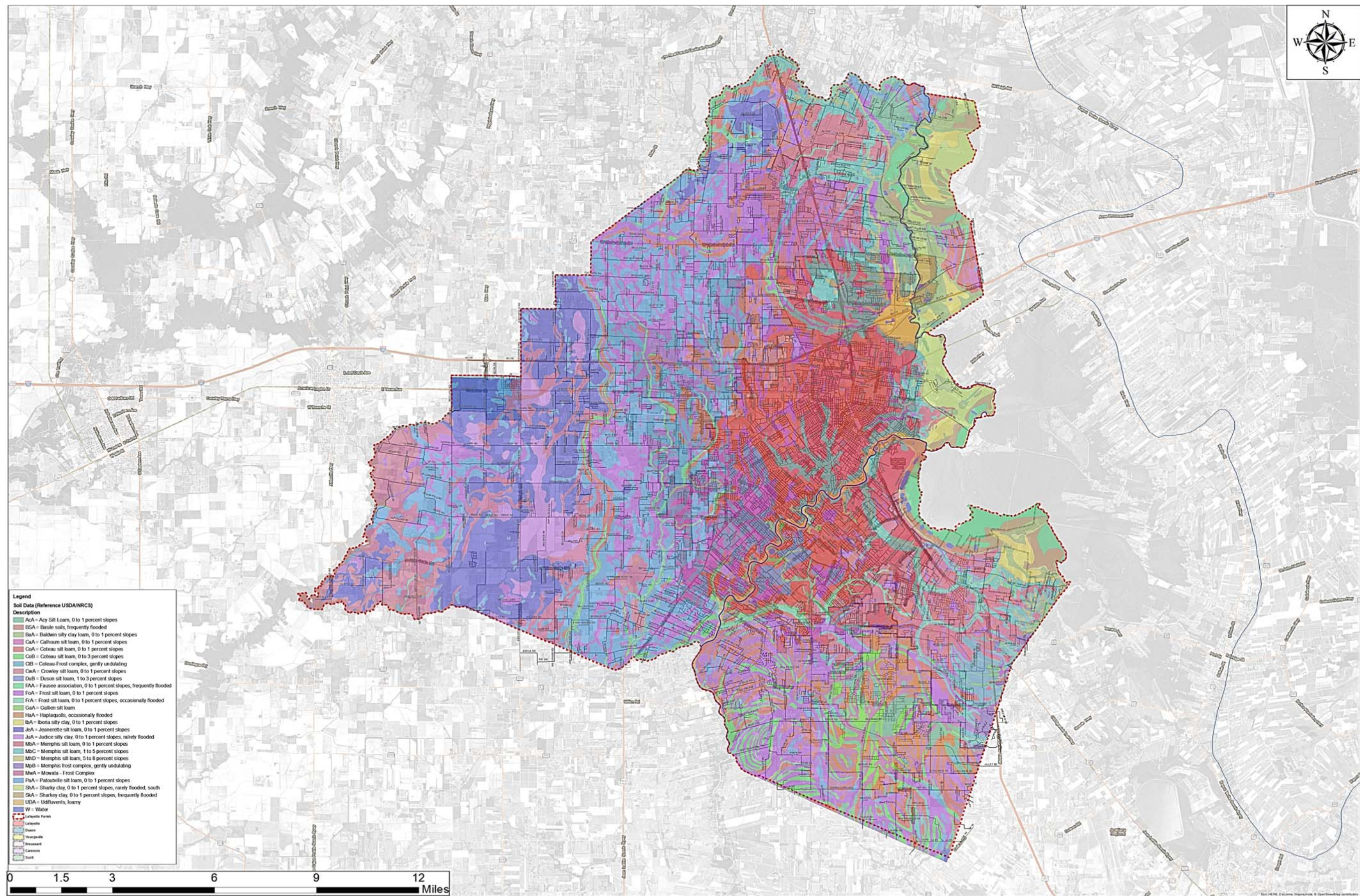


Exhibit 6

Lafayette Parish Soil Classification Map Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



4.1.3 Problem Areas

After the Tropical Storm Allison flood event of 2001, the LCG identified the top 5 problem areas within the parish to be Coulee Mine, Beau Basin, Coulee Fortune North, Coulee Fortune South and Coulee LaSalle. While there are many locations throughout the parish that experience localized flooding with as little as a 10-year storm event, the areas of high concern continue to be Coulee Mine, Coulee Fortune North, Coulee Fortune South, Coulee LaSalle, Bayou Carencro, Indian Bayou, Coulee Ile des Cannes, Bayou Parc Perdue, Anslem Coulee and Isaac Verot Coulee. **Exhibit 7** identifies the problem areas in Lafayette Parish.

4.2 City of Broussard

Located along U.S. Highway 90 in the southeast portion of the parish in the heart of the “energy corridor” filled with many oil and gas industry service companies the City of Broussard is a thriving community with more than 9,000 residents.

In 1884 Broussard was founded and named after Valsin Broussard who was a local merchant and a descendant of one of the first Acadians to arrive in Louisiana. For many years, Broussard’s primary resources were sugarcane, and soybean farming along with cattle and horse raising. Today that agricultural landscape has changed to commercial retailers and restaurants along with the oil and gas industry companies.



4.2.1 Drainage System

The older and rural portions of the city consist of open ditch systems for primary drainage. The more recent residential and commercial developments have closed drainage systems consisting of curb and gutter and subsurface drainage pipes. The primary drainage systems drain to the secondary systems consisting of coulees and laterals.

Coulee Fortune and Coulee Des Poches converge within the central section of the city of Broussard along US HWY 90 East. Bayou Tortue drains the eastern portion of Broussard and converges with Coulee Lasalle (a) Cypress aka Coulee Fortune South or Cypress Bayou to provide drainage for the City. See **Exhibit 8** for Existing Drainage Map for Broussard.

4.2.2 Problem Areas

Based upon previous studies, recent projects, recent rainfall events and city council meetings the greatest problem areas are along Cypress Bayou (Coulee Fortune South) and Coulee Fortune and at the crossings, in particular, along U.S. Hwy 90 at Coulee Fortune and Cypress Bayou. In addition, several internal city road cross drains are undersized creating localized flooding and impacting areas upstream of the cross drains.

Exhibit 9 identifies the problem area locations within Broussard.



4.3 City of Carencro

Carencro is located approximately five (5) miles north of the City of Lafayette in Lafayette Parish. Carencro was established in the late 1700's and by the late 1800's it became the largest shopping center in the area. Carencro is the home of more than 7,500 residents. The City has experienced a large amount of commercial and residential growth in the past ten years and continues to grow.



4.3.1 Drainage System

The city's primary drainage system is open ditches draining to coulees and laterals of coulees. The more recent residential and commercial developments consist of closed drainage systems.

Bayou Carencro drains the area north of the City to the Vermilion River. Coulee Mine drains the west side of the City while Dan Debaillon Coulee drains the east side of the City. Beau Bassin Coulee and numerous laterals of Dan Debaillon Coulee drain the central portion of the City to the Vermilion River. See **Exhibit 10** for Existing Drainage Map of Carencro.

4.3.2 Problem Areas

The city experienced major flooding events due to overtopping from Beau Bassin Coulee and the southern lateral in the following years: 1940, 1953, 1955, 1966, 1971, 1973, 1977, 1980, 1982, 1989, 1993, 2001, 2002, 2003 and 2004. Bayou Carencro has continued overflowing in large storm events. Many of the laterals to Beau Bassin Coulee are silted and have eroding side slopes and many of the city's cross drains are in need of being replaced as they are undersized with many in poor condition and placed at the



wrong elevations. **Exhibit 11** identifies problem areas within the City of Carencro.

4.4 City of Scott

The City of Scott is located on the west side of the City of Lafayette's corporate limits along the Interstate 10 (I-10) corridor. The City began as a railroad community in 1880 and named after J.B. Scott who was the Superintendent of Southern Pacific Railroad. Scott was known as "Where the West Begins" due to the Scott Station being where rates were different for travel to the east and to the west. The City continues to grow primarily along the I-10 corridor while preserving its rich heritage and culture and historic buildings.

4.4.1 Drainage System

The City's drainage consists primarily of roadside open ditches which drain to laterals of Coulee Mine West on the east side of the City and Coulee Ile des Cannes on the west side of the City. Sixty-eight (68%) of the City's landmass is located within floodplains. See **Exhibit 12** for Existing Drainage Map for Scott.



4.4.2 Problem Areas

Many of the City's laterals as well as Coulee Mine and Coulee Ile des Cannes overflow in large events and oftentimes in events as low as 10-year storms. There is a lack of channel maintenance along natural channels, many of which are overgrown with vegetation along the banks. In addition, there are drainage culverts and road cross drains that are undersized and placed at incorrect elevations causing localized drainage issues and affecting upstream drainage. More recent developments include detention systems to assist with the increased runoff from impervious surfaces.

Based upon the City's comprehensive plan there are no development regulations in place to provide protection of soils from growth in the floodplain or erosion due to stormwater runoff. **Exhibit 13** shows the problem areas within the City of Scott.

4.5 City of Youngsville

The City of Youngsville is located within Lafayette Parish, Louisiana. It is bordered by the City of Lafayette on the northern boundary, the City of Broussard on the eastern boundary, unincorporated areas of Lafayette Parish on the western boundary, and Vermilion Parish on the southern boundary.

The area known today as the City of Youngsville was settled in the early 1800s by French Acadian farmers. Initially, the community was known as "Royville" as named before 1839 by George Roy and his



son, Desire, who had laid out the area. In 1983, Youngsville was declared a town. After continued and fast growth, in 2006 Youngsville was declared a city. From 1990 to 2005 the City was considered the fastest growing town in Louisiana and since 2005 the fastest growing city in Louisiana. The City's population was more than 12,000 in 2015.

Despite its growth in size from the 1800s to 2005 and its change in status from settlement to village to town to city, Youngsville has primarily been an agricultural community with the majority of its land being used for sugarcane farming. In addition to working in the sugarcane farming industry, historically many City residents also work in the oil industry. This is partially due to the City's close proximity to LA Highway 90, numerous businesses providing oil industry services, and the City's easy access to ports.

4.5.1 Drainage System

In the older areas of the city, the primary drainage system is roadside open ditches. In the more recent residential and commercial developments the primary drainage system is closed drainage systems with curb and gutter and subsurface collection systems that drain to detention systems which outfall into laterals, bayous or coulees.

The City is drained by laterals that convey flow into the Bayou Teche and Vermilion River including Bayou Parc Perdu and Coulee LaSalle. The majority of the City drains to Bayou Parc Perdue with a portion of the eastern most city draining to Coulee LaSalle. A small portion of the western city limits drain to Anslem and Isaac Verot Coulees. Bayou Parc Perdue and Anslem Coulee drain south to Vermilion Parish and Coulee LaSalle drains southeast to the Bayou Teche. The laterals, bayous and coulees are earthen trapezoidal cross section channels with little or no permanent erosion protection along the channel side slopes or banks and are highly vegetated with evidence of silted bottoms. See **Exhibit 14** for Existing Drainage Map for Youngsville.

4.5.2 Problem Areas

The evaluation of the City's drainage infrastructure and watershed waterbodies revealed that the drainage of the developments is limited by the stage in the receiving stream, major arterial and major collector cross drains and bridges as well as the design of the detention pond outfall structures. The field investigations showed in dry periods that the channels lack cleaning and channel typical section maintenance, thereby decreasing conveyance capacity. The silt in the channels is a result of many years of lack of and improper erosion and sediment control operations in construction activities.

With the increase in silt, lack of maintenance, downstream blockage in other communities and tidal influence on the ultimate watershed waterbodies, the water level of the receiving stream or commonly referred to as the tailwater is directly related to the performance of the drainage system. If the actual tailwater is higher than the tailwater assumed in design, the system will not perform correctly. After reviewing many drainage studies and models of some of the recent and existing developments, it was observed that the tailwaters that are assumed in the

receiving streams are lower than those tailwaters that are actually observed. In many of the designs and models the backwater effect that many of these streams are exposed to were also not modeled or accounted for in the design of the drainage systems.

Review of the outfall designs and system function during rain events showed that the detention systems were functioning as equalization basins for the receiving stream due to absence of outfall control structures to prevent backflow. In areas where developments are experiencing street flooding, detention pond outfalls consist of pipes at the bottom of the pond entering the receiving stream. LCG's requirement of a five (5) year detention pond volume with no required outfall structure to prevent backflow hinders the system's ability to provide flood protection during storms greater than five (5) years. In several public hearings for new developments, residents consistently complain of localized "flooding" during the higher events and this is indicative of the current LCG requirements and the design of many of the existing developments.



The purpose of "true detention" is to detain the extreme events to when the receiving stream is past its peak and to gradually release the flow as to not inundate downstream. In other areas of the United States where detention has been a part of everyday design and construction since the 1970s, detention ponds are designed for the extreme events of twenty (25) years, fifty (50) year or one hundred (100) years. In addition, outfall structures are designed to prevent backflow of the receiving stream and to allow for the pond to "fill up" while the collection system lowers the levels in the streets within the development. Inlet capacity and collection piping systems are designed for the high intensity events like the two (2) year or minimal of five (5) year storm.



Another observation in the modeling and design of the drainage collection and detention systems is the development of the hydrographs representing the rainfall distribution of an event. Many designers are using the triangle hydrograph to determine peak flow in lieu of the bell curve hydrograph for runoff, which is prohibited in the LCG unified development code and existing requirements. The triangle method and the Hydroflow software used by designers is acceptable by LADOTD but is more aligned with state roadway design than urban and rural development design.

Many of the roads that are not categorized as major arterials and major collectors were historically local roads before the large and fast paced development began. The cross drains for these roads were designed and constructed to handle the ten (10) year storm event and in many cases even less than the ten (10) year storm event. While the intent of the roadway has changed, the cross drains and bridges that convey water have not been increased to the recommended twenty-five (25) year storm event for those roadway classifications. The result is that during events greater than a ten (10) year storm, the roadway is inundated with water and oftentimes impassable.



Developments that are experiencing flooding due to tailwater of receiving stream and detention pond outfall design are Highland Ridge, South Lake and Copper Meadows. Areas of localized roadway flooding due to cross drains or bridge capacity are Fortune Road at Bayou Parc Purdue, Bonin Road at lateral to Bayou Park Purdue and Anslem Coulee, Larriviere Road at Coulee LaSalle, Larriviere Road at the lateral to Coulee LaSalle, Larriviere Road at Hill Ridge Road and Larriviere Road at Almonaster. **Exhibit 15** shows the problem areas within the City of Youngsville.

An additional observation is the trend of designers to create swales along the rear of the developments and the rear of the inside lots. While this is done to decrease the pipe and inlet infrastructure and decrease cost respectively, residents refer to it as flooding when the swales fill with water until they are able to drain after the storm events. Since many residents are unaware of the site and development drainage patterns they unintentionally fill the area within their lots and block the drainage of the system upstream, creating localized flooding in other areas of the developments.

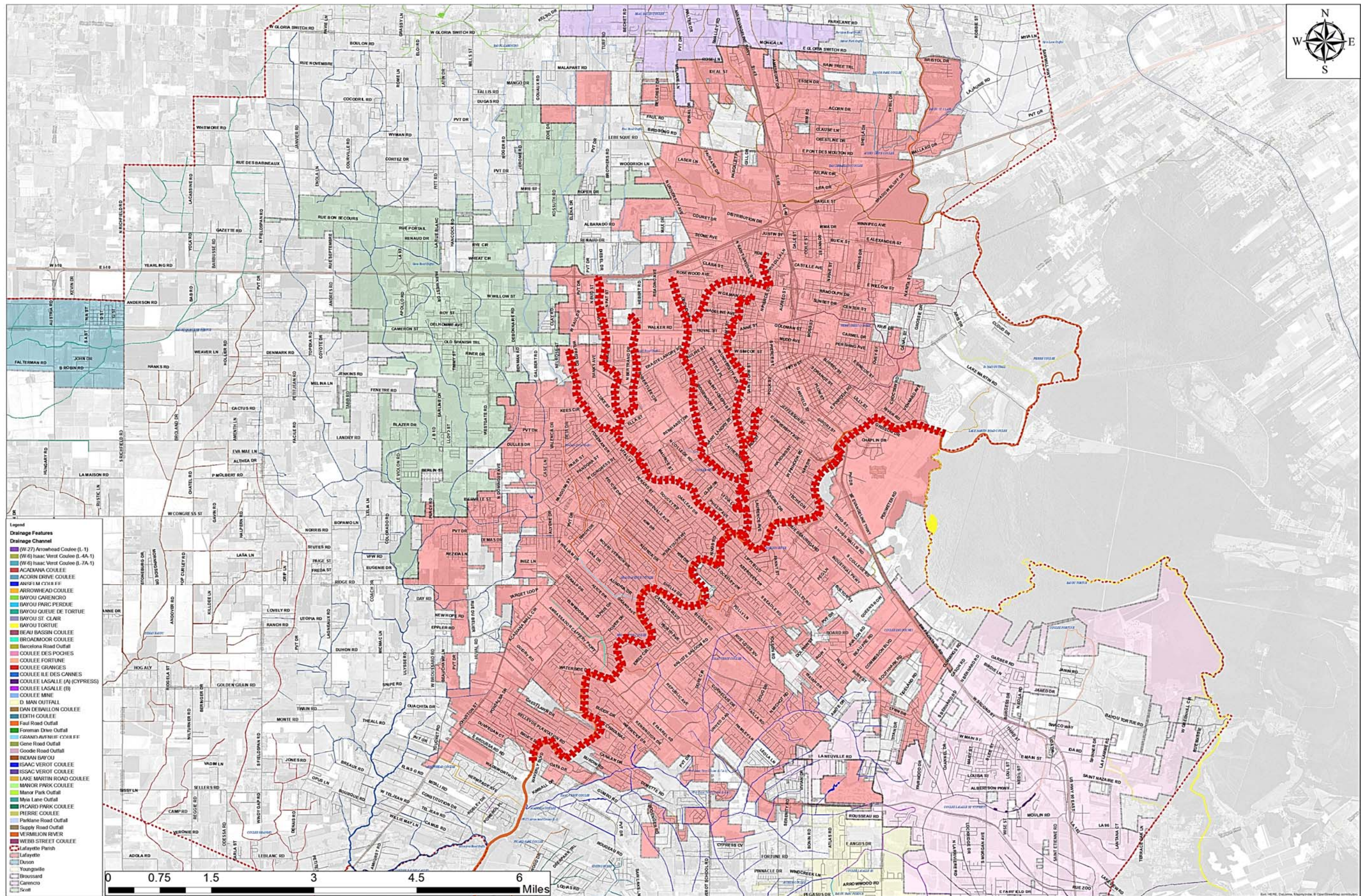


Exhibit 7

Drainage Areas of Concern in Lafayette, LA

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



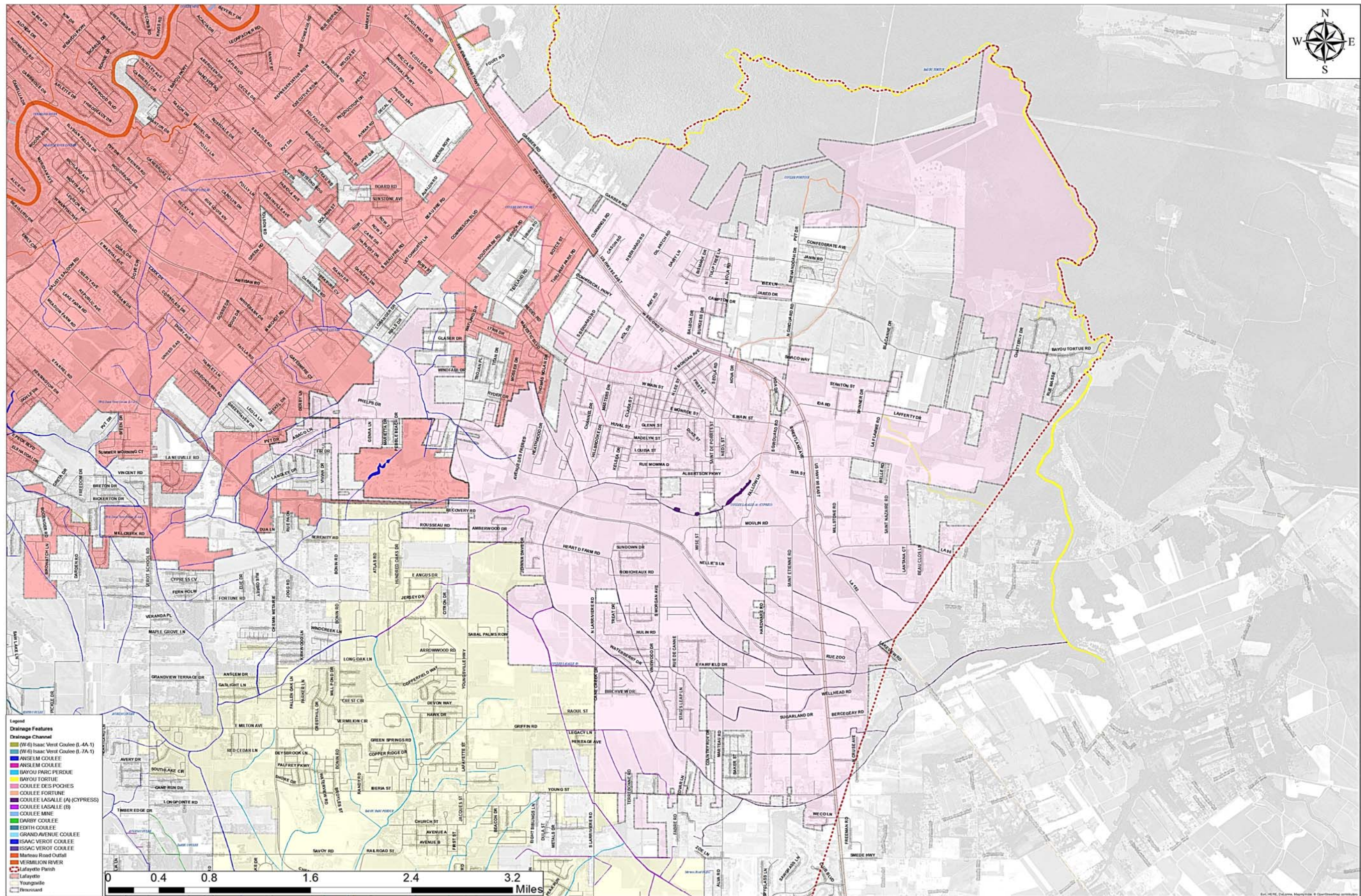


Exhibit 8

Existing Drainage Map of Broussard, LA Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



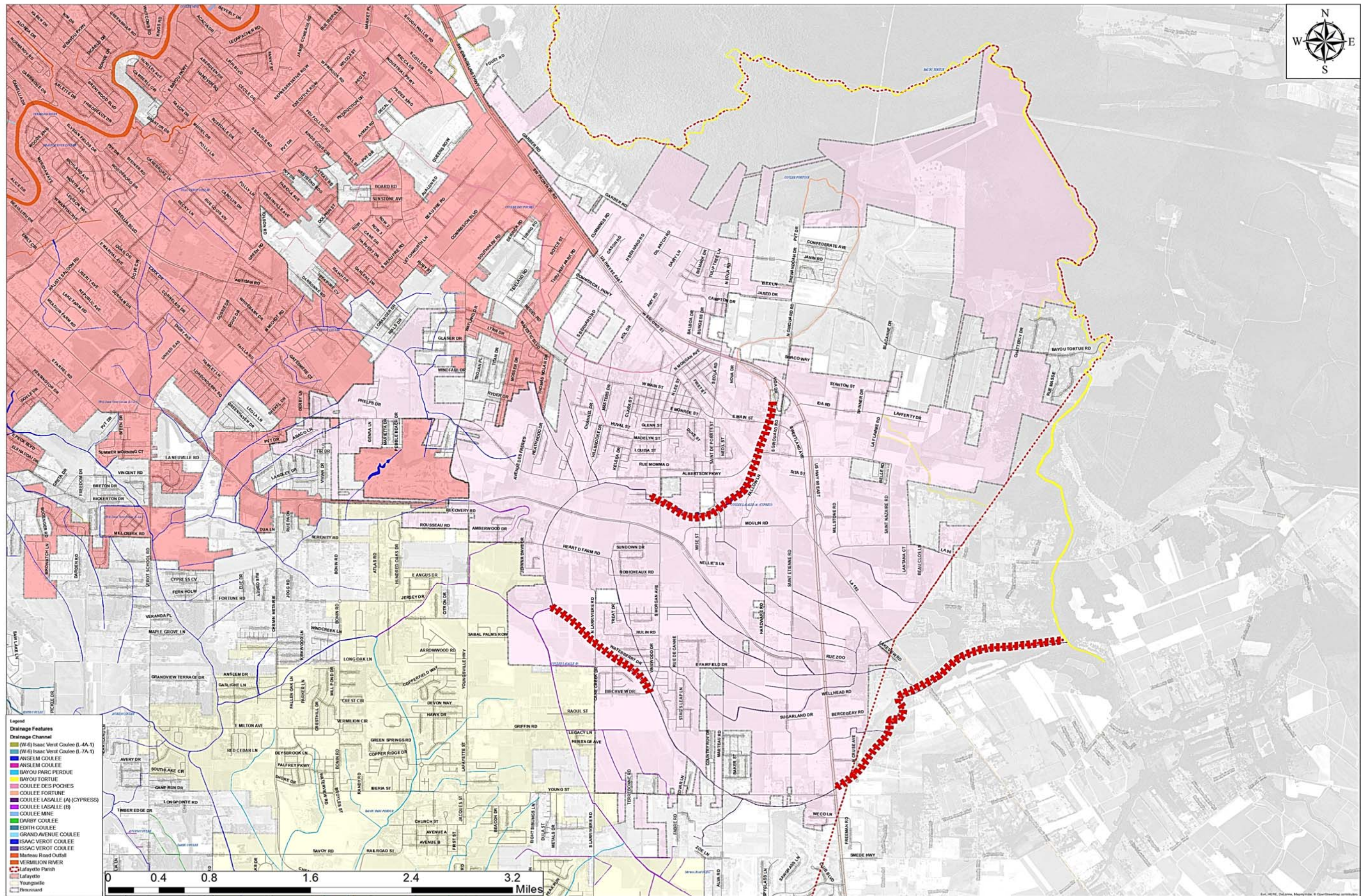


Exhibit 9

Drainage Areas of Concern in Broussard, LA

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



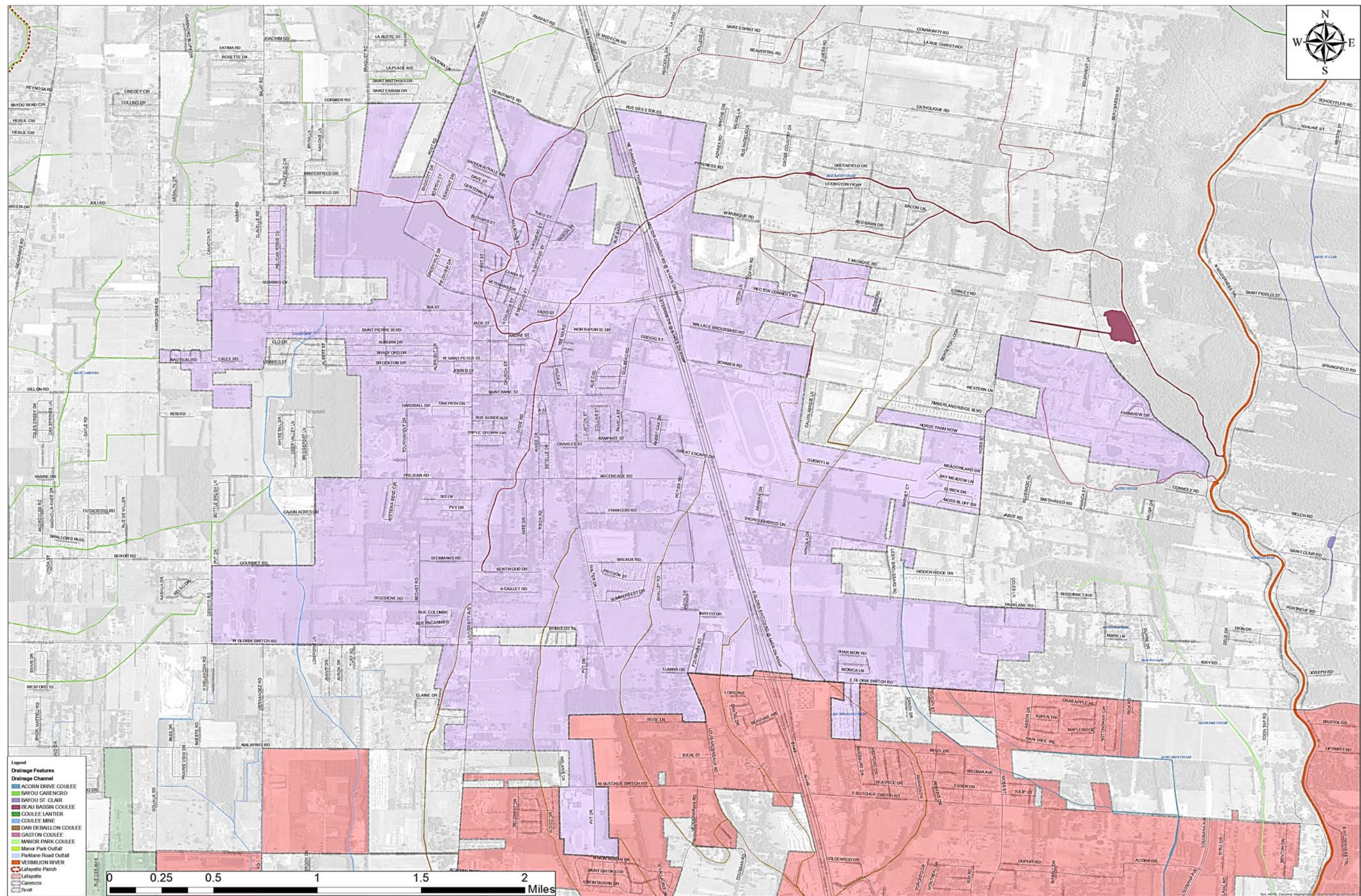


Exhibit 10

Existing Drainage Map of Carencro, LA

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



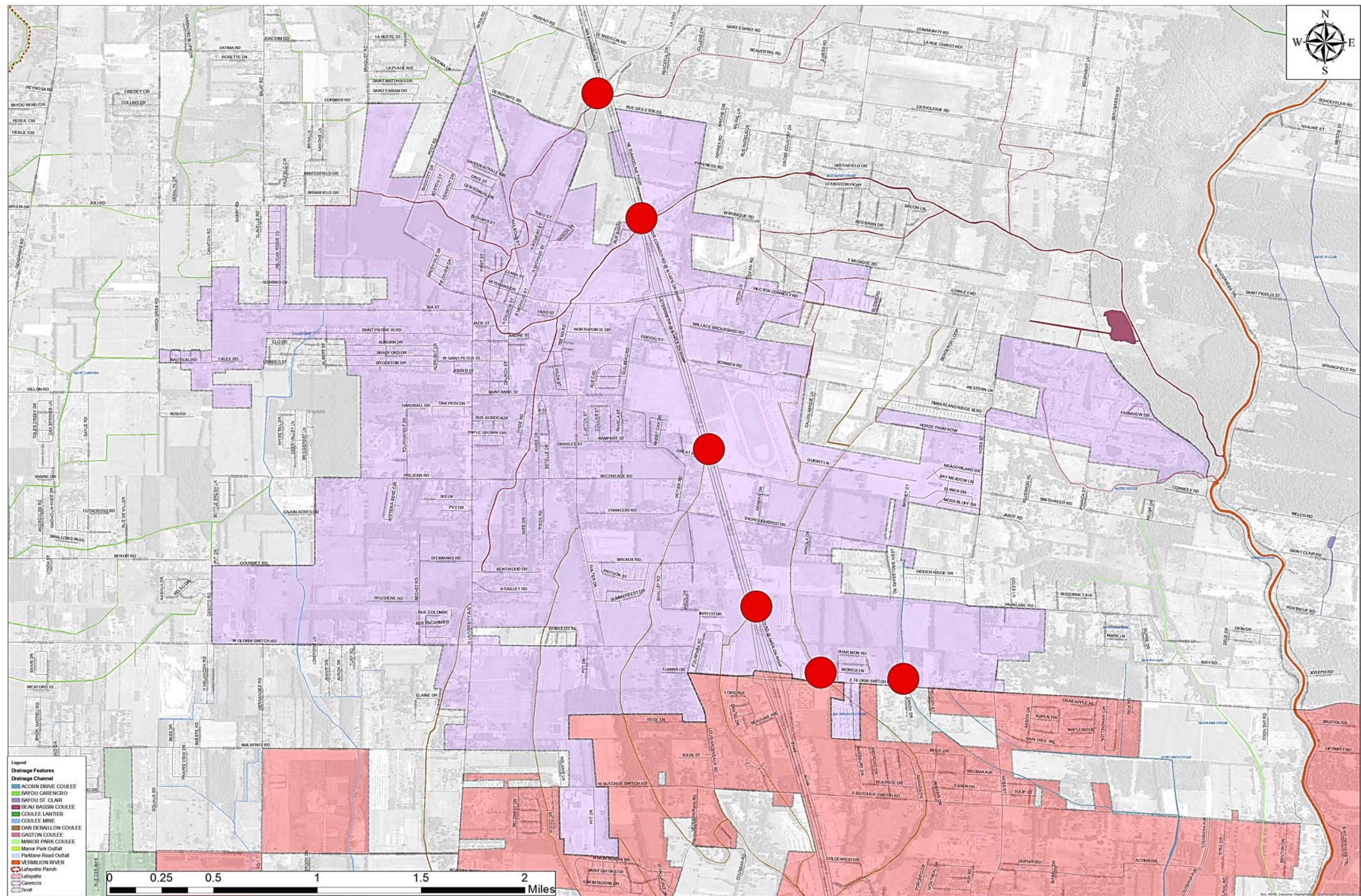


Exhibit 11

Drainage Areas of Concern in Carencro, LA

Lafayette Parish Area-wide Drainage Plan
State of Louisiana Silver Jackets Interagency Pilot Project Program



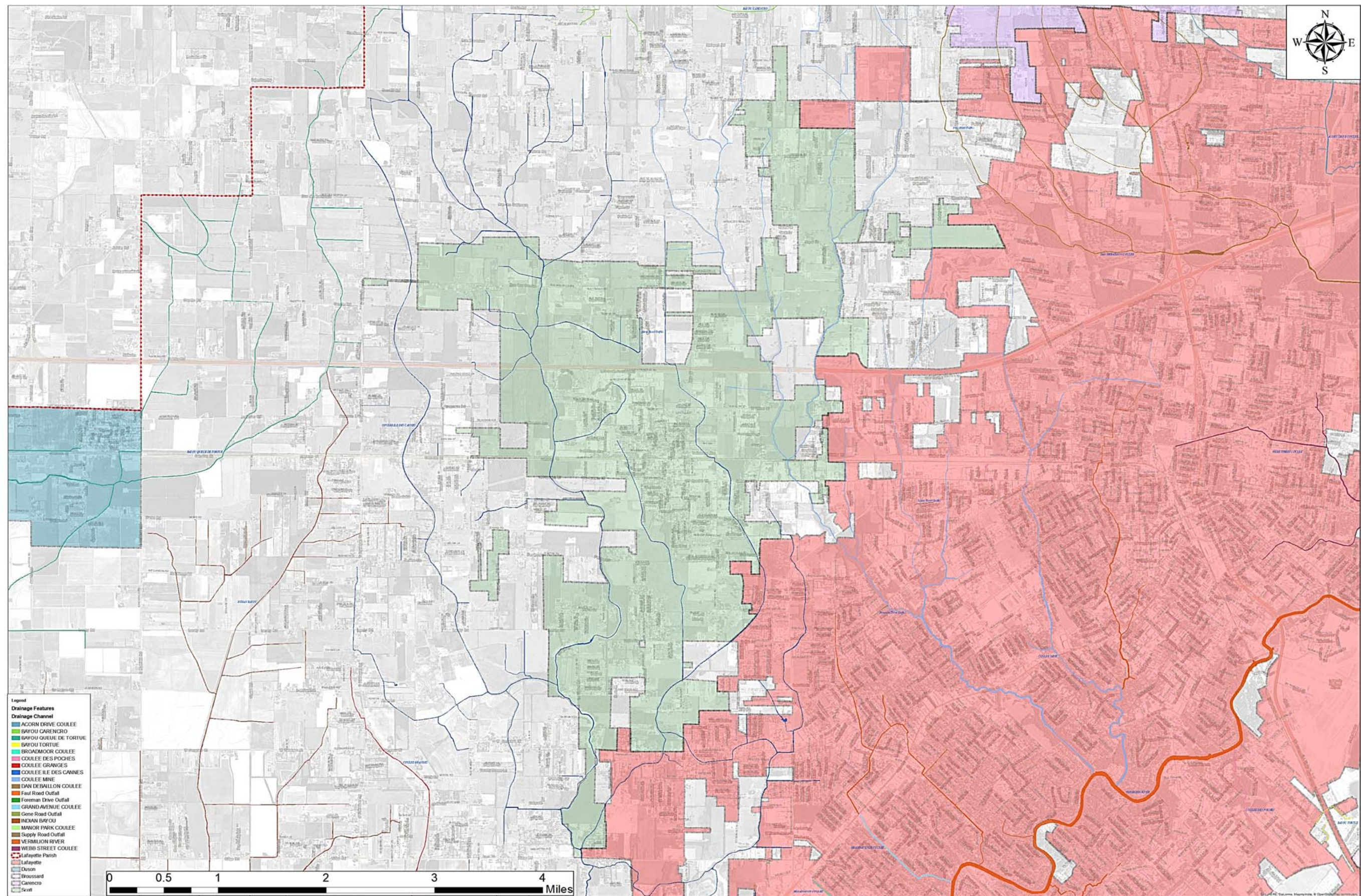


Exhibit 12

Existing Drainage Map of Scott, LA Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



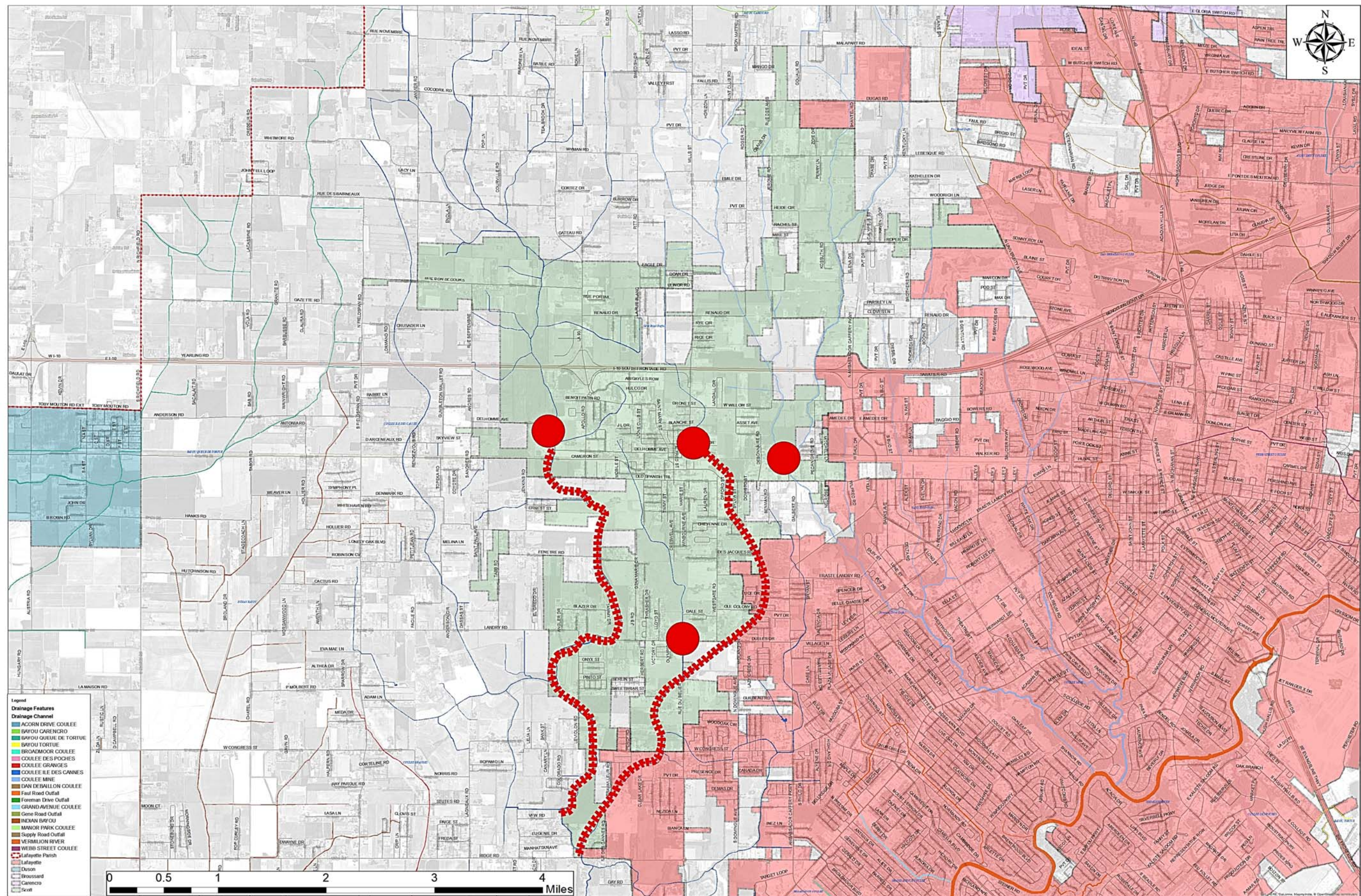


Exhibit 13

Drainage Areas of Concern in Scott, LA Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



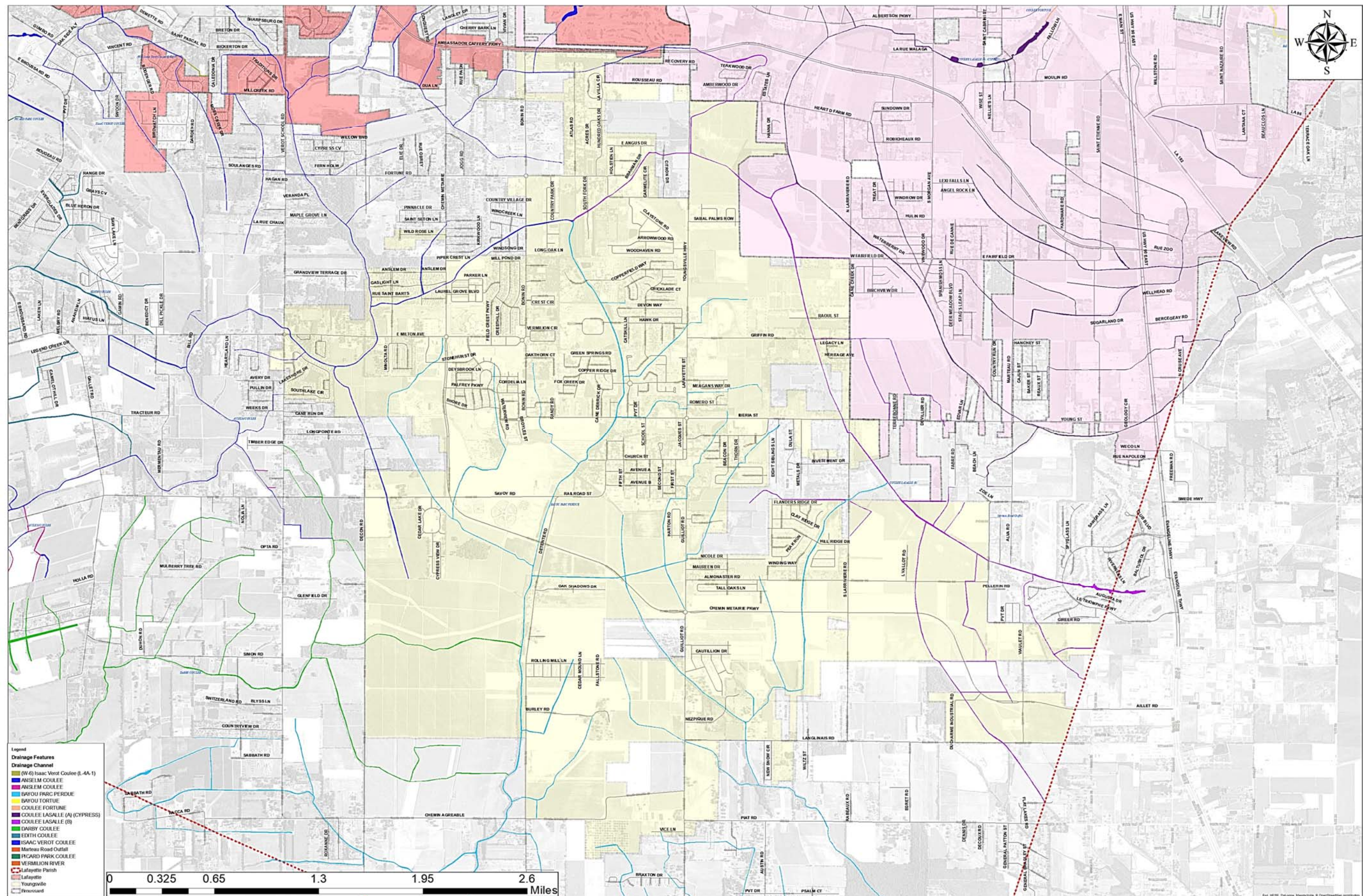


Exhibit 14

Existing Drainage Map of Youngsville, LA Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



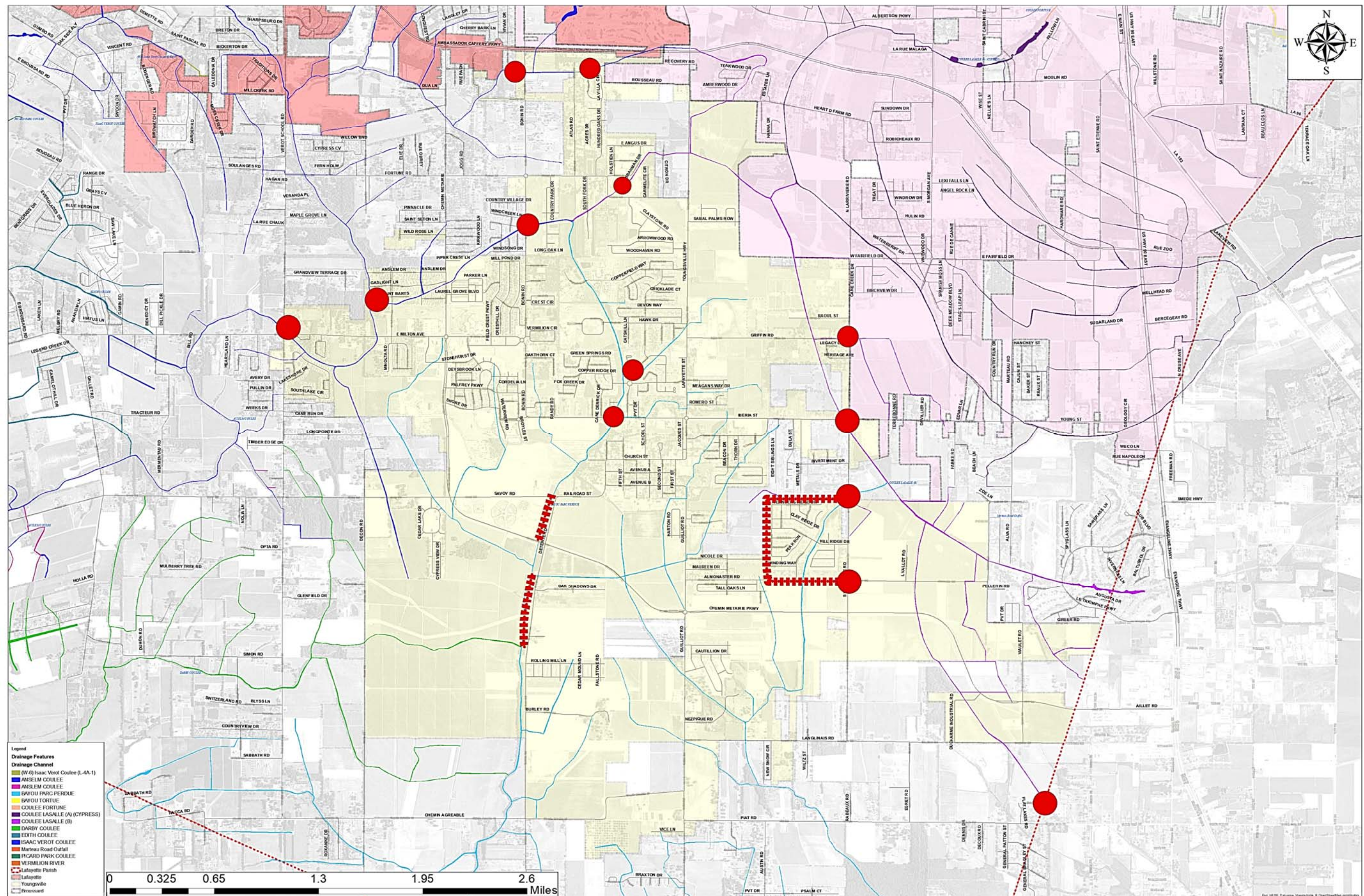


Exhibit 15

Drainage Areas of Concern in Youngsville, LA Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



5.0 Current Ordinances and Requirements

The newly adopted Unified Development Code (UDC) identifies the development requirements within the City of Lafayette and the unincorporated areas of Lafayette Parish which accounts for the parish's ordinances as well as other building codes. Other municipalities within the parish refer to the UDC and the parish's predecessor requirements in the absence of their own ordinances and/or requirements. The City of Youngsville and the City of Carencro have adopted their own ordinances with specific requirements for residential and commercial development that in some instances exceed the requirements of the UDC.

5.1 Detention

In the current UDC, the requirements include 10-year storm event detention for commercial developments and 5-year detention for residential developments. As of October 13, 2016, the City of Youngsville has adopted an ordinance that requires 25-year detention for both residential and commercial developments along with additional design and modeling requirements for drainage and detention systems.



5.2 Primary Drainage Systems

While open ditch collection systems are still allowed in some areas of the parish, the majority of the municipalities within the parish are requiring closed drainage systems in all new development. Primary drainage system features like ditches, inlet spacing, subsurface pipes and culverts are required to be designed for 10-year storm events for commercial development and 5-year storm events for residential developments.

There are no specific requirements regarding erosion and sediment control and protection of ditch and channel side slopes and bottoms.

5.3 Enforcement

Based upon the current requirements and ordinances, after review of the design of drainage systems and ultimate permitting there is minimal enforcement of the construction of the site to meet the approved design. For large commercial and residential developments, certifications, testing and inspections are required for plat approvals and/or certificates of occupancy. However, for individual site developments or home lot construction the inspections and enforcement are largely for the structural, electrical, plumbing and life safety codes with no final inspections to ensure that the drainage meets the design documents. Many issues associated with drainage construction design are not identified until adjacent property owners report it or until it creates a localized flooding problem.

5.4 Maintenance

For residential developments, ordinances and requirements identify the maintenance of a development's primary drainage system is the responsibility of the developer until 70-80% of the development's individual lots have completed construction. Some municipal ordinances require that the developer clean the sub surface drainage system once 80% of the homes are completed but there is little to no enforcement of these ordinances and many developers are not maintaining or cleaning the subsurface drainage systems unless forced by the municipality.

Laterals, coulees and bayous that are not concrete lined currently have no identified routine maintenance outside of chemical spraying of channel banks. While the chemical spraying of the banks assists in the growth of the weeds along channel banks, in areas where there is little other vegetation or erosion and sediment control measures along the bank it leaves the banks vulnerable to erosion due to lack of anything to protect the soil.



Poor erosion and sediment control of construction sites and erosion of channel banks results in channels silting and decreasing the receiving channel capacity.

6.0 Alternatives Analysis

Table 2 lists the projects that were identified by each of the municipalities as well as a few that were developed by the area-wide drainage plan team based upon the data collection efforts and the recent Great Flood of 2016. Each project was ranked based upon its impact on the following areas on a 1-5 basis with 1 being the least and 5 being the greatest impact with a weighting factor that ranges from 1-3. The projects with the highest points are of greatest priority and have the most benefit to the parish.

Table 2 Alternatives Analysis
Recommended Non-Structural and Structural Projects and Activities

Projects	Municipality	Impact to Decreased Flooding		Right of Way		Positive impact to Parish and other cities		Condition of Existing Infrastructure		Ability of Alternative to address drainage issue		Constructability		Permitting		Environmental Impacts		Impacts to adjacent property		Impacts to other infrastructure		Total	Comments
		Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)	Impact (1-5)	Weight (1-3)		
Vermilion River H&H model	Lafayette Parish																						
Teche-Vermilion Watershed H&H Model	Lafayette Parish																						
New Detention Requirements	Lafayette Parish																						
Channel cleaning and grubbing	Lafayette Parish	4	3	2	2	4	3	1	2	4	3	2	2	5	1	1	2	2	3	1	2	51	
Regional Plan	Watershed																						
Rain gauges and flow meters	Lafayette Parish																						
Cypress Bayou Lateral 2	Broussard	4	3	2	2	1	3	3	2	5	3	3	2	4	1	3	2	4	3	1	2	64	
Cypress Bayou Lateral 2-D	Broussard	4	3	2	2	1	3	3	2	5	3	3	2	4	1	3	2	4	3	1	2	64	
Albertson's Parkway Drainage Project	Broussard	4	3	2	2	1	3	3	2	4	3	5	2	2	1	1	2	1	3	1	2	52	
North Bernard Drainage Improvement Project	Broussard	4	3	2	2	1	3	3	2	4	3	5	2	2	1	1	2	1	3	1	2	52	
Cypress Bayou Lateral 4D	Broussard	4	3	2	2	1	3	3	2	5	3	3	2	4	1	3	2	4	3	1	2	64	
Prejean Road Maintenance Project	Carencro	3	3	1	2	1	3	3	2	3	3	4	2	1	1	1	2	1	3	1	2	43	
St. Pierre Drainage Project	Carencro	3	3	1	2	1	3	3	2	3	3	4	2	1	1	1	2	1	3	1	2	43	
Gloria Switch Drive Culvert Replacement Project	Carencro	3	3	1	2	1	3	2	2	3	3	4	2	1	1	1	2	1	3	1	2	41	
Bayou Carencro Improvement Project	Carencro	5	3	3	2	3	3	4	2	5	3	3	2	5	1	3	2	3	3	2	2	73	
Coulee Iles des Cannes widening	LCG	5	3	5	2	4	3	4	2	5	3	4	2	4	1	2	2	3	3	1	2	75	
Concrete Coulee Wall Repair Projects	LCG	3	3	2	2	2	3	4	2	3	3	4	2	5	1	1	2	4	3	2	2	63	
Erosion Protection Projects	LCG	3	3	2	2	1	3	4	2	3	3	4	2	2	1	3	2	2	3	3	2	59	
Widening of Cypress Bayou	LCG	5	3	5	2	4	3	4	2	5	3	5	2	5	1	4	2	4	3	3	2	89	
Bridge Replacement Projects	LCG	4	3	5	2	3	3	4	2	5	3	5	2	4	1	4	2	4	3	3	2	84	
Iles des Cannes Regional Detention	Scott	5	3	5	2	5	3	2	2	5	3	4	2	5	1	3	2	3	3	3	2	79	
Coulee Mines East Improvement Projects	Scott/LCG	4	3	3	2	4	3	3	2	5	3	4	2	3	1	2	2	3	3	3	2	69	
Youngsville Drainage Model	Youngsville																2						
Coulee Lasalle Culver Replacement at Hwy 90	Youngsville	5	3	3	2	3	3	5	2	5	3	4	2	3	2	2	2	3	3	2	2	76	
Bayou Parc Perdue Regional Detention	Youngsville	5	3	5	2	5	3	3	2	5	3	4	2	3	1	4	2	3	3	2	2	79	
Coulee LaSalle Regional Detention	Youngsville	5	3	5	2	5	3	5	2	5	3	5	2	4	1	5	2	5	3	5	2	100	
Isaac Verot Coulee Regional Detention	Youngsville	5	3	5	2	3	3	3	2	4	3	5	2	4	1	3	2	3	3	3	2	79	
Larriviere Road coulee and lateral crossings replacements	Youngsville	5	3	5	2	2	3	4	2	4	3	5	2	4	1	5	2	5	3	5	2	94	
Savoy Road Bridge Replacement	Youngsville	3	3	2	2	1	3	5	2	4	3	3	2	3	1	2	2	5	3	5	2	72	
Iberia Street Bridge Replacement	Youngsville	3	3	3	2	1	3	4	2	3	3	4	2	3	1	1	2	1	3	2	2	53	
Fortune Road Culvert Replacement	Youngsville	4	3	3	2	1	3	4	2	3	3	3	2	3	1	1	2	4	3	4	2	67	
Bonin Road Culvert Replacements	Youngsville	4	3	4	2	2	3	4	2	3	3	4	2	3	1	1	2	4	3	2	2	68	

7.0 Potential Funding Sources

The evaluation of the Parish's finances as well as each individual City's finances reflect that funds are limited for the needed infrastructure projects. If the Parish and Cities were to implement a proactive and preventative maintenance program there would be very little opportunity to complete capital projects. Therefore, the Parish and the Cities need to obtain funding from other sources in order to provide a proactive maintenance program and construct capital improvement projects to address drainage issues. The paragraphs below identify potential funding sources that could be pursued to provide the needed funding for the Parish and the individual Cities. To address infrastructure needs, programs have been put in place by governmental agencies to provide financial assistance to cities. The financial assistance provided by these agencies to cities or municipalities may be in the form of grants, loans, and bonding programs. The eligibility of the city to receive assistance is often related to several different criteria including the specific type of project, the project's impact to the overall health and safety of both the community and the environment, the project's correlation to a specific program's strategy, and the demographics of the area.

7.1 FEMA Pre-Disaster Mitigation (PDM) Grant Program

This grant program administered by FEMA provides resources to assist local communities, states and tribal governments with efforts to implement a sustained pre-disaster natural hazard mitigation program. The focus of the program is to assist in reducing the risk to population and structures in future hazard events. Projects that are eligible to apply for funding include:

- Climate Resilient Mitigation Activities (CRMA)
 - Aquifer Storage and Recovery (ASR)
 - Floodplain and Stream Restoration (FSR)
 - Flood Diversion and Storage (FDS)
 - Pre or post wildfire mitigation activities or any mitigation action that utilizes green infrastructure approaches
- Non-flood hazard mitigation projects and non-acquisition/elevation/mitigation reconstruction flood mitigation activities (i.e. stormwater management and flood control measures)
- Acquisition, elevation and mitigation reconstruction projects
- Generators for critical facilities as identified in a FEMA approved mitigation plan

This program is 75% federally funded with a 25% non-Federal sponsor cost share. The program is funded by congressional appropriations typically on an annual basis.

7.2 FEMA Flood Mitigation Assistance (FMA)

This program is authorized by Section 1366 of the National Flood Insurance Act of 1968 and is funded by the National Flood Insurance Program (NFIP) as appropriated by Congress. The program is focused on eligible activities or projects that reduce and eliminate flood insurance claims. Projects must be consistent with the states Hazard Mitigation Plan goals and objectives. Funding is only available to communities participating in the NFIP.

7.3 FEMA Hazard Mitigation Grant Program (HMGP)

The HGMP program is for mitigation projects resulting from a Presidentially declared disaster event. Projects eligible for funding under this program include:

- Elevation of flood prone structures above the base flood elevation (BFE) or higher
- Acquisition of flood prone structures and converting to green space perpetually
- Safe room construction providing for immediate near life-safety protection for either hurricane or tornado winds
- Localized drainage improvements that reduce localized flooding by increasing capacity
- Wind retrofit of structures by hardening the envelope of a structure in order to protect the structure against high winds

7.4 USACE Planning Assistance to States (PAS)

The PAS Program is a Congress annually funding program. While the program allotments for each state and tribe from the nationwide appropriation are limited to \$500,000 annually, amounts given are typically less. Individual studies selected for the program generally cost between \$25,000 to \$75,000. Eligible studies are those dealing with water and land related resources issues such as water supply and demand, water quality, floodplain management, coastal zone management and protection, harbor and port development, and master planning.

The studies that are part of this program usually provide a planning level of detail and involve analysis of existing data for planning purposes using standard engineering techniques. In some cases, data collection may be necessary. Many of the studies under this program become the basis for local planning decisions. This program is not for design for project construction. The cost-share for this program is on a 50 percent federal and 50 percent non-federal basis. The non-federal sponsor may provide half of their share as work-in-kind.

7.5 USACE Section 219 Environmental Infrastructure Program

This program is authorized under Section 219 of the 1992 Water Resources Development Act (WRDA) for the USACE to assist non-Federal interests in implementing water related infrastructure and resources protection and development projects. Assistance may be in the form of technical, planning and or design for interior drainage, water supply and storage, treatment and distribution systems and wastewater treatment systems including treatment plants. This program is a cost share of 75% Federal and 25% non-Federal sponsor.

7.6 USACE Floodplain Management Services (FPMS)

Under the Authority provide by Section 206 of the 1960 Flood Control Act the USACE can provide technical services and planning to support effective floodplain management. Examples of technical assistance provided under this program are:

- site-specific data on obstructions to flood flows,
- flood formation and timing;
- flood depths or stages;
- floodwater velocities;

- and the extent, duration and frequency of flooding.

The types of studies conducted under this program include:

- Floodplain delineation
- Dam failure analysis
- Hurricane evacuation
- Flood warning
- Flood damage reduction
- Stormwater management
- Flood proofing
- Inventories of flood prone structure

This program is 100% federally funded for state, regional and local governments, Indian tribes, and other non-federal public agencies. Detailed design and construction activities are not funded under this program.

7.7 USACE Continuing Authorities Program (CAP) Section 205 Funding

Under Section 205 of the 1948 Flood Control Act the Corps of Engineers is granted the authority to develop and construct small flood control projects. A feasibility study which includes detailed investigations that clearly show the engineering feasibility and economic justification for the improvement is needed before a project can obtain funding for design and construction under this program. Each project is limited to a not to exceed federal cost share of \$7 million, which includes all project-related costs for feasibility studies, detailed planning, engineering, construction, supervision and administration.

Projects eligible for this funding program are flood control projects that reduce flood damages by means of reservoirs, local protection works, or combinations of both. Examples of projects consist of one or more of the following:

- channel enlargement,
- channel realignment or paving,
- removal of obstruction,
- channel levee and wall construction,
- channel bank stabilization.

Under this program, the Corps oversees project construction, however, future maintenance and operation are the responsibility of the local sponsor. In addition, the local sponsor must also provide all lands, easements, right-of-way, relocations and disposal areas for the project. This program is a cost sharing of 65% federal sponsor and 35% local sponsor, with the local sponsor contributing at least 5% in cash to the project for design, preparation of plans and specifications and construction. The remainder of the contribution may be in-kind, land, easements or right of ways. The feasibility study for the project is 100% federally funded up to \$100,000.

7.8 NRCS Emergency Watershed Protection Program

The focus of this program responds to emergencies caused by natural disasters and is designed to help by relieving hazards to life and property caused by floods, fires, windstorms and other natural disasters. Projects are typically 75% federally funded and 25% non-federal sponsor funded. Eligible projects include:

- removal of debris from channels, road culverts and bridges
- reshape and protect eroded banks
- correct damaged drainage facilities
- establish cover on critically eroding banks
- repair levees and structures
- repair conservation practices

7.9 Clean Water State Revolving Fund (CWSRF) Assistance

The CWSRF is administered by the LDEQ. The majority of the funding available is through loans; however a small amount of funding is available each year for the purchase of debt or refinance, guarantees or insurance or for additional subsidization. The different types of CWSRF assistance is listed below:

- Loans
 - The terms of the loan may not exceed 30 years or the useful life of the project
 - Interest rates must be at or below market rate, including interest-free.
- Purchase of Debt or Refinance
 - A community's debt may be purchased by a CWSRF program.
 - The purchase may have terms up to 30 years, or the useful life of the project.
 - A CWSRF program may refinance previously issued debt.
- Guarantees and Insurance
 - Guarantees or insurance can be used where such assistance will result in improved credit market access or reduced interest rates.
 - The CWSRF program does not disburse funds for construction; such funds are procured borrower in the market.
- Guarantee SRF Revenue Debt
 - CWSRF programs may issue debt guaranteed by CWSRF funds. The revenue generated is used to provide assistance to borrowers for eligible projects. This expands the capacity of a program in the near-term.
- Provide Loan Guarantees
 - Similar revolving funds established by municipalities or inter-municipal agencies can receive loan guarantees.
- Additional Subsidization
 - Under certain conditions, CWSRF programs may provide up to a fixed percentage of their capitalization grants as additional subsidization in the form of principal forgiveness, negative, interest rate loans, or grants.
 - The annual CWSRF appropriation must be greater than \$1 billion

- The recipient must be a municipality or inter-municipal, interstate, or state agency.
- Additional subsidization may only be used to help address affordability water or energy efficiency goals; mitigate stormwater runoff; or encourages sustainable project planning, design, and construction.

CWSRF funding can be requested by municipalities for certain types of projects, mainly utility. The types of projects that are eligible for CWSRF are listed below.

- Nonpoint source
 - Assistance to any public, private, or nonprofit entity for the implementation of a state nonpoint pollution management program, established under CWA section 319.
- National estuary program projects
 - Assistance to any public, private, or nonprofit entity for the development and implementation of a conservation and management plan under CWA section 320
- Stormwater
 - Assistance to any public, private, or nonprofit entity for measures to manage, reduce, treat, or recapture stormwater or subsurface drainage water.
- Watershed pilot projects
 - Assistance to any public, private, or nonprofit entity for the development and implementation of watershed projects meeting the criteria in CWA Section 122.
- Water reuse
 - Assistance to any public, private, or nonprofit entity for projects for reusing or recycling, stormwater, or subsurface drainage water.

7.10 LADOTD Transportation Alternative Program (DOTDTAP)

The DOTDTAP, previously known as Transportation Enhancement Program (TEP), is a federally funded program administered through LADOTD. The goal is to work toward building a more balanced transportation system that includes pedestrians and bicyclists as well as the motoring public.

Eligible projects can include:

- bicycle and pedestrian facilities
- safe routes for non-drivers
- conversion of abandoned railway corridors to trails
- scenic turnouts
- overlooks and viewing areas
- archaeological activities
- stormwater mitigation
- wildlife management
- and community improvement activities (*Community improvement activities can include outdoor advertising management, historic preservation and rehabilitation of historic transportation facilities and vegetation management*)

7.11 Capital Outlay Program

The Capital Outlay Program distributes funds to cities through both Facility Planning and Control (FP&C) and DOTD. The FP&C Capital Outlay Budget represents funding for the construction or renovation of state and local public facilities or infrastructure. The DOTD Capital Outlay Budget represents funding for the construction or renovation of state transportation infrastructure; the Highway Priority Program; the Facilities Program; the Airport Priority Program; the Flood Control Program; the Ports Priority Program; Non-Federal Aid State Roads and Highways; various large scale infrastructure projects; and motor vessels and equipment.

7.12 Bonding

Municipal bonds are securities that are issued for the purpose of financing the infrastructure needs of the issuing municipality. These bonds can be used to construct schools, roads, bridges, hospitals, public housing, sewer, water systems, power utilities, and various public projects. The two basic types of municipal bonds are:

- **General obligation bonds:** Principal and interest are secured by the full faith and credit of the issuer and usually supported by either the issuer's unlimited or limited taxing power.
- **Revenue bonds:** Principal and interest are secured by revenues derived from tolls, charges or rents from the facility built with the proceeds of the bond issue. Public projects financed by revenue bonds such as water and sewage treatment facilities.

A municipality's bonding capacity is based upon income and amount of existing debt and overall financial position.

7.13 Impact Fees

An impact fee is a fee that is imposed by a local government on a new or proposed development project to pay for all or a portion of the costs of providing public services to the new development. These fees part of the development approval process and typically collected during the construction of or prior to commencing the construction of the development. Requiring an impact fee to provide adequate public facilities is similar to meeting site planning and zoning requirements. It is not a tax so it does not require an election or vote outside of the governing bodies voting authority. Impact fees are increasing in popularity and usage. In fact, throughout the country, many builders and Owners/Developers are impact fee proponents because they know that impact fees add predictability to the development approval process and create a "level playing field" between them and their competitors. These fees replace less fair negotiated exactions that are more common today when seeking approval for development.

The development and use of impact fees must pass the "rational nexus" and "rough proportionality" tests and meet the following three criteria. First, the fee must be a reasonable connection between the "need" for additional facilities and new development. Second, it must be shown that the fee payer will "benefit" in some way from the fee. And third, calculation of the fee must be based on a proportionate "fair share" formula.

Local communities within Louisiana that have developed and implemented impact fees are St. Tammany Parish and the City of Sulphur. While impact fees are fairly new to Louisiana and less common practice, numerous Cities in Florida and Texas have implemented impact fees for many years.

7.14 Permit Fees

The existing construction permit fees within the parish and within the individual cities do not cover the costs associated with the municipality's outside consultants as well as internal administrative and technical reviews. Further, with the low permit costs there is insufficient funding for the needed construction enforcement of drainage infrastructure systems. Permit fees should include additional fees to cover:

- Final Site Inspection (per lot)
- Drainage Study Review (per lot)
- Residential Building Plan Site/Drainage Review/Inspection Fee

7.15 Stormwater Utility Fee

A stormwater utility fee is a user fee that pays for the maintenance, improvements to the stormwater drainage system and other stormwater program activities. This fee is similar to the fee a user pays for water, wastewater and garbage. The fee is based upon the user's impervious area of the property and may be collected on a monthly or annual basis. The fees collected are placed in a stormwater enterprise fund, similar to that of a water and wastewater fee and is to be utilized only for stormwater program activities. Many municipalities across the country are implementing stormwater utility fees in order to address the stormwater management issues associated with rapid growth and deteriorating drainage infrastructure. The fee is established using impervious area and a "rational nexus" to support the calculated fee and funded programs to be fair and equitable. This fee is fairly new to Louisiana in areas like New Orleans where it has been recently implemented to address internal drainage infrastructure needs.

8.0 Recommendations

An approach, similar to that of other states, would be to work regionally specifically within a common watershed because the flow of stormwater is continuous through cities and parishes. Water does not know political boundaries. The majority of the projects identified by each municipality and by the parish are limited in scope to an immediate area within the city limits of that municipality due, in part, to limited joint efforts and coordination between the municipalities within and outside of the Lafayette Parish and limited available funds for the larger projects that would benefit a larger geographic area. A dedicated regional authority, to manage the water resources within the watershed, is recommended as a long-term solution. However, this will require legislation. In the absence of a dedicated authority, the governments within the watershed must commit to a regional approach, work with state and federal agencies in identifying and completing large scale projects, and work to develop ordinances, maintenance plans and minimum standards of practice for the management and design of regional stormwater management.

In concert with the regional approach for stormwater management, the following are recommended non-structural and structural projects, as well as activities, for an overall parish plan to address drainage issues.

8.1 Proposed Non-Structural Projects and Activities

While there are many structural projects identified by the cooperating cities to address flooding there are some non-structural project and activities that are recommended as equally important.

8.1.1 Models and Data Development

As identified in Section 2.0 Data Collection, while there have been a few plans and studies developed within the parish by the Parish or cooperating cities, there has been minimal modeling of many of the channels. In particular, no model has been developed for the Vermilion River outside of the limited modeling performed for the FEMA FIRMs. Since a large amount of the parish is influenced by the Vermilion River it is important to understand the capacity, limitations and influences of the Vermilion River on the overall drainage of the majority of the parish. In addition, many of the models, calculations and designs are based upon tailwater conditions of the Vermilion River and/or it's upstream channels that serve as the receiving streams for primary drainage systems. Furthermore, the rainfall distribution data used on any previous models were based upon curves and uniform hydrographs developed more than fifty (50) years ago. To address these issues, the following is recommended as a priority to assist in the location and sizing of drainage infrastructure to be added, modified and replaced as well as for planning and design in the future:

- Develop a model of the Vermilion River that includes updated cross sections and utilizes collected rainfall data for the past 15-20 years
- Develop a Vermilion-Teche Watershed model that includes the thirty-three identified channels of the Lafayette Parish Drainage Map

- Using the collected rainfall data, develop a watershed rainfall distribution to be used in the design calculations for structural project and the future planning and design for development
- Use the more recent trends of rainstorm events in planning, ordinance development and design regulations for drainage infrastructure

8.1.2 Ordinance, Regulations and Requirements

The results of the previous studies following Tropical Storm Allison in 2001 acknowledged that the issues associated with that storm event were volumetric in nature regardless of the conditions of the receiving streams. Many streets and areas were flooded in 2001 with as little as 10.62" of rain and as much as 31.9" of rain in 5 days. With the continued development and inability to fund some of the proposed projects from the 2008 Lafayette Stormwater Master Plan, the same areas as well as additional areas were far more inundated with the Great Flood of 2016 which resulted in over 28" of rain in 30 hours. Fifteen years of rapid growth and development with the majority of it providing as little as 5-year storm event detention results in localized flooding in many areas of the parish with as little as a 10-year storm event.

As mentioned previously, the City of Youngsville recently adopted an ordinance for new developments to provide detention for the 25-year storm event, provide backflow prevention from the receiving stream and account for the dynamic tailwater of the receiving stream. The new detention requirement is more in line with what most municipalities across the nation require. This was recommended in a 1997 Detention Seminar hosted by the Acadiana Branch American Society of Civil Engineers for the Lafayette area when detention was in its infancy in the parish and an ordinance had not yet been introduced or adopted. Detention is for the larger storm events to allow the receiving stream to recede after its peak before discharging from new development. While this ordinance does not assist with the current flood conditions it will keep future developments from exacerbating the problems during many of the rain events that the area routinely experiences. Requiring the calculations, models and designs of the detention systems to address the conditions of the receiving streams is a critical component as we have seen backflow in the Vermilion River in many storm events throughout the year which effects the ability of the channels upstream to provide a positive outfall for detention systems. Furthermore, if the detention system does not provide backflow prevention oftentimes the receiving stream will backflow into the detention pond and "equalize" the drainage system resulting in the development not draining to the detention system and causing flooding upstream in the development.

It is recommended that Lafayette Parish and the surrounding communities adopt a similar ordinance to provide for increased detention requirements and more advanced calculations and models for the design of future development drainage infrastructure.

It is also recommended that the Parish as well as the cities within the parish include in their permit and inspection process for new development inspection of all site development for conformance with the permit issued. Enforcement of the drainage ordinances that identify

developer maintenance of drainage collection systems until the developments are 70-80% complete is highly recommended as well.

There are ordinances in place and requirements regarding erosion and sediment control within the Parish and individual cities; however, the enforcement of the ordinances is not stringent. Increased monitoring and enforcement of erosion and sediment control measures on construction sites is recommended.

The development of a routine maintenance plan for channel maintenance within the Parish is recommended. The channel maintenance plan should include interagency agreements needed and identified schedules along with permitting requirements.

8.2 Infrastructure Improvement Projects

The infrastructure improvement projects identified by previous studies as well as city and parish staff can be categorized in one of the following categories:

- Channel cross drain or bridge replacement due to undersized infrastructure
- Roadside culvert replacements
- Channel regrading and grubbing
- Regional detention

Modeling performed for previous studies by the USACE indicated that the cross drain and bridge replacement projects assist with localized drainage issues but the impact on the downstream or upstream areas are minimal and sometimes even negatively impact upstream or downstream.

The projects that have the most impact on localized flooding and help areas upstream and downstream are regional detention projects. The continued rapid and high development of the parish has resulted in increased runoff volumes in 10-year and larger storm events that are not compensated with equivalent detention areas, therefore creating a volumetric problem regarding drainage. Channel regrading and grubbing is most effective to regain previous capacity thereby reducing the water surface elevation which serves as the tailwater condition that was used for the design of the drainage systems. This effort does not provide additional capacity to handle the increased and rapid development that has occurred over the past 20 years.

Taking into account data collection, modeling and alternatives analysis, permitting, land acquisition and funding it is recommended to separate the projects into near term and long-term projects that should be completed in concert with the projects and activities identified in Section 8.1.

8.2.1 Near Term Projects

It is recommended that the channels and laterals within the parish in need of cleaning be completed as soon as possible to restore the historical capacity of the water bodies. At a minimum the following are in need of cleaning:

- Coulee Ile Des Cannes
- Coulee Mine East
- Cypress Bayou and laterals
- Coulee LaSalle coulee and laterals
- Bayou Parc Perdue coulee and laterals
- Isaac Verot Coulee
- Anslem Coulee and laterals



It is also recommended to complete the channel regrading projects of Coulee Mine East and Cypress Bayou.

The Larriviere Road coulee and lateral crossing replacements should be a priority considering in August of 2017, the first new high school to be built in Lafayette parish in over 45 years will open along Larriviere Road. The study of 2008 showed in 2001 the road was inundated during a 10-year storm event. Larriviere Road will be the primary route to the school for approximately 1400 students in the Youngsville, Milton, Broussard and southern Lafayette Parish unincorporated areas. Providing safe access to and from the school during more common events makes this project a high priority for the near term that affects many resident families in the southern portions of the parish.



There are numerous roadside culverts and cross drain projects identified, many of these provide benefit in the immediate area only. The smaller cross drain and roadside ditch culvert projects should be completed in the near term. However, it is recommended that the larger culvert, cross drain and bridge replacement projects should be modeled to determine the upstream and downstream effects before proceeding with projects to ensure there are no upstream or downstream impacts. These projects should be modeled with and without regional detention within the watershed.

It is recommended that the Fortune Road and Bonin Road Culvert projects as well as the Savoy Road and Iberia Street bridge projects identified by Youngsville be completed after modeling of the Bayou Parc Perdue watershed is completed and under the conditions of with and without regional detention in the Bayou Parc Perdue watershed.

8.2.2 Long Term Projects

Based upon previous modeling and the recent results of large rain events regional detention systems provide the most benefit locally and regionally. The following are recommended as potential locations of regional detention systems:

- Along Coulee Ile Des Cannes in Scott
- Along Bayou Parc Perdue in Youngsville
- Along Coulee LaSalle in Youngsville
- Along Anslem Coulee/Isaac Verot Coulee in Youngsville/South Lafayette Parish
- Along Cypress Bayou in Broussard
- Along Indian Bayou in the unincorporated area of Lafayette Parish

It highly recommended to work with neighboring parishes on a regional watershed approach to look for diversion or larger detention systems that provide benefit to the parish and watershed on a much larger scale.

8.2 *Opinions of Probable Construction Costs*

Many of the projects that were recommended by the cooperating municipalities were not part of any previous studies or plans and the information provided during data collection did not provide any opinions of probable construction cost or diagrams of the project areas. The following costs are based upon the limited information provided at the time of the study. These costs are to be considered planning level costs and do not include any preliminary design efforts. It is recommended that the costs be refined during additional efforts of each individual when subsequent studies or preliminary design are performed.

Table 3 lists the projects and planning level opinions of probable cost.

Table 3 Planning Level Opinions of Probable Costs

Alternative	Planning Level Opinions of Probable Costs
Develop a model of the Vermilion River that includes updated cross sections and utilizes collected rainfall data for the past 15-20 years	\$500,000
Develop a Vermilion-Teche Watershed model that includes the thirty-three identified channels of the Lafayette Parish Drainage Map	\$750,000
Regional Plan Development including identification of choke points, problem areas and alternatives for improvement and modeling of alternatives with recommendations and planning level costs estimates and potential funding mechanisms and non-structural project recommendations	\$500,000
Using the collected rainfall data, develop a watershed rainfall distribution to be used in the design calculations for structural project and the future planning and design for development	\$50,000
Install rain gauges and flow meters along major channels prone to flooding to monitor and collect data for future planning and design	\$350,000
Use the more recent trends of rainstorm events in planning, ordinance development and design regulations for drainage infrastructure	Included in model and plan costs
Work with neighboring parishes on a regional watershed approach to look for diversion and/or larger detention systems that provide benefit to the parish and watershed on a much larger scale	Included in model and plan costs
Lafayette parish and surrounding areas within the Vermilion-Tech watershed adopt an ordinance similar to the City of Youngsville requiring 25-year storm event detention on new development with requirements for modeling using recent data, backflow prevention and 25-year event tailwaters on receiving streams	Included in model and plan costs
Cities within the parish should include in their permit and inspection process for new development inspection of all site development for conformance with the permit issued	N/A
Development of a Youngsville Drainage Model	\$250,000
Enforcement of the drainage ordinances that identify developer maintenance of drainage collection systems until the developments are 70-80%	N/A
Increased monitoring and enforcement of erosion and sediment control measures on construction sites	N/A
The development of a routine maintenance plan for channel maintenance within the Parish	\$1,500,000 annually

Alternative	Planning Level Opinions of Probable Costs
Clean channels and laterals within the parish as soon as possible to restore the historical capacity of the water bodies:	
Coulee Ile Des Cannes	\$500,000
Coulee Mine East	\$500,000
Cypress Bayou and laterals	\$750,000
Coulee LaSalle and laterals	\$750,000
Bayou Parc Perdue coulee and laterals	\$650,000
Isaac Verot Coulee	\$650,000
Anslem Coulee and laterals	\$350,000
Request USACE assistance with dredge maintenance of the Vermilion River	
Complete the channel regrading projects of Coulee Mine East and Cypress Bayou	\$2,500,000
Replace cross drains at along Hwy 90 at Coulee LaSalle and Cypress Bayou	\$1,000,000
Replace undersized Larriviere Road coulee and lateral crossings	\$1,250,000
Replace Fortune Road and Bonin Road undersized crossings	\$900,000
Replace Savoy Road and Iberia Street undersized bridges	\$950,000
Construct regional detention systems at the following locations:	
Along Coulee Ile Des Cannes in Scott	
Along Bayou Parc Perdue in Youngsville	\$8,000,000
Along Coulee LaSalle in Youngsville	\$4,000,000
Along Anslem Coulee/Isaac Verot Coulee in Youngsville	\$2,500,000
Along Cypress Bayou in Broussard	\$2,500,000
Along Indian Bayou in the unincorporated area of Lafayette Parish	\$3,500,000

9.0 Conclusions

The Parish's drainage issues are a result of limited capacity in receiving streams, design criteria of detention systems for the large amount of development, as well as, roadway cross drains and maintenance of private drainage systems in developments.

Due to ownership limitations of receiving streams the communities of Broussard, Carencro, Scott and Youngsville can request permission to clean the receiving streams but most of the them are under the control of the Lafayette Consolidated Government and the ability of the communities to clean the receiving streams are beyond their control. Therefore, the recommendations from each community are alternatives focused on the drainage improvements that the community can provide and regulate. There has been limited coordination and efforts within the parish to manage stormwater and address drainage issues on a parish-wide, region-wide or watershed basis.

This plan should serve as a guideline for the administrations within the parish and the cooperating cities to address stormwater management issues and the design and construction of drainage projects within the parish and the Vermilion-Teche watershed.

The figure below shows the six (6) categories of projects that were identified and are recommended to address stormwater management within Lafayette Parish. The projects provide the most benefit when performed in concert with a regional cooperation and coordination approach.

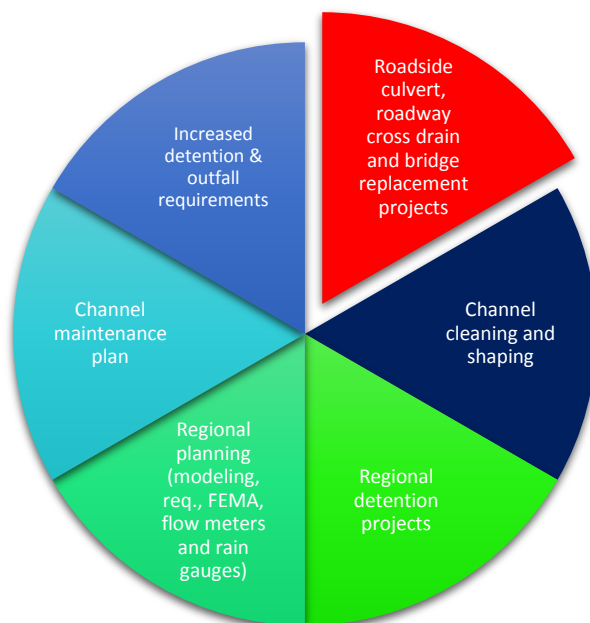


Table 4 is a summary of the recommended non-structural projects and activities, structural projects, beneficial areas, priority level, potential funding mechanisms and planning level opinions of probable construction costs. **Exhibits 16-21** shows the locations of the recommended projects for Lafayette Parish, Cities of Lafayette, Broussard, Carencro, Scott and Youngsville.

Table 4 Recommended Non-Structural and Structural Projects

Alternative	Beneficial Area	Priority Level	Potential Funding Mechanisms	Planning Level Costs
Develop a model of the Vermilion River that includes updated cross sections and utilizes collected rainfall data for the past 15-20 years	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$500,000
Develop a Vermilion-Teche Watershed model that includes the thirty-three identified channels of the Lafayette Parish Drainage Map	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$750,000
Using the collected rainfall data, develop a watershed rainfall distribution to be used in the design calculations for structural project and the future planning and design for development	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$50,000
Install rain gauges and flow meters along major channels prone to flooding to monitor and collect data for future planning and design	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	\$350,000
Use the more recent trends of rainstorm events in planning, ordinance development and design regulations for drainage infrastructure	Parish and Vermilion-Teche watershed	1	Planning Assistance to State (PAS), USACE Section 219, USACE FPMS	N/A
Work with neighboring parishes on a regional watershed approach to look for diversion and/or larger detention systems that provide benefit to the parish and watershed on a much larger scale	Parish and Vermilion-Teche watershed	1	USACE Section 205	N/A
Lafayette parish and surrounding areas within the Vermilion-Tech watershed adopt an ordinance similar to the City of Youngsville requiring 25-year storm event detention on new development with requirements for modeling using recent data, backflow prevention and 25-year event tailwaters on receiving streams	Parish and Vermilion-Teche watershed	1	General Fund	N/A
Cities within the parish should include in their permit and inspection process for new development inspection of all site development for conformance with the permit issued	Cities and Parish	1	Permit Fees, General Fund, Stormwater Utility	N/A
Development of a Youngsville Drainage Model	City of Youngsville and unincorporated areas of Lafayette Parish	1	Planning Assistance to States (PAS). USACE FPMS	\$250,000
Enforcement of the drainage ordinances that identify developer maintenance of drainage collection systems until the developments are 70-80%	Cities and Parish	1	Permit Fees, General Fund, Stormwater Utility	N/A
Increased monitoring and enforcement of erosion and sediment control measures on construction sites	Cities and Parish	1	Permit Fees, General Fund, Stormwater Utility	N/A
The development of a routine maintenance plan for channel maintenance within the Parish	Cities and Parish	1	General Fund, Impact Fee, Stormwater Utility	\$1,500,000 annually
Clean channels and laterals within the parish as soon as possible to restore the historical capacity of the water bodies:	Cities and Parish	1	General Fund, FEMA HGMP	
Coulee Ile Des Cannes	City of Scott, City of Lafayette and Unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$500,000
Coulee Mine East	City of Scott, City of Lafayette and Unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$500,000
Cypress Bayou and laterals	City of Broussard and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$750,000
Coulee LaSalle and laterals	City of Youngsville, City of Broussard and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$750,000

Alternative	Beneficial Area	Priority Level	Potential Funding Mechanisms	Planning Level Costs
Bayou Parc Perdue coulee and laterals	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$650,000
Isaac Verot Coulee	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP	\$650,000
Anslem Coulee and laterals	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HMGP	\$350,000
Request USACE assistance with dredge maintenance of the Vermilion River	Parish and Vermilion-Teche watershed	1	USACE Section 219	
Complete the channel regrading projects of Coulee Mine East and Cypress Bayou	City of Scott, City of Broussard, City of Lafayette and unincorporated areas of Lafayette Parish	2	USACE Section 219	\$2,500,000
Replace cross drains at along Hwy 90 at Coulee LaSalle and Cypress Bayou	City of Youngsville, City of Broussard and unincorporated areas of Lafayette Parish	1	LADOTDTAP	\$1,000,000
Replace undersized Larriviere Road coulee and lateral crossings	City of Youngsville and unincorporated areas of Lafayette Parish	1	General Fund, FEMA HGMP, USACE Section 219,	\$1,250,000
Replace Fortune Road and Bonin Road undersized crossings	City of Youngsville and unincorporated areas of Lafayette Parish	3		\$900,000
Replace Savoy Road and Iberia Street undersized bridges	City of Youngsville	3		\$950,000
Construct regional detention systems at the following locations:				
Along Coulee Ile Des Cannes in Scott	City of Scott, City of Lafayette and unincorporated areas of Lafayette Parish	1	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	
Along Bayou Parc Perdue in Youngsville	City of Youngsville and unincorporated areas of Lafayette Parish	1	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$8,000,000
Along Coulee LaSalle in Youngsville	City of Youngsville, City of Broussard and unincorporated areas of Lafayette Parish	1	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$4,000,000
Along Anslem Coulee/Isaac Verot Coulee in Youngsville	City of Youngsville and unincorporated areas of Lafayette Parish	3	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$2,500,000
Along Cypress Bayou in Broussard	City of Broussard and unincorporated areas of Lafayette Parish	3	USACE Section 205, FEMA HMGP, FEMA PDM	\$2,500,000
Along Indian Bayou in the unincorporated area of Lafayette Parish	Unincorporated areas of Lafayette Parish	3	USACE Section 205, FEMA HMGP, FEMA PDM, FEMA FMA	\$3,500,000

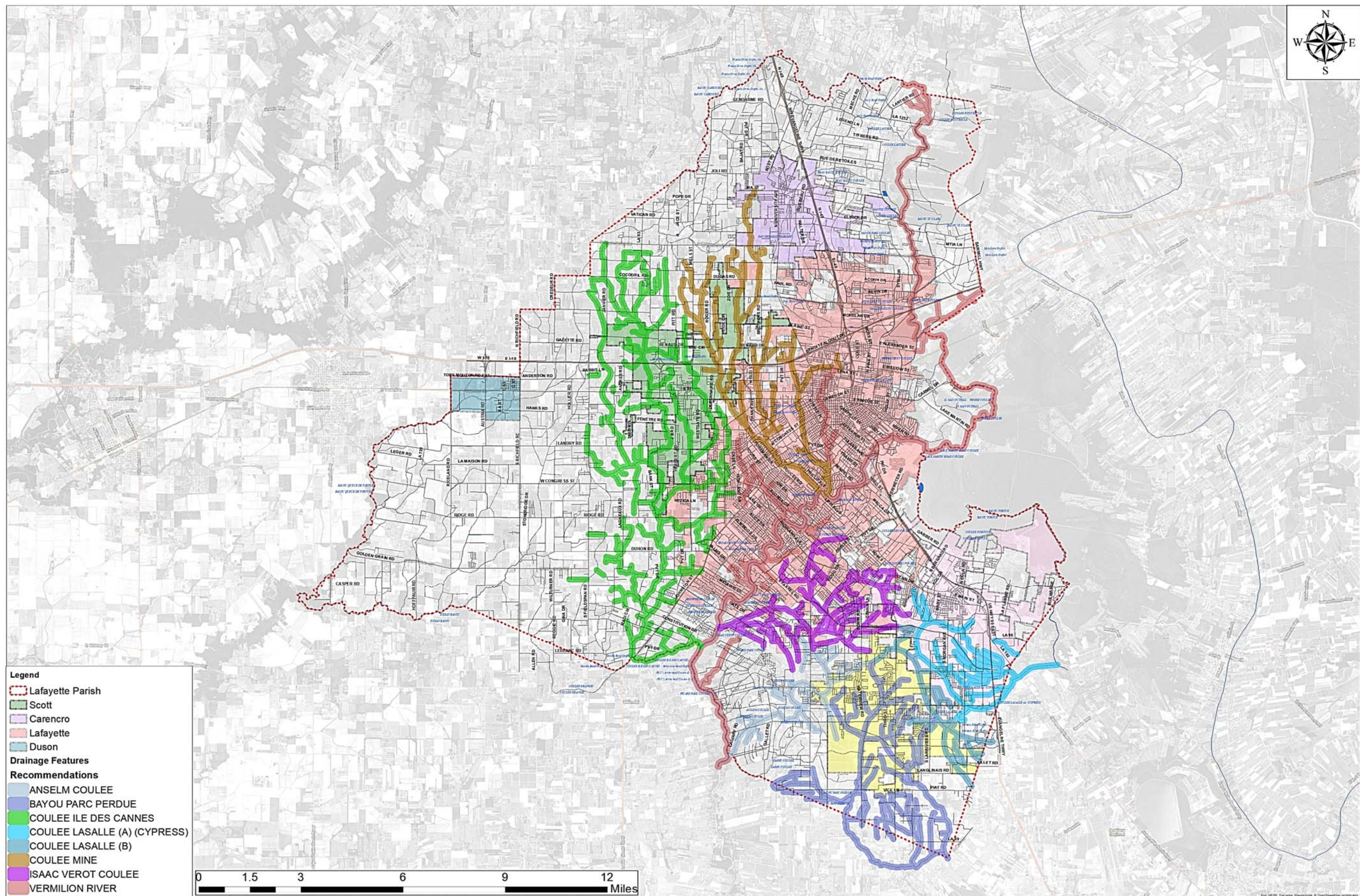


Exhibit 16

Lafayette Parish Drainage Recommendations

Lafayette Parish Area-wide Drainage Plan

State of Louisiana Silver Jackets Interagency Pilot Project Program



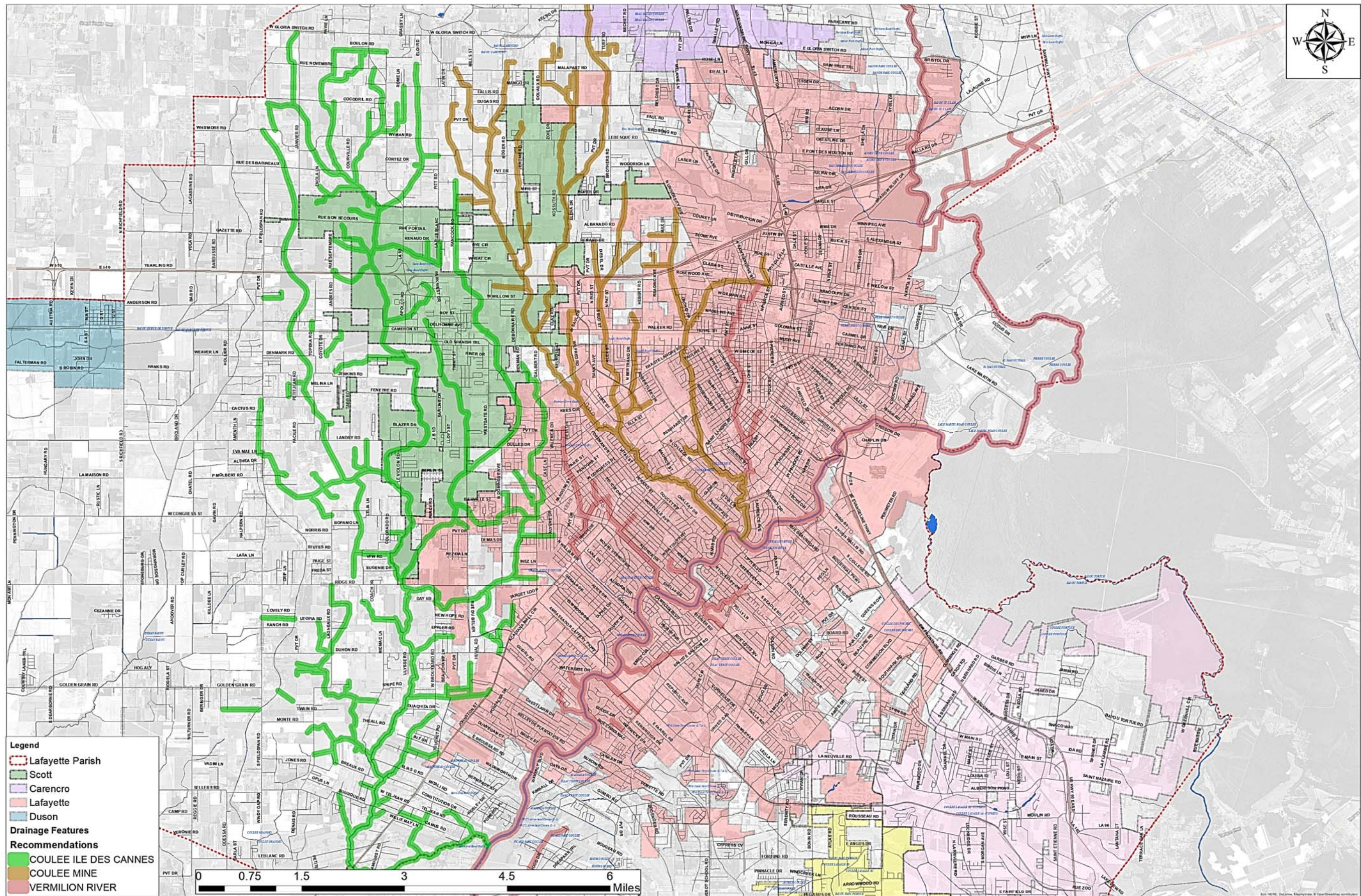


Exhibit 17

Lafayette Drainage Recommendations Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



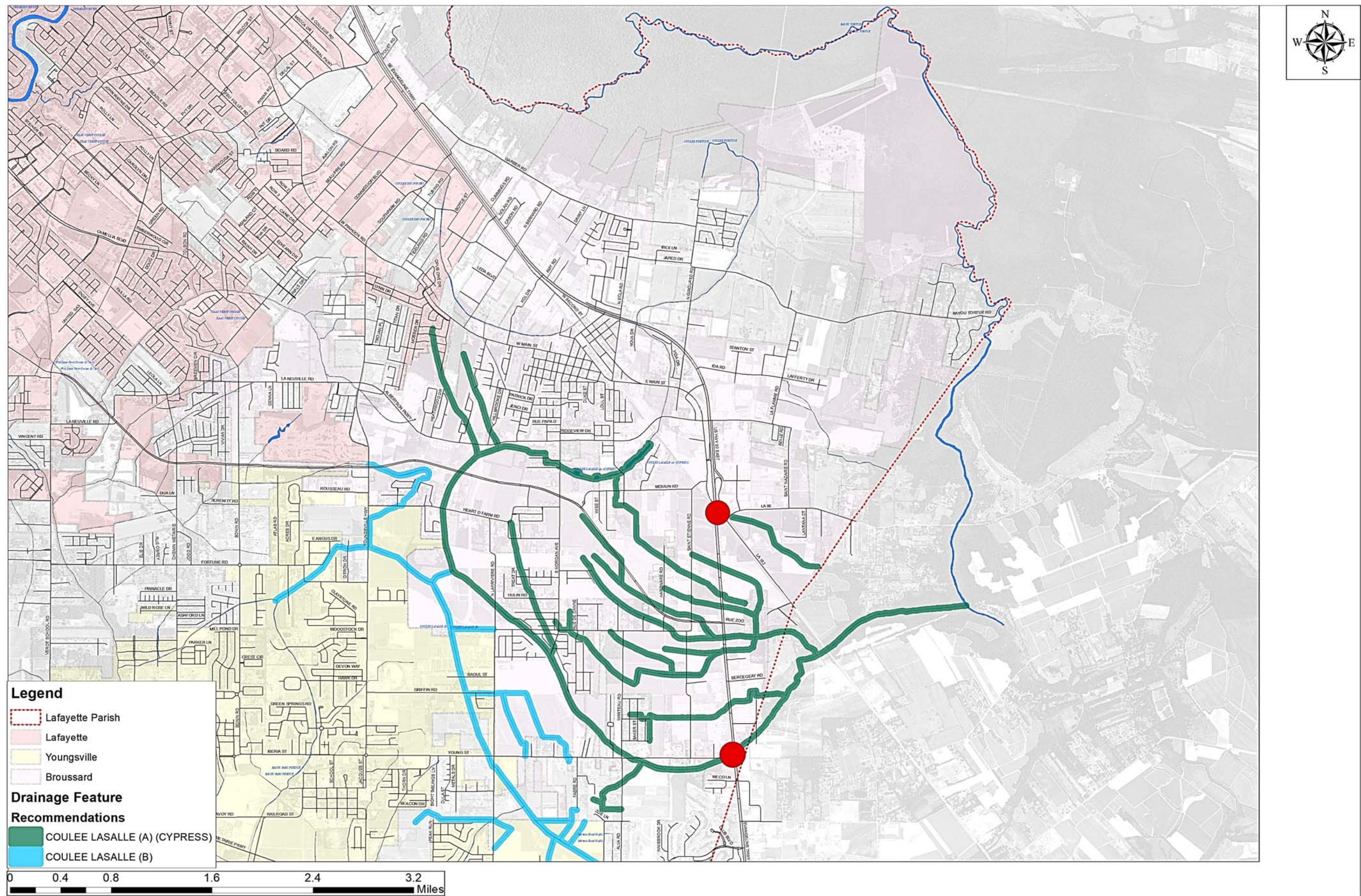


Exhibit 18

Broussard Drainage Recommendations Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



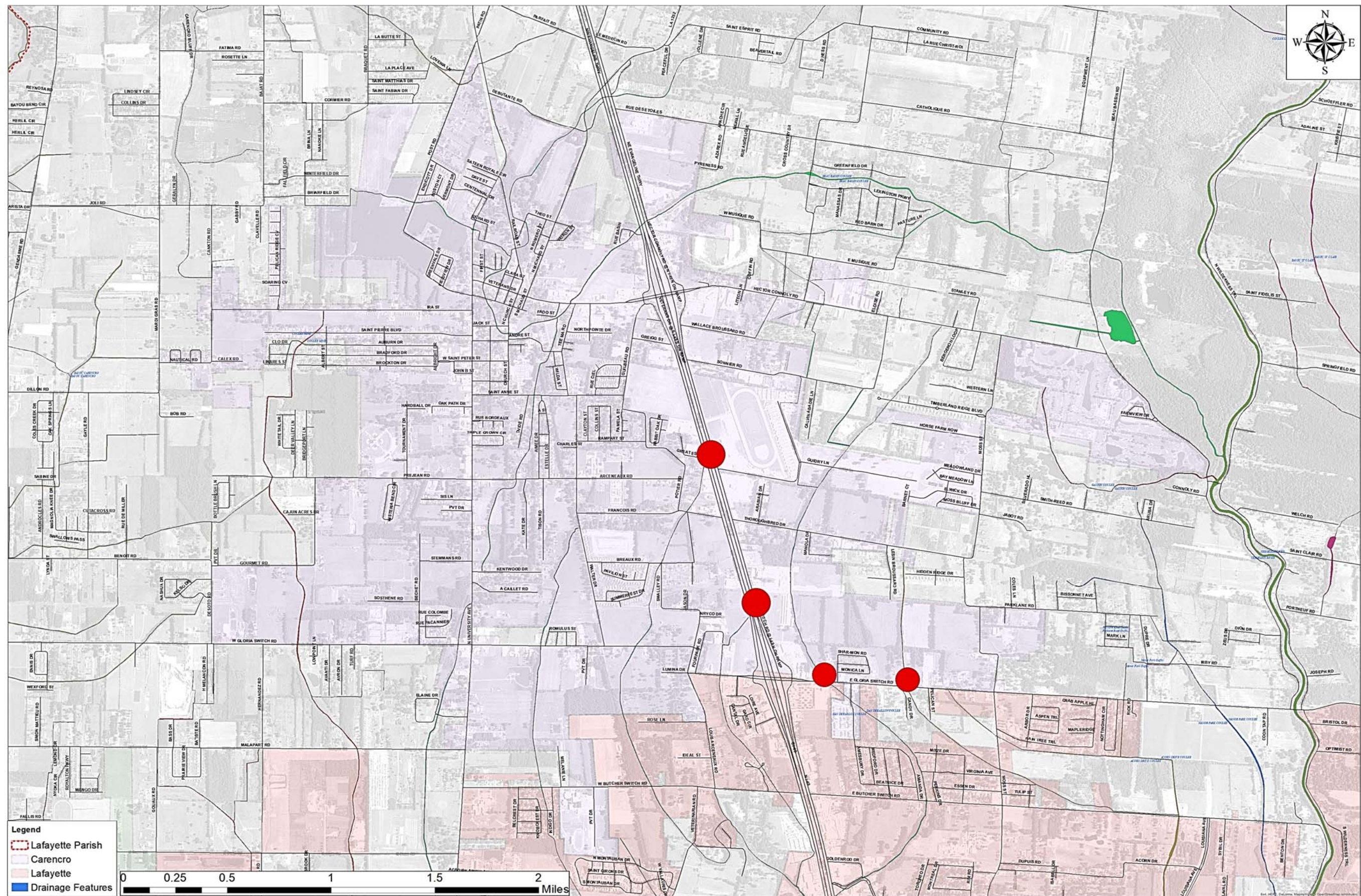


Exhibit 19

Carencro Drainage Recommendations Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



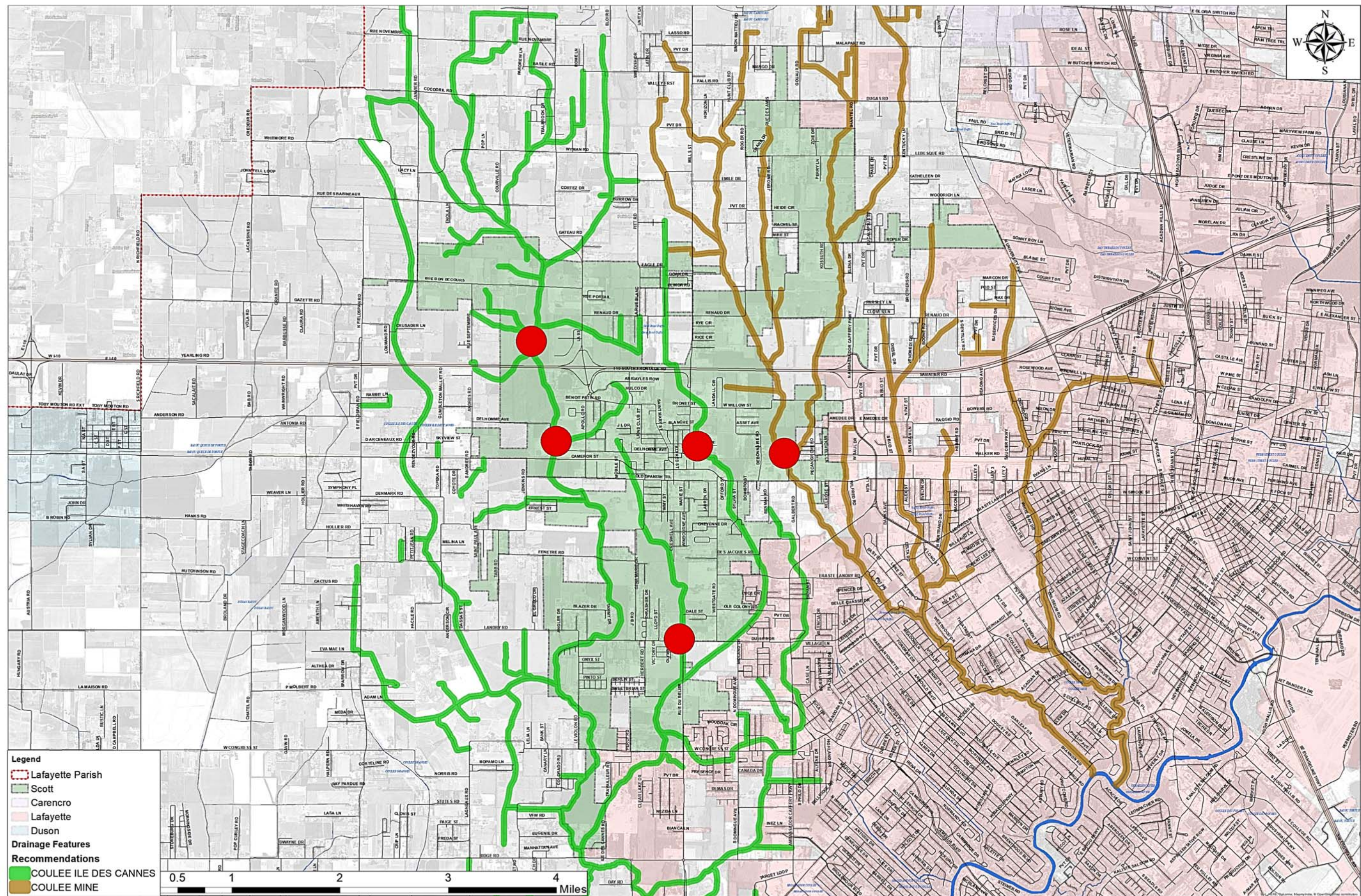


Exhibit 20

Scott Drainage Recommendations Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



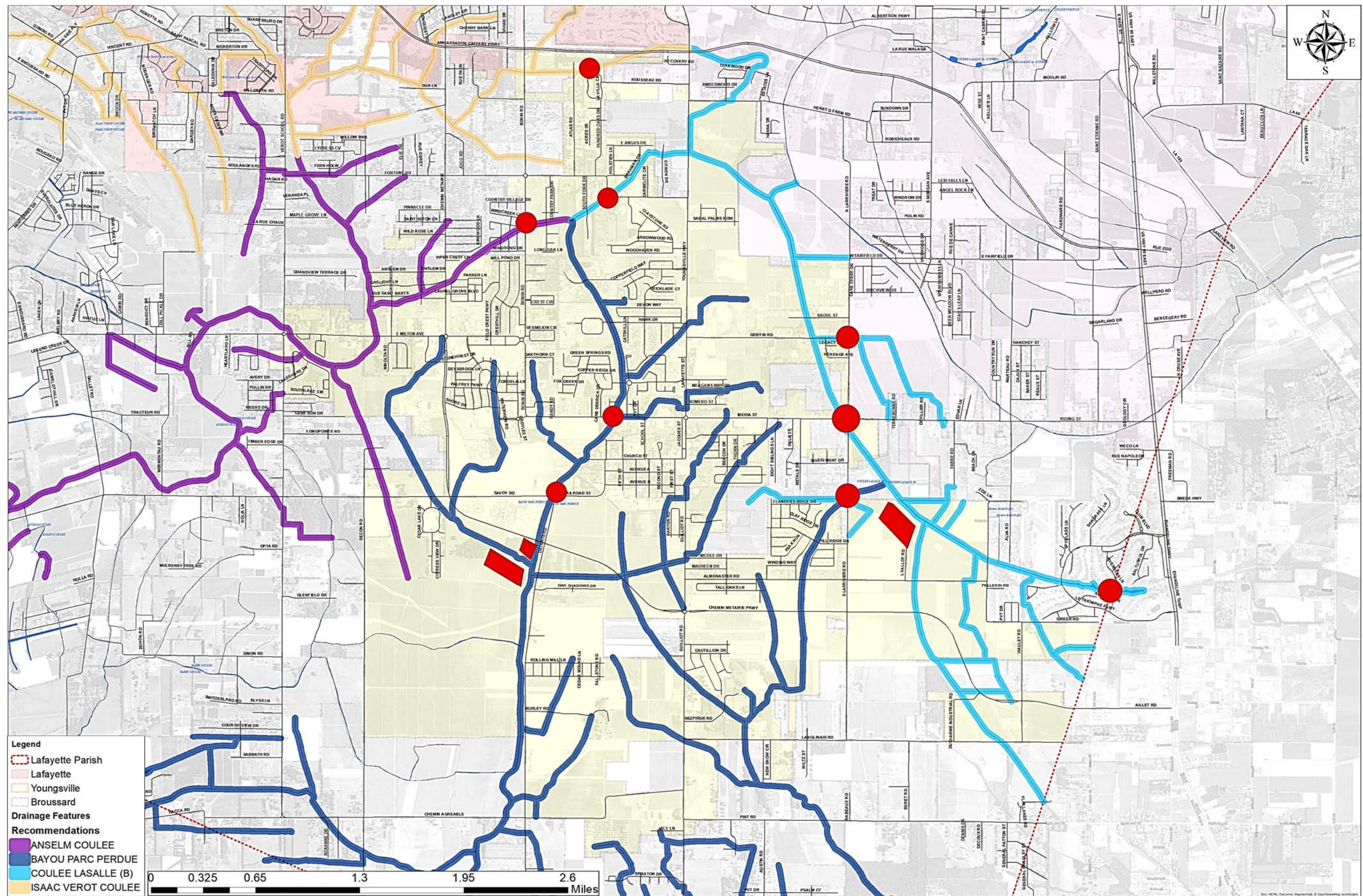


Exhibit 21

Youngsville Drainage Recommendations Lafayette Parish Area-wide Drainage Plan State of Louisiana Silver Jackets Interagency Pilot Project Program



10.0 References

1. *Lafayette Parish Master Drainage Plan* prepared for Lafayette Consolidated Government in partnership with the USACE and CH2MHILL dated February 2008.
2. *City of Carencro, Lafayette Parish, Louisiana, Continuing Authorities Program Section 205 Feasibility Study*, prepared by USACE dated December 2011.
3. *City of Youngsville Master Plan*, prepared for City of Youngsville, by CH2MHILL dated November 2015.
4. Carencro, Louisiana Code of Ordinances.
5. Youngsville, Louisiana Code of Ordinances.
6. *Scott 2032: City of Scott Comprehensive Plan*, adopted January 15, 2015.
7. *Lafayette Consolidated Government Unified Development Code*, adopted December 2015.



**US Army Corps
of Engineers®**

Funded by

New Orleans District

**State of Louisiana Silver Jackets Interagency
Pilot Project Program**

W912P8-11-D-0022

Lafayette Parish Areawide Drainage Plan



McBADE
ENGINEERS & CONSULTANTS, LLC

**327 Iberia Street Suite 5
Youngsville, La 70592**

P:(337)451-5823

F:(337)857-5947

JESCO ENVIRONMENTAL
& Geotechnical Services, Inc.

**1701 S. Thibodeaux Road
Jennings, La 70546**

P:(337)824-9074

F:(337)824-9076