

The City of Fayetteville has retained WK Dickson to evaluate the Buckhead Creek watershed for existing flooding as well as water quality and erosion problems and to recommend improvements for addressing identified issues. The goal of this project is to identify the capital improvements that will increase the level of service of drainage systems within the Buckhead Creek watershed and to reduce the frequency and severity of flooding for private residents.

The headwaters of Buckhead Creek originate in the vicinity of Cross Creek Mall north of Morganton Road. The creek generally flows south beyond the City of Fayetteville municipal limits before discharging to Little Rockfish Creek. The portion of Buckhead Creek within City limits is generally bordered by single family residential properties on either side with pockets of commercial development. Over 70 structures adjacent to the creek are located within the FEMA 100-year effective floodplain of Buckhead Creek. The majority of those structures are also at risk of flooding during more frequent storm events.

In addition to the flooding concerns along Buckhead Creek, fourteen (14) other areas were identified throughout the watershed by City staff and private residents as having flooding problems. These areas are located along conveyance systems that drain to Buckhead Creek and in areas where no centralized conveyance system exists. Flooding problems in these systems range from road inundation to finished floor flooding in some instances. For the purposes of this study, the main stem of Buckhead Creek is defined as the Primary System and all other areas are noted as Secondary Systems.

WK Dickson evaluated the hydrologic and hydraulic characteristics of the Buckhead Creek watershed to determine the existing flooding conditions for Buckhead Creek and the fourteen (14) secondary systems. These findings, along with flood mitigation recommendations, are included in this report. Capital costs were estimated for each proposed project to assist City staff in making planning level decisions and prioritizing improvements. The recommended projects are described below:

Primary System

- **Ferncreek Floodplain Bench and Floodwall:** The Ferncreek Floodplain Bench and Floodwall is proposed to reduce the frequency and severity of residential flooding along Buckhead Creek in the Windtree and Buckhead subdivisions from Lost Tree Court to the Buckhead Villas. The floodwall provides flood protection for several houses along the right bank that otherwise would have structural flooding during the 25-year storm event and the floodplain bench will reduce the frequency and severity of yard flooding for properties along Ferncreek Drive.
- **Raeford Road Culvert:** Raeford Road is an NCDOT maintained road located approximately in the middle of the watershed. The road does not overtop during the 100-year storm event, however the roadway embankment is approximately 20 feet high causing water to backup behind the road causing upstream flooding. An additional 60” RCP under Raeford Road will significantly reduce residential flooding along Stoneykirk Drive and the portion of the Buckhead Subdivision immediately upstream of the railroad tracks. While increasing the conveyance under Raeford Road

would significantly reduce flooding upstream of Raeford Road, water surface elevations would increase downstream of Raeford Road for portions of Buckhead Creek. The majority of those increases would not cause structural flooding; however increased levels of yard flooding may occur as a result of the Raeford Road Culvert project. Extensive coordination with NCDOT would be required to facilitate the design and construction of the project.

- Raeford Road Floodplain Bench: The Raeford Road Floodplain Bench is located immediately downstream of Raeford Road and includes excavation of material within the floodplain for approximately 600 linear feet to increase the floodplain storage and reduce water surface elevations. The floodplain bench will reduce the tailwater of the Raeford Road Culvert thereby reducing water surface elevations upstream of the culvert somewhat.
- Coventry Road Culvert and Floodplain Bench: The proposed Coventry Road culvert includes leaving the existing culverts in place and adding two floodplain box culverts along the left overbank to convey additional flow and provide a 25-year level of service through the culvert. The proposed culvert will significantly lower water surface elevations upstream of Coventry Road reducing the frequency and severity of flooding for several residences along Odom Drive. The proposed culvert and floodplain bench will also reduce flooding for several residences along Coventry Road.
- Devonshire Drive Floodplain Bench and Glenwick Drive Berm: The Devonshire Drive Floodplain Bench and Glenwick Drive Berm will offset some of the increases in water surface caused by the Raeford Road Culvert improvements. The Devonshire Drive floodplain bench will likely result in wetland impacts that may require mitigation. The Glenwick Drive Berm will protect several properties along Glenwick Drive during the 25-year storm event.
- Lake Francis Wetland Enhancement/Restoration: Three of the five projects identified for reducing flooding along Buckhead Creek will likely cause wetland impacts that may require mitigation. While mitigation can typically be offset paying fees-in-lieu to the State of North Carolina Ecosystem Enhancement Program (NCEEP) or a private banker, mitigation can also be completed through restoration and enhancement. Lake Francis has been breached, however a significant open body of water still exists. By removing the remainder of the dam and any downstream beaver dams, the lake could be restored to a wetland which would likely provide mitigation credits.

The cumulative benefit of the proposed Primary System projects includes the following:

- Reduction in water surface elevations during the 25-year storm event for 79 residential or commercial structures.
- The level of service improved to a less frequent storm event for 64 of the 79 structures.
- The level of service at Coventry Road improved from a 2-year level of service to a 25-

- year level of service.
- The level of service at the railroad improved from a 2-year level of service to a 10-year level of service.

Impacts from the proposed Primary System projects include increases in water surface elevations for six (6) properties, although the storm event where structural flooding occurs has not changed. Three of the six properties are located on a tributary to Buckhead Creek where the flood risk is more attributed to the tributary than to Buckhead Creek. The depth of yard flooding may increase for additional properties, but the width of the floodplain would not significantly increase.

With the exception of the Ferncreek Drive Floodplain Bench and Floodwall, the remainder of the proposed projects will require FEMA approval through a Conditional Letter of Map Revision (CLOMR) prior to construction. Each of the proposed projects is expected to require a 401/404 permit and could potentially require wetland mitigation as described above. If wetland impacts exceed 0.5 acre, which is likely for the Ferncreek Drive Floodplain Bench, Raeford Road Floodplain Bench, and the Devonshire Drive Floodplain Bench, an Individual Permit (IP) will likely be required from the Army Corps. Individual Permits typically require a lengthy review time.

Table ES-1 below shows the prioritization of the Primary System projects along with preliminary cost estimates and estimated design and permitting timeframes. Cost estimates include potential mitigation costs, administrative, legal, surveying, and engineering costs. Cost estimates are based on 2009 dollars and should be updated during the design process. Timeframes may vary based on regulatory agency reviews and easement negotiations/acquisition. All timeframes and cost estimates assume projects will be designed, permitted, and constructed individually. Combining the design and permitting of multiple projects may provide increased efficiencies and cost savings to the City.

Table ES-1: Primary System Prioritization and Cost

Prioritization	Project	Cost	Estimated Design/Permitting Timeframe
1	Coventry Road Culvert and Floodplain Bench	\$866,100	12 months
2	Raeford Road Floodplain Bench	\$906,400	18 months
3	Devonshire Drive Floodplain Bench and Glenwick Drive Berm	\$421,400	18 months
4	Raeford Road Culvert	\$352,700	12 months
5	Ferncreek Floodplain Bench and Floodwall	\$749,600	18 months
6	Lake Francis Wetland Enhancement/Restoration	\$423,400	12 months

The proposed prioritizations attempt to balance project benefits with potential impacts such as increasing downstream water surface elevations or wetland impacts. As discussed above, the Raeford Road culvert will provide the most overall benefit from a flood reduction perspective; however the proposed culvert will also generate downstream impacts that should

be considered. If the City elects to use the Lake Francis project for mitigation, then construction of the Lake Francis Wetland Enhancement/Restoration will be required prior to any projects resulting in wetland impacts that require mitigation.

Secondary Systems

Developing flood mitigation alternatives for the secondary systems typically included increases in pipe capacity and/or rerouting flows where more space was available for improvements.

The projects described below are the recommended alternatives for each of the secondary systems. In some instances, the full benefit of the proposed improvements may not be realized unless the proposed primary system improvements along Buckhead Creek are completed since several of the secondary systems are affected by backwater from Buckhead Creek.

- Buckhead Kingsford: The Buckhead Kingsford improvements reduce flooding for properties along Levenhall Drive, Murray Hill Road, and Ferncreek Drive. Properties near the outlet of the system along Ferncreek Drive and Humboldt Place may still have flooding during the 10-year event due to backwater from Buckhead Creek unless the Raeford Road Culvert improvements are completed.
- Broyhill Road: The Broyhill Road improvements include additional inlets and pipe improvements to reduce the frequency and severity of flooding in the intersection of Broyhill Road and Ferncreek Drive.
- Ferncreek Norwood: The Ferncreek Norwood improvements will help alleviate crawl space flooding at 4364 Ferncreek Drive and provide a 10-year level of service for the system.
- Westwood: The Westwood System improvements will reduce roadway and nuisance flooding in the Westwood subdivision. A portion of the runoff will be rerouted along Palomar Street and Rushmore Drive to reduce private property impacts and increase accessibility to the system for maintenance.
- Raeford Faison: The proposed improvements to alleviate roadway and structural flooding along Faison Avenue include a new conveyance system that will reroute storm flows south along Faison Avenue and tie into an existing 60" system that conveys flows west under Ireland Drive and ultimately to Buckhead Creek. The proposed system will provide a 10-year level of service.
- Montclair: Proposed improvements in the Montclair subdivision include increasing the size of approximately 500 linear feet of pipe at the downstream end of the system in the vicinity of Stoneykirk Drive. The improvements at the downstream end of the system will improve the level of service throughout the remainder of the system along Wellington Drive, Montclair Road, and Belford Road.

- Coventry Road: The Coventry Road improvements include increasing the size of the existing pipe between 4314 and 4318 Coventry Road to reduce yard flooding.
- Roxie Avenue: The Roxie Avenue is the largest secondary system in the watershed draining over 1 square mile including the Cumberland County Hospital, medical office buildings, and residential subdivisions. The proposed improvements include rerouting drainage with new infrastructure and increasing the size of existing infrastructure to reduce the frequency and severity of flooding along Roxie Avenue, Martindale Drive, Faison Avenue, and Village Drive in the vicinity of Brentwood Drive.
- Ashton Road Ramblewood Drive: Installing additional inlets along Ashton Road and increasing the size of the pipes at the downstream end of the system will increase the capture and conveyance of runoff. This increased capture and capacity of the system will reduce the frequency and severity of residential flooding along Ashton Road.
- Ashton Road Friar Avenue: The proposed improvements include a flow splitter at the intersection of Friar Avenue and Ashton Road that will divert a portion of the drainage to a new system along Park Knoll Drive. The new system along Park Knoll Drive will include a new outfall that directs drainage towards the upper end of Lake Francis.
- Ashton Road: The Ashton Road improvements will reduce the frequency and severity of flooding for residents at 1821 Ashton Road by collecting additional drainage through new inlets and conveying that drainage through an increased outfall pipe towards Buckhead Creek.
- Kimberly Drive: The Kimberly Drive improvements include parallel 24” pipes to the existing culvert that will help provide a 25-year level of service for the roadway. The additional culvert will also decrease water surface elevations upstream of the culvert reducing the frequency and severity of residential flooding to the surrounding property owners.

Table ES-2 below shows the prioritization of the Secondary Systems projects along with preliminary cost estimates.

Table ES-2: Secondary System Prioritization and Cost

Prioritization	Project	Cost	Estimated Design/Permitting Timeframe
1	Roxie Avenue	\$3,089,700	12 months
2	Buckhead Kingsford	\$2,212,700	12 months
3	Raeford Faison	\$260,400	6 months
4	Montclair	\$330,700	6 months
5	Ashton Road Friar Avenue	\$567,300	6 months
6	Ashton Road	\$224,000	3 months
7	Ashton Road Ramblewood Drive	\$261,000	4 months
8	Kimberly Drive	\$103,000	6 months
9	Ferncreek Norwood	\$107,000	3 months
10	Coventry Road	\$89,400	3 months
11	Westwood	\$672,900	6 months
12	Broyhill Road	\$163,800	3 months

Table ES-3 below shows the combined prioritization of the Primary and Secondary Systems projects. In some instances a Secondary Project may not provide the maximum proposed benefit without first completing the Primary System Improvements. Secondary System projects that can be implemented independently of the Primary System projects and provide the maximum intended benefits are noted below in Table ES-3.

Table ES-3: Overall Project Prioritization

Prioritization	Project	Implement Independent of Primary Projects
1	Coventry Road Culvert and Floodplain Bench	NA
2	Raeford Road Floodplain Bench	NA
3	Roxie Avenue	Yes
4	Devonshire Drive Floodplain Bench and Glenwick Drive Berm	NA
5	Raeford Road Culvert	NA
6	Buckhead Kingsford	No
7	Raeford Faison	Yes
8	Montclair	Yes
9	Ashton Road Friar Avenue	Yes
10	Ashton Road	Yes
11	Ashton Road Ramblewood Drive	Yes
12	Ferncreek Floodplain Bench and Floodwall	NA
13	Lake Francis Wetland Enhancement/Restoration	NA
14	Kimberly Drive	Yes
15	Ferncreek Norwood	No
16	Coventry Road	Yes
17	Westwood	Yes
18	Broyhill Road	No