

Executive Summary

This report is the final Master Watershed Plan report for Phase 1 of the Planning Assistance to States project prepared by the Memphis District Corps of Engineers for the City of Jonesboro, Arkansas. The Phase 1 study area is the drainage network draining Jonesboro toward the southwest, via Big Creek to Bayou DeView. The City of Jonesboro provided valuable in-kind services, including data, analysis, and guidance to support the development of the engineering models, complete the study tasks, and prepare this report. The report and associated engineering models and databases provide the following items of information:

- a description and assessment of the drainage network and an assessment of capacity
- identification of City land ownership, rights-of-way, and easements
- a rationale for prioritization of improvements for the drainage network
- recommendations for maintenance of the drainage network
- conceptual designs to reduce flood risk and provide positive drainage for Lost Creek, Christian Creek, Culberhouse Creek, and Joe Mack Campbell Park.

The recommended improvements will confine the 1 percent chance backwater flood event (100-year flood) to the channel for Lost Creek through town, Christian Creek from the mouth to Highway 63, Culberhouse Creek from the mouth to Ginger Drive, and the neighborhood between Cartwright Street and North Main Street. To take full advantage of the improved outlets provided by the recommended improvements, additional improvement of minor drainageways and storm sewers will be required to eliminate remaining local ponding.

The content of the report is supported by hydrologic and hydraulic models and geographic information system databases that will provide City personnel with long-term tools for planning development and informing the public about water resources issues.

The estimated cost of major construction items is approximately \$109.6 million with no cost contingency. The cost estimate reflects only direct construction and land costs and does not include associated costs such as utility relocations, engineering design, construction inspection and management, legal and financing costs, or maintenance.

Construction Items

Item	Quantity
channel improvement	8.2 mile
detention basin	10 ea
bore & jack culvert barrel	2 ea
box culvert to remove & replace	4 ea
box culvert to install	1 ea
concrete channel to install	0.38 mile
bridges to remove w/o replacement (vehicle)	4 ea
bridges to lengthen (vehicle)	8 ea
bridges to install (vehicle)	1 ea
railroad bridge to lengthen	1 ea
railroad bridge to remove & replace	1 ea

1 Introduction

This report is the final report for Phase 1 of the Jonesboro Comprehensive Drainage Study conducted by the City of Jonesboro, Arkansas and the Memphis District Corps of Engineers under the Planning Assistance to States (PAS) Program of the US Army Corps of Engineers. Phase 1 is the first of a four-phase study of all the drainage basins in Jonesboro. Phase 1 includes the watersheds of Lost Creek, Christian Creek, and Big Creek. This report presents the risk of flooding in the Lost Creek, Christian Creek, and Big Creek watersheds in Jonesboro and presents conceptual designs to reduce the risk. Although PAS projects do not produce design calculations, detailed drawings, and specifications for construction, the report does indicate the general nature and magnitude of drainage infrastructure improvements needed to reduce flood risk and includes associated conceptual drawings.

The 04Feb2016 revision of this report includes more detailed drawings and quantity estimate calculations for the conceptual designs, which are provided as additional E-plates in Volume 3. Also, all design material related to the conceptual designs was gathered into Appendix E.

The City of Jonesboro provided valuable data and engineering guidance to support the development of this report. Data provided by the City and used in the analysis included:

- field survey data
- USGS gaging of stages at Floyd Street on Lost Creek and flow measurements at the same location, greatly facilitating calibration of the hydrologic and hydraulic models
- LIDAR topographic mapping
- high resolution aerial photography
- GIS mapping of storm sewers, culverts, and impervious areas
- information in the report and data files prepared by the Carter Burgess engineering consultant firm in a previous study for the City.

The remainder of the body of the report is organized under the headings of:

- PAS project items
- goals of the flood risk reduction plan
- flood risk reduction approach
- data
- methods
- results
- report organization.

2 PAS Project Items

Phase 1 includes the accomplishment of nine items for the study area:

- Item A—describe the drainage area
- Item B—classify drainageways
- Item C—identify rights-of-way (ROW) and easements
- Item D—build an HEC-HMS hydrologic computer model

- Item E—build an HEC-RAS hydraulic computer model
- Item F—determine drainageway capacity
- Item G—determine a method to prioritize improvements
- Item H—recommend maintenance
- Item I—develop conceptual designs to reduce flood risk.

The data collection and analysis for the nine items are complete and the results are presented in this report. The report provides City leaders with the information needed to plan the infrastructure required to minimize flood risk in Jonesboro.

3 Goals of the Flood Risk Reduction Plan

The overall goals of the risk reduction plan are:

- to reduce flooding along Lost Creek, Christian Creek, Culberhouse Creek, and tributaries
- to support economic and recreational development
- to minimize adverse hydrologic effects outside of Jonesboro.

3.1 Flood Reduction

Flood reduction goals include confining the 1 percent chance exceedance flood in:

- Lost Creek between the confluence with Culberhouse Creek and Patrick Street
- Christian Creek between the railroad and Hester Street
- Culberhouse Creek between the mouth and Ginger Drive.

3.2 Drainageways

Drainageway goals include:

- improving drainage in the neighborhood north of Lost Creek and west of Main Street, between West Easy Street to the north and West Woodrow Street to the south
- providing positive drainage for Joe Mack Campbell Park.

3.3 Economic and Recreational Development

The intent of the conceptual designs is to support economic and recreational development for Jonesboro. Economic development goals include protecting neighborhoods from frequent flooding and poor drainage and facilitating new residential and commercial development.

The opportunity to further recreational development goals arises from the changes in land use associated with flood risk reduction. Channel improvement and detention basin construction require space for the infrastructure and the spreading of the excavated earth. The dedication of land to the drainage system infrastructure can provide opportunities for public recreation features. Therefore, the conceptual designs for channel work and detention basins support the installation of:

- a new park along Lost Creek east of Patrick Street and upstream of the confluence with Devew Bayou where a major detention facility is planned

- a 5.3-mile long walking trail along the bank of Lost Creek, connecting Joe Mack Campbell Park on the west side of Jonesboro and connecting with the proposed new park east of Patrick Street
- a park along the upstream reach of Christian Creek, upstream of Cherrywood Drive, which could enclose a new detention basin built to reduce flooding near Neely Road.

The maintenance access/walking trail along Lost Creek will be located on an excavated bench with a typical bottom width of 50 feet and a typical depth of 5 feet below natural ground elevation. The bench will provide additional flow area for the channel during the greater floods, and the walking trail will be located on the bench. Bridge enlargements along Lost Creek will not only increase bridge flow capacity but also provide a path for people walking on the trail to cross underneath streets.

3.4 Minimizing Adverse Hydrologic Effects

Goals to minimize adverse hydrologic effects outside of Jonesboro arise from the fact that Lost Creek, Christian Creek, and Big Creek form one drainage system. Changes in one part of the system can cause changes in another part of the system. Therefore, measures implemented to reduce flood risk and provide drainage for Jonesboro have the potential to affect the network outside of Jonesboro. Possible adverse changes include:

- deepening and widening of Big Creek downstream of the confluence with Lost Creek
- more frequent flooding on Big Creek downstream of the confluence with Lost Creek
- more frequent flooding on Big Creek along the reach between the confluence with Lost Creek and the confluence with Mud Creek
- deepening and widening of Lost Creek upstream of Jonesboro
- more frequent flooding on Lost Creek upstream of Jonesboro.

Decades ago, the replacement of the winding natural channels of Lost Creek, Christian Creek, and Big Creek were with straight channels that eroded to become deeper and wider than the originally constructed channels. The potential for continued incision still exists, and windrows of riprap extend across the Big Creek channel downstream of the confluence with Lost Creek to resist further incision. If risk reduction measures increase the peak flood flow at the outlet of Lost Creek, greater erosional attack on the Big Creek channel downstream is possible.

If flood risk reduction measures increase the peak flood flow at the outlet of Lost Creek, flooding may be more frequent on Big Creek downstream of the confluence with Lost Creek and upstream along Big Creek from the confluence of Lost Creek to the confluence with Mud Creek.

Deepening and widening of Lost Creek upstream of Jonesboro is possible if channel enlargement through Jonesboro lowers the grade of the channel or causes a drawdown in flowlines in Lost Creek upstream of Jonesboro.

More frequent flooding upstream of Jonesboro is possible because of installing a major detention facility near the confluence of Lost Creek and Deview Bayou. Detention basins function by pooling flood flow, and in that sense, some flooding is intentional. However, detention basin

flood pools need to be accurately mapped to assure the acquisition of adequate land rights. Balancing increased channel capacity with detention and controlling the timing of flood peaks at key points in the drainage system can minimize adverse hydrologic effects outside of Jonesboro.

4 Flood Risk Reduction Approach

The proposed approach to reduce flood risk in Jonesboro is to increase channel capacity and install detention basins in the Lost Creek and Christian Creek watersheds. The single most important factor controlling flood risk along Lost Creek and Christian Creek is the water surface elevation of the 1 percent chance exceedance flood at the confluence of Big Creek and Lost Creek.

5 Data

Data used in the study included:

- results of previous studies and models
- LIDAR topographic data
- soils mapping
- vegetative cover mapping
- percent imperviousness estimates
- channel cross section surveys
- City GIS layers describing roads, culverts, and storm sewers and cultural features
- rainfall data and stream flow data recorded by USGS and NOAA
- City experience regarding bid item unit prices
- Arkansas Department of Transportation historical bid item unit prices

6 Methods

Current methods in modeling hydrology and hydraulics was used in the study. Hydrology was modeled using HEC-HMS software. Hydraulics was modeled using unsteady HEC-RAS software. Other commercial software was used such as Bentley Culvert-Master and ESRI Arc-Info. The Memphis District developed Fortran 95 software as needed to supplement the HEC and commercially available software. Use of HEC-HMS and HEC-RAS for Jonesboro was supported by consultation with the software development leaders at the Corps of Engineers Hydrologic Engineering Center in Davis, California.

7 Results

Results of the study are provided in the appendixes, including flowlines, flood outlines, stream classification maps, HEC-RAS output tables, conceptual design drawings, and associated cost estimates. Much of the materials produced by the study is in the form of models and model run results too voluminous to include in the report. The models and run results will be given to the City as electronic files.

8 Report Organization

The remainder of the report is divided into Appendixes A through H and associated plates. Physically, the report is divided into three volumes:

- Volume 1, report body and Appendixes A through G (8.5" by 11" binder)
- Volume 2, Appendix H (8.5 " by 11" binder)
- Volume 3, Plates (11 " by 17" binder).

(This Page Intentionally Blank)