AMENDMENT NUMBER 1 TO PROFESSIONAL SERVICES AGREEMENT

This Amendment, made this 2nd day of ~~May~~ June 2003, by and between City of Jonesboro, by its authorized undersigned representative, Hubert Brodell, hereinafter referred to as the **OWNER**, and Carter - Burgess, Inc., hereinafter referred to as the **ENGINEER**, shall be attached to and become a part of the "Professional Services Agreement" for Engineering Services executed by the above parties and dated the 14th day of March, 2003.

WITNESSETH: THAT;

WHEREAS, Provision 7 of the original contract provides that:

"Additional services will be paid for by CLIENT as indicated in any Letter of Proposal, Task Authorization, or such other document as deemed appropriate by CLIENT and C&B." and

WHEREAS, the Engineer is agreeable to performing these services for a total contract amount that is acceptable to the Owner.

NOW, THEREFORE, it is hereby agreed between the parties hereto that the said contract of March 14, 2003, be modified as follows:

FIRST, the SCOPE needs to be revised to include two additional paragraphs stating:

"Additionally, Carter & Burgess will provide mapping and engineering services to complete a Pilot Study of approximately 30 square miles for the overall Master Storm Water Drainage Plan. The Scope of Services for this Pilot Study is detailed in Attachment B.

The Scope of Services for the entire Master Storm Water Drainage Plan is included in Attachment C as a reference, should the City exercise the option to pursue additional phases to complete the overall project. Work effort for Phases beyond the Pilot Study Phase will not begin until the scope of services and compensation for that particular phase have been reviewed and agreed by both parties and notice to proceed has been given."

SECOND. Compensation shall be increased from the original contract amount of $37,531.00 to include services for the Pilot Study of $487,472.00 for a new contract amount of **$525,003.00**. The contract amount for the remaining phases of the Master Storm Water Drainage Plan Scope of Services referenced in Attachment C shall not exceed $624,997.00.

THIRD. The Provisions shall be modified by adding the following:

"18. TERM, COMMENCEMENT, AND COMPLETION
This Agreement shall commence on the effective date set forth in the Contract and will remain in effect until the completion of the overall Scope of Services, as defined in Attachment C, to be completed by December 31, 2005, unless extended or terminated by the Owner in accordance with the provisions of this Agreement."

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized representatives, this Amendment on the respective dates indicated below.

Carter - Burgess, Inc..

BY: _____
Russell Karr, Senior Vice President

DATE: May 20, 2003

ATTEST: _____

SCOPE OF SERVICES

Jonesboro, Arkansas
Master Storm Water Drainage Plan

I. Introduction

The City of Jonesboro has engaged Carter – Burgess, Inc (C&B) to assist the City of Jonesboro, Arkansas (City) with development of a Master Storm Water Drainage Analysis. Services included with this proposal are to recommend feasible alternatives to reduce the risk of flooding in problematic areas, which will be further identified by this study. Services in this proposal are intended to meet the basic need for infrastructure improvement to reduce the risk of flooding in the City, calibrate existing hydrologic and hydraulic models, and develop urbanized hydrologic and hydraulic models to determine the effect of future storm drainage issues.

The project will be developed in distinct phases to immediately remediate problematic areas. The initial phase will consist of a **Pilot Study** focused on studying four stream segments and certain portions of the underground storm sewer system in the City. The four stream segments to be studied would be Turtle Creek and tributaries, Whitemans Creek, Higginbottom Creek and the common floodplain area of Viney Slough Ditch. The underground portion of the storm sewer system to be studied will be the problem areas that were observed during the storm of August 13, 2002. The four stream segments listed above form a logical area for this study because they are all southeast of a natural divide or area of high ground formed by Main / Nettleton streets. For the basis of this phase the above description will be noted as the "study area". The display at the end of Attachment B details the study area.

II. Proposed Basic Scope of Services

TASK 100 SERIES – DEVELOP AN ENGINEERING DESCRIPTION OF WATERSHED DRAINAGE SYSTEMS AND MAJOR PHYSICAL AND INSTITUTIONAL FACTORS IMPACTING DRAINAGE.

Task 101 – Project Kick-Off Meeting

C&B will conduct a project kick-off meeting with the City. The purpose of the meeting is to review the project scope and schedule, confirm points of contact, establish the schedule for intermediate tasks, confirm billing procedures, and to discuss basic project concepts to be used with the program development process.

The deliverable for this task will include meeting minutes, a project directory, and an updated project schedule.

Task 102 – Field Survey and Inventory Existing Drainage System

As the initial work element in this sub-task, C&B will review existing City mapping and engineering records regarding the storm drainage system. C&B will develop a map

compatible with a GIS system of the existing storm drainage system within the study area. C&B will identify the following drainage type structures:

- Pipes
- Box Culverts
- Bridges
- Inlets
- Junction Box
- Drop Inlets
- Tributaries defined by the current Flood Insurance Study (FIS)

Each structure will be given an identification number and inventoried on a separate electronic form compatible with a Microsoft Access Database system. Each form will be linked to the structure location on the GIS map either by identification number or GIS address (as applicable). The following inventory will be collected for each structure to include the following:

- Material Type
- Pipe Invert Elevations
- Pipe and Culvert Size
- Bridge Opening Geometry
- Junction Box Rim and Invert Elevation
- Drop Inlet Rim and Invert Elevation
- Inlet Type (Curb or Grate)
- Inlet and/or Grate Opening Length
- Picture (As appropriate)
- Condition Rating

The condition rating system will be developed for the inventory for use in the system analysis as well as to provide input to future GASB 34 requirements. The map will be tied to NAD83 Arkansas North Zone State Plane Coordinate system units in feet. All vertical elevation datum will be based upon NAVD 88 datum. Basis for all coordinate control and elevation will be NGS elevation.

ASSUMPTIONS

C&B assumes that no more than 14,000 linear feet of storm sewer system will be mapped and inventoried for the problematic area (Pilot Study). It is assumed that the City will allow street and/or traffic lane closures to the extent necessary so that work can proceed on consecutive days without interruption or crew remobilization.

If additional storm sewer system is necessary or requested by the City it will be provided in accordance with Section IV.

Basic traffic control (cones, barricades, warning lights and flag-personnel) is included in our fee estimate for this task, but it is assumed that officer-directed traffic control at major intersections or on major thoroughfares will be provided by the City.

C&B will provide a minimum of 48 hours notice for any anticipated traffic officer requirements. It is assumed that the City will also provide crews and equipment

for any clearing of obstructed storm drainage lines required for the work to proceed. In the absence of timely City crew availability for line clean out, individual line segments, including inaccessible upstream segments, will be bypassed and not inventoried.

Task 103 - Digital Topographic Development

Digital topographic development (contours) will be provided by C&B to determine the topographic features of the City within the study area defined. Aerial data acquisition will be obtained for the entire incorporated limits (approximately 110 square miles) of the city to reduce successive mobilization costs. Contour compilation will be performed on the entire study area. The digital topography will be provided at an interval of 2-ft. due to the low relief of the study area. The contour intervals will assist to define each drainage sub-basin extent of the study area. In addition the topography will be used to update and map current floodplain extents with up-to-date accurate topography for each tributary reach and closed network system investigated.

The digital topography will be obtained by accepted and proven photogrammetric or LiDAR methods. These methods will be in accordance with the Federal Emergency Management Agency's (FEMA) Flood Hazard Mapping Program. The digital topography (contours) within the floodplain will comply with "Guidelines and Specifications for Flood Hazard Mapping Partner" Appendix A, Guidance for Aerial Mapping and Surveying. Accuracies apply only to well-defined points, as defined by the National Standards for Spatial Data Accuracy of 1998 (NSSDA).

On well-defined points, the digital topographic mapping will be compiled to meet 3.5 feet horizontal accuracy at 95% confidence. Elevations obtained on well-defined points from spot elevations will meet 0.6-feet vertical accuracy. Elevations interpolated on well-defined points from contours will meet 1.2-feet vertical accuracy at 95% confidence.

Deliverable to the city will be one hard copy contour map of the city at (1"=500' panels min.) and an electronic shape file of the digital topographic information.

Identification of contours in obscured areas as a result of spring foliage are not included in the contract and will be supplemented by conventional field survey methods at the hourly rates established in Section IV or at a negotiated fee acceptable to both parties.

Task 104 – Update FEMA Cross Sections

For detailed flood hazard analyses, C&B shall survey cross sections immediately upstream and downstream of bridges and culverts, using field survey methods, to include survey of channel invert elevations (the elevation at the deepest part of a channel cross section). Intermediate cross sections by field methods will be taken when bridges or culverts are more than 1,000 feet apart, especially where a significant change in conveyance occurs between cross sections; otherwise photogrammetric contour elevations will be utilized. C&B will utilize cross sections compiled for the digital topographic mapping (provided under separate contract dated March 13, 2003) so long as no significant change in the stream channel geometry below the water level occurs.

The cross section width shall encompass the entire 0.2-percent-annual-chance floodplain.

The elevation data for updating the FEMA cross sections for intermediate locations are compiled utilizing photogrammetric methods it shall comply with "Guidelines and Specifications for Flood Hazard Mapping Partner" Appendix A, Guidance for Aerial Mapping and Surveying.

ASSUMPTION:

C&B has estimated 197 cross sections to be utilized in the scope of this study as determined from the existing FIRM's. Additional cross sections necessary to complete the scope of this study will be performed in accordance with Section IV.

Task 105 – Research and Review All Pertinent Storm Water Documents

C&B will review all available documents related to storm water management for the study area. The City shall provide C&B all available documents.

Task 106 – Capacity Analysis of Sub-Surface Inventoried Storm Sewer System

C&B will analyze the closed storm sewer system within the study area for a maximum of 5 design return periods used or anticipated to be used in City drainage design. Haestad's StormCad or Bentley's Storm SelectCad program will be used for the analysis. Hydrology will be developed from topography obtained in Task 103 utilizing the rational method for small localized drainage sub-basins not exceeding 300 acres.

System components will be analyzed to the inlet level of detail. Insufficient areas will be identified on a map compatible with a GIS system.

Each system will be analyzed for required system upgrades to bring the system to an acceptable level of service, expected to be a level consistent with established City drainage standards. Conceptual costs for system upgrades will be developed.

Deliverables for this task will include a map compatible with a GIS system (in hard copy and shape file format), five copies of a report detailing the analysis including a brief description of work and cost for each system upgrade, hard copy and electronic versions of the computer models.

ASSUMPTIONS:

C&B assumes that no more than 8 separate sub-drainage (closed system) storm drainage networks will be analyzed for the study area in the pilot study. A storm drainage network is defined as a system of pipes connected by structures containing multiple inlets not exceeding a total pipe length of 2,000 linear feet with one common outlet structure. No more than a total 14,000 linear feet of pipe and 8 separate outlet structures will be evaluated under this task. The pipe evaluated for this task is inclusive of the amount identified in Task 102.

SERIES 200 TASK – DEVELOP AND CALIBRATE HYDROLOGIC MODELS OF EACH WATERSHED USING HEC-RAS AND CONVERT EXISTING HEC-2 MODELS INTO HEC RAS

Task 201 – Calibrate Hydrologic & Hydraulic Models

C&B will request all available technical data from FEMA for all tributaries identified in Table 1. Every extent will be made to obtain electronic information to re-establish existing conditions of the FIS; however, it is anticipated that certain reaches will be unavailable electronically and C&B will have to re-create the effective (existing) hydrologic and hydraulic models.

The purpose of this task is to create the current effective models to establish a "base-line" for future urban development of a storm water drainage master plan. C&B will establish existing Base Flood Elevations (BFE) based upon the information available. The accuracy of calibration will be within 0.5 ft. of the existing BFE.

Table 1
Study Area Stream Reaches

Creek Name	Number of Crossings	Study Length (LF)	Number of Cross Sections	Limits (Upstream to Downstream)	FIS Zone
Turtle Creek	12	18,000	42	Confluence w/ Whiteman's Creek at Willow Rd. to US Hwy 49	A
Turtle Creek Lateral	6	8,000	20	Confluence w/ Turtle Ck. At RR to Aggie Rd.	AE
Lateral No. 5 of Turtle Ck.	11	13,000	35	Confluence w/ Turtle Ck. At Vans Ave. to Belt St.	AE
Whiteman's Creek	14	19,000	47	Highway 143 at Cross Sec A to Wilkin Dr.	AE
Higginbottom Creek	16	21,000	53	Viney Slough and Hwy 143 to U/S of Parkview St.	AE
Unnamed Tributary to Viney Slough Ditch	11	18,000	40	Viney Slough Ditch to Business Rd. 1	AE
Totals	70	97,000	237		

C&B will not re-calibrate existing HEC-1 (hydrologic models). The current effective HEC-2 (hydraulic) models will be calibrated utilizing the existing hydrologic information available in the FIS.

The study area limit for this task will be limited to areas identified in Table 1.

Deliverables for this task will be a HEC-RAS electronic file(s) of the studied areas that were calibrated from existing HEC-2 data and areas re-created to establish "base" conditions.

ASSUMPTIONS:

The scope identified does not include the preparation or submission of data to FEMA for review or comment. Any comments on the calibrated models identified by FEMA for incorporation into the work shall be performed in accordance with Section IV

Task 202 – Initial Stakeholder Group Meeting

C&B will coordinate one - two-hour meeting targeted to stakeholders interests who might be most directly impacted by storm water regulation. The meeting will consist of a 20-30 minute introduction to the Storm Water Management program requirements, with a slant towards how those regulations impact the City within the study area. Following the initial introduction, C&B will coordinate a focus group discussion designed to seek stakeholder input on program goals, perceived storm water problem areas, stakeholder willingness to accept some degree of regulation, as well as other key input designed to allow the City to best design its storm water program.

The task deliverable will consist of a 20-30 minute PowerPoint presentation and a summary of the public input provided.

The City will be responsible for providing the meeting location as well as public notice regarding the meeting.

SERIES 300 TASKS – IDENTIFY AND ANALYIZE EXISTING FLOODING PROBLEMS AND IDENTIFY ALTERNATIVE SOLUTIONS

Task 301- Determine Improvements for Existing Drainage Problems

C&B will coordinate with the City's staff, public awareness, and other maintenance personnel to locate drainage structures with known deficiencies within the study area.

The Office of Emergency Management, Craighead County has identified 25 residential and 54 commercial properties that received flooding damage on August 13, 2002 rainfall event. These locations will be documented as known deficiencies. These documented locations will be recorded for reference and placed on the City's GIS address system as noted problem areas.

These structures will also be included in the process to compute future flows so that the downstream structures can be properly sized to convey future discharges. The structures selected will be studied to determine the required improvements to convey future or upgraded discharges.

Sub-Task 301.01 - Compute Structure Size

Engineer will use the future coefficient factors to compute the flow at each existing bridge or culvert. For comparison purposes, the existing flow at each structure will also be computed using coefficients related to the existing level of development in the drainage basin. Both of the existing and future discharges will be computed for the 100-year storm at each structure.

Sub-Task 301.02 - Compute Channel Size

Engineer will also use the future coefficients to compute the flow in each channel reach listed in Table 1. Both of the existing and future discharges will be computed for up to 5 rainfall storm events.

Task 302 – Determine Structure Size for Future Systems

The following tasks will be performed in order to determine the size of bridges, culverts or drainage channels required to convey future flood flows.

Sub-Task 302.01 – Determine Future Hydrologic Conditions

C&B will revise the existing hydrologic models developed in Task 201 to reflect future urbanized conditions. For areas where existing electronic models are unavailable, C&B will create new hydrologic (HEC-HMS) models for future urbanized conditions. C&B will use topography developed in Phase I of this scope to perform this sub task.

Deliverables for this sub-task will include an electronic copy of the electronic HEC-HMS models created on a map of the studied areas (1"=1000' min.). Revised flows will be given at specific geographic locations such as bridges at cross streets.

Sub-Task 302.02- Compute Future Discharges

C&B will develop a HEC-RAS (hydraulic) model utilizing the hydrologic conditions in Task 201. Water surface profiles for each tributary defined in Task 201 will be determined for the five determined rainfall events. Water surface profiles will be determined for urbanized conditions within the study area, which are the tributaries defined by the FIS within the study limits.

C&B will identify existing channel reaches, culverts or bridges within the study area that may be inadequate to convey future flood flows.

Sub Task 302.03 - Determine Future Structure Size

The hydraulic computer models will then be iterated in order to obtain flood elevations along the stream that will reflect future conditions. Any stream reach, culvert or bridge that will be seen as having inadequate capacity to carry the future condition 100-year discharge will be noted for reference. C&B will recommend to the City the design storm event utilized determining the recommended infrastructure improvements to reduce the risk of flooding in the City. Only one rainfall event will be utilized to determine the drainage infrastructure improvements in the study area.

C&B will limit the amount of effort to a planning level type study. C&B will not compare flood elevations to house slab elevations along the stream reaches. General criteria will be developed to define an inadequate stream reach which will be approved by the City. The criteria can involve defining an inadequate reach as any location where the flood level exceeds the banks of the creek by a predetermined amount. Existing field conditions and observations will also be used in determining the criteria for defining an inadequate stream reach.

By computing the future flow at the existing drainage structure, C&B can determine if the structure will be inadequate to convey the future predicted discharge. From this process, C&B can locate the culverts and bridges that can cause flooding problems under a future development scenario.

C&B will use the future flow information to compute the hydraulic capacity of the drainage structure and stream reaches as identified in the FIS within the incorporated limits of the City. For computing the hydraulic capacity of culverts C&B will use either the Federal Highway Administration's HY8 computer program or CulvertMaster by Haestad Methods or other programs written by in-house staff. Hydraulic capacities of bridges, culverts, and open channels will be computed with simple applications of the United States Corps of Engineers' HEC-RAS Water Surface Profiles computer program or by an application of the Manning formula.

With the hydraulic capacity of each structure and stream reach known, C&B will know which structures are inadequate to convey the future rainfall event flood discharge.

Task 303 – Public Involvement Meeting

C&B will coordinate one two-hour general public meeting regarding the City's storm water management program development within the study area to identify publicly identified flooding concerns.
The meeting will consist of a "drop-by" sessions. C&B will coordinate a focus group discussion designed to seek citizen input on program goals, perceived storm water problem areas, citizen willingness to accept some degree of regulation, as well as other key input designed to allow the City to best design its storm water program. The public will have an opportunity to voice their concerns. Citizen concerns will be documented and identified on a GIS system linked by address. Citizen will be able to record, document or publicly address their concern. C&B will develop a form approved by the City to record the public issues compliant with the GIS address system.

The City will be responsible for providing the meeting location as well as public notice regarding the meeting.

Task 304 – Status Report Meeting

C&B will provide up to two status report meetings for selected members of City staff for Series 300 Tasks. This report will give a progress of the project and report current findings of the work. C&B will provide meeting minutes of each meeting. One of these meetings will be held in conjunction with Task 303.

SERIES 400 TASKS – PROVIDE CONCEPTUAL DESIGNS FOR RECOMMENDED ALTERNATIVES

Task 401 – Development of Conceptual Design

With the completion of the preceding tasks, information relating to the structure size needed to convey the selected design storm discharge will be available. C&B will use this information to develop a conceptual design for estimating costs to replace or improve the structure. The cost estimates will also be developed in small per-linear-foot (of channel or culvert) or per-square-foot (of bridge area) increments. Exhaustive design analyses will not be performed. Schematic level of information will be developed to include general information for structure flow line, top of road elevations, freeboard requirements and culvert lengths.

Task 402 - Cost Estimates for Improving Structures

C&B will meet with the City to determine an appropriate expenditure for each ward's (district or area) drainage improvements. The cost estimate information will be developed for projects that can be completed within these limits. The cost estimates will be developed in small per-linear-foot (of channel or culvert) or per-square-foot (of bridge area) increments so that the City can phase the improvements over several years or within a limited area if desired.

Task 403 - Prioritizing Improvement Projects

C&B will also provide a priority ranking of each proposed improvement project so that the City will know which projects should be completed first. The priority of projects will be broken down as directed by the City. Since cost is not the only factor that can be used to prioritize needed drainage improvements, C&B will use a project priority matrix. The project priority matrix allows other subjective factors to be considered when developing priorities for improvements. C&B will work closely with the City staff and the directors to determine the applicable factors and weights for the matrix.

Sub-Task 403.01 - Prepare a Schedule for Improvements

Once the projects have been prioritized according to the matrix approach, a schedule of projects will be prepared. The top prioritized projects will be scheduled for completion in each ward and only enough projects to spend the available funds for a particular year will be scheduled.

Task 404 - Prepare Map of Improvement Locations

The City's GIS base information will be utilized to develop a digital map of the improvement locations. The digital maps will be prepared with standard computer aided drafting software for a GIS compatible system but maps can be distributed in Adobe Acrobat file for reproduction and viewing.

A hard copy map will be prepared (1"=500' min.) will be prepared of the improvement locations.

Task 405 – Public Involvement Meeting

C&B will coordinate one two-hour general public meeting regarding the City's storm water management program development for conceptual design proposals related to Series Task 400.
The meeting will consist of a "drop-by" sessions. C&B will coordinate a focus group discussion designed to seek citizen input on program goals, perceived storm water problem areas, citizen willingness to accept some degree of regulation, as well as other key input designed to allow the City to best design its storm water program. The public will have an opportunity to voice their concerns. Citizen concerns will be documented and identified on a GIS system linked by address. Citizen will be able to record, document or publicly address their concern. C&B will develop a form approved by the City to record the public issues compliant with the GIS address system.

The City will be responsible for providing the meeting location as well as public notice regarding the meeting.

Task 406 – Status Report Meeting

C&B will provide up to twostatus report meetings for selected members of City staff for Series 400 Tasks. This report will give a progress of the project and report current findings of the work. C&B will provide meeting minutes of each meeting. One of these meetings will be conducted with Task 405.

SERIES 500 TASKS – PREPARE FORMAL REPORT

Task 501 – Preparation of Draft Report

The various components of the Study will be compiled into a cohesive report structure and 3 copies of the draft report will be submitted to City staff for review and comments. Staff will be designated by the City.

The anticipated sections will include the following:

- Introduction
- Scope of Work
- Identified Problem Areas
- Hydrology
- Hydraulics
- Analysis of Identified Problem Areas
- Organizational Analysis
- Drainage Improvements by Priority
- Capital Improvement Program

All materials in the draft report will be one-color only. Report binding will be limited to three-ring or GBC binder.

C&B will recommend to City staff an outline of the final report. The recommendations on the format will be developed and coordinated with City staff for approval.

Task 502 – Preparation of Final Report

Using the results of the description above, and incorporating the City's comments regarding the draft report, 3 color copies of the final report will be prepared and submitted to the City staff for approval. The City will establish the sequence of approvals by various department heads, public committees, council subcommittee for drainage, city council, etc. The report binding will be limited to three-ring or GBC binder.

Task 503 – City Council Meeting

C&B will provide one meeting to city council. This meeting will occur at the conclusion of the hydrologic and hydraulic modeling results to discuss initial findings of the problem areas. The second meeting will be at the conclusion of the study to report final findings and present capital improvement recommendations. These meeting will concur with Task 406.

The task deliverable will consist of a 20-30 minute PowerPoint presentation.

III. Compensation

A. Pilot Study Services.....$487,472.00

IV. Additional Services

Additional services requested by the City not explicitly identified in the scope of work will be performed in accordance with the hourly rate schedule given below subject to the City's request and approval. The contract can also be amended to a negotiated amount agreeable to both parties.

RATE SCHEDULE

Labor Category	Hourly Rate
Principal	$150.00
Project Manager	$125.00
Deputy Project Manager	$100.00
Senior Engineer	$90.00
Engineer	$80.00
Senior CADD Technician	$65.00
CADD Technician	$55.00
Land Surveyor	$95.00
Survey Crew (3-man GPS)	$135.00
Survey Crew (2-man)	$90.00
Survey Technician	$60.00
Clerical	$45.00
Expenses	Cost

Additional services requested by the City not explicitly identified in the scope of work will be performed in accordance with the hourly rate schedule given below subject to the City's request and approval. The contract can also be amended to a negotiated amount agreeable to both parties.

Additional services for field survey and inventory existing drainage system

Problematic Areas: $6.00 per linear foot (area defined by August 13, 2002 storm event)

Remaining Study Areas: $3.50 per linear foot

SCOPE OF SERVICE

Jonesboro, Arkansas
Master Storm Water Drainage Analysis

I. Introduction

The City of Jonesboro has engaged Carter – Burgess, Inc (C&B) to assist the City of Jonesboro, Arkansas (City) with development of a Master Storm Water Drainage Analysis and a Storm Water Management Manual. Services included with this proposal are to recommend feasible alternatives to reduce the risk of flooding in problematic areas, which will be further identified by this study. A Storm Water Management Manual will be developed by C&B which will be utilized by the City for future development of storm water systems throughout the planning limits. Services in this proposal are intended to meet the basic need for infrastructure improvement to reduce the risk of flooding in the City, develop a Geographic Information System (GIS) of the existing storm water infrastructure in the City, calibrate existing hydrologic and hydraulic models, develop urbanized hydrologic and hydraulic models to determine the effect of future storm drainage issues, and recommend organizational structure to manage and maintain an effect storm water system throughout the City.

The project will be developed into three distinct phases to immediately remediate problematic areas.

PHASE I: This phase of the work shall consist of providing Series Tasks 100 to Series Task 500 for all drainage sub-basins Southeast of Crowley's Ridge that drain to the St. Francis River Basin not previously identified by the Pilot Study (See Attachment A).

PHASE II: This phase of work shall consist of providing Series Tasks 100 to Series Task 500 for all remaining sub-basins in the City not previously identified in Phase I or the Pilot Study (See Attachment A).

PHASE III: This phase of the work shall consist of providing Series Tasks 600 to Series Task 700 and the remaining areas not previously identified in Phase I for Series Task 102, Task 104, Task 105, and Task 106.

Attachment D depicts the areas depicted by phase.

II. Proposed Basic Scope of Services

TASK 100 SERIES – DEVELOP AN ENGINEERING DESCRIPTION OF WATERSHED DRAINAGE SYSTEMS AND MAJOR PHYSICAL AND INSTITUTIONAL FACTORS IMPACTING DRAINAGE.

Task 101 – Project Kick-Off Meeting

C&B will conduct a project kick-off meeting with the City. The purpose of the meeting is to review the project scope and schedule, confirm points of contact, establish the schedule for intermediate tasks, confirm billing procedures, and to discuss basic project concepts to be used with the program development process.

The deliverable for this task will include meeting minutes, a project directory, and an updated project schedule.

Task 102 – Field Survey and Inventory Existing Drainage System

As the initial work element in this sub-task, C&B will review existing City mapping and engineering records regarding the storm drainage system. C&B will develop a GIS based map of the existing storm drainage system in the city of all drainage structures 18 inches and larger within the incorporated limits of the City. C&B will identify the following drainage type structures:

- Pipes
- Box Culverts
- Bridges
- Inlets
- Junction Box
- Drop Inlets
- Tributaries defined by the current Flood Insurance Study (FIS)

Each structure will be given an identification number and inventoried on a separate electronic form compatible with a Microsoft Access Database system. Each form will be linked to the structure location on the GIS map either by identification number or GIS address (as applicable). The following inventory will be collected for each structure to include the following:

- Material Type
- Pipe Invert Elevations
- Pipe and Culvert Size
- Bridge Opening Geometry
- Junction Box Rim and Invert Elevation
- Drop Inlet Rim and Invert Elevation
- Inlet Type (Curb or Grate)
- Inlet and/or Grate Opening Length
- Picture (As appropriate)
- Condition Rating

The condition rating system will be developed for the inventory for use in the system analysis as well as to provide input to future GASB 34 requirements. The map will be tied to NAD83 Arkansas North Zone State Plane Coordinate system units in feet. All vertical elevation datum will be based upon NAVD 88 datum. Basis for all coordinate control and elevation will be NGS elevation.

Deliverable product to the City will be ARC MAP file(s) and MS Access file(s) of all inventoried information of each structure in a theme format recommended by C&B and approved by the City. Large scale (1"=500' min.) will be delivered with electronic copy. C&B will provide a half-day instructional session to City personnel.

ASSUMPTIONS

C&B assumed that no more than 11,000 linear feet of storm sewer system will be mapped and inventoried (Phase I) and 50,000 linear feet for all remaining areas (Phase III), for a total inclusive amount of 75,000 linear feet (Pilot Study, Phase I, Phase II, and Phase III). It is assumed that the City will allow street and/or traffic lane closures to the extent necessary so that work can proceed on consecutive days without interruption or crew remobilization.

Basic traffic control (cones, barricades, warning lights and flag-personnel) is included in our fee estimate for this task, but it is assumed that officer-directed traffic control at major intersections or on major thoroughfares will be provided by the City.

C&B will provide a minimum of 48 hours notice for any anticipated traffic officer requirements. It is assumed that the City will also provide crews and equipment for any clearing of obstructed storm drainage lines required for the work to proceed. In the absence of timely City crew availability for line clean out, individual line segments, including inaccessible upstream segments, will be bypassed and not inventoried.

Task 103 – Update FEMA Cross Sections

For detailed flood hazard analyses, C&B shall survey cross sections immediately upstream and downstream of bridges and culverts, using field survey methods, to include survey of channel invert elevations (the elevation at the deepest part of a channel cross section). Intermediate cross sections by field methods will be taken when bridges or culverts are more than 1,000 feet apart, especially where a significant change in conveyance occurs between cross sections; otherwise photogrammetric contour elevations will be utilized. C&B will utilize cross sections from Task 101 so long as no significant change in the stream channel geometry below the water level occurs. The cross section width shall encompass the entire 0.2-percent-annual-chance floodplain.

The elevation data for updating the FEMA cross sections for intermediate locations are compiled utilizing photogrammetric methods it shall comply with "Guidelines and Specifications for Flood Hazard Mapping Partner" Appendix A, Guidance for Aerial Mapping and Surveying.

ASSUMPTION:

C&B has estimated 292 cross sections to be utilized in the scope of this study as determined from the existing FIRM's. Additional cross sections necessary to complete the scope of this study will be performed in accordance with Section IV.

Task 104 – Research and Review All Pertinent Storm Water Documents

C&B will review all available documents related to storm water management in the City. The City shall provide C&B all available documents.

Task 105 – Develop GIS Map and Database

C&B will propose a land use map based upon the flooding constraints of the 1% (100-yr) annual storm event. The City shall provide C&B the existing planning and zoning boundaries in a ARCMAP file. C&B will recommend planning and zoning boundary changes upon the evaluation of the flooding and drainage constraints on urban land growth.

C&B will create a GIS based map of the USGS soil classification for the incorporated areas of the City as determined by the existing FIRM's. C&B will delineate highly erosive soil areas as determined by the USGS soil survey for Craighead County.

Deliverables for this task will include a hard copy (1"=1000' min.) of recommended planning and zoning modifications as a result of the flooding and drainage constraints, and ARCMAP files of the proposed planning and zoning recommendations with USGS soil classifications.

The trend information will be related to land use within each drainage basin. Once the information is related to land use, then a future condition land use coefficient for use in the hydrologic model can be obtained. Since the information will be related to both residential and commercial land use, a weighted coefficient factor can be obtained to compute a discharge at each structure.

Task 106 – Capacity Analysis of Sub-Surface Inventoried Storm Sewer System

C&B will analyze the City's closed storm sewer system for a maximum of 5 design return periods used or anticipated to be used in City drainage design. Haestad's StormCad or Bentley's Storm SelectCad program will be used for the analysis. Hydrology will be developed from topography obtained in the Pilot Study (See Attachment A) utilizing the rational method for small localized drainage sub-basins not exceeding 300 acres.

System components will be analyzed to the inlet level of detail. A level of service rating system (based on capacity and condition) will be developed, and each system will be assigned a level of service rating.

A GIS-based system map will be produced with a color-coded designation of level of service ratings.

Each system will be analyzed for required system upgrades to bring the system to an acceptable level of service, expected to be a level consistent with established City drainage standards. Conceptual costs for system upgrades will be developed.

Deliverables for this task will include the GIS-based system map (in hard copy and ARCMAP shape file format), five copies of a report detailing the analysis including a brief

description of work and cost for each system upgrade, hard copy and electronic versions of the computer models.

ASSUMPTIONS:
C&B assumes that no more than 7 networks for (Phase III) for a total of 15 networks (Pilot Study, Phase I, Phase II, and Phase). A storm drainage network is defined as a system of pipes connected by structures containing multiple inlets not exceeding a total pipe length of 2,000 linear feet with one common outlet structure. No more than a total 30,000 linear feet of pipe and 15 separate outlet structures will be evaluated under this task. The pipe evaluated for this task is inclusive of the amount identified in Task 102.

SERIES 200 TASK – DEVELOP AND CALIBRATE HYDROLOGIC MODELS OF EACH WATERSHED USING HEC-RAS AND CONVERT EXISTING HEC-2 MODELS INTO HEC RAS

Task 201 – Calibrate Hydrolgic Models

C&B will request all available technical data from FEMA for all tributaries identified in Table 1. Every extent will be made to obtain electronic information to re-establish existing conditions of the FIS; however, it is anticipated that certain reaches will be unavailable electronically and C&B will have to re-create the effective (existing) hydrologic and hydraulic models.

The purpose of this task is to create the current effective models to establish a "base-line" for future urban development of a storm water drainage master plan. C&B will establish existing Base Flood Elevations (BFE) based upon the information available. The accuracy of calibration will be within 0.5 ft. of the existing BFE.

C&B will not re-calibrate existing HEC-1 (hydrologic models). The current effective HEC-2 (hydraulic) models will be calibrated utilizing the existing hydrologic information available in the FIS.

The study area limit for this task will be limited to areas identified in Table 1.

Deliverables for this task will be an HEC-RAS electronic file(s) of the studied areas that were calibrated from existing HEC-2 data and areas re-created to establish "base" conditions.

ASSUMPTIONS:

The scope identified does not include the preparation or submission of data to FEMA for review or comment. Any comments on the calibrated models identified by FEMA for incorporation into the work shall be performed in accordance with Section IV.

Table 1
Study Reaches

Creek Name	Number of Crossings	Study Length (LF)	Number of Cross Sections	Limits (Upstream to Downstream)	FIS Zone
Christian Creek	16	21,000	53	Confluence w/ Lost Creek to Cherrywood Dr.	
Christian Creek Lateral	6	6,000	18	Christian Creek at County Rd. to Clubhouse St.	AE
Lost Creek	15	37,000	67	Confluence w/ Big Creek Ditch to County-City Bdy.	AE
Big Creek Ditch	5	15,000	25	West City Bdy. to North City-County Bdy.	AE / A
Moore's Ditch	2	9,000	13	Lateral No. 3 to Road 332	AE
Lateral No. 3 of Moore's Ditch	10	20,000	40	Little Bay Ditch to Jonesboro Airport	AE
Moore's Ditch Lateral	4	9,000	17	Moore's Ditch to Jonesboro Airport	AE
Unnamed Airport Tributary	4	6,000	14	Hwy 332 to St. Louis SW RR	A
Roger's Bayou / Davis Branch	7	11,000	25	City-County Bdy. To City-County Bdy.	A
Unnamed Tributary to Turtle Creek Lateral	6	8,000	20	Confluence w/ Turtle Ck. Lateral to Hwy 49	A
Totals	145	239,000	529		
Total Number of	Creeks: 10	142,000	292		

Task 202 – Initial Stakeholder Group Meeting

C&B will coordinate two - two-hour meeting targeted to stakeholders interests who might be most directly impacted by storm water regulation. The meeting will consist of a 20-30 minute introduction to the Storm Water Management program requirements, with a slant towards how those regulations impact the City. Following the initial introduction, C&B will coordinate a focus group discussion designed to seek stakeholder input on program goals, perceived storm water problem areas, stakeholder willingness to accept some degree of regulation, as well as other key input designed to allow the City to best design its storm water program.

The task deliverable will consist of a 20-30 minute PowerPoint presentation and a summary of the public input provided.

The City will be responsible for providing the meeting location as well as public notice regarding the meeting.

SERIES 300 TASKS – IDENTIFY AND ANALYIZE EXISTING FLOODING PROBLEMS AND IDENTIFY ALTERNATIVE SOLUTIONS

Task 301- Determine Improvements for Existing Drainage Problems

C&B will coordinate with the City's staff, public awareness, and other maintenance personnel to locate drainage structures with known deficiencies.

These structures will also be included in the process to compute future flows so that the downstream structures can be properly sized to convey future discharges. The structures selected will be studied to determine the required improvements to convey future or upgraded discharges.

Sub-Task 301.01 - Compute Structure Size

Engineer will use the future coefficient factors to compute the flow at each existing bridge or culvert. For comparison purposes, the existing flow at each structure will also be computed using coefficients related to the existing level of development in the drainage basin. Both of the existing and future discharges will be computed for the 100-year storm at each structure.

Sub-Task 301.02 - Compute Channel Size

Engineer will also use the future coefficients to compute the flow in each channel reach listed as studied reaches in the FIS within the incorporated limits of the City. Both of the existing and future discharges will be computed for up to 5 rainfall storm events.

Task 302 – Determine Structure Size for Future Systems

The following tasks will be performed in order to determine the size of bridges, culverts or drainage channels required to convey future flood flows.

Sub-Task 302.01 – Determine Future Hydrologic Conditions

C&B will revise the existing hydrologic models developed in Task 300 to reflect future urbanized conditions. For areas were existing electronic models are unavailable, C&B will create new hydrologic (HEC-HMS) models for future urbanized conditions. C&B will use topography developed in Phase I of this scope to perform this sub task.

Deliverables for this sub-task will include an electronic copy of the electronic HEC-HMS models created on a map of the studied areas (1"=1000' min.) Revised flows will be given at specific geographic locations such as bridges at cross streets.

Sub-Task 302.02- Compute Future Discharges

C&B will develop a HEC-RAS (hydraulic) model utilizing the hydrologic conditions in Task 400. Water surface profiles for each tributary defined in Task 300 will be determined for the five determined rainfall events. Water surface profiles will be determined for urbanized conditions within the study area, which are the tributaries defined by the FIS within the incorporated limits of the City.

C&B will identify existing channel reaches, culverts or bridges within the study area that may be inadequate to convey future flood flows.

Sub Task 302.03 - Determine Future Structure Size

The hydraulic computer models will then be iterated in order to obtain flood elevations along the stream that will reflect future conditions. Any stream reach, culvert or bridge that will be seen as having inadequate capacity to carry the future condition 100-year discharge will be noted for reference. C&B will recommend to the City the design storm event utilized determining the recommended infrastructure improvements to reduce the risk of flooding in the City. Only one rainfall event will be utilized to determine the drainage infrastructure improvements in the study area.

C&B will limit the amount of effort to a planning level type study. C&B will not compare flood elevations to house slab elevations along the stream reaches. General criteria will be developed to define an inadequate stream reach which will be approved by the City. The criteria can involve defining an inadequate reach as any location where the flood level exceeds the banks of the creek by a predetermined amount. Existing field conditions and observations will also be used in determining the criteria for defining an inadequate stream reach.

By computing the future flow at the existing drainage structure, C&B can determine if the structure will be inadequate to convey the future predicted discharge. From this process, C&B can locate the culverts and bridges that can cause flooding problems under a future development scenario.

C&B will use the future flow information to compute the hydraulic capacity of the drainage structure and stream reaches as identified in the FIS within the incorporated limits of the City. For computing the hydraulic capacity of culverts C&B will use either the Federal Highway Administration's HY8 computer program or CulvertMaster by Haestad Methods or other programs written by in-house staff. Hydraulic capacities of bridges, culverts, and open channels will be computed with simple applications of the United States Corps of Engineers' HEC-RAS Water Surface Profiles computer program or by an application of the Manning formula.

With the hydraulic capacity of each structure and stream reach known, C&B will know which structures are inadequate to convey the future rainfall event flood discharge.

Task 303 – Public Involvement Meeting

C&B will coordinate one two-hour general public meeting regarding the City's storm water management program development to identify publicly identified flooding concerns. The meeting will consist of an open house, "drop-by" session. C&B will coordinate a focus group discussion designed to seek citizen input on program goals, perceived storm water problem areas, citizen willingness to accept some degree of regulation, as well as other key input designed to allow the City to best design its storm water program. The public will have an opportunity to voice their concerns. Citizen concerns will be identified and documented on a GIS system linked by address. C&B will develop a form approved by the City to record the public issues compliant with the GIS address system.

The City will be responsible for providing the meeting location as well as public notice regarding the meeting.

Task 304 – Status Report Meeting

C&B will provide up to one status report meetings for selected members of City staff for Series 300 Tasks. This report will give a progress of the project and report current findings of the work. C&B will provide meeting minutes of each meeting.

SERIES 400 TASKS – PROVIDE CONCEPTUAL DESIGNS FOR RECOMMENDED ALTERNATIVES

Task 401 – Development of Conceptual Design

With the completion of the preceding tasks, information relating to the structure size needed to convey the selected design storm discharge will be available. C&B will use this information to develop a conceptual design for estimating costs to replace or improve the structure. The cost estimates will also be developed in small per-linear-foot (of channel or culvert) or per-square-foot (of bridge area) increments. Exhaustive design analyses will not be performed. Schematic level of information will be developed to include general information for structure flow line, top of road elevations, freeboard requirements and culvert lengths.

Task 402 - Cost Estimates for Improving Structures

C&B will meet with the City to determine an appropriate expenditure for each ward's (district or area) drainage improvements. The cost estimate information will be developed for projects that can be completed within these limits. The cost estimates will be developed in small per-linear-foot (of channel or culvert) or per-square-foot (of bridge area) increments so that the City can phase the improvements over several years or within a limited area if desired.

Task 403 - Prioritizing Improvement Projects

C&B will also provide a priority ranking of each proposed improvement project so that the City will know which projects should be completed first. The priority of projects will be broken down as directed by the City. Since cost is not the only factor that can be used to prioritize needed drainage improvements, C&B will use a project priority matrix. The project priority matrix allows other subjective factors to be considered when developing priorities for improvements. C&B will work closely with the City staff and the directors to determine the applicable factors and weights for the matrix.

Sub-Task 403.01 - Prepare a Schedule for Improvements

Once the projects have been prioritized according to the matrix approach, a schedule of projects will be prepared. The top prioritized projects will be scheduled for completion in each ward and only enough projects to spend the available funds for a particular year will be scheduled.

Task 404 - Prepare Map of Improvement Locations

The City's GIS base information will be utilized to develop a digital map of the improvement locations. The digital maps will be prepared with a GIS standard software but maps can be distributed in Adobe Acrobat file for reproduction and viewing.

A hard copy map will be prepared (1"=500' min.) will be prepared of the improvement locations.

Task 405 – Public Involvement Meeting

C&B will coordinate one two-hour general public meetings regarding the City's storm water management program development for conceptual design proposals related to Series Task 400.

The meeting will consist of a "drop-by" sessions. C&B will coordinate a focus group discussion designed to seek citizen input on program goals, perceived storm water problem areas, citizen willingness to accept some degree of regulation, as well as other key input designed to allow the City to best design its storm water program. The public will have an opportunity to voice their concerns. Citizen concerns will be documented and identified on a GIS system linked by address. Citizen will be able to record, document or publicly address their concern. C&B will develop a form approved by the City to record the public issues compliant with the GIS address system.

The City will be responsible for providing the meeting location as well as public notice regarding the meeting.

Task 406 – Status Report Meeting

C&B will provide up to one status report meetings for selected members of City staff for Series 400 Tasks. This report will status project activities and present current findings of the work. C&B will provide meeting minutes of each meeting.

SERIES 500 TASKS – PREPARE FORMAL REPORT

Task 501 – Preparation of Draft Report

The various components of the Study will be compiled into a cohesive report structure and 5 copies of the draft report will be submitted to City staff for review and comments.

The anticipated sections will include the following:

- Introduction
- Scope of Work
- Identified Problem Areas
- Hydrology
- Hydraulics
- Analysis of Identified Problem Areas
- Organizational Analysis
- Drainage Improvements by Priority
- Capital Improvement Program

All materials in the draft report will be one-color only. Report binding will be limited to three-ring or GBC binder.

C&B will recommend to City staff an outline of the final report. The recommendations on the format will be developed and coordinated with City staff for approval.

Task 502 – Preparation of Final Report

Using the results of the description above, and incorporating the City's comments regarding the draft report, 5 color copies of the final report will be prepared and

submitted to the City for approval. The report binding will be limited to three-ring or GBC binder.

Task 503 – City Council Meeting

C&B will attend two city council meetings to present study findings. The first meeting will occur at the conclusion of the hydrologic and hydraulic modeling results to discuss initial findings of the problem areas. The second meeting will be at the conclusion of the study to report final findings and present capital improvement recommendations. These meeting will concur with Task 304 and Task 406.

The task deliverable will consist of a 20-30 minute PowerPoint presentation.

SERIES 600 TASKS – IDENTIFY INSTITUTIONAL FACTORS – IN-HOUSE DEPARTMENT REVIEW

Task 601 – Identify Institutional Factors

C&B will provide an organizational review with following departments: 1) Engineering, 2) Planning and Zoning, and 3) Street's and Maintenance. The purpose of the review will be to determine the organizational flow of responsibilities regarding drainage issues in the City.

Based on the initial data gathering tasks, Carter and Burgess will attend meetings with the major City departments involved in storm water management efforts to assess their views of the existing program, program elements that need adjustment or elimination, needed program elements or tools, and staffing and/or organizational issues. It is anticipated that approximately six 1 to 2-hour meetings will be conducted as part of this task. These meetings will also be used as the initial introduction to City staff on storm water management requirements.

Meetings will be scheduled to occur on 2 separate, consecutive days at a central location, with the first day scheduled for the meetings to be attended by legal counsel and the second day reserved for the balance of the meetings.

Current regulations and ordinances will be reviewed and how the current regulations are enforced. C&B will make recommendations to the City on the appropriate methods of addressing maintenance and drainage complaints to include recommendation of ordinances, regulation enforcement, dispersion of responsibilities, and man power shortages.

Deliverables will include recommendations to the City in the final report. Meeting minutes will be taken and distributed to all participants for review.

ASSUMPTIONS:

C&B assumes that the in-house review will take place over a period of two working days and have no more than six 1 to 2 hours meeting sessions each with the Engineering Department, Planning and Zoning Department, and Streets and Maintenance Department respectively.

Task 602 – Ordinance Review

C&B will review the City's existing ordinance and regulations and make recommendation to revise the documents to update current storm water management practices established by the scope of this work.

Sub-Task 602.01 – Final Draft Ordinance

Once the format has been selected, C&B will prepare a final draft for the City to review and approve for implementation with city codes.

The Final Draft Ordinance will be delivered to the City in the format selected for incorporation into city codes. C&B will not participate in city council meetings or public hearings for the approval of the ordinance.

SERIES 700 TASKS – PREPARE STORM WATER MANAGEMENT DESIGN MANUAL

Task 701 – Develop Drainage Manual

C&B will develop a storm water drainage manual for the City to establish design criteria for standard procedures for the storm sewer drainage.

The storm water management design manual will serve as a guide for the development of the design of all inlets, catch basins, manholes, sewers, open channels and creeks, culverts, or other hydraulic appurtenances.

Because storm drainage design is a widely variable process subject to situations and conditions beyond the control of C&B, cases will undoubtedly occur in which the criteria developed is not universally applicable. The City will decide the applicability of the manual or any part of the criteria for a particular case.

Anticipated Sections will include criteria for:

- Submittal Procedures
- Determination of Storm Runoff
- Storm Drains and Drainage Appurtenances
- Culvert Hydraulics
- Storm Water Detention
- Subsurface Storm Sewer Design
- Open Channels
- Floodplain Development Guidelines
- Erosion and Sediment Control

Deliverables for this task will be three draft storm water management design manuals for internal the City's internal review. The draft reports will be in monochrome format with three-ring binder. Five final reports will be delivered with color graphics. The final reports will be three ring or GBC binder.

III. Compensation

A. Phase I Services.....$117,208
B. Phase II Services.....$251,658
C. Phase III Services.....$256,131
$624,997

IV. Additional Services

Additional services requested by the City not explicitly identified in the scope of work will be performed in accordance with the hourly rate schedule given below, or an amendment to the contract can be executed for a negotiated amount agreeable to both parties.

RATE SCHEDULE

Labor Category	Hourly Rate
Principal	$150.00
Project Manager	$125.00
Deputy Project Manager	$100.00
Senior Engineer	$90.00
Engineer	$80.00
Senior CADD Technician	$65.00
CADD Technician	$55.00
Land Surveyor	$95.00
Survey Crew (3-man GPS)	$135.00
Survey Crew (2-man)	$90.00
Survey Technician	$60.00
Clerical	$45.00
Expenses	Cost

Additional services requested by the City not explicitly identified in the scope of work will be performed in accordance with the hourly rate schedule given below subject to the City's request and approval. The contract can also be amended to a negotiated amount agreeable to both parties.

Additional services for field survey and inventory existing drainage system

Problematic Areas: $6.00 per linear foot (area defined by August 13, 2002 storm event)

Remaining Study Areas: $3.50 per linear foot