RENEWAL PERMIT APPLICATON FOR THE FOLLOWING OPERATING YEARS

First Year of Operating Permit *Activities are reflected in the City's 2013-2018 Application, and will be reported by Feb. 28, 2019 deadline*	February 1, 2017	to	December 31, 2017
Second Year of Operating Permit *Activities are outlined below and are also reflected in the City's 2013-2018 Application, and will be reported by Feb. 28, 2019 deadline*	January 1, 2018	to	December 31, 2018
Third Year of Operating Permit	January 1, 2019	to	December 31, 2019
Fourth Year of Operating Permit	January 1, 2020	to	December 31, 2020
Fifth Year of Operating Permit	January 1, 2021	to	September 30, 2021

Permit Number: MO-R040041
Permittee Name: City of Joplin, Missouri
Mailing Address: 602 South Main Street, Joplin, Missouri 64801
MS4 System Location: Joplin, Missouri
Region: Southwest Missouri
Counties: Jasper County and Newton County
Primary Contact and Primary Responsible Person:
David Hertzberg, P.E. - Director of Public Works
Phone: 417-624-0820 extension 500 | E-mail: DHertzbe@joplinmo.org
Secondary Contact and Secondary Responsible Person:
Daniel Johnson, P.E. – Assistant Director-Public Works Engineering
Phone: 417-624-0820 extension 538 | E-mail: DJohnson@joplinmo.org

4.1.1.1 BMPs developed or designed with a purpose of reducing stormwater pollution. Each BMP shall contain a description of the BMP, the purpose of the BMP, and the expected result of the BMP.



4.1.1.1 The City of Joplin has held a Municipal Separate Storm Sewer Systems (MS4) permit since the year 2004. Based on years of experience and affordability, specific Best Management Practices (BMPs) have been successfully developed, designed, and utilized by staff, engineering consultants, stakeholders, the general public, and others. Each BMP description, purpose, and expected result is outlined on a spreadsheet titled *Implementation Schedule|Attachment 1.*

4.1.1.2 Measurable goals shall be established for each BMP or in conjunction with multiple BMPs. Each measurable goal shall contain a statement clearly indicating how it will be established to determine the appropriateness of identified BMPs and progress toward the expected results of the BMP. Measurable goals shall be quantifiable; however, if it is not feasible to utilize a measurable goal that is quantifiable, then the permittee shall provide justification indicating why the measurable goal cannot be quantifiable. If applicable, measurable goals shall also utilize interim and completion milestone dates, and a periodic frequency of measurement to document progress. It is recommended that interim and final milestone dates are established with a format of month and year. If the format of month and year cannot be utilized, the permittee shall ensure that schedules have the minimum format of 1st, 2nd, 3rd, 4th, and 5th year of the operating permit.

4.1.1.2 Measurable goals have been established for each BMP and abbreviated quantifiers are listed on *Attachment 1.* Details of quantifiers will be outlined in every annual report. For example, to determine an estimate of potential visitors to the City Hall Fourth Floor *stormwater brochure rack and signs*, staff will calculate how many people come in to get permits (building, fence, pool, zoning, sign, parade, etc.), attend pre-development meetings and bid openings, pick up city maps, and more. The potential visitors (or possible impressions) will be compared to the quantity of educational stormwater brochures that are consumed.

Appropriateness and affordability of the goals is based on the City's experience, advice from engineering consultants, and projected budgeting and staffing. Progress toward the expected results, as outlined on *Attachment 1,* will be reviewed using self-audit/self-analysis. Coordination with other agencies such as the Wildcat Glades Friends Group, Home Builders Association, the general public, etc., will be utilized.

4.1.1.3 The person primarily responsible for the SWMP and the person(s) responsible for each minimum control measure if different from the primary responsible person; and

4.1.1.4 An iterative process to be utilized by the permittee that documents how each BMP is evaluated and subject to replacement or modification. The permittee shall apply reasonable further progress by replacing or modifying ineffective BMPs with effective BMPs.

4.1.1.4 City staff will evaluate each BMP on an as needed basis during the permit cycle. Staff will replace or modify a BMP if it is determined to be ineffective. The decisions will be made based on experience, analysis of collected data, advice from engineering consultants, projected budgeting, staffing, or situational changes.

4.2.1. Minimum Control Measure #1 | Public Education and Outreach on Stormwater Impacts

4.1.1.3 MCM #1 Primary Responsible City Employee: Mary Anne Phillips, Recycling Coordinator and Stormwater Education Manager, or designee.

4.2.1.1 The permittee shall implement a public education program to distribute educational material to the community or conduct equivalent outreach activities about the impact of stormwater discharges on waterbodies and steps the public can take to reduce pollutants in stormwater runoff. As part of the SWMP, the Public Education and Outreach Program shall include the following information at a minimum:

4.2.1.1 Joplin will implement a public education program to distribute educational material to the community and conduct outreach activities about the impacts of stormwater discharges on waterbodies and steps the public can take to reduce pollutants in stormwater runoff. As part of the SWMP, the Public Education and Outreach Program will disseminate brochures, post information on the City's web site, partner with the local nature center and stream teams, maintain a library at City Hall, have a presence at local community events, speak to school groups, insert storm water language into press releases and media venues, and more. Description of specific best management practices, measurable goals, anticipated achievements, actions, activities, events, frequencies, and milestone dates are outlined on *Attachment 1.*

Staff will log every activity, measurable goal, targeted audience, impressions, milestones, achievements, and targeted pollutants in a spreadsheet; sample submitted herewith as *Activities Report*/*Attachment 2.* Periodically the data will be compared to targeted BMPs and reviewed as outlined in the *Implementation Schedule.*

4.2.1.1.1 A plan on how target audiences are identified for the public education program who are likely to have significant stormwater impacts (including commercial and industrial entities):

4.2.1.1.1 Joplin staff identified target audiences for the public education program who have the potential to cause or contribute to negative impacts to water quality. Target Audiences and Pollutants of Concern are outlined as follows:

TARGET AUDIENCES	POLLUTANTS OF CONCERN
Citizens Homeowners Landlords	Run Off from Pervious Surfaces; Lawn and Garden Activities; Illicit Discharge such as Sewer, Motor Oil, Household Hazardous Waste, etc.; Trash/Litter; Bacteria; Pool and Spa Discharges; Animal Waste
Restaurant Owners, Operators; Property Owners	Landscape Maintenance Products; Illicit Discharge such as Fats, Oils, Grease, and Detergents; Trash/Litter;

	Bacteria
Car Wash Owners and Operators; Property Owners	Detergents, Oils, Road Salt, Trash/Litter
Service Station and Oil/Lube Business Owners and Operators	Oils; Antifreeze; Trash/Litter
Lawn Service Companies	Lawn and Garden Activities; Trash/Litter; Chemical Run off
Developers, Builders, Contractors	Run off from Pervious Surfaces; Soil Run off from Construction Activities; Trash/Litter; Chemical Run off
Business Owners and Industries	Run off from Pervious Surfaces; Lawn and Garden Activities; Illicit Discharge; Trash/Litter; Bacteria
Municipal Operations	Run off from Pervious Surfaces; Soil Run off from Construction Activities; Lawn and Garden Activities; Trash/Litter; Chemical Run off; Bacteria; Pool Chemicals
Hospitals, Schools, medium to large sized Industries	Run off from Pervious Surfaces; Soil Run off from Construction Activities; Lawn and Garden Activities; Illicit Discharge; Trash/Litter; Bacteria

4.2.1.1.2 A plan to inform individuals and households about steps they can take to reduce stormwater pollution;

4.2.1.1.2 Joplin plans to inform individuals and households about steps they can take to reduce stormwater pollution to the maximum extent practicable through the following activities:

- Posting information on website and at community events
- Distributing BMP information at local Nature Center
- Maintaining a library at City Hall
- Distributing brochures detailing BMPs such as lawn and garden activities, dog waste digesters, rain barrels, hazardous waste disposal, trash management, septic system controls, Illicit Discharge Detection and Elimination, and others.
- Speaking engagements (Scouts, Churches, Schools, Civic groups, etc.)
- Public service announcements
- Community events (Third Thursday, WaterFest, etc.)
- Adopt-a-Storm Drain

4.2.1.1.3 A plan to inform individuals and groups on how to become involved in the SWMP (with activities such as local stream and lake restoration activities):

4.2.1.1.3 Joplin plans to inform individuals and groups on how to become involved in the SWMP by partnering with Wildcat Glades Friends Group, Downtown Joplin Alliance, Tri-State Water Resource Coalition, Missouri Southern State University and other area colleges, Harry S. Truman Coordinating Council, Missouri Department of Conservation, and others. Individuals and groups will receive information about seasonal events such as Earth Day, America Recycles Day, exhibitions, conferences, stream cleanups, water festivals, and others.

4.2.1.1.4 The outreach strategy, including the mechanisms (e.g., printed brochures, newspapers, media, workshops, etc….) to reach target audiences; and

4.2.1.1.4 The mechanisms to reach the target audiences include printed brochures, storm water language in news releases, featured articles in the "Citizen Newsletter," television interviews on local and college stations, signs posted at local Nature Center and trails that intersect with significant water bodies, and more. The number of people (or possible impressions) targeted to be reached by the public education and outreach strategy ***and*** public involvement and participation is grossly *estimated* at 150,000 per reporting year, times five operating years equals 750,000. Specific targets, BMPs, and activities are outlined on *Attachment 1.* Estimated actual impressions will be used to track and measure BMP effectiveness.

4.2.1.1.5 The pollutant(s) sources that the permittee's education program is designed to address.

4.2.1.1.5 Joplin will target the following pollutants and the possible sources of the pollutants in our education program:

- Sediment, chemicals, yard waste, solid and sanitary wastes from construction activities, homeowners, and businesses
- Over application of fertilizers, herbicides, pesticides, insecticides from construction activities, homeowners, lawn maintenance companies, and businesses
- Improper disposal of waste oil, grease, gasoline, cooking oil from restaurants, businesses and homeowners
- Trash, debris, and illegal dumping from residents and businesses
- Detergents washed into drains from restaurants, bars, car wash businesses, and homeowners
- Over application of salt and sand during snow removal by municipal operations and private contractors
- Sanitary sewer overflows from municipal operations
- Infiltration from cracked sanitary sewers from municipal operations
- Failing septic systems by homeowners
- Sewer service connections to storm drainage system from businesses and homeowners
- Foundation drains connected to storm drainage system from businesses and homeowners

- Downspouts connected to storm drainage system from businesses and homeowners
- Connected impervious areas covering large acreages by shopping malls, hospitals, schools, large businesses, and large institutions
- Stream bank erosion by developers, businesses, and municipal operations
- And others as identified through observations and routine operations

4.2.2 Minimum Control Measure #2 | Public Involvement and Participation

4.1.1.3 MCM #2 Primary Responsible City Employee is Mary Anne Phillips, Recycling Coordinator and Stormwater Education Manager, or designee.

4.2.2.1 The permittee shall implement a public involvement/participation program that provides opportunities for public involvement in the development and oversight of the permittee's SWMP, and provides opportunities for public involvement of the permittee's renewal application. The public involvement/participation program shall, at a minimum, include the following:

4.2.2.1 Joplin will implement a public involvement and participation program that provides opportunities for public involvement in the development and oversight of the City's SWMP, and will provide opportunities for public involvement in the City's renewal application.

4.2.2.1.1 A public notice period to allow the public to review the SWMP and renewal application prior to the submission of the SWMP and renewal application to the Department. It is recommended that the public review period is a least 10 (ten) business days;

4.2.2.1.1 The City's 2018-2021 application will be made available for public review after the final version is submitted to the Missouri DNR by posting it on the City's website. The permit renewal application for years 2021-2026 will be posted on the City's website and comments will be solicited and encouraged through civic venues, meetings, websites, posted at City Hall and the Joplin Library starting in December 2025.

4.2.2.1.2 A notice of public meeting, if needed, regarding the SWMP and renewal application. It is recommended that the notice should be at least 72 hours prior to the meeting;

4.2.2.1.2 Each public meeting will be advertised using standard City procedures and will be posted---at a minimum---72 hours prior to the meeting.

4.2.2.1.3 A plan to target all potentially affected stakeholder groups, including but not limited to, commercial and industrial businesses, trade associations, environmental groups, homeowner associations and educational organizations;

4.2.2.1.3 The City plans to target stakeholder groups such as local stream teams, Wildcat Glades Friends Group, Master Gardeners, Master Naturalists, citizens, homeowners, mass media, business leaders, contractors, home builders,

developers, civic organizations, the Tri-State Water Resource Coalition, and others.

4.2.2.1.4 If the permittee utilizes a stormwater management panel/committee, then the permittee shall provide opportunities for citizen representatives on the panel/committee;

4.2.2.1.4 All stakeholders will be asked to sit on a review panel and will be asked to help with public education and involvement. Furthermore, the City of Joplin will utilize existing media outlets such as the City of Joplin "Citizen Newsletter" which is a useful available media for informing and educating the public about stormwater matters. The newsletter can be found on the City's website and the archive can be found using the following link:

http://www.joplinmo.org/Archive.aspx?AMID=56

4.2.2.1.5 If appropriate, volunteer monitoring or stream/lake clean-up activities; and

4.2.2.1.5 The City will participate in stream clean-up activities such as the annual Shoal Creek Cleanup by hauling and properly recycling or disposing of hazardous waste, tires, appliances, and other items that cannot be landfilled. The City will participate in the annual Shoal Creek WaterFest, and encourage other groups to facilitate clean-up activities.

4.2.2.1.6 Provide opportunities and work with citizen volunteers willing to educate others about the permittee's SWMP.

4.2.2.1.6 The City will provide opportunities and work with citizen volunteers willing to educate others about the City's SWMP at the annual Shoal Creek WaterFest, home shows, teacher fairs, downtown Third Thursday outdoor events, and other activities.

4.4.1 The permittee shall conduct an annual review of their SWMP in conjunction with preparation of the MS4 SWMP Report required under Section 5.3;

4.4.1. The City of Joplin staff will conduct an annual review of the SWMP in conjunction with preparation of the MS4 SWMP bi-annual required report as required under Section 5.3 to 5.3.5. The report will include activities and achievements regarding all six minimum control measures.

ATTACHMENTS

Attachment 1	Implementation Schedule | MCM #1
Attachment 2	Activities Report | MCM #1-6

4.2.3.2.3 Minimum Control Measure #3 | Illicit Discharge Detection and Elimination

4.1.1.3 MCM #3 Primary Responsible City Employee is Dan Johnson, P.E., Assistant Director-Public Works Engineering, or designee.

4.2.3.1 The permittee shall develop, implement, and enforce a program to detect and eliminate illicit discharges, as defined in 10 CSR 20-6.200 and 40 CFR 122.34(b)(3), into the permittee's regulated Small MS4. As part of the SWMP document, the permittee's illicit discharge detection and elimination program shall include the development and implementation of, at a minimum:

4.2.3.1 The City has a codified program and staff to enforce, detect and eliminate illicit discharges. A more targeted, stand-alone Illicit Discharge Detection and Elimination Ordinance is currently in draft form and the goal is to codify it in April 2019.

4.2.3.1.1 A storm sewer map showing the location of all constructed outfalls and the names and locations of all receiving waters of the state that receive discharges from those outfalls. The permittee shall describe the sources of information used for the map(s), and how the permittee plans to verify the outfall locations with field surveys. If already completed, the permittee shall describe how the map was developed and how the map will be regularly updated. The permittee shall make the map information available to the Department upon request;

4.2.3.1.1 Joplin has developed a storm sewer map, showing the location of all outfalls and the names and location of all waters in the State that receive discharges from those outfalls. The map is still in development, City staff are updating the map throughout the year with newly constructed infrastructure as well as focused efforts in seven zones of the City that rotate annually. A tabulated list of all the outfalls as well as a map depicting a visual representation of the location of these outfalls has been submitted as *Joplin MS4 Outfalls|Attachment 3.*

4.2.3.1.2 To the extent allowable under state or local law an effective prohibition, through ordinance or other regulatory mechanism, of non-stormwater discharges into the permittee's storm sewer system and implementation of appropriate enforcement procedures and actions. The permittee shall identify the mechanism (ordinance or other regulatory mechanism) the permittee will use to effectively prohibit illicit discharges into the Small MS4. If the permittee needs to develop this mechanism, describe the permittee's plan and implementation schedule. If the permittee's ordinance or regulatory mechanism is already developed, include a copy of the relevant sections with the permittee's SWMP;

4.2.3.1.2 4.2.3.1.2 Joplin prohibits non-storm water discharges into the city's storm water system via *Chapter 54-Environment-Section 54-35 (4, 12, 14, 17 and 24;) and Chapter 118-Utilities Section 118-53* dealing generally with proper wastewater connection, discharges, penalties, violations, relief. Each ordinance or regulation is enforceable by Joplin with appropriate procedures and consequential actions via *Chapter 54-36 through 54-41,* generally about compliance, abatement, and legal action. Copies of these codes can be found on the City's website and using the following municode link:

https://library.municode.com/mo/joplin/codes/code_of_ordinances

City staff has developed a targeted, stand-alone Illicit Discharge Detection and Elimination Ordinance and a copy of the draft is submitted herewith as *Attachment 4.* The Timeline and Implementation Schedule draft is submitted herewith as *Attachment 5.* Once adopted by Council, the City of Joplin's new Illicit Discharge Detection and Elimination ordinance will be implemented and enforced and the SWMP will and appropriate annual reports which are submitted to DNR will be updated to reflect its implementation.

4.2.3.1.3 A plan and implementation schedule to detect and address non-stormwater discharges, including discharges from illegal dumping and spills, to the permittee's system;

4.2.3.1.4 A dry weather field screening plan for non-stormwater flows and field tests of selected chemical parameters as indicators of discharge sources. The plan shall also address on-site sewage disposal systems that flow into the permittee's storm drainage system;

4.2.3.1.3 and
4.2.3.1.4

The City of Joplin has developed a dry-weather screening plan to detect illicit discharges. City personnel will conduct on-site inspections of the City's documented outfalls (which has been documented as per section 4.2.3.1.1 of the City's SWMP) to visually inspect the outfall(s) to determine if illicit discharges exist or have occurred in the recent past. Should evidence of an illicit discharge occurring or having occurred present itself during the course of an on-site inspection of an outfall, an enforcement plan will be utilized to investigate the source of the illicit discharge and remove it. Depending on the illicit discharge the City may use various techniques including, but not limited to, Dye Testing, Video Testing, and Smoke Testing in its effort to locate the source of illicit discharge. Outfalls in areas deemed a higher risk or concern for illicit discharge, such as the Joplin Industrial park, will be prioritized with more frequent inspections.

The industrial pre-treatment inspection program implemented by the City of Joplin Waste Water Treatment personnel includes an overview of the storm water discharge at permitted significant industrial users. The schedule to detect discharges is on an annual and as needed basis. Inspectors have a check list pertaining to non-contact cooling water discharge sources, discharge frequency, and contaminants. During an inspection, visual attention is paid to possible storm water contamination sources, and counter-measures such as berms, containments areas, emergency procedures, etc. are questioned. The inspector also presents worst case scenarios to the industry concerning runoff, and if needed recommends that storm water protection is included in the solution. Storm water discharge permits are reviewed by the City and expiration dates are noted.

If the City gets a report of a spill or illicit discharge, the pretreatment inspector will go immediately to the site. Once there, the area of impact is surveyed to help determine containment and removal needs in order to prevent pollutants from entering any storm channel. If necessary, the fire department, sewer maintenance, and street department all work together to see that this containment and/or removal is abated. If the source is readily identified, testing is conducted for the most likely contaminants. If the source is unknown, knowledge of the area along with visual and olfactory observations help determine tests to perform in an effort to document concentrations, possible sources, and any effect on the surrounding environment. If the source is located, those responsible are required to do the necessary reporting to the state, as well as perform or pay for any cleanup that may be needed. Enforcement action is a tool the City may use in order to recoup cleanup costs and/or prevent any future occurrences as outlined in City codes.

All cases of Illicit Discharges are documented by City personnel using the Illicit Discharge investigation form submitted herewith as *Attachment 6.* The documentation will be recorded by the City for future reference and will be compiled and included in the Bi-Annual report submitted to the DNR as required by the MS4 permit.

The goals of these procedures and this process are to aid in effectively controlling storm water impact, reduce or prevent any adverse effects caused by runoff, prevent it from happening in the future, and to be an active participant in managing the City's storm water management program.

The Health Department inspects all ponds, reservoirs and detention ponds on an annual basis, when citizens register concerns and while performing routine duties. The Health Department has a map designed specifically for these water bodies.

Furthermore, Code Enforcers (a.k.a. Neighborhood Improvement Officers) inspect every property within the city limits on an annual basis, when citizens register concerns and during the course of routine duties. Because it is the Code Enforcers that have the power and efficiency of issuing notices of violations and bringing court action against offenders, storm water pollution and illicit discharge language is addressed in the "Environment-Nuisances" section of City ordinances and will also be outlined in the future IDDE ordinance. Abatement, legal action and penalties are also outlined in these ordinances and the future IDDE ordinance.

A list has been created showing every industry inside the city limits with a business permit submitted herewith as *Inspections of permitted Industries*| *Attachment 7.* Each one of these industries will be inventoried and inspected by

city staff on an annual basis or as needed. A copy of the inspection form used by City staff during these inspections is also included in *Attachment 7*.

4.2.3.1.5 Procedures for locating priority areas which include areas with higher likelihood of illicit connections (e.g., areas with older sanitary sewer lines) or ambient sampling to locate impacted reaches;

4.2.3.1.5 In developing a procedure for locating priority areas with a higher likelihood of Illicit connections, the City of Joplin will utilize the storm sewer system map and major watershed maps to identify potential high-risk locations based on proximities to possible Illicit discharge sources in conjunction with field screening techniques such as the Outfall Reconnaissance Inventory.
Furthermore, during the process of conducting dry-weather screening to detect illicit discharges, the City of Joplin will classify inspected outfalls as having "low", "medium", or "high" risk of having illicit connections/discharges based on their proximity to possible illicit discharge sources, the frequency in which the outfall needs to be inspected, and any history of illicit discharge attributed with the outfall.

4.2.3.1.6 Procedures for tracing the source of an illicit discharge, including the specific techniques the permittee will use to detect the location of the source;

4.2.3.1.6 City of Joplin inspectors bearing proper credentials and identification shall be permitted to enter all properties for the purposes of inspection, records examination and copying, observation, measurements, sampling, and testing pertinent to discharge or potential to discharge, and for repair and maintenance to the municipal separate storm sewer system. Specific techniques that will be used to trace sources of illicit connections/discharges include, but are not limited to, Dye Testing, Smoke Testing, and Video Testing. Further details are outlined in the City's future IDDE ordinance which once adopted and implemented by the City will also be implemented into the City SWMP.

4.2.3.1.7 Procedure for eliminating the illicit discharge;

4.2.3.1.6 The procedure for eliminating illicit discharges is outlined in the City's future IDDE ordinance which will be implemented into the City SWMP once the ordinance has been adopted and implemented. Whenever the City of Joplin finds that a person has violated a prohibition or failed to meet a requirement, the City may order compliance by written notice of violation to the responsible person. Such notice may require without limitation:

- The performance of monitoring, analyses, and reporting
- The elimination of illicit connections or discharges
- That violating discharges, practices, or operations shall cease and desist
- The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property
- Payment of a fine to cover administrative and remediation costs

- The implementation of source control or treatment BMPs

If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

4.2.3.1.8 A plan to ensure through appropriate enforcement procedures, including fines, and actions that the permittee's illicit discharge ordinance (or other regulator mechanisms) is implemented;

4.2.3.1.8 Various City employees, as outlined above in 4.2.3.1.4, are tasked with enforcing City Code-Environment Chapter 54-36 through 54-41 and City Code-Utilities Section 118-51 through 118-89 that address enforcement, actions to eliminate, and fines regarding illicit discharges.

The future IDDE ordinance will also address procedures, fines, and actions regarding illicit discharges, specifically, if the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, or, in the event of an appeal, within forty five (45) days of the decision of the municipal authority upholding the decision of the authorized enforcement agency, then representatives of the authorized enforcement agency shall enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any premises to refuse to allow the government agency or designated contractor to enter upon the premises for the purposes set forth above.

4.2.3.1.9 A plan to inform public employees, businesses and the general public of hazards associated with illegal discharges and improper disposal of waste. The permittee shall describe how this plan will coordinate with all other minimum control measures, monitoring, and TMDL implementation (if applicable);

4.2.3.1.9 Joplin will inform public employees, businesses and the general public of hazards associated with illegal discharges and improper disposal of waste using the following methods:

- Procedural training for city staff and other municipalities via Excal Visual training kit and staff meetings
- Literature distribution
- Posting signs
- Recycling program for household hazardous waste
- Illegal dumping hotline
- Articles placed in the *Citizen Newsletter*
- Illicit discharge is always mentioned during all public education activities

4.2.3.1.10 A plan to address non-stormwater discharges or flows (i.e., illicit discharges) the permittee identifies as significant contributors of pollutants to the regulated Small MS4 including authorized non-stormwater discharges contained in Section 1.2.2.2 of this permit.

4.2.3.1.10 Joplin has identified the following categories of non-stormwater discharges or flows as non-significant contributors of pollutants to our small MS4:

- landscape irrigation or lawn watering
- diverted stream flows
- rising groundwater
- uncontaminated groundwater infiltration to storm drains
- uncontaminated pumped groundwater
- foundation or footing drains (not including active groundwater dewatering systems)
- uncontaminated water from crawl space/basement sump pumps
- air conditioning condensation
- springs
- natural riparian habitat or wetland flows
- flows through mine tailings
- emergency fire-fighting activities
- dye testing (however does require written/verbal notification to the City prior to time of test)
- dechlorinated swimming pool discharges
- any other water source not containing pollutants

Should these occasional or incidental non-stormwater discharges be identified in the future, those entities responsible for discharging will be prohibited or conditions placed on them so as to minimize their discharge of pollutants. The public education brochure does recommend that vehicles be washed on lawns, and not in the street.

ATTACHMENTS

Attachment 3	Joplin MS4 Outfalls
Attachment 4	IDDE Ordinance Draft
Attachment 5	Proposed IDDE Ordinance Timeline
Attachment 6	Illicit Discharge Investigation Report Form
Attachment 7	Inspections of Permitted Industries

4.2.4 Minimum Control Measure #4 | Construction Site Stormwater Runoff Control

4.1.1.3 MCM #4 Primary Responsible City Employee is Dan Johnson, P.E., Assistant Director-Public Works Engineering, or designee.

4.2.4.1 The permittee shall develop, implement and enforce a program to reduce pollutants in any stormwater runoff to their regulated Small MS4 from construction activities that result in land disturbance of greater than or equal to one acre. Reduction of stormwater discharges from construction activity disturbing less that one acre shall be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. As part of the SWMP, the permittee's construction site stormwater runoff control program shall include the development and implementation of, at a minimum:

4.2.4.1 Joplin has developed, implements, and enforces a program to reduce pollutants in any stormwater runoff from construction activities that result in disturbance of greater than or equal to one acre. Joplin's plan also reduces pollutants in stormwater runoff from construction activities that disturb an area less than one acre if the site is part of a larger common plan of development or sale.

4.2.4.1.1 An ordinance or other regulatory mechanism to require operators to implement erosion and sediment control BMPs at construction sites; to include sanctions designed to ensure compliance, to the extent allowable under state or local law; and

4.2.4.1.1 Joplin has an ordinance with the required erosion and sediment controls (which can be found on the City's website using the following link: http://www.joplinmo.org/285/Stormwater-Recycling), as well as sanctions to ensure compliance, for commercial and residential construction activities. Regulatory mechanisms are also outlined in the City's *Stormwater Management Criteria,* which is part of the City of Joplin's *Standard Specifications,* both revised on April 1, 2018. City code *Chapter 54-Environment Section 54-31 to 54-41* outlines waste management regulations. The City's ordinance can be accessed online using the following weblink:

(https://library.municode.com/mo/joplin/codes/code_of_ordinances)

Furthermore, once adopted, the City of Joplin's Illicit Discharge Detection and Elimination ordinance (IDDE) will also be enforced and be made available to the public on the City's website.

4.2.4.1.1.1 If the permittee needs to develop this mechanism, the permittee shall describe the plan and scheduled implementation. If the permittee's ordinance or regulatory mechanism is already developed, the permittee shall include a copy of the relevant sections with the permittee's SWMP.

4.2.4.1.1.1 Joplin requires construction site operators to implement the appropriate erosion and sediment control Best Management Practices (BMPs). Joplin's *R1 & R2 Zoned Construction Sites Erosion and Sediment Control Guidelines-Division 400*

and Erosion and Sediment Control Regulations-Division 200 includes BMPs, construction specifications, and design standards. Regulatory mechanisms are also outlined in the City's *Stormwater Management Criteria which can be found on the City's website using the following link:*

http://www.joplinmo.org/DocumentCenter/View/606/Stormwater-Design-Guide?bidId=.

4.2.4.1.2 Requirements for construction site operators to control construction-site waste that may cause adverse impacts to water quality, such as discarded building materials, concrete truck washout, chemicals, litter and sanitary waste;

4.2.4.1.2 Joplin requires construction site operators to control wastes that may cause adverse impacts to water quality such as: discarded building materials; concrete truck washout, sediment, litter or trash, sanitary waste, and chemicals. City staff distributes a list of licensed trash haulers, construction and demolition haulers, transfer stations and landfills. Concrete truck washout procedures are outlined in *Erosion and Sediment Control Guidelines.* City code *Chapter 54-Environment Section 54-31 to 54-41* outlines waste management regulations.

4.2.4.1.3 Procedures for the permittee to consider and review all pre-construction site plans for potential water quality impacts;

4.2.4.1.3 Joplin has procedures in their ordinances for site plan review, which incorporates consideration of potential water quality impacts and review of the contractor SWPPP. The following city staff positions must sign off on all site plans before a building permit can be issued:

Plans Reviewer
Fire Marshal
Civil Engineer
Planner from Planning and Community Development
Assistant Director from Health Department

4.2.4.1.4 Procedures for the permittee to receive and consider information submitted by the public, including coordination with the permittee's public education and involvement programs;

4.2.4.1.4 The City of Joplin has several means of public input regarding storm water related issues. All applications for building permits are public record. Many building permits, especially commercial and multi-family residential, require both a storm water management report and a water quality report. These items are also available for the public to view by filling out a public records request form. Rezoning applications for Planned Developments and Special Use Permits for parking lots require site plans to be included for review prior to approval by the Planning & Zoning Commission. Public notices that are sent out to all

property owners within 185 feet of those properties receive a letter in the mail, which states that "site plans for this proposed development can be viewed at City Hall…" The City has also created a brochure with information about storm water and encourages residents to contact the Engineering Department if they have any questions or concerns about a storm water issue.

4.2.4.1.5 Procedures for the permittee to inspect sites and enforce control measures, including prioritization of site inspection; and

4.2.4.1.5 Joplin has procedures in their ordinance for site inspection and enforcement of erosion and sediment control measures via *Erosion and Sediment Control Guidelines.* Prioritization:

- Examination of control measures after a rain event
- Examination of control measures from complaints and concerns
- Examination of control measures along with site inspections for construction process

4.2.4.1.5.1 The permittee shall inspect (or require inspection of) any structure that functions to prevent pollution of stormwater or to remove pollutants from stormwater and ensure that all BMPs are implemented and effective; and a monitoring plan with implementation schedules shall be referenced in the SWMP document.

4.2.4.1.5.1 As part of its storm water management program, the City of Joplin will conduct construction site inspections for new or re-development projects within the city limits disturbing 1 acre or greater. City inspectors will follow an already established procedure in visiting project sites and inspecting the site's current erosion control practices and BMPs to ensure that they are installed and functioning as intended.

To aid inspection, City inspectors will utilize a checklist form, *Private Development Inspection Form/Attachment 8,* which outlines erosion control plan items to be inspected onsite and will be used in compiling an inspection report detailing pertinent information related to the site inspection such as, the name of the inspector conducting the inspection, the project site inspected, the date of the inspection, the items inspected and any deficiencies (if any) noted during the inspection of the erosion control plan and BMP's on site that need to be addressed.

The measurable goal of the Construction Site Inspections will be the inspection of the implementation, installation and effectiveness of erosion control BMP's in new and re-development projects disturbing 1 acre or more. This will be an ongoing program with the number of inspections conducted documented and reported in the bi-annual report submitted to Missouri DNR.

4.2.4.1.6 A plan designed to ensure compliance with the permittee's erosion and sediment control regulatory mechanism, including the sanctions and enforcement mechanisms the permittee will use to ensure compliance and procedures for when certain sanctions will be used. Possible

sanctions include non-monetary penalties (such as stop work orders), fines, bonding requirements, and/or permit denials for non-compliance.

4.2.4.1.6 Joplin has an ordinance that requires the use of erosion and sediment controls on construction sites. The ordinance outlines the requirement for designers and contractors before, during and after the construction activities. All residential construction permits purchased from the city of Joplin include a copy of the erosion and sediment control guidelines and the contractor must sign for receipt of the guidelines. By ordinance, enforcement procedures as outlined in *Attachment 9* are enforced, and they include stop-work orders and the process to suspend or revoke permits. Violations constitute a misdemeanor and can be punished in accordance with the City Code *Chapter 1 General Provisions-Section 1-5.*

Bonding is specified in the City's Stormwater Management Criteria dealing with a security agreement or other form of security acceptable to the City in the amount of the value of the required sediment and erosion controls, including the storm drainage system, must be received prior to issuance of the grading permit. If the grading permit is issued prior to the building permit, the only type of bond accepted will be a cash bond.

After issuance of the building permit, the cash bond can be converted to an escrow, security agreement, or other form of bond allowed in the Zoning Regulations.

Only cash bonds will be accepted for sites where a subdivision plat or building permit is not required. A cash bond is obtained by submitting the required bond amount to the Joplin City Clerk's office in the form of cash, cashier's check or money order, and obtaining a receipt.

The amount of security will be one thousand dollars ($1,000.00) per graded acre for seeding and mulching, plus the estimated construction cost for permanent sediment and erosion control measures specified on the SECP. This includes all elements of the storm drainage system.

The bond will be released one (1) year after seeding and mulching is complete, provided vegetation is firmly established. If vegetation is not firmly established at this time, the bond will be forfeited and the work will be completed under the direction of the City. Bonds may be released sooner if vegetation is firmly established. Vegetation will be considered firmly established when it has survived from the permanent seeding season in which it is placed to the next permanent seeding season and growth has been established on all eroded areas which have been noted for repair.

ATTACHMENTS

Attachment #8	Private Development Inspection Form
Attachment #9	Enforcement Procedures for Erosion and Sediment Control Guidelines (one page)

4.2.5 Minimum Control Measure #5 | Post-Construction Stormwater Management in New Development and Redevelopment



City owned New Construction Parking Lot
700 block of South Wall Avenue

4.1.1.3 MCM #5 Primary Responsible City Employee is Dan Johnson, P.E., Assistant Director-Public Works Engineering, or designee.

4.2.5.1 The permittee shall develop, implement and enforce a program to address the quality of long-term stormwater runoff from new development and redevelopment projects that disturb equal to and greater than one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the permittee's regulated Small MS4. The permittee's program shall ensure that controls are in place that have been designed and implemented to prevent or minimize water quality impacts. As part of the SWMP document, the post-construction runoff control program shall include the following information, at a minimum:

4.2.5.1 Joplin implements and enforces a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale. The city's *Storm Water Management Criteria* ordinance outlines designs of BMP's for the site as well as calculations and models that show the runoff characteristics of the site in a grassy meadow state and after the construction. Contractors must describe the water quality features of the site plan as well as provide detail on a maintenance and operation plan. Joplin also has a *Comprehensive Plan t*hat provides requirements and standards that direct growth to predetermined areas and protects sensitive areas. Joplin implements strategies that will include a combination of structural and/or non-structural Best Management Practices (BMPs) appropriate for the community via the original *Storm Water Master Plan* - Attachment 10, its extension the *Supplemental Storm Water Master Plan* - Attachment 11, the *Storm*

Water Management Criteria Ordinance, and the *2012 Comprehensive Plan*. *The Comprehensive plan* which can be accessed via the City's website using the following link:

http://www.joplinmo.org/DocumentCenter/View/1101/Comprehensive-Plan-2012?bidId=

4.2.5.1.1 An ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under state or local law. If the permittee needs to develop a mechanism, the permittee shall describe the plan and a schedule for implementation. If the permittee's ordinance or regulatory mechanism is already developed, the permittee shall include a copy of the relevant sections with the SWMP document;

4.2.5.1.1 Joplin has adopted zoning ordinances, comprehensive plans, guidelines, criteria, and the master plan to address post-construction runoff from new development and redevelopment projects to the extent allowable under State law. A copy of the *Storm Water Management Criteria* can be accessed from the City's website.

4.2.5.1.2 A plan to ensure adequate long-term operation and maintenance of selected BMPs, including, as appropriate, types of agreements between the permittee and other parties such as post-development landowners or regional authorities;

4.2.5.1.2 Joplin will continue to ensure adequate long-term operation and maintenance of BMPs, both public and private, as described in the *Storm Water Management Criteria* section "Maintenance Activities" - Attachment 12.

4.2.5.1.3 Strategies to minimize water quality impacts, which include a combination of structural and/or non-structural BMPs appropriate for the permittee's community, including but not limited to the assessment of site characteristics at the beginning of the construction site design phase to ensure adequate planning for stormwater program compliance. The goal of the approach is to arrive at designs that protect sensitive areas, minimize the creation of stormwater pollution, and utilize BMPs that effectively remove stormwater pollution. This can be achieved by reasonably mimicking pre-construction runoff conditions on all affected new development projects, or the permittee may achieve this goal through a method more appropriate for its community;

4.2.5.1.3 Joplin implements strategies that will include a combination of structural and/or non-structural Best Management Practices (BMPs) appropriate for the community and that are affordable to the maximum extent practicable via the *Storm Water Master Plan,* the *Supplemental Storm Water Master Plan,* the *Storm Water Management Criteria O*rdinance, and the *Comprehensive Plan.* As an example, in August 2018 the City built a parking lot at the 700 block of South Wall Avenue with a 10 to 12-foot buffer around an existing tree. This mature tree will be part of a greenspace that serves as a retention area. The parking lot will also feature islands with new trees planted within them.

Although there is no dedicated funding source for open space acquisition, grant money, matching funds and ongoing projects have been used in the past---and will continue to be used in the future---for the construction of trails along

streams. Most trails are constructed on undeveloped land, thus ensuring they will remain green space and undeveloped.

The City of Joplin also utilizes non-structural BMPs as a strategy to minimize water quality impacts. Both the zoning code and the *Comprehensive Plan* encourage infill development in higher density areas within the City of Joplin where infrastructure already exists. There is also a zoning district throughout the downtown area, and areas to the south, that allows for higher-density commercial development which utilize the upper floors as residential and/or office spaces.

The *Comprehensive Plan* encourages several corridors, specifically those destroyed in the May 2011 tornado, to redevelop as more sustainable areas. These areas are required to be multi-modal and have higher quality landscaping and green space requirements. Furthermore, the *Comprehensive Plan* also includes language on mixed-use zoning districts that applies to areas outside of the Central Business District, increased parking requirements for mixed-use districts that consider the mix of users at different times of the day, and the increase of other modes of transportation when set in a more walkable area. The resulting increase in density, increase in landscaping/open space, and decrease in surface parking will subsequently make for a more efficient storm water management system. City staff also encourages and supports re-development of brownfields and grayfields.

Moreover, The City of Joplin's zoning code has several requirements that prevent any property from being completely paved. The primary means of achieving this is through setbacks, which affect not only buildings but also parking lots. Along street right-of-ways, all parking lots should be setback 10 feet from the front property line. This 10-foot greenspace is used for street trees and other landscaping. Many commercial developments also use it for storm water management. Any commercial or industrial development that borders a residential property must also have a 10-foot setback on the sides and rear that will have landscaping and greenspace. This area has also been used for detention in many commercial developments. Although there is no specific minimum open space requirement, the zoning code ensures that there is green space and landscaping in every development. The City relies on citizens, property owners, and staff for good housekeeping measures. Citizens are encouraged to contact staff when they see spills, drainage issues, or deferred maintenance. City staff, including the following departments: storm water, zoning, building, and neighborhood improvement, all accept comments and concerns about storm water and environmental-related issues.

The City of Joplin also encourages---but does not require---the installation and practice of grassed swales, bioretention cells, cisterns, green roofs, planter boxes, street retrofits, and parking-lot infiltration. These structural BMPs are aimed at reducing flow rates and pollutant concentrations in Joplin runoff.

Several of these items are listed as best management practices (BMPs) in the City's *Comprehensive Plan.* According to the *Plan*, "The City should promote alternative 'green infrastructure' using natural systems to manage stormwater in both the public right-of-way and on private property." The *Comprehensive Plan* includes several images of preferred practices with captions explaining their significance.

4.2.5.1.4 An inspection plan with implementation schedules for post-construction BMPs; and

4.2.5.1.5 The permittee shall inspect or require the inspection of post-construction stormwater BMPs to ensure that all BMPs are implemented and effective.

4.2.5.1.4/4.2.5.1.5

The City of Joplin has developed a policy to inspect post-construction BMPs implemented with every addition to City infrastructure from every public and privately-owned development project disturbing soil of an area of one (1) acre or greater. The initial first post-construction inspection will occur at a minimum of Twelve (12) months after completion of the project (to allow for sufficient time for discernment of whether the BMP is effective or not for its intended purpose) and a maximum of twenty-four (24) months after completion of the project. Thereafter, each qualifying post-construction BMP will be inspected at a minimum of once per MS4 permit cycle with successive inspections of specific BMPs occurring after a failed inspection as necessary. Inspections will be documented on a written form. As the majority of the post-construction BMPs in the City of Joplin consist of wet or dry detention basins, a standardized form *Post-Construction BMP Inspection form* - Attachment 13 was developed to aide inspectors in their inspections. In addition to Water-Quality and Detention Basins, City staff will inspect other Post-Construction BMPs such as Infiltration/Trench Basins, Permeable Pavements, Sand Filters, Grassed swales/Filter strips and Bio-Retention/Rain Gardens for the presence of trash or other debris which may decrease their functionality or effectiveness.

ATTACHMENTS

Attachment 10	Stormwater Master Plan
Attachment 11	Supplemental Stormwater Master Plan
Attachment 12	Stormwater Management Criteria – Maintenance Activities
Attachment 13	Post-Construction BMP Inspection form

4.2.6 Minimum Control Measure #6 | Pollution Prevention/Good Housekeeping for Municipal Operations

4.1.1.3 MCM #6 Primary Responsible City Employee is Mary Anne Phillips, Recycling Coordinator and Stormwater Education Manager, or designee.

4.2.6.1 The permittee shall develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. As part of the SWMP, the pollution prevention/good housekeeping program shall include the following information, at a minimum:

4.2.6.1 Joplin has an operation, maintenance, and inspection program that includes a training component and has the goal of preventing or reducing pollutant runoff from municipal operations.

4.2.6.1.1 A government employee training program to prevent and reduce stormwater pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance. The permittee shall describe any existing, available material the permittee plans to use such as those available from EPA, the state, or other organizations. The permittee shall describe how this plan will coordinate with all other minimum control measures, monitoring and TMDL implementations where applicable;

4.2.6.1.1 City staff receives training as it becomes available from DNR and EPA websites, workshops, conferences, trade journals, other municipal employees, plus local engineers and consultants. Training that focuses on **MCM#5** comes primarily from the DNR and EPA websites, trade journals, conferences, consultants, and other venues.

Joplin Public Works Department employees (supervisors and certain general laborers) attend annual American Public Works conferences that has in part training on **MCM#1-6.** The training is via work sessions, visiting with vendors in the exhibit hall, watching demonstrations and videos, examining equipment and supplies, being exposed to success stories, and more.

Excal Visual training kits are presented to groups and are available for individual viewing. Each time a training workshop is offered, other municipalities, contractors, builders and others are invited and attendance is documented. Currently the City owns three Excal Visual training kits. Each kit includes a video, tests and attendance certificates.

Training that Focuses on MCM#6 via Excal Kit

- Municipal Storm Water Pollution Prevention-Everyday BMPs
  - Overview of Permit Requirements and MCM#1-6
  - Focus is on outdoor materials storage
  - Spill Response
  - Vehicle and Equipment Fueling and Repair

- Outdoor Manufacturing and maintenance
- Waste management
- Routine inspections
- How to recognize a possible illicit discharge

Training that Focuses on MCM#4 via Excal Kit

- Ground Control-Storm Water Pollution Prevention for Construction Sites
  - Overview of Permit Requirements and MCM#1-6
  - Teaches what BMPS are with examples
  - Explains why BMPs are present at the job site and how they function
  - What an employee should do if he/she observes a problem
  - Explains how to stabilize vehicle entrances/exits
  - Stormwater drain inlet protection devices
  - Management of industrial materials and wastes
  - Record Keeping
  - Reporting violations of related City Codes and Ordinances
  - Corrections to BMP failures

Training that Focuses on MCM#3 via Excal Kit

- Illicit Discharge Detection and Elimination
  - Overview of Permit Requirements and MCM#1-6
  - Spotting illicit discharges at the source
  - Spotting evidence of past illicit discharges
  - Reporting and documenting illicit discharges
  - Procedures to eliminate illicit discharges

4.2.6.1.2 A list of all municipal operations that are impacted by this operation and maintenance program. The permittee shall also include a list of industrial facilities that the permittee owns or operates that are subject to NDPES permits for discharges of stormwater associated with industrial activity that ultimately discharge to the permittee's MS4. The permittee shall include the permit number or a copy of the No Exposure Exemption Certification (if applicable) for each facility. NPDES permitted facilities not owned or operated by the permittee are not required to be part of the list;

4.2.6.1.2 Municipal operations impacted by good housekeeping minimum control measures:

- Public Works Center and Operations
- Joplin Regional Airport
- Shoal Creek Waste Water Treatment Plant
- Turkey Creek Waste Water Treatment Plant
- Parks and Recreation Department Golf Course
- Parks and Recreation Department Maintenance Center
- Parks and Recreation Department Office and Sports Complex
- Municipal Landfill (closed)
- Public Safety Training Center
- Fire Station #1, #2, #3, #4, #5, and #6

- Schifferdecker Pool, Cunningham Pool, Ewert Pool
- Justice Center
- City Hall

City facilities subject to NPDES permits include:

- Shoal Creek Waste Water Treatment Plant | Permit Number MO-0023256
- Turkey Creek Waste Water Treatment Plant | Permit Number MO-0103349
- Joplin Regional Airport | Permit Number MO-R80F046
- City Wide Permit | Permit Number MO-R100050

4.2.6.1.3 Maintenance BMPs, maintenance schedules, and long-term inspection procedures for controls to reduce floatable and other pollutants to the permittee's regulated Small MS4;

4.2.6.1.3 Joplin storm water ditch crews, catch basin cleaning crews, and street sweepers are dispatched Monday through Friday to predetermined locations and to complaint driven locations. One of their many goals is to remove floatables, dredge spoils, accumulated sediments, plus investigate/remove other pollutants. The amount of miles/feet of ditches cleaned and number of catch basins cleaned are recorded daily and reported quarterly. A sample of the quarterly report is illustrated in *Stormwater Report/Attachment 14.* The schedule for these tasks is on a rotation basis or as needed. Long-term inspection procedures are performed by the lead team member and/or the Infrastructure Maintenance Supervisors on a rotation basis.
Attachment 15 uses the Public Works Center checklist as a *sample* for routine or as needed inspections.

4.2.6.1.4 Controls for reducing or eliminating the discharge of pollutants from street, roads, highways, municipal parking lots, maintenance and storage yards, waste transfer station, fleet or maintenance shops with outdoor storage areas, and salt/sand storage locations and snow disposal areas the permittee operates;

4.2.6.1.4 City staff reduces discharge of pollutants through various activities such as inspections; training; storing chemicals indoors; maintaining lids on trash receptacles; ditch crew operations; street sweeping; secondary containment; routine trash disposal service through a private trash company contract; Parks Department employees pick up trash from their receptacles placed in parks, facility parking lots, Main Street streetscaping, and special events.

4.2.6.1.5 Procedures for the proper disposal of waste removed from the permittee's Small MS4 and areas of jurisdiction, including dredged material, accumulated sediments, floatables and other debris;

4.2.6.1.5 All City facilities are under one contract with a licensed trash service company for receptacles (dumpsters, polycarts, roll-off containers) and for the hauling and final disposal of the trash. The current contract is with Jordan Disposal, of which takes the trash to the Republic Services Transfer Station in Galena, Kansas and Waste Corporation of Missouri (WCA) Transfer Station west of Joplin city limits. Republic transfers some of the trash to the *Prairie View*

Landfill in Lamar, Missouri *and* some of the trash to the landfill in Cherryvale, Kansas. WCA transfers the trash to the *Oak Grove Landfill* in Arcadia, Kansas.

- Trash at City owned parking lots, parks, and swimming pools are picked up weekly (or more often) by the City Parks Department. The trash is deposited into six 4 cubic yard dumpsters at the Public Works Center. Jordan Disposal picks up the trash in the dumpsters three times per week.
- Trash generated at remaining City owned facilities as outlined in 4.2.6..1.2 above, is picked up by Jordan Disposal. Frequency ranges from once a week to three times a week.
- Dredged material and accumulated sediments are disposed of at a manmade pond at the Public Works Center and at two pieces of undeveloped property that the city owns. As needed, the materials are mixed with stockpiled clay and rocky soil as an amendment.
- Floatables are placed in the City's contracted trash hauler's (Jordan Disposal) 40 CY roll-off container staged at the Public Works Center for ultimate landfill disposal.
- Tires are brought to the Public Works Center enclosed tire trailer and then hauled and recycled by the City's contractor, Champlin Tire Recycling of Pittsburg and Parsons, Kansas.
- Household hazardous waste is brought to the City's HHW facility inside the Joplin Recycling Center by residents of McDonald, Newton, Jasper, Barton, and Vernon Counties and then hauled and recycled by the City's contractor, CARE Environmental.
- Hazardous waste (paint, chemicals, etc.) generated by City operations is managed on a case-by-case basis and appropriate contractors are hired for bulking, lab-packing, overpacking, pickup, analysis, and final disposal. CARE Environmental, Safety-Kleen, and other contractors have been utilized in the past. All hazardous waste and HHW contractors use various forms of retorting, waste to energy, incineration, fuel blending, and reuse. Some hazardous waste does go into licensed hazardous waste landfills. The City always receives a manifest.
- Used fluorescent lamps, U.V. lamps, and ballasts generated by City facilities are stored in the Sewer Maintenance Building. When the minimum quantity for shipment is reached, the City uses whatever contractor is listed on the State of Missouri Contract.
- Lead acid batteries generated by City facilities and lead acid batteries collected at the Joplin Recycling Center are hauled to CMC Recycling, 717 East 12th Street, Joplin, Missouri.
- CMC Recycling sites a 40 cubic yard roll-off container at the Public Works Center for the collection and hauling of scrap metal, appliances without compressors and refrigerants, and separated compressors.
- Some used motor oil collected at the Public Works Center Central Garage is stored and used in the oil-burning heater at the Central Garage. Some used

oil, lubricants and fuels are stored at the Central Garage and picked up by various contractors for reuse and fuel blending.

- Trash, bulky items, hazardous waste, tires etc. picked up in and around storm drains, ditches, rivers, creeks, streams, stormwater conveyances, etc. by City employees and volunteer groups are brought to the Public Works Center or Recycling Center as needed. Items are disposed of as outlined in above bullet points.

4.2.6.1.6 Procedures to assess impacts of water quality for new flood management projects, if applicable. Flood management projects are those projects developed or designed to reduce flooding.

4.2.6.1.6 During the last year the City of Joplin completed one flood management project, the regional detention basin on 32nd street and Arizona. As part of the procedures to assess the impacts of water quality for the project, like all other new flood management projects, inspections were conducted for the new regional detention facility. Typical items inspected during this process include but are not limited to:

- routine checking for any trash or debris which may have accumulated in the BMP.
- monitoring how much trash/debris is being removed from the BMP.
- monitoring the vegetation that will be acting as filters to ensure the diverse variety of trees and other filter vegetation is growing (has taken hold and is thriving).
- monitoring the flow of the existing stream through the BMP.
- monitoring the various filter systems associated with the flood management project, such as large rock blanket filters, to ensure they are functioning as intended in the BMP.

These and similar factors are considered in the assessment of impacts of water quality for new flood management projects. City staff evaluate these factors to determine whether the effectiveness of a flood management project.

4.2.6.2 All paints, solvents, petroleum products and petroleum waste products (except fuels) under the control of the permittee shall be stored so that these materials are not exposed to stormwater. Sufficient practices of spill prevention, control, and/or management shall be provided to prevent any spill of these pollutants from entering waters of the state. Any containment system used to implement this requirement shall be constructed of materials compatible with the substances contained and shall also prevent the contamination of groundwater.

4.2.6.2 Paint, solvents, petroleum products, etc. are stored indoors at all city facilities. Professional hazardous waste contractors are engaged when necessary. The Public Works Center and Joplin Regional Airport have fueling facilities which adhere to applicable federal and state regulations concerning underground storage, dispensers, spill alarms, and secondary containments. They are also inspected by staff routinely, as needed, and seasonally. Above mentioned items and spill prevention controls are listed on the Inspection Checklist. See *Attachment* 15.

4.4.1 The permittee shall conduct an annual review of their SWMP in conjunction with preparation of the MS4 SWMP Report required under Section 5.3;

4.4.1. The City of Joplin staff will conduct an annual review of the SWMP in conjunction with preparation of the MS4 SWMP bi-annual required Report as required under Section 5.3 to 5.3.5.

ATTACHMENTS

Attachment 14	Stormwater Report (Ditch and Catch Basin) | MCM #6
Attachment 15	Sample Inspection Checklist

ATTACHMENT 1 - IMPLEMENTATION SCHEDULE for BEST MANAGEMENT PRACTICES and ACTIVITIES -

BMP	Description of BMP's Actions (Tasks, Events, Activities)	Purpose of BMP	** Target Audience	Anticipated Achievement or Expected Results	Responsible Person or Designee	* Target Pollutant Sources	Measurable Goal Milestone Permit Year 1 2017	Measurable Goal Milestone Permit Year 2 2018	Measurable Goal Milestone Permit Year 3 2019	Measurable Goal Milestone Permit Year 4 2020	Measurable Goal Milestone Permit Year 5 2021	BMP Effectiveness Evaluation Process (Social, Programatic, Water Quality)
MINIMUM CONTROL MEASURE #1 Public Education and Outreach of Stormwater Impacts												
1	Permanent Sign at Joplin City Hall, Recycling Center & HHW Facility, and Nature Center	Educate the Public	Regional audience	10% of visitors will read signs	Mary Anne Phillips	ALL	N/A	200 possible impressions	200 possible impressions	200 possible impressions	200 possible impressions	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
2	Brochures at Joplin City Hall, Recycling Center & HHW Facility, and Nature Center	Educate the Public	Regional audience	150 brochures will be read	Mary Anne Phillips	ALL	N/A	150 brochures consumed	150 brochures consumed	150 brochures consumed	150 brochures consumed	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
3	Place Information on the City's Web Site	Educate the Public	Regional audience	TBD	Mary Anne Phillips	ALL	N/A	100 possible impressions	100 possible impressions	100 possible impressions	100 possible impressions	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
4	Joplin Creek Restoration Educational Placards	Educate the Public	Regional audience	10% of visitors will read placard	Mary Anne Phillips	RO, LG, T	N/A	100 possible impressions	100 possible impressions	100 possible impressions	100 possible impressions	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
5	Brochure to every new business licensees	Educate the Individual Business & Employees	Joplin Businesses	25% of info will be read	Mary Anne Phillips	ALL	N/A	144 mailings	144 mailings	144 mailings	144 mailings	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
6	Disseminate/Mail annual Recycling & Waste Disposal Guide	Educate the Public	Joplin Residents & Businesses	25% of info will be read	Mary Anne Phillips	ALL	N/A	disseminate 24,000 brochures	disseminate 24,000 brochures	disseminate 24,000 brochures	disseminate 24,000 brochures	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
7	Water Festival at Shoal Creek (or equivilant)	Educate the Public	Regional audience	speak to 25% of participants	Mary Anne Phillips	I, LG, RO, T	N/A	speak to 75 people	speak to 75 people	speak to 75 people	speak to 75 people	Analysis of Activities Report Spreadsheet (Evaluate Each Permit Cycle)

8	Third Thursday Event (or equivilant)	Educate the Public	Regional audience	speak to 1% of participants	Mary Anne Phillips	ALL	N/A	5,000 possible impressions	5,000 possible impressions	5,000 possible impressions	5,000 possible impressions	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
9	Joplin Insider TV show on MSSU	Educate the Public	Regional audience	capture 5% of the viewers	Mary Anne Phillips	ALL	N/A	80,000 possible viewers	80,000 possible viewers	80,000 possible viewers	80,000 possible viewers	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
10	Citizen Newsletter Stormwater Article	Educate the Public	Joplin residents & businesses	25% of info will be read	Mary Anne Phillips	TBD	N/A	72,000 newsletters	72,000 newsletters	72,000 newsletters	72,000 newsletters	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
11	Design & Conduct Educational Awareness Survey	Benchmark	Regional audience	find out what the public knows	Mary Anne Phillips	ALL	N/A	Pre-Survey 5% Participation			Post-Survey 5% participation	Evaluate Effectiveness of Survey & ask if there were behavior changes (evaluate each permit cycle)
12	Create & Disseminate PSAs for Television	Educate the Public	Regional audience		Mary Anne Phillips	ALL	N/A	Development	Completion	Implement once for each TV station	Implement once for each TV station	Analysis of TV Stations Air Frequency Reports (Evaluate Each Permit Cycle)

BMP	Description of BMPs Actions (Tasks, Events, Activities)	Purpose of BMP	** Target Audience	Annticipated Achievement or Expected Results	Responsible Person or Designee	* Target Pollutant Siources	Measurable Goal Milestone Permit Year 1 2017	Measurable Goal Milestone Permit Year 2 2018	Measurable Goal Milestone Permit Year 3 2019	Measurable Goal Milestone Permit Year 4 2020	Measurable Goal Milestone Permit Year 5 2021	BMP Effectiveness Evaluation Process (Social, Programatic, Water Quality)
MINIMUM CONTROL MEASURE #2 Public Involvement and Participation												
13	Post the MS4 2018-2021 Permit Application on City' Website	Gain Feedback	Joplin Residents & Stakeholders	Receive 50 Comments	Mary Anne Phillips	ALL	N/A	Reach out to 200 possible stakeholders, residents, etc.	Reach out to 200 possible stakeholders, residents, etc.	Reach out to 200 possible stakeholders, residents, etc.	Reach out to 200 possible stakeholders, residents, etc.	Stakeholder Review Panel Analysis of Feedback (Evaluate Each Permit Cycle)
14	Promote Rain Barrel Kit Sales & Education	Reduce Pollutants	Regional Customers	Sell 5 Annually	Mary Anne Phillips	LG	N/A	Reach out to 50 posible stakeholders, residents, etc.	Reach out to 50 posible stakeholders, residents, etc.	Reach out to 50 posible stakeholders, residents, etc.	Reach out to 50 posible stakeholders, residents, etc.	Analysis of Rain Barrel Program (Evaluate Each Permit Cycle)
15	Earth Day Event TBA	Reduce Pollutants	Regional Audience	Hold a Safe, Effective Event	Mary Anne Phillips	TBA	N/A	Conduct 1 Outreach Event	Conduct 1 Outreach Event	Conduct 1 Outreach Event	Conduct 1 Outreach Event	Analysis of Outreach Program (Evaluate Each Permit Cycle)
16	Stream Cleanups	Reduce Pollutants	Regional Audience	Create New or Sustain Current Partnerships	Mary Anne Phillips	I, T	N/A	Remove 15 Tires and/or 6 Cubic Yards of Trash	Remove 15 Tires and/or 6 Cubic Yards of Trash	Remove 15 Tires and/or 6 Cubic Yards of Trash	Remove 15 Tires and/or 6 Cubic Yards of Trash	Analysis of Actual Tire and Trash Removal (Evaluate Each Permit Cycle)
17	Compost Bin Giveaway or Sale	Reduce Pollutants	Residents in 5 County Area	Give away or sell 300 bins	Mary Anne Phillips	LG	N/A	Reach out to 200 Possible Homes	Reach out to 200 Possible Homes	Reach out to 200 Possible Homes	Reach out to 200 Possible Homes	Analysis of Compost Bin Program (Evaluate Each Permit Cycle)

BMP	Description of BMPs Actions (Tasks, Events, Activities)	Purpose of BMP	** Target Audience	Annticipated Achievement or Expected Results	Responsible Person or Designee	* Target Pollutant Siources	Measurable Goal Milestone Permit Year 1 2017	Measurable Goal Milestone Permit Year 2 2018	Measurable Goal Milestone Permit Year 3 2019	Measurable Goal Milestone Permit Year 4 2020	Measurable Goal Milestone Permit Year 5 2021	BMP Effectiveness Evaluation Process (Social, Programatic, Water Quality)
MINIMUM CONTROL MEASURE #3 Illicit Discharge Detection and Elimination												
18	Develop IDDE Ordinance	Reduce Pollutants & Increase Public Awareness	City Council	complete development and forward to City Council for adoption in April 2019	David Hertzberg	RO, SRC, LG, I, T	N/A	Development	Codify Ordinance	Enforce Ordinance	Enforce Ordinance	Analysis of Investigations and Final Outcomes via Annual Reports (Evaluate Each Permit Cycle)
19	Enforce Current Ordinances	Reduce Pollutants	Staff, Residents, Businesses, Industries	Increase Investigations and Remedies	David Hertzberg	RO, SRC, LG, I, T	N/A	Increase Investigations and Remedies by 5%	Increase Investigations and Remedies by 5%	Increase Investigations and Remedies by 5%	Increase Investigations and Remedies by 5%	Analysis of Investigations and Final Outcomes via Annual Reports (Evaluate Each Permit Cycle)
20	Illicit Discharge Training Class	Training	Municipal Employees	Increase Investigations and Remedies	Mary Anne Phillips	ALL	N/A	Conduct 1 Training Class	Conduct 1 Training Class	Conduct 1 Training Class	Conduct 1 Training Class	Analysis of Investigations and Class Attendance (Evaluate Each Permit Cycle)
21	Inspect Mfg. Companies for Illicit Discharge	Reduce Pollutants	Joplin Businesses & Industries	Increase Awareness and Compliance	Jeff Stephenson	I, T, H, B, MO	N/A	Inspect 100% of Pre-Treatment Permitees	Inspect 100% of Pre-Treatment Permitees	Inspect 100% of Pre-Treatment Permitees	Inspect 100% of Pre-Treatment Permitees	Analysis of Inspections and Final Outcomes via Annual Reports (Evaluate Each Permit Cycle)
22	Operate Spill Hotline	Reduce Pollutants and Educate the Public	Regional Audience	Coordination with all City Departments	Mary Anne Phillips	ALL	N/A	Complete Spreadsheet	Complete Spreadsheet	Complete Spreadsheet	Complete Spreadsheet	Analysis of Investigations via Annual Reports (Evaluate Each Permit Cycle)
23	Investigate all Possible Illicit Discharges	Reduce Pollutants	Joplin Businesses & Residents	Increase Awareness, Compliance, Remedies	Mary Anne Phillips	ALL	N/A	Increase Compliance	Increase Compliance	Increase Compliance	Increase Compliance	Analysis of Investigations via Annual Reports (Evaluate Each Permit Cycle)
24	Citizen Newsletter Stormwater Article	Educate the Public	Joplin Residents & Businesses	25% of info will be read	Mary Anne Phillips	TBD	N/A	72,000 newsletters	72,000 newsletters	72,000 newsletters	72,000 newsletters	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle)
25	Operate Fats, Oils, Grease Program	Reduce Pollutants	Regional Audience	Increase Quantity of FOG dropped off for Recycling	Mary Anne Phillips	I. T	N/A	Increase Participation	Increase Participation	Increase Participation	Increase Participation	Compare Annual Tonnage Reports (Evaluate Each Permit Cycle)

26	Maintain Educational Information	Reduce Pollutants	Regional Audience	Reprint or Repost Updates and Corrections	Mary Anne Phillips	I, T	N/A	Ongoing	Ongoing	Ongoing	Ongoing	Analysis of Awareness
27	Maintain Spreadsheet of Activities	Permit Compliance	Regional Audience	Posses all Necessary Documentation	Mary Anne Phillips	ALL	N/A	Complete Spreadsheet	Complete Spreadsheet	Complete Spreadsheet	Complete Spreadsheet	Analysis Data on Spreadsheet for Appropriatness

BMP	Description of BMPs Actions (Tasks, Events, Activities)	Purpose of BMP	** Target Audience	Annticipated Achievement or Expected Results	Responsible Person or Designee	* Target Pollutant Siources	Measurable Goal Milestone Permit Year 1 2017	Measurable Goal Milestone Permit Year 2 2018	Measurable Goal Milestone Permit Year 3 2019	Measurable Goal Milestone Permit Year 4 2020	Measurable Goal Milestone Permit Year 5 2021	BMP Effectiveness Evaluation Process (Social, Programatic, Water Quality)
MINIMUM CONTROL MEASURE #4 Construction Site Stormwater Runoff Control												
24	Citizen Newsletter Stormwater Article	Educate the Public	Joplin residents & contractors	25% of Info will be Read	Mary Anne Phillips	SRC	N/A	72,000 newsletters	72,000 newsletters	72,000 newsletters	72,000 newsletters	Analysis of Educational Awareness Survey (Evaluate Each Permit Cycle by identifying deficiencies, level of effectiveness and potential areas for improvements in implemented BMP and seeking to incorporate them into the development of the City SWMP)
28	Disseminate Guidelines with Every Building Permit	Educate Permitees	Joplin residents & contractors	95% Compliance	Bryan Wicklund	SRC, T	N/A	approx. 400 permits	approx. 400 permits	approx. 400 permits	approx. 400 permits	Analysis of Inspection Results (Evaluate Each Permit Cycle by identifying deficiencies, level of effectiveness and potential areas for improvements in implemented BMP and seeking to incorporate them into the development of the City SWMP)

29	Construction Site Training Classes	Educate, Train, Answer Questions	Contractors, Builders, City Staff, MS4 Municipal Partners	Attandance of 33% of those who are invited	Mary Anne Phillips	SRC, T, MO	N/A	2 classes per year	2 classes per year	2 classes per year	2 classes per year	Evaluate Effectiveness of each Class (Evaluate Each Permit Cycle by identifying deficiencies, level of effectiveness and potential areas for improvements in implemented BMP and seeking to incorporate them into the development of the City SWMP)
30	Inspections on all Applicable Construction Sites	To Confirm Compliance or Correct Deficiencies	Building Permittee	95% Compliance	Bryan Wicklund	SCR, T	N/A	approx. 400 permits	approx. 400 permits	approx. 400 permits	approx. 400 permits	Analysis of Inspection Results (Evaluate Each Permit Cycle by identifying deficiencies, level of effectiveness and potential areas for improvements in implemented BMP and seeking to incorporate them into the development of the City SWMP)
31	Place Guidelines & Ordinances on the City's Web Site	Educate the Builders	Regional audience	TBD	Steven Martinez	SCR, T	N/A	100 possible impressions	100 possible impressions	100 possible impressions	100 possible impressions	Analysis Documents(Evaluate Each Permit Cycle by identifying deficiencies, level of effectiveness and potential areas for improvements in implemented BMP and seeking to incorporate them into the development of the City SWMP)

32	Update and Reprint Handouts	Educate the Builders	Regional audience	25% of Info will be Read	Mary Anne Phillips	SCR, T	N/A	25 Brochures will be Consumed	25 Brochures will be Consumed	25 Brochures will be Consumed	25 Brochures will be Consumed	Analysis Documents (Evaluate Each Permit Cycle by identifying deficiencies, level of effectiveness and potential areas for improvements in implemented BMP and seeking to incorporate them into the development of the City SWMP)

BMP	Description of BMPs Actions (Tasks, Events, Activities)	Purpose of BMP	** Target Audience	Anticipated Achievement or Expected Results	Responsible Person or Designee	* Target Pollutant Siources	Measurable Goal Milestone Permit Year 1 2017	Measurable Goal Milestone Permit Year 2 2018	Measurable Goal Milestone Permit Year 3 2019	Measurable Goal Milestone Permit Year 4 2020	Measurable Goal Milestone Permit Year 5 2021	BMP Effectiveness Evaluation Process (Social, Programatic, Water Quality)
MINIMUM CONTROL MEASURE #5 Post-Construction Stormwater Management in New Development & Redevelopment												
33	Review SW Mgt Criteria, Comp. Plan, and Zoning Codes & recommend updates as needed	Educate the Builders & Public, Prevent Run Off	Property Owners, Builders, Etc.	100% of responsible staff will complete the review & make updates on time	Dan Johnson & Troy Bolander	RO, SCR, MO	N/A	Review completed by end of each calendar year	Review completed by end of each calendar year	Review completed by end of each calendar year	Review completed by end of each calendar year	City staff will confer with the City's engineering consultants annually.
34	Disseminate SW Mgt Criteria, Comp. Plan, and Zoning Codes	Educate the Builders & Public, Prevent Run Off	Property Owners, Builders, Etc.	25% of Info will be Read	Dan Johnson	RO, SCR, MO	N/A	5 Copies of Criteria & Comp Plan will be Consumed	5 Copies of Criteria & Comp Plan will be Consumed	5 Copies of Criteria & Comp Plan will be Consumed	5 Copies of Criteria & Comp Plan will be Consumed	Staff & Consultants Analyze Documents (Evaluate Each Permit Cycle to identify BMP effectiveness and potential areas for improvement and integrate improvement into SWMP)

35	Place SW Criteria, Comp. Plan and Zoning Codes on City's Web Site	Educate the Builders & Public, Prevent Run Off	Property Owners, Builders, Etc.	Keep documents current	Steven Martinez	RO, SCR, MO	N/A	50 possible impressions	50 possible impressions	50 possible impressions	50 possible impressions	Analyze Documents & ease of viewing (Evaluate Each Permit Cycle to identify BMP effectiveness and potential areas for improvement and integrate improvement into SWMP)
36	Track Infill, New Dev & ReDevelopment Projects	Reporting	City Staff	Enable staff to have an Overview for year to year comparisons	Steven Martinez	RO, SCR, MO	N/A	1 (one) possible construction project	1 (one) possible construction project	1 (one) possible construction project	1 (one) possible construction project	Analyze Document for ease of viewing (Evaluate Each Permit Cycle to identify BMP effectiveness and potential areas for improvement and integrate improvement into SWMP)
37	Inspection of City-owned Post-Construction BMPs	Ensure adequate long-term operation and maintanance of BMP	City Staff	Enable staff to review BMP effectiveness	Dan Johnson	RO, SCR, MO	N/A	Minimum 1 inspection of each BMP per permit cycle	Minimum 1 inspection of each BMP per permit cycle	Minimum 1 inspection of each BMP per permit cycle	Minimum 1 inspection of each BMP per permit cycle	Staff Analyze Documents (Evaluate Each Permit Cycle to identify BMP effectiveness and potential areas for improvement and integrate improvement into SWMP)
38	Compile Inspection Documentation of Privately Owned Post-Construction BMPs	Reporting	City Staff	Enable staff to track and document post-construction BMP's	Dan Johnson	RO, SCR, MO	N/A	Compile yearly inspection documentation for DNR Bi-annual submittal	Compile yearly inspection documentation for DNR Bi-annual submittal	Compile yearly inspection documentation for DNR Bi-annual submittal	Compile yearly inspection documentation for DNR Bi-annual submittal	Analyze Documents & ease of viewing (Evaluate Each Permit Cycle to identify BMP effectiveness and potential areas for improvement and integrate improvement into SWMP)

BMP	Description of BMPs Actions (Tasks, Events, Activities)	Purpose of BMP	** Target Audience	Anticipated Achievement or Expected Results	Responsible Person or Designee	* Target Pollutant Siources	Measurable Goal Milestone Permit Year 1 2017	Measurable Goal Milestone Permit Year 2 2018	Measurable Goal Milestone Permit Year 3 2019	Measurable Goal Milestone Permit Year 4 2020	Measurable Goal Milestone Permit Year 5 2021	BMP Effectiveness Evaluation Process (Social, Programatic, Water Quality)
MINIMUM CONTROL MEASURE #6 Pollution Prevention /Good Housekeeping for Municipal Operations												
39	Good Housekeeping Training Class	Training	Municipal Employees & SW Partners	Increase proper behavior & decrease incidents	Mary Anne Phillips	SRC, LG, I, T, B, MO	N/A	Conduct 1 Training Class	Conduct 1 Training Class	Conduct 1 Training Class	Conduct 1 Training Class	Analysis of Incidents & Investigations and Class Attendance (Evaluate Each Permit Cycle)
40	Distribute Procedure Documents	Increase proper behavior & decrease incidents	New Employees	Info will be Read by 75% of employees	Mary Anne Phillips	SRC, LG, I, T, B, MO	N/A	Send Document to 100% of New Employees	Send Document to 100% of New Employees	Send Document to 100% of New Employees	Send Document to 100% of New Employees	Analysis of Incidents & Investigations (Evaluate Each Permit Cycle)
41	Post the Procedure Document in every department or facility	Increase proper behavior & decrease incidents	All Employees	Info will be Read by 25% of employees	Mary Anne Phillips	SRC, LG, I, T, B, MO	N/A	Check on 50% of postings	Check on 50% of postings	Check on 50% of postings	Check on 50% of postings	Analysis of Incidents & Investigations (Evaluate Each Permit Cycle)
42	Compile and Monitor Municipal Operations Checklist	Increase proper behavior & decrease incidents	All Employees	Checklist will be completed by 75% of responsible employees	Mary Anne Phillips	SRC, LG, I, T, B, MO	N/A	Receive 75% of completed checklist by end of December	Receive 75% of completed checklist by end of December	Receive 75% of completed checklist by end of December	Receive 75% of completed checklist by end of December	Analysis of quantity & quality of completed checklists (Evaluate Each Permit Cycle)
43	Inspect Municipal Operation BMPs seasonally and as needed	Increase proper behavior & decrease incidents	All Employees	Inspections will be made by 75% of responsible employees	Mary Anne Phillips	SRC, LG, I, T, B, MO	N/A	Receive 75% of completed checklist by end of December	Receive 75% of completed checklist by end of December	Receive 75% of completed checklist by end of December	Receive 75% of completed checklist by end of December	Analysis of quantity & quality of completed checklists (Evaluate Each Permit Cycle)
44	Compile Logsheets for Street Sweeping, Ditch Maintenance, Leaf Pickup	Reporting	Appropriate City Staff	Receive accurate data for reporting purposes	Mary Anne Phillips	SRC, LG, T, MO	N/A	Receive 100% of data by end of December	Receive 100% of data by end of December	Receive 100% of data by end of December	Receive 100% of data by end of December	Analysis of data for annual comparison & budgeting purposes (Evaluate Each Permit Cycle)

***TARGET POLLUTANT SOURCE CODE:**
Run Off from Pervious Surfaces = RO
Soil & Erosion Control-Construction Activities = SRC
Lawn & Garden Activities = LG
Illicit Discharge = I
Trash/Litter Reduction &/or Clean Up = T
Heavy Metals = H
Bacteria = B
Municipal Operations = MO
All of the Above = ALL

<u> #1MCM TARGET AUDIENCE as listed in Permit Application</u>**
Citizens (Homeowners/Landlords)
Restaurants Owners and Operators
Car Wash Owners and Operators
Service Stations |Oil/Lube Business Owners and Operators
Lawn Service Companies
Developers | Builders | Contractors
Business Owners
Industries
Municipal Operations
Hospitals |Schools

<u> #2 MCM TARGET AUDIENCE as listed in Permit Application</u>**
Citizens and Homeowners (includes all races and economics groups)
Mass Media
Local Elected Officials
Business Leaders via the Chamber and others
Contractors | Home Builders | Developers
Teachers/Educators
Seniors
Civic Organizations
Tri-State Water Resource Coalition
Friends of Wildcat Glades
Master Naturalists
Master Gardeners
Home Builders|Developers

Joplin Regional Education and Activities | Measurable Goals related to permit and bi-annual reports

JANUARY 1, 2017 - to December 31, 2018

Attachement 2

Codes on Last Page

2017	MEDIA or EVENT or ACTIVITY	TARGET AUDIENCE and/or QUANTIFIERS or SUBJECT MATTER	IMPRESSIONS or CIRCULATION or STORMWATER BROCHURES DISSEMINATED	AUDIENCE QTY or POSSIBLE VIEWERS	VOLUNTEERS/CITY STAFF	TARGETED POLLUTANT SOURCES	MINIMUM CONTROL NUMBER
On Going	Permanent Sign at Joplin City Hall	General Population			Mary Anne Phillips	ALL	1
On Going	Permanent Signs at HHW Facility	General Population			Mary Anne Phillips	ALL	1
On Going	Permanent Signs at Nature Center	General Population			Mary Anne Phillips	ALL	1
On Going	Educational Graphics along Joplin Creek	General Population			Tony Robyn	ALL	1-6
On Going	Educational Graphics at Mercy Park	General Population			Tony Robyn	ALL	1-6
Monthly	Tri-State Area Contractors Assoc meetings with City Staff	Developers | Builders | Contractors | Landscapers		varies	city staff: Wicklund, Johnson	RO, SRC	4, 5
Jan and Feb	Annual Leaf Pick Up	residential homeowners and tenants			Mary Anne Phillips	LG, I	1, 2, 3
January	New Business Letter and Storm water brochure	Business Owners | Restaurants	11	11	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
Feb 7	News Release Leaf Pick-up ending	mentions need to stop gardening chemical runoff			Mary Anne Phillips	LG	1, 2, 3
Feb 21	515 S Grand Ave Illegal Dump | Homeless Camp Cleanup	Business Owner | Property next to Joplin Creek West			Paula Bone	T , B	3, 6
February	New Business Letter and Storm water brochure	Business Owners | Restaurants	12	12	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
March	New Business Letter and Storm water brochure	Business Owners | Hair Stylists	3	3	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
March 20	New Employee Orientation and Storm water Training	New City of Joplin Employees IDDE training film and test		5	Mary Anne Phillips	RO SRC LG I T MO	3, 4, 6
March 21	Public Mtg for Storm water Inlets & Pipes improvements	Homeowners | Engineers | Stakeholders | Media		3	Dan Johnson & Phillips	ALL	1-4
April	New Business Letter and Storm water brochure	Business Owners | Hair Stylists	9	9	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
April 18	Earth Day Conference at Missouri Southern State University	High School & College Students and Teachers		500	Mary Anne Phillips	ALL	1, 2
April 20	MS4 Workshop in Springfield, MO	Joplin City Employees			Johnson, Phillips, Lawson	ALL	1-6
April 27	New Employee Orientation and Storm water Training	New City of Joplin Employees			Mary Anne Phillips	RO SRC LG I T MO	3, 4, 6
May 5-6	Annual Tire Drop Off at Joplin Recycling Center	Joplin Residents | Empire District Electric resi. customers			Mary Anne Phillips	I, T	2, 3
May	New Business Letter and Stormwater brochure	Business Owners | a bank | etc.	6	6	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
June	New Business Letter and Stormwater brochure	Business Owners | Pharmacy, etc.	12	12	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
July 18 or 19	Shoal Creek Cleanup of tires	28 tires x 20 pounds = 560 pounds			Mary Anne Phillips	T	2
July 29	Shoal Creek Cleanup	55 volunteers | MDC | City Staff			Mary Anne Phillips	T	1, 2
July 29-30	Media Coverage in Joplin Globe Newspaper and TV	coverage about the Shoal Creek Cleanup			Chris Pistole	T	1, 2
July	New Business Letter and Stormwater brochure	Restaurants | Trift Store, etc.	8	8	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
August 2	Display booth at Joplin School Fair	teachers | staff | administration	4	300	Mary Anne Phillips	ALL	1, 2
August 12	Shoal Creek WaterFest	Interactive booth and storm water diorama		1,000	Mary Anne Phillips & Al Hash	ALL	1, 2, 3, 4
August 12-13	Media Coverage in Joplin Globe Newspaper and TV	News coverage of WaterFest			Chris Pistole	T, H, B	1, 2
August	New Business Letter and Stormwater brochure	Restaurants, etc.	15	15	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
September 6	partnered with Master Naturalist for Stream Cleanup	4 tires x 20 pounds = 80 pounds			Mary Anne Phillips	T	2
September 16	Camp Swampy - Boy Scout Jamboree	several hundred scouts and parents|sw diorama|rain barrel			Phillips & Jennifer Shotwell	ALL	1-5
September	New Business Letter and Stormwater brochure	General Merchandise, etc.	15	15	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
October	New Business Letter and Stormwater brochure	Gun store, etc.	9	9	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
November 8	America Recycles Day news releases	General Population|Homeowners|Gardeners|Dog Owners			Mary Anne Phillips	LG, I, T, H, B	1, 2, 3
Nov 17-18	Compost Bin Giveaway|Dog Waste Digester|Rain Barrel	Homeowners | Gardeners | Dog Owners	25	200	Mary Anne Phillips	T, LG, B	1, 2, 3
November 7	Residential Leaf Pick Up news releases	General Population | Homeowners | Gardeners			Mary Anne Phillips	LG, I, T	1, 2, 3
Nov-Dec	Annual residential Leaf Pick Up	Residential Homeowners and Tenants			Dean Smith/Steve Curry/MA Phillips	LG, I, T	1, 2, 3
November	New Business Letter and Stormwater brochure	Hair Studio | Grocer	13	13	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4

Codes on Last Page

2017 Continued	MEDIA or EVENT or ACTIVITY	TARGET AUDIENCE and/or QUANTIFIERS or SUBJECT MATTER	IMPRESSIONS or CIRCULATION or STORMWATER BROCHURES DISSEMINATED	AUDIENCE QTY or POSSIBLE VIEWERS	VOLUNTEERS/CITY STAFF	TARGETED POLLUTANT SOURCES	MINIMUM CONTROL NUMBER
Dec 13	MS4 Training Workshop in Springfield, MO				Dan Johnson	ALL	1-6
Dec 20	News Release about remaining compost bins/SproutFaster	KZRG Radio | KSN & KODE TV broadcasts | City Website			Mary Anne Phillips	LG	1, 2
three events|2017	HBA "Member Coffee" informal meetings	Developers | Builders | Contractors | Landscapers		20	Bryan Wicklund	RO, SRC	4, 5

2018

On Going	Permanent Sign & Brochures at Joplin City Hall	General Population			Mary Anne Phillips	ALL	1
On Going	Permanent Signs & Brochures at HHW Facility	General Population			Mary Anne Phillips	ALL	1
On Going	Permanent Signs & Brochures at Nature Center	General Population			Mary Anne Phillips	ALL	1
On Going	Educational Graphics along Joplin Creek	General Population			Troy Bolander	ALL	1-6
On Going	Educational Graphics at Mercy Park	General Population			Troy Bolander	ALL	1-6
Monthly	Tri-State Area Contractors Assoc meetings with City Staff	Developers | Builders | Contractors | Landscapers		varies	city staff: Wicklund, Johnson	RO, SRC	4, 5
January	New City Employees	received Waste, Recycling, Stormwater Procedures		7	Mary Anne Phillips	MO	6
January 22	Joplin Area Welcome Club	35 attendees	2	35	Mary Anne Phillips	ALL	1, 2
January 27	Stella, Mo. Eagle Days	1,000 people attended to observe educational booths	10	1,000	Phillips & Jennifer Shotwell	ALL	1, 2
January	New Business Letter and Storm water brochure	Business Owners | Restaurants | Grocer | Hotel	10	10	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
February	New City Employees	received Waste, Recycling, Stormwater Procedures		7	Mary Anne Phillips	MO	6
February 8-10	HBA Home Show	Developers|Builders|Contractors|Landscapers|Citizens	5	800	Phillips, Onstot, Martinez	ALL	1-5
February	New Business Letter and Storm water brochure	Business Owners | Restaurants | Merchants | Auto Sales	10	10	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
March 1	Shoal Creek Tire Cleanup (City & MO Dept Conservation)	25 tires x 20 pounds = 500 pounds			Mary Anne Phillips	T	2, 6
March 5	City Employee Storm Water Training Video and Quiz	Paula Bone and Steven Martinez		2	Mary Anne Phillips	ALL, Admin.	1-6
March 16	New Employee	Vivian Samuels Transit Driver II | MAPS Department		1	Mary Anne Phillips	MO	6
March 29	City Employee Storm Water Training Video and Quiz	James Cross		1	Mary Anne Phillips	ALL, Admin.	1-6
March	New Business Letter and Storm water brochure	Business Owners | Grocer | Merchants | Mobile Phone Co	11	11	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
April ?	Water Conference				Dan Johnson, others	ALL, Admin.	1-6
April	Citizen Newsletter about Earth Day Activities	Rain Barrel | Dog Waste Digester | Compost | Trash/Recycle			Phillips, Onstot		1, 2
April 18	Earth Day Conference at Missouri Southern State University	High School & College Students and Teachers		500	Mary Anne Phillips	ALL	1, 2
April 19	Downtown Third Thursday	General Population | Volunteers from North Middle School	10	1,000	Phillips, Onstot	ALL	1
April 20-21	Compost Bin Giveaway|Dog Waste Digester|Rain Barrel	Homeowners | Gardeners | Dog Owners	25	100	Mary Anne Phillips	T, LG, B	1, 2, 3
April	New Business Letter and Storm water brochure	Business Owners | Grocer | Merchants | Car Lot	10	10	Mary Anne Phillips	RO, LG, I, T, HB	1, 2, 3, 4
June pending	Shoal Creek Tire Cleanup	Stream Team and General Population		8	Tom Kernsey, Phillips	T	2

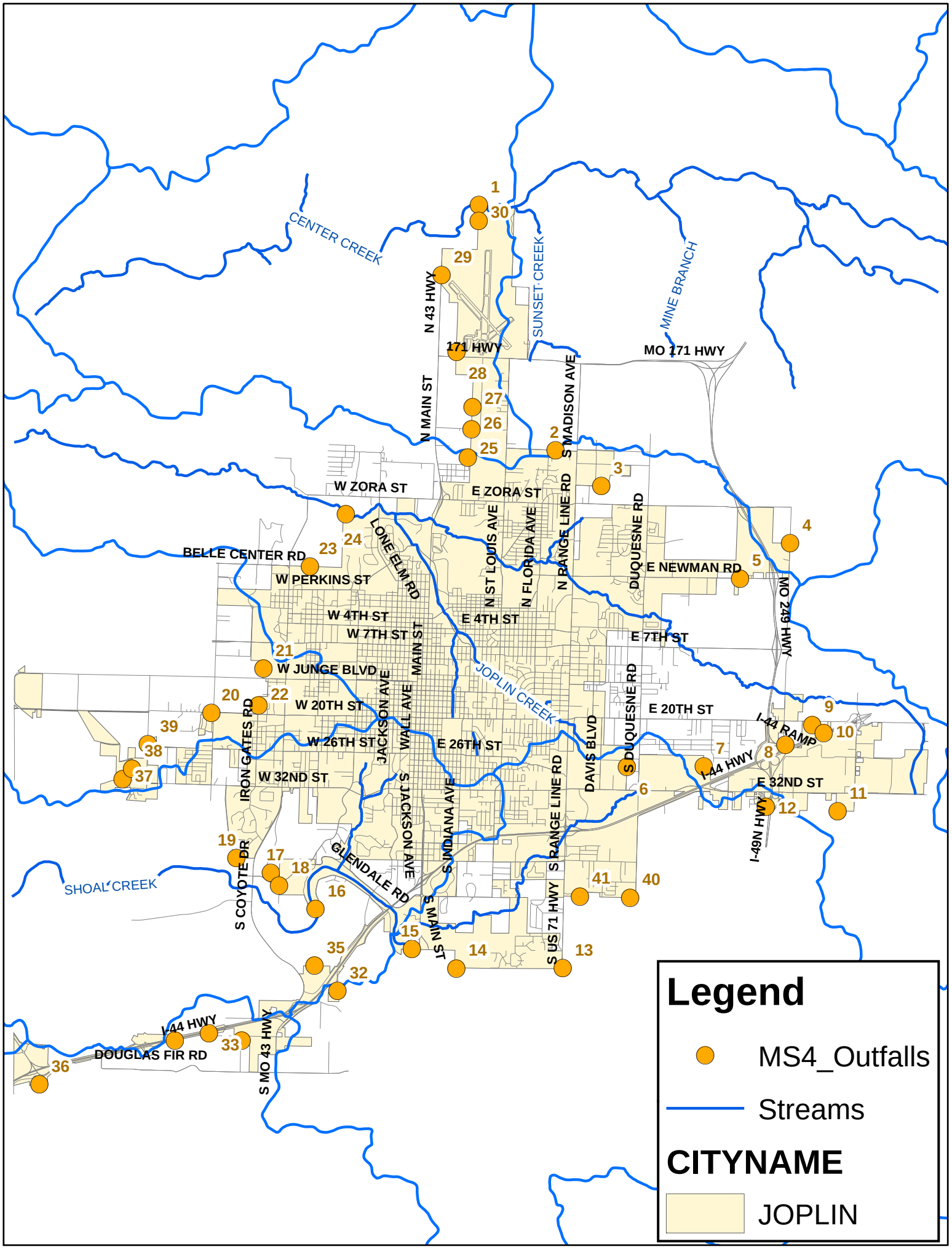
MINIMUM CONTROL NUMBER

#1 Public Education & Outreach
#2 Public Involvement & Participation
#3 Illicit Discharge Detection & Elimination
#4 Construction Site Storm water Runoff Control
#5 Post-Construction SW MGT in New Development & Redevelopment
#6 Pollution Prevention/Good Housekeeping for Municipal Operations

TARGETED POLLUTANT SOURCE CODE
Run Off from Pervious Surfaces = RO
Soil & Erosion Control-Construction Activities = SRC
Lawn & Garden Activities = LG
Illicit Discharge = I
Trash/Litter Reduction &/or Clean Up = T
Heavy Metals = H
Bacteria = B
Municipal Operations = MO
All of the Above = ALL
Administration = Admin.

#1 MCM TARGET AUDIENCE as listed in Permit Application
Citizens (Homeowners/Landlords)
Restaurants Owners and Operators
Car Wash Owners and Operators
Service Station and Oil/Lube Business Owners and Operators
Lawn Service Companies
Developers, Builders, Contractors
Business Owners
Municipal Operations
Hospitals, Schools, large to medium sized Industries

#2 MCM TARGET AUDIENCE as listed in the Permit Application
Citizens & Homeowners (includes all races and economics groups)
Mass Media
Local Elected Officials
Business Leaders via the Chamber and others
Contractors, Home Builders, Developers
Teachers/Educators
Seniors
Civic Organizations
Tri-State Water Resource Coalition
Shoal Creek Watershed Partnership
Spring River Water Coalition


CENTER CREEK
SUNSET CREEK
MINE BRANCH
JOPLIN CREEK
SHOAL CREEK
N 43 HWY
171 HWY
MO 171 HWY
N MAIN ST
S MADISON AVE
W ZORA ST
E ZORA ST
N RANGE LINE RD
DUQUESNE RD
E NEWMAN RD
MO 249 HWY
BELLE CENTER RD
W PERKINS ST
LONE ELM RD
N ST LOUIS AVE
N FLORIDA AVE
W 4TH ST
E 4TH ST
W 7TH ST
E 7TH ST
MAIN ST
W JUNGE BLVD
W 20TH ST
E 20TH ST
JACKSON AVE
WALL AVE
I-44 RAMP
I-44 HWY
W 26TH ST
E 26TH ST
DAVIS BLVD
S DUQUESNE RD
IRON GATES RD
W 32ND ST
E 32ND ST
I-49N HWY
S COYOTE DR
GLENDALE RD
S JACKSON AVE
S INDIANA AVE
S RANGE LINE RD
S MAIN ST
S US 71 HWY
I-44 HWY
DOUGLAS FIR RD
S MO 43 HWY
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Streams
CITYNAME
JOPLIN

MS4 Outfalls Locations - Joplin 2019

Name	Lat	Long	Legal	STR	Receiving
1	37° 10' 23.591" N	94° 30' 1.792" W	SE 1/4 SW 1/4	S2 T28 R33	Center Creek
2	37° 7' 25.052" N	94° 28' 51.778" W	NW 1/4 NE 1/4	S25 T28 R33	Center Creek
3	37° 6' 59.017" N	94° 28' 10.224" W	SE 1/4 SW 1/4	S30 T28 R32	Turkey Creek
4	37° 6' 17.370" N	94° 25' 18.187" W	SE 1/4 NE 1/4	S33 T28 R32	Center Creek
5	37° 5' 51.690" N	94° 26' 3.953" W	NW 1/4 NW 1/4	S3 T27 R32	Turkey Creek
6	37° 3' 34.649" N	94° 27' 46.938" W	NE 1/4 SE 1/4	S18 T27 R32	Silver Creek
7	37° 3' 34.981" N	94° 26' 36.994" W	NE 1/4 SE 1/4	S17 T27 R32	Turkey Creek
8	37° 3' 50.423" N	94° 25' 22.635" W	NW 1/4 NW 1/4	S15 T 27 R32	Turkey Creek
9	37° 4' 5.071" N	94° 24' 58.326" W	NE 1/4 NW 1/4	S15 T27 R32	Turkey Creek
10	37° 3' 59.227" N	94° 24' 47.886" W	NW 1/4 NE 1/4	S15 T27 R32	Turkey Creek
11	37° 3' 2.195" N	94° 24' 35.264" W	NE 1/4 NE 1/4	S22 T27 R32	Turkey Creek
12	37° 3' 5.477" N	94° 25' 40.462" W	NW 1/4 NE 1/4	S21 T27 R32	Shoal Creek
13	37° 1' 8.194" N	94° 28' 45.386" W	SW 1/4 NW 1/4	S31 T27 R32	Shoal Creek
14	37° 1' 7.902" N	94° 30' 22.131" W	NE 1/4 SW 1/4	S35 T27 R33	Shoal Creek
15	37° 1' 21.785" N	94° 31' 2.615" W	SE 1/4 NE 1/4	S34 T27 R33	Shoal Creek
16	37° 1' 51.184" N	94° 32' 30.238" W	NW 1/4 SW 1/4	S28 T27 R33	Shoal Creek
17	37° 2' 17.378" N	94° 33' 10.886" W	NE 1/4 NE 1/4	S29 T27 R33	Shoal Creek
18	37° 2' 8.082" N	94° 33' 3.464" W	SE 1/4 NE 1/4	S29 T27 R33	Shoal Creek
19	37° 2' 28.164" N	94° 33' 42.358" W	NE 1/4 NE 1/4	S29 T27 R33	Shoal Creek
20	37° 4' 13.674" N	94° 34' 5.252" W	NE 1/4 NE 1/4	S18 T27 R33	Short Creek
21	37° 4' 46.145" N	94° 33' 17.898" W	SE 1/4 NE 1/4	S8 T27 R33	Short Creek
22	37° 4' 19.424" N	94° 33' 22.299" W	SE 1/4 SE 1/4	S8 T27 R33	Short Creek
23	37° 6' 0.348" N	94° 32' 35.499" W	SW 1/4 SW 1/4	S33 T28 R33	Turkey Creek
24	37° 6' 38.651" N	94° 32' 2.727" W	SW 1/4 NE 1/4	S33 T28 R33	Turkey Creek
25	37° 7' 19.783" N	94° 30' 11.809" W	SE 1/4 NW 1/4	S26 T28 R 33	Turkey Creek
26	37° 7' 40.540" N	94° 30' 8.418" W	SE 1/4 SW 1/4	S23 T28 R33	Center Creek
27	37° 7' 56.501" N	94° 30' 7.508" W	NE 1/4 SW 1/4	S23 T28 R33	Center Creek
28	37° 8' 36.614" N	94° 30' 22.123" W	SW 1/4 SW 1/4	S14 T28 R33	Center Creek
29	37° 9' 32.663" N	94° 30' 35.689" W	SE 1/4 SE 1/4	S10 T28 R33	Center Creek
30	37° 10' 11.977" N	94° 30' 1.912" W	NE 1/4 NW 1/4	S11 T28 R33	Center Creek
31	37° 0' 15.456" N	94° 33' 37.311" W	NW 1/4 SE 1/4	S5 T26 R33	Rock Branch
32	37° 0' 51.369" N	94° 32' 10.297" W	SE 1/4 SE 1/4	S33 T27 R33	Spring Creek
33	37° 0' 20.597" N	94° 34' 7.212" W	SW 1/4 NW 1/4	S5 T26 R33	Rock Branch
34	37° 0' 15.456" N	94° 34' 38.221" W	NW 1/4 SE 1/4	S6 T26 R33	Rock Branch
35	37° 1' 10.037" N	94° 32' 31.101" W	SW 1/4 NE 1/4	S 33 T27 R33	Shoal Creek
36	36° 59' 43.168" N	94° 36' 41.436" W	SE 1/4 NW 1/4	S11 T26 R34	Rock Branch
37	37° 3' 25.632" N	94° 35' 25.872" W	SW 1/4 SE 1/4	S13 T27 R34	Spring Branch
38	37° 3' 33.322" N	94° 35' 17.255" W	SE 1/4 SE 1/4	S13 T27 R34	Spring Branch
39	37° 3' 50.980" N	94° 35' 2.973" W	SW 1/4 NW 1/4	S18 T27 R33	Spring Branch
40	37° 1' 59.327" N	94° 27' 44.191" W	SE 1/4 NE 1/4	S30 T27 R32	Thurman Creek
41	37° 2' 0.271" N	94° 28' 29.756" W	SW 1/4 NW 1/4	S30 T27 R32	Thurman Creek

Attachment 4

City of Joplin
Illicit Discharge Detection and Elimination (IDDE) Ordinance

Section 1. General Provisions

1.1 Findings of Fact

It is hereby determined that:

A. Federal regulations define an illicit discharge as "...any discharge to an MS4 that is not composed entirely of stormwater..." with some exceptions.
B. Illicit discharges are considered "illicit" because MS4s are not designed to accept, process, or discharge such non-stormwater wastes.
C. Illicit discharges result in untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses and bacteria to receiving waterbodies.

1.2 Purpose

The purpose and intent of this Ordinance is to ensure the health, safety and general welfare of citizens of the City of Joplin through the regulation of non-stormwater discharges to the storm drain system to the maximum extent practicable BMPs and found them to be effective for the Joplin region and in accordance with current city codes, as required by federal and state law. This Ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) permit. The objectives of this Ordinance are:

A. To regulate the contribution of pollutants to the municipal separate storm sewer system (MS4) by stormwater discharges from any user,
B. To prohibit Illicit Connections and Discharges to the municipal separate storm sewer system, and
C. To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this Ordinance
D. Enforcement – See Section 16

1.3 Authority

The City of Joplin, a Missouri Municipal Corporation.

1.4 Applicability

This Ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by the City of Joplin.

Section 2. Definitions

Authorized Enforcement Agency: Employees or designees of the City of Joplin designated to enforce this Ordinance.

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs

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also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act. The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity. Activities subject to NPDES Construction Permits, which generally include construction projects resulting in land disturbance of 1 acre or more, or less if part of a larger common project. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials. Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Discharge. Any direct or indirect non-stormwater discharge to the storm drain system, except as exempted in Section 7 of this Ordinance.

Illicit Connections. An illicit connection is defined as any of the following:
Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the storm drain system including but not limited to any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water to enter the storm drain system; and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency; or any drain or conveyance connected from a commercial or industrial land use to the storm drain system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Industrial Activity. Activities subject to NPDES Industrial Permits as defined in 40 CFR, Section 122.26 (b)(14).

MS4. Municipal Separate Storm Sewer System; a municipality which has a sanitary sewer system and a stormwater sewer system so that the two systems are completely separate.

National Pollutant Discharge Elimination System (NPDES) Permit. A permit issued by EPA (or by a State under authority delegated pursuant to 33 USC § 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Non-Stormwater Discharge. Any discharge to the storm drain system that is not composed entirely of stormwater.

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Person. Means any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinance, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

Premises. Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Storm Drain System. Publicly-owned facilities by which stormwater is collected and/or conveyed, including but not limited to any road drainage systems, municipal street, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs, and other drainage structures.

Stormwater. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation and resulting from such precipitation.

Stormwater Pollution Prevention Plan (SWPPP): A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Stormwater, Stormwater Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

Wastewater. Any water or other liquid, other than uncontaminated stormwater, discharged from a facility.

Section 3. Applicability
This Ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency.

Section 4. Responsibility for Administration
The City of Joplin shall administer, implement, and enforce the provisions of this Ordinance. Any powers granted or duties imposed upon the authorized enforcement agency may be delegated in writing by the administrator of the authorized enforcement agency to persons or entities acting in the beneficial interest of or in the employ of the agency.

Section 5. Severability.
The provisions of this Ordinance are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this Ordinance or the application thereof to any person, establishment,

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or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this Ordinance.

Section 6. Ultimate Responsibility.
The standards set forth herein and promulgated pursuant to this Ordinance are minimum standards; therefore this Ordinance does not intend nor imply that compliance by any person will ensure that there will be no contamination, pollution, nor unauthorized discharge of pollutants.

Section 7. Discharge Prohibitions.

A. Prohibition of Illegal Discharges. No person shall discharge or cause to be discharged into the municipal storm drain system or watercourses any materials, including but not limited to pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than stormwater.

B. The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:
   1. The following discharges are exempt from discharge prohibitions established by this Ordinance:
      - landscape irrigation or lawn watering;
      - diverted stream flows,
      - rising groundwater;
      - uncontaminated groundwater infiltration to storm drains;
      - uncontaminated pumped groundwater;
      - foundation or footing drains (not including active groundwater dewatering systems);
      - uncontaminated water from crawl space/basement sump pumps;
      - air conditioning condensation;
      - springs;
      - individual residential car washing as prescribed in Article IV – Section 114-358 (2)
      - natural riparian habitat or wetland flows;
      - flows through mine tailings;
      - emergency fire-fighting activities; and
      - any other water source not containing pollutants.
   2. The following discharges are not exempt from discharge prohibitions established by this Ordinance:
      a. Discharges from potable water sources, including water line flushing, hyperchlorinated water line flushing, fire hydrant system flushing, and pipeline hydrostatic test water.
         - However, planned discharges from potable water sources may be discharged to the MS4 provided they are de-chlorinated to a concentration of 0.1 ppm or less, pH-adjusted if necessary, and volumetrically and velocity controlled.

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b. Swimming pool discharges
    - Certain swimming pool discharges are permitted under the MO Department of Natural Resources' NPDES Industrial Permits;
    - Discharges from swimming pools not subject to MO Department of Natural Resources' NPDES Industrial Permits may be discharged to the MS4 provided that they are dechlorinated to a concentration of 0.1 ppm or less, pH-adjusted and reoxygenated if necessary, and volumetrically and velocity controlled.
    - Swimming pool cleaning wastewater and filter backwash shall not be discharged to the MS4, except where permitted with conditions under MO Department of Natural Resources' NPDES Industrial Permits.

c. Street and sidewalk wash water containing detergents, water used to control dust containing detergents, and routine external building wash down containing detergents. (Also prohibited in City Code Chapter 118 – Utilities – Article II – Sewers and Sewage Disposal - Section 118-86; and Chapter 54 – Environments - Section 54-35 (4)
    - Street and sidewalk wash water, water used to control dust, and routine external building wash down water may be discharged to the MS4 provided it does not contain detergents, streets and sidewalks are swept and material removed prior to washing. Active construction sites shall be scraped and swept daily prior to washing the street, as outlined in Appendix 29-F. Erosion and Sediment Control Regulations Section VI, 8. b. and c.

3. Discharges specified in writing by the City of Joplin as being necessary to protect public health and safety.
4. Dye testing is an allowable discharge, but requires a written/verbal notification to the City of Joplin prior to the time of the test.
5. The prohibition shall not apply to any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the permitting authority, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system.

C. Prohibition of Illicit Connections.
1. The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited. (Also prohibited in Chapter 118 Utilities – Article II – Sewers and Sewage Disposal - Section 118-86; and Chapter 54 - Environment - Section 54-35 (17)
2. This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.
3. A person is considered to be in violation of this Ordinance if the person connects a line conveying sewage to the MS4, or allows such a connection to continue. (Also prohibited in Chapter 118 Utilities – Article II – Sewers and Sewage Disposal - Section 118-86; and Chapter 54 - Environment - Section 54-35 (17).

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Section 8. Suspension of MS4 Access.

A. Suspension due to Illicit Discharges in Emergency Situations
The City of Joplin may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or waters of the State. If the violator fails to comply with a suspension order issued in an emergency, the authorized enforcement agency may take such steps as deemed necessary to prevent or minimize damage to the MS4 or waters of the State, or to minimize danger to persons.

B. Suspension due to the Detection of Illicit Discharge
1. Any person discharging to the MS4 in violation of this Ordinance may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The City of Joplin will notify a violator of the proposed termination of its MS4 access. The violator may petition the authorized enforcement agency for a reconsideration and hearing.
2. A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this Section, without the prior approval of the City of Joplin.

Section 9. Powers and Authority of Inspectors

A. The City of Joplin inspector bearing proper credentials and identification shall be permitted to enter all properties for the purposes of inspection, records examination and copying, observation, measurements, sampling, and testing pertinent to discharge or potential to discharge, and for repair and maintenance to the municipal separate storm sewer system.

B. Information and data on a non-domestic source obtained from reports, questionnaires, permit applications, permits and monitoring programs and from inspections shall be available to the public or other governmental agency without restriction, unless the non-domestic source specifically requests and is able to demonstrate to the satisfaction of the City of Joplin that the release of such information would divulge information, processes or methods of production entitled to protection as confidential information according to the criteria set forth in 40 CFR 2.208 and 2.302, as may be amended from time to time.

When requested by the person furnishing a report, the portions of a report which might disclose confidential information shall not be made available for inspection by the public. Stormwater constituents and characteristics will not be recognized as confidential information.

Information accepted by the City of Joplin as confidential shall be made available upon request to any agency meeting the requirements of Section 308 of the Clean Water Act, including officers, employees or authorized representatives of the United States concerned with carrying out the Clean Water Act, bound by the confidentiality rules in 40 CFR Part 2, as may be amended from time to time.

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C. While performing inspections the City of Joplin shall observe all safety rules applicable to the premises established by the company, and the company shall be held harmless for injury or death to the authorized representative(s), and the City of Joplin shall indemnify the company against loss or damage to its property by City of Joplin employees and against liability claims and demands for personal injury or property damage asserted against the company by City of Joplin employees and growing out of the inspection and sampling operation, except as such may be caused by negligence or failure of the company to maintain safe conditions.

D. Unreasonable delays in allowing the City of Joplin access to the premises or other interference with the activities of the City of Joplin shall be a violation of this law. Access to property and/or records of a non-domestic source may not be refused on the basis that the City of Joplin refuses to sign any waiver, access agreement, or similar document.

E. If the City of Joplin has been refused access to a building, structure or property or any part thereof, and if the City of Joplin has demonstrated probable cause to believe that there may be a violation of this law or that there is a need to inspect as part of a routine inspection program of the City of Joplin to verify compliance with this law or any permit or order issued hereunder, or to protect the environment and overall public health, safety and welfare of the community, then the City of Joplin will make an application to a court of competent jurisdiction for a search and/or seizure warrant describing therein the specific location subject to the warrant. The warrant application shall specify what, if anything, may be searched and/or seized on the property described. If granted by the court, such warrant shall be served at reasonable hours by the City of Joplin in the company of a uniformed officer of the law enforcement agency with jurisdiction over the property. In the event of an emergency affecting public health and safety, inspections may be made without the issuance of a warrant.

Section 10. Industrial or Construction Site Activity Discharges.

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the City of Joplin prior to the allowing of discharges to the MS4.

Section 11. Monitoring of Discharges.

A. Applicability.

This section applies to all facilities that have stormwater discharges associated with industrial activity, including construction activity.

B. Access to Facilities.

1. The City of Joplin shall be permitted to enter and inspect facilities subject to regulation under this Ordinance as often as may be necessary to determine compliance with this Ordinance. If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the authorized enforcement agency.

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2. Facility operators shall allow the City of Joplin ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge stormwater, and the performance of any additional duties as defined by state and federal law.
3. The City of Joplin shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the City of Joplin to conduct monitoring and/or sampling of the facility's stormwater discharge.
4. The City of Joplin has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.
5. Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the City of Joplin and shall not be replaced. The costs of clearing such access shall be borne by the operator.
6. Unreasonable delays in allowing the City of Joplin access to a permitted facility is a violation of a stormwater discharge permit and of this Ordinance. A person who is the operator of a facility with an NPDES permit to discharge stormwater associated with industrial activity commits an offense if the person denies the authorized enforcement agency reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this Ordinance.
7. If the City of Joplin has been refused access to any part of the premises from which stormwater is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this Ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this Ordinance or any order issued hereunder, or to protect the environment and overall public health, safety, and welfare of the community, then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction.

Section 12. Requirement to Prevent, Control, and Reduce Stormwater Pollutants by the Use of Best Management Practices.

The owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of these structural and non-structural Best Management Practices (BMPs). Further, any person responsible for a property or premise, which is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the municipal separate storm sewer system. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of stormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a stormwater pollution prevention plan (SWPPP) as necessary for compliance with requirements of the NPDES permit.

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Section 13. Watercourse Protection.
Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property reasonably free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. The owner or lessee shall not remove healthy bank vegetation beyond that actually necessary for maintenance, nor remove said vegetation in such a manner as to increase the vulnerability of the watercourse to erosion. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

Section 14. Notification of Spills.
Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into stormwater, the storm drain system, or water of the U.S. said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the authorized enforcement agency in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the City of Joplin within three business days of the phone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three (3) years.

Section 15. Illegal Dumping Prohibited
No person shall dump or otherwise deposit outside an authorized landfill or other authorized garbage or trash collection point, including but not limited to any grass clippings, leaves, motor oil, paint, wash water, chemicals, trash or garbage of any kind or description on any private or public property, occupied or unoccupied, with the potential to discharge to the municipal storm sewer system.

Section 16. Enforcement.
A. Notice of Violation.
Whenever the City of Joplin finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, the authorized enforcement agency may order compliance by written notice of violation to the responsible parties. Such notice may require without limitation:
1. The performance of monitoring, analyses, and reporting;
2. The elimination of illicit connections or discharges;
3. That violating discharges, practices, or operations shall cease and desist;
4. The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
5. Payment of a fine to cover administrative and remediation costs; and

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6. The implementation of source control or treatment BMPs. If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

Section 17. Appeal of Notice of Violation.
Any person receiving a Notice of Violation may appeal the determination of the authorized enforcement agency. The notice of appeal must be received within fifteen (15) days from the date of the Notice of Violation. Hearing on the appeal before the appropriate authority or his/her designee shall take place within fifteen (15) days from the date of receipt of the notice of appeal. The decision of the municipal authority or their designee shall be final.

Section 18. Enforcement Measures After Appeal.
If the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, or, in the event of an appeal, within fifteen (15) days of the decision of the municipal authority upholding the decision of the authorized enforcement agency, then representatives of the authorized enforcement agency shall enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any premises to refuse to allow the government agency or designated contractor to enter upon the premises for the purposes set forth above.

Section 19. Cost of Abatement of the Violation.
Within thirty (30) days after abatement of the violation, the owner of the property will be notified of the cost of abatement, including administrative costs. The property owner may file a written protest objecting to the amount of the assessment within fifteen (15) days. If the amount due is not paid within a timely manner as determined by the decision of the municipal authority or by the expiration of the time in which to file an appeal, the charges shall become a special assessment against the property and shall constitute a lien on the property for the amount of the assessment.

Any person violating any of the provisions of this Ordinance shall become liable to the City of Joplin by reason of such violation. The liability shall be paid in not more than 12 equal payments beginning thirty (30) days following final notification of the abatement costs. Interest at the rate of ten (10) percent per annum shall be assessed on the balance beginning on the 1st day following discovery of the violation.

Section 20. Injunctive Relief.
It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this Ordinance. If a person has violated or continues to violate the provisions of this Ordinance, the City of Joplin may petition for a preliminary or permanent injunction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

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Section 21. Compensatory Action.
In lieu of enforcement proceedings, penalties, and remedies authorized by this Ordinance, the City of Joplin may impose upon a violator alternative compensatory actions, such as storm drain stenciling, attendance at compliance workshops, creek cleanup, etc.

Section 22. Violations Deemed A Public Nuisance.
In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this Ordinance is a danger to the environment and threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

Section 23. Criminal Prosecution.
Any person that has violated or continues to violate this Ordinance shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty of not more than $500.00 per violation per day and/or imprisonment for a period of time not to exceed 100 days as outlined in City Code Section 1-5. – General penalty; continuing violations; violations deemed public nuisance (a), (b), and (c).

The City of Joplin may recover all attorney's fees court costs and other expenses associated with enforcement of this Ordinance, including sampling and monitoring expenses.

Section 24. Remedies Not Exclusive.
The remedies listed in this Ordinance are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the City of Joplin to seek cumulative remedies.

Section 25. Adoption of Ordinance.
This Ordinance shall be in full force and effect immediately after its final passage and adoption. All prior ordinances and parts of ordinances in conflict with this Ordinance are hereby repealed.

pending Council approval in 2019

Attachment 5

PROPOSED ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE) ORDINANCE TIMELINE

DRAFT #1

Action	Goal	Responsible Staff Member(s)	Due Date
Committee finishes Draft #1 of Ordinance	Design the document so that other departments/staff/consultant can easily make comments, suggestions or questions	D Johnson S Martinez C Parker MA Phillips	April 2018
Public Works Director authorizes Draft #1 to be forwarded to other departments for their input	Gain input and insite from affected departments in a timely fashion	David Hertzberg	May 2018
Set meeting date or dates with related departments	Maximum Attendance Possible	D Johnson	May 2018
Public Works Director, City Manager, Ordinance Committee meets with all related departments to explain the Ordinance and how it could or will effect their scope of work and staff; Show the IDDE training film	Educate related departments, explain the background and ultimate outcome of new Ordinance; Gain cooperation, "buy in" and input	D Hertzberg Sam Anselm	June 2018
Committee makes changes to Draft #1 if suggestions are made at the face-to-face meeting and sends Draft #2 to all related departments	Receive feedback from following departments: Planning & Community Development, Finance, Municipal Court, Health, Parks & Recreation, Neighborhood Services, Building, City Attorney, Prosecuting Attorney, City Clerk, PW Admin, Recycling, Wastewater Treatment Plants, Public Information Officer, City Manager	D Johnson S Martinez C Parker MA Phillips	July 2018
Receive comments from related departments	Write Draft #3	D Johnson	Sept 2018

Public Works Director approves Draft #3 and sends back to related departments	Receive final feedback in a timely fashion; gain positive staff involvement	D Hertzberg D Johnson	October 2018
Send Draft #3 to City Manager for authorization to proceed	*Will City Manager need informal City Council authorizaton to proceed ??*	D Hertzberg	October 2018
Send Draft #3 and cover letter to MS4 partners at Jasper County and Newton County	Receive positive feedback from partners	D Hertzberg	October 2018
Post Draft #3 on City's website, at various City facilities (City Hall, Library, etc.); conduct public awareness campaign; tap into social media, contact the media, etc.	Receive sufficient publicity and awareness	D Johnson MA Phillips Lynn Onstot	start Nov 2018 & then Ongoing
Create Visusal Displays for Public Meetings such as posters of sample illicit discharges, etc.	Stimulate interest, feedback and education at Public Meetings	MA Phillips J Gilligan	Nov 2018
Reach out to targeted interest groups such as the Nature Center, Master Gardners, Master Naturalists, Neighborhood Associations, Dept. of Conservation Joplin staff, Environmental Student Groups, Stream Teams, etc.	Gain positive partnerships and public involvement	D Johnson S Martinez C Parker MA Phillips L Onstot B Wicklund Misc. Staff	Nov 2018
Public Comment Period: Advertise, Promote and Conduct first Public Meeting at City Hall	Receive sufficient positive feedback from the public, targeted groups, elected officials, etc.	D Johnson S Martinez C Parker MA Phillips	Nov 2018

Public Comment Period: Advertise, Promote and Conduct second Public Meeting at Nature Center	Receive sufficient positive feedback from the public, targeted groups, elected officials, etc.	D Johnson S Martinez C Parker MA Phillips	Dec 2018
Create a presentation for City Council to include photographs, sample illicit discharges and summary of Public Comment Period	Educate Council, Staff and the Public regarding the need for the Ordinance	D Johnson S Martinez C Parker MA Phillips L Onstot Misc. Staff	Jan 2019
Write and Post Draft #4	Gain Authorization to Advance to City Council	D Hertzberg	Jan 2019
Write Green Sheet & Council Bill	Gain unanimous Council vote to adopt Ordinance	D Hertzberg D Johnson	Feb 2019
Disseminate Green Sheet to necessary staff for their signatures	Acquire signatures in a timely fashion	D Johnson	March 2019
1st Reading of Ordinance at City Council Meeting	Council Members vote unanimously to adopt the Ordinance and set an effective date	Mayor & City Clerk	*April 2019*
2nd & 3rd Reading of Ordinance at City Council Meeting	Council Members vote unanimously to adopt the Ordinance and set an effective date	Mayor & City Clerk	April 2019
IDDE Ordinance is entered into the City's system and "on line" MUNI CODE	IDDE Ordinance Takes Effect	City Clerk	May 2019
Conduct Public Education and Awareness of new Ordinance	Reduce Illicit Discharges, Illegal Dumping, etc.	MA Phillips L Onstot Misc. Staff	May and Ongoing

Manage Inspections, Reporting, etc.	Maintain appropriate documentation	Everyone !	Ongoing

Attachment 6

ILLICIT DISCHARGE INVESTIGATION REPORT

The City of Joplin helps residents and business owners protect and preserve our surface and ground water. Our staff investigates complaints of possible illicit discharges into storm drains, streets, alleys, yards, etc. This report summarizes the findings of the investigation and indicates if a violation of the City Code has occurred. We feel you need to be aware that an investigation has taken place and of the requirements of the law. The report also recommends corrective actions---review it carefully. Please be aware that failure to perform recommended corrective action(s) may result in enforcement action. If you have any questions, feel free to call City staff at the number(s) below. This document will be attached to the City's *STORM WATER PERMIT REPORT (National Pollutant Discharge Elimination System)* that is sent annually to the Missouri Department of Natural Resources.

DATE(S) INVESTIGATED _____

Address or Location of Possible Source _____

Property Owner of above Address _____

Name of Individual or Business
of Suspected/Reported Discharger _____

Address of Suspected/Reported Discharger _____

Telephone Number(s)

STORM DRAIN INLET, STREET, YARD, ETC. LOCATION(S)

_____

POSSIBLE WATER BODY AFFECTED _____

DISCHARGE CHARACTERISTICS (Use separate sheet if necessary)

- Failing Septic System _____
- Failing Sanitary Sewer (pipes not connected properly, etc.) _____
- Floor Drain improperly connected to a storm drain _____
- Illicit Connections (pipes, carpet cleaning hoses, etc.) _____
- Dumping (liquids, solids, yard waste, grease, etc.) _____
- Other _____

For Construction Site (soil, rocks, etc refer to
City Code - Zoning - Appendix 29-F Erosion & Sediment Control Regulations)

RECOMMENDATIONS OR CORRECTIVE ACTIONS

CITY CODE VIOLATION(S): ☐ **None** ☐ **Other**

☐ **Chapter 54-Environment** – Section 54-35 (4, 12, 14, 17 and 24)

☐ **Chapter 118 Utilities-Sewer & Sewage Disposal** - Section 118-86

☐ **Chapter 62 Health & Sanitation** - Section 62-204 (1) j.

INSPECTION PERFORMED BY:

Name _____

Title _____ **Department** _____

Office Address _____ **Telephone** _____

REPORT RECEIVED BY:

Signature **Title** **Date**

Attachment 7

INSPECTIONS of PERMITTED INDUSTRIES

TYPE	INDUSTRY NAME	PREVIOUS INSPECTION DATE	NEXT INSPECTION DATE
PRE-TREATMENT FACILITIES			
	AJINOMOTO WINDSOR	**NEW INDUSTRY**	Wednesday, April 18, 2018
	JASPER PRODUCTS	Friday, May 05, 2017	Tuesday, May 01, 2018
	MAPP #1	Wednesday, May 10, 2017	Thursday, May 10, 2018
	PROTEIN SOLUTIONS	Wednesday, June 07, 2017	Thursday, June 07, 2018
	CLEAN UNIFORM	Wednesday, July 19, 2017	Thursday, July 19, 2018
	INTERNATIONAL PAPER	Thursday, August 17, 2017	Friday, August 17, 2018
	EAGLE-PICHER C STREET	Wednesday, September 13, 2017	Thursday, September 13, 2018
	FAG	Monday, September 18, 2017	Tuesday, September 18, 2018
	TAMKO HIGH STREET	Wednesday, November 15, 2017	Thursday, November 15, 2018
	HEARTLAND PET FOOD MFG.	Tuesday, November 28, 2017	Wednesday, November 28, 2018
ALL OTHERS			
	MERCY HOSPITAL	Thursday, April 06, 2017	Friday, April 06, 2018
	COMMERCIAL METALS CO.	Tuesday, April 25, 2017	Wednesday, April 25, 2018
	MAPP #2	Wednesday, May 31, 2017	Thursday, May 31, 2018
	MODINE	Thursday, June 22, 2017	Thursday, June 21, 2018
	GILSTER-MARY LEE	Tuesday, August 23, 2016	Wednesday, June 27, 2018
	DUCOMMON	Monday, July 10, 2017	Tuesday, July 10, 2018
	DARLINGTON SNACKS	Friday, July 21, 2017	Tuesday, July 24, 2018
	AUTOTRONICS	Wednesday, August 30, 2017	Thursday, August 30, 2018
	FREEMAN EAST	Thursday, September 07, 2017	Friday, September 07, 2018
	FREEMAN WEST	Thursday, September 07, 2017	Friday, September 07, 2018
	CLIFFSTAR	Wednesday, September 27, 2017	Thursday, September 27, 2018
	PETRO	Thursday, October 12, 2017	Thursday, October 11, 2018
	HAMPSHIRE PET PRODUCTS	Tuesday, October 24, 2017	Wednesday, October 24, 2018
	LOZIER	Tuesday, October 31, 2017	Wednesday, October 31, 2018
	WESTROCK	Tuesday, November 07, 2017	Wednesday, November 07, 2018
	TAMKO RANGELINE	Wednesday, November 15, 2017	Thursday, November 15, 2018
	ABLE BODY	Tuesday, November 21, 2017	Wednesday, November 21, 2018
	PMI	Monday, December 04, 2017	Tuesday, December 04, 2018
	ARROW BOX	Thursday, December 07, 2017	Tuesday, December 04, 2018
	GENERAL MILLS	Thursday, December 07, 2017	Wednesday, December 05, 2018
	BEMIS PACKAGING	Wednesday, February 28, 2018	Thursday, February 28, 2019

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

1. Company:
2. Premise Address:
3. Category:
4. Inspection Contact Person(s):
5. Title:
6. Phone: Inspection Date:
7. Time of Inspection: From To
8. Last Inspection: Inspector:
   Type of Inspection:
9. Shifts Worked and Times:
10. Days Per Week: Is Production Seasonal?
11. Total Number of Employees:
12. Scheduled Shutdowns:
13. SIC Codes(s):
14. Nature of Operation:
15. Products Produced:
16. Raw Materials:
17. Manufacturing Processes:
18. Are Major Processes Batch or Continuous?

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

19. Within the Past Twelve (12) Months, Have There Been Any Changes In Processes or Raw Materials?

20. Within the Past Twelve (12) Months, Have There Been Any Changes In the Types of Products Produced?

21. Within the Past Twelve (12) Months, Have There Been Any Changes In Wastewater Quality or Quantity?

22. Is Any Water Used For Cooling? What Does the Water Cool?

23. Contact CW? Non-Contact? Once-Through? Recirculated?

24. Is the Water Conditioned or Treated?

25. What Contaminants May Be Present?

26. Any Cooling Towers? Capacity (Tons):

27. Frequency and Volume of Blow down

28. Discharged To:

29. Is Any Water Used In Boilers? Type:

30. Is the Water Conditioned or Treated?

31. What Contaminants May Be Present?

32. Frequency and Volume of Blow down?

33. Discharged To:

34. Is There Any Water Used In Air Pollution Control Devices?

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

35. Type:

36. What Contaminants May Be Present?

37. Discharge To:

38. Are There Any Oil or Grease Traps?

39. Food Wastes? Petroleum Wastes?

40. Frequency of Cleaning: Cleaning Logs?

41. How Is the Oil/Grease Disposed?

42. List the Waste streams Discharging To the City Sewer:

43. Number of Outfalls:

44. Sampling Location(s):

45. Are Any Solvents Used?

46. What Are They Used For?

47. Does the Company Have A Solvent Management Plan?

48. Are Any Infectious Materials Handled?

49. How Is the Waste Disposed?

50. Are Any Radioactive Materials Handled?

51. How is the Waste Disposed?

53. Are There Any X-Ray, Photo or Film Processing Operations?

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

54. Silver Recovery Units?

55. Discharged To:

56. Are There Any Wastes Generated Which Are Not Disposed To Sewer?

57. Does the Company Have Any Underground Storage Tanks?

58. What Do They Contain?

59. Have There Been Any Known Leaks From These Tanks?

60. Does the Company Have Any Above Ground Storage Tanks?

61. What Do They Contain?

62. Have There Been Any Known Leaks From These Tanks?

63. How Is the Accumulated Stormwater Disposed?

64. Could Spills or Leaks of Stored Chemicals or Wastes Easily Reach Sanitary Sewers?

65. Does the Company Have a Written Spill Prevention/Slug Discharge Control Plan?

66. Is There a Copy in the City's File?

67. Are Emergency Notification Procedures Posted?

68. Are City Contacts Listed?

69. Last City Actions:

    Sample:
    Violation:
    Enforcement:

70. Has the Problem Been Resolved?

71. Is Any Wastewater Subject To Categorical Pretreatment Standards?

72. Sampling Points:

73. Is the Combined Waste stream Formula (CWF) Applicable?

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

74. Is Any Water Subject To Production-Based Standards?

75. Is the Company Required to Self-Monitor Any of Their Discharges?

76. Is Requirement Contained In Permit?

77. Have the Reports Been On-Time and Complete?

78. Is the Company Collecting the Appropriate Type of Sample (Grab or composite?) For Each Pollutant Monitored?

79. Is the Company Using 40 CFR Part 136 Methods For All Reportable Analysis?

80. Does the Company Employ Continuous Monitoring Techniques For pH?

81. Is the Company Submitting the Results of All Reportable Monitoring?

82. Can Flow Be Measured at the Sampling Location?

83. Measuring Device:

84. Is the Company Maintaining Adequate Records?

85. Is the Company Under Any Type of Environmental Enforcement Orders?

86. Does the Company Have Any Discharges Subject to NPDES Permitting?

87. Are There Any Planned Changes to the Facility That Will Affect the Wastewater?

88. Does the Facility Pretreat Its Process Wastewater before Discharge to the POTW?

89. Type:

90. Date Originally Installed: Design Flow: Actual Flow:

91. Is Treatment Batch or Continuous?

92. Hours/Day Operated: Days/Week Operated:

93. FTE Needed to Operate:

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

94. Overall Condition:

95. Has the Facility Experienced Any Operational or Upset Problems since Last? Inspection?

96. Is There Any Sludge Generated At This Facility?

97. Sludge Dewatering Method:

98. Amount Generated: Moisture Content:

99. Disposal Method: Storage:

100. Shipping Frequency: Hazardous?

101. Haulers:

102. Disposal Location:

103. Chemical/Waste Storage Areas:

104. Hazardous Waste Storage:

Stormwater Section

105. Where does Stormwater Runoff to (stormwater ditch or drain, stormwater pond, etc.)?

106. Does the Facility have a Stormwater Permit?

107. Does the Facility have a Stormwater Pollution Prevention Plan?

108. Can anything other than what is contained in normal Stormwater runoff (dirt, gravel, yard debris) enter the storm drains? Examples would be waste from production, trash, chemicals, etc.?

109. Does the facility sample stormwater? If so, how often?

CITY OF JOPLIN
INDUSTRIAL FACILITY INSPECTION REPORT

INSPECTION RESULTS

110. Pass: Fail: Other:

111: Has Facility Complied With Their Permit?

112: Recommended Action(s) By the City:

Attachment 8

CONSTRUCTION RUNOFF CONTROL
on
PRIVATE DEVELOPMENT PROJECTS

Date: _____

PROJECT NAME: _____

PROJECT LOCATION: _____

CITY OF JOPLIN **COUNTY: JASPER / NEWTON**

Land Disturbance Permit obtained from:

☐ City (under 1 acre site) ☐ DNR (1 acre or larger site)

Inspection Items:

1. Erosion control BMP's – are they installed and functioning correctly?
   a. Stabilized Construction Site Entrance

Does Sediment Get Tracked on to Road?	Is the Rock Clean or is it Filled with Sediment?	Does All Traffic Use the Stabilized Entrance to Enter and Leave the Site?	Is the Culvert (if installed) Beneath the Entrance Working?

Describe Maintenance Required for the Construction Entrance _____

_____

b. Sediment Basins

Depth of Sediment Basin	Condition of Basin Side Slopes	Any Evidence of Overtopping of the Embankment	Condition of Outfall from Sediment Basins

Describe Maintenance Required for the Sediment Basins: _____

_____

c. Other Items

Erosion Control	Condition	Repair Req'd		Comments (Attach additional Sheets if Necessary)	Date Repaired	Initials
		Yes	No			
Filter Fabric Fences						
Straw Bales						
Waddles						
Seeded Areas						
Top Soil Stockpile(s)						
Outfalls						
Others						

CONSTRUCTION RUNOFF CONTROL
on
PRIVATE DEVELOPMENT PROJECTS

Describe Maintenance Required for the items above: _____

_____

2. SWPPP forms – are they up-to-date?

All Maintenance Items Required and Described above are:

To be performed by: _____ On or Before: _____

Signature: _____ Date: _____

Date Repaired: _____ By: _____

List of Items Repaired: _____

_____

# of additional sheets attached = _____

Attachment 9

Enforcement

1. Stop-Work Order; Revocation of Permit: In the event that any person holding a site development permit pursuant to this ordinance violates the terms of the permit, or implements site development in such a manner as to materially adversely affect the health, welfare, or safety or persons residing or working in the neighborhood or development site so as to be materially detrimental to the public welfare or injurious to property or improvements in the neighborhood, the City of Joplin may suspend or revoke the site development permit.

2. Violation of the provisions of this article or failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with granting of variances) shall constitute a misdemeanor. Any person who violates this article or fails to comply with any of its requirements shall, upon conviction thereof, be punished in accordance with the City Code. Each day such violation continues shall be considered a separate offense. Nothing herein contained shall prevent the city or other appropriate authority from taking such other lawful action as is necessary to prevent or remedy any violation.

Attachment 10

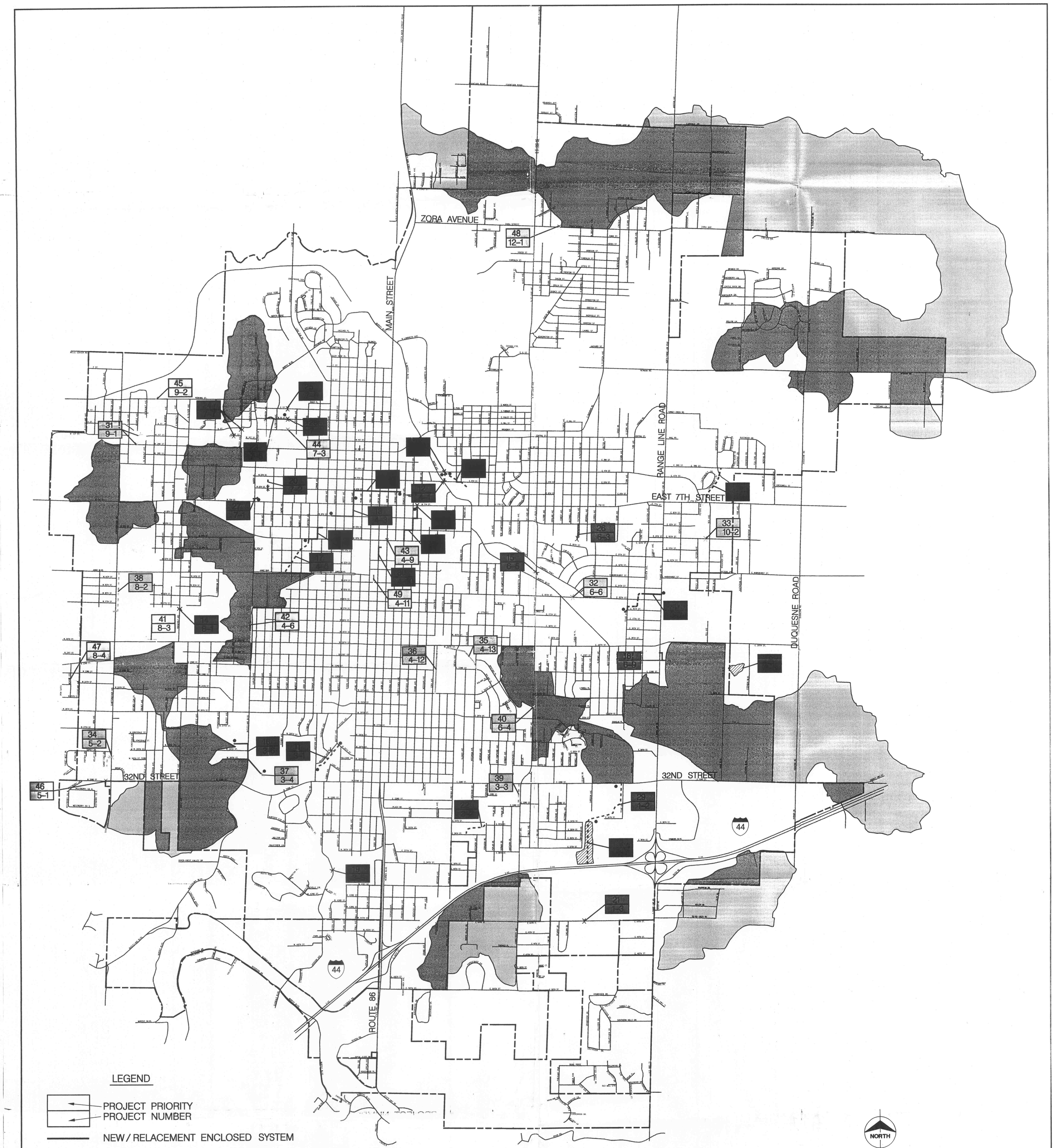


EXHIBIT 1
RECOMMENDED STORM DRAINAGE IMPROVEMENTS

Burns & McDonnell

City of Joplin

JOPEXH01.DGN/11-JUN-97 10:56/MDH

JOPLIN, MISSOURI

STORMWATER MANAGEMENT MASTER PLAN

City of Joplin

100% EMPLOYEE-OWNED
Burns & McDonnell
ENGINEERS · ARCHITECTS · CONSULTANTS

JUNE 1998

CITY OF JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN

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PART I

EXECUTIVE SUMMARY

PART I

EXECUTIVE SUMMARY

A. GENERAL INFORMATION

This Executive Summary presents a condensed discussion of the Joplin Stormwater Management Master Plan authorized by the City of Joplin on January 17, 1994. The following sections of this report, together with accompanying watershed maps, computer models, and exhibits, present the detailed report and supporting information resulting from the study of the City's major drainage system which is the focus of this project. The major system is considered to begin at the point where approximately 40 acres become tributary to the system.

Services performed by Burns & McDonnell Engineers of Kansas City, Missouri to complete the study included:

- Field investigation of the City's major drainage system.
- Preparation of a set of watershed maps covering the study area.
- Evaluation of the existing system's performance capability.
- Development of a recommended capital improvements plan for the City to correct existing major system deficiencies.
- Preparation of capital cost estimates for the proposed improvements to the major system.
- Recommendation of implementation priorities for improvements.
- Evaluation of potential mechanisms for funding the proposed improvements.

In addition, a draft "Stormwater Management Criteria" manual, which outlines specific technical standards and criteria for storm drainage system design, was prepared as a part of this study and submitted to the City as a separate document for the City's review.

The 16 principal watersheds included in this study cover over 50 square miles tributary to three major waterways: Turkey Creek, Joplin Creek, and Shoal Creek. Figure I-1, following this page, indicates the study area and the general extent of the 16 primary watersheds.

Average annual precipitation is 40.8 inches. Rainfall events that create peak demands on the system occur as convective thunderstorms an average of 55 times each year. Land slopes vary from nearly flat to greater than 20 percent toward the south.

Land use within the corporate limits is substantially developed with single family residential development comprising approximately 50 percent of the area. Office and business parks, institutional land use, and retail commercial areas cover approximately 15 percent, with industrial areas accounting for 10 to 15 percent and parks and recreation areas covering approximately 5 percent. Recent growth areas are limited to the south edge of the City along I-44, southwest near the medical centers, and east of the City. Future development will be mostly residential and industrial areas expanding to the east and south.

Data for modeling the existing system's performance were acquired from field investigations and a comprehensive review of City records and related studies. Two computer models developed by the Corps of Engineers were the primary tools used for the analyses. In addition, two programs developed by Burns & McDonnell were utilized for various aspects of the project. Specific models are:

- HEC-1 - Flood Hydrograph Package: Corps of Engineers hydrology program for generating runoff or streamflow hydrographs for peak flows.
- HEC-2 - Water Surface Profiles: Corps of Engineers program for determining flood elevations and evaluating open channels, bridges and culverts.
- SYCOST - B&McD program for estimating drainage system capital and annual maintenance costs.
- PRIOR - B&McD program for ranking improvement priorities on basis of benefit, cost and performance.

Operating copies of the models, users manuals, and data files are being furnished to the City for their use in continuing management of the stormwater system.

B. EXISTING SYSTEM PERFORMANCE

The existing major drainage system within the study area consists of both conveyance elements (enclosed pipe storm sewers, improved and natural open channels, and cross-road culverts) and storage elements (planned and, in some instances, as at highway culverts under high fill, unplanned). The entire existing major system was defined in individual sections, or reaches, for analysis. Peak rates of discharge for each reach were computed for events having return periods from 2 to 100 years. The hydraulic capacity of the various reaches of the major system was then evaluated in terms of the return period for which they provide adequate capacity (e.g., the level of service afforded by the various reaches was determined).

Proposed design criteria for new construction (embodied in the draft "Stormwater Management Criteria") requires that the system be designed for a 10-year return period in all areas with provisions for overflow channels to handle the 100-year peak flow when combined with the conveyance element capacity. By these proposed standards, the bulk of the existing improved system is hydraulically deficient.

However, identifying an existing system element as failing to meet either current or proposed criteria, according to the model, does not indicate deficiencies in design or construction at the time the element was originally constructed. The principal determinants of hydraulic demand on the drainage system are land use and rainfall, neither of which has remained static during the period of time over which Joplin's system has developed. Additionally, the development of more sophisticated computer modeling techniques and other analytical methods, which permit a much more refined analysis of the systems' performance than was previously practical, has had a major impact on the results of studies and design calculations.

The mere absence of "criteria" capacity also is not necessarily indicative of a problem requiring corrective action. Corrective action is warranted only when the deficiency results in damage from flooding, an unacceptable level of nuisance or a public safety issue. Conversely, adequate hydraulic capacity does not mean that a system component is performing satisfactorily. Significant erosion, difficult maintenance, and structural deterioration are examples of problems that may warrant the replacement of a storm drainage system component having adequate total hydraulic capacity.

For the purposes of identifying and developing recommended improvement projects for this study, only those system elements where the existing deficiency results in one or more of the recurring adverse effects listed below were considered.

- Building flooding at 25-year or more frequent intervals.
- Erosion on private property due to the direct discharge from public drainage facilities that, if permitted to continue, will eventually either endanger buildings or adversely affect the use of the property.
- Overflow of public streets by the 2-year storm for a time duration greater than 15 minutes.
- Recurring nuisance and the lack of maintenance control created by the uncontrolled discharge of water collected in public right-of-way onto adjacent private property.

Although this study focuses on the major drainage system, the criteria for replacement can also be applied to the improved minor system.

C. DRAINAGE POLICY

The draft "Stormwater Management Criteria" includes specific recommendations concerning all aspects of drainage policy and design. Its review and eventual adoption by the City is recommended. The following is a brief summary of criteria contained in the manual which relate to drainage policy issues.

1. STORMWATER DETENTION

A drainage system responds to rainfall in an interdependent and complex manner. Stormwater detention may either reduce or increase the peak rate of discharge to other drainage elements depending on the specific location of the basin within the system; therefore, requiring detention for all new development may not always accomplish the desired goal.

We recommend that the City establish a policy of requiring stormwater detention in connection with new development only when such detention is recommended by the Stormwater Management Master Plan in areas where it provides a clear benefit to the drainage system, or where the results of specific engineering analysis of any proposed development indicate a significant impact on the level of service afforded by downstream elements of the system.

2. GENERAL DESIGN CRITERIA

The detailed design criteria contained in the draft "Stormwater Management Criteria" provides that:

a. All enclosed and improved open channel drainage system components shall be designed for the 10-year return period peak flow or the capacity of the existing upstream improved system, whichever is greater.

b. Surface overflow channels shall be required in all areas in addition to, and above, the 10-year conveyance element. The overflow channel, when combined with the conveyance element, must provide sufficient capacity to convey the 100-year peak flow. Overflow channels will be provided in drainage easements, with restrictions on land use within the easement required to prevent obstruction of flow.

c. Enclosed pipe-inlet systems will be required under the following conditions:

   1) Within the right-of-way of improved streets in new developments.

   2) In all areas where the bank line of an open channel, either

natural or improved, would be within 30 feet of any existing or proposed habitable structure, regardless of system design capacity.

3) In new development areas where the permanent drainage easement of an open channel, either natural or improved, would encroach upon any existing or proposed structure.

d. Existing natural channels may be retained in the drainage system of a developed area provided that flow velocities do not exceed recommended maximums based on soils present in the channel bed and bank.

e. Dedication of easements for all improved system components to be maintained by the City shall be required, as well as maintenance access connections to street right-of-way. Easements will also be required along natural, unimproved channels and around detention facilities (other than parking lots, roof-top detention, or similar situations). Restrictions on land use within some easements are outlined in order to ensure proper function of the overflow system.

D. RECOMMENDED MAJOR SYSTEM IMPROVEMENTS

System capital improvement project recommendations were developed after consideration of the benefits, performance and cost of a broad range of options including:

- Land Use/Zoning Changes
- Flowage Easements
- Removal of Damageable Improvements
- Detention
- Open Channels
- Enclosed Pipe/Box Culvert Storm Drains

The resulting recommended improvement projects are generally structural improvements to the system. Detention, both regulatory and municipally constructed, is also proposed for limited areas and specific situations.

1. RECOMMENDED CAPITAL IMPROVEMENTS

The recommended improvements to the City's existing major drainage

system are consolidated into 49 defined projects. A detailed description of each project, together with the estimated capital cost of the project, is presented in Part VI of this report. The total estimated capital cost of the 49 improvement projects is $20.8 million, including estimated costs for construction, construction contingencies, engineering, and land acquisition.

2. PROJECT PRIORITIES

The recommended prioritization for the 49 improvement projects, as well as their geographic location, is presented on Exhibit 1. Table I-1 lists the 10 projects having the highest recommended priority. Recommendations are as developed by the PRIOR computer program. The priorities are established objectively to optimize the mitigation of property damage, benefit to the system, and cost.

Table I-1

RECOMMENDED IMPROVEMENT PROJECTS PRIORITY RANKING

Prior. No.	Proj. No.	Project Description	Estimated Cost($)
1	4-2	6th St. Relief Sewers, Virginia to Byers	2,470,000
2	4-7	Culvert Replacement, 7th East of Kentucky	165,000
3	4-8	Kentucky Relief Storm Sewers, 7th to 10th	648,000
4	10-1	Canterbury Ditch, 3rd to 7th	583,000
5	6-7	16th and Texas Storm Sewers	774,000
6	6-1	Culvert Replacement, 4th St. East of Murphy	1,001,000
7	6-2	Culvert Replacement, 5th & Division	951,000
8	4-4	Connor Ave. Relief Sewers, 9th to 10th	509,000
9	6-8	Davis Blvd. Detention Basin	502,000
10	1-1	Brownell Ave. Paved Ditch, 34th to I-44	606,000

A specific recommended prioritization for each of the 49 projects is presented on Exhibit 1; the structure of the software used in the prioritization permits no ties.

Of course, responsibility and authority for final establishment of project priorities rest with the Joplin City Council. The recommendations made herein do not and cannot consider the influence of other City programs and efforts on the desired timing and relative weight to be placed on completion of individual projects.

E. MINOR SYSTEM IMPROVEMENTS

The capital improvement projects recommended in this report are intended for the correction of existing deficiencies in the City's major drainage system. Analysis of the City's "minor" system was beyond the scope of Burns & McDonnell's contract with the City; as a result, no specific recommendations are made herein for the nature, location, and extent of necessary improvements to the minor system.

The designation of the smaller components of the City's overall storm drainage system as "minor" does not mean to imply that they are of little importance in the real (and perceived) overall performance of the system. To the contrary, the performance of the minor system directly affects the public perception of the adequacy of the City's system; deficient capacities in the minor system directly inconvenience both the public at large and individual properties, and do result in traffic interruptions and occasional damage to real property.

A regular program of improvement to the minor system is an integral element in any comprehensive plan of improvement to the storm drainage system, and in obtaining public acceptance of the need for the continued devotion of resources and effort to correction of the major system deficiencies. Definition of the level of spending necessary for improvement of the minor system, in the absence of a specific and comprehensive analysis of that system, is of necessity subjective in nature. For a minor system of the scale and age of that in the City of Joplin, we suggest that an appropriate level of spending would average roughly $500,000 per year.

F. SYSTEM MAINTENANCE

Past maintenance of the City's storm drainage system has been done on a complaint/emergency response basis. As a result, "normal" maintenance needs for many of the drainage facilities exist. Major system high-priority maintenance to open obstructed facilities and to repair structural deficiencies exist a numerous locations within the municipal boundaries.

It is recommended that a planned program of regular inspection and maintenance of the storm drainage system, with a corresponding budget, be established. We estimate that a total maintenance budget of approximately $250,000 annually is required for proper maintenance of the City of Joplin's system.

G. FUNDING

At present, the City funds maintenance and improvement of the storm drainage system from the City's general fund in an amount of roughly $500,000 per year. As indicated above, we consider that level of spending to be appropriate for the proper regular maintenance of the system, and for improvements to the minor system. An increase in the current level of funding for storm drainage is essential to construct the recommended capital improvements to correct present major drainage problems. An analysis of alternative funding mechanisms and revenue sources necessary to implement the improvements program was prepared, and is discussed in detail in Part VIII of the report.

The two basic alternatives for financing the recommended improvement projects are cash-basis and debt financing. It should be noted that general obligation bonds are not recommended for the capital improvements program, as the recent issuance of such bonds for improvements at the wastewater treatment plant have largely occupied the City's statutory debt limit.

Potential revenue sources, either for cash-basis or debt financing, include: the establishment of a stormwater utility; additional ad-valorem (property taxes); and a capital improvements sales tax.

It was determined that a one-quarter of one-percent sales tax can provide sufficient funds to construct the 49 recommended major system improvement projects on a cash basis over a 10 year period. Should the City elect to proceed with funding the major system improvements with that mechanism, we would recommend the concurrent continuation of an annual level of spending of $500,000 from the general fund for the proper operation and maintenance

of the system, and for construction of regular improvements to the minor system.

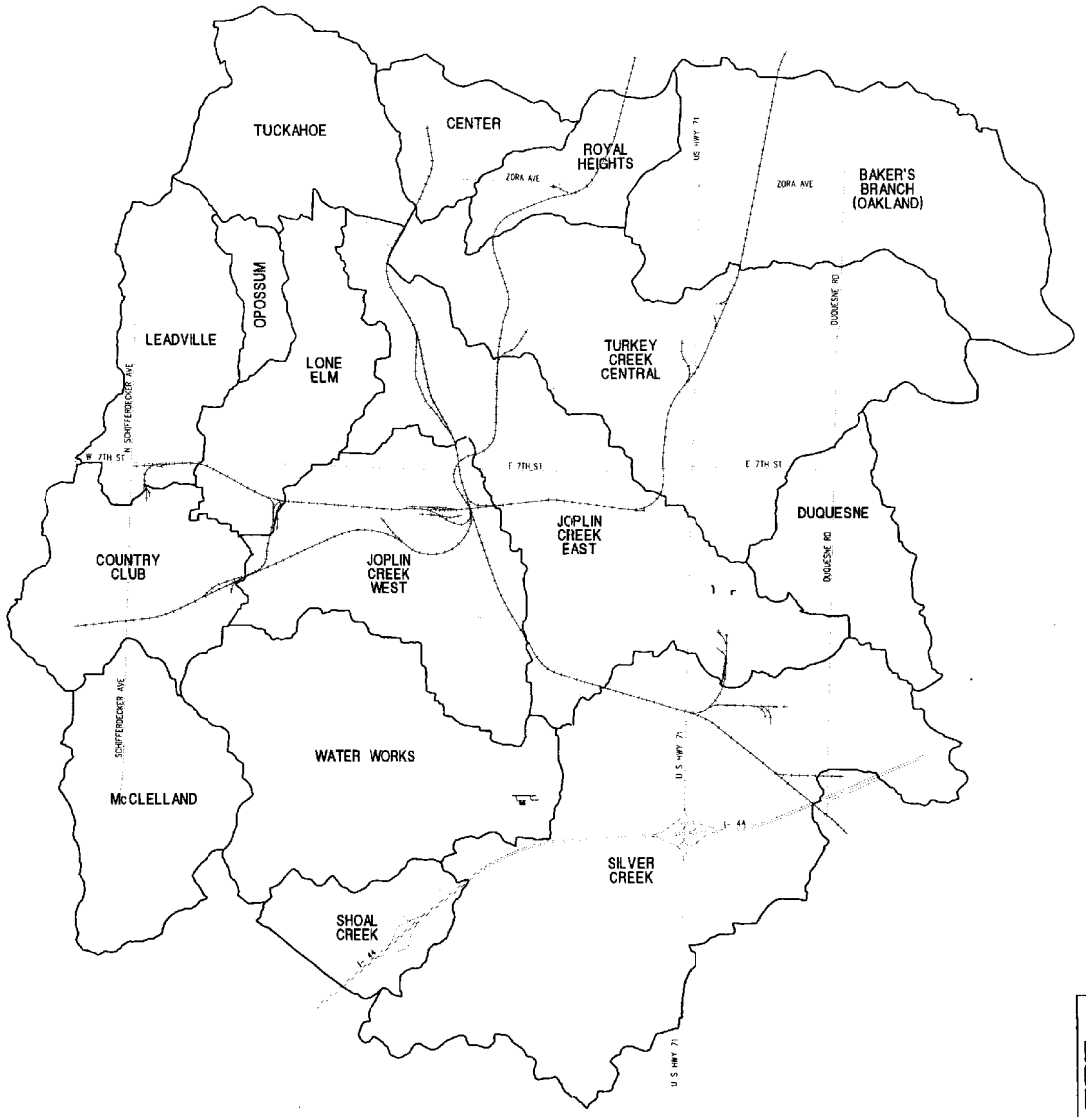
Should the City desire to consider the formation of a stormwater utility, proceeds from such a utility would be applied to all stormwater-related activities and expenditures in the City of Joplin. Revenues from such a utility could be utilized to retire revenue bonds issued for construction of the major system improvements, as well as for construction of minor system improvements and operation and maintenance of the overall storm drainage.

It is anticipated that the creation of such a utility, having an annual rate base of between $2.68 and $2.8 million per year, could adequately fund the needs of Joplin's storm drainage system without continuation of the current annual general fund investment in the system, either on a cash basis (completion of the recommended major system improvements over 10 years) or debt financed basis (issuance of 20-year revenue bonds, permitting completion of the recommended major system improvements over a 5 year period).

The determination of rate classifications and amounts for such a utility requires the conduct of extensive analyses well beyond the scope of this contract. However, on the assumption that the basic structure of the utility billings would be similar to that in other, established Missouri and Kansas stormwater utilities, we would anticipate that an annual utility income of $2.7 million would require the equivalent of monthly billings on the order of $4.00 per month for a typical single-family residence.

While the funding analysis in Part VIII presents options, the actual choice of funding mechanisms, spending levels and revenue sources is the prerogative of the City Council. It is the City's responsibility to balance the community's needs with available revenues which are acceptable to the community.

* * * * *



NORTH

NOT TO SCALE

Burns & McDonnell

CITY OF
JOPLIN, MISSOURI

FIGURE I-1
STUDY AREA

PART II

GENERAL INFORMATION

PART II

GENERAL INFORMATION

A. AUTHORIZATION AND SCOPE

This stormwater management master plan and report for the City of Joplin, Missouri were authorized by an agreement between the City and Burns & McDonnell Engineers of Kansas City, Missouri dated January 17, 1994. Specific services authorized included:

- Assembling, reviewing and organizing pertinent existing maps, records, reports, ordinances, criteria and floodplain studies available from the City and other agencies and sources.

- Planning and conducting public meetings early in the study process to gather information concerning existing drainage problems throughout the City and the public's perception and opinions regarding overall drainage service.

- A field investigation of the City's existing major drainage structures and open channel system, and of the hydrologic land use parameters throughout the drainage basins to measure and record data for use in computer modeling of the system.

- Preparing drainage system maps identifying:
  - Watershed and subwatershed boundaries.
  - Future land use and zoning coordinated with the City's Comprehensive Development Plan.
  - Existing major drainage system components.
  - Known drainage problem locations.
  - Composite soils map based on county soils reports and maps.

- Proposed system capital improvements plan.

- Evaluating the performance capability and deficiencies of the existing major drainage system through development of computer models utilizing the Corps of Engineers' HEC-1 and HEC-2 programs for return periods from one year to 100 years.

- Developing an optimized capital improvements plan incorporating structural components, public and private regulatory detention facilities, and improved and natural open channels considering hydraulic performance, capital costs, annual operation and maintenance costs, and water quality impacts.

- Defining recommended project priorities and an overall schedule for implementing the capital improvements plan.

- Performing a financial study to identify potential sources and estimates of revenue, and to balance selected revenue source(s) with the capital improvements plan and schedule.

- Preparing a Stormwater Design Criteria document coordinating technical design issues with recommended drainage policy issues for continuing management of the municipal drainage system.

- Conducting a stormwater criteria workshop for area developers and professionals when the draft criteria document is complete and a public information meeting/workshop when the draft final report has been approved by the City.

B. DEFINITION OF TERMS

Various technical terms are used throughout this report. They are defined as follows:

Detention Facility - Any structure, device or combination thereof that functions to accept inflow from surface runoff and discharge it at a controlled rate less than the peak inflow rate.

Developer - Any person or corporation engaged in the process of changing, modifying or altering the use of land.

Development - Any activity that alters the surface of the land that generally creates additional impervious surfaces including, but not limited to, pavement, buildings and structures.

Enclosed Drainage System - A drainage system consisting of essentially continuous pipes and/or box culverts below the ground surface.

Erosion - The removal of soil particles by the action of flowing water.

Freeboard - The vertical difference in elevation between the hydraulic gradient and a referenced point. Examples are the difference between the maximum water surface level behind a dam and the top of a dam, or the difference in elevation between the water surface at a culvert beneath the roadway and the surface of the roadway.

Hydraulic Gradient - The elevation of the surface of the water in the drainage system at any point.

Impervious Surface - Any surface that does not readily permit water to enter. Examples are roofs and concrete or asphalt-paved surfaces.

Improved Channel - Any channel whose characteristics are changed by either grading or construction of lining materials.

Level of Service - The return period for which a drainage system, or an individual element of that system, has adequate hydraulic capacity.

Natural Channel - An existing channel that has not been appreciably altered by grading, lining or changing its course.

Open System - A drainage system consisting of open channels, either natural or improved, with only comparatively short lengths enclosed by pipes or culverts.

Pervious Surfaces - Surfaces that absorb water such as yards and other unpaved areas.

Reach - A specific length of the storm drainage system between two points. For example, a reach may consist of a single culvert or may consist of several connected pipes or channel sections. The term "line" may also be used synonymously within the report.

Return Period - A statistical term for the average frequency that a given event may be expected to occur although it does not imply that the event will occur regularly at even intervals. It can also be defined as the reciprocal of the probability of an event. For example, a storm having a 10-year return period statistically can be expected to occur once in a period of 10 years, a probability of occurrence of 0.10, or 10%. However, the event may happen at any time and two such events may actually occur on successive days.

Sediment - Soil particles eroded by flowing water either in suspension in that water or as deposited.

Storm Drainage System - All of the natural and constructed facilities and appurtenances, such as ditches, natural channels, pipes, culverts, bridges, improved channels, street gutters, inlets and detention facilities, that serve to collect and convey surface drainage within the City.

Watershed - All land draining to the storm drainage system at any given point. This term is used synonymously with the terms tributary area, drainage area, drainage basin and catchment area.

C. STORM DRAINAGE SYSTEMS

There are two storm drainage systems in the City, the "major system" and the "minor system." The major system serves to carry relatively large volumes of water through the City while the minor system collects runoff from individual lots and smaller areas and carries it to the major system. Each must perform its function adequately to provide an acceptable level of drainage service; however, the consequences of poor performance by each system differ greatly.

Substandard performance by the major system is usually associated with significant consequences. When it fails to perform, the comparatively large volumes of water from that system overflow streets and property and may cause real damage by both erosion and flooding of buildings. The failure of the minor system to perform is characterized by lower volume, shorter duration overflows that may, on occasion, be a nuisance to traffic or cause objectionable quantities of water to flow across property although real damage is seldom experienced.

There is no clear line of demarcation between the major and minor systems. In general, the major system is considered to begin at the point at which approximately 40 acres become tributary to the system. This study and report are directed to the major system although some minor system elements have been included for continuity of the analysis.

D. AREA INFORMATION

The City of Joplin is located in the southwestern corner of Missouri, primarily in southwestern Jasper County although the southern edge lies in northwestern Newton County. It is surrounded by, or surrounds, a number of smaller cities and villages including Webb City, Airport Drive, Leawood, Shoal Creek Drive, Silver Creek and Duquesne. Major highways through the area include Interstate 44, US Highways 66 and 71, and State Highways 43, 96 and 171. Major waterways include Center Creek, along the north edge of the city; Shoal Creek, along the south edge; and Turkey Creek, which runs approximately through the middle. Missouri Southern College is located in the northeast quadrant of the City and the municipal

airport is at the north edge. Two large municipal parks, McClelland and Schifferdecker, and a golf course are located on the west edge.

For this study the city and adjacent areas tributary to the municipal drainage system are divided into 16 main watersheds. Each area is generally associated with one of the three main streams or their tributaries. These tributaries include Joplin Creek, Baker's Branch, Silver Creek, County Line Creek, and Tin Cup Creek.

Soils in the area generally are fine-grained with moderately pervious surface soils and less pervious subsoils. They are classified according to the Unified Classification system primarily as silt loams and silty-clay loams with some sandy loams in the floodplain areas. They typically are classified as hydrologic group B or C soils according to the Soil Conservation Service (SCS) system. Surface slopes across the area range from less than one percent, generally in the northern portions of the City, to greater than 20 percent toward the south.

Average annual precipitation in the area is 40.8 inches. Heaviest rainfall is expected during the spring and summer months with 75 percent of the total precipitation falling in the period from April to September. The driest period occurs from November to March. Rainfall events that place the most frequent demands on the drainage system occur as thunderstorms having intense, short duration rainfall which, on average, occur on approximately 55 days per year. Precipitation of 0.01 inch or more is recorded 108 days per year.

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PART III

TECHNICAL METHODS

AND CRITERIA

PART III

TECHNICAL METHODS AND CRITERIA

A. FIELD INVESTIGATION

A field reconnaissance survey was conducted by Burns & McDonnell staff to observe and confirm physical features of the existing drainage system throughout the City. Specific data regarding reach size, configuration, and hydraulic conditions were measured and recorded for over 500 individual reaches included in the system model. In addition to measured data, notes were taken concerning the apparent physical condition and state of maintenance of a number of the storm drainage structures, both City-owned and private. Additional information was obtained from the City's drainage system base map and records.

Field information was recorded concerning pertinent hydraulic and hydrologic data for each reach of the system surveyed. In addition to verifying sizes and materials of existing enclosed system and culvert elements, the following information was obtained where applicable:

- Channel/culvert depth to overflow or structural damage: Measurements were made of the available headwater (freeboard) at a number of principal culverts before overflow of the roadway or downstream property begins. These data were later used in office studies to evaluate allowable flow depths in the system reaches.

- Open channel conveyance capacity: Cross sections were measured for important open-channel reaches on the major system.

- Hydraulic roughness coefficients: Roughness coefficients (Manning's "n") values were estimated and recorded for system reaches in their existing condition. Table III-1 indicates the standards applied for estimating existing roughness coefficients.

TABLE III-1

FIELD EVALUATION STANDARDS FOR ROUGHNESS COEFFICIENTS

Conveyance Structure	Manning's "n"
Closed Conduits	
Reinforced Concrete Pipe	.013
Corrugated Metal Pipe	.023
Reinforced Concrete Box Culverts:	
a. Single Barrel	.013
b. Multiple Barrel, Effective	.0155
Stone or Brick Masonry	.022
Improved Open Channels	
Full Concrete Lining - Good Condition	.015
Full Concrete Lining - Minor Joint Problems	.017
Full Concrete Lining - Advanced Deterioration	.020
Full Asphalt Lining - Good Condition	.017
Full Asphalt Lining - Poor Condition	.020
Grouted Masonry - Good Condition	.023
Grouted Masonry - Poor Condition	.030
Riprap	.035
Concrete Invert - Maintained Turf Sides	.020
Concrete Invert - Moderate Brush/Shrub Sides	.030
Concrete Invert - Tree and/or Improvement Obstruction	.035
Concrete Invert - Appreciable Fences	.045
Turfed - Clean, Few Obstructions	.030
Turfed - Moderate Obstructions	.035
Turfed - Severe Obstructions	.045
RR Tie - One Bank	.023
RR Tie - Both Banks	.020
Concrete Block Sides - Concrete Bottom	.019
Concrete Block Sides - Earth or Turf Bottom	.023
Natural Ditches or Channels	
Straight to Moderately Sinuous	
Clean Earth Banks, Earth Bottom or Smooth Rock	.030
Clean Earth Banks, Rough Rock Bottom	.035
Brushy Banks - Few Obstructions	.040
Brushy Banks - Significant Obstructions	.050
Debris and/or Weed Choked	.070

Overbank Floodways

Street R/W Perpendicular to Flow	.035
Yards - Open Grass	.030
Yards - Grass - Some Bushes and Trees	.040
Yards - Significant Trees and Bushes	.050
Unimproved - Weedy - Moderate Brush	.050
Unimproved - Heavy Brush and Trees	.060
Unimproved - Dense	.100
Unimproved - Open	.040

B. SYSTEM MAPPING

The primary source of information for mapping was the existing drainage system map provided by the City. Information concerning the location of existing drainage structures was obtained by reference to these maps supplemented by information obtained during the field investigation phase of the work.

During the office study phase, the system maps were expanded to include definition of subwatershed boundaries and drainage areas tributary to each modeled reach of the drainage system. Orthotopographic maps at a scale of 1"= 200' were the primary source of information for defining the major watershed boundaries and subareas.

After defining the system and individual drainage areas, the maps were keyed and coded to correspond to the computer models used for performance evaluation and confirmation of system hydraulic capacity. The completed full-size maps have been separately furnished to city staff.

C. COMPUTER MODELING

1. GENERAL

Office studies were conducted to accomplish the following objectives.

- Define the performance level of the present drainage system under conditions of current land use and development.

- Define the hydraulic demand on the drainage system under conditions of future land use as defined by the City's comprehensive land use plan.

- Confirm the performance capacity of the system as improved according to recommendations contained in other sections of this report.

- Evaluate alternative system improvement possibilities and evaluate the effect of various sequences and priorities of recommended improvements.

2. COMPUTER MODELS

Two computer models developed by the Corps of Engineers Hydrologic Engineering Center for storm drainage analysis, were the primary tools used to model the existing and proposed drainage systems. The HEC-1 "Flood Hydrograph Package" was used for the hydrologic analysis and the HEC-2 "Water Surface Profiles" program was used for the hydraulic analysis of the open channel system. Enclosed system components were analyzed using the HYDRA Storm and Sanitary Sewer Analysis Software by Pizer, Inc, since neither HEC-1 nor HEC-2 accurately analyzes enclosed facilities. In addition, two programs developed by Burns & McDonnell were used to estimate costs and to prioritize recommended improvements. Each program has a number of options to tailor the model to the specific system components and conditions.

a. HEC-1 and HEC-2

The HEC-1 hydrology package generates streamflow or runoff hydrographs at desired locations for specific storm events over a watershed. The model simulates surface runoff within an area and the subsequent routing through various drainage system components, including pipes, channels and reservoirs, by representing the watershed as an interconnected system, or network, of hydrologic and hydraulic components. The runoff and routing simulation is based on the specific input parameters for each component of the process including the subwatershed.

For this study, the HEC-1 model was used to generate hydrographs to determine the peak flows at each of the drainage system components

for return periods of 1, 2, 5, 10, 25, 50 and 100 years. Options used in modeling the runoff to the system include the hypothetical storm generated from rainfall frequency data for precipitation, the SCS curve number for the loss rate, and the SCS dimensionless unit hydrograph.

The Muskingum-Cunge method was used for relatively short runs of channel and pipe routing. Typical input included is curve number and lag time for the drainage area; diameter or width, slope, roughness coefficient and length for pipes and box culverts; and a typical cross section, length, slope and roughness coefficients for open channels.

The HEC-2 program is used to calculate water surface profiles for steady, gradually varied flow in natural or improved open channels and to evaluate the effects of various obstructions such as bridges, culverts, weirs and structures within the floodplain of the particular stream. The procedure used for computations in the program is generally known as the standard step method and is based on solution of the one-dimensional energy equation with energy loss due to friction determined by Manning's equation.

The HEC-2 program was used in this study where appropriate to determine rating curves for channel reaches, as mentioned previously, and to evaluate the capacities of the open channels, bridges and cross-road culverts in the drainage system. Water surface profiles generated by the program for peak flows for the various return period storms were used to determine and/or verify the 100-year floodplain for the major open channels in the system and to determine the impact, if any, on adjacent existing or proposed development. Portions of the input data for the major channels were obtained from copies of the original HEC-2 model used to develop the flood profiles for the FEMA Flood Insurance Study (FIS) published in 1983.

b. SYCOST Program

The SYCOST program is used primarily for estimating the budget grade costs of storm drainage systems for study and planning purposes. The program performs conceptual grade design of component system facilities then estimates their capital and annual cost using current unit prices for key items. It accommodates pipe systems with pipe sizes up to 96 inches diameter, single and multi-span box culverts, lined or natural open channels, and site specific detention facilities. Output data for each reach includes structure type and size, and cost estimates for construction, land acquisition, design fees and contingencies, total capital cost, and annual maintenance cost.

This program was used in this study to determine the value of and annual maintenance costs for the existing drainage system; to evaluate alternative facility designs; and to develop cost estimates for the most feasible proposed improvements.

c. PRIOR Program

The PRIOR program is a model for developing rational and logical priorities among discrete "projects" included in a large scale program or proposal for stormwater system improvements. The model design is biased to assign the highest priorities to those projects that relieve deficiencies benefitting the greatest number of people at the lowest capital cost per benefitted system "user." Operation of the model sequentially determines a "score" for each project on an internally weighted scale then differentiates between equal "score" projects by secondary level comparison of component factors to establish an absolute priority ranking of all projects within the model. The evaluation scale used to determine project scores is presented in Part VI of this report.

Parameters analyzed for each project are frequency of damage from overflow of the existing system; number of damaged properties; type of damage such as structure and/or contents damage, erosion only, or

nuisance only with no direct economic damage; frequency of existing system overflow; effect of inadequate system on future land development; structural condition of an existing facility, if present; magnitude of the absolute hydraulic deficiency; and capital cost of the project.

Output data from this program for each project includes priority number, priority points (or raw score), capital cost, and priority control which was the model's justification for assigning that project's priority.

For this study, the PRIOR program was utilized with the recommended improvement plan to rank the series of projects made up of the reaches proposed for improvement.

D. RAINFALL AND STORM DURATION

The design storm used in the analyses of the drainage system is defined as the pattern of rainfall over a specific period of time, or duration, for a given return period. The duration that tends to put the greatest demand on the system is termed the "critical storm duration" and is roughly equal to the time of concentration of the watershed. The time of concentration, T_c, is defined as the time at which all parts of the drainage area begin to contribute runoff or the time of flow from the farthest point in the watershed to the outlet.

The regional conditions that are expected to produce the greatest demands on the system are those associated with short-duration, high-intensity thunderstorms occurring as part of longer duration rainfall. Within the HEC-1 program the "hypothetical storm" option most closely those conditions. Storm duration was selected based more or less on the critical storm concept described previously. Although the times of concentration for the various watersheds included in this study vary, a storm duration of six hours was selected for all modeling. This duration is long enough to insure that the model reflects the peak flow when all areas of the watershed are

contributing and that the effects of any detention within the system are accounted for without overstating the actual demand on the system.

Rainfall data for the Joplin area were obtained from the Cherokee County table from the Kansas Department of Transportation (KDOT) "Rainfall Intensity Tables for Counties in Kansas," 1991 edition which provides more detailed information than the intensity-duration-frequency curves available from current City design information. (Cherokee County is located approximately six miles west of Joplin, just across the state line.) From this information, total 6-hour rainfall depths for return periods of 1, 2, 5, 10, 25, 50 and 100 years were determined as indicated in Table III-2.

TABLE III-2

DESIGN RAINFALL EVENTS

Return Period (Years)	6-hour Rainfall (Inches)
1	2.28
2	2.82
5	3.60
10	4.14
25	4.98
50	5.58
100	6.18

E. LAND USE

Land use parameters influencing runoff were evaluated on the basis of the City's 1986 orthotopographic maps supplemented by data from the City's Comprehensive Development Plan and field observation to develop existing system performance models. The Comprehensive Development Plan was also used to develop model data for future fully-developed conditions.

According to information in the development plan, recent growth areas in Joplin are limited to the south edge of the City along I-44, southwest near the medical centers, and east of the City. Large tracts of land remain undeveloped throughout the area. Residential development is the largest single land use accounting for approximately 50 percent of the developed area within the city. Office and business parks, institutional land use,

and retail commercial areas cover approximately 15 percent of the City. Industrial areas account for another 10 to 15 percent, and parks and recreation areas cover approximately 5 percent. Future development, for the most part, will be residential and industrial areas expanding to the east and south according to the City's Comprehensive Development Plan.

Runoff parameters with respect to land use are as set forth in Table III-3. The land use categories indicated are those used in preparing data for the system models. They vary somewhat from the categories contained in the Comprehensive Development Plan or the Stormwater Management Criteria manual.

TABLE III-3

LAND USE RUNOFF PARAMETERS

Land Use	SCS Curve Number
Residential	83
Commercial	97
Industrial	90
Open/Agricultural	75
Developed Park	77
Abandoned Mines	78
Mine Tailings Areas	70

F. COMPARISON TO PREVIOUS STUDIES

The current FEMA Flood Insurance Study (FIS) was completed almost 15 years ago. In that period of time, the extent and type of development within Joplin has obviously changed to some degree. Less obvious are the many changes in the technical methods and the increased information available for analyzing the storm drainage system and simulating its performance. Therefore, it is somewhat difficult to directly compare the results of this report with previous studies. It should not be concluded, however, that any of the reports are incorrect simply because different results have been obtained.

As an example, substantial differences may be noted between the FIS peak flows and those determined in this study for several of the watersheds. This is due primarily to the different technical methods used to determine

those flows in each case. The current FIS study relied on peak flows for several basins generated in previous studies which were completed prior to 1976. Although specific information was not available, it appears that those flows were developed using a statistical method which, in certain cases, can provide fairly accurate data. However, the accuracy of this method when applied to small, developed urban watersheds is much less than in larger watersheds of primarily open land, for which the method was developed. Therefore, variations in the peak flows determined by the two studies can be considerable since the watersheds identified for this study are considered small, urbanized areas in this context.

* * * * *

PART IV

EXISTING SYSTEM PERFORMANCE

PART IV
EXISTING SYSTEM PERFORMANCE

A. GENERAL

This section presents the results of the hydrologic and hydraulic analysis of Joplin's major drainage system using the computer models and techniques described in Part III of this report. The analysis was based on the storm drainage system and land use as they existed in the summer of 1996. The performance of the existing system was reviewed based on both the current municipal drainage design criteria and the proposed "Stormwater Management Criteria" document which has been supplied separately to City staff.

The City's current drainage standards are based primarily on subdivision and floodplain ordinances, and review and approval of drainage plans for new development by the Director of Public Works. Generally, drainage system components are designed for a 10-year return period storm. The detention policy and design criteria have essentially been "borrowed" from the City of Springfield and never formally adopted by ordinance by Joplin. The proposed criteria, presented in the separate Stormwater Design Criteria document, outlines specific requirements for storm drainage systems including capacity and performance criteria for enclosed systems, open channels and detention facilities; design storms and precipitation data; design methods and techniques; easements; and plan submittal and review.

It is important to remember, however, that identifying an existing system element as failing to meet either current or proposed criteria, according to the model, does not indicate deficiencies in design or construction at the time the element was originally constructed. The principal determinants of hydraulic demand on the drainage system are land use and rainfall. Neither has remained static during the period of time over which Joplin's drainage system has developed. Major impacts on the capacity rating of the system include updated information on the predicted intensity of rainfall based on ongoing Weather Bureau statistical analysis of precipitation records; changes in land use not anticipated at the time

of the original design and construction; and development of computer modeling techniques and other analytical methods that permit a more refined analysis of system performance than was previously practical.

B. BASIN MODEL DEVELOPMENT

Computer models were developed for 16 principal watersheds including the City of Joplin and immediately adjacent areas. Each of the watersheds has its own unique drainage system tributary to one of the main waterways in the area. System maps indicating watershed limits and individual model reaches have been separately furnished to City staff.

The HEC-1 model was used to determine the demand discharge, or peak flow, to the drainage system (See Part III). The existing drainage system and structures were analyzed using the HEC-2 computer program, where appropriate. In addition to HEC-2, culverts were analyzed using inlet and outlet control and Manning's equation to determine capacities.

Although the models' calculations are precise with respect to the rainfall, land use, and system data, they are predicting system performance that is naturally variable. Infinitely changing rainfall rates, seasonal and other changes in day-to-day conditions of the land surface and vegetation, and the changing maintenance condition of the system itself will all influence the actual performance of the system at any given time.

Due to these natural variations, it is not realistic to conclude that a system element is not capable of supplying a given level of hydraulic service (i.e. 5-year, 10-year, etc.) simply because the model indicates a small capacity deficiency during the modeled storm. Therefore, deficiencies were not interpreted as being significant if the magnitude of the deficiency was relatively small or if it was determined that the deficiency was of a short duration (10 to 15 minutes or less).

C. EXISTING SYSTEM PERFORMANCE

Information on known drainage problems was gathered from City records and the residents of Joplin. The City provided a list of 29 known drainage problems with estimated costs for system improvements at those locations and a list of those projects that had been funded for the then current fiscal year. Information was obtained from residents through a questionnaire distributed to participants at two public meetings held in June, 1994. Of the 17 questionnaires that were completed, most pertained to problems that were already included on the City's list of problem areas.

The following pages contain descriptions of each watershed's major drainage system and summaries of the performance of the individual components.

1. SILVER CREEK WATERSHED

The Silver Creek watershed covers 6.25 square miles in the southeast corner of the city. It extends from approximately 1,000 feet south of West 20th Street east of Duquesne Road sloping southwest to its outlet at Shoal Creek. The upper watershed slopes north of Interstate Highway 44 are fairly flat, ranging from 1 to 4 percent. South of I-44 the slopes increase to around 8 percent and continue to increase towards the outlet where the slopes exceed 10 percent. The watershed drains to Shoal Creek at one main outlet 2,100 feet upstream of the I-44 crossing.

a. Land Use

This watershed is approximately half undeveloped. Residential land use comprises around 15 percent of the land use scattered throughout the watershed. The majority of the housing lies north of Interstate Highway 44. There is a fairly high concentration in the northwest corner of the watershed and the extreme northeast corner of the watershed just east of Duquesne Road. There are also residential developments located in the Leawood community just south of I-44. Industry makes up just over 5 percent of the land use. Most of the industrial development is along I-44 and

South Range Line Road. Commercial land use located along South Range Line Road also comprises around 5 percent. Maintained open areas, mostly located adjacent to the industrial and commercial areas, total approximately one quarter of the land use. Interstate Highway 44 runs from the northeast corner of the watershed to the west-central region with a cloverleaf interchange at the intersection with South Range Line Road.

b. Existing Drainage System

The existing major drainage system in this watershed consists of an open channel system fed by six tributaries consisting of natural and lined channels.

c. System Performance

Three major drainage problems have been reported in the Silver Creek watershed and are included in the City's current list of planned drainage improvements. The problem areas are: (1) intersection of East 25th Street and Ozark Avenue where street flooding is reported; (2) the area bounded by East 34th and East 35th Streets, Park Avenue and Highland Avenue where unimproved drainageways create flooding problems; and (3) the area from East 32nd Street to I-44, east of South Brownell Avenue, where another unimproved channel also creates flooding problems. The City's current plan calls for construction of new storm sewers and street inlets at the first location and paved channels or drainageways in the other two areas. The drainage facilities in the first two locations are not part of the major system and therefore, are not included in the system technical analysis. A summary of the rated capacity and level of source affected by the major drainage system in the silver Creek watershed is presented in Table IV-1.

2. SHOAL CREEK WATERSHED

The Shoal Creek watershed covers 0.84 square mile in the southwest corner of the Joplin city limits. It extends from as far north as East 41st Street near Pennsylvania Avenue south to its outlet at Shoal Creek about 500 feet east of Interstate Highway 44. Land slopes are fairly steep throughout most of the watershed, ranging from 5 to 12 percent. The majority of the watershed slopes at approximately 10 percent. The area drains to Shoal Creek at the main outlet east of the interstate with two smaller sub-watersheds of 117.8 acres and 90.85 acres draining to Shoal Creek west of the interstate.

a. Land Use

This watershed is approximately one-quarter residential with the majority of the housing concentrated in the northern half of the watershed. There is a small amount of industrial development, mostly along Interstate Highway 44 south of 44th Street. The rest of the watershed remains primarily undeveloped with some houses scattered throughout. Open land amounts to around 40 percent of the watershed. Undeveloped land with tree cover makes up almost one third of the land use. Interstate Highway 44 extends from the northeast corner to the southwest corner of the watershed.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily an open channel system consisting of natural channels discharging into Shoal Creek.

c. System Performance

One major drainage problem has been reported in the Shoal Creek watershed, located near East 43rd Street between Virginia and Pennsylvania Avenues. The problem has been reported as inadequate drainage capacity of a natural channel. The City's current improvement plans call for increasing the capacity of this channel. A summary of the rated capacity and land of source afforded by the major drainage system in the Shoal Creek watershed is presented in Table IV-2.

3. WATERWORKS WATERSHED

The Waterworks watershed covers 3.43 square miles located in the southwest corner of the city. It extends from East 4th Street east of Main Street to its confluence at Shoal Creek just west of Maiden Lane. The watershed extends as far east as St. Louis Avenue and nearly to Schifferdecker Avenue to the west. The land slopes in the northern and eastern regions of the watershed are fairly flat, generally ranging from 3 to 6 percent. The land slopes in the southern regions increase greatly ranging from 10 to 20 percent in some areas near the confluence at Shoal Creek. The area drains to Shoal Creek at one outlet located about 900 feet west of Maiden Lane extended.

The main drainage channel in this watershed is Tin Cup Creek, which was included in the 1983 Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for the City. Tin Cup Creek branches off into County Line Creek, which was also included in the FIS, just south of the Jasper-Newton County Line.

a. Land Use

This watershed is approximately 50 percent residential and 25 percent undeveloped. Industrial and commercial developments each make up around 5 percent of the watershed. Developed open areas, including parks, contribute just over 15 percent. The residential developments are located primarily in the northeast region of the watershed. The undeveloped land is located in the southern and southwestern regions of the watershed. The industrial and commercial developments are generally located along West 32nd Street and in an area south of West 26th Street and west of Picher Avenue. Park areas are located throughout the residential areas and near the major industrial facilities. Some areas of mine tailings are located in the extreme northwest corner of the watershed.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily an open channel system with some culverts and enclosed elements

conveying street runoff collected through curb inlets, and is divided into three main tributaries that converge near Shoal Creek.

c. System Performance

Six major drainage problems have been reported in the Waterworks watershed as follows:

(1) Mohaska Ave. ditch, Jackson Ave, to West 30th Street - Insufficient channel size and insufficient culvert capacity.

(2) West 35th Street and Pearl Ave. - Insufficient culvert capacity.

(3) West 34th Street and Grand Ave. - Insufficient ditch size.

(4) West 30th Street and Massachusetts Ave. - Street flooding due to lack of inlets.

(5) East 32nd street to East 33 rd Street west of Connecticut Ave.

(6) East 35th and Ferguson Rd. to East 36th Street West of Wisconsin Ave. - Drainage problems due to unproved channel.

The City's improvement plans call for increasing channel and culvert capacities at the first, second and third locations; constructing new storm sewers at the fourth location; and paving the channels at the other two locations. A summary of the rated capacity and level of source afforded by the major drainage system in the waterworks watershed is presented in Table IV-3.

4. JOPLIN CREEK WEST WATERSHED

The Joplin Creek West watershed covers 2.68 square miles in the center of the City of Joplin. It extends north from East 32nd Street to West 3rd Street, near Virginia Avenue; to the west just past Maiden Lane, and to New Hampshire Avenue on the east. The land is fairly flat throughout most of the watershed, with slopes rarely exceeding three (3) percent. The area drains to Joplin Creek at one outlet near the intersection of West 4th Street and Murphy Boulevard. The main channel in this watershed is identified as the Iowa Avenue Branch in the 1983 FEMA flood insurance study.

a. Land Use

Land use in this watershed is approximately 70 percent residential, 10 percent industrial, and 15 percent commercial. The residential developments are primarily in the southern and western regions of the watershed. The industrial and commercial developments are mixed in the northern and northeastern regions. Developed park areas make up about 5 percent of the watershed, with undeveloped areas totaling less than 5 percent.

b. Existing Drainage System

The existing drainage system in this watershed is a combination of an open channel system and an enclosed system collecting street runoff through curb inlets.

c. System Performance

Only one major drainage problem has been reported in the Joplin Creek West watershed. The area involved is a reach from the intersection of West 10th Street and Chestnut Avenue to West 6th Street and Virginia Avenue. Excessive flooding of the downtown area is reported due to insufficient drainage capacity in the enclosed components of the system. A summary of the rated capacity and level of service afforded by the major drainage system in the Joplin Creek West watershed is presented in Table IV-4.

5. McCLELLAND WATERSHED

The McClelland watershed covers 1.94 square miles along the southwest corner of Joplin's city limits. It extends from West 23rd Street and Schifferdecker Avenue south to its outlet at Shoal Creek. The watershed slopes are fairly steep. Upper watershed slopes range from 6 to 12 percent with the higher slopes mostly east of Schifferdecker Avenue. The middle of the watershed tends to be steeper with slopes ranging from 10 to 13 percent and some areas exceeding 20 percent. The lower regions of the watershed have land slopes ranging from 10 to 13 percent on the west side and 6 to 10 percent on the east side. There is one main outlet to Shoal Creek east of Schifferdecker Avenue.

a. Land Use

This watershed is approximately two-thirds undeveloped. Residential land use comprises nearly 25 percent of the watershed. Most of the residential areas are concentrated north of 32nd Street and east of Schifferdecker Avenue as well as just west of Schifferdecker Avenue. Other single-family residential areas are scattered throughout the watershed. Industrial land use totals less than 5 percent, located primarily south of 32nd Street.

b. System Performance

No major drainage problems have been reported in the McClelland watershed. For detailed existing system performance see Table IV-5.

6. JOPLIN CREEK EAST WATERSHED

The Joplin Creek East watershed covers square miles, exclusive of the 2.68 square unless in the Joplin Creek West watershed, which is tributary to Joplin Creek East 14 th and Murphy, extending from Duquesne Road in the southeast to the confluence of Joplin Creek and Turkey Creek, approximately 1,200 feet east of Lone Elm Road, in the northwest corner of the city. Watershed slopes are fairly flat ranging from 3 to 5 percent throughout most of the watershed. The slopes steepen near the confluence with Turkey Creek to over 10

percent. The area drains to Joplin Creek which is the only outlet to Turkey Creek for this watershed.

a. Land Use

This watershed is approximately one half residential, 10 percent industrial, 10 percent commercial, and 15 percent undeveloped. The residential development is located primarily in the southwest corner and along the northeast boundary of the watershed. The commercial and industrial development is mostly in the northwest corner in the downtown business district. The undeveloped land is located in the very southeast corner of the watershed.

b. Existing Drainage System

The major drainage system in this watershed is a combination of an open channel system and an enclosed system that collects street runoff through curb inlets.

c. System Performance

A summary of the rated capacity and level of service afforded by the major drainage system in the Joplin Creek East watershed is presented in table IV-6.

7. LONE ELM WATERSHED

The Lone Elm watershed covers 1.62 square miles near the northwest corner of the city limits. It extends from Junge Boulevard near the intersection with Maiden Lane, north to the intersection of Lone Elm Road and Zora Street where it outlets to Turkey Creek about 1,200 feet west of Lone Elm Road. It extends east to North Pearl Avenue and as far west as Roosevelt Avenue. Upper watershed slopes range generally from 3 to 5 percent in the southern regions and less than 3 percent in the southwestern regions. Land slopes increase to near 13 percent in the lower watershed regions with a few areas greater than 18 percent near the confluence. The area drains to Turkey Creek at one main outlet near Lone Elm Road, with the exception of 98.2 acres east of Lone Elm Road that drains separately to Turkey Creek.

a. Land Use

This watershed is approximately half residential located mostly east of Lone Elm Road. Industrial land use makes up around 10 percent of the watershed and is located primarily along North Maiden Lane and West 7th Street. Commercial development comprises nearly 10 percent and is also located along North Maiden Lane and West 7th Street. Undeveloped areas make up nearly 30 percent of the watershed and are primarily north of West C Street. Developed parks contribute around 5 percent to the watershed and there are some mine tailings that total less than 3 percent.

b. Existing Drainage System

The existing drainage system is a combination of enclosed systems and open channels.

c. System Performance

Two major drainage problems have been reported in the Lone Elm watershed. One, in the area from West 6th Street and Maiden Lane to West 5th Street and Porter Avenue, reports an undersized culvert at West 6th Street and an undersized channel between West 5th Street and West 6th Street. The second location, in the area between West A Street and West C Street and North Porter Avenue and North Picher Avenue, reports undersized culverts at West A Street and West B Street causing flooding problems. For detailed existing system performance data see Table IV-7.

8. COUNTRY CLUB WATERSHED

The Country Club watershed covers 1.80 square miles along the west-central Joplin city limits. The watershed slopes generally to the west. It is bounded to the south by West 27th Street, to the east by Maiden Lane, and to the north by West 7th Street, and outlets to the west approximately one-half mile west of the city limits. The upper watershed slopes are fairly flat at less than 3 percent. The land slopes increase to around 10 percent in the lower reaches. The main drainage channel through the watershed is Short Creek which continues

past the Joplin City limits. The Country Club watershed is the extreme upper sub-watershed draining to Short Creek.

a. Land Use

This watershed is approximately 40 percent undeveloped. Nearly one third of the watershed is covered by residential development. There is a high concentration of housing in the eastern region of the watershed and less dense residential development in the north and south central regions, mostly single-family units. Industrial development comprises around 15 percent of the watershed. Most of the industry is located along Schifferdecker Avenue and West 20th Street east of Schifferdecker. There is also some industry in the northwest corner of the watershed. Park areas make up around 10 percent and are located adjacent to the industrial developments. Mine tailings total less than 5 percent and are located mostly along the St. Louis - San Francisco Railroad east of Schifferdecker Avenue.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily an open channel system composed of natural channel with some lined channel.

c. System Performance

Three drainage problems have been reported in the Country Club watershed, each citing insufficient drainage capacity. One is located at West 16th Street and Willard Avenue, where a channel runs between houses to the main channel. Another reported problem, located at West 17th Street and Mina Avenue, is a minor system component and not part of the system analysis. The third reported problem, located at West 22nd Street and Willard Avenue, is a natural channel that flows northwest to the main channel. This is also a minor system component and not included in the analysis. Existing system performance data is summarized in Table IV-8.

9. LEADVILLE WATERSHED

The Leadville watershed covers 1.54 square miles along the western city limits. It extends from just south of West 9th Street near Schifferdecker Avenue north to its outlet to Turkey Creek southeast of the intersection of Zora Street and Schifferdecker Avenue. The extreme upper regions of the watershed contain fairly flat land slopes of 1 to 5 percent. Land slopes in the middle regions are around 3 to 6 percent, while the lower regions increase to between 10 and 20 percent with some areas in excess of 20 percent. The area drains to Turkey Creek at one main outlet near Zora Street and Schifferdecker Avenue.

a. Land Use

This watershed is approximately half covered by abandoned mines. They are mostly located north of Perkins Street. Nearby tailings make up a little less than 5 percent of the watershed. Approximately one-third of the watershed is residential with most single-family housing between Perkins Street and West 7th Street. Undeveloped areas make up around 7 percent of the land use with developed park areas covering about 8 percent. Industrial areas south of West 7th Street consume less than 5 percent of the watershed. Commercial land use totals only 1 percent.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily an open channel system composed primarily of natural channel.

c. System Performance

No major drainage problems have been reported in the Leadville watershed. For an analysis of existing system performance, see Table IV-9.

10. TURKEY CREEK CENTRAL WATERSHED

The Turkey Creek Central watershed covers 6.72 square miles and lies generally between the northern edge of Joplin and the southern edge of the Royal Heights community. It extends from the community of Duquesne

in the southeast corner to the community of Tuckahoe in the northwest corner. The section of Turkey Creek under analysis runs from the eastern city limits to the western city limits, however the creek actually begins about 9 miles upstream from the eastern city limit and outlets to Spring River about 5.8 miles downstream of the western city limit, just west of the Kansas-Missouri border. Land slopes vary across the watershed, ranging from 5 percent or less in the upper regions to 10 to 15 percent in the lower regions. Some of the more extreme slopes are located south of Turkey Creek between Main Street and Range Line Road. The area drains to Turkey Creek through various outlets.

a. Land Use

This watershed is approximately half undeveloped. The undeveloped areas are located mostly in the northeastern and northwestern regions of the watershed. Residential development comprises nearly one quarter of the land use. The concentrated residential areas are located in the northeast corner of Joplin and the southern half of the Royal Heights community. Other housing units are scattered throughout the watershed. Industrial development makes up just under 10 percent of the watershed and is located primarily along Newman Road and Range Line Road. Commercial development is intermixed with the industrial development and contributes just under 10 percent as well. A wastewater treatment plant is located on the south side of Turkey Creek just downstream of its confluence with Joplin Creek. The Missouri Southern State College campus is located at the southwest corner of the intersection of Duquesne Road and Newman Road. College housing is located north of Newman Road and athletic facilities are east of Duquesne Road. A major shopping mall is located east of Range Line Road between Turkey Creek Road and East 4th Street.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily an open channel system with an enclosed system present near the shopping mall.

c. System Performance

There are six reported flooding problems in the Turkey Creek Central watershed as follows:

(1) Florida Ave. between Newman Rd. and Princeton St - Insufficient drainage way.

(2) East, seventh street to west tank street west of Waggoner Insufficient drainage way.

(3) North end of Canterbury Lane - Street Flooding.

(4) East Seventh Street and Turk Ave. to Hodgdon Rd. and Range line road. Insufficient drainage way.

(5) College View Dr. and Butterfadd Ln. - Undersized ditch.

(6) Goetz Blvd between Willow Ln. and Ridge Dr. - Undersized ditch.

Locations 1, 5 and 6 are not a part of the major drainage system and, therefore, were not a part of the system analysis. The City has recently completed an improvement project at Location 4. A summary of the rated capacity and level of service afforded by the major drainage system in the Turkey Creek Central watershed is presented in Table IV-10.

11. CENTER WATERSHED

The Center watershed covers 0.84 square mile along the city's north side. It extends from Fountain Road at the northern most point to south of Zora Street where it drains to Turkey Creek at one outlet. The outlet is located between North Main Street and the Kansas City Southern Railroad. Land slopes vary from slightly over 5 percent in the upper watershed to around 10 percent in the downstream regions.

a. Land Use

This watershed is mostly undeveloped, with open acres comprising 72 percent of the land use. Industrial areas are located along the railroad. A lightly populated area of residential housing mixed with some small industrial structures is located east of the railroad and north of Zora Street, comprising approximately 15 percent of the land use.

b. Existing Drainage System

The existing major drainage system in this watershed is an open channel system comprised primarily of natural channel.

c. System Performance

For detailed existing system performance data see Table IV-11.

12. ROYAL HEIGHTS WATERSHED

The Royal Heights watershed covers 0.90 square mile along the city's north side and includes the northwest corner of the community of Oakland Park. It extends from Mount Hope Road, west of U.S Highway 71, and slopes generally to the southwest. Upper watershed land slopes are fairly flat, less than 2 percent, increasing to slightly greater than 5 percent downstream. The area drains to Turkey Creek at one main outlet west of the St. Louis-San Francisco Railroad.

a. Land Use

This watershed is approximately 80 percent undeveloped. Single-family dwelling units comprise 13 percent of the land use, mostly contained within Oakland Park in the eastern part of the watershed. Some isolated industrial areas are located in the southwest and south-central sections along the St. Louis-San Francisco Railroad. Royal Heights Park is located in the southeastern part of the watershed northwest of Oakland Park.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily natural open channel system.

c. System Performance

No major drainage problems have been reported in the Royal Heights watershed. For detailed system performance data see Table IV-12.

13. BAKER'S BRANCH WATERSHED

The Baker's Branch watershed is also referred to as the Oakland watershed in this study and report although the 1983 FIS also refers to it as Baker's Branch to correspond to the main channel through the area. The watershed covers 3.78 square miles in the extreme northeast corner of the city. It extends from east of Travis Acres Road near Newman Road to just north of Cardinal Drive south of Webb City and outlets to Turkey Creek north of Newman Road southeast of the Royal Heights community. Upper watershed slopes are fairly flat ranging mostly from 2 to 4 percent. The land slopes increase towards the lower end of the watershed ranging from 10 to 15 percent and some areas near the confluence approach 20 percent. There is one main outlet to Turkey Creek located southeast of Royal Heights.

a. Land Use

This watershed is over 75 percent undeveloped. Residential development comprises 15 percent of the watershed and is located primarily west of Range Line Road and south of Zora Avenue in the Royal Heights community. Industrial development makes up less than 5 percent of the watershed and is located mostly along Zora Avenue. Mine tailings, located in the northeast region of the watershed, cover around 3 percent of the watershed. Abandoned mines and quarries are located in the southeast region of the watershed and make up less than 3 percent of the land use.

b. Existing Drainage System

The existing major drainage system in this watershed is primarily a natural open channel system.

c. System Performance

Three major drainage problems have been reported in the Baker's Branch watershed. The first is located between Lincoln Avenue and

North Ozark Avenue south of Xenia Street where local flooding is reportedly caused by an undersized drainage ditch. The second location is south of Zora Street between North Turk Avenue and North Highview Avenue. The reported problem is flooding due to insufficient street drainage and an unimproved drainage ditch. The third reported problem, flooding due to insufficient drainage ditch capacity, is located along Goetz Boulevard between Castle Rock Drive and Hackberry Lane. All three locations are not a part of the major drainage system and therefore, are not included in the system analysis in these areas. For detailed information on the performance of the existing major system in this watershed, see Table IV-13.

14. DUQUESNE WATERSHED

The Duquesne watershed covers 1.26 square miles just outside the eastern Joplin City limits, north of Interstate 44. The upper limits of the watershed begin approximately 2,300 feet north of 32nd Street, east of Duquesne Road. The watershed slopes to the north and outlets at Turkey Creek 1,000 feet east of Duquesne Road. The land slopes vary from between 2 and 4 percent in the upper watershed to around 6 percent in the lower watershed. The land slopes decrease greatly near the confluence of Turkey Creek to just over 1 percent.

a. Land Use

This watershed is approximately one third residential land use, mostly single-family dwelling units. The residential areas are spread fairly evenly throughout the watershed, with the exceptions of the northern end near the confluence and the southwestern corner where there is no housing. Half of the watershed remains undeveloped. There is some industry in the southwest corner, totalling less than 5 percent of the land use. Parks and maintained open areas account for slightly over 10 percent of the watershed.

b. Existing Drainage System

The existing major drainage system in the Duquesne watershed is natural open channel system.

c. System Performance

No major drainage problems have been reported in the Duquesne watershed. For detailed information on the performance of the major drainage system, see Table IV-14.

15. OPOSSUM WATERSHED

The Opossum watershed covers 240 acres (0.38 square mile) in the northwest corner of the city. It extends from B Street just west of McCoy Avenue, north to its outlet to Turkey Creek near the intersection of the St. Louis-San Francisco and Missouri-Kansas-Texas Railroads. The extreme upper watershed land slopes are fairly flat ranging from 2 to 5 percent. The remainder of the watershed contains land slopes around 10 to 12 percent.

a. Land Use

This watershed is around 70 percent undeveloped. Mine tailings make up about 15 percent of the land use, located mostly in the southwest region of the watershed. There is an area of residential development in the southern part of the watershed with other single-family dwelling units scattered throughout, comprising nearly 6 percent. Industrial land use makes up approximately 7 percent of the watershed and is located in the southeast corner.

b. Existing Drainage System

The existing major drainage system is exclusively an open channel system.

c. System Performance

No major drainage problems have been identified in the Opossum watershed.

16. TUCKAHOE WATERSHED

The Tuckahoe watershed is located in the Northwest corner of the city limits and covers 1.8 square miles. It extends from Turkey Creek on the south to just north of Zora street on the north. The ranges from the eastern boundary of just west of the Kansas City Southern Railroad line to Schifferdecker Avenue on the west. The slopes vary from zero to ten percent.

a. Land Use

The watershed is approximately 15 percent residential, located primarily in the southern areas and along Lone Elm Road. Light Industrial accounts for approximately five percent of the watershed. Ten percent of the watershed is open fields and the remaining 70 percent is lightly forested.

b. Existing Drainage System

The existing major drainage system is open channel flow; the majority of the channels are natural channels while a few have rip rap or stone lined walls while maintaining natural flowlines.

c. System Performance

For detailed information on the existing major system performance see Table IV-16.

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EXISTING SYSTEM

CAPACITY ANALYSIS

TABLE IV- 1

SILVER CREEK

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
1000		3 - 8' X 2' RCA	N.A.		1,420	1,990	2,380	3,014	3,550	4,080	Low Water Crossing; Poor Condition
1002		Concrete Dam	N.A.		1,420	1,990	2,380	3,010	3,550	4,080	Privately Owned; Structure Repair Needed
1003		20' X 12' RCA	3,000		1,410	1,980	2,370	**3,000**	3,530	4,060	MHTD; MO Rte. 86
1016		Dam and Pond	N.A.		1,400	1,950	2,320	2,930	3,440	3,960	Privately Owned
1027		5.5' X 4.7' RCB, 2 - 42" RCP	400		150	250	320	**420**	510	590	50th E/O Indiana
1033		3' X 2.5' RCB	**38**		120	200	260	350	420	490	Private Entrance
1037		4' X 2.5' RCB	**60**		120	200	250	340	410	470	Private Entrance
1043		5' X 4.3' RCB	165		90	140	**180**	240	280	320	44th E/O Indiana
1077		18' X 5' RCB	**460**		1,260	1,760	2,080	2,580	2,990	3,480	Private Roadway
1123		3 - 9' X 7' Bridge	1,300		**1,190**	1,670	2,000	2,470	2,840	3,340	44th E/O Oaklawn

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
1127	2 - 8' X 4' RCB	560	170	250	300	380	**550**	820	
1133	8' X 6' RCB	540	170	250	290	370	**540**	810	Range Line Road
1137	6' X 6' RCB	330	140	220	250	**320**	470	730	Range Line Outer Rd; Analyzed as Detention Basin Outlet Due to Extended Low-lying U.S. Area
1142	2 - 24" RCP; 1 - 30" RCP; 1 - 24" CMP	**94**	200	300	380	500	590	680	Marjorie Lane
1150	2 - 18" CMP	**25**	90	140	180	240	290	340	Lilian Road
1158	3 - 10' X 5' RCB	1,350	540	770	980	**1,270**	1,420	1,860	
1163	12' X 6.5' RCB	1,260	530	750	960	**1,230**	1,380	1,810	I-44; Analyzed as Detention Basin Outlet Due to Extended Low-lying U.S. Area
1167	8' X 3' RCB	220	50	70	84	105	120	**140**	
1172	8' X 3' RCB	220	45	63	76	94	110	**120**	Private (Sam's Club)
1173	2 - 9' X 4' RCB	950	540	**860**	1,080	1,420	1,700	1,920	Entrance to Holiday Inn
1183	5 - 72" X 44" CMPA	800	510	**790**	1,020	1,350	1,620	1,840	Railroad
1197	2 - 30" RCP	72	46	64	**76**	94	108	120	32nd Street
1202	4 - 42" RCP	370	200	320	**400**	520	610	700	32nd Street

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
1203		2 - 30" RCP	80		40	60	**75**	100	110	130	32nd Street
1207		4 - 60" CMP	620		160	240	300	400	470	**540**	Railroad (Abandoned)
1223		4 - 72" CMP	920		220	360	450	630	760	**870**	Railroad
1224		53" X 34" RCHEP	82		20	30	35	45	55	**65**	32nd Street
1226		49" X 32" RCHEP	70		17	27	34	46	54	**63**	32nd Street
1227		3 - 60" RCP	570		190	330	410	**540**	660	760	Duquesne S/O 32nd
1232		3 - 42" RCP	280		100	180	220	**300**	360	410	32nd E/O Duquesne
1237		65" X 40" CMPA	90		**90**	150	190	250	300	340	Private Entrance
1238		65" X 40" CMPA	100		**90**	140	180	240	290	330	Private Entrance
1242		36" RCP	84		**74**	140	170	230	270	310	Detention Basin Outlet
1244		60" RCP; 350'L	200		100	150	**180**	220	260	290	
1245		60" RCP; 560'L	200		100	140	160	**200**	240	270	
1252		65" X 40" CMPA	90		**90**	140	180	240	290	330	Private Entrance
1253		58" X 36" CMPA	74		**80**	130	170	220	270	320	Field Entrance
1283		2 - 30" RCP; 2 - 24" RCP	114		**80**	140	170	230	280	320	Connecticutt S/O 48th
1285		3 - 24" RCP	70		40	**70**	90	120	150	170	Connecticutt S/O 46th
1286		36" RCP	42		**40**	70	90	120	150	170	46th E/O Connecticutt

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
1287	36" RCP	42	**40**	60	80	110	140	160	45th E/O Connecticutt
1288	4' X 5' RCB	170	34	55	70	100	120	**140**	44th E/O Connecticutt
1302	7' X 7' RCB	640	400	540	610	**660**	710	740	I-44; Analyzed as Detention Basion Outlet Due to Extended Low-lying U.S. Area
1308	2 - 7' X 6' RCB	700	510	**760**	930	1,190	1,400	1,590	37th E/O Brownell
1313	60" RCP; 100'L	250	90	130	150	200	230	**260**	32nd; Enclosed System Outlet
1314	72" RCP; 430'L	260	90	130	150	200	230	**260**	
1317	48" RCP; 100'L	144	70	100	120	**150**	170	190	30th @ McConnell; Enclosed System Outlet
1320	36" RCP; 150'L	67	29	43	52	**65**	76	86	On 30th W/O McConnell
1326	2 - 6' X 4' RCB	280	**300**	430	520	680	800	910	Private (Office Building)
1327	2 - 7' X 4' RCB	480	300	430	**520**	680	800	910	32nd Street
1328	58" X 36" CMPA; 50'L	130	50	70	90	110	**130**	145	Arizona N/O 32nd
1329	48" RCP; 160'L	130	50	70	90	110	**130**	145	On 32nd E/O Arizona
1333	2 - 6' X 3.5" RCB	300	180	270	**330**	420	490	550	28th & Arizona
1337	4' X 5' SMA	135	**150**	220	270	340	390	440	Railroad
1338	72" X 44" CMPA	130	100	**140**	170	210	240	270	Private (Lumber Co.)

TABLE IV-2

SHOAL CREEK

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
2025		6' X 4' RCB	>320		140	200	220	270	300	**320**	MHTD, Rt. 86; analyzed as outlet from unplanned detention.
2032		60" RCP	>240		80	110	140	180	210	**240**	MHTD; entrance ramp
2033		48" RCP; 400' L	200		70	100	126	161	**190**	210	MHTD; I-44/M-86
2034		42" RCP; 370' L	110		55	80	**100**	130	150	170	MHTD; I-44/M-86
2035		5' X 4' RCB	200		80	120	140	180	**210**	240	Virginia N/O 50th
2045		48" CMP	102		60	80	**100**	120	140	150	Outlet end needs repair
2055		48" RCP	>150		60	80	100	120	135	**150**	MHTD, I-44; Analyzed as outlet from unplanned detention.

TABLE IV-3

WATERWORKS

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
3005	2 - 10' x 6' RCB	1500	**1490**	2250	2800	3700	4400	5080	Glendale Road
3022	2 - 48" RCP	400	33	52	65	86	100	**120**	Oakmont & Rustic Ridge
3050	12' X 6' RCB	**400**	490	740	950	1250	1510	1730	Jackson Avenue
3052	8' X 4' RCB	280	22	36	45	60	72	**84**	Jackson Avenue @ 42nd
3065	48" RCP	120	33	49	59	75	88	**100**	Moffet & 36th
3095	8' X 8' RCB	960	430	670	800	**1020**	1260	1450	Main N/O 39th
3110	6' X 4' RCB	130	66	99	**120**	160	180	210	36th E/O Main
3117	6' X 4' RCB	260	59	87	100	130	160	**180**	34th E/O Main
3120	9' X 4' SMB	**200**	350	550	660	840	1000	1150	Virginia E/O Main
3135	6' X 2.5' RCB; 6' X 2.8' RCB	300	**290**	420	520	670	790	900	Indiana S/O 36th
3145	3 - 60" RCP	540	240	360	450	**570**	670	770	36th E/O Indiana

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
3160	8' X 4' RCB	210	150	**220**	270	340	400	450	35th & Ferguson
3162	42" RCP, 500' L	45	**43**	65	79	100	120	140	
3170	8' X 3' RCB	150	69	98	120	**150**	170	190	33rd W/O Norman
3180	6' X 3' RCB	80	47	68	**83**	100	120	140	Capacity Control @ US Parking Lot
3200	2 - 128" X 83" CMPA	1000	580	840	**1050**	1370	1620	1860	McIntosh Circle Drive
3210	4 - 72" CMP	1200	550	810	1000	**1310**	1550	1780	
3219	60" RCP	300	57	86	110	140	160	**180**	McIntosh Circle Drive
3230	2 - 12' CMP	2700	500	720	900	1170	1380	**1580**	32nd W/O Jackson
3238	2 - 48" RCP	170	110	**160**	200	260	300	340	28th W/O Bird
3240	42" RCP, 620'L	134	91	**130**	160	210	240	280	
3250	12' X 6' RCB	670	380	560	**690**	890	1040	1180	Jackson S/O Mohaska
3260	8' X 2' RCB	**81**	90	130	160	200	230	260	Mohaska at Sergeant
3270	11' - 10" X 5' RCB	470	240	350	**430**	550	650	740	30th & Moffet
3280	8' X 5' RCB	440	230	340	**420**	530	620	700	Pearl N/O 27th
3290	8' X 5' RCB, 235'L	520	210	300	370	470	**540**	620	Wall N/O 27th
3300	8' X 5' RCB	240	170	**260**	310	400	460	520	Alley E/O Wall, N/O 27th

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
3320.1	8' X 5' RCB, 185'L	600	160	240	290	370	440	**500**	Outlet W/O Joplin, N/O 27th
3320.2	5' - 9" X 4' - 8" RCB, 65'L	360	160	240	290	**370**	440	500	
3320.3	6' X 4.5' RCB, 120' L	360	150	220	260	**330**	390	450	
3320.4	6' X 5.5' RCB, 55'L	470	150	220	260	330	390	**450**	
3320.5	6' X 5' - 2" RCA, 45' L	380	130	190	230	290	340	**390**	
3320.6	4' X 5' - 2" SMB, 125'L	190	130	**190**	230	300	350	400	
3320.7	6' X 5' - 2" RCB, 25'L	430	130	190	230	300	350	**400**	Inlet E/O Main, S/O 27th
3330	48" RCP, 210'L	115	**120**	180	220	280	330	380	28th W/O Pennsylvania
3340	2 - 10' CMP	1500	400	580	710	900	1050	**1190**	32nd W/O McIntosh Circle Dr.
3350	12' X 5' RCB	400	**390**	560	690	870	1010	1150	
3371.1	48" RCP, 500'L	200	69	**97**	120	140	170	**190**	
3371.2	48" RCP, 300'L	270	69	97	120	140	170	**190**	
3372	42" RCP, 600'L	130	34	50	60	76	**88**	**100**	
3373	4' X 3.5' RCA, 470'L	160	28	40	48	61	**71**	**81**	
3374	42" RCP, 160'L	160	20	29	36	46	54	**62**	
3375	60" RCP, 580'L	330	**280**	410	500	640	750	860	
3376	72" X 64" RCA, 340'L	330	220	**320**	400	510	600	690	

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
3377		81" X 59" CMPA, 400'L	220		**210**	310	380	490	580	660	
3391		81" X 59" CMPA, 480'L	320		160	230	**280**	360	420	480	
3392		2 - 72" RCP, 60'L	850		150	220	260	330	390	**400**	
3393		60" RCP, 200'L	370		72	110	130	170	200	**220**	
3394		72" RCP, 490'L	280		71	100	120	160	180	**210**	
3395		60" RCP, 300'L	240		59	86	100	130	160	**180**	
3410		48" CMP	83		35	53	66	**85**	100	120	McCoy @ 25th

TABLE IV-4

JOPLIN CREEK WEST

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
4005	3-8' X 6' RCB	**1000**	1640	2280	2740	3410	3970	4510	TW Ctl. @ 6085; Poor Struct. Cond.
4007	5 - Span Timber Bridge	2100	1160	1600	**1910**	2390	2800	3170	Private; Tot. Span = 74'
4009	4 - Span Timber Bridge	2000	930	1330	1570	**1940**	2220	2520	RR; Tot. Span = 53'
4012	3.8' X 4.3' RCB;4.8' X 5' RCB	510	250	350	420	**520**	610	680	RR
4015	13' X 7' RCB	1180	480	680	820	1030	**1200**	1350	RR
4020	2-7' X 6' RCB	740	480	**680**	820	1030	1200	1350	Private
4030	13' X 7' RCB	1000	480	680	820	1030	**1200**	**1350**	Kentucky
4045.1	12' X 4' RCB, 110'L	620	**520**	740	880	1100	1270	1440	
4045.2	12' X 4' RCB, 450'L	460	**450**	640	770	980	1130	1280	U.S. End @ Alley w/o Main
4045.3	12' X 4' RCB, 760'L	460	**410**	580	710	900	1040	1180	U.S. End @ 6th St.

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
4045.4	12' X 4' RCB, 360'L	330	**380**	560	680	860	1000	1140	U.S. End @ Wall
4045.5	12' X 4' RCB, 390'L	330	**360**	530	640	820	960	1090	U.S. End @ Pearl
4050	8' X 5' RCB, 530'L	**280**	360	520	630	810	950	1080	U.S. End @ Byers
4055	1-8' X 4'; 1-4' X 4' RCB; 600'L	420	**350**	510	620	780	920	1040	U.S. End @ West Side Moffett
4060.1	7' X 5' RCB; 340'L	400	**340**	490	600	760	890	1010	U.S. End @ West Side Sergeant
4060.2	7' X 5' RCB; 500'L	400	310	**460**	560	710	830	940	U.S. End @ 8th St.
4067	9' X 5' RCB; 500'L	600	290	420	**520**	660	780	880	U.S. End @ 9th St.
4070.1	8' X 3' RCB; 400'L	250	**270**	400	480	620	730	830	U.S. End @ Conner
4070.2	8' X 3' RCB; 330'L	250	**230**	340	420	540	630	720	U.S. End @ Chestnut
4073	8' X 3' RCB; 220'L	250	**220**	330	400	510	600	680	U.S. End @ 10th
4076	8' X 4' Timber Bridge	320	220	**330**	400	510	600	680	RR
4077	9' X 3.6' RCB	200	**200**	300	360	470	550	620	Murphy
4080	9' X 3.8' RCB	200	**200**	300	360	470	550	620	11th St.
4090	8' X 3.5' RCB	270	180	**270**	330	430	500	570	12th St.
4100	8' X 3.9' RCB	260	150	220	**270**	350	410	470	Junge Blvd.

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
4106	48" CSP	130	**100**	160	190	250	290	330	RR
4115	5' X 3' RCB	80	40	**60**	70	95	110	125	17th St.
4140	4' X 3' RCB	22	**25**	35	45	60	70	80	19th St.
4150	13.2' X 5' RCB	510	250	350	420	**520**	610	680	Private
4155	2 - Span Bridge	---	230	330	390	500	570	**650**	Private; Tot. Span = 22'
4156	5' X 3' RCB, 180'L	**150**	230	330	390	500	570	650	U.S. End @ Alley s/o 7th
4160.1	6' X 5' RCB, 410'L	330	220	**320**	380	480	560	630	U.S. End @ 8th
4160.2	6' X 5' RCB, 460'L	330	210	**300**	360	460	530	600	U.S. End @ 9th
4160.3	6' X 5' RCB, 380'L	330	200	280	**340**	430	500	570	U.S. End @ 10th
4165	72" RCP, 1090'L	300	200	**280**	340	430	500	570	
4166	6' X 4.5' SMA, 60'L	250	200	**280**	340	430	490	560	Poor Struct. Cond.
4175	5' X 6.5' SMA, 100'L	310	200	**280**	340	430	490	560	
4176	6' X 8' Bridge	359	200	280	**340**	430	490	560	RR
4177	6' X 4' RCB, 250'L	179	**180**	260	310	390	460	520	U.S. End @ Joplin
4178	8' X 4' RCB, 560'L	250	180	**260**	310	390	460	520	U.S. End @ 11th
4179	6' X 4' RCB, 390'L	197	25	35	40	50	60	**70**	

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
4180	6' X 4' RCB	157	25	35	40	50	60	**70**	RR Culvert
4181	6' X 4' RCB, 330'L	157	25	35	40	50	60	**70**	Poor Struct. Cond.
4183	8' X 4' RCB, 360'L	234	150	**220**	270	340	400	450	
4185	8' X 4' RCB	234	150	**220**	270	340	400	450	RR
4186	8' X 5' RCB	300	130	190	230	**290**	340	380	Private
4190	10' X 3.3' RCB	300	110	160	190	240	**290**	320	Byers
4195	6' X 4' RCB	162	90	130	**160**	200	230	260	RR (Abandoned)
4200	7' X 2.3' RCB, 140'L	110	80	**110**	140	170	200	230	
4207	7.5' X 2.5' RCB, 270'L	90	40	60	**80**	100	110	**130**	
4208	3' X 2.3' RCB, 800'L	44	30	**40**	50	60	70	80	
4210	2-12' X 6' RCB	2200	930	1330	1570	1940	**2220**	2520	RR (Beneath 7th)
4220	2-11' X 4' RCB	1300	930	**1330**	1570	1940	2220	2520	9th St.
4226	9 - Span Timber Bridge, 60° Skew	870	**930**	1330	1570	1940	2220	2520	RR; 122' Tot. Span; East 4 Spans Ineffective
4227	4 - Span Timber Bridge	1010	800	**1140**	1340	1650	1880	2130	RR; 48' Total Span

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
4230	3-8' X 7' RCB	1050	800	**1140**	1340	1650	1880	2130	12th St.
4235	48" RCP; 330'L	87	**80**	110	130	160	180	200	
4236	36" RCP; 330'L	107	50	70	80	100	**110**	125	
4250	4-8' X 4' RCB	**400**	740	1060	1250	1540	1750	2000	RR (Abandoned)
4260	10' X 7' RCB; 10' X 4' RCB	1050	730	**1050**	1220	1530	1790	2120	15th St.
4270	2-6' X 3.2' RCB; 1-72" RCP	460	**490**	700	850	1090	1300	1480	17th St.
4280	4-60" RCP	570	460	**660**	800	1030	1190	1340	18th St.
4286	60" RCP, 650'L	176	**190**	270	330	420	490	550	
4287	54" RCP, 220'L	**133**	190	270	330	420	490	550	
4288	1-48" RCP, 1-36" RCP, 50'L	**143**	190	270	330	420	490	550	
4289	48" RCP, 890'L	**137**	170	240	300	380	440	500	
4290	2-6' X 4' RCB	440	220	310	380	**480**	560	630	20th St.
4292	36" RCP; 250'L	67	---	---	---	---	---	---	Rated with 4298
4296.1	58" X 36" CMPA, 950'L	**53**	160	230	280	360	420	480	

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
4296.2	58" X 36" CMPA, 900'L	**53**	120	180	210	270	320	360	
4298	58" X 36" CMPA	**138**	180	260	320	410	480	550	Includes 4292
4318	65" x 40" CMPA, 250'L	**90**	140	210	250	320	380	420	
4321	58" X 36" CMPA	106	**110**	160	190	240	280	320	24th St.
4326	50" X 31" CMPA	87	**80**	120	140	180	210	240	26th St.
4342.1	72" RCP, 400'L	424	230	340	**410**	520	600	680	
4342.2	72" RCP, 1000'L	519	200	290	350	440	**520**	590	
4342.3	72" RCP, 950'L	424	160	240	290	370	**430**	500	
4343.1	48" RCP, 1000'L	100	**120**	180	210	270	320	360	
4343.2	48" RCP, 1300'L	100	**80**	120	140	180	210	240	
4346	36" RCP, 350'L	47	**40**	60	70	90	100	120	
4350	48" RCP, 450'L	123	40	60	80	95	110	**125**	

TABLE IV- 5

McCLELLAND

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
5010	5 - 5' X 3' 8" RCB	750	410	**650**	840	1170	1440	1670	McClelland, outside corporate limits
5012	2 - 30" RCP	70	7	11	14	19	22	**26**	
5057	2 - 24" RCP	**40**	380	610	780	1090	1370	1620	Privately owned. Culvert tailwater causes problem for upstream structure 5018.
5018	2 - 9' 6" X 3' 6" RCB	580	340	**550**	720	1010	1260	1500	Outside corporate limits
5020	4' X 2' 6" RCB	**50**	250	390	490	640	770	890	McClelland Park
5025	2 - 8' X 3' 2" RCPA	240	**230**	350	440	580	690	790	McClelland Park
5047	43" X 27" CMPA	**40**	110	170	220	300	390	410	Outside corporate limits
5055	3 - 54" RCP	570	280	440	**580**	880	1110	1310	Shifferdecker Ave., outside corporate limits
5065	2 - 24" RCP	50	**40**	65	80	110	130	150	
5070	7' 5" X 3' 2" RCB	190	**150**	230	280	360	430	490	

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
5085	4 - 27" VCP	140	**64**	190	290	460	580	670	
5093	48" RCP Length = 350 ft	130	70	100	**130**	170	200	230	Enclosed system
5094	42" RCP Length = 315 ft	90	60	**85**	110	140	170	190	Enclosed system
5095	36" RCP Length = 170 ft	70	47	**73**	91	120	140	160	Enclosed system
5105	2 - 24" RCP	56	**50**	160	230	380	460	510	Upstream Detention generally ineffective for greater than 2-year return period.

TABLE IV-6

JOPLIN CREEK EAST

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
6030	2-66" RCP, 700'L	510	150	200	240	300	350	**390**	Lt Bank Trib @ Main & B St
6031	4' X 2.5' SMA, 730'L	100	30	45	55	70	80	**100**	
6033	5' X 6' RCB, 810'L	530	100	140	170	210	240	**270**	
6034	4' X 3.8' RCA, 350'L	110	75	**110**	130	160	190	210	
6039	48" RCP, 330'L	110	60	80	**100**	130	150	170	
6035	6' X 4' RCB	330	110	170	210	270	**320**	370	Rt Bank Trib @ Murphy & Pool
6045	72" CMP	280	100	150	190	250	**290**	330	Lined Invert
6055	5.7' RCP	230	90	140	170	**220**	260	300	10' X 4' RCB DS; 42" RCP US
6057	42" RCP	100	**90**	140	170	220	260	300	Inlet to 6055
6065	8' X 3' RCB	190	75	115	145	**190**	220	290	

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
6079		3-14' X 8' RC	2900		**3120**	4430	5300	6690	7790	8830	Main Stem, Murphy
6085		3-10' X 7' RCB	2900		**3120**	4430	5300	6690	7790	8830	4th St; Poor Struct. Cond.
6095		2-6.5' X 6' RCB, 220'L	**1200**		1460	2100	2530	3180	3710	4220	Poor Cond/ Under Building
6097		3-11.8' X 6' RCB	**1200**		1550	2200	2640	3310	3850	4350	TW Ctl by 6095; RR Culvert
6103		48" RCP	130		**100**	150	175	220	260	290	Rt Bank Trib @ 5th & Division
6104		42" RCP, 100'L	100		**90**	130	160	200	230	260	4th St. Crossing
6105		42" RCP, 350'L	100		75	**110**	130	165	190	220	
6106		42" RCP, 330'L	100		65	90	**110**	145	170	190	
6127		5.5' X 4.5' RCB, 250'L	390		120	170	210	260	310	**350**	Rt Bank Trib @ 7th & School
6128		66" SP, 440'L	350		110	160	200	250	290	**330**	Poor Struct. Cond.
6129		4' X 3' RCB, 300'L	160		105	**150**	180	230	270	300	
6135		48" RCP	110		**100**	145	175	220	260	290	Rt Bank Trib @ 5th & Club
6145		48" RCP	120		**100**	140	170	210	250	280	

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
6153		48" RCP, 370'L	210		90	130	160	**200**	235	265	
6165		2-12' X 9' RCB	3300		1250	1800	2170	2730	**3190**	3620	7th St
6175		3-12.5' X 5' RCB	**1000**		1240	1780	2150	2700	3150	3580	East Cell Ineffective; Private
6185		2-9' X 6' RCB	1650		1200	**1720**	2080	2610	3050	3470	RR Culv; HW Ctl @ Campbell
6194		2-9' X 6' RCB	--		---	---	---	---	---	---	RR Culv; Rated with 6185
6200		85" X 54" CMPA	150		**155**	220	260	330	380	430	Rt Bank Trib @ High & Campbell
6210		85" X 54" CMPA	150		**150**	210	250	310	360	400	
6220		6' X 4' RCB	94		**100**	140	160	200	230	250	RR Culv; HW Ctl @ 9th US
6222		3-30" RCP	94		**100**	140	160	200	230	250	Poor Struct. Cond.
6230		72" X 44" CMPA, 880'L	**46**		80	105	125	150	175	200	
6245		112" X 75" CMPA	1400		1010	**1460**	1770	2220	2600	2960	
6265		6' X 6' RCB	450		270	380	**460**	570	650	730	Lt Bank Trib @ Massachusetts
6275		2-60" RCP	440		260	370	**440**	540	620	690	

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
6285		2-5.7' X 4' RCB	450		205	280	330	400	**450**	500	
6295		2-8.5' X 3' RCB	390		160	215	250	300	330	**370**	
6296		42" RCP, 570'L	84		40	60	75	**90**	105	120	
6305		4' X 3' RCB	140		**140**	180	200	240	265	290	Old Road Bed
6312		3' X 3' RCB	120		100	115	**120**	125	130	140	RR Culv; HW Ctl @ Connecticut
6315		2-24" RCP	**43**		80	110	125	150	170	200	In HW Pool for 6312
6320		3-54" CMP	**600**		720	1080	1300	1660	1950	2210	
6330		2-66" RCP	600		**630**	930	1140	1460	1720	1950	
6355		42" RCP, 300'L	**82**		160	220	270	340	400	450	Under Residential Structure
6351		42" RCP	45		---	---	---	---	---	---	Rated with 6363
6359		2-24" RCP	36		---	---	---	---	---	---	Rated with 6365
6363		54" RCP, 20'L	130		**140**	200	240	310	360	410	Analysis includes 6351
6365		48" RCP, 170'L	**100**		140	200	240	310	360	410	Analysis includes 6359
6366		60" X 38" RCHEP, 80'L	**62**		140	190	230	290	340	380	

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
6367		50" X 31" CMPA	**57**		73	100	120	160	180	210	
6368		4' X 2.5' RCB	100		37	50	59	73	83	**93**	
6373		10' - 3" x 6' - 9" CMPA	450		320	**490**	610	790	930	1070	HW limited by US System; Q=500 at 20th Street overtop.
6377		65" X 40" CMPA, 800'L	72		**80**	110	130	160	180	200	
6378		65" X 40" CMPA, 560'L	72		**75**	100	120	140	160	180	
6379		5' X 3' RCB	140		63	85	100	120	**140**	150	
6380		117" X 79" CMPA	350		**300**	460	520	740	920	1000	
6390		2-8' X 3.5' RCB	**240**		280	430	530	680	810	930	
6400		2-6' X 4' RCB	350		**280**	430	530	680	810	930	
6415		2-8' X 3.2' RCB	530		270	410	**500**	650	770	890	
6417		3 - 65" X 40" CMPA	**210**		260	400	500	640	760	880	
6435		87" X 63" CMPA	200		110	**180**	230	310	370	430	

TABLE IV - 7

LONE ELM

EXISTING CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
7010		2 - 112" x 75" CSPA	900		**950**	1400	1700	2180	2530	2880	
7020		2 - 10' x 4' RCB	1100		**920**	1340	1640	2100	2430	2760	
7030		6' x 2' RCB	80		52	**77**	95	123	145	165	
7040		6' x 5' RCPA Length = 700 ft	260		120	170	210	**260**	310	350	Enclosed system.
7042		6' x 5' RCPA Length = 850 ft	260		75	110	130	170	200	**220**	Enclosed system.
7043		48" RCP Length = 550 ft	80		40	55	**70**	105	125	140	Enclosed system.
7045		6' x 5' RCPA Length = 550 ft	300		140	210	260	**320**	380	430	Enclosed system.
7055		2 - 48" RCP	190		**170**	290	310	390	460	520	Located under private, unused road.
7065		3 - 6' x 3'6" RCB	**460**		648	940	1142	1449	1692	1914	

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
7075	3 - 6' x 3'6" RCB	460	**439**	637	772	979	1146	1295	Structure in poor condition. Questionable for vehicle loads.
7076	2 - 36" RCP; 450' L	**150**	200	280	350	440	520	580	
7080.1	72" X 44" CMPA	**105**	180	265	325	400	480	540	Harlem @ B St.
7080.2	49" X 32" RCHEP	**105**	180	265	325	400	480	540	
7081	2 - 48" RCP	220	170	**250**	300	370	440	500	Maiden Lane N/O A St.
7082	48" RCP	**95**	140	210	250	320	370	420	McCoy S/O A St.
7083	6' X 4' RCB	230	120	170	**210**	260	300	340	2nd W/O McCoy
7090	3 - 6'6" X 3'6" RCB	621	415	**603**	730	926	1084	1224	Structure is deteriorating and is in poor condition.
7100	10' x 5' Precast RCB	364	**390**	566	687	867	1014	1143	Located under service road for Joplin Public Works Maintenance Area.
7110	7' x 7' RCB	850	388	561	676	**856**	1001	1127	
7120	6' x 6' RCB	400	311	**453**	550	701	821	926	Under private road.
7130	6' x 4'6" RCPA	39	23	34	**41**	52	61	69	
7135	106" x 72" CMPA	345	215	**319**	388	499	587	668	Enclosed system.
7140	60" RCP	152	95	**140**	171	220	258	294	
7160	5' X 5' RCB	193	120	**179**	217	279	329	374	

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
7170		5' x 4' RCB	**150**		208	308	378	486	570	648	
7180		2 - 60" RCP	460		159	240	298	386	**454**	521	Enclosed system.
7182		80" x 48" CMPA	**140**		159	240	298	386	454	521	Enclosed system.
7184		8' x 4' RCB Length = 80 ft	400		136	209	261	342	**407**	468	Enclosed system.
7186		12' x 3' RCB Length = 80 ft	410		136	209	261	342	**407**	468	Enclosed system.
7188		12' x 3' RCB Length = 110 ft	410		125	191	239	313	**372**	429	Enclosed system.
7190		2-54" RCP Length = 190 ft	320		125	191	239	**313**	372	429	Enclosed system, car wash parking lot.
7192		2-36" RCP Length = 30	112		**125**	191	239	313	372	429	Enclosed system in private alley.
7200		30" CMP & 36" CMP	126		36	56	70	93	111	**127**	Under railroad tracks.
7205		2 - 30" RCP	134		47	73	92	**121**	145	168	
7210		60" x 30" Steel Pipe Arch	137		47	73	92	121	**145**	168	Located under private road.

TABLE IV - 8

COUNTRY CLUB

EXISTING CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
8015	10' X 7' Bridge	500	220	330	420	540	640	**730**	Outside corporate limits; abutment undercutting
8020	2 - 10' X 7' Timber Bridge	1100	170	250	310	390	460	**530**	Railroad
8022	6' X 2'6" RCB	120	90	**130**	170	220	260	300	Iron Gates; outside corporate limits
8024	6'8" X 1'6" RCB	43	**45**	70	85	110	130	150	Meadow; outside corporate limits
8045	2 - 8' X 4' RCB	650	400	**640**	750	970	1140	1300	
8057	2 - 43" X 27" CMPA	**70**	100	150	180	220	260	300	
8059	2 - 43" X 27" CMPA	100	**100**	150	180	220	260	300	Culvert is damaged.
8080	2 - 24" RCP	**44**	55	70	75	85	90	100	Culvert is damaged.
8090	36" CMP & 24" CMP	90	55	70	75	85	**90**	100	Culverts under railroad tracks; analyzed as outlet from unplanned detention.
8100	2 - 36" RCP	130	**130**	190	240	310	360	410	Roosevelt S/O 16th

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
8105		2 - 36" RCP	130		**150**	220	270	350	410	470	Alley W/O Roosevelt

TABLE IV- 9

LEADVILLE

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
9030	2 - 120" CMP	600	440	**590**	670	780	860	930	Abandoned Mining Rd. Road bed overtops 4' below crown
9045	9' X 8' RCB	**N.A.**	380	510	620	730	800	870	Abandoned Mine Road; Poor structural condition
9046.1	96" RCP (Outlet)	500	380	**510**	620	730	800	870	Perkins W/O Monroe; structural damage
9046.2	90" RCP (Inlet)	500	380	**510**	620	730	800	870	
9055	3 - 36" RCP	**110**	350	480	590	680	750	820	B Street (Extended) W/O Monroe; Low water crossing
9070.1	6' X 5' - 6" RCA (Outlet)	380	**320**	460	550	630	700	790	Abandoned Railroad; 4 houses flood @ 25-year frequency due to backwater.
9070.2	8' X 8' - 6" RCA (Inlet)	380	**320**	460	550	630	700	790	Capacity control @ 2nd St. upstream

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
9080		6' X 6' RCB	**270**		310	450	550	670	730	820	2nd St. W/O Walnut needs structural correction
9100		8' X 6' RCB	600		250	360	430	**550**	640	720	4th St. W/O Walnut
9110		48" RCP	110		85	**120**	150	190	220	250	

TABLE IV- 10

TURKEY CREEK CENTRAL

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
10050	7' X 4' RCB	360	130	200	240	320	**380**	440	G St. W/O St. Louis
10060	7' X 4' RCB	240	110	180	**220**	290	350	400	Entrance Culvert; TW Influence from 10050
10067	48" RCP; 200' L	150	70	110	**130**	180	210	240	St. Louis
10095	48" RCP	72	22	33	40	52	61	**70**	Euclid E/O St. Louis
10165	3 - 48" CMP	330	**320**	460	560	720	840	960	Commercial Entrance
10175	3 - 48" CMP	**190**	310	450	550	710	830	950	Commercial Entrance; TW Influence from 10165
10185	10' X 4' RCB	440	310	**450**	540	700	820	940	Commercial Entrance
10195.1	3 - 60" X 38" RCHEP	470	280	410	**510**	660	760	880	
10195.2	3 - 60" CMP	470	280	410	**510**	660	760	880	Railroad
10205	10' X 5' RCB	460	270	390	**470**	600	700	800	Hodgdon Road

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
10211	8' X 4' RCB	380	270	**390**	470	600	700	800	Central E/O Turk
10220	42" RCP; 650' L	105	70	**100**	120	160	180	210	Central W/O Turk
10230	8' X 4' RCB	430	170	240	300	370	**430**	490	Turk N/O 3rd
10240	3' X 3' - 7" RCB	300	160	220	**270**	340	400	450	3rd St. W/O Turk
10250	6' X 3' RCB	126	**130**	190	230	290	340	380	4th St. @ Turk
10257.1	36" RCP; 180' L	110	24	33	40	47	54	**61**	
10257.2	42" RCP; 40' L	110	24	33	40	47	54	**61**	Railroad
10265	8' X 6' RCB	540	40	60	73	92	110	**120**	7th E/O Ozark
10266	42" CMP	92	20	30	35	45	50	**60**	7th W/O Highview
10275	2 - 36" CMP	95	22	32	40	50	60	**65**	Railroad S/O 7th
10290	2 - 60" RCP; 420' L	230	40	65	80	105	125	**140**	Newman E/O Range Line
10292	48" RCP	70	40	60	**70**	90	110	125	Industrial Entrance
10293	48" RCP	110	40	60	70	90	**110**	125	Industrial Entrance
10325	14' X 3' - 2" RCB	440	260	380	**460**	600	710	810	College Drive
10335	14' X 3' RCB	420	260	380	**460**	600	710	810	College Drive
10336	6' X 3' - 9" RCB	435	255	375	**460**	595	700	800	College Drive
10345	7' X 3' - 7" RCB	435	250	370	**460**	590	690	790	College Drive

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
10350	2 - 48" CMP; 490' L	180	**170**	250	320	410	480	560	College Parking lot
10355	5' X 4' RCB	165	80	115	**140**	180	210	240	Newman E/O Goetz
10376	2 - 42" RCP	120	**140**	220	270	360	420	490	Pedestrian Walkway
10377	2 - 42" RCP	156	**135**	210	260	345	400	470	Pedestrian Walkway
10378	2 - 42" RCP	130	**130**	200	250	330	390	450	College Parking Lot
10380	7' X 4' RCB	200	100	160	**210**	270	330	380	Newman W/O Duquesne
10387	2 - 53" X 34" RCHEP	200	80	130	160	**220**	270	310	
10390	73" X 45" RCPA	170	70	120	**150**	200	240	280	Duquesne N/O Newman
10415	54" RCP; 940' L	170	80	100	120	150	**170**	200	
10416	48" RCP	124	58	80	95	**120**	135	150	3rd W/O Northpark
10427	42" RCP; 225' L	110	43	58	67	82	94	**104**	3rd E/O Range Line
10435	2 - 103" X 71" CMPA	820	300	440	530	660	**770**	870	
10445	2 - 87" X 63" CMPA	460	290	**420**	510	640	740	830	3rd E/O Northpark
10450.1	48" RCP; 180' L	100	32	48	59	77	90	**103**	
10450.2	2 - 43" X 27" CMPA	100	32	48	59	77	90	**103**	
10455	2 - 81" X 59" CMPA	400	150	230	280	**360**	420	480	Northpark S/O 3rd

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
10465		2 - 36" CMP	140		70	100	110	130	140	**160**	7th E/O Rex; Analyzed as Detention Basin Outlet
10485		8' X 5' RCB	500		140	210	250	330	380	**440**	7th E/O Peters
10505		3 - 24" RCP	75		**80**	120	150	190	220	250	10th @ Peters
10525		2 - 8' X 4' RCB	540		220	360	**460**	620	750	880	Duquesne S/O Newman
10527		54" RCP	110		70	**110**	140	180	210	250	School Drive
10530		54" RCP	120		70	**110**	140	180	210	250	School Drive
10540		54" RCP	110		70	**110**	140	180	210	250	School Drive
10543		54" RCP; 640' L	206		61	96	120	160	**190**	220	School System
10545		48" RCP; 100' L	150		61	96	120	**160**	190	220	School System
10546		24" RCP; 250' L	**30**		53	84	106	140	168	194	School System
10555		73" X 45" RCPA	140		70	110	**140**	190	230	270	Newman E/O Sycamore

TABLE IV- 11

CENTER

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
11012		2 - 48" RCP	300		170	260	**330**	440	520	600	Railroad structure.
11014		54" x 42" CMPA	100		**110**	170	210	280	330	380	23rd W/O Main; Poor structure condition.
11025		6' x 4' Box Culvert	250		170	**260**	330	430	520	600	Main N/O Zora
11055		5' x 3' RCB	110		60	90	**110**	150	180	210	Main @ 23rd
11057		58" x 36" CMPA	80		53	**83**	104	137	164	188	Entrance Culvert
11060		58" x 36" CMPA	80		53	**83**	104	137	164	188	24th E/O Main
11062		58" x 36" CMPA	80		43	67	**83**	112	134	154	Entrance Culvert
11064		58" x 36" CMPA	80		33	52	66	**87**	104	120	Entrance Culvert

TABLE IV- 12

ROYAL HEIGHTS

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
12015	2 - 60" RCP	440	220	350	**450**	600	720	840	N. St. Louis S/O Zora
12020	3 - 48" RCP	390	180	280	**360**	480	590	690	Railroad
12035	6' X 6' - 2" RCA	330	160	270	**350**	460	560	650	Zora E/O Park; Structure in poor condition
12044	2 - 2.5' X 2.5' SMB	160	80	130	**160**	220	260	300	Under abandoned railroad, (now bike trail)
12065	2.5' X 2.5' SMB	75	30	90	60	**80**	90	110	Under abandoned railroad, (now bike trail)

TABLE IV- 13

OAKLAND
(Baker's Branch)

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
13020	60" x 38" RCHEP; 800' L	120	45	70	80	100	**120**	140	Turk S/O Zora
13030	2 - 10' x 8.5' RCB	1820	920	1440	**1830**	2450	3000	3530	Range Line Rd. S/O Zora; HW Control S. of Structure.
13055	6' x 6'4" RCPA	350	230	**370**	470	650	790	930	Zora E/O Mytle
13061	2 - 36" CMP	80	30	45	60	**80**	90	110	
13063	2 - 36" CMP	**78**	30	45	60	**80**	90	110	Under railroad
13070	2 - 60" RCP	340	120	210	260	**350**	410	470	
13077	42" RCP	60	**50**	80	100	140	160	190	Entrance culvert
13079	4' x 2'6" RCB	93	50	80	**100**	140	160	190	U.S. 71 S/O Enterprise
13080	2 - 42" RCP	140	50	70	90	120	**140**	160	
13109	Timber Bridge	>2800	710	1130	1470	1960	2370	**2820**	Railroad bridge; 480 S.F. Waterway

I.D. NO.	DESCRIPTION	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
13017	3 - 24" RCP	**>70**	80	130	170	230	280	330	Chelsea W/O Wellington
13120	2 - 6' x 6'4" RCPA	>290	80	130	170	230	**280**	330	
13155	6' x 6'4" RCPA	366	120	200	260	**360**	430	500	Zora W/O Duquesne
13164	2 - 48" RCB	220	90	160	**200**	270	320	370	Duquesne N/O Zora
13185	2 - 10' x 5' RCB	950	500	800	**1010**	1370	1680	1980	Duquesne S/O Zora
13224	2 - 42" RCP	160	**120**	190	250	330	400	460	Zora E/O Duquesne; Outside Corporate Limits

TABLE IV- 14

DUQUESNE

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
14002		2 - 13' X 4' RCB	1040		440	700	870	**1150**	1380	1590	7th E/O Duquesne
14005		3 - 27" RCP 1 - 18" RCP	**110**		240	360	450	600	700	800	Duquesne S/O 7th
14012		58" X 36" CMPA	**110**		190	290	360	460	550	630	10th E/O Katherine
14020		2 - 5' X 4' RCB	320		160	240	**300**	400	470	540	Markwardt W/O Duquesne
14045		2 - 43" X 27" CMPA	70		20	30	35	45	55	**60**	Markwardt E/O Duquesne
14060		6' X 2.5' RCB	**150**		190	290	360	470	560	640	Markwardt W/O Murphy Lane
14065		48" RCP	**100**		160	240	310	400	470	540	Murphy Lane S/O Markwardt; Moble Home at unprotectable elevation

TABLE IV- 15

OPOSSUM

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
* * * NO STRUCTURES * * *											

TABLE IV- 16

TUCKAHOE

EXISTING SYSTEM CAPACITY ANALYSIS

I.D. NO.		DESCRIPTION	CAP (cfs)		2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	REMARKS
16015		6' X 6' RCA	**260**		320	540	690	920	1110	1280	Zora W/O Lone Elm
16025		2 - 4' X 2' RCB	**100**		160	240	330	440	540	620	
16035		2 - 4' X 2' 6" Box	**100**		120	180	220	280	330	370	Lone Elm Road
16050		2 - 27" RCP	**60**		70	110	130	170	210	240	Zora W/O Lone Elm
16052		3' 6" X 3' SMB	105		30	40	50	60	75	**85**	Lone Elm Road
16063		60" RCP	300		90	140	170	230	**280**	320	Zora E/O Lone Elm

PART V

DRAINAGE POLICY

PART V

DRAINAGE POLICY

A. GENERAL

This section discusses the principal public policy issues that are integral to implementing a drainage management plan. Specific policy recommendations in this section were used to develop the capital improvement project list and maintenance program recommendations presented in other sections of this report, as well as the "Stormwater Design Criteria" manual, furnished separately.

Because typical urban land ownerships are small, and approximately 15 percent of the land area is typically owned by the municipality itself in the form of street right-of-way, it's not practical for each landowner to individually provide and maintain a private drainage system. Therefore, municipalities have by necessity and tradition assumed responsibility for establishing specific drainage systems within their boundaries and have become the "owners" of most structural drainage systems. In so doing the municipality also accepts the corresponding duty to maintain those improved facilities. For the City to reasonably manage drainage in its boundaries it must:

- Specifically define a common level of service to be established.
- Provide for the construction of physical components of the drainage system.
- Control the use of land to avoid the obstruction of drainage.
- Provide for physical maintenance of drainage system improvements to ensure their function is not impaired.

B. GENERAL POLICY OBJECTIVES

Equitable division of responsibility for management of drainage between the City and private property owners is a fundamental consideration in establishing policies for providing drainage service. Pure equity must be tempered with practical constraints. The ultimate objective is to provide

an equal and acceptable level of drainage service to all citizens and to fairly apportion the cost of that service.

C. NEW CONSTRUCTION AND DEVELOPMENT

It is recommended that the City adopt the "Stormwater Management Criteria" manual, which has been furnished separately to City staff. This manual defines what is generally accepted as a reasonable level of service for storm drainage systems and outlines current standards of practice and technology for design of those systems. Included in the specific policy recommendations contained within the manual are the following:

1. All enclosed and improved open channel drainage system components shall be designed for the 10-year return period peak flow or the capacity of the existing upstream improved system, whichever is greater.

2. Enclosed pipe-inlet systems will be required under the following conditions:

   a. Within the right-of-way of improved streets regardless of system design capacity.

   b. In all areas other than residential where the bank line of an open channel, either natural or improved, would be within 30 feet of any habitable structure.

   c. In residential areas where the bank line of an open channel, either natural or improved, would be within 60 feet of any existing or proposed residential structure.

Although higher in initial cost than open channels, enclosed systems have less maintenance requirements and a longer life cycle. Because they are enclosed there is less potential hazard to the public, and they generally meet with greater public acceptance. However, surface

overflow space must still be provided to assure the passage of discharges that exceed the design capacity of the enclosed system.

3. Improved open channels may be used in all areas except those where an enclosed system is specifically required. Channel lining is required in developed areas where the 10-year peak flow is equal to or greater than 200 cfs and less than or equal to 500 cfs.

4. Existing natural channels may be retained in the drainage system of a developed area where the 10-year peak flow is greater than 500 cfs and flow velocities do not exceed recommended maximums based on soils present in the channel bed and bank.

5. Overflow channels will be required in all areas in addition to, and above, the conveyance elements, whether open or enclosed. Overflow channels shall have sufficient capacity, when combined with the capacity of the conveyance element, to convey the 100-year peak discharge without damage to land or buildings. Restrictions on land use within the overflow areas will be required to prevent obstruction of flow.

6. Detention facilities shall be provided in connection with land development under the following conditions:

   a. Where recommended by the City's current Stormwater Management Master Plan.

   b. Where homes, buildings, or other structures downstream from a proposed development are currently flooded in a 100-year or more frequent flood.

   c. Where flood damage problem areas have been identified, or an engineering study indicates the proposed development would cause or increase such flooding.

Public and private detention facilities may be either wet or dry. Joint uses, such as parking and recreation, not interfering with detention functions, are permitted for dry facilities. Rooftop and parking lot detention are acceptable for private facilities only. Performance requirements shall be based on maximum release rates outlined in the City's "Stormwater Management Criteria" manual.

In addition, it is recommended that detention basins serving more than one property owner be dedicated to the City for operation and maintenance. Operation and maintenance of private detention facilities such as residential subdivision ponds owned by homeowners associations, parking lot impoundments, roof-top basins, and other similar facilities, should be the responsibility of the owner.

7. Dedication of easements for all improved system components to be maintained by the City shall be required as well as maintenance access connections to street right-of-way. Easements will also be required, although not for City maintenance purposes, along natural, or unimproved, channels and around private detention facilities other than parking lots, rooftop detention or similar situations.

In addition to these specific criteria, it is recommended that the City adopt regulations requiring erosion control plans for all new construction projects to prevent siltation on streets and in the existing downstream drainage system.

D. EXISTING SYSTEM CAPITAL IMPROVEMENTS

When an existing drainage system component is replaced, the replacement unit should be designed and constructed to meet current City criteria and standards. The mere failure of any existing element of the drainage system to meet those current standards for hydraulic capacity should, however, not be cause for automatically planning and budgeting for its replacement. Sound and maintainable facilities should only be replaced when their lack of capacity results in, or will result in, economic consequences

commensurate with the cost of replacement, or when there is an overriding public safety or property damage issue involved.

The following recommendations apply to the upgrading of existing drainage system elements that have been previously provided by developers and accepted by the City; those which cross or are located in public right-of-way or other City-owned property; or those that are major system elements not subject to developer improvement in connection with the development of open land. It is recommended that the City replace facilities where:

1. Structural failure has occurred or is impending.

2. Building flooding occurs at 25-year or more frequent intervals due to inadequacies in the public drainage system.

3. Overflow of public streets by the 2-year storm lasts for a time duration greater than 10 to 15 minutes.

4. Erosion on private property due to direct discharge from public drainage facilities will eventually either endanger buildings or otherwise adversely affect the use of the property.

5. Uncontrolled discharge of water from public right-of-way onto adjacent private property creates a recurring nuisance and the lack of maintenance control for the property owner.

E. MINOR SYSTEM IMPROVEMENTS IN DEVELOPED AREAS

For a number of years, the City has required developers to install culverts, storm sewers, lined channels and other improvements to adequately handle storm water in their developments and dedicate them to the City for operation and maintenance. The capital cost of these "minor system" improvements was, in effect, paid for by individual property owners through special assessment to their property. However, some areas within the corporate limits, primarily those annexed after development, have no such improved facilities. Their "minor system" consists of small

roadside ditches and driveway culverts. Property owners in these areas have not made an individual investment commensurate with that of other property owners.

Because of the different levels of individual investment, it is not equitable for the City to upgrade the unimproved minor drainage system simply to relieve the adjoining property owners of what may be perceived as a nuisance. The City as a whole, however, derives specific and general benefits from unimpeded traffic flow and free access by emergency and public service vehicles so it is necessary that the City maintain the unimproved minor system to assure its continued function. In addition, since the runoff from the street right-of-way is a part of the total system demand, and the culverts and ditches on the right-of-way act to concentrate and channelize flow at its point of release to private property, the City has the common duty to control its release to avoid damage to such property. Therefore, it is recommended that the City:

1. Construct new or upgraded minor system drainage facilities only when water discharged from a public street or other City property is causing damage in the form of erosion or structure flooding to the downstream property.

2. Require individual property owners to install, repair, and maintain driveway culverts on streets not having curb and gutter with enclosed drainage systems.

3. Replace cross-road culverts if their structural condition is not serviceable, or when hydraulic capacity is less than 2-year return period demand and the deficiency causes structure flooding upstream from the culvert.

4. Replace or extend enclosed pipe-inlet systems only when structural failure has occurred, or is impending, or when the hydraulic capacity is less than a 5-year storm demand and structure flooding has occurred or is predicted to occur by competent professional advice.

* * * * *

PROJECT

DESCRIPTIONS

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Brownell Ave. Paved Ditch, 34th to I-44

Project Identification Number: 1-1

Pertinent Data Summary

Watershed:	Silver Creek
Priority No.:	10
Design Capacity:	1,000 cfs (10-year)
Estimated Cost:	$606,421
Model ID No.:	1307, 1308, 1309
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	24-27-33

Existing Problem Description

Throughout this reach, the capacity of the existing system is limited by the capacity of the existing 7'x7' RCB (1302) beneath I-44. The system as it exists results in substantial storage upstream of I-44, with the result that low-lying properties along the main drainage channel are subject to inundation due to backwater at intervals of less than 5 years. That basic cause of flooding is further worsened by the limited capacity of the existing open system.

Recommended Improvements

Replace open channel 1309 with a concrete lined trapezoidal channel having a bottom width of 10 ft, a lined depth of 3 ft, and side slopes of 2:1. In this reach, the estimated flow depth will range from 6 to 5 ft; the channel slope will be slightly less than 0.2%. Retain structure 1308 (dbl. 7'x6' RCB) in place, with properly designed transitions to the improved upstream and downstream channels. Between 1308 and 1302, construct a gabion-lined open channel having a similar cross section to that in reach 1309, at an approximate invert slope of 1%. Proper performance of the system will require that the existing detention storage remain available; it is therefor further recommended that a flowage easement to elevation 1007 be obtained between I-44 and 37th; along reach 1309, it is recommended that a flowage easement be obtained along the left descending bank to elevation 1009. Completion of the recommended improvements will result in roughly a 20-to-25-year level of protection for existing residential structures along the project; a further increase in the level of protection provided will not be possible without major investment in downstream improvements.

Downstream Controls: None.

Potential Alternatives: Consider the potential for acquisition of flood-prone properties along this reach.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Texas Ave. Paved Ditch, 32nd to 34th

Project Identification Number: 1-2

Pertinent Data Summary

Watershed:	Silver Creek
Priority No.: 29	
Design Capacity:	Varies, 640-520 cfs (10-year)
Estimated Cost:	$317,987
Model ID No.:	1325, 1326
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	24-27-33

Existing Problem Description

Through this reach, the existing unimproved open channel system provides an in-system capacity equal to roughly a 2-year event. It is estimated that one commercial property and one residential property experience flooding at roughly 5 year intervals.

Recommended Improvements

Replace the existing unimproved open channel throughout this reach with a concrete-lined trapezoidal channel having a bottom width of 8 feet, side slopes of 2:1, and a lined depth of 4 feet. Retain existing structure 1326 in place, with properly designed transitions to the upstream and downstream improved channels.

Downstream Controls: Project No. 1-1 should be completed in advance of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Structure Replacement, 44th E/O Oaklawn

Project Identification Number: 1-3

Pertinent Data Summary

Watershed:	Silver Creek
Priority No.:	21
Design Capacity:	2,000 cfs (10-year)
Estimated Cost:	$278,374
Model ID No.:	1123
Map Reference Numbers:	
Master Plan Mapping:	11
Topographic (Section):	24-27-33

Existing Problem Description

The existing structure provides roughly a 2-year level of protection against overtopping of 44th St., and is in relatively poor structural condition. No upstream structures are known to flood as a result of the deficient structure capacity.

Recommended Improvements

Replace the existing 3-9'x7' bridge with a triple 9'x9' RCB; raise approximately 450' of 44th St. a maximum of 1.6 feet (to approximate elevation 978.6). A further increase in roadway elevation would not be recommended due to a resultant increase in the headwater elevation occurring under the 100-year flood event.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Mohaska Ditch, Jackson to Moffett

Project Identification Number: 3-1

Pertinent Data Summary

Watershed:	Water Works
Priority No.:	11
Design Capacity:	Varies; 530-690 cfs (10-year)
Estimated Cost:	$593,104
Model ID No.:	3255, 3260, 3269
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	15-27-33

Existing Problem Description

The existing Mohaska Ditch provides a bankfull capacity of roughly 560 cfs, equivalent to roughly a 5-10 year level of service, dependent upon location. Discharges exceeding the ditch capacity result in flooding along the adjacent Mohaska Avenue, and damage to 3 residences. The danger to the travelling public resulting from the street flooding is exacerbated by the close proximity of the ditch to the existing roadway, and by the steepness (roughly 1:1) of the ditch side slope.

Structure 3260 consists of an 8'x2' RCB beneath Mohaska at its intersection with Sergeant; the existing structure provides less than a 2-year level of service prior to overtopping of Mohaska.

Recommended Improvements

Reaches 3255 and 3269 should be reconstructed to increase waterway area and to establish a suitable shoulder along Mohaska. Each reach is anticipated to consist of a gabion-lined trapezoidal channel having a bottom width of 10 feet and side slopes of 3:1. The overall depth of the lined channel in reach 3255 would be 4' below roadway shoulder; in reach 3269, the depth would be 4.5'. The 10-year water surface elevation would be 1.0' below roadway shoulder; each channel would be capable of carrying roughly the 100-year discharge when bankfull.

Structure 3260 should be replaced with a 10'x3' RCB.

Construction and subsequent maintenance of the improved open channels in reaches 3255 and 3269 will require the acquisition of permanent drainage easements roughly 50 feet in width adjacent to the Mohaska right-of-way.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Paved Ditch, 36th to Ferguson

Project Identification Number: 3-2

Pertinent Data Summary

Watershed:	Water Works
Priority No.:	22
Design Capacity:	380 cfs (10-year)
Estimated Cost:	$211,230
Model ID No.:	3155
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	23-27-33

Existing Problem Description

Reach 3155 consists of an unlined open channel having a bankfull capacity of roughly 50 cfs, much less than a 2-year capacity. Erosion is not considered a significant problem, but events exceeding the channel capacity result in wide overbank flow on the adjacent, relatively flat lands. Events exceeding roughly a 10-year discharge are expected to result in damage to 3 residential structures.

Recommended Improvements

Reach 3155 should be reconstructed as a concrete lined open channel having a bottom width of 8 feet, a lined depth of 2 feet, and side slopes of 3:1, yielding a bankfull (2' depth) capacity equal to the 10 year event. It will be necessary to acquire a 50' permanent easement for the construction and maintenance of this improved open channel.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Paved Ditch, 33rd to 32nd West of Connecticutt

Project Identification Number: 3-3

Pertinent Data Summary

Watershed:	Water Works
Priority No.:	39
Design Capacity:	110 cfs (10-year)
Estimated Cost:	$95,808
Model ID No.:	3175
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	23-27-33

Existing Problem Description

Reach 3175 consists of an unlined open channel having a bankfull capacity of roughly 40 cfs, much less than a 2-year capacity. Erosion is not considered a significant problem, but events exceeding the channel capacity result in overflow onto the adjacent storage yard of Midwest Lumber. Events exceeding roughly a 10-year discharge are expected to result in damage to 1 additional structure located just east of the existing ditch.

Recommended Improvements

Reach 3175 should be reconstructed as a concrete lined open channel having a bottom width of 4 feet, a lined depth of 2 feet, and side slopes of 2:1, yielding a bankfull (2' depth) capacity slightly greater than the 10 year discharge. It will be necessary to acquire a 32' permanent easement for the construction and maintenance of this improved open channel.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Old 32nd E/O McClelland

Project Identification Number: 3-4

Pertinent Data Summary

Watershed:	Water Works
Priority No.:	37
Design Capacity:	690 cfs (10-year)
Estimated Cost:	$461,500
Model ID No.:	3350
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	15-27-33

Existing Problem Description

The existing structure beneath old 32nd consists of a 12'x5' RCB having a rated capacity, assuming the structure to be fully open and functional, roughly equal to a 2-year discharge. At present, the structure and its outlet are partially blocked by accumulated sediment; water stands to a depth of roughly 2.5 feet in the box. Immediately upstream of this structure are the outlets of a 60" RCP (line 3275) and a 48" RCP (line 3271); the crowns of those outlets are slightly above the roadway grade at 3350. Reach 3350 discharges to an unimproved open channel lying adjacent to the roadway; the horizontal and vertical geometrics of this channel contribute to the sedimentation and blockage at 3350. No structures are known to flood as a result of the deficient culvert capacity.

Recommended Improvements

Replace the existing 12'x5'x30'(approx) RCB with a 12'x5.5'x410' RCB crossing the roadway at a skew of roughly 45 degrees and extending downstream along and adjacent to the westerly edge of pavement of the roadway, constructed at a slope of roughly 0.4 %. The new culvert invert would be roughly 1' below the existing invert at the inlet end. Relay approx. 50' each of the existing upstream 60" RCP and 48" RCP to lower the outlet crown elevations, and construct a junction/inlet structure at the confluence of the three lines.

Downstream Controls: None.

Potential Alternative: Prior to construction of this project, the potential for permanent closure of old 32nd, coupled with removal of the existing culvert and development of an open connection to the downstream channel, should be evaluated.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 38th & Jackson

Project Identification Number: 3-5

Pertinent Data Summary

Watershed:	Water Works
Priority No.:	19
Design Capacity:	950 cfs (10-year)
Estimated Cost:	$70,200
Model ID No.:	3050
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	22-27-33

Existing Problem Description

The existing structure beneath Jackson consists of a 12'x6' RCB having a rated capacity roughly 80% of the 2-year discharge. No upstream structures are known to flood as a result of the deficient culvert capacity. The relatively low structure capacity results in part from the limited available headwater depth prior to overtopping of Jackson (approx. 0.7' above the crown of the culvert).

Recommended Improvements

It is anticipated that replacement of the existing culvert will be scheduled concurrent with the eventual reconstruction of Jackson, irrespective of the priority computed for the structure replacement. At that time, replace the existing 12'x6' RCB with a double 8'x6' RCB; the profile grade of Jackson should be established to provide not less than 2.5' of allowable headwater depth above the crown elevation of the culvert inlet. The estimated cost for the culvert replacement includes only the new structure proper, plus associated engineering and contingent costs. All other costs for the new structure (earthwork, removal of existing structure, etc.) are considered as included in the eventual roadway construction cost for reconstruction of Jackson.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: 30th & McClelland Storm Sewers

Project Identification Number: 3-6

Pertinent Data Summary

Watershed:	Water Works
Priority No.:	16
Design Capacity:	Varies: 380-500 cfs (10-year)
Estimated Cost:	$666,278
Model ID No.:	3375, 3376, 3377
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	15-27-33 & 16-27-33

Existing Problem Description

These three reaches of the system provide roughly a 2-year level of service; for greater events, structure flooding occurs at 2 office buildings along 29th west of McClelland. In addition, for events greater than 2-year, ponding depths in a sump area on McClelland at 30th Street can exceed 1.5 ft.

Recommended Improvements

Retain the existing system in place, and construct a 60" RCP relief sewer. The upstream end of the relief sewer would be immediately east of the upstream end of existing reach 3377; from that point, the relief sewer would extend east to McClelland, then south along McClelland to a point north of and adjacent to the existing reach 3376 crossing of McClelland, then along and adjacent to reaches 3376 and 3375 to the lower end of 3375. The diverted discharge under a 10-year event would vary from 200 cfs west of McClelland to 220 cfs along and downstream of McClelland. The two systems should act in combination to limit headwater elevations at the upper end of 3377 to approximate elevation 978, providing a 10-year level of protection to the office buildings along 29th west of McClelland. Should a higher level of service be desired, it is recommended that floodproofing of openings beneath the main floor elevation of the buildings be considered.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 5th & Murphy

Project Identification Number: 4-1

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	12
Design Capacity:	1,640 cfs (2-year)
Estimated Cost:	$391,094
Model ID No.:	4000, 4005
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	2-27-33

Existing Problem Description

The existing 3-7'x6' RCB beneath the intersection of 5th & Murphy is in very poor structural condition, and presently provides slightly less than a 1-year level of protection to the overlying roadways. The hydraulic capacity of this structure (4005) is directly influenced by headwater elevations at reach no. 6085 (4th St. culvert on Joplin Creek), which is scheduled for replacement under Project No. 6-1, and is limited by the relatively low elevation of the roadway. Following completion of Project 6-1, the headwater elevation at 6085 under a 10-year event will be slightly above the roadway elevation at 5th & Murphy. As a result, it is not considered practicable to provide a 10-year level of service at 4005, at least for storm events in which both Joplin Creek East and Joplin Creek West are contributing to discharge at 6085.

Recommended Improvements

It is recommended that Structure 4005 be replaced with a 3-10'x6' RCB, and that the approximately 250 ft. of existing channel downstream of 4005 and upstream of the confluence of Joplin Creek West with Joplin Creek East be improved to the hydraulic equivalent of a gabion-lined rectangular channel having a bottom width of 30 feet and a lined height of roughly 7 feet; a similar channel improvement should be included upstream of 4005 for a length of roughly 50 feet. Those improvements can be expected to result in a 2-year level of service at 4005 for an instance in which both Joplin Creek West and Joplin Creek East are contributing to flow at 6085; for an instance in which Joplin Creek West is the primary contributor of flow at 6085 (e.g., little or no inflow from Joplin Creek East at 6085), those improvements would result in a level of service approaching 10 years at 4005.

Downstream Controls: None. However, this project will not operate at its design capacity until completion of Project No. 6-1.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: 6th St. Relief Sewers, Virginia to Byers

Project Identification Number: 4-2

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	1
Design Capacity:	500 cfs (25-year diversion rate)
Estimated Cost:	$2,469,834
Model ID No.:	4045, 4050
Map Reference Numbers:	
Master Plan Mapping:	4, 5
Topographic (Section):	3-27-33, 10-27-33

Existing Problem Description

Throughout this reach, which extends from a point east of Virginia at 6th to a sump area in Byers north of 7th, the existing storm sewers provide in-system capacity roughly equal to a 2-year event, and pass directly beneath several commercial structures. The deficient storm sewer capacity, coupled with the lack of an effective surface overflow system, leads to frequent damages to commercial properties (approximately 12-15 properties at a frequency of from 2-5 years), as well as widespread surface flooding and ponding in the downtown area of Joplin.

Recommended Improvements

Construct a system of relief sewers to increase in-system capacity. Given the lack of an effective surface overflow system, the recommended rate of diversion is roughly 500 cfs throughout this reach, resulting in approximately a 25-year level of service. The relief system includes approximately 920 ft. of 7'x5' RCB extending west along 6th St. from the outlet of the existing system (roughly 100 ft. east of Virginia), constructed at a slope of roughly 0.90% and intersecting the existing 12'x4' RCB at its 6th St. crossing; and approx. 1,270' of 11'x5' RCB continuing west along 6th to Byers and south along Byers to the existing 8'x5' RCB crossing Byers north of 7th St. (approx. 0.3% slope).

Downstream Controls: None.

Potential Alternative: Should it be desired to limit the improved in-system capacity to a 10-year level of service, the diversion rate would reduce to approximately 350 cfs, and the height of the proposed relief sewers would reduce from 5' to 4'.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Moffett Relief Sewers, 7th to 8th

Project Identification Number: 4-3

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.: 13	
Design Capacity:	200 cfs (10-year diversion rate)
Estimated Cost:	$625,790
Model ID No.:	4055, 4060
Map Reference Numbers:	
Master Plan Mapping:	4, 5
Topographic (Section):	3-27-33, 10-27-33

Existing Problem Description

Throughout this reach, which extends from a sump on Byers north of 7th St. to a point on 8th St. between Sergeant and Jackson, the existing storm sewers provide in-system capacity roughly equal to a 3-year event, and pass directly beneath and immediately adjacent to several residential structures. Demand discharges exceeding system capacity are carried along the curbed street system, leading eventually to the sump area on Byers north of 7th. Street flooding can be expected at roughly 3-5 year frequencies; damage to up to approximately 4 residences can be expected at return periods of 10 years or greater.

Recommended Improvements

Construct a system of relief sewers to increase in-system capacity. The relief system includes approximately 1,480 ft. of 60" dia. RCP. The lower end of the relief sewer would connect to the upper end of Project No. 4-2 in Byers north of 7th St. From that point, the relief sewer would be constructed south along Byers to 8th St., then west along 8th St. to the alley west of Sergeant, where it would connect to the lower end of an existing 9'x5' RCB (4067).

Downstream Controls: Project No. 4-2 should be completed prior to completion of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Connor Ave. Relief Sewers, 9th to 10th

Project Identification Number: 4-4

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	8
Design Capacity:	Varies, 150-230 cfs (10-year diversion rate)
Estimated Cost:	$508,880
Model ID No.:	4070, 4073
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	10-27-33

Existing Problem Description

Throughout this reach, which extends upstream from an existing 9'x5' RCB in 9th St. west of Jackson to 10th & Chestnut, the existing system is rated at roughly a 2-year capacity. Overflows are carried in the curbed street system, eventually leading to a sump area on Byers north of 7th St. Significant street flooding can be expected at intervals of less than 5 years; structure flooding would not be anticipated until roughly a 10-year event, with approximately 4 houses affected at that frequency.

Recommended Improvements

Construct a system of relief sewers to increase in-system capacity. The design capacity of the relief system varies from 230 cfs at the lower end (in 9th) to 150 cfs at the upper end (10th & Chestnut). The system would consist of approximately 300' of 5'x5' RCB in 9th St., extending west to Connor from the existing 9'x5' RCB (4067); 250' of 60" RCP in Connor, extending south from 9th to the existing 8'x3' RCB crossing Connor; and 550' of 54" RCP extending south along Connor to 10th, and west along 10th to Chestnut.

Downstream Controls: Project No. 4-3 should be completed prior to completion of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Picher Ave. Channel Improvements, 10th to Junge

Project Identification Number: 4-5

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	17
Design Capacity:	Varies, 270-360 cfs (10-year)
Estimated Cost:	$530,530
Model ID No.:	4075-4095
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	10-27-33

Existing Problem Description

Throughout this reach the existing system is rated at roughly a 2-year capacity. Discharges exceeding system capacity result in overtopping of Murphy, 11th, and 12th; in addition, a sump area on 12th at Empire will pond to objectionable depths at intervals of one year or less. It is estimated that 2 structures will receive damage at a 2-year frequency, and 2 additional structures will receive damage at a 5-10 year frequency.

Recommended Improvements

The existing open channel between the intersection of 10th & Chestnut (upstream end of Project 4-4) and the outlet of str. 4100 (8'x3.9' RCB beneath Junge) should be reconstructed to the hydraulic equivalent of an 8' wide concrete lined rectangular channel, 4' wall height. In addition, 2-30" CMP storm sewers draining the sump area on 12th at Empire should be replaced with a 5'x2.5' RCB. The recommended improvements will increase the rated capacity of existing culverts along this reach to 10-year; however, replacement of the existing culvert beneath Murphy (4077) is recommended due to its relatively poor structural condition.

Downstream Controls: Project No. 4-4 should be completed prior to completion of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Maidenlane Storm Sewers, 17th to 20th

Project Identification Number: 4-6

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.: 42	
Design Capacity:	Varies, 60-85 cfs (10-year)
Estimated Cost:	$593,339
Model ID No.:	4135, 4140, 4145
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	10-27-33

Existing Problem Description

Throughout this reach the existing system is rated at roughly a 2-year capacity. Discharges exceeding system capacity result in flooding of the northbound lanes of Maidenlane. In addition, the nature of the existing system (open channel on street right-of-way, little or no shoulder, guard rail at the edge of the travelled way) leads to substandard roadway cross section geometrics. No structure flooding is anticipated to result from the deficient hydraulic capacity of the system.

Recommended Improvements

Replace the existing undersized open channel along the east side of Maidenlane between 17th and 20th with enclosed storm sewers. The existing 5'x3' RCB beneath 17th has adequate capacity, and can be retained in place. From that structure, extend a 4'x3' RCB upstream to 19th; construct a 54"x34" RCHEP from 19th to 20th.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 7th E/O Kentucky

Project Identification Number: 4-7

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	2
Design Capacity:	500 cfs (25-year)
Estimated Cost:	$165,140
Model ID No.:	4156
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	11-27-33

Existing Problem Description

The existing 5'x3'RCB across 7th St. provides significantly less than a 2-year level of service. The limited capacity of this crossing prevents full utilization of the upstream system, which is rated at roughly a 5-year capacity. The lack of in-system capacity is made even more significant by the presence of sump areas upstream; significant system overflows result in damage to structures, with such damages occurring to an estimated 4 properties at roughly 2-year intervals due primarily to the constricted opening at the 7th St. crossing.

Recommended Improvements

Replace the existing 5'x3' RCB with an 8'x5' RCB across 7th, having an overall length of approximately 180 ft. The proposed culvert is sized for a 25-year return period, given the lack of a suitable overflow system upstream.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Kentucky Relief Storm Sewers, 7th to 10th

Project Identification Number: 4-8

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	3
Design Capacity:	130-150 cfs (10-25 year overflow)
Estimated Cost:	$648,041
Model ID No.:	4160, 4165
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	11-27-33

Existing Problem Description

Upon completion of Project 4-7, the existing major system from 7th east of Kentucky to 10th and Main has adequate capacity for roughly a 5-year event. System overflows will gather in a sump area on Kentucky, generally extending from 8th to 9th. The lack of an effective overflow system from that sump area can be expected to lead to damage to roughly 8 structures at intervals of from 5-10 years.

Recommended Improvements

Construct a system of storm sewers to intercept and convey system overflows to the upper end of Project 4-7 (reach 4156, culvert beneath 7th east of Kentucky). That system should be designed to accept overflows ranging from 150 cfs at 8th St. to 130 cfs at 10th & Pennsylvania. Proposed improvements include: parallel the existing 6'x5' RCB in the alley east of Kentucky between 7th and 8th with a 60" RCP; construct a new 60" RCP in 8th from the alley west to Kentucky, and along Kentucky south to 9th; construct a new 48" RCP in 9th west from Kentucky to Pennsylvania, and south along Pennsylvania to 10th. Those improvements are intended to result in a 25-year level of protection to the adjacent buildings.

Downstream Controls: Project No. 4-7 should be completed in advance of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Structure Replacement, Main Street at 10th

Project Identification Number: 4-9

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	43
Design Capacity:	300 cfs (5-year)
Estimated Cost:	$47,269
Model ID No.:	4166
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	11-27-33

Existing Problem Description

The existing 6'x4.5' stone masonry arch across Main at 10th is in poor structural condition; the top slab consists of stone supported by heavily-corroded iron members.

Recommended Improvements

Replace the existing crossing with a 6'x5' RCB; the existing system upstream and downstream of the crossing provides roughly a 5-year level of service, which is the recommended level of service for this structure replacement.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Joplin Ave. Storm Sewers, 11th to 12th

Project Identification Number: 4-10

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	30
Design Capacity:	310 cfs (10-year)
Estimated Cost:	$329,443
Model ID No.:	4177, 4178
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	10-27-33

Existing Problem Description

Reach No. 4177 consists of approx. 250' of 6'x4' RCB along the east side of Joplin north of 11th; this line provides a 2-year level of service, and limits the capacity of the upstream system (8'x4' RCB, reach no. 4178), which would otherwise provide roughly a 5-year level of service. Overflows from 4178 follow 12th St. to Joplin, and then north along Joplin. For the system as it exists, it is estimated that 4 structures may be subject to damage at intervals of 5-10 years.

Recommended Improvements

Replace the existing 6'x4' RCB (4177) with an 8'x5' RCB. Extend a 42" RCP south along Joplin to 12th St. to pick up overflows from reach no. 4178 (8'x4' RCB in the alley west of Joplin); the design overflow rate for this segment is roughly 50 cfs during a 10-year event.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Structure Replacement, 14th St. W/O Joplin Ave.

Project Identification Number: 4-11

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	49
Design Capacity:	N.A.
Estimated Cost:	$222,211
Model ID No.:	4181
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	10-27-33

Existing Problem Description

Reach No. 4181 consists of approx. 330' of 6'x4' RCB along the alley west of Joplin, extending north of 14th St. The existing structure is adequately sized for hydraulic requirements, but has structurally failed.

Recommended Improvements

Replace the existing structure with a new 6'x4' RCB, replacing the original hydraulic capacity.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Iowa Ave. Storm Sewers, 20th to 24th

Project Identification Number: 4-12

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	36
Design Capacity:	210-320 cfs (10-Year)
Estimated Cost:	$1,379,048
Model ID No.:	4292, 4296, 4298
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	14-27-33

Existing Problem Description

Throughout this reach, the existing storm sewers are rated at much less than a 2-year capacity. Despite that deficiency, no structures are known to flood, although it is probable that ponding depths in Iowa become excessive (hindrance to traffic) frequently.

Recommended Improvements

Replace the existing system with new storm sewers extending south from 20th St. (structure 4290) along the east side of Iowa to 24th Street. Downstream of 22nd St., the existing 58"x36" CMPA would be replaced with an 8'x4' RCB; upstream of 22nd St., the existing 58"x36" CMPA would be replaced with a 6'x4' RCB.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Indiana Ave. Storm Sewers, 20th to 22nd

Project Identification Number: 4-13

Pertinent Data Summary

Watershed:	Joplin Creek West
Priority No.:	35
Design Capacity:	250-330 cfs (10-Year)
Estimated Cost:	$1,324,861
Model ID No.:	4286, 4287, 4288, 4318
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	14-27-33

Existing Problem Description

Throughout this reach, the existing storm sewers are rated at much less than a 2-year capacity. Despite that deficiency, no structures are known to flood at frequent intervals, although it is probable that ponding depths in Indiana south of 20th become excessive (hindrance to traffic) frequently. In addition, objectionable surface overflows on properties east of Indiana and on the school property west of Indiana can be expected annually.

Recommended Improvements

Construct a new relief sewer from the upstream end of 4290 (dbl. 6'x4' RCB across 20th) to the downstream end of reach 4288 (sump on Indiana), parallelling existing reaches 4286 and 4288; the relief sewer would be a 5'x4' RCB extending on a direct route across the school property, designed for a relief rate of discharge of 200 cfs. Replace reach 4288 (Indiana Avenue crossing) with a 7'x4' RCB; replace reaches 4289 (48" RCP) and 4318 (65"x40" CMPA) with a 6'x4' RCB.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 32nd W/O Schifferdecker
Project Identification Number: 5-1

Pertinent Data Summary

Watershed:	McClelland
Priority No.:	34
Design Capacity:	290 cfs (10-year)
Estimated Cost:	$56,912
Model ID No.:	5085
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	17-27-33

Existing Problem Description

The existing culvert consists of 4-27" vitrified clay pipes providing less than a 5-year capacity. The hydraulic deficiency of this structure is masked under events having return periods of 2 years and less due to the influence of existing detention storage east of Schifferdecker north of 32nd St.

Recommended Improvements

Replace the existing structure with a 10'x4' RCB.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Schifferdecker N/O 32nd
Project Identification Number: 5-2

Pertinent Data Summary

Watershed:	McClelland
Priority No.:	34
Design Capacity:	230 cfs (10-year)
Estimated Cost:	$79,024
Model ID No.:	5105
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	16-27-33

Existing Problem Description

The existing culvert consists of 2-24" RCP's providing roughly a 2-year capacity. The true hydraulic deficiency of this structure is masked under events having return periods of 2 years and less due to the influence of existing detention storage east of Schifferdecker north of 32nd St.

Recommended Improvements

Replace the existing structure with a 10'x4' RCB. In order to develop adequate cover over the RCB, it will also be necessary to improve roughly 150 feet of the downstream channel in order to lower the channel invert. The lining is expected to consist of the hydraulic equivalent of a concrete-lined trapezoidal channel having a bottom width of 8 feet and a lined depth of 3 feet.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 4th St. East of Murphy

Project Identification Number: 6-1

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	6
Design Capacity:	5,200 cfs (10-year)
Estimated Cost:	$1,000,805
Model ID No.:	6085
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	2-27-33

Existing Problem Description

The existing culvert consists of a triple 10'x7' RCB beneath 4th Street. The culvert is rated at slightly less than a 2-year capacity, and is in an advanced state of structural deterioration. An 8-inch utility line is supported from the downstream face of the structure at an elevation below the crown of the culvert.

The structure acts as a significant obstruction to flow in Joplin Creek immediately downstream of the confluence of the Joplin Creek East and West primary tributaries. Backwater from this culvert inundates an existing structure at the intersection of Murphy and 5th under a 2-yr. event, as well as industrial yard areas on the left bank of Joplin Creek East downstream of 5th (2 year frequency) and industrial/commercial structures in that same area (approx. 20-year frequency).

Recommended Improvements

Replace the existing structure with a triple 20'x9' RCB; raise the profile of 4th St. along a length of approx. 500' extending east from Murphy, approx. min. roadway el. 967.0. Construct PCC paved downstream transition to the existing channel, approx. 140' long; construct PCC paved upstream transition to existing Joplin Creek East and West channels, total length upstream of structure of approx. 140' (includes approx. 80' along each channel).

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 5th and Division

Project Identification Number: 6-2

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	7
Design Capacity:	2,460 cfs (10-year)
Estimated Cost:	$951,180
Model ID No.:	6090, 6095
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	2-27-33

Existing Problem Description

The existing culvert consists of a 6' high concrete box culvert, having a basic width of 14 feet, roughly 220' in length. The inlet end (beneath the intersection of 5th and Division) is a double 6.5'x6' RCB in extremely poor structural condition. That inlet section is then followed by a 14'x6' RCB passing beneath the Drillers Supply Co. building; 12" columns supporting the building are situated at the mid-span of the box. Downstream of the building, the box is a true 14'x6' RCB. The downstream channel (reach 6090) is rock rubble lined and of irregular cross section.

The limited conveyance of the downstream channel results in damage to structures at a return period of roughly 25 years (after completion of project 6-1), and contributes to the limited capacity of the culvert, which is rated at but slightly greater than a 1-year return period. Backwater from this structure adversely affects the performance of the triple 12'x6' RCB railroad culvert just upstream, as well as the performance of a 48" culvert beneath 5th St. just upstream of the railroad (6103).

Recommended Improvements

Replace the existing structure with a double 14'x6' RCB constructed on a curvalinear alignment, generally following 5th St., between the existing termini of the structure. Improve the downstream channel (6090) to a gabion-lined trapezoidal section having a bottom width of 20' and 2:1 side slopes lined to a depth of 7'; the channel improvement would extend downstream to the approach transition to the proposed 4th St. culvert (6085). Extend a rectangular concrete channel between the upstream sidewalls of the new 2-14'x6' RCB and the existing 3-12'x6' RCB beneath the railroad.

Downstream Controls: Project No. 6-1 should be completed in advance of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: 8th and Patterson Storm Sewers

Project Identification Number: 6-3

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	26
Design Capacity:	125 cfs (10-year @ 6230, 5-year @ 6222)
Estimated Cost:	$284,577
Model ID No.:	6222, 6230
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	12-27-33

Existing Problem Description

Line 6230 extends south from 7th St. along Patterson, eventually discharging to open channel south of 8th St. west of Patterson. A sump is present on Patterson north of 8th; ponding depths can exceed 2' in Patterson prior to surface overflow from the sump. The capacity of this storm sewer is much less than 2-year, leading to frequent ponding of excessive depth in Patterson.

At the downstream end of the open channel, flows are carried beneath newly constructed 9th St. through 3-30" RCPs; those culverts are in poor condition. An existing 6'x4' RCB railroad culvert is situated immediately downstream of 9th; 9th was constructed too low to take advantage of the available capacity in this structure. New duplexes just north of 9th are subject to damage during 9th St. overflows.

Recommended Improvements

Replace line 6230 with a 48" RCP from the south curb line of 7th St. to the existing downstream terminus of the pipe. Replace the existing 3-30" RCPs beneath 9th St. with a 6'x3.5' RCB (top slab as roadway surface).

It is not recommended that 9th St. be raised, as upstream residences would be adversely impacted by increased headwater depths. It is not considered reasonably practicable to obtain a full 10-year level of service for the 9th St. culvert.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Connecticutt Ave. North of 26th

Project Identification Number: 6-4

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	40
Design Capacity:	125 cfs (10-year)
Estimated Cost:	$43,833
Model ID No.:	6315
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	14-27-33

Existing Problem Description

The existing 2-24" RCPs culvert afford less than a 1-year level of protection to Connecticutt (south of the culvert) and to existing upstream buildings. Computed demand discharges at this location have been greatly reduced to reflect the operation of an existing railroad culvert roughly 1,400' upstream (below subarea 6315) as an unplanned detention area. The actual capacity of this culvert is reduced due to its presence in the headwater pool of an additional unplanned detention area upstream of a 3'x3' RCB railroad culvert west of Connecticutt.

Recommended Improvements

Replace line 6315 with a 60" RCP; the available head loss across this structure is limited to slightly over 1' due to storage elevations in the unplanned detention area formed by the 3'x3' railroad culvert (6312).

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Connecticutt Ave. South of Campbell

Project Identification Number: 6-5

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	15
Design Capacity:	1,200 cfs (10-year)
Estimated Cost:	$156,000
Model ID No.:	6320
Map Reference Numbers:	
Master Plan Mapping:	5
Topographic (Section):	12-27-33

Existing Problem Description

The existing triple 54" CMP affords roughly a 1-year level of service prior to overtopping of Connecticutt.

Recommended Improvements

Replace the existing structure with a double 10'x5' RCB constructed at roughly a 25-degree skew to Connecticutt to align with the stream.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 15th St. East of Delaware

Project Identification Number: 6-6

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	32
Design Capacity:	1,060 cfs (10-year)
Estimated Cost:	$207,000
Model ID No.:	6330
Map Reference Numbers:	
Master Plan Mapping:	8
Topographic (Section):	12-27-33

Existing Problem Description

The existing double 66" RCP affords roughly a 1-year level of service prior to overtopping of 15th Street. The alignment of the existing structure contributes to debris accumulation and blockage in the westerly culvert.

Recommended Improvements

Replace the existing structure with a double 10'x5' RCB constructed at roughly a 30-degree skew to 15th Street to align with the stream.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: 16th and Texas Storm Sewers

Project Identification Number: 6-7

Pertinent Data Summary

Watershed: Joplin Creek East
Priority No.: 5
Design Capacity: Varies; 270-65 cfs (10-year)
Estimated Cost: $774,332
Model ID No.: 6351-6367
Map Reference Numbers:
Master Plan Mapping: 5,9
Topographic (Section): 12-27-33

Existing Problem Description

Throughout this reach of the system, which extends from the intersection of 16th and Texas to the west side of Range Line Road north of 15th Street, the existing system is rated at markedly less than 2-year capacity. Approximately 8 residences and 3 street crossings are subjected to frequent surface overflows, and are occasionally damaged thereby. Approximately 10 additional residences are regularly subjected to fairly wide spread, slowly draining storm water.

Recommended Improvements

Reconstruct this entire reach. The following is a summary listing of anticipated improvements:

Line No.	Disch. (cfs)	Length (ft)	Size	Slope (%)	Remarks
6355	270	350	8'x4' RCB	0.43	Follow Texas to NLL*
6359	270	300	8'x4.5'	0.27	PCC lined ditch
6363	240	290	6'x4' RCB	0.70	Crossing 15th
6365	180	350	6'x4.5'	1.40	Gabion lined ditch
6366	120	100	48" RCP	1.00	Crossing Highview
6367	65	500	36" RCP	2.00	End at 4'x2.5' RCB

* North Lot Line, 2nd tier of lots south of 15th

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Davis Blvd. Detention Basin

Project Identification Number: 6-8

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.: 9	
Design Capacity:	Varies; 370/46 cfs (100-year)
Estimated Cost:	$502,275
Model ID No.:	6435
Map Reference Numbers:	
Master Plan Mapping:	9
Topographic (Section):	18-27-32

Existing Problem Description

The existing system between 20th St. at Texas and Davis Blvd. roughly 1/4-mile south of 20th St. has insufficient hydraulic capacity, with capacities generally ranging from 2 to 5 years. Construction of this detention basin will reduce or eliminate the need for improvements along 20th between Texas and Range Line, as well as replacement of the Davis Blvd. culvert (line no. 6435); it will also make practicable the improvements recommended for Project No. 6-9, and will substantially reduce the design discharges for Projects 6-5 and 6-6.

Recommended Improvements

Construct a stormwater detention basin just east of Davis Blvd. at a point roughly 1/4-mile south of 20th St. The basin would control discharges from a 148-acre area for all events up to and including the 100-year event, and should provide an active storage of roughly 30 acre-feet with a maximum controlled discharge of 46 cfs.

Downstream Controls: This project should be completed prior to Projects 6-5, 6-6 and 6-9, as the design of those projects will be influenced by the presence of this detention basin.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Range Line Rd. S/O 20th St.

Project Identification Number: 6-9

Pertinent Data Summary

Watershed:	Joplin Creek East
Priority No.:	18
Design Capacity:	Varies; 400 cfs (10-year)
Estimated Cost:	$426,600
Model ID No.:	6417
Map Reference Numbers:	
Master Plan Mapping:	9
Topographic (Section):	18-27-32

Existing Problem Description

Structure No. 6415 consists of a 2-8'x3.2' RCB beneath Range Line Rd., and is rated at roughly a 10-year capacity. Just upstream of this structure, the main drainage channel passes beneath commercial entrances off Range Line through 6417, which consists of 3-65"x40" CMPA's having substantially less than a 2-year capacity. The restriction imposed by these culverts and the upstream 300' of open channel (downstream of Geneva) results in damage to commercial properties (in particular the Thunderbird Motel) under less than a 2-year event.

Recommended Improvements

The design rates of discharge are developed upon the assumption that the Davis Blvd. Detention Basin (Project No. 6-8) has been constructed. Structure 6417 should be removed; the existing 2-8'x3.2' RCB beneath Range Line should be extended approximately 185 feet; between the upstream end of that extension and Geneva (a length of approx. 330 feet), the open channel should be improved to a rectangular concrete-lined open channel having a bottom width of 16'-8" and sidewall heights of roughly 5 feet. In order to further improve the level of protection afforded the Thunderbird Motel, it is recommended that an earthen fill be placed along the left bank of the channel for a length of roughly 300 feet downstream (south) of the south end of Geneva, tieing to higher ground at elevation 1040.0.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Replacement Sewer, Maiden Lane N/O 7th

Project Identification Number: 7-1

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.: 27	
Design Capacity:	300 cfs (10-year)
Estimated Cost:	$87,387
Model ID No.:	7182
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	3-27-33

Existing Problem Description

Reach 7182 consists of a 79"x49" CMPA crossing Maiden Lane and extending into the McDonald's parking lot northeast of the intersection of Maiden Lane with 7th, and is one part of what is essentially an enclosed system extending upstream to the alley south of 7th and west of Maiden Lane. Immediately upstream of the CMPA, the system consists of an 8'x4' RCB; the CMPA discharges to 2-60" RCP's. This reach represents a severe restriction in the overall capacity of the enclosed system, providing less than a 2-year level of service; the balance of the enclosed system would provide in excess of a 10-year level of service upon removal of the restriction. No structures are known to frequently flood as a result of the deficient hydraulic capacity, but nuisance flooding to 2 properties and excessive ponding depths in the sump on Maiden Lane can be expected at intervals of 2 years or less.

Recommended Improvements

Replace the existing 79"x49" CMPA with an 8'x4' RCB; the replacement extends from the west curb line of Maiden Lane to the upstream end of the 2-60" RCP's on the McDonald's parking lot.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 6th W/O Porter

Project Identification Number: 7-2

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.:	20
Design Capacity:	380 cfs (10-year)
Estimated Cost:	$307,035
Model ID No.:	7165, 7170, 7175
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	3-27-33

Existing Problem Description

The existing 5'x4' RCB beneath Porter (7170) provides less than a 2-year level of protection against overtopping of the street. The existing unlined ditches upstream and downstream of 6th St. provide less than 2-year capacity at bank full, and exhibit significant erosion.

Recommended Improvements

Improve the open channels between the upstream end of line 7160 (5'x5' RCB at 5th west of Porter) and the downstream end of line 7180 (2-60" RCP east of Maiden Lane south of 6th) with a gabion lined channel having a bottom width of 8 ft., a lined depth of 3 feet, and side slopes of 3:1. Replace the existing 5'x4' RCB beneath 6th west of Porter with an 8'x4' RCB.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, A St. W/O Porter

Project Identification Number: 7-3

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.:	44
Design Capacity:	730 cfs (10-year)
Estimated Cost:	$88,529
Model ID No.:	7090
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	3-27-33

Existing Problem Description

The existing 3 cell 6.5'x3.5' RCB beneath A St. provides roughly a 5-year level of protection against overtopping of the street, and is in fairly poor structural condition. The above dimensions of the box are nominal; the total cross-sectional area of the box is roughly 60 square feet.

Recommended Improvements

Replace the existing structure with a 3-7'x3.5' RCB, increasing the waterway area by roughly 20-25%. The primary need for this project is replacement of the existing structure due to its advancing state of structural deterioration.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Removal, B St. W/O Porter

Project Identification Number: 7-4

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.:	28
Design Capacity:	770 cfs (10-year)
Estimated Cost:	$62,626
Model ID No.:	7075
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	3-27-33

Existing Problem Description

The existing 3 cell 6.5'x3.5' RCB beneath B St. provides roughly a 2-year level of protection against overtopping of the street, and is in poor structural condition. The above dimensions of the box are nominal; the total cross-sectional area of the box is roughly 60 square feet. The limited hydraulic capacity of the structure is due in part to the presence of roughly a 45-degree bend in the culvert barrels.

Recommended Improvements

B Street immediately west of this structure is presently closed, but is used for private parking by a commercial interest northwest of the structure. It is recommended that this structure be removed in total and replaced with an open channel matching the cross section of the upstream and downstream improved open channels.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, C St. W/O Porter

Project Identification Number: 7-5

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.:	25
Design Capacity:	900 cfs (5-year)
Estimated Cost:	$190,801
Model ID No.:	7065
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	3-27-33

Existing Problem Description

The existing 3 cell 6.5'x3.5' RCB beneath C St. provides less than a 2-year level of protection against overtopping of the street. The above dimensions of the box are nominal; the total cross-sectional area of the box is roughly 60 square feet. The capacity of the structure is limited by the alignment of the Eagle Picher retaining wall immediately downstream, which largely blocks the exit from the westerly cell of the structure. The existing channel upstream of C St. is improved (12 ft. bottom width, 4.5 ft. depth, 20 ft. top width, grouted rock lining), and provides a bankfull capacity (with no backwater from structure 7065) of roughly 900 cfs (approximately a 5-year level of service).

Recommended Improvements

Replace the existing structure with a new 2-8'x4.5' RCB, located east of the existing structure and crossing C St. on approximately a 45-degree skew. Realign the upstream channel to provide a smooth transition from the existing channel to the new structure.

The additional height of the structure (as compared to existing) would be accommodated by lowering the channel invert roughly one foot, requiring roughly a 150-ft. downstream extension of the channel improvement.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: B St. Storm Sewers, Harlem to Empire

Project Identification Number: 7-6

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.: 23	
Design Capacity:	350 cfs (10-year)
Estimated Cost:	$796,800
Model ID No.:	7076, 7080
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	3-27-33

Existing Problem Description

Reach No. 7076 consists of approximately 450 ft. of 2-36" RCP storm sewers which provide less than a 2-year level of service. No structures are known to flood as a result of the deficient capacity, but frequent overflows across a parking area and into B Street do occur. That system is preceded by an open channel extending upstream to the intersection of B St. and Harlem; discharges are carried through that intersection by structure 7080 (a 72"x44" CMPA beneath Harlem, and a 49"x32" RCHEP beneath B St.). Reach 7080 provides much less than a 2-year capacity; nuisance flooding on 3 properties occurs almost annually.

Recommended Improvements

Construct an 8'x4' RCB from the open channel southwest of the intersection of B St. and Harlem to the outlet of the existing reach 7076 (at structure 7075).

Downstream Controls: Project 7-3 should be completed in advance of this project.

Potential Alternative: Consider the possibillity of a partial replacement of reach 7076 (where along B St.), followed by construction of a relief sewer continuing west along B St. to the west side of Harlem; the design capacity of the relief sewer would be 200 cfs; structure 7080 and the upstream segment of 7076 would be retained in place.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacements, McCoy & West 1st St.

Project Identification Number: 7-7

Pertinent Data Summary

Watershed:	Lone Elm
Priority No.:	24
Design Capacity:	250 cfs (10-year)
Estimated Cost:	$92,933
Model ID No.:	7082
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	9-27-33

Existing Problem Description

The existing culvert consists of a 48" RCP providing less than a 2-year level of service; nuisance flooding on 3 properties occurs under all events equal to or greater than a 2-year. Two additional properties are subject to nuisance flooding at similar return periods due to the limited capacity of the existing structure beneath West 1st St. west of McCoy.

Recommended Improvements

Replace each of these two structures with an 8'x4' RCB.

Downstream Controls: Project 7-6 should be completed in advance of this project.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Roosevelt S/O 17th
Project Identification Number: 8-1

Pertinent Data Summary

Watershed:	Country Club
Priority No.:	14
Design Capacity:	240 cfs (10-year)
Estimated Cost:	$45,892
Model ID No.:	8100, 8105
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	9-27-33

Existing Problem Description

The existing culverts each consist of 2-36" RCP's providing roughly a 2-year capacity. The downstream structure (8105) is beneath an alley west of Roosevelt; channel improvements have previously been completed downstream of and between these structures; the bankfull capacity of that improved channel approaches the 100-year discharge. The constriction resulting from the presence of 8105 is estimated to result in damage to two upstream residential structures at roughly a 5-year frequency, and influences the performance of the culvert beneath Roosevelt. The constriction at Roosevelt (8100) is estimated to result in nuisance flooding on two properties for events having return periods of 5 years and greater.

Recommended Improvements

Remove structure 8105 (alley culvert) in total, and replace with a connecting segment of improved open channel matching the upstream and downstream cross section. Replace the existing 2-36" RCP culvert beneath Roosevelt with an 8'x3.5' RCB.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Schifferdecker Paved Ditch, Junge to S/O 17th
Project Identification Number: 8-2

Pertinent Data Summary

Watershed:	Country Club
Priority No.: 38	
Design Capacity:	200 cfs (10-year)
Estimated Cost:	$366,593
Model ID No.:	8045, 8056, 8057, 8058, 8059
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	9-27-33

Existing Problem Description

The existing system along the east side of Schifferdecker between Junge and structure 8045 (2-8'x4' RCB south of 17th) provides roughly a 2-year nominal capacity; that capacity cannot be fully realized due to the structural condition of existing entrance culverts. Flooding of Schifferdecker, as well as nuisance flooding on 4 properties east of Schifferdecker, can be expected under 5-year and greater events.

Recommended Improvements

Replace the existing system from structure 8045 to the north side of 16th with a PCC lined channel equivalent to a trapezoidal section having a bottom width of 6 feet, a lined depth of 3 feet, and 3:1 side slopes; construction on easement will probably be required. Construct a 6'x4' RCB beneath 16th at the upper end of the reach and at the lower end, crossing Schifferdecker (augmenting the capacity of structure 8045. At entrances, provide not less than 6'x3' RCB's.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: 20th St. Storm Sewers, W/O Roosevelt
Project Identification Number: 8-3

Pertinent Data Summary

Watershed:	Country Club
Priority No.:	41
Design Capacity:	100 cfs (10-year)
Estimated Cost:	$313,607
Model ID No.:	8108, 8080, 8087
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	9-27-33

Existing Problem Description

The existing system throughout this reach provides less than a 2 year level of protection. Nuisance flooding on roughly 4 properties can be expected at intervals of less than 5 years.

Recommended Improvements

Construct an enclosed system from the existing structure beneath the railroad (reach no. 8090) downstream to a point roughly 1,100 ft. west of Roosevelt and 300 ft. north of 20th. Throughout that length, the proposed sewer would consist of a 48" RCP.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: 24th & Meadow Storm Sewers
Project Identification Number: 8-4

Pertinent Data Summary

Watershed:	Country Club
Priority No.:	47
Design Capacity:	Varies, 85-310 cfs (10-year)
Estimated Cost:	$515,749
Model ID No.:	8022, 8023, 8024
Map Reference Numbers:	
Master Plan Mapping:	7
Topographic (Section):	17-27-33

Existing Problem Description

The existing system throughout this reach provides between a 2 and 5 year level of protection. Nuisance flooding on roughly 7 properties can be expected at intervals of less than 5 years. Downstream of Iron Gates Rd., the lack of gradient in the recently enlarged earthen channel is contributing to a ponded water condition.

Recommended Improvements

Construct an enclosed system from Iron Gates Rd. south of 23rd to Cleveland just south of 24th. From Cleveland to Meadow, the sewer would consist of a 42" RCP; from Meadow to a point upstream of Iron Gates, a 48" RCP; the Iron Gates crossing would be a 5'x4' RCB.

Downstream of Iron Gates, and extending to the railroad bridge (approx. 700' length), construct an improved open channel equivalent to a gabion-lined trapezoid having a bottom width of 8 ft., a lined depth of 4 ft., and 2:1 side slopes.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 2nd St. W/O Walnut
Project Identification Number: 9-1

Pertinent Data Summary

Watershed:	Leadville
Priority No.:	31
Design Capacity:	550 cfs (10-year)
Estimated Cost:	$120,926
Model ID No.:	9070, 9080
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	4-27-33

Existing Problem Description

The existing 6'x6' RCB beneath 2nd St. provides less than a 2-year level of service; replacement of the structure with one of adequate capacity would be of little value without removal of structure 9070 (reinforced concrete arches beneath an abandoned railway grade), as backwater from that structure would flood 2nd St. at slightly more than 2 year intervals. The backwater from the railroad culverts can be expected to result in damage to 4 residential structures under events having return periods of 25 years and greater.

Recommended Improvements

Replace the existing 6'x6' RCB under 2nd St. with a 12'x6' RCB. Remove the existing reinforced concrete arches beneath the abandoned railroad grade.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Perkins W/O Monroe
Project Identification Number: 9-2

Pertinent Data Summary

Watershed:	Leadville
Priority No.: 45	
Design Capacity:	730 cfs (10-year)
Estimated Cost:	$78,480
Model ID No.:	9045, 9046
Map Reference Numbers:	
Master Plan Mapping:	4
Topographic (Section):	4-27-33

Existing Problem Description

The existing 90" RCP beneath Perkins (structure 9046) provides roughly a 5-year level of service; no upstream structures are known to flood as a result of the deficient culvert capacity. The downstream segment of this structure (96" RCP) is exhibiting structural distress; the lower wall of the RCP has failed over roughly a 20-foot length. Structure 9045 consists of a 9'x8' RCB in very poor structural condition beneath an apparently abandoned mining road just downstream of Perkins.

Recommended Improvements

Replace the existing 90" RCP under Perkins with a 9'x7' RCB. Remove the existing 9'x8' RCB downstream of Perkins.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Canterbury Ditch, 3rd to 7th

Project Identification Number: 10-1

Pertinent Data Summary

Watershed:	Turkey Creek Central
Priority No.:	4
Design Capacity:	Varies; 280-480 cfs (10-year)
Estimated Cost:	$583,166
Model ID No.:	10457, 10480
Map Reference Numbers:	
Master Plan Mapping:	6
Topographic (Section):	6-27-32

Existing Problem Description

The existing unimproved ditch along the rear lot line east of Canterbury Lane from 3rd to 7th provides a bank-full capacity roughly equal to a 2-year event; for events having return periods of roughly 10 years, a total of 6 houses can be expected to receive damage.

Recommended Improvements

Recommended improvements include the construction of walled gabion-lined channels extending from 3rd Street (structure 10445) to 7th St. (structure 10485). The existing double arch pipe (structure 10455) beneath Northpark Lane would remain in place. Downstream of that structure, and extending to a point roughly 100 ft. upstream, the improved channel would have a bottom width of 10 feet and a lined height of 6 feet; between the upstream end of that reach and 7th Street, the improved channel would have a bottom width of 8 feet and a lined height of 4.5 feet. The proposed improvements would maintain the 10 year event within banks, and would provide a level of protection approaching 100 years to the affected residential structures.

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, 10th E/O Peters

Project Identification Number: 10-2

Pertinent Data Summary

Watershed:	Turkey Creek Central
Priority No.:	33
Design Capacity:	150 cfs (10-year)
Estimated Cost:	$46,606
Model ID No.:	10505
Map Reference Numbers:	
Master Plan Mapping:	6
Topographic (Section):	7-27-32

Existing Problem Description

The existing 3-24" RCP culvert beneath 10th immediately east of Peters provides roughly a 2-year level of service against overtopping of the roadway. An existing gravel surfaced parking area southwest of the intersection is overtopped at a more frequent interval; a building adjacent to that parking area is subject to damage at intervals estimated to be 10 years or less.

Recommended Improvements

Replace the existing 3-24" RCP culvert with an 8'x3' RCB

Downstream Controls: None.

JOPLIN, MISSOURI
STORMWATER MANAGEMENT MASTER PLAN
CAPITAL IMPROVEMENT PROJECT RECOMMENDATION

Project Name: Culvert Replacement, Zora E/O Park
Project Identification Number: 12-1

Pertinent Data Summary

Watershed:	Royal Heights
Priority No.:	48
Design Capacity:	350 cfs (10-year)
Estimated Cost:	$66,654
Model ID No.:	12035
Map Reference Numbers:	
Master Plan Mapping:	2
Topographic (Section):	25-28-33

Existing Problem Description

The existing reinforced concrete arch culvert provides adequate end area for the design discharge, but is in poor structural condition. The floor on roughly the upstream half of the structure has either washed out or collapsed, and undermining of the walls is in evidence.

Recommended Improvements

Replace the existing culvert with a 6'x6' RCB.

Downstream Controls: None.

Potential Alternative: Investigate the possibillity of structural repair of the existing structure; a slight (10% or less) loss of end area can be accommodated while maintaining the desired 10-year capacity of the structure.

PART VI

RECOMMENDED SYSTEM IMPROVEMENTS

PART VI

RECOMMENDED SYSTEM IMPROVEMENTS

A. ALTERNATIVE SYSTEM COMPONENTS

There are two basic types of drainage system components, "structural" and "nonstructural." Both types must be operated in a complementary way to avoid drainage "problems." Each element of the system has a cost associated with providing it. The goal of this plan is to recommend the best balanced combination of all system elements that will provide an acceptable level of service at the greatest economic benefit to the City as a whole.

1. NONSTRUCTURAL ELEMENTS

Nonstructural elements of a drainage system are generally those elements that don't involve significant capital construction but function as a part of the system of limiting runoff. Their "cost" is primarily measured by generally lowered tax revenue and economic activity, although some direct maintenance cost often applies to their continued performance. Once they become part of the "system" they can't readily be modified because such modifications will increase runoff to the entire downstream system reducing its level of service. Nonstructural elements include the following.

a. Zoning and Land Use

Zoning ordinances prescribe types of land use and density of development which determines, in part, relative runoff rates. Dense land use, such as commercial or industrial development, generates high runoff rates compared to residential or agricultural land use; areas of small lots will generate more runoff than areas developed in large lots. In real estate vernacular, the "highest and best use" of land produces the greatest tax revenue which corresponds with the densest types of development. Down-zoning to reduce runoff, and the associated

cost of the downstream drainage system, reduces the potential revenue from properties. This loss of revenues, then, can be viewed as the "cost" of zoning with respect to drainage.

b. Flowage Easements

Flowage easements involve the acquisition of the right to periodically use a natural channel and its overbank floodway or the overflow channel above an improved conveyance element to convey drainage. In some sense, these easements represent a form of limited conservation zoning in that they preclude any improvement of the land occupied by the easement. Flowage easements follow the natural channel or pipe alignment and vary in width to include all land below the elevation of the design hydraulic gradient plus a freeboard allowance. Representative easement widths are in the range of 50 to 100 feet for natural channels and 15 to 40 feet for improved system facilities. Natural channels and their overbank areas require little initial construction but must be maintained on a regular basis to remove obstructing debris and snags. Overflow channels above enclosed pipes or along improved channels must also be maintained to prevent obstructions to flow. Because these easements are typically located on private property, this responsibility generally falls to the individual property owners.

c. Regulatory Detention

Regulatory detention is the adoption of appropriate ordinances and implementation of regulations that, while permitting intense land uses, require the provision, operation, and maintenance of on-site detention facilities to limit the peak rate of discharge from the owner's, or developer's, site to the downstream system. They require no direct capital investment by the City but have the effect of either diminishing the net developable land by the area required for detention or requiring more costly structures as part of the development. They are most effective when physically located at the upper end of watersheds.

d. Removal of Improvements

The purchase, demolition, and removal of structures subject to damage from drainage is a viable method of providing drainage service to the City as a whole. Drainage "problems" are the damage and/or extreme nuisance resulting from the flow of storm water on private and public property. Removal of the affected improvements is a viable choice in cases where the cost of managing the water is disproportionately large compared with the value of the improvement.

2. STRUCTURAL ELEMENTS

Structural elements of a drainage system are those designed to collect and convey runoff. They include structures that require a significant capital investment to build, and will depreciate over a long period of time. Structural components of the system include conveyance facilities and public detention facilities.

a. Conveyance Facilities

Conveyance facilities are the conventional drainage structures such as:

- Pipes
- Inlets
- Culverts
- Bridges
- Lined open channels

b. Public Detention Facilities

Public detention facilities are ponds, dry ponds, and functionally similar structures constructed with controlled service and emergency spillways that are operated by the City to reduce the peak rate of flow in the drainage system. Land enclosed by some may be capable of other beneficial uses such as open parks and buffer zones between different land use areas. The construction cost of the facility is often moderate when compared with alternative structural conveyance facilities. Because they are

functionally most effective when located near the upper reaches of watersheds, the land occupied is valuable, and its acquisition forms a large part of the cost of their development. They require regular maintenance in the form of mowing and periodic removal of the sediment trapped by the facility.

3. COMPARISON OF ALTERNATIVES

Table VI-1 presents a qualitative comparison of the performance and cost impact typical of the alternative system components.

TABLE VI-1

COMPARISON OF ALTERNATIVES

System Component	Land Area Required	Land Value	Tax Base Effect	Regular Maint. Required	Capital Cost	Depr.
Nonstructural						
Downzoning	None	High	Negative	None	None	None
Flowage Easements	High	Low	None	High	None	None
Regulatory Detention	Moderate	High	Slight	None	None	None
Removal of Improvements	Moderate	High	Negative	None	None	None
Structural						
Enclosed Pipe/Culvert	Low	None	None	Moderate	High	High
Lined Open Channels	Moderate	None	None	Moderate	Moderate	High
Municipal Detention Basin	High	High	Slight	High	Moderate	Low

4. EVALUATION OF ALTERNATIVES

a. Zoning and Land Use

The majority of the undeveloped areas which are zoned for more intense future land uses are located within the Turkey Creek East, Silver Creek, McClelland, Turkey Creek Central, and Baker's Branch watersheds. Most of the undeveloped land is intended for low- to medium-density residential development. Turkey Creek East and Waterworks both contain some areas intended for industrial/commercial development, but are extensions of the existing industrial/commercial areas along Interstate 44.

Analysis of the runoff based on future development indicates that the impact of future developments on downstream drainage

structures does not necessitate a zoning change in these watersheds.

b. Flowage Easements

It is recommended that the City require dedication of flowage easements for all new or reconstructed conveyance elements, including natural channels retained in the system in developing areas, where the 10-year peak discharge exceeds 100 CFS. These easements should cover the overflow area for the element, whether open channel or enclosed system, determined as the 100-year flood elevation plus one foot. Limitations on permanent obstructions within the easement should be included in the dedication. Specific requirements for flowage easements are included in the proposed "Stormwater Management Criteria" document which has been furnished separately to City staff.

c. Regulatory Detention

The City's current drainage policies include the use of regulatory detention in connection with commercial development; however, continuation of this policy as currently applied is not recommended. In general, detention requirements should be based on actual need rather than an arbitrary rule. In most areas where existing problems have been identified, physical space for adequate detention facilities is not available and small, localized basins will not eliminate major problems. It is recommended, therefore, that the detention policy be revised as outlined in the "Stormwater Management Criteria" manual prepared as a separate document from this report.

As a result of the analyses conducted in connection with this study, we have identified certain areas, both interior and exterior to the City's corporate limits, where regulatory detection should regularly be required in connection with any significant new development. Those areas are depicted on Exhibit 1.

d. Removal of Improvements

The removal of improvements was not considered in any of the watersheds. Analysis did not reveal any cases where the cost of managing the water was disproportionately large compared to the value of improvements. Removing structures would not eliminate the street flooding and associated traffic problems or the need for improving the undersized downstream drainage system. Therefore, the removal of structures is not recommended except as a possible interim solution to structure flooding problems, or where demonstrated by subsequent analysis to be more cost-effective than constructing facilities to protect the improvements.

e. Conveyance Facilities

The recommended system improvements primarily involve enlarged or modified conveyance facilities, typically through replacement of existing facilities with larger pipes or box culverts. Open channels currently included in the system were generally retained with channel lining recommended in some instances.

f. Public Detention Facilities

The construction public detention facilities is included in the recommended plan of improvement where appropriate to reduce the extent and cost of downstream improvements.

B. CAPITAL IMPROVEMENT PROJECTS

The location of capital improvement projects recommended by the study to correct deficiencies in the existing drainage system are indicated on Exhibit 1. Projects include one or more deficient modeled reaches of the drainage system that have been grouped to define a project that is logically constructable as an entity and, when complete, will eliminate an existing deficiency within the drainage system.

Although all existing major drainage system components were included in the analysis and problem identification process, not all elements that fail to meet the proposed recommended hydraulic criteria for new construction are included in the project recommendations. Locations where deficiencies are indicated by the analysis but where there are no apparent or reported adverse effects are not recommended for improvement. In addition, facilities such as state highway culverts and privately-owned drainage facilities have not been recommended for improvement since the City does not have jurisdiction over those system elements.

Generally, only those system elements which are currently public facilities and where the existing deficiency has one or more of the following recurring adverse effects are included in the identified projects:

- Building flooding at 25 year or more frequent intervals.

- Overflow of public streets by the 2-year storm for a time duration greater than 15 minutes.

- Erosion on private property due to the direct discharge from public drainage facilities that, if permitted to continue, will eventually either endanger buildings or adversely affect the use of the property.

- Recurring nuisance and the lack of maintenance control created by the uncontrolled discharge of water collected in public right-of-way onto adjacent private property.

Forty-nine improvement projects are recommended to upgrade the existing municipal storm drainage system. Tables VI-2 and VI-3 summarize the projects and the costs included in the recommended improvements program; the total estimated cost of the recommended improvements is $20.782 million in current dollars.

Detailed information for each project is included immediately following this Part VI. It should be noted that the recommended improvements are limited to the major drainage system; there is without question a need for regular improvement to the minor system as well; definition of minor system improvement needs is beyond the scope of this study.

C. BASIS FOR COST ESTIMATES

Cost estimates for the recommended conveyance element improvements were prepared by the SYCOST computer model that generates planning grade estimates for both the capital and annual operating and maintenance cost of storm drainage system components. Although the program is capable of estimating land costs, the cost estimates for the recommended projects assume that all easements necessary for the construction and maintenance of improvements, including flowage easements, will be dedicated by property owners without charge to the City.

The time basis of cost estimates is July, 1996 with a corresponding Engineering News Record Construction Cost Index for the Kansas City Metropolitan Area of 5546. Recent price trends indicate that an annual cost escalation factor of 3 percent compounded annually is appropriate for escalating base year estimates to future year implementation schedules; that escalation rate is consistent with the current recommendations of the federal office of Management and Budget.

D. IMPROVEMENT PRIORITIES

Since there are many elements of the existing city-wide drainage system that do not provide an acceptable level of service, and all cannot be corrected "first," it is necessary for the City to establish priorities on an objective basis. The end objectives in setting these priorities should be to accomplish the following in order:

- Provide an equal minimum level of service to all citizens as soon as possible.

- Upgrade the drainage system as a whole to meet criteria standards for a higher level of service.

- Improve the system in order to yield the best practical benefit for the earliest investment.

- Accomplish the improvement in an order such that any isolated improvement does not add to an existing problem or create a new problem elsewhere.

- Directly benefit as many individual citizens as early as practical and reasonable to maintain continuing support for an orderly prioritized program of improving drainage service.

1. PRIORITY EVALUATION

Priority recommendations for capital improvement projects were formulated through use of the PRIOR computer model.

a. First Order

PRIOR uses the following factors and a calibrated scale of "priority points" to calculate a raw score of "priority points" for each project in the model:

(1) Frequency of Structure and Contents Damage.

(2) Relative Magnitude of Damage

(a) Structural and contents

(b) Erosion

(c) Nuisance

(3) Frequency of Hydraulic Inadequacy

(4) Effect on City Development

(5) Structural Condition of Existing Facility

(6) Magnitude of 10-year Hydraulic Deficiency

(7) Capital Cost per Benefitted Property

b. Second Order

After calculating the raw score, the model differentiates between projects having the same number of total points in the following order:

(1) Frequency of damaged is compared. Projects having the most frequent incidence of damage are assigned the highest priority. If there is no difference in this category then;

(2) Point scores in the structural and contents damage category are compared. Those projects having the higher score in this area are assigned the higher priorities. If there is no difference in this category then;

(3) Point scores in the category of capital cost per benefitted property are compared. Those projects having the lower cost per benefitted property are assigned the higher priority. If there is no difference in this category then;

(4) Point scores in the erosion damage category are compared. Those projects having the higher score in this area are assigned the higher priorities. If there is no difference in this category then;

(5) Point scores in the nuisance category are compared. Those projects having the higher score in this area are assigned the higher priority.

(6) Point scores in the category of absolute project cost are compared. Those projects having the lower cost are assigned the higher priority.

c. System Adjustments

After second order differentiation of priority without regard to the physical hydraulic relationship between projects, priorities are reevaluated on a "system" basis to insure that implementation of a high priority upstream project will not unreasonably worsen downstream conditions. Worsened conditions are defined as:

- Increasing discharge to an area already experiencing structure and contents damage at 10-year or more frequent return periods; or

- Increasing discharge to downstream areas having 2-year or less return period capacity, regardless of any associated damage; or

- Increasing discharge to a downstream area experiencing erosion damage at return periods more frequent than 5 years.

2. RECOMMENDED PLAN PRIORITIES

Exhibit 1 presents the recommended priorities for the recommended improvement projects; the recommended prioritization is also included on the project descriptions following this Part VI. It is important to note that the willingness of potentially benefitted property owners to dedicate easements for the construction of improvements is not a model factor. It is an important factor as the City implements an improvement plan. In addition, the prioritization does not consider the potential influence of other improvement programs on the desired relative timing of the storm drainage improvement projects. For those reasons, the priorities should not be considered as absolute.

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PART VII

OPERATION AND

MAINTENANCE

PART VII

OPERATION AND MAINTENANCE

A. GENERAL

Continuing regular maintenance of the storm drainage system is essential to assure that the system hydraulic capacity is available when storm runoff occurs. It is equally essential to preserve the considerable capital value of the system.

Generally, there is not a clear and accepted line of demarcation between street and drainage maintenance activities and budgets. Maintenance of the storm drainage system shares a need for many of the same types of equipment and labor as is common to sanitary sewer and street maintenance. Because of these common factors, it is logical to assign responsibility for storm drainage system maintenance to the Public Works Department.

The existing maintenance condition of Joplin's drainage system at the time of the field observation activities gave clear evidence of the lack of any systematic maintenance program. Conditions were characteristic of those developing over time under a maintenance program generally limited to responding to emergencies "after-the-fact" on the basis of complaints.

B. MAINTENANCE RESPONSIBILITY

The City currently assumes maintenance responsibility for improved drainage system facilities within the corporate limits and will continue to do so in the future. These facilities include enclosed pipe-inlet systems, road culverts, roadside ditches within city street right-of-way, and improved open channels, generally those which are concrete or riprap-lined. Maintenance of public detention facilities, if constructed in the future, will become the responsibility of the City.

Maintenance of natural or unimproved channels is currently not performed by City personnel which will continue to be policy in the future. Upkeep

of these facilities is the responsibility of the private property owner(s) whose land abuts the channels.

C. ORGANIZATION AND EQUIPMENT

A "typical" storm sewer system maintenance/repair crew would be assigned by the City's Public Works Department and comprised of two laborers, a loader and a dump truck, all from the street maintenance division, with additional personnel and equipment available for specific, larger jobs as needed. This "typical" crew would be capable of performing many of the routine maintenance tasks, described on the following pages, for the existing drainage system.

As the City grows and the system expands, however, additional crews will be required just to perform the routine tasks. The following labor and equipment availability is recommended for eventual normal maintenance of the storm drainage system (see Table VII-1). These recommendations assume that the City will continue its policy of not performing regular maintenance along unimproved channels which is particularly labor intensive. In the event that policy is reversed, additional labor and equipment will be required.

TABLE VII -1

ORGANIZATION AND EQUIPMENT FOR STORM SEWER SYSTEM MAINTENANCE

ITEM	DESCRIPTION	NO.
1.0	LABOR	
1.1	Foreman	1
1.2	Laborers/Equipment Operators	4
2.0	EQUIPMENT	
2.1	Jet Rodder	1
2.2	Industrial Tractor/Loader Backhoe	1
2.3	Tractor/Mower	1
2.4	Concrete Mixer - 3-1/2 cu ft	1
2.5	Portable Generator	1
2.6	Air Compressor	1
2.7	Chain Saws	2
2.8	Truck, Dump Body	1
2.9	Truck, Flat Bed Utility or Pickup	1
2.10	Hand Tools	-

D. MAINTENANCE TASKS

There is not a clear line of demarcation between work classified as maintenance and that more properly classified as construction. City maintenance in the context of this study is defined as work necessary to preserve the capacity and function of an existing facility which can be performed by reasonably available conventional city equipment and labor forces. The following types of maintenance tasks are those necessary to effectively maintain the storm drainage system.

1. INSPECTION

System facilities should be routinely inspected and maintenance scheduled to correct deficiencies noted during the inspection. A systematic method of record keeping should be initiated to record the

inspection and track the maintenance history of individual system components. Routine inspection can be performed by public works maintenance staff personnel with special follow-up inspections by staff professional engineers or consultants in those infrequent instances that the routine inspection identifies any unusual structural or operational defect in the facility. The following is the recommended inspection schedule for the various drainage facilities.

FACILITY TYPE	INSPECTION FREQUENCY
Inlet/Catch Basins	Annual
Open Channels	Annual
Culverts on Open Channels	Annual
Roadside Ditches	Annual
Detention Basins	Annual

Interior inspection of pipe storm sewers is not routinely necessary; however, those sections of pipe having a known history of becoming obstructed due to the entry of debris and sediment from upstream open ditches should be inspected annually. Television inspection is recommended for old existing pipe and box structures not accessible for visual inspection.

2. ROADSIDE DITCHES

Normal recurring maintenance needs are removal of sediment and debris from the ditch and driveway culverts. Although located in street right-of-way, regular mowing in season should be considered the responsibility of the abutting property owner. It is also recommended that replacement of private driveway culverts be the responsibility of the property owner. Since many driveway culverts are older, partly corroded metal pipes, a high initial incidence of failure during or after clean-out should be expected.

The rate of ditch sedimentation will vary across the City. Where grades are steep, the rate will be relatively slow while flatter ditch slopes will result in a higher sedimentation rate. A maintenance interval of two years is suggested for initial programming until

experience in specific areas indicates the need to shorten or lengthen the time period.

3. CULVERTS ON OPEN CHANNELS

Normal recurring maintenance needs are the removal of debris and sediment. Multi-barrel culverts are most prone to the accumulation of obstructing sediment. In areas where maintenance of natural open channels is adequate, the maintenance requirements for culverts will decrease.

Structural repairs such as minor patching of surface spalls, joint sealing, etc., will be necessary during the service life of the structures at irregular intervals. Sediment removal should be expected on an annual basis.

4. LINED OPEN CHANNELS

Annual maintenance requirements are usually limited to the removal of debris. Periodic surface patching and repair of joints in concrete-lined sections should be performed on an as-needed basis. Expansion joints and cracks that permit vegetation to lodge and produce root damage should be treated with an appropriate herbicide to control vegetation. Replacement or repair of lining material in riprap or gabion-lined channels should also be performed on an as-needed basis. Brush or other vegetation which obstructs the channel or causes deformation or displacement of the lining should be cut periodically.

Scheduled storm drainage system maintenance activities, especially those related to the maintenance of open channels, should be planned for the months of November through April to both assure maximum system capacity during the season of heaviest normal rain, and to take advantage of the most favorable conditions for accessibility of the work. Such seasonal scheduling of maintenance is also most conducive to efficient overall utilization of staff and equipment.

E. ANNUAL MAINTENANCE

The City's existing major drainage system includes 59.3 miles of pipe, culverts, and open channels. Average annual expenditures from maintenance of the storm drainage system in Joplin, excluding regular maintenance of unimproved open channels should be on the order of $200,000. With regular maintenance (snagging, etc.) of unimproved open channels, the average annual maintenance expenditures should be on the order of $300,000.

F. MAINTENANCE OF PRIVATE SYSTEM FACILITIES

Regular maintenance of all storm drainage facilities is necessary to insure the system's continuing function at an acceptable level of service. However, maintenance of components which are the responsibility of private property owners is often neglected, especially along natural channels, creating potential drainage problems. Depending on the size and location of the element, its failure to function properly can affect the system as a whole and impact a much larger group than just the residents in the immediate area. Maintenance of private components is generally difficult to regulate or enforce, though, since no ordinances currently exist that explicitly require the performance of such tasks. Annual maintenance of the natural channels comprising the major drainage system would require approximately 2,240 hours. This results in an annual cost to the City of roughly $100,000 for maintaining the natural channels alone. This assumes that drainage easements are acquired from the private property owners and the City is then responsible for maintenance. Alternative methods of dealing with this issue suggested in the following paragraphs will require revisions to municipal ordinances and codes.

To insure that adequate private storm drainage maintenance is performed, the City may want to consider regulations similar to existing codes requiring upkeep of houses, yards, buildings, vacant lots, etc. This approach would include periodic inspections of private drainage facilities, which could be incorporated into the routine inspections recommended for public facilities, with notices of required maintenance issued to property owners as necessary. Once the owner has been notified, a reasonable period of time would be allowed to accomplish the work and a

reinspection made at the end of the period. In the event the required maintenance has not been completed, City crews could perform the work and bill the property owner for the actual labor, equipment and administrative costs. Fines could also be imposed either in addition to, or in lieu of, the City billing the owner for the work. In extreme cases, a "last resort" approach could include revoking the occupancy or use permit for the property or possibly even condemning the property if the problems caused by the lack of maintenance are serious enough.

For private detention facilities, requiring an annual operating permit is also a possible solution to controlling private maintenance. The process would include an annual inspection, notices of required maintenance and follow-up activities similar to those for conveyance facilities. A nominal fee could be required to cover the City's inspection and administrative costs although this would, in a sense, penalize detention systems if similar charges are not required for conveyance facilities.

In addition to the requirements for maintaining the actual drainage system, it is recommended the City adopt a policy and appropriate regulations requiring erosion control plans for all new construction projects. These plans can be as simple as requiring a line of hay bales along the edges of a residential building lot, to a more complex system of silt fencing, filters and siltation ponds on larger projects. This recommendation is intended to prevent siltation on public streets and in the existing downstream drainage system which increases the City's maintenance program and costs.

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PART VIII

FUNDING

PART VIII

FUNDING

A. GENERAL

This section considers alternative methods of funding the City of Joplin's storm drainage system, considering not only the recommended improvements to the major drainage system, but also regular improvements to the minor drainage system and the cost for proper maintenance of the entire system.

The time span over which the capital improvement program is accomplished affects both the cost of the program and the choice of method, or combination of methods, for developing revenue to support the program. Even though it would be desirable to correct all present drainage problems immediately, it is not a practical concept. Besides the financing issues, the City staff available to administer the capital improvement program is a constraint on the speed at which improvements can be made. For the purposes of this analysis, it has been assumed that the desired duration of a capital program including all improvements to the major drainage system recommended in Part VI is no greater than 10 years.

B. FINANCING ALTERNATIVES

There are in essence but two alternatives for funding the recommended improvement projects: cash-basis and debt financing. The cash-basis method assumes that improvements will be constructed only as adequated funds become available from the identified revenue sources. Debt financing would be accomplished through the issuance of municipal bonds of one of the following types: general obligation bonds, revenue bonds and special assessment bonds. Of course, should the City opt to finance the improvement program through the issuance of bonds, it is recommended that a qualified financial advisor be consulted to develop and assess specific proposals and schedules.

1. GENERAL OBLIGATION BONDS

Missouri statutes require the approval of a four-sevenths majority of the voters for issuance of general obligation bonds, which are then typically retired by proceeds from ad valorem taxes.

Under the Missouri Constitution, general obligation bonded indebtedness is limited to 10 percent of the most recent assessed valuation. Given that limitation, the legal debt margin in Joplin is roughly $22,000,000 (based on a November, 1993 total assessed valuation of roughly $220,000,000). The City has recently approved the issuance of $20,000,000 in general obligation bonds for improvements at the Wastewater Treatment Plant. As a result, the use of general obligation bonds is not considered an implementable strategy for the proposed storm drainage improvements.

2. REVENUE BONDS

Revenue bonds require the approval of a simple majority, and are applicable to this discussion assuming the creation of a stormwater utility. Such bonds may be issued to finance improvements to any City utility and are payable solely for the fees collected for the use of that utility. Disadvantages of revenue bonds as compared to general obligation bonds include: greater issuance costs, higher interest rates, and the requirement to fund a debt-service reserve account when the bonds are issued.

Unlike general obligation bonds, indebtedness due to the issuance of revenue bonds are not limited by the Missouri Constitution. However, the use of such bonds can affect the City's credit rating, potentially impacting the rates for both the revenue bonds and any future issuance of general obligation bonds.

3. SPECIAL ASSESSMENT BONDS

The third alternative, special assessment bonds, are also subject to voter approval, and are retired by a combination of city-at-large contributions and special assessments on benefitted properties. Difficulties in application of this alternative are primarily associated with determination of the appropriate relative contributions of city-at-large and special assessment

revenues, and in distribution of assigned benefits to specially assessed properties on an equitable basis. Such bonds have not been typically employed for storm drainage improvements in Missouri, and would tend to place a disproportionate burden on assessed properties. As a result, this potential financing method is not further considered.

C. POTENTIAL REVENUE SOURCES

A number of traditional and innovative financing techniques are available to the City to fund its proposed program, each with its own legal restraints. Explicit statutory authority exists to utilize traditional funding sources such as ad valorem taxes, special assessments, sales taxes, occupational taxes and fees and excise taxes. In addition, authority to utilize innovative funding techniques exists pursuant to the City's home rule power or pursuant to authority implied from specific statutory grants of power including creation of a stormwater utility and imposition of impact fees on new development to recoup the cost of public facilities necessary to support new development. At this time there are no known grants or subsidies available from either state or federal sources specifically for funding storm drainage improvements. Community Development Block Grants can include storm drainage improvements which are incidental to grant projects but are not intended to fund drainage projects as such. There have also been matching funds for storm drainage improvements made available from the federal Economic Development Administration for certain projects in which the potential for urban redevelopment and jobs creation had been limited by the lack of an effective storm drainage system.

1. SALES TAX

The City of Joplin's current sales tax rates include: a 1-percent sales tax with revenues applied to the City's general fund; a 1/2-percent sales tax for transportation improvements; and a 1/8-percent sales tax for funding the "911" emergency response system. Sales taxes in the City of Joplin currently generate roughly $8.7 million annually for each 1-percent sales tax increment.

2. STORMWATER UTILITY

Although commonly utilized in other parts of the country, the utility concept relative to the improvement, operation and maintenance of a municipal storm drainage system has not been extensively employed in the Midwest thus far. In recent years, however, the cities of Wichita, Olathe, Topeka, Manhattan and Lawrence, Kansas and Columbia and Kansas City, Missouri have implemented the stormwater utility concept. The City of Kansas City, Kansas is now planning the conduct of feasibility study to investigate the advantages and disadvantages of a stormwater utility, and to develop an implementation plan and a probable user fee/rate for such a utility. Brief summaries of some of these existing utilities, including basic identification of the rate base and annual income, are included as an appendix to this Part VIII for reference. The potential annual income to be derived from such a source would be directly dependent upon the basic rate(s) established by the City.

The stormwater utility can act as the organizational unit for all stormwater management activities, including implementation of the stormwater management plan policies, oversight of the completion of the associated capital improvement projects, and continuing management and maintenance of the City's drainage system. The authority to charge user fees through a stormwater utility for the use of stormwater services or facilities is derived from the City's authority to tax. Therefore, utility rates need not be restricted to use on facilities which are needed due to new development. Revenue can generally be used for any service or facility directly related to stormwater management including planning, consultant services, educational programs, administrative costs, water quality monitoring, Best Management Practices (such as street sweeping) and capital facility costs. Utility revenues must be deposited in a dedicated fund, earmarked solely for stormwater management activities, which can be restricted from use for other governmental purposes. A dedicated revenue source also enables the City to issue revenue bonds to pay for the cost of major capital projects if that is determined to be a desirable financing method.

Stormwater utility rates generally include two primary components: user fees and development or connection charges. Rates charged by utilities must be reasonable, just, nondiscriminatory, and uniform within a defined class of users. The user fee is normally based on the relative contribution of runoff to the storm sewer system for general categories of individual properties determined by the amount of impervious, or improved, area on each parcel. The development or connection charge should be tied to the cost for improvements to the storm drainage system necessitated by the development.

A common approach in the determination of user fees is definition a basic unit of measurement, the Equivalent Residential Unit (or ERU); the imervious area associated with a typical single family residential dwelling unit is determined, and the number of ERU's for other classes of land use established relative to the ERU. Billings to any given property are on the basis of the number of ERU's associated with the property. The number of ERU's for a given classes of residential properties can be varied based on the total impervious area relative to the ERU.

The structure of impact or development fees must be carefully tailored to ensure that a relationship exists between the required fee and the burden imposed on the community by the new development. These financing techniques can equitably and defensibly be used only to address demands for new or expanded public facilities created by new growth in a developing area, not the correction of existing drainage problems (which is the focus of the capital improvement program recommended in Part VI).

In the City of Joplin, one possible application of impact or development fees would be to finance the development of municipally-constructed stormwater detention facilities of a regional scale, in lieu of the direct construction of regulatory detention by developers intended to control runoff from their development only. As the construction of such facilities would be in lieu of regulatory detention, and the cost for those facilities is not included in the recommended capital program, the potential income from such fees is excluded from this discussion.

Analysis of the potential income from a stormwater utility, and definition of associated utility rates and income, is beyond the scope of this study, as it requires the specific, extensive analysis of all available land use data. However, we would anticipate, based on a limited review of such data as is presently available to us, that such a utility could generate approximately $650,000 per year for each $1.00/month/ERU. That figure is highly speculative in nature, but is in our opinion representative what might be realized from such a fee.

3. CURRENT FUNDING

At present, the City of Joplin funds the maintenance and improvement of the storm drainage system from the City's general fund in the approximate amount of $500,000 per year.

D. ALTERNATIVES CONSIDERED

As might be inferred from the preceding discussion, there exists a wide variety of potential means for funding the improvement and maintenance of Joplin's City's storm drainage system. For this analysis, three basic alternatives have been considered in some detail. The first consists of a cash-basis approach to construction of the recommended major system capital improvement program, with revenues derived from a combination of the continuance of the City's existing funding, supplemented by an additional sales tax for construction of the capital improvement program over a 10 year period. The second consists of the potential establishment of a stormwater utility, with proceeds from the utility fees used to finance all stormwater-related activities in Joplin; revenue bonds, retired by proceeds from the utility, would be issued to accelerate the major system improvements for completion within a 5 year period. The third alternative consists of establishment of a stormwater utility, with proceeds from the utility fees used to finance all stormwater-related activities, including major system capital improvements completed over a 10 year period on cash-basis.

1. PROGRAM COSTS

The basic program costs considered in the analysis include: an average annual amount of $250,000 for maintenance of the City's storm drainage system; an average annual amount of $250,000 for improvements to the minor drainage system in the City (e.g.,

necessary improvements not included in the scope of the major system capital improvement program recommended in Part VI); and those funds necessary for completion of the major system capital improvement program.

2. CASH-BASIS FUNDING WITH SALES TAX

For this alternative, it is assumed that the City will continue its current general-fund contributions to storm drainage system maintenance and construction (in the current amount of $500,000 per year), with construction funding utilized for minor system improvements, supplemented by a new sales tax for construction of the recommended major system improvements. The total estimated capital cost of the major system improvement program is $20.782 million, in current dollars. Average annual expenditures over a 10-year period necessary to complete those improvements would thus be $2.08 million. A 1/2 percent sales tax would be expected to generate roughly $2.175 million in its first full year.

A cash-flow analysis for this alternative is presented in Table VIII-1. That analysis is developed upon the assumption of a fixed annual general-fund contribution of $500,000; all other revenues and expenditures are escalated at an average annual rate of 3 percent. Annual expenditures for capital improvements are uniformly distributed (on the basis of current dollars) throughout the proposed 10-year duration of the capital improvement program (and sales tax life). The data summarized in Table VIII-1 verifies the adequacy of a 1/4-percent sales tax, coupled with continuation of the current general-fund expenditures, to fund the proposed capital improvement program, ongoing minor system improvements, and operation and maintenance of the City's storm drainage system.

3. REVENUE BONDS WITH STORMWATER UTILITY

Program costs for this alternative are generally as described above, with the exception that there would be additional costs for debt service on bonds, and additional administrative costs for establishment and operation of the utility. An average annual allowance of $100,000 (in current dollars) is made for the additional administrative costs, primarily for two additional

positions on City staff (stormwater utility engineer and clerical assistant) and billing costs. Total debt service on revenue bonds is estimated based on a 20-year term and a 7 percent interest rate. A cash-flow and financing analysis for this alternative is presented in Table VIII-2. That analysis is based on completion of the major system improvements in a five-year period, and indicates that the annual revenue from the utility would need to be roughly $2.7 million per year (applied in the first year, assumed to grow at 2 percent per year thereafter as the City grows). It is anticipated that a utility billing of roughly $4.00 per ERU per month would be needed to generate that level of income; as earlier discussed, that estimated ERU charge is quite preliminary. Final determination of the rate would require extensive additional analysis.

3. CASH-BASIS FUNDING WITH STORMWATER UTILITY

For this alternative, it is assumed that a stormwater utility would be implemented, and that existing general fund contributions to storm drainage system construction and maintenance would end. The recommended major system improvements would be completed on a cash basis over a 10 year period. A cash flow analysis for this alternative is presented in Table VIII-3; that analysis indicates the need for an initial annual income from the utility of $2.8 million.

* * * * *

TABLE VIII–1

JOPLIN, MISSOURI STORMWATER MANAGEMENT PLAN FINANCIAL WORKSHEET
10–YEAR CAPITAL IMPROVEMENTS PROGRAM FINANCED BY 1/4% SALES TAX

CASHFLOW

Cashflow Table

Line No.	System Operations	1	2	3	4	5	6	7	8	9	10	Increase
1	Revenues – 1/4% Sales Tax	2,175,000	2,240,300	2,307,500	2,376,700	2,448,000	2,521,400	2,597,000	2,674,900	2,755,100	2,837,800	3.00%
2	General Fund Contribution	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	0.00%
3	Storm Drainage Expenditures											
	a Maintenance incl. maint crew salaries,equip.,etc.	250,000	257,500	265,200	273,200	281,400	289,800	298,500	307,500	316,700	326,200	3.00%
	b Minor System Improvements	250,000	257,500	265,200	273,200	281,400	289,800	298,500	307,500	316,700	326,200	3.00%
	Total	500,000	515,000	530,400	546,400	562,800	579,600	597,000	615,000	633,400	652,400	
4	Outstanding Debt Service	0	0	0	0	0	0	0	0	0	0	
	Proposed Debt Service:											
	Year / Month / Amount / Type / Interest / Term											
5	1 / 1 / 0	0	0	0	0	0	0	0	0	0	0	
6	2 / 1 / 0		0	0	0	0	0	0	0	0	0	
7	3 / 1 / 0			0	0	0	0	0	0	0	0	
8	4 / 1 / 0				0	0	0	0	0	0	0	
9	5 / 1 / 0					0	0	0	0	0	0	
10	6 / 1 / 0						0	0	0	0	0	
11	7 / 1 / 0							0	0	0	0	
12	8 / 1 / 0								0	0	0	
13	9 / 1 / 0									0	0	
14	10 / 1 / 0										0	
15	Total Proposed Debt Service	0	0	0	0	0	0	0	0	0	0	
16	Total Operating Expenses	500,000	515,000	530,400	546,400	562,800	579,600	597,000	615,000	633,400	652,400	
17	Annual Balance	2,175,000	2,225,300	2,277,100	2,330,300	2,385,200	2,441,800	2,500,000	2,559,900	2,621,700	2,685,400	
	Major Capital Improvement Financing											
19	Beginning Balance – Capital Funds	0	96,800	181,554	253,892	313,286	359,454	392,051	410,571	414,547	403,646	
20	Bond or Note Issue	0	0	0	0	0	0	0	0	0	0	
21	Issuance Costs	0	0	0	0	0	0	0	0	0	0	
22	Reserve Fund	0	0	0	0	0	0	0	0	0	0	
	Revenue Available for Capital Funds	2,175,000	2,225,300	2,277,100	2,330,300	2,385,200	2,441,800	2,500,000	2,559,900	2,621,700	2,685,400	
23	Interest Earnings – Capital Funds	0	0	0	0	0	0	0	0	0	0	
24	Total Available Capital Funds	2,175,000	2,322,100	2,458,654	2,584,192	2,698,486	2,801,254	2,892,051	2,970,471	3,036,247	3,089,046	
25	Major Capital Improvements	2,078,200	2,140,546	2,204,762	2,270,905	2,339,032	2,409,203	2,481,479	2,555,924	2,632,602	2,711,580	
26	Ending Balance – Capital Funds	96,800	181,554	253,892	313,286	359,454	392,051	410,571	414,547	403,646	377,466	

TABLE VIII-2

JOPLIN, MISSOURI STORMWATER MANAGEMENT PLAN FINANCIAL WORKSHEET
5-YEAR CAPITAL IMPROVEMENTS PROGRAM FINANCED BY 20-YEAR REVENUE BONDS

CASHFLOW

Cashflow Table **********

Line No.	System Operations						1	2	3	4	5	6	7	8	9	10	Increase
1	Revenues – Stormwater Utility Fees @ $4/ERU						2,680,000	2,733,600	2,788,300	2,844,100	2,901,000	2,959,000	3,018,200	3,078,600	3,140,200	3,203,000	2.00%
2	Operating Fund Interest Earnings						0	0	0	0	0	0	0	0	0	0	0.00%
3	Stormwater Utility Expenses																
	a Administrative incl. engr & clerk salaries, rent, etc.						100,000	103,000	106,100	109,300	112,600	116,000	119,500	123,100	126,800	130,600	3.00%
	b Maintenance incl. maint crew salaries,equip.,etc.						250,000	257,500	265,200	273,200	281,400	289,800	298,500	307,500	316,700	326,200	3.00%
	c Minor System Improvements						250,000	257,500	265,200	273,200	281,400	289,800	298,500	307,500	316,700	326,200	3.00%
	Total						600,000	618,000	636,500	655,700	675,400	695,600	716,500	738,100	760,200	783,000	
4	Outstanding Debt Service						0	0	0	0	0	0	0	0	0	0	
	Proposed Debt Service:																
	Year	Month	Amount	Type	Interest	Term											
5	1	1	11,000,000	Revenue	7.00%	20	1,038,320	1,038,320	1,038,320	1,038,320	1,038,320	1,038,320	1,038,320	1,038,320	1,038,320	1,038,320	
6	2	1	0	Revenue	7.00%	20		0	0	0	0	0	0	0	0	0	
7	3	1	0	Revenue	7.00%	20			0	0	0	0	0	0	0	0	
8	4	1	9,000,000	Revenue	7.00%	20				849,540	849,540	849,540	849,540	849,540	849,540	849,540	
9	5	1	0	Revenue	7.00%	20					0	0	0	0	0	0	
10	6	1	0	Revenue	7.00%	20						0	0	0	0	0	
11	7	1	0	Revenue	7.00%	20							0	0	0	0	
12	8	1	0	Revenue	7.00%	20								0	0	0	
13	9	1	0	Revenue	7.00%	20									0	0	
14	10	1	0	Revenue	7.00%	20										0	
15	Total Proposed Debt Service						1,038,320	1,038,320	1,038,320	1,887,860	1,887,860	1,887,860	1,887,860	1,887,860	1,887,860	1,887,860	
16	Total Operating Expenses						1,638,320	1,656,320	1,674,820	2,543,560	2,563,260	2,583,460	2,604,360	2,625,960	2,648,060	2,670,860	
17	Annual Balance						1,041,680	1,077,280	1,113,480	300,540	337,740	375,540	413,840	452,640	492,140	532,140	
	Major Capital Improvement Financing																
19	Beginning Balance – Capital Funds						0	6,703,400	3,703,648	489,633	4,267,303	10,868	394,358	832,248	1,327,228	1,882,298	
20	Bond or Note Issue						11,000,000	0	0	9,000,000	0	0	0	0	0	0	
21	Issuance Costs						(275,000)	0	0	(225,000)	0	0	0	0	0	0	
22	Reserve Fund						(1,038,320)	0	0	(849,540)	0	0	0	0	0	0	
	Revenue Available for Capital Funds						1,041,680	1,077,280	1,113,480	300,540	337,740	375,540	413,840	452,640	492,140	532,140	
23	Interest Earnings – Capital Funds						131,440	204,060	82,230	93,260	83,890	7,950	24,050	42,340	62,930	85,930	
24	Total Available Capital Funds						10,859,800	7,984,740	4,899,358	6,809,113	4,688,933	394,358	832,248	1,327,228	1,882,298	2,500,368	
25	Major Capital Improvements						4,156,400	4,281,092	4,409,525	4,541,811	4,678,065	0	0	0	0	0	
26	Ending Balance – Capital Funds						6,703,400	3,703,648	489,833	4,267,303	10,868	394,358	832,248	1,327,228	1,882,298	2,500,368	

TABLE VIII-3

JOPLIN, MISSOURI STORMWATER MANAGEMENT PLAN FINANCIAL WORKSHEET
10-YEAR CAPITAL IMPROVEMENTS PROGRAM FINANCED BY UTILITY, CASH-BASIS

CASHFLOW

Cashflow Table

Line No.	System Operations	1	2	3	4	5	6	7	8	9	10	Increase
1	Revenues - Stormwater Utility Fees	2,800,000	2,856,000	2,913,100	2,971,400	3,030,800	3,091,400	3,153,200	3,216,300	3,280,600	3,346,200	2.00%
2	General Fund Contribution	0	0	0	0	0	0	0	0	0	0	0.00%
3	Storm Drainage Expenditures											
	a Administrative incl. engr & clerk salaries, rent, etc.	100,000	103,000	106,100	109,300	112,600	116,000	119,500	123,100	126,800	130,600	3.00%
	b Maintenance incl. maint crew salaries,equip.,etc.	250,000	257,500	265,200	273,200	281,400	289,800	298,500	307,500	316,700	326,200	3.00%
	c Minor System Improvements	250,000	257,500	265,200	273,200	281,400	289,800	298,500	307,500	316,700	326,200	3.00%
	Total	600,000	618,000	636,500	655,700	675,400	695,600	716,500	738,100	760,200	783,000	
4	Outstanding Debt Service	0	0	0	0	0	0	0	0	0	0	
	Proposed Debt Service:											
	Year / Month / Amount / Type / Interest / Term											
5	1 / 1 / 0	0	0	0	0	0	0	0	0	0	0	
6	2 / 1 / 0		0	0	0	0	0	0	0	0	0	
7	3 / 1 / 0			0	0	0	0	0	0	0	0	
8	4 / 1 / 0				0	0	0	0	0	0	0	
9	5 / 1 / 0					0	0	0	0	0	0	
10	6 / 1 / 0						0	0	0	0	0	
11	7 / 1 / 0							0	0	0	0	
12	8 / 1 / 0								0	0	0	
13	9 / 1 / 0									0	0	
14	10 / 1 / 0										0	
15	Total Proposed Debt Service	0	0	0	0	0	0	0	0	0	0	
16	Total Operating Expenses	600,000	618,000	636,500	655,700	675,400	695,600	716,500	738,100	760,200	783,000	
17	Annual Balance	2,200,000	2,238,000	2,276,600	2,315,700	2,355,400	2,395,800	2,436,700	2,478,200	2,520,400	2,563,200	
	Major Capital Improvement Financing											
19	Beginning Balance - Capital Funds	0	124,236	226,124	303,921	355,690	379,498	373,417	335,210	262,636	153,443	
20	Bond or Note Issue	0	0	0	0	0	0	0	0	0	0	
21	Issuance Costs	0	0	0	0	0	0	0	0	0	0	
22	Reserve Fund	0	0	0	0	0	0	0	0	0	0	
	Revenue Available for Capital Funds	2,200,000	2,238,000	2,276,600	2,315,700	2,355,400	2,395,800	2,436,700	2,478,200	2,520,400	2,563,200	
23	Interest Earnings - Capital Funds @ 4%	2,436	4,434	5,959	6,974	7,441	7,322	6,573	5,150	3,009	101	
24	Total Available Capital Funds	2,202,436	2,366,670	2,508,683	2,626,595	2,718,531	2,782,620	2,816,690	2,818,560	2,786,045	2,716,744	
25	Major Capital Improvements	2,078,200	2,140,546	2,204,762	2,270,905	2,339,032	2,409,203	2,481,479	2,555,924	2,632,602	2,711,580	
26	Ending Balance - Capital Funds	124,236	226,124	303,921	355,690	379,498	373,417	335,210	262,636	153,443	5,165	

SUMMARY OF EXISTING STORMWATER UTILITIES

SUMMARY OF EXISTING STORMWATER UTILITIES

One of the many ways to administer and fund storm drainage system operation, maintenance, expansion and improvements is through the formation of a stormwater utility. Although utilized in other parts of the country rather extensively, this approach is relatively new to the Midwest. The basic concept is the same as for municipal water, wastewater or other utility organizations and is gaining acceptance in this area as public awareness of storm drainage issues increases.

Within this region several cities have established stormwater utilities. These include Lawrence, Olathe, Manhattan, Topeka and Wichita, Kansas, and Columbia and Kansas City, Missouri. Kansas City, Kansas is also investigating and evaluating implementation of a stormwater utility. The following are summaries of some of these utilities for reference and comparison.

CITY OF LAWRENCE, KANSAS

The City of Lawrence is in the early stages of development of a stormwater utility. The *Stormwater Master Plan,* completed by Burns & McDonnell in May 1996, outlined the basic structure of the proposed utility. The formation of the new utility was proposed to pay for capital improvements to the existing storm drainage system and to fund maintenance and staff positions for daily operations. Both the City and local property owner's have endorsed the utility, and implementation is currently underway. The proposed utility will be under the jurisdiction of the Director of Public works and will generate an estimated two million dollars annually.

The rate structure divides properties into four residential and six commercial classifications. Each property is assigned an Equivalent Residential Unit (ERU) based on the amount of total improved area within the property; described as follows:

Property Category	Total Improved Area/Parcel (square ft)	No. Of ERUs Billed
Single-family Residential	<1,200	0.67
	1,200 to 3,000	1.00
	>3,000	1.50
Multi-family Residential	N/A	0.67
Commercial	<10,000	2.5
	10,000 to 25,000	8.5
	25,000 to 50,000	18.0
	50,000 to 75,000	32.0
	75,000 to 100,000	44.5
	>100,000	Actual No. ERUs

The standard property (ERU equal to 1.00) is defined as 11,320 square feet of land with 1,888 square feet of total improved area. A monthly rate of $4.00 per ERU will be billed to each property owner through the City Water Department.

CITY OF OLATHE, KANSAS

Olathe's utility has been in operation for approximately five years. It was enacted by an ordinance which must be renewed annually in conjunction with the city's budget. Originally, the utility was implemented for and authorized to fund only storm drainage capital improvements. It's purpose has recently been expanded to include funding of utility staff positions and system maintenance. Currently the utility generates approximately $750,000 annually.

The rate structure is divided into two main categories, residential and non-residential, with the equivalent residential unit (ERU) based on 10,000 square feet of land area. All residential customers pay the same fee of $2.00 per month. Non-residential customers are further divided into classes based on increments of 20,000 square feet of land area. The fees range from $2.00 per month for 20,000 square feet or less, up to $100.00 per month (the maximum fee for any class) for over 500,000 square feet. Fees are billed through the City's water utility.

CITY OF TOPEKA, KANSAS

Topeka's stormwater utility began operation in 1993, and is under the jurisdiction of the Department of Public Works. Property is divided into two basic classifications, residential and nonresidential. Charges are based on Equivalent Residential Units which is defined as 2,018 square feet of impervious area. This impervious area includes all buildings, driveways, parking areas, etc. The basic rate for one ERU is $2.85 per month although all residential customers do not pay the same fee. The residential classification is further divided into three rate groups as follows.

Total Impervious Area	No. of ERU's	Monthly Billing
<1,500	0.65	$1.85
>1,500, <3,500	1.00	$2.85
>3,500	1.56	$4.45

All nonresidential properties are billed on the basis of the number of ERU's for the specific parcel calculated as the total impervious area (determined from aerial photo analysis) divided by 2,018. The total charge for a parcel is then determined by multiplying the number of ERU's by $2.85. Governmental entities, including the State of Kansas, pay stormwater utility fees. The only areas excepted are impervious surfaces in public rights-of-way (streets, highways, etc.) and impervious areas at the airfield.

Billings are included with the City's water billing. Actual charges are computed daily, with the result that payments vary slightly by month. Topeka's stormwater utility generates approximately $3.66 million per year.

CITY OF WICHITA, KANSAS

Wichita's stormwater utility operates similarly to Topeka's. It is also under the jurisdiction of the Department of Public Works with two basic classifications, residential and nonresidential,

although the residential classification is not further broken down as in Topeka. An ERU in Wichita is defined as 2,139 square feet with the monthly charge set at $1.66/month/ERU.

Residential customers are charged for one ERU, irrespective of lot or house size. Multi-family units also are charged one ERU per unit. Nonresidential properties are billed on the basis of the number of ERU's for the parcel times the basic ERU rate. Billings are handled as a separate line item on the City's water and sewer billing system. Governmental and tax-exempt properties are included in the rate base. Streets and highways are excluded. The airport, including the runway, is included in the rate base. Wichita's stormwater utility generates approximately $5.0 million per year.

CITY OF MANHATTAN, KANSAS

Manhattan's stormwater utility is presently funded through the imposition of a fee billed with the water and sewer billing. Residential properties, including multi-family units, are assessed at a monthly rate of $0.25 per living unit irrespective of lot or building size. Properties devoted to any use other than residential are assessed on the basis of total developed area (e.g., tract size), not impervious area. A total of six rate groups are defined with monthly fees varying from $1.30 for tracts less than or equal to 20,000 square feet, to $150.00 for tracts greater than 1,000,000 square feet. The campus of Kansas State University is specifically included in the rate base by direct reference in the ordinance.

Manhattan's stormwater utility presently generates approximately $112,000 per year. This amount, and the associated billing rates, was established as a start-up, or phase in, measure. The City's recently completed storm drainage master plan reviews the City's rates and rate base, and recommends adjustments or modifications necessary or desirable to properly fund the stormwater utility and recommended capital improvements.

CITY OF COLUMBIA, MISSOURI

Establishment of Columbia's stormwater utility, initial fee structure, and stormwater development

charge on new construction were authorized by a special election in 1993. The initial proposal was based on the need to fund a $5,000,000 storm drainage capital improvements program outlined in an earlier master plan.

The rate structure is based on four residential tiers with commercial property rates based on actual impervious area. The University of Missouri's properties are included in the utility customer base although they are billed a negotiated fee rather than charges based on actual impervious area.

Initially, the residential fee was $0.65 per month for all units and $4.00 per month for all nonresidential properties. The utility fees were revised in 1994 as indicated in the following table while development charges remained as originally approved. Annual revenues from the combination of utility fees and development charges are approximately $830,000.

COLUMBIA, MISSOURI STORMWATER CHARGES

Utility Charges	
Multifamily dwellings with more than 4 units	$0.65/month
Single-family homes less than 750 sq. ft.	$0.65/month
Multifamily dwellings with 4 or fewer units	$0.85/month
Single-family homes 750 to 1,250 sq.ft.	$0.85/month
Single-family homes 1,250 to 2,000 sq.ft.	$1.15/month
Single-family homes more than 2,000 sq. ft.	$1.35/month
Non-residential uses of developed land	$4.00 or $0.04/100 SF imperv. area per mo., whichever is greater
Development Charges on New Building Permits	
Single-family homes and duplexes	$0.09/SF
Multifamily buildings, offices, schools, churches	$0.16/SF
Commercial and industrial	$0.195/SF
Use categories not listed above	$0.195/SF

The utility charges are based on "main floor area" as opposed to total impervious area per property and development charges on "total floor area." Total floor area is defined as the area within the perimeter of the outside walls of a building including basement area, main and upper floor areas, carports, garages, decks and porches. This development charge is similar in concept

to an impact fee although the rates are somewhat arbitrary and not based on the actual impact of increased impervious area on the existing drainage system. The charge is waived, however, for any property served by a private detention facility constructed in accordance with City criteria and privately maintained.

* * * * *

Attachment 11

JOPLIN, MISSOURI

SUPPLEMENTAL STORMWATER MANAGEMENT MASTER PLAN

CITY OF JOPLIN MISSOURI

ALLGEIER, MARTIN and ASSOCIATES, INC.
Consulting Engineers and Surveyors

April, 2009

CITY OF JOPLIN, MISSOURI
SUPPLEMENTAL STORMWATER MANAGEMENT MASTER PLAN

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Appendix A – Exhibit 1 - Recommended Storm Drainage Improvement Map
(Included in envelope at beginning of Appendices)

Appendix B – HEC-1 Data Summary

WATERSHED MAPS, Drawing Numbers 1 thru 12
(Separate attachment set)

I. INTRODUCTION

Allgeier, Martin and Associates, Inc. (AMA) entered into an agreement with the City of Joplin on January 8, 2008 to update the City's Stormwater Management Master Plan. Burns and McDonnell created the original plan in June 1998. Since 1998 many new developments have occurred, stormwater improvements have been constructed, and new aerial photography and LYDAR topographic information has been made available. The following report is intended to provide supplemental information to the City of Joplin's 1998 Stormwater Management Master Plan. Figure 1 identifies and outlines the major drainage basins included in this study. This figure is similar to the one in the original Master Plan, but has been updated and expanded to include additional areas.

AMA met with the City to determine the areas of greatest need. The public was also given the opportunity to voice concerns at a public hearing. From these sources AMA and the City developed a list of problem areas. The problem areas were prioritized and sorted into large projects (those in need of detailed hydrologic modeling) and those involving localized drainage problems that needed improvement. Recommendations and cost estimates for the proposed improvements are included in this report.

II. SCOPE

In preparation of this report a map of problem areas was developed based on public opinion and the City's recommendations. After investigations were completed the City's watershed area map was updated using the latest LYDAR topographic information. Using the revised watershed areas the original Hydrologic models were updated for those areas requiring a detailed analysis. An estimated cost for construction was determined for each of the proposed improvements. In addition, the proposed Stormwater Management Regulations were reviewed and evaluated for conformance with the current clean Water Act and Phase II requirements. AMA also

developed the GIS framework for implementing the stormwater collection system into the City's existing ArcView Based system.

III. METHOD OF ANALYSIS

A. Recommended Storm Drainage Improvement Map

The City experienced several localized flooding events during 2007 and 2008. During those events, city staff kept record of complaints dealing with street, basement, and yard flooding. A map was then made identifying all of these complaints. AMA then reviewed each of these complaints and determined which ones were caused by the city's drainage system. AMA and the City met and reviewed the map to identify any other problem areas. Using this information, a public hearing was held to give the public the opportunity to identify other areas within the drainage system that experiences flooding. The Recommended Storm Drainage Improvement Map as shown in Appendix A – Exhibit 1 identifies the problem areas that are addressed in this report. AMA conducted site investigations at each of the problems that were identified by the City of Joplin and the feasibility of making improvements was determined.

B. Watershed Area Map

The original Burns and McDonnell Watershed Area Maps were updated using the City's latest LYDAR topographic information. All of the City's modeled drainage basins were redrawn as shown in Watershed Maps, Drawing Numbers 1 thru 12 (a separate attachment to this report). The original basin label number and structure label number designations that were created by Burns and McDonnell were reused with some minor modifications to the basin label numbers. Modifications to the basins and basin labels were due to addition, subtraction, or grouping of the original basins based on current information or typographical errors on the original map. The modified basin areas were recorded as shown in Appendix B – HEC-1 Data Summary.

C. Hydrologic Model

For this study, as in the original study, HEC-1 was used to model the watersheds for the areas of interest. The HEC-1 models were updated using the revised Watershed Area Map for the areas that required a detailed analysis. The revised hydrologic modeling is consistent with preliminary design. In some cases, curve numbers and lag times were updated as well. These updates were based on the limited information discussed above. **All future detailed engineering projects will require a more detailed investigation of the project site and drainage basin, and the models shall be adjusted accordingly.**

D. Hydraulic Model

For those projects that had significant drainage areas and flow, a hydraulic model of the system was created in order to evaluate the existing design capacity and determine the needed improvements to pass the desired design capacity. The hydraulic models utilized the U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package, HEC-1 computer program, version 4.1. The NRCS dimensionless unit hydrograph method was used to generate runoff and the NRCS Curve Number technique was used to compute abstractions from rainfall. Rainfall data analyzed were for 2-, 5-, 10-, 25-, 50-, and 100-year return periods and 1-, 2-, 3-, 6-, 12-, and 24-hour storm durations. The storm duration that created the maximum discharge for each return period was used for computations of the water surface profile. The rainfall depths were distributed temporally using Huff's Quartile distributions. Rainfall was assumed to have a uniform spatial distribution. A one-minute computational interval was selected for use in modeling the rainfall-runoff response in the watershed. Frequency-based data used in the hydrologic analysis were taken from the "Rainfall Frequency Atlas for the Midwest," (1992).

Updates were made to the existing Burns & McDonnell hydrologic model as a result of new data. The computational time increment (CTI) in the data set was changed from 15-minutes to 1-minute to comply with the computational requirements of the methodology.

Table 1 shows the existing system capacity analysis summary for a few of the main projects and structures. All other existing system capacities may be obtained from the HEC-1 models. Several of the recommended projects address localized nuisance flooding of yards, streets, ditches, etc. and improvements are limited to what can be reasonably constructed. Due to the relatively small size of the drainage basins, these projects will need more detailed field information in order to provide a detailed evaluation.

IV. RECOMMENDED IMPROVEMENTS

A. Capital Improvements

For each area of interest AMA generated recommend improvements. The areas of interest are located in various watersheds throughout the City of Joplin as shown previously in Appendix A – Exhibit 1. Each area has been summarized with an existing problem description, recommended improvements, downstream controls, and potential alternatives to the recommended improvements. A construction cost estimate was also generated for each area. Based on site investigations, number of complaints received, city personnel experiences, and watershed impact, each area has also been given a recommended priority level for improvement with number one being the most critical. The assigned priority was based on the opinion of the engineer who prepared this report and the city's engineering staff after considering the factors mentioned above. As previously stated in the original Master Plan, it is important to note that the willingness of potentially benefited property owners to dedicate easements for the construction of improvements has not been considered. Another factor not considered is the potential influence of other improvement programs within the vicinity of the storm drainage improvement projects. For those reasons, the priorities should not be considered as absolute.

Table 2 lists the 41 projects identified in this report with present worth cost estimates for each. A future worth estimate for the year 2017 is also shown

since these projects may not start construction until 2011 and will not finish until possibly 2021. Following Table 2 are the individual project descriptions.

B. Minor System Improvements

The capital improvements recommended in this report are intended to correct deficiencies within the system that are known to be a nuisance by city staff, or have been reported by the citizens of the community. As these problems are corrected, other smaller components of the City's overall storm drainage system will start appearing to be deficient because the public will begin to notice them after the more prevalent problems are corrected. It is also common to experience after one problem is corrected the problem will relocate further downstream to an area that did not experience problems before.

As stated in the 1998 Stormwater Master Plan, a regular program of improvement to the minor system is an integral element in any comprehensive plan of improvement to the storm drainage system, and in obtaining public acceptance of the need for the continued devotion of resources and effort to correction of the major system deficiencies. For a minor system of the scale and age of that in the City of Joplin, an appropriate level of spending would average roughly $500,000 per year.

C. Economic Development

As the City expands its boundaries and begins to improve undeveloped land, the increase in impervious area will create problems that currently do not exists in the stormwater system. One tool used to attract new prospects to build and create jobs in the community is to provide the necessary utilities for the development. Stormwater improvements are a utility the same as water, sewer, electric, etc. The City of Joplin is fortunate to have leaders in the community who expend a great amount of effort and finances to attract new industries and expand existing ones which requires the City to have the necessary funding to improve utilities stormwater infrastructure. Based on the level of expansion over

the past 20 years, we suggest that an appropriate level of spending would average $100,000 per year.

D. Ditch and Detention Pond Maintenance

The City has many miles of improved and unimproved ditches that must be maintained for several reasons. In order for the system to function properly, obstructions must be removed on a regular basis to prevent the clogging of the system, which can cause sever flooding. If the city does not provide proper maintenance of the City system, then they could be liable for flooding caused by the lack of maintenance. Obstructions that periodically require removal include vegetation, yard debris, shopping carts, silt, illegal dumping, etc.

Since the adoption of the 1998 Stormwater Management Master Plan and the Stormwater Management Criteria, there have been numerous regional detention basins constructed in which the City is responsible for maintaining. These numbers will continue to grow as the City continues to take a proactive approach to reduce the number of areas that flood during heavy rains. There are even a larger number of private developments with detention basins in which are not maintained by the owners. Without proper maintenance the basins become overgrown with vegetation and harbor unwanted wildlife and mosquitoes. Silt will accumulate over time thereby reducing the storage available for stormwater making the detention basins less affective.

Based on the miles of ditches and number of detention basins, a suggested level of spending would average $400,000 per year.

E. Catch Basin and Closed System Maintenance

As the City continues to strive to meet the ever-changing EPA Clean Water Act and Phase II Stormwater Requirements, the need to clean silt and debris out of catch basins and stormwater pipes will increase. Most likely the City will begin seeing the installation of catch basins designed to trap sediment.

Currently the City has over 9,000 catch basins and 100 miles of stormwater pipes and culverts. Using an estimated fee of $3 per lineal foot and $100 each to clean the pipes and inlets, an annual spending of $250,000 per year for 10 years would be needed to clean the entire system.

Table 1
Existing System Capacity Analysis

Project I.D. No.	Structure I.D. No.	Description	CAP (cfs)	2 Yr. (cfs)	5 Yr. (cfs)	10 Yr. (cfs)	25 Yr. (cfs)	50 Yr. (cfs)	100 Yr. (cfs)	Remarks
1-4	1062	21" RCP	14	12	23	32	41	54	63	
1-5	1330	Ditch	480	237	388	514	634	793	909	Proir to detention
3-7	3164	21" & 24" RCP	28	20	37	52	66	84	98	All area west of Connecticut
3-10	3315	Main N of 26th		7	12	17	21	26	30	
		Main and E 26th		18	31	43	54	68	79	
		Structure 3290		129	219	298	372	469	539	
4-14	4335			3	6	9	12	16	19	Flow approx 20 ft US of Michigan & 28th
6-10	6275		440	145	246	352	454	565	653	
6-12	6168			14	25	34	42	53	61	Flow captered at III (no main channel overflow)
6-13	6071			2	3	5	8	11	14	Portion of A6070 draining to N. side of Pool
6-14	6330	Existing		520	696	1009	1408	1791	2071	
		w/Davis		407	643	861	1120	1412	1617	
		w/Davis and 15th @ 1013 ft		302	370	416	731	1014	1272	
6-15	6091	2 - 24" RCP	32	27	44	58	71	87	99	
6-15	6105	48" RCP	181	58	95	125	153	189	214	Upstream End
6-15	6105	48" RCP	181	90	146	192	234	287	326	Downstream End
7-10	7020	2-10x4	540	496	863	1176	1473	1858	2139	
7-10	7030	6x2	60	24	44	61	78	99	115	
10-3	10505	3 - 24" RCP	60	41	73	101	127	162	187	
10-4	10105	15" RCP	8	5	11	15	19	25	29	Flow down E side of Euclid at N side of Odessa
13-2	13061	Pre-detention	41	224	443	624	797	1026	1191	Detention in A13061
		Post-detention		145	264	468	664	915	1082	

Table 2
Capital Improvement Project Recommendation

Priority Number	Project ID	Project Description	2009 Cost Estimate	2017 Cost Estimate
21	1-4	Storm Sewer Improvements, 6021 W. Highland Drive	$20,000	$30,000
8	1-5	Regional Detention, W. of Arizona & N. of 32nd	$2,040,000	$3,015,000
23	1-6	Silver Creek Ditch Improvements	$313,000	$463,000
24	2-1	Shoal Creek System Improvements	$87,000	$129,000
3	3-7	Ditch & Culvert Improvements, Connecticut between 32nd & 35th	$444,000	$656,000
3	3-7A	Ditch & Culvert Improvements, Connecticut between 35th & 37th	$350,000	$518,000
11	3-8	Flume & Ditch Improvements, Grand & 34th	$10,000	$15,000
12	3-9	Curb Inlet Improvements, 32nd & Pearl	$60,000	$89,000
5	3-10	New Culvert System, Main between 25th & 27th	$363,000	$537,000
25	3-11	Water Works Culvert, Inlet, and Ditch Improvements	$473,000	$699,000
4	4-14	New Culvert System, Michigan between 30th &27th	$420,000	$621,000
20	4-15	Curb Inlet Improvements, 9th & Minnesota	$87,000	$129,000
26	4-16	Joplin Creek West System Improvements	$375,000	$555,000
27	5-3	McClelland Culvert, Inlet and Ditch Improvements	$261,000	$386,000
22	6-10	Regional Detention, 15th & Massachusetts	$1,044,000	$1,543,000
10	6-11	Culvert Improvements, 14th & Florida Ave.	$36,000	$54,000
6	6-12	Storm Sewer Improvements, Illinois between 7th & 9th	$668,000	$987,000
18	6-13	New Culvert System, Hill between Division & Mineral	$182,000	$269,000
1	6-14	Regional Detention, NE side of Murphy Blvd. & S. of 15th	$748,000	$1,106,000
7	6-15	Ditch & Culvert Improvements, 4th & School Ave.	$500,000	$739,000
28	6-16	Joplin Creek East Ditch Improvements	$675,000	$998,000
14	7-8	Curb Inlet Improvements, 4th & Tyler/Adele	$242,000	$358,000
15	7-9	Ditch Improvements, 2nd & Oliver/McCoy	$80,000	$119,000
19	7-10	Culvert Improvements, Lone Elm & Murphy Blvd.	$382,000	$565,000
29	7-11	Lone Elm Ditch & Culvert Improvements	$625,000	$924,000
37	8-2	Channel Improvement, Schifferdecker from Junge to 17th	$495,000	$732,000
38	8-3	Ditch & Culvert Improvements, 20th & Roosevelt	$423,370	$626,000
9	8-5	Culvert Improvements, Cleveland between 25th & 24th	$27,000	$40,000
9.1	8-5A	System Improvements, 25th & Cleveland	$400,000	$591,000
30	8-6	Country Club Storm Water Improvements	$174,000	$258,000
31	9-3	Leadville Basin Improvements	$384,000	$568,000
36	10-1	Channel Improvement, Canterbury Ditch 3rd to 7th	$787,000	$1,163,000
2	10-3	Ditch & Culvert Improvements, 10th & Peters Ave.	$376,000	$556,000
16	10-4	Ditch Improvements, Euclid & Odessa/Rolla	$355,000	$525,000
17	10-5	Inlet Improvements, E. of Salem & Park	$9,000	$14,000
32	10-6	Turkey Creek System Improvements	$424,000	$627,000
33	11-1	Center Creek Culvert and Ditch Improvements	$78,000	$116,000
13	12-2	Ditch & Culvert Improvements, Windsor & Michigan	$57,000	$85,000
34	12-3	Royal Heights Inlet, Culvert, & Ditch Improvements	$289,000	$427,000
35	13-1	Oakland (Baker's Branch) System Improvements	$213,000	$315,000
36	13-2	Regional Detention, Ind. Park Rd. & Kennedy Lane	$160,000	$237,000
	B	Minor System Improvements ($500,000 Annual Exp.)	$5,000,000	$5,000,000
	C	Economic Development Improvements ($100,000 Annual Exp.)	$1,000,000	$1,000,000
	D	Ditch and Detention Pond Maintenance ($400,000 Annual Exp.)	$4,000,000	$4,000,000
	E	Catch Basin and Closed System Maint. ($250,000 Annual Exp.)	$2,500,000	$2,500,000
		Sub-Total	**$27,636,370**	**$34,884,000**
		Projected Project Cost for 2009 Study		
		2009 Construction Cost Estimate	$27,636,370	$34,884,000
		Easement & Land Acquisition Services	$1,381,819	$1,744,200
		Engineering, Surveying, Bidding & Construction Management	$6,909,093	$8,721,000
		Annual i (%)	5	
		Yrs (# periods)	8	
		Total Cost	**$35,927,281**	**$45,349,200**

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: 6021 W. Highland Drive, Relief Sewer

Project Identification Number: 1-4

Data Summary

Watershed:	Silver Creek
Priority No.:	21
Design Capacity:	25 Year
Estimated Cost:	$20,000
Model ID No.:	1062
Map Sheet Reference Number:	11

Existing Problem Description

The development has a large swale that runs through the back several properties. The property owner at 6021 W. Highland Ave. has water that backs up in the yard due to the insufficient capacity of the 21" culvert until it discharges over the road to the northwest.

Recommended Improvements

Add a parallel 24" RCP to pass the 25 year flood event.

Downstream Controls

Existing open channel immediately downstream is adequate for design discharge.

Potential Alternatives

Do nothing; allow ponding to occur on property owner.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: 32nd St. to 28th St. Between Mississippi Ave. & Arizona Ave.,

Project Identification Number: 1-5

Data Summary

Watershed:	Silver Creek
Priority No.:	8
Estimated Cost:	$2,040,000
Model ID No.:	1330
Map Sheet Reference Number:	8 & 9

Existing Problem Description

Roadway and property flooding downstream to I-44 is common. Excessive peak discharges at downstream structures and channels, which are above design capacities is the major cause of flooding. All structures downstream of this project are undersized as shown in the following table.

Structure	Description	Capacity	10 Yr
1335	Rock Lined Ditch		330
1333	Double 6' x 3'-6" RCB	300 - 5 Yr	330
1330	Earth Ditch		520
1327	Double 7' x 4' RCB	480 - 5 Yr	520
1326	Double 6' x 4' RCB Downstream	280 - <2 Yr	520

However, increasing capacity of these structures will not improve the flooding conditions between I-44 and 34th Street.

Recommended Improvements

Build a storm water detention facility to reduce the frequency of flooding downstream. Improvements to or replacement of structure No. 1326 downstream is recommended to increase the design capacity to 500 cfs.

Downstream Controls

Structure No. 1326 and No. 1302

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Connecticut Ave. Between 32nd St. & 37th St.

Project Identification Number: 3-7 & 3-7A

Data Summary

Watershed:	Water Works
Priority No.:	3
Estimated Cost:	$444,000 and $350,000
Model ID No.:	3167
Map Sheet Reference Number:	8

Existing Problem Description

The open ditch on east side of Connecticut Ave. has two drives across it north of 33rd Street, and seven drives across the ditch between 33rd Street and 34th Street, and one south of 34th Street, all of which have pipe diameters ranging from 12" to 15" to convey the ditch flow to a central point in front of 3325 Connecticut Ave. From there, the flow crosses under Connecticut Street via two reinforced concrete pipes, a 21" diameter and a 24" diameter. During heavy rainfall events the culvert pipes under the drives become clogged and force water to be diverted across Connecticut Ave causing significant erosion of the drives, traffic impediments on Connecticut Ave., and water to be forced into garages.

Recommended Improvements

Replace drives and existing small diameter pipes that are prone to clogging with 970 linear feet of 18" to 36" diameter reinforced concrete pipe along the east side of Connecticut Ave. from the end of the existing curb north of 33rd Street to the south side of 34th Street. Widen Connecticut Ave. to desired width, place curb & gutter on east side of Connecticut Ave. and add curb inlets. Construct curb inlet in front of 3325 Connecticut Ave. at the existing location of the two reinforced concrete pipes afore mentioned. The two afore mentioned existing pipes crossing Connecticut are to remain in place.

Downstream Controls

Existing 36" and 42" pipes have a 2-year design capacity.

Potential Alternatives

Project 3-7A would include improving the ditch along the East side of Connecticut all the way to 37th Street in the same manner as Project 3-7 to allow Connecticut to be widened all the way to I-44.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Grand Ave. & 34th St., Paved Ditch

Project Identification Number: 3-8

Data Summary

Watershed:	Water Works
Priority No.:	11
Estimated Cost:	$10,000
Sub-basin ID No.:	3130
Map Sheet Reference Number:	8

Existing Problem Description

The flume on the south side of the intersection of Grand Ave. and 34th St. is insufficient to convey the amount of runoff that accumulates at that point. The earthen ditch to the south of the existing flume has weeds, small trees, and large deposits of sediment accumulated in it; all of which impede the water as it flows south and contributes to the water backing up into the intersection.

Recommended Improvements

Replace existing flume with type 1 flume as per City of Joplin Standard Plans. Clean and re-shape approximately 200 feet of ditch south of the new flume.

Downstream Controls

None.

Potential Alternatives

Line ditch with concrete to reduce maintenance and increase capacity of ditch without increasing current size.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Intersection of 32nd St. & Pearl Ave.

Project Number: 12

Project Identification Number: 3-9

Data Summary

Watershed:	Water Works
Priority No.:	
Design Capacity:	2-year
Estimated Cost:	$59,368
Sub-basin ID No.:	3225
Map Sheet Reference Number:	8

Existing Problem Description

Water flowing from the north down Pearl Ave. does not flow into the existing curb inlets on the north side of 32nd St. The pavement surface also does not provide positive drainage into existing inlets and causes minor ponding. This causes surface water to accumulate on 32nd St. and Pearl Ave. until it evaporates.

Recommended Improvements

Install 2 – 8' x 4' curb inlet boxes on the north side of intersection to intercept flow along Pearl Ave. before it reaches 32nd St., add 30 feet of 30" RCP to connect new inlet boxes to the existing inlet boxes. Cold mill roadway surface to ensure proper drainage into existing inlets and overlay with 1 to 2 inches of asphalt.

Downstream Controls

None.

Potential Alternatives

Rework surface of intersection to force water into existing inlets, do not install new inlets or new pipes.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Main St. from 25th St. to 27th St., New System

Project Identification Number: 3-10

Data Summary

Watershed:	Water Works
Priority No.:	5
Estimated Cost:	$363,000
Model ID No.:	3315
Map Sheet Reference Number:	8

Existing Problem Description

Water ponds along Main St. due to inadequate curb inlets. Structure No. 3300 (8' x 5' RCB) has a capacity of 240 cfs, the 5-year storm event yields 260 cfs more than the structure is capable of carrying, and the 10-year storm event yields 310 cfs, which is the desired design capacity.

Recommended Improvements

Install 7 – 8' x 4' curb inlets on the east side of Main St. from 25th St. to 27th St. connected with 24" RCP. Install 3 – 8' x 4' curb inlets on the north side of 27th St. empting via a 24" concrete flared end section into the open channel northwest of the 27th St. and Joplin Ave. intersection.

Downstream Controls

None.

Potential Alternatives

Run line into existing RCB on Main St.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Michigan Ave. from 30th St. to 27th St., New System

Project Identification Number: 4-14

Data Summary

Watershed:	Joplin Creek West
Priority No.:	4
Estimated Cost:	$420,000
Model ID No.:	4335
Map Sheet Reference Number:	8

Existing Problem Description

Homes on the east side of Michigan Ave. are subject to flooding due to water flowing in the gutter of the street rising above the gutter and flowing east into the properties. This is due to two reasons. The first is the ditch that flows into the intersection of 30th St. & Michigan Ave. from the west flows across the intersection eastward via a gutter crossing, but during heavy rainfall events, the flow will split and contribute to the amount of water flowing north on Michigan Ave. The second is the length of roadway contributing to the gutter flow is substantial, with no relief until it reaches the existing inlets on 28th St. approximately ¼ mile north and east.

Recommended Improvements

Install a curb inlet with an opening in the back to intercept the flow from the west on the northwest side of the intersection of 30th St. & Michigan Ave. and a curb inlet on the northeast side of said intersection. Every 200 to 300 feet, install 2 - 8'x 4' curb inlet boxes, one on the east side of the road and one on the west, until reaching 28th St. Use 18" RCP to connect the inlet boxes across the street and 24" RCP to connect the inlet boxes in the north-south direction. Continue east past Kansas Ave. with three more curb inlets and 24" RCP to the existing curb inlet on the south side of 28th St. Replace the two boxes on 28th St. and the existing pipe with new curb inlets and 24" RCP. Continue north replacing the existing pipe with 24" RCP. In the schoolyard place an area drain inlet. Continue northwest to the existing curb inlet on the northwest side of 27th St. and Kansas Ave.

Downstream Controls

Structure No. 4326 has a 2-year design capacity of 87 cfs.

Potential Alternatives

Continue north on Michigan Ave., turn east with piping on 26th St. and empty into the open channel on the north side of 26th St., 120 feet east of the Michigan Ave. and 26th St. intersection.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Intersection of 9th St. and Minnesota Ave., Storm Sewers

Project Number: 20

Project Identification Number: 4-15

Data Summary

Watershed:	Joplin Creek West
Priority No.:	
Design Capacity:	
Estimated Cost:	$86,878
Model ID No.:	
Map Sheet Reference Number:	5

Existing Problem Description

Excessive surface water along 9th St. caused by insufficient inlet capacity to convey runoff from roadway. Area at headwall on north side of 9th St. and entrance of pipe on south side of 9th St. partially blocked with debris and rock. Structure No. 4220 has 1330 cfs of capacity currently. 10-year storm discharge for this structure is 1570 cfs.

Recommended Improvements

Install two 8'x 4' curb inlets on 9th St. west of the intersection of 9th St. & Minnesota Ave., one on the north side of the street, one on the south side. Install 30 LF 18" RCP between the two new curb inlets. Use the existing 36" RCP on north side of 9th St., build a curb inlet box and headwall structure to utilize existing pipe. Install two 8'x 4' curb inlets on 9th St. west of the railroad tracks, replacing the existing inlets. Install 50 LF of 15" RCP between the two new curb inlets. Install two 8'x 4' curb inlets on 9th St. west of the intersection of 9th St. & the small alley going north, one on the north side of the street, one on the south side. Install 30 LF 15" RCP between the two new curb inlets. Connect the east pair of inlets to the middle pair using 175 linear feet of 18" RCP on the north side of 9th St.

Downstream Controls

None.

Potential Alternatives

Replace structure No. 4220 (2-11' x 4' RCB) with 2-15' x 4' RCB, capable of discharging more than 1570 cfs.

Use a precast single span arch for structure No. 4220.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Massachusetts Ave. from 15th St. to 18th St., Regional Detention

Project Number: 22

Project Identification Number: 6-10

Data Summary

Watershed:	Joplin Creek East
Priority No.:	
Design Capacity:	
Estimated Cost:	$843,150
Model ID No.:	6280
Map Sheet Reference Number:	8

Existing Problem Description

Roadway flooding on 15th St., property flooding within the project vicinity, and excessive peak discharges at downstream structures and channels are experienced. The structure immediately downstream of this project is undersized as shown in the following table.

Structure	Description	Capacity	10 Yr
6295	2-8.5'X3' RCB approx. 1.5' of head - Upstream of Site	390 - 100 Yr	250
6285	2-5.7'X4' RCB approx. 3.5' of head - On Site	450 - 50 Yr	330
6275	2-60" RCP approx. 1'4" of head - On Site	440 - 10 Yr	440
6265	6'X6' RCB approx. 2' of head - Downstream of Site	450 – 5 Yr	460

Recommended Improvements

Convert the large area that is currently a park with trails and sports amenities into a regional detention basin. Detention in this area will reduce downstream flooding. Outlet structures will discharge under 15th Street and will be included in this project.

Downstream Controls

Structure No. 6265, a 6'X6' RCB downstream of this site is only capable of conveying 450 cfs through the structure.

Potential Alternatives

Upgrade culverts with no additional detention. This option could cause additional flooding at the 7th St. and Illinois Ave. intersection.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Intersection of 14th St. and Florida Ave., Replacement

Project Identification Number: 6-11

Data Summary

Watershed:	Joplin Creek East
Priority No.:	10
Estimated Cost:	$36,000
Sub-basin ID No.:	6325
Map Sheet Reference Number:	5

Existing Problem Description

3' x 6.5' drop inlet in back yard of 2625 14th St. property not allowing enough flow into it, causes yard flooding. This is because of small openings in the box and yard debris builds up around the openings. Also, the pipe from the inlet to the street is collapsed due to tree roots.

Recommended Improvements

Add inlet to reduce chances of clogging, replace existing 18" pipe with 24" RCP, this will require the removal of several large trees.

Downstream Controls

None.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Illinois Ave. Between 7th St. and 9th St., Storm Sewers

Project Identification Number: 6-12

Data Summary

Watershed:	Joplin Creek East
Priority No.:	6
Estimated Cost:	$668,000
Sub-basin ID No.:	6100
Map Sheet Reference Number:	5

Existing Problem Description

Excessive surface water due to lack of curb inlets to take runoff off roadway during low flow conditions. During high flow conditions water backs up in Joplin Creek located to the east. Consequently the existing outlet pipes conveying discharge from the roadway through the existing curb inlets become full of water with no outlet and water backs up onto Illinois Ave.

Recommended Improvements

Install two 8'x 4' curb inlets on 8th St. at the intersection of 8th St. & Illinois Ave., one on the north side and one on the south side of the street. Install 30 L.F. of 24" RCP from the north inlet box to the south inlet box. Install one 8'x 4' drop inlet in drive apron on the east side of the intersection of 8th St. & Illinois Ave. Install 55 L.F. of 36" RCP from the south inlet box on 8th St. to the drop inlet. Install one 8'x 4' curb inlet on the northeast side of Illinois Ave. at the intersection of Murphy Blvd. & Illinois Ave. Install 215 L.F. of 24" RCP from the 8'x 4' curb inlet on the northeast side of Illinois Ave. at the intersection of Murphy Blvd. & Illinois Ave. to the drop inlet. From the drop inlet install 385 L.F. of 36" RCP to the east, day-lighting in existing channel flowing north. Place stormwater check valve in channel at end of 36" RCP and at the end of all other drainage pipes from this area that are going to the open ditch.

Downstream Controls

Projects 6-1 and 6-2 should be completed in advance of this project. Upstream regional detention is needed to reduce frequency of flooding in this area.

Potential Alternatives

When water rises in channel, pump water off Illinois Ave. into channel. Replace existing piping and improved inlet boxes. Could also make channel improvements to reduce the water surface elevation in the channel, thereby reducing the potential for water backing up onto Illinois Ave.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Disconnect inlets and piping system along Illinois Ave. from Joplin Creek and bore under 7th St. utilizing inverted siphon and convey the discharge to the channel further downstream. More detailed survey information needed to determine feasibility. $500,000 included for this option.

Notes

Water flows from the main channel back up though the existing pipes into the inlet boxes and out onto Illinois Ave. This is the primary problem during high flow events, and adding the proposed improvements will not aid in alleviating this problem. Water also rises upstream of this site due to structure No. 6175, then flows north on Illinois Ave. adding to the existing flooding. Without addressing this problem first, the pump alternative would prove ineffective. Also, boring under 7th St. and conveying the discharge to the main channel downstream would be possible, but due to minimal gradient, utilities, easement acquisition, and downstream conditions, this option will be costly and possibly only provide minimal enhancement to the current conditions. Main channel improvements would provide the best results, but would also have all the caveats of boring with an even higher cost associated therewith.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Ditch north of Hill St. from Division Ave. to Mineral Ave., Storm Sewers

Project Identification Number: 6-13

Data Summary

Watershed:	Joplin Creek East
Priority No.:	18
Estimated Cost:	$182,000
Model ID No.:	6070
Map Sheet Reference Number:	5

Existing Problem Description

The intersection of Division Ave. and Valley St. is susceptible to water ponding. This is due to the insufficient amount of relief provided by existing curb inlets for surface runoff to migrate from the street to the channel flowing west from the intersection. Similar problems exist at the channel and Cox Ave. intersection. Water flowing south from the Tamko complex enters a low-rise 2' wide trickle channel that overflows frequently. The low point on Mineral Ave. just north of the channel crossing the street has deficient drop inlets with broken grates and inadequate capacity.

Recommended Improvements

Construction of a new type 1 flume as per City of Joplin standard plans on the west side of Division St. into the channel to provide adequate surface relief. Existing curb inlets and drainage structures are to be left in place in this area. Beginning at Pool St., the southbound flow from Tamko can be intercepted with a curb inlet, thence the flow would be conveyed south via 30" concrete pipes to Spring St, then extending along the south side of Spring St. west to the west side of Cox Ave. via 36" concrete pipes. Finally the flow would be directed south along the west side of Cox. Ave. in 36" concrete pipes, day-lighting in the main channel at the intersection of Cox Ave. and the channel on the west side. The 4 existing curb inlets are to be left in place with existing piping. At the low point on Mineral Ave. just north of the channel, the two existing drop inlets are to be replaced with two new 8' x 4' curb inlets. In addition, install 25 L.F. of 30" RCP to connect the boxes and 108 L.F. of 30" RCP from the west box to the existing RCB to the south, flowing west.

Downstream Controls

None.

Potential Alternatives

Tamko Complex Detention

Joplin, Missouri
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Capital Improvement Project Recommendation

Project Name: Northeast side of Murphy Blvd. between 15th Street and 20th St., Regional Detention

Project Identification Number: 6-14

Data Summary

Watershed:	Joplin Creek East
Priority No.:	1
Estimated Cost:	$748,000
Model ID No.:	6335
Map Sheet Reference Number:	8

Existing Problem Description

Roadway flooding on 15th St., property flooding downstream, and excessive peak discharges at downstream structures and channels, above that which they are capable of conveying.

Recommended Improvements

Project No. 6-8, Davis Blvd. Regional Detention, must be completed prior to constructing these improvements. Convert large area that is currently a park with trails and a large channel into a regional detention basin. Detention at this area will provide downstream areas increased flood protection during peak discharges after storm events by reducing the existing 100 year design flow from 1617 cfs to 1272 cfs, which is less than the 50 year design flow. These flows assume Project No. 6-8 is complete. Constructing a berm on the south side of 15th Street and excavating the park area above the top of existing bank should accomplish the needed detention. Altering the existing channel provides minimal benefit.

Downstream Controls

Structure No. 6330 is to be replaced and reconstructed as addressed in Project ID 6-6. It should also be noted that construction of a detention facility at this location may cause the upstream structure No. 6373 (117" x 79" CMPA) to function with less capacity due to backwater and must be a consideration of the design.

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Capital Improvement Project Recommendation

Project Name: 4th St. and School Ave., Culvert and Ditch Improvements

Project Identification Number: 6-15

Data Summary

Watershed:	Joplin Creek East
Priority No.:	7
Estimated Cost:	$500,000
Model ID No.:	6091, 6105
Map Sheet Reference Number:	5

Existing Problem Description

The existing ditch and culverts running between the old railroad tracks and Empire District Electric do not have sufficient capacity and cause flooding in the Empire Buildings. The ditch empties into 2-24" RCP culverts where it crosses under 4th St. and into structure 6105, which has less than a 5-year design capacity.

Recommended Improvements

Improve the existing ditch by constructing a trapezoidal concrete ditch and utilize a 5'x2' RCB for ditch crossing into Empire. Replace existing 24" RCPs under 4th St. with a 42" RCP. Structure No. 6105 should be replaced with a 5' x 4' RCB from the ditch to School Ave. approximately 400 linear feet.

Downstream Controls

None.

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Capital Improvement Project Recommendation

Project Name: 4th St. and Tyler Ave., 4th St. and Adele Ave.

Project Identification Number: 7-8

Data Summary

Watershed:	Lone Elm
Priority No.:	14
Estimated Cost:	$242,000
Model ID No.:	7064
Map Sheet Reference Number:	4

Existing Problem Description

A significant amount of water is ponding on the south side of 4th St. just east of Tyler St. Existing inlets are unable to convey the discharge from the roadway. Excessive surface water on Tyler Ave. and Adele Ave. leading up to 4th St. due to lack of surface relief is causing frequent street flooding.

Recommended Improvements

Install 3 - 8' x 4' curb inlet boxes where Tyler Ave. and Adele Ave. intersect 4th St. Install 2 - 8' x 4' area inlet boxes on Tyler Ave. approximately 240 feet south of the Tyler Ave. and 4th St intersection. Install 2 - 8' x 4' curb inlet boxes on Adele Ave. approximately 260 feet south of the Adele Ave. and 4th St intersection. Connect curb inlet boxes with 15" to 18" RCP. Use all other existing piping and incorporate with new curb inlet boxes.

Downstream Controls

Ditch to north and exiting 3' RCP adequate for design flows. Existing pipes at connection point for new piping may need to be replaced depending on size and condition.

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Capital Improvement Project Recommendation

Project Name: 2nd St. between Oliver Ave. and McCoy Ave., also Oliver Ave. and 3rd St.

Project Identification Number: 7-9

Data Summary

Watershed:	Lone Elm
Priority No.:	15
Estimated Cost:	$80,000
Model ID No.:	7083
Map Sheet Reference Number:	4

Existing Problem Description

Stagnant water in the ditch to the east of Oliver Ave. and 3rd St. Street flooding is prominent due to an undersized curb opening at this location also. Street flooding on 2nd St. due to 2 undersized curb openings over structure No. 7083. common. Standing water due to fill placed for loading dock also a problem.

Recommended Improvements

Re-grade the ditch east from the 3rd St. and Oliver Ave. intersection, approximately 1000 L.F. to 2nd St. Cut the ditch through the fill placed to level a turn-around for the loading dock. Construct a new type 1 flume, 6' wide, to allow water to drain off of roadway and into the ditch. At structure No. 7083 replace the existing flumes with new wider type 1 flumes as per City of Joplin standard plans. At the end of each flume, place riprap to prevent erosion.

Included in the cost estimate is the reconstruction of the aerial sanitary sewer crossing just north of structure No. 7083.

Downstream Controls

None.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Intersection of Lone Elm Rd. and Murphy Blvd.

Project Identification Number: 7-10

Data Summary

Watershed:	Lone Elm
Priority No.:	19
Estimated Cost:	$382,000
Model ID No.:	7020, 7030
Map Sheet Reference Number:	4

Existing Problem Description

Structure No. 7020 (2 - 10' x 4' RCB) under Murphy Blvd. is undersized, with only slightly more capacity than a 2 year storm discharge. Structure No. 7030 (6' x 2' RCB) under Lone Elm Rd. has only slightly more capacity than a 5-year storm discharge. At the north corner of the Lone Elm Rd. and Murphy Blvd. intersection, water ponds on the edge of the roadway and in the beginning of the ditch. The beginning of the ditch has silted in blocking the discharge path for surface runoff from the northeast going around the curb radius and into the ditch. On the northeast side of Lone Elm Rd. approximately 150' north of the afore mentioned intersection there is a 15" corrugated plastic pipe used for egress/ingress to a property that is also installed too high where water cannot pass in low flow conditions. In this same location, a 24" RCP runs west under Lone Elm Rd. to a concreted ditch. The ditch is capable of carrying more flow than the pipe; the pipe entrance is also partially blocked.

Recommended Improvements

Improvements to or replacement of Structure No. 7020 to enable passage of the 10-year storm event is recommended. When structure No. 7020 is replaced and allows more passage of water, structure No. 7030 would be capable of conveying more flow. Hence structure No. 7030 can remain in place, along with the 24" RCP flowing to it and the 6' x 3.5' curb inlet conveying water into the 24" RCP. On the northeast side of the intersection the ditch is to be cleaned and a type 2 flume as per City of Joplin standard plans installed to provide positive drainage from the roadway into the ditch. Re-grade approximately 120' of the earth ditch. The existing 15" CPP used for egress/ingress should be replaced with a 24" RCP. The existing 24" RCP flowing west under Lone Elm Rd. should be upgraded to a 36" RCP. Construction of a headwall at the low point of the ditch on the east side of Lone Elm Rd. will facilitate the new 24" RCP and also the new 36" RCP exit and entrance needs, respectively. Re-grade approximately 200 feet of the ditch on the east side of Lone Elm Rd. north of the new headwall structure.

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Capital Improvement Project Recommendation

Downstream Controls

The ditch north of these improvements along the west side of Lone Elm Rd. is adequate for the design discharges, however, structure No. 7010 is not. Consideration should be given to the effectiveness of these improvements given downstream restrictions.

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Capital Improvement Project Recommendation

Project Name: Cleveland Ave. Between 25th St. and 24th St.

Project Identification Number: 8-5

Data Summary

Watershed:	Country Club
Priority No.:	9
Estimated Cost:	$27,000
Model ID No.:	8024
Map Sheet Reference Number:	7

Existing Problem Description

Area flooding along Cleveland Ave. between 24th and 25th streets due to existing system being inadequate.

Recommended Improvements

Replace existing 16" CMP with 45 linear feet of 24" RCP and shape the gutter leading into the new flared end section.

Downstream Controls

Project 8-4 should be done in conjunction with or prior to this project.

Potential Alternatives

Existing HDPE piping and inlet system extending south from the ditch near 24th along Cleveland Ave. is a newer system that was constructed as part of the subdivision prior to the subdivisions' incorporation into the city of Joplin. This system was not designed or constructed in a manner to prevent nuisance flooding in yards and of the roadway. This system could be completely replaced for approximately $400,000 (Project 8-5A)

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Capital Improvement Project Recommendation

Project Name: 10th St. & Peters Ave., Ditch and Culvert Improvements

Project Identification Number: 10-3

Data Summary

Watershed:	Turkey Creek Central
Priority No.:	2
Estimated Cost:	$376,000
Model ID No.:	10500
Map Sheet Reference Number:	6

Existing Problem Description

Gravel is washing out onto Geneva Ave. from an alley. The discharge flows east across Geneva Ave. into a large flume and earth ditch. The ditch conveys the water downstream to a drive crossing, consisting of a shared gravel drive with a 36" corrugated plastic pipe (CPP) projecting from the fill. The house at 3128 9th St. is subject to flooding when the 36" CPP is unable to pass the flow and the driveway overtops. On Peters Ave. there is significant washing out of the roadway gravel into the ditch. Water flowing north on the west side of Peters Ave. in the existing ditch from 12th St. crosses Peters Ave. via 2-12" RCPs. These pipes are undersized and forces water to flow across the intersection. Water flowing from 11th St. flows east across Peters Ave. causing more erosion of the gravel in the intersection. North of the intersection of 11th St and Peters Ave. to 10th St. the street is washed out. The intersection of Peters Ave. and 10th St. is also eroded as water flows east on the south side of 10th St. across Peters Ave.

Recommended Improvements

Pave the alley from the intersection of the alley and Geneva Ave. to parking lot adjacent to Rangeline Ave. to eliminate gavel washing onto street. On Peters Ave., the 2-12" RCPs should be replaced with a 24" RCP and 2-24" flared end sections. Grade and concrete line the trapezoidal ditch on the east side of Peters Ave. the entire length, approximately 420 linear feet. Construct concrete gutter crossing at intersection of 10th St. and Peters Ave. to convey water from south ditch on 10th St across the intersection into the ditch on east side of Peters Ave. Peters Ave. should be paved from 10th St. to 12th St. Project No. 10-2 should be completed at the same time as the improvements recommended herein. Also recommended is placing the proposed 8' x 3' RCB on a skew to better align the channel. Stabilization of the bank immediately north of structure No. 10505 can be accomplished via the addition of grouted riprap on the bottom and east side of the channel, approximately 80 feet of bank needs to be stabilized.

Potential Alternatives

Add flared end section to existing 36" corrugated plastic pipe to help alleviate flooding at 3128 9th St. A parallel 36" CPP could be placed next to the existing pipe to serve this purpose better.

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Capital Improvement Project Recommendation

Project Name: Euclid Ave. from Odessa St. to Rolla St., Ditch Improvements

Project Identification Number: 10-4

Data Summary

Watershed:	Turkey Creek Central
Priority No.:	16
Estimated Cost:	$355,000
Model ID No.:	10105
Map Sheet Reference Number:	2

Existing Problem Description

The steep ditches along the east side of Euclid Ave. are prone to erosion and frequent flooding onto the street. Compounding the problem are the small 15" pipes under driveways and streets.

Recommended Improvements

Pipe the ditch, beginning at the south side of Rolla Ave. and continuing southwest using 24" RCP to the north side of Princeton St., then further southwest to the south side of Odessa St. with 30" RCP. At each street intersection place 2 – 8' x 4' curb inlets except at the Rolla St. intersection, use only the 1 – 8' x 4' curb inlet afore mentioned. At the end of the 30" pipe, place a flared end section and concrete line the ditch to the south property line. This system will pass the 5-year design storm. A larger system is recommended if the detailed design will allow without major cost increases.

Downstream Controls

None.

Potential Alternatives

Continue on with the piping to the south.

Joplin, Missouri
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Capital Improvement Project Recommendation

Project Name: Salem St. just east of Park Ave.

Project Identification Number: 10-5

Data Summary

Watershed:	Turkey Creek Central
Priority No.:	17
Estimated Cost:	$9,000
Model ID No.:	
Map Sheet Reference Number:	2

Existing Problem Description

The ditch flowing south onto Salem St. floods across the street and continues flowing south.

Recommended Improvements

Install 24 linear feet of 24" RCP with a flared end section pointed north to intercept the southbound flow. Connect the pipe to the existing curb inlet box on the north side of Salem St.

Downstream Controls

None.

Joplin, Missouri
10-Year Stormwater Management Master Plan
Capital Improvement Project Recommendation

Project Name: Windsor St. from Michigan Ave. to Illinois Ave.

Project Identification Number: 12-2

Data Summary

Watershed:	Royal Heights
Priority No.:	13
Estimated Cost:	$57,000
Sub-basin ID No.:	12005
Map Sheet Reference Number:	2

Existing Problem Description

At the intersection of Michigan Ave. and Windsor St. the runoff flows south off the stub out of Michigan Ave. over riprap and into an earthen ditch. The ditch is eroding and the riprap is too small, causing it to migrate downstream. At the intersection of Illinois Ave. and Windsor St. the runoff flows to a low point in the street located in front of 1032 Windsor St. An existing curb inlet (8.5' x 3.5') is in place to remove the water from the street, which then flows into a 24" corrugated plastic pipe that discharges at the back of the property into an existing channel. Any overflow flows through the yard to the back of the property into the same channel. This area collects a significant amount of runoff from three directions, and the existing stormwater control devices are insufficient to remove the water in a timely fashion. At the east end (stub out) of Windsor St. the water flows straight off the street into a channel. There does not appear to be any prominent problem in this area.

Recommended Improvements

Add larger riprap where Michigan Ave. stubs out to the south. Clean out the ditch from there and line with riprap. Add curb inlet extensions to existing curb inlet in front of 1032 Windsor St. Run a parallel line consisting of 160 L.F of 24" CPP, discharging at the south side of the property.

Downstream Controls

Impractical to attempt downstream channel improvements in the woods. Limbs and debris will wash out during major storm events, the channel is adequate if not blocked.

Potential Alternatives

Channel flowing south from intersection Michigan Ave. and Windsor St. could be concreted if Michigan Ave. was not going to be extended.

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Capital Improvement Project Recommendation

Project Name: Industrial Park Road and Kennedy Lane, Regional Detention

Project Identification Number: 13-2

Data Summary

Watershed:	Baker's Branch (Oakland)
Priority No.:	36
Estimated Cost:	$160,000
Sub-basin ID No.:	13061
Map Sheet Reference Number:	3

Existing Problem Description

Excessive surface water coming from the existing industrial park is causing ditch to erode on private property to the South. The industrial park was constructed prior to regulations being in place to require storm water detention.

Recommended Improvements

Construct a six-acre regional detention basin within the industrial park to decrease the 2- and 5-year design storms by 40%, the 10-year by 25%, and the higher intense storms by approximately 10%. By controlling the more frequent storms, erosion of the natural channel may subside. Following are the estimated pre- and post-developed flows immediately downstream of the proposed detention basin:

	DISCHARGE (cfs)					
	2YR	5YR	10YR	25YR	50YR	100YR
Pre-Developed	224	443	624	797	1026	1191
Post-Developed	138	260	468	664	915	1082
% Reduction	38%	41%	25%	16%	10%	9%

Downstream Controls

None.

APPENDIX A

EXHIBIT 1 – RECOMMENDED STORM DRAINAGE IMPROVEMENT MAP

APPENDIX B

HEC –1 DATA SUMMARY

Joplin, Missouri
10-Year Stormwater Management Master Plan
HEC-1 Data Summary

	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
TCE1	4.500	75.4	0.74	5.783			
TCE2A	0.750	75.3	0.60	1.883			Includes TCE2B
TCE3	2.800	76.5	0.91	1.201			
TCE4	1.900	77	0.87	3.494			
TCE5	1.400	76.6	0.87	0.757			
TCE6	0.800	75.3	0.84				Does not exist on Area Map
1000	0.009	80	0.25	0.009			
1002	0.076	72	0.45	0.074			
1005	0.256	73	0.60	0.240			
1020	0.021	72	0.20	0.020			
1025	0.162	74	0.50	0.173			
1030	0.064	76	0.38	0.063			
1035	0.009	77	0.20	0.009			
1040	0.115	73	0.41	0.115			
1050	0.183	76	0.30	0.183			Incorrectly named 1043 in original model
1055	0.101	72	0.45	0.102			
1060	0.317	72	0.50	0.317			
1065	0.094	75	0.30	0.097			
1070	0.048	72	0.45	0.046			
1085	0.046	72	0.35	0.044			
1090	0.017	72	0.38	0.021			
1095	0.207	78	0.45	0.205			
1100	0.108	80	0.30	0.108			
1105	0.072	72	0.45	0.082			
1110	0.086	74	0.45	0.090			
1115	0.059	74	0.25	0.047			
1120	0.042	72	0.40	0.043			
1125	0.170	75	0.45	0.174			
1130	0.010	72	0.26	0.008			
1135	0.082	76	0.40	0.076			
1140	0.058	75	0.38	0.052			
1145	0.212	80	0.45	0.220			
1150	0.235	75	0.45	0.242			
1160	0.091	75	0.30	0.087			
1165	0.115	82	0.40	0.116			Removed 23.63 Ac. (Drury Site)
1170	0.009	75	0.20	0.008			
1172	0.056	85	0.25	0.053			
1175	0.125	75	0.36	0.129			
1180	0.019	75	0.25	0.019			
1185	0.054	75	0.30	0.054			
1190	0.013	83	0.20	0.013			
1195	0.031	75	0.36	0.032			
1196	0.032	85	0.21	0.032			
1200	0.056	88	0.40	0.061			Incorrectly named 1197 in original model
1203	0.062	83	0.35	0.064			
1205	0.100	87	0.36	0.098			
1210	0.124	75	0.35	0.125			
1215	0.127	80	0.35	0.115			
1220	0.096	75	0.40	0.115			
1224	0.036	75	0.25	0.035			
1225	0.051	75	0.30	0.049			
1226	0.018	79	0.20	0.018			
1230	0.007	84	0.20	0.007			
1235	0.065	75	0.40	0.053			
1240	0.009	88	0.20	0.010			

Joplin, Missouri
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HEC-1 Data Summary

	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
1243	0.011	85	0.25	0.015			
1244	0.011	85	0.23	0.011			
1245	0.122	85	0.30	0.125			
1250	0.014	88	0.20	0.012			
1255	0.082	75	0.45	0.078			
1260	0.142	73	0.40	0.150			
1275	0.061	72	0.45	0.064			
1280	0.091	75	0.45	0.089			
1284	0.110	75	0.45	0.109			
1285	0.003	78	0.15	0.004			
1286	0.008	78	0.20	0.009			
1287	0.013	78	0.20	0.013			
1290	0.096	73	0.40	0.094			Incorrectly named 1288 in original model
1295	0.127	73	0.45	0.091			
1297				0.027			Not included in original model
1300	0.094	72	0.45	0.100			
1301	0.071	80	0.40	0.068			
1307	0.045	75	0.25	0.052	78	0.2	
1309	0.158	82	0.35	0.152	82.5	0.3	
1310	0.069	75	0.30	0.070	85		
1315	0.033	87.4	0.30	0.028		0.12	
1317	0.051	83	0.30	0.025	76.6	0.19	
1320	0.041	83	0.30	0.069	76.7	0.3	
1325	0.126	80	0.46	0.123	90.1	0.3	
1329	0.067	84	0.30	0.074	96.9	0.32	
1330	0.160	80	0.40	0.161	80.2	0.4	
1335	0.011	75	0.23	0.011	70	0.19	
1337	0.011	80	0.15	0.013	80.4	0.13	
1340	0.078	80	0.25	0.105	73.9	0.37	
1345	0.086	85	0.35	0.085	90.8	0.29	
1346	0.042	85	0.20	0.035	95.7	0.19	
1349	0.047	70	0.45	0.052	92.5	0.28	
1350	0.019	85	0.25	0.018	87	0.17	
2000	0.038	73	0.30	0.036			
2005				0.198			Not included in original model
2010				0.142			Not included in original model
2015	0.057	78	0.30	0.062			
2020	0.110	77	0.40	0.112			
2030	0.031	75	0.20	0.029			
2032	0.012	80	0.20	0.012			
2033	0.023	80	0.20	0.022			
2034	0.076	81	0.25	0.079			
2040	0.066	74	0.45	0.062			
2045	0.003	80	0.15	0.003			
2060	0.108	80	0.34	0.108			Incorrectly named 2055 in original model
3010	0.129	73	0.33	0.130			
3022	0.068	76	0.32	0.068			
3030	0.040	72	0.40	0.036			
3035	0.024	76	0.25	0.025			
3040	0.085	78.3	0.35	0.086			
3045	0.079	75.24	0.31	0.079			
3060	0.033	80.2	0.30	0.030			
3070	0.049	81.4	0.25	0.048			
3075	0.044	79.8	0.25	0.040			
3080	0.022	75.4	0.26	0.024			

Joplin, Missouri
10-Year Stormwater Management Master Plan
HEC-1 Data Summary

	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
3085	0.020	77	0.12	0.019			
3090	0.062	78.6	0.31	0.065			
3100	0.039	83	0.24	0.038			
3105	0.042	86.1	0.20	0.042			
3115	0.024	75	0.25	0.024			
3117	0.087	83	0.35	0.088			
3125	0.047	79.8	0.25	0.049			
3130	0.151	77	0.39	0.152			
3140	0.064	85.6	0.29	0.062			
3150	0.053	83	0.22	0.051			
3052	0.042	77	0.20	0.041			Incorrectly named 3152 in original model
3155	0.096	76.3	0.75	0.040			
3055	0.020	77	0.18	0.025			Incorrectly named 3155 in original model
3162	0.070	80	0.30	0.077			
3165	0.059	81.4	0.25	0.059			
3166	0.068	81	0.25	0.062			
3175	0.028	89.25	0.18	0.028			
3180	0.067	83	0.33	0.069			
3190	0.035	72	0.42	0.050			
3195	0.084	73.8	0.56	0.083			
3197	0.037	72	0.45	0.040			
3205	0.051	82.8	0.33	0.051			
3215	0.028	73.45	0.25	0.028			
3220	0.033	78	0.20	0.031			
3225	0.063	81	0.35	0.064			
3235	0.072	73	0.40	0.073	70.9	0.24	
3239	0.036	79	0.25	0.038	75.4	0.13	
3245	0.143	83	0.40	0.144	79.6	0.22	
3255	0.101	81.9	0.32	0.102	77.8	0.26	
3265	0.022	76.4	0.27	0.022	72.3	0.19	
3266	0.110	85.8	0.34	0.113	81.7	0.33	
3275	0.034	76.95	0.54	0.034	74.1	0.21	
3285	0.050	83	0.31	0.049	80.1	0.19	
3295	0.044	85.1	0.20	0.046	81.2	0.22	
3305	0.015	85.1	0.15	0.019	82.7	0.12	
3315	0.050	83.7	0.32	0.044	81.4	0.25	
3325	0.010	79.7	0.14	0.011		0.16	
3335	0.199	83	0.42	0.193	79.3	0.33	
3345	0.026	81.6	0.21	0.024	82.3	0.13	
3350	0.058	88	0.25	0.057	77.8		
3371	0.034	89	0.20	0.035	87.3	0.15	
3372	0.015	89	0.20	0.018	95.2	0.08	
3375	0.081	85	0.30	0.079	92.9	0.15	
3376	0.016	80	0.20	0.020	85.8	0.16	
3380	0.027	82	0.20	0.027	78.3	0.12	
3385	0.071	77	0.40	0.072	69.5	0.26	
3390	0.034	80	0.20	0.032	76.1	0.12	
3391	0.019	83	0.20	0.020	91	0.13	
3392	0.007	83	0.18	0.007	91	0.11	
3393	0.052	83	0.32	0.058	78.9	0.17	
3394	0.017	83	0.20	0.017	87.5	0.11	
3395	0.086	83	0.35	0.082	74.6	0.13	
3410	0.060	80	0.34	0.056	77.5	0.17	
4000	0.006	90	0.25	0.013			
4010	0.011	85	0.25	0.013			

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SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
4011	0.017	80	0.31	0.020			
4025	0.009	86	0.25	0.022			
4035	0.016	90	0.25	0.015			
4040	0.061	96	0.25	0.063			
4045	0.075	96	0.25	0.077			Removed 2 Acres, Moved to A4055
4050	0.007	83	0.2	0.009			Added 6 Acres, Field Verified by AM
4055	0.063	84	0.35	0.069			Added 2 Acres, Field Verified by AM
4060	0.031	83	0.25	0.030			
4065	0.027	83	0.38	0.022			
4070	0.052	83	0.25	0.049			
4073	0.020	81	0.35	0.022			
4075	0.028	84	0.39	0.027			
4085	0.025	83	0.25	0.023			
4095	0.044	86	0.25	0.045			
4105	0.059	86	0.3	0.052			
4110	0.082	83	0.31	0.055			
4125	0.044	72	0.68	0.039			
4126	0.039	72	0.68	0.039			
4130	0.035	82.6	0.42	0.033			
4140	0.016	83	0.3	0.027			4135 included in 4140
4145	0.034	83	0.54	0.049			
4155	0.024	90	0.25	0.018			
4164	0.012	89	0.25	0.015			
4165	0.040	88	0.25	0.039			
4166	0.010	83	0.25	0.009			
4170	0.018	92	0.25	0.019			
4175	0.016	96	0.31	0.014			
4176	0.016	96	0.31	0.019			
4180	0.030	86	0.31	0.026			
4181	0.031	86	0.31	0.035			
4185	0.028	81	0.25	0.028			
4195	0.029	83	0.34	0.031			
4205	0.017	83	0.26	0.028			
4206	0.012	83	0.2				Does not exist on Area Map
4215	0.052	82	0.4	0.050			
4225	0.080	81	0.34	0.074			
4240	0.050	91	0.25	0.047			
4245	0.040	83	0.3	0.041			
4255	0.039	80	0.4	0.040			
4256	0.048	86	0.41	0.050			
4257	0.084	84	0.4	0.093			
4265	0.069	86	0.38	0.058			
4266	0.021	86	0.3	0.032			
4275	0.067	85	0.32	0.068			
4276	0.035	85	0.2	0.035			
4285	0.074	83	0.29	0.077			
4295	0.065	82	0.4	0.066			
4300	0.107	83	0.34	0.108			
4305	0.065	83	0.25	0.069			
4310	0.033	84	0.25	0.032			
4311	0.037	88	0.2	0.040			
4312	0.025	83	0.2	0.025			
4315	0.040	82	0.37	0.044			
4320	0.051	83	0.25	0.052			
4325	0.041	83	0.25	0.041			

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SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
4330	0.114	83	0.3	0.114			
4335	0.059	83	0.25	0.055			
4340	0.145	83	0.5	0.127			
4341	0.060	83	0.3	0.074			
4345	0.037	83	0.3	0.040			
4346	0.056	83	0.25	0.055			
5000	0.050	78.6	0.30	0.046			
5005	0.021	75.4	0.41	0.017			
5010	0.080	75.5	0.45	0.081			
5007	0.0123	76	0.32	0.012			Incorrectly named 5012 in original model
5015	0.030	77.8	0.35	0.029			
5020	0.050	75	0.34	0.058			
5025	0.080	76.2	0.40	0.085			
5030	0.080	79.7	0.39	0.071			
5035	0.077	77.9	0.40	0.074			
5040	0.080	75.2	0.44	0.081			
5045	0.140	75.8	0.39	0.138			
5050	0.170	75.4	0.43	0.174			
5057	0.080	75	0.37	0.071			
5060	0.150	75.6	0.37	0.123			
5063	0.010	75	0.27	0.009			
5065	0.090	75.4	0.39	0.073			
5070	0.090	79.6	0.40	0.097			
5075	0.066	79.45	0.28	0.071			
5076	0.016	83	0.20	0.017			
5077	0.0133	79.45	0.28	0.012			
5080	0.050	75	0.39	0.056			
5085	0.070	81.6	0.28	0.071			
5090	0.120	76	0.46	0.124			Incorrectly named 5091 in original model
5097	0.030	81.4	0.29	0.031			
5100	0.060	77	0.45	0.051			
5105	0.005	78	0.20	0.004			
5106	0.025	78	0.25	0.024			
5107	0.063	80	0.25	0.055			
5108	0.140	80	0.30	0.160			
6000				0.166			Not Included in original model
6005	0.151	79.15	0.346	0.148			
6010	0.048	73.8	0.569	0.049			
6015	0.075	72.85	0.651	0.076			
6020	0.017	72.55	0.25	0.015			
6022	0.031	80	0.3	0.030			
6027	0.061	80	0.4	0.061			
6030	0.015	95	0.15	0.015			
6031	0.024	83	0.25	0.025			
6033	0.023	96	0.2	0.018			
6034	0.017	94	0.2	0.017			
6037	0.024	83	0.2	0.021			
6039	0.086	83	0.375	0.079			
6040	0.025	72.55	0.013	0.025			
6050	0.024	76.4	0.008	0.022			
6060	0.026	78.6	0.2	0.027			
6070	0.141	80	0.4	0.057			
6076				0.111			Not included in original model
6078	0.057	82	0.4	0.061			
6080	0.039	76.7	0.366	0.048			

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	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
6090	0.061	86.8	0.272	0.051			
6100	0.062	83	0.369	0.066			
6103	0.016	83	0.2				Does not exist on Area Map
6104	0.018	89	0.2				Does not exist on Area Map
6105	0.012	89	0.2				Does not exist on Area Map
6106	0.093	82.05	0.3				Does not exist on Area Map
6110				0.041			
6115				0.086			
6125	0.044	83	0.3	0.042			
6127	0.009	80	0.2	0.013			
6128	0.014	79	0.2	0.014			
6130	0.006	77	0.25	0.005			
6140	0.008	74	0.25	0.010			
6150	0.008	79	0.2	0.013			
6153	0.069	83	0.3	0.016			
6154	0.008	83	0.2	0.010			
6155	0.008	83	0.2				Does not exist on Area Map
6160				0.098			Not included in original model
6163	0.016	83	0.2				Does not exist on Area Map
6164	0.026	83	0.25				Does not exist on Area Map
6170	0.035	90	0.208	0.035			
6180	0.073	84.4	0.357	0.071			
6190	0.005	79	0.288	0.006			
6194	0.067	82.45	0.417	0.067			Includes 6205
6215	0.028	78.6	0.038	0.030			
6225	0.030	83.2	0.233	0.026			
6235	0.080	90	0.25	0.086			
6240	0.085	81.35	0.44	0.067			
6250	0.057	79.4	0.313	0.066			
6255	0.030	76	0.443	0.030			
6270	0.036	80.2	0.189	0.033			
6280	0.098	82.6	0.372	0.089			
6290	0.013	79.8	0.332	0.016			
6296	0.057	83	0.3	0.059			
6300	0.043	86	0.25	0.043			
6310	0.088	80.35	0.3	0.088	84.5		
6312	0.075	80	0.3	0.072	75.1	0.31	
6315	0.120	82	0.25	0.088	71.5	0.35	
6320	0.065	79	0.3	0.064	73.1	0.32	
6325	0.204	81.4	0.404	0.205			
6335	0.011	77	0.323	0.010			
6340	0.052	76	0.3	0.039			
6345	0.061	76.2	0.416	0.061			
6350	0.042	77	0.449	0.036			
6359	0.009	83	0.15	0.007			
6360	0.021	83	0.25	0.024			
6365	0.086	83	0.25	0.088			Incorrectly named 6366 in original model
6367	0.048	83	0.2	0.048			
6368	0.038	90	0.25	0.037	97.1	0.17	
6370	0.082	81.4	0.236	0.058	72.4	0.28	
6375	0.071	83	0.217	0.076	73	0.3	
6377	0.005	85	0.15	0.005	89.9	0.11	
6378	0.013	85	0.2	0.015	89.9	0.2	
6379	0.048	92	0.15	0.010	98	0.1	
6385				0.029			Was not included in the original model

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SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
6395				0.004			Was not included in the original model
6405	0.032	83	0.15	0.031	90.4	0.26	
6415	0.005	97	0.15				Removed from model
6417	0.012	97	0.15				Removed from model
6419	0.124	79	0.3	0.049	92	0.2	
6420				0.028	86	0.15	New basin
6421				0.039	84	0.2	New basin
6425	0.032	80	0.3	0.056			
6430	0.055	81	0.35	0.029			
6431				0.031	92	0.05	Added Davis Detention
6435	0.083	78	0.3	0.092	90		
6436	0.022	82	0.15	0.025	90	0.18	
6437	0.163	76	0.42	0.158	90	0.35	
6440	0.008	96	0.15	0.026	98	0.14	
6442	0.045	81	0.2	0.022	88	0.1	
6444	0.011	96	0.15	0.036	84	0.25	
6448	0.014	83	0.2	0.019	92	0.1	
6450	0.032	83	0.25				Replaced w/ GRE model
7000	0.153	81.4	0.27	0.153			
7005	0.090	79	0.36	0.095			
7015	0.084	75	0.41	0.084			
7025	0.069	81	0.33	0.064			
7035	0.060	76.75	0.37	0.057			
7040	0.059	83.35	0.29	0.062			
7042	0.039	83	0.25	0.036			
7043	0.036	83	0.20	0.040			
7044	0.018	83	0.20	0.022			
7050	0.050	80.35	0.36	0.047			
7060	0.054	87.8	0.26	0.049			
7070	0.024	81.95	0.29	0.023			
7080	0.024	86.4	0.28	0.025			
7081	0.051	82.15	0.32	0.048			
7082	0.043	79	0.44	0.037			
7083	0.063	84.8	0.43	0.062			
7084	0.078	86.2	0.36	0.074			
7085	0.029	84	0.29	0.028			
7095	0.035	81.45	0.34	0.032			
7105	0.011	78.75	0.36	0.010			
7115	0.075	88.6	0.33	0.073			
7125	0.038	88.8	0.29	0.034			
7127	0.036	82.9	0.32	0.035			
7140	0.012	84.4	0.31	0.010			
7145	0.003	83	0.12	0.004			
7155	0.013	83	0.35	0.014			
7165	0.011	84.5	0.30	0.011			
7175	0.012	93.5	0.13	0.012			
7177	0.040	85.1	0.31	0.043			
7185	0.022	83	0.23	0.027			
7186	0.016	98	0.17	0.015			
7187	0.009	83	0.20	0.008			
7195	0.066	83	0.26	0.066			
7200	0.073	78.05	0.51	0.069			
7205	0.018	82.7	0.52	0.017			
7210	0.107	77.3	0.59	0.113			
8000	0.025	75	0.46	0.019			

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SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
8005	0.038	75.4	0.38	0.039			
8010	0.013	75.4	0.43	0.014			
8015	0.118	78.8	0.43	0.119			
8020	0.119	79.8	0.25	0.121			
8022				0.039			*** Lag time not given
8024	0.065	80	0.21	0.064			
8025	0.041	79.5	0.53	0.038			
8030	0.130	77	0.54	0.140			
8035	0.130	77	0.58	0.126			
8040	0.123	81.79	0.45	0.119			
8050	0.087	82.85	0.44	0.090			
8055	0.054	87	0.29	0.051			
8060	0.025	75	0.32	0.025			
8065	0.063	80.75	0.42	0.074			
8070	0.036	87.8	0.30	0.019			
8075	0.050	83	0.40	0.055			
8080	0.031	78	0.35	0.032			
8085	0.072	75.16	0.45	0.059			
8090	0.137	79	0.40	0.138			
8095	0.150	80	0.45	0.150			
8097	0.030	81	0.41	0.027			
8110	0.038	84	0.37	0.044			
8115	0.061	82	0.45	0.053			
8120	0.069	78	0.48	0.075			
8125	0.051	84	0.39	0.045			Includes small unnamed basin
9000	0.087	78	0.35	0.070			
9005	0.095	77	0.35	0.129			
9010	0.130	78	0.35	0.185			
9015	0.219	77	0.22	0.210			
9020	0.198	77	0.40	0.192			
9030	0.039	81	0.20	0.039			Incorrectly named 9033 in original model
9035	0.061	79	0.30	0.052			
9040	0.113	81	0.31	0.093			
9050	0.040	81	0.29	0.044			
9060	0.047	81	0.29	0.045			
9065	0.068	83	0.28	0.060			
9075	0.022	80	0.22	0.039			
9085	0.033	81	0.20	0.029			
9090	0.013	83	0.34	0.015			
9095	0.044	77	0.29	0.047			
9105	0.045	80.6	0.24	0.044			
9115	0.037	83	0.30	0.031			
9120	0.033	77	0.24	0.012			
9125	0.017	90	0.16	0.023			
9130	0.035	83	0.25	0.030			
9135	0.049	77	0.38	0.052			
9140	0.076	85	0.26	0.123			
9145	0.036	83	0.28	0.020			
10000	0.058	78.3	0.35	0.061			
10005	0.090	82.74	0.29	0.090			
10010	0.122	75.56	0.52	0.119			
10015	0.049	75	0.37	0.052			
10020	0.132	75.24	0.63	0.136			
10025	0.079	77.4	0.57	0.061			
10030	0.095	75.69	0.41	0.090			

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SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
10035	0.071	75.96	0.41	0.070			
10040	0.082	78.6	0.35	0.087			
10045	0.011	82.5	0.20	0.012			
10055	0.015	83	0.23	0.026			
10065	0.041	79	0.30	0.036			
10075	0.020	75	0.28	0.037			Incorrectly named 10070 in original model
10080	0.015	83	0.23	0.017			
10085	0.091	75	0.45	0.073			
10090	0.052	81	0.37	0.051			
10095	0.033	81	0.35	0.033			
10100	0.076	83	0.35	0.078			
10105	0.080	81.8	0.35	0.083			
10110	0.024	75.16	0.60	0.026			
10115	0.044	83	0.32	0.042			
10120	0.046	75.24	0.33	0.036			
10125	0.058	75.4	0.29	0.052			
10130	0.097	82.76	0.33	0.096			
10135	0.053	81.24	0.37	0.049			
10140	0.054	76.1	0.37	0.054			
10145	0.079	82.5	0.39	0.088			
10150	0.030	75.24	0.05	0.071			
10155	0.065	90	0.22	0.030			
10160	0.003	90	0.17	0.003			
10170	0.002	90	0.15	0.002			
10180	0.007	90	0.14	0.010			
10190	0.025	89	0.21	0.025			
10200	0.044	76	0.39	0.036			
10210	0.034	75	0.30	0.039			
10215	0.051	79	0.38	0.049			
10225	0.090	83	0.31	0.090			Incorrectly named 10220 in original model
10235	0.018	83	0.29	0.017			
10245	0.030	83	0.29	0.032			
10255	0.047	82	0.32	0.054			
10258	0.020	90	0.20	0.016			Incorrectly named 10257 in original model
10263	0.023	81	0.27	0.019			
10266	0.025	83	0.25	0.027			
10270	0.025	83	0.23	0.039			
10280	0.028	83	0.26	0.034			Incorrectly named 10275 in original model
10285	0.011	75	0.35	0.021			Includes 10285B
10291	0.009	83	0.15	0.007			
10295	0.065	80	0.40	0.063			Incorrectly named 10293 in original model
10300	0.112	76.36	0.56	0.174			Includes 10300B
10305	0.022	76.5	0.46	0.018			
10310	0.056	82.5	0.29	0.060			
10315	0.153	77.6	0.43	0.148			
10320	0.050	78	0.40	0.053			
10340	0.008	90	0.11	0.009			
10350	0.014	85	0.23	0.013			
10360	0.021	77	0.34	0.022			
10365	0.083	80	0.37	0.086			
10370	0.076	80	0.35	0.072			
10375	0.016	85	0.20	0.011			
10376	0.016	85	0.20	0.009			
10378	0.030	85	0.30	0.029			
10385	0.033	86	0.30	0.028			

Joplin, Missouri
10-Year Stormwater Management Master Plan
HEC-1 Data Summary

	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
10388	0.012	85	0.20	0.018			
10395	0.042	75	0.30	0.037			
10400	0.143	75	0.48	0.098			
10405	0.069	81.16	0.41	0.080			
10410	0.049	75	0.48	0.049			
10415	0.018	90	0.20	0.017			Includes small unnamed basin
10425	0.021	82.9	0.33	0.033			
10430	0.040	90	0.25	0.029			Incorrectly named 10427 in original model
10440	0.018	81	0.30	0.022			
10445	0.045	81	0.15				Does Not Exist
10450	0.050	81	0.37	0.057			Includes small unnamed basin
10460	0.020	75	0.35	0.021			
10470	0.135	78	0.35	0.116			
10480	0.020	80	0.25	0.015			
10500	0.094	82	0.34	0.108			
10505	0.117	82	0.35	0.104			
10510	0.085	69.9	0.45	0.085			
10512	0.021	69.9	0.26	0.021			
10515	0.049	78.75	0.39	0.043			
10520	0.119	81	0.35	0.133			Includes 10520B
10535	0.010	84	0.25	0.011			
10543	0.020	82	0.20	0.014			
10546	0.128	76	0.50	0.117			
10550	0.315	75	0.70	0.331			
10555	0.059	75	0.40	0.063			
10560	0.112	75	0.45	0.111			
10565	0.050	75.8	0.32	0.049			
11000	0.032	78	0.32	0.056			
11012	0.024	78	0.37	0.022			
11014	0.024	78	0.37	0.026			
11015	0.052	77	0.29	0.034			
11020	0.029	82	0.27	0.033			
11030	0.066	75	0.36	0.058			
11035	0.130	75	0.45	0.132			
11040	0.105	80	0.40	0.115			
11045	0.070	75	0.40	0.070			
11055	0.012	78	0.30	0.018			
11057	0.015	78	0.25	0.015			
11060	0.037	81	0.36	0.038			
11065	0.066	78	0.40	0.061			Incorrectly named 11064 in original model
11070	0.078	84	0.32	0.088			
11075	0.093	75	0.35	0.100			
12000	0.081	75	0.40	0.077			
12003	0.079	75	0.44	0.080			
12005	0.066	75	0.42	0.066			
12010	0.044	78	0.38	0.042			
12018	0.008	78.2	0.25	0.010			
12025	0.010	75	0.37	0.009			
12030	0.030	75	0.38	0.028			
12040	0.091	75	0.42	0.093			
12045	0.032	75	0.48	0.029			
12050	0.105	75	0.47	0.099			
12055	0.032	75	0.48	0.033			
12058	0.039	75	0.56	0.039			
12060	0.067	75	0.50	0.066			

Joplin, Missouri
10-Year Stormwater Management Master Plan
HEC-1 Data Summary

	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
12065	0.068	77	0.46	0.072			
12070	0.029	81.5	0.36	0.031			
12075	0.084	80	0.40	0.085			
12080	0.040	77	0.48	0.037			
13000	0.111	75.4	0.18	0.111			
13003	0.019	75.4	0.35	0.019			
13005	0.019	75.16	0.16	0.020			
13007	0.027	81.1	0.30	0.033			
13010	0.031	79	0.34	0.030			
13015	0.091	83	0.35	0.089			
13020	0.056	81.4	0.20	0.053			
13022	0.063	81.4	0.29	0.067			
13025	0.037	77.6	0.34	0.035			
13040	0.048	80.7	0.32	0.049			
13045	0.123	74.5	0.42	0.134			
13050	0.012	81	0.27	0.010			
13060	0.089	77	0.49	0.093			
13063	0.068	75.2	0.51	0.075			
13065	0.028	75	0.44	0.031			
13075	0.103	77.1	0.32	0.101			
13076	0.094	77.1	0.31	0.093			
13085	0.078	79.2	0.34	0.081			
13090	0.027	75.2	0.40	0.025			
13095	0.054	76.1	0.38	0.053			
13100	0.073	75.2	0.45	0.062			
13105	0.018	75	0.46	0.011			
13110	0.172	80.8	0.37	0.155			
13115	0.019	79.8	0.31	0.022			
13125	0.029	77.3	0.33	0.033			
13130	0.045	75	0.47	0.041			
13135	0.081	75	0.50	0.086			
13140	0.051	75.4	0.46	0.052			
13145	0.105	75.1	0.49	0.116			
13150	0.017	75	0.40	0.011			
13160	0.100	75.8	0.55	0.108			
13165	0.073	77	0.42	0.074			
13170	0.050	76.4	0.37	0.049			
13175	0.130	74.6	0.47	0.125			
13180	0.014	75.4	0.34	0.017			
13190	0.024	75.9	0.25	0.022			
13195	0.044	76.6	0.15	0.045			
13200	0.081	77	0.32	0.080			
13205	0.009	75	0.21	0.010			
13210	0.059	78.2	0.37	0.060			
13215	0.055	74.9	0.39	0.053			
13220	0.021	75.4	0.41	0.019			
13225	0.098	73.9	0.41	0.103			
13230	0.062	74.9	0.50	0.058			
13235	0.029	75	0.40	0.034			
13240	0.113	74.5	0.51	0.116			
13245	0.066	75	0.43	0.061			
13250	0.070	75.4	0.41	0.071			
13260	0.015	75	0.39	0.014			
13265	0.051	74.75	0.47	0.049			
13270	0.195	75	0.52	0.202			

Joplin, Missouri
10-Year Stormwater Management Master Plan
HEC-1 Data Summary

	Original Model as Done by B&M			Revised Model as Completed by AMA			
SUBBASIN	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	AREA (SQ. MI)	CN	BASIN LAG (Hrs.)	COMMENTS
13275	0.144	77.25	0.53	0.147			
13280	0.094	74.9	0.54	0.071			
13285	0.133	74.9	0.57	0.182			
13290	0.048	75	0.46	0.046			
13295	0.219	75.6	0.79	0.272			
14000	0.059	77	0.40	0.087			
14002				0.022			Not included in original model
14003	0.016	77	0.30	0.018			Includes 14003B
14005	0.034	80	0.35	0.034			
14010	0.097	81	0.34	0.098			
14015	0.074	81	0.34	0.074			
14020	0.046	76	0.35	0.030			
14025	0.089	77	0.40	0.101			
14030	0.081	78	0.47	0.079			
14035	0.082	83	0.39	0.079			
14040	0.108	80	0.37	0.083			
14043	0.026	78	0.25	0.028			
14045	0.028	80	0.30	0.034			
14050	0.055	78	0.41	0.056			
14060	0.084	76	0.53	0.083			
14065	0.135	78	0.55	0.132			
14070	0.069	78	0.39	0.069			
14075	0.150	79	0.50	0.148			
15000	0.117	74.65	0.27	0.125			
15005	0.011	75.16	0.24	0.010			
15010	0.038	76.6	0.34	0.037			
15015	0.011	75	0.31	0.008			
15020	0.058	75.4	0.26	0.061			
15025	0.140	76.9	0.35	0.148			
16000				0.093			Not included in original model
16005				0.136			Not included in original model
16010				0.006			Not included in original model
16015	0.178	73	0.45	0.174			
16020	0.095	77	0.35	0.085			
16025	0.247	76	0.40	0.265			
16030	0.114	73	0.30	0.118			
16035	0.174	80	0.30	0.160			
16040				0.044			Not included in original model
16045				0.175			Not included in original model
16050	0.075	79	0.30	0.073			
16052	0.042	78	0.30	0.040			
16055				0.065			Not included in original model
16060	0.028	74	0.08	0.025			
16063	0.065	77	0.35	0.056			
16065	0.112	76	0.35	0.100			
16075	0.127	78	0.30	0.125			

4. Retaining walls or curbs used to contain storm water in parking lots must be constructed of reinforced concrete.
5. Parking lot detention areas are exempt from sediment storage requirements.

10.8 Construction, Operation and Maintenance:

A. Easements: Access and permanent drainage easements shall be required as outlined in Section 3.

B. Public Facilities:

1. Public detention facilities shall be constructed by the developer where approved by the City and after plan approval and issuance of a permit. Dedication of easements to the City will be required.
2. Regional detention facilities may be dedicated as public facilities upon conceptual approval of the location and final approval of the design and construction by the City.
3. Operation and maintenance shall become the responsibility of the City after dedication of the easements and acceptance of the facility by the City.

C. Private Facilities:

1. Private detention facilities shall be constructed by the developer or property owner after plan approval and issuance of a permit by the City. Dedication of permanent drainage easements to the City will be required.
2. Operation and maintenance of private detention facilities shall be the responsibility of the property owner and successors.

D. Maintenance Activities: For both public and private drainage facilities, required maintenance activities include but are not limited to, debris removal and cleaning, cutting of vegetation that impairs the function of the structure or otherwise creates a public nuisance, repair of erosion, removal of silt, and maintenance of structural facilities including outlet works.

E. Construction Record Drawings: Construction record drawings showing as-built elevations and dimensions for detention structures are required. Both grading and outlet structure as-built data is to be submitted. Construction record drawings shall have field verified dimensions and elevations noted by revision clouds.

Attachment 13

POST-CONSTRUCTION BMP INSPECTION FORM

DEVELOPMENT NAME: _____ **Location:** _____

Size of Lot: _____ acres

I. Type of Development Project:

☐ Residential ☐ Commercial ☐ Industrial ☐ Other: _____

II. Type of Water Quality BMP(s):

☐ Above-Ground Basin Year Built: 20____

☐ Perforated Riser ☐ Concrete Box with Flow Control (perforated plate, notched weir, etc.)

☐ Other: _____

☐ Below-Ground Basin Year Built: 20____

☐ Perforated Half-Pipe ☐ Permeable Pavers ☐ Solid-Wall Pipe

☐ Other: _____

III. Condition:

A. Evidence of Proper Maintenance:

Mowed? ☐ Y ☐ N Excess Sedimentation or Debris? ☐ Y ☐ N

Erosion at Outfall? ☐ Y ☐ N

B. Any foreseeable issues?

☐ Y ☐ N If so, what? _____

_____

IV. Inspected by:

_____ _____ Date: _____

Name Title

Attachment 14 Stormwater Report (Ditch and Catch Basin)

MEMORANDUM

City of Joplin
Public Works – Engineering
602 S Main Street, Joplin, MO 64801
Phone 417-624-0820
Fax 417-625-4738

Stormwater Report for Fiscal year 2017-2018

	Ditch maintanence performed (feet)	Number of catch basins cleaned	Miles of street sweeping logged
First Quarter	1,940	136	914
Second Quarter	2,837	217	2,092
Third Quarter	148,535	51	2,485
Fourth Quarter	158,700	77	2654
Total	312,012	481	8,145

Attachment 15

STORMWATER POLLUTION PREVENTION REQUIREMENTS

City of Joplin's Regulated Small Municipal Separate Storm Sewer Systems (MS4)
Operating Permit #MO-R040041
Revised January 2019 by Mary Anne Phillips

4.2.6.1.3 Maintenance BMPs, maintenance schedules, and long-term inspection procedures for controls to reduce floatables (trash) and other pollutant to the permittee's regulated small MS4.

4.2.6.1.4 Controls for reducing or eliminating the discharge of pollutants from streets, roads, highways municipal parking lots, maintenance and storage yards, waste transfer stations, fleet or maintenance shops with outdoor storage areas, and salt/sand storage locations and snow disposal areas the permittee operates.

4.2.6.2 All paint, solvents, petroleum products and petroleum waste products (except fuels) under the control of the permittee shall be stored so that these materials are not exposed to stormwater. Sufficient practices of spill prevention, control, and /or management shall be provided to prevent any spills of these pollutants from entering a water of the state. Any containment system used to implement this requirement shall be constructed of materials compatible, with the substances contained and shall also prevent the contamination of groundwater.

Report or Checklist should reflect: Dates of Inspections, Monitoring Schedule, Staff Member(s) in Charge of Inspections, Outcome, Methods to Remove Pollutants

Suggestions: Check on oil staining, clean up petroleum and paint spills, make sure trash dumpster lids are closed, make sure paint drums are closed, check on soluble & erodible material exposed to precipitation, etc.

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PUBLIC WORKS CENTER | 1301 West Second Street | Joplin
Main Contact: Dean Smith, Infrastructure Superintendent

INSPECTION REPORT

Permit Years 2017 & 2018 - Minimum Control Measure #6
Pollution Prevention & Good Housekeeping for Municipal Operations
Best Management Practice #42 - Inspect Municipal Operations seasonally and as needed

SALT/CINDER/SAND STORAGE
YARD CHEMICALS: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

DETENTION BASIN: Date &/or Schedule _____ Performed by _____
(street sweeper clean out)
Outcome: _____

Methods to Remove Pollutants: _____

DIESEL FUELING STATION: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

UNLEADED FUELING STATION: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

OIL SECONDARY CONTAINMENT: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

FUEL SECONDARY CONTAINMENT: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

SIGN & SIGNAL BUILDING: Date &/or Schedule _____ Performed by _____
(paint & solvent storage area)
Outcome: _____

Methods to Remove Pollutants: _____

Spill Prevention, Control, and/or Management: _____

TRASH DUMPSTER AREAS: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

LITTER PICKUP: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

STORMWATER DITCH: Date &/or Schedule _____ Performed by _____
that runs through PWC

Outcome: _____

Methods to Remove Pollutants: _____

SOLVENTS/PETROLEUM PRODUCTS
PETROLEUM WASTE PRODUCTS: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

Spill Prevention, Control, and/or Management: _____

OTHER TASKS AS NEEDED: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

OTHER TASKS AS NEEDED: Date &/or Schedule _____ Performed by _____

Outcome: _____

Methods to Remove Pollutants: _____

Return by February 1, 2019 to Mary Anne Phillips via e-mail or hard copy.
Current Reporting Year for the City's Storm Water Permit is January 1, 2017 to December 31, 2018.