City of Columbia Stormwater Utility: Current and Future Goals and Stormwater Regulatory Programs

PREPARED FOR: City of Columbia, MO

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1. Introduction

The City of Columbia, Missouri adopted a set of new stormwater regulations in 2007. Stream Buffer Requirements were added to Chapter 12A of the City Code of Ordinances on January 2, 2007, and additional modifications to the stormwater requirements in the City Code were made effective on September 4, 2007. The City's "Stormwater Management & Water Quality Manual" (hereafter referred to as "the Manual") was approved by the Director of Public Works on March 19, 2007. The City hired CH2M HILL in September, 2007 to perform an independent evaluation of the City's stormwater program, focusing on the current regulations, the current and future goals of the stormwater utility, and current and future stormwater utility funding. The purpose of this technical memorandum is to identify and prioritize current and future goals and objectives for the City's stormwater utility, along with recommendations for achieving those goals.

This memorandum references three other technical memorandums from this project:

TM#2: City of Columbia Stormwater Utility: Review 2007 Stormwater Management and Water Quality Manual

TM#3: City of Columbia Stormwater Utility: Extended Baseline Financial Model

TM#4: City of Columbia Stormwater Utility—Financial Model Results for Two Rate Scenarios

2. Goals and Objectives Identification

CH2M HILL led three workshops with three stakeholder groups on September 28, 2007. The three stakeholder groups included representatives from the City's Public Works Department and Boone County, representatives of the development community, and

representatives from the Stormwater Task Force, Sierra Club, and Hinkson Creek Watershed Restoration Project. The stormwater concerns and goals for each stakeholder group were discussed during each workshop. Additional information on goals and concerns was identified from documents pertaining to the City's regulatory programs, minutes from previous stakeholder meetings and other communication documentation between City Staff and the development community, motions prepared by the Stormwater Task Force, and additional information submitted by the Hinkson Creek Watershed Restoration Project.

The individual goals identified are summarized in Table 1, which is found at the end of this memorandum.

3. Prioritized Future goals, Objectives and Recommendations

CH2M HILL reviewed the identified goals and objectives along with additional information gathered on the internal workings of the City's stormwater utility. This information was used to develop the following prioritized listing of goals along with recommendations of specific actions to achieve those goals. Recommendations to achieve each goal are also prioritized in order of importance.

The goals with the highest priority provide for the immediate health, safety, and welfare of the citizens of Columbia. Although the stakeholder workshops and the goals developed in the workshops were heavily geared toward environmental protection, the stormwater utility must first keep citizens safe from harm and have the available resources necessary to provide environmental protection. To ensure that these basic safety needs and the remaining goals and objectives are met, the utility must be adequately funded and staffed. Note that while this memorandum assumes the City would be providing all recommended actions with additional staff, these activities could be outsourced to the private sector at a comparable cost.

3.1 Goal #1: Provide for Public Safety

At a minimum, the stormwater utility has an obligation to citizens, stakeholders, and rate payers to ensure that stormwater conveyance occurs in a safe manner. The individual goals identified during the stakeholder workshops that concern public safety are as follows:

- Assure the movement of emergency vehicles during storm periods
- Public protection from infrastructure failures
- Public protection from rapidly flowing water or flash floods

3.1.1 Recommendation

1. **Continue Current Activities:** Protection of the public from flood events and infrastructure failures is an existing goal of the stormwater utility and should continue to be one. The utility currently works to provide these services. However, funding limitations are preventing the City from addressing all needed capital improvement project, fully identifying and prioritizing flooding locations, and instituting an asset management program for the identification, repair, and replacement of failing infrastructure.

2. **Implement an Infrastructure Replacement Program:** The City's infrastructure is aging. Older parts of the City have had stormwater pipes in service for over 100 years that have likely never been inspected. It is important that the City utilize routine inspection results to identify and prioritize infrastructure replacements to avoid infrastructure failures. This is discussed in detail in Recommendation #2 of Goal #2.

   A desktop corrosion analysis showed the expected life of corrugated metal pipe (CMP) in Columbia is between 33 and 44 years. To avoid failure of these pipes and collapses that compromise health and safety, 75% of the pipe that has exceeded its life expectancy should be replaced within the next ten years and the remainder of that within the next 25 years. A conceptual cost for this replacement program was calculated to be approximately $5.8 million/year through 2019 and $2.7 million/year from 2020-2033. Because the risk of failure is an immediate health and safety risk, these costs were included in the baseline financial rate analysis described in TM#3.

3. **Increase Capital Improvement Project (CIP) Funding:** CIPs are currently funded at $600,000/year. As a result, only a limited number of large projects can be completed and other projects are routinely pushed back in the schedule, often several years. An analysis of the currently identified needs shows that $18.8 million of CIPs needs to be completed within the next 10 years to ensure health and safety standards. Note that this amount includes projects that are identified but have not been programmed into the CIP because of the annual funding restriction of $600,000/year. Regular CIP spending should be increased to $2 million per year thereafter. Because these projects are necessary to protect the basic health and safety of citizens, these costs were included in the baseline financial rate analysis described in TM#3.

   City engineers are already 115% utilized with current workloads and currently lack the time to administer an increased CIP workload and the pipe replacement program described in Recommendation #3 of Goal #2. An additional engineer with a technician was added to the baseline financial rate analysis described in TM#3 to ensure that these needs can be administered by City staff.

4. **Complete a Current Stormwater Master Plan:** The City currently has a listing of known problem locations. However, this list is primarily based only on locations of citizen complaints. Stream assessment and asset management results should also be incorporated into the overall master plan and added to the overall project prioritization. These components of the plan are discussed in detail as part of Goal #2. Phase 1 of the full stormwater master plan should be completed within the next two years and should include the following components:

   - Identification of stormwater flooding and erosion problems throughout the City. Problem identification should be based on known complaint locations, existing modeling results, undersized system identification spot checks, stream assessment and asset management results, and results of a survey mailed to a statistical representation of the City population. All problems should have a point ranking representing the severity of the problem.

- Conceptual-level solutions for identified stormwater problems. Solutions should include both conventional and low-impact solutions where possible. All solutions should have conceptual-level cost estimates.
- Prioritization of problem locations based on point rankings and solution cost estimates.
- A stormwater project capital improvement plan for completing the identified projects that identifies the necessary stormwater utility rate increase to implement the stormwater master plan. The capital improvement plan should also assess what additional investigations are necessary and include estimated costs for hydraulic modeling and any additional stream assessment and infrastructure inspections needed to complete a second phase of the Master plan.
- Hydraulic models. The Association of State Floodplain Managers (ASFPM) recommends that "All floodplains should be mapped all the way to the upstream source of flow" (National Flood Programs and Policies in Review, 2007, ASFPM). Likewise, this is the most desirable modeling extent for the City of Columbia. If such comprehensive modeling is not possible, or if development is occurring in an area where modeling has not been completed, a policy should be put in place requiring a hydraulic analysis if a development produces a 15% increase or greater in the annual runoff volume as modeled at the most downstream end of the site, or if the area of the development is 200 acres or greater. The City currently has updated models for regulatory floodplain locations only. These typically model up to the upper 1 mi^2 of the waterway.

5. **Flood Hazard Mitigation Program:** Research floodproofing programs throughout Missouri and throughout the country and develop an appropriate program for Columbia. Typically these programs offer financial and technical assistance to homeowners to flood-proof properties. Many times a flooding problem can be solved cost-effectively by using flood-proofing and other mitigation techniques.
6. **Flood-Prone Structure Buyout Program:** Create a fund to buyout flood-prone properties. Work closely with Missouri's State Emergency Management Association (SEMA) for program development and grant application. The City of Arnold, Missouri is a good model for a flood buyout program. If the city has or develops an approved multi-hazard disaster mitigation plan, a pre-disaster grant may be available from FEMA.

3.2 Goal #2: Maintain the Stormwater Conveyance System

The stormwater utility must maintain current stormwater infrastructure and protect property and infrastructure from damage due to stormwater. The utility currently does not maintain open channels. This leaves property owners responsible for maintaining the portion of channel adjacent to their property and, when not done properly, erosion problems develop throughout the City. Solutions to erosion

problems tend to be low-budget, non-continuous (on a lot-by-lot basis), or not implemented at all. Water quality is also impacted, as sediment loads to streams are increased due to the erosion. Meanwhile, the condition of older stormwater management infrastructure is unknown. Public safety is a high priority. Without regular inspection and maintenance of the conveyance system, the risk of structural failure continues to increase.

The individual goals identified during the stakeholder workshops that concern public safety are as follows:

- Minimize losses and property damage resulting from uncontrolled storm water runoff
- Channel protection/erosion control
- Avoid future problems downstream of a project location
- Identify aging infrastructure, maintain/replace infrastructure as necessary, and provide routine maintenance
- Enforce maintenance regulations
- Adequately maintain open channels
- Complete capital improvement projects

Stream stabilization efforts would be optimized if studied for an entire channel, rather than addressing individual problems. The maintenance and inspection procedures identified in Section 12A-95 of the stormwater ordinance provide for maintenance and inspection of stormwater management facilities, but these do not currently include open channels.

3.2.1 Recommendations

1. **Continue routine maintenance:** The City currently has the responsibility to provide routine maintenance of some stormwater management facilities. These exclude open channels (except for the first 15 feet at the end of a channel and box culverts). However, the current staffing level is not sufficient to provide adequate inspection and maintenance and in fact most pipes have never been inspected.

   New stormwater management technology will introduce different infrastructure that the City must be able to maintain. For example, the City does not currently have a vacuum truck capable of cleaning pervious pavements. The City also needs to make arrangements, internal or via special contract, to ensure the establishment of native vegetation for BMP installations on City property or privately owned BMPs that are deeded to the City for maintenance.

   Continue performing routine maintenance of the stormwater management system. When the next existing street sweeper is ready to be replaced, it should be replaced with one capable of vacuuming. City maintenance staff should also attend training for maintenance of native vegetation.

The stormwater utility should immediately fund its own CCTV inspection vehicle and 3-person crew that could be cost- and time-shared with the sanitary sewer division at a 75% storm/25%-sanitary split. A vactor truck for maintenance is also immediately needed and should be shared with the sanitary utility at a 50%/50% split. This equipment and personnel is needed to properly maintain the system and help avoid structural failures. For this reason, it was included in the baseline financial analysis included in TM#3.

2. **Identify inadequate infrastructure and institute a repair and replacement program:** Some of the stormwater infrastructure currently in service in downtown Columbia was constructed in the 1800's, and its condition is currently unknown because no comprehensive inspection of the City's stormwater infrastructure has even been done. There is physical evidence that the corrugated metal pipe (CMP) used in many subdivisions built in the 1960's and 1970's is degrading, which was confirmed by a desktop corrosion analysis. However, as noted in Goal #1, there is no comprehensive plan, inadequate staffing, and insufficient equipment to address old and failing infrastructure. Such a plan should begin inspection in high-risk locations, such as downtown and older subdivisions.

   Currently the City does have CCTV capability, but the equipment is utilized 90% of the time by the sanitary sewer utility. The city also currently lacks adequate staffing to administer a comprehensive inspection, repair, and replacement program. The City also does not currently have an asset management program.

   Within the next 1-2 years, the City should institute a stormwater management infrastructure inspection, repair, design, and replacement program. The program should have an asset management and design component. Initially, all downtown storm sewer and all CMP installed prior to 1980 should be inspected at an estimated cost of $6 million. Identified problem locations should be incorporated into the Stormwater Master Plan and identified replacement projects included in the prioritized project listing. One additional staff member should be dedicated to managing the implementation of this program, as described in Recommendation #2 of Goal #1.

3. **Continue Capital Improvement Program:** The City's FY 2008 CIP has a total of 31 projects identified at a cost of $5.6 million. These projects are scheduled to have construction start dates through the year 2016. Additional projects are needed but have not been fully identified because funding is too limited to complete these projects within the next ten years. Currently, the City funds capital projects at $600,000 per year. This level of funding has proved to be inadequate to meet the City's basic safety needs as discussed as part of Recommendation #3 of Goal #1.

   The City should prioritize the projects currently in the CIP and future projects as part of the Stormwater Master Plan described in Recommendation #4 of Goal #1. The prioritized master plan list should be used to develop an implementation schedule and a cash flow projection that are consistent with the severity of the problems that the CIP needs to address. A draft CIP was completed as part of this project that includes additional projects not currently on the CIP and that reflects increased projected costs for

some projects. This was completed for cost estimation purposes and is further described as Recommendation #3 of Goal #1.

4. **Institute a Channel Protection Volume Requirement into the Manual:** The current stormwater design guidelines do not include channel protection criteria.

   As recommended in TM#2, the City should institute a channel protection volume requirement to safeguard life and property while protecting environmental resources.

5. **Complete Stream Assessments for Open Channels:** A comprehensive stream assessment would provide several benefits to the City. The system would be examined as a whole for the first time by a professional trained in performing stream assessments and the City could begin to truly understand the existing conditions within the creeks and open channels. Key areas for stabilization could then be identified *based on a comprehensive analysis* and stream stabilization projects added to the capital improvement program.

   This approach provides a consistent unbiased evaluation of all stream segments. Developers would then not need to perform their own stream assessments when designing a new development along an open channel, but could obtain stream assessment data from the City. This would save the developer time and money, as the City could offer the data for less than what it would cost the developer to perform the assessment on their own.

   Within the next two years, the City should complete initial stream assessments for approximately 90 miles of high-priority open channels shown as a blue line on USGS quadrangle maps (perennial streams) and develop a procedure for providing this information to the development community at an estimated cost of $150,000. The Manual should be amended to allow and encourage developers to obtain stream assessment information from the City where it is available.

   Assessment results should be used to develop stream restoration projects. These projects should be incorporated into the capital improvement program at the same time as the recommended stormwater master plan. The assessment could be incorporated as part of a natural resources inventory that has current interest within the City Council.

6. **Maintenance and Inspection of BMP's and Detention Facilities:** Current city staffing levels are likely adequate to inspect and enforce maintenance regulations for the current number of stormwater maintenance facilities. However, as more development occurs under the new regulations, there will be significantly more stormwater management facilities to track. More inspections will be necessary, as well as the necessary software to track the inspections and equipment to perform inspections.

   Within the next 2-5 years, the City will likely have to increase staffing to continue to inspect each facility once every one or two years and enforce the maintenance and inspection responsibilities of the facility owners. The City should have a formalized inspection schedule and procedure established within the next year.

   Handheld computers should be purchased for on-site logging of inspection data, inspection staff should be adequately trained, and customized software should be used to

track inspection results, status, and scheduling. (The software and handheld computers could also be used for the inspection and asset management programs described above in Item #2.)

7. **Assume Responsibility for Open Channel Maintenance and Stabilization:** The City's creeks and open channels are an important part of the City's stormwater conveyance system. The current system of property owner responsibility for channel maintenance has contributed to serious erosion problems throughout the City. Stream stabilization projects should be properly designed and installed looking at the system as a whole, not as patchwork spot repairs throughout the creek. Patchwork repair can actually worsen existing problems by transferring the problem to another location.

   Because the City has never had responsibility for open channels, maintenance and stabilization obligations should be gradually phased in. A stormwater master plan and stream assessment recommended elsewhere in this memorandum will provide a solid understanding of the open channel maintenance and stabilization needs as well as a capital improvement plan for implementing improvements.

   Within the next ten to twenty years, the City should assume responsibility for open channel maintenance and stabilization. In the time period before these responsibilities are assumed, the City should offer conceptual design guidance to interested property owners to help guide the use of proper stabilization techniques and to identify where stabilization projects are taking place. The City does not currently have adequate funding to assume this responsibility. The financial implications of this are discussed under Goal #3. If the City ultimately decides not to assume responsibility for open channel maintenance, it should consider assuming 404 permitting duties from the US Army Corps of Engineers for the City of Columbia. This allows some level of oversight for stream related construction activities.

3.3 Goal #3: Adequately Fund, Staff, and Organize the Stormwater Utility

One of the goals for the stormwater utility is to provide proactive water quality and quantity protection, yet a common theme through the discussions with City staff and stakeholders was the comment that the stormwater utility is not adequately funded or staffed, and that the organizational structure is not well established. Proactive protection is necessary so that the City invest in up-front activities that will position it to avoid monitoring costs should it become a Phase I community and to avoid possible third-party litigation. It is not always apparent to stakeholders outside the City how the stormwater utility is organized and who to contact for different inquiries during the plan review process.

While the staff has had important accomplishments with limited resources in implementing new regulations, the utility must have adequate funding, staffing, and internal organization to implement and enforce the regulations, meet its goals, meet the needs of rate payers and constituents, and provide state-of-the-art stormwater management services.

The related individual goals identified during the stakeholder workshops are as follows:

1. Meet the needs of constituents
2. Provide a utility rate structure that meets the infrastructure and stormwater management needs of the City
3. Provide a fair rate structure that meets the stormwater needs of rate payers
4. Maintain an satisfactorily staffed, adequately funded, and well-organized stormwater utility

3.3.1 Recommendations

1. **Adequately fund the Utility:** A 25-year forecast financial model was developed, which evaluated two rate scenarios. The first scenario (extended baseline) evaluated extended baseline condition, while the second scenario (increased level of service) evaluated an increased level of service. The financial models show that existing rates are not adequate to fund the projected operating and CIP expenditures for both scenarios. Therefore, a rate increase will be necessary to cover projected revenue requirements.

   Figure 1 in TM#4 shows the timing of rate adjustments for the extended baseline scenario, which includes a 105 percent increase in FY 2009 and an additional 156 percent increase in FY 2010. Note that this rate increase only meets immediate needs, which include continuing current activities with the addition of CCTV capability, a vactor truck, two inspectors, an engineer and technician, CMP replacement and CIP acceleration as described elsewhere in this memorandum. ***Detailed information on baseline financial projections is included in TM#3.***

   Figure 3 in TM#4 shows the timing of rate adjustments for the increased level of service scenario, which includes a 151 percent increase in FY 2009 and an additional 52 percent increase in FY 2010. The estimated rate increases are necessary to meet additional staff needs to address increased workload due to new regulations. The differences in this scenario also have to do with the timing of capital projects.

   While the financial model shows rate adjustments out to FY 2033, it is recommended that the City look at five year rate periods. As better information becomes available, the rate model can be updated for another five year rate setting period.

2. **Maintain adequate staffing levels:** A common theme throughout the City and stakeholder workshops was that the current City staffing level is inadequate to meet the level of service required by the new regulations. The City's 2008 budget shows 12.46 full-time equivalent (FTE) employees funded by the utility. Manager and supervisor level positions are not included in the Utility's FTE count. Based on a review of current city staffing levels, duties required by the new regulations, and interviews with City staff and stakeholders the following additional positions have been identified as necessary to provide the level of

service identified in the regulations and to implement the recommendations made in this technical memorandum.

The following positions are needed immediately and are included in the baseline financial analysis presented in TM#3:

- *Three-person CCTV inspection crew to be shared with sanitary utility (See Recommendation #1 of Goal #2).*
- *Two construction inspectors are needed. Although currently all inspections are being completed, staffing limitations are preventing inspectors from spending an adequate amount of time on all inspections. Construction inspections are a focus of the NPDES program, both Phase I and II. MoDNR has indicated that pre-and post-construction activities will have more of a focus in coming years and the City needs to have adequate staff to meet regulatory expectations and decrease the likelihood of third party litigation.*
- *One full time engineer with one full time technician to oversee the following activities:*
    i. *A stormwater management infrastructure inspection, repair, and replacement program (Goal #2, Recommendation #2)*
    ii. *Accelerated CIPs (Goal #1, Recommendation #3)*
    iii. *Stormwater master planning efforts (Goal #1, Recommendation #4)*
    iv. *Stream assessment projects. (Goal #2, Recommendation #5)*

    These programs can be funded with a rate increase, but cannot be realistically administered within the City's current staffing levels.

The following positions will be necessary in the future to administer the increased workload due to the City's new stormwater regulations and will be presented in the projected financial analysis presented to be presented in Technical Memorandum #4:

- *One to two full time employees to be hired within 1-2 years to handle additional BMP inspections and enforce implementation of facility owner responsibilities resulting from the new requirements (Recommendation #6 of Goal #2).*
- *One full time employee hired within two years to act as the head of the stormwater utility (Recommendation #3of Goal #3).*
- *Immediate need to bring a part-time temporary employee in as a part-time permanent employee with benefits*
- *One plant specialist, such as a landscape architect, familiar with native vegetation and trees, to be hired in 1-2 years.*
- *Immediate need for one full-time technician, as the utility's current technician is highly utilized by other departments.*
- *For Goal #6, one more full time education and outreach staff member*

- *Overall recommendations will also require two full time technicians.*
- *One additional plan review engineer to be hired in 2 years.*

3. **Define the Utility's Organization:** Components of the stormwater utility currently reside in different areas within the Public Works Department. Billing and finance issues are handled primarily in the City's Finance Department, with a rate analyst in Public Works. Operations and maintenance are part of the Streets Division, and design personnel are part of the newly formed Environmental Section. The stormwater utility currently has a technician whose time is often used by other divisions and who serves as mapping liaison for Public Works as a whole; he spends a relatively small portion of his time working on stormwater projects although he is needed by the utility full time. Sharing staff between different divisions is common among municipalities and can save the City money while being efficient, but during the September workshops it was clear that outside stakeholders do not seem to understand how the utility is organized.

   While the organization chart in the City's 2008 budget defines the Utility organization, the City should develop another parallel chart that identifies the personnel by name and/or position description and what their day-to-day responsibilities include. A clear leader of stormwater activities, reporting to the Environmental Section head or Director of Public Works, would bring unity to the Utility as its responsibilities continue to grow, the regulatory environment becomes more complicated, and stormwater activities become more visible to outside stakeholders. This is further described in Recommendation # 2 of Goal #3.

4. **Unify Stormwater Management Efforts:** The City already has several very good programs in place that contribute to good stormwater management. However, they are not all currently unified under one umbrella or "branded" as part of one program. Current programs, some of which are partnerships with outside organizations, include:

   - Permit compliance
   - Operations and maintenance
   - Plan Review
   - Capital Improvements
   - Administration of stormwater rules and regulations
   - Illicit discharge detection and elimination
   - Construction site stormwater runoff control
   - Stormwater infrastructure and BMP inspections
   - Floodplain management
   - Pollution protection/good housekeeping for municipal operations
   - "Show Me Yards and Neighborhoods"
   - Educational outreach
   - E-newsletter "Stream Line"
   - Columbia/Boone County Stormwater Task Force
   - Stream extravaganza
   - Storm drain decals

- Bonne Femme project partnership
- Hinkson Creek restoration project partnership
- Online stormwater challenge
- Stormwater articles in *City Source*
- City Channel video production television
- Community contact at Earth Day celebration, Home Shows, Twilight Festivals, LID Conference
- Citizen's Watershed Committee
- Adopt-a-Stream program (not currently implemented, but planned)
- Adopt-a-Spot program
- Cleanup Columbia Day
- City Channel video production television
- Community stormwater hotline
- Stream cleanups
- Household hazardous waste collection
- The Hinkson Clean Sweep

The utility needs a clear leader reporting to the Director of Public Works or Environmental Section Head to unify all stormwater activities. This individual would oversee stormwater management efforts city-wide and implement proactive watershed planning efforts. The leader would also direct development and implementation of an overall concept plan and branding for the utility that would unify all stormwater management efforts under one clearly defined umbrella. An example of this is the Rain to Recreation program in Lenexa, KS.

5. **Map non-residential impervious areas and update billing records:** The City does not have current impervious surface mapping to use as a basis for non-residential properties. The stormwater utility was developed based on initial impervious area data, but no complete GIS layer documenting impervious surfaces exists. As a result, the City could be losing revenue. The city should update the electronic impervious area information and develop procedures for periodic updates. During this process it would also be a good idea to confirm the base unit (ERU). As the City implements the new stormwater regulations, updating the GIS and impervious area mapping will provide the defensible supporting documentation for the rate structure, especially when rates are expected to increase to fund necessary improvements.

   There are several important considerations in developing stormwater utility fees. A crucial element is legal defensibility, which rests largely on what may be termed the "rational nexus" test for the imposition of utility rates. In brief, this test requires that utility rates be related to and proportional with the utility service provided. Fees that are not based on users' contributions to stormwater will not meet this standard and could potentially be contested.

   In most cases a stormwater utility fee structure is based on the Equivalent Residential Unit, or ERU, which is determined based on the impervious area of a typical single family unit. The ERU typically includes the building footprint,

plus driveways and sidewalks and typically ranges from about 1,500 square feet to 2,500 square feet.

Since single family residential properties are fairly homogenous in terms of total impervious area, these properties would pay the same fee. In the certain cases, a tiered rate structure can be implemented in order to address equity among different sizes of single family properties. For example, townhouses are general smaller than detached houses and are usually 40 to 70 percent of 1 ERU. Conversely, some single family properties are much large than the average detached property and could as much as 200 percent of 1 ERU.

Nonresidential properties are unique and an average impervious area is typically not representative; therefore, actual impervious areas are used for each property. An approach to obtaining the required property specific information is most often based on the assessment of GIS and real estate databases.

Figure 1 illustrates an example of where the total average impervious area is 2,059 square feet, which is generally determined based on a statistical analysis of single family detached properties. Figure 2 illustrates an example of a non-residential property with a total impervious area equal to 20,590 square feet or 10 ERUs (20,590/2,059).

FIGURE 1
Typical Residence Defines the Base Unit or ERU

House Area	1,639 Ft^2
Other Impervious	420 Ft^2
Area Total	2,059 Ft^2

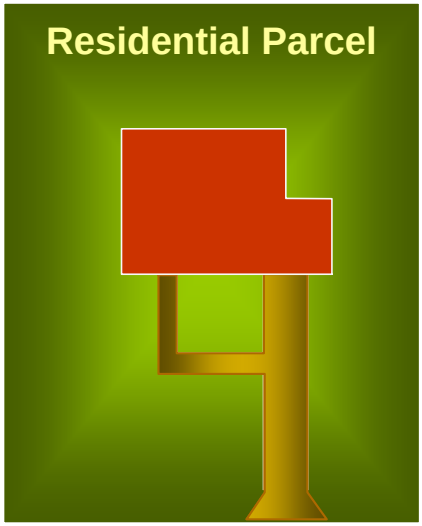
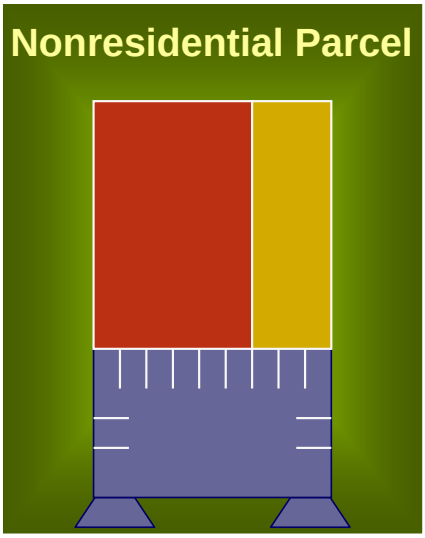


FIGURE 2
Non-Residential and Multi-Family Residential proprieties are billed as multiples of the base unit.

Building Area	6,000 Ft^2
Parking	10,000 Ft^2
Other Impervious Area	4,590 Ft^2
Total	20,590 Ft^2



Within two years, develop impervious coverage mapping for non-residential properties and update billing records accordingly. Consider implementation of an ERU based billing system. Also develop procedures for periodic updates.

3.4 Goal #4: Environmental Protection without Unreasonable Economic Burdens

Concern that the new stormwater regulations will cause an undue burden on the community was a recurring theme in stakeholder workshops and other documentation researched as part of the management project. The 100-year detention requirement, stream buffer ordinance, and stream assessment requirements are of particular concern. However, workshop participants also recognized the importance of environmental protection. There is a desire to find a balance between cost and environmental protection. The specific goals identified during the workshops related to economic hardship concerns are:

- Implement and enforce reasonable stormwater requirements and regulations for newly developed areas
- Promote the availability of affordable housing
- Cost-effective environmental protection

3.4.1 Recommendation:

The following recommendations are summarized from the findings in Technical Memorandum #2.

1. **Detention:** The City should keep the water quality volume requirements and implement a channel protection volume requirement in lieu of the current 100-year detention requirement for all developments.

The manual should require that new developments provide flood protection by affording an appropriate level of detention where increased flow would either create a flooding problem or worsen an existing problem. Otherwise, meeting water quality volume and channel protection volume requirements is adequate. The city has already mapped problem locations identified since 2003, and should map problems known prior to 2003. The city should then delineate the drainage areas for all problem locations for easy identification and documentation of areas where flood protection detention should be required due to known problems. When the master plan recommended in Goal #1 is completed, it can be used to identify known problem locations.

Detailed information on the detention recommendation and analysis can be found in TM#2**.**

2. **Stream Buffer:** The City's stream buffer ordinance is comparable to ordinances in effect in similar size cities in the Midwest and throughout the United States. MoDNR has also indicated that future NPDES II permit renewals will focus on post-construction control measures such as appropriate buffer widths. Despite the perceived economic ramifications of land lost to development due to the ordinance, it should remain in effect for environmental protection and permit compliance. A 1995 study of the economic benefits of runoff controls found that natural surroundings increase real residential property values by up to 28 percent while enhancing the quality of life (*"Economic Benefits of Runoff Controls"*, EPA 841-S-95-002, September 1995).

3. Allowance of a **trail or public greenway within the buffer** was another stakeholder concern. Recent studies have actually shown that streamside lots, even with greenway trails, can increase lot value (*"Economic Benefits of Trails and Greenways"*, Rails to Trails, Conservancy, 2006). Construction of greenways and trails along creeks is not unusual in Missouri. In August 2007 a state law was passed (Missouri Revised Statutes, Section 258.100) that limits the property owner liability for greenway trails. Also, an easement would have to be obtained prior to any trail construction. The City may want to reconsider how trails are allowed within the buffer zone, for example a fence could be constructed by the owner of the trail within the easement, therefore separating the trail from the private property. Developers can also create a trail along the creek as part of the common ground of the development and market it as an amenity.

4. **Stream Assessment:** Section 3.2.1(5) of this memorandum recommends that the City should complete stream assessments for all open channels and develop a procedure for providing this information to the development community. If this is not possible, detailed recommendations for stream assessments can be found in TM#2.

5. **Weed Ordinance:** The City should amend the weed ordinance (11-250) to allow exceptions for native vegetation in BMPs.

6. **Advisory Board:** Stakeholders present at the afternoon workshops expressed a desire to have a voice in revisions to the Manual by implementation of an

advisory board. The City should consider creating a technical advisory board, consisting of three professional engineers. The board will focus on technical issues regarding the manual.

7. **Enforce Maintenance Covenants:** Stakeholders expressed a concern that due to the way land is developed in Columbia (the developer prepares the property and sells the lots, but does not actually build the homes), that lot-level and common area BMP's will not be maintained. The City needs to ensure enforcement of the maintenance covenant and inspection requirements outlined in Section 12A-95 of the ordinance. However, the maintenance covenants cover "stormwater management facilities" which are defined in the ordinance as primarily structural measures. The City should consider requiring some sort of maintenance covenant for smaller lot-level BMP's, such as rain gardens.

8. **Mitigation Banks:** Investigate the feasibility of a locally administered mitigation bank program for both stream mitigation and wetland mitigation. Implement a mitigation bank program if it is found to be feasible for the City.

3.5 Goal #5: Improve Current Environmental Integrity and Reduce Flooding

The new regulations are crucial in protecting the health and quality of Columbia's streams. However, the regulations are written to maintain current conditions without further degradation but have no provisions for mitigation of existing degradation. The creeks and streams in Columbia would benefit from improvement, as is evidenced by Hinkson Creek's listing on the 303(d) list of impaired waterbodies. The goals identified during stakeholder workshops that are related to this goal include:

- Completion of capital improvement projects
- Improvement of degraded open channels

3.5.1 Recommendations

1. **Lead by Example:** There are several tasks the City should implement into its regular activities that will serve to enhance environmental integrity. The actions include:

   - **Set aside a portion of the annual CIP for actions that will reduce runoff and improve water quality on city-owned property.** These projects should be identified and prioritized within the CIP. This approach should include simple activities such as downspout disconnection and rain gardens to larger infiltration facilities and street-edge alternatives. These improvements should be visible to the public with signage explaining the technology and where more information on the technology can be found.

   - **Incorporate water quality improvements into the CIP.** This may involve identification and purchase of property for BMP installation. Higher priority in the CIP should be given to projects and retrofits in more problematic watersheds such as Harmony, Mill Creek, and Memorial Cemetery Watershed.

- **Demonstrate Show-Me-Yards practices on all city-owned property**. The Show-Me-Yards program is well defined and should be incorporated on City property.

- **Add water quality benefits to planned projects.**
  - Establish an interdisciplinary team at the start of all planned City projects that includes engineers, managers, landscape architects, planners, and department heads. This includes all city construction projects that disturb land, not only stormwater projects. Identify project-specific ideas for additional water quality and quantity enhancements beyond the main project focus. Examples of enhancements include: greater drainage easements, minimizing piped stormwater conveyance, native area restoration, soil improvements, eliminating curb and gutter, roadside swales, planting trees and native plants, street medians with infiltration capacity, creating small detention areas, and downspout disconnections.
  - Consider a street-edge program for planned street improvement projects. This includes reducing impervious surface by narrowing streets, eliminating curb and gutter, providing open swales for drainage, and installing appropriate native plantings. An example of this approach for residential streets is the Street Edge Alternatives (SEA Streets) project done by Seattle Public Utilities in Seattle, Washington.
  - Stormwater CIP projects should identify any private property retrofits that would provide additional water quality and/or quantity benefits to the project. Add a public involvement component to CIP projects to Identify property owners willing to work with the City to incorporate retrofits. Include some funding for private property retrofits in each project budget.
  - Install Open Graded Friction Course (OGFC) overlays in areas with flooding problems to improve tire contact with the pavement and reduce the potential for hydroplaning. Perform a pilot study by incorporating OGFC into an already-planned street reconstruction project in a flood-prone location.
  - Start small with these example projects, introducing them to the public as pilot projects. The right-of-way is within the City's authority, which makes some projects easier to do although property owners should be consulted on aesthetic preferences and expectations to gain community acceptance.

2. **Encourage Non-Residential Property Owners:** Develop a program that recognizes non-residential development owners (commercial, industrial, churches, etc) who implement runoff-reduction, water quality retrofits, and native area restorations for unused areas (see Item #1) of their properties. These retrofits should have signage similar to City-owned retrofits. Recognition for these retrofits could be as simple as acknowledging the owner/development as a

"partner for water quality" and presenting a plaque to the owner or providing credits on the property's stormwater utility bill.

3. **Downspout Disconnection:** Develop a downspout disconnection program in conjunction with the sewer utility and set goals for annual stormwater sewer disconnections. Disconnections benefit the sanitary sewer utility and provide water quality benefits. Provide education and technical support to homeowners so that disconnections are correctly made to pervious surfaces away from a building foundation and not directly connected impervious areas such as driveways. Consider reserving a portion of the annual CIP to provide vouchers for disconnections in high-priority areas. A single disconnection costs approximately $200. The disconnections should be included in the stormwater master plan CIP and accomplished over a 5-year period, with 20% of disconnections occurring each year.

4. **Rain Gardens:** Encourage rain garden installation on homeowner property. Partner with the Hinkson Creek Watershed Restoration Project to develop a program with reasonable goals, as it is partially implementing this goal over the next three years. Support the program financially as budgeting allows. At a minimum, provide technical support in the form of an annual workshop, standard designs, and signage the property owner can install that identifies them as a "partner for water quality." Consider stormwater utility bill credits for successful installations in high-priority areas.

   Support an annual contest for rain gardens in conjunction with Earth Day or the Stream Extravaganza. The contents could include a cash prize for the best installed rain garden.

5. **Private Sector Education:** Provide a free annual education session for private lawn-care providers and landscape designers. Training would include care of native plants, care of rain gardens, appropriate fertilizer application, other components of Show Me Yards, and training on rain garden design and installation. City could issue a "partner in water quality" certification to those who attend the training session.

6. **Promote Projects:** Track, document, and publish local BMP and stormwater activity success stories both in the public and private sector. This should be done in conjunction with presenting a unified front on stormwater-related activities as described in Recommendation #2, Goal #4. This will also help document regulatory permitting efforts and preparing for a possible NPDES I permit.

7. **Native Area Program/Tree Planting/Soil Improvement:** Encourage native area restorations, soil improvement and tree planting, particularly near streams.

   - Incorporate native restorations on unused pieces of City and State land into the CIP.
   - Provide technical support to the public, provide assistance finding non-mainstream planting materials (possibly work with a vendor to have materials available for sale at Earth Day)

- Potentially provide small equipment loans, and provide recommended plant lists and seed mixes.

8. **Rain Barrels:** Encourage rain barrel installation on homeowner property. Partner with the Hinkson Creek Watershed Restoration Project to develop a program with reasonable goals, as it is partially implementing this goal over the next three years. Support the program financially as budgeting allows. At a minimum, provide technical support in the form of an annual workshop, stress to homeowners the importance of emptying the rain barrel, develop standard designs, and provide signage the property owner can install that identifies them as a "partner for water quality". Consider vouchers or one-time stormwater utility bill credits for successful installations in high-priority areas.

   Support an annual contest for rain barrels in conjunction with Earth Day or the Stream Extravaganza. This could include a cash prize for the most artistic (similar to the St. Louis People Project) rain barrel.

9. **How-To Videos:** Create instructional videos using local BMP installations or purchase videos from another entity. Show these videos on Columbia's public access channel several times a year and make them available for online viewing and checkout from Public Works and/or the Public Library. See www.raingardens.org for an example of a locally produced rain garden video. HGTV has produced an episode of "Gardening by the Yard" that includes a rain barrel installation.

3.6 Goal #6: Regulatory Compliance

The City is currently subject to NPDES Phase II regulations and has implemented additional stormwater programs and regulations to ensure Phase II compliance with the six minimum control measures. MoDNR is generally pleased with Columbia's permit compliance, however they have noted that there should be more Illicit Discharge and Elimination activities.

The City's population is approaching 100,000, at which point it may be subject to NPDES Phase I regulations. MoDNR has confirmed with both regional and federal EPA offices that at this time there are no plans to require Columbia to obtain a Phase I permit, but rather the City will continue as a Phase II community (Telephone conversation with Ruth Wallace, MoDNR, 11/27/2007). However, this could change in the future.

A review of Phase I application requirements shows that becoming a Phase I community could require implementation of a monitoring program. Other Phase I requirements are already being addressed by the City's existing Phase II program. If water quality monitoring is required, it is typically at 5 to 10 outfall locations. However, some Phase I communities such as Hampton Roads, Virginia, have successfully petitioned regulators to replace Phase I monitoring requirements with preventive activities such as those the City is already performing as part of its Phase II permit. If the City can continue to develop a strong Phase II program and continue its implementation, it is likely that monitoring requirements can be avoided.

Hinkson Creek is on the 303d list of impaired waters, and is the target of an upcoming TMDL regulation by MoDNR. It is likely that this TMDL will be for urban runoff quantity, and compliance will require the City to reduce runoff volume to Hinkson Creek.

The specific goals identified by the City and stakeholders for regulatory compliance include:

- Meet NPDES II Requirements
- Prepare for upcoming NPDES I Requirements
- Anticipate any future regulations or changes

3.6.1 Recommendations

1. **NPDES II:** The City holds a NPDES Phase II stormwater permit from MoDNR. MoDNR has indicated that future permit renewals will focus more on post-construction control measures, for example adequate stream buffer width requirements. The City should continue current activities, but should increase activities for illicit discharge and detection.

   The City should develop and implement a detailed screening and elimination plan, including inspection of all outfalls (not just large outfalls), what to inspect (wet/dry), a formal process to follow if a potential discharge is identified, training for inspectors with a formal program, identify the parameters used during inspection, a written inspection schedule, and document the rationale for the plan. One third of all outfalls greater than 24 inches in diameter should be inspected every year

   Although 36-inch and above are considered outfalls by the EPA, all outfalls can carry illicit discharges regardless of size. It is important to strengthen illicit discharge and elimination activities because this would help avoid monitoring requirements should the City have to meet Phase I requirements, can also help the City avoid third party lawsuits, and decreases the chance of water quality degradation due to illicit discharges.

2. **NPDES I:** The City should plan for holding a NPDES Phase I permit as the population nears 100,000 people. While the MoDNR's exact requirements are unclear and there are no current plans to impose Phase I requirements on Columbia, there are some actions the City should take to anticipate this regulation. The City's current actions for compliance with the NPDES II six minimum control measures are a good start towards a Phase I program. If the City can continue to be proactive and can show implementation of a strong program (specifically, improve pre- and post-construction inspections and strengthen illicit discharge elimination as described above), the current program may be able to be carried over into Phase I. As part of this effort, the City should review the metrics it uses to track Phase II activities and verify that they are clear indicators of environmental protection, as this data can be used in a Phase I application and help to avoid monitoring requirements. The goal is to suggest to MoDNR that these metrics can be used in lieu of expensive outfall monitoring.

3. **Hinkson Creek TMDL**: It is likely that this TMDL will require runoff reduction in the Hinkson Creek watershed. The City should become familiar with another

similar TMDL in Vermont (Potash Brook Final TMDL, October 2006, VT05-11) and begin the framework of a plan to meet the TMDL. The City should also begin implementing flow reduction techniques on city-owned property in the Hinkson Creek watershed as discussed in Goal #5 and increase public education and outreach for flow reduction techniques. The City should also communicate with MoDNR frequently to be able to anticipate the outcome of the TMDL.

The City should also incorporate a channel protection volume requirement for the Hinkson Creek watershed (discussed under Goal #2, Recommendation #4) as it will likely be necessary to meet the TMDL's requirement for future development, similar to the Potash Brook TMDL. Dr. Jason Hubbart from MU is researching the water budget for Hinkson Creek, and is planning multiple gaging stations. The City should partner with Dr. Hubbart to take advantage of the new data and results.

The City should also develop a consistent baseline of stream geomorphic assessments (SGAs) for Hinkson Creek. These SGAs can be used as a point of comparison for future assessments to document improvements or degradation of Hinkson Creek.

4. **Future Regulations**: The City wishes to be proactive and anticipate future regulatory changes, rather than being in a reactive mode. Specific actions the City can take include:

   - **Conferences:** When attending conference and other educational training sessions, seek out coastal municipalities of similar sizes and discuss their regulatory environment. Coastal municipalities are more likely to have progressive programs in place. Regulatory requirements tend to be in place in coastal communities before moving inland to the Midwest. Also attend sessions dealing with regulations.

   - **NPDES II Activity Documentation:** The City should closely track performance metrics associated with the NPDES Phase II stormwater program, as having detailed, concrete data on both the City's activities and results will be helpful to avoid monitoring requirements should the City be required to submit a NPDES Phase I application.

   - **Regulatory Tracking:** Task a staff member in the stormwater utility with tracking the regulatory environment around the country and to have regular discussions with MoDNR representatives. This person should submit bi-monthly reports to the head of the stormwater utility summarizing any changes in the regulatory environment and making recommendations for being proactive. Total Maximum Daily Load (TMDL) regulations such as the one for Hinkson Creek continue to be an issue on a national scale and should be included in the regulatory tracking.

   - **Third-Party Lawsuits:** This type of litigation is becoming more of an issue around the country. The outcome of these lawsuits is often in the hands of judges who do not have a technical background, and the City should keep a strong stormwater program to avoid such litigation. The City's Phase II

stormwater program is a good start of such a strong program. However, to further lessen the risk of litigation the City should increase illicit discharge and detection activities and have adequate personnel to inspect pre- and post-construction stormwater activities as described throughout this memorandum. The City should also continue/build relationships with local environmental non-profit organizations, understand their goals, and have a good working relationship with them to lessen the chance of a costly lawsuit.

TABLE 1: CITY OF COLUMBIA, MISSOURI GOALS AND OBJECTIVES IDENTIFICATION SUMMARY

	Stakeholder Group							
Identified Goal/Objective	**Stormwater Utility/City Staff**	**Development Community**	**Elected Officials**	**Citizens**	**Rate Payers**	**Homeowners's Associations**	**Regulators**	**Environmental Groups**
Assure the movement of emergency vehicles during storm periods	X							
Minimize losses and property damage resulting from uncontrolled storm water runoff	X							X
State of the art water quality and quantity protection	X							X
Protect quality of life	X	X						X
Limit stormwater runoff as much as possible	X							X
Protect natural resources necessary for watershed health and integrity (Environmental Protection)	X		X	X			X	X
Developed sites mimic pre-existing hydrology	X							X
Public protection from rapidly flowing water or flash floods	X		X	X				X
Channel protection/Erosion Control	X		X	X				X
Groundwater recharge	X							X
Pollutant removal	X			X			X	X
Add water quality aspects to city projects	X			X			X	X
Avoid future problems downstream of a project location	X	X		X				X
Implement and enforce *reasonable* stormwater requirements and regulations for newly developed areas	X	X	X	X	X	X	X	X
Identify aging infrastructure and maintain/replace it as necessary; Routine maintenance	X	X	X	X	X	X		X
Meet NPDES II requirements	X						X	
Prepare for upcoming NPDES I requirements	X						X	
Anticipate any future regulations or changes	X							
Economic resolution with environmental preservation		X						
Meeting the stormwater needs of constituents			X					
Providing a fair stormwater utility rate structure that meets the infrastructure and stormwater management needs of the City			X					
Incorporating “green” activities			X					X
Completion of Capital Improvement Projects	X		X	X				
Columbia is a attractive place to live and work			X	X				
Fair rate structure that meets the stormwater needs of rate payers	X		X		X	X		
Available affordable housing		X		X				
Institute an Advisory Board for the new Stormwater Regulations		X						X
Adequately staffed, adequately funded, and well-organized Stormwater Utility	X	X						X
Enforcement of maintenance regulations	X	X	X	X				X
Adequate maintenance of open channels			X	X			X	X
Improvement of degraded open channels			X	X			X	X