

Executive Summary

The City of Concord, New Hampshire, is developing a master plan to better manage storm water throughout the city as well as identify and plan various capital improvement projects. This report will be the basis for this effort.

Background

The City of Concord's drainage system handles all of the city's public storm water. This system stems from the early 1980s, when the City separated its combined sewer system. That project consisted largely of new sewer construction, in which the existing combined pipes were converted to drains.

Later, in the summer of 2000, Camp Dresser & McKee Inc. (CDM) prepared a Storm Water Master Plan for the City. The initial project intended to analyze all the city's drainage sub-basins, but the scope of work was later modified to reflect changing priorities for the City. The modified scope is considered Phase I. The project was also affected by information from initial field investigations, hydraulic modeling and other information generated by city-wide mapping.

In late 2004, the City of Concord and CDM signed an amendment to complete analysis of the remaining sub-basin and finalize the Storm Water Master Plan Report. The remaining work is considered Phase II. A revised report summarizing all work completed to date is included in this Final Submittal.

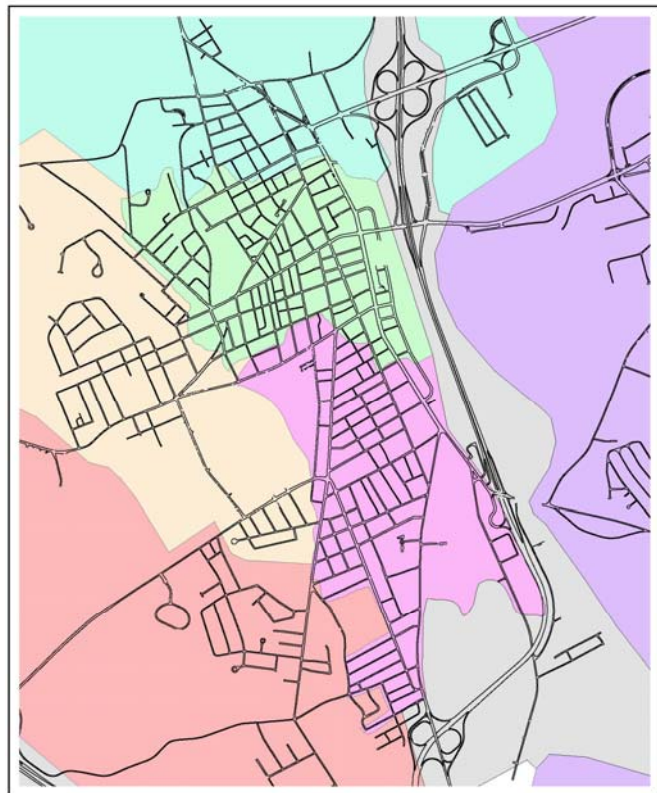
Purpose/Project Scope

The purpose of this report is to provide the City with a tool to better manage its drainage system. The report also includes a list of projects and a corresponding Capital Improvement Plan (CIP) for planning future projects. Other tasks include:

Task	Description
1. Data Collection	Collect plans, reports, and other information on the existing storm water system.
2. Field Survey	Collect additional system information where required, through field investigation.
3. Funding	Evaluate alternative methods of funding the City's storm water management program; apply for applicable grants.
4. Hydrology	Delineate select drainage basins in the City, and develop information about rainfall and runoff in these basins.
5. GIS	Develop a Geographic Information System (GIS) of the City's closed storm water system infrastructure.
6. Hydraulic Analysis	Create a computer simulation or spreadsheet model of select drainage basins in the City and/or perform TV or manhole inspections to evaluate the hydraulics of the system.
7. Develop Recommendations	Make recommendations to improve the system, based on the information collected and/or calculated through the above tasks, and based on input from the City.
8. Enterprise Fund	Evaluate the feasibility of funding the storm water capital improvements program with a storm water use fee.

Task	Description
9. NPDES Permitting	Discussion of EPA's Phase II Storm water permitting requirements; Prepare a storm water management plan suitable for fulfilling these requirements.
10. Project Meetings	Prepare for and attend meetings with Concord staff to present project progress and/or alternatives analysis.
11. Report Preparation	Prepare and distribute draft reports presenting results and analysis. Revise the reports based upon comments from Concord staff. Prepare and distribute final reports.
12. Public Meeting	Prepare for and present information at a public meeting to present information about the City's storm water plan and funding alternatives.

Two major tasks included detailed study (through either hydrologic and hydraulic modeling and/or field investigations) of two drainage basins - the Terrible Trapezoid and the Washington Street Basin. The report recommends several improvements within these basins. These two basins were intended to be "pilot areas" for determining a recommended approach for similar evaluations city-wide, ultimately resulting in a recommended storm water master plan for the entire city. However, the methods used in these sub-basins were time consuming and labor intensive. As a result, a different approach was used to evaluate the remaining sub-basins. These two areas were included in the July 2002 draft report submittal.



*Terrible Trapezoid Area = Pink
Washington Street Area = Green*

The report's third major task, resulting from the 2004 contract amendment, analyzes the remaining 10 drainage sub-basins. The approach used is more standardized across all the basins. Each sub-basin focused on its developed areas containing drain pipes. Smaller-diameter drain networks and outlying undeveloped areas were not investigated. A spreadsheet model incorporating the "Rational Method" was used to evaluate sub-basin physical characteristics and existing stormwater collection systems. These 10 areas are included in the report.

USEPA Storm Water Compliance

The Storm Water Master Plan was also prepared for the City of Concord to minimize storm water pollution from its system independent of the EPA regulations. EPA did not designate Concord as a regulated small Municipal Separate Storm Sewer System (MS4) community. Communities regulated as a small MS4 must:

- Apply for a National Pollutant Discharge Elimination System (NPDES) permit
- Develop a storm water management program, including the “six minimum controls,”
- Implement the program using storm water management controls or best management practices (BMPs)
- Develop measurable goals and periodically evaluate the effectiveness of the program

SIX MINIMUM CONTROLS
1. Public education and outreach
2. Public participation and involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/good housekeeping

If the Environmental Protection Agency (EPA) and New Hampshire Department of Environmental Services (DES) includes Concord in a Phase II program, the Storm Water Master Plan will help achieve compliance. Meanwhile, it will serve to direct Concord’s storm water management and pollution minimization.

The following examples provide a BMP for two of the Six Minimum Controls, indicating the measurable goal and justification of the storm water management control:

<p>BMP: Improve pet waste management in City parks by installing "pet waste stations" with waste receptacles, a supply of disposal waste collection bags, and scoops or shovels.</p>
<p>Measurable Goal: Reduce the amount of pet waste entering surface water bodies by 50 gallons during the 1st year.</p>
<p>Justification: When pet waste is not properly disposed of, it can wash into nearby waterbodies or can be carried by runoff into storm drains. Since storm drains do not connect to treatment facilities, but rather drain directly into lakes and streams, untreated animal feces can become a significant source of runoff pollution. Having designated places to dispose of the feces makes proper disposal more convenient for dog owners, and measuring the goal possible.</p>

Example 1 - Minimum Control – Public Education and Outreach

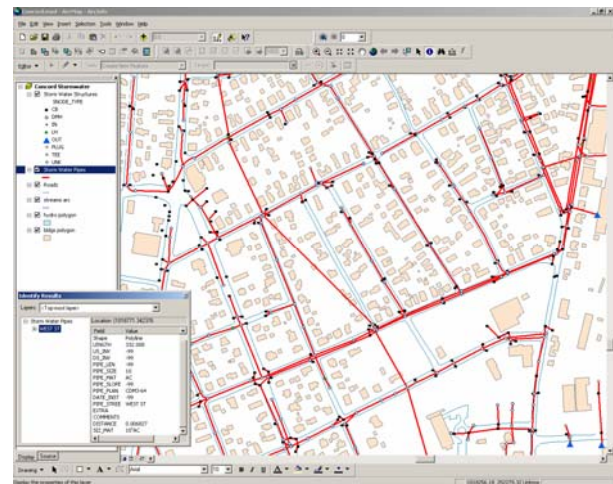
BMP: Incorporate the use of road salt alternatives for roadway deicing.
Measurable Goals: During the 1st year, reduce the amount of road salt applied to roadways by 50% through the use of less-toxic alternatives, such as liquid calcium magnesium acetate (CMA).
Justification: CMA is just as effective as road salt at deicing, but it appears to be much less harmful to the environment and is less corrosive, causing less damage to roadways and vehicles.

Example 2 - Minimum Control - Pollution Prevention/Good Housekeeping

A detailed overview of the Phase II Storm Water Program, although not relevant to Concord at this time, is presented in the report. The EPA program can serve as a model of how to develop an effective storm water management plan, and can describe the steps other neighboring communities, such as Manchester, Hooksett, and Portsmouth, are taking towards storm water management. This section may also serve as guidance if Concord is designated in the future.

GIS System

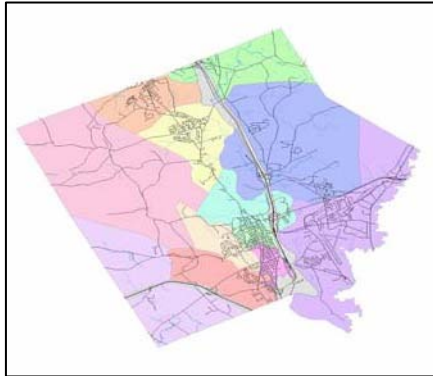
A Geographical Information System (GIS) is a common means of collecting and organizing geographically based information. The system is essentially a “smart” map, in that an electronic map on a desktop or laptop computer is linked to a database of information. The City maintains an extensive GIS database that includes information on parcels, zoning, utilities, aerial mapping, and many other layers. For this project, CDM has developed a GIS data layer consisting of storm water facilities. This storm water layer is supporting nearly all other aspects of the storm water master plan.



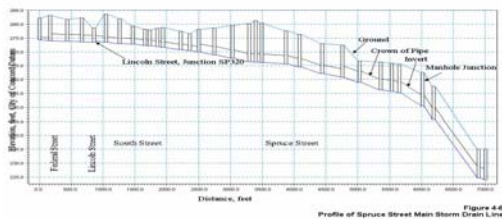
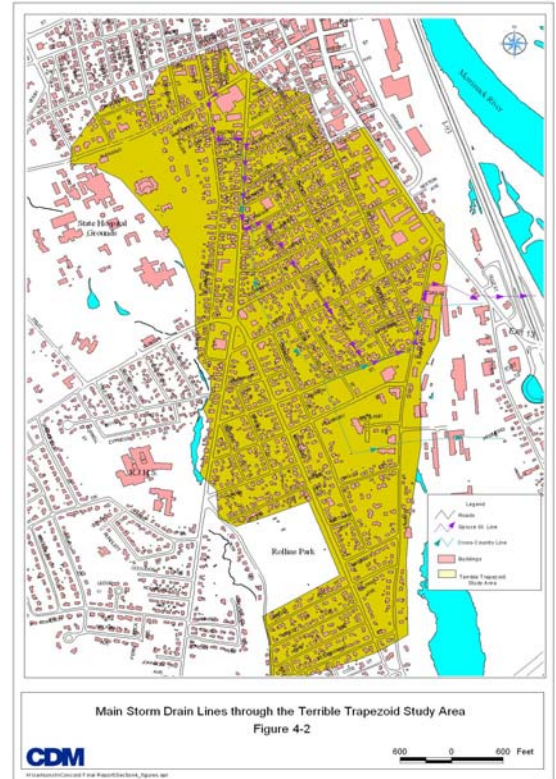
Custom applications have been developed for the City in addition to the standard applications built into the GIS software. These custom applications will allow easy access and analysis of the data. A field application for gathering manhole inspection data was also developed. This field application allows the City to locate and comment on structures in the field, and easily upload this information to the entire City's database.

Sub-basin Analysis

Twelve drainage sub-basins were identified in Concord based on topography. For those twelve, three different methods of analysis were performed for this report:



Method #1 – This method focused on the Terrible Trapezoid sub-basin, which is an urban and densely populated downtown area with extensive drainage infrastructure. A detailed hydrologic and hydraulic study of the sub-basin resulted in a network model (SWMM) that plots the expected water levels within the system during four different rain events. The model also identifies problem areas or potential surcharging locations. From the model results, the report includes a discussion of the problems areas and recommended mitigation improvements.



Method #2 – This method focused on the Washington Street sub-basin, another urban and densely populated downtown area with extensive drainage infrastructure. Instead of a model/computer-based approach used in Method #1, this method focused on a physical approach. Manholes inspections and closed circuit television inspections were performed throughout the drainage pipe network. Each physical inspection was reviewed and summarized. From the summary, a list of recommendations was included.

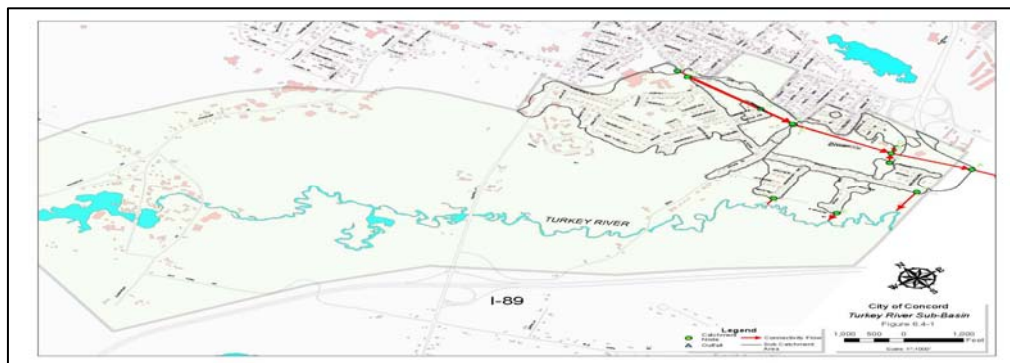


Problem	Solution	Recommendation
Possible illicit connection on a cross country pipe west of Valley Street	TV 250 feet from Chestnut to Valley to pinpoint location; redirect illicit connection(s) to sanitary sewer line.	Investigate and redirect connection(s).
Small amount of grey-colored flow with a slight septic smell noticed on Valley Street between Forest Street and Liberty Street into White Park.	Repair of the above item may eliminate need for further investigation.	Investigate and redirect connection at Valley Street (above), and reassess.
Possible cross connection near North Main Street at Pearl Street	TV 350 feet along Pearl Street to pinpoint location; redirect illicit connection(s) to sewer in street.	Investigate and redirect connection(s).
Excess sedimentation in manholes	Schedule City vactor-truck to clean	Clean out excess sediment.

**Priority Problems Identified During Manhole Inspection Program
Washington Street Drainage Basin**

Method #3 – This method focused on the remaining ten sub-basins, which ranges in land use from downtown urban and very developed to rural and forested. The more developed areas containing existing drain pipes were the focus of each sub-basin. Smaller-diameter drain networks and outlying areas were not investigated. A “Rational Method” spreadsheet model was used to evaluate the sub-basins physical characteristics and existing stormwater collection systems. The expected pipe size resulting from the analysis was compared to the actual pipe in place. If the actual pipe sizes were too small, it was flagged (highlighted in blue as shown in the spreadsheet above) as a potential problem. Each sub-basin section summarizes the potential problems and recommends a solution.

Table E-4.1
Turkey River Drainage Basin Calculations



Outfall Inspections

An outfall inspection program was performed on all outfalls along the Merrimack River. The inspection program determined if illicit sewer connections were in the drainage system. As part of the analysis, water samples were also taken to measure contaminant levels. A map showing the location of each outfall and summary of the inspections are included in the report.



Outfall on the Merrimack River

Summary of Projects and Prioritization

A list of the problem areas identified in the twelve drainage basins throughout the City was formed. Each identified problem area was given a score based on eight types of criteria – property/traffic, pipe size, recurrence of problem, pipe age, stream impacts, constructability, impact on road projects and cost. The City and CDM agreed upon the criteria and associated score for each item. Once all the scores for each problem area was totaled, the list was sorted from highest score to lowest. The projects at the top of the list would be highest priority.

Criterion	Range	Maximum
Property/Traffic Impacts	0-5	5
Pipe Size	0-5	5
Percent Undersized	0-5	5
Recurrence of the Problem	0-5	5
Pipe Age	0-5	5
Stream Impacts	0-5	5
Constructability	0-5	5
Potential Road Projects	0-5	5
Project Cost	N/A	-
Total		40

Prioritization Criteria Summary

Capital Improvement Plan and Project Costs

A CIP was formed from the prioritized list mentioned above and will be the basis for selecting drainage projects in the City. The estimated project cost and fees are also listed with each problem area, to gauge the magnitude of each project.

Ninety-one projects were identified for the City. These projects included the problem areas and known problems for each of the 12 drainage basins throughout Concord. The estimated cost to complete all 89 projects is summarized in Section 10.

Total scores for the projects ranged from the lowest of 10 to the highest of 34. Fifteen projects scored 25 or more; 20 projects scored 20-24; 34 projects scored 15-19; and 20 projects scored 14 or less.

Evaluation of Funding Mechanisms

Alternative methods were evaluated for funding a storm water management program and implementing the recommendations in this report. Four funding mechanisms were evaluated: general fund, village districts, sewer user fees and storm water utility.