LAWRENCEVILLE
GEORGIA

STORMWATER AUTHORITY

AGENDA

Wednesday, October 18, 2023	Third Floor GwMA Conference Room
6:00 PM	70 S. Clayton St, GA 30046

Call to Order

Review of Current Projects

1. Discuss and Review Stormwater Master Plan Preliminary Draft

Comments from Utility Board Staff

Final Adjournment

LAWRENCEVILLE
GEORGIA

AGENDA REPORT
MEETING: STORMWATER UTILITY BOARD
AGENDA CATEGORY: STORMWATER MASTER PLAN PRELIMINARY DRAFT

Item:	Discuss and Review Stormwater Master Plan Preliminary Draft
Department:	Engineering
Date of Meeting:	Wednesday, October 18, 2023
Fiscal Impact:	$0
Presented By:	Hussey Gay Bell
Action Requested:	None

Summary:
Hussey Gay Bell (HGB) was contracted to develop a Stormwater Master Plan (SMP). The purpose of the SMP is to develop a blueprint for the City to address current and future stormwater maintenance obligations. Also, the SMP will identify future stormwater investment needs and propose funding options. The City of Lawrenceville's stormwater infrastructure is nearing the end of its useful life. In order to stay ahead of repairs, HGB developed the Master Plan to be proactive by providing estimated costs for repairs and categorizing them based on ratings. These ratings determine where the project lies within the schedule for repair. HGB will be presenting the preliminary draft of the plan and be available for any questions on their recommendations.

Fiscal Impact:
None

Attachments/Exhibits:
HGB Stormwater Master Plan

STORM WATER MASTER PLAN & CAPITAL IMPROVEMENT PROGRAM

CITY OF LAWRENCEVILLE
GWINNETT COUNTY, GEORGIA

LAWRENCEVILLE
GEORGIA

HUSSEY GAY BELL
Established 1958

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Hussey Gay Bell Project No. 22-0006-C
OCTOBER 2023

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Acknowledgements

Acknowledgements

The following contributed to the development of the Master Plan:

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Storm Water Authority:

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Jason Ray, GISP, Integrated Science and Engineering, Inc.

1 Overview of Lawrenceville Storm Water

1.1 Introduction

The Storm Water Master Plan (SWMP) provides guidance for the City of Lawrenceville's future management of the storm water system. The plan is focused on methods to address storm water infrastructure across the City and prioritizes solutions to address conditions.

The major goals of this plan are to improve storm water management in Lawrenceville's neighborhoods, rights-of-way, and Downtown District/public spaces.

In this plan, reviews of existing storm water infrastructure, recommendations on improving overall storm water management and prioritized lists of recommended storm water improvements are provided.

An overview of the storm water system, previous studies and storm water detention facilities follows.

1.2 Overview

The City of Lawrenceville has three primary drainage basins that are included in this study. Shoal Creek is approximately 3,020 acres, Redland Creek is approximately 1,555 acres, and Pew Creek is approximately 2,155 acres. These basins make up most of the area within the city limits. Redland Creek and Pew Creek both flow west and converge before their confluence with the Yellow River. Shoal Creek flows east and drains to the Alcovy River. The location of the drainage basins is shown on Map 1.0 on the following page.

To give an idea of the scope and scale of the storm water infrastructure within the city, below is an inventory of what storm drainage pipes and structures have been documented within the city limits:

- There are ±275,700 linear feet (±52 miles) of storm pipe
    - ±48% of that is Corrugated Metal Pipe (CMP)
    - ±52% is Reinforced Concrete Pipe (RCP)
- There are ±4,090 structures
    - ±42% are precast concrete curb inlets
    - Remaining structures are headwalls, culverts and junction boxes.

Like many cities in the area, Lawrenceville has had significant development and growth. Different amounts of residential development occur based on population movements or times of economic growth. Often, commercial development follows a growth in housing. In the 1960s through the late 80s there was considerable growth in the Gwinnett area and Lawrenceville. Those areas are now seeing some of the late stages of life for the storm water infrastructure.

Maps 1.1 and 1.2, on the following pages, provide a visual aid showing the age of the storm drainage system in different areas of the City. The system age is one of the most critical elements of the storm water system since pipes and structures have a limited lifespan. This is

important since in the years of the most infrastructure development, corrugated metal pipe (CMP) was the primary pipe material used. CMP can have a lifespan of 50 to 60 years before deterioration occurs. Unfortunately, the pipe material manufactured and installed during the years that saw the most significant amount of development is more impacted by the acidity (pH) of the soils in this area resulting in a lifespan of only 20 to 30 years.

As seen in Maps 1.1 and Maps 1.2, there are large areas within the City that have been developed that have drainage systems older than the pipe materials' lifespans.

1.3 Flood Hazard Areas

An important function of the SWMP is the regulation of the areas that are subject to flooding in the event of a 100-year storm. The Federal Emergency Management Agency (FEMA) regulates and establishes the flood plain in drainage basins that are one (1) square mile (640 acres) and larger. Recognizing the importance of knowing the potential impacts in smaller drainage areas, a flood plain study was prepared for each of the drainage basins in 2007 to provide the potential limits of flooding where the drainage basins were larger than 100 acres. This is more extensive than what is provide by FEMA.

The location of the 100-year flood plain limits has been provided to the City's GIS Department and is now available as a tool to evaluate where potential impacts may occur during large storm events. Additional information is provide in Appendix B.

1.4 Review of Major Culverts Report (Drainage area larger than 50 acres)

In 2018, an evaluation of the drainage system in Lawrenceville was completed. It studied areas that conveyed a drainage basin larger than 50 acres. This study included private systems, often defined as systems that reside outside of the public right-of-way. The piped systems were documented in three reports entitled "Drainage Basin Study for Pew Creek and Tributaries within Lawrenceville City Limits," dated August 2, 2018, "Drainage Basin Study for Redland Creek and Tributaries within Lawrenceville City Limits," dated August 24, 2018, and "Drainage Basin Study for Shoal Creek and Tributaries within Lawrenceville City Limits," dated October 5, 2018.

The portions of the systems that were designated moderate, severe, priority or safety hazard were revisited to document the current condition. Private drainage systems were not considered in this study.

As part of the Storm Water Master Plan, the studies prepared in 2018 for the larger drainage basins were reviewed. The 2018 studies provided recommendations for repairs to pipe culverts

that were exhibiting poor conditions. Typically, these culverts are larger pipes (60" diameter and above) like the one shown in the photograph on the following page).

The culvert shown above is listed as an 84"x240" elliptical CMP that is part of a double barrel road crossing of Sarah Lane in the Pew Creek basin. It has an approximate watershed basin of 1,140 acres for storm water conveyance.

The pipe culverts that were recommended for repairs in the 2018 study have been reviewed in the field as part of the SWMP. The results of the review are provided in Appendix C.

Refer to Tables C 1-3 in Appendix C for a summary of the 2023 site visits.

1.5 Existing Detention Ponds

As development occurs, the characteristics of the land change. As impervious structures and parking areas are built, the nutrient rich topsoil is removed, and the remaining layers are moved or compacted through the construction process. The volume of storm water runoff is increased as less water can be absorbed into the soil. One of the most common measures taken to remediate the increased storm water runoff is to collect it in a detention pond. The pond's primary functions are to reduce the rate of storm water runoff as well as reduce the soil particulates from traveling downstream.

The detention ponds function better when they are properly maintained, and this responsibility typically falls to the owner. Removal of debris from the inlet and outlet structures as well as invasive vegetation is important to the health of the pond. Sediment accumulation will occur over time reducing the storage capacity and pond function. Sediment should be monitored and removed periodically to maintain adequate pond volume.

The first step of incorporating maintenance of the storm water detention facilities within the City in the SWMP is to document their locations.

An inventory of approximately 100 detention ponds was conducted utilizing available GIS information as well as Google Earth to identify locations of these facilities to initiate this program. In addition to the location of the storm water detention pond, an exhibit has been created that shows the approximate limits of the watershed for the specified pond, information on the pond itself, and the Owner of the property on which the pond is located. The City plans to utilize this information to help keep track of pond maintenance as that is part of the overall health of the streams in the region.

The pond shown at left has an outlet control structure that is in disrepair, has invasive growth, and can no longer function as designed.

The pond, below, is well maintained and is able to treat the storm water runoff as well as detain water in the event of heavy rainfall.

The inventory of existing detention ponds is available at the City of Lawrenceville Engineering Department and included in Appendix D of the SWMP.

2 Storm Water Utility Program Overview

2.1 Introduction

The City of Lawrenceville has a storm water utility program that was created in 2007 to provide a dedicated source of funding for managing storm water requirements and stormwater infrastructure. Storm water management includes the operations and maintenance of the infrastructure that the City is responsible for, the City's personnel and equipment needed to both manage the program and perform maintenance, along with outside resources. Outside resources include engineering consultants, and companies that the City has annual contracts with to make repairs.

The utility program is defined in the "City of Lawrenceville Storm Water Utility Ordinance" Ord. No. 2021-5 last amended May 24, 2021.

2.2 Extent of Service (EOS)

The Extent of Service refers to the components of the storm drainage system maintained by the city.

In accordance with the City of Lawrenceville Storm Water Utility Ordinance, the City owns or has rights established by written agreements which allow the storm water utility to provide storm water management services and access those storm water management systems and facilities which are located:

- Within public road rights-of-way maintained by the City and public road easements maintained by the City;
- On private property, but within easements granted to and accepted by the City, or are otherwise permitted to be located on such private property by written agreements for rights-of-entry, rights-of-access, rights-of-use or other permanent provisions;
- On public land which is owned by the City or by another governmental entity, and with which the City has written agreements to provide storm water management services and access to the storm water management systems and facilities; or
- Any pipe which begins within the public road rights-of-way maintained by the City or public road easements maintained by the City that conveys water from the public road rights-of-way/road easement (maintained by the City) until said pipe ends. This shall not include any pipes that begin on private property, convey water to public rights-of-way/road easements and/or end on public rights-of-way/road easements.

The City is not responsible for storm water drainage facilities located on Gwinnett County maintained roadways, Georgia Department of Transportation maintained roadways or drainage pipes or structures located on private property unless there has been a written agreement between the City and the other party. Detention facilities on private property are the responsibility of the property owner. Where a subdivision has an owners' association, the owners' association is the responsible party.

2.3 Personnel and Staffing

The City employs a full-time staff to support the storm water utility. This includes:

- Public Works Director
- City Engineer
- Storm Water Coordinator
- Inspector (1) that is available to make field observations
- Public Works Staff* (2) that are available for operation of a vacuum truck
- Street Department Staff*
- GIS Staff

*There is not currently maintenance staff that is dedicated fully to maintenance of the storm water system.

For maintenance, a supervisor and one maintenance crew make routine repairs as needed and perform maintenance, such as grouting around pipes, replacing lids, installing riprap at pipe outlets, repairing sink holes, removing debris, and vacuuming storm structures and pipes. Under the current structure, the maintenance crew is not dedicated full-time to the storm water program. In the event of an emergency, the Department of Public Works may conduct maintenance if the responsible party fails to maintain the facility in working order.

In addition, engineering consultants and contractors are utilized when needed. For support of the MS4 permitting requirements, the city contracts with an outside company to visually inspect and document the storm drainage system. The permit requires the whole system to be inspected every five years. Currently, about 20% of the system is looked at every year. The inspections began in 2017.

For maintenance and repairs that require more resources than the City has, annual contracts have been established with two (2) construction firms to provide assistance.

2.4 Storm Water Authority/Storm Water Utility Board

A storm water authority provides assistance to the City staff in the Engineering and Public Works Departments. The Authority is a collection of seven people comprised of city officials and residents of the city and they meet once per month. Each position serves a 4-year term, and the positions are at-large. Their purpose is to facilitate the maintenance and repair of existing storm sewer systems as well as evaluate the need for additional measures to provide a healthy and well-functioning storm sewer system within the city limits.

The authority is comprised of the City Manager, the Assistant City Manager, Public Works Director, the City Engineer, one member of the Lawrenceville City Council, and three citizens of the City of Lawrenceville or owners/employees of businesses located within the City of Lawrenceville.

2.5 Geographic Information System (GIS)

The City of Lawrenceville updates and maintains a GIS database containing infrastructure owned or maintained by the city. Roads, waterlines, gas lines, and storm infrastructure are among some of the information tracked by the program. Information is continuously updated from new development as-builts and field verification. The current GIS mapping is based on information in Gwinnett County's GIS database with supplements added from the yearly MS4 inspections. For storm water, the GIS mapping provides the location along with the pipe size and material for the City's infrastructure. A sample "screenshot" of what is available is shown below.

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Working with input from the City of Lawrenceville Engineering Department and GIS staff, the capability of the GIS mapping has been upgraded.

This upgrade includes linkage of information provided by the MS4 consultant and the assessment of the storm water system presented in Section 3.0 on the Storm Water Master Plan to the GIS system.

2.6 Storm Water Utility Fee

A storm water utility fee is a fee that is collected by the City in an effort to fund the maintenance or replacement of the storm water infrastructure, replace old or damaged pipes and structures, reduce pollution, and monitor water quality. It is becoming increasingly more common for municipalities to implement this as a way to raise the funds to take care of their infrastructure and it is paid for by those that contribute to its need rather than a tax increase paid for by all.

The reason for doing this is because having a well-maintained storm water system protects the local streams and neighborhoods as well as keeps the city in compliance with federal regulations, such as the Clean Water Act. This is funded with a user-fee system whereby the owner of the property is responsible for paying the fee. With the funds that are raised, the City is able to provide construction inspections, capital improvements, water quality monitoring, illicit discharge detection and elimination, shoulder and ditch maintenance, storm pipe cleaning and repairs and similar functions.

Fees are assessed according to the impervious surface area or storm water "footprint" of each parcel, rather than property value. Each parcel is billed for each equivalent resident unit ("ERU"). Equivalent residential unit means 3,000 square feet of impervious surface. Each ERU is billed at a rate of $5.00 per month. Residentially-zoned property, excluding multi-family housing, is billed one (1) ERU (ex. $5.00 per month). For non-residentially-zoned property, including multi-family housing, the number of ERUs to be billed is calculated by taking the square footage of the property and multiplying the square footage by Seventy-five percent (75%) and then dividing by 3,000 (ex. 5-acre parcel – 43,560 x 5 = 217,800; 217,800 x 75% = 163,350 / 3,000 = 54.45 ERUs; 54.45 x $5.00 = $272.25 per month).

As a comparison, storm water utility fees for other municipalities in the Atlanta area are provided in Table 2.1 on the following page.

TABLE 2.1 – User Fee Rate Comparison

CITY	RESIDENTIAL	COMMERCIAL
Lawrenceville	$5.00/month (for 3,000 sf)	75% x impervious (sf)/3,000 x $5.00/month ~$3.75 month (for 3,000 sf)
Johns Creek	$2.90 (0 - 3,000 sf) - $14.50/month (9,000-11,000 sf) (Tiered)	$5.80 x impervious/4,000 sf ~ $4.35 (for 3,000 sf)
Roswell	$3.23 (0 - 3,400 sf) - $7.43/month (4,951 - 10,000 sf)	$4.95 month x impervious (sf)/4,100 ~$3.71 month (for 3,000 sf)
Clayton County	$3.75/month	Not available
Douglasville/Douglas Co	$4.71/month (for 3,000 sf)	$4.00 x impervious (sf)/2,543 ~ $4.72 (for 3,000 sf)
Norcross/Gwinnett	$6.15/month (3,000 sf impervious)	$6.15/month (3,000 sf impervious)
Duluth	$6.25/month (for 3,000 sf)	
Suwanee	$7.50/month	Not available
Brookhaven	$7.83/month	
DeKalb	*$8.00/month *Increasing to $10 by 2026	
Rockdale County	$9.50/month *Expected to go to $13.50/month	Not available
Decatur	$7.08/ month (0 – 2,500 sf) - $25/ month (>5,000 sf) ($12.50 (2,500 – 3,999 sf))	$17.92 x Impervious/4,000 sf

Notes:
1. The current fee that is charged by the City of Lawrenceville went into effect in 2017/2018.
2. Lawrenceville is currently assessing a lower fee than most of the other municipalities in the Atlanta area.

3 System Assessment

3.1 Current Procedure for Storm Drainage Related Issues

The current process of addressing storm water problems is reactive in nature. When a resident has a storm water issue, they generally call Public Works, the Engineering Department, or City Hall. The complaints or concerns are then transferred to Public Works where someone will go onsite to evaluate the problem and assign an inspection to the appropriate department. Drainage issues can be assigned to Public Works if a pipe is clogged or a sediment-related issue. The City of Lawrenceville Engineering Department addresses the problem if there is damage to the storm system such as pipe failure or a sink hole. If there is a damaged pipe under a road causing a sink hole, the Street Department will need to get involved as well.

If it is a maintenance problem or smaller repair, the city will add it to a list of ongoing issues and fix them in the order of when the complaints came in. If it is a larger repair or if it requires equipment/manpower the city does not have available, it will be assigned to one of the two companies that have an annual contract for storm drainage repairs.

One of the primary goals of the Storm Water Master Plan is to be proactive with the maintenance and known problems rather than reactive. In this way, problems can be resolved in a manner that can be safer, less costly, and the overall health of the storm water collection system will be increased.

3.2 Municipal Separate Storm Sewer System (MS4) Reviews

As a part of maintaining compliance with the NPDES Phase 1 MS4 Permit, the entire storm system needs to be inspected at least once every five years. The City has contracted with Integrated Science and Engineering (ISE) to provide this service. ISE typically inspects about 20% of the system per year and then provides a report of its findings to the city. Notes are communicated to the city to document unique findings or sections requiring attention. These notes are prepared as a detailed spreadsheet that is updated annually.

The MS4's pipe inspector's observations are documented as separate reports for pipes and structures. There are many categories documented. The following are the ones most impactful for this report:

<u>Pipes</u>

1. Maintenance Needed
2. Pipe Type
3. Corrosion Upstream
4. Corrosion Downstream
5. Pipe Size

The following key elements are most impactful for structures:

Structures

1. Maintenance Needed
2. Structure Damage
3. Scour
4. Structure Sedimentation

3.3 Pipe and Structure Evaluation

One of the main functions of this report is to develop a process to identify and prioritize structures and pipes in most need of repair/replacement. This will allow for the best use of the available storm water funds.

The data available from the MS4 contractor reviews has been utilized to develop a computer program that will score and grade both storm drainage pipes and structures. The computer program provides a method of organizing repair projects so that they can be listed in order of worst condition to best. The development of the program was done in close coordination with City Engineer staff along with the City GIS Department.

A separate program was developed for pipes and for structures. The basis for the program is a scoring and grading system. For pipes, the scoring and grading system includes the following key elements and ratings as evaluated by the inspector:

1. Maintenance Needed
   a. Safety Hazard
   b. Priority
   c. Routine
   d. Remedial

2. Pipe Type
   a. Coated CMP
   b. Plain CMP
   c. Other Material (concrete or HDPE)

3. Corrosion Upstream and Downstream
   a. Severe
   b. Moderate/Severe
   c. Moderate
   d. Minor

4. Pipe Size
   a. Less than 36”
   b. 36” – 42”

c. 48” – 54”
d. 60” – 66”
e. 72” and greater

For structures, the scoring and grading system includes the following key elements and ratings as evaluated by the inspector:

1. Maintenance Needed
   a. Safety Hazard
   b. Priority
   c. Routine
   d. Remedial

2. Scour
   a. Severe
   b. Moderate
   c. Minor

3. Structural Damage
   a. Public Safety Hazard
   b. Severe
   c. Moderate
   d. Minor

4. Structural Sedimentation
   a. 76-100%
   b. 51-75%
   c. 26-50%
   d. 1-25%

The computer program provides a score and final grade of each pipe and structure that have been documented in the City. This allows for planning repairs and maintenance in an orderly fashion. The system assessment generated is provided in Appendix E of this report. It has also been coordinated with the Engineering Department and can be accessed and used by the city electronically.

A final step in developing the computer program was establishing a step where the storm drainage assessment could be linked to the GIS database. That provides a mechanism where the location of the repairs needed can be visually seen on the GIS maps.

Some of the pipes and structures do not currently have enough information documented to be scored and graded. In those instances, a grade of “Inspect” was given on the assessment. This informs the City and MS4 consultant that an inspector will need to reevaluate that pipe or structure. There were also instances that an evaluation of a storm line could not be completed

due to the physical limitations or difficulty in locating the storm lines due to buried structures, fences blocking the inspection process and similar items.

See Appendix E for Pipe and Structure Assessments and Evaluation tools.

3.4 Project Prioritization and Selection

The ranking and grading system (algorithm) is intended to be a tool and it is recommended the City use engineering judgment with all decisions. It should be used in conjunction with any other available information and evaluated on a case-by-case basis. The system is able to help provide guidance to make more informed decisions. It is recommended that the engineer exercise flexibility when the situation necessitates it; the lowest graded pipe/structure doesn't necessarily need to be the very next project.

The ranking and grading can be used to:

- Identify the next group of the lowest graded pipes and structures
- Review those locations on the GIS map and see if projects can be grouped together to save costs
- Identify safety issues which are considered to be the highest priority

Many pipes/structures may have the same grade. It is recommended that the city use their discretion on which pipes should have higher priority. The spreadsheet uses only elements that were measured in the field, while there are other considerations to factor in:

- Potential safety issues
- Proximity to other poorly graded pipes/structures
- If a pipe is a good candidate for relining as opposed to replacement (based on video)
- Age of pipes/structures in a community

3.5 Conceptual Cost Estimate

Another element provided by this assessment is a cost estimate for each of the tasks that would generate a need to repair/replace a pipe or structure in the system. This is important as it allows the City to forecast the amount of storm water projects that can be performed in a given year. This is not intended to be an exact opinion of construction costs as there are too many variables with the different projects and each project has its own unique challenges.

The computer program has been further developed and incorporated in the system assessment to estimate the potential costs. These calculations include the following criteria:

1. Pipes:
    a. Size
    b. Excavation and installation
    c. One (1) structure per pipe installation
    d. Pavement replacement

e. Demolition
f. Traffic control
g. Erosion control
h. Utility replacement
i. Survey and design fees at 20% of items listed above

2. Structures:
    a. Full replacement
    b. Replace headwall
    c. Maintenance
    d. Damage to lid

    Note: ±565 structures were reviewed based on field notes from the inspector with an estimated cost applied.

Appendix E contains the Conceptual Cost Estimate for the pipes and structures in the system assessment.

3.6 Annual Projections

Having an approximate cost for each of the projects to be repaired or replaced and knowing the current budget allocated for storm water expenditures, allows for an annual projection for what can be repaired. This allows the city to easily see how many of the higher priority projects can be fixed in a given year. It also allows for the city to see the pace at which the repairs are expected to be made and thus, how quickly the entirety of the stormwater infrastructure can be brought up to the preferred grade for the pipes and structures.

3.7 System Assessment from Other Studies

The overall system assessment includes other studies that have been prepared as follows:

A. Potential Impacts of the 100-Year Storm
B. Evaluation of Major Culverts and Piped Systems

The above assessments are included in Appendices B and C of this report.

3.8 Summary of Findings from the Assessment

A brief summary of the most important aspects of the system assessment for pipes and structures follows:

Pipes:

- 3,495 runs of pipe totaling 275,712 linear feet
  - Average grade of 83 when "Inspect" pipes are excluded
  - 9 runs totaling 954 lf are graded 0-19 (red)
  - 178 runs totaling 14,578 lf are graded 20-39 (yellow)
  - 96 runs totaling 8,585 lf are graded 40-59 (blue)
  - 1,741 runs totaling 134,146 lf are graded 60-99 (green)
  - 1,046 runs totaling 80,839 lf are graded 100 (purple)
  - 425 runs totaling 36,611 lf are graded "Inspect" (orange)
- Maintenance Needed: 4 categorized as Safety Hazard
  - 1 of those has a grade less than 20 (red)
  - 2 have a grade 20-39 (blue)
  - 1 has a grade 66-99 (green)
- Grades 0-19 typically have these characteristics:
  - Material - corrugated metal pipe
  - Corrosion upstream and/or downstream - Severe
  - Maintenance needed - Priority
- Grades 20-39 typically have these characteristics:
  - Material - corrugated metal pipe
  - Corrosion upstream and/or downstream - Severe or moderate/severe
  - Maintenance needed - Priority
- Grades 40-59 typically have these characteristics:
  - Material - corrugated metal pipe
  - Corrosion upstream and/or downstream – Moderate
  - Maintenance needed - Routine
- Grades 60-90 typically have these characteristics:
  - Pipe material - RCP
  - Corrosion upstream and/or downstream – Minor/none
  - Maintenance needed - Remedial

Based on the current (2023) budget, the pipes graded below 33 could be repaired. A breakdown with location is provided in Appendix E.

TABLE 3.1 – No. of Pipes Repaired Over 5 Years

Year	No. of Pipes	Grades Repaired
1	23	0-21
2	21	21-24
3	13	24-24
4	19	24-24
5	20	24-33

Structures:

- 4,093 structures
  - Average grade of 87 when "Inspect" structures are excluded
  - 17 graded 0-19 (red)
  - 58 graded 20-39 (yellow)
  - 56 graded 40-59 (blue)
  - 3,223 graded 60-99 (green)
  - 373 graded 100 (purple)
  - 366 graded "Inspect" (orange)
- Structure Damage: 21 categorized as Public Safety Hazard
  - 16 of those have a grade less than 20 (red)
  - 5 have a grade 20-39 (yellow)
- Maintenance Needed: 36 categorized as Safety Hazard
  - 17 of those have a grade less than 20 (red)
  - 1 has a grade 20-39 (yellow)
  - 18 have a grade 40-59 (blue)
- A total of 31 structures have a safety designation
- Grades 0-19 typically have these characteristics:
  - Structure Damage – Public Safety Hazard
  - Maintenance Needed – Safety Hazard
  - Structure Sedimentation – 51%-75% of Pipe Diameter
  - Scour – Moderate
- Grades 20-39 typically have these characteristics:
  - Structure Damage – Moderate
  - Maintenance Needed – Safety Hazard
  - Structure Sedimentation – 1%-25% of Pipe Diameter
  - Scour – Moderate
- Grades 40-59 typically have these characteristics:
  - Structure Damage – Moderate
  - Maintenance Needed – Priority
  - Structure Sedimentation – 11%-25% of Pipe Diameter
  - Scour – Moderate
- Grades 60-90 typically have these characteristics:
  - Structure Damage – None
  - Maintenance Needed – Routine
  - Structure Sedimentation – 1%-25% of Pipe Diameter
  - Scour – None
- At current price estimates and funding, all Safety Hazard structures that graded 1-39 (red and yellow) will be fixed in CIP Year 1, and the remainder will be done in Year 2. The number of structures repaired over a 5-year period with current funding is provided in Table 3.2.

TABLE 3.2 – No. of Structures Repaired Over a 5-Year Period

Year	No. of Structures	Grades Repaired
1	82	0-49
2	55	49-63
3	105	63-71
4	98	71-75
5	97	75-78

4 Capital Improvement Program

4.1 Summary

A key component of the Storm Water Master Plan is defining the components and budgeted expenditures to maintain the storm water system.

The primary goal of the 5-year CIP is to address the backlog of storm water projects and develop a process to transition from being reactive to proactive, as it relates to infrastructure maintenance.

Table 4.1, on the following page, presents a summary of different functions that the City of Lawrenceville provides that are coordinated by the City Engineering Department. A description of the item, whether the item is out of the scope of the Capital Improvement Program (CIP) or within the scope of the CIP and subsequently funded by it through the collection of user fees.

The algorithm has identified pipes and structures in greatest need of repair and assigned a cost to them. With that cost, the City can more accurately forecast the number of projects that can be done in a given year at current funding and staffing levels.

If the City desires to have an accelerated pace for repairs, the funding, staff, or both would need to be increased. In this way, the safety and priority issues can be eliminated more quickly, and the City can move to a more planned and deliberate mode of administering funds in the desired proactive manner.

TABLE 4.1 Components of Capital Improvement Program

Item	Cost In CIP	Cost Funded By Storm Water Fee	Comment
1. City Engineering Staff	–	–	Operating Budget
2. MS4 Consultant	no	100%	Operating Budget
3. Engineering/Surveying Consultants	no	100%	Operating Budget
4. Street Sweeping	no	–	Street Sweeping Contract
5. Future Street Sweeper	yes	100%	Equipment Purchase CIP Does not include staffing and maintenance costs → several years until purchase
6. Vacuum Truck and Staffing	no	–	Vacuum truck operated by Public Works – additional staff may be required
7. GIS Staff			N/A
8. System Maintenance/Repairs Based on Day-to-Day Operations and Citizen Complaints	yes	100%	$600,000 used in previous budgets, including projects which would classify as CIP
9. System Maintenance/Repairs Safety and Priority List Based on Algorithm	yes	100%	
10. System Maintenance/Repairs Safety and Priority List Based on Algorithm – LINING	yes	100%	Lining is option to full pipe replacement
11. Pipe and Culvert Replacement Due to Capacity Issue	yes	100%	
12. System Repairs based on previous studies recommendations	yes	100%	Projects to be evaluated based on future inspections
13. System Repairs due to reported failures (Example: Sandalwood Crosshill Trail and King Arthur.)	no	N/A	Some projects are funded through other resources
14. MS4 Permit Requirements	yes	yes	Environmental reporting and public outreach
15. Future TV Inspection Program	yes	100%	Prescreen infrastructure for maintenance/repair determinations [evaluating low grade infrastructure prior to digging]
16. Storm Water Repair and Maintenance Crew In-house	yes	–	To be evaluated over time

The elements noted in Table 4.1, components of the Capital Improvement Program are funded through the collection of the user fees. At the current fee of $5.00/month, a total of $2,479,529 is collected each year to fund the program.

4.2 Annual Income from the Storm Water Utility Fee

Table 4.2 provides a summary of the user fees collected.

TABLE 4.2 Annual Income from Storm Water Utility User Fee

Property Type	Property Acreage	Income from User Fee	Percentage of Total Income
Tax Exempt/Commercial	1,812	$ 670,797	27.0%
Commercial	2,433	$ 1,183,467	47.8%
Industrial	245	$ 164,714	6.6%
Residential	3,098	$ 460,546	18.6%
TOTAL	7,588	$ 2,479,524	100.0%

Note: Residential customers account for 18.6% of the income while 81.4% comes from government/commercial/industrial customers.

4.3 Budget for Pipe and Structure Repairs

The current allocation for use of the funds for pipe and structure repairs is $1,850,000 per year. It is recommended that 80% of this amount (±$1,440,000) be utilized to repair pipes and 20% of this amount (±360,000) be used to repair structures each year. Based on this 80%/20% distribution of costs, the number of projects and repairs that can be performed on an annual basis can be determined.

Table 4.3 provides a summary of this number of projects that can be performed over the next five years. A breakdown of the projects (pipes and structures) is provided in Appendix E of the System Assessment.

TABLE 4.3 Projects Over 5 Years CIP

CIP Year	No. of Pipes	No. of Structures	Total Cost
1	23	82	$1,785,783.98
2	21	55	$1,552,970.96
3	13	105	$1,755,594.32
4	19	98	$1,798,387.18
5	20	97	$1,798,836.86
5 Year Total	96	437	$8,691,573.30

It should be noted that these cost estimates are made with 2023-dollar values, no escalation was factored into the calculations.

4.4 Replacement of Impaired Culverts

It is recommended that the 5-year CIP include a systematic plan for repair of larger culverts where needed. Table 4.4 provides the number of projects, the projected cost and the locations for these improvements.

TABLE 4.4 Replacement of Impaired Culverts

Year	No. of Structure Projects	Projected Cost	Comment
2024	1	$ 195,870.00	Bedford Bay Trail
2025	2	$ 241,147.00	Huff Street, 292 Summit Ridge
2026	3	$ 188,441.00	187 Willow Road, 52 Gwinnett Drive, Daniel Lane
2027	2	$ 286,434.00	Juniper and Channel, Ind. Park and Harris
2028	2	$ 834,400.00	Springlake Road, 371 Northdale Road
TOTAL	10	$ 1,746,292.00	

Note: The 5-year CIP includes ten (10) projects noted as priority for repairs of impaired culverts, designated in Appendix C. The total estimated cost is ±$1,746,292.00. The remaining sixteen (16) projects are recommended to be studied and included in the next CIP beginning in 2029.

4.5 Future Television Inspection Program

A future television inspection program is included in the components of the Capital Improvement Program.

The cost and annual budget estimated for this component is provided in Table 4.5.

TABLE 4.5 Television Inspection CCTV Program

Year	Pipe Length	Project Cost	Comment
2024	22,500	$ 49,500.00	*
2025	69,375	$ 152,625.00	**
2026	69,375	$ 152,625.00	**
2027	69,375	$ 152,625.00	**
2028	69,375	$ 152,625.00	**
TOTAL	300,000	$ 660,000.00	

Notes: 1. Based on estimated length of pipes within the City of 300,000 LF.
2. Cost per foot for TV inspection is $2.20/LF.

*Initial Year 1 television inspection program would include the areas within the City which have had the most issues reported.

**Beginning in 2025, the length of pipes that are inspected is based on distributing the television inspection program over ±4 years.

Notes: 1. Television inspection of storm water facilities may be incorporated into annual inspections by MS4 consultant.
2. The project cost does not include staff or engineering fees to review and interpret the videos.

4.6 Summary of CIP Costs by Year

Table 4.6 presents a summary of anticipated costs for the 5-year CIP. (Note: this table may have items added to it.)

TABLE 4.6 Summary of CIP Costs by Year

Item	2024	2025	2026	2027	2028	TOTAL
Pipe and Structure Repairs	$1,785,784	$1,552,971	$1,775,594	$1,798,387	$1,798,836	$8,711,572
Impaired Culverts	$195,870	$241,147	$188,441	$286,400	$834,400	$1,746,258
Television Inspection Program	$49,500	$152,625	$152,625	$152,625	$152,625	$660,000
SUBTOTAL	$2,031,154	$1,946,743	$2,116,660	$2,237,412	$2,785,861	$11,117,830

For Discussion with City Engineering Department

The following tables summarize the effort to improve the system from existing conditions to repairing pipes and structures that are below a grade of 50 and a grade of 75.

Replacement of entire system would cost ±$300,000,000 based on the costing formula.

PIPES

Graded	No.	Length	% of System	Estimated Cost
Below Grade 50	248	21,688	7%*	$16.5M
Below Grade 75	682	52,705	19.1%	$43.1M

*Based on system length of 275,500 LF

STRUCTURES

Graded	No.	% of System	Estimated Cost
Below Grade 50	95	2%*	±$445,000
Below Grade 75	311	7.6%	±$1.1M

*Based on 4,093 Structures

STORMWATER MASTER PLAN & CAPITAL IMPROVEMENT PROGRAM

CITY OF LAWRENCEVILLE
GWINNETT COUNTY, GEORGIA

APPENDICES

HUSSEY GAY BELL
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Hussey Gay Bell Project No. 22-0006-C
OCTOBER 2023

APPENDICES

A P P E N D I X A

APPENDIX A

TABLE A-1: Summary of Studies and Reports

Report Type	Basin	Project No.	Date
Flood and Potential Hazards Report	Shoal Creek and	07-0197-C	05/30/2008
Hydrological Analysis	Shoal Creek and	07-0197-C	05/30/2008
Hydrological Analysis	Pew Creek and	07-0197-C	08/28/2008
Flood Elevation Study	Pew Creek and	07-0197-C	09/29/2008
Flood and Potential Hazards Report	Pew Creek and	07-0197-C	09/29/2008
Creek Assessment	Pew Creek and	07-0197-C	09/29/2008
Hydrological Analysis	Redland Creek and	07-0197-C	11/11/2008
Creek Assessment	Redland Creek and	07-0197-C	11/11/2008
Flood Elevation Study	Redland Creek and	07-0197-C	11/11/2008
Hydrological Analysis	Yellow River and	07-0197-C	01/10/2009
Creek Assessment	Yellow River and	07-0197-C	01/10/2009
Flood Elevation Study	Yellow River and	07-0197-C	01/27/2009
Hydrological Analysis and Creek	Hwy 316 Creek	07-0197-C	03/17/2009
Basin Study	Pew Creek and	17-0028-C	08/02/2018
Basin Study	Shoal Creek and	17-0028-C	08/24/2018
Basin Study	Redland Creek and	17-0028-C	10/05/2018
MS4 Annual System Review*	All Basins	N/A	Ongoing

*MS4 consultant, Integrated Science and Engineering, reviews storm drainage system composed of structures and pipes within the city limits on an ongoing basis. Each pipe and structure is reviewed every five (5) years.

Note: The above documents are available at the City of Lawrenceville Engineering Office.

A P P E N D I X B

APPENDIX B

Potential Impacts of 100-Year Flooding

Map B-1: 100-Year Flood Limit

Map B-2: Roads Potentially Impacted by 100-Year Flood

Table B-1: Roads Potentially Impacted in a 100-Year Storm Event

Aerial Photos of Road Crossings and 100-Year Flood Limit

INTRODUCTION

The Federal Emergency Management Agency (FEMA) has established the limits of areas that are subject to flooding. FEMA publishes these limits for drainage basins of ±640 acres and larger in size. Recognizing the need to understand the impacts of storm events on smaller drainage areas, the City of Lawrenceville commissioned Hayes, James & Associates, Inc. to prepare studies of the three (3) primary drainage basins up to 100 acres in size in 2007. The location of the 100-year flood plain limits is shown on the Map B-1 on the following pages.

The method used for computing the 100-year flow rates, used in the 2007 study, was the SCS Method. This method is conservative in that it generates flows that tend to be high when compared to actual stream gauge data, Regression Equation, or other calculation methods. In addition, the flows were generated assuming that there is no storm water detention within the basin as per city guidelines. This is consistent with current flood plain management guidance that has been recommended since the major storm events in 2008 that resulted in significant damage in the area.

A review of the Flood Hazard Limits study for the streams and drainage basins larger than 100 acres showed that 34 road crossings in the city may be impacted by a 100-year storm event with the roadway being overtopped. This does not mean that it is going to occur but that it has a probability of occurring. It is also an indicator that the culverts at these locations may be more stressed during rainfall events. They may require more maintenance or require replacement due to the impact of erosive forces. Table B-1 provides a description of the storm drainage system at each road crossing location that may be potentially impacted in a 100-year storm event.

Map B-1 provides the 100-year flood limits for the three primary drainage basins located within the City of Lawrenceville. The location of the road crossings that may be impacted are shown on Map B-2.

In addition to the road crossings, 38 houses, eight commercial buildings, two apartment buildings and one school building may be within the 100-year flood limits. Detailed information such as updated topography and obtaining finished floor elevations are required in order to more accurately determine whether or not these structures fall within the flood limits and could possibly be impacted. Further detailed study may show that these buildings may actually only border the flood plain.

Table B-1: Roads Potentially Impacted in a 100-Year Storm Event

No. Refers to the location found on the 100-Year Flood Limit Map

No.	Street Name	Comment
1 **A**	Blazing Ridge W	96" CMP with moderate corrosion. Backwater does not appear to place houses within the flood plain.
2	Carithers Rd.	Shows on Gwinnett flood map. Drainage area less than 100 acres.
3 **A**	Channel Dr.	(2) 60" RCP. Upstream houses do not appear to be within the 100-year boundary.
4 **I**	Clearsprings Dr.	(2) 54" CMPs with moderate-severe corrosion. Eleven upstream houses are within the 100-year flood boundary.
5 **I**	Daniel Lane at Johnson Rd. and Mill Ridge	(3) 48" CMP with moderate to severe corrosion. One house may be within the 100-year flood plain due to backwater.
6	Dogwood Dr.	There are multiple private driveway culverts that may be contributing to backwater in road. No houses appear to fall within the 100-year flood limit.
7	Forest Valley Rd.	Flooding appears to be a result of culvert under Scenic Hwy. – study by Gwinnett County. Maple Wood Dr. also overtops. Four houses appear to be within the 100-year backwater from Scenic Hwy.
8 **I A**	Grayland Hills Dr.	72" CMP with moderate to severe corrosion, backwater appears to place four houses in the 100-year flood plain.
9	Grizzly Pkwy. near Spring Cir. and Northdale Rd.	Grizzly Pkwy. was constructed after the flood study was completed. Update study. Northdale Rd. overtops – Gwinnett Study.
10 **I A**	Gwinnett Dr. – near Nash	The 36" CMP (moderate to severe condition) under Gwinnett Drive and connecting downstream pipes through school property are undersized. Flows overtopping the Gwinnett Dr. travel through the school's parking lot. One building falls within the 100-year flood zone. Significant base flow through system.
11 **A**	Gwinnett Dr. near Stone Mountain St.	Culverts under Gwinnett Dr. appear undersized. Fairly recently culvert replacement/relining occurred in this area. 3-4 commercial buildings appear to be within the flood plain limit.
12	Harris Dr.	The downstream ditch is full of water year-round and does not drain. Two houses, downstream of crossing, appear to be in the 100-year flood limit and backwater from Industrial Park Dr.

* Gwinnett County maintained roadway
** Georgia D.O.T. maintained roadway
I – Culvert in poor condition
A – Potential limited access to area if flooding occurs

13	Herbert Hayes Dr.	The road floods due to backwater from Shoal Creek not the 24" culvert under Herbert Hayes Dr. No flooding of houses occurs on the south side of the Herbert Hayes Dr.
14	Hillcrest Green Dr.	54" RCP – No upstream buildings are within the upstream 100-year flood boundary.
* 15 **A**	Hurricane Shoals – 316	Upstream buildings appear to be outside of the flood limits.
* 16	Hurricane Shoals – Old Norcross	One upstream commercial building appears to be within the 100-year flood plain.
17 **I A**	Juniper Ct.	The 66" CMP under Juniper has significant sediment buildup and corrosion. Additionally, the downstream channel is full of water and sediment and does not drain. The downstream private piped system is inadequate for a 100-year storm. Four houses appear to be within the 100-year flood limit. This location require further detailed study to determine the best solution. Immediate clearing of downstream channel is recommended.
*18 **I**	Lakeview Road (City Park)	No buildings within the 100-year flood limit. Maintenance for culvert is in question. GIS shows city-maintained road within Rhodes Jordan Park.
*19	Langley Dr.	Backwater from culvert under Langley and/or contributing upstream pipe systems results in one or two upstream office buildings within the flood plain. Portions of the upstream area may have been developed after flood study was completed.
20	Maplewood Dr. (3 crossings)	48" HDPE north of Brandy Creek Rd. intersection appears to be undersized resulting in two houses being within the flood boundary. The 48" CMP crossing near Saddle Trail appears undersized; however, no houses appear to be within the flood limit as a result. See Forest Valley Rd. for the third crossing.
21	Paper Mill Rd. – near Paper Mill Dr.	Two 36"h x 54"w Elliptical RCPs appear undersized. No upstream houses adversely affected.
22 **I A**	Pike Park Dr.	Two 72" CMP in poor condition. One commercial building is near the flood boundary.
23 **A**	Private drive at Mulberry Place Apartments	No buildings appear to be affected by the undersized culvert.
24	Nash St. (Update required)	Nash St. is shown in the flood plain; however, the flood study was done prior to Nash St. extension to Gwinnett Dr. Refer to Gwinnett Dr. – near Nash St. for description.

* Gwinnett County maintained roadway
** Georgia D.O.T. maintained roadway
I – Culvert in poor condition
A – Limited Access

25 **A**	Private drive to Oaks at New Hope	84" RCP is in good condition. Appears to overtop in 100-year storm. No buildings appear to be within the flood limit.
* 26 **A**	New Hope Rd. near Hickory View Dr.	No houses appear to be within the flood limits on the upstream side due to the under sized culvert.
* 27 **A**	New Hope Rd. near Herbert Hayes	No buildings appear to be within the 100-year flood boundary upstream of New Hope.
28 **A**	Sandalwood Cir.	Private drive. Pipes were evaluated in a prior report. Maintenance of upstream channel (private property) is highly recommended. See Juniper Ct. (located upstream)
29 **A	Scenic Highway near New Hope Rd.	Multiple apartment buildings (Conclave at Southlawn) are shown within the 100-year flood plain. Flood study was completed prior to the development. Update to 100-year flood limit is required.
** 30 **A**	Scenic Hwy near Scenic Park Ct.	100-year floodplain showing no buildings upstream of Scenic Hwy within the 100-year flood limit.
31 **A**	Scenic Park Ct.	Three 48" RCP. Two houses may be within the 100-year backwater.
32 **A**	Scenic Park Trail near Scenic Park Ct.	6'hx12'w box culvert. Two houses may be within the 100-year backwater.
33 **A**	Scenic Park Trail near cul-de-sac	Two 66" RCP. One house may be within the 100-year backwater.
34 **I A**	Springlake Rd. near Saddle Shoals Dr.	Four CMP culverts under road. One culvert is completely blocked and nonfunctional. One or two houses may be affected by the backwater.
* 35	Stone Mountain St. near Gwinnett Dr.	Backwater from culverts under Stone Mtn. St. and pipes under Gwinnett Drive result in ~four businesses and two apartment buildings falling within the 100-year flood plain.
**36	Sugarloaf Pkwy. near Scenic Hwy.	100-year backwater does not appear to encroach on upstream buildings.
37 **A**	Winer Ind. Way	84" CMP moderate corrosion – commercial building within the 100-year flood plain.

* Gwinnett County maintained roadway
** Georgia D.O.T. maintained roadway
I – Culvert in poor condition
A – Limited Access

Note: Based on a review, since 2007, locations 2, 9, 24, 29 and 31 through 33 have been developed or have been improved.

SUMMARY & RECOMMENDATIONS

In order to develop priority for maintenance and repairs for drainage systems where roadways could potentially be flooded and the roadways overtopped in the Capital Improvement Plan, the following criteria is recommended:

1. Is the location subject to potential flooding based on the 2007 Flood Study?

2. Is the drainage structure listed in the 2018 Drainage Basin Study and noted as needing repairs? Noted as "I" on Table B-1 and Maps B-1 and B-2.
3. Is the location of the roadway and drainage crossing where failure would result in limiting access to residents or resulting in a public safety concern (one way in and one way out)? Noted as "A" on Table B-1 and Maps B-1 and B-2.

Based on these criteria, the following locations should be reviewed and addressed in the initial CIP.

8 – Grayland Hills Drive

10 – Gwinnett Drive near Nash Street *

17 – Juniper Court

34 – Spring Lake Road near Saddle Shoals Drive **

* TV inspection recommended

** Gwinnett GIS shows Spring Lake Rd as city-maintained. To be verified.

Aerial Photographs of Road Crossings and 100-year Flood Plain Limits

1-Blazing Ridge, 5-Daniel Lane and 8-Grayland Hills Dr.

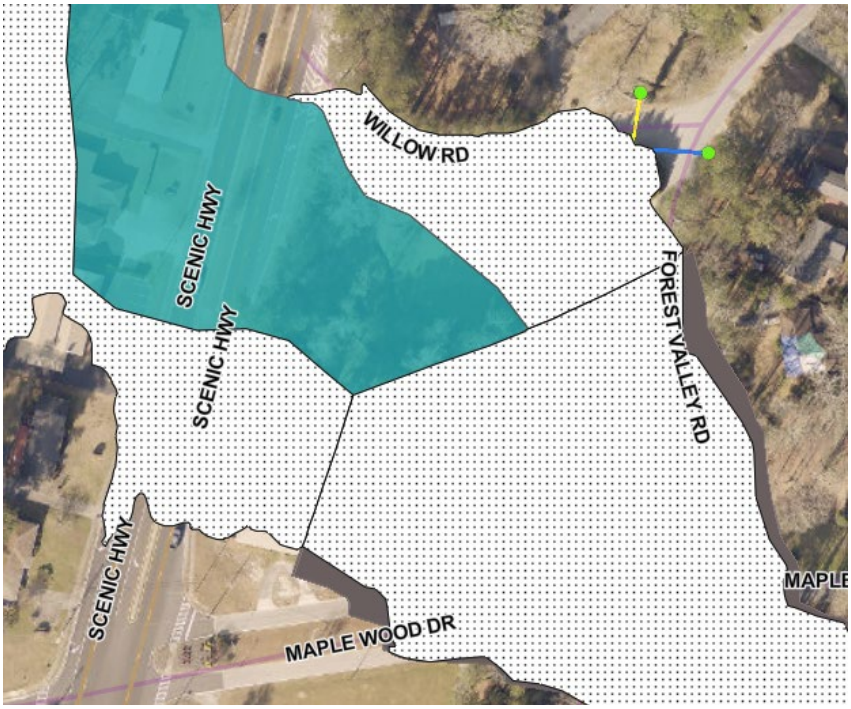
2-Carithers Rd.

3-Channel Dr. and 33-Scenic Park Trail

4-Clearsprings Dr.

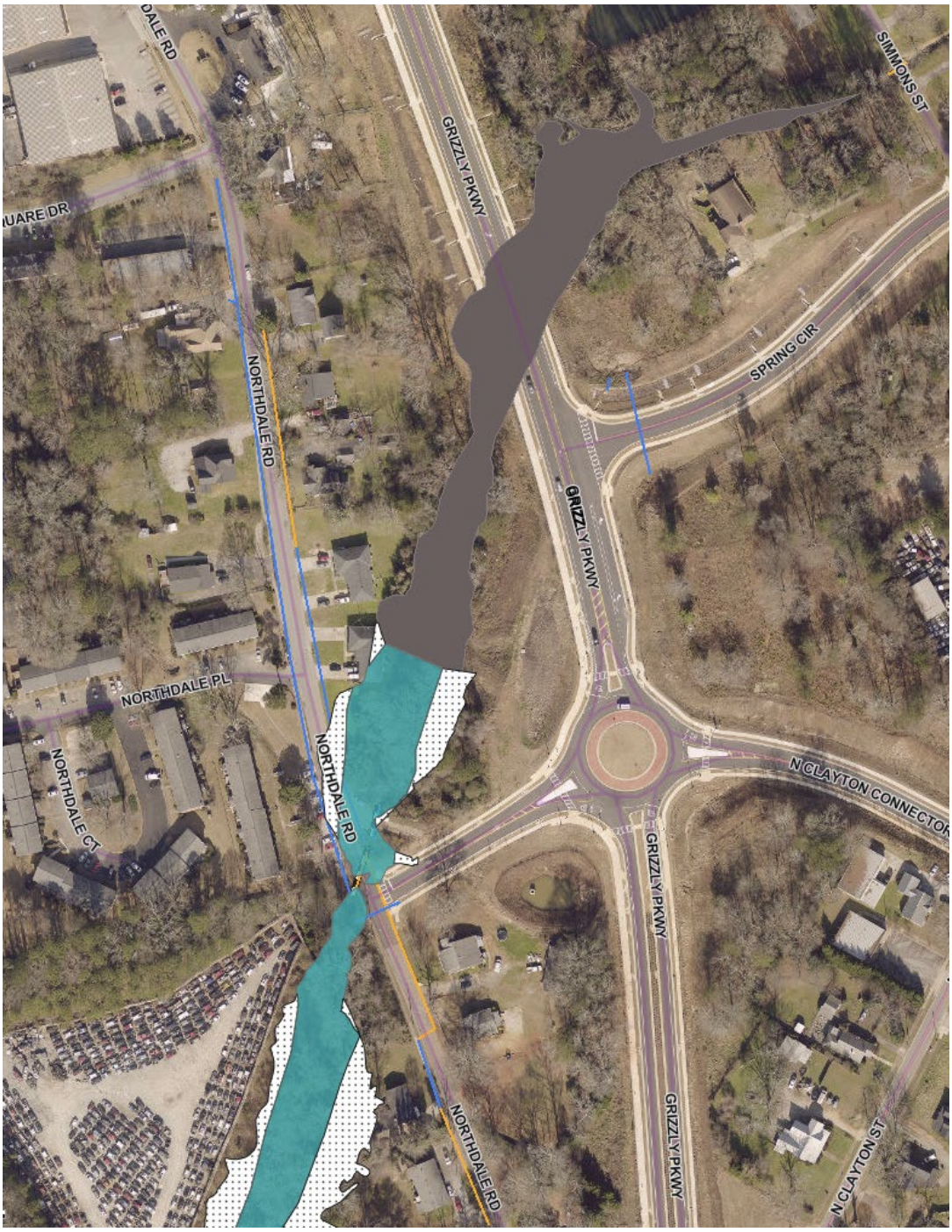
5-Daniel Lane - See Photo No. 1

6-Dogwood Dr.

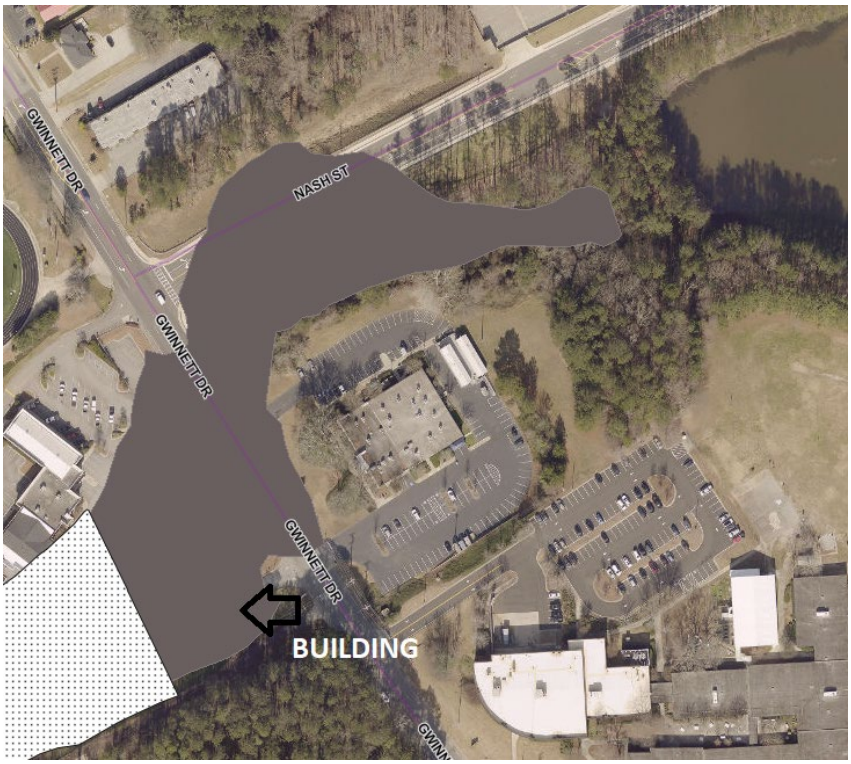


7-Forest Valley Dr.

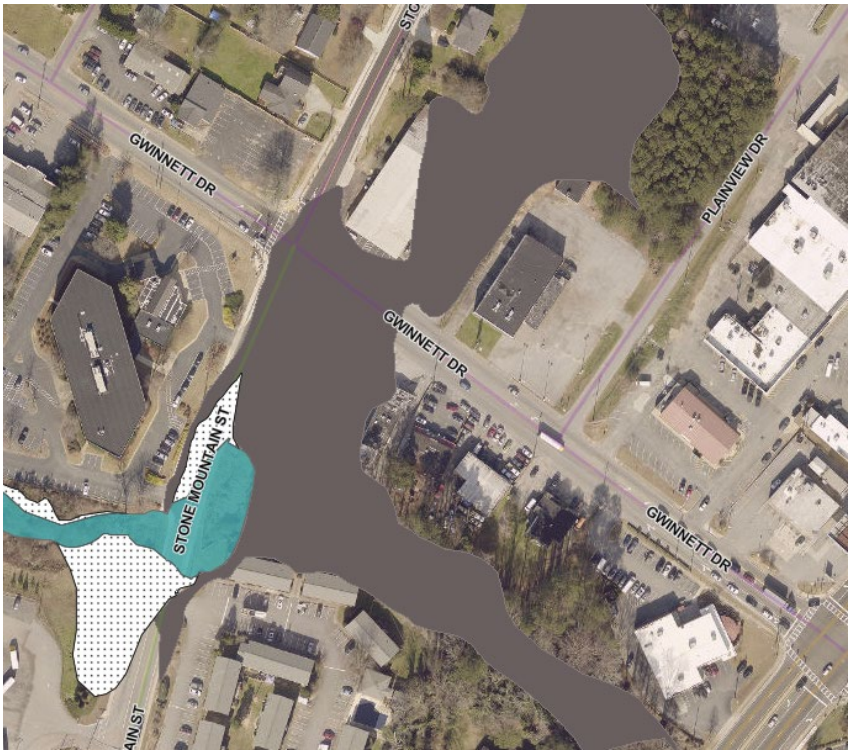
8-Grayland Hills Dr. - see Photo No. 1



9-Grizzly Parkway and Northdale Rd.



10-Gwinnett Dr. near Nash St.



11-Gwinnett Dr. near Stone Mountain St.

12-Harris Dr.

13-Herbert Hayes Dr.

14-Hillcrest Green Dr.

15-Hurricane Shoals Rd. near Hwy. 316

16-Hurricane Shoals Rd. near Old Norcross Rd.

17-Juniper Ct. and 28-Sandalwood Cir.

18-Lakeview Rd.

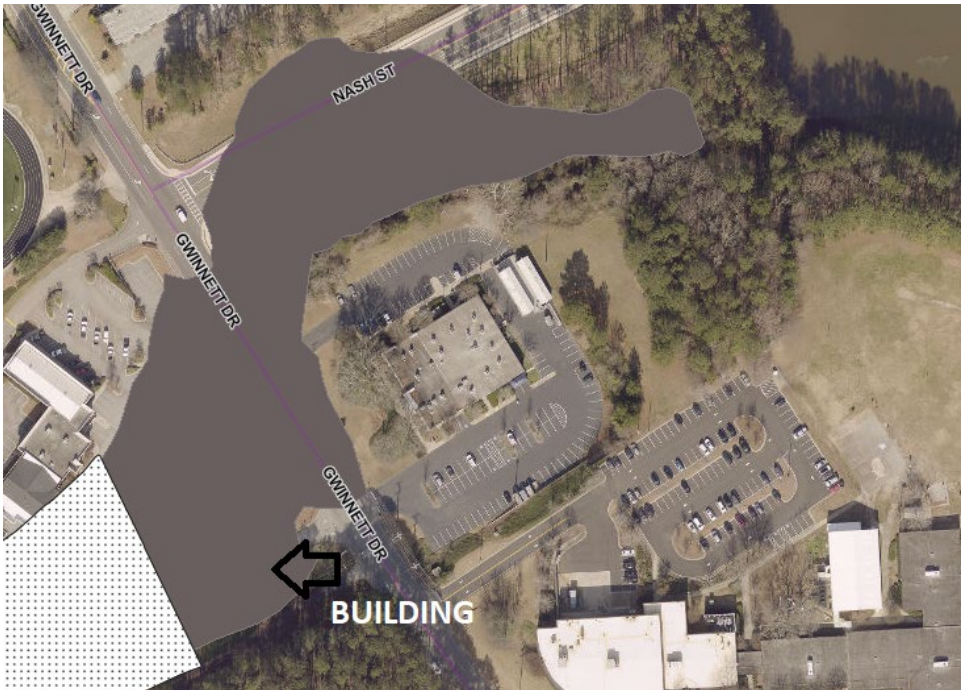
19-Langley Dr.

20-Maplewood Dr. – three (3) crossings

21-Paper Mill Rd. near Paper Mill Dr.

22-Pike Park Dr.

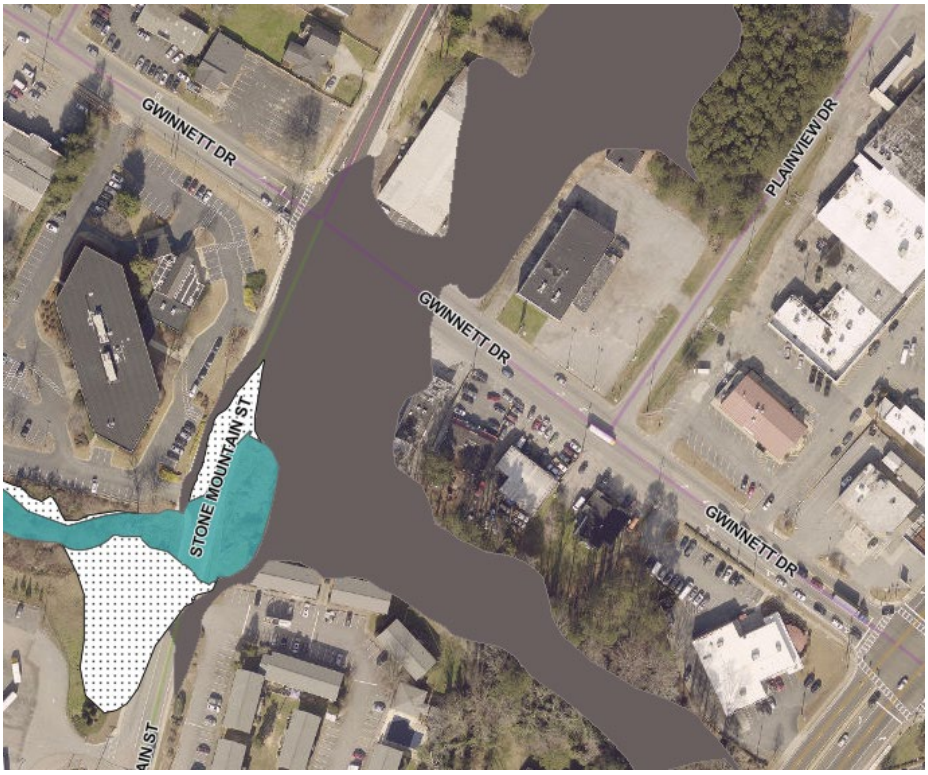
23-Private Drive at Mulberry Place Apartments



24-Nash St.

26-New Hope Rd. near Hickory Mill Dr.

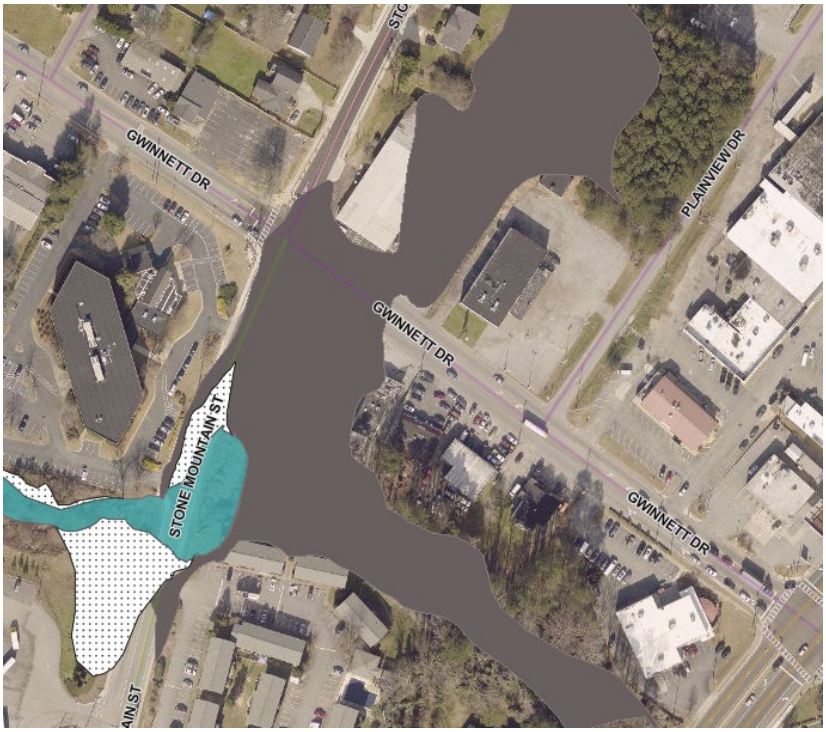
27-New Hope Rd. near Herbert Hayes Dr. and
25-Private drive to the Oaks at New Hope Rd.



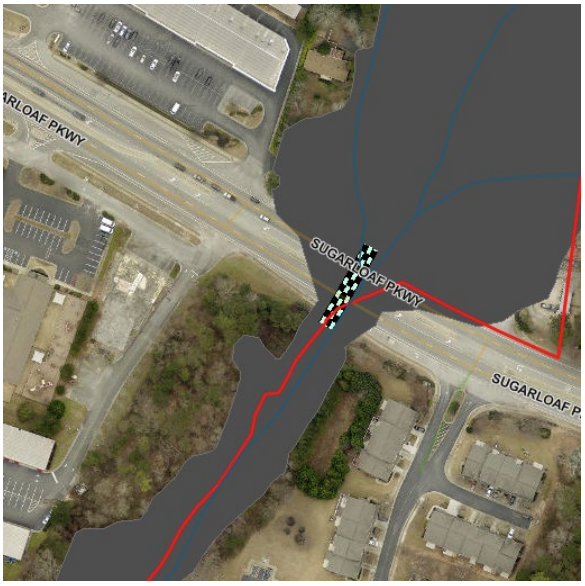
29-Scenic Highway near New Hope Rd. and Jackson St.

30-33 Scenic Hwy., Scenic Park Ct., Scenic Park Trail

34-Springlake Rd.



35-Stone Mountain St. near Gwinnett Dr.



36-Sugarloaf Parkway near Gwinnett Dr.

37- Winer Industrial Way

A P P E N D I X C

APPENDIX C

Evaluation of Major Culverts and Piped Systems

Table of Contents

EVALUATION OF MAJOR CULVERTS AND PIPED SYSTEMS

Summary

The piped systems within Lawrenceville that convey large drainage areas have been documented in three reports entitled “Drainage Basin Study for Pew Creek and Tributaries within Lawrenceville City Limits,” dated August 2, 2018, “Drainage Basin Study for Redland Creek and Tributaries within Lawrenceville City Limits,” dated August 24, 2018, and “Drainage Basin Study for Shoal Creek and Tributaries within Lawrenceville City Limits,” dated October 5, 2018. These reports were prepared by Hayes, James & Associates, Inc. on behalf of the City of Lawrenceville. Within these comprehensive reports contained a summary of the results for each basin. These reports reviewed conditions of culverts with a drainage area of approximately 50 acres or more.

There were thirty-six (36) locations within the three (3) drainage basins that were designated as moderate, severe, priority or safety hazard. These locations are shown on the following map, Map C-1*“Impaired Culvert Location Map.”*

Due to the time interval between the 2018 Drainage Basin Studies and today, the thirty-six locations were visited in the field in June 2023 by Hussey Gay Bell staff. This was to document the current condition at these locations. This field review confirmed the storm drainage facilities had been improved or repaired at ten (10) of the locations with twenty-six (26) of the locations remaining to be addressed. The locations are shown on Map C-1, “*Impaired Culvert Location Map*.”

Tables C-1, C-2 and C-3 provide a summary of the storm drainage facilities along with the description of conditions for the remaining 26 locations.

The storm water facilities were studied further to select 10 locations (±40%) to be considered for inclusion in the initial 5-year Capital Improvement Plan.

The storm water facilities chosen were based on the following criteria:

1. Overall pipe condition.
2. Potential for flooding adjoined buildings or roads in the event of pipe failure.
3. Whether the drainage system is public or is privately owned and maintained.

A preliminary construction cost estimate was prepared for the repair of the storm water facilities at these locations. The estimated cost of these improvements is $2,058,136. The remaining storm water facilities should be reviewed at the end of the five-year period to establish a priority for repairs at these locations.

Summary CIP Selected Large Projects

1. Bedford Bay Trail #8 thru #14 Pew 4 – Grade: Inspect.
   Master Id: 1415, 259, 2640, 193
   Installed August 1986. Pipe sizes vary. The pipe system does not have positive drainage away from the headwall and the system is flooded into the R/W. There is a high probability of significant corrosion throughout the system. Upstream structures, within kudzu field, are safety hazards.

2. Huff St. to Creek #50 and #51 Red 4 – Grade: N/A. Master ID: N/A
   48"CMP installed June 1982. The city does not have this pipe in its GIS; however, GIS shows Huff St. as city-maintained. Pipe may pass under the paved area of the gas station. The pipe is in very poor condition: CMP bottom is rusted through, pipe cave-ins exist, and sink holes are forming.

3. 292 Summit Ridge Dr #6 and #7 Pew 6 – Grade: 19. Master ID: 2592
   54" CMP installed in September 1973. Severe corrosion and ruptures.

4. 187 Willow Road #5 Pew 7 – Grade: 33. Master ID: 282
   48" CMP installed in June 1982. Severe corrosion in the bottom of the pipe at the upstream end reported in 2018. Downstream pipes were previously replaced with HDPE.

5. 52 Gwinnett Dr #3 Pew 10 – Grade: 74. Master ID: 325
   36" CMP installed under Gwinnett Dr. June 1982. High base flow. The upstream end is corroded through. Pipe undersized.

6. Daniel Lane #30 thru #32 Pew 2 – Grade: 48. Master ID: 177, 178, 179
   Three 48" CMP installed August 1986. Severe corrosion on upstream ends, but appears solid after 10'. An alternative entrance to subdivision is available. Undersized for the 100-year flood.

7. Juniper Ct. and D.S. channel #76 and #77 Shoal 9 – Grade: 64. Master ID: 1224
   66" CMP installed in 1975. Significant sedimentation in pipe. The downstream channel silted and blocked. Clearing of downstream channel is critical to adjacent property owners.

8. Industrial Park & Harris #60 and #61 Shoal 2 – Grade: Inspect. Master ID:722 & 1237
   60" CMP under Industrial Park installed 1968. Water backing up from the downstream area is causing the culvert to remain submerged. Additionally, the concrete box culvert under Harris Dr. is constantly submerged due to the lack of positive drainage. This concrete box is likely in good condition.

9. Four Culverts under Springlake Rd #79 thru #82 Shoal 15 –
   Grade: 33, 62, 62 and nonfunctioning. Master ID: 1565, 589, 590, 591.
   Installed in May 1981. Essentially there are only three 48" CMP carrying flows under Springlake Rd. For some reason the downstream end of one of the four is completely blocked. The remaining three culverts are undersized. The pipes are moderately corroded, but the bottoms appear firm. The drainage area is in excess of 100 acres.

10. 371 Northdale #55 Red 1- Grade: 52. Master ID: 1584

72”w x 42”h CMP arch installed October 1993. Damage to downstream side of culvert. Moderate corrosion. Flowing stream. Backwater appears to place an upstream house in the 100-year flood plain.

#’s - refer to callouts on the Impaired Culvert Location Map
Shoal #, Pew # and Redland # - refer to the basin and map number in the previous studies.
Score - refers to the scores calculated in the System Assessment Section

CIP Large Project Cost Estimate Summary

CIP Ranking #	Location	Cost	Alternate
1	Bedford Bay Trail	$195,869.80	
2	Huff St.	$151,876.90	
3	292 Summit Ridge	$89,271.00	
4	187 Willow Road	$59,668.00	
5	52 Gwinnett Dr.	$65,706.20	$367,638.60
6	Daniel Lane	$63,067.40	
7	Juniper and Channel	$51,562.14	
8	Ind. Park and Harris	$234,782.80	
9	Springlake Rd.	$588,000.00 *	
10	371 Northdale	$246,400.00	
Total		**1,756,204.20**	**2,058,136.60**

Notes:

1. *Estimates are based on preliminary sizing and assumptions. Actual engineering design and plans are required for accurate estimates.*
2. *The remaining 16 locations are recommended to be reviewed for repair in Phase II of the Capital Improvement Plan.*

** Confirmation needed to determine maintenance responsibility for Springlake Road.*

CIP Ranking 1

Road name: Bedford Bay Trail Road Classification: Local

Basin: Pew Creek (Pew-4)

Map #8 – #14 Score-Inspect. Installed August 1986. Because of the lack of positive drainage away from the headwall, the system is flooded past the upstream right-of-way. Significant pipe damage and corrosion was observed at the downstream headwall and there is a high probability of corrosion throughout the system. Drainage structures within the kudzu field between Bedford Bay and Stone Mtn. St. are safety hazards.

Condition of existing system: Poor

CIP design flood: 25-year Limited by downstream system and cover in road

Drainage Area: 28 acres Tc = 21 min

Rational Method: C=.51 Q25 = 69 cfs, Q100 = 86 cfs

Existing system: 530 lf of 30" & 36" CMP and 5 structures:

Preliminary calculations show a 42" HDPE is required to carry 100-year flow. The downstream system is 36" HDPE and upstream, the system ties to a 5'x5' box culvert under Stone Mtn. St. It's unknown if cover is available under Bedford Bay for a 42" pipe.

Design: Since the downstream system was recently replaced as 36" diameter HDPE assume 36" HDPE or equal. Excavate the downstream channel 3'W x 2' D for approximately 150' to drain.

Estimated Costs

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	5	$10,000	50,000
36" HDPE	LF	530	$63	33,390
Asphalt	SY	872	$40	34,907
Ditch Stabilization	LF	150	$20	3,000
(3'wx2'd) channel 2:1 SS	CY	80	$10	800
Rip Rap	LS	1	$1,000	1,000
Clearing	LS	1	$2,000	2,000
Grassing	SFT	17,424	$0.85	14,810
Subtotal				**$139,907**
Design, survey and contingency	%	40		55,962.80
TOTAL				**$195,869.80**

CIP Ranking 2

Road name: Huff Street Road Classification: Local (May be Private)

Basin: Redland Creek (Red-4)

Map #50 and #51 Score (Not in GIS) - Installed June 1982. This system does not appear in the City's GIS, but Huff St. shows as city-maintained. The 48" CMP may pass under gas station paved area. The pipe is in very poor condition: CMP bottom rusted through, pipe cave ins and sink holes forming.

Condition of existing system: Poor

CIP design flood: 10-Year Limited by cover

Drainage Area: 52 acres Tc = 16 min

SCS: CN: 74Residential Q25 = 210 cfs,Q100 = 292 cfs

Rational Equation: C: .60 Q25 = 176 cfs, Q100 = 218 cfs

USE AVERAGE Q25 = 193 cfs Q100 = 255 cfs

Existing system: 243 lf of 48" CMP and 3 structures:

Design: Since the immediate upstream system is 48", bump up 1 pipe size use 54" RCP or equal. Minimum cover and utility conflicts are concerns.

Estimated Costs

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	3	$10,000	30,000
54" RCP	LF	243	$94.5	22,963.5
Asphalt	SY	450	$40	17,880
Concrete and Demolition	SY	458	$80	36,640
Rip Rap	LS	1	$1,000	1,000
Subtotal				**$108,483.50**
Design, survey and contingency	%	40		43,393.40
TOTAL				**$151,876.90**

CIP Ranking 3

Road name: 292 Summit Ridge Road Classification: Local

Basin: Pew Creek

Map #6 and #7 Score 19 Installed in September 1973. Severe corrosion and ruptures.

Condition of existing culvert: Poor

CIP design flood: 5-year Limited by cover and downstream culvert size.

Drainage Area: 84 acres Tc = 24 min

SCS: CN: 71 Residential Q25 = 243 cfs, Q100 = 346 cfs

Rational Method: c = .6 Q25 = 227 cfs, Q100 = 281 cfs

Existing system: 61 lf of 54" CMP and 3 structures (the downstream headwall is finished with decorative stone and tied into retaining wall). Downstream crossing under Maple Wood Dr. is a 48" HDPE.

Design: Replace existing 54" CMP with 54" RCP.

Estimated Costs

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	3	$10,000	30,000
54" RCP	LF	61	$94.5	5,765
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Rip Rap & Concrete apron	LS	1	$5,000	5,000
Additional for downstream headwall	LS	1	$5,000	5,000
Subtotal				**$63,765**
Design, survey and contingency	%	40		$25,506
TOTAL				**$89,271**

CIP Ranking 4

Road name: 187 Willow Road Road Classification: Local

Basin: Pew Creek (Pew-7)

Map #5 Score 33. Installed under the road June 1982. Severe corrosion in bottom of pipe at upstream side in 2018. Downstream pipes were previously replaced.

Condition of existing culvert: Poor

CIP design flood: 2-Year - Limited by the existing downstream piped system and cover.

Drainage Area: 61 acres Tc = 22 min

Rational: C=.6 Q25 = 173 cfs, Q100 = 215 cfs

Existing system: 55 lf of 48" CMP and 2 structures. The downstream system is ~220 LF of relatively new 48" HDPE.

Rough calculations show two 54" RCPs minimum are needed to carry 25-year flow; however, there is not enough cover to accommodate the increase in pipe diameter. In addition, the downstream system is currently piped via a 48" HDPE.

Design: Unless there is evidence or history of the road flooding, it is recommended that the existing pipe under the road be replaced with 48" RCP.

Estimated Costs

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	2	$10,000	20,000
48" RCP	LF	55	$84	4,620
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Subtotal				**$42,620**
Design, survey and contingency	%	40		$17,048
TOTAL				**$59,668**

CIP Ranking 5

Road name: 53 Gwinnett Dr. Road Classification: Collector

Basin: Pew Creek (Pew-10)

Map #3 Score 74 Installed under Gwinnett Dr. June 1982. High base flow. The upstream end is corroded through. The 36" CMP is undersized assuming un-detained conditions.

Condition of existing system: Poor-Fair

CIP design flood: 10 Year two 48" Pipes - Limited by existing downstream system and cover

Drainage Area: 149 acres Tc = 32 min

SCS: CN: 80 Office Q25 = 489 cfs, Q100 = 656 cfs

Existing system: 78 lf of 36" CMP and 2 structures. The downstream system is 42" HDPE - 48" HDPE under school property. Two 54"CMP across service road and Two 60" RCP under Nottingham.

Available head ~ 6'

Design: Since the downstream piped system is 42"- 48" further study on the history of flooding and the functionality of the upstream pond is required. For purposes of pricing, assume:

Alt No. 1: Replace 36" CMP with 48" RCP under the Gwinnett Drive.

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	2	$10,000	20,000
48" RCP	LF	78	$84	6,552
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Sidewalk	SY	40	$80	3,200
Subtotal				**$46,933.00**
Design, survey and contingency	%	40		$18,773.20
TOTAL				**$65,706.20**

Alt No. 2: Alternate No. 1 and an additional 48" HDPE paralleling the existing storm system through the downstream property.

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	6	$10,000	60,000
48" HDPE	LF	882	$84	74,088
Asphalt	SY	2088	$40	83,551
Demolition	SY	2088	$20	41,760
Sidewalk	SY	40	$80	3,200
Subtotal				**$262,599.00**
Design, survey and contingency	%	40		$105,039.60
TOTAL				**$367,638.60**

CIP Ranking 6

Road name: Daniel Lane Road Classification: Local

Basin: Pew Creek (Pew-2)

Map #30 – #32 Score 48 Three 48" CMPs installed August 1986. Severe corrosion on upstream ends, but appears solid after 10'. An alternate entrance to subdivision exists.

Condition of existing system: Fair

CIP design flood: 50-Year Limited by cover

Drainage Area: 116 acres Tc = 23 min

SCS: CN = 73 Q25 = 374 cfs, Q100 = 523 cfs

Existing system: 72 lf of three 48" CMP and 2 structures:

Design: Recommend replacement with three 48" RCP. Verify elevation of upstream house relative to the 100-year flood plain.

Estimated Costs

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	2	$10,000	20,000
48" RCP	LF	72	$84	6,048
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Rip Rap	LS	1	$1,000	1,000
Subtotal				**$45,048.00**
Design, survey and contingency	%	40		$18,019.20
TOTAL				**$63,067.40**

CIP Ranking 7

Road name: Juniper Ct & D.S. channel Road Classification: Local

Basin: Shoal Creek (Shoal-9)

Map #76 and #77 Score 64 66" CMP installed in 1975. Significant sedimentation in pipe. The downstream channel silted and blocked. Clearing of downstream channel critical to adjacent property owners.

Condition of existing culvert: Fair-Poor

CIP design flood: 10-Year Limited by cover

Drainage Area: 100 acres Tc = 25 min

SCS: CN: 80 Mixed Q25 = 381 cfs, Q100 = 510 cfs

Existing system: 100 lf of 66" CMP and two structures: Ditch 2' deep x 2' wide

Design: Recommend replacement with 66" RCP. Excavate and enlarge downstream channel. Investigation into history of flooding. Purchase of houses within the floodplain.

2-year storm = 185 cfs, channel 7'wide x 3' deep. V2 = 4 fps, d = 2.92'.

Conclusion: There does not appear to be a logical way to remove the houses in the area from the 100-year flood plain. Further more detailed study is required to determine the best solution at this location.

Estimated Costs

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	2	$10,000	20,000
66" RCP	LF	100	$173.25	17,325
Asphalt	SY	444	$40	17,760
Demolition	SY	444	$20	8,880
Rip Rap	LS	1	$1,000	1,000
(7'wx3'd) channel 2:1 SS	CY	222	$10	2,222
Ditch Stabilization	LF	250	$20	5,000
Subtotal				**$72,187**
Design, survey and contingency	%	40		$28,874.80
TOTAL				**$51,562.14**

CIP Ranking 8

Road name: Industrial Park Dr. & Harris Dr. D.S channel Road Classification: Local

Basin: Shoal Creek (Shoal-2)

Map #60 and #61 Score: Inspect 60" CMP under Industrial Park installed 1968. Water backing up from downstream channel is causing the culvert to remain submerged. The concrete box culvert under Harris is probably in good condition; however, downstream conditions are causing water to back up through the box.

Condition of existing system: Fair

CIP design flood: 25-Year

Drainage Area: 118 acres Tc = 26 min

SCS: CN: 84 Industrial Q25 = 477 cfs, Q100 = 625 cfs

Existing system: 77 lf of 60" CMP and two structures. (Pipe appears to connect to an OCS.)

Design: Recommend replacement with 72" RCP. Improve the channel from the railroad upstream to Harris Dr. to create positive drainage. Multiple property owners could be affected.

Alt No. 1 - Excavate channel from Railroad to Harris Dr. and replace culvert under Industrial Park

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structure	EA	1	$10,000	10,000
Replace OCS	EA	1	$30,000	30,000
72" RCP	LF	77	$126	9,702
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Rip Rap	LS	1	$1,000	1,000
*(7'wx3'dx800'l) channel 3:1 SS	CY	1,200	$30	36,000
Ditch Stabilization	LF	1,200	$20	24,000
Cr-Construction Rd 15'w x 800'l	SFT	12,000	$3	36,000
Clearing	AC	1.5	$2,000	3,000
Subtotal				**$167,702.00**
Design, survey and contingency	%	40		$67,080.80
TOTAL				**$234,782.80**

* Excavation: The water table of the downstream area is very high. Wetland permits may be required.

CIP Ranking 9

Road name: Springlake Road Road Classification: Collector

Basin: Shoal Creek (Shoal-15)

Map #79 – #82 Score 33, 62, 62 and nonfunctioning Four (4) CMPs installed in May 1981. Essentially there are only three (3) 48" CMP carrying flows under Springlake Rd. For some reason the downstream end of one of the four is completely blocked. The remaining three (3) culverts are undersized. The drainage area is in excess of 640 acres. The pipes are moderately corroded, but the bottoms appear firm.

Condition of existing system: Fair & undersized

CIP design flood: 25-Year Limited by cover

Drainage Area: 648 acres Tc = 54 min

SCS: CN: 72 Residential Q25 = 1,158 cfs, Q100 = 1,640 cfs

Existing system: Three 48" CMP at 60LF and 2 structures

Design: Estimate replacement with two 10'w x 6' h concrete box culverts (Bury 1'). Additional study of the upstream drainage basin, including upstream detention and storage and downstream channel stability required.

Estimated Cost

Item	Unit	No. of Units	Cost/Unit	Cost
Drainage Structures	EA	2	$50,000	100,000
8'w x 6'h concrete box culvert	LF	120	$2500	300,000
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Rip Rap	LS	2	$1,000	2,000
Subtotal				**$420,000**
Design, survey and contingency	%	40		$168,000
TOTAL				**$588,000**

CIP Ranking 10

Road name: 371 Northdale Road Road Classification: Collector

Basin: Redland Creek (Red-1)

Map No.55 Score 52 Installed October 1993. Damage to downstream side of culvert. Moderate corrosion. Flowing stream. Backwater from culvert appears to place upstream house in flood plain.

Condition of existing system: Fair

CIP design flood: 10-year Limited by cover

Drainage Area: 131 acres Tc = 35 min

SCS: CN: 75 Q25 = 348 cfs,Q100 = 482 cfs

Existing system: 40"h x 75" w @ 66LF and 2 structures

Design: Recommend replacement with two 8' span x 3'4" rise Multi-Plate/ALSP. Topographic survey and further analysis required.

Estimated Cost

Item	Unit	No. of Units	Cost/Unit	Cost
Headwalls	EA	2	$30,000	60,000
Dual 8'w x 3'4" multiplate arch	LF	60	$1,600	96,000
Asphalt	SY	300	$40	12,000
Demolition	SY	300	$20	6,000
Rip Rap	LS	2	$1,000	2,000
Subtotal				**$176,000**
Design, survey and contingency	%	40		$70,400
TOTAL				**$246,400**

An alternative to replacing the culvert may be to dead-end Northdale on either side and remove the existing culvert. This would allow the creek to flow unimpeded. Further study of traffic patterns, emergency access and community input would be required.

A P P E N D I X D

APPENDIX D – Stormwater Detention Facilities

The areas of the primary drainage basins within the City of Lawrenceville have been reviewed in order to inventory the location of the existing detention ponds within the city. The inventory included the location, ownership and the contributing drainage basin to clarify who benefits from the storm water detention facility.

Report D-1 – Shoal Creek Basin
Report D-2 – Redland Creek Basin
Report D-3 – Pew Creek Basin

Note: The above-referenced reports are available at the City of Lawrenceville's Engineering Office.

A P P E N D I X E

APPENDIX E

System Assessment

Appendix E contains the following:

Note: Tables E1, E2, E3 and E4 are available at the City of Lawrenceville Engineering Office. They are also available electronically.

IDENTIFICATION		PIPE CHARACTERISTICS		PIPE CONDITION		PROJECT MATERIAL COSTS				
Master ID	PIPE TYPE	PIPE MATERIAL	PIPE HEIGHT	SHAPE.STLength()	Grade	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	DIFFERENCE B/W BUDGET & EXPENSES	CIP YEAR	
1658	Circular Pipe	Plain CMP	30	88.7	10	$69,855.95	$69,855.95		Year	0
1722	Circular Pipe	Plain CMP	60	78.5	17	$107,431.20	$177,287.15			1
2592	Circular Pipe	Coated CMP	48	37.2	19	$53,151.37	$230,438.52			1
114	Circular Pipe	Coated CMP	48	35.4	19	$51,582.16	$282,020.68			1
122	Circular Pipe	Coated CMP	48	550.4	19	$512,538.82	$794,559.49			1
1229	Circular Pipe	Coated CMP	48	49.3	19	$63,946.20	$858,505.70			1
1299	Circular Pipe	Coated CMP	48	85.0	19	$95,941.22	$954,446.92			1
1617	Circular Pipe	Coated CMP	48	20.0	19	$37,752.77	$992,199.68			1
1733	Circular Pipe	Coated CMP	48	9.5	19	$28,361.28	$1,020,560.97			1
2684	Circular Pipe	Plain CMP	36	26.5	21	$37,720.44	$1,058,281.41			1
10	Circular Pipe	Coated CMP	36	41.3	21	$47,696.44	$1,105,977.85			1
62	Circular Pipe	Coated CMP	42	24.8	21	$39,337.04	$1,145,314.89			1
93	Circular Pipe	Coated CMP	36	25.4	21	$36,986.84	$1,182,301.73			1
115	Circular Pipe	Plain CMP	36	177.8	21	$139,753.71	$1,322,055.43			1
342	Circular Pipe	Coated CMP	36	53.3	21	$55,777.32	**$1,377,832.75**	**$62,167.25**	Year	**1**
372	Circular Pipe	Plain CMP	36	226.2	21	$172,398.00	$172,398.00			2
375	Circular Pipe	Coated CMP	36	68.5	21	$66,059.70	$238,457.71			2
644	Circular Pipe	Coated CMP	36	63.5	21	$62,692.06	$301,149.77			2
880	Circular Pipe	Plain CMP	42	27.1	21	$41,104.48	$342,254.25			2
1311	Circular Pipe	Coated CMP	36	30.2	21	$40,192.02	$382,446.27			2
1413	Circular Pipe	Plain CMP	42	110.0	21	$106,152.98	$488,599.25			2
1463	Circular Pipe	Coated CMP	36	37.1	21	$44,872.92	$533,472.17			2
1472	Circular Pipe	Plain CMP	36	123.0	21	$102,775.43	$636,247.60			2
1534	Circular Pipe	Plain CMP	36	130.7	21	$108,005.76	$744,253.36			2
1701	Circular Pipe	Coated CMP	36	5.8	21	$23,785.22	$768,038.58			2
1818	Circular Pipe	Coated CMP	36	30.9	21	$40,695.02	$808,733.60			2
1878	Circular Pipe	Plain CMP	36	58.2	21	$59,098.00	$867,831.60			2
2302	Circular Pipe	Plain CMP	36	30.7	21	$40,585.68	$908,417.28			2
2682	Circular Pipe	Plain CMP	24	194.4	24	$108,051.40	$1,016,468.67			2
2	Circular Pipe	Plain CMP	30	25.9	24	$34,477.24	$1,050,945.91			2
22	Circular Pipe	Plain CMP	15	35.3	24	$30,027.11	$1,080,973.02			2
33	Circular Pipe	Plain CMP	18	19.6	24	$26,585.00	$1,107,558.02			2
52	Circular Pipe	Plain CMP	24	63.7	24	$48,735.35	$1,156,293.37			2
53	Circular Pipe	Plain CMP	24	81.0	24	$56,590.53	$1,212,883.89			2
71	Circular Pipe	Plain CMP	24	30.0	24	$33,456.98	$1,246,340.88			2
97	Circular Pipe	Plain CMP	24	58.7	24	$46,455.11	$1,292,795.98			2
112	Circular Pipe	Plain CMP	18	35.8	24	$32,146.35	$1,324,942.33			2
124	Circular Pipe	Plain CMP	30	110.0	24	$81,888.83	**$1,406,831.16**	**$33,168.84**	Year	**2**
142	Circular Pipe	Plain CMP	24	126.3	24	$77,158.60	$77,158.60			3
213	Circular Pipe	Plain CMP	24	106.1	24	$67,980.05	$145,138.65			3
266	Circular Pipe	Plain CMP	18	119.8	24	$60,958.90	$206,097.55			3
271	Circular Pipe	Plain CMP	18	109.2	24	$57,337.01	$263,434.56			3
283	Circular Pipe	Coated CMP	24	50.5	24	$42,764.03	$306,198.60			3
351	Circular Pipe	Coated CMP	18	49.7	24	$36,890.79	$343,089.39			3
380	Circular Pipe	Plain CMP	30	47.3	24	$46,514.17	$389,603.55			3
548	Circular Pipe	Plain CMP	15	83.2	24	$43,796.14	$433,399.69			3
562	Circular Pipe	Plain CMP	18	9.4	24	$23,067.13	$456,466.82			3
585	Circular Pipe	Coated CMP	18	56.5	24	$39,250.40	$495,717.21			3
623	Circular Pipe	Coated CMP	30	25.3	24	$34,122.11	$529,839.32			3
626	Circular Pipe	Coated CMP	18	79.7	24	$47,216.00	$577,055.32			3
628	Circular Pipe	Coated CMP	18	34.0	24	$31,519.50	$608,574.83			3
629	Circular Pipe	Coated CMP	18	40.3	24	$33,687.02	$642,261.84			3
635	Circular Pipe	Coated CMP	30	20.9	24	$31,614.69	$673,876.53			3
639	Circular Pipe	Coated CMP	24	106.3	24	$68,058.07	$741,934.60			3
641	Circular Pipe	Coated CMP	30	127.3	24	$91,620.18	$833,554.77			3
652	Circular Pipe	Coated CMP	30	83.1	24	$66,726.51	$900,281.29			3
655	Circular Pipe	Plain CMP	24	105.4	24	$67,672.91	$967,954.20			3
661	Circular Pipe	Coated CMP	30	31.5	24	$37,633.32	$1,005,587.52			3
724	Circular Pipe	Plain CMP	18	107.5	24	$56,757.21	$1,062,344.73			3
739	Circular Pipe	Plain CMP	24	58.8	24	$46,501.39	$1,108,846.12			3
770	Circular Pipe	Plain CMP	24	126.1	24	$77,038.06	$1,185,884.17			3
772	Circular Pipe	Coated CMP	18	27.6	24	$29,317.91	$1,215,202.09			3
882	Circular Pipe	Plain CMP	18	29.9	24	$30,122.63	$1,245,324.72			3
903	Circular Pipe	Coated CMP	30	51.6	24	$48,976.09	$1,294,300.81			3
924	Circular Pipe	Coated CMP	18	101.6	24	$54,730.12	**$1,349,030.93**	**$90,969.07**	Year	**3**
955	Circular Pipe	Reninforced Concrete Pipe	54	107.5	24	$127,925.26	$127,925.26			4

IDENTIFICATION		PIPE CHARACTERISTICS		PIPE CONDITION		PROJECT MATERIAL COSTS				
Master ID	PIPE TYPE	PIPE MATERIAL	PIPE HEIGHT	SHAPE.STLength()	Grade	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	DIFFERENCE B/W BUDGET & EXPENSES	CIP YEAR	
1029	Circular Pipe	Plain CMP	18	118.5	24	$60,528.53	$188,453.79			4
1068	Circular Pipe	Plain CMP	18	134.9	24	$66,153.46	$254,607.26			4
1094	Circular Pipe	Plain CMP	18	30.0	24	$30,146.79	$284,754.04			4
1099	Circular Pipe	Plain CMP	24	52.8	24	$43,806.53	$328,560.58			4
1101	Circular Pipe	Coated CMP	18	115.7	24	$59,570.53	$388,131.11			4
1102	Circular Pipe	Coated CMP	18	31.7	24	$30,723.76	$418,854.87			4
1152	Circular Pipe	Coated CMP	18	62.9	24	$41,423.51	$460,278.38			4
1167	Circular Pipe	Plain CMP	30	125.0	24	$90,348.91	$550,627.29			4
1228	Circular Pipe	Coated CMP	30	122.5	24	$88,951.08	$639,578.36			4
1260	Circular Pipe	Coated CMP	24	18.8	24	$28,363.87	$667,942.24			4
1263	Circular Pipe	Plain CMP	24	80.0	24	$56,128.82	$724,071.05			4
1345	Circular Pipe	Plain CMP	18	165.8	24	$76,740.87	$800,811.92			4
1347	Circular Pipe	Plain CMP	24	33.4	24	$34,977.66	$835,789.58			4
1443	Circular Pipe	Coated CMP	24	34.9	24	$35,679.36	$871,468.94			4
1462	Circular Pipe	Coated CMP	18	95.4	24	$52,585.30	$924,054.24			4
1465	Circular Pipe	Plain CMP	18	113.9	24	$58,933.20	$982,987.44			4
1510	Circular Pipe	Plain CMP	30	34.5	24	$39,302.65	$1,022,290.09			4
1522	Circular Pipe	Coated CMP	30	32.5	24	$38,193.40	$1,060,483.48			4
1532	Circular Pipe	Coated CMP	30	142.1	24	$99,983.44	$1,160,466.93			4
1569	Circular Pipe	Plain CMP	12	22.9	24	$25,183.17	$1,185,650.10			4
1572	Circular Pipe	Plain CMP	24	138.4	24	$82,646.30	$1,268,296.40			4
1575	Circular Pipe	Coated CMP	18	32.4	24	$30,977.25	$1,299,273.65			4
1604	Circular Pipe	Plain CMP	18	59.8	24	$40,370.78	$1,339,644.42			4
1618	Circular Pipe	Plain CMP	18	119.4	24	$60,843.67	**$1,400,488.10**	**$39,511.90**	Year	4
1621	Circular Pipe	Plain CMP	24	115.5	24	$72,237.35	$72,237.35			5
1645	Circular Pipe	Plain CMP	24	125.8	24	$76,925.92	$149,163.27			5
1656	Circular Pipe	Plain CMP	24	23.7	24	$30,584.84	$179,748.11			5
1657	Circular Pipe	Plain CMP	30	84.6	24	$67,559.22	$247,307.33			5
1677	Circular Pipe	Coated CMP	24	48.6	24	$41,887.38	$289,194.71			5
1707	Circular Pipe	Plain CMP	24	51.0	24	$42,978.05	$332,172.75			5
1729	Circular Pipe	Plain CMP	15	100.0	24	$48,648.88	$380,821.63			5
1735	Circular Pipe	Plain CMP	30	105.4	24	$79,318.36	$460,139.99			5
1788	Circular Pipe	Coated CMP	30	13.9	24	$27,681.89	$487,821.88			5
1792	Circular Pipe		18	19.2	24	$26,442.72	$514,264.60			5
1794	Circular Pipe	Plain CMP	18	30.5	24	$30,331.69	$544,596.29			5
1799	Circular Pipe	Plain CMP	24	37.5	24	$36,840.20	$581,436.49			5
1887	Circular Pipe	Coated CMP	18	39.0	24	$33,238.59	$614,675.08			5
1888	Circular Pipe	Coated CMP	18	29.5	24	$29,978.03	$644,653.11			5
1903	Circular Pipe	Plain CMP	18	23.5	24	$27,925.05	$672,578.16			5
1911	Circular Pipe	Coated CMP	18	23.9	24	$28,042.31	$700,620.47			5
1983	Circular Pipe	Plain CMP	18	20.1	24	$26,733.88	$727,354.35			5
1988	Circular Pipe	Plain CMP	18	25.8	24	$28,712.56	$756,066.91			5
2225	Circular Pipe	Plain CMP	18	83.9	24	$48,656.93	$804,723.83			5
2226	Circular Pipe	Plain CMP	18	31.5	24	$30,643.52	$835,367.35			5
2238	Circular Pipe	Plain CMP	24	47.6	24	$41,448.46	$876,815.81			5
2242	Circular Pipe	Plain CMP	18	99.7	24	$54,050.53	$930,866.33			5
3520	Circular Pipe	Plain CMP	18	31.3	24	$30,584.34	$961,450.67			5
3521	Circular Pipe	Plain CMP	18	50.6	24	$37,221.03	$998,671.70			5
350	Circular Pipe	Reninforced Concrete Pipe	18	80.5	29	$47,479.19	$1,046,150.89			5
670	Circular Pipe	Reninforced Concrete Pipe	15	29.3	29	$28,295.12	$1,074,446.01			5
1254	Circular Pipe	Reninforced Concrete Pipe	18	27.6	29	$29,309.74	$1,103,755.75			5
2382	Circular Pipe	RCP	18	57.1	29	$39,444.29	$1,143,200.03			5
1758	Circular Pipe	Plain CMP	60	25.6	31	$48,385.37	$1,191,585.41			5
272	Circular Pipe	Plain CMP	48	96.5	33	$106,259.60	$1,297,845.01			5
282	Circular Pipe	Coated CMP	48	53.8	33	$68,052.68	**$1,365,897.69**	**$74,102.31**	Year	5
1115	Circular Pipe	Plain CMP	48	308.2	33	$295,785.56	$295,785.56			6
1565	Circular Pipe	Coated CMP	48	46.4	33	$61,409.44	$357,195.00			6
1	Circular Pipe	Coated CMP	36	45.5	36	$50,566.11	$407,761.11			6
7	Circular Pipe	Coated CMP	36	33.4	36	$42,406.16	$450,167.26			6
18	Circular Pipe	Plain CMP	42	119.0	36	$113,224.51	$563,391.77			6
25	Circular Pipe	Plain CMP	36	90.0	36	$80,549.67	$643,941.43			6
46	Circular Pipe	Coated CMP	36	31.1	36	$40,795.85	$684,737.29			6
51	Circular Pipe	Plain CMP	36	263.0	36	$197,237.44	$881,974.73			6
377	Circular Pipe	Plain CMP	42	94.1	36	$93,687.43	$975,662.16			6
662	Circular Pipe	Coated CMP	36	120.5	36	$101,102.14	$1,076,764.30			6
733	Circular Pipe	Plain CMP	36	25.5	36	$37,076.69	$1,113,840.99			6
734	Circular Pipe	Plain CMP	42	276.7	36	$237,004.58	**$1,350,845.56**	**$89,154.44**	Year	6
960	Circular Pipe	Coated CMP	36	105.7	36	$91,117.32	$91,117.32			7
1199	Circular Pipe	Coated CMP	42	35.3	36	$47,574.86	$138,692.18			7

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
1583	Junction Box	0	$1,800.00	$1,800.00		1
2050	End of Pipe	0	$12,000.00	$13,800.00		1
3919	Drop Inlet: In Street	0	$12,000.00	$25,800.00		1
2236	Curb Inlet: Pre-Cast Open Throat	7	$12,000.00	$37,800.00		1
3536	Curb Inlet: Pre-Cast Open Throat	7	$12,000.00	$49,800.00		1
648	Junction Box	13	$12,000.00	$61,800.00		1
3894	Junction Box	14	$12,000.00	$73,800.00		1
1066	End of Pipe	15	$12,000.00	$85,800.00		1
1707	Curb Inlet: Pre-Cast Open Throat	15	$12,000.00	$97,800.00		1
3594	Curb Inlet: Pre-Cast Open Throat	15	$12,000.00	$109,800.00		1
3909	Junction Box	15	$12,000.00	$121,800.00		1
90	Drop Inlet: In Grassed Area (Not Road Shoulder)	15	$12,000.00	$133,800.00		1
618	Drop Inlet: In Grassed Area (Not Road Shoulder)	15	$12,000.00	$145,800.00		1
2296	Curb Inlet: Pre-Cast Open Throat	15	$12,000.00	$157,800.00		1
2297	Curb Inlet: Pre-Cast Open Throat	15	$12,000.00	$169,800.00		1
2404	Curb Inlet: Pre-Cast Open Throat	15	$12,000.00	$181,800.00		1
871	Yard Inlet	17	$12,000.00	$193,800.00		1
352	Drop Inlet: In Grassed Area (Not Road Shoulder)	21	$0.00	$193,800.00		1
358	End of Pipe	21	$0.00	$193,800.00		1
365	Yard Inlet	21	$0.00	$193,800.00		1
485	End of Pipe	21	$0.00	$193,800.00		1
524	Headwall	21	$0.00	$193,800.00		1
587	Headwall	21	$0.00	$193,800.00		1
733	End of Pipe	21	$0.00	$193,800.00		1
889	End of Pipe	21	$0.00	$193,800.00		1
959	Yard Inlet	21	$0.00	$193,800.00		1
1331	End of Pipe	21	$0.00	$193,800.00		1
1417	End of Pipe	21	$0.00	$193,800.00		1
1509	End of Pipe	21	$0.00	$193,800.00		1
1529	Headwall	21	$0.00	$193,800.00		1
1703	End of Pipe	21	$0.00	$193,800.00		1
1763	End of Pipe	21	$3,600.00	$197,400.00		1
1774	End of Pipe	21	$0.00	$197,400.00		1
1834	Headwall	21	$3,600.00	$201,000.00		1
1846	Headwall	21	$0.00	$201,000.00		1
2082	End of Pipe	21	$0.00	$201,000.00		1
2092	Headwall	21	$0.00	$201,000.00		1
2169	Junction Box	21	$0.00	$201,000.00		1
2191	End of Pipe	21	$3,600.00	$204,600.00		1
2204	End of Pipe	21	$0.00	$204,600.00		1
3366	Drop Inlet: In Grassed Area (Not Road Shoulder)	21	$0.00	$204,600.00		1
3551	Curb Inlet: Pre-Cast Open Throat	21	$3,600.00	$208,200.00		1
3568	Junction Box	21	$12,000.00	$220,200.00		1
3632	Drop Inlet: In Grassed Area (Not Road Shoulder)	21	$0.00	$220,200.00		1
3705	Pipe Direction	21	$0.00	$220,200.00		1
4031	Curb Inlet: Metal Open Throat	21	$3,600.00	$223,800.00		1
4043	Pipe Direction	21	$0.00	$223,800.00		1
4050	Curb Inlet: Hooded Grate	21	$3,600.00	$227,400.00		1
1946	Drop Inlet: In Grassed Area (Not Road Shoulder)	21	$0.00	$227,400.00		1
2625	Headwall	21	$6,000.00	$233,400.00		1
3005	Headwall	21	$3,600.00	$237,000.00		1
3006	Outlet Structure	21	$3,600.00	$240,600.00		1
3374	Other	25	$0.00	$240,600.00		1
2323	Curb Inlet: Pre-Cast Open Throat	25	$0.00	$240,600.00		1
4655	End of Pipe	29	$0.00	$240,600.00		1
94	Headwall	29	$0.00	$240,600.00		1
324	End of Pipe	29	$0.00	$240,600.00		1
325	End of Pipe	29	$0.00	$240,600.00		1
430	End of Pipe	29	$0.00	$240,600.00		1
842	Curb Inlet: Pre-Cast Open Throat	29	$0.00	$240,600.00		1
1015	Headwall	29	$0.00	$240,600.00		1
1130	End of Pipe	29	$0.00	$240,600.00		1
1131	End of Pipe	29	$0.00	$240,600.00		1
1854	End of Pipe	29	$0.00	$240,600.00		1
2105	End of Pipe	29	$0.00	$240,600.00		1
2945	Curb Inlet: Pre-Cast Open Throat	29	$0.00	$240,600.00		1
3481	End of Pipe	29	$0.00	$240,600.00		1
2648	Headwall	29	$6,000.00	$246,600.00		1
2753	Headwall	29	$3,600.00	$250,200.00		1

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
2344	Curb Inlet: Pre-Cast Open Throat	29	$0.00	$250,200.00		1
901	Headwall	33	$6,000.00	$256,200.00		1
1101	Curb Inlet: Pre-Cast Open Throat	34	$12,000.00	$268,200.00		1
3897	Flared End Section	35	$3,600.00	$271,800.00		1
2618	Junction Box	35	$12,000.00	$283,800.00		1
55	Curb Inlet: Pre-Cast Open Throat	36	$12,000.00	$295,800.00		1
921	Yard Inlet	36	$12,000.00	$307,800.00		1
2759	Yard Inlet	39	$3,600.00	$311,400.00		1
4313	Curb Inlet: Pre-Cast Open Throat	42	$12,000.00	$323,400.00		1
291	Headwall	42	$6,000.00	$329,400.00		1
1859	Yard Inlet	42	$12,000.00	$341,400.00		1
328	Curb Inlet: Pre-Cast Open Throat	43	$12,000.00	$353,400.00		1
6	Curb Inlet: Pre-Cast Open Throat	49	$3,600.00	$357,000.00	End of Year	1
8	Curb Inlet: Pre-Cast Open Throat	49	$12,000.00	$12,000.00		2
79	Headwall	49	$6,000.00	$18,000.00		2
277	Curb Inlet: Pre-Cast Open Throat	49	$3,600.00	$21,600.00		2
810	Outlet Structure	49	$12,000.00	$33,600.00		2
858	Yard Inlet	49	$3,600.00	$37,200.00		2
1039	Outlet Structure	49	$12,000.00	$49,200.00		2
1702	Outlet Structure	49	$12,000.00	$61,200.00		2
1734	Junction Box	49	$1,800.00	$63,000.00		2
2081	Headwall	49	$6,000.00	$69,000.00		2
2138	Curb Inlet: Pre-Cast Open Throat	49	$3,600.00	$72,600.00		2
2199	Headwall	49	$6,000.00	$78,600.00		2
3835	Headwall	49	$6,000.00	$84,600.00		2
2807	End of Pipe	49	$3,600.00	$88,200.00		2
4197	Headwall	50	$6,000.00	$94,200.00		2
293	End of Pipe	50	$12,000.00	$106,200.00		2
1586	Headwall	50	$6,000.00	$112,200.00		2
1795	Headwall	50	$6,000.00	$118,200.00		2
1837	End of Pipe	50	$12,000.00	$130,200.00		2
1864	Curb Inlet: Pre-Cast Open Throat	50	$12,000.00	$142,200.00		2
2060	Curb Inlet: Pre-Cast Open Throat	50	$1,800.00	$144,000.00		2
2890	Drop Inlet: In Grassed Area (Not Road Shoulder)	50	$1,800.00	$145,800.00		2
4390	Junction Box	53	$3,600.00	$149,400.00		2
4274	Headwall	54	$6,000.00	$155,400.00		2
347	Flared End Section	54	$12,000.00	$167,400.00		2
915	Headwall	54	$6,000.00	$173,400.00		2
1155	End of Pipe	54	$12,000.00	$185,400.00		2
2210	End of Pipe	54	$12,000.00	$197,400.00		2
317	Headwall	55	$12,000.00	$209,400.00		2
624	Headwall	55	$6,000.00	$215,400.00		2
1046	Curb Inlet: Pre-Cast Open Throat	55	$12,000.00	$227,400.00		2
2173	Curb Inlet: Pre-Cast Open Throat	55	$3,600.00	$231,000.00		2
3685	Drop Inlet: In Street	55	$3,600.00	$234,600.00		2
316	Curb Inlet: Pre-Cast Open Throat	57	$3,600.00	$238,200.00		2
578	Headwall	57	$6,000.00	$244,200.00		2
885	Curb Inlet: Pre-Cast Open Throat	57	$12,000.00	$256,200.00		2
903	Curb Inlet: Pre-Cast Open Throat	57	$12,000.00	$268,200.00		2
1457	Curb Inlet: Pre-Cast Open Throat	57	$1,800.00	$270,000.00		2
1786	Yard Inlet	57	$1,800.00	$271,800.00		2
1938	Curb Inlet: Pre-Cast Open Throat	57	$12,000.00	$283,800.00		2
2244	Curb Inlet: Pre-Cast Open Throat	57	$1,800.00	$285,600.00		2
3785	Yard Inlet	57	$1,800.00	$287,400.00		2
1423	Drop Inlet: In Grassed Area (Not Road Shoulder)	57	$1,800.00	$289,200.00		2
1580	Drop Inlet: In Street	57	$1,800.00	$291,000.00		2
1632	Drop Inlet: In Grassed Area (Not Road Shoulder)	57	$1,800.00	$292,800.00		2
1510	Curb Inlet: Pre-Cast Open Throat	57	$12,000.00	$304,800.00		2
2375	Junction Box	57	$12,000.00	$316,800.00		2
2379	Curb Inlet: Pre-Cast Open Throat	57	$3,600.00	$320,400.00		2
2724	Junction Box	57	$1,800.00	$322,200.00		2
2792	Curb Inlet: Pre-Cast Open Throat	57	$12,000.00	$334,200.00		2
4211	Junction Box	58	$1,800.00	$336,000.00		2
1530	Curb Inlet: Pre-Cast Open Throat	58	$3,600.00	$339,600.00		2
95	Headwall	60	$6,000.00	$345,600.00		2
1347	End of Pipe	60	$3,600.00	$349,200.00		2
3515	Curb Inlet: Metal Open Throat	61	$3,600.00	$352,800.00		2
117	Headwall	63	$3,600.00	$356,400.00	End of Year	2
477	Headwall	63	$6,000.00	$6,000.00		3

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
3413	Headwall	63	$6,000.00	$12,000.00		3
2111	Headwall	63	$3,600.00	$15,600.00		3
494	Headwall	63	$0.00	$15,600.00		3
990	Headwall	63	$0.00	$15,600.00		3
2754	Headwall	63	$0.00	$15,600.00		3
2765	Yard Inlet	63	$3,600.00	$19,200.00		3
2611	Headwall	63	$3,600.00	$22,800.00		3
1635	Headwall	63	$6,000.00	$28,800.00		3
2932	Yard Inlet	63	$1,800.00	$30,600.00		3
424	End of Pipe	64	$3,600.00	$34,200.00		3
523	Headwall	64	$6,000.00	$40,200.00		3
692	Headwall	64	$6,000.00	$46,200.00		3
762	Headwall	64	$3,600.00	$49,800.00		3
1078	End of Pipe	64	$3,600.00	$53,400.00		3
1921	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$57,000.00		3
1944	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$60,600.00		3
1981	Junction Box	64	$3,600.00	$64,200.00		3
2122	Headwall	64	$3,600.00	$67,800.00		3
2206	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$71,400.00		3
3642	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$75,000.00		3
199	Junction Box	64	$1,800.00	$76,800.00		3
515	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$80,400.00		3
2384	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$84,000.00		3
2386	End of Pipe	64	$3,600.00	$87,600.00		3
955	Curb Inlet: Pre-Cast Open Throat	64	$3,600.00	$91,200.00		3
1158	End of Pipe	65	$3,600.00	$94,800.00		3
63	Curb Inlet: Pre-Cast Open Throat	67	$3,600.00	$98,400.00		3
679	Curb Inlet: Pre-Cast Open Throat	67	$3,600.00	$102,000.00		3
2322	Curb Inlet: Pre-Cast Open Throat	67	$0.00	$102,000.00		3
342	Headwall	68	$3,600.00	$105,600.00		3
1086	Headwall	68	$3,600.00	$109,200.00		3
1647	End of Pipe	68	$3,600.00	$112,800.00		3
1873	Headwall	68	$3,600.00	$116,400.00		3
3592	End of Pipe	68	$3,600.00	$120,000.00		3
561	Curb Inlet: Pre-Cast Open Throat	68	$3,600.00	$123,600.00		3
2635	Headwall	68	$3,600.00	$127,200.00		3
2634	Headwall	69	$3,600.00	$130,800.00		3
4312	Headwall	69	$3,600.00	$134,400.00		3
701	Headwall	69	$6,000.00	$140,400.00		3
801	End of Pipe	69	$3,600.00	$144,000.00		3
1557	Headwall	69	$3,600.00	$147,600.00		3
2214	Headwall	69	$6,000.00	$153,600.00		3
3804	Flared End Section	69	$3,600.00	$157,200.00		3
4181	Headwall	69	$3,600.00	$160,800.00		3
321	Curb Inlet: Pre-Cast Open Throat	69	$3,600.00	$164,400.00		3
2981	End of Pipe	69	$3,600.00	$168,000.00		3
2675	Headwall	69	$3,600.00	$171,600.00		3
4191	Drop Inlet: In Street	71	$3,600.00	$175,200.00		3
4198	End of Pipe	71	$3,600.00	$178,800.00		3
4225	Curb Inlet: Hooded Grate	71	$3,600.00	$182,400.00		3
4241	Headwall	71	$3,600.00	$186,000.00		3
4244	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$189,600.00		3
4249	Headwall	71	$3,600.00	$193,200.00		3
4297	Junction Box	71	$3,600.00	$196,800.00		3
4369	End of Pipe	71	$0.00	$196,800.00		3
4540	Junction Box	71	$3,600.00	$200,400.00		3
4633	Flume	71	$3,600.00	$204,000.00		3
4650	Headwall	71	$6,000.00	$210,000.00		3
4654	End of Pipe	71	$0.00	$210,000.00		3
2	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$213,600.00		3
11	Headwall	71	$0.00	$213,600.00		3
13	End of Pipe	71	$3,600.00	$217,200.00		3
49	Curb Inlet: Pre-Cast Open Throat	71	$1,800.00	$219,000.00		3
234	Headwall	71	$3,600.00	$222,600.00		3
273	End of Pipe	71	$3,600.00	$226,200.00		3
275	Flared End Section	71	$3,600.00	$229,800.00		3
289	Headwall	71	$0.00	$229,800.00		3
292	Headwall	71	$3,600.00	$233,400.00		3
296	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$237,000.00		3

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
307	Headwall	71	$3,600.00	$240,600.00		3
318	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$244,200.00		3
385	Headwall	71	$3,600.00	$247,800.00		3
445	Headwall	71	$3,600.00	$251,400.00		3
469	End of Pipe	71	$3,600.00	$255,000.00		3
479	Headwall	71	$3,600.00	$258,600.00		3
525	Headwall	71	$3,600.00	$262,200.00		3
534	Headwall	71	$3,600.00	$265,800.00		3
544	Headwall	71	$3,600.00	$269,400.00		3
574	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$273,000.00		3
628	Headwall	71	$3,600.00	$276,600.00		3
645	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$280,200.00		3
650	Headwall	71	$3,600.00	$283,800.00		3
693	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$287,400.00		3
702	Headwall	71	$3,600.00	$291,000.00		3
712	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$294,600.00		3
727	Yard Inlet	71	$3,600.00	$298,200.00		3
755	End of Pipe	71	$3,600.00	$301,800.00		3
763	End of Pipe	71	$3,600.00	$305,400.00		3
808	Headwall	71	$3,600.00	$309,000.00		3
809	Headwall	71	$3,600.00	$312,600.00		3
874	Curb Inlet: Hooded Grate	71	$3,600.00	$316,200.00		3
888	End of Pipe	71	$3,600.00	$319,800.00		3
913	Headwall	71	$3,600.00	$323,400.00		3
918	Headwall	71	$3,600.00	$327,000.00		3
947	Headwall	71	$3,600.00	$330,600.00		3
965	End of Pipe	71	$3,600.00	$334,200.00		3
992	Headwall	71	$3,600.00	$337,800.00		3
1037	Headwall	71	$0.00	$337,800.00		3
1042	Yard Inlet	71	$3,600.00	$341,400.00		3
1080	End of Pipe	71	$3,600.00	$345,000.00		3
1117	Drop Inlet: In Grassed Area (Not Road Shoulder)	71	$3,600.00	$348,600.00		3
1185	Headwall	71	$3,600.00	$352,200.00		3
1235	Headwall	71	$3,600.00	$355,800.00		3
1237	Headwall	71	$3,600.00	$359,400.00	End of Year	3
1291	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$3,600.00		4
1343	Headwall	71	$3,600.00	$7,200.00		4
1385	Headwall	71	$3,600.00	$10,800.00		4
1415	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$14,400.00		4
1496	Headwall	71	$3,600.00	$18,000.00		4
1578	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$21,600.00		4
1615	Headwall	71	$3,600.00	$25,200.00		4
1646	End of Pipe	71	$3,600.00	$28,800.00		4
1649	Headwall	71	$3,600.00	$32,400.00		4
1670	Headwall	71	$12,000.00	$44,400.00		4
1811	Curb Inlet: Pre-Cast Open Throat	71	$1,800.00	$46,200.00		4
1898	Headwall	71	$3,600.00	$49,800.00		4
1901	Headwall	71	$3,600.00	$53,400.00		4
1984	Headwall	71	$3,600.00	$57,000.00		4
1992	End of Pipe	71	$3,600.00	$60,600.00		4
1999	Headwall	71	$3,600.00	$64,200.00		4
2116	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$67,800.00		4
2139	End of Pipe	71	$3,600.00	$71,400.00		4
2224	Headwall	71	$6,000.00	$77,400.00		4
2345	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$81,000.00		4
2946	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$84,600.00		4
3252	Curb Inlet: Pre-Cast Open Throat	71	$1,800.00	$86,400.00		4
3264	Headwall	71	$3,600.00	$90,000.00		4
3364	End of Pipe	71	$3,600.00	$93,600.00		4
3425	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$97,200.00		4
3483	Headwall	71	$6,000.00	$103,200.00		4
3552	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$106,800.00		4
3572	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$110,400.00		4
3597	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$114,000.00		4
3669	End of Pipe	71	$3,600.00	$117,600.00		4
3749	Curb Inlet: Hooded Grate	71	$3,600.00	$121,200.00		4
3752	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$124,800.00		4
3850	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$128,400.00		4
4005	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$132,000.00		4

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
4029	Drop Inlet: In Street	71	$3,600.00	$135,600.00		4
4030	Drop Inlet: In Street	71	$3,600.00	$139,200.00		4
4062	Flared End Section	71	$3,600.00	$142,800.00		4
4068	Junction Box	71	$3,600.00	$146,400.00		4
4159	End of Pipe	71	$3,600.00	$150,000.00		4
322	Headwall	71	$3,600.00	$153,600.00		4
323	Headwall	71	$3,600.00	$157,200.00		4
1084	Headwall	71	$3,600.00	$160,800.00		4
1139	Drop Inlet: In Grassed Area (Not Road Shoulder)	71	$3,600.00	$164,400.00		4
1631	Headwall	71	$3,600.00	$168,000.00		4
1818	Headwall	71	$3,600.00	$171,600.00		4
2026	Drop Inlet: In Street	71	$3,600.00	$175,200.00		4
3036	Headwall	71	$3,600.00	$178,800.00		4
3526	End of Pipe	71	$0.00	$178,800.00		4
437	Headwall	71	$3,600.00	$182,400.00		4
840	Headwall	71	$3,600.00	$186,000.00		4
1213	Headwall	71	$3,600.00	$189,600.00		4
1306	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$193,200.00		4
1591	Headwall	71	$3,600.00	$196,800.00		4
2131	Headwall	71	$3,600.00	$200,400.00		4
2272	Headwall	71	$3,600.00	$204,000.00		4
2551	Curb Inlet: Pre-Cast Open Throat	71	$3,600.00	$207,600.00		4
2674	Headwall	71	$3,600.00	$211,200.00		4
2795	Headwall	71	$3,600.00	$214,800.00		4
2796	Headwall	71	$3,600.00	$218,400.00		4
2599	Junction Box	71	$3,600.00	$222,000.00		4
38	Curb Inlet: Pre-Cast Open Throat	72	$3,600.00	$225,600.00		4
1521	Curb Inlet: Pre-Cast Open Throat	72	$3,600.00	$229,200.00		4
4221	Flume	73	$3,600.00	$232,800.00		4
4300	Curb Inlet: Pre-Cast Open Throat	74	$3,600.00	$236,400.00		4
3409	Headwall	74	$3,600.00	$240,000.00		4
42	Headwall	74	$3,600.00	$243,600.00		4
2751	Yard Inlet	74	$3,600.00	$247,200.00		4
2400	Curb Inlet: Pre-Cast Open Throat	74	$3,600.00	$250,800.00		4
2605	Headwall	74	$3,600.00	$254,400.00		4
4243	Headwall	75	$3,600.00	$258,000.00		4
4256	Flume	75	$3,600.00	$261,600.00		4
4306	Curb Inlet: Pre-Cast Open Throat	75	$3,600.00	$265,200.00		4
118	Headwall	75	$3,600.00	$268,800.00		4
364	End of Pipe	75	$3,600.00	$272,400.00		4
444	Headwall	75	$3,600.00	$276,000.00		4
484	End of Pipe	75	$3,600.00	$279,600.00		4
789	Headwall	75	$3,600.00	$283,200.00		4
1025	Headwall	75	$3,600.00	$286,800.00		4
1183	End of Pipe	75	$3,600.00	$290,400.00		4
1210	Flared End Section	75	$3,600.00	$294,000.00		4
1236	Headwall	75	$3,600.00	$297,600.00		4
1755	Headwall	75	$3,600.00	$301,200.00		4
2125	Headwall	75	$3,600.00	$304,800.00		4
3126	Flume	75	$3,600.00	$308,400.00		4
3426	End of Pipe	75	$3,600.00	$312,000.00		4
3471	Headwall	75	$3,600.00	$315,600.00		4
3473	Headwall	75	$3,600.00	$319,200.00		4
3573	Curb Inlet: Pre-Cast Open Throat	75	$3,600.00	$322,800.00		4
3731	Flared End Section	75	$3,600.00	$326,400.00		4
3836	Flared End Section	75	$3,600.00	$330,000.00		4
4028	Curb Inlet: Metal Open Throat	75	$3,600.00	$333,600.00		4
1100	Headwall	75	$3,600.00	$337,200.00		4
2893	Headwall	75	$3,600.00	$340,800.00		4
3019	Headwall	75	$3,600.00	$344,400.00		4
160	Headwall	75	$3,600.00	$348,000.00		4
554	Headwall	75	$3,600.00	$351,600.00		4
1191	Headwall	75	$3,600.00	$355,200.00		4
1644	Headwall	75	$3,600.00	$358,800.00	End of Year	4
2385	Curb Inlet: Pre-Cast Open Throat	75	$3,600.00	$3,600.00		5
2668	Headwall	75	$3,600.00	$7,200.00		5
2671	Headwall	75	$3,600.00	$10,800.00		5
2638	Headwall	75	$3,600.00	$14,400.00		5
4268	Outlet Structure	76	$3,600.00	$18,000.00		5

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
59	Headwall	76	$3,600.00	$21,600.00		5
327	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$25,200.00		5
379	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$28,800.00		5
602	Headwall	76	$3,600.00	$32,400.00		5
831	Headwall	76	$3,600.00	$36,000.00		5
1863	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$39,600.00		5
3614	Flared End Section	76	$3,600.00	$43,200.00		5
3661	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$46,800.00		5
593	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$50,400.00		5
113	Headwall	76	$3,600.00	$54,000.00		5
2456	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$57,600.00		5
2682	Headwall	76	$3,600.00	$61,200.00		5
4275	End of Pipe	76	$3,600.00	$64,800.00		5
4298	Headwall	76	$3,600.00	$68,400.00		5
4537	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$72,000.00		5
121	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$75,600.00		5
207	Curb Inlet: Hooded Grate	76	$3,600.00	$79,200.00		5
232	Headwall	76	$3,600.00	$82,800.00		5
335	End of Pipe	76	$3,600.00	$86,400.00		5
433	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$90,000.00		5
571	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$93,600.00		5
684	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$97,200.00		5
819	End of Pipe	76	$3,600.00	$100,800.00		5
886	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$104,400.00		5
904	Headwall	76	$3,600.00	$108,000.00		5
972	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$111,600.00		5
985	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$115,200.00		5
1091	Flared End Section	76	$3,600.00	$118,800.00		5
1455	Headwall	76	$3,600.00	$122,400.00		5
1916	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$126,000.00		5
2035	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$129,600.00		5
3103	End of Pipe	76	$3,600.00	$133,200.00		5
3104	End of Pipe	76	$3,600.00	$136,800.00		5
3277	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$140,400.00		5
3491	Junction Box	76	$3,600.00	$144,000.00		5
3714	End of Pipe	76	$12,000.00	$156,000.00		5
3786	Flared End Section	76	$3,600.00	$159,600.00		5
73	Headwall	76	$3,600.00	$163,200.00		5
87	Headwall	76	$3,600.00	$166,800.00		5
1194	Headwall	76	$3,600.00	$170,400.00		5
2276	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$174,000.00		5
2583	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$177,600.00		5
2794	Headwall	76	$3,600.00	$181,200.00		5
2827	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$184,800.00		5
2397	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$188,400.00		5
1469	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$192,000.00		5
2401	Curb Inlet: Pre-Cast Open Throat	76	$3,600.00	$195,600.00		5
260	Curb Inlet: Pre-Cast Open Throat	77	$3,600.00	$199,200.00		5
270	Headwall	77	$3,600.00	$202,800.00		5
426	Headwall	77	$3,600.00	$206,400.00		5
1038	Headwall	77	$3,600.00	$210,000.00		5
1544	Curb Inlet: Pre-Cast Open Throat	77	$3,600.00	$213,600.00		5
1662	Headwall	77	$3,600.00	$217,200.00		5
3537	Flared End Section	77	$3,600.00	$220,800.00		5
3757	Drop Inlet: In Grassed Area (Not Road Shoulder)	77	$3,600.00	$224,400.00		5
2259	End of Pipe	77	$3,600.00	$228,000.00		5
4308	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$231,600.00		5
4322	Yard Inlet	78	$3,600.00	$235,200.00		5
4486	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$238,800.00		5
4588	Drop Inlet: In Grassed Area (Not Road Shoulder)	78	$3,600.00	$242,400.00		5
4620	Yard Inlet	78	$3,600.00	$246,000.00		5
4634	Junction Box	78	$3,600.00	$249,600.00		5
4682	Drop Inlet: In Street	78	$3,600.00	$253,200.00		5
4736	Outlet Structure	78	$3,600.00	$256,800.00		5
24	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$260,400.00		5
31	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$264,000.00		5
56	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$267,600.00		5
106	Outlet Structure	78	$3,600.00	$271,200.00		5
177	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$274,800.00		5

	IDENTIFICATION	CTURE COND	PROJECT COSTS			
STRUCTURE ID	STRUCTURE TYPE	GRADE	TOTAL COST ($) INCLUDES DESIGN FEES	ESTIMATED YEARLY COST ($)	CIP YEAR	
238	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$278,400.00		5
241	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$282,000.00		5
303	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$285,600.00		5
338	Flared End Section	78	$3,600.00	$289,200.00		5
368	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$292,800.00		5
408	Junction Box	78	$3,600.00	$296,400.00		5
504	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$300,000.00		5
507	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$303,600.00		5
541	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$307,200.00		5
552	Headwall	78	$6,000.00	$313,200.00		5
598	End of Pipe	78	$3,600.00	$316,800.00		5
604	Headwall	78	$3,600.00	$320,400.00		5
607	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$324,000.00		5
655	Headwall	78	$3,600.00	$327,600.00		5
658	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$331,200.00		5
662	Headwall	78	$3,600.00	$334,800.00		5
683	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$338,400.00		5
708	Curb Inlet: Hooded Grate	78	$3,600.00	$342,000.00		5
717	Headwall	78	$3,600.00	$345,600.00		5
731	Junction Box	78	$3,600.00	$349,200.00		5
735	Yard Inlet	78	$3,600.00	$352,800.00		5
752	End of Pipe	78	$3,600.00	$356,400.00		5
793	Curb Inlet: Pre-Cast Open Throat	78	$3,600.00	$360,000.00	End of Year	5

Summary of Algorithm/Ranking System

The City of Lawrenceville hired Integrated Science & Engineering, an MS4 (Municipal Separate Storm Sewer System) inspection firm to assess the city's storm sewer system. The observations provided by the MS4 inspection firm for the city's storm structures and pipes were converted to a Microsoft Excel worksheet. The excel worksheet has been amended to include a score for the observations considered priority by the city, thus enabling the city to determine the structure or pipe condition and then prioritize its maintenance or replacement. The method used to create the scoring system is mentioned below.

The observations used for the evaluation of the storm structures are listed under the headings of Structure Damage, Maintenance Needed, Structure Sedimentation, and Scour. The observations used for evaluation of the storm pipes are listed under the headings of Pipe Type, Pipe Size, Maintenance Needed, Corrosion Upstream, and Corrosion Downstream. Each observation was given a rating by the inspector.

The Excel spreadsheet takes each rating and converts it to a numerical value. All relevant observations were added together to produce a final score for each structure or pipe. At the city's request, the score was turned into a grade on the 0-100% scale where a 100% score was a structure or pipe in the best condition and a 0% in the worst condition. A grade for each structure or pipe provides the city with a way to compare the items and identify which are in the greatest need of repair. Identifying the priority issues is meant to help the city make more informed decisions efficiently and objectively on which items can be maintained or replaced.

Many structures on the list had no observations attributed to them. The city needed a way to evaluate items with insufficient information separately from the already existing items with a grade. To accomplish this separation, any item with missing information in the higher "priority observations," was given a grade that returns the word "Inspect" instead of an actual grade percentage. A logic function was written into the Excel worksheet to distinguish between the Graded Condition and the Inspect Condition, taking the "Priority Observations" into account (See "Priority Observations" below for clarification).

"Priority Observations" - A decision was made to prioritize a few of the ratings under each observed heading. In the case of an item having some information missing, but also being listed as a Public Safety Hazard, this item would still be given a grade and compared to others instead of being listed under "Inspect." The same consideration was not given to items if there was missing information and only minor damage was noted, or routine maintenance was needed.

The following pages provide the steps for the logic function included in the Excel worksheet.

Structures Score Adjustment Logic

The purpose of this logic function is to distinguish between structures that do not have enough information and need to be inspected – **Inspected Condition**, and the structures that do not have some information, but have enough "Priority Observations" to be compared with all other structures that have a grade – **Graded Condition**.

Structure Damage

1. Check if Structure Damage Score trips the inspection score.
   (Does Structure Damage = N/A or Blank?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Structure Damage. (**Graded Condition**)

Process for: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of the Maintenance Needed observation.

If the Maintenance Needed is listed as a "Safety Hazard" or "Priority," the Structure Damage Score is set to the highest score for Structure Damage. (**Graded Condition**)

If the Maintenance Needed is not listed as "Safety Hazard" or "Priority," the Structure Damage Score maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Maintenance Needed

1. Check if Maintenance Needed Score trips the inspection score.
   (Does Maintenance Needed = N/A or Blank?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Maintenance Needed. (**Graded Condition**)

Process: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of the Structure Damage observation.

If the Structure Damage is listed as a "Public Safety Hazard" or "Severe," the Maintenance Needed Score is set to the highest score for Maintenance Needed. (**Graded Condition**)

If the Structure Damage is not listed as "Public Safety Hazard" or "Severe," the Maintenance Needed Score maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Sedimentation Score

1. Check if Sedimentation Score trips the inspection score.
   (Does Structure Sedimentation = N/A or Blank?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Structure Sedimentation. (**Graded Condition**)

Process: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of both the Structure Damage and Maintenance Needed observations.

If either of these scores are listed in the range of (Structure Damage) "Public Safety Hazard" to "Severe," or (Maintenance Needed) "Safety Hazard" or "Priority," the Sedimentation Score is set to the highest score for Sedimentation. (**Graded Condition**)

If the Structure Damage is not listed as "Public Safety Hazard" or "Severe," or the Maintenance Needed is not listed as "Safety Hazard" or "Priority," the Sedimentation Score maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Scour Score

1. Check if Scour Score trips the inspection score.
   (Does Scour = N/A or Blank?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Scour. (**Graded Condition**)

Process: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of both the Structure Damage and Maintenance Needed observations.

If either of these scores are listed in the range of (Structure Damage) "Public Safety Hazard" to "Severe," or (Maintenance Needed) "Safety Hazard" or "Priority," the Scour Score is set to the highest score for Scour. (**Graded Condition**)

If the Structure Damage is not listed as "Public Safety Hazard" or "Severe," or the Maintenance Needed is not listed as "Safety Hazard" or "Priority," the Scour Score maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Pipe Score Adjustment Logic

The purpose of this logic function is to distinguish between pipes that do not have enough information and need to be inspected – **Inspected Condition**, and the pipes that do not have some information but have enough "Priority Observations" to be compared with all other pipes that have a grade – **Graded Condition**.

Pipe Type

1. Check if Material Score trips the inspection score. (Does Pipe Type = N/A, Blank, or other?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Pipe Type. (**Graded Condition**)

Process: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of the Maintenance Needed, Corrosion Upstream, and Corrosion Downstream observations.

If any one of these scores are listed as (Maintenance Needed) "Safety Hazard" or "Priority," (Corrosion Upstream) "Severe", or (Corrosion Downstream) "Severe," the Material Score is set to the highest score for Pipe Material (**Graded Condition**).

If none of the conditions listed above are met, the Material Score maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Maintenance Needed

1. Check if Maintenance Needed Score trips the inspection score. (Does Maintenance Needed = N/A or Blank?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Maintenance Needed. (**Graded Condition**)

Process: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of the Corrosion Upstream and Corrosion Downstream observations.

If either of these scores are listed as (Corrosion Upstream) "Severe", or (Corrosion Downstream) "Severe," the Maintenance Needed Score is set to the highest score for Maintenance Needed (**Graded Condition**).

If none of the conditions listed above are met, the Maintenance Needed maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Corrosion Upstream

1. Check if Corrosion Upstream Score trips the inspection score.
   (Does Corrosion Upstream = Blank or Unable to Access?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Corrosion Upstream. (**Graded Condition**)

Process: Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of the Maintenance Needed and Corrosion Downstream observations.

If either of these scores are listed as (Maintenance Needed) "Safety Hazard" or "Priority," or (Corrosion Downstream) "Severe," the Corrosion Upstream is set to the highest score for Corrosion Upstream (**Graded Condition**).

If none of the conditions listed above are met, the Corrosion Upstream maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

Corrosion Downstream

1. Check if Corrosion Downstream Score trips the inspection score.
   (Does Corrosion Downstream = Blank or Unable to Access?)
   a. Yes – Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.
   b. No – Maintain the current Grade for Corrosion Downstream. (**Graded Condition**).

Process: 1a. Go through checks to decide whether to keep score in the **Inspection Condition** or drop the score to the **Graded Condition**.

- This is a check of the Maintenance Needed and Corrosion Upstream observations.

If either of these scores are listed as (Maintenance Needed) "Safety Hazard" or "Priority," or (Corrosion Upstream) "Severe," the Corrosion Downstream is set to the highest score for Corrosion Downstream (**Graded Condition**).

If none of the conditions listed above are met, the Corrosion Downstream maintains its **Inspection Condition**.

Note: Higher scores result in lower grades

A P P E N D I X F

APPENDIX F

Television Inspection Program

Television Inspection Program

The pipe observations performed at most of the locations have been limited to as much as the inspector can see from the top of the structure. In most cases, this may only be a few feet of the upstream or downstream end of the pipe. Thus, if a pipe is listed as poor condition, it is important to collect more information on that pipe. A closed-captioned television (CCTV) inspection of the pipe will be necessary to obtain more reliable information and is less expensive than other methods of evaluating pipe conditions between structures.

View of interior of pipe. Corrosion evident at interface of baseflow (water), air and steel pipe. An obstruction (gasline) is evident in this photograph.

It is much more cost effective to perform a video inspection than it is to physically dig up sections of the pipe system to observe the conditions.

The video of the pipe section can reveal if there is structural damage to the pipe, holes, deterioration, blockages, or even other pipes or obstructions affecting the storm water flow.

The television inspection can also be used to determine if the pipe can be restored by relining or if a full replacement is required. If a pipe can be relined, repairs can be done with less impact to the property and the general public.

A television inspection program could be incorporated with the MS4 annual inspection and performed over a five-year period.