Strategic Maintenance Plan

Appendix
to the
Stormwater Environmental Utility Strategic Plan
for the
Drainage Operations Division
of the
Operations and Maintenance Service Center
of the
Public Works Business Center

December 1999
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<td>Q</td>
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</table>
Executive Summary

The Mission of the Drainage Operations Division of the Operations and Maintenance Service Center of the Sarasota County Public Works Business Center (PWBC) is to assist the Sarasota County Stormwater Environmental Utility (SEU) in their mission to provide

A ... responsive, courteous, quality service to all customers in the maintenance, repair, improvement, management, and operation of the public stormwater management system ...

by operating and maintaining the capital facilities that make up the public stormwater management system.

Background Information

The Drainage Operations Division maintains the following types of public stormwater facilities:

- Drainage Canals
- Subdivision Lakes
- Retention or Detention Ponds
- Storm Sewers, Culvert Pipes, and Inlets
- Water Control Structures, Weirs, and Pumps
- Permitted Wetland Mitigation Sites
- Roadside Ditches
- Maintenance Dredging of Canals

Funding for the Drainage Operations Division activities is derived from the Stormwater Environmental Utility Service Assessment.

Types of Maintenance Activities

The Drainage Operations Division maintains the drainage systems in the unincorporated portions of the County as well as the City of Sarasota and portions of Florida Department of Transportation (FDOT) stormwater system.

Maintenance activities are, in broad terms, classified as either of the following:

- Routine Maintenance: A term that refers to scheduled, programmed maintenance sometimes called preventive maintenance. Routine Maintenance service responsibilities include:
  - Hand clearing (by contractor or prison crew)
  - Erosion repair
Bank stabilization
Channel dredging for drainage purposes
Structure and pipe repair/replacement
Lake, pond, and mitigation area maintenance and monitoring.

Extraordinary Maintenance: A response to an unanticipated, deteriorated condition. This may include emergency repair or replacement activities in response to structure or road to flooding. Extraordinary maintenance services may include:

- Repair or replacement of damaged or failed pipes or structures
- Roadside ditch cleaning
- Dredging activities related to the stormwater system
- Response to Customer Service Requests (CSR’s)

Methodologies for Balancing Maintenance Demand Versus Budget and Staff Capability

Several methodologies have evolved to systematize the process of scheduling maintenance activities to balance total maintenance demands with the SEU maintenance capacity. These include the following processes:

- Routine, Scheduled Maintenance

  The methodology ensures maintenance that varies from once in a year to once in three years, depending upon land use, risk of rainstorm inconvenience or flooding, and overall location within a stormwater system.

- Extraordinary Maintenance

  Customer Service Requests, used to respond to extraordinary (i.e., unscheduled) maintenance, are assigned to a responsible Initial Response Team member and are tracked in the Work Management System database to ensure an efficient, effective and thorough response, appropriate to the nature of the reported problem or issue. Sometimes, responding to a CSR involves complex design and permitting issues and these CSR’s are assigned to an engineer in Drainage Operations. When internal resources do not permit a timely or economical response, then an external contractor is used. Regardless, the key point is responsibility, accountability, and a documented process for responding to CSR’s within three days of initial receipt (except during declared emergencies).

The overall goal of these processes is to maintain system level of service (i.e., stormwater management functional capacity) while balancing the available SEU funding.

Related and Support Activities
In addition to routine maintenance and extraordinary maintenance activities, the Drainage Operations Division also engages in other related, support activities. These include:

- Record-keeping: In addition to the normal record keeping activity required of all County agencies, the Drainage Operations Division also maintains data, often required by permits issued to the County, such as:
  - Initial construction (As-built or record drawings and contract documents)
  - Environmental permits
  - Customer service requests
  - Service work orders, purchase orders, and contracts (for services)
  - Periodic condition assessment reports
  - Functional evaluation or testing
  - Structural evaluation or testing
  - Others, etc.

- Coordination with the County’s Program Coordinator for the Federal Emergency Management Agency’s Flood Insurance Administration’s Community Rating System.

### Stormwater Infrastructure Maintenance Issues

There are several issues that relate to, or affect, the normal activities of the Drainage Operations Division. Some of these include:

- Acceptance of aging stormwater systems for maintenance
- Continued use of stormwater infrastructure beyond expected design service life
- Public access to County property, from a risk perspective
- Public perception versus stormwater system capacity
- Inadequate access for work crews and equipment
- Technological innovation (finding out new maintenance approaches that will work effectively with this particular climate and system construction)
- Public policy and regulatory changes (often resulting in unfunded mandates)
- The specific definition and extent of primary versus secondary drainage systems
- Dollar limits on repair and rehabilitation projects

Recommendations for ways to resolve these issues are being developed as a product of annual action plans.
Section I - Introduction

Mission

The Mission of the Drainage Operations Division of the Sarasota County Public Works Business Center (PWBC) is to assist the Sarasota County Stormwater Environmental Utility (SEU) in their mission to provide

A ... responsive, courteous, quality service to all customers in the maintenance, repair, improvement, management, and operation of the public stormwater management system ...

by operating and maintaining the capital facilities that make up the public stormwater management system.

Types of Facilities Maintained

The Drainage Operations Division maintains the following types of public stormwater facilities:

- Drainage Canals
- Subdivision Lakes
- Retention or Detention Ponds
- Storm Sewers, Culvert Pipes, and Inlets
- Water Control Structures, Weirs, and Pumps
- Permitted Wetland Mitigation Sites
- Roadside Ditches
- Maintenance Dredging of Canals

Organization

Exhibit A, Operations & Maintenance/Drainage Organization Chart, illustrates the functional organization of the Drainage Operations Division. The Division is basically organized with a North and a South County operation. The North County Yard, at 100 Cattlemen Road, is the focus for North County drainage operations. The South County Yard, at South County Administration Center, is the focus for selected South County drainage operations. Additionally, the Aquatic Plant Group is located in North County and utilizes storage space at the Pickney Yard.

Funding

Funding for the Drainage Operations Division activities is derived from the Stormwater Environmental Utility Service Assessment. The current FY00 funding for the program is in budget.
Section II B Origin of Maintenance Requirements

The specific requirements for stormwater infrastructure maintenance come from many sources, including:

- Stormwater Ordinance 094-066 (Exhibit B)
- Sarasota County Comprehensive Plan
- Permits from Several Federal, State, and Regional Agencies
- System Design Criteria and Construction Specifications
- Contracts, Agreements, and Joint Participation Agreements
- Customer Service Requests
- Internally Generated Inspection Reports
- Contract No. 98-359, Interlocal Agreement between Sarasota County and The City of Sarasota (Exhibit C)
- Stormwater Ordinance 84-05 (Exhibit D)
- Private Stormwater Conveyance Maintenance Ordinance 99-050 (Exhibit E)
Section III B Drainage Operations

Definition of Terms

BOX CULVERT: A man-made object, typically box shaped and open on two ends, designed to convey stormwater runoff.

CANAL/DITCH/SWALE: An artificial or natural waterway or improved river used for conveying stormwater runoff.

CULVERT or PIPE: An underground device that conveys or transports stormwater from one location to another. Examples include: cross road culverts, side drains, driveway culverts, and storm sewers.

CUSTOMER SERVICE REQUEST: A formal request by, or on the behalf of, a citizen reporting a problem or adverse condition that will require investigation and response by Drainage Operations.

DETENTION POND: A temporary storage area for water to be detained, treated and slowly released into the receiving body of water.

DRIVEWAY CULVERT: Driveway Culverts, or Pipes, are normally placed in an open drainage system to gain access to a residence or place of business. In accordance with Ordinance No. 84-05, the property owner is responsible for the repair and replacement of the pipe and driveway. The County will clean the pipe to maintain flow.

EXTRAORDINARY MAINTENANCE: Extraordinary Maintenance is a response to an unanticipated, deteriorated condition. This maintenance activity is sometimes called reactive maintenance because it cannot be scheduled and is in reaction to a specific system condition.

INITIAL RESPONSE TEAM: The team of responsible individuals who are tasked with investigating and coordinating a response to a Customer Service Request.

LAKE: Relatively large bodies of natural or man-made standing water in which open water areas predominate over shallow vegetated areas.

MITIGATION AREA: Mitigation is an action or series of actions to offset the adverse impacts that would otherwise cause a regulated activity to fail to meet the criteria set forth in Environmental Resource Permitting. Mitigation consists of restoration, enhancement, creation, preservation, or a combination thereof of wetlands and upland plantings.

ORIFICE: A hole or opening that discharges water from a water control structure.
OUTFALL DITCH: A man-made conveyance providing storm water runoff from a roadside ditch to the main conveyance.

POND: Natural bodies of water or man-made objects having defined boundaries and which function to control, retain or convey stormwater runoff.

PRODUCTION CAPACITY: The total of all labor, equipment, and supplies available to do maintenance activities.

PRODUCTION DEMAND: The total of all activities, in terms of labor, equipment, and supplies, that is required to do desired maintenance activities.

RETENTION POND: A storage area for the sediments to settle and the pollutants to be removed.

ROADSIDE DITCH: A man-made conveyance to provide, during major/minor stormwater runoff events, temporary storage and conveyance of stormwater.

ROUTINE MAINTENANCE: Routine Maintenance is a term that refers to scheduled, programmed maintenance sometimes called preventive maintenance.

SKIMMER: A device that skims floating debris or oil from water before it discharges into the outlet bay or waterway.

STORM SEWER: A collection of culverts or pipes and inlets and junction boxes that make up a complete system to collect and convey water underground from several points in a basin to an outfall point such as a pond.

WATER CONTROL STRUCTURES: A man-made device constructed of concrete, steel, earth and etc. Some have weir openings, skimmers, and small orifices for runoff or drain down. Others are much larger with a number of gates that open and close to control water flow.

WEIR: A weir is a structure (usually concrete) used to control the water level upstream of the structure.

**Overview of Responsibilities**

The Drainage Operations Division is a component part of the organization of the Public Works Business Center (see Exhibit A for details on the organizational structure). The Drainage Operations Division maintains the drainage systems in the unincorporated portions of the County as well as the City of Sarasota and portions of Florida Department of Transportation
(FDOT) stormwater system.

**County Maintenance Assets**

Existing maintenance assets for the Drainage Operations Division consist of the following:

- Canals
- Ponds
- Lakes
- Roadside ditches
- Water control structures
- Wetland mitigation sites
- Storm sewer pipe and inlets
Section IV B Routine Maintenance

Definition

Routine Maintenance is a term that refers to scheduled, programmed maintenance sometimes called preventive maintenance. The Drainage Operations Division tries to closely schedule Routine Maintenance, although emergencies and weather can cause problems with scheduling. Routine Maintenance services include:

- Herbicide Spraying
- Preventive components such as vegetation mowing
- Palliative components such as filling erosion gullies.

Routine Maintenance Services

Some of the services provided by the Drainage Operations Division that fall under the classification of Routine Maintenance include the following:

- Canal Mowing and Hand-cleaning
- Pond and Lake Mowing
- Canal and Pond Herbicide Bank Spraying

Where appropriate, herbicide treatment provides a cost-effective way to ensure prolonged control of undesirable, quick growing plants. The schedule for this activity is closely coordinated with mowing and cleaning operations. The objective is to try to avoid area-wide application of herbicide, to minimize the loss of desirable plant material and to minimize bank erosion. It is also important to effectively remove undesirable plant material that can either shade or crowd out the preferred plant stabilization material.

- Mechanical System Servicing

Routine Maintenance also includes servicing operable and mechanical systems such as: stormwater pumping stations and adjustable weirs.
Pump Stations:

- St. Armand Pump Station
- Sunnyside Lane (PROPOSED)
- Siesta Key Pump Station

Mechanical Weirs:

- Main AC
- Celery Fields Control Structures
- Cow Pen Slough Weirs (Dortz and Kingsgate)

Repair, replacement, and rehabilitation of existing stormwater systems

When detected early by routine inspection programs, it is often possible to schedule repair, replacement, and rehabilitation projects well in advance as routine maintenance. At other times, especially in response to Customer Service Requests, repair, replacement, and rehabilitation projects are handled as extraordinary maintenance.
Section V  Extraordinary Maintenance

Definition

Extraordinary Maintenance is a response to an unanticipated, deteriorated condition. It is possible to effectively schedule some extraordinary maintenance activity, when primarily the result of observed, long-term deterioration. Sometimes the deterioration is not easily seen and the condition is unobserved until the problem is serious enough to repair or replace (such as damage from an underground pipe failure). Extraordinary Maintenance may include repair or replacement activities, as well as a Good Neighbor response to flooding emergencies not otherwise related to the routine operation of the SEU stormwater management infrastructure.

Extraordinary Maintenance Services

Pipes or Structure Repair or Replacement

A periodic condition assessment, including the use of television cameras to see the inside of long culvert pipes, helps to set priorities for repair and replacement. Complaint frequency and apparent deterioration of performance, as intended by the original design, greatly influence repair and replacement priorities.

Dredging Activities Related to Stormwater System

Sand bar removal and bank stabilization is an on-condition maintenance effort. Activities in this effort will be in conjunction with a countywide navigational maintenance dredging program. The program describes method, priority, and funding mechanisms.

Roadside Ditch Cleaning

The Drainage Operations Division currently maintains roadside ditches under routine maintenance, but may also be in response to Customer Service Requests, which would categorize it as “extraordinary”.

Unscheduled Restoration, Improvement, or Enhancement of Stormwater Level of Service.

Deterioration in stormwater system infrastructure components can lead to a reduced stormwater Level of Service (LOS) condition. With a slow rate of deterioration, the reduced stormwater LOS is often discovered during an extreme rainfall event, accompanied with flooding. Sometimes this is a response to a flooding condition not otherwise related to the SEU infrastructure.
Response to Customer Service Requests

This is because Customer Service Requests cannot be scheduled in advance. For example, it is difficult to know exactly when a tree will blow down or debris will be dumped in a canal.
Section VI – Response Methodology

Routine,Scheduled Maintenance

Due to the large number of drainage canals, structures, ponds, and lakes located within the SEU system, a methodology was formulated to establish priorities for realistic, routine, scheduled maintenance. This methodology evaluates and ranks each facility individually. The system considers land use, flooding history, and facility type, as the primary criteria in setting routine, scheduled maintenance. These parameters are defined as follows:

1. Land Use: Determine whether the land area supported by each facility is either residential (high density), residential (low density), industrial or agricultural. If more than one land use exists for a canal or canal segment, then choose the land use that represents the majority land use by area.

2. Flooding History: Determine whether structure flooding, yard flooding, or street flooding occurs in the area support by each facility during a normal rain event. Use the highest point value determined to exist for each canal=s, or canal segment=s, drainage area.

3. Facility Type: Determine whether each facility is a Secondary, Primary, or a Main facility. A Secondary facility is a small canal or ditch that collects and conveys runoff from roadside ditches and curb inlets. A Primary facility conveys flows from more than one Secondary facility to a Main facility. A Main facility, typically a river, creek or large constructed channel, conveys flows from more than one Primary facility to a system discharge point such as Sarasota Bay.

This system permits ranking the component parts of the SEU system objectively and fairly. The total number of points determines the frequency of scheduled maintenance. The goal is to result in no more than a three-year turn around between routine, scheduled maintenance visits for any portion of the system. This methodology is summarized in the following tables:
Each canal or canal reach is rated according the previous table. The total of all factors determines the frequency of maintenance, according to the following chart:

<table>
<thead>
<tr>
<th>Total Points</th>
<th>Frequency of Maintenance</th>
<th>Class Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 to 11</td>
<td>Once Each Year</td>
<td>A</td>
</tr>
<tr>
<td>5 to 7</td>
<td>Once in a Two Year Period</td>
<td>B</td>
</tr>
<tr>
<td>3 or 4</td>
<td>Once in a Three Year Period</td>
<td>C</td>
</tr>
</tbody>
</table>

It is recognized that the goal is to ensure systematic maintenance of the entire system within a 3-year period. It is also important to give the maximum feasible frequency of maintenance to systems affecting residential areas that are subject to frequent rainstorm inconvenience or flooding. It is equally important to have some available production capacity to respond quickly to extraordinary (i.e., unscheduled) maintenance demands. Therefore, after prioritizing all canals, canal segments, or facilities, the total (average annual) maintenance production demand is compared to the available maintenance production capacity from all sources. If production demand exceeds production capacity, then the priorities may need to be adjusted. This comparison is made in an annual action plan that outlines the work plan for the Division each fiscal year.

Extraordinary Maintenance
I. A Customer Service Request (CSR) to perform Extraordinary & Routine Maintenance is usually generated by a contact to a Customer Service Representative by a citizen. It can also be initiated by:

- The Board of County Commissioners (BCC)
- The County Administrator
- The Sheriff’s Office
- Other County personnel

The Request would contain the following information:

- The complainant’s first and last name
- The complainant’s address & phone number
- The nearest cross street to the problem
- A short explanation of the problem
- The name of the IRT member contacted
- The date of contact
- An IRT identification number
- A priority status ranking
- A map locating the site (on the reverse side)

II. The Customer Service Representative performs the following tasks:

1. Enters the Request into the Work Management Application (WMA) database.

2. Determine whether the request is an Emergency. (A life-threatening circumstance or an imminent danger to the public would constitute an emergency.) An emergency would require an immediate response from County personnel.

3. The Customer Service Representative would immediately refer Emergency Requests to the appropriate Division Manager.

Table 1. Illustrates examples of problems and their corresponding contact.

4. Refer Requests that are not pertaining to Public Works to the appropriate agency.

5. Requests resolved over the telephone are noted as such and are not referred for inspection.
6. All other requests are then referred to the Initial Response Team (IRT) Supervisor who assigns them to an Initial Response Representative for investigation.

Table 1  Examples of problems and their corresponding County Government contact.

<table>
<thead>
<tr>
<th>CSR Problem type</th>
<th>Division to contact</th>
<th>Contact Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure Flooding</td>
<td>Drainage Ops</td>
<td>Jim Somers</td>
</tr>
<tr>
<td>Roadway Sinkhole</td>
<td>Drainage Ops</td>
<td>Jim Somers</td>
</tr>
<tr>
<td>Manhole cover off, in roadway or sidewalk</td>
<td>Drainage Ops</td>
<td>Jim Somers</td>
</tr>
<tr>
<td>Potholes</td>
<td>Road &amp; Bridge</td>
<td>Dan Blackwood</td>
</tr>
<tr>
<td>Signs and Signals</td>
<td>Road &amp; Bridge</td>
<td>Don Galloway</td>
</tr>
<tr>
<td>Tree down in road</td>
<td>Landscape</td>
<td>Norm Easey</td>
</tr>
</tbody>
</table>

III. One, or more, of the Initial Response Representatives would then perform a site visit within 3 working days. The Representative(s) will perform the following tasks:

1. Determine if a similar request has been previously documented. If so, link the requests together.

2. Establish personal contact with the citizen in-person, by telephone, or by door hanger.

3. Record observations on the CSR form, along with any information that may be useful for the Division performing the work.

4. Perform minor services on the site to solve the problem, or provide safety-warning devices.

5. Report code violations, land ownership, and drainage status to the IRT Supervisor.

6. Takes picture(s) of the site for clarification.

7. Assigns a preliminary priority to the request as indicated in Table 2 (i.e. 2, 3, and 4).

8. Forward the Request to the Drainage Division Manager. (Other Divisions may
bypass the manager & go directly to the foremen)

**Table 2.** Priority determination criteria for inspected problem sites

<table>
<thead>
<tr>
<th>Priority Number</th>
<th>Priority Name</th>
<th>Priority Status Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emergency</td>
<td>Immediate response required by County personnel</td>
</tr>
<tr>
<td>2</td>
<td>Critical</td>
<td>High and urgent priority</td>
</tr>
<tr>
<td>3</td>
<td>Serious</td>
<td>Future Potential to be a public concern</td>
</tr>
<tr>
<td>4</td>
<td>Routine</td>
<td>Normal maintenance work</td>
</tr>
</tbody>
</table>

IV. For CSR’s for Drainage Operations, the Division Manager receives the CSR and performs the following:

1. Determine if the work would be more appropriately assigned to an outside contractor,

2. Determine if the work is within the scope of services provided by the Division at which point assign the work to one of the following:
   A. Engineering, for design and permitting considerations.
   B. One of the foremen.

V. The CSR is entered into the WMA program, which now includes the name of the person designated to the project. A work-order is initiated and details the responsibility to an engineer or a foreman. If the project is assigned to an engineer, design and permitting criteria are completed before it is presented to the foreman. Engineers follow the same priority criteria as the foremen.

VI. If an engineer has been assigned for the project, the following events would take place:

1. The engineer would contact the customer and set up a time to visit the site. If the customer contacts an engineer directly; the engineer would generate CSR on the WMA database.

2. The engineer would establish the design needs which require one or more of the following actions:
   A. If a survey is needed, the engineer could perform the necessary surveying tasks, subcontract the job to an outside vender, or request assistance from the County Surveyor.
   B. If a South West Florida Water Management District (SWFWMD) or FDEP permits or exemptions are needed, the engineer would make the necessary contacts.
   C. If the problem is larger than the scope of complexity handled within the agency, it may be contracted out under:
I. A committee of three may award professional services costing under $25,000.00, to a Technical Advisor.

II. Professional Services over $25,000.00 would require a request for proposal and would be reviewed by the County Professional Services Review Committee (PSRC).

D. Provide status reports to the customer.
E. Create design plans for "in house" staff or contract to do work.

VII. A foreman would then receive the assigned Work-Order from the engineer or the Senior Secretary and the following events will take place:

1. The foreman would evaluate the amount of work needed to solve the problem.

2. The foreman would adjust the priority of the project, with possible direction from the Division Manager.

3. The foreman must schedule the project within the current workload and enter the information in the WMA database.

4. The Maintenance Coordinator (MC*) would perform weekly checks of the database and notify the complainant of the construction schedule.

5. The MC would monitor the "Scheduled" due date for construction to start on weekly bases. The WMA program would alert the MC 10 calendar-days prior to the scheduled starting date of construction.

6. If the construction schedule required adjustment, the MC would contact and inform the affected citizen of the delay no later than 3 days before the initial scheduled start date of construction. The capability of the WMA program to alert the MC of the nearing of the construction date would help keep the citizen informed ahead of the construction schedule.

7. The necessary work is then performed.

VIII. Once a work order is completed, the foreman informs the MC of the conclusion of the project. The MC would enter the information into the database and that would inform the Customer Service Representative. The Customer Service Representative would then perform the following tasks:
1. Contacts the customer and informs them of the completion of the project. The Customer Service Representative member would also inform the complainant to look for the performance survey in the mail. If the project originated with the BCC or Administration, a Customer Service Representative would notify them of the scope of work and completion date.

2. The Customer Service Representative would then perform a final entry in the WMA computer program, mail out the customer survey, and file the CSR.

3. The survey, if returned, is then documented in the WMA system.

IX. Extreme Events:

The above procedure and series of events may not function adequately during extraordinary events, such as El Nino. Many CSR’s would be handled through an open work order. During an extreme storm, and as declared by the BCC, documentation of accomplished work would be on Federal Emergency Management Agency (FEMA) forms. This tracking is required for possible reimbursement and can be converted to information entered into work-order forms, if necessary.

(*) The Maintenance Coordinator will perform the following tasks:

1. Conduct the necessary public relations activities to keep citizens informed of the status of their requests.
2. Coordinate with the foremen and engineers on CSR status, priorities, and scheduling of projects.
3. Report to the Division Managers on the status of progress in request resolutions through coordination with the IRT tem, Senior Secretary, Engineers, and the Foremen.
4. Assist in equipment scheduling to minimize down time.
5. Assist Staff of the Monthly and Annual Reports.
7. Assist in Budget preparations.

Section VII B Causes of Deterioration

Definition
Deterioration is a loss of function, or functional characteristic, of an essential element of the SEU stormwater management infrastructure. While Drainage Operations—activities include structure operation for stormwater management, especially during flooding situations, the majority of maintenance activities are directed at coping with infrastructure deterioration. Through Routine Maintenance, it is possible to maximize the useful life of the infrastructure. Through Extraordinary (Reactive) Maintenance, it is possible to restore a lost or reduced function of an element of the infrastructure.

**Causes**

There are many different factors that contribute to Infrastructure Deterioration and that are beyond the control of the County. These are summarized below.

**Corrosion**

All common construction materials corrode or lose material due to chemical interaction with the environment. Some materials appear to last longer than others. Corrugated metal culvert pipes are especially susceptible to corrosion, even if galvanized and coated with asphalt, especially in well-aerated water that contains dissolved salt. This condition is very common near the coastline of Sarasota County. The most common corrosion of steel pipes is in the wet-dry and splash zones (i.e., mostly on the top and side of the pipe). Corrosion is often seen before it becomes so serious a problem that the culvert pipe collapses. Sometimes the corrosion happens behind a coating or on the soil side of the pipe and goes unseen until collapse happens.

Mechanical systems, such as pumps, electrical controls, in addition to common construction materials, such as culverts, are susceptible to galvanic or induced electric current corrosion. Small differences in the chemistry of the soil, water, or deposited salts can considerably accelerate the corrosion rate. Pump impellers, for example, are particularly susceptible to saltwater corrosion. As it happens, very tiny changes in pump impeller dimensions greatly affects the capacity of the pump to move water.

**Fatigue**

Fatigue is a weakening of a material from repeated, cyclic application of a load. This is very common with roadway cross drains that are subject to frequent, high wheel loads (i.e., along well-traveled roads and shallow culverts). There are very few external, warning signs of fatigue. When the strength of the culvert has gotten sufficiently low, it simply collapses without any advance warning.

**Wear**

Structural components, such as operable slide gates, wear due to friction and abrasion during
operations. Mechanical systems such as stormwater pumps are subject to abrasion from the suspended matter in stormwater. Consistent with the need to minimize wear and to minimize the amount of oil and grease that enters stormwater runoff, it is necessary to periodically lubricate structures and test the operation of mechanical systems such as pumps.

**Erosion and Sedimentation**

Erosion and sedimentation are opposite sides of the same coin. Erosion is the removal of material (in this case, soil) while sedimentation is its movement and deposition at a different location. All land areas, including streams, erode and deposit in varying amounts. When the amount of soil that moves into a stream reach equals the amount that moves out of the reach, the reach is in equilibrium.

The ideal situation is an equilibrium channel configuration that also meets stormwater level of service criteria, environmental permit requirements, and navigational requirement, if any. Simply removing sedimentation can actually accelerate channel erosion by upsetting the equilibrium between erosion and sedimentation. Therefore, it is necessary to manage erosion at the same time as removing sedimentation.

The capability of a channel to convey water is directly related to the channel geometry (i.e., depth, width, side slopes, and bed slope) and to the type of material that lines the sides and bottom (i.e., soil, grass, concrete, etc.).

Erosion happens throughout a drainage basin as a result of natural conditions and constructed alterations. In engineering, this is commonly expressed in the form of the Uniform Soil Loss Equation which relates erosion rate in a basin or watershed to soil types, land slope, land use practices, erosion control practices, rainfall patterns, and similar factors. The County cannot control the majority of the factors that influence erosion, beyond the physical conditions in the drainage canals themselves. Therefore, the erosion rate within a given watershed can change over time and without warning, producing an increase in the sedimentation rate in the channel.

The Drainage Operations Division has an active erosion management program in place. Vegetation management, including mowing, hand-cutting, and a reduction in herbicide application, are major components of the bank and channel erosion management program in Sarasota County. Bank and channel stabilization (i.e., concrete slabs, riprap, articulated blocks and mats, etc.) and hard-lining are constructed in problem areas and are inspected as a part of the mowing program. When damaged areas are discovered, repairs are scheduled.

Additionally, the County is constructing stormwater management areas that will also assist with erosion and sedimentation management. The Celery Fields project is one such example that is expected to reduce the sediment being discharged downstream and, thereby, reduce the rate of deposition in the downstream channels.

**Unanticipated Structural Damage**
When mowing, running over unseen gullies can cause the mower deck to scalpel the grass, exposing bare soil to rainfall or flowing water. Guards are being installed on the mowing decks to minimize this problem.

Sometimes a culvert may have a heavier load placed over it than it was designed to support. The culvert may settle or move, or it may open up a gap at the joints between pipe sections, or it could fracture and collapse. Also, soil conditions may be such that differential settlement happens over a long period of time.

Collapse of culvert pipes or sewer lines that did not apparently have adequate bedding or cover are common. When this happens, repairs are programmed as soon as practical.

**Fouling**

Fouling happens when biological growth, such as algae or barnacles, coats, covers, or blocks a structure and reduces its effectiveness. Continued monitoring and Routine Maintenance minimize the risk from fouling. The public is encouraged to avoid using the canals to dispose of yard waste and trimmings, that can decompose and provide nutrients to encourage biological growth.

**Junk and Debris Removal**

Even with a continuing public education program to not dispose of junk and debris in the canals, it is necessary to frequently remove junk and debris to prevent it moving through the system as flotsam and possibly blocking culverts and water management structures. Removing junk and debris also removes habitat opportunities for undesirable wildlife.

**Latent or Hidden Defects**

Some of these problems happen as the result of latent defects showing up some time after the initial construction. Latent defects can come from either the original construction material having a small, undetected flaw, or from poor quality control during the fabrication or installation of the construction materials.

Testing is underway to determine the extend and severity of the problem with poor quality installations. As areas are identified, repairs are programmed as soon as practical or, if failure does not seem immediate, monitor their condition.
Section VIII B System Life-cycle Cost

The system life-cycle cost approach recognizes that the cost of infrastructure consists of various components, such as the following:

- Initial construction cost
- Periodic maintenance cost
- Rehabilitation cost
- Replacement cost
- Historic trends in the value of goods and services

The general notion, of life-cycle cost, is important to consider when designing a maintenance program. For example, the general trend is for routine maintenance costs to drop, after a major rehabilitation or repair (i.e., extraordinary maintenance). Being lowest immediately after initial construction is also common for such costs.

Historic trends are generally for increasing costs. This is due to several factors such as the following:

- Inflation B for example, in cost of money, materials, and labor
- System aging B requiring more effort to achieve the same performance (i.e., level of service)
- Technological enhancements B consider increases in performance made possible by new materials, methods, or systems
- Changing regulatory requirements B such as, requiring aquatic weed control when not an original project requirement
- Adding functional requirements B for example, adding a public boat ramp where there was none before
- Increased or enhanced performance standards B such as, adding flood management (such as increased level of service (LOS) definition) to an agricultural drainage project.
The Drainage Operations Division keeps records on their activities as related to the SEU Stormwater Management Infrastructure. Some of these records are required by permit. Other data help to form the basis for prioritizing routine maintenance activities. Still other data form an experience basis during the annual budget process.

These records include information on:

- Initial construction (as-built or record drawings and specifications)
- Environmental permits
- Customer service requests
- Service work orders, purchase orders, and contracts (for services)
- Periodic condition assessment
- Functional evaluation or testing
- Structural evaluation or testing
Section X B Coordination with FEMA FIA=s CRS Program

Background

The Federal Emergency Management Agency (FEMA) promotes community-level management of emergencies (such as: flooding, windstorm, etc.). A separate initiative within FEMA, called the Flood Insurance Administration (FIA), administers the national flood insurance program. Communities are rated for insurance purposes using the Community Rating System (CRS).

The CRS program encourages communities to undertake 18 different activities that FEMA recognizes as methods to reduce hazard (in this case, flood) damages. These activities are organized into creditable activities that include:

- Public Information,
- Mapping and Regulation,
- Flood Damage Reduction, and
- Flood Preparedness.

Maintenance of the stormwater management system (FEMA calls this the drainage system) is a creditable activity under the CRS program.

CRS Program Coordination

Sarasota County Drainage Operations is primarily responsible for several tasks under the FEMA heading of Activity 540, Drainage System Maintenance. The following is an abbreviated response, item by item, to the Drainage System Maintenance Program requirements. In some cases, reference is made to other sections of this document. The terminology comes from the CRS Coordinator=s Manual.

Activity 540, Drainage System Maintenance

a. Channel and basin Debris Removal (CDR)

1. Inspections of the system are conducted at least once a year. The tables in Exhibits AF, AG, AH, and AK through AQ identify the specific extent of the drainage system and, in many cases, specifically identify the items inspected. If not otherwise mentioned, an informal schedule is followed that results in a minimum of one visitation during a year. Storm events in Sarasota County are frequent, especially during the wet season from May through November. Whenever unusually prolonged
rain events happen, or potentially damaging single rainfall events occur, it is normal to visually inspect the primary drainage system to check for debris and flotsam blockages, structural failures, or erosion failures. Any observed deficiencies are reported and programmed for maintenance response.

An important component of the Drainage Operations services relating to this CRS activity is the Customer Service Request. Any citizen may report any concern with the drainage system, including channel and basin debris removal. All Customer Service Requests are assigned to a staff member to investigate and respond within three days of receipt.

If an inspection identifies a need for maintenance, repair, or rehabilitation, the problem is reported and evaluated for both inclusion in the routine or extraordinary maintenance programs. If the problem is in a basin that has not yet been improved, the condition is reported to the Stormwater and Environmental Utility staff, and the feasibility of interim repairs is considered. In these ways, any identified maintenance need receives an appropriate response.

2. Drainage Operations maintains lists, both informally and formally, of problem structures or areas. These areas receive frequent monitoring during prolonged or intense rainfall events to ensure that flooding can be kept as minimal as feasible.

3. The Stormwater and Environmental Utility has an ongoing, capital improvements program (CIP) that funds improvements to the drainage system. Program management of the SEU CIP is outside the Drainage Operations Division authority.

b. 1. Sarasota County has regulations that prohibit in-stream dumping of yard and industrial debris.

2. Literature on this subject, that comes from the SEU and other organizations, is distributed. Storm drain markers and area maps are distributed to voluntary groups. Regulations are explained to citizens when inspecting Customer Service Requests, if appropriate to the reported problem. Otherwise, public information programs are handled by the Stormwater and Environmental Utility staff.

c. Sarasota County has regulations protecting coastal areas from activities that can accelerate erosion. The State of Florida also has the Coastal Zone Protection Program. Drainage Operations does not specifically manage coastal erosion protection
maintenance programs, unless damage is found to adversely impact freshwater discharges from the drainage system.

**Impact Adjustment Credit**

Drainage Operations= authority and responsibility extends to the entire jurisdictional area of the Stormwater and Environmental Utility. Undeveloped areas deliberately receive less frequent maintenance than the developed and populated areas. Maintenance is not improvement. Where the basin CIP program is not yet complete, the existing system is maintained to its most feasible condition until such time as it can be repaired or rehabilitated.

**Activity 540 Documentation**

1. **Responsibility.** Exhibit AA= describes the Drainage Operations Organization. Responsibility for SEU drainage system maintenance rests with the Drainage Operations Manager, Mr. James N. Somers, P.E. As shown on the organization chart, the Drainage Operations Manager may delegate responsibility and authority to subordinates, for specific maintenance or inspection activities.

2. **Description of Community= s Drainage System.** The Strategic Plan document of the Stormwater and Environmental Utility includes a description of the complete, jurisdictional drainage system. Exhibits AF, AG, AH, and AK through AQ include additional, specific description of the maintained portions of the total area served by the SEU.

3. **Inspection Processes.** Copies of inspection and customer service request forms are kept in Drainage Operations= files, and are available for examination. A narrative description of the inspection program is given previously in this section.

4. **Debris Removal Procedures.** Procedure descriptions are maintained in Drainage Operations= records, and are available for examination.

5. **Records.** The records that document inspections and debris removal are kept in Drainage Operations= files, and are available for examination.
Section XI B  Stormwater Infrastructure Maintenance Issues

Acceptance of Aging Stormwater Systems for Maintenance

Recent new land developments, that have had their stormwater management and drainage systems transferred to the County for operation and maintenance, have shown unexpected evidence of accelerated aging. For example, Lockwood Ridge Road (opened in 1989) has drainage culverts, etc., that are already in a highly aged state and appear to be beyond their expected design life.

Use of Stormwater Infrastructure Beyond Design Service Life

This is particularly an issue for culverts and bridge-culverts where long-term contact with soil and water can cause deterioration (see Section IV). Also, changes in climate and environmental conditions can alter the rate of deterioration. For example, the Florida Department of Transportation suggests the following design service life (i.e., average years to perforation), under ideal conditions (no chemical attack, no galvanic or induced electric current corrosion, no mechanical damage, abrasion, etc.), for 16-gage (gauge), galvanized, steel culvert pipe:

\[
\begin{align*}
\text{With soil-water acidity of 7.0 (pH) and resistivity of 50,000 (ohm/cm)} & \quad 50 \text{ years} \\
\text{With soil-water acidity of 6.0 (pH) and resistivity of 3,000 (ohm/cm)} & \quad 20 \text{ years}
\end{align*}
\]

For comparison, typical values for seawater are an acidity of 8.0 (pH) and resistivity of a few hundred ohm/cm. Solutions with a pH of 7.0 are considered neutral; 6.0 pH is acidic; and, 8.0 pH is alkaline. Solutions with a low resistivity have a higher concentration of dissolved salts (dissolved salts conduct electricity and result in lower resistivity values). The above figures follow common sense where one expects to see more deterioration when the pipe is in an environment that is either acid or salty or both.

Public Access and Risk

It seems logical to permit public access to the public right-of-way associated with the SEU stormwater system. Normal and adequate, routine maintenance that meets the stormwater level of service requirements may still have minor gullies, woody vegetation cut off near ground level (but, protruding above ground), steep channel side-slopes, deep water pools in channel, and other physical hazards. In addition, the public have a tendency to modify the public right-of-way for their convenience (such as adding a platform to sit or stand on while fishing, etc.), which creates hazards for work crews and equipment.

Public Perception
Each person (i.e., public) has their own perception about what is an acceptable level of maintenance. Many understand that the canals can look somewhat rough and not have any loss of conveyance capacity (that is, they will provide the design stormwater level of service). Many Customer Service Requests come from individuals who clearly state that they expect the SEU canals to be a visual and architectural amenity to their property.

**Inadequate Access for Crews and Equipment**

Many areas of the SEU stormwater management facilities lack access suitable for the safe passage of crews and equipment. In some cases, crews and small tools for hand-clearing are used when equipment would be much more efficient and cost-effective. Where it is possible to locate a willing land owner, a permanent maintenance easement is secured if at no cost to the County. However, there are several areas where this has not been possible and some areas where effective maintenance is virtually impossible.

**Technological Innovation**

It is important to continue to look for ways to improve the service to customers. For example, as a direct result of experience with metal pipe corrosion and deterioration, only reinforced concrete or high-density polyethylene (HDPE) culvert pipes, or similar long service life materials, are being used on County projects.

**Public Policy and Regulatory Changes**

Public policy and regulatory changes, in the form of unfunded mandates, will continue to be issues affecting SEU stormwater system maintenance. There are also opportunities for improved efficiency through changes in public policy, rules, regulations, and laws in Sarasota County. An example of the latter is the ordinance, being drafted, that would allow maintenance of a stormwater management system on private property if the private property owner failed to adequately maintain the private system such that it caused or could cause damage to adjacent properties or the SEU system, and allow collecting the reasonable cost of such maintenance from the property owner.

The new interlocal agreement between the City of Sarasota and the County, will allow for maintenance activity to cross municipal boundaries, will go a long way towards ensuring complete and adequate maintenance on a system-wide level.

**Primary Versus Secondary Drainage Systems**
A primary drainage system is the canal or culvert pipe that drains a whole basin or watershed to a main system. A secondary drainage system conveys water to the primary system. Main systems discharge to a receiving body such as Sarasota Bay. All drainage systems are branched, to greater or lesser degrees, like a tree. In that case, the trunk as the main system, the central trunk, and some large limbs, as the primary drainage system, and the branches and twigs make up the secondary drainage system.

A failure in a primary drainage system will cause deep and prolonged flooding to a large portion of the basin or watershed. On the other hand, a failure in a secondary drainage system may cause flooding, but usually only of a shallow or intermittent nature, and very localized.

Because of resource limitations, smaller, secondary drainage systems such as side and back lot-line swales are not maintained. Additionally, in accordance with Ordinance 84-05, individual driveway culverts are the responsibility of the property owner.

**Repair, Replacement, and Rehabilitation of Existing Stormwater Systems**

In response to Customer Service Requests, repair, replacement, and rehabilitation projects are handled as extraordinary maintenance. However, doing so often places demands on a fiscal year=s budget, in terms of both dollars and staff time, resulting in scheduling problems for the remaining routine maintenance activities.

**Dollar Limits on Repair and Rehabilitation Projects**

Extraordinary maintenance, frequently consisting of wholesale replacement of aging stormwater systems or required by inspection during a customer service request, results in unanticipated demand on SEU maintenance capacity (e.g., limits placed by available funding). To ensure effective and prompt response, there should not be any dollar limit, other than available funding, placed on a repair and rehabilitation project.

An annual action plan will be developed by staff that identifies plans and activities.
Exhibit A

Public Works Business Center, Operations & Maintenance/Drainage (organization)
Exhibit B

Sarasota County, Florida, 094-066,
Stormwater Ordinance
Exhibit C

Contract No. 98-359, Interlocal Agreement Between Sarasota County and The City of Sarasota Regarding Total Consolidation of Stormwater Management
Exhibit D

Ordinance No. 84-05, An Ordinance of The County of Sarasota, Florida, relating to maintenance, repair, replacement or demolition of existing structures or improvements in County rights of way that specially benefit abutting property within the unincorporated area, ...
Exhibit E

Ordinance No. 99-050, An Ordinance of Sarasota County, Florida, to be named the private stormwater conveyance maintenance ordinance, ...
Exhibit F

Canal Inventory Width, Length and Acres
Exhibit G

Roadside Ditches for Sarasota County
Exhibit H

Sarasota County Drainage Structures
Exhibit I

Year 2000 Equipment Drainage Operations
Exhibit J

Five Year Pipe Replacement Program
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<th>Line</th>
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Sub-total, Countywide 63,455.5

CITY OF SARASOTA

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Grand Total, Countywide & City 75,968' 14.4 miles
Exhibit K

City of Sarasota Retention Pond Mowing
Exhibit M

Sarasota County Retention/Detention Pond Mowing
Exhibit N

City of Sarasota Retention Pond Herbicide Treatment
Exhibit O

Florida Department of Transportation
Herbicide Treatment
Exhibit P

Sarasota County Retention/Detention Pond
Herbicide Treatment
Exhibit Q

County Owned and Maintained Lake Inventory