EAST CAROLINA UNIVERSITY

Stormwater Sewer System

Utility Condition Assessment

April 26, 2017

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UTILITY CONDITION ASSESSMENT

SECTION 1

OVERVIEW

OVERVIEW

Introduction

The Brody School of Medicine at East Carolina University (ECU) is on the Health Sciences Campus (HSC) located west of downtown Greenville. It was started in the late 1970s/early 1980s and has grown dramatically since then. The south side of campus is relatively flat, and there is a gradual downslope to the north.

The HSC has multiple means of addressing stormwater runoff. Stormwater from facilities along Moye Boulevard and some on Arlington Boulevard typically discharges to city-owned drains and basins along the street right-of-way and is then transported via city-owned lines. In the middle of the medical campus, stormwater runoff flows to the north towards Lake Laupus and to the northwest towards the stormwater retention pond northwest of the Dental School. From these surface water collection points, the stormwater has controlled discharges into the small open channel north of Lake Laupus and to the Schoolhouse Branch, respectively, and both subsequently discharge to the Tar River.

The campus grounds are between about 75 feet (Brody Building) and 25 feet above sea level (retention pond northwest of the Dental School) in an area of slightly sloping coastal plain upland from the Tar River floodplain. Due to the relative location of the university to the ocean and the semitropical coastal environment, minor and major rainfall events occur regularly throughout the year. The annual precipitation for this area is around 49 inches, including an average of 2 to 3 inches of snow. As a result of the sometimes significant rainfall events in this area, the campus infrastructure and hardscape structures are subject to severe moisture and dampness, which results in metallic corrosion and severe settling of concrete structures from the saturated soils.

The stormwater sewer system at the HSC is in good operating condition. Original construction began around 1980, and all of the lines are typically first-time installations, not replacements of previously existing lines. The system consists of over 34,600 linear feet of drain line that is mostly concrete construction. Over 10,300 linear feet of this drain line is large 24 to 66 inch main outfall lines with the remaining 24,350 linear feet collection and service lateral sized lines 4 to 18 inches in diameter. Additional stormwater site components include the approximately 266 stormwater catch basins and drop inlets, and the estimated 75 stormwater manholes of various depths.

Costs Overview

Current Replacement Value

The estimated cost in current dollars to replace the stormwater sewer system is $7,750,000. This is not a construction estimate or a detailed take-off but rather an estimate of replacement with like components. It does not include any ejector pumps or pumped sumps within the individual buildings previously inspected by ISES, which were covered in the individual Facility Condition Assessment reports for those buildings.

Total Renewal Costs

Since the drain lines are well within their lifecycles and no problems have been indicated, no lifecycle replacement of linear assets is recommended. The recommendations consist of improving drainage to the west and northwest of the new Student Center, replacing a manhole, and dredging Lake Laupus to restore capacity and improve water quality. The recommended renewal costs for the stormwater sewer system total $432,010.

Methodology

Data collected during inspections on March 8 and 9, 2017, have been used to generate this utility infrastructure report. The goal was to produce a single campuswide report with recommendations developed by ISES engineers. The assessments and estimates are based solely on visual and nondestructive observations, discussions with university personnel, and a review of existing drawings and previous engineering reports, such as the September, 2014 *HSC Utilities Master Plan, Phase Two, Sanitary Sewer and Storm Sewer System Evaluation* report by Rivers and Associates, Inc., and its January, 2016 amendment. Nonstandard and/or additional inspection procedures and methods, along with engineering design support, may be necessary to fully define the specific costs and scope to renew various infrastructure utility asset components.

Stormwater Sewer System General Description

The stormwater sewer system is a collection and conveyance system. Surface water runoff collecting on paved areas drains into storm sewer catch basins and drop inlets normally at street corners, curb and gutter lines, and parking lots. Rainfall on landscaped areas is channeled around campus utilizing grassed swales that typically lead to subsurface drainage structures. Stormwater is the rainfall runoff that flows across the ground and pavement that must be controlled to eliminate soil erosion and potential flooding of low-lying areas and facilities. Catch basins and drop inlets on the surface are connected to a series of underground sewer collection pipes that convey the discharge to nearby open channels and/or larger city-owned outfall lines and culverts.

As stormwater recedes, the leaves, sediment, and debris transported during a storm settle in catch basins and sewer lines, reducing the overall capacity of the system. Stormwater can also pick up chemicals and other pollutants as it flows across streets, curbs, and gutters and can erode ditches, grass ways, or stream banks. The debris-laden or polluted runoff is commonly transported to municipal separate storm sewer systems (MS4s) and ultimately discharged into local streams, lakes, and coastal marshlands without treatment. The National Pollution Discharge Elimination System (NPDES) is the federal program through which discharges to streams and other surface water bodies, as well as groundwater, are regulated.

Stormwater systems should be checked routinely, debris removed, and lines flushed as necessary to maintain a properly functioning network. The university appears to be in compliance with the requirements of the MS4 federal EPA and state programs for stormwater management. An emphasis on good housekeeping and general pollution prevention was observed on the campus. The purpose of the regulatory program is to promote health, safety, and welfare within the university and its watershed by minimizing harm to the environment caused by stormwater from the campus.

Mitigation for any projected changes in stormwater runoff quantity and quality will be achieved through the incorporation of best management practices (BMP) in stormwater management. Any areas for new building construction or expansion will have to be controlled within the total stormwater master plan to discharge that area at controlled rates.

Approach to Lifecycle Calculation

Each component of the stormwater sewer system has a quantifiable industry standard expected lifecycle. Information related to system performance was reviewed to determine trends that might affect that lifecycle and the future safety, reliability, and efficiency of the system. The table below shows the expected useful, reliable life of typical stormwater management system components.

Table 1: Average Expected Useful Life

COMPONENT	TYPE	USEFUL LIFE (YEARS)
Storm drain pipe	Concrete	100
Storm drain pipe	Terra cotta clay	75
Storm drain pipe	Ductile iron	50
Storm drain pipe	Corrugated metal	45
Manhole	Concrete	100
Manhole	Brick masonry	75
Catch basin/drop Inlet	Concrete	100
Catch basin/drop Inlet	Brick masonry	75
Combo drain	Concrete	100
Combo drain	Brick masonry	75

Source Data: ASHRAE, BOMA, Hartford Ins. Co., ISES Database

The realization of the full expected useful life preserves the original capital investment strategy while accelerated depreciation results in premature expenditure of resources. It should be emphasized that expected useful life values are averaged forecasts based on components that are properly maintained and operated without frequent and/or severe operating conditions. Chronological age is not the primary determinant of service life. In many instances, there is ample evidence of components operating well beyond predicted useful life values. This is why it is important to modify these values based on actual conditions, service history, operating conditions, installation environment, and actual field performance.

In addition, system components reaching the predicted endpoint of expected useful life do not necessarily cease to function. What does occur is a downward trend toward loss of service reliability, a potential increase in maintenance costs, and damage caused by stormwater flooding.

It is important to note that utility infrastructure assets normally encompass more than just a single component and will, in most situations, represent a section or group of materials, i.e. linear footage of installed piping systems. The majority of these systems will continue to operate reliably and safely beyond the ten-year planning horizon of this assessment. However, beyond the next ten years, it will be necessary to reinspect the systems to ensure that they continue to operate reliably.

UTILITY CONDITION ASSESSMENT

SECTION 2

SYSTEM FINDINGS

SYSTEM FINDINGS

Description

Originally installed in the early 1980s, the stormwater sewer system has been modified as new construction has taken place. The campus system is made up of two watersheds – the eastern watershed that collects and flows north to discharge into Lake Laupus and a western watershed that collects and flows northwest, discharging into the retention pond to the northwest of the Dental School. Lake Laupus has a manmade damn with a weir to control flow from the lake, which passes through two city-owned 60-inch pipes under Fifth Street before discharging into an open channel that feeds a tributary of Schoolhouse Branch. The retention pond at the northwest corner of the developed campus has a controlled outlet that allows flow directly to the Schoolhouse Branch, which subsequently flows to the eastern flowing Tar River farther to the north.

There are approximately 6.7 miles of buried stormwater sewer lines of varying ages, material composition, and sizes on campus. The larger diameter main lines are generally precast concrete, while the small service collection lines may be the original concrete or PVC. The following table is an estimate of the stormwater pipe that serves the HSC.

Table 2: Summary of Stormwater Sewer System Components

MATERIALS	QUANTITY	UNITS	ESTIMATED INSTALL DATE
6 INCH PIPE	2,000	LINEAR FEET	1980-2010
8 INCH PIPE	2,000	LINEAR FEET	1980-2010
10 INCH PIPE	2,100	LINEAR FEET	1980-2010
12 INCH PIPE	2,965	LINEAR FEET	1980-2010
15 INCH PIPE	8,915	LINEAR FEET	1980-2010
18 INCH PIPE	6,365	LINEAR FEET	1980-2010
24 INCH PIPE	2,845	LINEAR FEET	1980-2010
30 INCH PIPE	1,620	LINEAR FEET	1980-2010
36 INCH PIPE	2,270	LINEAR FEET	1980-2010
42 INCH PIPE	1,200	LINEAR FEET	1980-2010
48 INCH PIPE	270	LINEAR FEET	1980-2010
60 INCH PIPE	895	LINEAR FEET	1980-2010
66 INCH PIPE	1,230	LINEAR FEET	1980-2010
MANHOLES 0-5’ DEPTH	24	EACH	1980-2010
MANHOLES 5-10’ DEPTH	35	EACH	1980-2010
MANHOLES 10-15’DEPTH	10	EACH	1980-2010
MANHOLES 15-20’ DEPTH	1	EACH	1980-2010

MATERIALS	QUANTITY	UNITS	ESTIMATED INSTALL DATE
CONCRETE COMBO DRAIN	266	EACH	1980-2010

The stormwater sewer system is in overall good condition, due in great measure to the operating age of the majority of the system. All of the stormwater lines were installed around 1980 or later, making the stormwater lines about 38 years old or younger. None of the installed lines or subsurface structures are nearing the end of their expected service life, and there is no root intrusion or a significant accumulation of deferred maintenance. Only a few corrective action projects have been recommended to address some issues that were observed.

Recommendations

Lake Laupus should be dredged out at least once every ten years or so to maintain the original design capacity of this manmade stormwater retention lake and maintain the concrete outlet and control structures. The lake was dredged about four to five years ago, and it is anticipated that it will require dredging in another five to six years.

Based on a recommendation by the medical campus facility staff, it is proposed that a larger stormwater manhole or underground vault be constructed to capture the undesired and nonstandard building stormwater service tap that intersects the main pipe outside of the nearest manhole.

The September 2014 HSC Utility Master Plan Phase Two report concluded that the stormwater sewer on the east side of campus had sufficient capacity and was operating properly, suggesting no present concerns or future issues with capacity as the campus grows. Analysis of the west side of campus indicates that the network is mostly sufficient in capacity for current and future conditions. However, based on computer modeling, it appears that stormwater collection lines to the west and northwest of the new Student Center are insufficient to provide the necessary capacity to support future growth planned for that area of campus. Based on the Rivers report, an additional 18 inch stormwater collection line should be installed to alleviate the potential problem area.

It is a good policy and a recommendation of this report to develop and conduct a preventative maintenance program for the stormwater sewer system. As the system continues to age with respect to operating life, elevated levels of preventive maintenance should be applied to ensure continued operating reliability.

A typical preventative maintenance program for stormwater inlets and outlets includes:

- Inspect and remove debris/litter as necessary
- Inspect for structural repairs and concrete headwall deterioration

- Inspect for erosion issues, filling eroded areas and re-sodding or replanting vegetation and replacing riprap that has washed away
- Unplug or replace damaged screens and/or grates
- Inspect for and reduce potential mosquito breeding habitats

There are numerous catch basins, drop inlets, and curb drains around campus. Some are in natural and/or heavily landscaped areas with well-developed vegetation. As a result, these collection inlets have the potential to clog with vegetative debris and may cause localized flooding. There are also several locations where the collected stormwater is discharged through a pipe outlet to a surface swale or ditch or to a stormwater pond or lake on campus. These areas sometimes erode due to the quantity or velocity of flow from the pipe unless properly protected with riprap or some other laminar flow dissipater. Clean any clogged or partially obstructed inlets, and inspect pipe discharge points to mitigate any erosion. Also make any needed miscellaneous structural or concrete repairs, including replacing broken storm grates and inlet covers and securing both existing and new grates with an adequate concrete collar.

It is believed that some of the stormwater sewer lines may have been previously inspected with closed circuit television (CCTV) cameras. Based on the relatively young age of the stormwater collection lines and the good condition of the buried assets, it is not anticipated that the network will need wholesale jetwashing and videotaping over the next ten years. However, it is recommended that any built-up debris or sediment discovered in the lines and/or basins be jetwashed to ensure that the pipes have the maximum flow capacity available to handle peak flow demand.

SECTION 3

CONDITION ASSESSMENT DEFINITIONS

CONDITION ASSESSMENT DEFINITIONS

The following information is a clarification of the Asset Report using example definitions.

Material and Labor Cost Factors and Additional Markups

The database contains an R. S. Means City Cost Index for material and labor cost factors to adjust the project costs from the national averages to reflect conditions in Greenville. The percentage adjustment of the national average is shown below. Typical general contractor fees (which could include profit, overhead, bonds, and insurance) and professional fees (architect or engineer design fees and in-house design costs) are also included. However, most of the project costs were provided by University personnel, so no mark-ups have been applied.

GLOBAL MARKUP	%
Local Labor Index	71.3
Local Materials Index	100.7
General Contractor Markup	20.0
Professional Fees	16.0

Recurring and Nonrecurring Renewal Costs

Renewal costs are divided into two main categories – recurring and nonrecurring. Recurring costs are cyclical and consist primarily of major repairs to or replacement/rebuilding of systems and components. The tool for projecting the recurring renewal costs is the Lifecycle Component Inventory, which is explained in detail below. Nonrecurring costs typically consist of modifications or repairs necessary to comply with code requirements or to address isolated, nonrecurring deficiencies that could negatively affect the systems and components. For these nonrecurring costs, projects have been developed and include estimated material and labor costs.

Recurring Costs

Asset Component Inventory and Cost Projections

The Asset Component Inventory is a list of major systems and components and is based on industry standard lifecycle expectancies. Each indicated component has the following associated information:

CATEGORY	DEFINITION
Uniformat Code	The standard Uniformat Code that applies to the component
Component Description	This line item describes the individual component
Identifier	Unique identifying information entered for a component as necessary
Quantity	The quantity of the listed component
Units	The unit of measure associated with the quantity
Unit Cost	The cost to replace each individual component unit (this cost is in today's dollars)
Complexity Adjustment	A factor utilize to adjust component replacement costs accordingly when it is anticipated that the actual cost will deviate from the average for that component
Total Cost	Unit cost multiplied by quantity, in today's dollars. Note that this is a one-time renewal/replacement cost
Install Date	Year that the component was or is estimated to have been installed. When this data is not available, it defaults to the year the asset was constructed
Life Expectancy	Average life expectancy for each individual component
Life Expectancy Adjustment	Utilized to adjust the first lifecycle of the component and to express when the next replacement should occur

The component listing forms the basis of the Recurring Component Renewal Schedule, which provides a year-by-year list of projected recurring renewal costs over the next ten years. Each individual component is assigned a replacement year based on lifecycles, and the costs for each item are in future year dollars. For items that are already past the end of their lifecycle, the replacement year is shown as Deferred Renewal.

Recurring Cost Classifications

- Deferred Renewal
  Recurring repairs, generated by the Asset Component Inventory, that are past due for completion but have not yet been accomplished as part of normal maintenance or capital repair efforts. Further deferral of such renewal could impair the proper functioning of the system. Estimated Deferred Renewal costs should include compliance with applicable codes, even if such compliance requires expenditures beyond those essential to effect the needed repairs.

- Projected Renewal
  Recurring renewal efforts, generated by the Asset Component Inventory, that will be due within

the scope of the assessment. These are regular or normal maintenance, repair, or renovation efforts that should be planned in the near future.

Nonrecurring Costs

As previously mentioned, modifications or repairs necessary to comply with code requirements and those that address isolated, nonrecurring deficiencies that could negatively affect the systems and components are not included in the Lifecycle Component Inventory. For each such deficiency, a project with an estimated cost to rectify said deficiency is recommended. These projects each have a unique number and are categorized by system type, priority, and classification, which are defined below. The costs in these projects are also indexed to local conditions and markups applied as the situation dictates.

Project Number

Each project has a unique number consisting of three elements, the asset identification number, system code, and a sequential number assigned by the FCA software. For example, the fourth electrical project identified for asset 0001 would have a project number of 0001EL04:

Example: Project Number 0001EL04		
0001	-	Asset Identification Number
EL	-	System Code (EL represents Electrical)
04	-	The next sequential number for an Electrical project

Project Classification

- Plant Adaption
  Nonrecurring expenditures required to adapt the physical plant to the evolving needs of the institution and to changing codes or standards. These are expenditures beyond normal maintenance. Examples include compliance with changing codes and improvements occasioned by the adoption of modern technology (e.g., the use of personal computer networks).

- Corrective Action
  Nonrecurring expenditures for repairs needed to correct random and unpredictable deficiencies. Such projects are not related to aligning a building with codes or standards. Deficiencies classified as Corrective Action could have an effect on utility safety or usability.

Priority Class

- Immediate

  Projects in this category require immediate action to:

  a. correct a cited safety hazard
  b. stop accelerated deterioration
  c. and/or return a facility to normal operation

- Critical

  Projects in this category include actions that must be addressed in the short-term:

  a. repairs to prevent further deterioration
  b. improvements to facilities associated with critical accessibility needs
  c. potential safety hazards

- Noncritical

  Projects in this category include:

  a. improvements to facilities associated with noncritical accessibility needs
  b. actions to bring a facility into compliance with current building codes
  c. actions to improve the usability of a facility following an occupancy or use change

Category Code

CATEGORY CODE*	SYSTEM DESCRIPTION
EL1A – EL8A	ELECTRICAL
HV1A – HV8B	HVAC
PL1A – PL5A	PLUMBING

**Refer to the Category Code Report starting on the following page.*

Example: Category Code = EL5A	
EL	System Description
5	Component Description
A	Element Description

Priority Sequence

A Priority Sequence number is automatically assigned to each project to rank the projects in order of relative criticality and show the recommended execution order. This number is calculated based on the Priority Class and identified system of each project.

Example:			
Priority Class	**Category Code**	**Project Number**	**Priority Sequence**
1	HV2C	0001HV04	01
2	PL1D	0001PL02	02
2	EL4C	0001EL03	03

CATEGORY CODE REPORT

PLUMBING			
CODE	**COMPONENT DESCRIPTION**	**ELEMENT DESCRIPTION**	**DEFINITION**
PL1A	Domestic Water	Piping Network	Repair or replacement of domestic water supply piping network, insulation, hangers, etc.
PL1B	Domestic Water	Pumps	Domestic water booster pumps, circulating pumps, related controls, etc.
PL1C	Domestic Water	Storage/ Treatment	Equipment or vessels for storage or treatment of domestic water.
PL1D	Domestic Water	Metering	Installation, repair, or replacement of water meters.
PL1E	Domestic Water	Heating	Domestic water heaters, including gas, oil, and electric water heaters, shell-and-tube heat exchangers, tank type, and instantaneous.
PL1F	Domestic Water	Cooling	Central systems for cooling and distributing drinking water.
PL1G	Domestic Water	Fixtures	Plumbing fixtures, including sinks, drinking fountains, water closets, urinals, etc.
PL1H	Domestic Water	Conservation	Alternations made to the water distribution system to conserve water.
PL1I	Domestic Water	Backflow Protection	Backflow protection devices, including backflow preventers, vacuum breakers, etc.
PL2A	Wastewater	Piping Network	Repair or replacement of building wastewater piping network.
PL2B	Wastewater	Pumps	Pump systems used to lift wastewater, including sewage ejectors and other sump systems.
PL3A	Special Systems	Process Gas/Fluids	Generation and/or distribution of process steam, compressed air, natural and LP gas, process water, vacuum, etc.
PL4A	Infrastructure	Potable Water Storage/ Treatment	Storage and treatment of potable water for distribution.
PL4B	Infrastructure	Industrial Water Distribution/ Treatment	Storage and treatment of industrial water for distribution.
PL4C	Infrastructure	Sanitary Water Collection	Sanitary water collection systems and sanitary sewer systems, including combined systems.
PL4D	Infrastructure	Stormwater Collection	Stormwater collection systems and storm sewer systems; stormwater only.
PL4E	Infrastructure	Potable Water Distribution	Potable water distribution network.
PL4F	Infrastructure	Wastewater Treatment	Wastewater treatment plants, associated equipment, etc.
PL5A	General	Other	Plumbing issues not categorized elsewhere.

SECTION 4

COST SUMMARIES AND TOTALS

RENEWAL COSTS MATRIX

All dollars shown as Present Value

CATEGORY	NONRECURRING PROJECT NEEDS			RECURRING COMPONENT REPLACEMENT NEEDS											
	Immediate	Critical	Noncritical	Deferred Renewal	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	TOTAL
ACCESSIBILITY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
EXTERIOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
INTERIOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
PLUMBING	0	72,874	359,136	0	0	0	0	0	0	0	0	0	0	0	$432,010
HVAC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
FIRE/LIFE SAFETY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
ELECTRICAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
SITE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
VERT. TRANS.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
HEALTH/EQUIP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$0
SUBTOTAL	$0	$72,874	$359,136	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$432,010
TOTAL NONRECURRING PROJECT NEEDS			$432,010	TOTAL RECURRING COMPONENT REPLACEMENT NEEDS										$0	

CURRENT REPLACEMENT VALUE	$7,750,000
FACILITY CONDITION NEEDS INDEX	0.06
FACILITY CONDITION INDEX	0.00

GSF	TOTAL 10-YEAR FACILITY RENEWAL NEEDS	10-YEAR NEEDS/SF
NA	$432,010	NA

FACILITIES RENEWAL PLAN

NONRECURRING PROJECT COSTS

All costs shown as Present Value

PROJECT NUMBER	PROJECT TITLE	UNI-FORMAT	PRIORITY CLASS	PROJECT CLASSIFICATION	PROJECT COST
STRMPL01	REPLACE MH OUTSIDE OF WARREN LIFE SCI WITH LARGER MH		2	Corrective Action	14,071
STRMPL02	INSTALL NEW 18" OUTFALL FROM BEHIND STUDENT LIFE BLDG		2	Plant Adaption	58,803
STRMPL03	DREDGE AND REHABILITATE LAKE LAUPUS		3	Corrective Action	359,136
				TOTAL	**$432,010**

SECTION 5

PROJECT DETAILS

All costs shown as Present Value

REPLACE MH OUTSIDE OF WARREN LIFE SCI WITH LARGER MH

Project Number:	STRMPL01	**Category Code:**	PL4C
Priority Sequence:	1		
Priority Class:	Critical	**System:**	PLUMBING
Project Class:	Corrective Action	**Component:**	INFRASTRUCTURE
Date Basis:	4/6/2017	**Element:**	SANITARY WATER COLLECTION

Code Application:	**Subclass/Savings:**	**Project Location:**
Not Applicable	Not Applicable	Item Only: Floor(s) S

Description

Based on a recommendation by the medical campus facility staff, it is proposed that a larger stormwater manhole or underground vault be constructed to capture the undesired and nonstandard building stormwater service tap that intersects the main pipe outside of the nearest manhole.

All costs shown as Present Value

Project Cost Estimate

Task Description	Unit	Qnty	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Total Cost
Construct new stormwater sewer manhole with reconnected lines	EA	1	$2,842	$2,842	$4,263	$4,263	$7,105
New lines	LF	20	$60.06	$1,201	$90.09	$1,802	$3,003
			Base Material/Labor Costs	**$4,043**		**$6,065**	
			Indexed Material/Labor Costs	**$4,043**		**$6,065**	**$10,108**
						General Contractor Mark Up at 20.0%	**$2,022**
						Original Construction Cost	**$12,130**
Date of Original Estimate:	4/6/2017					**Inflation**	**$0**
						Current Year Construction Cost	**$12,130**
						Professional Fees at 16.0%	**$1,941**
						TOTAL PROJECT COST	**$14,071**

All costs shown as Present Value

INSTALL NEW 18" OUTFALL FROM BEHIND STUDENT LIFE BLDG

Project Number:	STRMPL02
Priority Sequence:	2
Priority Class:	Critical
Project Class:	Plant Adaption
Date Basis:	4/6/2017

Category Code: PL4D

System:	PLUMBING
Component:	INFRASTRUCTURE
Element:	STORM WATER COLLECTION

Code Application:	Subclass/Savings:	Project Location:
Not Applicable	Not Applicable	Area Wide: Floor(s) S

Description

The September 2014 HSC Utilities Master Plan Phase Two report indicates that the drainage system for the area behind the new Student Life building and the area to the northwest of it does not have adequate capacity to support the projected campus development planned for this area. It is recommended that a new 18 inch outfall line (approximately 280 linear feet) that will discharge into stormwater catch basin E1.2.11 be installed to correct this inadequacy.

All costs shown as Present Value

Project Cost Estimate

Task Description	Unit	Qnty	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Total Cost
Install new 18 inch RCP stormwater outfall	LF	280	$60.35	$16,898	$90.52	$25,346	$42,244
			Base Material/Labor Costs	**$16,898**		**$25,346**	
			Indexed Material/Labor Costs	**$16,898**		**$25,346**	**$42,244**
						General Contractor Mark Up at 20.0%	**$8,449**
						Original Construction Cost	**$50,692**
Date of Original Estimate:	4/6/2017					**Inflation**	**$0**
						Current Year Construction Cost	**$50,692**
						Professional Fees at 16.0%	**$8,111**
						TOTAL PROJECT COST	**$58,803**

All costs shown as Present Value

DREDGE AND REHABILITATE LAKE LAUPUS

Project Number:	STRMPL03	**Category Code:**	PL4D
Priority Sequence:	3		
Priority Class:	Non-Critical	**System:**	PLUMBING
Project Class:	Corrective Action	**Component:**	INFRASTRUCTURE
Date Basis:	3/30/2017	**Element:**	STORM WATER COLLECTION

Code Application:	Subclass/Savings:	Project Location:
Not Applicable	Not Applicable	Area Wide: Floor(s) S

Description

Lake Laupus should be dredged out at least once every ten years or so to maintain the original design capacity of this manmade stormwater retention lake and maintain the concrete outlet and control structures. The lake was dredged about four to five years ago, and it is anticipated that it will require dredging in another five to six years.

All costs shown as Present Value

Project Cost Estimate

Task Description	Unit	Qnty	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Total Cost
Dredge Lake Laupus and properly dispose of dredge spoil	LOT	1	$150,000	$150,000	$150,000	$150,000	$300,000
Base Material/Labor Costs				**$150,000**		**$150,000**	
Indexed Material/Labor Costs				**$151,050**		**$106,950**	**$258,000**
General Contractor Mark Up at 20.0%							**$51,600**
Original Construction Cost							**$309,600**
Date of Original Estimate: 3/30/2017						**Inflation**	**$0**
Current Year Construction Cost							**$309,600**
Professional Fees at 16.0%							**$49,536**
TOTAL PROJECT COST							**$359,136**

SECTION 6

ASSET COMPONENT INVENTORY

ASSET COMPONENT INVENTORY

UNI-FORMAT	COMPONENT DESCRIPTION	IDENTIFIER	QTY	UNITS	UNIT COST	CMPLX ADJ	TOTAL COST	INSTALL DATE	USEFUL LIFE	USEFUL LIFE ADJ
G3020	PVC PIPE - 8" DIAMETER	BLDG & ROOF DRAINS	2,000	LF	$169.81		$339,624	2000	50	
G3020	PVC PIPE - 10" DIAMETER	BLDG & ROOF DRAINS	2,000	LF	$177.00		$354,008	2000	50	
G3030	CONCRETE MANHOLE - LESS THAN 5 FT DEEP - STORM SEWER		18	EA	$2,722.41		$49,003	1980	100	
G3030	CONCRETE MANHOLE - LESS THAN 5 FT DEEP - STORM SEWER		5	EA	$2,722.41		$13,612	2000	100	
G3030	CONCRETE MANHOLE - LESS THAN 5 FT DEEP - STORM SEWER		1	EA	$2,722.41		$2,722	2010	100	
G3030	CONCRETE MANHOLE - 5 TO 10 FT DEEP - STORM SEWER		23	EA	$5,488.57		$126,237	1980	100	
G3030	CONCRETE MANHOLE - 5 TO 10 FT DEEP - STORM SEWER		10	EA	$5,488.57		$54,886	2000	100	
G3030	CONCRETE MANHOLE - 5 TO 10 FT DEEP - STORM SEWER		2	EA	$5,488.57		$10,977	2010	100	
G3030	CONCRETE MANHOLE - 10 TO 15 FT DEEP - STORM SEWER		7	EA	$8,215.25		$57,507	1980	100	
G3030	CONCRETE MANHOLE - 10 TO 15 FT DEEP - STORM SEWER		1	EA	$8,215.25		$8,215	2000	100	
G3030	CONCRETE MANHOLE - 10 TO 15 FT DEEP - STORM SEWER		2	EA	$8,215.25		$16,430	2010	100	
G3030	CONCRETE MANHOLE - 15 TO 20 FT DEEP - STORM SEWER		6	EA	$11,330.37		$67,982	1980	100	
G3030	CONCRETE PIPE - 10" DIAMETER	CORRUGATED PLASTIC	100	LF	$162.26		$16,226	2000	100	
G3030	CONCRETE PIPE - 12" DIAMETER - STORM		355	LF	$169.31		$60,107	1980	100	
G3030	CONCRETE PIPE - 12" DIAMETER - STORM		2,525	LF	$169.31		$427,519	2000	100	

ASSET COMPONENT INVENTORY

UNI-FORMAT	COMPONENT DESCRIPTION	IDENTIFIER	QTY	UNITS	UNIT COST	CMPLX ADJ	TOTAL COST	INSTALL DATE	USEFUL LIFE	USEFUL LIFE ADJ
G3030	CONCRETE PIPE - 12" DIAMETER - STORM		25	LF	$169.31		$4,233	2010	100	
G3030	CONCRETE PIPE - 12" DIAMETER - STORM	CORRUGATED PLASTIC	60	LF	$169.31		$10,159	2000	100	
G3030	CONCRETE PIPE - 15" DIAMETER - STORM		6,375	LF	$173.61		$1,106,751	1980	100	
G3030	CONCRETE PIPE - 15" DIAMETER - STORM		2,285	LF	$173.61		$396,694	2000	100	
G3030	CONCRETE PIPE - 15" DIAMETER - STORM		255	LF	$173.61		$44,270	2010	100	
G3030	CONCRETE PIPE - 18" DIAMETER - STORM		2,660	LF	$178.48		$474,765	2000	100	
G3030	CONCRETE PIPE - 18" DIAMETER - STORM		310	LF	$178.48		$55,330	2010	100	
G3030	CONCRETE PIPE - 18" DIAMETER - STORM		3,395	LF	$178.48		$605,949	1980	100	
G3030	CONCRETE PIPE - 24" DIAMETER - STORM		445	LF	$193.01		$85,889	2000	100	
G3030	CONCRETE PIPE - 24" DIAMETER - STORM		2,400	LF	$193.01		$463,223	1980	100	
G3030	CONCRETE PIPE - 30" DIAMETER		940	LF	$197.53		$185,674	1980	100	
G3030	CONCRETE PIPE - 30" DIAMETER		680	LF	$197.53		$134,317	2000	100	
G3030	CONCRETE PIPE - 36" DIAMETER		1,720	LF	$204.59		$351,893	1980	100	
G3030	CONCRETE PIPE - 36" DIAMETER		550	LF	$204.59		$112,524	2000	100	
G3030	CONCRETE PIPE - 42" DIAMETER		970	LF	$211.64		$205,293	1980	100	
G3030	CONCRETE PIPE - 42" DIAMETER		230	LF	$211.64		$48,678	2000	100	
G3030	CONCRETE PIPE - 48" DIAMETER		170	LF	$216.58		$36,818	1980	100	

ASSET COMPONENT INVENTORY

UNI-FORMAT	COMPONENT DESCRIPTION	IDENTIFIER	QTY	UNITS	UNIT COST	CMPLX ADJ	TOTAL COST	INSTALL DATE	USEFUL LIFE	USEFUL LIFE ADJ
G3030	CONCRETE PIPE - 48" DIAMETER		100	LF	$216.58		$21,658	2000	100	
G3030	CONCRETE PIPE - 60" DIAMETER		895	LF	$224.34		$200,780	1980	100	
G3030	CONCRETE PIPE - 66" DIAMETER		1,230	LF	$231.47		$284,705	1980	100	
G3030	CONCRETE COMBO DRAIN - LESS THAN 5 FT DEEP		170	EA	$2,877.31		$489,143	1980	100	
G3030	CONCRETE COMBO DRAIN - LESS THAN 5 FT DEEP		84	EA	$2,877.31		$241,694	2000	100	
G3030	CONCRETE COMBO DRAIN - LESS THAN 5 FT DEEP		12	EA	$2,877.31		$34,528	2010	100	
G4020	PLASTIC HDPE - 6 INCH	PVC BLDG & ROOF DRAINS	2,000	LF	$156.64		$313,275	2000	50	
					Grand Total:		$7,513,300			

SECTION 7

SYSTEM PHOTOLOG

STRM001e 3/8/2017
Concrete headwall with 66 inch concrete pipe discharge
South end of Lake Laupus by Facility Svcs

STRM002e 3/8/2017
Concrete headwall with 66 inch concrete pipe discharge
South end of Lake Laupus by Facility Svcs

STRM003e 3/8/2017
Lake Laupus
South end of Lake Laupus

STRM004e 3/8/2017
Concrete headwall with 36 inch concrete pipe discharge
South end of Lake Laupus

STRM005e 3/8/2017
36 inch pipe with outlet blockage
South end of Lake Laupus

STRM006e 3/8/2017
Concrete headwall with 66 inch concrete pipe discharge
South end of Lake Laupus by modular units

STRM007e 3/8/2017

Riprap-lined and filled drainage swale

From pipe outlet toward Lake Laupus

STRM008e 3/8/2017

Riprap-armored slope around pipe outlet

Lake Laupus west side

STRM009e 3/8/2017

Riprap-armored slope around pipe outlet

Lake Laupus west side

STRM010e 3/8/2017

Riprap-armored slope around pipe outlet with stone blocking outlet

Lake Laupus northeast side

STRM011e 3/8/2017

Riprap-armored slope around pipe outlet with stone blocking outlet

Lake Laupus northeast side

STRM012e 3/8/2017

Concrete dam and overflow weir

Lake Laupus

STRM013e 3/8/2017

Double 60 inch concrete pipe to carry lake flow north

Under West 5th Street

STRM014e 3/8/2017

Brick headwall and riprapped slope

Under West 5th Street

STRM015e 3/8/2017

Drainage inlet

HSB south parking

STRM016e 3/8/2017

Drainage inlet

Health Sciences Drive

STRM017e 3/8/2017

Drainage inlet

HSB northeast parking

STRM018e 3/8/2017

Brick headwall for dual 66 inch pipe outfall from Lake Laupus

Under West 5th Street

STRM019e 3/8/2017
Drainage inlet
HSB north parking

STRM020e 3/8/2017
Drainage inlet
Planter island in north Dental parking lot

STRM021e 3/8/2017
Drainage inlet
Planter island in north Dental parking lot

STRM022e 3/8/2017
Drainage inlet
North Dental parking lot

STRM023e 3/8/2017
Stormwater retention pond
Dental sch. stormwater management pond

STRM024e 3/8/2017
Stormwater retention pond
Dental sch. stormwater management pond

STRM025e 3/8/2017
Concrete headwall for 54 inch concrete pipe
Dental sch. stormwater management pond

STRM026e 3/8/2017
Stormwater retention pond sediment control check dam
Dental sch. stormwater management pond

STRM027e 3/8/2017
Stormwater discharge structure
Dental sch. stormwater management pond

STRM028e 3/8/2017
Stormwater discharge structure
Dental sch. stormwater management pond

STRM029e 3/8/2017
Inlet control device
Dental sch. stormwater management pond

STRM030e 3/8/2017
Twin concrete discharge pipes
Dental sch. stormwater management pond

STRM031e 3/8/2017

Stormwater retention pond

Dental sch. stormwater management pond

STRM032e 3/8/2017

Wood debris from past flooding blocking main channel

Meeting House Branch

STRM033e 3/8/2017

Riprap-armored slope around pipe outlet

Along MacGregor Downs Road

STRM034e 3/8/2017

Riprap-armored slope around pipe outlet

Along MacGregor Downs Road

STRM035e 3/8/2017

Riprap-armored slope and small check dam

Along MacGregor Downs Road

STRM036e 3/8/2017

Riprap-armored slope around pipe outlet

Along MacGregor Downs Road

STRM037e 3/8/2017
72 inch corrugated metal pipe
Under MacGregor Downs Road

STRM038e 3/8/2017
Riprap-armored slope around pipe outlet
Along MacGregor Downs Road

STRM039e 3/8/2017
Riprap-armored slope around pipe outlet
Along MacGregor Downs Road

STRM040e 3/8/2017
Double 60 inch concrete pipe to carry lake flow northeast
Under W Arlington to MacGregor Downs

STRM041e 3/8/2017
Double 60 inch concrete pipe to carry lake flow northeast
Under W Arlington to MacGregor Downs

STRM042e 3/8/2017
Double 60 inch concrete pipe to carry lake flow northeast
Under W Arlington to MacGregor Downs

STRM043e 3/8/2017
Riprap-armored slope around 36 inch pipe outlet
Northeast corner of Heart Dr and W Arlington

STRM044e 3/8/2017
Riprap-armored slope
Northeast corner of Heart Dr and W Arlington

STRM045e 3/8/2017
Drainage inlets
Southwest corner of Fam Med parking

STRM046e 3/8/2017
Riprap-armored slope around 36 inch pipe outlet
Southwest corner of Fam Med parking

STRM047e 3/8/2017
Stormwater management pond
Grounds complex on W Arlington

STRM048e 3/8/2017
Riprap-armored slope around 30 inch pipe outlet
Under road leading to Grounds complex

STRM049e 3/8/2017
Riprap-armored slope around pipe outlet
Grounds stormwater management pond

STRM050e 3/8/2017
Outlet structure
Grounds stormwater management pond

STRM051e 3/8/2017
Outlet structure
Grounds stormwater management pond

STRM052e 3/8/2017
Stormwater sediment control check dam
Grounds stormwater management pond

STRM053e 3/8/2017
Double 66 inch concrete pipes to carry flow northeast
Under W Arlington to W 5th St

STRM054e 3/8/2017
Double 66 inch concrete pipes discharging flow northeast
Under W Arlington to W 5th St

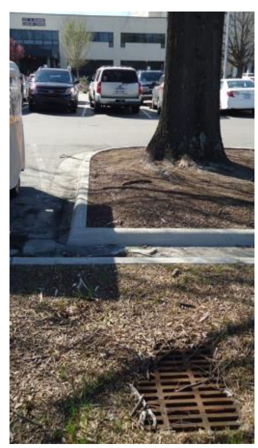
STRM055e 3/8/2017
Twin 4'x6' concrete box culverts to carry flow under road
Under W 5th St to the north

STRM056e 3/8/2017
Elliptical 4'x6' culvert to carry flow under road
Under W 5th St to the north

STRM057e 3/8/2017
Drainage inlet
Along a roadside

STRM058e 3/8/2017
Drainage inlet
Along a roadside

STRM059e 3/8/2017
Drainage inlet in landscaping
Off of North Campus loop



STRM060e 3/8/2017
Drainage inlet in landscaping
Off of North Campus loop

STRM061e 3/8/2017
Concrete stormwater manhole
Off North Campus loop by Biotechnology

STRM062e 3/8/2017
Concrete stormwater manhole
East of HSB in Health Sciences Dr

STRM063e 3/8/2017
Concrete stormwater manhole
North of Family Medicine

STRM064e 3/8/2017
Concrete stormwater manhole
East of MacGregor Downs G2

STRM065e 3/8/2017
Concrete stormwater manhole
In MacGregor Downs G1

STRM066e 3/8/2017
Concrete stormwater manhole
Parking lot by north Dental pond

STRM067e 3/8/2017
Concrete stormwater manhole
Parking lot by north Dental pond

STRM068e 3/8/2017
Concrete stormwater manhole
Parking lot by north Dental pond

STRM069e 3/8/2017
Concrete stormwater manhole
In parking just north of Dental