BROWN, MITCHELL & ALEXANDER, INC.
CONSULTING ENGINEERS

MEMO

To: **Rob Blackman**

From: **Ben Smith**

Date: **November 24, 2025**

RE: **Document Transmittal - Ocean Springs Drainage Study**

Rob,

Here is a copy of the "OS Drainage Study" prepared by Neel Schaffer in 2008. We used this as a reference document when we took some initial steps on drafting a Capital Improvement plan (CIP) in 2021. The CIP never progressed beyond some initial steps.

A number of the projects outlined in this study have been completed.

I am also including a 1 page document I prepared and presented to the last administration in an effort to encourage the City to fund a Stormwater Master Plan. One of the challenges we have is not having a clear understanding of the various watersheds throughout the City. This makes it extremely challenging to identify the most cost effective and/or most feasible approach to drainage issues. It's worth noting that NS identified this as an issue in 2008. They had to rely on anecdotal information from Public Works.

With the annexation and the change in USACE regulations around wetlands, there is going to be more pressure on the City's infrastructure. Some of the flat/poorly draining areas will now be more cost effective to develop and the current City/State regulations do not do enough to prevent significant problems in the near future.

I would encourage the City to consider developing a Stormwater Management Plan as a top priority. With the grant funding opportunities available at the State level, I think we could develop a funding strategy that would allow grants to carry most of this cost.

I would be glad to discuss further.

Thanks...Hope you and your family have a Happy Thanksgiving.

EXECUTIVE SUMMARY

The purpose of the City's Stormwater Management Master Plan (SWMMP) is to establish the standards for the design, construction, development, operation and maintenance of the City's stormwater system. These standards are intended to protect watersheds; to mitigate and reduce flooding of public and private assets; to reduce pollution loads in the system and to improve water quality in our bayous, bays and the MS Sound.

Specific Objectives:

1. Protect human life, health, and safety through stormwater management
2. Reduce and Prevent flooding of public and private assets
3. Reduce pollutant discharge into natural water bodies
4. Provide for the responsible development of undeveloped areas and redevelopment of areas within the City
5. Develop a framework for consistent and proactive maintenance of the system
6. Promote stormwater as a resource that enhances quality of life

To support and promote the objectives outline, the following tools will be developed:

1. Stormwater Asset Map

   This is a digital map of all components of the City's current stormwater system including Open Channels, Discharge Points to natural water bodies, Pipes, Inlets, etc.

2. Stormwater Asset Management Plan

   This plan compiles system information on location, age, function and condition of the system.

3. Watershed Management Plan

   Plan that identifies each of the watersheds within the City and evaluates the critical needs that must be addressed in each watershed to meet the needs of the SWMMP.

4. Stormwater Operations and Maintenance Program

   This program would provide detailed management objectives for proper inspection and maintenance of the City's Stormwater System

5. Stormwater System Capital Improvement Plan (CIP)
   The Capital Improvement Plan would provide detailed scope of work and costs for short-, medium-, and long-term improvements required to bring the City's stormwater System in to compliance with the SWMMP.

OCEAN SPRINGS DRAINAGE STUDY

MAY 2008

DRAFT FINAL REPORT

Submitted to:

City of Ocean Springs, Mississippi

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BACKGROUND

The last drainage study of the City of Ocean Springs was conducted in1992 by Neel-Schaffer,Inc (NSI). As a part of that study, the city was provided with a list of recommended drainage projects to be performed. Since the 1992 Study, the City of Ocean Springs has been diligently working to complete the listed projects. Neel-Schaffer, Inc. (NSI) was hired in 2007 to provide an update to the 1992 study.

INTRODUCTION

Ocean Springs is a well established coastal community. Ocean Springs has expanded its corporate limits over the years and now extends from Biloxi Bay in the West all the way to Highway 57 to the East. The City has an abundance of natural drainage ways surrounding and intermingled throughout the community; however, aged drainage systems and lack of significant grade changes in some areas, create challenging drainage conditions.

APPROACH

NSI began the 2008 Study as an update to the 1992 Study. We developed maps of the 1992 project areas to determine, with the help of the city staff, which projects had been completed. Through early discussions with the city personnel, we determined that most of the projects from the 1992 Study were complete and that drainage conditions have changed over the 16 year span due to annexation/expansion, development, and Hurricane Katrina. It was determined that the 2008 Study would be a completely new study and not an "update" to the 1992 study. The City was mainly interested in costs associated with the project areas so that funds could be budgeted.

The Public Works Department has been working diligently to resolve all of the major drainage problems. In fact, the Public Works Department was not aware of any perpetual loss properties or any serious drainage problems within the City of Ocean Springs at the time the current study began. Fortunately, all of the "problem areas" in this report could be considered more of a maintenance or nuisance problem. The list of projects detailed in this report stem from complaints received by the Public Works Department or Alderman. The problems include standing water, high water during rain events, "slow" drainage during rain events, back up of water onto private properties, aging systems, maintenance, & erosion control.

Several problem areas were discussed by city personnel, but were not included in this report because they were already being handled by others or the problems had already been resolved. These projects include:

- Forrest Hills Drainage Projects (Being handled by NRCS)

- Porter Ave., Little Children's Park, Ocean Ave., Front Beach Outfall Project (Being handled by Compton Engineering)
- Hospital Road Culvert Crossing Near Gay Lemon Fields (Being handled by Compton Engineering and Jackson County)
- Hunter Drive Culvert Crossing (Being handled by Compton Engineering)
- Churchill Dr. to Sussex Subsurface Drainage Failures/Cave-ins (Being handled by Compton Engineering
- Brumbaugh Culvert Crossing (Being handled by subdivision developer)
- Barbara Circle Drainage Back-up (City personnel believed problem had been resolved by removing a garbage can lid from the drainage pipe.)
- Hudson Road Culvert Crossing (City personnel wanted to make sure that the culvert crossing was not contributing to the Simon/White drainage problems. Simon/White appear to drain to the Inner Harbor and not across Hudson Road.)

The following is a list of project areas included in this report:

A. Citywide Projects & Goals

B. West (West of Pine Dr.)
   - West Porter Ave.
   - Front Beach Outfalls
   - Cleveland/Rayburn
   - Signal/Rayburn
   - General Pershing/Ward

C. Central (Pine to Hanley)
   - Simon and White
   - Simon Blvd.
   - Hickory
   - Watersedge Drive
   - Monster Ditch

D. East (East of Hanley)
   - Eagle Point/Eagle Nest
   - Bristol Blvd.
   - Londonderry/Wellington
   - Government
   - Wal-Mart Area
   - Reilly Road

METHODOLOGY & ASSUMPTIONS

As mentioned previously, the City's main goal for this study was to receive budgetary costs to remedy any drainage problems within the City. This study is not intended to represent an engineering analysis, survey, or design. In this

study NSI had a very limited budget, so only the limited available data could be utilized to conceptually determine what improvements were needed in order to develop an associated cost estimate. The available date included, but was not limited to:

- Aerial Photography (2007)
- Contour Shapefile (Provided by Jackson County)
- Ward & City Limits Shapefile (Provided by the City of Ocean Springs)
- Partial Drainage System Maps w/ Contours (Provided in the 1992 Study)
- USGS Topographic 1:24,000 Quad Maps compiled by Delorme 3-D TopoQuads

In many cases, a preliminary analysis was performed to determine appropriate (ball park) pipe sizes for the cost estimates. Preliminary analyses were based on a 25-year design storm. Other pipe sizing criteria such as pipe cover, conflicts, etc. were not considered for the preliminary analyses.

Costs were developed using available unit prices from similar work. Since the costs were for budgetary purposes, the unit prices used were conservative in nature. Standard "across the board" fees were set for some items as follows:

A. Erosion Control – A flat fee of $1,500 was used for each estimate since existing condition and phasing are not know at this time.
B. Maintenance of Traffic – A flat fee of $1,500 was used for each estimate since existing condition and phasing are not know at this time.
C. Mobilization – Fees were set at 10% with a cap of $20,000 for any one project.
D. Engineering & Surveying – Costs shown for each estimate are for budgetary purposes only. Engineering fees are negotiated at the time of need. For the budgetary costs in this study, engineering fees were set at 10% for any construction cost over $100,000. For any construction cost under $100,000, a flat fee of $10,000 was used.
E. Construction Inspection & Construction Testing – Fees for each were set at 5% for any construction cost over $100,000. For any construction cost under $100,000, a flat fee of $5,000 each was used.

CITYWIDE DRAINAGE GOALS

While the main focus of this study was to determine where the problem drainage areas are located and a determination of the probable cost to remedy the problems, the following items are few ideas the City may want to consider implementing in order to help prevent long term problems, better utilize City personnel time, and keep the drainage system working efficiently:

A. Implement a Geographic Information System (GIS)

The Public Works Department personnel seem to have a good working knowledge of the drainage system, but without a formal mapping system the knowledge is only one dimensional. The knowledge of the system is only gained by experience and is difficult to pass on to other employees, consultants, and developer. Without a formal mapping system there is a chance that some of the knowledge is lost over the years through employees retiring or quitting.

The City of Ocean Springs had a drainage GIS system implemented in the early 90's, but the system was not utilized or kept up to date. The City of Ocean Springs would receive a lot of benefit from mapping the City's drainage system. The benefits include knowledge of all city employees of the size and location of pipes inlets, ditches, outfalls, etc.; time savings of staff; better communication tools between city staff and the public, hired consultants, & contractors; and a mapping system would be the first step in other computerized assistance programs the city may want to implement at a later date such as system modeling, GIS based work order programs such as CityWorks, and computerized maintenance scheduling. The following is a list of tasks the city may want to consider to develop a GIS program for drainage.

1. Inventory Existing System – All existing drainage structures, ditches, outfalls, etc. should be GPS'd using sub-meter accurate GPS units such as Tremble units. The existing pipe sizes, pipe materials, and inverts could also be obtained. The cost for this task could range from $75,000 to $250,000 (or more) depending on how much information is obtained.

2. Create Drainage GIS Shapefiles – Utilize information collected in the field to create a mapping system of the drainage system. Shapefiles could include drainage structures, outfalls, pipes, ditches, drainage flow direction arrows, etc. The cost for this task could range from $50,000 to $250,000.

3. Additional Shapefiles - Additional shapefiles would enhance the City's GIS program and also save time and effort. These could include:
   a. Drainage Basins
   b. Easements
   c. Wetlands Locations
   d. Private Detention Pond Locations

B. Implement an Annual Maintenance Program – In order to keep the drainage system working efficiently, the city would be well served by implementing an annual maintenance program for the drainage system. Each inlet, pipe, and ditch within the city could be set-up for scheduled cleaning and inspection at a regular interval. Cleaning will ensure there are no blockages in the system and inspection will reveal damage & age of the system, as well as cross-connections that need to be resolved. The cost to develop a maintenance program could range from $50,000 to $150,000 if a complete GIS mapping system is available.

C. Model the Drainage System – Modeling the storm drainage system would reveal to the City where drainage systems are undersized so the City can prioritize drainage system improvements based on the most critical areas. Also modeling the drainage system will provide the City with the necessary tools to determine the impact of new development on the existing system. Several GIS based modeling programs are available to model storm drain systems such as SewerGems. The cost for this task could range from $30,000 to $100,000 if a complete GIS mapping system is available.

D. Continue to Implement/Enforce Development Standards – Development standards for runoff quantity and quality control should be implemented and enforced that would limit development impact on the City's storm drainage system.

E. Implement Construction Projects/Maintenance Properly – The City should carefully consider any modifications to the storm drainage system to ensure the existing capacity will not be decrease, the problem area is not transferred downstream, and that any existing problems are not magnified by the modifications. These are a few areas to consider when implementing changes to the drainage system:

   1. Phasing Projects – When phasing project, make sure to proceed with phasing starting at the downstream end and working upstream to ensure transition problems are not created between the upgraded system and the existing system.

2. Upgrading Part of Drainage System – As with properly phasing projects, when upgrading only part of a drainage system, ensure through a proper analysis and design that the upgrade will not transfer the problem area to another location downstream.

3. Changing Ditch Cross Sections – Ditch cross-sections (width, depth, side slopes) should not be modified without a proper analysis. Making a ditch wider may inadvertently make the ditch wider than the right-of-way or easement containing the ditch which could cause private property issues or the wider ditch could create a hazard for adjacent roadways. Digging ditches deeper may create a ditch that holds water if the ditch is dug deeper than the outfall or downstream pipe culverts. Changing side slopes of ditches could create a safety hazard or an erosion control problem is the side slopes are too steep. Also changing the cross-section of a ditch without a proper analysis could lessen the capacity of the ditch.

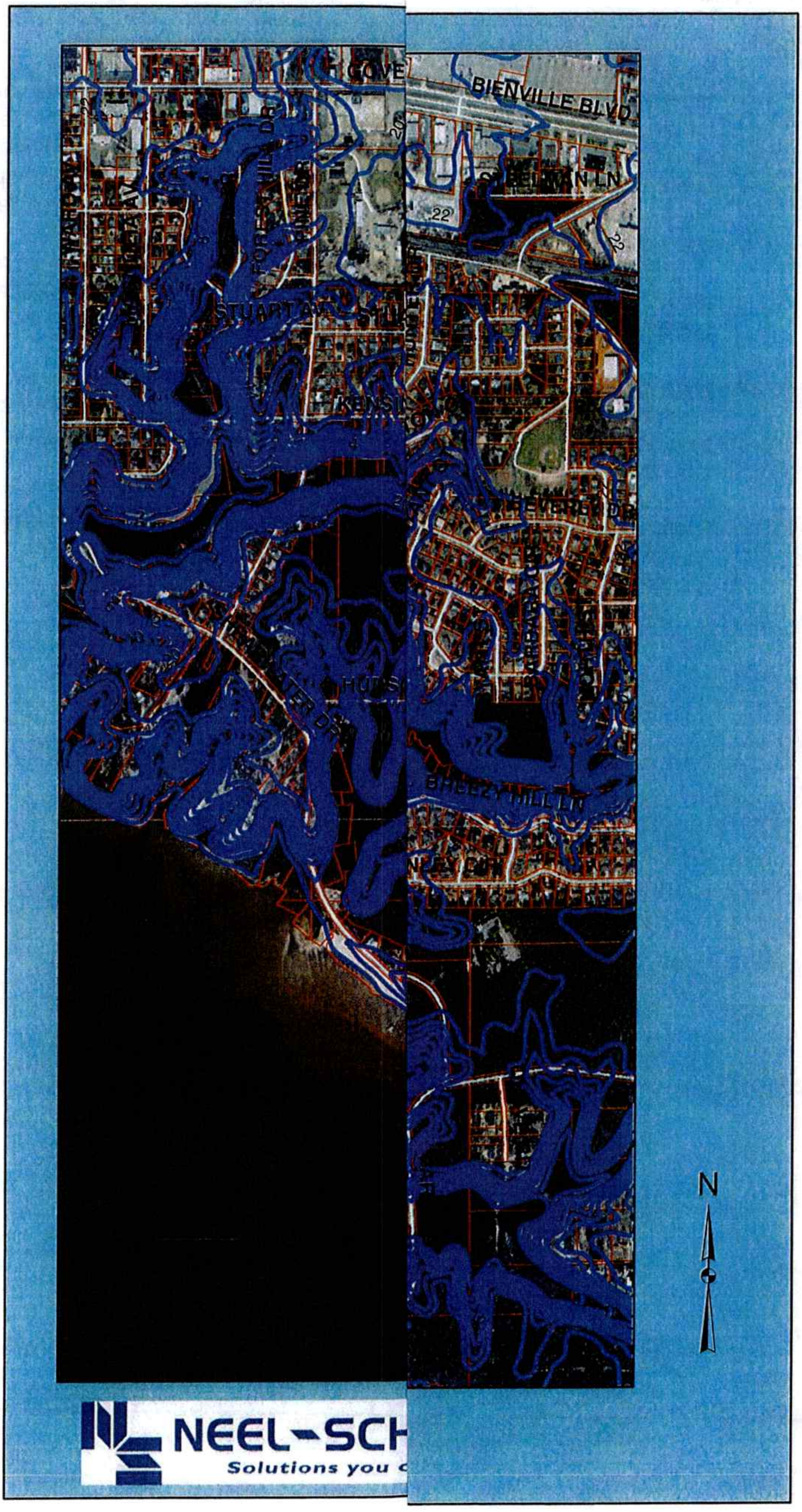
4. Piping Ditches – A proper analysis should always be performed before piping a ditch or placing a culvert in a ditch. An analysis will provide the proper size and slope required for the installation. Pipes and culverts that are undersized or improperly installed (incorrect slope or grade) create unnecessary choke point in the drainage system. In addition, the pipe used should be the proper material and installed in accordance with the manufacturer's recommendations for the installation location and use. A crushed or deformed pipe will limit the capacity of the drainage system and create a choke point.

5. Making Improvements With Out Analyses – Before making improvements to the drainage system, a proper analysis should be performed to determine the proper size, slope, etc. of the drainage system. A detailed analysis should be performed before any improvements listed in this study are installed. Improvements listed in this report are based on very limited available data. This report does not constitute a full design or analysis for construction. The pipe sizes and recommended improvements are for budgetary cost determination only and should only be used for reference purposes.

F. Conduct Smaller Drainage Area Studies – Ocean Springs is a well established community which has expanded its limits over the years. As the city grew, the drainage system was pieced together without an overall master plan to follow. Studies of smaller areas in the City may benefit the City to determine if the existing drainage systems in the area are efficient or if a different long term improvements plan would better serve the city. The following are two areas that appear to be very flat and may benefit from a more detailed study:

1. Pine St. to Halstead Study – the area south of Government St. between Pine and Halstead (as shown on the following map) is very flat and the drainage system has been pieced together over the years as new smaller subdivision were built. A detailed study and Master Drainage Plan of this area would provide the city with a good grasp of the existing problems and provide a long term master plan to correct any problems found. The city may find that a change in the arrangement of the drainage piping in the area may provide a more efficient system. The cost for this task could range from $50,000 to $150,000 if a complete GIS mapping system is available.

2. Hwy. 57/Hospital Rd./Hwy. 90 Study – the area between Hwy. 57, Hospital Rd, & Hwy. 90 is also very flat. A detailed study and Master Development Plan of this area would provide the City and Jackson County with information on how to handle drainage for future development in the area. This area is discuss in further detail in the Reilly Road section of this report. The cost for this task could range from $75,000 to $250,000 if a complete GIS mapping system is available.



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WEST PORTER AVENUE

Description of Area

Porter Avenue runs between Front Beach Drive and Magnolia Avenue. The area of interest for this study is the residential property adjacent to the curved portion of Porter between Howard Ave and Williams Ave near the Hwy.90/Railroad overpass.

Description of Existing Drainage System

There are two separate drainage systems in this small area which accommodates approximately 4 acres of drainage runoff. The first system consists of an inlet in front of 310 Porter Ave. that should collect water from 306, 308, 310, and part of 312 Porter and the runoff from the street itself. The inlet collects drainage from the area and then a cross-drain under Porter conveys the drainage runoff to the north and releases it within MDOT's right-of-way.

The second drainage system is a collection of inlets, piping, and open ditch from Williams Avenue to Porter Avenue through side and rear yards. Runoff is collected from Williams Avenue and then conveyed westerly then northerly adjacent to 314 Porter Ave. to an inlet in the front yard of 314 Porter Ave. then westerly to another inlet in front of 314 Porter Avenue. The runoff is then conveyed through a cross-drain under Porter to the north and released within MDOT's right-of-way.

Description of Known Drainage Concerns in the Area

The Alderman for Ward 2 has received complaints of high standing water in the yards adjacent to Porter Avenue and high water in the rear yard of 314 Porter Avenue.

Findings & Recommended Improvements

The first area has standing water in the front yards/right-of-way areas adjacent to 306, 308, & 310 Porter. There is currently no defined drainage system to convey the runoff to the inlet in front of 310 Porter. The Porter Ave. culvert crossing could also possibly be blocked by the bridge construction activities.

The second area contains the home at 314 Porter Avenue. The drainage system located in the side yard of 314 Porter conveys water from Williams Ave. to Porter St. If the city determines that the drainage problem is a public issue, the rear yard flooding could possible be resolved by placing an additional inlet at the rear

corner of the house on the existing drainage pipe traveling from the Williams Ave. area. The yard (which is private property) would then need to be re-graded to direct storm water to the inlet.

A detailed survey and analysis should be conducted for both areas to determine the exact cause and solution of the standing water. The budgetary cost estimate below reflects upgrading one of the Porter St. culvert crossings, installing an inlet behind 314 Porter St., and installing a roadside drainage system for 306, 308, and 310 consisting of driveway trench drains, pipe, and inlets.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to each outfall.
- Perform an analysis to determine the appropriate size for each pipe and ditch.
- Obtain any required easements and outside agency permits.
- Install new drainage system as required and re-grade area to promote positive drainage.
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	40	LF	$5.00	$200
REMOVAL OF CONCRETE	65	SY	$12.00	$780
REMOVAL OF ASPHALT	60	SY	$12.00	$720
REMOVE & REPLACE FENCE	20	LF	$20.00	$400
SAWCUT	240	LF	$10.00	$2,400
BORROW EXCAVATION	130	CY	$15.00	$1,950
LIMESTONE	25	CY	$60.00	$1,500
BEDDING	20	CY	$50.00	$1,000
SOD	150	SY	$5.00	$750
EROSION CONTROL	1	LS	$1,500.00	$1,500
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	60	SY	$42.00	$2,520
CONCRETE DRIVEWAYS	65	SY	$35.00	$2,275
15" RCP	185	LF	$40.00	$7,400
15" RCP FES	1	EA	$1,020.00	$1,020
TRENCH DRAIN	50	LF	$90.00	$4,500
DRAINAGE STRUCTURE	6	EA	$4,000.00	$24,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$5,541.50	$5,542
Total				**$60,957**
Contingencies (10%)				$6,096
Total Construction Cost				**$67,052**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$87,052**

BUDGETARY COST - $90,000

WEST PORTER AVENUE MAP

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FRONT BEACH OUTFALLS (West of Jackson Ave.)

Description of Area
Front Beach Drive constitutes the southernmost part of the western end of the city. Front Beach Drive runs along Front Beach between Porter Ave. and the harbor.

Description of Existing Drainage System
There are 5 major outfalls on Front Beach west of Jackson Ave. The existing drainage system in the area consists of drainage ditches and a small amount of subsurface drainage piping and inlets. Most of the drainage flow in the area is accommodated by overland flow that follows the natural lay of the land. The five outfalls accommodate a watershed area which constitutes the majority of land between Hillandale Avenue to the west, Jackson Avenue to the east, and Porter Avenue to the north. This land is primarily residential development.

Description of Known Drainage Concerns in the Area
The Public Works Department has received complaints of high water in various parts of the area immediately north of Front Beach Drive. The Public Works Department had concerns that the outfall pipes may be undersized and was a contributing factor to the high water. NSI was asked to check the outfall pipe sizes as a part of this study.

Findings & Recommended Improvements
In most cases due to siltation and the lack of detailed information on the exact location of the outfall pipes, the outfalls on the beach could not be easily found to check the condition or the existing pipe sizes. Based on very limited available data, preliminary calculation revealed pipe sizes as shown below. A more detailed investigation will need to be performed by the city to determine the existing sizes.

Without knowing the location/existing size of the outfalls or the exact location of the high water complaints, there is no way of knowing if the complaints are connected with the outfall pipe sizes. Additionally, more updated and accurate surveys of the area should be conducted to properly reflect existing infrastructure and ground elevations. The outfall pipes should be cleared of siltation/vegetation/debris, as well as all other pipes/inlets/drainage ways within the basins.

Front Beach Outfall #1
Preliminary calculations for Outfall #1 show that a 36" diameter pipe will be necessary to accommodate the contributing drainage basin.

Front Beach Outfall #2
Preliminary calculations for Outfall #2 show that a 36" diameter pipe will be necessary to accommodate the contributing drainage basin.

Front Beach Outfall #3
Preliminary calculations for Outfall #3 show that 3 – 36" (or equivalent) diameter pipes will be necessary to accommodate the contributing drainage basin.

Front Beach Outfall #4
Preliminary calculations for Outfall #4 show that a 24" diameter pipe will be necessary to accommodate the contributing drainage basin.

Front Beach Outfall #5
Preliminary calculations for Outfall #5 show that 2 – 42" (or equivalent) diameter pipes will be necessary to accommodate the contributing drainage basin.

Possible improvements include:

Without information on the existing outfall pipes, the worst case scenario would be the need to upgrade all five outfall pipes. The assumption was made to upgrade all pipes in order to obtain budgetary figures.

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Obtain any required easements and outside agency permits.
- Perform outfall (and any other necessary) improvements.
- Establish permanent erosion control.

Opinion of Probable Project Cost – Outfall #1

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	230	LF	$5.00	$1,150
REMOVAL OF CONCRETE	40	SY	$12.00	$480
SAWCUT	60	LF	$10.00	$600
MUCK	5	CY	$8.00	$40
LIMESTONE	15	CY	$60.00	$900
BEDDING	15	CY	$50.00	$750
CORE THROUGH SEAWALL	1	LS	$5,000.00	$5,000
SOD	30	SY	$5.00	$150
EROSION CONTROL	1	LS	$1,500.00	$1,500
CONCRETE PAVING	40	SY	$40.00	$1,600
36" RCP	230	LF	$140.00	$32,200
DRAINAGE STRUCTURE	2	EA	$4,000.00	$8,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$5,387.00	$5,387
Total				**$59,257**
Contingencies (10%)				$5,926
Total Construction Cost				**$65,183**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$85,183**

BUDGETARY COST - $90,000

Opinion of Probable Project Cost – Outfall #2

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	230	LF	$5.00	$1,150
REMOVAL OF CONCRETE	40	SY	$12.00	$480
SAWCUT	60	LF	$10.00	$600
MUCK	2	CY	$8.00	$16
LIMESTONE	15	CY	$60.00	$900
BEDDING	20	CY	$50.00	$1,000
CORE THROUGH SEAWALL	1	LS	$5,000.00	$5,000
SOD	29	SY	$5.00	$147
EROSION CONTROL	1	LS	$1,500.00	$1,500
CONCRETE PAVING	40	SY	$40.00	$1,600
36" RCP	330	LF	$140.00	$46,200
DRAINAGE STRUCTURE	1	EA	$4,000.00	$4,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$6,409.27	$6,409
Total				**$70,502**
Contingencies (10%)				$7,050
Total Construction Cost				**$77,552**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$97,552**

BUDGETARY COST - $100,000

Opinion of Probable Project Cost – Outfall #3

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	420	LF	$5.00	$2,100
REMOVAL OF CONCRETE	110	SY	$12.00	$1,320
SAWCUT	180	LF	$10.00	$1,800
MUCK	6	CY	$8.00	$48
LIMESTONE	20	CY	$60.00	$1,200
BEDDING	70	CY	$50.00	$3,500
CORE THROUGH SEAWALL	1	LS	$10,000.00	$10,000
SOD	90	SY	$5.00	$450
EROSION CONTROL	1	LS	$1,500.00	$1,500
CONCRETE PAVING	110	SY	$40.00	$4,400
36" RCP	1260	LF	$140.00	$176,400
DRAINAGE STRUCTURE	3	EA	$4,000.00	$12,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION	1	LS	$20,000.00	$20,000
Total				**$236,218**
Contingencies (10%)				$23,622
Total Construction Cost				**$259,840**
Engineering & Surveying (10%)				$25,984
Construction Inspection (5%)				$12,992
Construction Testing (5%)				$12,992
TOTAL PROJECT COST				**$311,808**

BUDGETARY COST - $315,000

Opinion of Probable Project Cost – Outfall #4

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	410	LF	$5.00	$2,050
REMOVAL OF CONCRETE	40	SY	$12.00	$480
SAWCUT	60	LF	$10.00	$600
MUCK	2	CY	$8.00	$16
LIMESTONE	15	CY	$60.00	$900
BEDDING	20	CY	$50.00	$1,000
CORE THROUGH SEAWALL	1	LS	$5,000.00	$5,000
SOD	30	SY	$5.00	$150
EROSION CONTROL	1	LS	$1,500.00	$1,500
CONCRETE PAVING	40	SY	$40.00	$1,600
24" RCP	410	LF	$70.00	$28,700
DRAINAGE STRUCTURE	3	EA	$4,000.00	$12,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$5,549.60	$5,550
Total				**$61,046**
Contingencies (10%)				$6,105
Total Construction Cost				**$67,150**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$87,150**

BUDGETARY COST - $90,000

Opinion of Probable Project Cost – Outfall #5

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	410	LF	$5.00	$2,050
REMOVAL OF CONCRETE	80	SY	$12.00	$960
SAWCUT	120	LF	$10.00	$1,200
MUCK	4	CY	$8.00	$32
LIMESTONE	20	CY	$60.00	$1,200
BEDDING	60	CY	$50.00	$3,000
CORE THROUGH SEAWALL	1	LS	$7,000.00	$7,000
SOD	70	SY	$5.00	$350
EROSION CONTROL	1	LS	$1,500.00	$1,500
CONCRETE PAVING	80	SY	$40.00	$3,200
42" RCP	680	LF	$170.00	$115,600
DRAINAGE STRUCTURE	3	EA	$4,000.00	$12,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$14,959.20	$14,959
Total				**$164,551**
Contingencies (10%)				$16,455
Total Construction Cost				**$181,006**
Engineering & Surveying (10%)				$18,101
Construction Inspection (5%)				$9,050
Construction Testing (5%)				$9,050
TOTAL PROJECT COST				**$217,208**

BUDGETARY COST - $220,000

FRONT BEACH OUTFALLS MAP

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CLEVELAND AND RAYBURN

Description of Area

Cleveland Avenue and Rayburn Avenue are located in the oldest part of Ocean Springs in the western end of town. The area is a well established residential neighborhood and is located south of Highway 90 and west of Washington Avenue. Cleveland Avenue is an east-west residential street which runs between Porter Avenue (west end) and Jackson Avenue(east end). Rayburn Avenue is a north-south residential street which runs between Cleveland Avenue (south end) and Signal Street (north end). Immediately west of the Cleveland/Rayburn intersection is the Cleveland/Ruskin intersection.

Description of Existing Drainage System

The existing drainage system in the area consists of drainage ditches and some subsurface drainage piping and inlets. Most of the drainage flow in the area is accommodated by overland flow that follows the natural lay of the land. The drainage in this area ultimately outfalls at Front Beach. The drainage system at Cleveland and Rayburn consists of a drainage inlet at the northeast corner of the intersection that collects surface drainage as well as drainage from a pipe that extends to the northeast. From the inlet, a culvert extends to the west under Rayburn. An open ditch then extends along the north side of Cleveland to a culvert that crosses Cleveland at Ruskin Ave. The culverts in the area of Rayburn/Cleveland/Ruskin range in size from 12" to 18" in diameter. The drainage system then extends southward through pipe along the east side of Ruskin and eventually releases into the drainage ditch that runs north-south behind the Ruskin Ave./Jackson Ave. houses The open ditch with intermittent culverts extends south to the beach. According to available contour maps the Rayburn/Cleveland intersection drainage system accommodates approximately 7 acres and the Cleveland/Ruskin intersection accommodates approximately 17 acres.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of "slow" drainage in the area. The Public Works Department thought the drainage culvert crossing under the intersection may be choking the flow.

Findings & Recommended Improvements

Standing water was observed in parts of the drainage area. Preliminary calculations showed the existing pipes in the drainage area to be undersized. More appropriate pipe sizes would be 30" to 48" diameter pipes. Due to the standing water, the ditches and pipes also appear to be improperly graded. Blockages in the drainage system downstream could also be a contributing factor to the standing water.

A complete survey, analysis, and design of this drainage area would be pertinent in order to correct the existing drainage problems in this area. The analysis should include the entire drainage area all the way to the outfall at Front Beach. If only part of the drainage system is upgraded, the drainage problems may be transferred to another area downstream.

Possible improvements include:

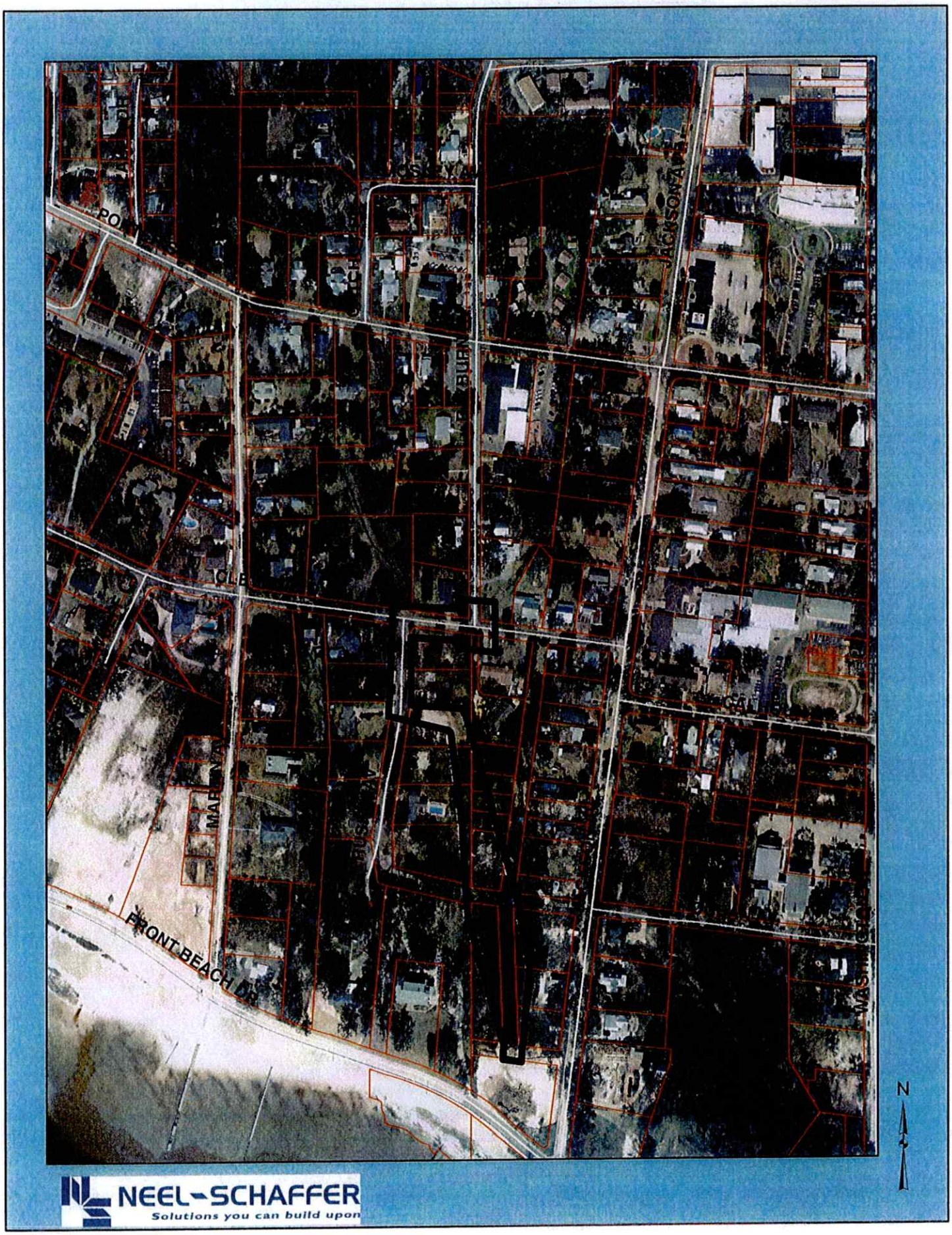
- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to each outfall.
- Perform an analysis to determine the appropriate size for each pipe and ditch.
- Obtain any required easements and outside agency permits.
- Re-grade ditches and install new culverts/pipes as required.
- Clean any existing pipes/culverts to remain.
- Upgrade Front Beach Outfall (see Front Beach Outfalls – Outfall #5 for description and cost)
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	753	LF	$5.00	$3,765
REMOVAL OF CONCRETE	28	SY	$12.00	$336
REMOVAL OF ASPHALT	225	SY	$12.00	$2,697
SAWCUT	511	LF	$10.00	$5,110
LIMESTONE	42	CY	$60.00	$2,528
BEDDING	48	CY	$50.00	$2,383
SOD	514	SY	$5.00	$2,568
EROSION CONTROL	1	LS	$1,500.00	$1,500
RE-GRADING/SHAPING	800	LF	$10.00	$8,000
RIP RAP	40	TON	$50.00	$2,000
ASPHALT PAVING	225	SY	$42.00	$9,441
CONCRETE DRIVEWAYS	28	SY	$35.00	$980
15" RCP	30	LF	$40.00	$1,200
30" RCP	55	LF	$100.00	$5,500
48" RCP	225	LF	$215.00	$48,375
54" RCP	230	LF	$260.00	$59,800
30" RCP FES	1	EA	$1,300.00	$1,300
54" RCP FES	1	EA	$3,600.00	$3,600
DRAINAGE STRUCTURE	6	EA	$4,000.00	$24,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$18,658.23	$18,658
Total				**$205,240**
Contingencies (10%)				$20,524
Total Construction Cost				**$225,765**
Engineering & Surveying (10%)				$22,576
Construction Inspection (5%)				$11,288
Construction Testing (5%)				$11,288
TOTAL PROJECT COST				**$270,917**

BUDGETARY COST - $275,000

CLEVELAND/RAYBURN MAP



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RAYBURN AND SIGNAL

Description of Area

Rayburn Avenue is a north-south residential street which runs between Cleveland Avenue (south end) and Signal Street (north end). Signal Street is a residential street that parallels the south side of the railroad tracks and runs between Rayburn and Cox Avenue. The area consists of primarily residential development south of the railroad tracks and commercial development north of the railroad tracks.

Description of Existing Drainage System

The drainage system at Rayburn and Signal consists of a railroad pipe crossing just east of the intersection that flows south into an open ditch for a short distance and then is collected by the open end of a drainage pipe that extends southwest under Signal Street and then under Rayburn Street. The pipe dumps into an open ditch/creek on the west side of Rayburn just south of the Signal/Rayburn intersection. The open ditch/creek meanders southwest until it joins a small bayou. The bayou flows northwest to the railroad tracks to a railroad pipe crossing and then makes its way through pipe and open ditch to Fort Bayou on the north side of Highway 90. The contributing drainage area to the Signal/Rayburn pipe crossing is approximately 6 acres and is a mix of residential (south side of railroad) and commercial development (north side of railroad).

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints about the standing water in the ditch/creek on the west side of Rayburn Avenue and the standing water in the open ditch north of Signal Street. Also, there have been complaints that there is deep water in the street during heavy rains. The Public Works Department was concerned that the drainage system in this area is tidally influenced.

Findings & Recommended Improvements

Rayburn Avenue dips in the location of the intersection cross-drain mentioned above. Evidence was observed that would suggest that water tops the road periodically. The existing cross-drain is approximately 18" in diameter.

A substantial portion of the runoff contributing to this small drainage area is actually being received from the north side of the railroad. The railroad's cross-drain is substantially larger than the intersection's 18" cross-drain which is downstream of the railroad crossing. Preliminary calculations revealed that the cross-drain should be upgraded to accommodate the contributing watershed area.

The open ditch/creek appears to be at an elevation of 8-10' according to the contour maps, so it is very unlikely that the standing water is due to tidal influence. The area downstream of the intersection should be analyzed to ensure that the ditch/creek is properly sized and properly graded to accommodate the additional drainage due to upgrading the Rayburn/Signal intersection cross-drain, so that the drainage problem is not transferred downstream. A full survey, analysis, and design should be conducted in order to ensure an adequate solution to the problem. The existing drainage system seems to send drainage from the north side of the railroad in a circle. A full survey and analysis may reveal a better arrangement for the distribution of storm water.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to each outfall, if determined that the ditch/creek should not remain in a natural state.
- Or determine a consistent grade for the pipes from the highest point to the outfall at the ditch/creek and remove the debris and blockages from the ditch/creek to improve performance.
- Perform an analysis to determine the appropriate size for each pipe and ditch.
- Obtain any required easements and outside agency permits.
- Re-grade ditches and install new culverts/pipes. (Note: The existing ditch/creek has the appearance of a natural drainage area. If properly sized/graded, the ditch/creek will lose the appearance of a natural area which may be an asset to some property owners.)
- Clean any existing pipes/culverts to remain.

- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	144	LF	$5.00	$720
REMOVAL OF ASPHALT	95	SY	$12.00	$1,140
SAWCUT	235	LF	$10.00	$2,350
BORROW EXCAVATION	140	CY	$15.00	$2,100
LIMESTONE	20	CY	$60.00	$1,200
BEDDING	10	CY	$50.00	$500
SOD	100	SY	$5.00	$500
EROSION CONTROL	1	LS	$1,500.00	$1,500
RE-GRADING/SHAPING	375	LF	$20.00	$7,500
RIP RAP	40	TON	$50.00	$2,000
ASPHALT PAVING	95	SY	$42.00	$3,990
30" RCP	144	LF	$100.00	$14,400
30" RCP FES	1	EA	$1,300.00	$1,300
DRAINAGE STRUCTURE	1	EA	$4,000.00	$4,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$4,470.00	$4,470
Total				**$49,170**
Contingencies (10%)				$4,917
Total Construction Cost				**$54,087**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$74,087**

BUDGETARY COST - $75,000

RAYBURN/SIGNAL MAP

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GENERAL PERSHING AND WARD AVENUE

Description of Area

General Pershing Avenue and Ward Avenue are adjacent parallel north-south streets. General Pershing runs from the railroad tracks to the harbor bridge. Ward Ave. runs from the railroad tracks to Kensington Ave. The area of concern for this report is between Porter Ave. and Kensington which is a fully developed residential neighborhood.

Description of Existing Drainage System

The General Pershing-Ward area is in the older part of Ocean Springs. The drainage system is a mishmash of open ditches and subsurface drainage consisting of pipes and inlets. While the drainage system of concern for this report lies between Porter and Kensington, the drainage basin contributing to the drainage system is approximately 23 acres. The area extends from the east beyond Ward and just south of Calhoun. Most of the land draining to Middle Avenue is also included in this drainage area. General Pershing runoff is collected in a series of concrete inlets along General Pershing Ave.

and is piped to the crossing at Calhoun, where it is released into the natural drainage system. From Ward, there is a combination of ditches and pipes through yards that conveys the drainage to the same outfall south of Calhoun.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of collapsed pipe in the yards between Ward Ave. and General Pershing Ave.

Findings & Recommended Improvements

The existing drainage system is an aged system which has been added to over the years. The existing ditch running through yards from Ward to General Pershing does not carry a constant capacity. The ditch in some areas has been modified by homeowners and is filled with overgrown vegetation in other areas. A portion of the drainage system between Ward and General Pershing is piped and there appears to be evidence that the pipe has collapsed in some areas. The existing pipe is 18", but based on preliminary

calculations which are based on very limited available data, the pipe should be substantially larger. In addition, the pipe crossing General Pershing and Calhoun should be upgraded.

The drainage system further upstream appears to be very old and should be investigated by the city to determine if replacement is feasible.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to each outfall.
- Perform an analysis to determine the appropriate size for each pipe and ditch.
- Obtain any required easements and outside agency permits.
- Re-grade ditches and install new culverts/pipes.
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	470	LF	$5.00	$2,350
REMOVAL OF ASPHALT	120	SY	$12.00	$1,440
SAWCUT	100	LF	$10.00	$1,000
LIMESTONE	20	CY	$60.00	$1,200
BEDDING	250	CY	$50.00	$12,500
SOD	1425	SY	$5.00	$7,125
EROSION CONTROL	1	LS	$1,500.00	$1,500
RE-GRADING/SHAPING	200	LF	$10.00	$2,000
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	120	SY	$42.00	$5,040
4X2 BOX	1465	LF	$300.00	$439,500
6X4 BOX	100	LF	$680.00	$68,000
DRAINAGE STRUCTURE	9	EA	$4,000.00	$36,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$20,000.00	$20,000
Total				**$600,155**
Contingencies (10%)				$60,016
Total Construction Cost				**$660,171**
Engineering & Surveying (10%)				$66,017
Construction Inspection (5%)				$33,009
Construction Testing (5%)				$33,009
TOTAL PROJECT COST				**$792,205**

BUDGETARY COST $800,000

GENERAL PERSHING/WARD MAP

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SIMON BOULEVARD ROADSIDE DITCH

Description of Area

Simon Boulevard is a residential street that runs parallel and west of Holcomb Blvd. Simon begins on the north side at Ogden Avenue and travels south until it dead ends on Hudson Road.

Description of Existing Drainage System

The drainage system along Simon Blvd. consists of a deep ditch with steep sides.

Description of Known Drainage Concerns in the Area

The alderman has received complaints regarding the size of the ditch on the west side of Simon Blvd. The alderman has asked for a cost estimate to pipe the ditch.

Findings & Recommended Improvements

The contributing drainage area is very difficult to delineate. There is a very complex network of ditches and pipes darting in and out of private property, behind houses, and even underneath buildings. To further complicate the problem, the land in the area is so flat that it is difficult without a current survey to ascertain the direction of flow and its ultimate destination.

According to the contour maps, the drainage area contributing to the Simon Boulevard ditch is very small, and based on preliminary calculation would require a 36" pipe to pipe the ditch. However, the contour maps do not reflect pipe systems contributing to the area or ditches that have been modified or added over the years since the contour maps were derived. Conversation with the Public Works Department personnel revealed that the ditch may be carrying a much larger drainage area.

With the limited available information, two cost estimates were developed. One estimate is on the low end of the scale and represents a small contributing drainage area and the other estimate is on the high end of the scale and represents piping the ditch to provide the equivalent capacity that the ditch cross-section provides. The true required pipe size and cost will be somewhere in between.

Recommended improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Perform an analysis to determine the appropriate size for the pipe.

- Obtain any required easements and outside agency permits.
- Perform the work.
- Establish permanent erosion control.

Opinion of Probable Project Cost

Smaller Pipe Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF CONCRETE	84	SY	$12.00	$1,013
REMOVAL OF ASPHALT	106	SY	$12.00	$1,267
SAWCUT	180	LF	$10.00	$1,800
BORROW EXCAVATION	2583	CY	$15.00	$38,740
MUCK	331	CY	$8.00	$2,649
LIMESTONE	32	CY	$60.00	$1,900
BEDDING	71	CY	$50.00	$3,561
SOD	2871	SY	$5.00	$14,356
EROSION CONTROL	1	LS	$1,500.00	$1,500
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	106	SY	$42.00	$4,433
CONCRETE DRIVEWAYS	84	SY	$35.00	$2,956
36" RCP	90	LF	$140.00	$12,600
36" A2000	1192	LF	$82.00	$97,744
DRAINAGE STRUCTURE	4	EA	$4,000.00	$16,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION	1	LS	$20,000.00	$20,000
Total				**$223,018**
Contingencies (10%)				$22,302
Total Construction Cost				**$245,320**
Engineering & Surveying (10%)				$24,532
Construction Inspection (5%)				$12,266
Construction Testing (5%)				$12,266
TOTAL PROJECT COST				**$294,384**

Larger Pipe Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF CONCRETE	142	SY	$12.00	$1,707
REMOVAL OF ASPHALT	178	SY	$12.00	$2,133
SAWCUT	180	LF	$10.00	$1,800
BORROW EXCAVATION	5165	CY	$15.00	$77,480
MUCK	1192	CY	$8.00	$9,536
LIMESTONE	53	CY	$60.00	$3,200
BEDDING	1367	CY	$50.00	$68,373
SOD	4836	SY	$5.00	$24,178
EROSION CONTROL	1	LS	$1,500.00	$1,500
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	178	SY	$42.00	$7,467
CONCRETE DRIVEWAYS	142	SY	$35.00	$4,978
8X4 BOX	2564	LF	$880.00	$2,256,320
8X4 BOX END SECTION	2	EA	$6,200.00	$12,400
DRAINAGE STRUCTURE	4	EA	$4,000.00	$16,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION	1	LS	$20,000.00	$20,000
Total				**$2,509,572**
Contingencies (10%)				$250,957
Total Construction Cost				**$2,760,529**
Engineering & Surveying (10%)				$276,053
Construction Inspection (5%)				$138,026
Construction Testing (5%)				$138,026
TOTAL PROJECT COST				**$3,312,634**

BUDGETARY COST - $300,000 TO $3,350,000

SIMON BLVD. ROADSIDE DITCH MAP

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SIMON AND WHITE

Description of Area

Simon Boulevard and White Avenue are residential streets that runs parallel and west of Holcomb Blvd. Simon and White begin on the north side at Ogden Avenue and travels south to Hudson Road.

Description of Existing Drainage System

The area of importance for this portion of the study is the east-west drainage system from Holcomb Blvd. to Simon Boulevard just south of Lafitte St. The drainage system runs through residential yards and crosses White Avenue and Simon Boulevard. The system outfalls on the west side of Simon, which ultimately empties into the inner harbor. The drainage system consists of subsurface drainage and open ditch. The east-west drainage system accommodates a drainage area of approximately 10 acres at the upper end of the system to approximately 53 acres at the Simon Blvd. crossing. The drainage area consists of mainly single family residence, but also includes Westgate Apartments and part of Ocean Springs High School.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints regarding standing water in the yards of residences adjacent to the Simon/White Blvd drainage system.

Findings & Recommended Improvements

Currently the east-west drainage system consists of pipe and inlets in some areas and open ditch in other areas. Standing water was observed in some areas and other areas were found that are not graded towards existing inlets. NSI was asked to provide a budgetary cost estimate to install a new sub-surface drainage system for the entire length of the system from Holcomb to the west side of Simon. A budgetary cost estimate is also provided below to reshape & re-grade the area utilizing the existing drainage system if a detailed analysis reveals that the existing system is adequate to accommodate the contributing drainage basin.

Possible Improvements Include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to the outfall.
- Perform an analysis to determine the appropriate size for each pipe and ditch (if applicable).
- Obtain any required easements and outside agency permits.
- Install new drainage system or re-grade/reshape portions of drainage system to promote positive drainage.
- Establish permanent erosion control.

Opinion of Probable Project Cost

Install new subsurface drainage system

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	543	LF	$5.00	$2,715.00
REMOVAL OF ASPHALT	149	SY	$12.00	$1,792.00
SAWCUT	96	LF	$10.00	$960.00
BORROW EXCAVATION	1300	CY	$15.00	$19,500.00
MUCK	1300	CY	$8.00	$10,400.00
LIMESTONE	25	CY	$60.00	$1,493.33
BEDDING	2119	CY	$50.00	$105,925.93
SOD	4044	SY	$5.00	$20,222.22
EROSION CONTROL	1	LS	$1,500.00	$1,500.00
RIP RAP	40	TON	$50.00	$2,000.00
ASPHALT PAVING	149	SY	$42.00	$6,272.00
10X4 BOX	1300	LF	$1,265.00	$1,644,500.00
10X4 BOX END SECTION	2	EA	$6,780.00	$13,560.00
DRAINAGE STRUCTURE	5	EA	$4,000.00	$20,000.00
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500.00
MOBILIZATION	1	LS	$20,000.00	$20,000.00
Total				**$1,872,340**
Contingencies (10%)				$187,234
Total Construction Cost				**$2,059,575**
Engineering & Surveying (10%)				$205,957
Construction Inspection (5%)				$102,979
Construction Testing (5%)				$102,979
TOTAL PROJECT COST				**$2,471,489**

BUDGETARY COST - $2,500,000

Re-grade/reshape area and utilize existing drainage system

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
SOD	780	SY	$5.00	$3,900.00
EROSION CONTROL	1	LS	$1,500.00	$1,500.00
RE-GRADING/SHAPING	700	LF	$10.00	$7,000.00
MOBILIZATION (10%)	1	LS	$1,240.00	$1,240.00
Total				**$13,640**
Contingencies (10%)				$1,364
Total Construction Cost				**$15,004**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$35,004**

BUDGETARY COST - $40,000

SIMON/WHITE/HOLCOMB MAP

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HICKORY DRIVE

Description of Area

Hickory Drive is a residential road which runs between Bechtel Blvd. and Government St. From the west (Bechtel) the street follows an easterly path and turns ninety degrees to the north to Government Street.

Description of Existing Drainage System

There is curb and gutter along the full length of Hickory Drive on both sides. Rainfall runoff from this street is sent in four different directions. Three of the four outfalls carry water to the city's stormwater drainage system by means of a small ditch. The fourth outfall carries the water to the city's stormwater drainage system by means of a small pipe. The drainage area is comprised entirely of residential development and encompasses only areas directly adjacent to Hickory.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of standing water on Hickory and high water levels during rain events.

Findings & Recommended Improvements

Standing water in the street and in the outfall ditches was observed. Some of the outfalls have become blocked by leaves and other debris and are generally too flat to adequately drain the road and keep the structures clear of debris. Street grades appear to be too flat to prevent the accumulation of standing water.

Currently this small drainage system has 4 outfalls. All 4 outfalls are through private yards, where over the years, trees, fences, and even a shed have encroach on the drainage outfalls. One outfall to Government St. would be easier to maintain and easier to control.

The Hickory Drive drainage system should be completely reconstructed in order to promote positive drainage and prevent standing water. The city can opt to totally reconstruct the roadway and drainage system or reconstruct the curb & gutters installing trench drains to collect the drainage and overlaying the street to effectively

shed water to the curb & gutters. If the sanitary sewer lines and water lines along Hickory Drive also need to be reconstructed, the city should opt for the total road reconstruction.

Recommended improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Perform an analysis to determine the appropriate size and layout for subsurface drainage system. (One options may be to send all of the drainage northerly straight down Hickory to Government Street and abandon the four small existing outfalls.)
- Obtain any required easements and outside agency permits.
- Install new drainage system.
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	120	LF	$5.00	$600
REMOVAL OF ASPHALT	51	SY	$12.00	$608
SAWCUT	96	LF	$10.00	$960
LIMESTONE	8	CY	$60.00	$507
BEDDING	1	CY	$50.00	$47
SOD	51	SY	$5.00	$253
EROSION CONTROL	1	LS	$1,500.00	$1,500
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	7200	SY	$42.00	$302,400
CURB & GUTTER	2600	LF	$20.00	$52,000
CONCRETE DRIVEWAYS	389	SY	$35.00	$13,611
21" RCP	620	LF	$58.00	$35,960
24" RCP	390	LF	$70.00	$27,300
24" RCP FES	1	EA	$1,200.00	$1,200
TRENCH DRAIN	2600	LF	$90.00	$234,000
DRAINAGE STRUCTURE	7	EA	$4,000.00	$28,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION	1	LS	$20,000.00	$20,000
Total				**$721,445**
Contingencies (10%)				$72,145
Total Construction Cost				**$793,590**
Engineering & Surveying (10%)				$79,359
Construction Inspection (5%)				$39,680
Construction Testing (5%)				$39,680
TOTAL PROJECT COST				**$952,309**

BUDGETARY COST - $960,000

HICKORY DRIVE MAP

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WATERSEDGE DRIVE

Description of Area

Watersedge Drive is a residential street that begins at its southern end on East Beach Drive and extends north until it dead ends into a cul-de-sac near Brumbaugh Road.

Description of Existing Drainage System

The drainage basin mainly consists of a single row of houses adjacent to Watersedge Drive. The neighborhood drainage system is a subsurface drainage system consisting of inlets and pipes. The street and front yard runoff is collected by a curb and gutter system into curb inlets and the rear yard drainage runoff is collected by area inlets and piped through back yards. The drainage flow is collected and transported to the west of the neighborhood into the adjacent bayou which ultimately outfalls to the Inner Harbor.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of sinkholes in the yards of homes on Watersedge Drive. The Public Works Department requested a cost to replace the aged subsurface drainage system.

Findings & Recommended Improvements

The existing pipes and inlets in the rear yards were difficult to find. The inlets may be silted in or covered with vegetation. There was evidence of recent repairs within the roadway areas.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Perform an analysis to ensure the existing pipe sizes are adequate for the drainage
- e basin.
- Obtain any required easements and outside agency permits.
- Replace pipe network within subdivision.
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	1360	LF	$5.00	$6,800
REMOVAL OF CONCRETE	20	SY	$12.00	$240
REMOVAL OF ASPHALT	200	SY	$12.00	$2,400
REMOVE & REPLACE FENCE	425	LF	$20.00	$8,500
SAWCUT	430	LF	$10.00	$4,300
LIMESTONE	35	CY	$60.00	$2,111
BEDDING	35	CY	$50.00	$1,744
SOD	1200	SY	$5.00	$6,000
EROSION CONTROL	1	LS	$1,500.00	$1,500
RE-GRADING/SHAPING	200	LF	$10.00	$2,000
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	200	SY	$42.00	$8,400
CURB & GUTTER	235	LF	$20.00	$4,700
CONCRETE DRIVEWAYS	20	SY	$35.00	$700
24" RCP	280	LF	$70.00	$19,600
24" A2000	1080	LF	$46.00	$49,680
24" RCP FES	3	EA	$1,200.00	$3,600
DRAINAGE STRUCTURE	10	EA	$4,000.00	$40,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION (10%)	1	LS	$16,477.48	$16,477
Total				**$181,252**
Contingencies (10%)				$18,125
Total Construction Cost				**$199,378**
Engineering & Surveying (10%)				$19,938
Construction Inspection (5%)				$9,969
Construction Testing (5%)				$9,969
TOTAL PROJECT COST				**$239,253**

BUDGETARY COST - $240,000

WATERSEDGE MAP

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MONSTER DITCH #1 (Between Hanley and Halstead)

Description of Area

The existing Monster Ditch #1 is a north-south ditch located between (and runs parallel with) Halstead Road and Hanley Road. The ditch is known as "Monster Ditch" by city personnel, but there is also another ditch in Ocean Springs called "Monster Ditch" (ditch through Trentwood Subdivision), so for clarity the ditch just east of Halstead will be referred to as Monster Ditch #1. The ditch begins at the north end at the Ridgewood Drive outfall pipe, extend south, crosses Brumbaugh Road and ultimately outfalls into Halstead Bayou.

Description of Existing Drainage System

Monster Ditch drains approximately 120 acres to the crossing at Brumbaugh. The drainage area corresponds roughly with the area that falls between Halstead on the west, Hanley on the east, Brumbaugh on the south and Havard Road to the north. The area consists of residential subdivision developments. The Monster Ditch collects runoff from the surrounding watershed by a combination of surface flow from yards and streets, as well as piped street drainage.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints over the years about erosion along the ditch banks including damage to fences.

Findings & Recommended Improvements

The drainage area has been fully developed and is unlikely to be further developed in the near future. The continual erosion maintenance problems are likely due to the steep banks of the ditch and the fast velocity of the drainage traveling through the ditch. Many areas of the ditch lack permanent erosion control, such as vegetation. Without permanent erosion control, the erosion problems will continue to perpetuate. Unfortunately with such steep ditch banks and a high velocity of flow, grass alone will not serve as a permanent erosion control technique. The problem areas should be properly graded and then protected with rip-rap or erosion control seed impregnated tubes. Care should be taken during grading and erosion control installation operations to ensure the capacity of the ditch is not diminished. Care should also be taken to disturb only the areas necessary to correct the problem areas and not damage or destroy existing natural vegetation that exists within the ditch.

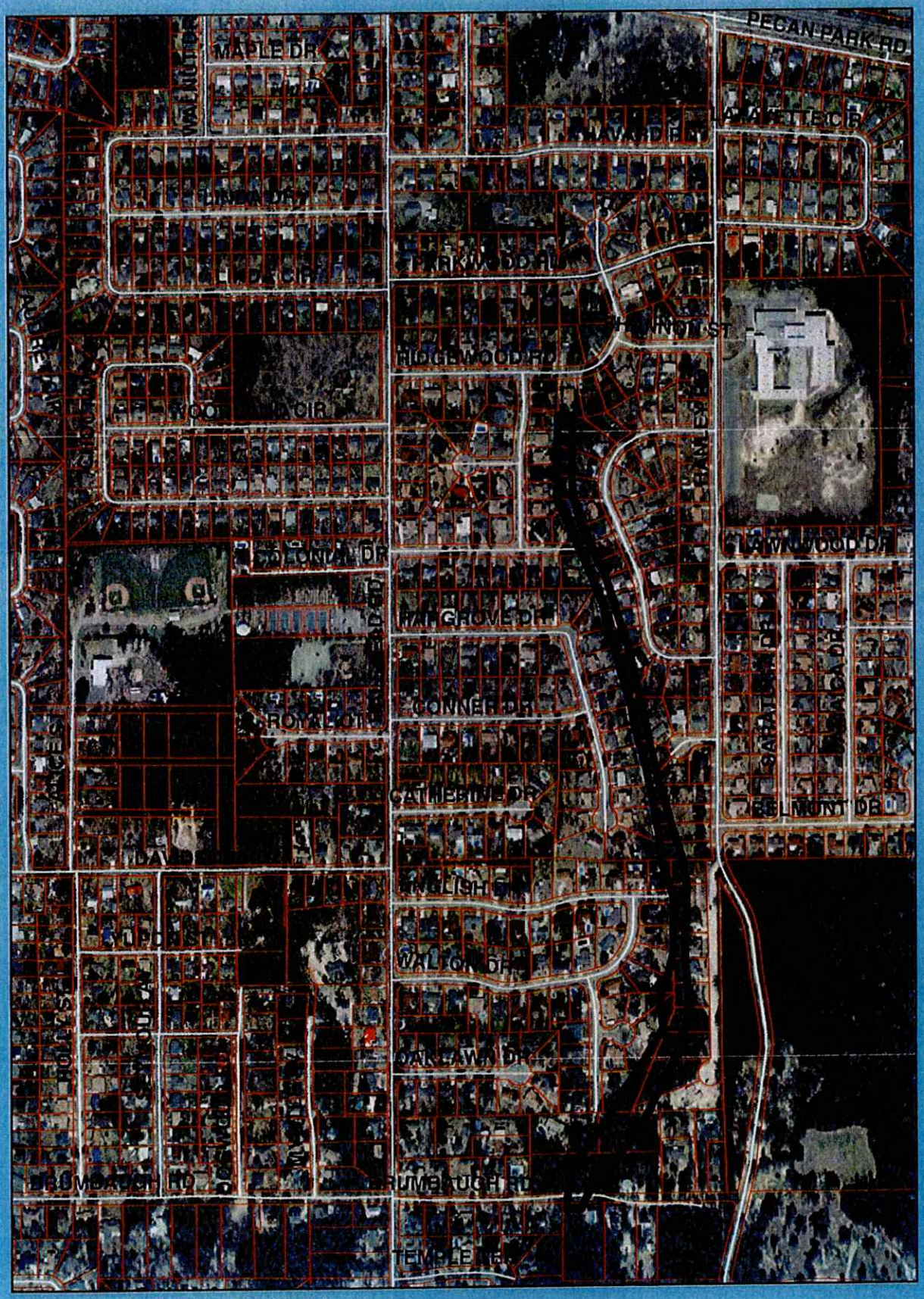
Possible improvements include:

- Obtain easements and outside agency approvals/permits as required.
- Install rip rap at erosion problem sites as needed.
- Install seed impregnated compost tubes as needed for a more natural appearance.

Opinion of Probable Project Cost

BUDGETARY COST - $75,000

MONSTER DITCH #1 MAP



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EAGLE POINT AND EAGLE NEST

Description of Area

Eagle Point and Eagle Nest is an isolated residential area. The only access to the Eagle Point/Eagle Nest area is provided through the Gulf Islands National Seashore or by boat.

Description of Existing Drainage System

This small area currently has no defined path for water to be conveyed from the city streets and houses to the Bayous and Mississippi Sound that border the drainage areas. There are defined ditches in a few areas, but no way for the water to outfall.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of standing water adjacent to the roadways in the area.

Findings & Recommended Improvements

There is standing water along the east side of Eagle Point Drive and on both sides (north and south) of Eagle Nest Drive. There is an outfall for the drainage on the west end of Eagle Nest Drive, but no defined drainage system or outfall exists for the remainder of Eagle Nest Drive or Eagle Point Drive. Driveways have either no culverts at all or very small culverts.

Since there is no outfall adjacent to the city's right-of-way, the city should obtain an easement across private property to obtain access to the Mississippi Sound. A defined drainage system of open ditches/driveway culverts or a subsurface drainage system should be installed in order for drainage to be properly conveyed to the outfall. Two alternative areas for an outfall location are shown on the attached map.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. The survey should include the areas for the two outfall alternates.

- Obtain easements and outside agency approvals/permits as required.
- Determine a consistent grade for the ditches/pipes from the highest point to the chosen outfall.
- Perform an analysis to determine the appropriate size for each pipe and ditch.
- Re-grade ditches and install new culverts/pipes.
- Establish permanent erosion control.

Opinion of Probable Project Cost – Option 1

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	15	LF	$5.00	$75
REMOVAL OF CONCRETE	275	SY	$12.00	$3,300
REMOVAL OF ASPHALT	40	SY	$12.00	$480
SAWCUT	600	LF	$10.00	$6,000
LIMESTONE	50	CY	$60.00	$3,022
BEDDING	15	CY	$50.00	$750
SOD	423	SY	$5.00	$2,113
EROSION CONTROL	1	LS	$1,500.00	$1,500
RE-GRADING/SHAPING	1675	LF	$10.00	$16,750
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	40	SY	$42.00	$1,680
CONCRETE DRIVEWAYS	275	SY	$35.00	$9,625
15" RCP	290	LF	$40.00	$11,600
18" RCP	120	LF	$45.00	$5,400
18" RCP FES	1	EA	$1,020.00	$1,020
DRAINAGE STRUCTURE	1	EA	$4,000.00	$4,000
MOBILIZATION (10%)	1	LS	$6,831.50	$6,832
Total				**$75,147**
Contingencies (10%)				$7,515
Total Construction Cost				**$82,661**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$102,661**

Opinion of Probable Project Cost – Option 2

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	15	LF	$5.00	$75
REMOVAL OF CONCRETE	275	SY	$12.00	$3,300
REMOVAL OF ASPHALT	40	SY	$12.00	$480
SAWCUT	600	LF	$10.00	$6,000
LIMESTONE	50	CY	$60.00	$3,022
BEDDING	15	CY	$50.00	$750
SOD	550	SY	$5.00	$2,750
EROSION CONTROL	1	LS	$1,500.00	$1,500
RE-GRADING/SHAPING	1675	LF	$10.00	$16,750
RIP RAP	20	TON	$50.00	$1,000
ASPHALT PAVING	40	SY	$42.00	$1,680
CONCRETE DRIVEWAYS	275	SY	$35.00	$9,625
15" RCP	290	LF	$40.00	$11,600
18" RCP	240	LF	$45.00	$10,800
18" RCP FES	1	EA	$1,020.00	$1,020
DRAINAGE STRUCTURE	1	EA	$4,000.00	$4,000
MOBILIZATION (10%)	1	LS	$7,435.17	$7,435
Total				**$81,787**
Contingencies (10%)				$8,179
Total Construction Cost				**$89,966**
Engineering & Surveying				$10,000
Construction Inspection				$5,000
Construction Testing				$5,000
TOTAL PROJECT COST				**$109,966**

BUDGETARY COST (OPTION 1 OR 2) - $110,000

EAGLE POINT MAP

BRISTOL BOULEVARD (FORT BAYOU ESTATES)

Description of Area

Bristol Boulevard is the main entrance drive into Fort Bayou Estates. The street runs north-south between Bienville Blvd. (Hwy. 90) and Nottingham Road.

Description of Existing Drainage System

The study area of Bristol Blvd. is the portion of the street from Cumberland Road to Nottingham Road. The drainage system is subsurface and consist of roadside curb inlets and drainage pipe. The system accommodates surface runoff from Bristol Blvd. and a portion of the adjacent residential lots. The drainage is conveyed north to Fort Bayou.

Description of Known Drainage Concerns in the Area

The Alderman for Ward 2 has received complaints of sink holes in the area and has asked for a cost estimate to replace the drainage system.

Findings & Recommended Improvements

Recently replaced sections of sidewalk were observed which could have been due to sinkholes.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Perform an analysis to ensure that the existing system design is adequate.
- Replace the drainage system.
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	1980	LF	$5.00	$9,900.00
REMOVAL OF CONCRETE	400	SY	$12.00	$4,800.00
REMOVAL OF ASPHALT	860	SY	$12.00	$10,320.00
SAWCUT	2550	LF	$10.00	$25,500.00
LIMESTONE	220	CY	$60.00	$13,200.00
BEDDING	60	CY	$50.00	$3,000.00
SOD	850	SY	$5.00	$4,250.00
EROSION CONTROL	1	LS	$3,000.00	$3,000.00
ASPHALT PAVING	860	SY	$42.00	$36,120.00
CURB & GUTTER	1475	LF	$20.00	$29,500.00
CONCRETE DRIVEWAYS	390	SY	$35.00	$13,650.00
24" RCP	1980	LF	$70.00	$138,600.00
24" RCP FES	2	EA	$1,200.00	$2,400.00
DRAINAGE STRUCTURE	11	EA	$4,000.00	$44,000.00
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500.00
MOBILIZATION	1	LS	$20,000.00	20,000.00
Total				**$359,740**
Contingencies (10%)				$35,974
Total Construction Cost				**$395,714**
Engineering & Surveying (10%)				$39,571
Construction Inspection (5%)				$19,786
Construction Testing (5%)				$19,786
TOTAL PROJECT COST				**$474,857**

BUDGETARY COST $500,000

BRISTOL BOULEVARD AREA MAP

LONDONDERRY AND WELLINGTON (FORT BAYOU ESTATES)

Description of Area

Londonderry and Wellington are two parallel well established residential streets in the Fort Bayou Estates Subdivision. The street runs north-south between Cumberland Road and Nottingham Road.

Description of Existing Drainage System

The drainage area is composed mostly of the land between these streets and also accommodates a portion of Nottingham's drainage runoff. The drainage system runs parallel to the streets in the rear yards of the houses that front Wellington and Londonderry. The drainage systems consists of drainage pipe, inlets, and some portions of open ditch which begins with a pipe crossing under Nottingham and then conveys drainage northerly and ultimately outfalls into Fort Bayou on the north side of Cumberland.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of sink holes in the area of the rear yard drainage system. The Public Works has tried to video the pipe, but the camera could not make it through the pipe, indicating that the pipe is collapsed.

The Public Works Department has had continual problems with the Nottingham pipe crossing between Londonderry/Wellington, Wellington/Lancelot, and Lancelot/Hammersmith.

Findings & Recommended Improvements

Sink holes and collapsed pipe were observed in the area. Also, there is evidence of asphalt repairs at the Nottingham crossings and depressions in the roadway.

Possible improvements include:

- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the pipes from the highest point to the outfall.
- Perform an analysis to ensure that the existing system design is adequate.
- Obtain any required easements and outside agency permits.

- Remove any fences within the easement area and reinstall on the easement lines.
- Install new drainage pipe and inlets.
- Establish permanent erosion control.

Opinion of Probable Project Cost

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	1870	LF	$5.00	$9,350
REMOVAL OF ASPHALT	140	SY	$12.00	$1,680
REMOVE & REPLACE FENCE	500	LF	$20.00	$10,000
SAWCUT	250	LF	$10.00	$2,500
LIMESTONE	30	CY	$60.00	$1,800
BEDDING	50	CY	$50.00	$2,514
SOD	2000	SY	$5.00	$10,000
EROSION CONTROL	1	LS	$1,500.00	$1,500
ASPHALT PAVING	126	SY	$42.00	$5,308
CURB & GUTTER	58	LF	$20.00	$1,150
15" RCP	110	LF	$40.00	$4,400
18" RCP	35	LF	$45.00	$1,575
24" RCP	250	LF	$70.00	$17,500
18" A2000	335	LF	$27.00	$9,045
24" A2000	1040	LF	$46.00	$47,840
30" A2000	100	LF	$60.00	$6,000
24" RCP FES	1	EA	$1,200.00	$1,200
DRAINAGE STRUCTURE	11	EA	$4,000.00	$44,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$2,500
MOBILIZATION (10%)	1	LS	$17,986.25	$17,986
Total				**$197,849**
Contingencies (10%)				$19,785
Total Construction Cost				**$217,634**
Engineering & Surveying (10%)				$21,763
Construction Inspection (5%)				$10,882
Construction Testing (5%)				$10,882
TOTAL PROJECT COST				**$261,160**

BUDGETARY COST $265,000

NOTTINGHAM/WELLINGTON/LONDONDERY AREA MAP

GOVERNMENT STREET
(Between Hunter Drive & Magnolia Park School)

Description of Area

Government Street is a major east-west corridor (this portion of Government is the only section that is north-south) in Ocean Springs that begins at Washington Ave. on the western end and extend easterly to the city limits where the streets name changes to "Old Spanish Trail". The area of concern for this study is the portion of Government Street between Hunter Drive to the west and Magnolia Park Elementary School to the east as shown on the attached map.

Description of Existing Drainage System

The drainage system along Government Street consists of roadside ditches and culverts at driveway crossings. Government Street has no curb & gutter in the area. Based on the available limited data, it appears that the Government Street drainage system in this area collects and transports/retains approximately 73 acres of runoff. Development within the drainage basin for this system include residential & commercial. This area of Government Street should ultimately outfall to Stark Bayou.

Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints about the standing water in the ditches along Government Street. The Public Works Department stated that the invert grades of the ditches and culverts are not consistent.

Findings & Recommended Improvements

Based on field investigation, the following conditions of concern were observed:

- The ditches are very flat. In certain areas the ditch bottom elevation does not change significantly over the course of several thousand feet.
- The ditches are not graded consistently to take advantage of the natural change in grade.
- Many of the existing culverts are not installed at the proper grade or slope.

The inverts of the culverts are either installed below the bottom of the ditch or above the bottom of the ditch. The culverts that are installed too low are not operating at full capacity and are much more susceptible to siltation which in turn diminishes the capacity even more over time and requires additional maintenance effort to remove siltation. The culverts that are installed too high create a dam within the ditch which traps water in the ditch until the water either evaporates or is absorbed into the ground.

- Many of the existing culverts are undersized or are not graded properly.

Recommended improvements include:

- Determine which alternate is preferred (Option 1 – Open Ditches & Culverts or Option 2 – Install subsurface drainage throughout the entire area.)
- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to each outfall.
- Perform an analysis to determine the appropriate size for each pipe and/or ditch.
- Obtain any required easements and outside agency permits.
- Re-grade the ditches and install culverts or install new subsurface drainage system.
- Establish permanent erosion control.

Opinion of Probable Project Cost – Option 1 (Open Ditches & Culverts)

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	1645	LF	$5.00	$8,225
REMOVAL OF CONCRETE	270	SY	$12.00	$3,240
REMOVAL OF ASPHALT	1550	SY	$12.00	$18,600
SAWCUT	3300	LF	$10.00	$33,000
LIMESTONE	310	CY	$60.00	$18,600
BEDDING	50	CY	$50.00	$2,500
GRASSING	1	AC	$4,000.00	$4,000
EROSION CONTROL	1	LS	$4,500.00	$4,500
RE-GRADING/SHAPING	11250	LF	$10.00	$112,500
RIP RAP	50	TON	$50.00	$2,500
ASPHALT PAVING	1550	SY	$42.00	$65,100
CONCRETE DRIVEWAYS	270	SY	$35.00	$9,450
18" RCP	1190	LF	$45.00	$53,550
24" RCP	140	LF	$70.00	$9,800
36" RCP	70	LF	$140.00	$9,800
42" RCP	245	LF	$170.00	$41,650
42" RCP FES	1	EA	$2,800.00	$2,800
DRAINAGE STRUCTURE	11	EA	$4,000.00	$44,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION	1	LS	$20,000.00	$20,000
Total				**$465,315**
Contingencies (10%)				$46,532
Total Construction Cost				**$511,847**
Engineering & Surveying (10%)				$51,185
Construction Inspection (5%)				$25,592
Construction Testing (5%)				$25,592
TOTAL PROJECT COST				**$614,216**

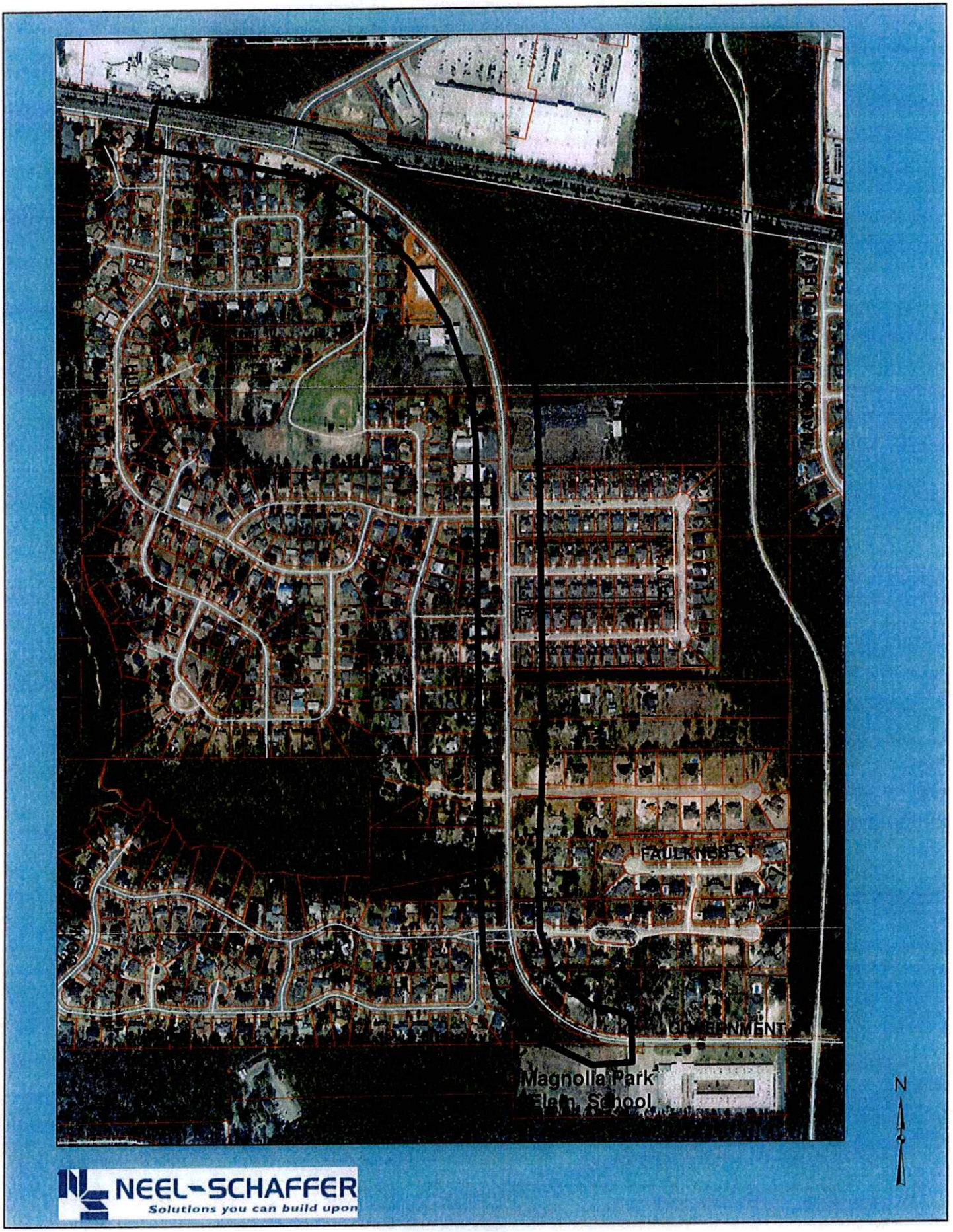
BUDGETARY COST $625,000

Opinion of Probable Project Cost – Option 2 (Subsurface Drainage Throughout the Entire Area)

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF PIPE	1645	LF	$5.00	$8,225
REMOVAL OF CONCRETE	270	SY	$12.00	$3,240
REMOVAL OF ASPHALT	1550	SY	$12.00	$18,600
SAWCUT	3290	LF	$10.00	$32,900
BORROW EXCAVATION	25833	CY	$15.00	$387,500
MUCK	3056	CY	$8.00	$24,444
LIMESTONE	302	CY	$60.00	$18,103
BEDDING	49	CY	$50.00	$2,432
EROSION CONTROL	1	LS	$4,500.00	$4,500
RE-GRADING/SHAPING	1250	LF	$10.00	$12,500
ASPHALT PAVING	1550	SY	$42.00	$65,100
CONCRETE DRIVEWAYS	270	SY	$35.00	$9,450
18" RCP	1190	LF	$45.00	$53,550
24" RCP	140	LF	$70.00	$9,800
36" RCP	70	LF	$140.00	$9,800
42" RCP	245	LF	$170.00	$41,650
24" A2000	5000	LF	$46.00	$230,000
30" A2000	5000	LF	$60.00	$300,000
36" A2000	2500	LF	$82.00	$205,000
42" RCP FES	1	EA	$2,800.00	$2,800
DRAINAGE STRUCTURE	69	EA	$4,000.00	$276,000
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500
MOBILIZATION	1	LS	$20,000.00	$20,000
Total				**$1,737,095**
Contingencies (10%)				$173,710
Total Construction Cost				**$1,910,805**
Engineering & Surveying (10%)				$191,081
Construction Inspection (5%)				$95,540
Construction Testing (5%)				$95,540
TOTAL PROJECT COST				**$2,292,966**

BUDGETARY COST $2,300,000

GOVERNMENT ST. MAP



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WAL-MART AREA

Description of Area

Wal-Mart is located on the north side of Highway 90 between Deana Road and Parktown Drive in eastern Ocean Springs. The What-a-burger and Tire Kingdom are located adjacent to the Wal-Mart property on the west side. First Federal Bank is located to the south-west of Wal-Mart at the Wal-Mart Hwy. 90 entrance drive. A strip mall, McDonalds, & Sonic Drive-In are located adjacent to Wal-Mart to the front and to the east. Parktown East Subdivision wraps around the Wal-Mart development to the east and to the north. Commercial development including a Chinese Restaurant, exists south of Wal-Mart on the south side of Hwy. 90.

Description of Existing Drainage System

The ditch in question for this study area begins at Yosemite Drive and flows approximately 1130' southward to Groveland. The Yosemite/Groveland ditch runs between and parallel to Glacier and Woodward Dr. and collects water from Yosemite and from the adjacent residential lots. The drainage crosses Groveland via two pipe culverts and then the ditch continues south approximately 1500' passing between Wal-Mart/First Federal Bank and What-a-burger then turns to the east and runs parallel to Hwy. 90 for approximately 160'. The ditch is piped for approximately 300' for the Wal-mart entrance driveway and turn lane. Still paralleling the north side of Hwy. 90, the ditch opens back up for approximately 180' until it reaches three large culverts that cross Hwy. 90 to the south. The three large Hwy. 90 culverts empty into a ditch on the south side of Hwy. 90 at the Chinese Restaurant. The open ditch continues south along the western edge of the Chinese Restaurant and then meanders through wooded property crossing under the railroad tracks and Pabst Road until it reaches Heron Bayou where the drainage runoff ultimately outfalls. The drainage area contributing to the Wal-Mart Area ditch and the Hwy. 90 crossing is approximately 40 acres of residential and commercial development.

Some of the commercial developments have incorporated detention facilities, but it is unknown if the detention facilities work properly.

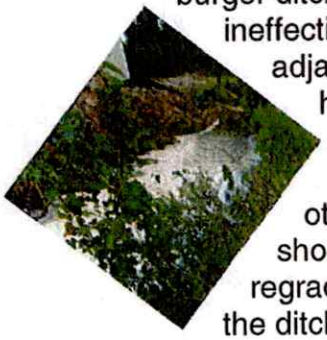
Description of Known Drainage Concerns in the Area

The Public Works Department has received complaints of standing water and "slow" drainage in the Yosemite/Groveland ditch and in the What-a-burger ditch. The Public Works Department continually cleans the Hwy. 90 crossing pipes due to siltation.

Findings & Recommended Improvements

Standing water was observed throughout the drainage area. The Yosemite/Groveland ditch is very flat which contributes to the standing water in the ditch. The ditch can not be regraded to promote positive drainage due to the existing elevation of Groveland, Yosemite and the adjacent properties, unless a significant amount of work is done to the surrounding areas such as raising the road and installing retaining walls. The easiest solution to collect the standing water may be to install a sock pipe and filter bed below the invert of the ditch.

The What-a-burger ditch also contains standing water. The ditch does not appear to be uniformly graded. There appear to be low spots in the ditch that promote standing water. In addition, there is evidence of heavy siltation in the What-a-burger ditch and in the pipes downstream due to ineffective erosion control measures on the adjacent commercial properties. Also, the ditch has very steep sides which is very susceptible to erosion problems. The ditch should be uniformly graded and rip-rap or other erosion control stabilization techniques should be utilized to stabilize the steep ditch sides. Ensure that the regrading and stabilization operations do no diminish the capacity of the ditch.



Preliminary calculations based on very limited available data showed the existing pipe running under the Wal-mart driveway entrance to be adequately sized, but upsizing the culvert would increase the efficiency of the upstream drainage

system. The east-west pipes could be sized to more closely compliment the capacity of the Hwy. 90 (north-south) cross drains.

Recommended improvements include:

- Enforce erosion control guidelines for adjacent commercial construction activities.
- Conduct a complete survey of the area and the existing grades/drainage system. Survey should include a determination of the complete limits of the contributing runoff.
- Determine a consistent grade for the ditches/pipes from the highest point to each outfall.
- Perform an analysis to determine the appropriate size for each pipe and/or ditch.
- Obtain any required easements and outside agency permits.
- Perform improvements at once or in phases.
- Establish permanent erosion control.

Opinion of Probable Project Cost

Yosemite/Groveland Sock Pipe

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF ASPHALT	31	SY	$12.00	$366.67
SAWCUT	50	LF	$10.00	$500.00
BORROW EXCAVATION	1000	CY	$15.00	$15,000.00
MUCK	417	CY	$8.00	$3,333.33
LIMESTONE	5	CY	$60.00	$305.56
BEDDING	85	CY	$50.00	$4,236.11
SOD	1863	SY	$5.00	$9,313.33
EROSION CONTROL	1	LS	$1,500.00	$1,500.00
ASPHALT PAVING	31	SY	$42.00	$1,283.33
CURB & GUTTER	22	LF	$20.00	$440.00
36" RCP	25	LF	$140.00	$3,500.00
36" A2000	1500	LF	$82.00	$123,000.00
36" RCP FES	1	EA	$2,200.00	$2,200.00
DRAINAGE STRUCTURE	2	EA	$4,000.00	$8,000.00
MAINT OF TRAFFIC	1	LS	$1,500.00	$1,500.00
MOBILIZATION (10%)	1	LS	$20,000.00	$20,000.00
Total				**$194,478**
Contingencies (10%)				$19,448
Total Construction Cost				**$213,926**
Engineering & Surveying (10%)				$21,393
Construction Inspection (5%)				$10,696
Construction Testing (5%)				$10,696
TOTAL PROJECT COST				**$256,711**

BUDGETARY COST $260,000

Regrade & Pave What-a-burger Ditch

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
EROSION CONTROL	1	LS	$1,500.00	$1,500.00
RE-GRADING/SHAPING	1550	LF	$10.00	$15,500.00
PAVED DITCH	500	CY	$200.00	$100,000.00
MOBILIZATION (10%)	1	LS	$11,700.00	$11,700.00
Total				**$128,700**
Contingencies (10%)				$12,870
Total Construction Cost				**$141,570**
Engineering & Surveying (10%)				$14,157
Construction Inspection (5%)				$7,079
Construction Testing (5%)				$7,079
TOTAL PROJECT COST				**$169,885**

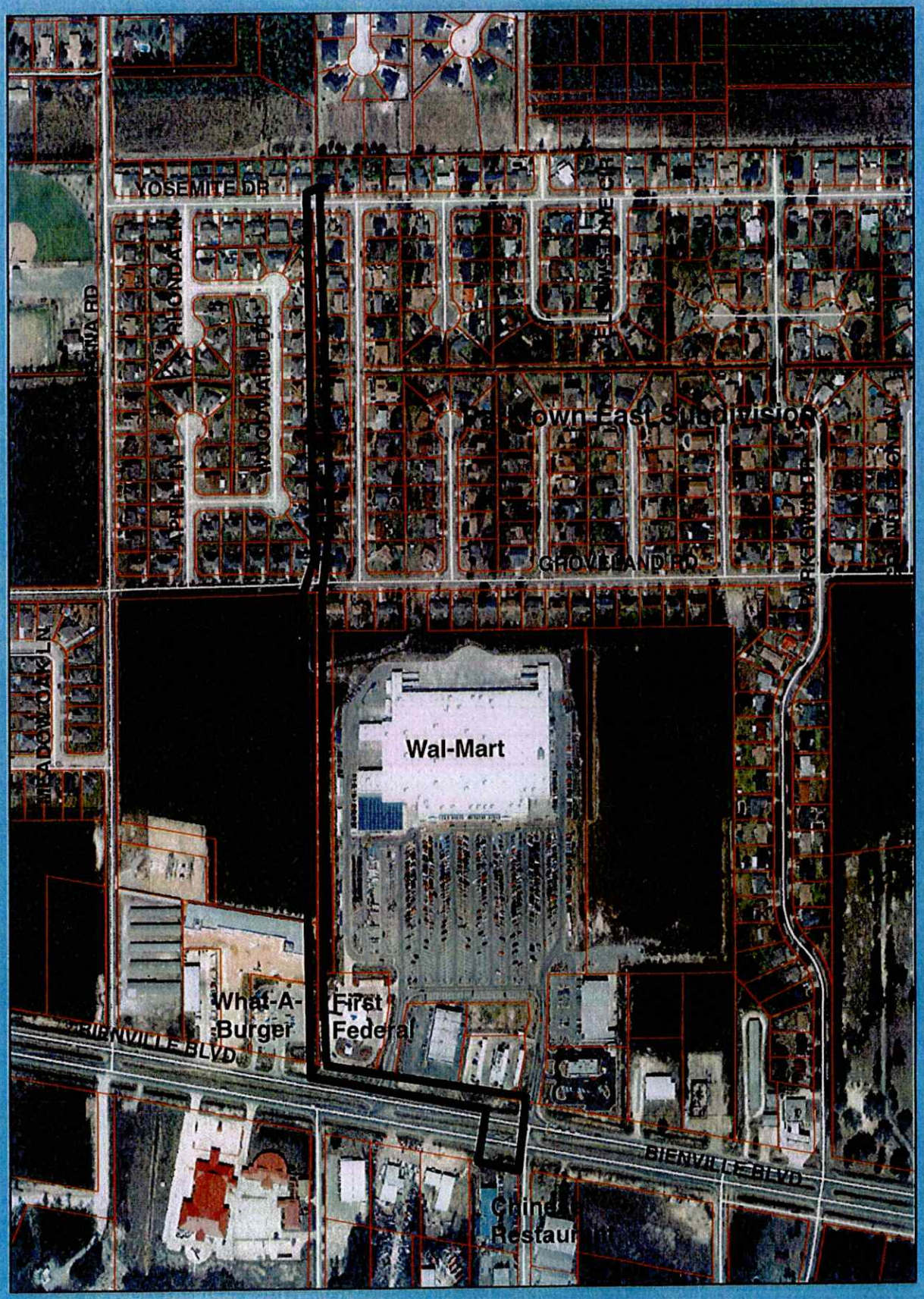
BUDGETARY COST $175,000

Replace Wal-Mart Driveway Pipe

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
REMOVAL OF ASPHALT	70	SY	$12.00	$840.00
SAWCUT	60	LF	$10.00	$600.00
LIMESTONE	12	CY	$60.00	$713.89
BEDDING	45	CY	$50.00	$2,250.00
SOD	600	SY	$5.00	$3,000.00
EROSION CONTROL	1	LS	$1,500.00	$1,500.00
ASPHALT PAVING	70	SY	$42.00	$2,940.00
65X40 ARCH	300	LF	$280.00	$84,000.00
DRAINAGE STRUCTURE	2	EA	$4,000.00	$8,000.00
MOBILIZATION (10%)	1	LS	$10,384.00	$10,384.00
Total				**$114,228**
Contingencies (10%)				$11,423
Total Construction Cost				**$125,651**
Engineering & Surveying (10%)				$12,565
Construction Inspection (5%)				$6,283
Construction Testing (5%)				$6,283
TOTAL PROJECT COST				**$150,782**

BUDGETARY COST $155,000

WAL-MART MAP



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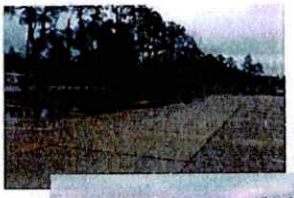
REILLY ROAD

Description of Area

Reilly Road is a major connecting road on the eastern limits of the city that connects Highway 90 on the south side to Ocean Springs Road on the north. CCC Camp Road is an east-west residential road that intersects Reilly at a point about two thirds of the way from Reilly's southern end.

Description of Existing Drainage System

The drainage along Reilly Road consists of open ditches on both sides of the road with a few pipe culvert crossings. The entire length of Reilly Road north of Trentwood Subdivision is attempting to drain to the Trentwood ditch also known as the "Monster Ditch" by city staff. For clarity the Trentwood ditch will be referred to as Monster Ditch #2. Based on the limited available data, the potential surrounding drainage area contributing runoff to the Reilly Road ditches is approximately 400 acres. The drainage area is very large and flat. The basin includes portions of CCC Camp Road and Colonial Estates. A large portion of the drainage basin is in Jackson County. Currently drainage on Reilly Road is potentially conveyed through ditches as far north as Ocean Springs Road south to the Trentwood ditch and eventual outfalls just south of Highway 90 into Davis Bayou. Rainfall runoff from the farthest parts of the basin must travel over two miles to reach the outfall. Most of the land within the drainage basin is not developed, though there is a substantial portion that has developed streets and houses.



Description of Known Drainage Concerns in the Area

The Public Works Department receives continuous complaints about (1) the depth of water in the Reilly Road drainage ditches and the velocity (speed) of the flow in the ditches, (2) the "slow" drainage and standing water in the Reilly Road ditches, (3) Reilly Road street flooding, and (4) flooding of the Catholic Church parking lot, (5) flooding of the Trentwood playground on Reilly, and (6) flooding of other private properties in the vicinity.

Findings & Possible Improvements

The land in the contributing drainage basin is very flat and very large with a long travel distance from the furthest point of the basin to the outfall. There is a substantial amount of standing water throughout the drainage basin long after a rain event. A majority of the runoff in the basin may never reach the outfall, but was included in the basin because there is a potential that all of the area shown in the basin could contribute to the Reilly Road drainage system now or at a future date if improvements are made or vacant properties are developed. The water in the Reilly Road ditches and in the Trentwood ditch is deep and travels very swiftly following rain events. In an effort to "speed" up drainage in the Reilly Road ditches, the city has dug the ditches deeper over the years, which has only perpetuated the standing water in the ditches. Now the ditches are deeper than the outfalls and will hold water until the water has time to infiltrate into the ground.

While only the area adjacent to Reilly Road was briefly studied in this report, the entire area between Hwy. 57,

Hwy. 90, and Ocean Springs-Hospital Road consists of the same drainage characteristics (very large and very flat). Much of this area is undeveloped and could potentially be annexed in the future by the city of Ocean Springs. The entire area between Hwy. 57, Hwy. 90, and Ocean Springs-Hospital Road should be studied in detail to determine a master plan for the drainage system and to fully utilize all available/potential outfalls.

Possible Improvements Include:

1. Split the Drainage Basin into a North Basin and a South Basin – The outfall for the entire basin as it exists today is Davis Bayou south of Hwy. 90. The drainage basin should be split into a north basin that would outfall to Old Fort Bayou and a south basin that would continue to outfall to Davis Bayou. The basin should be split for the following reasons:
    a. Splitting the basin would more evenly distribute the runoff between Old Fort Bayou and Davis Bayou.
    b. Splitting the basin would shorten the travel time for the runoff.
    c. Splitting the basin would relieve much of the drainage going through Trentwood Subdivision (which is a residential area) and would eliminate additional inundation by future development.

    d. The undeveloped areas and the drainage runoff contributed by property within Jackson County will be directed towards Old Fort Bayou instead of Davis Bayou via the Trentwood Subdivision ditch.

2. Environmental Study - An environmental study should be conducted to ensure that changing the quantity of drainage runoff to Trentwood drainage ditch (or any of the other areas in the basin/future outfall areas) will not be detrimental to the current environmental conditions of the area.
3. Further Breakdown of Future North Drainage Basin – the north basin could be broken down further into smaller basins if easements can be obtained for separate outfalls. A further breakdown could split Jackson County drainage and Ocean Springs drainage into separate basin, so that each entity can handle their own drainage infrastructure. Splitting the basin would also shorten runoff travel time, reduce the size of drainage piping, and will make phasing drainage improvements easier to coordinate.
4. South Drainage Basin Improvements – Based on the limited available data, the current drainage system along Reilly Road appears to be undersized not only for the entire existing 400 acre drainage basin, but unfortunately even if the drainage basin is split and the northern portion is redirected to Old Fort Bayou, the current system appears to be undersized

for the smaller amount of drainage runoff. A complete survey should be conducted of all of the contributing area of the (future) drainage basin and a complete design should be prepared.

5. North Drainage Basin(s) Improvements – Once the limits of the north basin(s) is determined and outfall locations have been determined, a complete survey should be conducted of all of the contributing area of the (future) drainage basin(s) and a complete design should be prepared.

Although breaking the large 400 acre drainage area into smaller areas will tremendously reduce the runoff to any one particular area, the drainage system components for the smaller areas will still be large due to the volume of water and the lack of a significant change in elevation across the drainage area. Alternative solutions should be considered to minimize the cost and impacts of the improvements. One alternative would be the use of pumping stations (or lift stations) similar to those used in sewage collection/transmission systems could be utilized. Pumping stations, while a necessary part of sewage system design, should be avoided as much as possible in drainage system design. Unlike standard drainage pipe and ditches, pumping stations are mechanical/electrical systems that require frequent inspection, cleaning, and maintenance. Pumping stations are also susceptible to power outages, which frequently occur during rain events. Pumping station malfunctions during rain events can be detrimental to all areas upstream of the pumping station. Pumping stations should only be used as a "last resort".

A second alternative would be to purchase property to create detention areas within the basins. Detention ponds can be incorporated into public parks and recreation areas.

The City of Ocean Springs should also consider restrictions/requirements on future developments to limit their impact to the drainage systems. Unfortunately the City does not have any jurisdiction over the future development in Jackson County that contribute additional runoff to the City, but discussion with the county may provide some cooperation on the issues.

Opinion of Probable Project Cost

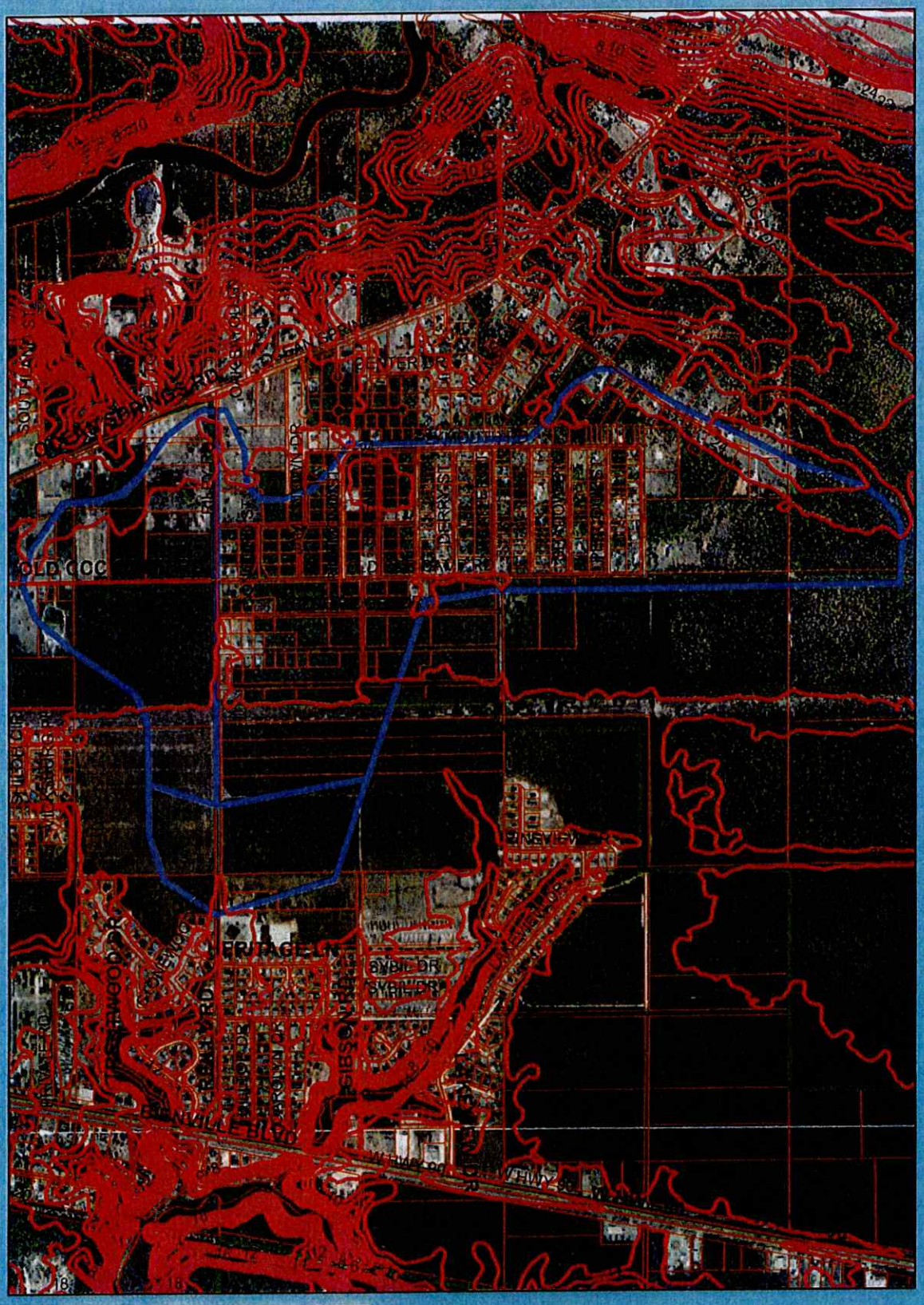
COST TO MODIFY DRAINAGE SYSTEM TO HANDLE CITY OF OCEAN SPRINGS INCORPORATED AREA ONLY

BUDGETARY COST - $5 TO $15 MILLION

COST TO MODIFY DRAINAGE SYSTEM TO HANDLE CITY OF OCEAN SPRINGS INCORPORATED AREA AND JACKSON COUNTY UNINCORPORATED AREA

BUDGETARY COST - $15 TO $25 MILLION

REILLY ROAD CURRENT POTENTIAL DRAINAGE BASIN



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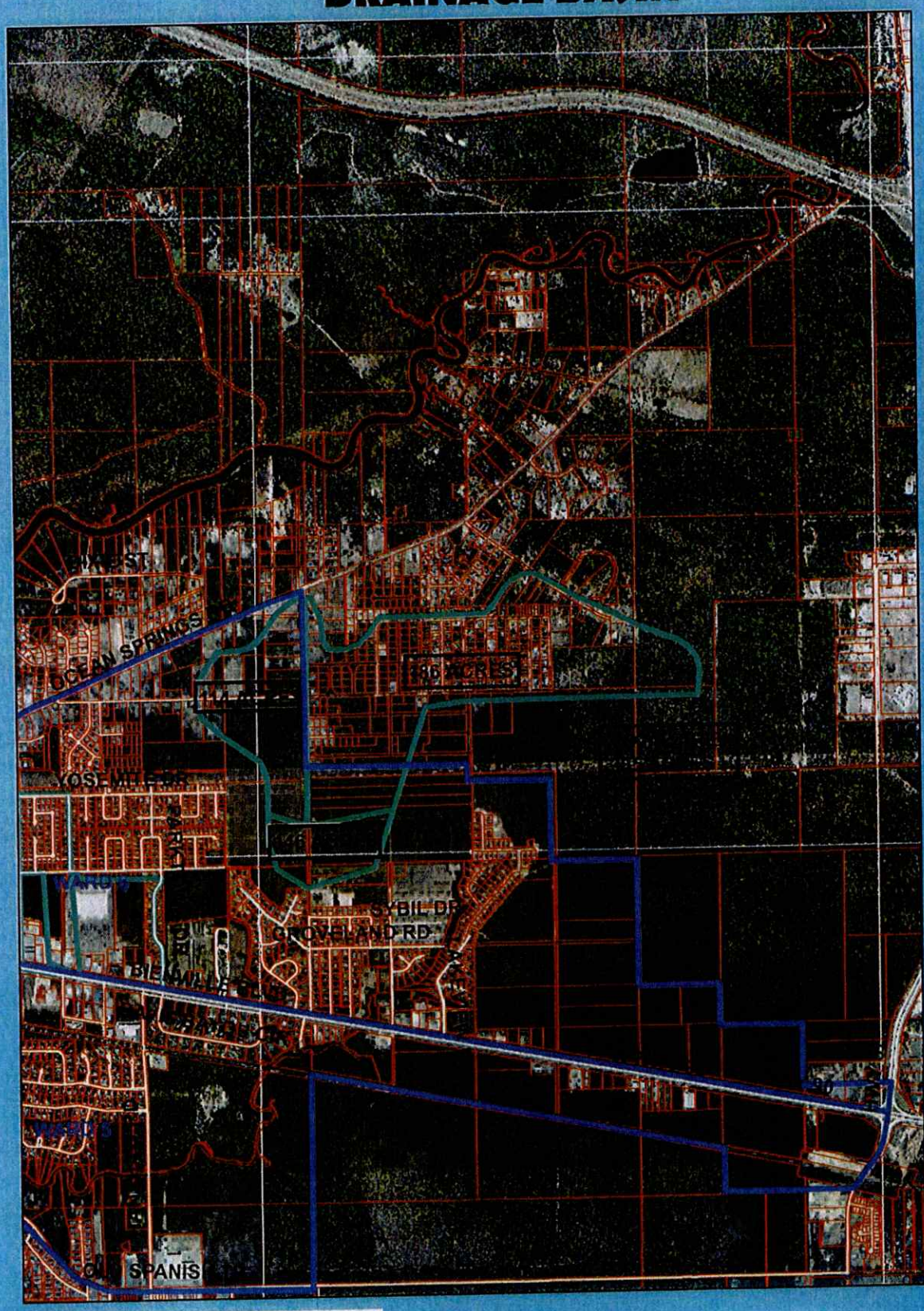
REILLY ROAD AREA CURRENT POTENTIAL DRAINAGE BASIN



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REILLY ROAD AREA FUTURE DRAINAGE AREA SPLIT

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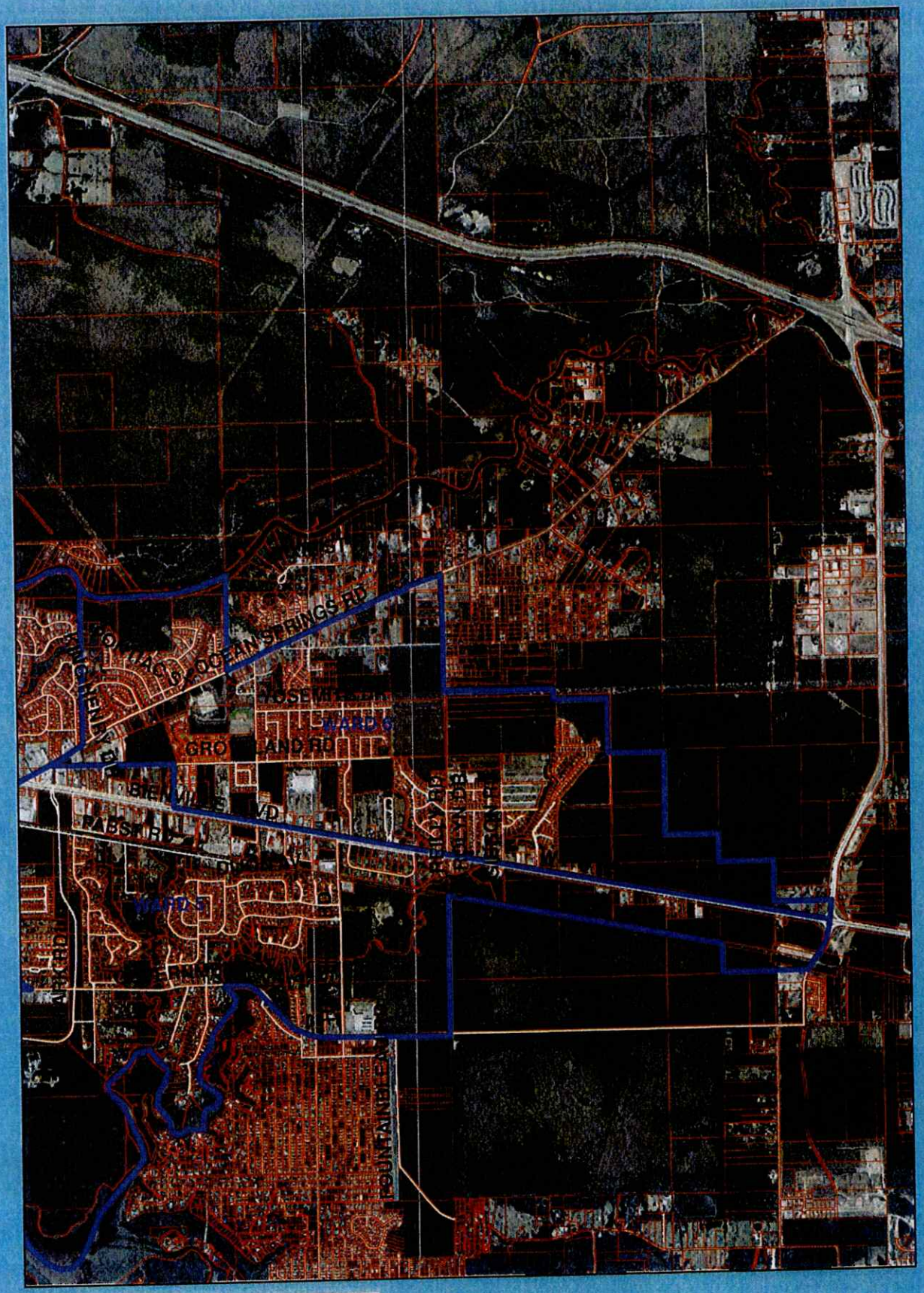
HWY.57/HOSPITAL RD./HWY.90 AREA MAP



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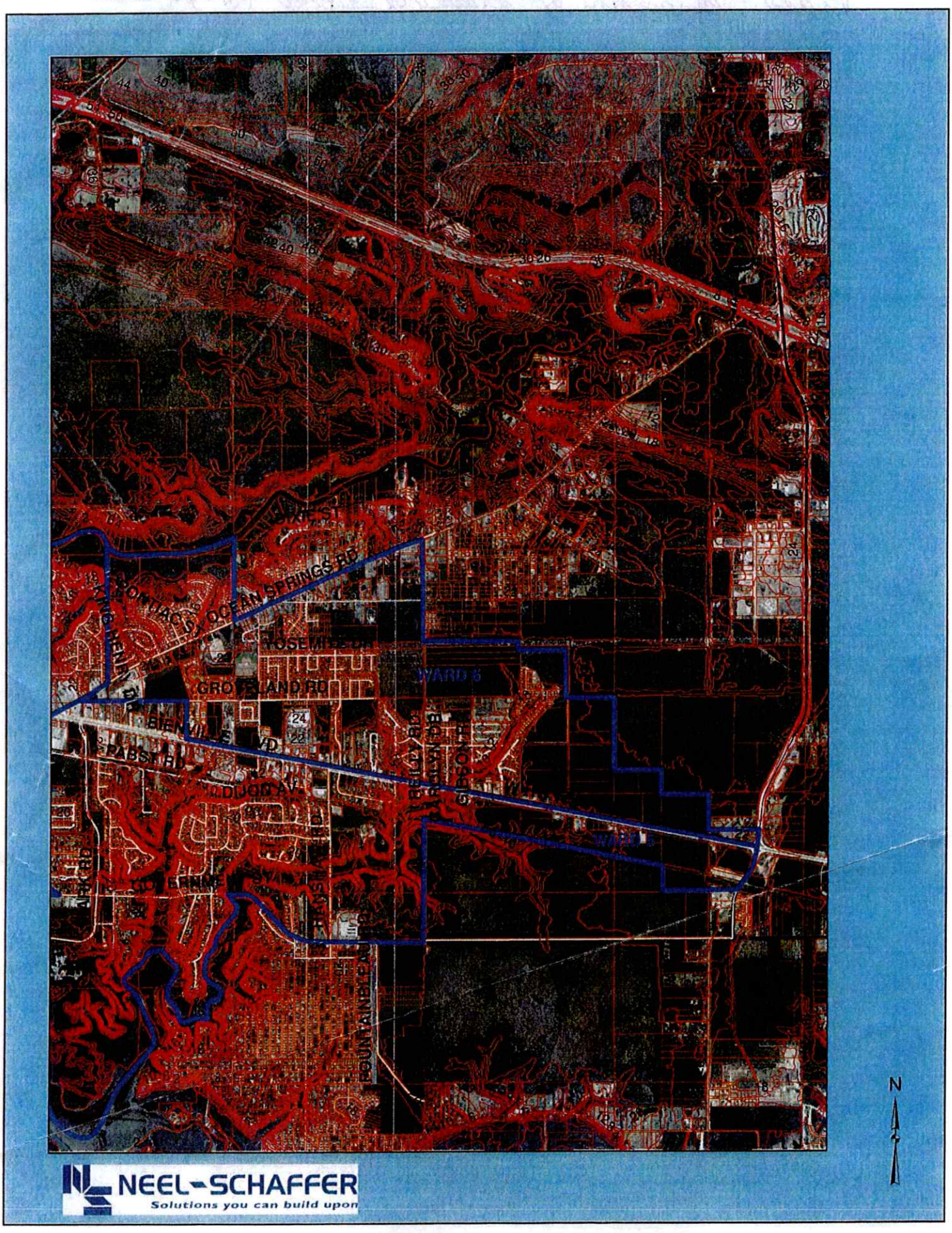
HWY.57/HOSPITAL RD./HWY.90 AREA MAP



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SUMMARY OF BUDGETARY COSTS

West Project Areas (West of Pine Drive)

West Porter Avenue .....$90,000 FIXED

Front Beach Outfalls $815,000

Cleveland and Rayburn $275,000

Rayburn and Signal $75,000

General Pershing and Ward Avenue $800,000

Central Project Areas (Pine to Hanley)

* Simon Boulevard Roadside Ditch ..... $300,000 - $3,350,000

Simon and White ..... $40,000 - $2,500,000

Hickory Drive $960,000

Watersedge Drive $240,000

Monster Ditch #1 ..... $75,000

East Project Areas (East of Hanley)

Eagle Point and Eagle Nest $110,000

Bristol Boulevard $500,000

Londonderry and Wellington $265,000

Government Street .....$625,000 to $2,300,000

Wal-Mart Area .....$155,000 to $260,000

Reilly Road ..... $5 to $15 Million