

# ***WOOLMARKET MASTER PLAN***

*City of Biloxi  
Harrison County, Mississippi*



*May 2018*

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## SECTION 1 – INTRODUCTION

### 1.1 BACKGROUND

The City of Biloxi is in the southeastern quadrant of Harrison County on the Gulf Coast of Mississippi. Biloxi has a subtropical climate with an average annual rainfall of 65 inches. The city is generally subdivided into four distinct parts—East Biloxi, West Biloxi, North Biloxi, and Woolmarket.

The Woolmarket area is the northernmost part of the city bounded on the south by the Tchoutacabouffa River, on the west by the Biloxi River and to the east by the City of D'Iberville. To the north lies unincorporated Harrison County. Most of the Woolmarket area lies north of Interstate 10 (I-10). The notable exception being the Eagle Point subdivision which is bounded by I-10 to the north and the Tchoutacabouffa River to the south. A majority of the study area was originally annexed by the City of Biloxi in 1999, and the annexation area has been expanded three times since that date. In 2004, with the addition of the Wells Ferry subdivision, in 2010, with the addition of 2.5 square miles of land straddling Mississippi Highway 67 (MS 67) in northeast Woolmarket, and most recently in 2014, the Belle la Vie subdivision in northwest Woolmarket was added. Figure 2-1 shows the Study Area including the Biloxi City Limits as well as the Woolmarket area specifically.

The City of Biloxi currently owns, operates, and maintains the major infrastructure systems in the Woolmarket area—sanitary sewer, water, storm drainage and transportation. Prior to annexation, portions of Woolmarket were served by either Superior Utilities or French Utilities. These systems were acquired by and are now maintained and operated by the City of Biloxi. Recent improvements have been made to the area's sanitary sewer and water systems. The Harrison County Utility Authority (HCUA) constructed a new wastewater treatment plant (WWTP) on Shorecrest Road north of I-10 and several gravity sewer mains. These improvements allowed the Eagle Point Lagoon to be taken offline and provided residents of Biloxi in the Woolmarket area with the capacity needed for existing developments and future growth. The City of Biloxi also constructed an elevated water storage tank on Oaklawn Road and connected the City's water system to the HCUA water system. These improvements provide the necessary pressure and capacity for future expansion of the City's water distribution system.

The storm drainage system has been an issue in several different sections of Woolmarket due to aging and undersized drainage structures. The City of Biloxi recently conducted a drainage study that identified needed improvements in the East Woolmarket Road area which is in the vicinity of Woolmarket Road between Shriner's Boulevard and Old Highway 67. Currently, serious storm drainage issues occur in the Woolmarket Plantation (Larkin Subdivision), located in the area north of the intersection of Larkin Drive and Woolmarket Road. To help reduce runoff issues created by development, the city requires developers in the area to design drainage systems that meet the

100-year storm standard, as well as limit the amount of additional runoff that can be generated by the development.

The existing roadways in Woolmarket were primarily constructed by either Harrison County, the Mississippi Department of Transportation (MDOT) or private property developments that were then granted to the City for maintenance. Limited information relating to roadway geometry, rights-of-way, vehicular capacity, traffic volume, collisions, base type, pavement thickness and pavement condition is available for most major roadways in the area. Bridge ratings are available for all bridges. Complete information for these roadways is crucial for developing maintenance and construction plans for existing and proposed new roadways. The need for new facilities and improvements to existing arterials and collectors has been identified through Gulf Regional Planning Commission's (GRPC) Transportation Improvement Program (TIP) and Metropolitan Transportation Plan (MTP) as well as the MDOT Statewide Transportation Plan.

## **1.2 OBJECTIVES**

The purpose of this report is to provide the City of Biloxi with a master plan for the optimization, operation, and expansion of utilities and infrastructure in the Woolmarket area. Four utility and infrastructure systems are detailed in this report—water, sanitary sewer, storm drainage, and transportation. Each of these systems have been reviewed, and based on existing data, the current state of each system has been established as well as a preliminary cost estimate for proposed improvements. Current and future needs of each system along with the prioritization of improvement projects have been identified. An implementation schedule will ultimately be developed to assist the City with the planning of infrastructure and utility projects throughout the Woolmarket area.

## **1.3 PLAN ORGANIZATION**

This report consists of seven major sections:

*Section 1* presents an overview of the plan, including its background, objectives and limitations.

*Section 2* provides a description of the study area focusing on population, land use and demographics. This section also identifies information management tools that are currently being used by the City of Biloxi.

*Section 3* summarizes an evaluation of the existing sewerage system in the study area and presents the findings of that evaluation regarding system capacity and the ability of the system's various components to meet current and future needs for the collection, treatment and disposal of sewage. This section also identifies known system concerns and provides recommendations for upgrades and renovations as well as preliminary cost estimates for those recommendations.

*Section 4* offers an evaluation of the existing water delivery system in the study area and presents the findings of that evaluation regarding the carrying capacity of the system and its ability to meet

current and future needs. This section also identifies known system concerns and provides recommendations for replacement of existing infrastructure, expansion of the current system, and installation of SCADA systems at two water wells. Preliminary cost estimates associated with these recommendations are also included.

*Section 5* examines existing storm drainage infrastructure and conditions in the study area. It presents drainage runoff calculations performed to estimate the discharge to specified points of interest consistent with theoretical rainfall events. Where deficiencies were identified, preliminary recommendations are offered along with preliminary cost estimates for the improvements.

*Section 6* presents an overview of the study area transportation system, describing the functional classification and operational characteristics of major roadways, assembling historical traffic data, and providing analysis of crash data obtained from the Mississippi Department of Transportation (MDOT) *Safety Analysis Management System (SAMS)*. Current and projected traffic volumes are compared to theoretical roadway capacity to identify existing or potential future deficiencies. Current and future needs for bicycle and pedestrian facilities are also identified. An overview of the statewide bridge inventory is presented along with a summary of each individual bridge survey based on the reports included in Appendix A. Preliminary cost estimates for all the recommended improvements are included.

*Section 7* provides a summary of the recommended improvements to infrastructure in the study area and the preliminary cost estimates associated with them. This section includes a prioritization of the identified projects based on a benefit-cost analysis and logical phasing to minimize rework and inconvenience to City of Biloxi residents and the traveling public.

## **1.4 PLAN LIMITATIONS**

The data, figures, tables, findings, and recommendations presented in this master plan are valid as of the date of publication and are based on the best information available at the time of its development. Implementation of more detailed investigations, regulatory changes, or the addition of more accurate information may affect the conclusions and recommendations contained in this master plan. Various sections of this plan should be reviewed periodically to determine whether the assumptions, conclusions, and recommendations remain valid.

## SECTION 2 – STUDY AREA OVERVIEW

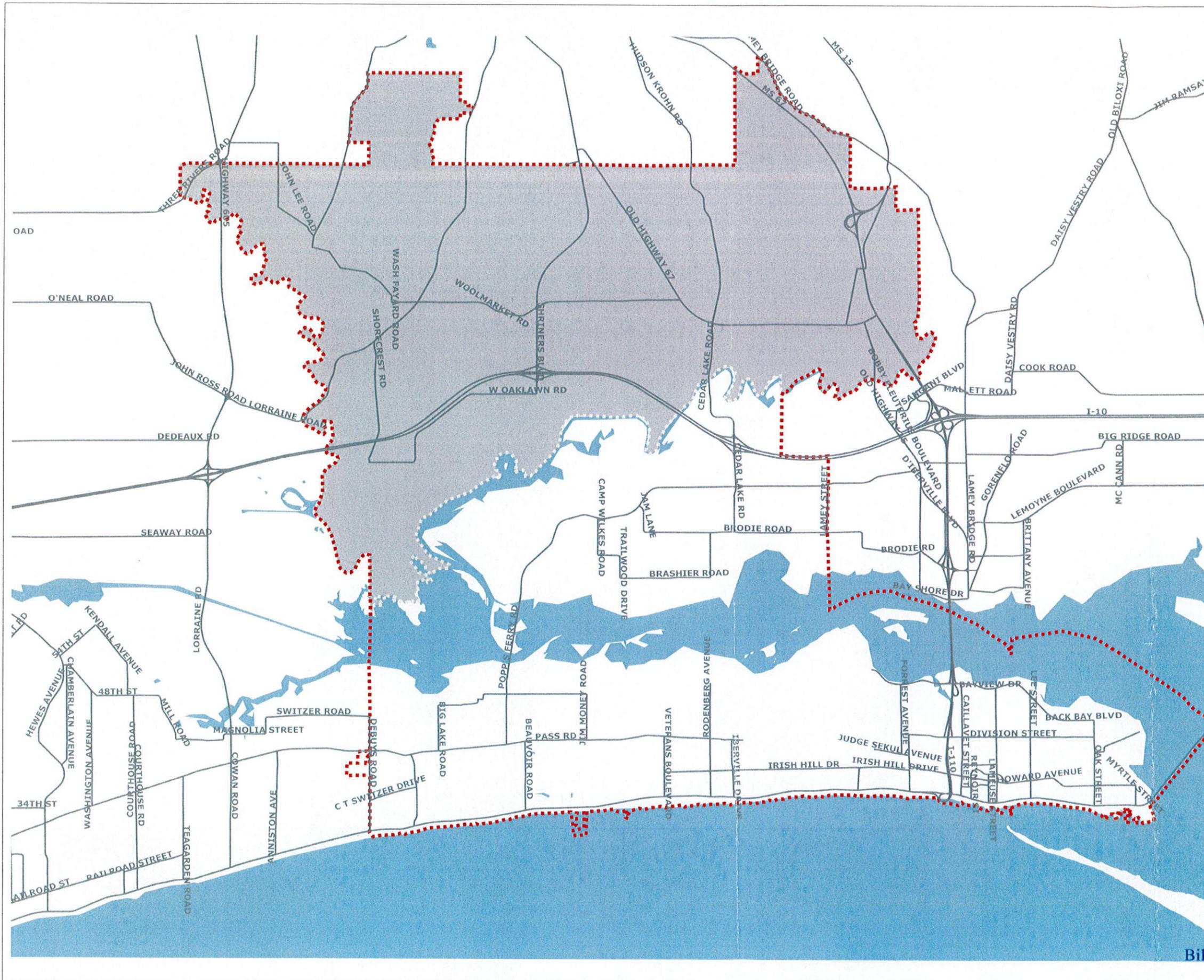
### 2.1 STUDY AREA

As previously stated in Section 1, the study area is primarily comprised of that portion of the City of Biloxi located north of the Tchoutacabouffa River (see Figure 2-1). The land area of Woolmarket and the City were calculated by aggregating 2010 census block data, and adjusting for areas annexed since the decennial count that do not match the census geography exactly. The City of Biloxi has a total land area of 37.65 square miles, with Woolmarket encompassing 20.65 square miles or 55 percent of the all land located within the municipal limits of Biloxi. However, as documented below, only 13.1 percent of the city's residents were living in Woolmarket in 2010; and the population density of the study area was less than 0.5 per acre compared to almost two persons per acre in the city and 3.5 per acre in that portion of Biloxi not including Woolmarket.

### 2.2 SERVICE AREA POPULATION

Woolmarket had a population of approximately 5,806 in 2010, based on decennial census data (adjusted with the aid of contemporaneous aerial photography where areas annexed since 2010 do not match up exactly with census geography). That represented 13.1 percent of the estimated 44,316 people living within the current municipal limits of Biloxi (see Table 2-1). The 2016 population estimate of 6,248 made for this study reflects an increase of 7.6 percent over the 2010 Census figure, accounting for 13.6 percent of all individuals estimated to be living in the city. The Woolmarket growth rate during the period since the last census more than doubled the rate at which population increased in the city during the same time span. This suggests a trend that is likely to continue as the city expands and home buyers and builders seek more affordable housing and less expensive land on which to build. With this growth comes the need to improve and expand existing infrastructure to provide the basic services and means of circulation necessary to sustain a community. The projection of future population provides a basis for anticipating the scope of those needs.

The 2016 estimate of population for the Woolmarket area was derived in the following manner: An initial intercensal estimate for 2015 was made by holding the study area share of city population constant at 13.1 percent based on 2010 Census data. This percentage was applied to the Census Bureau's 2015 estimate for the City of Biloxi, and the result was labeled Scenario 1. The second study area estimate (Scenario 2) assumed an annual growth rate for the Woolmarket area of 1.9 percent based on the Gulf Regional Planning Commission (GRPC) long-range demographic forecast for traffic analysis zones located wholly or in part within Woolmarket (*2040 Mississippi Gulf Coast Metropolitan Transportation Plan*, Gulf Regional Planning Commission, 2015). Under this scenario the estimated population change within the Woolmarket area would represent 27.7 percent of the total increase in Biloxi from 2010 to 2015.



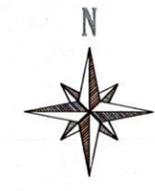
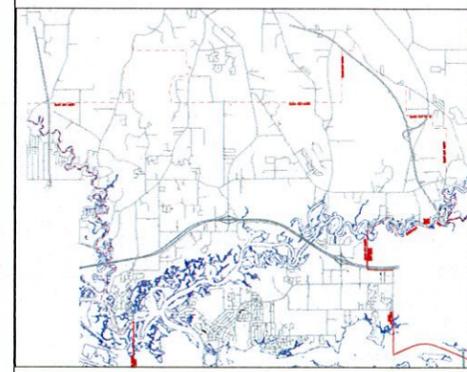
CITY OF BILOXI



LEGEND

- Woolmarket Area
- Biloxi City Limits

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	2-1
PLOT DATE	
6-01-18	
SHEET FILE	STUDY AREA LOCATION

[Figure 2-1]

**Table 2-1:**

**DERIVATION OF 2016 ESTIMATED WOOLMARKET STUDY AREA POPULATION**

YEAR	POPULATION CHANGE SCENARIO	AREA	POPULATION	PERCENT OF TOTAL CITY POPULATION	POPULATION CHANGE FROM 2010	PERCENT CHANGE FROM 2010
2010	--	Woolmarket	5,806	13.1	--	--
		Balance of Biloxi	38,510	86.9	--	--
		Biloxi (Total)	44,316	100.0	--	--
2015	1 (Low)	Woolmarket	5,978	13.1	172	3.0
		Balance of Biloxi	39,659	86.9	1,149	3.0
		Biloxi (Total)	45,637	100.0	1,321	3.0
2015	2 (High)	Woolmarket	6,366	14.0	560	9.7
		Balance of Biloxi	39,271	86.0	761	2.0
		Biloxi (Total)	45,637	100.00	1,321	3.0
2015	3 (Medium)	Woolmarket	6,172	13.5	366	6.3
		Balance of Biloxi	39,465	86.5	955	2.5
		Biloxi (Total)	45,637	100.00	1,321	3.0
2016	--	Woolmarket	6,248	13.6	442	7.6
		Balance of Biloxi	39,658	86.4	1,148	3.0
		Biloxi (Total)	45,906	100.00	1,590	3.6

*Note: All data are based on the current city limits of Biloxi, including areas annexed after the 2010 Census. In the case of some census blocks, it was established based on contemporaneous aerial photography that the annexed portions consisted entirely of vacant land. In other cases, census block data were adjusted to exclude population in areas not within the revised municipal limits.*

*Source: U. S. Department of Commerce, Bureau of the Census, 2010 Census of Population and Housing, for 2010 base data and 2015 intercensal estimate of population for the City of Biloxi; Neel-Schaffer, Inc. for all estimates.*

The third set of estimates (Scenario 3) simply averaged the preceding low (1) and high (2) figures. Under this scenario the population growth in Woolmarket accounts for 27.7 percent of the total growth in Biloxi. The 2016 figures were extrapolated from the mid-range 2015 estimates by applying growth rates derived from the 2010 and 2015 data for each area: 1.2 percent per annum for Woolmarket; 0.5 percent for the balance of Biloxi; and 0.6 percent for the city.

Based on the 2016 estimates, the population density of Biloxi is approximately 1,219 residents per square mile (see Table 2-2). However, this calculation includes the sizable Woolmarket area which has only 303 residents per square mile. Looking only at the balance of the city—without Woolmarket—population density jumps to 2,333 residents per square mile. Thus, while Woolmarket makes up 55 percent of the city’s total land area, its density is one-eighth that of the rest of Biloxi. This differential suggests the study area can certainly sustain and will very likely experience a substantial increase in both population and population density as the city grows.

**Table 2-2:**

**WOOLMARKET LAND AREA AND POPULATION DENSITY**

YEAR	AREA	POPULATION	LAND AREA (ACRES)	LAND AREA (SQUARE MILES)	POPULATION/ ACRE	POPULATION/ SQUARE MILE
2010	Woolmarket	5,806	13,216	20.7	0.4	281.2
	Balance of Biloxi	38,510	10,880	17.0	3.5	2,265.3
	Biloxi (Total)	44,316	24,096	37.7	1.8	1,177.1
2016	Woolmarket	6,248	13,216	20.7	0.5	302.6
	Balance of Biloxi	39,658	10,880	17.0	3.7	2,332.8
	Biloxi (Total)	45,906	24,096	37.7	1.9	1,219.3

*Source: 2010 population and land area data were derived from U. S. Department of Commerce, Census Bureau: 2010 Census of Population and Housing; population data for 2016 were based on the 2015 Census Bureau intercensal estimate for Biloxi (see Table 2-1).*

**2.3 LAND USE**

The existing land use in Woolmarket is generally rural with a large majority of the area consisting of vacant and forested land, single-family residential properties, mobile homes sites and local business and service venues. Development in the study area is scattered with sizable areas dedicated to residential use separated by vacant and generally forested land. The single-family residential land use in Woolmarket consists largely of low-density areas having large parcels at least one acre in size. Many of the mobile home sites are located in the northeastern quadrant of the study area, primarily in the area north of Woolmarket Road between Shriners Boulevard and Hudson-Krohn Road (see Figure 2-2).

Of the 20.7 square miles of land within the limits of the study area, approximately 60 percent remains undeveloped vacant and forested land (see Table 2-3). Another 25 percent of the land in Woolmarket is occupied by single-family residential properties, and about 6.5 percent is zoned for mobile-home sites. All the other land uses in Woolmarket collectively occupy about 1.7 square miles or eight percent of the land area total.

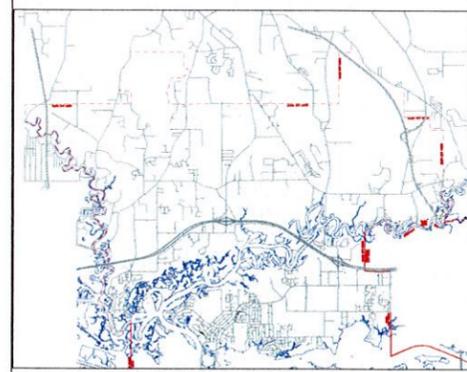
The amount of land classified as single-family residential in Woolmarket easily exceeds that in all other parts of Biloxi combined (see Table 2-4). It is important to note that the comparison being made involves not the number of residences but the overall acreage allotted for single-family residential use. As already noted, Woolmarket accounts for almost 55 percent of the total land area of Biloxi but only 13.6 percent of the city’s estimated 2016 population. There are only 1,690 parcels in Woolmarket classified as single-family residential compared to 9,500 similarly classified parcels in the balance of Biloxi.



LEGEND

See map inset

KEY MAP



SCALE      FIGURE NUMBER

N.T.S.

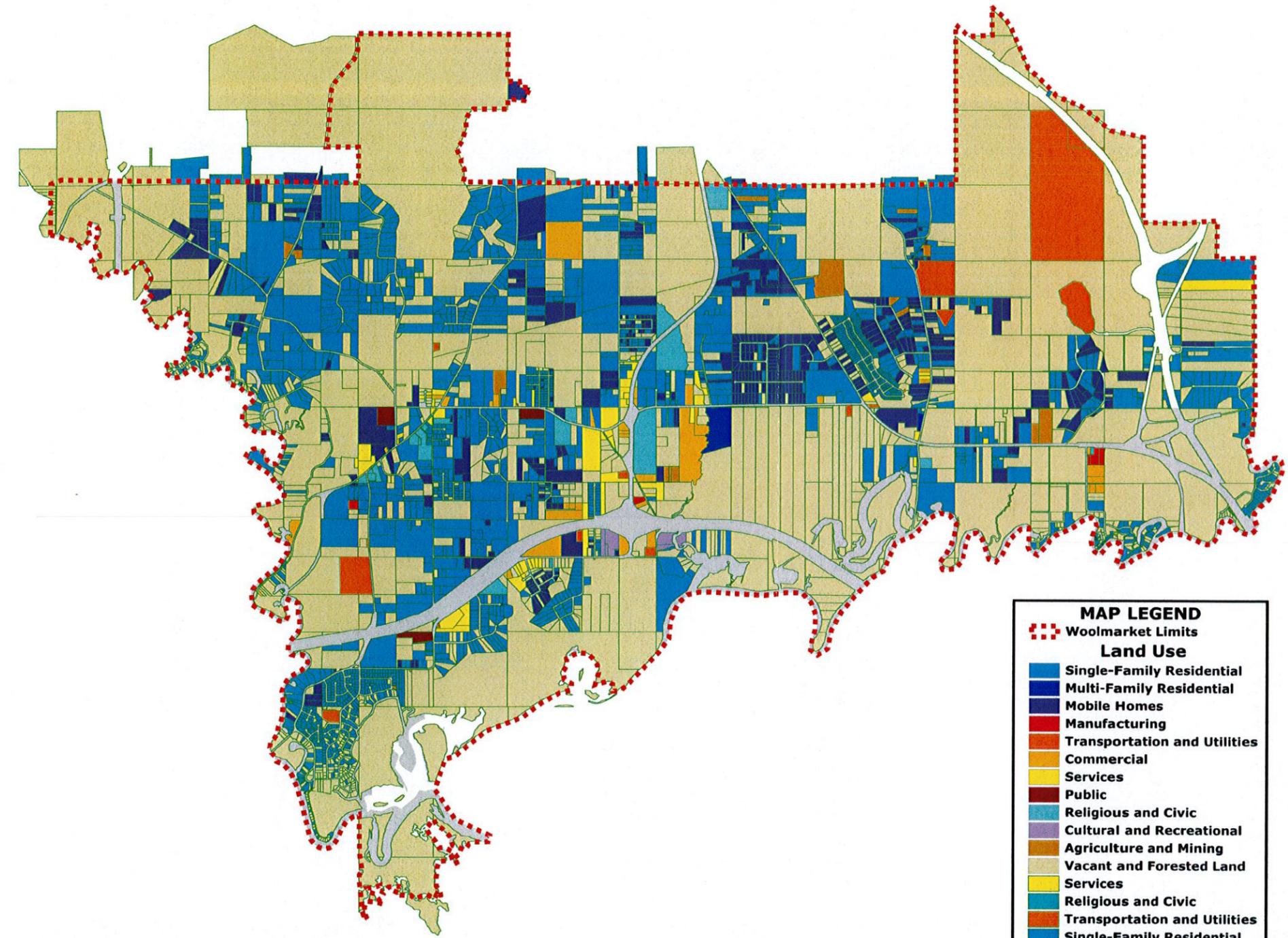
2-2

PLOT DATE

6-01-18

SHEET FILE

STUDY AREA LAND USE



**MAP LEGEND**

--- Woolmarket Limits

**Land Use**

- Single-Family Residential
- Multi-Family Residential
- Mobile Homes
- Manufacturing
- Transportation and Utilities
- Commercial
- Services
- Public
- Religious and Civic
- Cultural and Recreational
- Agriculture and Mining
- Vacant and Forested Land
- Services
- Religious and Civic
- Transportation and Utilities
- Single-Family Residential
- Mobile Homes
- Vacant and Forested Land

0      .5      1      1.5  
Miles

Source: Mississippi Department of Marine Resources and Gulf Regional Planning Commission

**Table 2-3:**

**WOOLMARKET STUDY AREA GENERALIZED LAND USE**

LAND USE	LU CODE	WOOLMARKET LAND AREA		PERCENT OF TOTAL ACREAGE
		Square Miles	Acres	
Single-Family Residential	1100-1111	5.14	3,289.6	24.9
Two-Family Residential	1120	0.00	0.0	0.0
Multi-Family Residential	1130	0.05	33.3	0.3
Other Residential	1270, 1300	0.00	0.0	0.0
Mobile Homes	1400-1420	1.35	863.2	6.5
Hotels and Motels	1520, 1530	0.00	0.0	0.0
Nursing Homes	1900	0.00	0.0	0.0
Condos and Townhomes	1910, 1920	0.00	0.0	0.0
Manufacturing	2000-3991	0.02	12.5	0.1
Transportation and Utilities	4000-4990	0.64	412.5	3.1
Commercial	5100-5990	0.26	173.7	1.3
Services	6100-6690, 6960	0.26	168.3	1.3
Public	6700-6890	0.04	25.4	0.2
Religious and Civic	6900-6950	0.24	151.1	1.1
Cultural and Recreational	7080-7900	0.03	22.4	0.2
Agriculture and Mining	8100-8900	0.13	82.0	0.6
Vacant and Forested Land	9000-9700	12.48	7,982.5	60.4
<b>TOTAL</b>		<b>20.65</b>	<b>13,216.5</b>	<b>100.00</b>

Source: Mississippi Department of Marine Resources and Gulf Regional Planning Commission (2012).

**Table 2-4:**

**WOOLMARKET STUDY AREA GENERALIZED LAND USE COMPARED TO THE CITY OF BILOXI**

LAND USE	LAND USE CODE	LAND AREA IN ACRES			WOOLMARKET PCT OF TOTAL
		Woolmarket	Balance of Biloxi	Biloxi Total	
Single-Family Residential	1100-1111	3,289.6	2,830.6	6,120.1	53.8
Two-Family Residential	1120	0.0	42.0	42.0	0.0
Multi-Family Residential	1130	33.3	371.0	404.3	8.2
Other Residential	1270 and 1300	0.0	33.1	33.1	0.0
Mobile Homes	1400-1420	863.2	128.8	992.0	87.0
Hotels and Motels	1520 and 1530	0.0	31.6	31.6	0.0
Nursing Homes	1900	0.0	1.7	1.7	0.0
Condos and Townhomes	1910 and 1920	0.0	54.2	54.2	0.0
Manufacturing	2000-3991	12.5	35.4	47.9	26.0
Transportation & Utilities	4000-4990	412.5	258.7	671.2	61.5
Commercial	5100-5990	173.7	428.0	601.7	28.9
Services	6100-6690, 6960	168.3	328.7	497.0	33.9
Public	6700-6890	25.4	2,230.7	2,256.1	1.1
Religious and Civic	6900-6950	151.1	177.0	328.1	46.0
Cultural and Recreational	7080-7900	22.4	750.8	773.2	2.9
Agriculture and Mining	8100-8900	82.0	0.4	82.4	99.6
Vacant and Forested Land	9000-9700	7,982.5	3,180.6	11,163.1	71.5
<b>TOTAL/PCT OF TOTAL</b>		<b>13,216.5</b>	<b>10,883.3</b>	<b>24,099.8</b>	<b>54.8</b>

Source: Mississippi Department of Marine Resources and Gulf Regional Planning Commission (2012).

The average single-family residential parcel in Woolmarket is 1.9 acres in area compared to 0.3 acre in the rest of the city. At the same time, property occupied by mobile homes is heavily concentrated in the study area – 87 percent of the Biloxi total. Virtually 100 percent of agricultural land in Biloxi is in the Woolmarket area. Conversely, there are no hotels, motels, nursing homes, condominiums or townhomes in the study area.

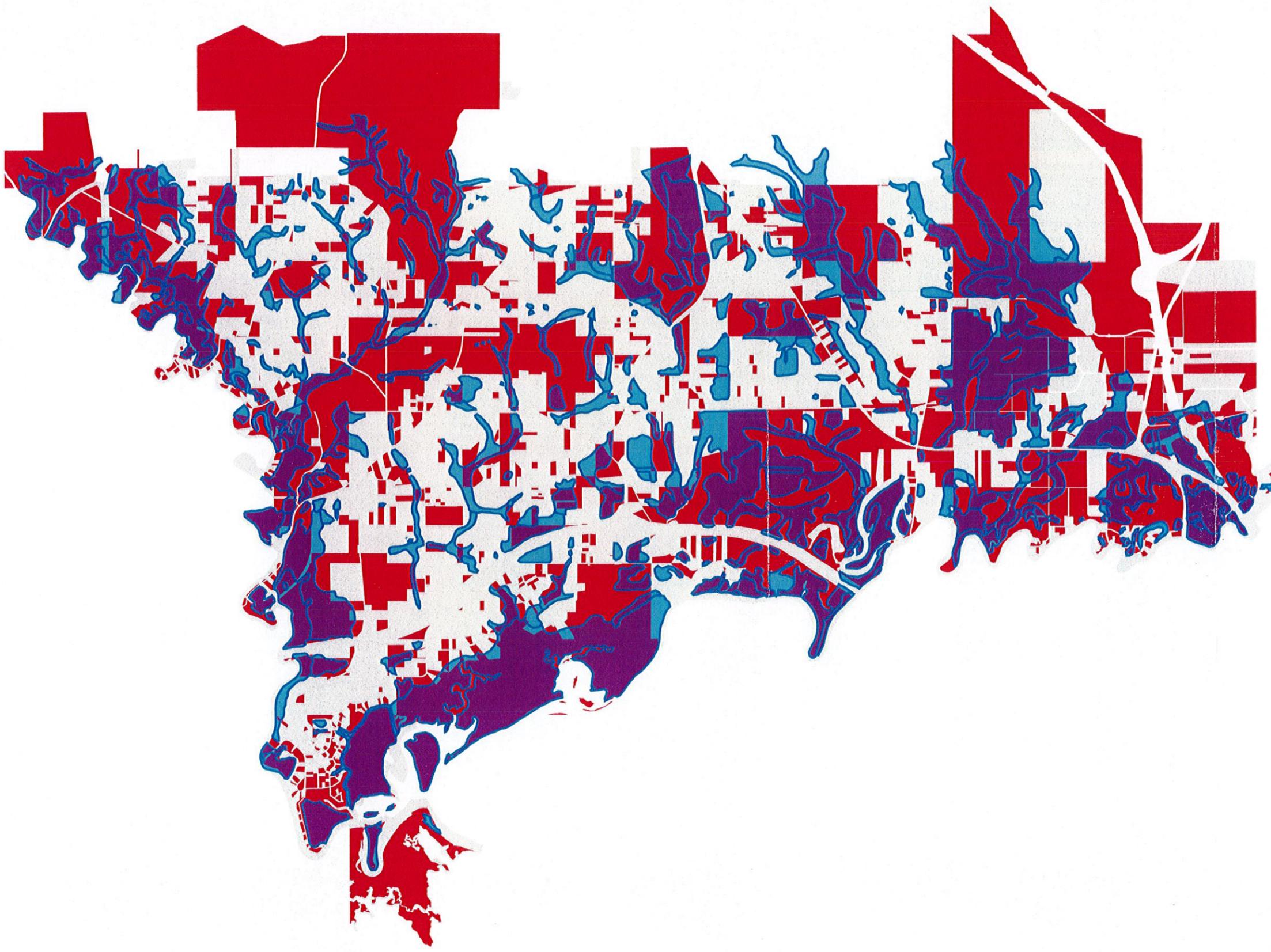
Over 71 percent of all vacant and forested land in Biloxi is in the study area; and as more than half the land in Woolmarket remains vacant, there is an abundance of potentially developable property. However, much of this undeveloped property is wetland, according to the U. S. Fish and Wildlife Service's *National Wetlands Inventory* (NWI). Construction in wetlands delineated by actual survey would require permits issued by the U. S. Army Corps of Engineers (USACE) pursuant to Section 404 of the *Clean Water Act*. Any loss of wetlands resulting from site preparation or construction would require mitigation of the impact through the establishment of compensatory wetlands at a remote location.

There are approximately 6.8 square miles of wetlands in the Woolmarket area, according to the NWI. That represents one-third of all land in the study area. Moreover, roughly 6.6 square miles, or nearly 97 percent of all wetlands, occur in areas classified as vacant or forested. That means that more than half of the 12.5 square miles of undeveloped property in the Woolmarket area is potentially wetland. This relationship is represented in Figure 2-3 by the superimposition of a blue wetland layer on a red layer corresponding to vacant and forested land. The resulting purple areas indicate where the development of vacant property might be constrained by USACE regulations regarding wetlands and waters under the jurisdictional control of the United States. As one would expect they are predominantly located along the major waterways bordering the study area on the west (the Biloxi River) and south (the Tchoutacabouffa River).

## 2.4 DEMOGRAPHICS

In Section 2.2 the Woolmarket service area population was estimated based on block data collected in the 2010 Census. However, the range of data published by the Census Bureau at the block level is extremely narrow. This is necessary to protect the privacy of individuals who live in blocks that may contain a very small number of households. To consider a broader range of demographic characteristics, it was necessary to make use of census data available at less refined levels of geographic analysis: the block group and census tract. A block group is an aggregation of census blocks; census tracts are comprised of one or more block groups.

Unlike census blocks, block groups and tracts cannot be aggregated to approximate the study area: They are relatively large in area and overlap the study area boundary, encompassing parts of Woolmarket along with portions of unincorporated Harrison County and the City of D'Iberville. Presumably the Census Bureau will adjust its geography for the 2020 Census, splitting block groups and census tracts to separate the incorporated and unincorporated areas. Until then a demographic analysis of the Woolmarket area must make do with what is available.



Source: U. S. Fish and Wildlife Service, National Wetlands Inventory

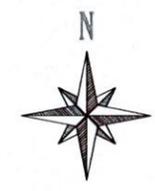
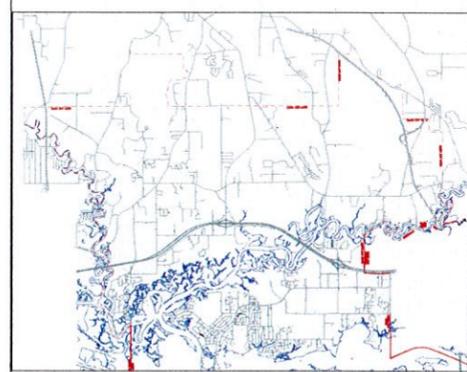
CITY OF BILOXI



LEGEND

- Wetland
- Vacant/Forested
- Other Land Use

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	2-3
PLOT DATE	
6-01-18	
SHEET FILE	
STUDY AREA WETLANDS	

For the purposes of the present analysis it was considered expedient to make use of any data applicable at least in part to the service area population. Portions of the Woolmarket area are included in two different census tracts and five separate block groups (see Figure 2-4). Census Tract 3403, on the west side of the study area, is made up of a single block group, almost half of which lies within the study area (see Table 2-5). Based on data from the last decennial census, more than half the people living within the tract are Woolmarket residents. Three of the four block groups in Census Tract 3402 (1, 3 and 4) lie predominantly within the study area, although only two (3 and 4) have a majority of block group residents. The outlier is Block Group 2 which includes the easternmost end of the study area along with a much larger section of unincorporated Harrison County and the northern part of D'Iberville.

Looking at all five block groups containing parts of the study area, the Woolmarket share of total land area in census tracts 3402 and 3403 is a little less than 43 percent. The study area population share is 47.5 percent. However, excluding Block Group 2 raises the Woolmarket land area share to 62.1 percent and the study area share of population to 61.6 percent. This suggests the four-block-group sub-area is likely to be a more meaningful indicator of demographic conditions in the study area.

In most cases the differences between statistics generated for the five-block-group area encompassing all Woolmarket and the four-block-group sub-area encompassing most of the study area are relatively small. For example, according to the *2015 American Community Survey* (ACS), the gender split in both areas is essentially 52 to 48 percent in favor of females, with only half-a-percentage-point difference between the two areas (see Table 2-6). Both fall short of Harrison County in terms of the male share (nearly 50 percent countywide) and well short of the State of Mississippi (over 52 percent).

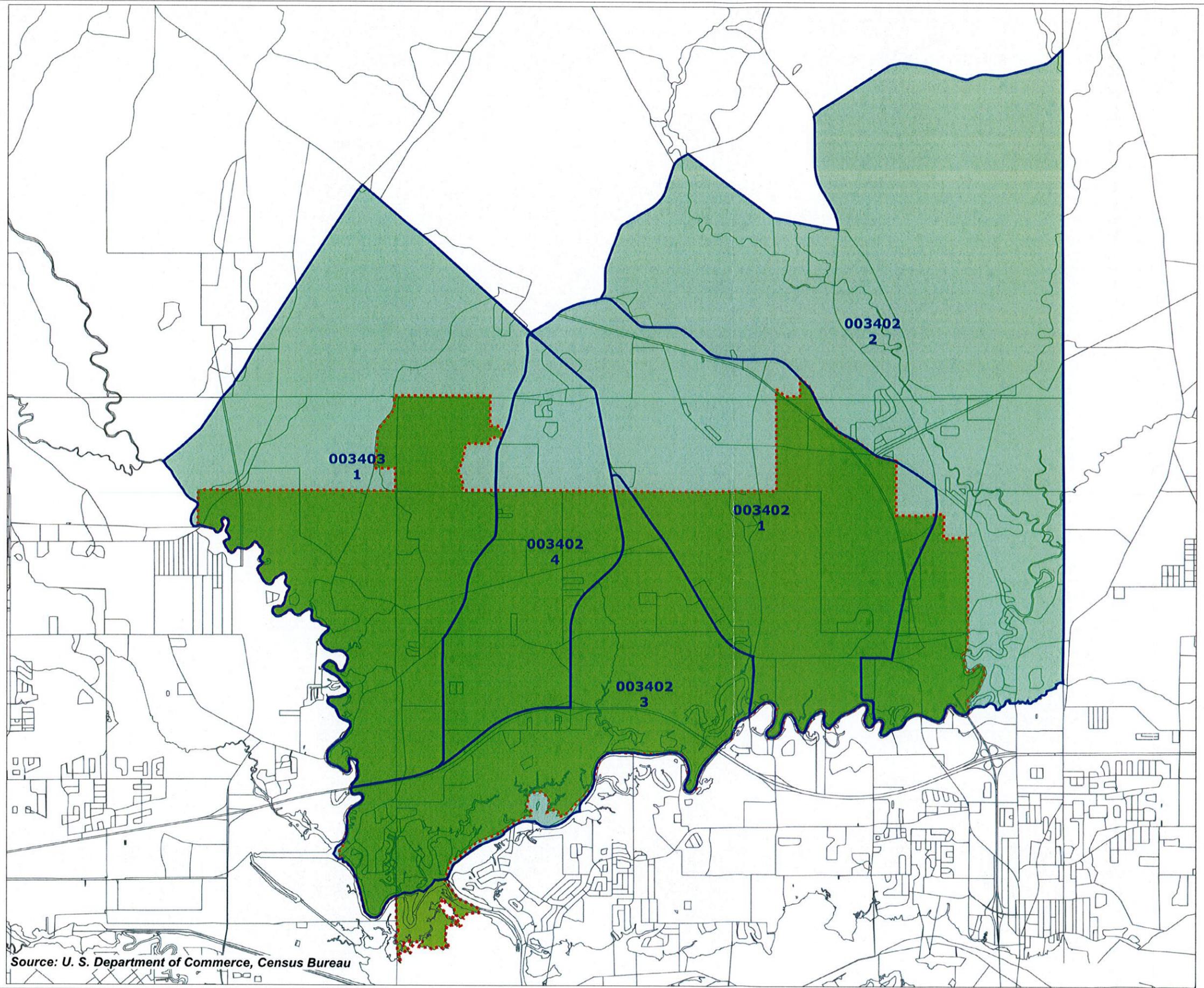
**Table 2-5:  
2010 WOOLMARKET AREA CENSUS BLOCK GROUPS: LAND AREA AND POPULATION**

CENSUS TRACT NUMBER	BLOCK GROUP			STUDY AREA PORTION OF BLOCK GROUP (1)			
	NO	LAND AREA (SQ MILES)	POPULATION	LAND AREA (SQ MILES)	ESTIMATED POPULATION	PCT OF BLOCK GROUP	
						LAND AREA	POPULATION
3402	1	8.56	2,023	4.86	953	56.8	47.1
3402	2	16.45	3,515	1.30	442	7.9	12.6
3402	3	5.22	1,915	4.88	1,823	93.5	95.2
3402	4	4.29	2,703	3.31	1,518	77.2	56.2
3403	1	11.60	2,069	5.38	1,071	46.4	51.8
TOT/AVG	--	46.12	12,225	19.73	5,806	42.8	47.5
SUB-TOT (2)	--	29.67	8,710	18.43	5,364	62.1	61.6

(1) Portion of block group within the municipal limits of Biloxi (i.e., within the Woolmarket study area).

(2) Total excluding Census Tract 3402, Block Group 2.

Source: U. S. Department of Commerce, Census Bureau, 2010 Census of Population and Housing.



Source: U. S. Department of Commerce, Census Bureau

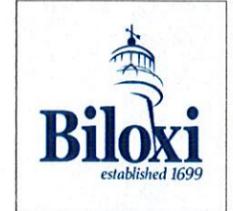
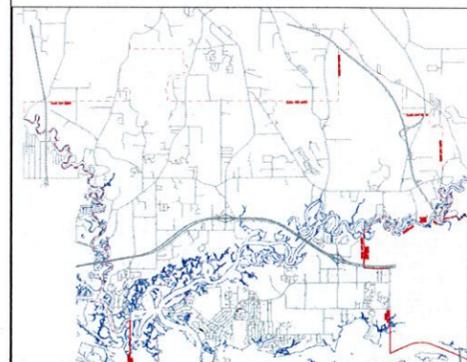
CITY OF BILOXI



LEGEND

- Woolmarket Study Area
- Woolmarket Block Groups

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	2-4
PLOT DATE	
6-01-18	
SHEET FILE	
STUDY AREA CENSUS GEOGRAPHY	

Table 2-6:

## 2015 WOOLMARKET STUDY AREA CENSUS BLOCK GROUPS: POPULATION BY SEX (1)

CENSUS TRACT NUMBER	BLOCK GROUP NUMBER	TOTAL POPULATION	MALE	FEMALE	PERCENT MALE	PERCENT FEMALE
3402	1	2,497	1,221	1,276	48.9	51.1
3402	2	4,781	2,361	2,420	49.4	50.6
3402	3	2,272	1,075	1,197	47.3	52.7
3402	4	3,052	1,431	1,621	46.9	53.1
3403	1	2,029	977	1,052	48.2	51.8
TOTAL	--	14,631	7,065	7,566	48.3	51.7
<b>SUB-TOTAL (2)</b>	--	<b>9,850</b>	<b>4,704</b>	<b>5,146</b>	<b>47.8</b>	<b>52.2</b>
BILOXI HARRISON CO	--	44,825	23,443	21,382	52.3	47.7
	--	196,268	97,349	98,919	49.6	50.4

(1) 2011-2015 American Community Survey 5-Year Estimates

(2) Total excluding Census Tract 3402, Block Group 2

Source: U. S. Department of Commerce, Census Bureau, 2015 American Community Survey

In other cases, there are significant differences. For instance, the breakdown of population by race—again according to estimates developed by the 2015 ACS—shows that the nonwhite component in the larger area is nearly five percentage points higher than in the sub-area (see Table 2-7). This is presumably attributable to the inclusion of a large somewhat dissimilar area outside the study area proper. In both areas the white-only share of population exceeds the corresponding figures for the City of Biloxi and Harrison County by wide margins, but the sub-area margins exceed those for the larger area by the same five-percentage spread already noted.

Table 2-7:

## 2015 WOOLMARKET STUDY AREA CENSUS BLOCK GROUPS: POPULATION BY RACE (1)

CENSUS TRACT NUMBER	BLOCK GROUP NUMBER	TOTAL POPULATION	WHITE	BLACK	AMERICAN INDIAN	ASIAN	OTHER/ 2 OR MORE RACES
3402	1	2,497	1,749	63	0	50	635
3402	2	4,781	3,226	783	0	677	95
3402	3	2,272	1,850	379	0	0	43
3402	4	3,052	2,784	161	0	27	80
3403	1	2,029	1,966	0	0	5	58
TOTAL	--	14,631	11,575	1,386	0	759	911
PCT OF TOTAL	--	100.0	79.1	9.5	0.0	5.2	6.2
<b>SUB-TOTAL (2)</b>		<b>9,850</b>	<b>8,349</b>	<b>603</b>	<b>0</b>	<b>82</b>	<b>816</b>
<b>PCT OF SUB-TOTAL</b>		<b>100.0</b>	<b>84.8</b>	<b>6.1</b>	<b>0.0</b>	<b>0.8</b>	<b>8.3</b>
BILOXI TOTAL/PERCENT		44,825	66.2	21.5	0.3	4.9	7.1
HARRISON CO TOT/PCT		196,268	69.4	23.3	0.5	3.0	3.8

(1) 2011-2015 American Community Survey 5-Year Estimates

(2) Total excluding Census Tract 3402, Block Group 2

Source: U. S. Department of Commerce, Census Bureau, 2015 American Community Survey

The Hispanic or Latino share of population was less than four percent in both the five-block-group area and the four-block-group sub-area at the time of the 2010 Census (see Table 2-8). The figure for the City of Biloxi was closer to nine percent, and the figure for Harrison County exceeded five percent. Combined with the distribution of population by race, the data for Hispanic/Latino ethnicity indicates a more homogeneous population in the Woolmarket area than in Biloxi or in all of Harrison County.

**Table 2-8:**  
**2010 WOOLMARKET STUDY AREA CENSUS BLOCK GROUPS: HISPANIC OR LATINO POPULATION**

CENSUS TRACT NUMBER	BLOCK GROUP NUMBER	TOTAL POPULATION	NOT HISPANIC/LATINO	HISPANIC/LATINO	PCT NOT HISPANIC/LATINO	PERCENT HISPANIC/LATINO
3402	1	2,023	1,940	83	95.9	4.1
3402	2	3,515	3,399	116	96.7	3.3
3402	3	1,915	1,852	63	96.7	3.3
3402	4	2,703	2,617	86	96.8	3.2
3403	1	2,069	1,973	96	95.4	4.6
TOTAL		12,225	11,781	444	96.4	3.6
<b>SUB-TOTAL (1)</b>		<b>8,710</b>	<b>8,382</b>	<b>328</b>	<b>96.2</b>	<b>3.8</b>
BILOXI		44,054	40,207	3,847	91.3	8.7
HARRISON CO		187,105	177,168	9,937	94.7	5.3

(1) Total excluding Census Tract 3402, Block Group 2

Source: U. S. Department of Commerce, Census Bureau, 2010 Census of Population and Housing

The 2015 ACS revealed some interesting differences in the distribution of population by age among the areas compared. The overall median age for the four-block-group sub-area, 38.4 years, exceeded the median age for the larger five-block-group area by more than a year and a half. More telling was the fact that the sub-area median age exceeded the corresponding statistic for Harrison County by three full years and the median age for the City of Biloxi by very nearly five years (see Table 2-9).

The median age for males in the four-block-group sub-area was just under 40 years and exceeded the median age for males in the other areas by margins ranging from 3.6 to 8.3 years. On the other hand, the median ages for females in the five-block-group area and four-block-group sub-area, 37 years and 36.9 years respectively, exceeded only slightly the median ages for females in Biloxi and Harrison County.

At the same time, counter to what one might have expected given the older median age in the area encompassing Woolmarket, the relative size of the under-18 age group was significantly larger than that of the same group in Biloxi or Harrison County. Moreover, the relative size of the over-65 age group was lower than that of the same age-group in either the city or the county. The relative size of the working-age population (18-64 years) in Woolmarket—64 percent—was lower than the figure for the City of Biloxi (66 percent) and the same as the figure for Harrison County. Thus, while the Woolmarket area has a higher median age, it also has a greater preponderance of young people and a relative scarcity of old people.

Table 2-9:

**2015 WOOLMARKET STUDY AREA CENSUS BLOCK GROUPS: MEDIAN AGE BY SEX, UNDER 18 AND 65 YEARS OF AGE OR OLDER (1)**

CENSUS TRACT NUMBER	BLOCK GROUP NUMBER	TOTAL POPULATION	MEDIAN AGE TOTAL	MEDIAN AGE MALE	MEDIAN AGE FEMALE	UNDER 18 YEARS OF AGE	65 YEARS OF AGE OR OLDER	18-64 YEARS OF AGE
3402	1	2,497	32.5	35.0	32.1	817	230	1,450
3402	2	4,781	33.2	29.3	37.2	1468	341	2,972
3402	3	2,272	34.3	37.4	28.3	742	98	1,432
3402	4	3,052	43.2	44.1	42.7	393	475	2,184
3403	1	2,029	42.9	42.5	43.4	516	247	1,266
TOTAL/WEIGHTED AVG		14,631	36.7	36.3	37.0	3,936	1,391	9,304
PCT OF TOTAL		100.0	--	--	--	26.9	9.5	63.6
<b>SUB-TOT/WEIGHT AVG (2)</b>		<b>9,850</b>	<b>38.4</b>	<b>39.9</b>	<b>36.9</b>	<b>2,468</b>	<b>1,050</b>	<b>6,332</b>
<b>PCT OF SUB-TOTAL</b>		<b>100.0</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>25.1</b>	<b>10.7</b>	<b>64.3</b>
BILOXI TOT/MED/PCT		44,825	33.5	31.6	35.6	22.0	12.1	65.9
HARRISON CO AVG/PCT		196,268	35.3	34.1	36.7	24.5	11.7	63.8

(1) 2011-2015 American Community Survey 5-Year Estimates

(2) Total excluding Census Tract 3402, Block Group 2

Source: U. S. Department of Commerce, Census Bureau, 2015 American Community Survey

According to data collected in the 2010 Census, housing occupancy was relatively high in the Woolmarket area—almost 90 percent—especially when compared to Biloxi (80 percent) and Harrison County (84 percent) (see Table 2-10). This is probably attributable to the preponderance of single-family residences and a lower turnover rate in the resident population consistent with the very limited amount of multi-family housing available in the area. Average household size was also significantly higher in the Woolmarket area for both owner-occupied and rental housing, indicating a relatively greater number of families and fewer single occupants and couples without children.

Table 2-10:

**2010 WOOLMARKET STUDY AREA CENSUS BLOCK GROUPS: HOUSING OCCUPANCY AND AVERAGE HOUSEHOLD SIZE**

CENSUS TRACT NUMBER	BLOCK GROUP NUMBER	TOTAL HOUSING UNITS	OCCUPIED HOUSING UNITS	VACANT HOUSING UNITS	PERCENT OCCUPIED	AVG HH SIZE OWNER-OCCUPIED	AVG HH SIZE RENTER-OCCUPIED	AVG HH SIZE TOT OCCUPIED
3402	1	952	760	192	79.8	2.61	2.78	2.66
3402	2	1,440	1,208	232	83.9	2.91	2.90	2.91
3402	3	815	751	64	92.1	2.59	2.42	2.55
3402	4	1,059	998	61	94.2	2.65	3.02	2.71
3403	1	835	776	59	92.9	2.58	3.07	2.67
TOTAL/AVG		5,101	4,493	608	88.1	2.67	2.84	2.70
<b>SUB-TOTAL/AVG (1)</b>		<b>3,661</b>	<b>3,285</b>	<b>376</b>	<b>89.7</b>	<b>2.58</b>	<b>3.07</b>	<b>2.67</b>
BILOXI TOTAL/AVERAGE		21,278	17,104	4,174	80.4	2.40	2.40	2.40
HARRISON CO TOT/AVG		85,181	71,476	13,705	83.9	2.57	2.49	2.54

(1) Total excluding Census Tract 3402, Block Group 2

Source: U. S. Department of Commerce, Census Bureau, 2010 Census of Population and Housing

Household income data collected by the 2015 ACS showed less widespread poverty in the area encompassing Woolmarket than in the City of Biloxi or Harrison County (see Table 2-11). Only 15 percent of households in the block group areas had income below the poverty threshold, compared to 21 percent in all of Biloxi and 17 percent in Harrison County.

Table 2-11:

**2015 WOOLMARKET STUDY AREA CENSUS BLOCK GROUPS: HOUSEHOLD INCOME POVERTY STATUS**

CENSUS TRACT NUMBER	BLOCK GROUP NUMBER	ESTIMATED TOTAL HOUSEHOLDS	INCOME AT/ ABOVE POV-ERTY LEVEL	INCOME BELOW POV-ERTY LEVEL	PERCENT AT/ ABOVE POV-ERTY LEVEL	PERCENT BELOW POV-ERTY LEVEL
3402	1	633	496	137	78.4	21.6
3402	2	1,256	1,063	193	84.6	15.4
3402	3	663	485	178	73.2	26.8
3402	4	833	774	59	92.9	7.1
3403	1	581	538	43	92.6	7.4
TOTAL/AVERAGE		3,966	3,356	610	84.6	15.4
<b>SUB-TOTAL/AVG (1)</b>		<b>2,710</b>	<b>2,293</b>	<b>417</b>	<b>84.6</b>	<b>15.4</b>
BILOXI TOTAL/AVERAGE		10,675	8,401	2,274	78.7	21.3
HARRISON CO TOT/AVG		49,743	41,154	8,589	82.7	17.3

(1) 2011-2015 American Community Survey 5-Year Estimates

(2) Total excluding Census Tract 3402, Block Group 2

Source: U. S. Department of Commerce, Census Bureau, 2015 American Community Survey

In conclusion, Census data specifically relating to the Woolmarket study area proper are only available at the block level and in terms of demographics do not go much beyond the basic population count. Block group data, while not conforming to the current municipal limits of Biloxi, offer a wider range of informational items of interest. These are available from both the 2010 Census and the 2015 American Community Survey.

In summary, the following can be said of the area consisting of four block groups encompassing most of Woolmarket along with adjacent portions of unincorporated Harrison County:

- Sixty-two (62) percent of the land within the (four) block-group-based area of analysis lies inside the Woolmarket study area boundary.
- Sixty-two (62) percent of the population in the analysis area is in Woolmarket.
- The gender split in the analysis area reveals a female majority of 52 percent, mirroring a male-majority of 52 percent in all of Biloxi.
- The white majority-share of population in the analysis area (85 percent) exceeds that in the city (66 percent) by 19 percentage points.
- The Hispanic/Latino component of population in the analysis area is less than four percent—which is less than half the relative size of that population group in all of Biloxi (8.7 percent).
- The median age in the analysis area (38.4 years) exceeds the median age for Biloxi (33.5) by approximately five years.

- The median age for males in the analysis area (39.9 years) exceeds the median age for males in Biloxi (31.4) by eight and one-half years.
- The under-18 component of the analysis area population (25.1 percent) is significantly—and somewhat counterintuitively considering the area’s higher median age—larger than in the city as a whole (22.0 percent).
- At the same time, the analysis area’s 65-plus age component share (10.7 percent of total population) is lower than that for all of Biloxi (12.1 percent).
- Housing occupancy in the analysis area is very high (almost 90 percent), especially in comparison with the City of Biloxi (80 percent).
- Average household size in the analysis area (2.67) is significantly higher than in the city (2.40).
- The percentage of households with income below the poverty threshold is much lower for the analysis area (15.4) than it is for all of Biloxi (21.3 percent).

It is worth noting that most of the figures cited above are based on the 2015 American Community Survey and that the resulting estimates for the City of Biloxi include the Woolmarket area. Thus, it is possible that the differences between the analysis area and the city are somewhat understated and that a comparison of demographic items for the Woolmarket area proper and the balance of the city excluding the study area would yield more pronounced differences.

## **2.5 INFRASTRUCTURE MANAGEMENT TOOLS**

The City of Biloxi currently uses Cityworks, ESRI, Munis, and SCADA software to effectively manage their infrastructure systems. Cityworks has several key functions, such as work order tracking, asset management, the ability to store customer information, permitting, and customer billing services. ESRI’s GIS software is mainly used to create and maintain an up-to-date source of information regarding the city’s infrastructure. Several data sets are stored for each system (transportation, water, sanitary sewer, storm drainage), including street names and locations, signage, pipe locations, pipe sizes, pipe material, and the locations of lift stations, water wells, and water storage tanks. Munis is used to track and generate reports of the water usage throughout the city. Actual water used, water replaced, and water billed are all tracked and used to determine the amount of unbilled water, whether through water leaks, unbilled customers, malfunctioning meters, or other sources. The SCADA system is used to effectively manage and control the key assets of the water and sewer system—water wells, water storage tanks, and sewer lift stations. Overall, the current structure is adequate in managing the infrastructure systems in the Woolmarket area.

## **SECTION 3 - WASTEWATER SYSTEM**

This report was prepared to address and evaluate the existing wastewater infrastructure of the City of Biloxi's (City) utility system in the Woolmarket area and to outline a plan to expand and improve the system to meet current and future needs. In this report, the terms "wastewater" and "sewer" are used interchangeably. The comprehensive master plan for the wastewater utilities system includes this report along with tables and figures referenced and included herein and in Appendix A.

### **3.1 PURPOSE**

The report develops herein a master sewer utilities plan for the Woolmarket area within the City and its adjacent planning area. Based on available data, maps, plans, reports and studies, the existing sewer system infrastructure components within the planning area were identified, compiled and mapped in AutoCAD format, relying heavily on the available Geographic Information System (GIS) sources maintained by the City and by the Harrison County Utility Authority (HCUA). The present service area for sewer utilities in the Woolmarket community was mapped, along with other private utility providers (if any) certificated to serve any other territory within the City, or its adjacent primary planning area.

The existing sewer utility systems were analyzed and evaluated to identify areas of deficiencies and to determine the overall capabilities to accommodate the existing and future needs of the customers. Needed improvements to the systems were identified, prioritized and developed into a phased capital improvement program.

The primary study area is generally described as the Woolmarket community, with boundaries generally described on the west by the Biloxi River and the Gulfport corporate limits, on the south by the Tchoutacabouffa River, and on the east and north by the Biloxi corporate limits. The study area boundary is shown herein on Figure 3.0.

The primary objective of the sewer utilities comprehensive plan is to evaluate the existing public and private systems and incorporate these into an overall consolidated system consistent with established design criteria to meet the existing and future needs within the primary study area. The sewer utilities comprehensive plan presented herein provides for area wide system improvements for reliability, and for expansion into unserved areas within and adjacent to the study area.

The results and recommendations of the comprehensive plan are intended to provide an area wide sewer utilities system capable of providing customers with reliable sanitary sewer service in compliance with regulatory requirements.

### **3.2 EXISTING SANITARY WASTEWATER SYSTEM**

The area encompassed by the project study limits in the Woolmarket community is currently served by public sewer systems owned and operated by the City and the HCUA or by private individual on-site systems regulated by the Mississippi Department of Health. The infrastructure owned and maintained by the HCUA was constructed as a supplement to the City's collection

system to provide for more collection capacity and efficient transport of sewage to the adjacent wastewater treatment plants (WWTP).

The existing collection system is comprised primarily of limited gravity sewer and accompanying pump stations providing service to specific geographic locations within the study area. A portion of the collection system within the study area on Hudson-Krohn Road was funded and constructed by the HCUA and consists of a Septic Tank Effluent Pump (STEP) low pressure system as well as gravity sewer. This portion of the wastewater system discharges to the North D'Iberville Wastewater Treatment Plant.

### **3.2.1 OWNERSHIP**

#### **CITY OF BILOXI SYSTEMS**

Prior to the 1999 and 2004 annexations of the study area, the Woolmarket area residents relied on private individual on-site systems for treatment of sewage wastes. Soon after the annexations, the City constructed a system of gravity sewer collection and pump stations that efficiently transport the sewage to the nearby WWTP. In addition to those systems, the City also acquired additional collection and transport systems associated with the development of new residential subdivisions and commercial areas.

To provide additional infrastructure in the aftermath of the damage caused by Hurricane Katrina, the HCUA constructed additional collection infrastructure in the study area consisting of both low pressure and gravity sewer collection systems which serve areas without community sewer collection. These systems have allowed additional infrastructure to be constructed adjacent to and to connect to the collection systems constructed by the HCUA. Currently, a sizable portion of the study area remains without a City-operated sewer system. This report is intended to identify problem areas within the existing system that will require further study as well as future needs and upgrades, which will further the City's efforts to provide centralized sewer collection to all its residents.

#### **HCUA SYSTEMS**

The HCUA owns and operates seven (7) regional pump stations and four (4) regional gravity sewer interceptor systems and two (2) WWTPs serving the study area. The pump stations are the: Wash Fayard PS; South Woolmarket PS; North, East and West Oaklawn PS; Pin Oak PS; and, the Hudson-Krohn PS. The WWTPs are the Woolmarket plant and the D'Iberville plant. The regional gravity sewer interceptor systems are further discussed in the "INVENTORY OF EXISTING SYSTEMS" section below.

#### **CERTIFICATED FRANCHISE AREAS**

There are several small Certificated Franchise Areas for Sewer Service within the study area. These areas, and their location within the study area, are indicated on Figure 3.0 and are tabulated below:

- Total Environmental Solutions, Inc. (TESI);
- Superior Utilities, Inc.;
- Honey Dipper of Biloxi Corp.;
- Southeast Mississippi Utility, Inc.; and,
- City of D'Iberville

The TESI franchise in the Eagle Point area contains City-owned infrastructure already in service. Unlike the TESI area, the Southeast Mississippi Utility, Inc. area has its own low-pressure sewer system that contributes sewage flow into the City of D'Iberville collection system. It is unknown if any infrastructure related to the two remaining private and one municipal franchise areas are in-place and functioning.

#### **PRIVATE UTILITY SYSTEMS**

Based on the available data, it is unknown whether there are any private utility systems in the study area, apart from those facilities in certificated franchise areas, which may be privately operated.

### **3.2.2 INVENTORY OF EXISTING SYSTEMS**

#### **COMPILATION OF DATA**

Where available, maps, plans, and information regarding the existing sewer utility infrastructure system for the Woolmarket community within the City were obtained and compiled. This information consisted of material obtained from the following sources:

- GIS data, layout maps, construction plans and subdivision plans from the City Engineering and Water and Sewer Departments.
- GIS data, construction plans and subdivision plans from the HCUA.
- Construction plans and subdivision plans from 3rd-party consulting engineers.
- Available layout maps and construction plans obtained from private utility companies.
- Certificated franchise maps from the Public Service Commission.

Based on all the available information obtained, a general flow schematic of the different pump stations within the sewer collection system in the study area was developed and is presented as Figure 3.1.

#### **MAPPING**

All available information was drafted onto various layers in AutoCAD format. Physical features of the existing sewer systems, such as sewer main diameters, manholes, pump stations, and force mains were drafted onto multiple drawing layers for the benefit of the City's future utilization and updates to the facilities maps. Additionally, existing and future sewer basins were delineated. These sewer basins follow a simple labeling scheme: sewer basins contributing flow to the Woolmarket WWTP are numbered incrementally from 100; while basins contributing to the D'Iberville WWTP are numbered incrementally from 200. Larger, "regional size" pump stations are incremented by 10 within their respective WWTP numbering scheme, while smaller pump stations contributing to a "regional" pump station are incremented similarly by 1. Thus, the relative location and flow pattern of any particular pump station or sewer basin is somewhat obvious from its associated label.

#### **BACKGROUND STUDIES**

Previous studies and reports prepared for the City and for the HCUA pertaining to the existing sewer system and proposed improvements were obtained and reviewed. Improvement projects recommended in these documents were reviewed to determine which have been completed and to incorporate any uncompleted projects into the comprehensive plan, as warranted. The studies and reports that were obtained and reviewed included the following:

- Wastewater Facilities Plan, Woolmarket Sewer Extension Phase III, August 2008, as prepared by A. Garner Russell & Associates, Inc. (AGR)
- Water and Sewer Master Plan for the HCUA, November 2015, as prepared by Brown, Mitchell & Alexander, Inc. (BMA) and Digital Engineering and Imaging, Inc. (DEII)

## **PHYSICAL ASSETS**

### ***Sewer Collection Systems***

The existing sewer systems serving the study area within the Woolmarket community are shown on Figures 3.2 through 3.5. It is apparent that the Woolmarket sewer system serves areas outside the study area, such as from the HCUA sewer system on Hudson-Krohn road, which is operated by the City and discharges to the North D'Iberville WWTP. The referenced figures indicate the location and size of existing sewer mains, manholes, pump stations and force mains. The existing service areas of the separate, individual sewer systems are also indicated on the referenced figures.

Most of the gravity sewer mains in the Woolmarket System are SDR-35 or SDR-26 PVC pipes. There are no areas within the community sewer collection system that are known to be constructed of clay pipes. Based on GIS information provided by the City and by the HCUA, there are approximately 23,200 linear feet of HCUA-owned gravity sewer main and approximately 140,500 LF of City-owned gravity sewer main in the Woolmarket area, ranging in size from 6" to 20" in diameter.

Most, if not all, sewer manholes are pre-cast concrete and should be in good working condition. There are no known areas that contain brick manholes within the study area.

### ***Pump Stations***

The City currently owns and operates sixteen pump stations within the Woolmarket study area, and the HCUA currently owns and operates eight pump stations within the study area, which are discussed in more depth below. Of the eight HCUA stations, seven are "regional" stations serving a substantial portion of the Woolmarket area, while one station is located at the Woolmarket WWTP on Shorecrest Rd. Where available, the specific information for each pump station, including nominal capacity and location, is shown in Table 3-2.

Sewer force mains in the system consist of either SDR-26 PVC, C-900 PVC, or ductile iron pipes. Based on GIS information provided by the City and by the HCUA, there are approximately 18,700 linear feet of HCUA-owned force mains and over 62,300 linear feet of City-owned force mains in the Woolmarket area. These force mains range from 2" to 16" in diameter.

As stated above, all known pump stations, force mains, discharge points, and the main gravity sewer system arterials serving the Woolmarket community are shown on Figures 3.2 through 3.5. Throughout this report, "pump station" and "lift station" may be used interchangeably. Additionally, the terms "force main" and "pressure main" may be used interchangeably.

### ***Regional Pump Stations and Interceptor Systems***

The seven regional pump stations and four regional gravity sewer interceptor systems operated by HCUA within the study area can serve large portions of the study area.

The HCUA has funded several regional pump station and interceptor system projects since its inception. These systems and the areas they serve are as follows:

<b>PUMP STATION (PS) OR INTERCEPTOR (INT.)</b>	<b>SERVICE AREAS</b>
Lorraine/Shorecrest (INT.)	Shorecrest Road and Lorraine Road areas
Wash Fayard (INT. & PS)	Wash Fayard and John Lee Roads, Nature's Trail S/D, Hidden Springs, S/D
Hudson-Krohn (INT. & PS)	Hudson-Krohn and John Lee Road Areas including several adjacent residential developments
South Woolmarket (PS)	Woolmarket Road
North Oaklawn (PS)	Residential and commercial areas in the northwest quadrant of MS Hwy 67 and I-10
East Oaklawn (PS)	Commercial Areas south of I-10
West Oaklawn (PS)	East Oaklawn Service Area and adjacent residential subdivisions
Pin Oak (PS)	East and West Oaklawn Service Areas as well as the Eagle Point and North Shorecrest Areas

Per the Conceptual Report for the CDBG projects prepared for the HCUA by the Mississippi Engineering Group (MSEG), each regional pump station and gravity interceptor was designed utilizing 20-year population projections for capacity design. These facilities have been analyzed to determine their dependability for long-term use and capability of handling the present and future wastewater flows.

Specific information for each regional pump station, including nominal capacity and location, is shown in Table 3-2.

***Wastewater Treatment Plants***

Wastewater from the vast majority of the Woolmarket community is transported to wastewater treatment facilities owned and operated by the HCUA. Other areas within the study area that are not presently transporting wastewater to a permitted facility are currently believed to be served by private on-site treatment systems. It is the intent of this report to provide recommendations for expansion to provide community sewer collection to these unserved areas and transporting of the wastewater to a permitted HCUA facility.

Wastewater treatment plants are usually sized based on the expected average daily flow of the areas served, with some consideration also given for peak hourly flows, and wet weather flows.

Limited flow data was obtained for both WWTPs in the study area, but there was little indication of extreme inflow & infiltration in wet periods. The average daily flow of contributing areas was utilized, with consideration also given for the allowable peak hydraulic flow (the total momentary peak flow from any combination of sewer basins).

There are two wastewater treatment facilities that are permitted to serve the study area. These are the Woolmarket Wastewater Treatment Plant (WWTP), located north of Interstate 10 along Shorecrest Road, and the North D'Iberville Wastewater Treatment Plant. Both the Woolmarket and the North D'Iberville WWTP are owned and operated by the HCUA.

The Woolmarket WWTP plant on Shorecrest Dr. (as indicated on Figure 3.4) has a treatment capacity of 2 MGD, equivalent to 1,389 gallons per minute (GPM), and has the capacity to serve the entire study area within the Woolmarket community. The existing average daily flows into the Woolmarket WWTP are estimated to be approximately 0.46 MGD (338 GPM), based on the available flow data. Projected future flows into the Woolmarket WWTP based on full build-out of the available parcels in study area are estimated to be approximately 0.9 MGD (603 GPM), which is considerably less than the design flow of the plant. The allowable peak hydraulic flow at the plant is 6 MGD (4,166 GPM), which is well below the anticipated peak flow from the Woolmarket area of 1,809 GPM. Based on these comparisons of average daily flow and peak momentary flow, there appears to be no need for an expansion at this plant due to the wastewater system expansions recommended herein.

The North D'Iberville WWTP on Rd. 127 (as indicated on Figure 3.5) was constructed in 2011 and has a treatment capacity of 1.5 MGD (1,042 GPM). Currently, available flow data indicates that the North D'Iberville facility receives sewage from the City of D'Iberville at a rate of approximately 1 MGD (694 GPM). A portion of the wastewater collected from the eastern parts of the Woolmarket study area (i.e., the Hudson-Krohn Road area) is also transported to the North D'Iberville WWTP at an estimated flow rate of .05 MGD (39 GPM) per the WWTP flow data. Projected future flows into the North D'Iberville WWTP based on full build-out of the available parcels in the eastern portion of the study area are estimated to be approximately 0.11 MGD (76 GPM). The allowable peak hydraulic flow at the plant is 4.5 MGD (3,125 GPM), which is well below the anticipated peak flow into the D'Iberville plant of 922 GPM (694 GPM from D'Iberville plus 228 GPM from the Woolmarket area). Based on the current capacities of the WWTP, the projected future flows resulting from the expansion of sewer collection into the unserved areas is not expected to have any adverse impacts on the treatment facilities nor should an expansion be required because of the additional flows.

### **3.2.3 DEVELOPMENT OF WASTEWATER FLOWS**

#### **DESIGN CONSIDERATIONS**

The primary objective of the sewer utilities plan was to consider all existing sewer systems in the Study Area to determine collection service areas and evaluate each flow area's system and the overall system in its ability to meet existing needs. This analysis is based on the performance criteria detailed in the "Guidance for Design of Publicly Owned Wastewater Facilities" as published by the Mississippi Department of Environmental Quality (MDEQ). The sewer system assessment criteria used herein is shown in Table 3-0.

**TABLE 3-0  
EXISTING WASTEWATER SYSTEM ANALYSIS CRITERIA**

ANALYSIS PARAMETER	CRITERIA
<b>WASTEWATER FLOWS</b>	
1. RESIDENTIAL STRUCTURE AVERAGE DAILY FLOW RATE	400 GPD (gal/day) *
2. COMMERCIAL STRUCTURE AVERAGE DAILY FLOW RATE	400 GPD *
3. PEAKING FACTOR	3
<b>GRAVITY SEWER MAIN CAPACITY</b>	
1. MINIMUM CAPACITY	> Peak Estimated Flow Rate
2. MAXIMUM GRAVITY SEWER CAPACITY	**
8" @ 0.34%	411 GPM (gal/min)
10" @ 0.25%	639 GPM
12" @ 0.20%	929 GPM
15" @ 0.15%	1458 GPM
18" @ 0.12%	2121 GPM
20" @ 0.10%	2565 GPM
21" @ 0.10%	2921 GPM
<b>PUMP STATIONS</b>	
1. DESIGN CAPACITY	Individual pumps sized to pump peak contributing flow rate
2. MOTOR SIZING	Pump curve should not intersect ***
	the horsepower curve under "worst-case" low-head conditions.

\* Per the Mississippi Department of Environmental Quality - Guidance for the Design of Publicly Owned Wastewater Facilities (MDEQ Guidance)

\*\* Using minimum pipe slopes per the MDEQ Guidance

\*\*\* "Worst-case" low-head conditions assumed to be 15' total dynamic head (TDH) less than pump station design point. Actual "worst-case" may vary considerably.

## **EXISTING WASTEWATER FLOWS**

For estimation of the city's existing wastewater flows, the following information from the Biloxi GIS data source was utilized:

- Parcel Counts
- Structure Counts

To determine the wastewater flows from various areas of the system, the Woolmarket wastewater system service area was divided into smaller service areas served by a City or HCUA regional pump station or a gravity interceptor system which may discharge directly to a treatment plant. These sewer basins, or flow areas, are shown in Figures 3.2 through 3.5. The existing peak wastewater flow rates, including inflow and infiltration rates, were estimated for each of the Biloxi flow areas based on the existing structure and parcel counts in each flow area. These estimated peak wastewater flows are indicated in Table 3-1. Limited consideration was given to residential and commercial zoning, and estimated land use projections to estimate actual wastewater flow to the system. Large flows, if any, from well-established entities such as hospitals and commercial businesses should be considered to better estimate actual wastewater flow to the system. Such data was not available at the time of this report.

## **ANALYSIS OF EXISTING COLLECTION SYSTEM CAPACITY**

According to the system assessment criteria shown in Table 3-0, it is necessary that a gravity sewer line, when flowing full, must be able to handle the peak flow rate discharging into it. According to information from the HCUA, the existing collection system is not experiencing a significant amount of inflow & infiltration (I&I) during wet weather periods. Based on this anecdotal evidence and the flow data from the WWTPs, it is reasonable to assume for purposes of analysis that the sewer system in the study area receives contributing flows from residential structures at a total flow rate of 120 gallons per day per capita, which is based on the MDEQ "Guidance for the Design of Publicly Owned Wastewater Facilities". Based on this estimated flowrate per capita and local design experience, it is reasonable to anticipate 400 gallons per day total from a residential structure. For purposes of simplicity and based on the relatively small amount of commercial properties as indicated by the City's GIS data sources, it was furthermore assumed that commercial structures contribute wastewater flows at the same flowrate as the residential structures. It is believed that this methodology produces a more conservative, i.e., higher estimate of the peak sewer flows.

The estimated peak sewer flows, tabulated in Table 3-1, were then compared to the minimum capacity of gravity sewer mains indicated on Table 3-0. This comparison reveals that the existing collection system is sufficient to handle existing peak sewer flows. The above stated method is general in nature and the methodology for estimation of peak wastewater flow rates is only as accurate as the flow and property data currently received.

**TABLE 3-1  
ESTIMATED EXISTING WASTEWATER FLOWS**

SEWER BASIN NO.	SEWER BASIN DESCRIPTION	ESTIMATED EXISTING LAND USE *	ESTIMATED EXISTING AVERAGE DAILY FLOW (GPM) **	ESTIMATED EXISTING PEAK FLOW (GPM) **
100	SHORECREST (WOOLMARKET WWTF)	69	19	58
101	MILLCREEK	25	7	21
110	PIN OAK	183	51	153
111	EAST SHORECREST	52	14	43
112	SOUTH RIVER DR.	8	2	7
120	WEST OAKLAWN	28	8	23
121	SCENIC RIVER DR.	30	8	25
122	RIVER OAKS CT.	10	3	8
123	HOSLI HILLS	8	2	7
130	EAST OAKLAWN	57	16	48
131	PARKERS LANDING	7	2	6
132	RIVER ESTATES NORTH	22	6	18
133	RIVER ESTATES SOUTH	9	3	8
134	PARKERS CIRCLE	25	7	21
135	GOLDEN FLAKE	8	2	7
140	NORTH OAKLAWN	32	9	27
141	PARKERS CREEK RD.	15	4	13
142	T & E	25	7	21
143	GATES OF BILOXI	45	13	38
144	WOOLMARKET & TEODIA HUSLEY RD.	129	36	108
145	TIMBER CREEK	186	52	155
150	WOOLMARKET & MARTIN COVE	166	46	138
160	WASH FAYARD RD.	12	3	10
200	TUXACHENIE SEWER - SOUTH	158	44	132
TOTAL FLOW (GPM)			364	1,091

\* Estimated Existing Land Use is the total number of structures, contributing sewage flow, currently existing in each sewer basin.

\*\* Existing Flows are the estimated existing sewerage flow from developed parcels in each flow area.

**TABLE 3-2  
EXISTING PUMP STATIONS**

PUMP STATION NO.	PS OWNER	PUMP STATION DESCRIPTION	ALT. DESIG.	LOCATION (RELATIVE TO I-10)	YEAR INSTALLED	NO. OF PUMPS	MOTOR SIZE (HP)	MANUFACT.	DISCHARGE SIZE (IN)	MODEL	RPM	IMPELLER SIZE (IN)	TDH (FT)	NOMINAL CAPACITY (GPM)	FORCE MAIN SIZE (IN)	WETWELL DIAM. (FT)	DEPTH (FT)
4	HCUA	LAGOON EFFLUENT (DECOMMISSIONED)		SOUTH													
100	HCUA	SHORECREST (WOOLMARKET WWTF)	S19A	NORTH													
101	BILOXI	MILLCREEK		NORTH		2	5	WEMCO	6	3X11CLCES	1160	9	36.21	80	3	6	11
110	HCUA	PIN OAK		SOUTH	2009	2	16.6	MYERS	4	6VC300M4-23	1750	8-1/8	74	960	8	6	18.88
111	BILOXI	EAST SHORE CREST		SOUTH		2	20	WEMCO	4	4X11CLCES	1780	6	52	350	8	8	22.78
112	BILOXI	SOUTH RIVER DR		SOUTH		2	5	WEMCO	4	3X11CLCES	1780	6	32	80	4	6	16
120	HCUA	WEST OAKLAWN	S-1/S20	SOUTH		2	34	PUMPEX	4	K254-F-CH-7358	1885	7-3/4	24	1700	4	5	21.7
121	BILOXI	SCENIC RIVER DRIVE	S-5	SOUTH	2012	2	5	WEMCO	4	4X11CLCES	1150	6-1/8	35	80	4	5	13
122	BILOXI	RIVER OAKS COURT	S-6	SOUTH	2012	2	5	WEMCO	4	3X11CLCES	1750	6-1/8	35	100	4	5	10.6
123	BILOXI	HOSLI HILLS GRINDER PUMP		SOUTH		1	1.5										
130	HCUA	EAST OAKLAWN	S-3/S20	SOUTH	2012	2	34	PUMPEX	4	K204-F-CH-7421	885	7-7/8	22.5	1400	6	5	19.5
131	BILOXI	PARKERS LANDING	S-4	SOUTH	2012	2	7.5	WEMCO	4	4X11CLCES	1150	6-1/2	16.5	220	4	5	15.5
132	BILOXI	RIVER ESTATES NORTH	S-8	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6	13	80	4	5	13
133	BILOXI	RIVER ESTATES SOUTH	S-9	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6	13	80	4	5	12
134	BILOXI	PARKERS CIRCLE	S-7	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6-1/4	15	80	4	5	11.5
135	BILOXI	GOLDEN FLAKE	S-2	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6	14.07	80	4	5	15
140	HCUA	NORTH OAKLAWN	N-1/S20	NORTH		2	11	PUMPEX	4	K158-F-CD-7305	845	8-1/4	25	200	6	5	17.3
141	BILOXI	PARKERS CREEK ROAD	N-2	NORTH	2012	2	7.5	WEMCO	4	4X11CLCES	1150	7-1/2	40	200	6	5	12
142	BILOXI	T & E	N-4	NORTH	2009	2	10	ESSCO	4	4X12	1750	8	47	200	6	5	19
143	BILOXI	GATES OF BILOXI		NORTH	2009	2	15	ESSCO	4	4X12TF	1750	8	47	375	8	6	12.25
144	BILOXI	WOOLMARKET & TEODIA		NORTH	2015	2	7.5	WEMCO	4	3X11CLCES	1750	7-1/4	42	200	8	6	12.25
145	BILOXI	HUSLEY RD		NORTH	2010	2	15							180			
150	HCUA	TIMBER CREEK		NORTH		2	25	ABS	4	AFP 1047	1760	9.84	92.9	456	6	8	19
160	HCUA	WOOLMARKET RD NEAR MARTIN COVE		NORTH	2014	2	30	FLYGT	4	NP3171.181MT	1760	9.61	55.6	1344	12	12	16.5
200	HCUA	WASH-FAYARD TUXACHENIE SEWER - SOUTH	S19B	NORTH	2014	2	45	FLYGT	4	NP 3202	1775	79	79	554	8	6	18.28

DECOMMISSIONED, NOT SHOWN IN EXHIBITS  
INFORMATION NOT AVAILABLE OR OTHERWISE UNKNOWN

## **ANALYSIS OF EXISTING PUMP STATION CAPACITY**

The sewer system assessment criteria as shown in Table 3-0 establishes that a pump station's minimum pumping capacity, with one pump out of service, should exceed the peak flow rate. Pump stations, incapable of handling the estimated existing peak sewer flows as indicated in Table 3-1, were identified and are discussed in the following paragraphs:

- Station #143 "Gates of Biloxi" at Woolmarket Rd. & Husley Rd.
- Station #121 "Scenic River Drive" at 9127 Scenic River Dr.

Station #143 is deemed below capacity because the Jordan Property subdivision, in sewer Basin #144, is currently approved by the City. A full buildout of that development, following the flow patterns of the existing system, could lead to overflows unless the station is upgraded. Basins #144 and #145 both contribute flow to Basin/Station #143.

Station #121 is identified as possibly being below the needed capacity, because the upstream Station #122 at River Oaks Court, has a higher design capacity. However, based on the analysis of estimated existing peak sewer flows, both stations have sufficient capacity to pump actual contributing flows. Station #121 is therefore not recommended for any upgrades at this time.

Also regarding other pump stations concerns, interviews with City maintenance personnel revealed concerns that several of the pump stations in the study area "overload" during high flow events, which may occur during an extended rain or storm event. Overloading occurs when high flows contribute to lower head conditions, which may cause the motor to operate at higher-than-normal loads or other detrimental operational conditions. While this high operation speed can lead to increased flow rates, excessive motor operation time while overloaded may lead to premature motor failure. A preliminary check for an overloaded condition can be performed by checking if the impeller/pump curve crosses the selected motor horsepower curve on the manufacturer-provided pump curve sheet. The stations which may fall under this condition are:

- Station #144 at Woolmarket Rd. & Teodia Husley Rd.
- Station #142 "T & E" on Highway 67
- Station #121 at 9127 Scenic River Dr.

Recommendations for such deficient pump stations are discussed in the "CAPITAL IMPROVEMENT PROJECTS" section later in this report.

## **3.3 FUTURE SANITARY WASTEWATER SYSTEM**

Upon establishment of the conditions, flows, and capacities of the existing sanitary wastewater system in the Woolmarket area, Figures 3.2 through 3.5 were utilized to identify currently unserved residential or commercial areas which could be served by extensions to the wastewater collection system.

### **3.3.1 DEVELOPMENT OF FUTURE WASTEWATER FLOWS**

#### **DESIGN CONSIDERATIONS**

The same sewer system design criteria and procedures used for evaluation of the existing wastewater flows and collection system capacities were utilized in determining probable future wastewater flows and the capacities of the proposed future systems.

Consideration for providing new sewage collection to unserved residential and commercial parcels was largely based on the general topography of the area, the density of the structures in the area, and how the area could be connected to an existing portion of the City's wastewater infrastructure. Existing topographic features and estimated rights-of-way and easements were also considered in determining the recommended infrastructure type. Direct connections to existing gravity sewer systems were given primary consideration, where construction is feasible within reasonable depths. Where proposed gravity system depths were greater than 18-feet or when the topography and drainage features had to be accommodated, pump stations and sewer force mains were proposed for connection to existing systems. In areas where this was not feasible, primarily due to topographic constraints, the use of a low-pressure sewer system (LPSS) was given consideration in providing collection services to existing residences and commercial establishments within the study area.

### **FUTURE WASTEWATER FLOWS**

Within the existing sewage basins, future flows were calculated based on the total estimated number of parcels within the sewer basin, assuming each parcel was developed as a single-family residence. While it is possible and likely that some parcels will develop at a greater density, some of the parcels will likely not develop at all in the near future.

Therefore, it seems that this estimation methodology strikes a reasonable balance for estimation of average future sewer flows. While this estimation method may not exactly correlate with estimated water usages for similar areas (which should be based on MS Dept. of Health standards), it presumes that future wastewater flows will grow linearly based on available land amounts and following the general patterns and amounts observable from existing sewer flow rates.

Future wastewater flows from unserved areas within the study area were calculated by dividing the unserved areas into individual collection basins. From the geographic boundaries of the individual collection basins, the number of existing land parcels was estimated and the peak daily flow for each parcel was calculated using the design criteria provided in Table 3-0. Further, peak flow rates from known under-construction or approved developments in the area were included in the peak flow rate calculations for each sewer basin. These under-construction or approved developments are the Emerald Lake development in Basin 200, the Rock Creek subdivision in Basin 150, the Jordan Property subdivision in Basin 144, Nature's Trail subdivision contributing to Basin 160 and 100, Bellewood subdivision flowing to Basin 100, and the Hidden Springs subdivision draining to Basin 160. The individual collection basins and the respective future peak flows for each basin are provided in Table 3-3

**TABLE 3-3  
ESTIMATED FUTURE WASTEWATER FLOWS**

SEWER BASIN NO.	SEWER BASIN DESCRIPTION	ESTIMATED AVAILABLE LAND USE *	ESTIMATED FUTURE AVERAGE DAILY FLOW (GPM) **	ESTIMATED FUTURE PEAK FLOW (GPM) **
100	SHORECREST (HCUA GRAVITY SYSTEM - WOOLMARKET WWTF)	107	30	89
101	MILLCREEK	25	6.9	21
102	TIFFANY LN.	18	5	15
103	BOYETTE/OAKLAWN RD.	110	31	92
104	OAKLAWN RD. SOUTH	32	9	27
105	SELENA DR.	23	6	19
106	VICTORY LN.	19	5	16
107	SOUTH MILL CREEK RD.	18	5	15
110	PIN OAK	187	52	156
111	EAST SHORECREST	127	35	106
112	SOUTH RIVER DR.	8	2	7
120	WEST OAKLAWN	40	11	33
121	SCENIC RIVER DR	46	13	38
122	RIVER OAKS CT.	11	3	9
123	HOSLI HILLS	6	2	5
130	EAST OAKLAWN	55	15	46
131	PARKERS LANDING	8	2	7
132	RIVER ESTATES NORTH	26	7	22
133	RIVER ESTATES SOUTH	13	4	11
134	PARKERS CIRCLE	47	13	39
135	GOLDEN FLAKE	9	3	8
140	NORTH OAKLAWN	40	11	33
141	PARKERS CREEK RD.	14	4	12
142	T & E	26	7	22
143	GATES OF BILOXI	49	14	41
144	WOOLMARKET & TEODIA HUSLEY RD.	159	44	133
145	TIMBER CREEK	186	52	155
146	JIM BYRD SOUTH	60	17	50
147	JIM BYRD NORTH	15	4	13
148	OLD HWY. 67 NORTH	40	11	33
150	WOOLMARKET & MARTIN COVE	300	83	250
151	AIRPORT RD.	87	24	73
152	COUNTRY LN.	14	4	12
160	WASH FAYARD RD. (HCUA GRAVITY SYSTEM)	21	6	18
161	WOODLANDS DR.	34	9	28
162	WOODLAND HILLS	28	8	23
170	JOHN LEE RD. SOUTH	25	7	21
171	OLD WOOLMARKET RD.	21	6	18
172	DUNDEEWOOD RD.	29	8	24
173	TIMBER RIDGE LN.	11	3	9
174	JOHN LEE RD. NORTH	35	10	29
175	WOOLMARKET LAKE RD.	66	18	55
176	SNUG HARBOR RD.	18	5	15
177	RIVERLAND DR.	50	14	42
200	TUXACHANIE SEWER - SOUTH	158	44	132
201	OLD HWY. 67 SOUTH	39	11	33
202	PARADISE LN.	55	15	46
204	STACY LN.	21	6	18
<b>TOTAL FLOW (GPM)</b>			<b>704</b>	<b>2,113</b>

\* Estimated available land use is the greater of the total available parcels or the total existing structures.

\*\* Future Flows are the estimated future sewerage flow from all existing parcels in each flow area.

### **ANALYSIS OF FUTURE COLLECTION SYSTEM CAPACITY**

An analysis of the future collection system capacity was performed in like manner to the existing collection system capacity analysis, as detailed in the "EXISTING SANITARY WASTEWATER SYSTEM" section. This analysis shows that the existing collection systems in place will be sufficient to satisfactorily handle the estimated future peak sewer flows.

### **ANALYSIS OF FUTURE PUMP STATION CAPACITY**

Based on the projected peak future inflow rates from each sewer basin, a total of three pump stations were deemed to have insufficient capacity for the future peak sewer flow per the study methodology. The stations so identified are:

- Station #143 "Gates of Biloxi" at Woolmarket Rd. & Husley Rd.
- Station #144 at Woolmarket Rd. & Teodia Husley Rd.
- Station #200 at Old Hwy. 67 & Hudson-Krohn Rd.

In addition to the increase in flow rate due to projected development of existing parcels within the basin, several of the pump stations in the area will receive additional sewer flows due to construction of already approved or under-construction subdivisions. These impacts will only take affect when the developments are fully built-out and the majority of land available for future development has been developed; however, continued development within this area will produce small impacts to the pump station over time. Taking into consideration that it may take years to realize these increases in flow, it is recommended that City personnel monitor the flow rates and runtimes at the above noted station as development continues. More precise recommendations for upgrades can be provided once definitive need for an upgrade has been established.

Future expansion of the City sewage collection system to include unserved areas will require the addition of several additional pump stations in locations where traditional gravity sewer cannot transport the waste stream to a larger interceptor or transmission pipeline. The proposed new sewage basins which will require the use of a pump station in the design of the collection system, and the design flow rates for the proposed pump stations within each sewer basin area, along with recommended upgrades for any existing pump station are presented in Table 3-4.

**TABLE 3-4  
FUTURE PUMP STATIONS (WITH MODIFICATIONS TO EXISTING STATIONS)**

PUMP STATION NO.	PS OWNER	PS RECOMMENDATION	PUMP STATION DESCRIPTION	ALT. DESIG.	LOCATION (RELATIVE TO I-10)	YEAR INSTALLED	NO. OF PUMPS	MOTOR SIZE (HP)	MANUFACTURER	DISCHARGE SIZE (IN)	MODEL	RPM	IMPELLER SIZE (IN)	TDH (FT)	NOMINAL CAPACITY (GPM)*	FORCE MAIN SIZE (IN)	WETWELL DIAM. (FT)	DEPTH (FT)	
DECOMMISSIONED; NOT SHOWN IN EXHIBITS																			
4	HCUA		LAGOON EFFLUENT (DECOMMISSIONED)		SOUTH														
100	HCUA		SHORECREST (WOOLMARKET WWTF)	S19A	NORTH		2	5 SHP	WEMCO	4	3X11CLCES	1160	9	36.21	80	3	6	11	
104	BILOXI	CONSTRUCT **	OAKLAWN RD. SOUTH		NORTH		2	5 SHP	WEMCO	4	4S3				80				
107	BILOXI	CONSTRUCT **	SOUTH MILL CREEK RD.		SOUTH	2009	2	16.6 SHP	MYERS	6	6VC300M4.23	1750		74	960	6	6	18.88	
110	HCUA		PIN OAK		SOUTH		2	20	WEMCO	4	4X11CLCES	1780	6-1/8	52	350	3	3	22.78	
111	BILOXI		EAST SHORE CREST		SOUTH		2	5	WEMCO	4	3X11CLCES	1780	6	32	80	4	6	16	
112	BILOXI		SOUTH RIVER DR		SOUTH		2	34	PUMPEX	4	K254F-CH-735B	885		1700	1700	4	5	21.7	
120	HCUA	UPGRADE MOTORS	WEST OAKLAWN	S-1/S20	SOUTH	2012	2	7.5	WEMCO	4	4X11CLCES	1190	7-3/4	24	80	4	5	13	
121	BILOXI		SCENIC RIVER DRIVE	S-5	SOUTH	2012	2	5	WEMCO	4	3X11CLCES	1750	6-1/8	35	100	4	5	10.6	
122	BILOXI		RIVER OAKS COURT	S-6	SOUTH		2	1.5											
123	BILOXI		HOSLI HILLS GRINDER PUMP		SOUTH		1	34	PUMPEX						1400				
130	HCUA		EAST OAKLAWN	S-2/S20	SOUTH	2012	2	7.5	WEMCO	4	K204F-CH-7421	865		22.5	220	6	5	19.5	
131	BILOXI		PARKERS LANDING	S-4	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	7-7/8	16.5	80	4	5	13	
132	BILOXI		RIVER STATES NORTH	S-8	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6-1/2	13	80	4	5	12	
133	BILOXI		RIVER STATES SOUTH	S-9	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6	15	80	4	5	11.5	
134	BILOXI		PARKERS CIRCLE	S-7	SOUTH	2012	2	3	WEMCO	3	3X11CLCES	1150	6-1/4	14	80	4	5	16	
135	BILOXI		GOLDEN FLAKE	S-2	SOUTH	2012	2	11	PUMPEX	3	3X11CLCES	1150	6	14.07	80	4	5	17.3	
140	HCUA		NORTH OAKLAWN	N-1/S20	NORTH	2012	2	7.5	WEMCO	4	K158-F-CD-7305	845		25	200	6	5	12	
142	BILOXI	UPGRADE MOTORS	PARKERS CREEK ROAD	N-2	NORTH		2	15	ESSCO	4	4X11CLCES	1750	8-1/4	40	200	6	5	19	
143	BILOXI	UPGRADE CAPACITY	T & E	N-4	NORTH		2	30	WEMCO	4	4X11CLCES	1750	7-1/2	-74	500	8	6	12.25	
144	BILOXI	UPGRADE CAPACITY	WOOLMARKET & TEODIA		NORTH		2	20	WEMCO	4	3X11CLCES	1750	-9-1/2	-80	300	8	6	12.25	
145	BILOXI		HUSLEY RD		NORTH		2	5HP	WEMCO	4	4S3				80				
147	BILOXI	CONSTRUCT **	TIMBER CREEK		NORTH		2	5HP	WEMCO	4	4S3				80				
148	BILOXI	CONSTRUCT **	JIM BYRD NORTH		NORTH		2	5HP	WEMCO	4	4S3				80				
150	HCUA		OLD HWY. 87 NORTH		NORTH		2	5HP	WEMCO	4	4S3				80				
151	BILOXI	CONSTRUCT **	WOOLMARKET RD NEAR MARTIN COVE		NORTH	2014	2	25	ABS	4	AFP 1047	1780	9.84	92.9	456	6	8	19	
160	HCUA	CONSTRUCT **	AIRPORT RD.		NORTH		2	30	WEMCO	4	4S3				100				
162	BILOXI	CONSTRUCT **	WASH-FAYARD	S19B	NORTH	2014	2	30	FLYGT	4	NP3171.011MT	1780	9.61	55.6	1344	12	12	16.5	
170	BILOXI	CONSTRUCT **	WOODLAND HILLS		NORTH		2	25	WEMCO	4	4S3				80				
173	BILOXI	CONSTRUCT **	JOHN LEE RD. SOUTH		NORTH		2	5HP	WEMCO	4	4X11CLCES	1780			400				
175	BILOXI	CONSTRUCT **	TIMBER RIDGE LN		NORTH		2	5HP	WEMCO	4	4S3				80				
176	BILOXI	CONSTRUCT **	WOOLMARKET LAKE RD.		NORTH		2	10	WEMCO	4	4X11CLCES	1150			200				
177	BILOXI	CONSTRUCT **	SNUG HARBOR RD.		NORTH		2	9HP	WEMCO	4	4S3				80				
200	HCUA	UPGRADE CAPACITY	RIVERLAND DR.		NORTH		2	79	WEMCO	4	4S3				80				
201	BILOXI	CONSTRUCT **	TUXACHENE SEWER - SOUTH		NORTH		2	5HP	WEMCO	4	4S3				130				
203	BILOXI	CONSTRUCT **	OLD HWY. 87 SOUTH		NORTH		2	5HP	WEMCO	4	4S3				80				
203	BILOXI	CONSTRUCT **	MASON RD.		NORTH		2	5HP	WEMCO	4	4S3				80				

### 3.4 CAPITAL IMPROVEMENT PROJECTS

The projects listed below are a combination of the deficiencies found in the existing system and those projects necessary to provide wastewater collection to unserved areas and to improve existing system capacities as required for satisfactory service in the unserved areas. Several projects could be initiated to provide sewer collection without having to implement any large-scale improvements to the downstream transmission system. These projects would consist mainly of constructing a gravity sewer collection system that flows to an existing gravity transmission pipeline owned and maintained by the City and/or the HCUA.

Beyond the initial scope of providing gravity sewer collection only to areas where this conventional gravity collection system is feasible, we have developed additional capital projects that would provide sewage collection to presently unserved areas using gravity sewer with the use of a pump station and also by using a Low Pressure Sewer System (LPSS) as an alternative means of collection where gravity sewer is not practical or may require easement acquisition in lieu of the public right-of-way.

This suggested list of proposed capital projects is intended to provide collection to existing "high density" areas, where the analysis of peak flows indicates a "dense" population, where such projects could be completed with minimal ongoing operations and maintenance (O&M) costs, where there is minimal required property acquisition, and where ready access to existing infrastructure already exists.

Although priority of construction of any of the suggested projects must be determined by the Owner, using such information as population density, need for the project, projected costs, property acquisition needs, etc., Table 7-2 does provide a preliminary project ranking for sewer projects based on the total estimated cost for the project within a basin compared to the total estimated number of customers potentially added or benefitted by the project. Obviously, some "downstream" projects are necessary elements of an "upstream" improvement. For instance, the projects proposed for sewer basins 171 through 177 cannot be constructed and put into service until the improvements in basin 170 ("John Lee Rd. South") are satisfactorily completed. Therefore, the customers potentially served by such "upstream" basins are included in the potential beneficiaries of the "downstream" projects. This methodology generally serves to prioritize the "downstream" projects for earlier construction. Although the pump station upgrades projects are ranked highly, City planners should use discretion when selecting these upgrades, as the upgrades required are based on predicted future flows which may not materialize for some time, as can be seen in the "ANALYSIS OF FUTURE PUMP STATION CAPACITY" discussion above.

While the project priorities indicated in Table 7-2 are suitable for use in selecting the order for construction of sewer projects alone, it is likely and even recommendable that the City should build water and wastewater projects simultaneously to gain the maximum efficiency and cost-effectiveness for construction and the least time of disturbance for citizens. In that case, proposed wastewater projects should be paired with proposed water projects recommended in this Master Plan, so that City-provided sewer is only available when the City can also supply water to a property. In that case, projects should be selected inside similar geographic areas, which generally correspond to the basin/project numbers utilized herein. For instance, should the City decide to expand water service to John Lee Road South as part of water project 170.W1, sewer project 170.S1 is proposed to expand sewer service into the same geographic area.

As discussed above, the project numbers indicated below are a direct reflection of the sewer basin within which the project is located, which are indicated on Figures 3.6 through 3.9. Based on the projects proposed for the future wastewater system, a general flow schematic of the future sewer basins within the sewer collection system in the study area was developed and is presented as Figure 3.10.

### **3.4.1 PUMP STATION IMPROVEMENTS (EXISTING)**

As detailed in the above analyses of pump stations (existing or future), there are several existing pump stations which must be improved. The necessary improvements, discussed below, include either an increase in the size of the motors to solve existing reported motor-overloading issues, or the replacement of motors and pumps to increase the available pumping capacity at the station.

#### **UPGRADE CAPACITY OF PUMP STATIONS**

These projects are necessary to increase the pumping capacity of an existing pump station. To increase the pump capacity, the motors, pumps, and related electrical systems must be replaced. It is assumed that other components in the station will be reusable.

A. Station #143 (Gates of Biloxi) – Project No. 143.S1

This station is currently below capacity due to the flows expected from the Jordan Property subdivision and should be upgraded when necessary to meet the expected future peak sewer flow. A breakdown of the costs is provided in Estimate 3.1.

B. Station #144 (Woolmarket Road and Teodia Husley Rd) – Project No. 144.S1

This station isn't currently under capacity but could change as development continues in the area, especially in the Jordan Property subdivision. City personnel should monitor the station runtimes to determine the timing of the upgrade. A breakdown of the costs is provided in Estimate 3.2.

C. Station #200 (Tuxachenie South) – Project No. 200.S1

This station isn't currently under capacity but that could change as development continues in the area, especially in the Emerald Lake Estates subdivision and in the northern portion of the Tuxachenie sewer basin (Basin 200). City personnel should monitor the station runtimes to determine the timing of the upgrade. A breakdown of the costs is provided in Estimate 3.3.

#### **REPLACEMENT OF MOTORS AT PUMP STATIONS**

These projects are necessitated based on the verbal reports of the City's O&M personnel who advise that the stations are overloading in high-flow, low-head conditions, such as during an extended rain storm which creates significant inflow & infiltration in most sewer systems. This can happen when the station's operating condition on the pump curve requires more horsepower than the motor can sustain. This project type will necessitate replacement of the motors and the related electrical systems. It is assumed that other components in the station will be reusable.

A. Station #144 – (Woolmarket Road and Teodia Husley Rd) - Project No. 144.S1

Since this station needs upgrades to provide additional capacity, no estimate was made to repair the possible motor overloading condition. The estimate to create increased capacity is provided in Estimate 3.2.

B. Station #142 - (T & E) – Project No. 142.S1

A breakdown of the costs is provided in Estimate 3.4.

C. Station #121 – (Scenic River Drive) - Project No. 121.S1

A breakdown of the costs is provided in Estimate 3.5.

Cost estimates for these renovations are based on the reports of City maintenance personnel and without benefit of a field survey or inventory of existing station components.

### **3.4.2 EXPANSION TO UNSERVED AREAS**

Using existing topographic information, conceptual designs of sewer collection system were developed to provide service to unserved areas and to develop probable costs for the work. The figures relative to these conceptual designs number 24 in total and are identified utilizing the project numbers indicated below, which also correspond to the relative sewer basin as schematically indicated on Figure. 3.10. For instance, Figure 204.S1 is the figure indicating the conceptual design of the improvements required in the Stacy Ln. sewer basin (#204), also known as Project 204.S1 in the project list below.

As discussed previously, Table 7-2 provides a project ranking based on estimated cost per parcel served. However, the types of projects listed below are offered in an order combining ease of construction and minimal O&M costs. Based on that precedence, the recommended project types include: (1) gravity system with no pump station required; (2) gravity system requiring a pump station or stations; and (3) low pressure sewer system collection. These “designs” are conceptual in nature and were developed without the benefit of any surveying. Figures for each project mentioned below can be found in Appendix A.

#### **GRAVITY SEWER COLLECTION**

A. Pine Haven Mobile Home Park – Project No. 100.S1

Pine Haven Mobile Home Park is located at the northern boundary line of the study area on the east side of Lorraine Road. At the time of this report, there were an estimated 107 mobile homes on the property. The property fronts on Lorraine Road and the existing sewer system consists of a gravity system that drains to an oxidation pond at the east end of the property. The Harrison County Utility Authority has an 18” gravity sewer interceptor on Lorraine Road that could accept this waste stream, thereby allowing for closure of the oxidation pond. Due to a lack of information regarding the construction of the existing sewer system within the park, neither a figure showing proposed infrastructure construction nor a more descriptive breakdown of the costs to make the connection to existing collection facilities, including closure of onsite treatment is included with this report.

B. Henry’s Mobile Home Park – Project No. 100.S2

This mobile home park is located on the west side of John Lee Road north of its intersection with Lorraine Road. This property is also bordered on the east by Lorraine Road, which has a 20” gravity sewer interceptor capable of accepting this waste stream. This park has approximately 60 residences currently utilizing its services. Due to a lack of information regarding the construction of the existing sewer system within the park, neither a figure showing proposed infrastructure construction nor a more

descriptive breakdown of the costs to make the connection to existing collection facilities, including closure of onsite treatment is included with this report.

C. Mobile Home Park on Old Hwy 67- Project No. 200.S2

This mobile home park is located on the east side of Old Highway 67, north of the intersection of Old Highway 67 and Hudson-Krohn Road. This park has approximately 92 available spaces for occupancy. Due to a lack of information regarding the construction of the existing sewer system within the park, neither a figure showing proposed infrastructure construction nor a more descriptive breakdown of the costs to make the connection to existing collection facilities, including closure of onsite treatment is included with this report.

D. Oaklawn RV Park – Project No. 130.S1

This mobile home park is located south of Interstate 10, west of Shriners Blvd. This property is bordered on the south by Oaklawn Avenue, which has a 10” gravity sewer main that flows to HCUA pump station no. 2. This park has approximately 31 residences currently utilizing its services. Due to a lack of information regarding the construction of the existing sewer system within the park, neither a figure showing proposed infrastructure construction nor a more descriptive breakdown of the costs to make the connection to existing collection facilities, including closure of onsite treatment is included with this report.

E. Stacy Lane – Project No. 204.S1

This proposed project will provide municipal sewage collection to 21 future customers utilizing a new gravity sewer collection system that would transport the waste to the adjacent HCUA 10” gravity interceptor. The project area is located on the east side of Hudson-Krohn Road. The proposed sewer collection system, consisting of approximately 3,260 lf of 8” gravity sewer and 23 manholes, could easily be connected to the existing infrastructure. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$1,074,041.32. A more descriptive breakdown of the costs is provided in Estimate 3.6.

F. Jim Byrd South – Project No. 146.S1

This proposed project will provide municipal sewage collection to 60 future customers utilizing a new gravity sewer collection system that would transport the waste to the existing municipal gravity sewer collection system within the sewage basin of Lift Station 11. The project area is located on Jim Byrd Road. The proposed sewer collection system would consist of approximately 6,280 lf of 8” gravity sewer and 22 manholes and could be connected to existing City of Biloxi infrastructure. Estimated costs for providing collection services and connecting to the adjacent municipal system are approximately \$1,753,163.75. A more descriptive breakdown of the costs is provided in Estimate 3.7.

G. Boyette/Oaklawn North – Project No. 103.S1

This proposed project would provide municipal sewage collection to 110 future customers utilizing a new gravity sewer collection system that would transport the waste to the existing 20” HCUA gravity sewer interceptor on Lorraine Road. This

project area would terminate with the connection to an existing manhole on Lorraine Road for transport to the WWTP. The project area is located on Oaklawn Road south of the intersection of Lorraine Road and Woolmarket Road. The proposed sewer collection system would consist of approximately 10,390 lf of 8" gravity sewer and 32 manholes, and could be connected to existing HCUA infrastructure. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$2,778,482.10. A more descriptive breakdown of the costs is provided in Estimate 3.8.

H. Country Lane – Project No. 152.S1

This proposed project will provide municipal sewage collection to 14 future customers utilizing a new gravity sewer collection system that would transport the waste to the existing municipal gravity sewer collection system within the sewage basin of Lift Station 21, which is owned by the HCUA but operated by the City of Biloxi. The proposed sewer collection system would consist of approximately 2,300 lf of 8" gravity sewer and 7 manholes and could be connected to existing City of Biloxi infrastructure on the northern terminus of Poplar Trail. Estimated costs for providing collection services and connecting to the adjacent municipal system are approximately \$730,606.17. A more descriptive breakdown of the costs is provided in Estimate 3.9.

I. Victory Lane – Project No. 106.S1

This proposed project will provide municipal sewage collection to 19 future customers utilizing a new gravity sewer collection system that would transport the waste to the adjacent HCUA 18" gravity interceptor. The project area is located on the east side of Lorraine Road south of Pine Haven Mobile Home Park. The proposed sewer collection system, consisting of approximately 3,500 lf of 8" gravity sewer and 9 manholes, could be connected to existing infrastructure. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$976,959.92. A more descriptive breakdown of the costs is provided in Estimate 3.10.

J. Tiffany Lane – Project No. 102.S1

This proposed project will provide municipal sewage collection to 18 future customers utilizing a new gravity sewer collection system that would transport the waste to the existing 20" HCUA gravity sewer interceptor on Lorraine Road. This project area would terminate with the connection to an existing manhole on Lorraine Road for transport to the WWTP. The project area is located on the east side of Lorraine Road south of the intersection of Lorraine Road and John Lee Road. The proposed sewer collection system would consist of approximately 1,870 lf of 8" gravity sewer and 8 manholes, and could be connected to existing HCUA infrastructure. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$651,841.27. A more descriptive breakdown of the costs is provided in Estimate 3.11.

**GRAVITY SEWER COLLECTION WITH PUMP STATION**

A. John Lee Road South – Project No. 170.S1

This proposed project will provide the basic sewage infrastructure to unserved parts of the study area west of Wash Fayard Road. The gravity sewer collection system

proposed for this area will provide service to approximately 25 future customers. This project will include 4,625 lf of 8" gravity sewer, 13 manholes, one 400 gpm pump station, and 1,800 lf of 8" force main. Future projects proposed for the area beyond the limits of this southern portion of John Lee Road will transport their sewage into this gravity collection system. The is project area is located from the intersection of Woolmarket Road and John Lee Road south along John Lee Road to the intersection of John Lee Road and Wash Fayard Road. Initially, the pumps for this pump station can be sized according to the flows anticipated with the projects selected for construction; however, as additional projects are constructed, modifications to the pumps/impellers may have to be implemented to accommodate the additional flows. The force main associated with this project can transport the waste stream south and connect to an existing manhole within the HCUA gravity sewer interceptor at the intersection of John Lee Road and Wash Fayard Road. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$1,940,691.75. A more descriptive breakdown of the costs is provided in Estimate 3.12.

a. Riverland Drive – Project No. 177.S1

This proposed project will provide municipal sewage collection to 50 future customers in the area south of John Lee Road, utilizing a new gravity sewer collection system that would transport the waste to the adjacent John Lee Road South project area. This project will include 5,500 lf of 8" gravity sewer, 24 manholes, 5,900 lf of 4" force main and one (1), 80 gpm pump station. The force main proposed as part of this project would connect to a manhole proposed as part of the John Lee Road South project. Estimated costs for providing collection services are approximately \$2,142,865.43. A more descriptive breakdown of the costs is provided in Estimate 3.13.

b. Woolmarket Lake Road – Project No. 175.S1

This proposed project will provide municipal sewage collection to approximately 66 future customers in the area south of John Lee Road and west of Riverland Drive, utilizing a new gravity sewer collection system that would transport the waste to the adjacent John Lee Road South project area. This project will include 5,775 lf of 8" gravity sewer, 32 manholes, 4,875 lf of 4" force main and one (1), 200 gpm pump station. The force main proposed as part of this project would connect to a manhole proposed as part of the John Lee Road South project. Estimated costs for providing collection services are approximately \$2,509,235.40. A more descriptive breakdown of the costs is provided in Estimate 3.14.

c. Snug Harbor Road – Project No. 176.S1

This proposed project will provide municipal sewage collection to approximately 18 future customers in the area south of Woolmarket Lake Road, utilizing a new gravity sewer collection system that would transport the waste to the adjacent John Lee Road South project area. This project will include 1,560 lf of 8" gravity sewer, 13 manholes, 1,575 lf of 4" force main and one (1), 80 gpm pump station. The force main proposed as part of this project would connect to a manhole proposed as part of the Woolmarket Lake Road project

and would gravity flow into the pump station associated with that project, which would transport it to the John Lee Road gravity collection system. As a result, the construction of the Woolmarket Lake Road would need to be completed prior to providing service to customers within this project area. Estimated costs for providing collection services are approximately \$931,847.66. A more descriptive breakdown of the costs is provided in Estimate 3.15.

d. John Lee Road North – Project No. 174.S1

This proposed project will provide municipal sewage collection to approximately 35 future customers in the area north of the intersection of John Lee Road and old Woolmarket Road, utilizing a new gravity sewer collection system that would transport the waste to the adjacent John Lee Road South gravity collection system. This project will include 5,000 lf of 8” gravity sewer, and 10 manholes. The force main proposed as part of this project would connect to a manhole proposed as part of the John Lee Road South project. Estimated costs for providing collection services are approximately \$1,501,821.87. A more descriptive breakdown of the costs is provided in Estimate 3.16.

e. Old Woolmarket Road – Project No. 171.S1

This proposed project will provide municipal sewage collection to approximately 21 future customers in the area north of the intersection of John Lee Road and Old Woolmarket Road, utilizing a new gravity sewer collection system that would transport the waste to the adjacent John Lee Road South gravity collection system. This project will include 5,500 lf of 8” gravity sewer, and 16 manholes. This gravity system would connect to a manhole proposed as part of the John Lee Road South project. Construction of this project is contingent upon the completion of the John Lee Road South Project. Estimated costs for providing collection services are approximately \$1,540,497.04. A more descriptive breakdown of the costs is provided in Estimate 3.17.

i. Timber Ridge Lane – Project No. 173.S1

This proposed project will provide municipal sewage collection to approximately 11 future customers in the area north of Old Woolmarket Road, utilizing a new gravity sewer collection system that would transport the waste into the Old Woolmarket Road collection system, which then would travel to the adjacent John Lee Road South sewage system. This project is located on the west side of the northern boundary of Old Woolmarket Road near the northern limits of the study area. This project will include 1,350 lf of 8” gravity sewer, and 4 manholes, 2,200 lf of 4” force main and one (1), 80 gpm pump station. The force main transporting the waste would connect to a manhole proposed as part of the Old Woolmarket Road project, which then flows to the John Lee Road South project. The construction of this project would be feasible only upon completion of the John Lee Road South and Old Woolmarket Road projects. Estimated costs for providing collection services are approximately \$843,425.44. A more descriptive breakdown of the costs is provided in Estimate 3.18.

ii. Dundewood Road – Project No. 172.S1

This proposed project will provide municipal sewage collection to approximately 29 future customers in the area north of Old Woolmarket Road, utilizing a new gravity sewer collection system that would transport the waste into the Old Woolmarket Road collection system, which then would travel to the adjacent John Lee Road South sewage system. The project area is located on the east side of Old Woolmarket Road South of the intersection of Timber Ridge Lane and Old Woolmarket Road. This project will include 2,860 lf of 8” gravity sewer, and 5 manholes. The gravity system transporting the waste stream would connect to a manhole proposed as part of the Old Woolmarket Road project, which then flows to the John Lee Road South project. The construction of this project would be feasible only upon completion of the John Lee Road South and Old Woolmarket Road projects. Estimated costs for providing collection services are approximately \$870,579.63. A more descriptive breakdown of the costs is provided in Estimate 3.19.

B. Woodland Hills – Project No. 162.S1

This proposed project will provide municipal sewage collection to approximately 28 future customers in the area of the northern reaches of Wash Fayard Road utilizing a new gravity sewer collection system that would transport the waste into the existing HCUA Wash Fayard Road interceptor system, which then would travel south via gravity/force main to HCUA WWTP. This project is located on the west side of the northern terminus of Wash Fayard Road near the northern limits of the study area. This project will include 3,700 lf of 8” gravity sewer, and 18 manholes, 800 lf of 4” force main and one (1), 80 gpm pump station. The force main transporting the waste would connect to a manhole proposed as part of the Old Woolmarket Road project, which then flows to the John Lee Road South project. The construction of this project would be feasible only upon completion of the John Lee Road South and Old Woolmarket Road projects. Estimated costs for providing collection services are approximately \$1,433,888.38. A more descriptive breakdown of the costs is provided in Estimate 3.20.

C. South Mill Creek – Project No. 107.S1

This proposed project will provide municipal sewage collection to approximately 18 future customers utilizing a new gravity sewer collection system that would transport the waste to the adjacent HCUA 18” gravity interceptor. The project area is located on the west side of Lorraine Road north of Pine Haven Mobile Home Park. The proposed sewer collection system consists of approximately 2,600 lf of 8” gravity sewer, 15 manholes, 3,200 lf of 4” force main and one (1), 80 gpm pump station. The force main discharge could easily be connected to the existing HCUA infrastructure on Lorraine Road. Estimated costs for providing collection services are approximately \$1,290,942.05. A more descriptive breakdown of the costs is provided in Estimate 3.21.

D. Oaklawn Road South – Project No. 104.S1

This proposed project would provide municipal sewage collection to approximately 32 future customers utilizing a new gravity sewer collection system that would transport the waste to the gravity sewer collection system proposed as the Boyette/Oaklawn North project and then to the existing 20" HCUA gravity sewer interceptor on Lorraine Road for ultimate transport to the WWTP. The project area is located on Oaklawn Road south of the intersection of Oaklawn Road and Boyette Road. The proposed sewer collection system would consist of approximately 3,870 lf of 8" gravity sewer, 11 manholes, 4,050 lf of 4" force main and two (2) 80 gpm pump stations. This project consists of two parts: the collection and transport system on North Oaklawn Road and the collection and transport system on the southern portion of Oaklawn Road. The work proposed for the North Oaklawn Road segment will collect sewage and transport the sewage to a pump station located at the intersection of Oaklawn Road and North Oaklawn Road. The receiving pump station on Oaklawn Road will transport the sewage to gravity collection system manhole at the southern terminus of the proposed Boyette/Oaklawn North project through which, and could easily be connected to the existing HCUA infrastructure. Estimated costs for providing collection services are approximately \$1,823,838.39. A more descriptive breakdown of the costs is provided in Estimate 3.22.

E. Airport Road – Project No. 151.S1

This proposed project will provide municipal sewage collection to approximately 87 future customers utilizing a new gravity sewer collection system that would transport the waste to the City of Biloxi gravity sewer collection system that flows to the adjacent HCUA pump station (PS 21) on Woolmarket Road. The project area is located on the south side of Woolmarket Road directly south of Michael Street and east of Marvin Street. The proposed sewer collection system consists of approximately 12,256 lf of 8" gravity sewer, 40 manholes, 3,100 lf of 4" force main and one (1), 100 gpm pump station. Estimated costs for providing collection services and connecting to the existing gravity sewer are approximately \$3,617,913.61. A more descriptive breakdown of the costs is provided in Estimate 3.23.

F. Jim Byrd North – Project No. 147.S1

This proposed project will provide municipal sewage collection to approximately 15 future customers utilizing a new gravity sewer collection system that would transport the waste to another proposed project (i.e., Jim Byrd South), which flows into the existing City of Biloxi gravity sewer system and on to an existing pump station that flows to the adjacent HCUA pump station (PS 21) on Woolmarket Road. The project area is located north of the proposed Jim Byrd South project on Jim Byrd Road. The proposed sewer collection system consists of approximately 3,100 lf of 8" gravity sewer, 10 manholes, 1,350 lf of 4" force main and one (1), 80 gpm pump station. Because this project is located north of the Jim Byrd South project, the construction of this project requires the completion of the proposed Jim Byrd South project to allow for the sewage to be transported to the existing gravity sewer system. Estimated costs for providing collection services and connecting to the existing gravity sewer are

approximately \$1,234,462.34. A more descriptive breakdown of the costs is provided in Estimate 3.24.

G. Old Highway 67 North – Project No.148.S1

This proposed project will provide municipal sewage collection to approximately 55 future customers utilizing a new gravity sewer collection system and pump station that would transport the waste to the existing City of Biloxi gravity sewer system and eventually to the WWTP. This expansion of the sewer collection system in this area will also provide for future sewer collection and transport for (2) two proposed subdivisions with an estimated 180 new single-family homes. The project area is located on Old Highway 67, north of the intersection of Allegheny Drive and Old Highway 67. The proposed sewer collection system consists of approximately 7,625 lf of 8" gravity sewer, 20 manholes, 450 lf of 4" force main and one (1), 80 gpm pump station. Estimated costs for providing collection services and connecting to the existing gravity sewer are approximately \$2,295,432.36. A more descriptive breakdown of the costs is provided in Estimate 3.25.

H. Old Highway 67 South – Project No. 201.S1

This proposed project will provide municipal sewage collection to approximately 39 future customers utilizing a new gravity sewer collection system that would transport the waste to the existing HCUA pump station at the intersection of Old Highway 67 and Hudson-Krohn Road. The project area is located on Old Highway 67, east of the intersection of Old Highway 67 and Hudson-Krohn Road with its eastern boundary at Paradise Lane. The proposed sewer collection system consists of approximately 3,900 lf of 8" gravity sewer, 11 manholes, 5,340 lf of 4" force main and one (1), 80 gpm pump station. Estimated costs for providing collection services and connecting to the existing pump station are approximately \$1,709,790.17. A more descriptive breakdown of the costs is provided in Estimate 3.26.

I. Paradise Lane – Project No. 202.S1

This proposed project will provide municipal sewage collection to approximately 55 future customers utilizing a new gravity sewer collection system that would transport the waste to the pump station proposed as part of the proposed Old Highway 67 project, which will then transport the waste to the existing HCUA pump station at the intersection of Old Highway 67 and Hudson-Krohn Road. The project area is located on the north side of Old Highway 67, at the intersection of Old Highway 67 and Paradise Lane. The proposed sewer collection system consists of approximately 8,540 lf of 8" gravity sewer, and 26 manholes. Estimated costs for providing collection services and connecting to the existing gravity sewer are approximately \$2,235,907.77. A more descriptive breakdown of the costs is provided in Estimate 3.27.

## **LOW PRESSURE SEWER SYSTEM**

A. Woodlands Drive – Project No. 161.S1

This proposed project will provide municipal sewer collection to 34 future customers utilizing a low-pressure sewer system with individual grinder pump stations that would pump via a common small diameter force main into the adjacent gravity sewer system on Wash Fayard Road. The gravity sewer system on Wash Fayard Road is 15" diameter

and is owned and operated by the HCUA. The project area is located on the west side of Wash Fayard Road north of the intersection of Virginia Lee Road and Wash Fayard Road. The proposed system consists of 34 service connections, 2,400 lf of 2.5" pressure sewer piping, 1,000 lf of 2" pressure sewer piping and approximately 300 lf of 1.5" pressure sewer piping. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$320,762.28. These estimated costs do not include the costs of the individual grinder pump unit, the control panel, connecting to the existing home sewer or abandonment of the existing septic tank which would be the responsibility of the homeowner. A more descriptive breakdown of the costs is provided in Estimate 3.28.

**B. Selena Drive – Project No. 105.S1**

This proposed project will provide municipal sewer collection to 23 future customers utilizing a low-pressure sewer system with individual grinder pump stations that would pump via a common small diameter force main into the adjacent gravity sewer system on Lorraine Road. The existing gravity sewer system on Lorraine Road is 18" diameter and is owned and operated by the HCUA. The project area is located on the west side of Lorraine Road at the intersection of Selena Drive and Lorraine Road. The proposed system consists of 23 service connections, approximately 1,150 lf of 2" pressure sewer piping and 1,500 lf of 1.5" pressure sewer piping. Estimated costs for providing collection services and connecting to the adjacent interceptor are approximately \$273,519.72. These estimated costs do not include the costs of the individual grinder pump unit, the control panel, connecting to the existing home sewer or abandonment of the existing septic tank which would be the responsibility of the homeowner. A more descriptive breakdown of the costs is provided in Estimate 3.29.

**3.4.3 COST ESTIMATES**

1. Apart from the middle school and the mobile home/RV parks, we have prepared estimates of probable costs associated with each of the proposed capital improvement projects listed for providing service to new areas. Without having any knowledge of the current systems utilized by the middle school and mobile home/RV parks, we assumed that these high-density developments could be best served by providing the present Owner/user with a gravity sewer connection to the existing infrastructure which is located adjacent to or very near their establishment. Probable cost estimates could be developed for these establishments if additional information was made available regarding the design of the existing system.
2. Cost estimates for providing sewer collection to areas proposed for expansion are provided in Estimates 3.6 through 3.29.

The total estimated cost for constructing all upgrades recommended herein and for providing sewer collection to areas presently utilizing private on-site systems is \$37,283,415.82.





































<b>ESTIMATE NO. 3.19</b>				
<b>PROJECT #</b> 172.S1	<b>PROPOSED WOOLMARKET CONSTRUCTION PROJECT DATA</b>		<b>DATE</b>	
<b>INFRASTRUCTURE TO BE IMPROVED:</b> SS / SD / W / T			10/30/2017	
<b>PROJECT LOCATION</b> DUNDEEWOOD ROAD	<b>PROJECT DESCRIPTION</b> Provide for a sewer collection system in the area of Dundewood Road.		<b>ESTIMATED PROJECT COST</b> <b>\$870,580</b>	
<b>OPINION OF PROBABLE COST</b>				
<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>ITEM TOTAL</b>
MOBILIZATION	1	LS	\$ 75,000.00	\$ 75,000.00
SELECT SANDY BACKFILL (FM)	9,295.0	CY	\$ 12.00	\$ 111,540.00
PIPE FOUNDATION MATERIAL (PM)	268.8	CY	\$ 70.00	\$ 18,818.80
8", SDR 26 PVC, GRAVITY SEWER PIPE	2,860.0	LF	\$ 40.00	\$ 114,400.00
4" C900, PVC FORCE MAIN	0	LF	\$ 10.58	\$ -
6" PVC SINGLE SEWER SERVICE ASSEMBLY	29	EA.	\$ 750.00	\$ 21,750.00
4' DIA. MANHOLE	5	EA.	\$ 6,250.00	\$ 31,250.00
PUMP STATION (80 GPM)	0	EA.	\$ 175,000.00	\$ -
MAINTENANCE OF TRAFFIC	1	LS	\$ 10,000.00	\$ 10,000.00
STORMWATER MANAGEMENT	1	LS	\$ 5,000.00	\$ 5,000.00
RESTORATION	2,860.0	LF	\$ 65.00	\$ 185,900.00
			SUBTOTAL BID	\$ 573,658.80
			CONTINGENCIES	\$ 143,400.00
			TOTAL BID	\$ 717,058.80
			CONST. ENG.	\$ 153,520.83
			ESTIMATED TOTAL CONSTRUCTION COST	\$ 870,579.63
<b>DESCRIPTION OF EXISTING CONDITIONS AND PROPOSED CONSTRUCTION</b>				
<p>The existing conditions do not provide for any municipal sewage collection. This work will include providing a gravity sewer collection system, with a small duplex pump station and force main for this currently unsewered area. The limits of the collection basin area for this work are provided on Figure 172.S1 of the Master Plan Report.</p>				













<b>ESTIMATE NO. 3.26</b>				
<b>PROJECT #</b> 201.S1	<b>PROPOSED WOOLMARKET CONSTRUCTION PROJECT DATA</b>		<b>DATE</b>	
<b>INFRASTRUCTURE TO BE IMPROVED:</b> SS / SD / W / T			10/30/2017	
<b>PROJECT LOCATION</b> OLD HIGHWAY 67 SOUTH	<b>PROJECT DESCRIPTION</b> Provide for a sewer collection system in the southern area of Old Highway 67.		<b>ESTIMATED PROJECT COST</b> <b>\$1,709,790</b>	
<b>OPINION OF PROBABLE COST</b>				
<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>ITEM TOTAL</b>
MOBILIZATION	1	LS	\$ 50,000.00	\$ 50,000.00
SELECT SANDY BACKFILL (FM)	14,811.0	CY	\$ 12.00	\$ 177,732.00
PIPE FOUNDATION MATERIAL (PM)	868.6	CY	\$ 70.00	\$ 60,799.20
8", SDR 26 PVC, GRAVITY SEWER PIPE	3,900.0	LF	\$ 40.00	\$ 156,000.00
4" C900, PVC FORCE MAIN	5,340.0	LF	\$ 23.75	\$ 126,825.00
6" PVC SINGLE SEWER SERVICE ASSEMBLY	39	EA.	\$ 750.00	\$ 29,250.00
4" DIA. MANHOLE	11	EA.	\$ 6,250.00	\$ 68,750.00
PUMP STATION (130 GPM)	1	EA.	\$ 205,000.00	\$ 205,000.00
MAINTENANCE OF TRAFFIC	1	LS	\$ 15,000.00	\$ 15,000.00
STORMWATER MANAGEMENT RESTORATION	1	LS	\$ 6,250.00	\$ 6,250.00
	3,900.0	LF	\$ 65.00	\$ 253,500.00
			<b>SUBTOTAL BID</b>	<b>\$ 1,149,106.20</b>
			<b>CONTINGENCIES</b>	<b>\$ 287,300.00</b>
			<b>TOTAL BID</b>	<b>\$ 1,436,406.20</b>
			<b>CONST. ENG.</b>	<b>\$ 273,383.97</b>
			<b>ESTIMATED TOTAL CONSTRUCTION COST</b>	<b>\$ 1,709,790.17</b>
<b>DESCRIPTION OF EXISTING CONDITIONS AND PROPOSED CONSTRUCTION</b>				
<p>The existing conditions do not provide for any municipal sewage collection. This work will include providing a gravity sewer collection system, with a duplex pump station and force main for this currently unsewered area. The limits of the collection basin area for this work are provided on Figure 201.S1 of the Master Plan Report.</p>				







## **SECTION 4 – WATER SYSTEM**

In this section, the existing water infrastructure in the Woolmarket area was reviewed and evaluated in order to define deficiencies in the system and recommend improvements to meet current and future water needs. Opinion of probable costs were developed to identify immediate and future improvements in the system and incorporated into a phased capital improvement program.

### **4.1 EXISTING WATER SYSTEM**

The existing water system in the study area defined in the previous sections are owned, operated and managed by either the City of Biloxi, HCUA, a Certificated Franchised Area, or by private individual water wells. The Mississippi Department of Health monitors those systems that provide potable water service to a minimum of 25 persons or to 15 separate connections in the area for water quality and available system capacity. Water service providers have rights to provide water service to an area that is not certified and is outside of the city's corporate limits, but must receive a Certificate of Public Convenience and Necessity from the Mississippi Public Service Commission.

#### **4.1.1 OWNERSHIP**

##### **CITY OF BILOXI SYSTEMS**

The City of Biloxi, as well as other municipalities, are authorized by State law to provide water inside of their corporate limits without receiving a certificate from the Public Service Commission. The city may also provide water service up to one mile from their corporate limits without obtaining certification if the area is not already served by another utility, and may serve an area up to five miles from their limits with certification by the Public Service Commission. Prior to annexation, the residents of Woolmarket relied on private on-site wells for water treatment and service. After annexation, the city has constructed a water tank, water wells and distribution systems. The city has also acquired individual water distribution systems associated with the development of new residential subdivisions and commercial areas. An overview of the city's water system is shown on Figure 4.2 and 4.3 in Appendix B.

##### **HCUA SYSTEMS**

The water infrastructure owned and maintained by the HCUA was constructed post-Katrina to supplement the city's water system. Custody transfer units were installed to meter water sold to the city by the HCUA. Currently, the city utilizes the water from the HCUA custody transfer station at Cedar Lake Road south of Old 67, but could do so from the other stations when needed. The HCUA owns and operates one (1) water tank, three (3) water wells, four (4) custody transfer stations (CTS), and water distribution systems within the study area and are shown on Figure 4.3.

## **CERTIFICATED FRANCHISE AREAS**

There are several small Certificated Franchise Areas for Water Service within the study area that are shown on Figure 4.1 and listed below:

- French Utilities, Inc.;
- Superior Utilities, Inc.;
- Southeast Mississippi Utility, Inc.; and,
- City of D'Iberville

The French Utilities franchise in Eagle Point and the Superior Utilities, Inc. area within the study limits were bought out by the City of Biloxi. The Southeast Mississippi Utility, Inc. area serves customers in the southeastern region of the study area. The City of D'Iberville also has a franchise area within the City limits.

## **AREAS SERVED BY PRIVATE WELLS**

The remaining areas of Woolmarket are served by private domestic individual wells. These include shallow, private water wells that were installed either because there was a lack of water providers in rural areas or because there was superior quality groundwater available at a lower cost to the individual user. Based on the population and household data in Section 2 of this report and the City's consumption reports, there are approximately 2,340 households and approximately 1,200 active connections in the study area. Thus, it can be assumed that approximately 1,140 households, or 49 percent of the total households in the study area, utilize private wells as their primary water source.

## **4.1.2 INVENTORY OF EXISTING SYSTEMS**

### **COMPILATION OF DATA**

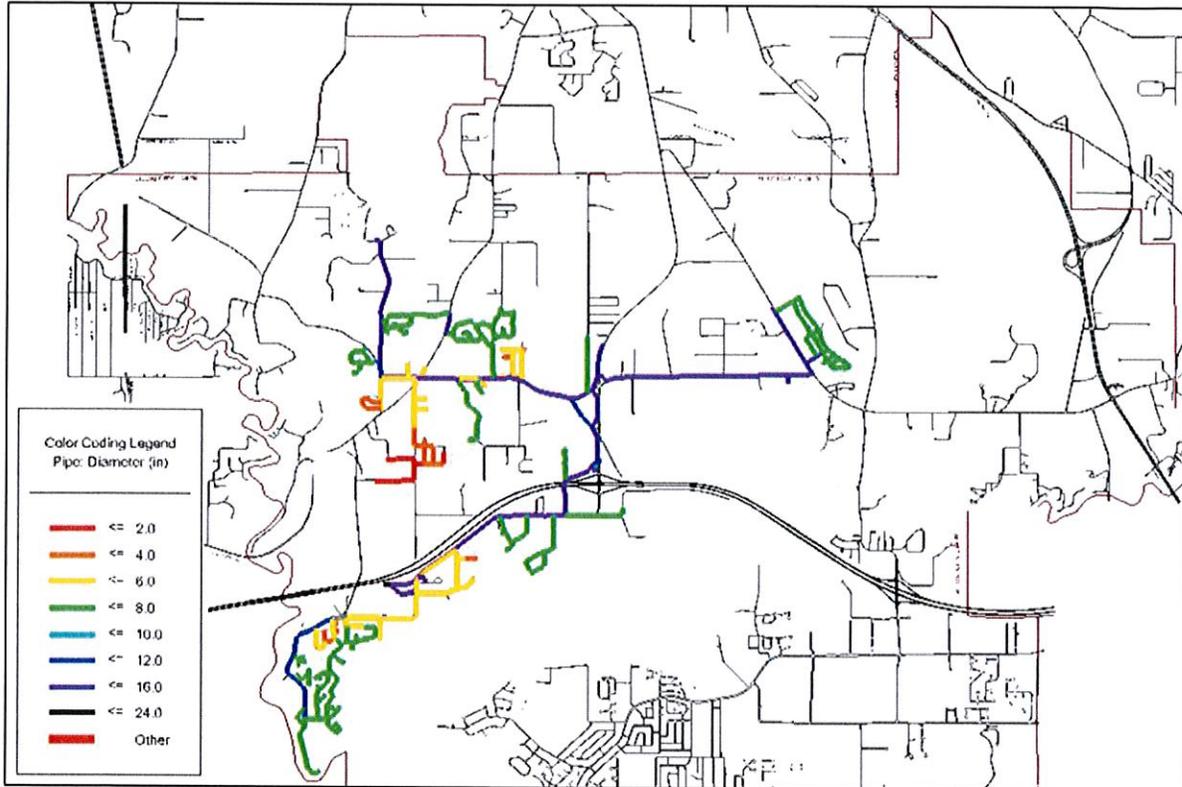
Maps, plans, and information regarding the existing water utility infrastructure system for the Woolmarket community within the City of Biloxi were obtained and compiled. This information consisted of material obtained from the following sources:

- GIS data, layout maps, construction plans, and subdivision plans from the City of Biloxi Engineering and Water and Sewer Departments;
- GIS data, construction plans, and subdivision plans from the HCUA;
- Construction plans and subdivision plans from 3rd-party consulting engineers;
- Available layout maps and construction plans obtained from private utility companies; and
- Certificated franchise maps from the Public Service Commission.

### **WATER SYSTEM HYDRAULIC MODEL**

Neel-Schaffer has developed a water system hydraulic model for defining deficiencies and recommending improvements to meet the current and future water demands of the city. The model was developed using WaterCAD, one of Bentley's Haestad software products, and is capable of being updated as development occurs and system upgrades are constructed. Existing maps, construction drawings, and the City's GIS and SCADA data were used to create the pipe network and input the tank characteristics and well/tank control points. Pump test reports for the four wells

in the study area were used to develop pump curves, which were used to define the wells in the model. The Woolmarket portion of the model was evaluated to determine the adequacy of the existing system under current conditions as well as with proposed developments and future population growth and to recommend needed distribution, supply, and/or storage improvements. A screengrab of the Woolmarket model is shown below and shall be referred to as the “existing system” throughout this section.



Though the model has been developed and is currently able to produce raw data and results from various user defined scenarios (peak hour, max day with or without fire flow, extended period average day, etc.), a detailed calibration must be performed to ensure the accuracy of the model. Model calibration is completed by obtaining fire hydrant flow data throughout the system and comparing the pressures and flows to those at the junctions corresponding with the locations of the hydrants. Minor adjustments are then made within the model. Model calibration ensures that the model is performing and yielding similar data to that of the physical water system. At the time of this report, the water system hydraulic model for the Woolmarket area has not been calibrated due to fire flow data not being available at the time of this report. Once the model has been properly calibrated, the raw data, results, and recommendations discussed throughout this section can be revised.

## PHYSICAL ASSETS

### *Water Distribution Systems*

The existing water system serving the study area within Woolmarket is shown on Figures 4.2 and 4.3. The referenced figures include the location and size of the existing water system. There is approximately 30 miles of water main ranging in size from 2" to 16" in diameter. Table 4.1 below outlines the approximate length of each pipe size found in the Woolmarket water distribution system.

**Table 4.1:**  
**Distribution System Pipe Summary**

PIPE DIAMETER	APPROXIMATE LENGTH (MILES)
2"	0.81
4"	1.85
6"	5.47
8"	10.07
10"	0.03
12"	2.37
16"	8.57

A majority of the water infrastructure in the study area south of I-10 was replaced under the City of Biloxi Infrastructure Repair Program due to damage during Hurricane Katrina.

The portion of Superior Utilities Water System within the study area limits, as shown on Figure 4.1, was acquired by the city. The system consists of a single 400 GPM water well and a 12,000-gallon hydro-pneumatic water tank. Since the system consists of a single well without auxiliary power and lacks elevated storage, the system is vulnerable to power outages, pump failures and other problems that may shut down all water supply. The system consists of approximately 2.8 miles of 6-inch water main, 1.8 miles of 4-inch water main and 0.8 miles of 2-inch water main. The Superior Utilities Water System accounts for approximately 18.5% of the total length of water distribution pipes found in the study area.

### *Water Wells*

There are four (4) city-owned and maintained water wells that supply water within the study area. These locations are shown on Figure 4.2 and are listed below along with their capacity:

- Oaklawn Well (525 GPM), located at 9339 Oaklawn Road, Biloxi, MS
- North River Vue Well (150 GPM), located at 11186 N. River Vue Circle, Biloxi, MS
- 67 & Oaklawn Well (1500 GPM), located at 11237 N. Oaklawn Road, Biloxi, MS
- Superior Well (400 GPM), located at 9003 Woolmarket Road, Biloxi, MS

The Oaklawn and North River View Wells are on SCADA and are controlled by the Woolmarket Fire Station Tank. The 67 & Oaklawn and Superior Wells are not on SCADA but are set on timers to run a few hours per day as needed, and will eventually be tied into the SCADA system if funding

becomes available to the city. In 2015, the four wells pumped approximately 75,000,000 gallons of water and provided water to approximately 1,200 households in the Woolmarket system.

### ***Water Tanks***

There are four (4) city-owned and maintained water storage tanks that within the study area. All the tanks are ground storage tanks with the exception of the Woolmarket Fire Station Tank which is an elevated storage tank. These locations are shown on Figure 4.2 and 4.3 and are listed below along with their capacity:

- Oaklawn Tank (21,000 gallons) – 9339 Oaklawn Road, Biloxi, MS
- North River View Tank (13,000 gallons) – 11186 N. River Vue Circle, Biloxi, MS
- Woolmarket Fire Station Tank (1,000,000 gallons) – 9378 Oaklawn Road, Biloxi
- Superior Tank (12,000 gallons) – 9003 Woolmarket Road, Biloxi, MS

### ***Regional Water Systems***

There are four (4) custody transfer stations, one (1) water tank, and three (3) water wells owned and operated by the HCUA in the study area. The names and locations of each custody transfer station, tank, and well are shown on Figure 4.3.

The custody transfer stations were installed to provide metering of water between HCUA and the City for billing purposes. These connection points between the HCUA and City of Biloxi water systems allow for additional water to be supplied to the City as needed. The names and locations of each CTS:

- Cedar Lake CTS – Old Highway 67 and Hudson Krohn/Cedar Lake Road
- Woolmarket CTS – Old Highway 67 and Woolmarket Road
- Brandon James CTS – Highway 67 and Brandon James Drive
- Wells Ferry CTS – Brandon James Drive and Wells Ferry Cove

HCUA owns and operates the Woolmarket Tank, which falls within the study area. This elevated storage tank is located at 6403 Woolmarket Road, Biloxi MS and has a capacity of 1,000,000 gallons.

The HCUA water wells in the study area are listed below:

- Horace Rushing Well (1,000 GPM) – 14327 Old Highway 67, Biloxi, MS
- Woolmarket Well (1,000 GPM) – 6403 Woolmarket Road, Biloxi MS
- Joe Husley Well (1,000 GPM) – 11720 Old Highway 67, Biloxi, MS

The HCUA has approximately 26,000 linear feet of water main ranging in size from 6-inch to 16-inch diameter pipe. Potential tie-in points to be utilized for potential expansion projects to serve new customers have been identified and will be discussed in the Section 4.3.

### **DESIGN CAPACITY**

To determine the design capacity of the existing water system and evaluate the future water system, the Type #1 criteria, found in Appendix J (Standard Procedure for Determining Customer Design

Capacity of a Public Water System) of the *Recommended Minimum Design Criteria for Mississippi Public Water Systems* was used. The Type #1 criteria/equation is shown below.

$$\text{Design capacity (\# connections)} = \frac{\text{well capacity (gpm)} + \text{elevated storage (gallons)}}{200}$$

**NOTE:** Design capacity is limited to twice (2x) well capacity(gpm) unless excess elevated storage is usable (See Note 5 below). Water systems with wells pumping into pressure tanks will have a design capacity equal to the total well capacity (gpm).

The well capacity of the existing water system equated to 2,575 GPM, which is the sum of the 67 & Oaklawn, Superior, Oaklawn, and North River Vue Wells. The elevated storage of the existing system is 1,000,000 gallons, which is the Woolmarket Fire Station Tank. HCUA's Woolmarket Tank was not used for this calculation. The equation yielded a design capacity of 7,575 connections, which exceeded the limit of 2x the well capacity. Therefore, the design capacity of the existing water system was determined to be 5,150 connections, which is less than the demand of the system that is comprised of 2,340 households, of which approximately 1,200 are currently connected, and minimal commercial developments.

#### **4.1.3 DEVELOPMENT OF WATER FLOWS**

##### **DESIGN CONSIDERATIONS**

The purpose of this section is to establish a baseline to determine the state of the existing water system and its ability to meet existing need. The analysis is based on performance criteria that can be found in the *Recommended Minimum Design Criteria for Mississippi Public Water Systems*, produced by the Mississippi Department of Health, Division of Water Supply, which states that all distribution systems should be designed to maintain a minimum dynamic pressure of 20 psi and a maximum static pressure of 80 psi as well as produce flow velocities not to exceed 5 feet per second (ft/s).

##### **EXISTING WATER FLOWS**

For estimation of the city's existing water flow, the water system hydraulic model was used. The computer model was based on the collection data on existing facilities, water consumption records, and demand curve values for rural water systems. The City-furnished records of water use were reviewed and used to establish historical demands in the study area and develop future demands based on proposed developments and population growth. Water customer records for 2014 were used as the basis for establishing average and maximum day demands. These demands were entered into the water model, and various scenarios were run. The results from these scenarios, which will help determine the adequacy of the existing system, are discussed below.

#### **4.2 KNOWN SYSTEM CONCERNS**

##### **4.2.1 WATER MODEL RESULTS AND OBSERVATIONS**

The existing water main capacity and fire suppression capacity were analyzed by running various scenarios in the water model to determine if pressure and flows were acceptable. The three scenarios used in the model are: Peak Hour, Max Day with Fire Flow at 750 GPM, and Average

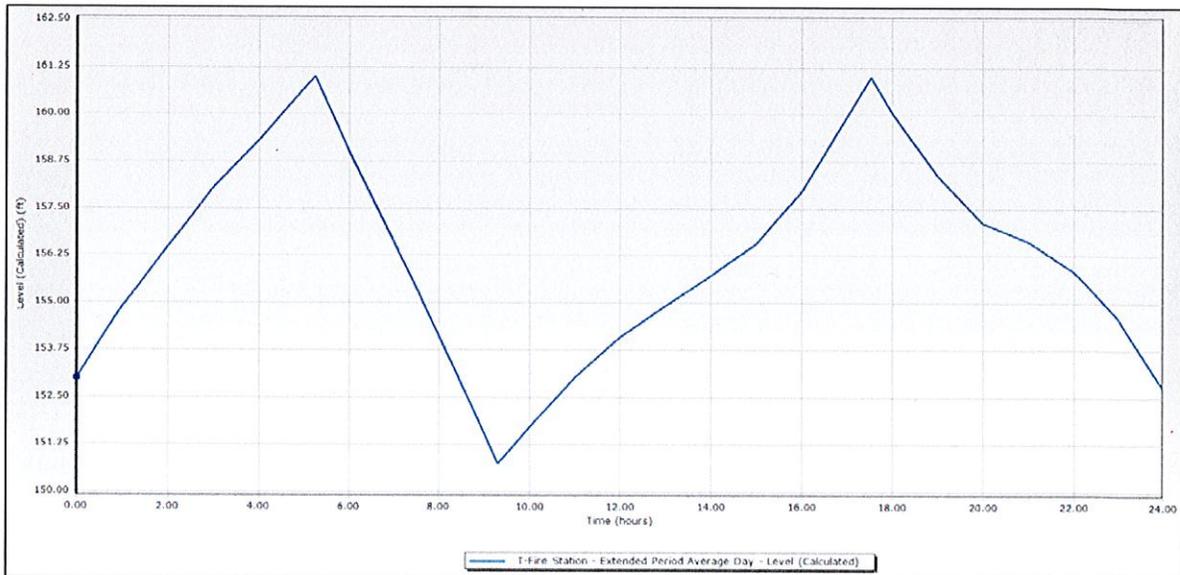
Day, which is represented by an extended period simulation (EPS). The results and observations from each scenario are discussed below.

### PEAK HOUR

The Peak Hour Scenario was computed and performed using the peak hourly demand (PHD), which represents the maximum volume of water delivered to the system in a single hour. The pressure at each junction ranged between 40 psi and 83 psi with an average pressure of 68 psi throughout the system. Of the 193 junctions in the model, twenty returned pressure higher than the recommended maximum value of 80 psi. These junctions are in Timber Creek Estates and the area along W Oaklawn Road between and along Landing Court and River Estates Circle. Of the 231 pipe segments in the model, only one returned a velocity above the maximum value of 5 ft/s. The section of 10-inch pipe connecting the 67 & Oaklawn Well to the system has a velocity of 5.63 ft/s. The model shows that the existing system has adequate storage, pressure, and flow to supply the required PHD.

### AVERAGE DAY (EPS)

This scenario was computed using a 24-hour simulation with 1-hour intervals beginning at 6:00 AM. It can analyze the system during an “average day”. Each junction in the model will have a unique demand value at corresponding hours of the simulation. The demands are calculated using the average demand for that junction and a typical diurnal pattern. Pump and tank operations are also considered with this scenario. Pressures at the junctions during the simulation ranged between 56 and 86 psi. As with the Max Day Scenario, the junctions experiencing pressures above 80 psi are in Timber Creek Estates and the area along W Oaklawn Road between and along Landing Court and River Estates Circle. The wells were set to turn off when the Fire Station Tank was full at a level of 161 feet and were set to turn back on once the level dropped to 151 feet. A graph showing the tank level at each hour during the simulation is shown below.



The wells began the simulation filling the tank at 6:00 AM, turned off at 9:43 AM, turned back on at 3:06 PM, off again at 8:29 PM, and finally back on at 3:30 AM and were on for the remainder of the simulation. The wells ran for a total time of 11 hours and 36 minutes. The model shows

that the existing system has adequate storage, pressure, and flow to supply the average daily demands and that the pumps and tank operations are sufficient.

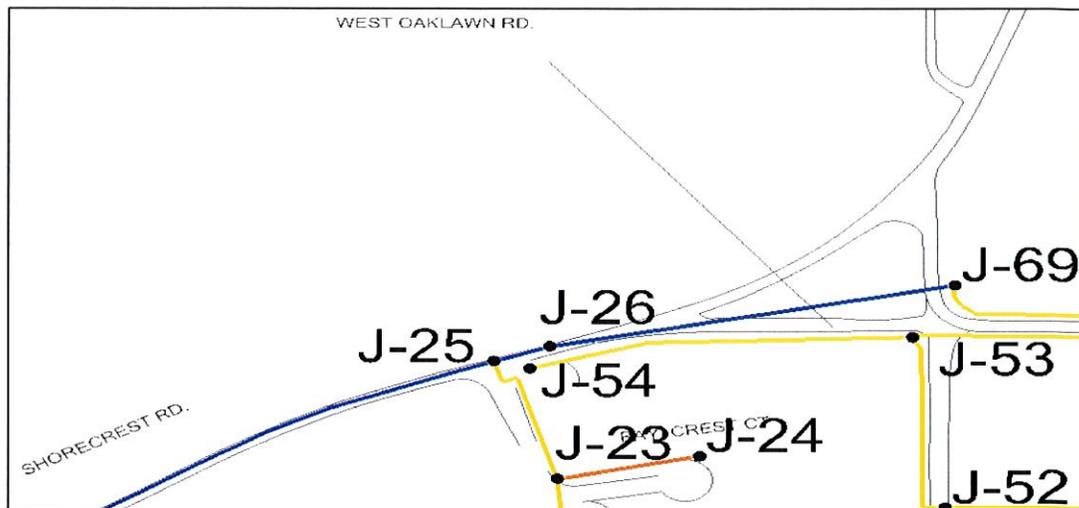
### MAX DAY + FIRE FLOW

This scenario was computed and performed using the maximum day demand (MDD), which represents the largest demand experienced by the system during a 24-hour period, in addition to a required fire flow of 750 GPM. A fire flow analysis was performed using the results produced by this scenario. Of the 193 junctions in the model, 76 of them failed to produce the required additional fire flow.

Because of the junction failures, the model was reviewed to determine which changes would best improve the number of junctions able to produce the required fire flows—two were identified. A 240 linear feet section of 12-inch main was added between Junctions 223 and 224. This pipe connects the Superior Utilities system to the existing City system at the intersection of Woolmarket Road and Martin Cove. A screenshot from the model showing the connection is below.



The other identified improvement is to install 560 linear feet of 12-inch main between Junctions 26 and 69, which connects an existing 12-inch main at the intersection of Shorecrest Road and W Oaklawn Road with a 6-inch main at W Oaklawn Road and Pin Oak Drive. A screenshot of the model showing the connection along with existing junctions and pipe segments is shown below.



These connections were added to the model, the scenario was recomputed, and another fire flow analysis was performed. With these new additions, the number of junction failures due to fire flow requirements decreased from 76 to 21. Each of the 21 remaining junctions are located on all the existing 2-inch and 4-inch water mains in the system. These junction failures were caused by flow restrictions in the 2-inch and 4-inch water mains. All 2-inch and 4-inch water mains were changed to 8-inch mains, the scenario was recomputed, and another fire flow analysis was performed. With these new additions, the number of junction failures due to fire flow requirements decreased from 21 to 0. Each of the 193 junctions in the system could produce the additional fire flows.

#### 4.2.2 RECOMMENDATIONS

Overall, the existing water system has adequate storage, pressure, flow, and tank/well operation to serve the customers within the study area. However, some areas in the system are unable to produce the required 750 GPM fire flow. Recommendations to improve the system are listed below.

- Install a 240 linear feet section of 12-inch main at the intersection of Woolmarket Road and Martin Cove. This pipe connects the Superior Utilities system to the existing City system.
- Install 560 linear feet of 12-inch main between Junctions 26 and 69, which connects an existing 12-inch main at the intersection of Shorecrest Road and W Oaklawn Road with a 6-inch main at W Oaklawn Road and Pin Oak Drive.
- Replace all existing 2-inch and 4-inch water mains (approximately 12,250 linear feet) with 8-inch water main.
- Add Superior Well and 67 & Oaklawn Well to the City's existing SCADA system.

Interviews with city personnel identified the need to have the two wells added to the City's SCADA system. There were not any additional specific water needs for the study area at the time of the report.

## 4.3 FUTURE NEEDS AND RECOMMENDATIONS

### 4.3.1 DEVELOPMENT OF WATER FLOWS

#### DESIGN CONSIDERATIONS

The purpose of this section is to analyze the state of the water system and its ability to meet the demand of the current system along with the Section 4.2 improvements, Section 4.3 future demands, and Section 4.4 recommended projects added to the model. The analysis is based on performance criteria that can be found in the *Recommended Minimum Design Criteria for Mississippi Public Water Systems*, produced by the Mississippi Department of Health, Division of Water Supply, which states that all distribution systems should be designed to maintain a minimum dynamic pressure of 20 psi and a maximum static pressure of 80 psi as well as produce flow velocities not to exceed 5 feet per second (ft/s).

#### DEFINING SCENARIOS AND FUTURE DEMANDS

The water model was used to determine the adequacy of the existing system as demands increase over time from previously discussed recommended improvements, population growth, and planned subdivisions. These scenarios, and the adjustments made within the model to represent the changes, are discussed below. It is important to note that a variety of unknown factors, such as population growth, economic changes, changes in water use habits, and government programs/regulations, affect the future demand of a water system, making it very difficult to predict.

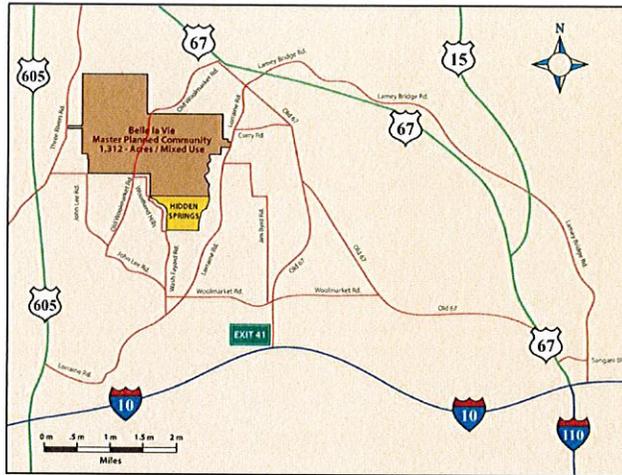
#### *Recommended Improvements*

The recommended improvements discussed in Section 4.2.2 and the identified capital improvement projects discussed in Section 4.4 were reflected in the model. The corresponding demands of each new junction were evaluated and added to the model.

#### *Future Developments – Hidden Springs and Belle la Vie*

There are several subdivisions currently being planned and constructed in the Woolmarket area, and these have been accounted for in the water model for the existing system. However, two major developments, Hidden Springs and Belle la Vie, are currently being planned both within the study area and within a 1-mile radius of the city limits, which allows the City to serve them. The water demands produced by these new developments will be quantified and added to the water model to determine the effects they will have on the overall system.

Hidden Springs is a planned development in the northwestern quadrant of the study area and is part of the Belle la Vie Master Plan. This development will add 411 new single family residential units to the City's existing water system. A 16-inch water main was recently installed along Wash Fayard Road from Woolmarket Road to Woodlands Hill to provide the development with a water supply. A map showing the proposed locations of Hidden Springs and Belle la Vie is displayed below. This development is represented in the water model with a single 16-inch water main ending with a junction that has the corresponding demand applied to it. For peak hour, an assumed demand of 1 GPM per customer was used, which equates to 411 GPM. For the average day and maximum day simulations, the demands applied to the junction (J-508) were 137 GPM and 274 GPM, respectfully.



Belle la Vie is a proposed master planned community located both inside and outside of the city limits. Once fully constructed, this development will provide 2,868 single-family residential units, 1,392 multi-family residential units, 1,000 retirement community units, and 2.5 million square feet of commercial space. This development is represented in the model with a 16-inch water main and junction node. The corresponding demand values, which were calculated using peak hour demands, flow ratios, and using the guidelines in Appendix G of the *Recommended Minimum Design Criteria for Mississippi Public Water Systems*, produced by the Mississippi Department of Health, Division of Water Supply guidelines, for the peak hour, average day, and max day scenarios are 5,800 GPM, 1,900 GPM, and 3,800 GPM, respectfully. The demands were applied to junction J-509.

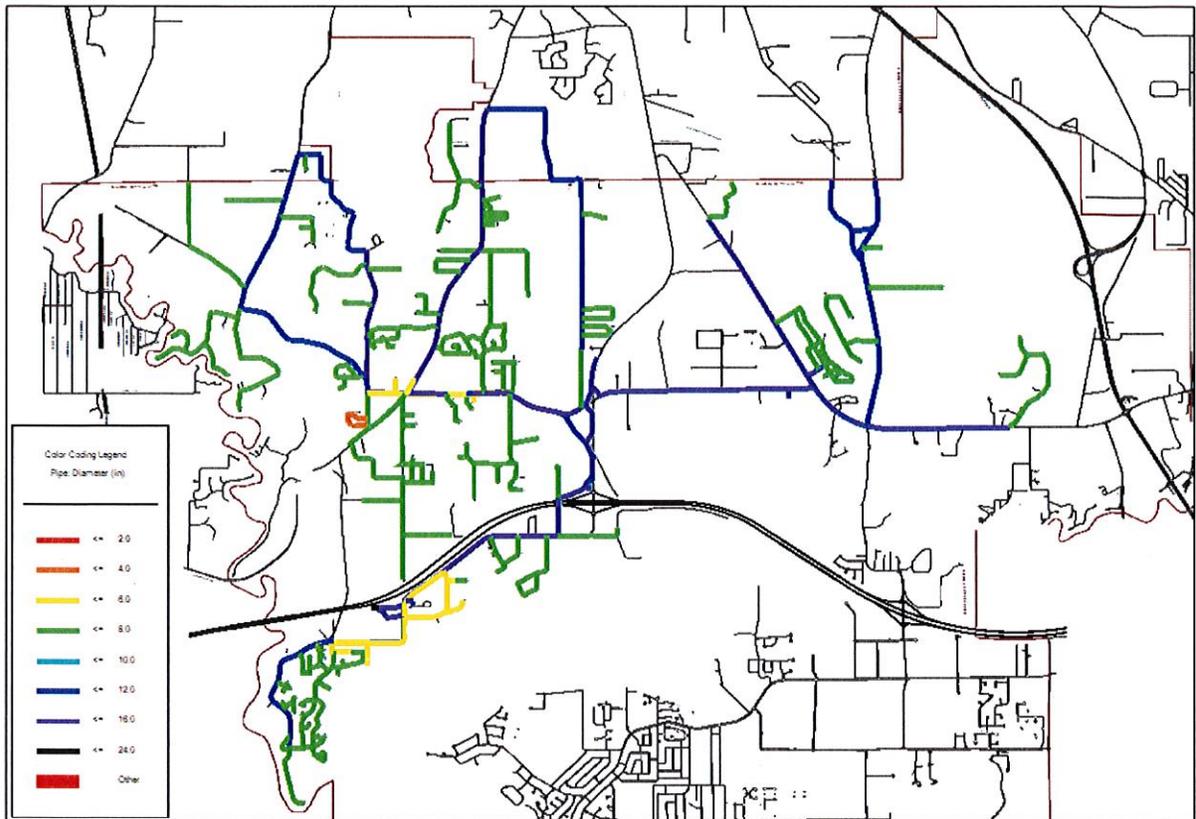
#### **Population Growth – Year 2030 and Year 2040**

Using the 2015 consumption reports and provided by the City and the assumption that the nearly 50% of the population using private wells will be tied into the system, it was determined that the study area has an annual demand of 0.41 million gallons per day (mgd). Using the calculated 2015 population of the study area, 6,172, discussed in Section 2, the demand per capita equated to 66.5 gpd. To determine the needed demand growth to apply to the model, an annual growth rate for the Woolmarket area of 1.9 percent, which was based on the Gulf Regional Planning Commission (GRPC) long-range demographic forecast for traffic analysis zones located wholly or in part within Woolmarket (*2040 Mississippi Gulf Coast Metropolitan Transportation Plan*, Gulf Regional Planning Commission, 2015), was used to generate a 2030 per capita demand of 88.4 gpd, or a 33 percent growth from the year 2015. This percent growth was applied to each junction’s demand in the model. The same process was used to determine the percent growth of demands in year 2040. The calculated 2040 per capita demand was 106.9 gpd, or a 61 percent growth from the year 2015. This percent growth was applied to each junction’s demand in the model.

### **4.3.2 WATER MODEL RESULTS AND OBSERVATIONS**

#### ***Recommended Improvements***

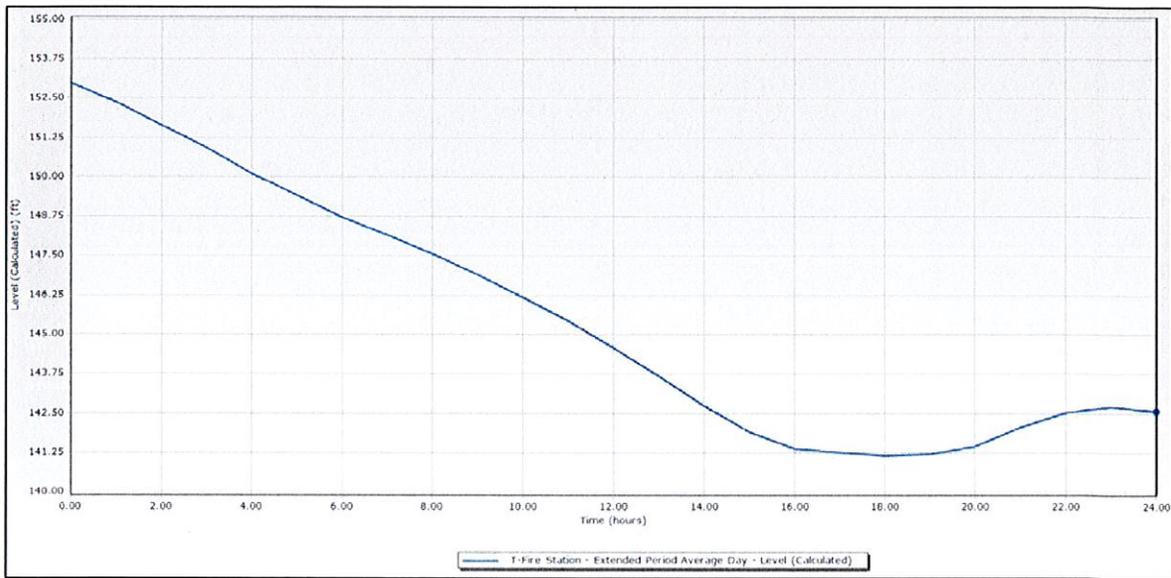
A screengrab of the water model with all recommended improvements and proposed projects is shown below and shall be referred to as the “future system” throughout this section.



The same scenarios as in Section 4.2 (Peak Hour, Max Day with Fire Flow at 750 GPM, and Average Day) were computed and their results analyzed to determine the adequacy of the system to provide the required demands.

The Peak Hour analysis revealed that the future system has adequate storage, pressure, and flow to supply the required PHD. The pressure at each junction ranged between 36 psi and 85 psi. Of the 304 junctions in the model, eleven returned pressure higher than the recommended maximum value of 80 psi but are within a satisfactory range. Of the 359 pipe segments in the model, only one returned a velocity above the maximum value of 5 ft/s. The section of 10-inch pipe connecting the 67 & Oaklawn Well to the system has a velocity of 5.71 ft/s.

The Average Day scenario was computed using a 24-hour simulation with 1-hour intervals beginning at 6:00 AM. Pressures at the junctions during the simulation ranged between 36 and 85 psi but are within a satisfactory range for distribution. The wells were set to turn off when the Fire Station Tank was full at a level of 161 feet and were set to turn back on once the level dropped to 151 feet. A graph showing the tank level at each hour during the simulation is shown below.



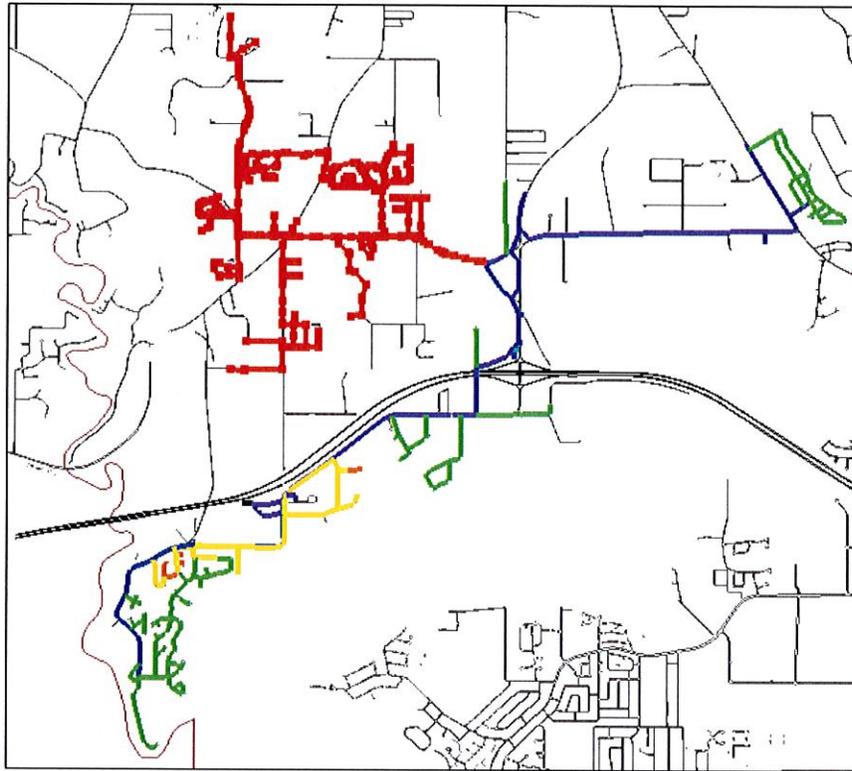
The Max Day with 750 GPM Fire Flow scenario was computed and a fire flow analysis was performed. The fire flow analysis showed each of the 304 junctions in the model were able to provide the minimum required flow and meet the system’s demand.

***Future Developments – Hidden Springs and Belle la Vie***

Each of these developments were added to the “existing system” model and the “future system” model, and scenarios were performed with both developments added as well as each development separately. The Peak Hour, Max Day with Fire Flow at 750 GPM, and Average Day scenarios were computed and their results analyzed to determine the adequacy of the system to provide the required demands.

***Existing System***

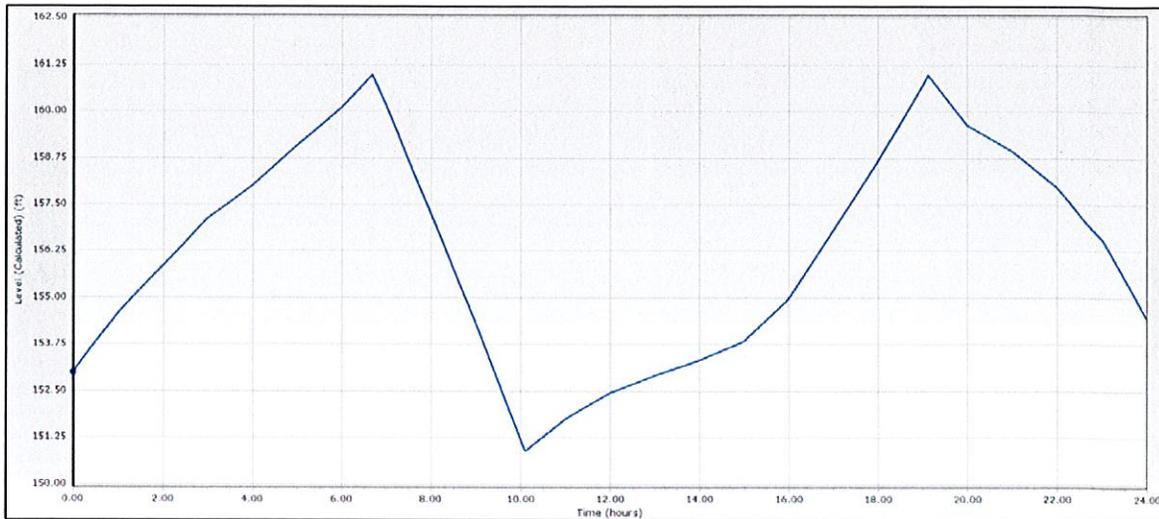
The Peak Hour analysis revealed that the existing system does not have adequate storage, pressure, or flow to supply the required PHD of the system, Hidden Springs, and Belle la Vie. The pressures at the junctions highlighted red in the image below were all negative ranging between -139 psi and -4 psi. The pipe segments in this highlighted area experienced very high flow velocities—32 of 235 segments had velocities higher than the recommended 5 ft/s.



An additional analysis was performed on the system with only the Hidden Springs junction active. The simulation yielded satisfactory results. Pressure and flow velocity were within recommended ranged.

The Average Day scenario, with both developments active, was computed using a 24-hour simulation with 1-hour intervals beginning at 6:00 AM. The results showed the junctions to have inadequate pressures, like those of the Peak Hour scenarios. The wells were set to turn off when the Fire Station Tank was full at a level of 161 feet and were set to turn back on once the level dropped to 151 feet. At the beginning of the simulation, the tank level was at 153 feet and steadily declined to 121 feet at 6:00 PM. At the same time, a calculation warning message stating "Tank T-Fire Station is empty" was recorded. The tank level remained at 121 feet until 2:00 AM where the tank began filling, peaked at 5:00 AM, and began declining for the remainder of the simulation.

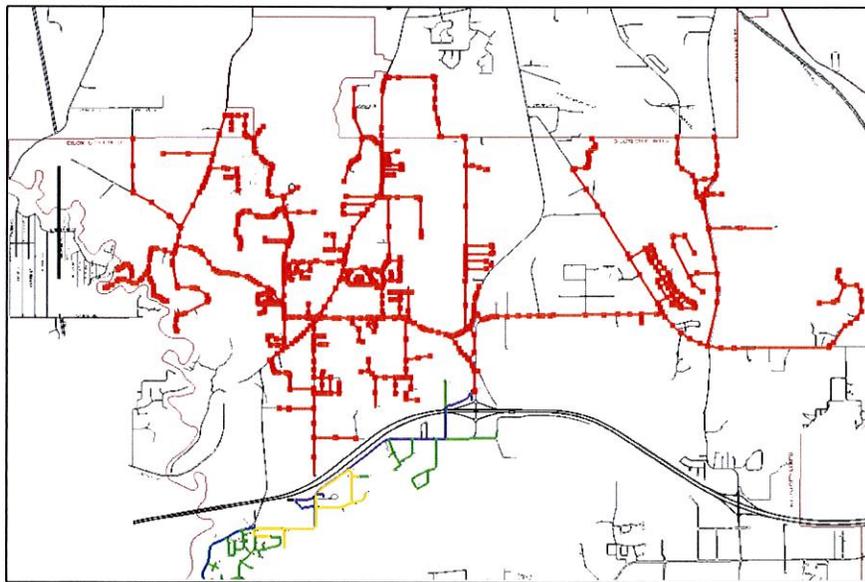
An additional analysis was performed on the system with only the Hidden Springs junction active. The pressure at each junction and flow velocity in each pipe segment were found to be satisfactory. A graph of the Fire Station Tank's water level throughout the 24-hour simulation is shown below.



The Max Day with 750 GPM Fire Flow scenario with both developments' junctions active was computed and a fire flow analysis was performed. The fire flow analysis showed each of the 195 junctions in the model failed to provide the minimum required flow and meet the system's demand. An additional analysis was performed on the system with only the Hidden Springs junction active. The fire flow analysis showed a significant decrease in failed junctions from all 195 to only 23. These 23 failed junctions were all addressed with the recommended improvements discussed in the previous section.

#### *Future System*

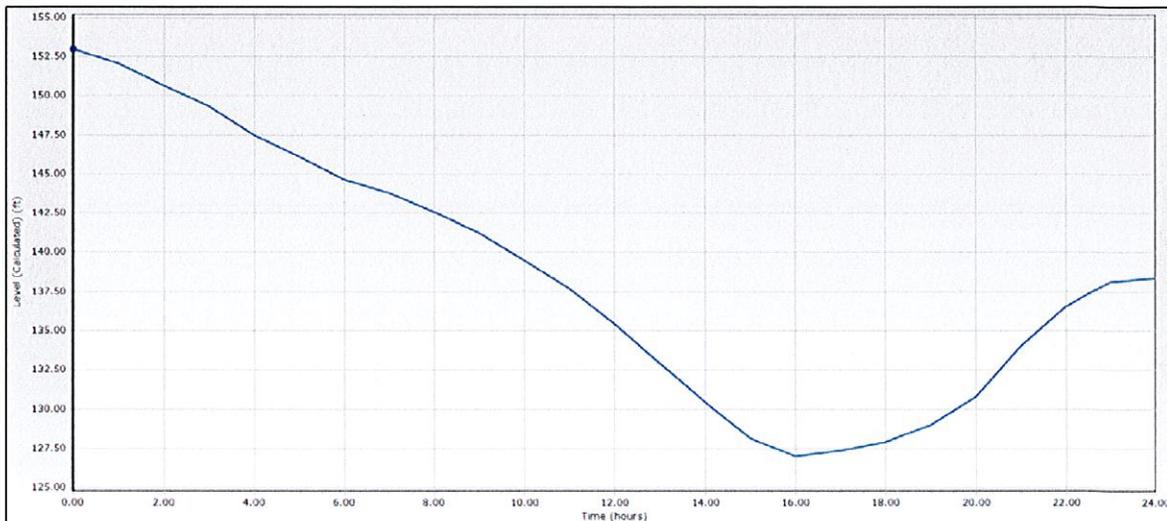
The Peak Hour analysis revealed that the existing system does not have adequate storage, pressure, or flow to supply the required PHD of the system, Hidden Springs, and Belle la Vie. The pressures at the junctions highlighted with red in the image below were all negative ranging between -183 psi and -4 psi. The pipe segments in this highlighted area experienced very high flow velocities—49 of 360 segments had velocities higher than the recommended 5 ft/s.



An additional analysis was performed on the system with only the Hidden Springs junction active. The simulation yielded satisfactory results. Pressure and flow velocity were within recommended ranges.

The Average Day scenario, with both developments active, was computed using a 24-hour simulation with 1-hour intervals beginning at 6:00 AM. The results showed the junctions to have inadequate pressures, like those of the Peak Hour scenarios. The wells were set to turn off when the Fire Station Tank was full at a level of 161 feet and were set to turn back on once the level dropped to 151 feet. At the beginning of the simulation, the tank level was at 153 feet and steadily declined to 121 feet at 12:00 PM. At the same time, a calculation warning message stating “Tank T-Fire Station is empty” was recorded. The tank level remained at 121 feet until 3 AM where the tank began to fill, peak at 4 AM, and decline to 121 for the remainder of the simulation.

An additional analysis was performed on the system with only the Hidden Springs junction active. The pressure at each junction and flow velocity in each pipe segment were found to be satisfactory. A graph of the Fire Station Tank’s water level throughout the 24-hour simulation is shown below.



The Max Day with 750 GPM Fire Flow scenario with both developments’ junctions active was computed and a fire flow analysis was performed. The fire flow analysis showed each of the 304 junctions in the model failed to provide the minimum required flow and meet the system’s demand.

An additional analysis was performed on the system with only the Hidden Springs junction active. The fire flow analysis showed a significant decrease in failed junctions from all 304 to only 2. These 2 failed junctions are located at Henry’s Mobile Home Park and Louise Street with available fire flows of 720 GPM and 718 GPM, respectfully.

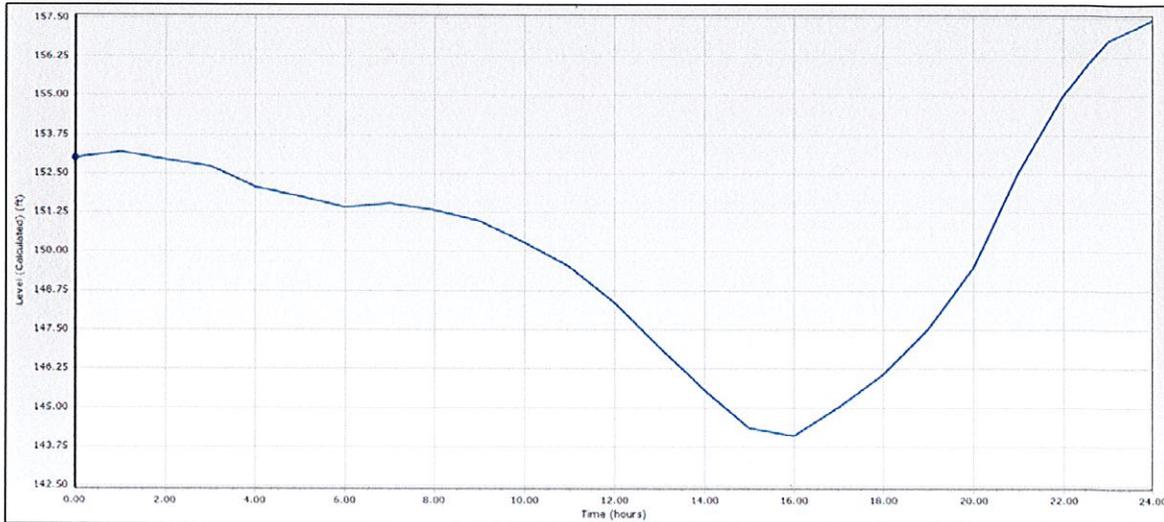
#### ***Population Growth – Year 2030 and Year 2040***

The Peak Hour, Max Day with Fire Flow at 750 GPM, and Average Day scenarios were computed and their results analyzed to determine the adequacy of both the existing and future systems to provide the required, projected demands in the year 2030 and 2040.

### *Existing System*

The Peak Hour analysis revealed that the existing system without any recommended improvements has borderline adequate storage, pressure, and flow to supply the required PHD of both Year 2030 and Year 2040. The pressure at each junction ranged between 17 psi and 82 psi and between -6 psi and 82 psi for each scenario, respectfully. The only two junctions with pressures below the recommended range are both located along the 2-inch main on Boyette Road. Of the 304 junctions in the model, eleven returned pressure higher than the recommended maximum value of 80 psi but are within a satisfactory range. Of the 235 pipe segments in the model, only one returned a velocity above the maximum value of 5 ft/s for Year 2030 demand and three above for Year 2040. These sections of pipes are all within the immediate vicinity of the 67 & Oaklawn Well.

The Average Day scenario for the Year 2030 was computed using a 24-hour simulation with 1-hour intervals beginning at 6:00 AM. The results showed the junctions to have adequate pressures, like those of the Peak Hour scenarios. The wells were set to turn off when the Fire Station Tank was full at a level of 161 feet and were set to turn back on once the level dropped to 151 feet. A graph showing the tank level throughout the simulation is shown below.



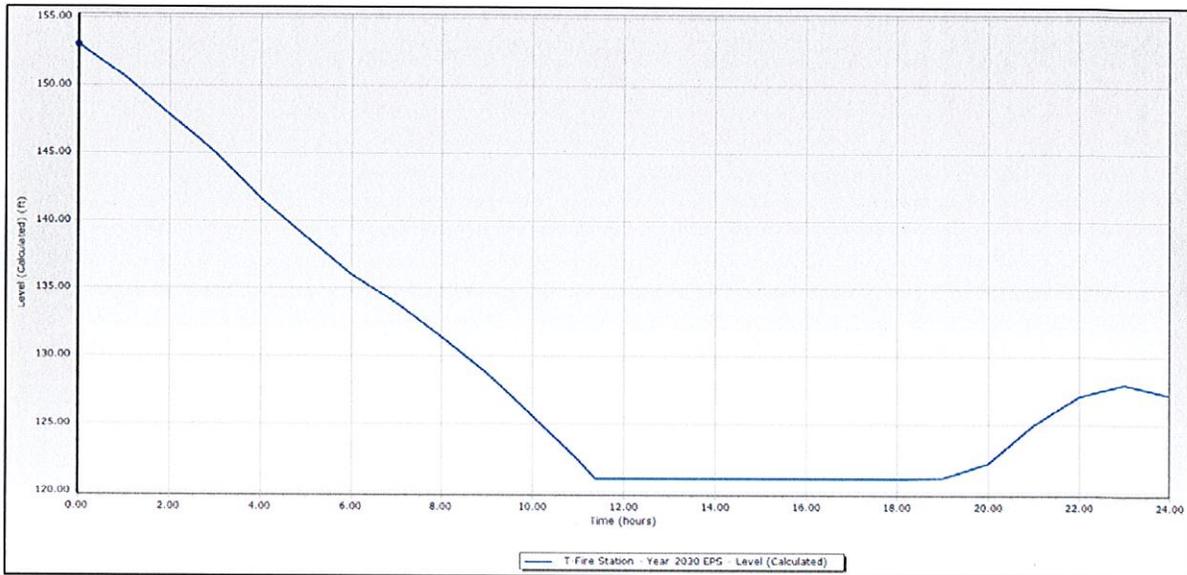
The Max Day with 750 GPM Fire Flow scenario was computed and a fire flow analysis was performed. The fire flow analysis for the Year 2030 showed 24 of the 193 junctions in the model failed to provide the minimum required flow and meet the system's demand. These 24 failed junctions were all addressed with the recommended improvements discussed in the previous section. The fire flow analysis for the Year 2040 showed three additional junctions failing to provide the minimum required flow. These were also addressed with the recommended improvements.

### *Future System*

The Peak Hour analysis revealed that the future system has borderline adequate storage, pressure, and flow to supply the required PHD of both Year 2030 and Year 2040. The pressure at each junction ranged between 26 psi and 80 psi and between 17 psi and 79 psi. Of the 304 junctions in the model, eleven returned pressure higher than the recommended maximum value of 80 psi but

are within a satisfactory range. Of the 359 pipe segments in the model, only one returned a velocity above the maximum value of 5 ft/s for Year 2030 demand and three above for Year 2040. These sections of pipes are all within the immediate vicinity of the 67 & Oaklawn Well.

The Average Day scenario for the Year 2030 was computed using a 24-hour simulation with 1-hour intervals beginning at 6:00 AM. The results showed the junctions to have inadequate pressures and the pipe segments to have inadequate flow velocities. The wells were set to turn off when the Fire Station Tank was full at a level of 161 feet and were set to turn back on once the level dropped to 151 feet. A graph showing the tank level throughout the simulation is shown below.

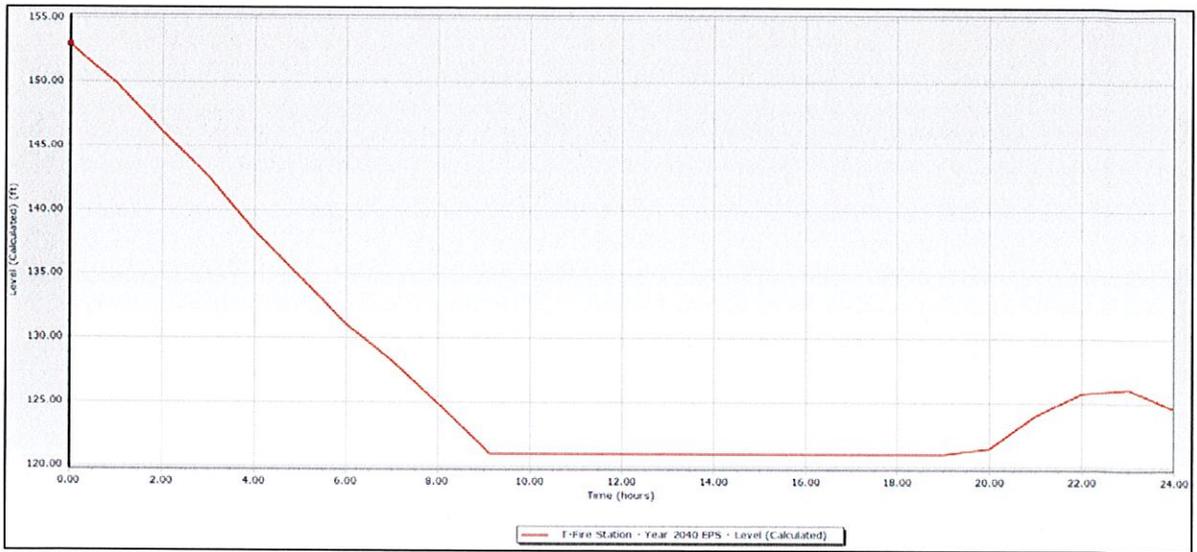


The Max Day with 750 GPM Fire Flow scenario was computed and a fire flow analysis was performed. The fire flow analysis for the Year 2030 showed 10 of the 302 junctions in the model failed to provide the minimum required flow and meet the system's demand. These 10 failed junctions are located along Michael Street, Marvin Street, Louise Street, Henry's Mobile Home Park, and John Lee Road at the northern city limits. The fire flow analysis for the Year 2040 showed 25 additional junctions failing to provide the minimum required flow.

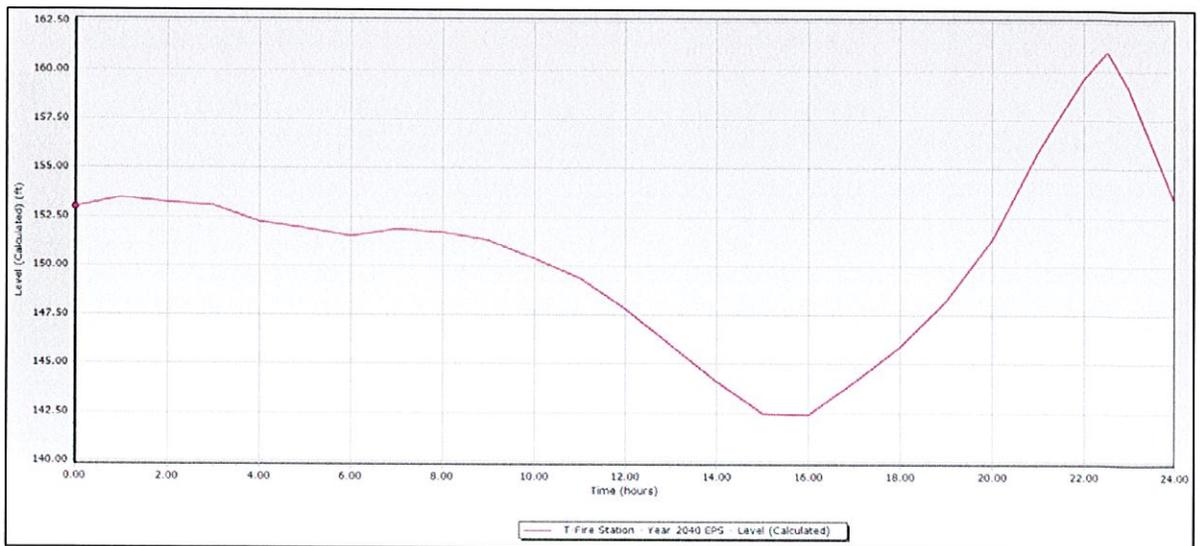
### 4.3.3 RECOMMENDATIONS

#### SYSTEM IMPROVEMENTS

As discussed in Section 4.1.2, the design capacity of the existing water system and the evaluation of the future water system were calculated using the Type #1 criteria, found in Appendix J (Standard Procedure for Determining Customer Design Capacity of a Public Water System) of the *Recommended Minimum Design Criteria for Mississippi Public Water Systems*. The design capacity of the existing water system was determined to be 5,150 connections. A graph depicting the tank level throughout the Average Day scenario of the future system in the Year 2040 with the Hidden Springs junction active is shown below.



It is recommended for a 1,000 GPM well be installed to provide more supply to the system and fill the tank. The graph depicting the level of the Woolmarket Fire Station Tank throughout the Average Day scenario of the future system in the Year 2040 with the Hidden Springs junction active and the recommended 1,000 GPM well installed is shown below.



After conducting a fire flow analysis on the future system in the Year 2040 with Hidden Springs and the new 1,000 GPM well active, it was determined that all 304 junctions could meet or exceed the minimum required fire flows. The pressures at these junctions ranged between 38 and 85 psi. The design capacity of the water system with the 1,000 GPM well installed was determined to be 7,156 connections. The number of connections in the system is not expected to exceed the design capacity until Belle la Vie or any other similar developments are constructed. It is recommended for additional storage and supply be installed for new expansions to the system.

## **HYDRANT FLUSHING PROGRAM**

It is recommended that the City develops and implements a hydrant flushing program for each of their water distribution systems. A well-thought-out hydrant flushing program can improve water quality, restore capacity throughout the system, and verify the proper operation of valves and hydrants. A Peak Hour scenario was computed for the existing system, and the flow velocities were analyzed for each pipe segment. The pipe segments with less than 1 ft/s were identified as potential areas needing flushing—the following subdivisions: Eagle Point, Rock Creek, Nature’s Trail, and Timber Creek Estates, the water system previously owned by Superior Utilities, the 16-inch water main along Woolmarket Road, and all dead-end lines. It is recommended that additional studies be performed to develop either a traditional or unidirectional flushing program for each of the City’s water distribution systems.

## **VALVE MAINTENANCE PROGRAM**

It is recommended that the City develops and implements a valve maintenance program for each of their water systems. Developing a program involves planning and prioritizing a list of areas to work, identifying the critical valves, locating and mapping all valves in the system, fully exercising and inspecting the valves, maintaining detailed valve records, and scheduling and performing necessary repairs. A successfully implemented valve maintenance program can reduce customer complaints, outage times, and cost of repairs and ultimately lead to a more reliable water distribution system.

## **4.4 CAPITAL IMPROVEMENTS PLAN**

Thirty-seven capital improvement projects to improve and expand the existing water system have been identified and are discussed below. Each project has been placed in one of three categories: Immediate Needs and Expansion to Unserved Areas both Short Term and Long Term. Each project focuses on improving fire flow availability, improving overall system performance, and/or expanding the system to serve new customers. The numbering system used to identify these projects are based on the project numbers indicated below, which also correspond to the relative sewer basin as schematically indicated on Figure 3.10 found in Appendix B. The additional customers added from each project was determined by the number of parcels within the project area. Figures for each project mentioned below can be found in Appendix B.

### **4.4.1 UPGRADE OF EXISTING WELLS (SCADA FOR EXISTING TANKS)**

There are two wells in the study area that do not have SCADA systems, 67 & Oaklawn Water Well and Superior Water Well. Estimated costs for these projects are approximately \$75,000. A more descriptive breakdown of the costs is provided in Estimate 4.1.

### **4.4.2 IMMEDIATE NEEDS**

#### **A. Bayview–Karli – Project No. 110.W1**

Install approximately 600 linear feet of new 12-inch water main between the 12-inch main at Shorecrest Road and Bayview Lane and the 6-inch main at Shorecrest Road

and W Oaklawn Road. Per the model, this additional connection will significantly increase the available flow throughout Eagle Point and the surrounding area. Replace approximately 3,350 linear feet of existing 4-inch and 6-inch water main along Karli Lane, Oak Hill Drive, Bay Hill Court, Bay Crest Court, and Bayview Lane between Oak Hill Drive and Shorecrest Road. New fire hydrant assemblies will also be installed as part of this project. Per the model, the current available fire flow in this area ranges between 208 GPM and 258 GPM, which is significantly less than the required 750 GPM. With the improvements made, the model shows this area having available fire flows over 1000 GPM. This project would provide the area with adequate fire flow and better system connectivity. Estimated costs for this project are approximately \$745,040. A more descriptive breakdown of the costs is provided in Estimate 4.2.

B. River Oaks Court – Project No. 122.W1

Replace approximately 500 linear feet of existing 6-inch water main along River Oaks Court with new 8-inch main. New fire hydrant assemblies will also be installed as part of this project. Per the model, the current available fire flow in this area is 582 GPM, which is less than the required 750 GPM. With the improvements made, the model shows this area having available fire flows above the required minimum. The additions of new, larger water mains will provide adequate fire protection for the community it serves as well as update and improve the performance and reliability of the overall water system. Estimated costs for this project are approximately \$105,610. A more descriptive breakdown of the costs is provided in Estimate 4.3.

C. Tiffany Lane – Project No.102.W1

Approximately 2,600 linear feet of new 8-inch water main will be installed to replace undersized 2" water main along Tiffany Lane. New fire hydrant assemblies will also be installed as part of this project. Roughly 50% of the existing water mains being replaced were installed in the 1960's; the remaining pipe was installed between 1982 and 2002. There are currently approximately 18 existing water connections in this system based on existing facility maps. Estimated costs for this project are approximately \$564,060. A more descriptive breakdown of the costs is provided in Estimate 4.4.

D. Boyette–Oaklawn – Project No. 103.W1

Replace approximately 15,220 linear feet of existing 2-inch, 4-inch, and 6-inch water main with new 8-inch PVC water main along Oaklawn Road, Boyette Road, N Oaklawn Road, Pinecrest Drive, Evelyn Avenue, Dixie Avenue, Stella Avenue, Virginia Street, Nancy Drive, Taylor Drive, and the 2-inch main between N Oaklawn Road and Tiffany Lane. New fire hydrant assemblies will also be installed as part of this project. Roughly 50% of the existing water mains being replaced were installed in the 1960's; the remaining pipe was installed between 1982 and 2002. Per the model, the current available fire flow in the 2-inch and 4-inch mains range between 14 GPM and 348 GPM, which is significantly less than the required 750 GPM. The current available fire flow in the remaining 6-inch mains is 674 GPM plus. With the

improvements made, the model shows this area having available fire flows over 1000 GPM. This project will provide service and fire protection to existing customers. Estimated costs for this project are approximately \$2,989,620. A more descriptive breakdown of the costs is provided in Estimate 4.5.

E. Airport Road – Project No. 151.W1

Replace approximately 1,200 linear feet of existing 4-inch and 6-inch water main with new 8-inch water main along Cardinal Lane and West Cardinal Lane. Approximately 8,000 feet of new 8-inch water main will be installed along Airport Road, Delynn Drive, Boss Husley Road, Road 533, Bates Road, and Cardinal Lane. New fire hydrant assemblies will also be installed as part of this project. This project will provide service and adequate fire protection to 87 new customers (based on the approximate number of properties along proposed route). Estimated costs for this project are approximately \$1,937,300. A more descriptive breakdown of the costs is provided in Estimate 4.6.

F. Raintree–Martin – Project No. 151.W2

Tie into existing 16-inch water main at the intersections of Woolmarket Road and Raintree Place and Woolmarket Road and Martin Cove. Replace approximately 1,875 linear feet of existing 4-inch and 6-inch water main with new 8-inch water main along Raintree Place and Martin Cove. Per the model, the current available fire flows for Raintree Place and Martin Cove are 195 GPM and 442 GPM, respectfully. This project will provide service and adequate fire protection to existing customers. Estimated costs for this project are approximately \$392,580. A more descriptive breakdown of the costs is provided in Estimate 4.7.

G. Marvin–Michael – Project No. 151.W3

Replace approximately 3,950 linear feet of existing 4-inch and 6-inch water main with new 8-inch PVC water main along a portion of Woolmarket Road, Marvin Street, Mary Street, Louise Street, and Michael Street. New fire hydrant assemblies will also be installed as part of this project. Per the model, the available fire flow in this area ranges between 394 GPM and 602 GPM, which is below the minimum requirement of 750 GPM. This project will provide service and adequate fire protection to existing customers. Estimated costs for this project are approximately \$793,760. A more descriptive breakdown of the costs is provided in Estimate 4.8.

#### **4.4.3 EXPANSION TO UNSERVED AREAS (SHORT TERM)**

A. John Lee Road South – Project No. 170.W1

Tie into existing 12-inch water main at intersection of Woodrow Place and John Lee Road. Install approximately 5,400 linear feet of 12-inch water main west along John Lee Road to Old Woolmarket Road and 850 linear feet of 12-inch water main north along Old Woolmarket Road to the intersection at John Lee Road. This project will provide service and fire protection to 25 new customers. Estimated costs for this

project are approximately \$1,389,200. A more descriptive breakdown of the costs is provided in Estimate 4.9.

i. Riverland Drive – Project No. 177.W1

Approximately 5,700 linear feet of 8-inch water main will be installed along Riverland Drive from Woolmarket Lake Road to its end. This project will provide service and fire protection to 50 new customers. Estimated costs for this project are approximately \$1,196,920. A more descriptive breakdown of the costs is provided in Estimate 4.10.

ii. Woolmarket Lake Road – Project No. 175.W1

Approximately 5420 linear feet of 8-inch water main will be installed along Woolmarket Lake Road, and Shirene Lane, and River Road. This project will provide service and fire protection to 66 new customers. Estimated costs for this project are approximately \$1,156,660. A more descriptive breakdown of the costs is provided in Estimate 4.11.

a. Snug Harbor Road – Project No. 176.W1

Approximately 1650 linear feet of 8-inch water main will be installed along Snug Harbor Road from the newly installed 8-inch water main on Woolmarket Lake Road (Project No. 175.W1). This project will provide service and fire protection to 18 new customers. Estimated costs for this project are approximately \$358,990. A more descriptive breakdown of the costs is provided in Estimate 4.12.

iii. John Lee Road North – Project No. 174.W1

Tie-in to the 12-inch water main (installed with Project No.170.W1) at southern intersection of John Lee Rd and Old Woolmarket Rd. Approximately 5000 linear feet of 8-inch water main will be installed along North John Lee Rd west of Old Woolmarket Rd. This project will provide service and fire protection to 35 new customers. Estimated costs for this project are approximately \$1,045,180. A more descriptive breakdown of the costs is provided in Estimate 4.13.

B. Hudson-Krohn Road – Project No. 200.W1

Tie into existing HCUA 16-inch water main at the intersection of Hudson-Krohn Road and Old Highway 67 with a bore across Old Highway 67 and a custody transfer station. Install approximately 6,250 linear feet of 12-inch water main north along Hudson-Krohn Road from the intersection at Old Highway 67 to the intersection at Mason Drive. This project will provide service and fire protection to 43 new customers. Estimated costs for this project are approximately \$1,254,990. A more descriptive breakdown of the costs is provided in Estimate 4.14. If the Old Highway 67 Water Main is installed prior to this project, a bore across Old Highway 67 and custody transfer station will not be required.

i. North Bend Drive – Project No. 200.W2

Tie into existing 12-inch water main at the intersection of Hudson Krohn Road and North Bend Drive (Project No. 200.W1). Approximately 5,550 linear feet of 8-inch water main will be installed along North Bend Drive, North Sandy Creek Road, South Sandy Creek Road, and Shady Creek Drive. This project will provide service and fire protection to 50 new customers. Estimated costs for this project are approximately \$1,147,950. A more descriptive breakdown of the costs is provided in Estimate 4.15.

ii. Mason Road – Project No. 203.W1

Tie into existing 12-inch water main at the intersection of Hudson-Krohn Road and Mason Road (Project No. 200.W1). Approximately 2,700 linear feet of 8-inch water main will be installed along Mason Road. This project will provide service and fire protection to 19 new customers. Estimated costs for this project are approximately \$567,470. A more descriptive breakdown of the costs is provided in Estimate 4.16.

iii. Stacy Lane – Project No. 204.W1

Tie into 12-inch water main (installed with Project No. 200.W1) at the intersection of Schoenewitz Road and Hudson Krohn Road. Approximately 2,780 linear feet of 12-inch water main will be installed along Big John Road and Schoenewitz Road. 760 linear feet of 8-inch water main will be installed along Stacy Lane. This project will provide service and fire protection to 21 new customers. Estimated costs for this project are approximately \$788,360. A more descriptive breakdown of the costs is provided in Estimate 4.17.

C. Paradise Lane – Project No. 202.W1

Bore across Old Highway 67 and tie into existing HCUA 16-inch water main at intersection of Old Highway 67 and Paradise Lane. Install approximately 6,100 linear feet of 8-inch water main along Paradise Lane and Eden Place. This project will provide service and fire protection to 46 new customers. Estimated costs for this project are approximately \$1,381,920. A more descriptive breakdown of the costs is provided in Estimate 4.18.

D. Woodlands Drive – Project No. 161.W1

Install approximately 3,700 linear feet of 8-inch water main along Woodlands Drive. This project will provide service and fire protection to 34 new customers. Estimated costs for this project are approximately \$788,300. A more descriptive breakdown of the costs is provided in Estimate 4.19.

#### **4.4.4 EXPANSION TO UNSERVED AREAS (LONG TERM)**

A. Jim Byrd Road South – Project No. 146.W1

Install 2,000 linear feet of 12-inch water main along Jim Byrd Road from just south of Beverin Road to the northern intersection of Jim Byrd Road and Greenhill Circle. Approximately 5,280 feet of 8-inch water main will be installed along Beverin Road, Jack Graves Roads, and Greenhill Circle. This project will provide service and fire protection to 60 new customers. Estimated costs for this project are approximately \$1,549,390. A more descriptive breakdown of the costs is provided in Estimate 4.20.

i. Jim Byrd Road North – Project No. 147.W1

Tie into 12-inch water main (installed with Project No. 146.W1) at the intersection of Jim Byrd Road and Greenhill Circle. Install approximately 3,250 linear feet of 12-inch water main along Jim Byrd Road from Greenhill Circle to Frank Hudson Road. Approximately 1,100 linear feet of 8-inch water main will be installed along Frank Hudson Road. This project will provide service and fire protection to 15 new customers. Estimated costs for this project are approximately \$939,490. A more descriptive breakdown of the costs is provided in Estimate 4.21.

B. Old Woolmarket Road – Project No. 171.W1

Tie-in to 12-inch water main (installed with Project No. 173.W1) at southern intersection of John Lee Rd and Old Woolmarket Rd. Install approximately 11,200 linear feet of 12-inch water main north along Old Woolmarket Rd to the City Limits. This project will provide service and fire protection to 21 new customers. Estimated costs for this project are approximately \$1,022,550. A more descriptive breakdown of the costs is provided in Estimate 4.22.

i. Dundewood Road – Project No. 172.W1

Approximately 2860 linear feet of 8-inch water main will be installed along Dundewood Rd and Dundewood Ln. This project will provide service and fire protection to 29 new customers. Estimated costs for this project are approximately \$612,190. A more descriptive breakdown of the costs is provided in Estimate 4.23.

ii. Timber Ridge Lane – Project No. 173.W1

Approximately 2000 linear feet of 8-inch water main will be installed along Timber Ridge Ln. This project will provide service and fire protection to 11 new customers. Estimated costs for this project are approximately \$413,200. A more descriptive breakdown of the costs is provided in Estimate 4.24.

iii. Karen Lee Court – Project No. 162.W2

Loop existing 12-inch water main on Old Woolmarket Rd at the City Limits and on Woodlands Hills Drive at the City Limits. Install approximately 3800 linear feet of 12-inch water main. Approximately 680 linear feet of 8-inch water main will be installed on Karen Lee Ct. The City is allowed to serve customers up to one mile outside its city limits. This project will provide service and fire protection to 21 new customers as well as create a loop between Old Woolmarket Road and Woodlands Hills Drive, which improves water quality and system connectivity.

This project is outside the City Limits. Estimated costs for this project are approximately \$993,170. A more descriptive breakdown of the costs is provided in Estimate 4.25. The City is allowed to serve up to one (1) mile outside its limits and looping the system is important for the overall performance and avoidance of taste and odor water quality problems that are possible with dead-end lines.

a. Woodlands Hills – Project No. 162.W1

Tie-in to existing 12-inch water main at Wash Fayard Road and Woodlands Drive. Install approximately 3000 linear feet of 12-inch water main north along Woodlands Hills Drive to the City Limits. This project will provide service and fire protection to 28 new customers. Estimated costs for this project are approximately \$686,840. A more descriptive breakdown of the costs is provided in Estimate 4.26.

C. Lorraine Road – Project No. 105.W2

Install approximately 3,400 linear feet of 16-inch water main along Lorraine Road. This project will provide service and fire protection to 20 new customers. Estimated costs for this project are approximately \$873,510. A more descriptive breakdown of the costs is provided in Estimate 4.27.

i. Selena Drive – Project No. 105.W1

Install approximately 1,950 linear feet of 8-inch water main along Selena Drive and Damon Court. This project will provide service and fire protection to 23 new customers. Estimated costs for this project are approximately \$425,550. A more descriptive breakdown of the costs is provided in Estimate 4.28.

ii. Hillside Road – Project No. 105.W3

Install approximately 1,600 linear feet of 8-inch water main along Hillside Road, tying into newly installed water main at Lorraine Road and Hillside Road (Project No. 105.W2). This project will provide service and fire protection to 8 new customers. Estimated costs for this project are approximately \$379,140. A more descriptive breakdown of the costs is provided in Estimate 4.29.

iii. Victory Lane – Project No. 106.W1

Install approximately 3,400 linear feet of 8-inch water main along Victory Lane. This project will provide service and fire protection to 19 new customers. Estimated costs for this project are approximately \$722,340. A more descriptive breakdown of the costs is provided in Estimate 4.30.

a. Country Lane – Project No. 152.W1

Install approximately 2,850 linear feet of 8-inch water main along Country Lane and Sugar Shack Lane. This project will provide service and fire protection to 14 new customers. Estimated costs for this project are

approximately \$641,880. A more descriptive breakdown of the costs is provided in Estimate 4.31.

iv. Lorraine–Pine Haven – Project No. 105.W4

Tie into newly installed 16-inch water main at intersection of Lorraine Road and Hillside Road (Project No. 105.W2). Install approximately 1,950 linear feet of 16-inch water main north along Lorraine Road to Skyline Drive. Future connection to Pinehaven Mobile Home Park could add approximately 107 mobile homes to the system that are currently on private water. New fire hydrant assemblies will be also be installed as part of this project. This project would provide service and adequate fire protection to 12 new customers. Estimated costs for this project are approximately \$554,240. A more descriptive breakdown of the costs is provided in Estimate 4.32.

a. South Mill Creek Drive – Project No. 107.W1

Tie into existing 16-inch water main at intersection of Lorraine Road and Skyline Drive (Project No. 105.W4). Install approximately 3,300 linear feet of 8-inch water main along South Mill Creek Drive and Shadow Lake Place. New fire hydrant assemblies will be also be installed as part of this project. This project would provide service and adequate fire protection to 18 new customers. Estimated costs for this project are approximately \$718,790. A more descriptive breakdown of the costs is provided in Estimate 4.33.

D. Virginia Lee Road – Project No. 161.W3

Install approximately 1,050 linear feet of 8-inch water main along Virginia Lee Road tying into Wash Fayard Road. This project will provide service and fire protection to 6 new customers. Estimated costs for this project are approximately \$231,480. A more descriptive breakdown of the costs is provided in Estimate 4.34.

E. Joncie Lane – Project No. 161.W2

Install approximately 1,950 linear feet of 8-inch water main along Joncie Lane, tying into Wash Fayard Road. This project will provide service and fire protection to 10 new customers. Estimated costs for this project are approximately \$404,300. A more descriptive breakdown of the costs is provided in Estimate 4.35.

F. Fayard Road – Project No. 148.W1

Tie into existing HCUA water main at intersection of Old Highway 67 and Fayard Road with a bore across Old Highway 67 and a custody transfer station. Install approximately 1,600 linear feet of 8-inch water main along Fayard Road. New fire hydrant assemblies will also be installed as part of this project. This project would provide service, adequate fire protection, and better system connectivity to 8 new customers. Estimated costs for this project are approximately \$364,140. A more descriptive breakdown of the costs is provided in Estimate 4.36. If the Old Highway

67 Water Main is installed prior to this project, a bore across Old Highway 67 and custody transfer station will not be required.

G. John Lee–Lorraine – Project No. 100.W1

Approximately 4,150 linear feet of new 8-inch water main will be installed along Lorraine Road from Tiffany Lane to Woolmarket Road and along John Lee Road from Lorraine Road to Woolmarket Road. There is an existing 6-inch water main be along Lorraine Road between Woolmarket Road and Oaklawn Road. This project will provide service and fire protection to 56 new customers. Estimated costs for this project are approximately \$857,350. A more descriptive breakdown of the costs is provided in Estimate 4.37.

H. Old Highway 67 Water Main – Project No. 145.W1

Install approximately 20,285 linear feet of 8” Water Main along Old Highway 67 from Shriners Boulevard to Licksillet Road on the opposite side of the road as the HCUA 16-inch water main. Two custody transfer stations are required to tie into the HCUA system at both ends of the project. This project would help to avoid costly bores across Old Highway 67 to tie in services. Estimated costs for this project are approximately \$4,157,480. A more descriptive breakdown of the costs is provided in Estimate 4.38.

## **4.5 COST ESTIMATES**

Detailed opinions of probable costs associated with each of the thirty-eight proposed capital improvement projects have been created. These projects will improve and expand the existing water system found throughout the Woolmarket area. Each project focuses on improving fire flow availability, improving overall system performance, and/or expanding the system to serve new customers. The opinions of probable costs can be found on the subsequent pages.

<b>ESTIMATE NO. 4.1</b>				
<b>PROJECT #</b> 001.W1	<b>PROPOSED WOOLMARKET CONSTRUCTION PROJECT DATA</b>		<b>DATE</b>	
<b>INFRASTRUCTURE TO BE IMPROVED:</b> SS / SD / <u>W</u> / T			10/30/2017	
<b>PROJECT LOCATION</b> EXISTING WELLS (67 & OAKLAWN; SUPERIOR)	<b>PROJECT DESCRIPTION</b> Existing water well upgrades - SCADA		<b>ESTIMATED PROJECT COST</b>  \$75,000	
<b>OPINION OF PROBABLE COST</b>				
<b>DESCRIPTION</b>	<b>UNITS</b>	<b>QUANTITY</b>	<b>UNIT PRICE</b>	<b>ITEM TOTAL</b>
67 & OAKLAWN WATER WELL - SCADA	LS	1	\$ 25,000.00	\$ 25,000.00
SUPERIOR WATER WELL - SCADA	LS	1	\$ 25,000.00	\$ 25,000.00
			<b>SUBTOTAL BID</b>	\$ 50,000.00
			<b>CONTINGENCIES</b>	\$ 12,500.00
			<b>TOTAL BID</b>	\$ 62,500.00
			<b>CONST. ENG.</b>	\$ 12,500.00
			<b>ESTIMATED TOTAL CONSTRUCTION COST</b>	\$ 75,000.00
<b>DESCRIPTION OF EXISTING CONDITIONS AND PROPOSED CONSTRUCTION</b>				
Provide SCADA systems to the existing 67 & Oaklawn Water Well and Superior Water Well.				











































































## **SECTION 5 – DRAINAGE SYSTEM**

### **5.1 EXISTING DRAINAGE SYSTEM**

#### **5.1.1 PURPOSE**

The purpose of this section is to examine the existing drainage infrastructure in the Woolmarket area. An inventory will be made of existing natural drainage ways and the largest of the existing artificial (man-made) drainage improvements within the area. Where elements of the existing infrastructure are identified to be seriously deficient, alternative infrastructure will be suggested to alleviate the deficiencies.

It is not the intent of this master plan to provide detailed construction plans for recommended drainage improvements. This would require field surveys and detailed calculations which are outside the scope of this plan. The purpose of this master plan is limited to the identification of specific drainage features which can and should be enlarged or otherwise improved, to alleviate drainage problems experienced in the past.

The master plan for the drainage system includes this report along with figures, tables, and exhibits referenced and included herein.

#### **5.1.2 SCOPE**

The entire study area is depicted on Figure 5-1 and is further detailed on Figures 5-2 thru 5-5. It consists of 17,200 acres of gently rolling, coastal plain, sloping from north to south. Elevations at the northern edge of the area reach 140 feet above sea level, and elevations along I-10 at the south edge are between 8 and 12 feet above sea level. The elevations along the Biloxi River and the Tchoutacabouffa River are essentially at sea level. Soils tend to be silt and clay, and have relatively low permeability.

All drainage runoff from the area is channeled to one of five major outfalls which pass through or adjacent to the study area. These are:

1. The Biloxi River, along the western edge of the area.
2. Parker's Creek, which originates near the intersection of Lorraine Road and Old Highway 67 and discharges into the Tchoutacabouffa River just east of Lorraine Road.
3. Howard's Creek, which also originates near the intersection of Lorraine Road and Old Highway 67 and discharges into the Tchoutacabouffa River.
4. The Tchoutacabouffa River (east and west), which is a major river flowing north to south at the eastern boundary of the study area, turning west and forming the southern boundary of the study area, and ultimately flowing into the Biloxi River at the southwest corner of the study area.

Parker's Creek and Howard's Creek flow directly through the study area and therefore are analyzed as a part of the study. Both creeks drain areas outside and to the north of the Biloxi's city limits, but the extent of the area served has been identified and the runoff from those outside areas has been included in the analysis. The Biloxi River and the Tchoutacabouffa River drain large areas outside the city limits, but these rivers do not directly affect drainage of the study area except for possible tidal effects, and therefore are not analyzed.

The methodology used for this drainage study follows design procedures promulgated by the Mississippi Department of Transportation in its Design Manual of 2001. This procedure is widely used in the study area for several types of drainage projects, including rural highway projects and drainage improvement projects by local cities and counties. Experience has shown that drainage calculations made using the MDOT methodology provide usable and cost-effective results.

This methodology was used to calculate the expected drainage discharge to each of many specific points of interest within the study area for several types of rainfall events. These points of interest are termed analysis points. Many of these analysis points correspond to where existing drainage pipes carry drainage across roads. The rainfall events are characterized by the frequency that an event of that severity may be expected in the study area. A 25-year storm is one that has a one-in-twenty-five chance of occurring in any given year. Many drainage projects are designed using the 25-year storm criteria. However, where the potential for damage from flooding is especially severe, then the 100-year storm should be used. The City of Biloxi has elected to utilize the 100-year storm for drainage improvements, where feasible.

After the expected drainage discharge is calculated for each analysis point, the calculated discharge rate is compared with the estimated capacity of the existing pipe or pipes at a given location. The ratio between the existing capacity and the needed capacity may be considered as a sufficiency ratio, with lower values indicating more deficient pipes.

Wherever existing pipes are found to be deficient, the "correct" size pipe is determined to pass expected discharges for each of several storm frequencies. These preliminary pipe size recommendations are indicated in the tables and figures included in this report. These preliminary pipe size determinations are made assuming that the new pipes will be installed at a slope which is typical for the area. Additional information gained from a detailed survey and design may change the size pipe that is recommended.

Based on the calculated flow estimates and the preliminary estimates of pipe sizes at the analysis points, recommendations have been provided for improvements to additional existing pipes situated between the analysis points. These preliminary size recommendations are displayed on the figures included in this report.

For budgeting purposes, planning level opinions of probable cost for all recommended pipe improvements have been provided. These estimates may be used to help determine the priority for improvements and for preliminary budgeting purposes, but should not be relied upon as firm estimates of needed funding. Final detailed design is required for this.

### **5.1.3 METHODOLOGY**

The study area was first divided into drainage areas, each of which discharging through a separate existing drainage structure, or in some cases, through a major branch of an open ditch drainage system. Each discharge point is termed herein an analysis point. The drainage areas and analysis points are depicted on the accompanying figures. Note that each drainage area is numbered according to the number of the analysis point immediately downstream. The drainage areas and analysis points are summarized in Exhibit 5-1.

Very large drainage areas, exceeding 40 acres, were analyzed per the procedure given in Section 7-4.02.02 in the MDOT Design Manual of 2001. This procedure is titled "Method of USGS 1991 Report, Flood Characteristics of Mississippi Streams (Rural Discharge)". This method is applicable for rural natural drainage basins between 38 acres and 800 square miles. Results for this drainage study are shown in Exhibit 5-2.

For smaller drainage subareas, Section 7-4.01, "Rational Method," of the MDOT Design Manual will be used. This method uses the formula  $Q=CIA$ , where "Q" is flow, "C" is a runoff coefficient selected based on the surface characteristics of the drainage area, "A" is the area of the subarea in acres, and "I" is a rainfall intensity factor, which is taken from Rainfall Intensity-Duration-Frequency ("IDF") curves. The IDF curves used for this study are shown in Exhibit 5-3. Also included is Exhibit 5-4 which shows the calculation of flow velocities for several types of ditches common in this area.

The drainage subareas in the study area combine and interact with each other in a variety of ways. Based upon existing maps and limited field inspection, it is believed that the drainage subareas interact in accordance with the charts shown in Exhibit 5-1. Analysis of the study area will be based upon schematic flow diagrams included in the completed master plan, along with final calculation of drainage discharges to each analysis point for a storm frequency of 100 years.

A chart (see Exhibit 5-5) comparing the calculated discharge rates with the capacity of the existing pipes will be developed, for storm frequencies of 5, 25, and 100 years. Capacity of existing pipes will be calculated based upon an assumed hydraulic gradient slope of 0.5%, which is typical in the study area. Included in the final report will be a sufficiency rating, which is the percentage of the needed capacity available with the existing pipe at a designated analysis point and is calculated assuming that the pipe is at a slope of at least 0.5% and in good condition. Existing pipes in the study area were found to vary from 6% to 145% of the capacity needed to accommodate the 100-year storm event.

## **5.2 KNOWN CONCERNS**

### **5.2.1 RESULTS AND CONCLUSIONS**

There are several locations where existing pipes at analysis points are obviously deficient. It must be noted that in many instances, there are additional existing pipes between the analysis points that have not yet been evaluated, but should be taken into consideration when planning improvements to the overall drainage system. As previously noted, needed pipe sizes at each site must be

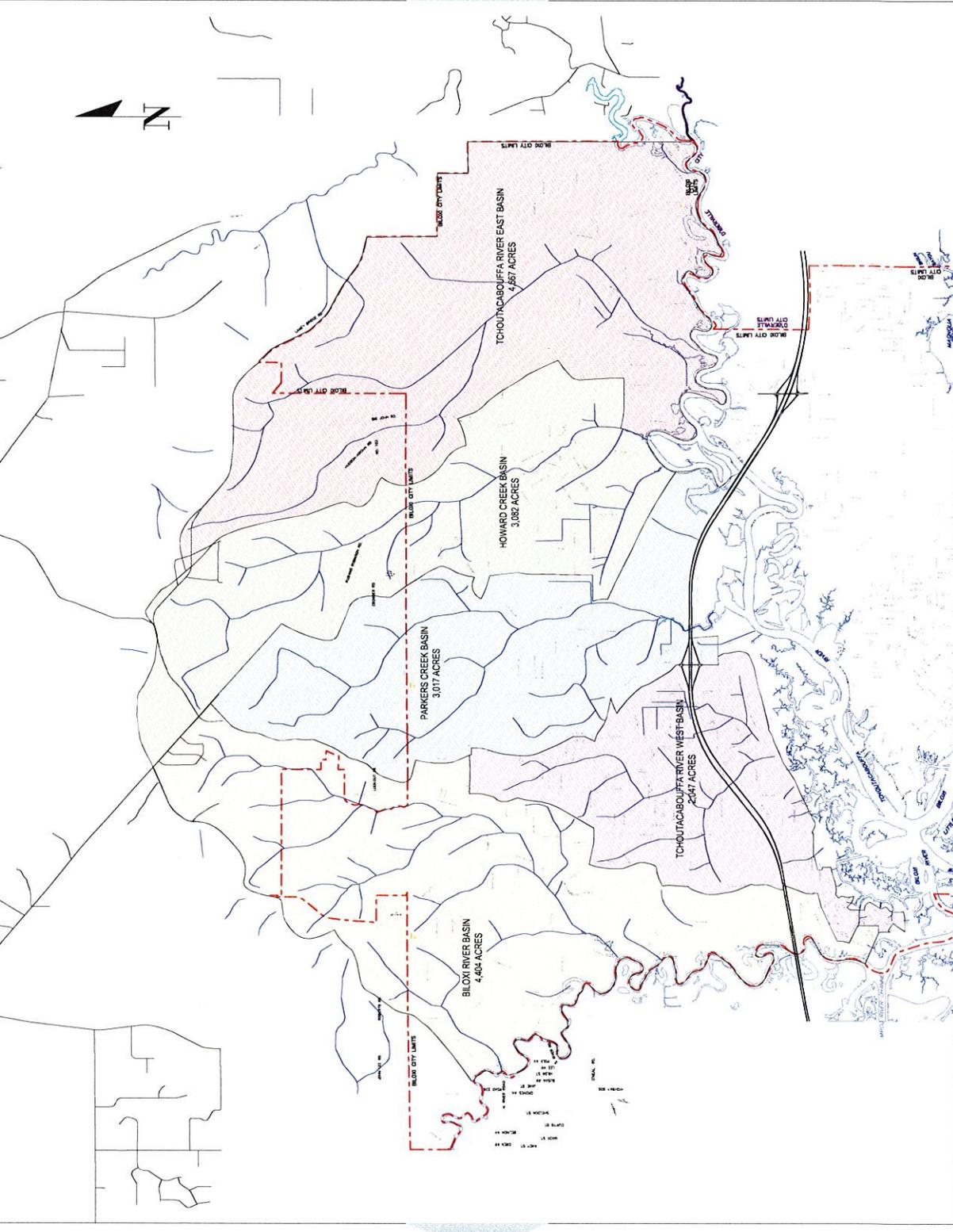
confirmed by engineering calculations based upon field surveys, with due consideration of existing constraints. Pipe sizes will also vary depending upon which storm frequency is selected. In many cases, existing ditches are insufficient in width and/or depth to carry the required flows. The flow characteristics of these channels must also be taken into consideration when implementing significant drainage improvements; however, that level of detailed analysis is not included in the scope of work for this report.

### **5.2.2 COST ESTIMATES**

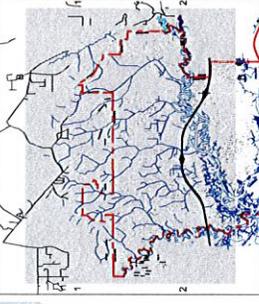
The adequacy of existing drainage culverts throughout the study area varies greatly. It seems reasonable to use available financial resources to correct the largest deficiencies first, but other factors must also be considered when assigning priorities. First, the condition of existing pipes must be considered. Detailed field inspection of every pipe within the study area should be performed. If existing pipes are discovered to be collapsed or obstructed, they will have a sufficiency ratio of zero and should be moved to the top of the priority list. Pipes which are significantly off-grade should also be corrected. Secondly, priority should be given to solving drainage problems at locations where the risk of injury or damage is greatest, especially where significant flooding has previously occurred. . Lastly, the condition and adequacy of open ditches between the culvert pipes must be considered and corrected where required.

For purposes of this report, opinions of probable cost for the replacement of drainage pipes determined to be inadequate for a 100-Year storm were prepared, based only upon the preliminary size analysis performed herein. They do not include replacement of pipes which may be adequately sized but require replacement for other reasons, such as poor physical condition. We will include allowances for minor cleaning and improvements to intermediate open ditches where appropriate, but these estimates assume that the ditch is basically of adequate size, shape, and depth and only require minor maintenance cleaning. The opinion of probable cost for improvements to each of the major basins in the study area—Biloxi River, Tchoutacabouffa River West, Parkers Creek, Tchoutacabouffa River East, and Howards Creek—totals \$3,787,834.

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<b>LEGEND</b>	
	BILOXI RIVER BASIN
	PARKERS CREEK BASIN
	HOWARD CREEK BASIN
	TCHOUTACABOUFFA RIVER WEST BASIN
	TCHOUTACABOUFFA RIVER EAST BASIN
	TCHOUTACABOUFFA RIVER EAST BASIN



**KEY MAP**



SCALE	FIGURE NUMBER
1" = 2000'	5-1
DATE	
6-26-2018	
SHEET FILE	
MAJOR DRAINAGE BASINS	

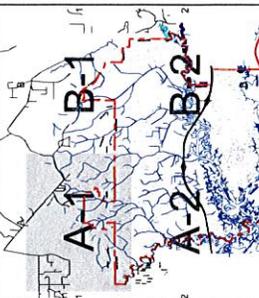
CONSULTANT TEAM



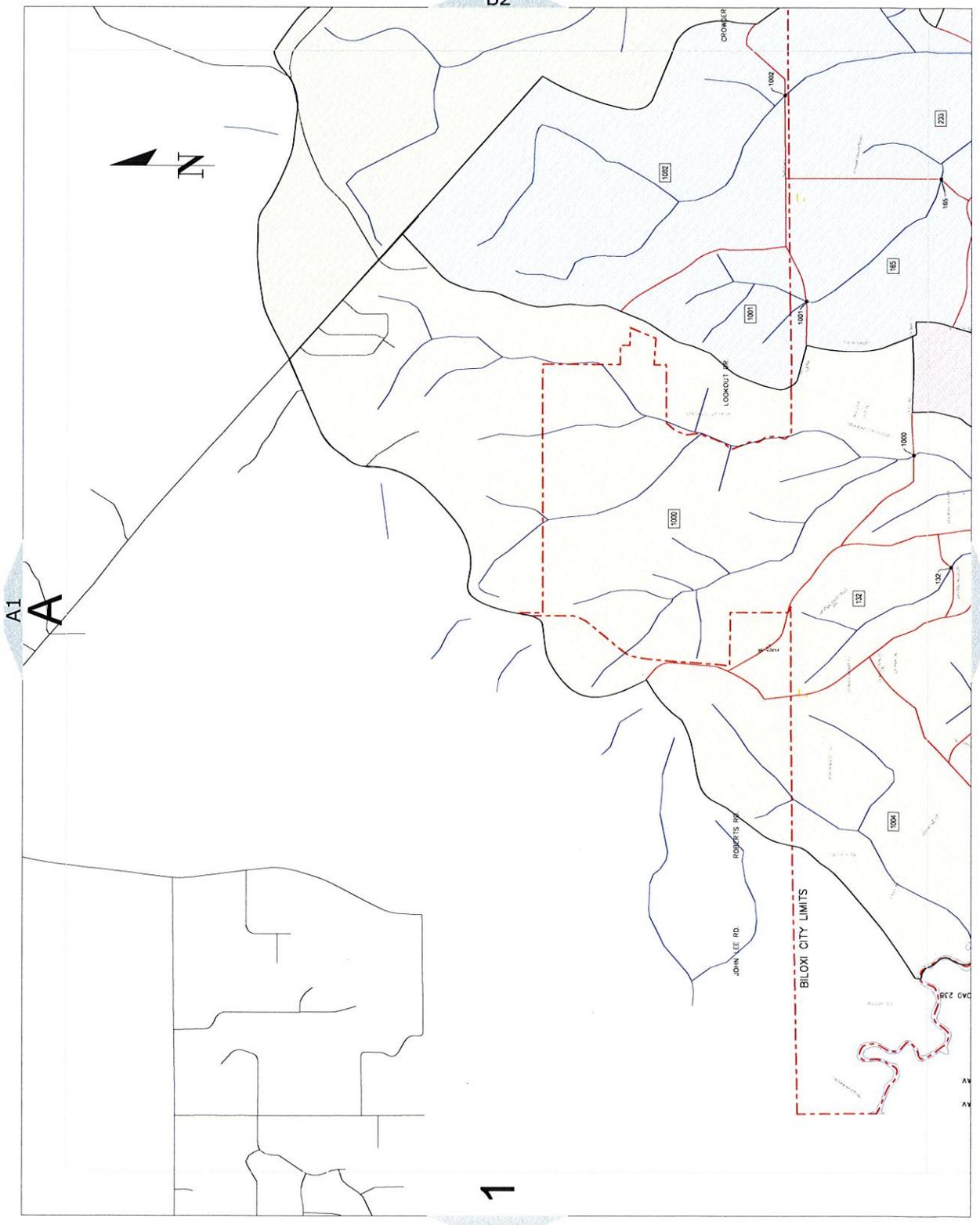
LEGEND

- BILOXI RIVER BASIN
- PARKERS CREEK BASIN
- HOWARD CREEK BASIN
- TCHOUTACABOFFA RIVER WEST BASIN
- TCHOUTACABOFFA RIVER EAST BASIN
- DRAINAGE BASIN
- ANALYSIS POINT
- STREAM
- BASIN BOUNDARY

KEY MAP



SCALE	FIGURE NUMBER
1" = 1000'	5-2
PLOT DATE	SECTION A-1
6-26-2018	
SHEET FILE	DRAINAGE AREAS





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- BILOXI RIVER BASIN
- PARKERS CREEK BASIN
- HOWARD CREEK BASIN
- TCHOITACABOUFFA RIVER WEST BASIN
- TCHOITACABOUFFA RIVER EAST BASIN
- DRAINAGE BASIN
- ANALYSIS POINT
- STREAM
- BASIN BOUNDARY

**KEY MAP**

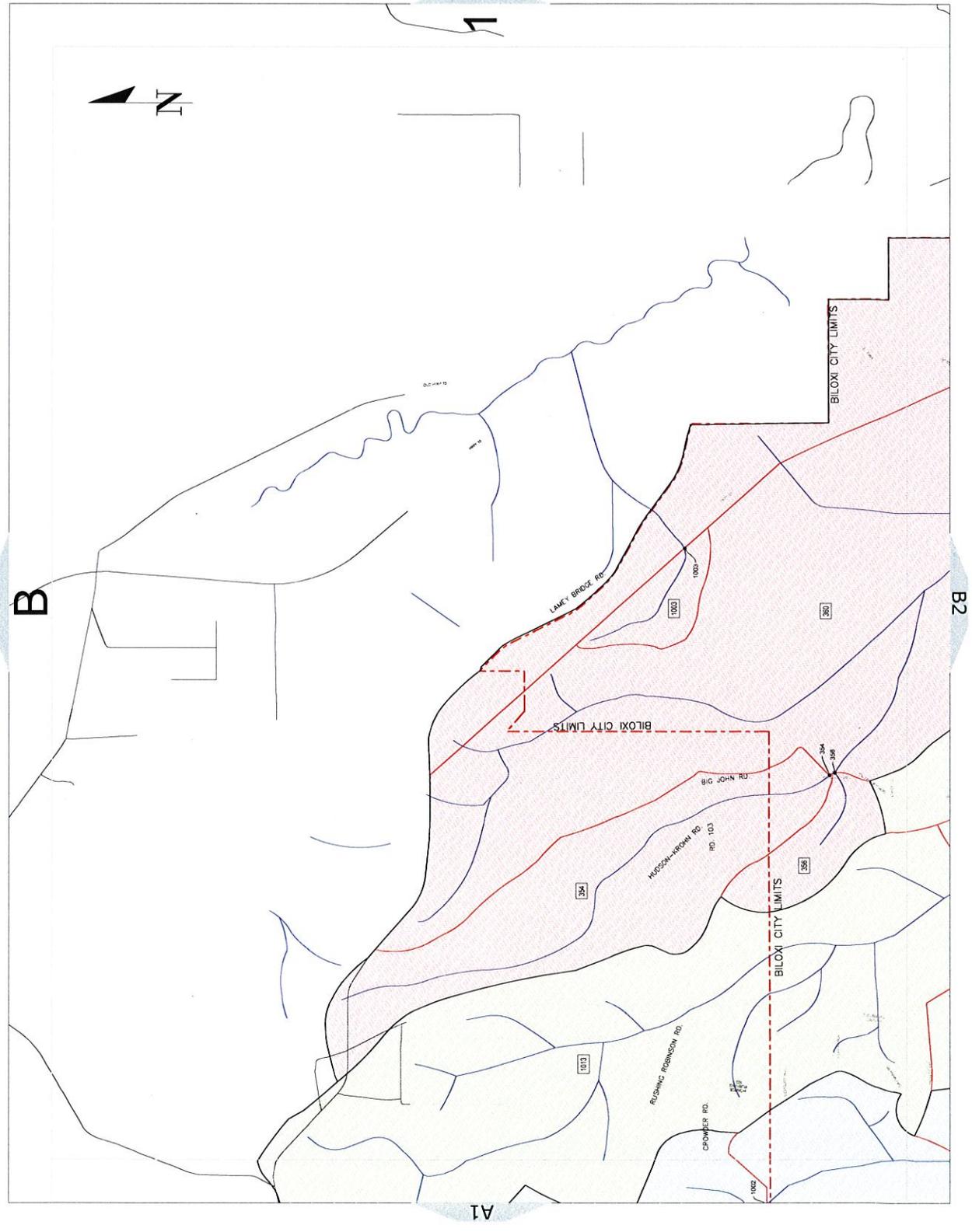
**Biloxi**  
established 1899

**SCALE**  
1" = 1000'

**FIGURE NUMBER**  
5-4

**PLOT DATE**  
6-26-2018

**SHEET FILE**  
DRAINAGE AREAS

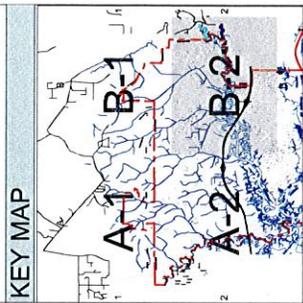


**CONSULTANT TEAM**

**GR** GARNER RUSSELL & ASSOC.  
CONSULTING ENGINEERS

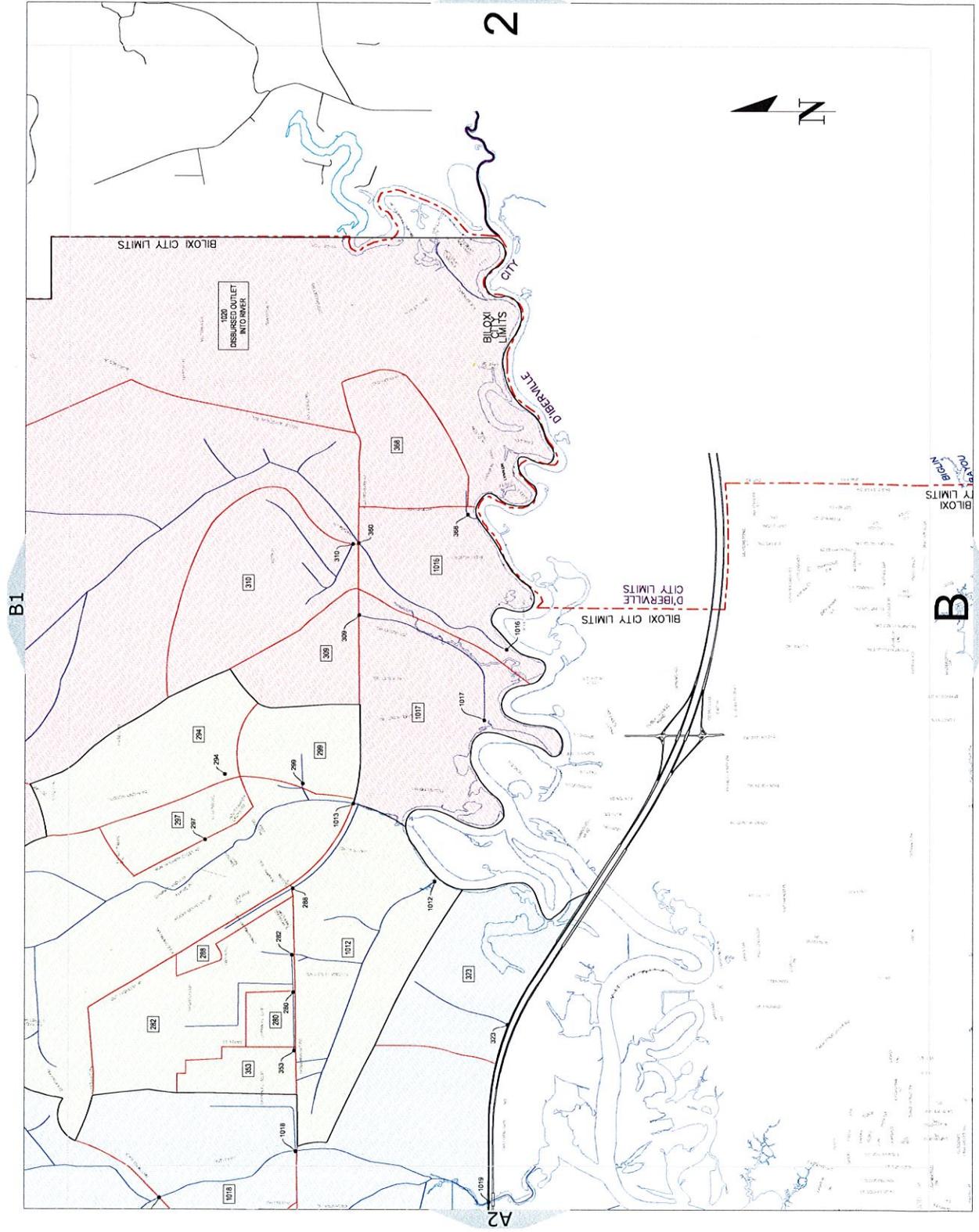
**IN NEEL-SCHAFFER**  
Solutions you can build upon

- LEGEND**
- 1000 BILOXI RIVER BASIN
  - 1000 PARKERS CREEK BASIN
  - 1000 HOWARD CREEK BASIN
  - 1000 TCHOUTACABOUFFA RIVER WEST BASIN
  - 1000 TCHOUTACABOUFFA RIVER EAST BASIN
  - 132 DRAINAGE BASIN
  - 134 ANALYSIS POINT
  - STREAM
  - BASIN BOUNDARY



**Biloxi**  
established 1699

SCALE	FIGURE NUMBER
1" = 1000'	5-5
PLOT DATE	SECTION B-2
6-26-2018	
SHEET FILE	
DRAINAGE AREAS	





**SUMMARY OF DRAINAGE AREA AND ANALYSIS POINT DATA**  
Basin "T82"

Analysis Point #	Analysis			Road Name	Existing Structure
	Acres this area	AP's upstream	Total acres this point		
<b>AREAS DRAINING SOUTH TO TCHOUTACABOUFFA RIVER, WEST OF PARKER'S CREEK:</b>					
2009	6.8	none	6.8	East Shore Vue Drive	18" RCP
2008	9.1	none	9.1	River Vue Drive	24" RCP
2005	7.3	none	7.3	Shady Place	unknown
2002	10.4	none	10.4	Shore Cove	24"
2011	4.5	none	4.5	West River View Drive	13"x22" RCP
2003	45.6	2002, 2011	60.5	Pin Oak Drive	unknown
2004	20.7	none	20.7	Pin Oak Drive	24"
2006	8.4	none	8.4	River Vue Circle	24" RCP
2007	4.8	none	4.8	River Vue Circle	21" RCP
276	94.3	none	94.3	I-10	36" RCP
392	72.0	276	166.3	West Oaklawn Road	18"x28" RCP
390	9.7	none	9.7	West Oaklawn Road	18" RCP
382	15.3	none	15.3	West Oaklawn Road	27"x52" RCP
1023	101.7	382	117.0	Toucatabouffa River	ditch
147	35.3	none	35.3	Lorraine Road	24" RCP
150	141.8	147	177.0	Boyette Drive	36" RCP
46	128.7	150	305.7	Oaklawn Road	5'x9' Conc
156	52.6	none	52.6	Woolmarket Road	42" RCP
180	236.7	none	236.7	Woolmarket Road	4'x6' Conc
125	23.2	none	23.2	Boss Husley Road	36" RCP
1009	374.5	46, 125, 156, 180	992.8	North Oaklawn Road	unknown
499	39.5	1009	1,032.3	I-10	10'x10' Conc
1022	119.5	499	1,151.8	Toucatabouffa River	ditch
458	46.6	none	46.6	I-10	36"x51" RCP
456	31.5	458	78.1	West Oaklawn Road	18" RCP
461	155.8	none	155.8	I-10	5'x8' Conc
457	30.4	461	186.3	West Oaklawn Road	72"x114" CMP
270	37.7	none	37.7	West Oaklawn Road	25"x35" RCP
1021	160.4	270, 456, 457	462.5	none	ditch
268	32.4	none	32.4	West Oaklawn Road	18" CMP







**CALCULATION OF LARGE AREA DISCHARGES,  
per 1991 USGS Discharge Equations**

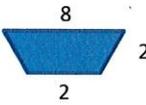
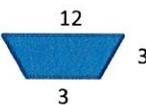
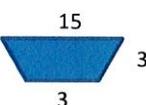
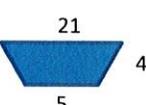
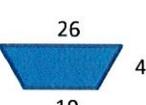
	AREA	AREA	AREA	AREA	AREA
	TR West	Biloxi River	Parkers Creek	Howards Creek	TR East
A (AC)	2,047	4,404	3,017	3,082	4,667
A (SQ MI)	3.20	6.88	4.71	4.82	7.29
High Elev	60	100	110	100	95
Low Elev	10	10	10	10	10
Dist (ft)	11,500	19,000	22,400	24,000	22,200
S (ft/mi)	23.0	25.0	23.6	19.8	20.2
L (ft)	6,402	15,472	26,141	26,142	26,143
L (mi)	1.2	2.9	5.0	5.0	5.0
RQ2	781	1060	640	648	907
RQ5	1260	1771	1060	1068	1513
RQ10	1615	2310	1384	1389	1978
RQ25	2002	2917	1765	1769	2520
RQ100	2572	3819	2335	2336	3328

**MDOT IDF CURVES**  
**RAINFALL INTENSITY (in per hour)**

		STORM FREQUENCY (yrs)					
		2	5	10	25	50	100
DURATION (tc) (min)	5	6.8	7.6	8.3	9.6	10.0	12.2
	6	6.6	7.4	8.1	9.2	9.7	11.6
	7	6.4	7.2	7.8	8.9	9.4	11.1
	8	6.1	6.9	7.6	8.5	9.2	10.5
	9	5.9	6.7	7.3	8.2	8.9	10.0
	10	5.7	6.5	7.1	7.8	8.6	9.4
	11	5.5	6.3	6.9	7.6	8.4	9.2
	12	3.8	4.3	4.9	5.6	6.2	6.8
	13	5.2	6.0	6.6	7.3	8.0	8.7
	14	5.1	5.8	6.4	7.1	7.8	8.5
	15	4.9	5.6	6.2	6.9	7.6	8.3
	16	4.8	5.5	6.1	6.8	7.5	8.2
	17	4.7	5.4	6.0	6.6	7.4	8.0
	18	4.6	5.2	5.8	6.5	7.2	7.9
	19	4.5	5.1	5.7	6.3	7.1	7.7
	20	4.4	5.0	5.6	6.2	7.0	7.6
	22	4.3	4.8	5.4	6.0	6.8	7.4
	24	4.1	4.7	5.2	5.8	6.5	7.2
	26	4.0	4.5	5.1	5.6	6.3	6.9
	28	3.8	4.4	4.9	5.4	6.0	6.7
30	3.7	4.2	4.7	5.2	5.8	6.5	
35	3.5	4.0	4.4	4.9	5.5	6.2	
40	3.3	3.7	4.2	4.7	5.2	5.9	
45	3.1	3.5	3.9	4.4	4.8	5.5	
50	2.9	3.2	3.7	4.2	4.5	5.2	
55	2.7	3.0	3.4	3.9	4.2	4.9	
60	2.6	2.8	3.2	3.6	4.1	4.6	

RAINFALL INTENSITY - DURATION - FREQUENCY CURVES  
 Southern Region - Region III  
 (Figure 7-4F in MDOT Design Manual)

## CALCULATION OF FLOW VELOCITIES IN TYPICAL OPEN DITCHES

Small Roadside Ditch:	1.5:1		<table border="1" style="border-collapse: collapse; width: 100%; text-align: center;"> <tbody> <tr> <td>S (%):</td> <td>0.3%</td> <td>0.5%</td> <td>1.0%</td> <td>1.5%</td> </tr> <tr> <td>V (fps):</td> <td>2.5</td> <td>3.2</td> <td>4.5</td> <td>5.5</td> </tr> <tr> <td>Q (cfs):</td> <td>25</td> <td>32</td> <td>45</td> <td>55</td> </tr> </tbody> </table>	S (%):	0.3%	0.5%	1.0%	1.5%	V (fps):	2.5	3.2	4.5	5.5	Q (cfs):	25	32	45	55
S (%):	0.3%	0.5%	1.0%	1.5%														
V (fps):	2.5	3.2	4.5	5.5														
Q (cfs):	25	32	45	55														
Large Roadside Ditch:	1.5:1		<table border="1" style="border-collapse: collapse; width: 100%; text-align: center;"> <tbody> <tr> <td>S (%):</td> <td>0.3%</td> <td>0.5%</td> <td>1.0%</td> <td>1.5%</td> </tr> <tr> <td>V (fps):</td> <td>3.2</td> <td>4.2</td> <td>5.9</td> <td>7.2</td> </tr> <tr> <td>Q (cfs):</td> <td>72</td> <td>93</td> <td>132</td> <td>162</td> </tr> </tbody> </table>	S (%):	0.3%	0.5%	1.0%	1.5%	V (fps):	3.2	4.2	5.9	7.2	Q (cfs):	72	93	132	162
S (%):	0.3%	0.5%	1.0%	1.5%														
V (fps):	3.2	4.2	5.9	7.2														
Q (cfs):	72	93	132	162														
Small Open Ditch:	2:1		<table border="1" style="border-collapse: collapse; width: 100%; text-align: center;"> <tbody> <tr> <td>S (%):</td> <td>0.3%</td> <td>0.5%</td> <td>1.0%</td> <td>1.5%</td> </tr> <tr> <td>V (fps):</td> <td>3.2</td> <td>4.2</td> <td>5.9</td> <td>7.2</td> </tr> <tr> <td>Q (cfs):</td> <td>87</td> <td>113</td> <td>160</td> <td>196</td> </tr> </tbody> </table>	S (%):	0.3%	0.5%	1.0%	1.5%	V (fps):	3.2	4.2	5.9	7.2	Q (cfs):	87	113	160	196
S (%):	0.3%	0.5%	1.0%	1.5%														
V (fps):	3.2	4.2	5.9	7.2														
Q (cfs):	87	113	160	196														
Medium Open Ditch:	2:1		<table border="1" style="border-collapse: collapse; width: 100%; text-align: center;"> <tbody> <tr> <td>S (%):</td> <td>0.3%</td> <td>0.5%</td> <td>1.0%</td> <td>1.5%</td> </tr> <tr> <td>V (fps):</td> <td>4.0</td> <td>5.7</td> <td>7.4</td> <td>9.0</td> </tr> <tr> <td>Q (cfs):</td> <td>209</td> <td>270</td> <td>381</td> <td>467</td> </tr> </tbody> </table>	S (%):	0.3%	0.5%	1.0%	1.5%	V (fps):	4.0	5.7	7.4	9.0	Q (cfs):	209	270	381	467
S (%):	0.3%	0.5%	1.0%	1.5%														
V (fps):	4.0	5.7	7.4	9.0														
Q (cfs):	209	270	381	467														
Large Open Ditch:	2:1		<table border="1" style="border-collapse: collapse; width: 100%; text-align: center;"> <tbody> <tr> <td>S (%):</td> <td>0.3%</td> <td>0.5%</td> <td>1.0%</td> <td>1.5%</td> </tr> <tr> <td>V (fps):</td> <td>4.4</td> <td>5.6</td> <td>8.0</td> <td>9.8</td> </tr> <tr> <td>Q (cfs):</td> <td>315</td> <td>407</td> <td>575</td> <td>705</td> </tr> </tbody> </table>	S (%):	0.3%	0.5%	1.0%	1.5%	V (fps):	4.4	5.6	8.0	9.8	Q (cfs):	315	407	575	705
S (%):	0.3%	0.5%	1.0%	1.5%														
V (fps):	4.4	5.6	8.0	9.8														
Q (cfs):	315	407	575	705														

(Calculated per Manning Equation, using <http://www.eng.auburn.edu/~xzf0001/Handbook/Channels.html>, n=0.035)



COMPARE EXISTING AND NEEDED PIPE SIZES

SUMMARY OF DRAINAGE AREA AND ANALYSIS POINT DATA  
Basin "TB2"

Analysis Point #	Acres this area	AP's upstream	Total acres this point	Road Name	Existing Structure	Proposed Size		
						5	25	100
<b>AREAS DRAINING SOUTH TO TCHOUTACABOUFFA RIVER, WEST OF PARKER'S CREEK:</b>								
2009	6.8	none	6.8	East Shore Vue Drive	18" RCP	18	18	36
2008	9.1	none	9.1	River Vue Drive	24" RCP	24	24	42
2005	7.3	none	7.3	Shady Place	unknown			
2002	10.4	none	10.4	Shore Cove	24"	24	24	42
2011	4.5	none	4.5	West River View Drive	13"x22" RCP	18	18	36
2003	45.6	2002, 2011	60.5	Pin Oak Drive	unknown			
2004	20.7	none	20.7	Pin Oak Drive	24"	24	24	42
2006	8.4	none	8.4	River Vue Circle	24" RCP	24	24	42
2007	4.8	none	4.8	River Vue Circle	21" RCP	24	24	36
276	94.3	none	94.3	I-10	36" RCP	36	36	54
392	72.0	276	166.3	West Oaklawn Road	18"x28" RCP	24	24	42
390	9.7	none	9.7	West Oaklawn Road	18" RCP	18	18	36
382	15.3	none	15.3	West Oaklawn Road	27"x52" RCP	42	42	60
1023	101.7	382	117.0	Toucatabouffa River	ditch			
147	35.3	none	35.3	Lorraine Road	24" RCP	24	24	42
150	141.8	147	177.0	Boyette Drive	36" RCP	36	36	54
46	128.7	150	305.7	Oaklawn Road	5'x9' Conc			
156	52.6	none	52.6	Woolmarket Road	42" RCP	42	42	60
180	236.7	none	236.7	Woolmarket Road	4'x6' Conc			
125	23.2	none	23.2	Boss Husley Road	36" RCP	36	36	54
1009	374.5	46, 125, 156, 180	992.8	North Oaklawn Road	unknown			
499	39.5	1009	1,032.3	I-10	10'x10' Conc			
1022	119.5	499	1,151.8	Toucatabouffa River	ditch			
458	46.6	none	46.6	I-10	36"x51" RCP	42	42	60
456	31.5	458	78.1	West Oaklawn Road	18" RCP	18	18	36
461	155.8	none	155.8	I-10	5'x8' Conc			
457	30.4	461	186.3	West Oaklawn Road	72"x114" CMP	96	96	120
270	37.7	none	37.7	West Oaklawn Road	25"x35" RCP	30	30	48
1021	160.4	270, 456, 457	462.5	none	ditch			
258	32.4	none	32.4	West Oaklawn Road	18" CMP	18	18	36



COMPARE EXISTING AND NEEDED PIPE SIZES

SUMMARY OF DRAINAGE AREA AND ANALYSIS POINT DATA  
Basin "TB"

Analysis Point #	Analysis Point #			Road Name	Existing Structure	Proposed Size		
	Acres this area	AP's upstream	Total acres this point			5	25	100
AREAS DRAINING TO TCHOUTACABOUFFA RIVER, EAST OF PARKER'S CREEK:								
353	50.7	none	50.7	Woolmarket Road	(3) 30"x51" RCP	42	42	60
280	28.7	none	28.7	Woolmarket Road	(2) 30"x51" RCP	42	42	60
282	215.1	none	215.1	Woolmarket Road	(4) 30"x51" RCP	42	42	60
1012	328.5	280, 282, 353	623.0	Toucatabouffa River	ditch			
288	22.2	none	22.2	Woolmarket Road	34"x54" RCP	48	48	66
323	208.0	none	208.0	I-10	44" RCP	48	48	65
354	559.1	none	559.1	Big John Road	41"x62" rcp	54	54	72
356	107.1	none	107.1	Big John Road	41"x62" rcp	54	54	72
310	244.0	none	244.0	Paradise Lane	30" RCP	30	30	48
360	1,772.9	310, 354, 356	2,683.1	Old Hwy 67	6'x12' Conc			
1016	189.3	360	2,872.3	Toucatabouffa River	ditch			
368	131.0	none	131.0	Hickman Road	72" CMP	72	72	90
1017	290.1	none	290.1	none	disbursed			
1020	1,200.0	none	1,200.0	Toucatabouffa River	ditch			
1003	76.7	none	76.7	New Hwy 67	unknown			



### CHART OF PIPE CAPACITIES AT VARIOUS SLOPES

(per Manning Formula, n=.013)

PIPE SIZE	Pipe Capacity (cfs) @ Slope		
	0.3%	0.5%	1.0%
15	4	5	7
18	6	8	11
21	9	11	16
24	13	16	23
27	17	22	30
30	23	29	41
33	28	38	53
36	37	47	66
42	56	72	100
48	78	100	140
54	110	140	195
60	140	180	260

Q (cfs)	Req'd Pipe Size @ Slope		
	0.3%	0.5%	1.0%
5	18	18	15
8	21	18	18
10	24	21	18
20	30	27	24
30	33	30	27
40	42	36	30
50	42	36	33
60	42	42	36
70	48	42	36
80	48	48	42
90	54	48	42
100	54	48	42
150	60	54	48
200	2-54	60	54
300	3-54	2-54	2-48
400	3-60	2-60	2-54
500	3-60	3-54	2-60

<b>ESTIMATE NO. 1-BR</b>					
<b>PROJECT #</b>	<b>1-BR</b>	<b>PROPOSED WOOLMARKET CONSTRUCTION PROJECT DATA</b>		<b>DATE</b>	
<b>INFRASTRUCTURE TO BE IMPROVED:</b>	<b>SS / SD / W / T</b>			<b>5/1/2018</b>	
<b>PROJECT LOCATION</b>	<b>PROJECT DESCRIPTION</b>	<b>ESTIMATED PROJECT COST</b>			
Biloxi River Basin	Storm Drainage upgrades to the Biloxi River Basin	<b>\$901,170</b>			
<b>OPINION OF PROBABLE COST</b>					
<b>DESCRIPTION</b>	<b>QUANTITY</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>ITEM TOTAL</b>	
15" RCP CULVERT PIPE	-	LS	\$ 30	\$ -	
18" RCP CULVERT PIPE	-	LS	\$ 40	\$ -	
24" RCP CULVERT PIPE	-	LS	\$ 50	\$ -	
36" RCP CULVERT PIPE (OR EQUIV)	-	LS	\$ 75	\$ -	
42" RCP CULVERT PIPE (OR EQUIV)	50	LS	\$ 90	\$ 4,500.00	
48" RCP CULVERT PIPE (OR EQUIV)	-	LS	\$ 110	\$ -	
54" RCP CULVERT PIPE (OR EQUIV)	50	LS	\$ 130	\$ 6,500.00	
60" RCP CULVERT PIPE (OR EQUIV)	-	LS	\$ 175	\$ -	
72" RCP CULVERT PIPE (OR EQUIV)	50	LS	\$ 260	\$ 13,000.00	
6' X 10' DBL BOX CULVERT	-	LS	\$ 1,200	\$ -	
SMALL HEADWALL	-	LS	\$ 1,200	\$ -	
LARGE MULTI-PIPE HEADWALL	-	LS	\$ 2,500	\$ -	
RESTORATION OF EXISTING FACILITIES	150	LS	\$ 100	\$ 15,000.00	
CLEAN ROADSIDE DRAINAGE DITCH	15,000	LS	\$ 10	\$ 150,000.00	
CLEAN OPEN DITCH IN EASEMENT	20,000	LS	\$ 20	\$ 400,000.00	
			<b>SUBTOTAL BID</b>	<b>\$ 589,000.00</b>	
			<b>ENGINEERING</b>	<b>\$ 76,570.00</b>	
			<b>TOTAL BID</b>	<b>\$ 665,570.00</b>	
			<b>CON. CONTINGENCIES</b>	<b>\$ 147,250.00</b>	
			<b>CON. ENGINEERING</b>	<b>\$ 88,350.00</b>	
			<b>ESTIMATED TOTAL</b>	<b>\$ 901,170.00</b>	
			<b>CONSTRUCTION COST</b>	<b>\$ 901,170.00</b>	
<b>DESCRIPTION OF EXISTING CONDITIONS AND PROPOSED CONSTRUCTION</b>					
Existing conditions indicate the storm drain pipes and ditches are not sufficient to accommodate a 100 year storm. This work will increase the storm drain culverts and ditches to accommodate a 100 year storm capacity.					





ESTIMATE NO. 4-LP				
PROJECT #	4-LP	PROPOSED WOOLMARKET CONSTRUCTION PROJECT DATA	DATE	
INFRASTRUCTURE TO BE IMPROVED:	SS / SD / W / T		5/1/2018	
PROJECT LOCATION	Tchoutacabouffa River East	PROJECT DESCRIPTION	ESTIMATED PROJECT COST	
		Storm Drainage upgrades to the Tchoutacabouffa River East Basin	\$730,194	
OPINION OF PROBABLE COST				
DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	ITEM TOTAL
15" RCP CULVERT PIPE	-	LS	\$ 30	\$ -
18" RCP CULVERT PIPE	-	LS	\$ 40	\$ -
24" RCP CULVERT PIPE	-	LS	\$ 50	\$ -
36" RCP CULVERT PIPE (OR EQUIV)	-	LS	\$ 75	\$ -
42" RCP CULVERT PIPE (OR EQUIV)	-	LS	\$ 90	\$ -
48" RCP CULVERT PIPE (OR EQUIV)	150	LS	\$ 110	\$ 16,500.00
54" RCP CULVERT PIPE (OR EQUIV)	-	LS	\$ 130	\$ -
60" RCP CULVERT PIPE (OR EQUIV)	450	LS	\$ 175	\$ 78,750.00
72" RCP CULVERT PIPE (OR EQUIV)	200	LS	\$ 260	\$ 52,000.00
6' X 10' DBL BOX CULVERT	-	LS	\$ 1,200	\$ -
SMALL HEADWALL	-	LS	\$ 1,200	\$ -
LARGE MULTI-PIPE HEADWALL	-	LS	\$ 2,500	\$ -
RESTORATION OF EXISTING FACILITIES	800	LS	\$ 100	\$ 80,000.00
CLEAN ROADSIDE DRAINAGE DITCH	-	LS	\$ 10	\$ -
CLEAN OPEN DITCH IN EASEMENT	12,500	LS	\$ 20	\$ 250,000.00
			SUBTOTAL BID	\$ 477,250.00
			ENGINEERING	\$ 62,043.00
			TOTAL BID	\$ 539,293.00
			CON. CONTINGENCIES	\$ 119,313.00
			CON. ENGINEERING	\$ 71,588.00
			ESTIMATED TOTAL	\$ 730,194.00
			CONSTRUCTION COST	\$ 730,194.00
DESCRIPTION OF EXISTING CONDITIONS AND PROPOSED CONSTRUCTION				
Existing conditions indicate the storm drain pipes and ditches are not sufficient to accommodate a 100 year storm. This work will increase the storm drain culverts and ditches to accommodate a 100 year storm capacity.				



ESTIMATE NO. Summary of Probable Cost					
PROJECT #	Summary	PROPOSED WOOLMARKET CONSTRUCTION PROJECT DATA		DATE	
INFRASTRUCTURE TO BE IMPROVED: SS / SD / W / T				5/1/2018	
PROJECT LOCATION		PROJECT DESCRIPTION		ESTIMATED PROJECT COST	
Woolmarket		Summary of Probable Costs for Storm Drain Projects		\$4,037,676	
OPINION OF PROBABLE COST					
DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	ITEM TOTAL	
1 - Major Basin - Biloxi River	1	LS	\$ 901,170	\$ 901,170.00	
2 - Major Basin - Tchoutacabouffa River West	1	LS	\$ 1,474,539	\$ 1,474,539.00	
3 - Major Basin - Parkers Creek	1	LS	\$ 761,559	\$ 761,559.00	
4 - Major Basin - Tchoutacabouffa River East	1	LS	\$ 730,194	\$ 730,194.00	
5 - Major Basin - Howards Creek	1	LS	\$ 170,214	\$ 170,214.00	
<p>Engineer's opinions of probable Construction Cost provided for herein are to be made on the basis of experience and qualifications and represent Engineer's best judgment as an experienced and qualified professional generally familiar with the construction industry. Since Engineer has no control over the cost of labor, materials, equipment, services furnished by others, Contractor's methods of determining prices, competitive bidding or market conditions, the Engineer cannot and does not guarantee that proposals, bids or actual Construction Cost will not vary from this opinions of probable cost.</p>			<p>EST. SUMMARY TOTAL PROJ. COST \$ 4,037,676.00</p>		
<p><b>DESCRIPTION OF EXISTING CONDITIONS AND PROPOSED CONSTRUCTION</b></p> <p>SUMMARY OF EACH PROJECT'S COST AND TOTAL.</p>					

## SECTION 6 – TRANSPORTATION SYSTEM NEEDS

### 6.1 STREETS AND HIGHWAYS

While Woolmarket occupies more than half the total land area of Biloxi, only about one-quarter of the street and highway mileage in the city, both in terms of routes and roadway capacity, is in the study area (see Table 6-1). Moreover, there are one or two noticeable differences in the distribution of route and lane-mileage by functional class between the Woolmarket area and the city as a whole: The study area has a more fully articulated collector route system but suffers from a comparative lack of local streets to feed the collectors and arterials in the area.

#### 6.1.1 FUNCTIONAL CLASSIFICATION OF ROADWAY

The Federal Highway Administration (FHWA) *Highway Functional Classification: Concepts, Criteria and Procedures* report presents the following representative ranges (in Table 6-1) for the distribution of mileage by functional class:

Interstate	1 to 3 percent
Other Freeways and Expressways	0 to 2 percent
Other Principal Arterials	2 to 6 percent
Minor Arterials	2 to 6 percent
Collectors (Major/Minor)	11 to 34 percent
Local Streets	62 to 74 percent

With respect to these criteria: Interstate highway and other principal arterial mileage in both the study area and the city seem to be well represented. On the other hand, minor arterial mileage is over-represented in the Woolmarket area, and collector mileage is under-represented when looking at all of Biloxi. Local street mileage falls below the low end of the range in Woolmarket and at the high end of the range for the city. Considering this information together with the graphical representation of the Woolmarket streets network (in Figure 6-1) suggests two potential needs in the study area:

- Broader distribution of principal arterial mileage which could possibly be achieved by upgrading existing minor arterials or even collectors to provide greater capacity and mobility.
- Additional local street mileage to facilitate both residential and commercial development where conditions are amenable.

New local streets would presumably be built by developers; expanding the arterial streets network would be the responsibility of local and possibly state government. Arterials in the Woolmarket

area are primarily oriented east and west, while connecting collector roads run mostly north and south.

**Table 6-1:  
WOOLMARKET STUDY AREA STREET AND HIGHWAY MILEAGE BY FUNCTIONAL CLASS**

FUNCTIONAL CLASS	WOOLMARKET STUDY AREA				CITY OF BILOXI				STUDY AREA PCT OF TOTAL MILEAGE	
	Route Miles	Pct of Total	Lane Miles	Pct of Total	Route Miles	Pct of Total	Lane Miles	Pct of Total	Route	Lane
	Interstate Highway	4.20	4.19	25.14	10.99	14.00	3.61	84.07	9.53	30.00
Interstate Ramp	1.27	1.27	1.27	0.56	4.58	1.18	4.67	0.53	27.73	27.19
Principal Arterial	4.99	4.98	19.58	8.56	22.50	5.80	88.51	10.03	22.18	22.12
Minor Arterial	11.61	11.61	22.97	10.04	28.11	7.24	63.28	7.17	41.37	36.30
Collector	18.99	18.96	41.66	18.21	38.64	9.95	81.12	9.19	49.15	51.36
Local Road	59.07	58.99	118.14	51.64	280.39	72.22	560.78	63.55	21.07	21.07
<b>TOTAL</b>	<b>100.15</b>	<b>100.00</b>	<b>224.30</b>	<b>100.00</b>	<b>388.22</b>	<b>100.00</b>	<b>882.43</b>	<b>100.00</b>	<b>25.80</b>	<b>25.92</b>

*Note: Route-mileage corresponds to right-of-way length, so that in the case of interstate highways and other separated or divided roadways, route-mileage is calculated for one direction or the other but not both.*

I-10 traverses the southern portion of the study area, from the Biloxi River on the west to the Tchoutacabouffa River on the east, with an interchange at Shriners Boulevard. The only principal arterial in Woolmarket is a four-mile section of MS 67 at the extreme east end of the study area. Running in a generally north/south direction from the northernmost limit of the city to the Tchoutacabouffa River, MS 67 terminates near the Promenade and Lakeview Village in D'Iberville, connecting there to I-10 and I-110.

Woolmarket is bisected north and south by a minor arterial corridor running seven miles from the Biloxi River on the west to MS 67 on the east. The corridor includes the following routes:

- Lorraine Road from the Biloxi River to an intersection with Woolmarket Road just east of John Lee Road (1.90 miles);
- Woolmarket Road from Lorraine Road to Old Highway 67 (2.94 miles);
- Old Highway 67 from Woolmarket Road to MS 67 (2.29 miles).

In addition to MS 15, which diverges from MS 67 near the midpoint of the latter's Woolmarket stretch, passing to the east into Jackson County, there are also short segments of minor arterials running north and south at the northwestern and southeastern extremes of the study area. A 0.60-mile segment of Highway 605 intersects Three Rivers Road at the northern limit of Biloxi and runs due south from there to the Biloxi River. At the other end of the study area a segment of Old Highway 15 of similar length runs south from Old Highway 67 to the Tchoutacabouffa River.

The numerous collectors in Woolmarket play a vital role in the overall transportation network by providing north-south mobility, access to the few arterial roadways and connectivity among the various parts of the study area. The following roads are classified as collectors:

- *Three Rivers Road* from Highway 605 at the northern limit of Biloxi to the Biloxi River (0.60 mile);
- *John Lee Road* from the northern limit of Biloxi to Woolmarket Road (2.27 miles);
- *Woolmarket Road* from John Lee Road Road to Lorraine Road (.29 mile);
- *Old Woolmarket Road* from the northern limit of Biloxi to John Lee Road (.85 mile);
- *Shorecrest Road* from Lorraine Road to West Oaklawn Road (1.31 miles);
- *West Oaklawn Road* from Shorecrest Road to Shriners Boulevard (2.31 miles);
- *Lorraine Road* from the northern limit of Biloxi to Woolmarket Road (1.64 miles);
- *Shriners Boulevard* from the northern limit of Biloxi to West Oaklawn Road (2.72 miles);
- *Old Highway 67* from the northern limit of Biloxi to Woolmarket Road (1.75 miles);
- *Hudson Krohn Road* from the northern limit of Biloxi to Old Highway 67 (1.84 miles);
- *Cedar Lake Road* from Old Highway 67 to the Tchoutacabouffa River (0.63 mile);
- *Lickskillet Road* from MS 67 to McCully Road (.67mile).

There are also three discontinuous segments of collectors located on the edges of the northeastern and northwestern annexation areas. A 1.39-mile section of Lamey Bridge Road defines one edge of the northeastern annexation area but does not connect to any other roads in the study area. Similarly, a segment of Old Woolmarket Road, measuring 0.82 mile, lies on the western periphery of the northwestern annexation area; and a 0.10-mile portion of Lorraine Road lies along the east side. These abbreviated segments of collectors on the edges of the study area, while representing only a fraction of the overall Woolmarket network, will provide access to major streets for new development within the annexation areas.

Local streets scattered throughout the study area consist predominantly of two types: older rural roads which once served isolated communities now absorbed into the City of Biloxi; and newer streets laid out to serve areas subdivided for residential development. The latter are likely to increase in number in the years ahead as development pushes northward in Biloxi.

### **6.1.2 TRAFFIC**

Historical traffic data collected by MDOT and Gulf Regional Planning Commission (GRPC) were assembled for the 10-year period from 2004 through 2013, the most recent year for which annual average daily traffic (AADT) estimates were available (see Table 6-2). AADT estimates based on actual traffic counts, adjusted by the application of empirically derived factors relating to the time of year, vehicle mix and other variables, are meant to represent the average 24-hour traffic volume at a location over the course of a year. Data collection is generally limited to a single 48 to 72-hour period. In some cases, such as high-volume locations on major highways, traffic is continuously monitored by means of permanently installed data collection devices. There are seven such continuous traffic recorders in Harrison County; however, none are in the Woolmarket area.

Estimated AADT on I-10 east of the Woolmarket (Shriners Boulevard) interchange has been in the range of 65,000-67,000 vehicles per day (vpd) in recent years (2009-2013). As one might expect, these are easily the highest volumes recorded on any roadway in the Woolmarket study area. The only other count locations with AADT more than 10,000 vpd are on MS 67 – one of only two principal arterials in the area – north and south of Old Highway 67 (15,000 north and 17,500 south). Daily traffic on the next most heavily traveled route, Shriners Boulevard – a functionally classified collector – has ranged from 8,600 to 10,000 vehicles just north of the Woolmarket interchange during the 10-year historical survey period.

Rounding out the top five, Cedar Lake Road registered 6,000 vpd in recent years north of its interchange with I-10. Prior to the relocation of MS 67, what is now called *Old Highway 67* carried daily volumes around 10,000-11,000 east of Hudson-Krohn Road. However, the route now carries about half that much traffic, although it's functional classification has been upgraded to principal arterial. That is less than the amount West Oaklawn Road, another collector, carries daily on the south side of the Woolmarket interchange (5,900 vehicles). As Woolmarket continues to develop and the need for higher capacity roadways increases, the collectors experiencing heavy traffic (e.g., Woolmarket Road, Shriners Boulevard and Cedar Lake Road) could be improved and upgraded to minor arterials to better serve the area.

### **6.1.3 CRASH DATA**

For any transportation system, the safety of users is a vital concern. Design criteria, proper maintenance and law enforcement – as well as appropriate signage, signalization and striping – all play a part in making streets, highways and other transportation facilities as safe as possible for travelers, whether they be motorists, passengers, bicyclists or pedestrians. The MDOT Safety

Analysis Management System (SAMS) assembles valuable information regarding the location, type, severity and circumstances involved in vehicular collisions. SAMS crash data for the Woolmarket area, for the three most recent years available (2011-2013), were analyzed to establish a basis for identifying potential transportation safety issues in the study area. There were 217 crashes in the Woolmarket area during the three years examined. Three involved fatalities, and eight resulted in life-threatening injuries (see Table 6-3). A significant majority (nearly 58 percent) involved some degree of injury. Roughly 84 percent of all vehicular collisions occurred on the arterial streets network. All the crashes resulting in death or life-threatening injury occurred on arterial roadways – all but one on numbered (i.e., state-maintained) routes: Interstate 10, MS 67, MS 15 or Highway 605. The exception was a fatal accident on Woolmarket Road near Marvin Street.

**Table 6-2:  
WOOLMARKET AREA ESTIMATED ANNUAL AVERAGE DAILY TRAFFIC VOLUME (2004-2013)**

ROUTE	LOCATION	YEAR										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Interstate 10	E of Shriners Blvd	54,000	54,000	86,000	73,000	60,000	65,000	66,000	67,000	67,000	67,000	
MS Hwy 67/15	N Of Old Hwy 67	NA	NA	NA	NA	7,600	7,400	7,500	15,000	15,000	15,000	
MS Hwy 67/15	S of Old Hwy 67	10,000	10,000	12,000	12,000	12,000	11,000	16,000	17,500	17,500	17,500	
Old Hwy 67	N of Woolmarket Rd	4,200	4,200	4,400	4,400	4,400	3,500	1,900	1,300	1,300	1,300	
Old Hwy 67	E of Hudson Krohn Rd	8,300	8,300	11,000	10,000	9,900	10,000	10,000	10,000	5,600	5,600	
Old Hwy 67	W of MS Hwy 67/15	NA	NA	NA	NA	5,400	5,300	5,400	5,600	5,600	5,600	
Lorraine Rd	N of Woolmarket Rd	NA	NA	NA	3,000	3,000	2,900	3,000	3,100	3,100	3,100	
Lorraine Rd	S of Woolmarket Rd	4,500	4,500	3,600	3,600	3,500	3,400	3,800	3,800	3,800	4,000	
Woolmarket Rd	W of Lorraine Rd	NA	2,500	2,500								
Woolmarket Rd	E of Lorraine Rd	4,100	4,100	5,900	5,900	5,800	5,000	5,100	5,100	5,200	5,200	
Woolmarket Rd	E of Shriners Blvd	3,700	3,700	3,700	3,900	3,800	3,700	3,900	3,900	4,100	4,100	
Shriners Blvd	N of Woolmarket Rd	4,000	4,000	8,200	7,700	7,900	7,700	7,800	3,900	3,900	3,900	
Shriners Blvd	N of I-10	9,800	9,800	9,800	9,800	9,500	8,600	8,800	10,000	10,000	9,800	
Hudson Krohn Rd	N of Old Hwy 67	3,600	3,600	4,600	4,800	4,800	4,700	4,800	1,300	1,300	1,300	
Cedar Lake Rd	N of I-10	4,800	5,100	5,100	5,100	5,000	4,900	6,800	6,000	6,000	6,000	
Three Rivers Rd	W of Hwy 605	NA	NA	NA	NA	1,700	1,700	1,700	3,400	3,400	3,400	
Shorecrest Rd	S of Lorraine Rd	1,500	2,300	2,300	2,300	2,200	2,200	2,200	2,200	1,200	1,200	
W Oaklawn Rd	S of Interstate 10	3,800	3,800	5,300	4,600	5,300	5,900	6,000	5,900	5,900	5,900	

NA -Not Available

Source: Gulf Regional Planning Commission

Table 6-3:

WOOLMARKET CRASHES BY ROUTE, SEVERITY AND ALCOHOL INVOLVEMENT: 2011-2013

ROUTE	FUNCTIONAL CLASS	SEVERITY OF CRASH				PDO (1)	TOTAL	PCT OF GRAND TOTAL	ALCOHOL INVOLVEMENT
		Fatal	Life Threat	Major Injury	Minor Injury				
Interstate 10		0	3	8	28	33	72	33.2	4
MS Hwy 67	Principal Arterial	2	3	1	11	20	37	17.1	4
MS Hwy 15	Minor Arterial	0	2	3	10	5	20	9.2	4
Hwy 605	Minor Arterial	0	0	1	0	0	1	0.5	0
Woolmarket Rd	Minor Arterial	1	0	5	7	5	18	8.3	2
Old Hwy 67	Minor Arterial (2)	0	0	2	10	5	17	7.8	4
Lorraine Rd	Minor Arterial (2)	0	0	4	2	8	14	6.5	3
Old Hwy 15	Minor Arterial	0	0	0	1	2	3	1.4	0
<i>Arterial Network Subtotal</i>		3	8	24	69	78	182	83.9	21
<i>Arterial Network Percent of Total</i>		100.0	100.0	66.7	88.5	84.8	83.9	--	80.8
Shriners Blvd	Collector	0	0	0	6	2	8	3.7	0
John Lee Rd	Collector	0	0	2	0	1	3	1.4	0
Shorecrest Rd	Collector	0	0	1	0	2	3	1.4	0
W Oaklawn Rd	Collector	0	0	1	0	2	3	1.4	0
Cedar Lake Rd	Collector	0	0	0	0	2	2	0.9	0
E Oaklawn Rd	Collector	0	0	0	0	1	1	0.5	0
Hudson Krohn Rd	Collector	0	0	1	0	1	2	0.9	1
Licksillet Rd	Collector	0	0	0	1	0	1	0.5	1
Three Rivers Rd	Collector	0	0	1	0	0	1	0.5	0
<i>Collector Subtotal</i>		0	0	6	7	11	24	11.1	2
<i>Collector Percent of Total</i>		0.0	0.0	16.7	9.0	12.0	11.1	--	7.7
Hickman Rd	Local Street	0	0	1	1	0	2	0.9	1
Wash Fayard Rd	Local Street	0	0	2	0	0	2	0.9	1
Jim Byrd Rd	Local Street	0	0	2	1	0	3	1.4	1
North Bend Dr	Local Street	0	0	1	0	0	1	0.5	0
River Estates Cir	Local Street	0	0	0	0	1	1	0.5	0
Paradise Lane	Local Street	0	0	0	0	1	1	0.5	0
Shortcut Rd	Local Street	0	0	0	0	1	1	0.5	0
<i>Local Street Subtotal</i>		0	0	6	2	3	11	5.1	3
<i>Local Street Percent of Total</i>		0.0	0.0	16.7	2.6	3.3	5.1	--	11.5
TOTAL		3	8	36	78	92	217	--	26
PCT OF TOTAL		1.38	3.69	16.59	35.94	42.4	100.0	--	12.0

(1) Property Damage Only. (2) Collector north of Woolmarket Road.

Source: Mississippi Department of Transportation, Safety Analysis Management System.

The balance of 35 accidents on city-owned thoroughfares was scattered among 16 different collectors and local streets. Eight was by far the largest number on any single road. That road was Shriners Boulevard, a collector that may be under-classified; since it interchanges with Interstate 10, carries approximately 10,000 vpd between I-10 and Woolmarket Road and serves as the principal north-south route spanning the central section of the study area. The intersection of Shriners Boulevard with the east-west corridor at Woolmarket Road effectively represents the central node of the study area transportation network.

One-third of all vehicular accidents happened on I-10; and over half occurred on Woolmarket Road, MS 67, Old Highway 67, Shriners Boulevard, Lorraine Road or MS 15. The balance – less than 15 percent of all collisions – was spread among 17 different roadways in the study area. Alcohol was a factor in 12 percent of all Woolmarket area accidents during the analysis period. Based on the analysis, safety-related improvements in the Woolmarket area need to be focused on the east-west corridor that includes all Woolmarket Road and connecting segments of Lorraine Road, Old Highway 67 and Old Highway 15. As already noted, this corridor accounts for most of the accidents on city streets in the study area. Moreover, of 52 accidents involving injury, 32 (61.6 percent) occurred in this corridor.

#### **6.1.4 ROADWAY CAPACITY**

An analysis of peak-hour traffic, based on the 2013 AADT estimates previously presented in Table 6-2, indicated all major roadways in the Woolmarket study area currently have sufficient capacity to meet existing travel demand, with one possible exception: Shriners Boulevard north of I-10. The 2013 AADT estimates were updated to 2016 by applying an annual growth factor of 1.23 percent consistent with the factor previously applied to population. As the analysis sought to focus on peak-hour conditions, an hourly directional capacity was determined for each of the major roadways for which an AADT estimate was available.

The analysis assumed a roadway capacity of 2,000 vehicles per lane per hour for interstate highways; 1,600 for principal arterials, 750 for minor arterials; and 550 for collectors. Peak-hour volumes for both directions were assumed to be 10 percent of estimated AADT volumes, based on data collected by MDOT at seven continuous traffic recorder (CTR) sites in Harrison County. The further assumption was made that 56 percent of peak-hour traffic would be headed in the peak travel direction, and 44 percent would be traveling in the other direction. Again, this was based on MDOT CTR data for monitored roadways in Harrison County published by the Planning Division in 2016 (*Mississippi Public Roads: Selected Statistics*).

The resulting peak-hour volume and capacity figures for the base year of 2016 were used to calculate volume-to-capacity ratios which could be used both as measures of utilization and indicators of roadway capacity sufficiency (or insufficiency). The results indicated that 15 of the 18 roadway segments analyzed currently have significant levels of excess capacity (see Table 6-4). Only three roadway segments have utilization levels more than 50 percent as measured by

volume capacity (V/C): West Oaklawn Road south of I-10 (63 percent); Interstate 10 east of Shriners Boulevard (65 percent); and Shriners Boulevard north of I-10 (104 percent). All three of these roadway segments are in the immediate vicinity of the Woolmarket interchange. As the volume of traffic on Shriners Boulevard is already at capacity in the peak travel hours there is clearly a need to consider possible means of meeting the shortfall that already exists, especially as the analysis suggests it will likely grow steadily worse in the years ahead.

**Table 6-4:  
WOOLMARKET STUDY AREA EXISTING AND PROJECTED ROADWAY CAPACITY  
SUFFICIENCY**

ROUTE	FUNC CLASS	LOCATION	LANES	2016 AADT	HRLY CAP	2016 EST		2040 PROJECT	
						PHV	V/C	PHV	V/C
Interstate 10	IH	E of Shriners Blvd	3	69,500	6,000	3,890	0.65	5,215	0.87
MS Hwy 67/15	PA	N Of Old Hwy 67	2	15,560	3,200	870	0.27	1,165	0.36
MS Hwy 67/15	PA	S of Old Hwy 67	2	18,155	3,200	1,015	0.32	1,360	0.42
Old Hwy 67	MA	E of Hudson Krohn	1	5,810	750	325	0.43	435	0.58
Old Hwy 67	MA	W of MS Hwy							
Old Hwy 67	MA	67/15	1	5,810	750	325	0.43	435	0.58
Old Hwy 67	COLL	N of Woolmarket	1	1,350	550	75	0.14	100	0.18
Lorraine Rd	MA	S of Woolmarket	1	4,150	750	230	0.31	310	0.41
Lorraine Rd	COLL	N of Woolmarket	1	3,215	550	180	0.33	240	0.44
Woolmarket Rd	MA	E of Lorraine Rd	1	5,395	750	300	0.40	400	0.53
Woolmarket Rd	MA	E of Shriners Blvd	1	4,255	750	240	0.32	320	0.43
Woolmarket Rd	COLL	W of Lorraine Rd	1	2,595	550	145	0.26	195	0.35
Cedar Lake Rd	MA	N of I-10	1	6,225	750	350	0.47	470	0.63
Shriners Blvd	COLL	N of Woolmarket	1	4,045	550	225	0.41	300	0.55
Shriners Blvd	COLL	N of I-10	1	10,165	550	570	1.04	765	1.39
Hudson Krohn	COLL	N of Old Hwy 67	1	1,350	550	75	0.14	100	0.18
Three Rivers Rd	COLL	W of Hwy 605	1	3,525	550	195	0.36	260	0.47
Shorecrest Rd	COLL	S of Lorraine Rd	1	1,245	550	70	0.13	95	0.17
W Oaklawn Rd	COLL	S of Interstate 10	1	6,120	550	345	0.63	460	0.84

**Notes:**

- (1) Functional classes include Interstate Highway (IH), Principal Arterial (PA), Minor Arterial (MA) and Collector (COLL).
- (2) LANES present the number of lanes available for travel in the higher-volume (peak) travel direction.
- (3) 2016 AADT is annual average daily traffic for 2013 updated to the base year, assuming a 1.23 percent annual increase consistent with projected population growth in the study area (refer to Table 2-1).
- (4) Hourly capacity (HRLY CAP) is the theoretical number of vehicles that can pass a given point on a roadway within one hour, based on functional class and number of lanes; in this context, for travel in the peak direction only.
- (5) Peak-hour volume (PHV) represents the number of vehicles traveling in the peak travel direction during the hour with the highest volume of traffic. Two assumptions were made based on continuous traffic recorder data collected by the Mississippi Department of Transportation in Harrison County: (1) The average peak-hour volume for travel in both directions is 10 percent of total daily traffic; and (2) the average directional split during the peak hour is 56 percent in the higher-volume.
- (6) Volume/capacity (V/C) is a measure of the utilization of roadway capacity, used here as an indicator of its sufficiency.

Source: Gulf Regional Planning Commission for 2013 annual average daily traffic (AADT) estimates; Mississippi Department of Transportation Planning Division, MS Public Roads: Selected Statistics (2016), for continuous traffic recorder data.

To identify potential future capacity deficiencies, peak-hour traffic for each of the 18 count locations was projected to the year 2040 by applying the growth factor of 1.23 percent per annum. The resulting traffic projections were compared to existing roadway capacity to identify where deficiencies might occur in the future. The Shriners Boulevard segment was again the only location with V/C exceeding 1.00, the value corresponding to theoretical capacity. The projected V/C of 1.39 suggested this roadway segment is likely to pose a significant bottleneck in the future if the lack of capacity is not addressed.

The other locations with elevated base-year congestion measures, I-10 east of the Woolmarket interchange and West Oaklawn Road south of the interchange, had projected V/C of 0.87 and 0.84 respectively. That indicates that the operational levels of service experienced by motorists traveling on these roads and others in the same vicinity are likely to decline steadily over the next 25 years in the absence of improvements. Other roads with projected utilization exceeding 50 percent in 2040 include Old Highway 67 (58 percent), Woolmarket Road (53 percent), Cedar Lake Road (63 percent) and Shriners Boulevard north of Woolmarket Road (55 percent).

#### **6.1.5 CONCLUSIONS AND RECOMMENDATIONS**

While the 2040 Metropolitan Transportation Plan listed no proposed improvements in Woolmarket to be made during the long-range planning period ending in 2040, the Biloxi Comprehensive Plan identified four recommended roadway improvements in the study area. One of them, realignment of the Lorraine Road bridge across the Biloxi River, has already been accomplished. The other three were the following:

- Extension of Woolmarket Road westward to connect with O'Neal Road in Gulfport.
- Improvements to Shorecrest Road to include extension northward to intersect with the westward extension of Woolmarket Road.
- Construction of a new I-10 interchange at Shorecrest Road.

The Woolmarket extension, new I-10 interchange and improvements to existing Shorecrest Road (not including the northward extension) also appeared in the Harrison County Comprehensive Plan. These and other potential improvements were evaluated based on the considerations relating to functional classification, safety and roadway capacity. The resulting program includes the following recommended projects (see Figure 6-2):

- Reconstruction of Old Highway 67 from Woolmarket Road to MS 67 to include a continuous center turn lane, four-foot shoulders, a five-foot sidewalk on one side of the road and a 10-foot multi-use path on the other.
- Reconstruction of Woolmarket Road from John Lee Road to Old Highway 67 to include a continuous center turn lane, four-foot shoulders, a five-foot sidewalk on one side of the road and a 10-foot-multi-use path on the other.

- Reconstruction of Shriners Boulevard from Woolmarket Road to West Oaklawn Drive as a four-lane divided arterial with four-foot shoulders marked as designated bicycle lanes and five-foot sidewalks.
- Reconstruction of Shriners Boulevard from the northern city limit to Woolmarket Road as a four-lane divided arterial with four-foot shoulders marked as designated bicycle lanes and five-foot sidewalks.
- Widening of Cedar Lake Road from Old Highway 67 to the Tchoutacabouffa River bridge, to provide four-foot shoulders on both sides of the road, a five-foot sidewalk on one side and a 10-foot multi-use path on the other; and elevating a section of roadway subject to flooding, entailing approximately four-tenths of one mile immediately north of the river.
- Widening of Hudson Krohn Road from the northern city limit to Old Highway 67 to provide four-foot shoulders marked as designated bicycle lanes.
- Widening of Shorecrest Road from Lorraine Road to West Oaklawn Road to provide four-foot shoulders marked as designated bicycle lanes.
- Widening of West Oaklawn Road from Shorecrest Road to Shriners Boulevard to provide four-foot shoulders marked as designated bicycle lanes.
- Widening of Old Highway 67 from the northern city limit to Woolmarket Road to provide four-foot shoulders marked as designated bicycle lanes.
- Widening of Lorraine Road from the northern city limit to Woolmarket Road to provide four-foot shoulders on both sides marked as designated bicycle lanes.
- Widening of Lorraine Road from Woolmarket Road to the Biloxi River to provide four-foot shoulders marked as designated bicycle lanes.
- Construction of a separated bicycle path parallel and adjacent to MS 67 from MS 15 to the Tchoutacabouffa River.
- Construction of a roundabout to facilitate the flow of traffic through the intersection of Shriners Boulevard and Woolmarket Road.
- Construction of a new collector road bisecting the northwestern annexation area between Lorraine Road and Old Woolmarket Road; connecting local roads in the area to the major streets network; and making residential or other development possible by providing access to the newly annexed area.

- Construction of a new four-lane divided bridge over the Tchoutacabouffa River with vertical clearance of 40 feet, connecting on the north to Shriners Boulevard, and on the south to a new road intersecting with Popp's Ferry Road at Riverview Drive.

## **6.2 BICYCLE AND PEDESTRIAN FACILITIES**

One indicator of the semi-rural character which still prevails in the study area is the almost total lack of bicycle and pedestrian facilities along major roads in Woolmarket. The transition to a more urban environment in the post-annexation period will require greater attention to the non-motorized travel needs of people living or working in the area. By its inclusion in the City of Biloxi, Woolmarket will enjoy greater access to Surface Transportation Program (STP) funds allocated annually to the Gulfport-Biloxi Urbanized Area by the U. S. Department of Transportation. STP funds are programmed in the Transportation Improvement Program (TIP) adopted periodically by the Transportation Policy Committee (TPC), the decision-making body for the Mississippi Gulf Coast Metropolitan Planning Organization (MPO). The TPC has committed 10 percent of the annual STP allotment for the implementation of bicycle, pedestrian and transit projects.

In 2015 the TPC adopted a Complete Streets Policy which seeks to ensure that every new or improved roadway constructed in the area will accommodate non-motorized traffic in an appropriate way. The policy requires that all federally funded projects in the urban planning area be made suitable for bicycles and pedestrians unless there are unavoidable and insurmountable obstacles to doing so. Local planning agencies must consider a variety of factors, including traffic volume, speed and surrounding land use, in determining the best way to accommodate the use of a new or improved road by bicyclists and pedestrians. When plans are developed to build new roads or to improve existing roads in the Woolmarket area, there will have to be sufficient right-of-way and funding to meet the requirements of the Complete Streets Policy. Sidewalks, crosswalks, bicycle lanes and multi-use paths are among the features that will need to be considered in deciding how best to meet the needs of those traveling on foot or by bicycle.

### **6.2.1 BICYCLE SUITABILITY**

The MPO Complete Streets Policy provides a *bicycle facility guidance matrix* for use in determining what type of bicycle facilities are suitable for inclusion in a roadway given the anticipated volume of traffic and the maximum allowable posted speed. The Policy adopted by the TPC identifies five types of bicycle amenities:

- An 8 to 10-foot multi-use path located on one side of the roadway capable of accommodating two-way bicycle traffic as well as pedestrians;

- Shoulders at least three feet wide on each side of the road where the paved surface is lined by curbing on both sides;
- Shoulders at least four feet wide on each side of the road where the paved surface is not lined by curbing;
- Bicycle lanes at least five feet wide on each side of the road;
- Shared-lane usage of regular travel lanes, clearly indicated by pavement markings and signage, where joint use of the roadway can be safely accommodated.

In addition, three types of pedestrian improvements were identified for inclusion in proposed new roadway or roadway reconstruction projects: A continuous sidewalk, five feet wide, on both sides of the road; a continuous sidewalk, five feet wide, on one side of the road; or, where a multi-use path is to be provided on one side of the road, a continuous five-foot sidewalk on the other.

The Bicycle Facility Guidance Matrix included in the Policy document employs two variables, the average daily traffic on a road and the posted speed limit, to determine the kind of facility that would be suitable for a new or reconstructed road (see Page 6-15). The criteria established by the matrix may be summarized in the following terms:

- *Shared Path* – Suitable where annual average daily traffic (AADT) is 1,000 or less vehicles per day (vpd) and the posted speed limit is not higher than 45 miles per hour (mph); *or* when daily traffic is 3,000 vpd or less and the speed limit does not exceed 30 mph.
- *Paved Shoulder or Bike Lane* – This category lumps together two facilities that are very much alike in terms of how they operate, which is to say, on designated pavement clearly marked for bicycle use located immediately adjacent to the vehicular travel lanes. The matrix assumes equal conditions of suitability for both: Annual average daily traffic of no more than 3,000 vpd when posted speed limit is 35-45 mph; AADT between 3,000 and 15,000 when the posted speed is 15-45 mph; AADT between 16,000 and 18,000 when posted speed does not exceed 30 mph.
- *Separated Path* – Warranted when AADT is 16,000-18,000 vpd, and the posted speed limit is 35-45 mph.

The matrix is silent regarding the suitability of roads with average daily traffic volumes greater than 18,000 vpd or speed limits exceeding 45 mph. One might infer that such roads are *prima facie* unsuitable for bicycle facilities. However, the only road in Woolmarket with clearly marked bicycle lanes, Highway 605, is a major highway with a posted speed limit of 65 mph.

To get some idea of the suitability of existing major roads in the Woolmarket study area for bicycle use, the traffic and speed associated with each roadway segment, as well as the physical characteristics of each facility, were compared with the criteria presented in the Complete Streets matrix (see Figure 6-4). The overwhelming majority of major road route-mileage fell in the Paved Shoulder/Bicycle Lane category. Shared-use mileage is limited to low-volume, low-speed two-lane roads located in the northwestern and southeastern sections of the study area. These include John Lee Road, Old Woolmarket Road and Wash Fayard Road in the northwest, all of which have 30 mile-per-hour (mph) speed limits and low-volume traffic; and Lickskillet Road at the southeast end of the study area with a speed limit of 35 mph and estimated traffic of less than 1,000 vpd. At the other end of the scale Mississippi Highway 67 (MS 67), proceeding south from Mississippi Highway 15 (MS 15) to the bridge at the Tchoutacabouffa River, merits a separated bicycle path due to the high volume of traffic and high operating speed on this road that connects to Interstate 110 (I-110) at the I-10 interchange.

The remaining 22 roadway segments all fall in the Paved Shoulder/Bicycle Lane category (see Table 6-5). However, only one of these—the short segment of Highway 605 that crosses the northwestern corner of the study area—has continuous paved shoulders suitable for use by bicyclists with pavement markings indicating their reservation for such use. Apart from MS 67 already mentioned, and the short section of MS 15 diverging from MS 67 to the east and proceeding out of the study area, there are no other roads in Woolmarket with sufficient paved surface to accommodate bicycles except on a shared-lane basis.

**MISSISSIPPI GULF COAST MPO COMPLETE STREETS POLICY**

Annual Average Daily Traffic	BICYCLE FACILITY GUIDANCE MATRIX							
	15	20	25	30	35	40	45	
18000								
17000								
16000								
15000								
14000								
13000								
12000								
11000								
10000								
9000								
8000								
7000								
6000								
5000								
4000								
3000								
2000								
1000								
	15	20	25	30	35	40	45	
	<b>Posted Speed (Miles per Hour)</b>							



Source: Mississippi Gulf Coast Metropolitan Planning Organization Complete Streets Policy.

**Table 6-5:  
WOOLMARKET MAJOR ROADWAY SUITABILITY FOR BICYCLE USE**

NO	ROUTE	LOCATION	ROW (FT)	LANES	EST AADT	SHOULDER		POST SPEED (MPH)	BICYCLE SUITABILITY CATEGORY
						IN (FT)	OUT (FT)		
1	I-10	W of Shriners Blvd	400+	6	69000	10	14	70	Not suitable
2	I-10	E of Shriners Blvd	380+	6	67000	10	14	70	Not suitable
3	MS 67	S of Old Hwy 67	300+	4	17500	4	8	55	Separated path
4	MS 67	N of Old Hwy 67	250+	4	17000	4	8	65	Separated path
5	MS 67	N of MS 15	280+	4	11100	4	8	65	Shoulder/Lane
6	Woolmarket Rd	W of Shriners Blvd	80	2	5300	0	0	35	Shoulder/Lane
7	Woolmarket Rd	E of Shriners Blvd	80	2	4000	0	0	35	Shoulder/Lane
8	Old Hwy 67	S of Woolmarket Rd	100	2	5300	0	0	45	Shoulder/Lane
9	Old Hwy 67	E of Hudson Krohn Rd	100+	2	5200	0	0	45	Shoulder/Lane
10	Old Hwy 67	W of MS 67	160	2	3000	0	0	45	Shoulder/Lane
11	Old Hwy 15	S of Old Hwy 67	100+	2	3400	0	0	45	Shoulder/Lane
12	MS 15	E of MS 67	260+	4	6400	4	8	55	Shoulder/Lane
13	Lorraine Rd	S of Shorecrest Rd	50	2	3700	0	0	35	Shoulder/Lane
14	Lorraine Rd	N of Shorecrest Rd	50	2	4000	0	0	35	Shoulder/Lane
15	Woolmarket Rd	W of Lorraine Rd	50	2	2400	0	0	35	Shoulder/Lane
16	Licksillet Rd	E of MS 67	40+	2	970	0	0	35	Shared Use
17	Hudson Krohn Rd	N of Old Hwy 67	60	2	3300	0	0	35	Shoulder/Lane
18	Cedar Lake Rd	S of Old Hwy 67	60	2	3300	0	0	35	Shoulder/Lane
19	Old Hwy 67	N of Woolmarket Rd	60	2	1300	0	0	45	Shoulder/Lane
20	Shriners Blvd	N of Woolmarket Rd	150	2	3900	0	0	55	Shoulder/Lane
21	Shriners Blvd	S of Woolmarket Rd	150	2	9800	0	0	55	Shoulder/Lane
22	Shriners Blvd	S of I-10 Interchange	125	3	5900	0	0	45	Shoulder/Lane
23	West Oaklawn Rd	W of Shriners Blvd	50	2	1300	0	0	35	Shoulder/Lane
24	Shorecrest Rd	S of Lorraine Rd	50	2	1200	0	0	35	Shoulder/Lane
25	Lorraine Rd	N of Woolmarket Rd	60	2	3100	0	0	35	Shoulder/Lane
26	John Lee Rd	N of Old Woolmarket	60	2	1000	0	0	30	Shared Use
27	Old Woolmarket	N of John Lee Rd	60	2	1000	0	0	30	Shared Use
28	Old Woolmarket	S of John Lee Rd	60	2	1000	0	0	30	Shared Use
29	John Lee Rd	S of Old Woolmarket Rd	60	2	1000	0	0	30	Shared Use
30	Wash Fayard Rd	N of Woolmarket Rd	60	2	1000	0	0	30	Shared Use
31	Hwy 605	N of Biloxi River	240+	4	10000	4	8	65	Shoulder/Lane
32	Three Rivers Rd	N of Biloxi River	80+	2	3400	0	0	40	Shoulder/Lane

Source: Neel-Schaffer, Inc.

## 6.2.2 PREVIOUS PLANS AND STUDIES

Previous studies, plans and policy documents that addressed the need for bicycle and pedestrian facilities were examined to evaluate the recommendations they produced. Additional attention was given to the following:

- *City of Biloxi Comprehensive Plan* – The City of Biloxi’s post-Katrina Comprehensive Plan, adopted in December of 2009, states as its primary

transportation goal, “Provide a multimodal, interconnected network that provides choices for people to move safely inside and outside Biloxi via vehicular, transit, bicycle, pedestrian, air, and waterborne transportation.” The third objective listed under that primary goal calls for the city to, “Provide a multimodal street network that accommodates vehicular, transit, pedestrian, and bicycle travel.” And the accompanying action item reads, “Develop a ‘Complete Streets’ policy and design standards to accommodate pedestrians, bicyclists, and transit service in roadway and intersection improvement projects.”

- “Mississippi Gulf Coast Metropolitan Planning Organization’s Complete Streets Policy” – Adopted in September of 2015 by the TPC, consisting of the heads of government for the three counties and 13 municipalities within the MPO planning area, this document has as its stated purpose, “Designing and building roads that meet the needs of all road users, including pedestrians, bicyclists, users of mass transit, people with disabilities, older adults and young children, motorists, freight providers, emergency responders, and adjacent land users.” In addition to its “Bicycle Sustainability Guidance Matrix” the policy document includes 11 typical sections providing suggested alternatives for meeting the needs of pedestrians and bicyclists as well as motorists.
- *Plan for Opportunity: Mississippi Gulf Coast Transportation Assessment* - This document was produced under the direction of a Transportation Subcommittee, representing a consortium of city, county and state transportation, planning and development, and environmental agencies, as well as public advocacy groups and transportation providers. The *Plan for Opportunity* initiative was supported by a grant from the U. S. Department of Housing and Urban Development (HUD) and grew out of the Partnership for Sustainable Communities jointly launched by HUD, the U. S. Environmental Protection Agency (EPA) and U. S. Department of Transportation (DOT) in 2010.
- *2030 Harrison County Comprehensive Plan* – The post-Katrina county comprehensive plan completed in 2008, endorses the Complete Streets concept in the following terms: “By providing complete streets, citizens [sic] have more choices in travel options. The citizens of Harrison County have repeatedly requested more sidewalks and cycling options. By utilizing a complete streets policy, citizens’ access [sic] to multiple modes of transportation would increase. The promotion and development of complete streets could significantly benefit citizens by providing a safer travel environment and encouraging more active and healthy lifestyles.”

- *Mississippi Gulf Coast Metropolitan Planning Organization 2040 Metropolitan Transportation Plan* – Adopted in December of 2015 by the TPC, the current long-range transportation plan for the Mississippi Gulf Coast area (Hancock, Harrison and Jackson counties) provide an overview of existing transportation facilities and needs, including those for non-motorized travel on foot or bicycle. Projected future funding for bicycle and pedestrian needs is identified in the document as are proposed projects for implementation over the next 20-plus years.
- *Mississippi Gulf Coast Area Transportation Study: 2035 Long-Range Transportation Plan* - The previous long-range plan for the area included a chapter dedicated to bicycle and pedestrian facilities, outlining goals and objectives and specifying recommended improvements for implementation in each county.

The *City of Biloxi Comprehensive Plan* noted (in 2009) that pedestrian facilities along Beach Boulevard (US 90) were in the process of being reconstructed after being destroyed by Hurricane Katrina in August of 2005. The pedestrian and bicycle path on the new bridge across the Bay of Biloxi was enjoying heavy usage – as it has ever since – and according to the plan, “[T]here is enormous potential to develop additional pedestrian and bicycle facilities in the City as an alternative to automobile use.” This potential has been realized to some extent in downtown Biloxi and older parts of the city. The newly inaugurated (at that time) Coast Transit Authority (CTA) Bike’N’Bus program provided bicycle racks along all fixed-route bus lines in the city and equipped CTA buses with bicycle holders for the convenience of bicyclists using transit. The Comprehensive Plan recommended development of a “Complete Streets Policy with standards to accommodate the needs of pedestrians, bicyclists, transit service, and vehicular traffic in Biloxi’s roadway network.” A proposed network of bicycle facilities would include off-road paths, bicycle lanes and shared-use roadways. Proposed facilities in the Woolmarket area included the following:

- A bicycle lane beginning at the intersection of Shorecrest Road and West Oaklawn Road, proceeding eastward along West Oaklawn to Shriners Boulevard, and continuing along that roadway to its intersection with Old Highway 67 at the northern limit of the city;
- A multi-use path along the length of Woolmarket Road, from John Lee Road at the west end to Old Highway 67 on the east, with a western extension beyond Woolmarket Elementary School and a north-south connection to Lorraine Road near its intersection with Shorecrest Road;
- A multi-use path along the length of Old Highway 67 from its intersection with Shriners Boulevard near the northern limit of Biloxi to its east end at relocated MS 67, with a connection to the Woolmarket multi-use path midway;

- A shared-use route on Lorraine Road from the Biloxi River to the northern limit of the city, crossing the Woolmarket multi-use path near its west end; and
- A shared-use path on Old Woolmarket Road and John Lee Road from the northern limit of the city to Woolmarket Road, connecting to the multi-use path there.

The plan also noted the existence of bicycle lanes on the newly constructed MS 67 and a north-south shared-use route on Hudson Krohn Road and Cedar Lake Road between the northern city limit and the Tchoutacabouffa River.

In addition to committing local jurisdictions to the design of new or improved roads that make provision for their use by bicyclists and pedestrians, the *MPO Complete Streets Policy* provides a broad range of typical section drawings for guidance. These include two, three and four-lane roadway sections with and without subsurface drainage (i.e., curb and gutter), either undivided or divided (by median or continuous center turn lane). All include accommodations for pedestrians and bicycles: sidewalks, multiuse paths, shoulders suitable for cycling and/or designated bicycle lanes.

The *Plan for Opportunity Transportation Assessment* identified 149 miles of roadways on the Mississippi Gulf Coast “suitable for some form of bicycle access amenities addition.” These roadway segments, selected by a more refined application of criteria presented in the MPO Complete Streets Policy, were proposed as additions to the existing bicycle network which, at that time, was comprised of seven miles of bicycle lanes and 11 miles of multiuse paths. However, the only segment deemed suitable in the Woolmarket area was the bicycle lane along MS 67 at the eastern edge of the study area.

The *2030 Harrison County Comprehensive Plan*, while endorsing the concept of complete streets, suggested only one bicycle improvement in Woolmarket. The proposed “bicycle route” along Lorraine Road would extend beyond the northern limit of Biloxi into unincorporated Harrison County. At its southern end the route would cross the Biloxi River into Gulfport and continue westward along Dedeaux Road. The county plan did not specify the type of facility that would be appropriate for the proposed route.

The *2040 Metropolitan Transportation Plan* presented a Staged Improvement Program listing sidewalk improvement that would cost \$1,921,800 during the short-range planning period from 2016 through 2020. No pedestrian improvements were programmed for implementation in Woolmarket. A total of \$25,334,250 in bicycle improvements was programmed for implementation during the same period. No bicycle projects in Woolmarket appeared on the list.

While the previous metropolitan transportation plan, the *2035 Long-Range Transportation Plan*, addressed bicycle and pedestrian needs throughout the region in considerable detail, no recommended improvements were listed for the Woolmarket area. However, in one of a series of figures identifying “Existing and Proposed Bicycle-Pedestrian Facilities” across the three-county area, several proposed bike routes in Woolmarket are shown along with one shared roadway. These include the following:

- *Lorraine Road* from the Biloxi River to the northern limit of Biloxi, extending at the southern end westward into Gulfport and at the northern end northward into unincorporated Harrison County;
- *Shorecrest Road* from Lorraine Road to West Oaklawn Road;
- *West Oaklawn Road* from Shorecrest Road to Shriners Boulevard;
- *Shriners Boulevard* from West Oaklawn Road to Woolmarket Road, and on northward from there to a point of intersection with Old Highway 67 just north of the city limit;
- *John Lee Road* between Woolmarket Elementary School at the west end of Woolmarket Road and Lorraine Road in the Coalville area;
- *Old Highway 67* from Shriners Boulevard to Woolmarket Road, continuing to Hudson-Krohn Road, thence eastward to Old Highway 15 (Reece Bergeron Road); and
- *Hudson-Krohn Road* from northern city limit to Big John Road.

These are all identified as proposed bike routes without any specification of the type of facility that would be appropriate. Where necessary the names of roads have been updated to reflect post-annexation nomenclature. The following proposed facilities are assigned to specific categories of improvement:

- *Shared Use* - Big John Road from Hudson-Krohn Road north to city limit, continuing into unincorporated Harrison County; Hudson-Krohn Road from Big John Road south to Old Highway 67; Cedar Lake Road from Old Highway 67 south to Tchoutacabouffa River, continuing from there to the I-10 interchange; Old Highway 15 (Reece Bergeron Road) from Old Highway 67 north to Victoria Lane, crossing MS 67/15 there, then continuing northward on Scruggs Lane to MS 15 and on to the eastern city limit of Biloxi and beyond; Old Highway 67 from Old Highway 15 (Reece Bergeron Road) to MS 67/15; and Lickskillet Road from MS 67/15 to the eastern city limit, thence crossing the Tchoutacabouffa River via Lamey Bridge Road and continuing into Jackson County.

- *Bike Lane* – MS 67 from the Tchoutacabouffa River to the northern limit of Biloxi and beyond into unincorporated Harrison County.

### **6.2.3 CONCLUSIONS AND RECOMMENDATIONS**

Pedestrian facilities are virtually non-existent along major roads in the Woolmarket area, being confined rather to local thoroughfares in more recently developed subdivisions. This is a situation that must be remedied as new and improved roadways are constructed in conformance with the MPO Complete Streets Policy. Specific recommendations presented in this section are largely limited to bicycle measures, although in some cases multi-use paths that would serve both bicyclists and pedestrians are recommended. Sidewalks and other pedestrian accommodations are included in all recommendations relating to the widening or existing roads or construction of new streets (see Section 6.1). There are currently two roadways in the study area that feature bicycle lanes, but only one of them – Highway 605 – is properly marked. Moreover, that roadway merely cuts across the northwestern corner of Biloxi, passing in one-half-mile from unincorporated Harrison County into Gulfport.

MS 67 is listed in the program (outlined in Table 6-6) because of this need for adequate signage and pavement markings to make clear that dedicated bicycle lanes are located on the outside shoulders of both the north bound and southbound roadways. Hudson-Krohn Road and Cedar Lake Road are the only Woolmarket routes currently designated as shared-use facilities. The recommendations presented here are based largely on the City of Biloxi Comprehensive Plan but also take into consideration improvements listed in the other sources described above.

**Table 6-6:  
PROPOSED BICYCLE IMPROVEMENT PROGRAM**

ROUTE	LOCATION		TYPE	IMPROVEMENTS
	FROM (N/W)	TO (S/E)		
John Lee Rd	North City Limit	Lorraine Rd	Shared Use	Sign and mark existing lanes
Lickskillet Rd	MS 67/15	East City Limit	Shared Use	Sign and mark existing lanes
Old Woolmarket Rd	North City Limit	John Lee Rd	Shared Use	Sign and mark existing lanes
MS 15	MS 67	East City Limit	Shoulder	Sign and mark existing shoulder
MS 67	North City Limit	Tchoutacabouffa River	Shoulder	Sign and mark existing shoulder
Shorecrest Rd	Lorraine Rd	W Oaklawn Rd	Shared Use	Sign and mark existing lanes
W Oaklawn Rd	Shorecrest Rd	Shriners Blvd	Shared Use	Sign and mark existing lanes
Old Hwy 67	North City Limit	Woolmarket Rd	Shared Use	Sign and mark existing lanes
Old Hwy 67	Woolmarket Rd	MS 67	Shoulder	Add shoulder, sign and mark
Woolmarket Rd	Lorraine Rd	Old Hwy 67	Shoulder	Add shoulder, sign and mark
Lorraine Rd	North City Limit	Biloxi River	Shoulder	Add shoulder, sign and mark
Shriners Blvd	North City Limit	W Oaklawn Rd	Shoulder	Add shoulder, sign and mark
MS 67	MS 15	Tchoutacabouffa River	Separated	Upgrade lane to separated path
Cedar Lake Rd	Old Hwy 67	Tchoutacabouffa River	Shoulder	Add shoulder, sign and mark
Hudson Krohn Rd	North City Limit	Old Hwy 67	Shoulder	Add shoulder, sign and mark
Shorecrest Rd	Lorraine Rd	W Oaklawn Rd	Shoulder	Add shoulder, sign and mark
W Oaklawn Rd	Shorecrest Rd	Shriners Blvd	Shoulder	Add shoulder, sign and mark
Old Hwy 67	North City Limit	Woolmarket Rd	Shoulder	Add shoulder, sign and mark
Old Hwy 67	Woolmarket Rd	MS 67	Multi-Use	Add 8-10' multi-use path
Woolmarket Rd	Lorraine Rd	Old Hwy 67	Multi-Use	Add 8-10' multi-use path

Source: Neel-Schaffer, Inc.

### 6.3 BRIDGE INVENTORY

The study area has seven (7) bridges within the planning area boundaries. These bridges are routinely inspected by A. Garner Russell & Associates, Inc. through the State Aid Bridge Inspection Inventory Program administered by Harrison County. The State Aid Bridge Inspection Inventory Program is partly instituted to systematically repair and replace bridges based on condition, current design standards, local use and others factors to produce the sufficiency rating for each bridge. The sufficiency rating is used to schedule the replacement as funds are available. Several were recently replaced and therefore have little maintenance required, while others are reaching the end of their design life, making maintenance costlier and possible replacement a more cost effective solution. Maintenance and repair costs are typically not funded through the State Aid Program, thus requiring funding through local entities.

Table 6-7 below provides a summary of the more pertinent data derived from each of the Bridge Survey

Reports. A complete copy of each Bridge Survey Report containing all the detailed inspection data, results, and pictures are included herein for reference. Table 6-8 provides a summary of each of the bridge's estimated repair and replacement costs and the time frame in which these improvements are expected to be needed. Figure 6-5 included herein indicates the location of each bridge and identifies the bridge number which is cross referenced to Table 6-7 and 6-8.

**TABLE 6-7  
BRIDGE INVENTORY SUMMARY DATA**

BRIDGE NUMBER (MAP REFERENCE)	STRUCTURE NUMBER	FEATURES INTERSECTED	FACILITY CARRIED BY STRUCTURE	YEAR BUILT	LANES ON AND UNDER STRUCTURE	LANES UNDER STRUCTURE	ADT	YEAR OF ADT	OPEN, POSTED OR CLOSED TO TRAFFIC	DECK	SUPERSTRUCTURE	SUBSTRUCTURE	CHANNEL AND CHANNEL PROTECTION	SUFFICIENCY RATING*
51	SA2400000000051	MILL CREEK	JOHN LEE ROAD	2011	2	0	800	2010	OPEN	6	9	8	9	92.3
52	SA2400000000052	MILL CREEK	WASH FAYARD ROAD	1999	2	0	800	2009	OPEN	6	7	6	6	85.2
53	SA2400000000053	PARKER CREEK	WOOLMARKET ROAD	1954	2	0	4,000	2010	POSTED	6	6	5	5	65.1
87	SA2400000000057	HOWARD CREEK	OLD HWY 67	1960	2	0	5,000	2008	POSTED	5	5	5	6	14.4
89	SA2400000000059	TCHOUTACABOUFFA RIVER	CEDAR LAKE ROAD	1973	2	0	29,000	2015	POSTED	6	5	6	6	20.2
89	SA2400000000059	PARKERS CREEK	OAKLAWN RD EAST	1970	2	0	800	2011	OPEN	6	8	7	7	79.7
91	SA2400000000091	BILOXI RIVER	FAS 139 (LORRAINE ROAD)	1975	2	0	18,000	2013	REPLACED IN 2016 (NEW BRIDGE NO. 195)					
195	SA2400000000195	BILOXI RIVER	FAS 139 (LORRAINE ROAD)	2016	2	0	18,000	2013	OPEN	9	9	9	9	**

\* SUFFICIENCY RATINGS ARE ADJUSTED ANNUALLY AND THESE HAVE NOT BEEN ADJUSTED FOR CURRENT INSPECTION RATING

**TABLE 6.8  
ESTIMATED BRIDGE REPAIR AND REPLACEMENT COSTS**

BRIDGE NUMBER (MAP REFERENCE)	FEATURES INTERSECTED	FACILITY CARRIED BY STRUCTURE	YEAR FOR REPAIR	ESTIMATED REPAIR COSTS	YEAR FOR REPLACEMENT	ESTIMATED REPLACEMENT COSTS
51	MILL CREEK	JOHN LEE ROAD	2017	\$15,000		
52	MILL CREEK	WASH FAYARD ROAD	2017	\$20,000		
52	MILL CREEK	WASH FAYARD ROAD	2020	\$100,000		
52	MILL CREEK	WASH FAYARD ROAD			2020	\$300,000
53	PARKER CREEK	WOOLMARKET RD	2017	\$225,000		
53	PARKER CREEK	WOOLMARKET RD			2020	\$600,000
87	HOWARD CREEK	OLD HWY 67			2019	\$700,000
88	TCHOUTACABOUFFA RIVER	CEDAR LAKE RD			2019	\$5,000,000
89	PARKERS CREEK	OAKLAWN RD EAST	2018	\$25,000	2020	\$1,200,000

**TOTAL ESTIMATED REPAIR COSTS: \$385,000**

### **6.3.1 BRIDGE REPORT SUMMARY**

Copies of each bridge report described below can be found in Appendix B at the conclusion of this report.

#### **#51 – SA 24(51): JOHN LEE ROAD OVER MILL CREEK**

This bridge was constructed in 2011 and is in structurally excellent condition. The substructure, superstructure, and deck are precast concrete. The bridge approaches are settling due to erosion around the wing walls and abutments. Cost estimated to repair the approaches is approximately \$15,000 and should be scheduled in FY 2018-2019.

#### **#52 – SA 24(52): WASH FAYARD ROAD OVER MILL CREEK**

This bridge was constructed in 1989 and is in structurally satisfactory condition. The bridge consists of a wood substructure and precast concrete superstructure/deck. The piling and headwall are pressure treated wood and will likely need partial repair or replacement in 3-7 years. The bridge approaches have some settling due to sub base material loss and will likely need to be corrected within the year. Cost estimated to repair the approaches is approximately \$20,000 and should be scheduled in FY 2018-2019. Cost estimated to repair the piling and headwall is approximately \$100,000 and should be scheduled as early as 2020. Cost estimated to replace the bridge is approximately \$300,000.

#### **#53 – SA 24(53): WOOLMARKET ROAD OVER PARKER CREEK**

This bridge was constructed in 1964 and is in structurally fair condition, with a sufficiency rating of 65.1, and has a posted weight limit restriction. The bridge consists of a wood substructure and precast concrete superstructure/deck. The pilings are pressure treated wood and will likely need partial repair or replacement in 1-3 years. Four (4) of the 30 wood piling have interior or exterior deterioration and should be evaluated for an immediate repair. The bridge approaches are settling due to erosion around the abutments which will require correction within the year. Cost estimated to repair the piling is approximately \$200,000 and cost estimated to repair the approaches is approximately \$25,000, both of which should be scheduled in FY 2018-2019. Cost estimated to replace the bridge is approximately \$600,000.

#### **#87 – SA 24(87): OLD HIGHWAY 67 OVER HOWARD CREEK**

This bridge was constructed in 1960 and is in structurally fair to poor condition. The bridge consists of a wood substructure, steel superstructure and poured in place concrete deck. Due to the condition and other rating factors the bridge has a sufficiency rating of 14.4, and has a posted weight limit restriction. This bridge has been programmed with Harrison County through State Aid funds for replacement. There isn't an accurate timeline for replacement to begin, but it is anticipated to likely begin construction in 2019. Cost estimated to replace is approximately \$700,000.

#### **#88 – SA 24(88): CEDAR LAKE ROAD OVER TCHOUTACABOUFFA RIVER**

This bridge was constructed in 1973 and is in structurally fair to poor condition, with a sufficiency rating of 20.2, and has a posted weight limit restriction. The main span of the bridge is a steel turn

span. The substructure is concrete and remaining spans have precast superstructure and poured in place concrete deck. There are numerous defects and issues in the bridge, with the majority occurring in the main swing span superstructure and deck. State Aid has had in-depth and underwater inspections conducted and copies are attached within the report. The bridge is eligible for State Aid funds but they have not yet been allocated for a replacement project. Due to the costs, funding sources in addition to State Aid funds will need to be secured. Cost to replace this bridge is estimated to be over \$5,000,000.

**#89 – SA 24(89): OAKLAWN ROAD EAST OVER PARKER’S CREEK**

This bridge was constructed in 1970 and structurally is in satisfactory condition. The substructure and superstructure are precast concrete and poured in place concrete deck. The western bridge approach has some settling due to minor undermining around the wing walls and abutments which will require to be corrected within a year. Cost estimated to repair the approaches is approximately \$25,000 and should be scheduled for FY 2018-2019 or sooner. Cost estimated to replace the bridge is approximately \$1,200,000.

**#91/#195- SA 24(91/195): FAS 139(LORRAINE ROAD) OVER BILOXI RIVER**

This bridge was recently constructed in 2016 and is in structurally excellent condition with no current repair or maintenance identified. The bridge consists of a precast concrete substructure and superstructure and poured in place deck. The old bridge was numbered 91 but the new bridge will be renumbered 195 on the future State Aid bridge inventory.

## 6.4. COST ESTIMATES

Detailed opinions of probable costs associated with each of the twenty-four-proposed transportation and bridge capital improvement projects identified throughout this section. Table 6-9 summarizes all the proposed capital improvement projects. The opinions of probable costs associated with the fourteen transportation projects (T01-15) can be found on the subsequent pages.

TABLE 6-9: TRANSPORTATION and BRIDGE CAPITAL IMPROVEMENT PROJECTS

Project #		Project Location	Project Description	Estimated Project Cost
T01	Transportation	Old 67 (Woolmarket Rd to MS 67)	Widen Road/Add Shoulders/Sidewalk/Multiuse Path	\$19,275,000
T02	Transportation	Woolmarket Rd (John Lee to Old 67)	Widen Road/Add Shoulders/Sidewalk/Multiuse Path	\$26,883,000
T03	Transportation	Shriners (Woolmarket Rd to W. Oaklawn)	Widen Road/Bike Lanes/Sidewalks	\$10,970,000
T04	Transportation	Shriners (Woolmarket Rd to City Limits)	Widen Road/Bike Lanes/Sidewalk	\$18,454,000
T05	Transportation	Cedar Lake Rd (Old 67 to Tchoutacabouffa River)	Add Shoulders, Multiuse Path	\$2,233,000
T06	Transportation	Hudson Krohn (Old 67 to City Limits)	Add Shoulders/Designated Bike Lanes	\$1,201,000
T07	Transportation	Shorecrest (Lorraine to W. Oaklawn)	Add Shoulders/Designated Bike Lanes	\$847,000
T08	Transportation	W. Oaklawn - Shorecrest to Shriners	Add Shoulders/Designated Bike Lanes	\$1,509,000
T09	Transportation	Old 67 (Woolmarket Rd to City Limits)	Add Shoulders/Designated Bike Lanes	\$1,129,000
T10	Transportation	Lorraine Rd (Woolmarket Rd to City Limits)	Add Shoulders/Designated Bike Lanes	\$1,076,000
T11	Transportation	Lorraine Rd (Woolmarket Rd to Biloxi River)	Add Shoulders/Designated Bike Lanes	\$1,253,000
T12	Transportation	MS 67 (MS 15 to Tchoutacabouffa River)	Add Separated Bike Path	\$4,450,000
T13	Transportation	Woolmarket Rd at Shriners	Multilane Roundabout	\$603,000
T14	Transportation	Belle La Vie	Two Lane Road/Shoulders/Sidewalks	\$16,629,000
T15	Transportation	Woolmarket I-10 Interchange to Popp's Ferry @ Riverview	Construct new four-lane bridge across Tchoutacabouffa River and connecting road	\$153,713,000
B #51	Bridge	Mill Creek (John Lee Road)	Bridge Repair (Year 2017)	\$15,000
B #52	Bridge	Mill Creek (Wash Fayard Road)	Bridge Repair (Year 2017)	\$20,000
B #52	Bridge	Mill Creek (Wash Fayard Road)	Bridge Repair (Year 2020)	\$100,000
B #52	Bridge	Mill Creek (Wash Fayard Road)	Bridge Replacement (Year 2020)	\$300,000
B #53	Bridge	Parker Creek (Woolmarket Road)	Bridge Repair (Year 2017)	\$225,000
B #53	Bridge	Parker Creek (Woolmarket Road)	Bridge Replacement (Year 2020)	\$600,000
B #87	Bridge	Howard Creek (Old Hwy 67)	Bridge Replacement (Year 2019)	\$700,000
B #88	Bridge	Tchoutacabouffa River (Cedar Lake Road)	Bridge Replacement (Year 2019)	\$5,000,000
B #89	Bridge	Parkers Creek (Oaklawn Rd East)	Bridge Repair (Year 2018)	\$25,000
B #89	Bridge	Parkers Creek (Oaklawn Rd East)	Bridge Replacement (Year 2020)	\$1,200,000
			<b>TOTAL ESTIMATED PROJECT COSTS</b>	<b>\$268,410,000</b>





















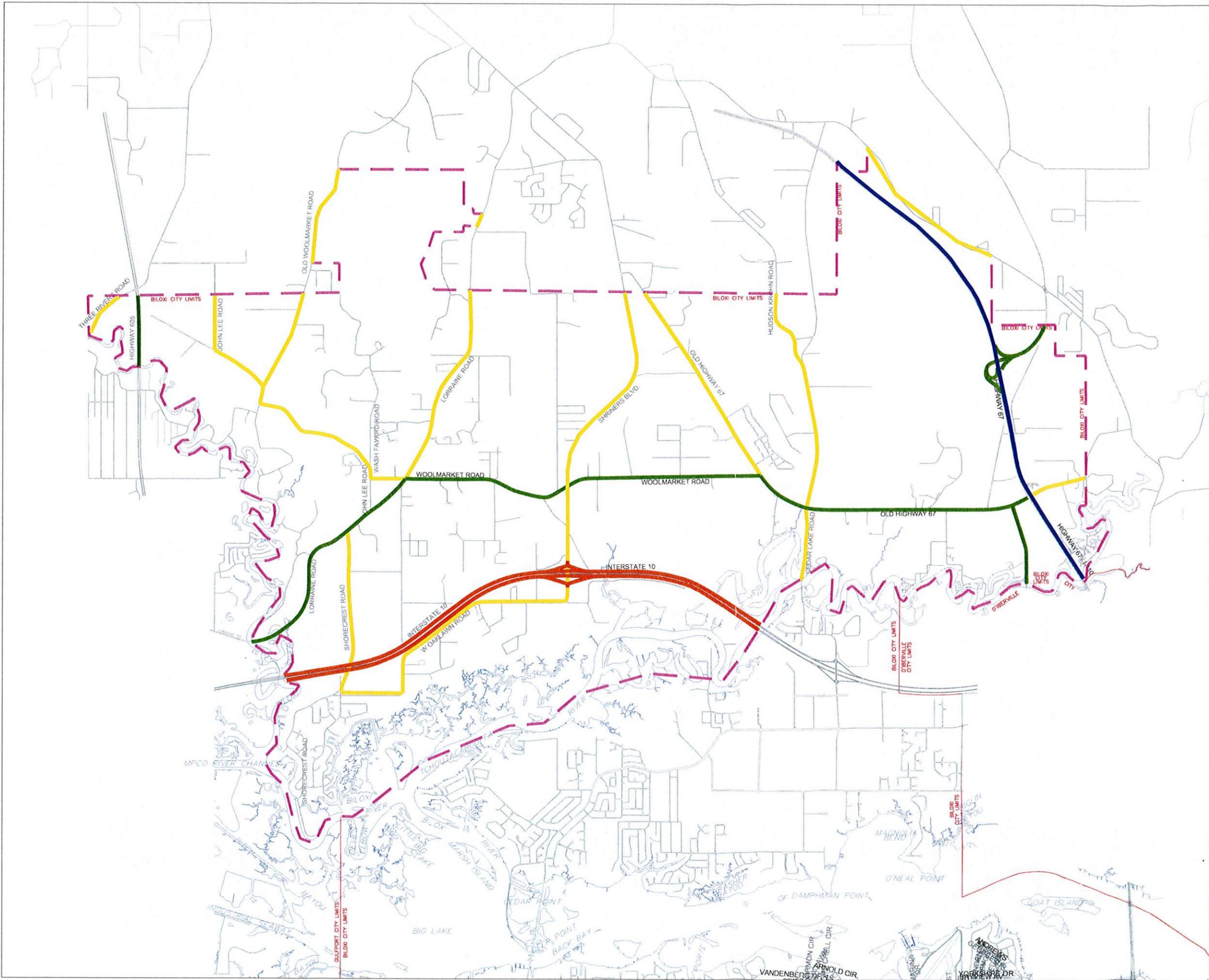












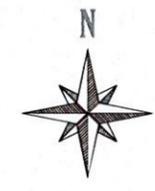
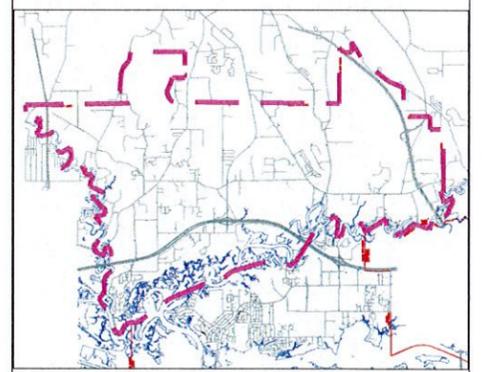
CITY OF BILOXI



LEGEND

- STUDY BOUNDARY
- LOCAL STREET
- COLLECTOR
- MINOR ARTERIAL
- PRINCIPAL ARTERIAL
- INTERSTATE HIGHWAY

KEY MAP

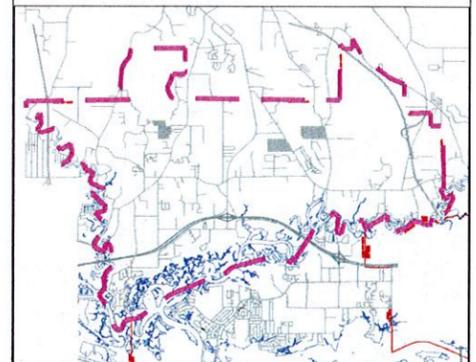


SCALE	FIGURE NUMBER
1" = 2000'	6-1
PLOT DATE	
6-01-18	
SHEET FILE	
STUDY AREA STREETS AND HIGHWAYS	

**LEGEND**

- - - STUDY BOUNDARY
- ROADWAY WIDENING
- ADD SHOULDERS
- MULTI-USE/ SEPARATED PATH
- NEW COLLECTOR
- ROUNDABOUT
- T9 PROJECT NUMBER

**KEY MAP**



SCALE	FIGURE NUMBER
-------	---------------

1" = 2000'

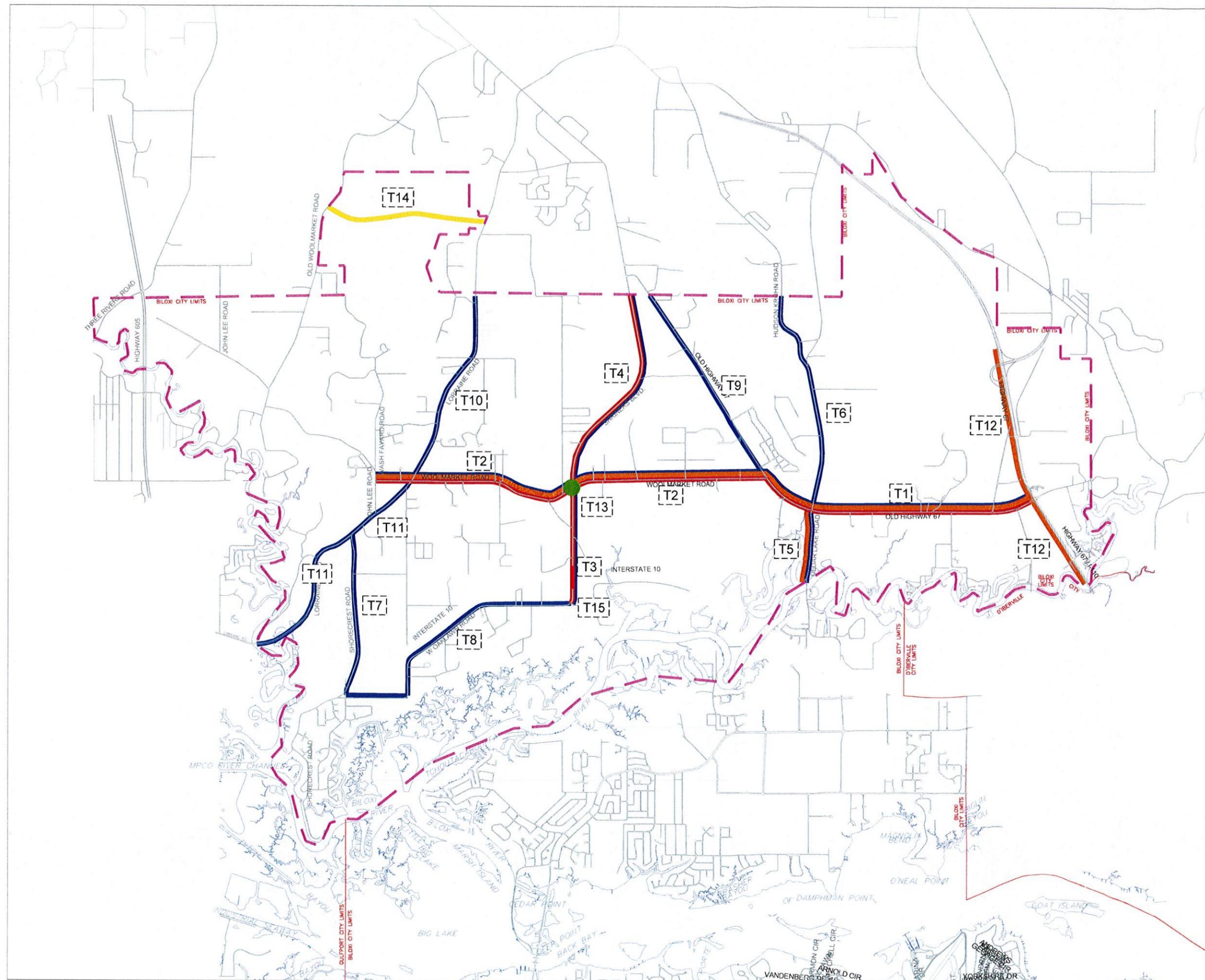
PLOT DATE

6-01-18

SHEET FILE

RECOMMENDED ROADWAY IMPROVEMENTS

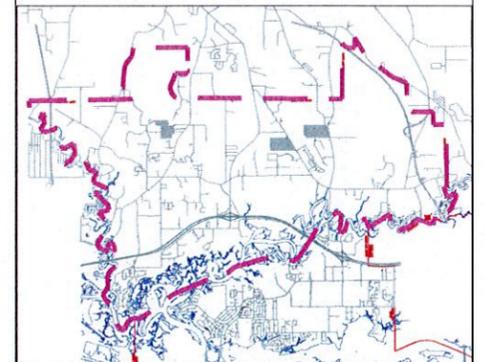
6-2



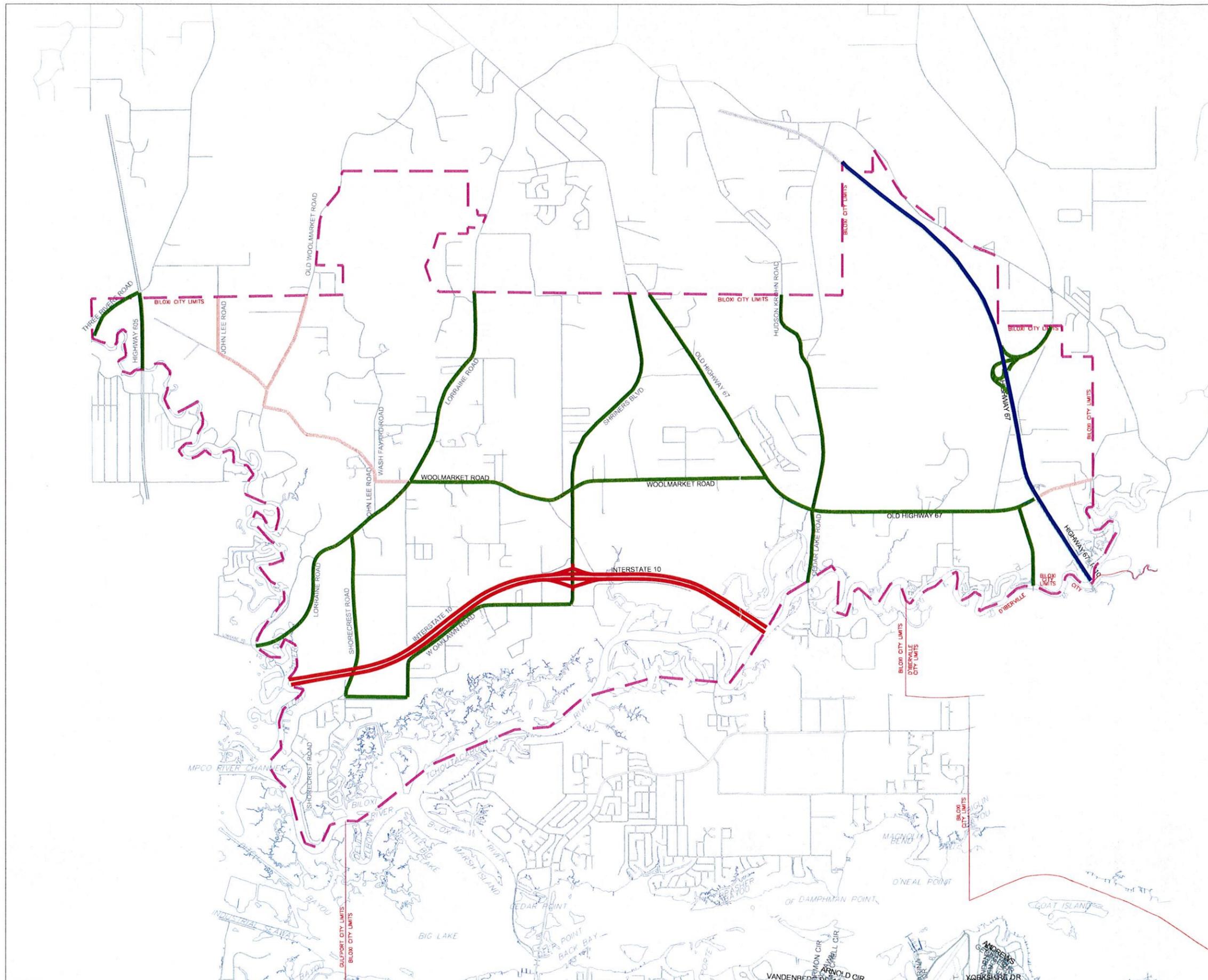
**LEGEND**

- - - STUDY BOUNDARY
- TYPE OF FACILITY**
- SHARED-USE LANE
- SHOULDER/ LANE
- SEPARATED PATH:1
- NOT SUITABLE

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 2000'	<b>6-3</b>
PLOT DATE	
6-01-18	
SHEET FILE	
BICYCLE SUITABILITY OF MAJOR STREETS	



CONSULTANT TEAM

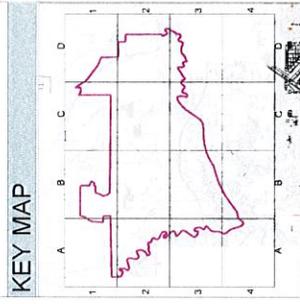
**GARNER RUSSELL & ASSOCIATES**  
CONSULTING ENGINEERS

**NEEL-SCHAFFER**  
*Advancing your construction vision*

**LEGEND**

 EXISTING BUILDING

BRIDGE NUMBER



SCALE: 1" = 500'

SHEET NUMBER

**FIGURE 6-4**

PLOT DATE: 3-15-2017

SHEET FILE: BRIDGE LAYOUT



CONSULTANT TEAM

**JUGARNER RUSSELL & ASSOCIATES**  
CONSULTING ENGINEERS

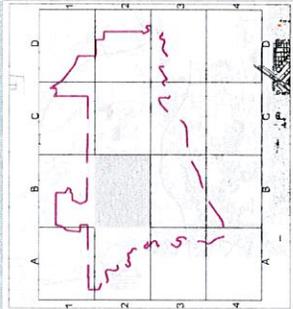
**NEEL-SCHAFFER**  
*Solutions you can build upon.*

**LEGEND**

 EXISTING BUILDING

 BRIDGE NUMBER

**KEY MAP**



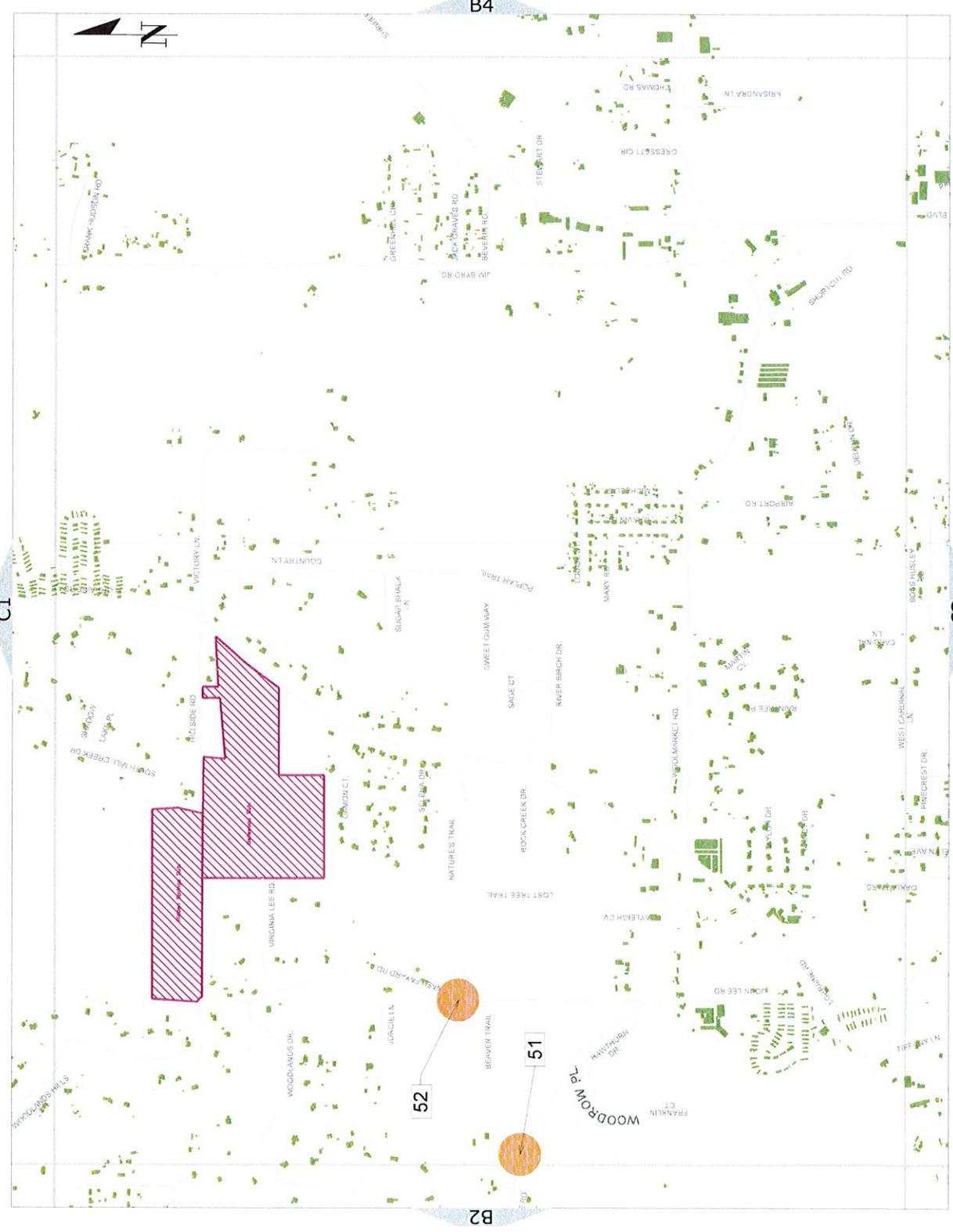
**Biloxi**  
established 1999

SHEET NUMBER

SCALE 1" = 500'

PLOT DATE 3-15-2017

SHEET FILE BRIDGE LAYOUT



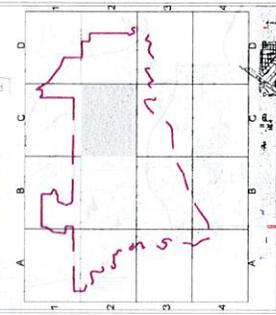
CONSULTANT TEAM

**G** GARNER RUSSELL & ASSOCIATES  
CONSULTING ENGINEERS  
**NEEL-SCHAFFER**  
Solutions you can build upon

LEGEND

- EXISTING BUILDING
- BRIDGE NUMBER

KEY MAP



SCALE  
1" = 500'

SHEET NUMBER  
FIGURE 6-6

PLANT DATE  
3-15-2017

SHEET FILE  
BRIDGE LAYOUT



C1

D2

B2

C3

CONSULTANT TEAM

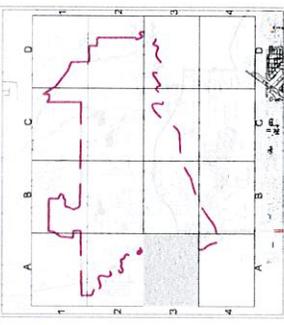
**HIGARNER RUSSELL & ASSOCIATES**  
CONSULTING ENGINEERS

**NEEL-SCHAFFER**  
*Solutions you can build upon*

LEGEND

- EXISTING BUILDING
- BRIDGE NUMBER

KEY MAP



SCALE	SHEET NUMBER
1" = 500'	
PLOT DATE	FIGURE 6-7
3-15-2017	
SHEET FILE	BRIDGE LAYOUT



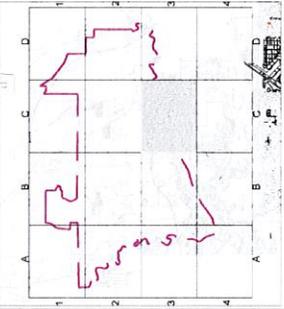
CONSULTANT TEAM



LEGEND

- EXISTING BUILDING
- BRIDGE NUMBER

KEY MAP



SCALE	1" = 500'
SHEET NUMBER	FIGURE 6-8
PLOT DATE	3-15-2017
SHEET FILE	BRIDGE LAYOUT



## SECTION 7 – PRIORITIZATION OF PROJECTS AND IMPLEMENTATION SCHEDULE

This section provides the City of Biloxi with a summary of the prioritization of the recommended improvements to the utility systems in Woolmarket that are detailed throughout this master plan.

Table 7-1 below summarizes the total estimated cost of proposed projects for each utility system.

**Table 7-1:  
TOTAL ESTIMATED COST OF PROPOSED PROJECTS**

UTILITY SYSTEM	TOTAL ESTIMATED COST
SANITARY SEWER	\$37,283,416
WATER	\$35,225,940
DRAINAGE	\$3,787,834
TRANSPORTATION	\$268,410,000
<b>TOTAL:</b>	<b>\$344,707,190</b>

### 7.1 PRIORITIZATION AND IMPLEMENTATION SCHEDULE OF WASTEWATER AND WATER PROJECTS

A listing for proposed implementation of the wastewater and water capital improvement projects was created. Consultation with City leaders and their review of probable costs of the projects, City budgets, and needs throughout the project area were the driving factors in developing the prioritization and implementation schedule, which is listed in Table 7-2 and Table 7-3, respectively.

Table 7-2, which displays the prioritization of each wastewater project, lists the project's number identifier and ranking, the corresponding sewer basin and sub-basin, and estimated cost per parcel, which was calculated by dividing the estimated project cost by the number of parcels in the project area. The wastewater projects were prioritized using the water project areas since there is cost savings to install the water and sewer projects under the same construction project. It is important to note while the wastewater projects follow the water projects, some downstream infrastructure will be necessary prior to constructing the upstream collection systems. This can be seen in such projects as the Old Woolmarket Road project (Project No. 171.S1), which must be constructed prior to the construction of either the Timber Ridge (Project No. 173.S1) or the Dundewood Road (Project No. 172.S1) projects.

**TABLE 7-2: PRIORITIZATION OF WASTEWATER CAPITAL IMPROVEMENT PROJECTS**

PROJECT NO.	SEWER BASIN DESCRIPTION	SUB-BASINS	ESTIMATED COST PER PARCEL	PROJECT RANKING
200.S1	TUXACHANIE SOUTH		\$100.35	1
145	TIMBER CREEK		\$370.10	2
144.S1	WOOLMARKET & TEODIA HUSLEY		\$433.21	3
143.S1	GATES OF BILOXI	WOOLMARKET & TEODIA HUSLEY, TIMBER CREEK	\$461.99	4
121.S1	SCENIC RIVER DRIVE		\$1,234.46	5
170.S1	JOHN LEE RD. SOUTH	OLD WOOLMARKET RD., DUNDEEWOOD RD., TIMBER RIDGE LN., JOHN LEE RD. NORTH, WOOLMARKET LAKE RD., SNUG HARBOR RD., RIVERLAND DR.	\$7,610.56	6
161.S1	WOODLANDS DR.		\$9,434.18	7
105.S1	SELENA DR.		\$11,892.16	8
201.S1	OLD HWY. 67 SOUTH	PARADISE LN.	\$14,867.74	9
103.S1	BOYETTE/OAKLAWN RD.	OAKLAWN RD. SOUTH	\$19,566.78	10
171.S1	OLD WOOLMARKET RD.	DUNDEEWOOD RD., TIMBER RIDGE LN.	\$25,254.05	11
146.S1	JIM BYRD SOUTH	JIM BYRD NORTH	\$26,563.09	12
175.S1	WOOLMARKET LAKE RD.	SNUG HARBOR RD.	\$29,871.85	13
172.S1	DUNDEEWOOD RD.		\$30,019.99	14
102.S1	TIFFANY LN.		\$36,213.40	15
202.S1	PARADISE LN.		\$40,652.87	16
151.S1	AIRPORT RD.		\$41,585.21	17
148.S1	OLD HWY. 67 NORTH		\$41,735.13	18
177.S1	RIVERLAND DR.		\$42,857.31	19
174.S1	JOHN LEE RD. NORTH		\$42,909.20	20
204.S1	STACEY LN.		\$46,697.45	21
162.S1	WOODLAND HILLS		\$51,210.30	22
106.S1	VICTORY LN.		\$51,418.94	23
176.S1	SNUG HARBOR RD.		\$51,769.31	24
152.S1	COUNTRY LN.		\$52,186.15	25
104.S1	OAKLAWN RD. SOUTH		\$56,994.95	26
107.S1	SOUTH MILL CREEK RD.		\$71,719.00	27
173.S1	TIMBER RIDGE LN.		\$76,675.04	28
147.S1	JIM BYRD NORTH		\$82,297.49	29

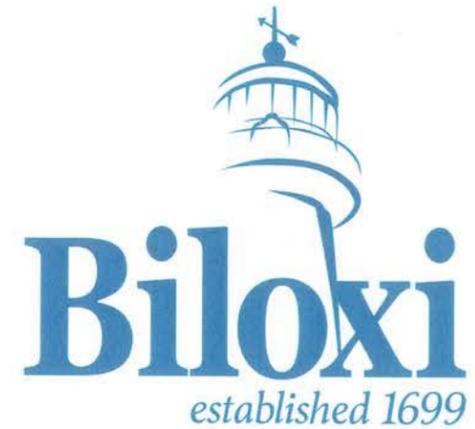
Table 7-3, which displays the prioritization of each water project, lists the project's phase, number identifier, and location, the length of new water line to be installed, the number of existing customers to be added to the system, the estimated project cost, and the cost per connection, which is the estimated project cost divided by the number of new customers. As in Section 4.4, the projects are sorted into one of three categories: Immediate Needs, Expansion to Unserved Areas (Short Term), and Expansion to Unserved Areas (Long Term). Projects categorized as Immediate Needs—i.e. projects to provide areas with adequate fire protection that do not currently have it—were given priority to all other improvement projects. Each category of projects is further divided into phases, which group the projects based on location, system connectivity, project costs, and construction feasibility. The phases are listed in the order each should be implemented. Each phase might be further broken into multiple sub-phases. Each project categorized in Table 7-3 below displays the recommended implementation schedule to complete each capital improvement project based on the priorities identified above.

# WOOLMARKET MASTER PLAN

City of Biloxi

Harrison County, Mississippi

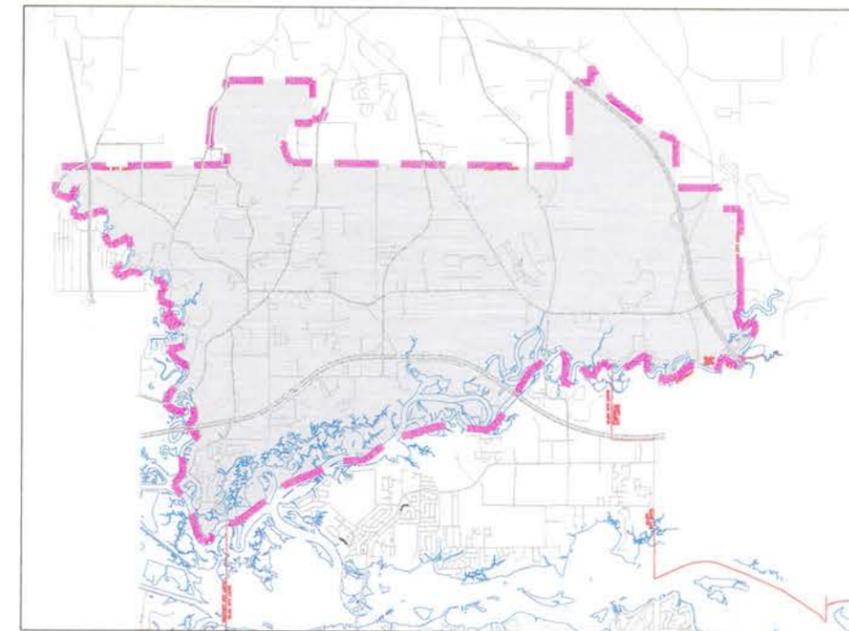
## APPENDIX "A"



**A. M. Gilich, Jr., Mayor**

**City Council**

George Lawrence	Ward 1	Paul Tisdale	Ward 5
Felix Gines	Ward 2	Kenny Glavan	Ward 6
Dixie Newman	Ward 3	Nathan Barrett	Ward 7
Robert L. Deming III	Ward 4		



KEY MAP

— STUDY BOUNDARY



***Prepared By:***



***In Association With:***





GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

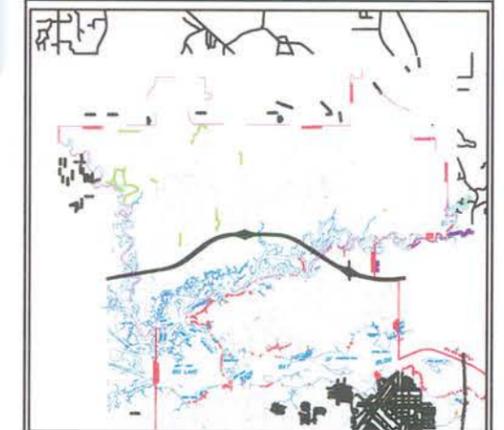
CITY OF BILOXI



LEGEND

- STUDY BOUNDARY
- SUBDIVISION UNDER CONSTRUCTION
- SUPERIOR UTILITIES
- CITY OF D'ARVILLE
- HONEY DIPPER OF BILOXI
- SOUTHEAST MISS. UTIL.
- TOTAL ENVIRONMENTAL SOLUTIONS, INC.

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.0
PLOT DATE	
2-09-2018	

SHEET FILE  
STUDY AREA/ SEWER FRANCHISE AREAS

CITY OF BILOXI

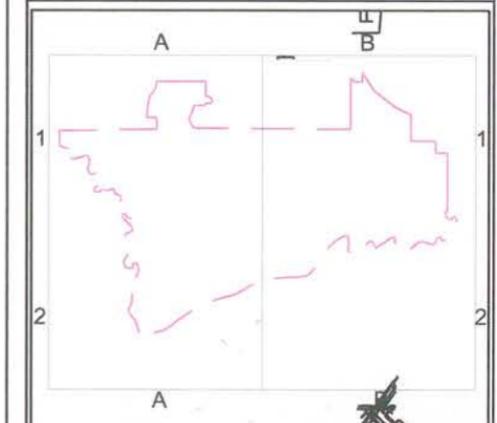
**GR** GARNER RUSSELL & ASSOC.  
CONSULTING ENGINEERS

**NEEL-SCHAFFER**  
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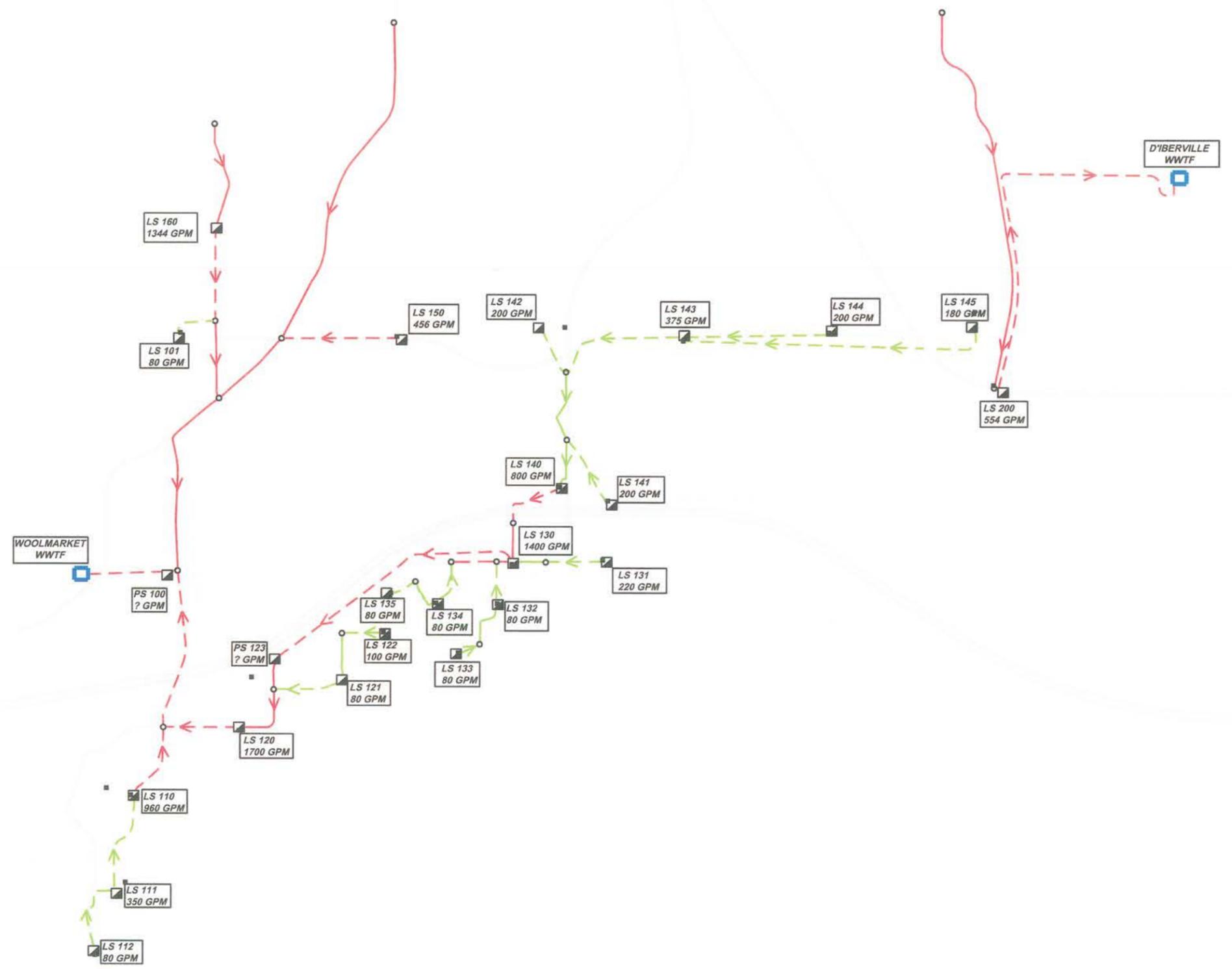
LEGEND

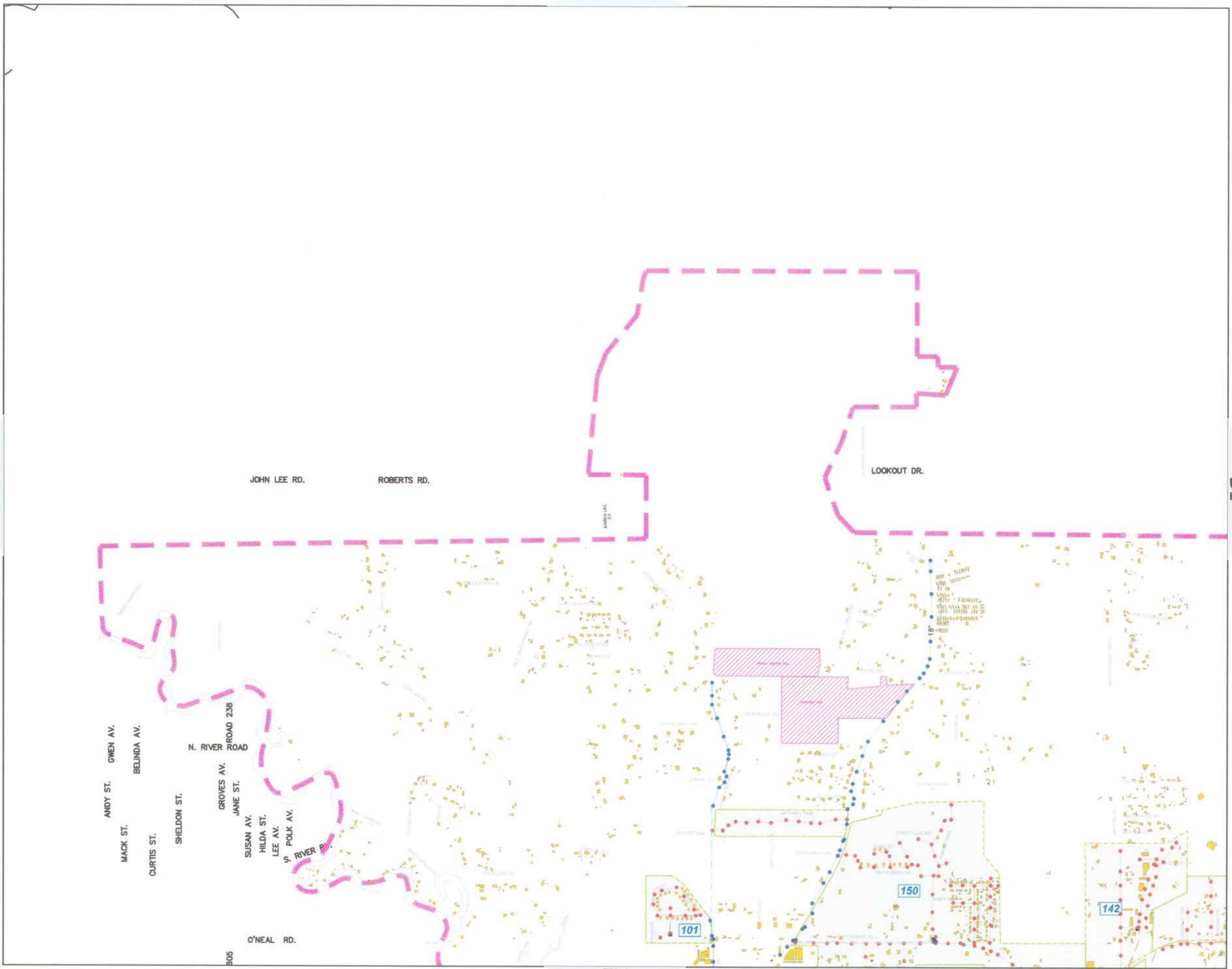
- HCUA GRAVITY SEWER
- - - HCUA FORCE MAIN
- BLX GRAVITY SEWER
- - - BLX FORCE MAIN
- TREATMENT FACILITY
- CONNECTION / FLOW CHANGE
- LIFT STATION
- > FLOW DIRECTION

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	<b>3.1</b>
PLOT DATE	
10-05-2017	
SHEET FILE	
EXISTING FLOW SCHEMATIC	





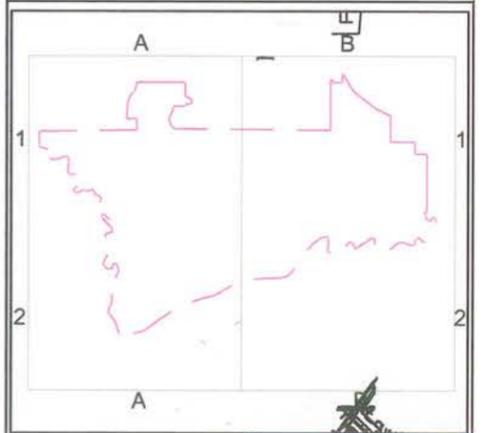
CITY OF BILOXI



LEGEND

- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- - - HCUA FORCE MAIN
- HCUA MANHOLE
- BLOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- - - BLX FORCE MAIN
- > FLOW DIRECTION
- ▭ EXISTING BUILDING
- - - SEWER SUB-BASINS
- - - STUDY AREA

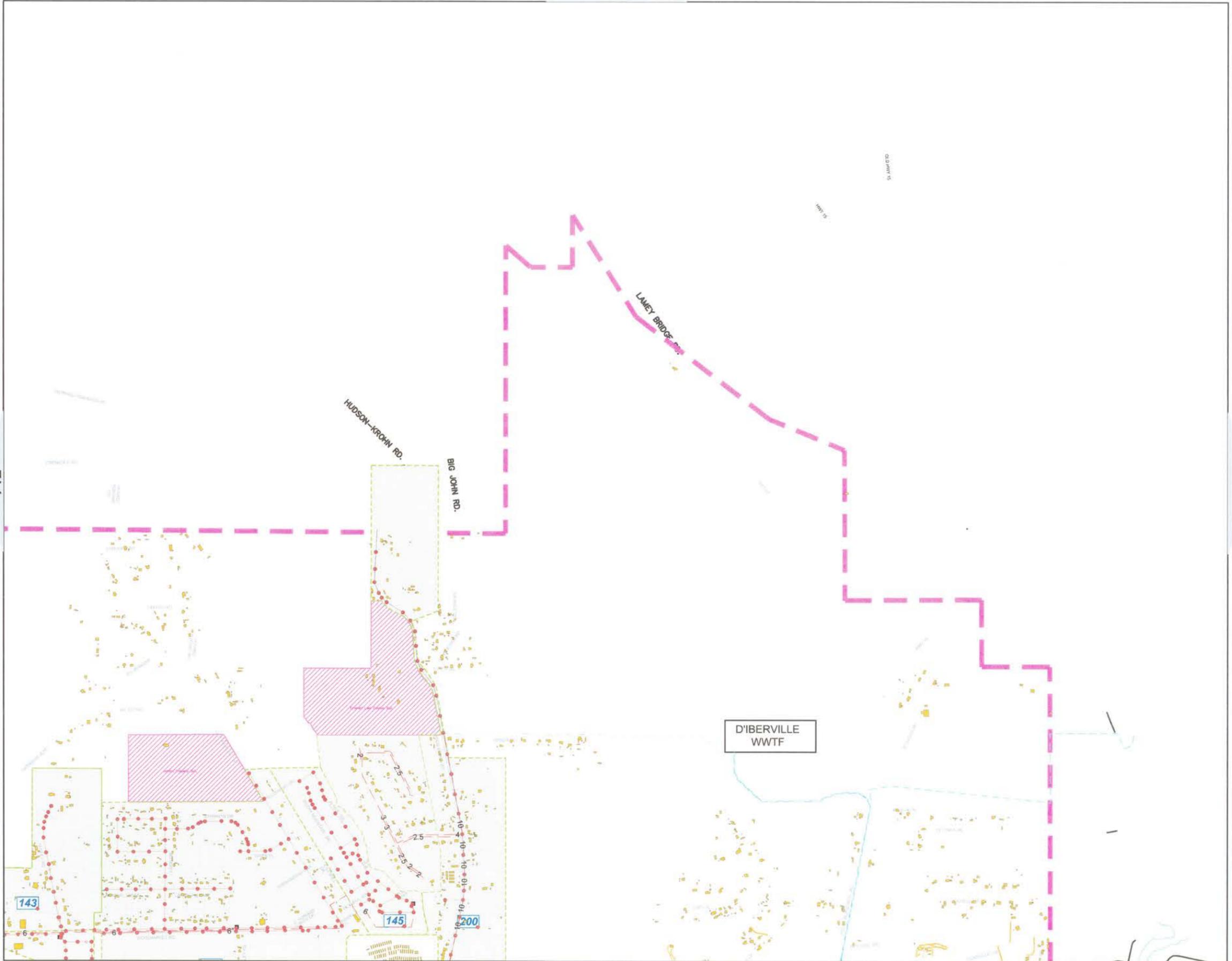
KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.2
PLOT DATE	
9-20-2017	

SHEET FILE  
**EXISTING SEWER BASIN**

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



A1

B2

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

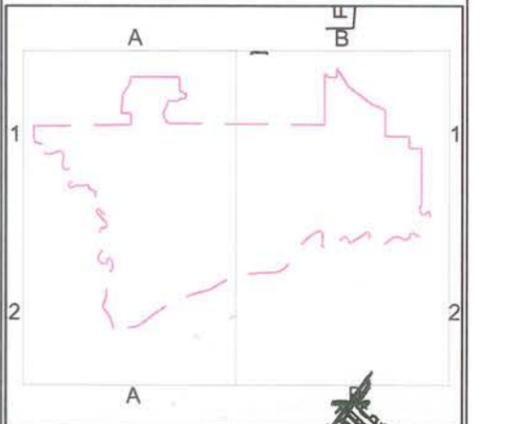
CITY OF BILOXI



LEGEND

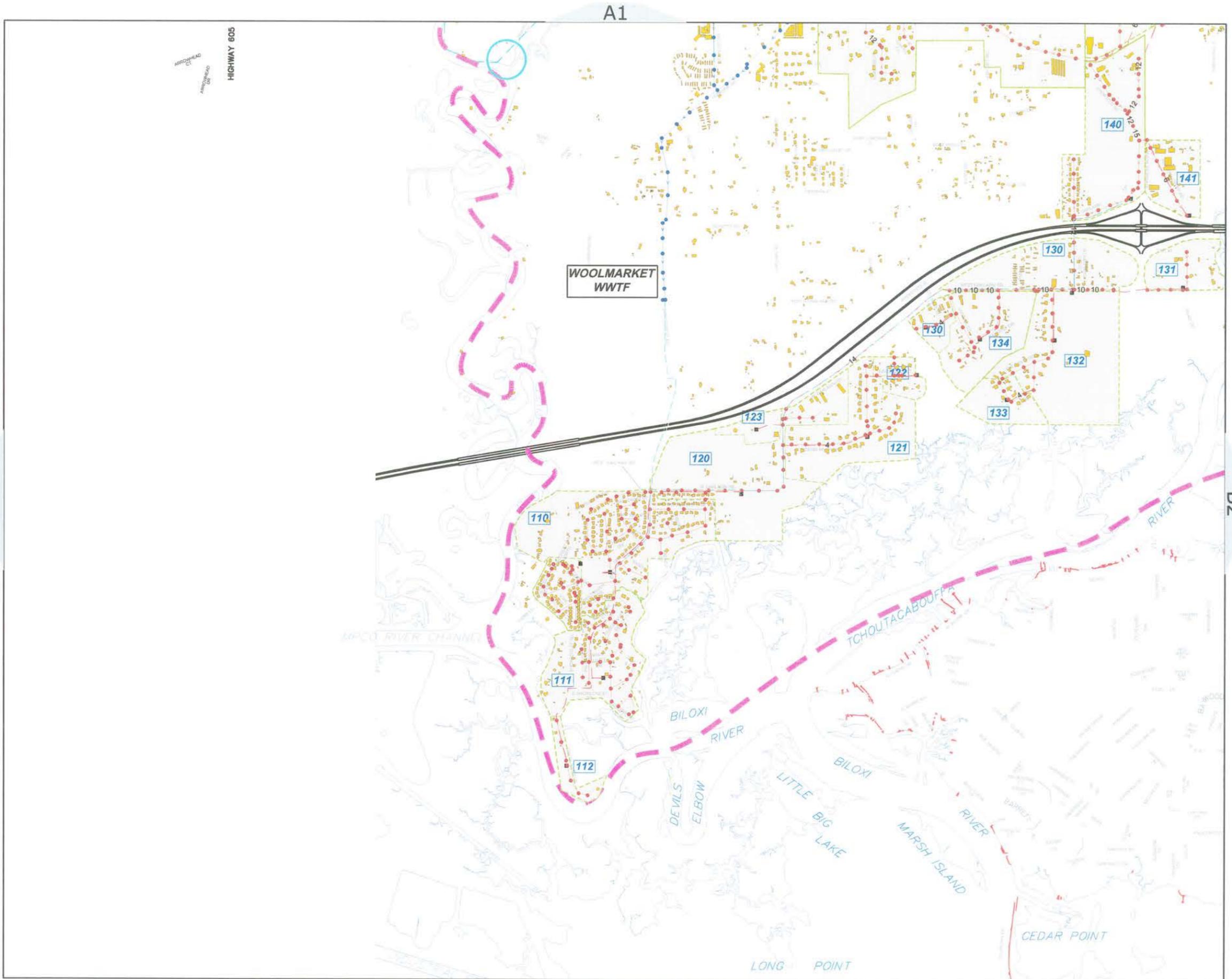
- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- HCUA FORCE MAIN
- HCUA MANHOLE
- BLOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- BLX FORCE MAIN
- FLOW DIRECTION
- EXISTING BUILDING
- SEWER SUB-BASINS
- STUDY AREA

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.3
PLOT DATE	
9-20-2017	

SHEET FILE  
EXISTING SEWER BASIN



AIRCRAFT
   
 AIRCRAFT
   
 HIGHWAY 805

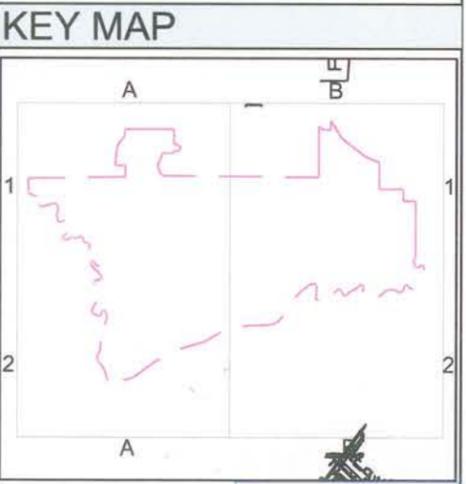
**CITY OF BILOXI**

**GARNER RUSSELL & ASSOC.**  
 CONSULTING ENGINEERS

**NEEL-SCHAFFER**  
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**LEGEND**

	HCUA GRAVITY SEWER
	HCUA LIFT STATION
	HCUA FORCE MAIN
	HCUA MANHOLE
	BLOXI MANHOLE
	BLX GRAVITY SEWER
	BLX LIFT STATION
	BLX FORCE MAIN
	FLOW DIRECTION
	EXISTING BUILDING
	SEWER SUB-BASINS
	STUDY AREA



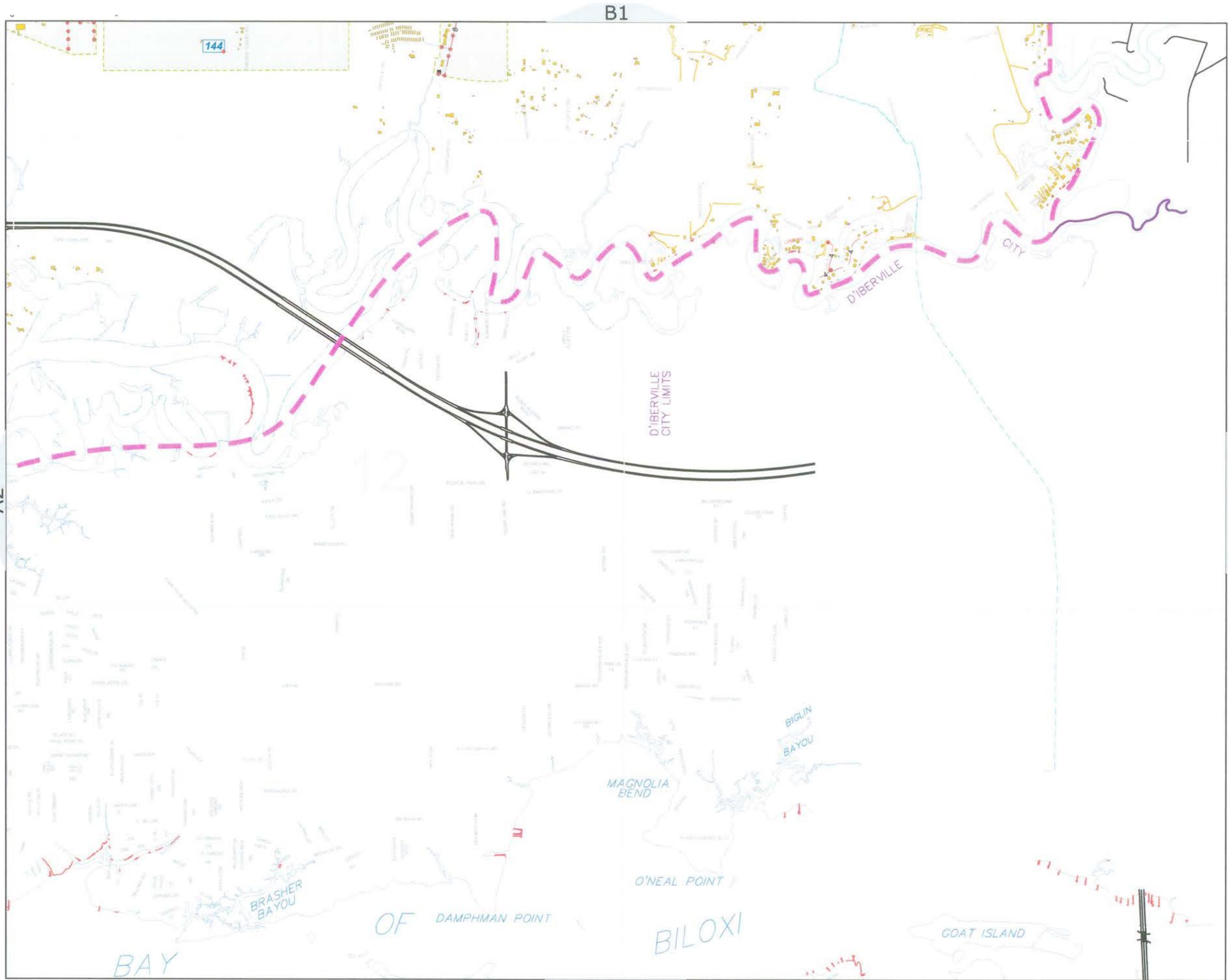
**Biloxi**  
*established 1699*

SCALE	FIGURE NUMBER
N.T.S.	<b>3.4</b>
PLOT DATE	
9-20-2017	

SHEET FILE

**EXISTING SEWER BASIN**

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



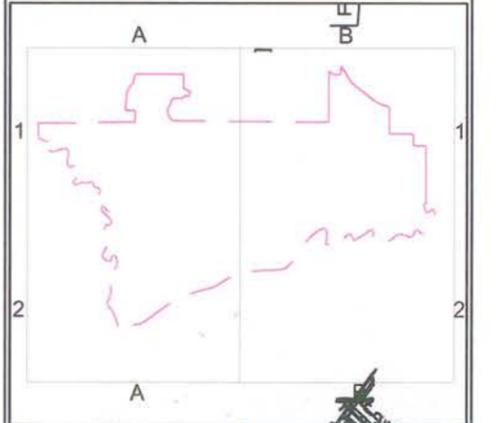
CITY OF BILOXI



LEGEND

- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- HCUA FORCE MAIN
- HCUA MANHOLE
- BLOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- - - BLX FORCE MAIN
- > FLOW DIRECTION
- EXISTING BUILDING
- - - SEWER SUB-BASINS
- - - - - STUDY AREA

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.5
PLOT DATE	
9-20-2017	

SHEET FILE  
**EXISTING SEWER BASIN**

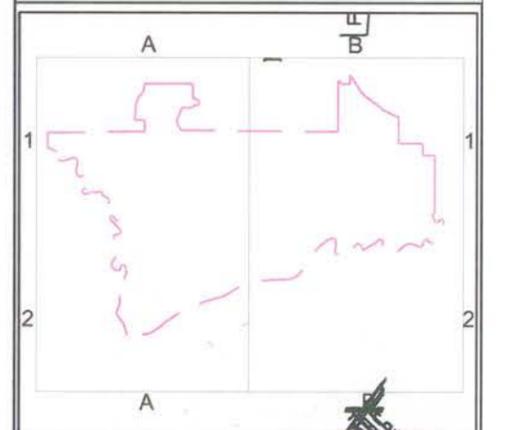
GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



LEGEND

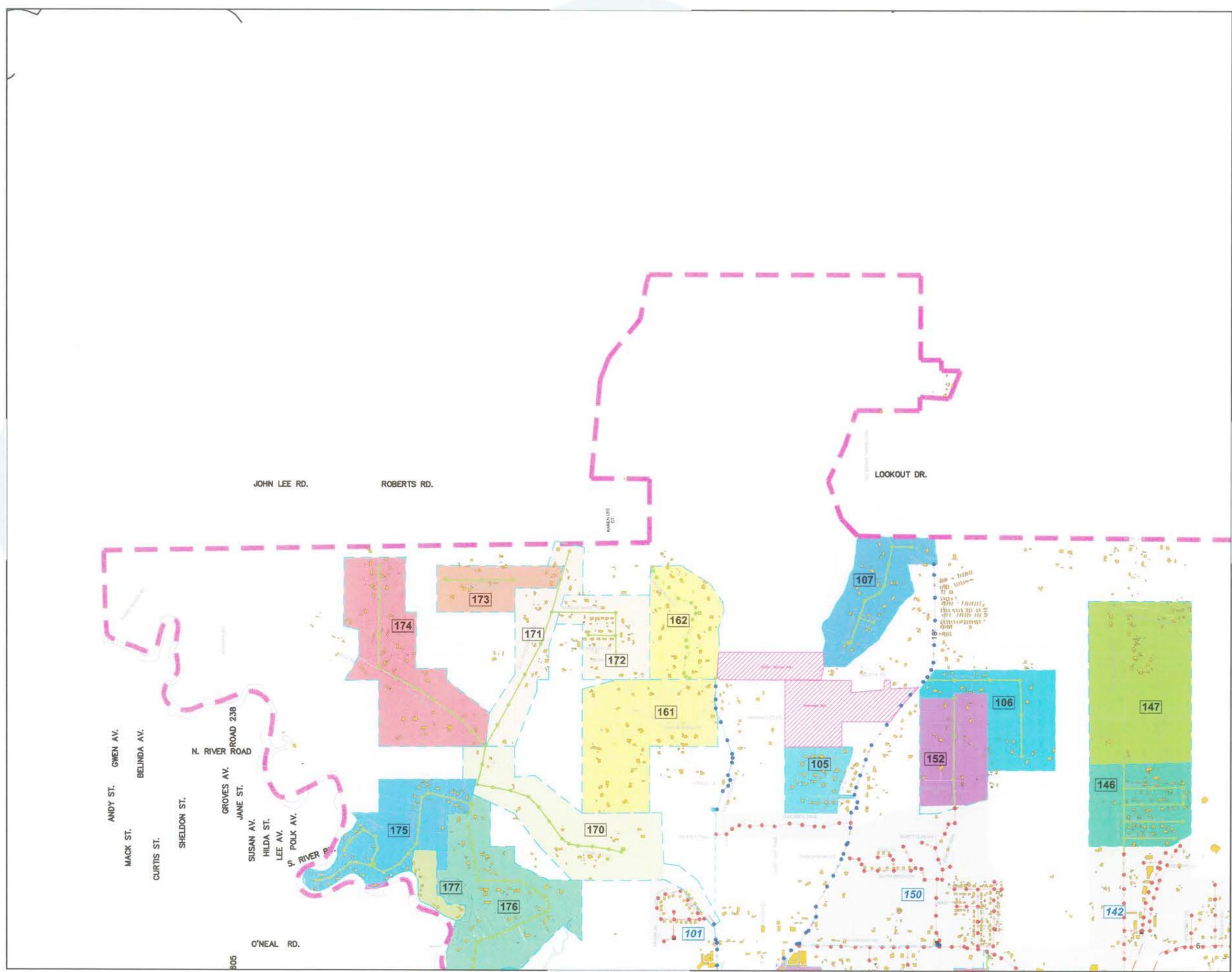
- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- HCUA FORCE MAIN
- HCUA MANHOLE
- BLOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- BLX FORCE MAIN
- FLOW DIRECTION
- EXISTING BUILDING
- SEWER SUB-BASINS
- STUDY AREA

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.6
PLOT DATE	
9-20-2017	

SHEET FILE  
**FUTURE SEWER BASIN**



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

A2

B1



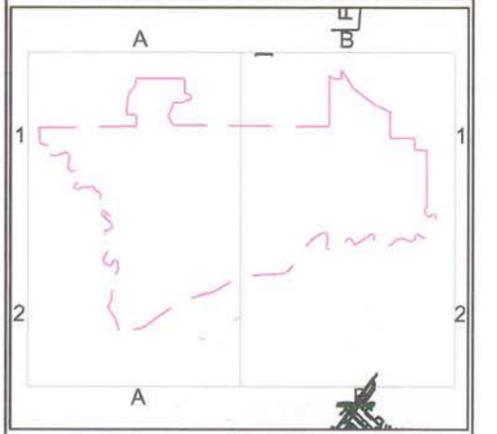
CITY OF BILOXI



LEGEND

- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- HCUA FORCE MAIN
- HCUA MANHOLE
- BLOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- BLX FORCE MAIN
- > FLOW DIRECTION
- EXISTING BUILDING
- SEWER SUB-BASINS
- STUDY AREA

KEY MAP



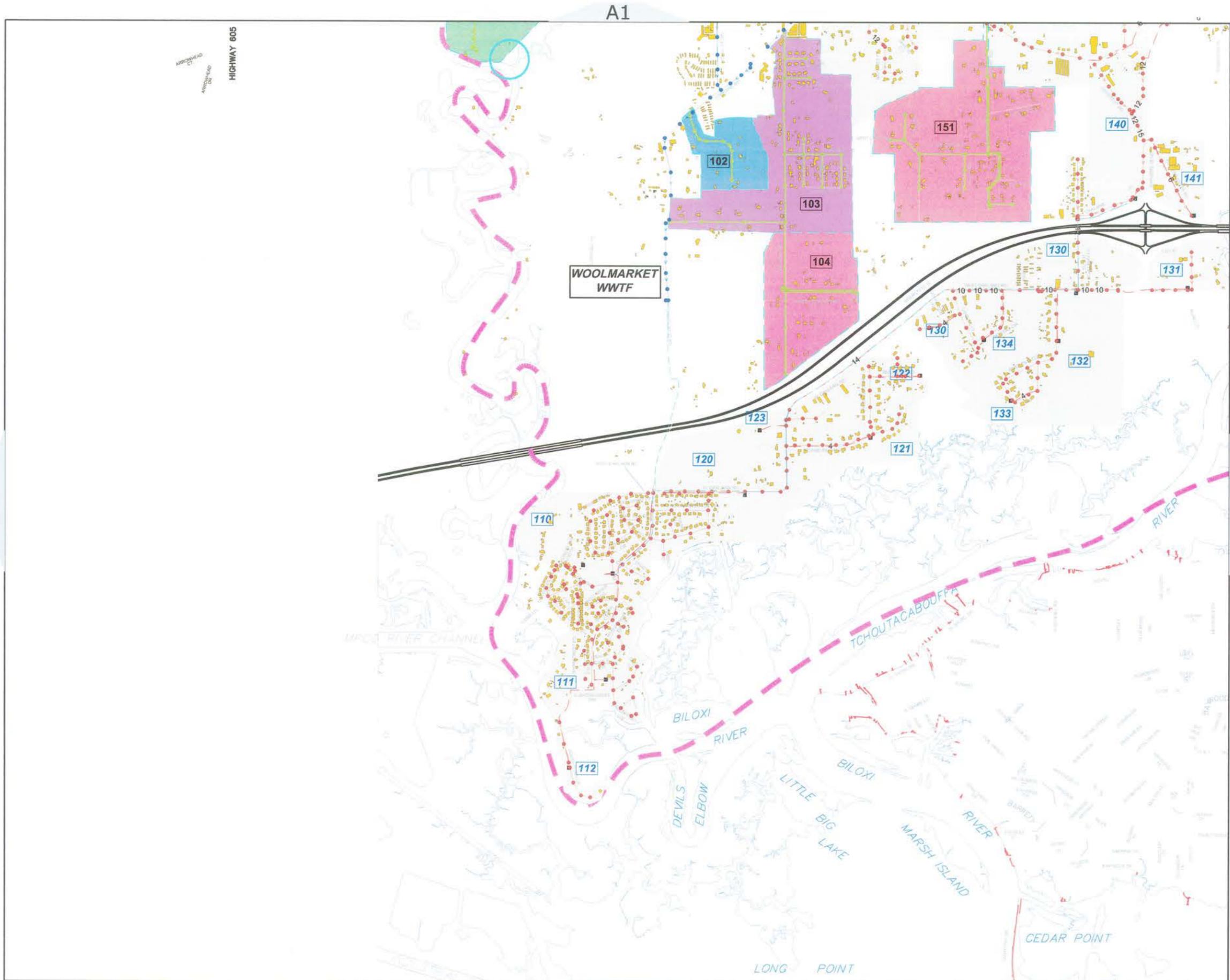
SCALE	FIGURE NUMBER
N.T.S.	3.7
PLOT DATE	
9-20-2017	

SHEET FILE  
**FUTURE SEWER BASIN**

A1

B2

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



HIGHWAY 605  
 AIRBORNE CT.  
 AIRBORNE DR.

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

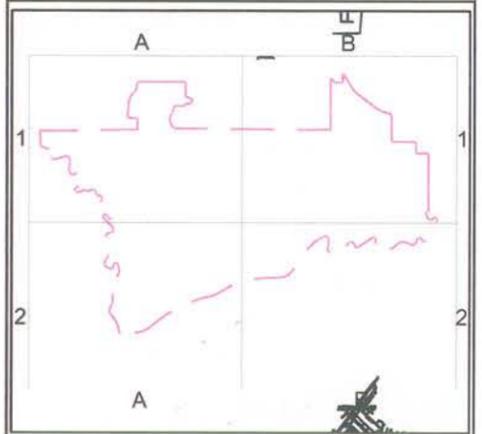
CITY OF BILOXI



LEGEND

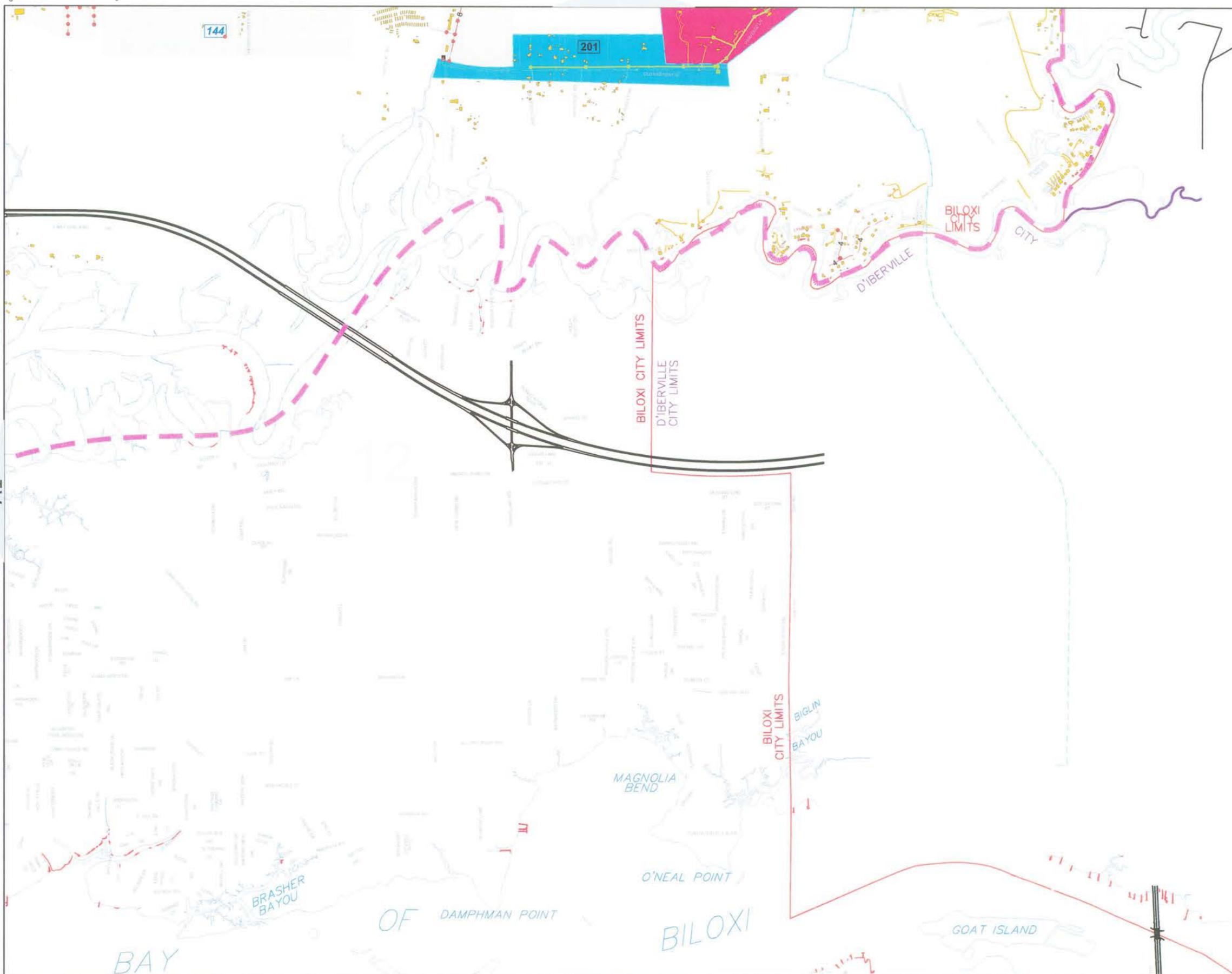
- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- HCUA FORCE MAIN
- HCUA MANHOLE
- BLOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- - - BLX FORCE MAIN
- > FLOW DIRECTION
- EXISTING BUILDING
- - - SEWER SUB-BASINS
- - - STUDY AREA

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.8
PLOT DATE	
9-20-2017	

SHEET FILE  
**FUTURE SEWER BASIN**



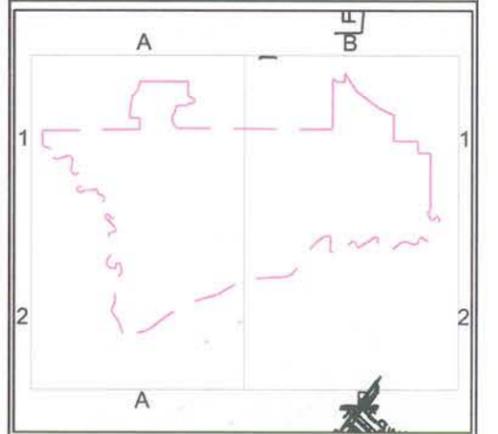
CITY OF BILOXI



LEGEND

- HCUA GRAVITY SEWER
- HCUA LIFT STATION
- HCUA FORCE MAIN
- HCUA MANHOLE
- BILOXI MANHOLE
- BLX GRAVITY SEWER
- BLX LIFT STATION
- BLX FORCE MAIN
- > FLOW DIRECTION
- EXISTING BUILDING
- SEWER SUB-BASINS
- - - - - STUDY AREA

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	3.9
PLOT DATE	
9-20-2017	

SHEET FILE  
**FUTURE SEWER BASIN**

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

CITY OF BILOXI



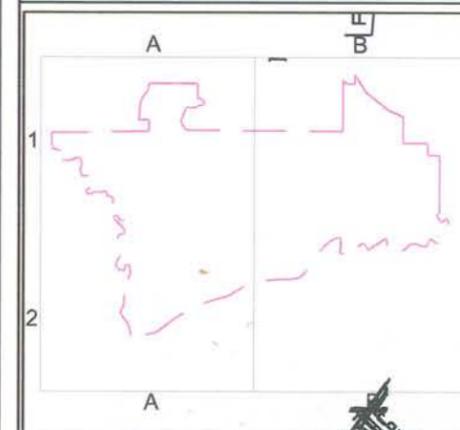
LEGEND

- HCUA GRAVITY SEWER
- - - HCUA FORCE MAIN
- BLX GRAVITY SEWER
- - - BLX FORCE MAIN
- TREATMENT FACILITY
- CONNECTION / FLOW CHANGE
- LIFT STATION
- > FLOW DIRECTION

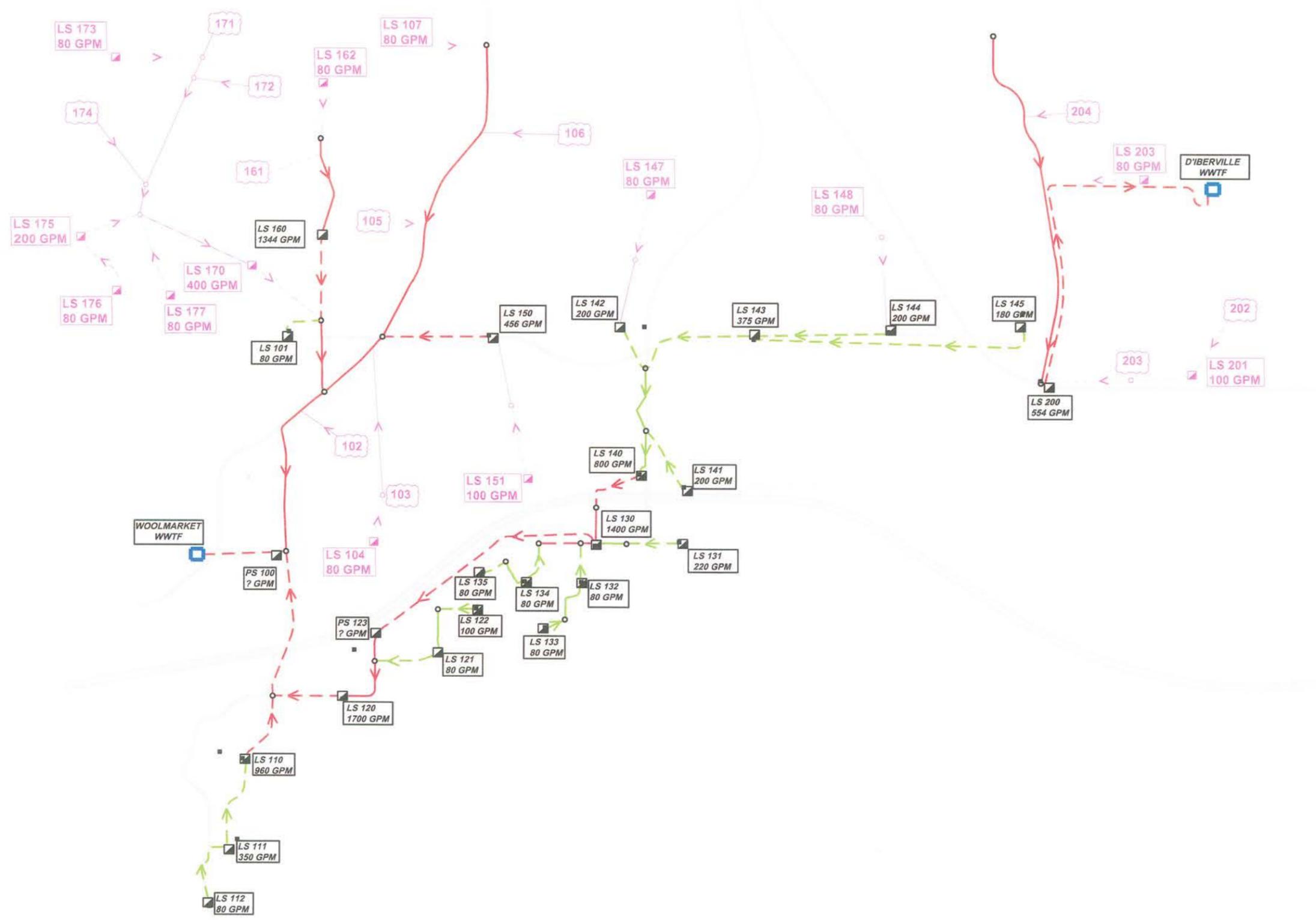
FUTURE IMPROVEMENTS

- 202 SEWER BASIN
- LS 201  
100 GPM LIFT STATION

KEY MAP



SCALE	FIGURE NUMBER
N.T.S.	<b>3.10</b>
PLOT DATE	
10-30-2017	
SHEET FILE	
PROPOSED FLOW SCHEMATIC	





GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

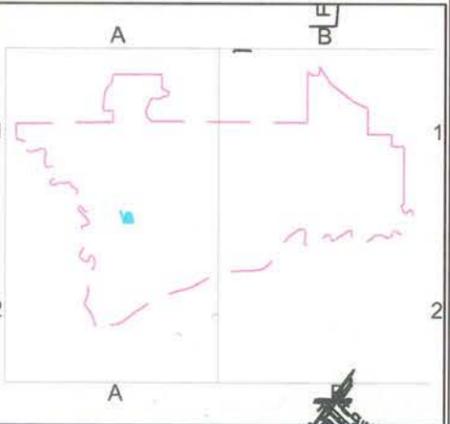
CITY OF BILOXI



LEGEND

- TIFFANY LANE
- 8 PROPOSED MANHOLES
- 1870 L.F. 8" GRAVITY SEWER SERVICES
- FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	102.S1
PLOT DATE	
9-10-2017	
SHEET FILE	
TIFFANY LANE	



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

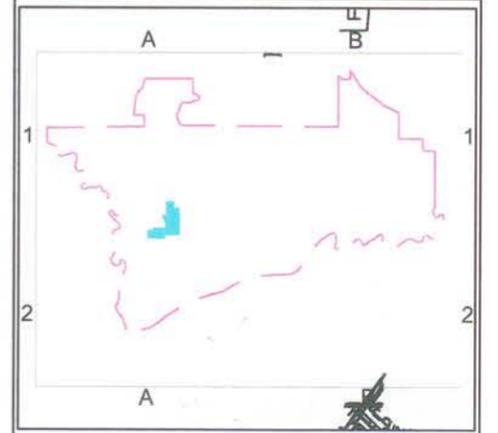
CITY OF BILOXI



LEGEND

- BOYETTE/OAKLAWN
- 32 PROPOSED MANHOLES
- 10390 L.F. 8" GRAVITY SEWER SERVICES
- > FLOW DIRECTION
- EXISTING BUILDING
- - - PROPERTY LINE
- PROPOSED GRAVITY
- - - PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	103.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
BOYETTE / OAKLAWN NORTH



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

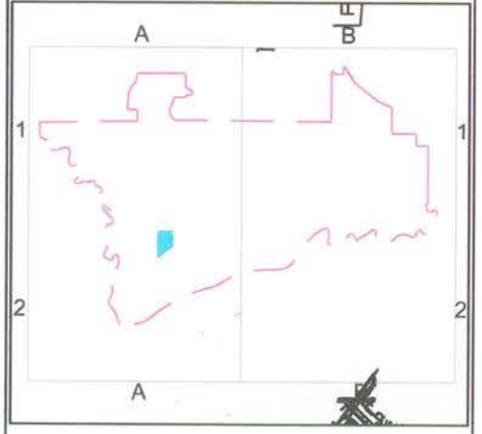
CITY OF BILOXI



LEGEND

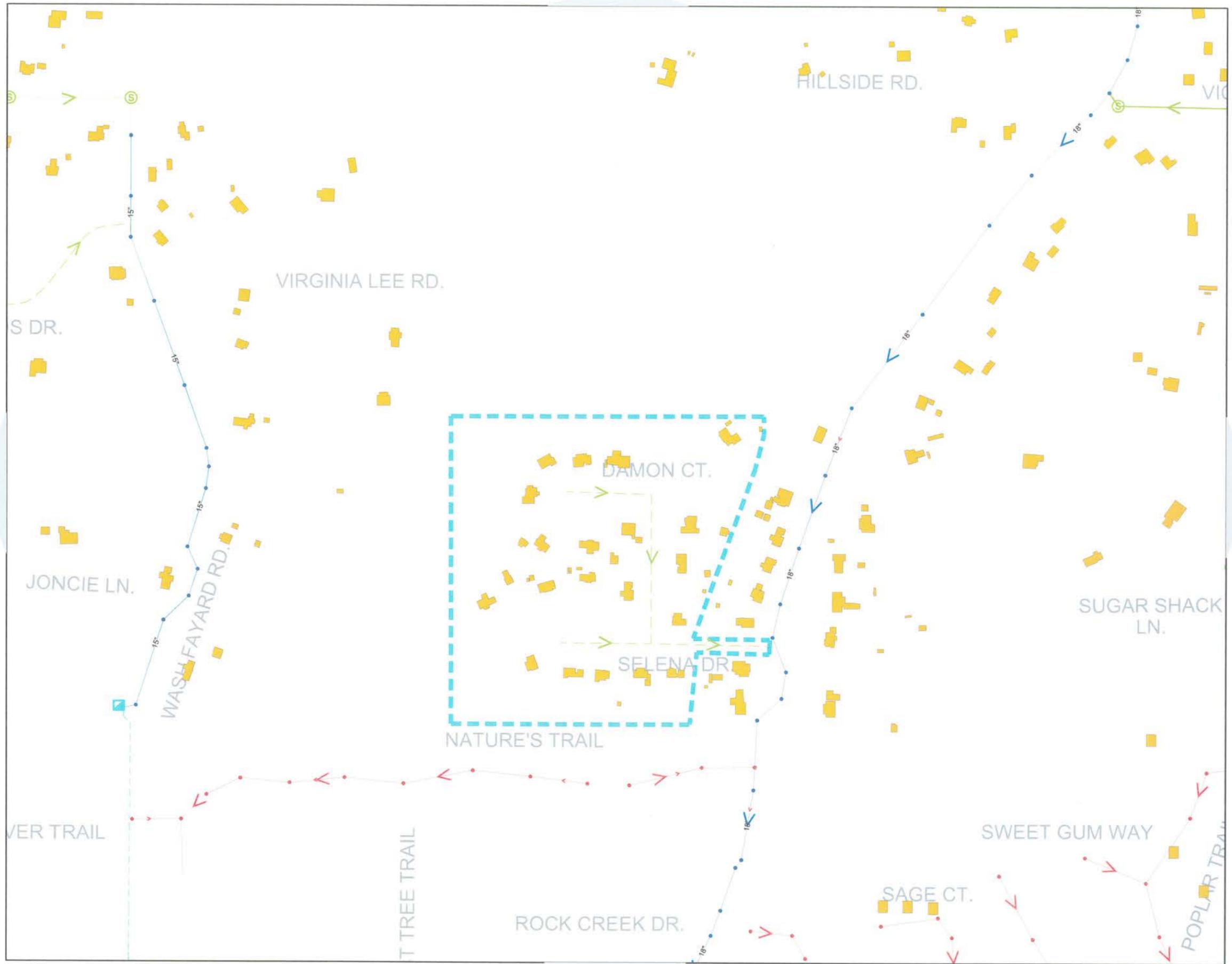
- OAKLAWN SOUTH
- 11 PROPOSED MANHOLES
- 3870 L.F. 8" GRAVITY SEWER SERVICES
- 32 4" FORCE MAIN
- 4050 L.F. (2)80 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- - - PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	104.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
OAKLAWN SOUTH



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

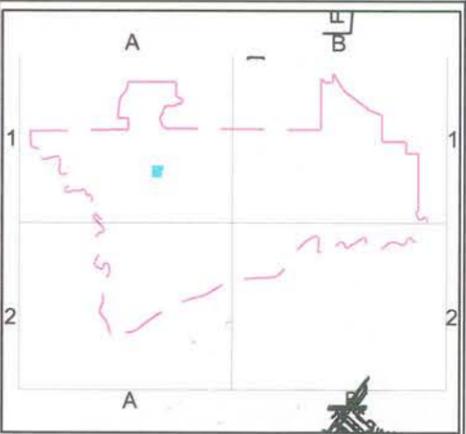
CITY OF BILOXI



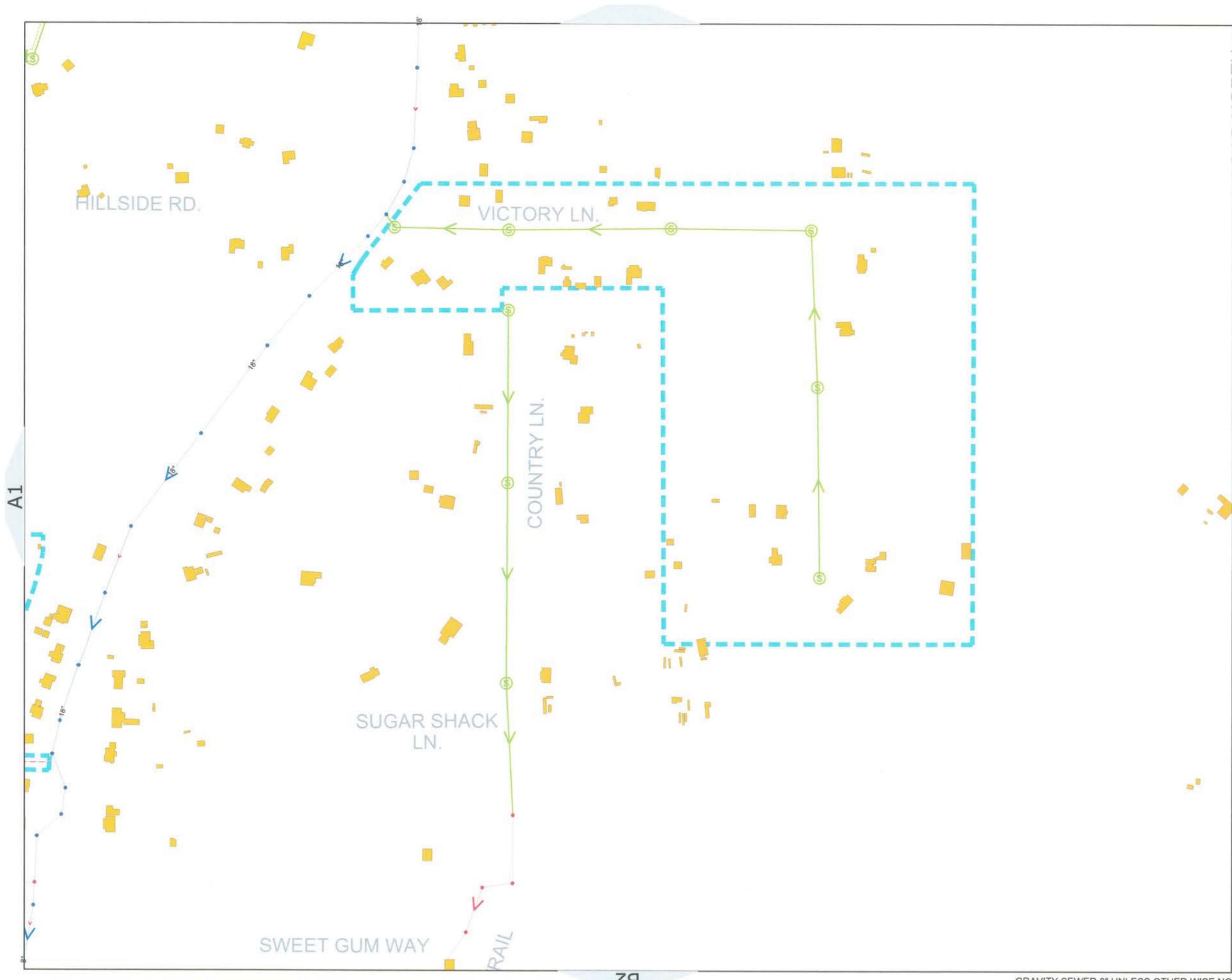
LEGEND

- SELENA DRIVE
- PROPOSED MANHOLES
- 8" GRAVITY SEWER
- SERVICES
- 2.5" FORCE MAIN
- PUMP STATION
- FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	105.S1
PLOT DATE	
9-10-2017	
SHEET FILE	SELENA DRIVE



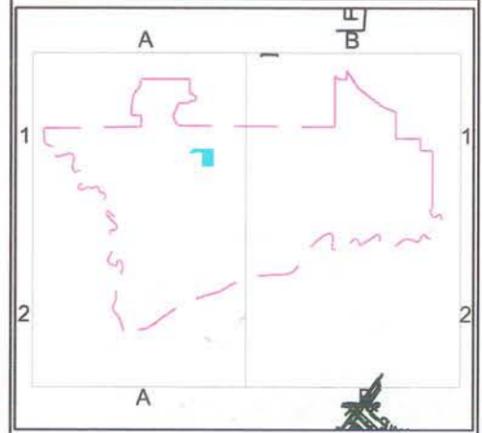
CITY OF BILOXI



LEGEND

- VICTORY LANE
- 9 PROPOSED MANHOLES
- 3500 L.F. 8" GRAVITY SEWER SERVICES
- 19
- > FLOW DIRECTION
- EXISTING BUILDING
- - - PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	106.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
VICTORY LANE

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

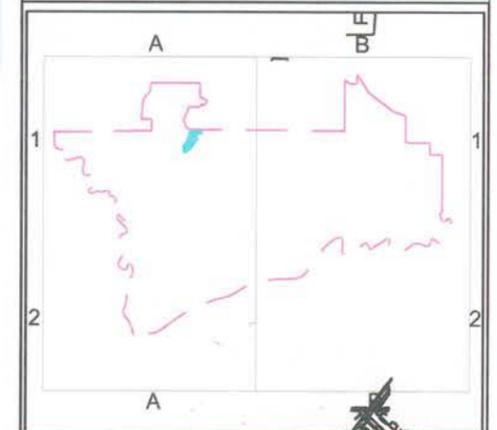
CITY OF BILOXI



LEGEND

- SOUTH MILL CREEK
- 16 PROPOSED MANHOLES
- 2600 L.F. 8" GRAVITY SEWER
- 18 SERVICES
- 3200 L.F. 4" FORCE MAIN
- (1)80 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- - - - - PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

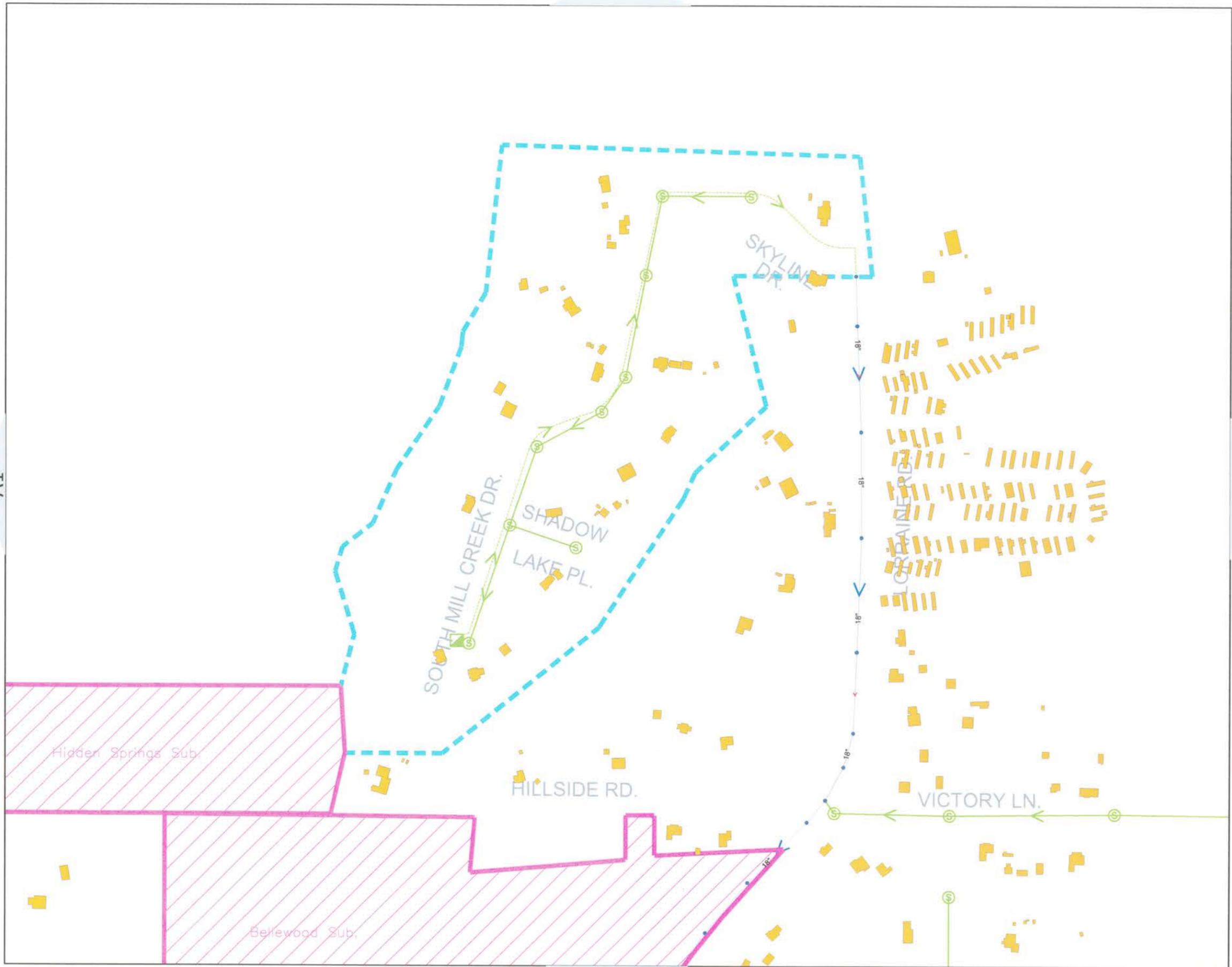
KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	107.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
**SOUTH MILL CREEK**

A1



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

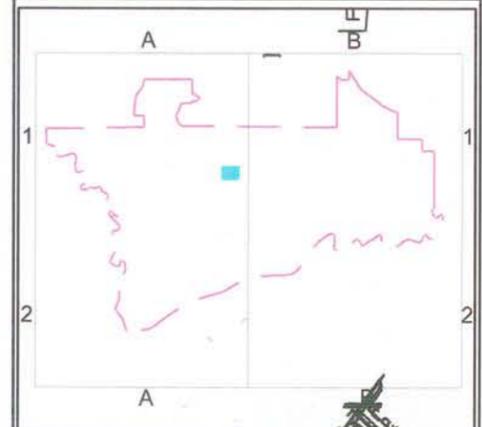
CITY OF BILOXI



LEGEND

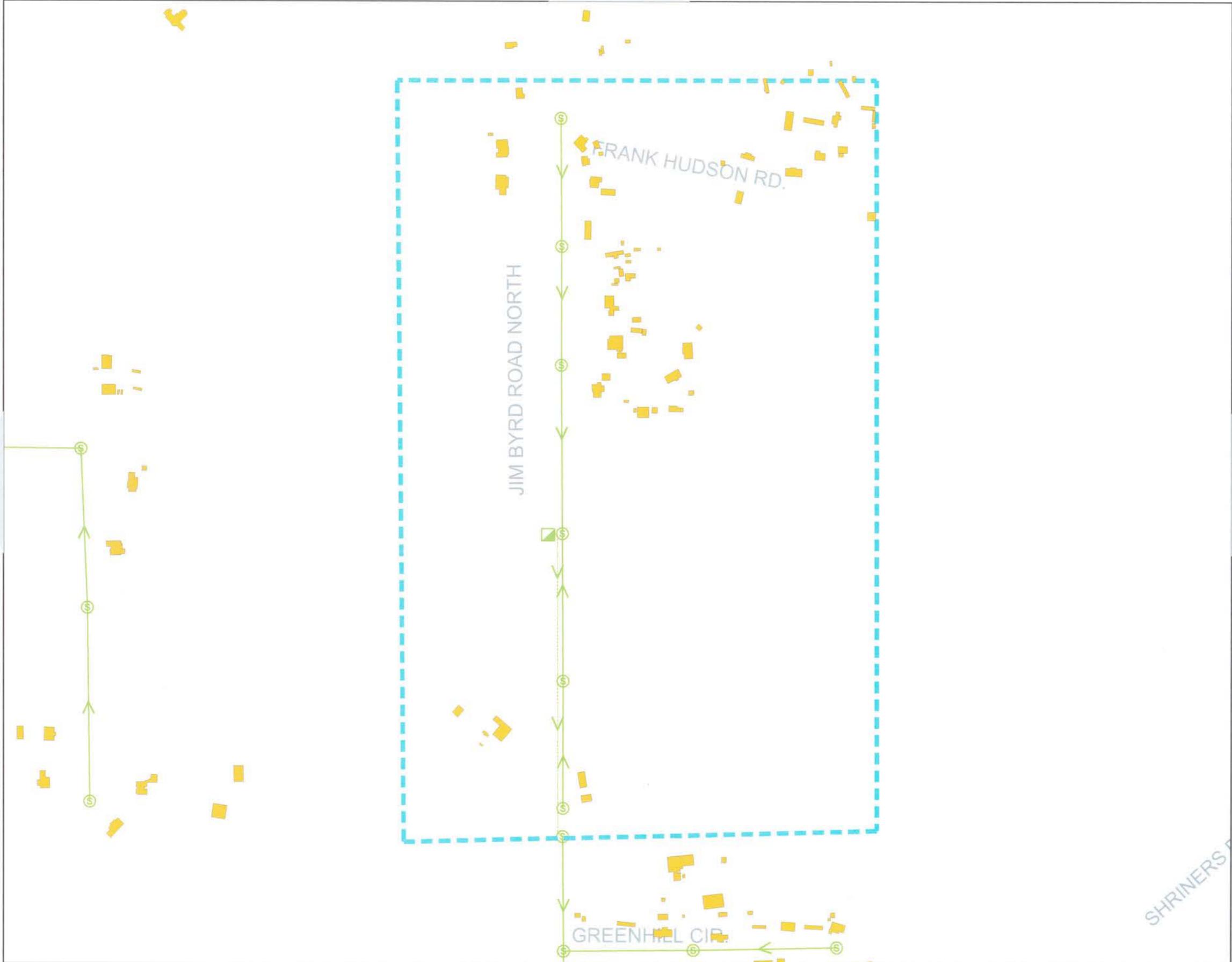
- JIM BYRD SOUTH
- 22 PROPOSED MANHOLES
- 6250 L.F. 8" GRAVITY SEWER SERVICES
- 60
- > FLOW DIRECTION
- EXISTING BUILDING
- - - - - PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	146.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
JIM BYRD SOUTH



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

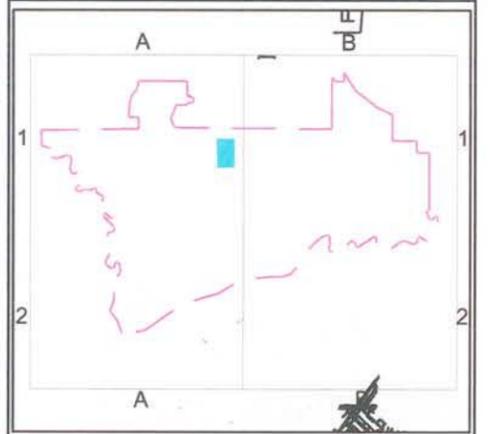
CITY OF BILOXI



LEGEND

- JIM BYRD NORTH
- 10 PROPOSED MANHOLES
- 3100 L.F. 8" GRAVITY SEWER SERVICES
- 15 4" FORCE MAIN
- 1350 L.F. (1)80 GPM PUMP STATION
- FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

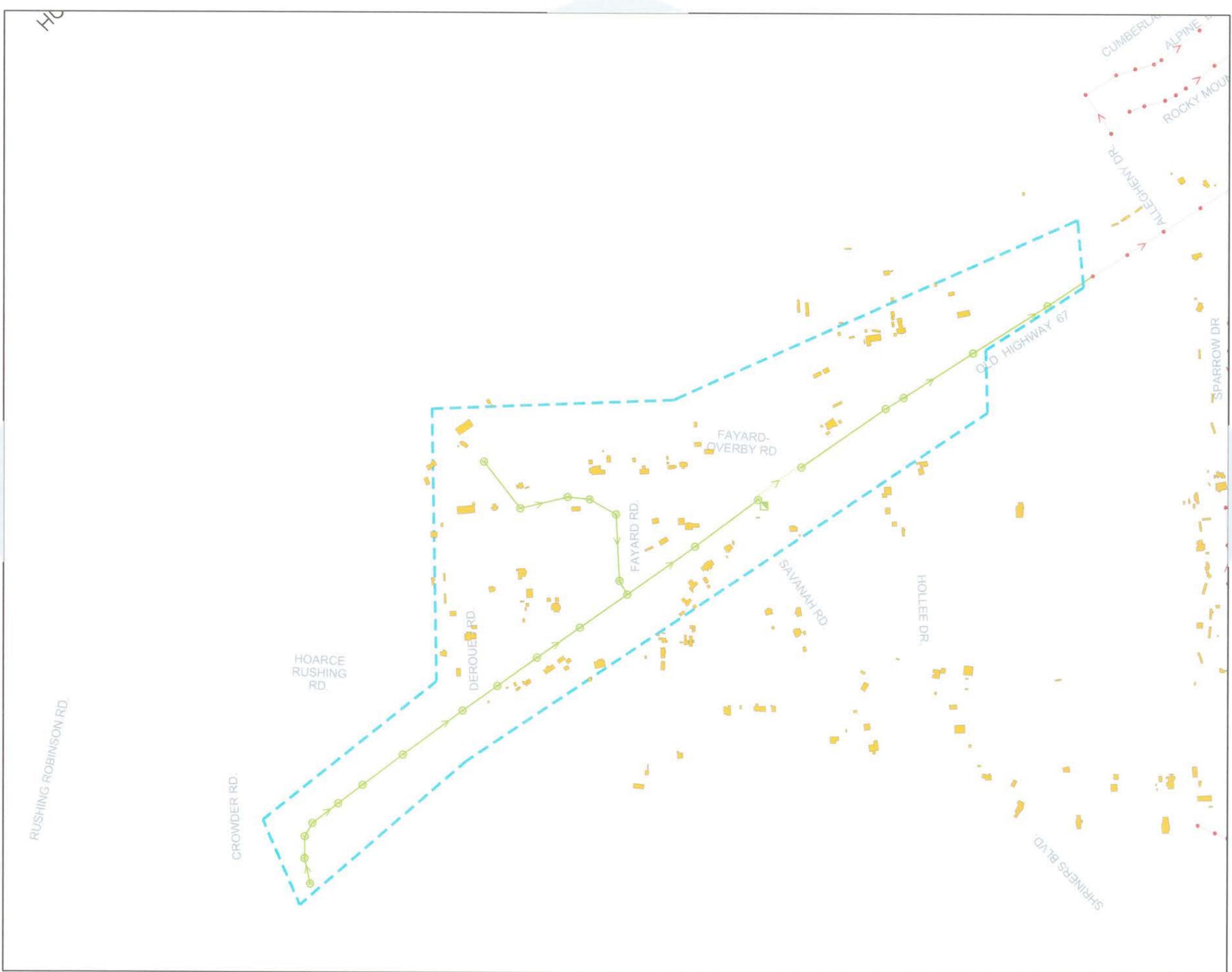
KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	147.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
JIM BYRD NORTH

SHRINERS P



GRAVITY SEWER 8" UNLESS OTHER WISE NOTED

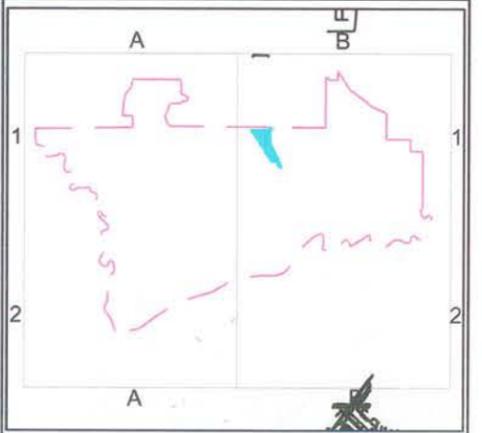
CITY OF BILOXI



LEGEND

- OLD HWY 67 NORTH
- 20 PROPOSED MANHOLES
- 7625 L.F. 8" GRAVITY SEWER SERVICES
- 50 450 L.F. 4" FORCE MAIN
- (1)80 GPM PUMP STATION
- FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 250'	148.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
**OLD HWY 67 NORTH**



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

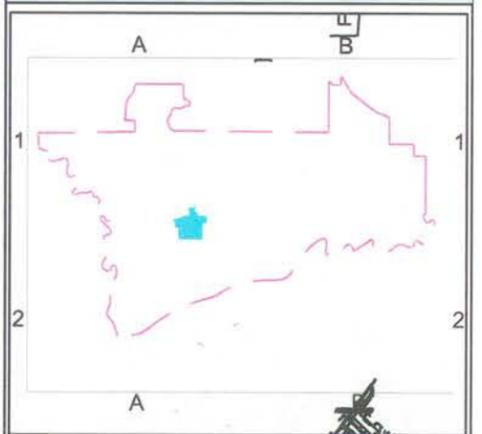
CITY OF BILOXI



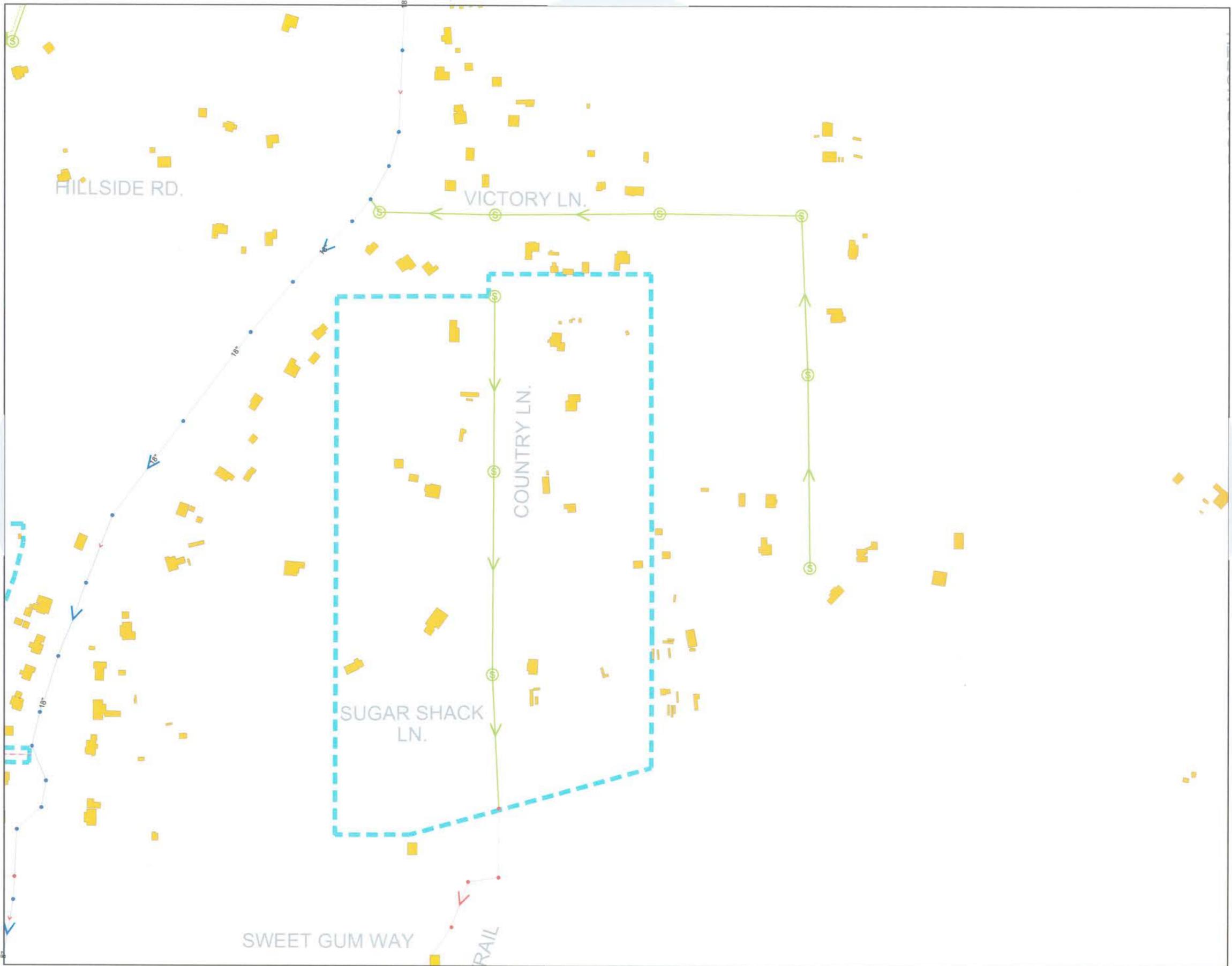
LEGEND

- AIRPORT ROAD
- 40 PROPOSED MANHOLES
- 12256 L.F. 8" GRAVITY SEWER
- 87 SERVICES
- 3100 L.F. 4" FORCE MAIN
- (1)80 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	151.S1
PLOT DATE	
9-10-2017	
SHEET FILE	
AIRPORT ROAD	



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

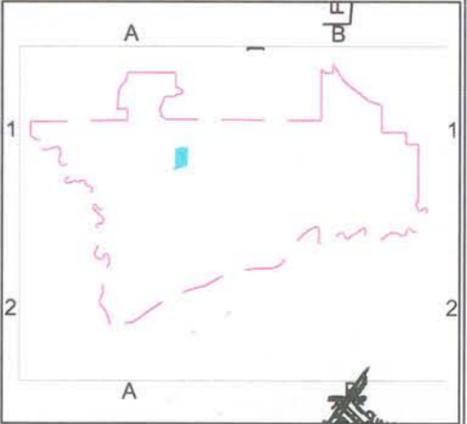
CITY OF BILOXI



LEGEND

- COUNTRY LANE
- 7 PROPOSED MANHOLES
- 2300 L.F. 8" GRAVITY SEWER SERVICES
- > 14 FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	152.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
COUNTRY LANE



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

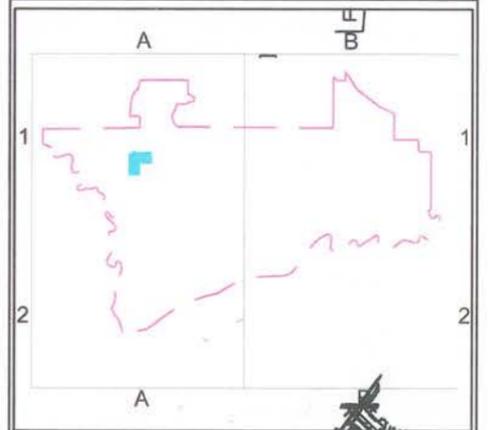
CITY OF BILOXI



LEGEND

- WOODLANDS DRIVE
- PROPOSED MANHOLES
- 0 L.F. 8" GRAVITY SEWER
- 34 SERVICES
- 2400 L.F. 2.5" FORCE MAIN
- Grinder PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>161.S1</b>
PLOT DATE	
9-10-2017	
SHEET FILE	
<b>WOODLANDS DRIVE</b>	



GRAVITY SEWER 8" UNLESS OTHER WISE NOTED

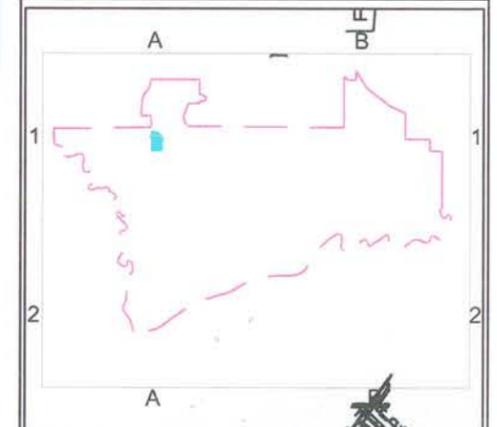
CITY OF BILOXI



LEGEND

- WOODLANDS HILLS
- 18** PROPOSED MANHOLES
- 3700 L.F.** 8" GRAVITY SEWER SERVICES
- 28** SERVICES
- 800 L.F.** 4" FORCE MAIN
- (1)80 GPM** PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>162.S1</b>
PLOT DATE	
9-10-2017	

SHEET FILE  
**WOODLANDS HILLS**



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

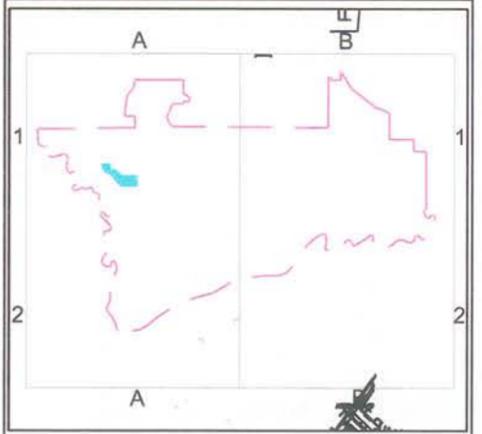
CITY OF BILOXI



LEGEND

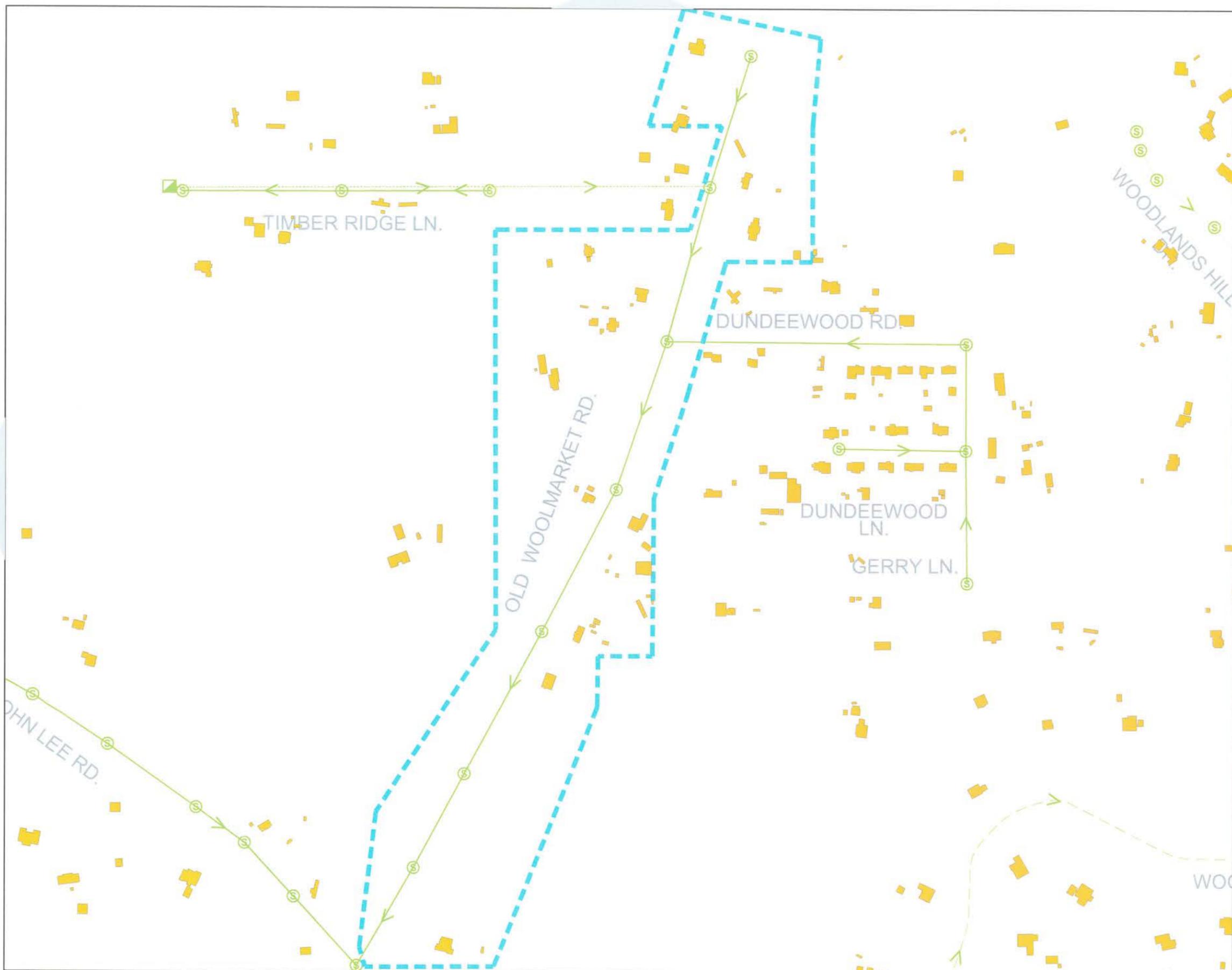
- JOHN LEE ROAD SOUTH
- 13 PROPOSED MANHOLES
- 4625 L.F. 8" GRAVITY SEWER SERVICES
- 25 8" FORCE MAIN
- 1880 L.F. 400 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- - - PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	170.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
JOHN LEE ROAD SOUTH



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

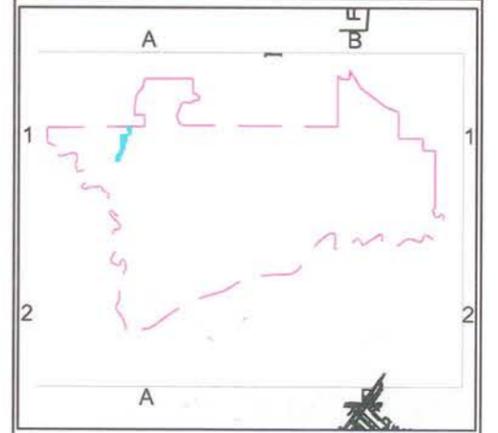
CITY OF BILOXI



LEGEND

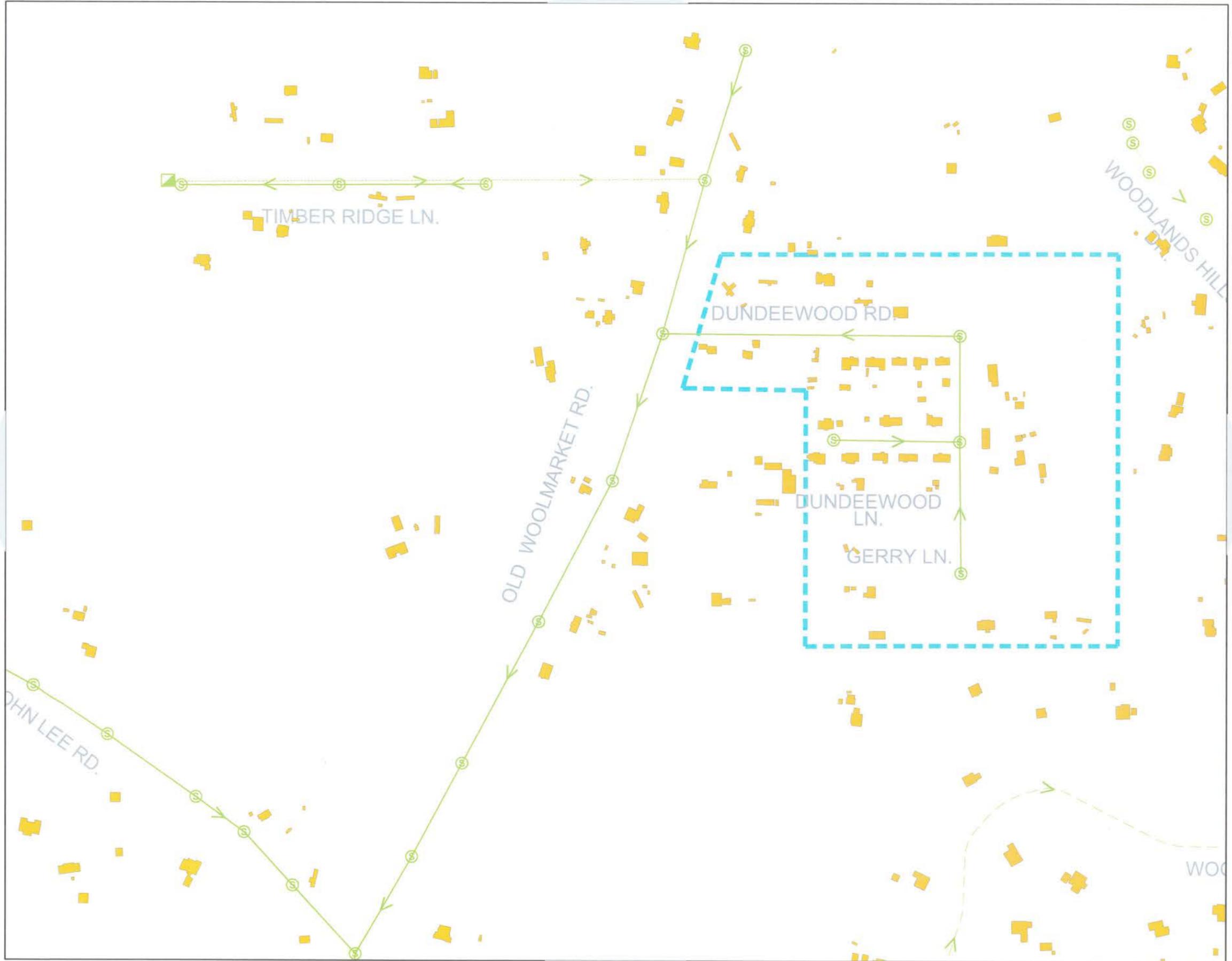
- OLD WOOLMARKET ROAD
- 16** PROPOSED MANHOLES
- 5500 L.F.** **8" GRAVITY SEWER SERVICES**
- 21** **SERVICES**
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- - - PROPOSED LIFT STATION
- - - PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>171.S1</b>
PLOT DATE	
9-10-2017	

SHEET FILE  
**OLD WOOLMARKET ROAD**



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

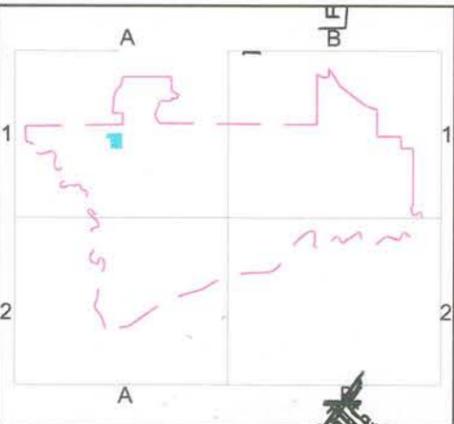
CITY OF BILOXI



LEGEND

- DUNDEEWOOD ROAD
- 5 PROPOSED MANHOLES
- 2860 L.F. 8" GRAVITY SEWER SERVICES
- > 29 FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP

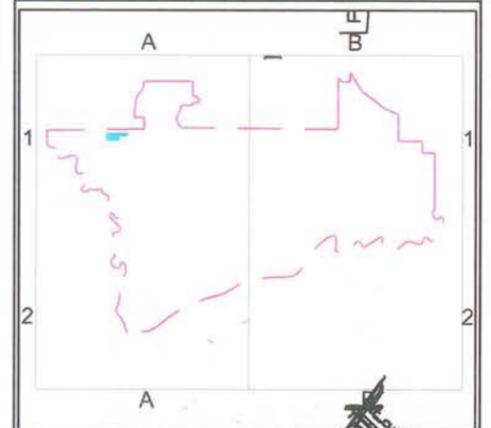


SCALE	FIGURE NUMBER
1" = 200'	172.S1
PLOT DATE	
9-10-2017	
SHEET FILE	
DUNDEEWOOD ROAD	

**LEGEND**

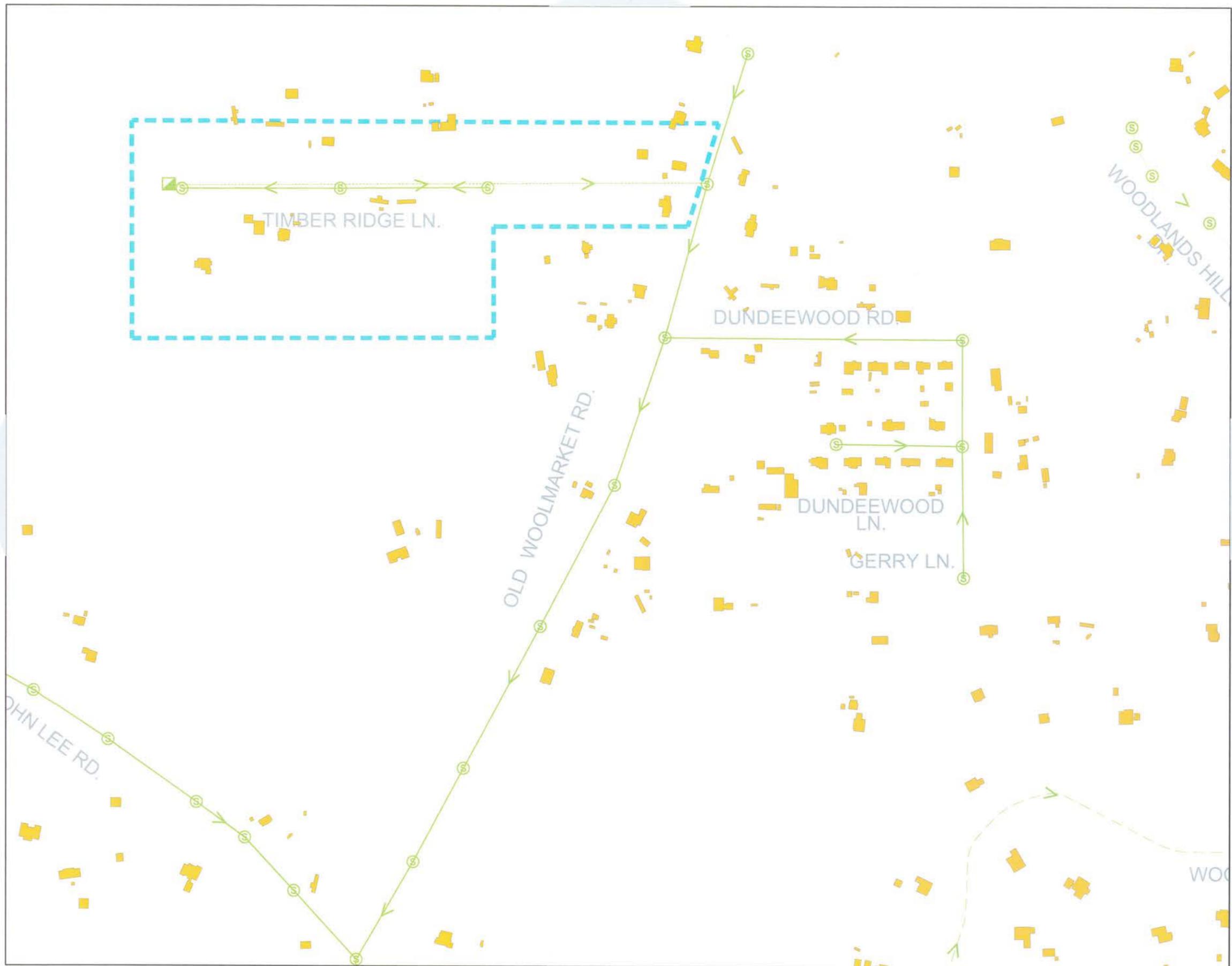
- TIMBER RIDGE ROAD
- 4 PROPOSED MANHOLES
- 1350 L.F. 8" GRAVITY SEWER SERVICES
- 11 4" FORCE MAIN
- 2200 L.F. 4" FORCE MAIN
- (1)80 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- - - - - PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- - - - - PROPOSED FORCE MAIN

**KEY MAP**



SCALE 1" = 200'	FIGURE NUMBER <b>173.S1</b>
PLOT DATE 9-10-2017	

SHEET FILE <b>TIMBER RIDGE ROAD</b>
--



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



GRAVITY SEWER 8" UNLESS OTHER WISE NOTED

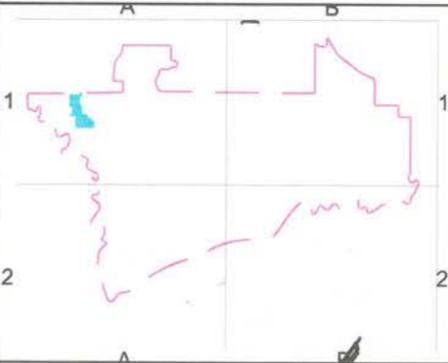
CITY OF BILOXI



LEGEND

- JOHN LEE ROAD NORTH
- 14 PROPOSED MANHOLES
- 5000 L.F. 8" GRAVITY SEWER
- 35 SERVICES
- > FLOW DIRECTION
- EXISTING BUILDING
- - - - - PROPERTY LINE
- PROPOSED GRAVITY SEWER
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	174.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
JOHN LEE ROAD NORTH



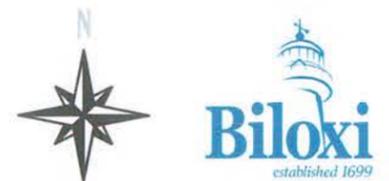
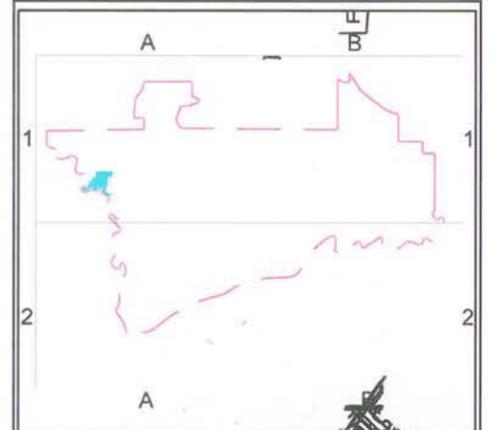
CITY OF BILOXI



LEGEND

- WOOLMARKET LAKE ROAD
- 32 PROPOSED MANHOLES
- 5775 L.F. 8" GRAVITY SEWER SERVICES
- 4875 L.F. 4" FORCE MAIN
- (1) 200 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	175.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
**WOOLMARKET LAKE ROAD**

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



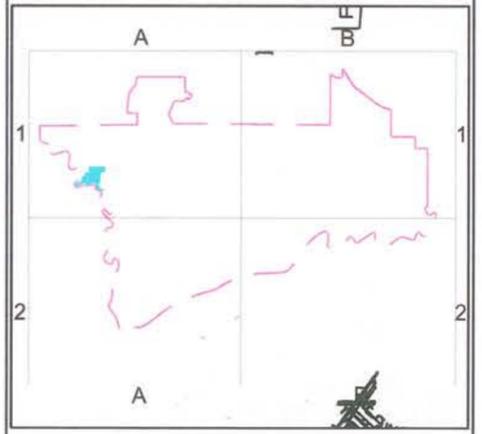
CITY OF BILOXI



LEGEND

- SNUGG HARBOR
- 13 PROPOSED MANHOLES
- 1560 L.F. 8" GRAVITY SEWER SERVICES
- 18 4" FORCE MAIN
- 80 GPM PUMP STATION
- FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>176.S1</b>
PLOT DATE	
9-10-2017	

SHEET FILE  
**SNUG HARBOR ROAD**

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

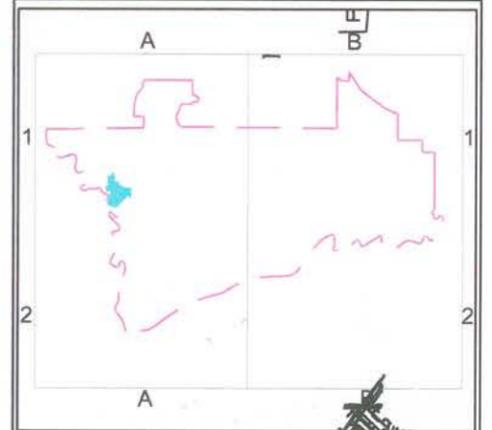
CITY OF BILOXI



LEGEND

- RIVERLAND DRIVE
- 24 PROPOSED MANHOLES
- 5500L.F. 8" GRAVITY SEWER SERVICES
- 50
- 5900 L.F. 4" FORCE MAIN
- 80 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	177.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
RIVERLAND DRIVE



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

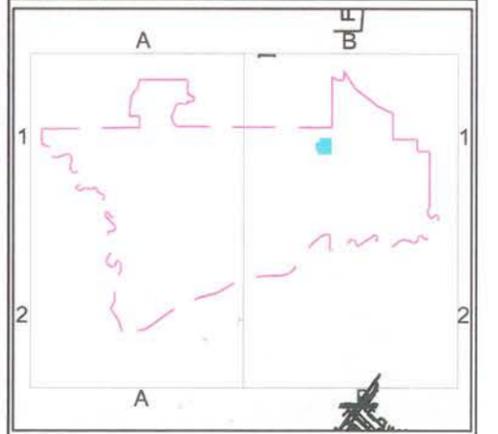
CITY OF BILOXI



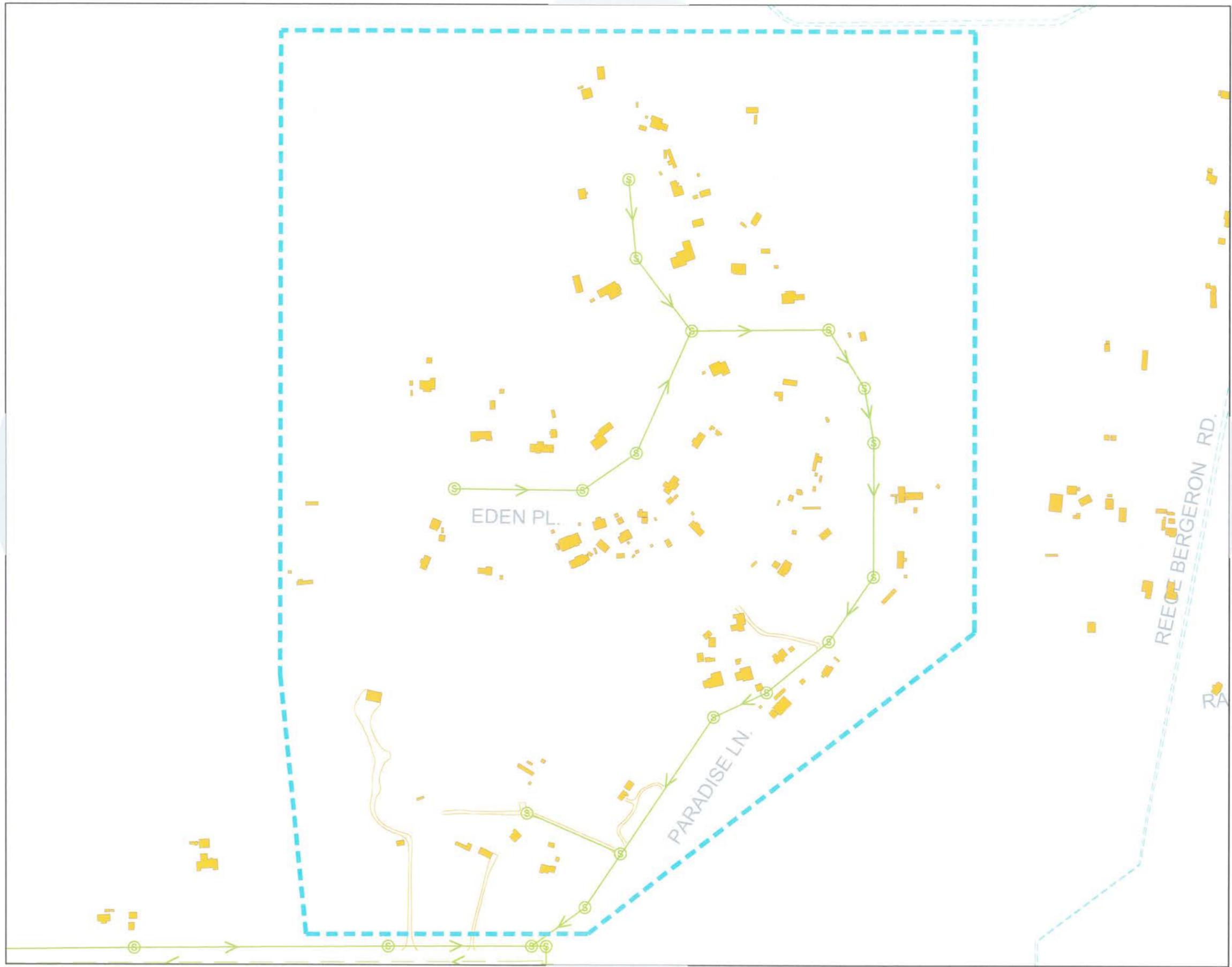
LEGEND

- OLD HY 67 SOUTH
- 11 PROPOSED MANHOLES
- 3900 L.F. 8" GRAVITY SEWER SERVICES
- 39 4" FORCE MAIN
- 5340 L.F. (1)130 GPM PUMP STATION
- FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	201.S1
PLOT DATE	
9-10-2017	
SHEET FILE	
OLD HWY 67 SOUTH	



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

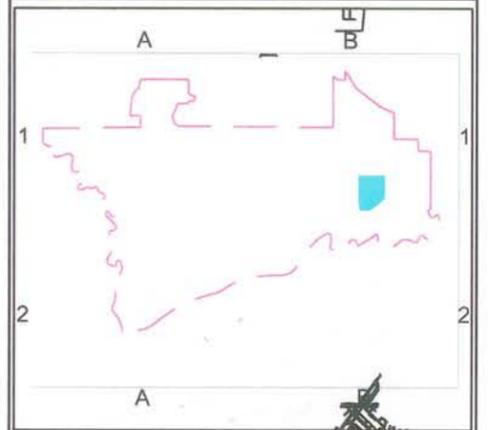
CITY OF BILOXI



LEGEND

- PARADISE LANE
- 26 PROPOSED MANHOLES
- 8450 L.F. 8" GRAVITY SEWER SERVICES
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	202.S1
PLOT DATE	
9-10-2017	

SHEET FILE  
PARADISE LANE



GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

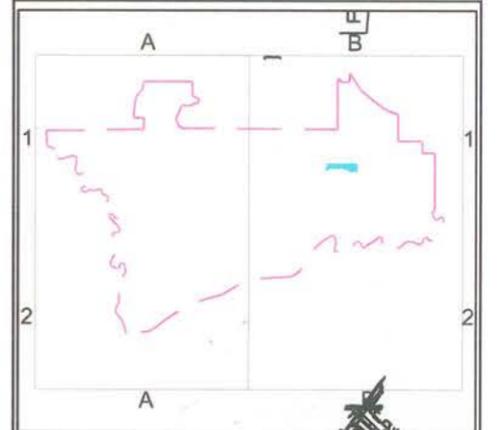
CITY OF BILOXI



LEGEND

- MASON ROAD
- ⊙ 8 PROPOSED MANHOLES
- 2700 L.F. 8" GRAVITY SEWER SERVICES
- 19 2950 L.F. 4" FORCE MAIN
- ⊠ (1) 80 GPM PUMP STATION
- > FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- ⊠ PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>203.S1</b>
PLOT DATE	
9-10-2017	

SHEET FILE  
**MASON ROAD**



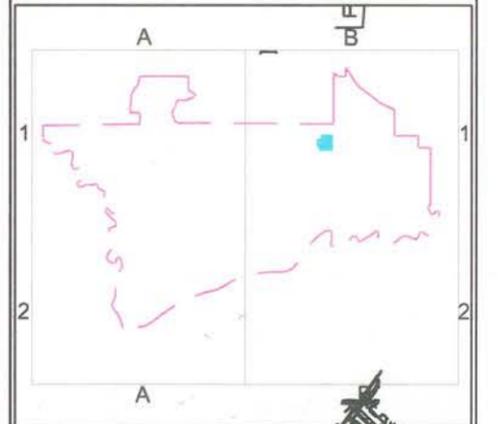
CITY OF BILOXI



LEGEND

- STACY LANE
- ⊕ 23 PROPOSED MANHOLES
- 3260 L.F. 8" GRAVITY SEWER SERVICES
- 21 FLOW DIRECTION
- EXISTING BUILDING
- PROPERTY LINE
- PROPOSED GRAVITY
- ⊕ PROPOSED LIFT STATION
- PROPOSED FORCE MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>204.S1</b>
PLOT DATE	
6-28-18	

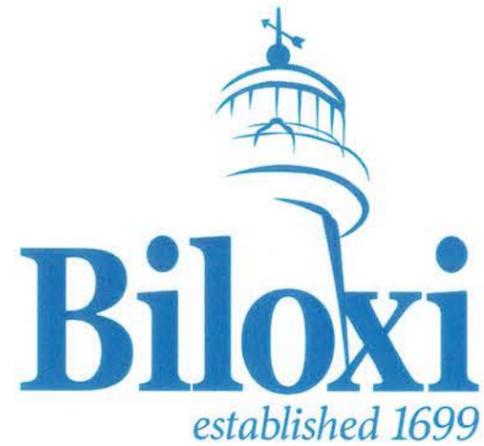
SHEET FILE  
**STACY LANE**

GRAVITY SEWER 8" UNLESS OTHERWISE NOTED

# WOOLMARKET MASTER PLAN

*City of Biloxi*  
*Harrison County, Mississippi*

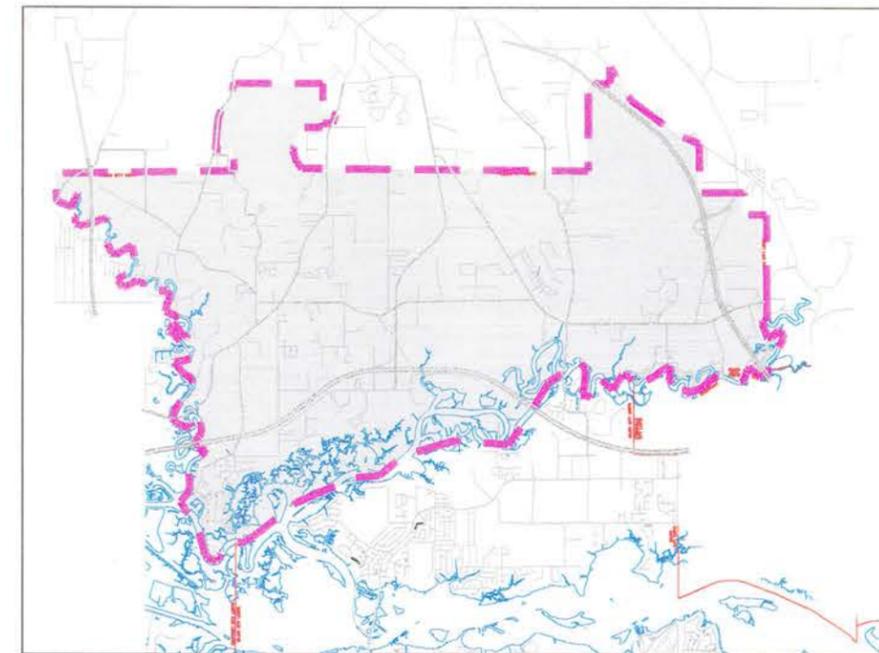
## APPENDIX "B"



**A. M. Gilich, Jr., Mayor**

### City Council

George Lawrence	Ward 1	Paul Tisdale	Ward 5
Felix Gines	Ward 2	Kenny Glavan	Ward 6
Dixie Newman	Ward 3	Nathan Barrett	Ward 7
Robert L. Deming III	Ward 4		



KEY MAP

— STUDY BOUNDARY



*Prepared By:*



*In Association With:*

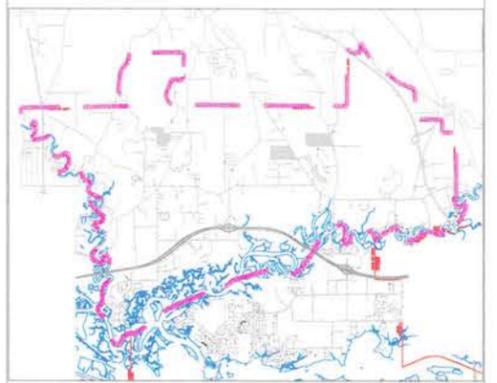




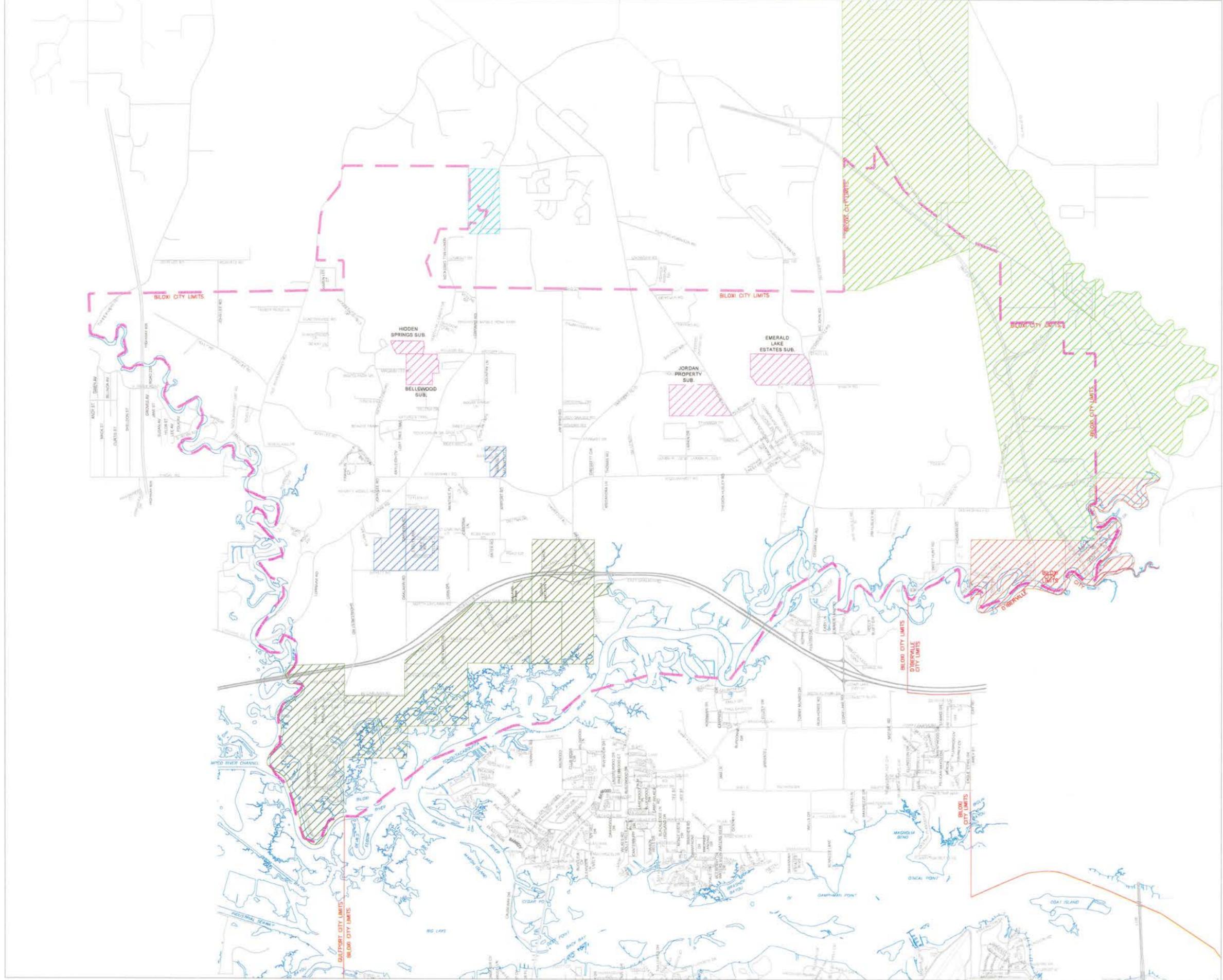
LEGEND

- STUDY BOUNDARY
- SUBDIVISION UNDER CONSTRUCTION
- CITY OF BILOXI FORMERLY SUPERIOR UTILITIES
- CITY OF D'IBERVILLE
- SOUTHEAST MISS. UTIL.
- CITY OF BILOXI FORMERLY FRENCH
- CITY OF BILOXI

KEY MAP



SCALE	FIGURE NUMBER
1" = 2000'	4.1
PLOT DATE	
6-01-18	
SHEET FILE	
STUDY AREA - WATER FRANCHISE AREA	

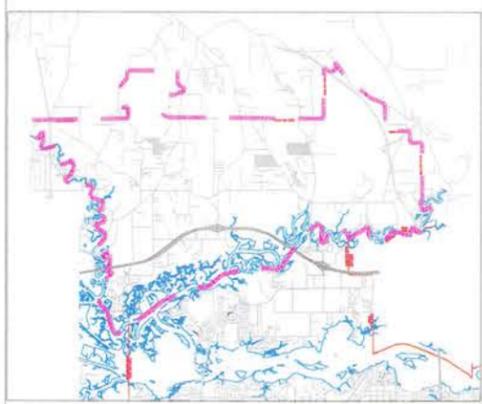




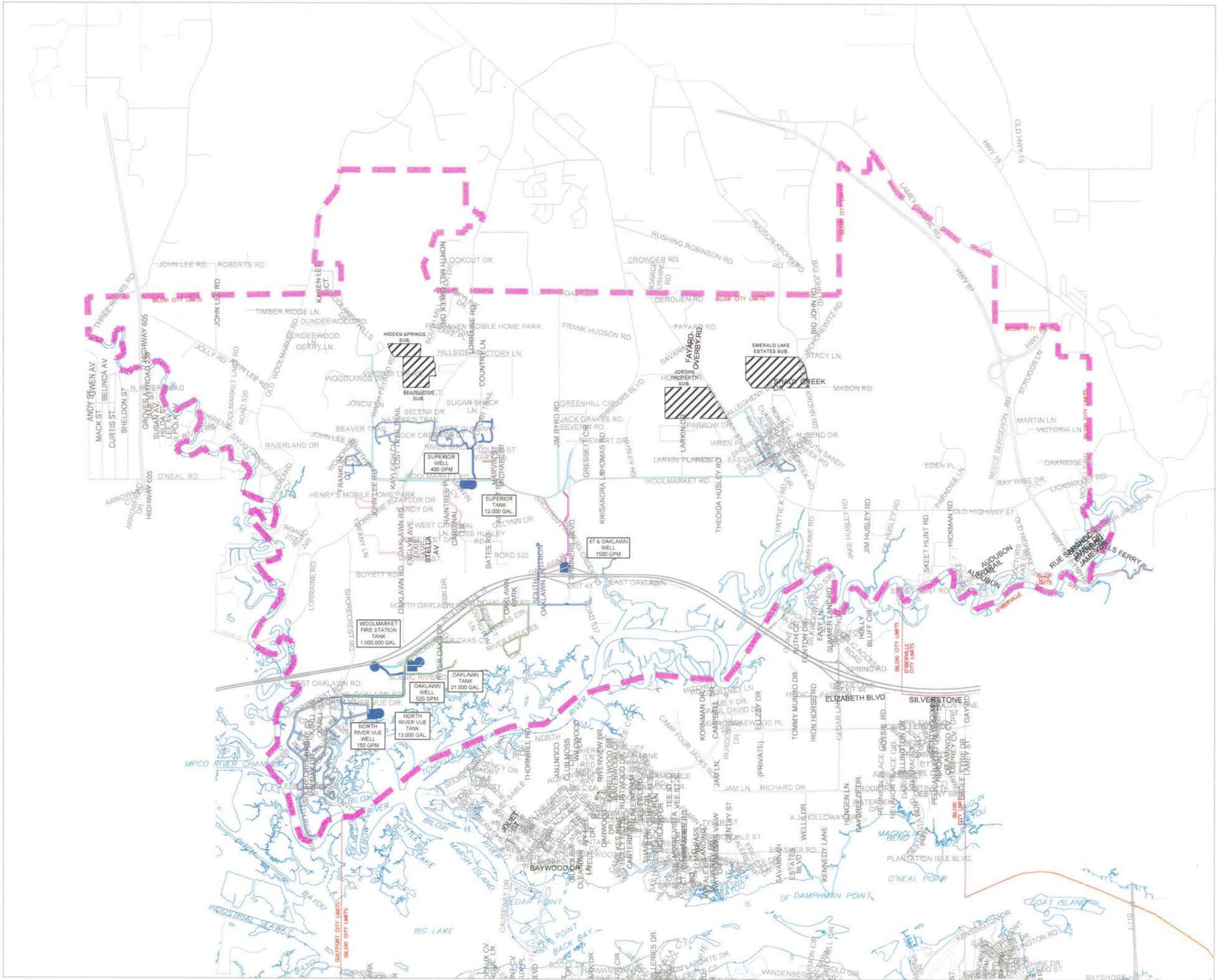
LEGEND

- STUDY BOUNDARY
- 2" WATER MAIN
- 4" WATER MAIN
- 6" WATER MAIN
- 8" WATER MAIN
- 10" WATER MAIN
- 12" WATER MAIN
- 16" WATER MAIN
- CITY OF BILOXI WELL
- CITY OF BILOXI TANK

KEY MAP



SCALE	FIGURE NUMBER
1" = 2000'	4.2
PLOT DATE	
6-01-18	
SHEET FILE	
BILOXI WATER SYSTEM SCHEMATIC	



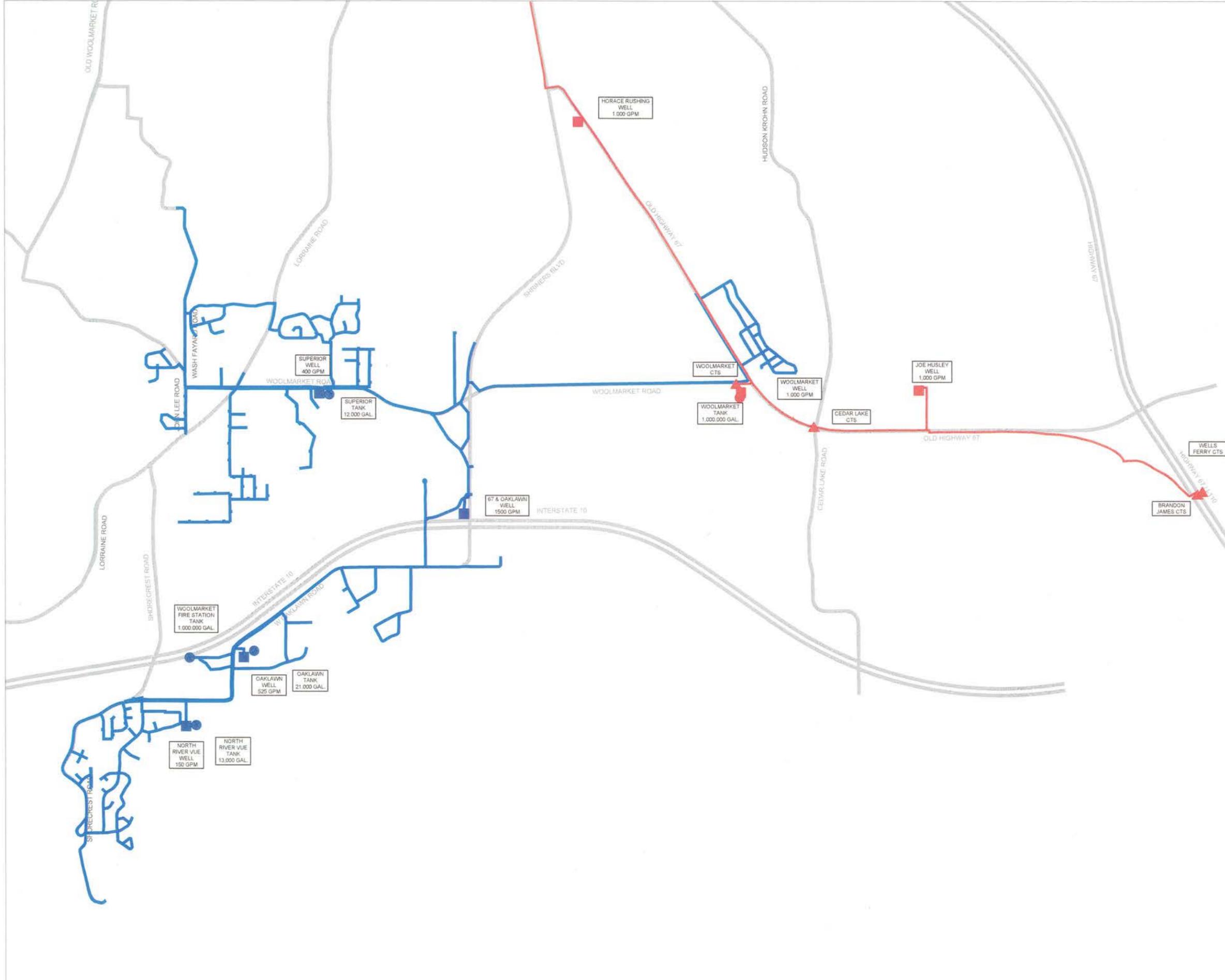
LEGEND

-  STUDY BOUNDARY
-  HCUA WATER MAIN
-  BILOXI WATER MAIN
-  HCUA TANK
-  HCUA WELL
-  HCUA CTS
-  BILOXI TANK
-  BILOXI WELL

KEY MAP



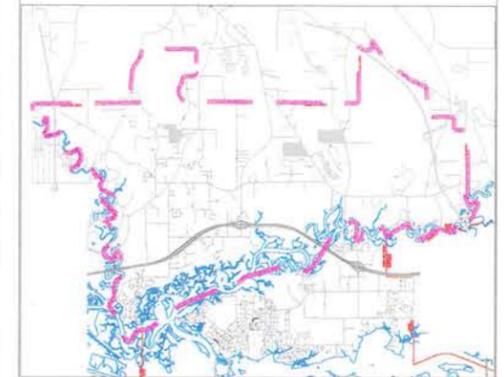
SCALE	FIGURE NUMBER
1" = 1400'	4.3
PLOT DATE	
6-01-18	
SHEET FILE	
EXISTING WATER SCHEMATIC	



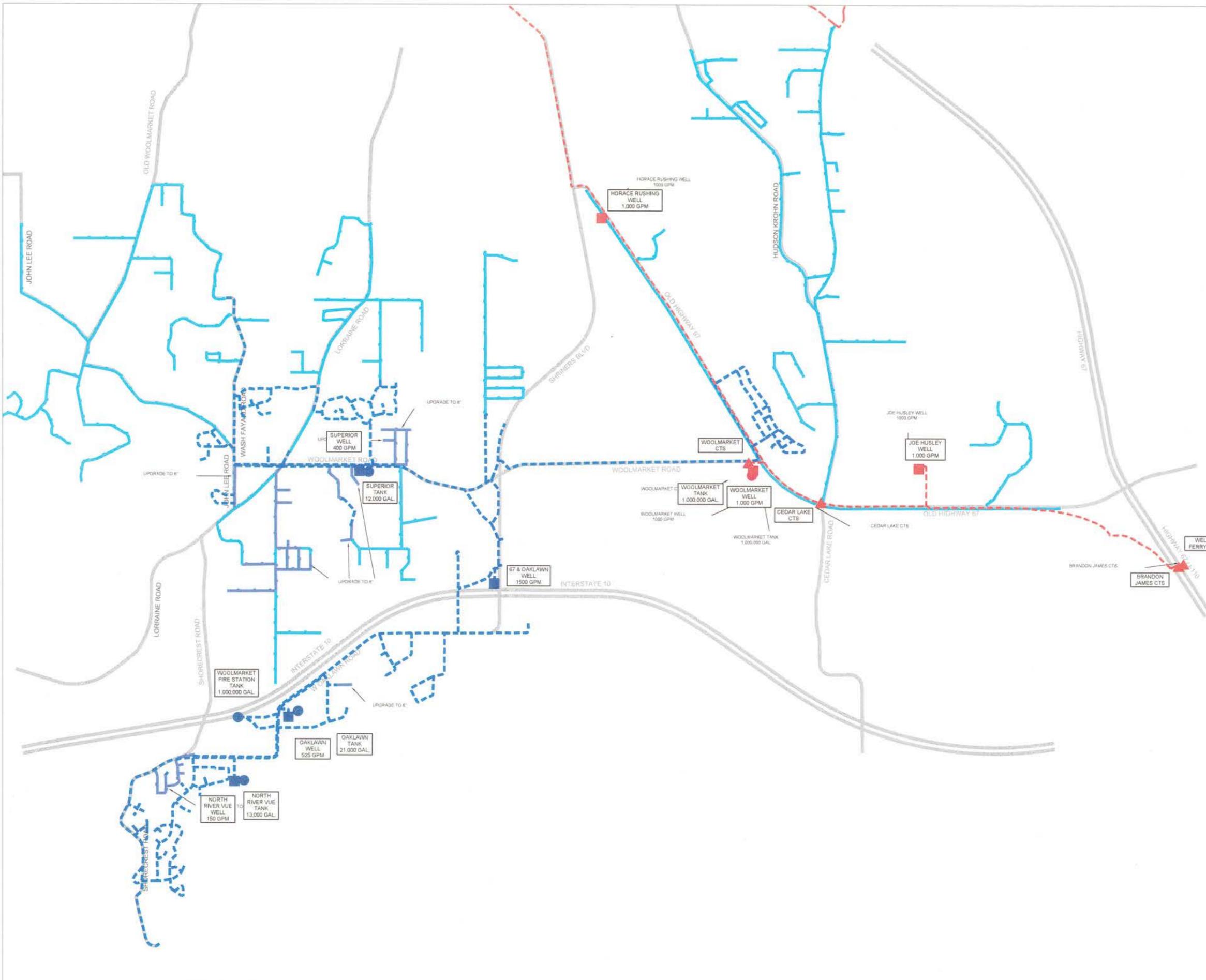
**LEGEND**

- STUDY BOUNDARY
- HCUA WATER MAIN
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN
- HCUA TANK
- HCUA WELL
- ▲ HCUA CTS
- BILOXI TANK
- BILOXI WELL

**KEY MAP**



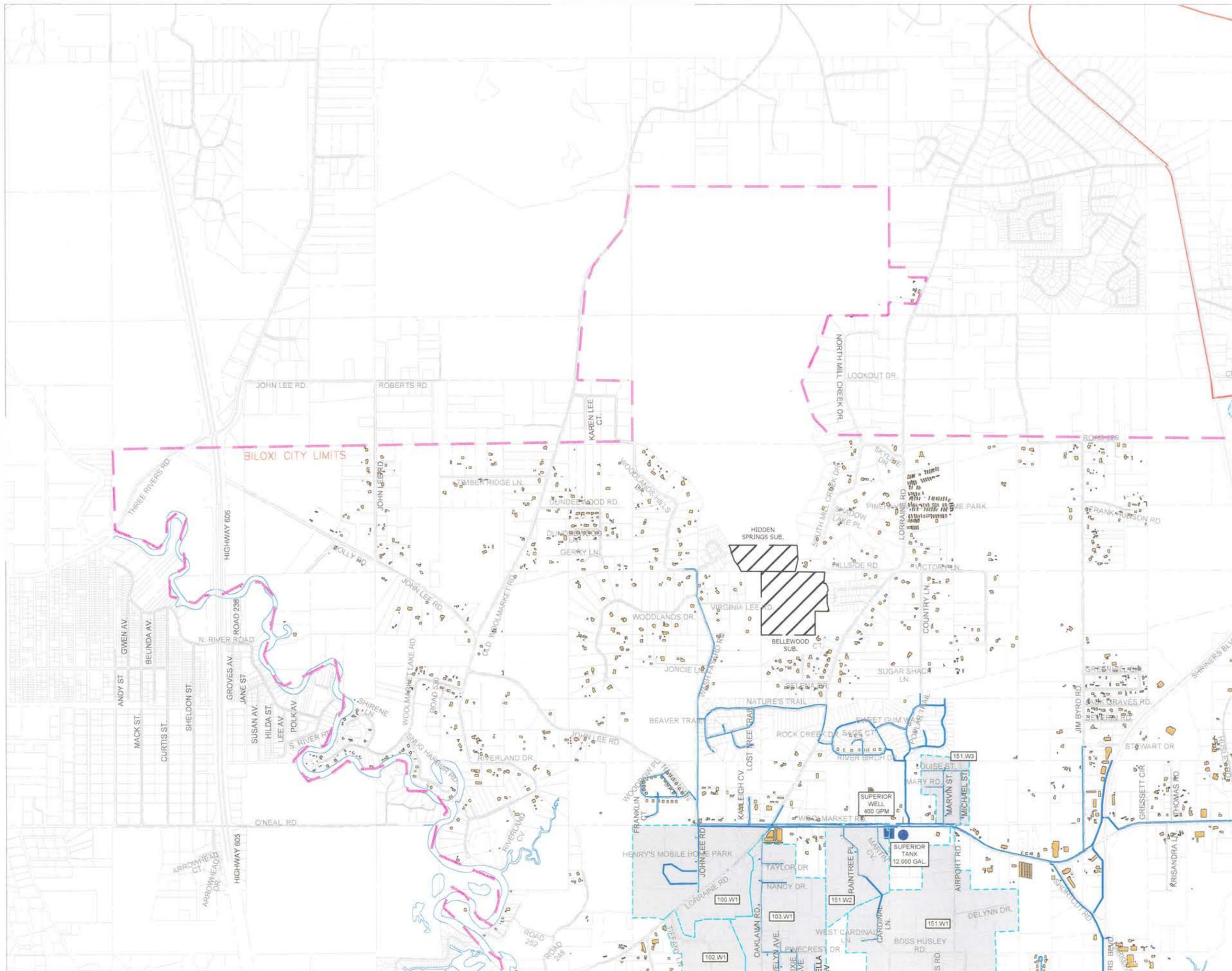
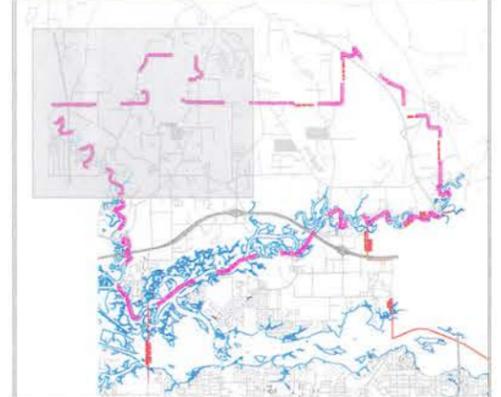
SCALE	FIGURE NUMBER
N.T.S.	4.4
PLOT DATE	
6-01-18	
SHEET FILE	
FUTURE WATER SCHEMATIC	



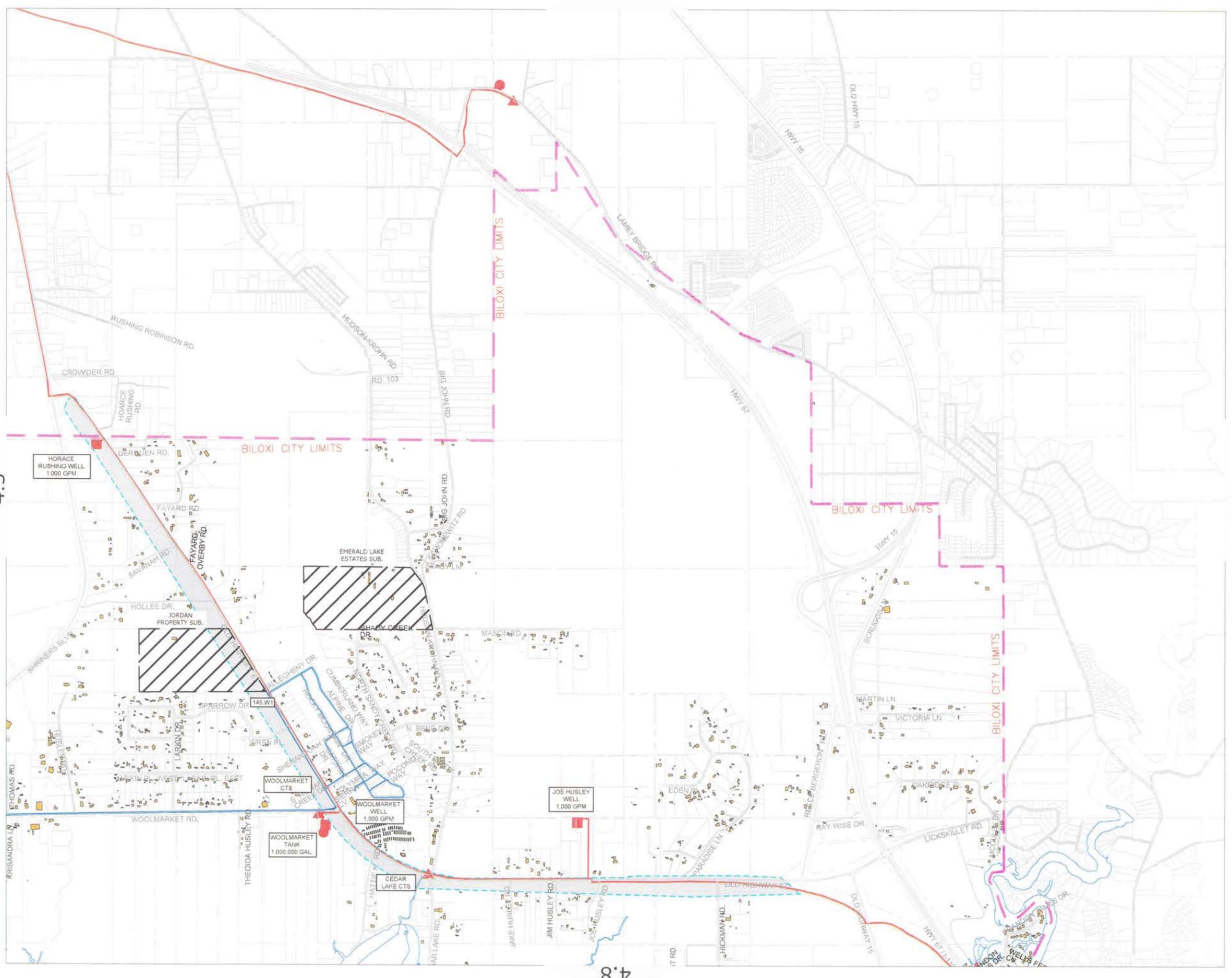
**LEGEND**

- STUDY AREA
- PROJECT AREA
- HCUA WATER MAIN
- BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- EXISTING BUILDING
- PROPERTY LINE

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 1000'	<b>4.5</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>EXISTING WATER BASINS</b>	



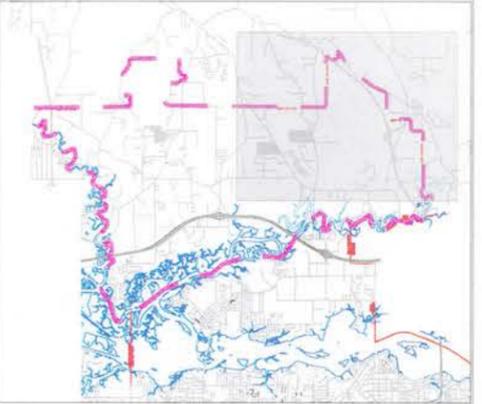
CITY OF BILOXI



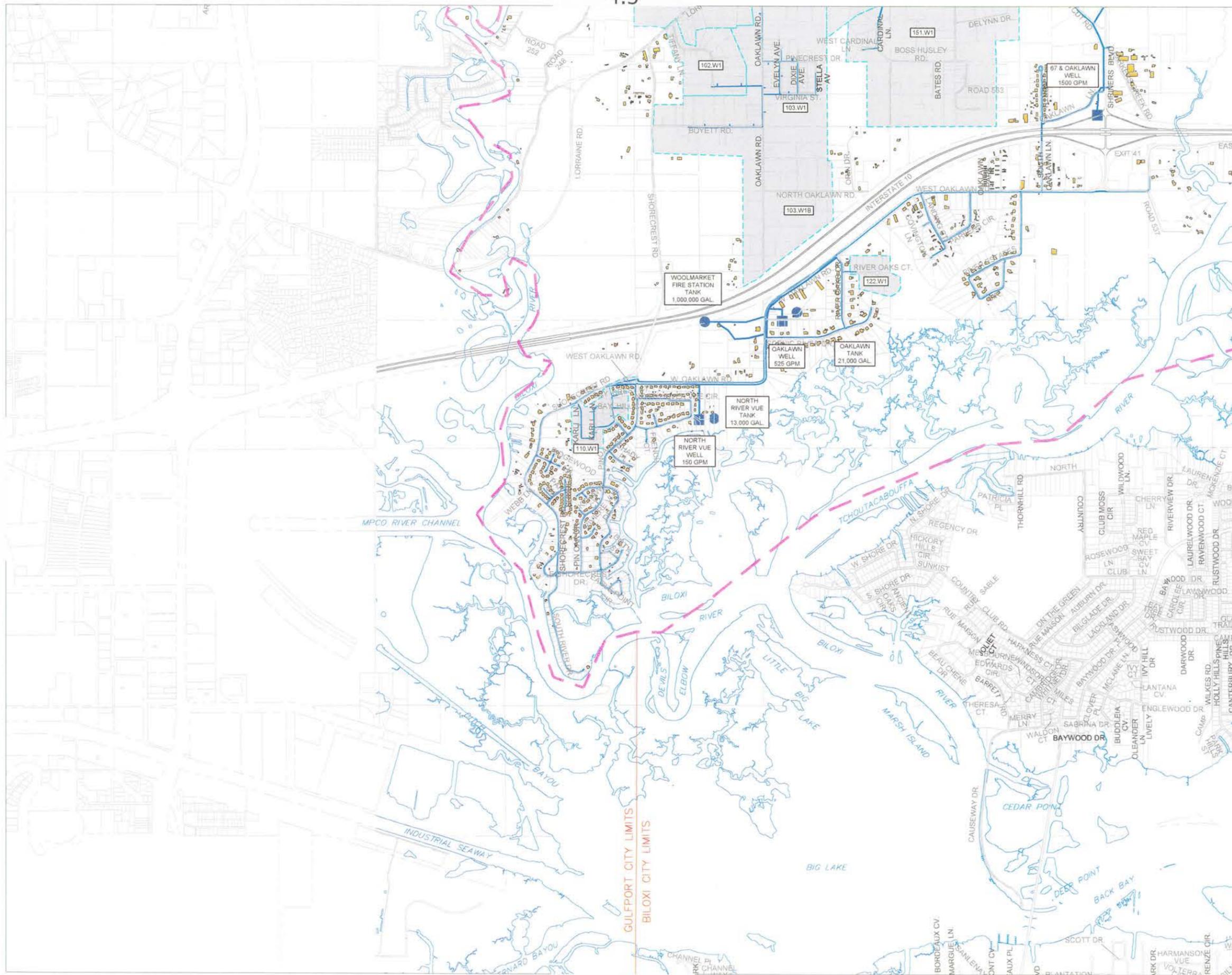
LEGEND

- STUDY AREA
- PROJECT AREA
- HCUA WATER MAIN
- BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- EXISTING BUILDING
- PROPERTY LINE

KEY MAP

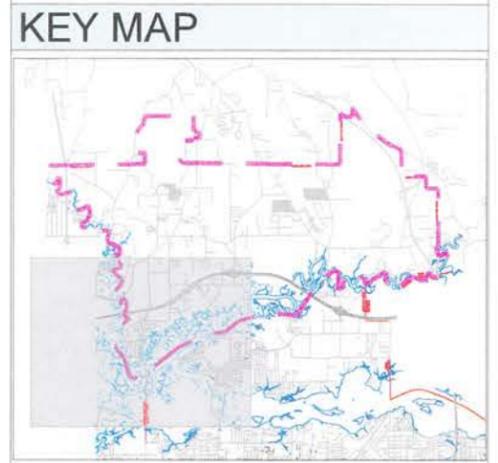


SCALE	FIGURE NUMBER
1" = 1000'	4.6
PLOT DATE	
6-01-18	
SHEET FILE	
EXISTING WATER BASINS	



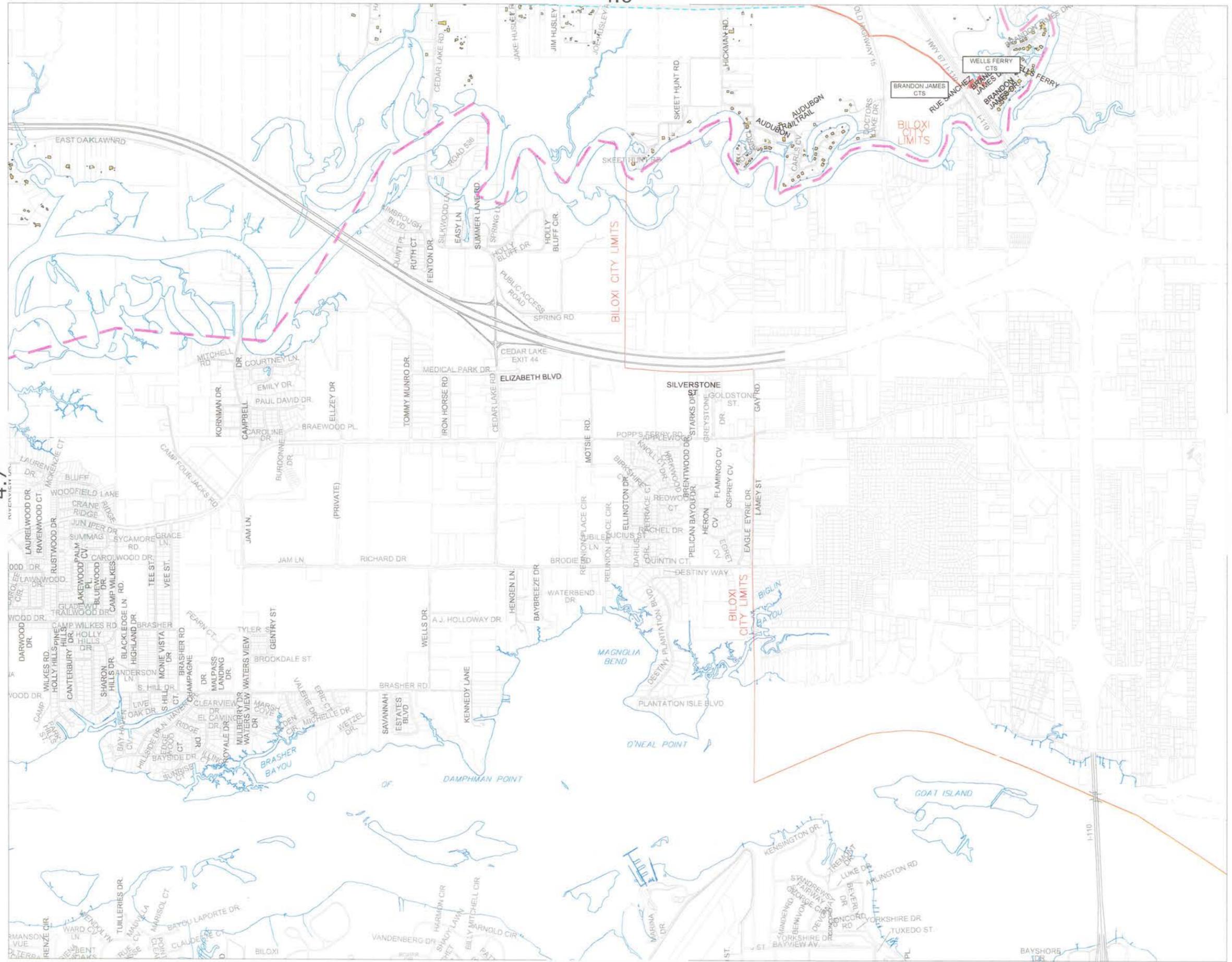
**LEGEND**

- STUDY AREA
- PROJECT AREA
- HCUA WATER MAIN
- BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- ▭ EXISTING BUILDING
- PROPERTY LINE



4.8

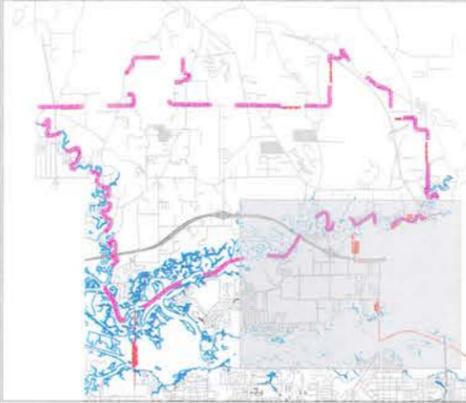
SCALE	FIGURE NUMBER
1" = 1000'	4.7
PLOT DATE	
6-01-18	
SHEET FILE	
EXISTING WATER BASINS	



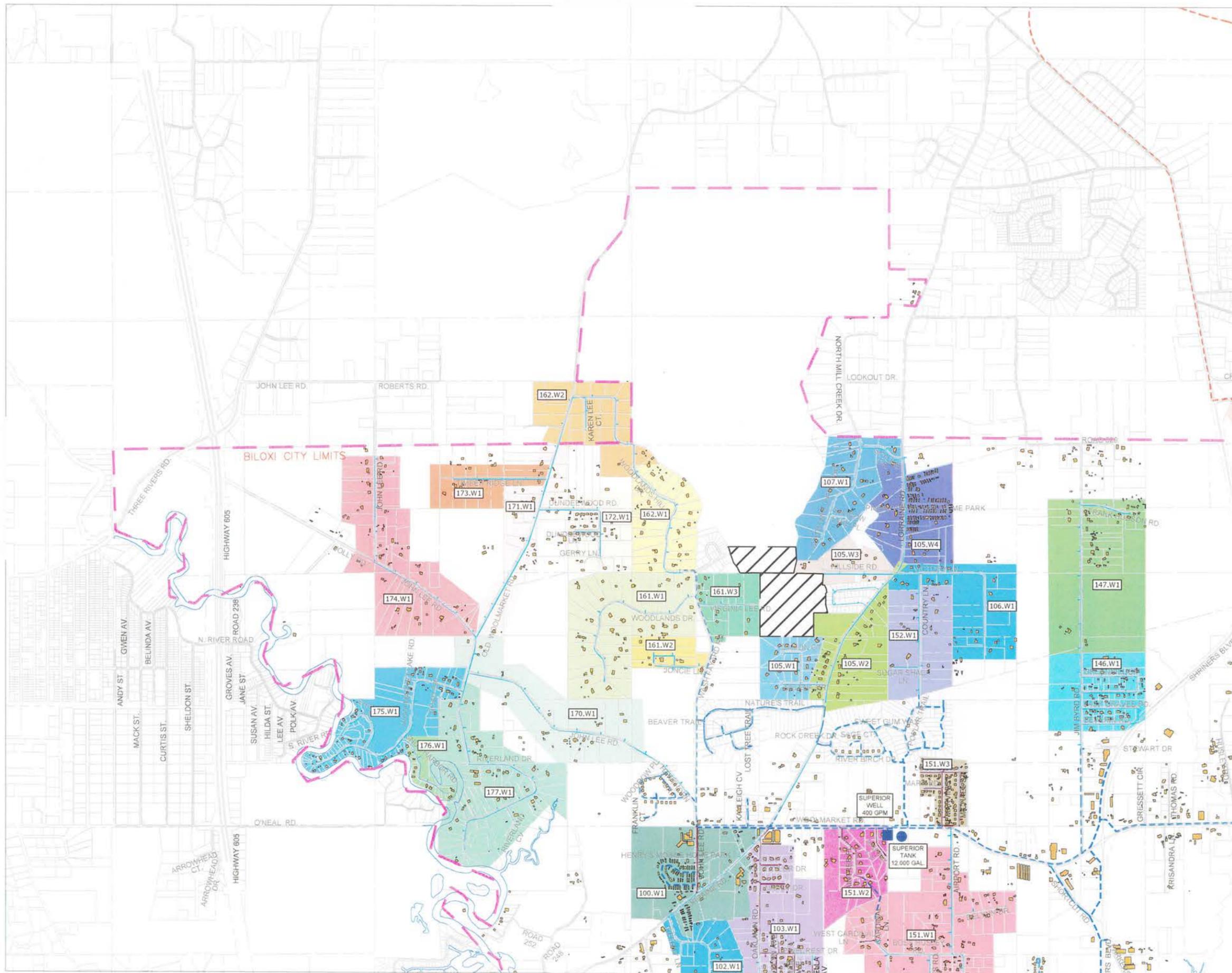
LEGEND

- STUDY AREA
- PROJECT AREA
- HCUA WATER MAIN
- BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- ▭ EXISTING BUILDING
- PROPERTY LINE

KEY MAP



SCALE	FIGURE NUMBER
1" = 1000'	4.8
PLOT DATE	
6-01-18	
SHEET FILE	
EXISTING WATER BASINS	



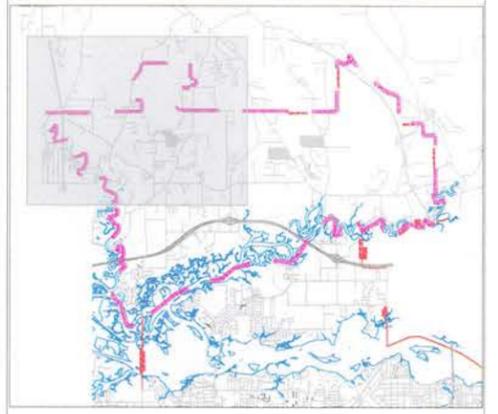
CITY OF BILOXI



LEGEND

- STUDY AREA
- PROJECT AREA
- EXISTING HCUA WATER MAIN
- EXISTING BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN
- FUTURE BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- EXISTING BUILDING
- PROPERTY LINE

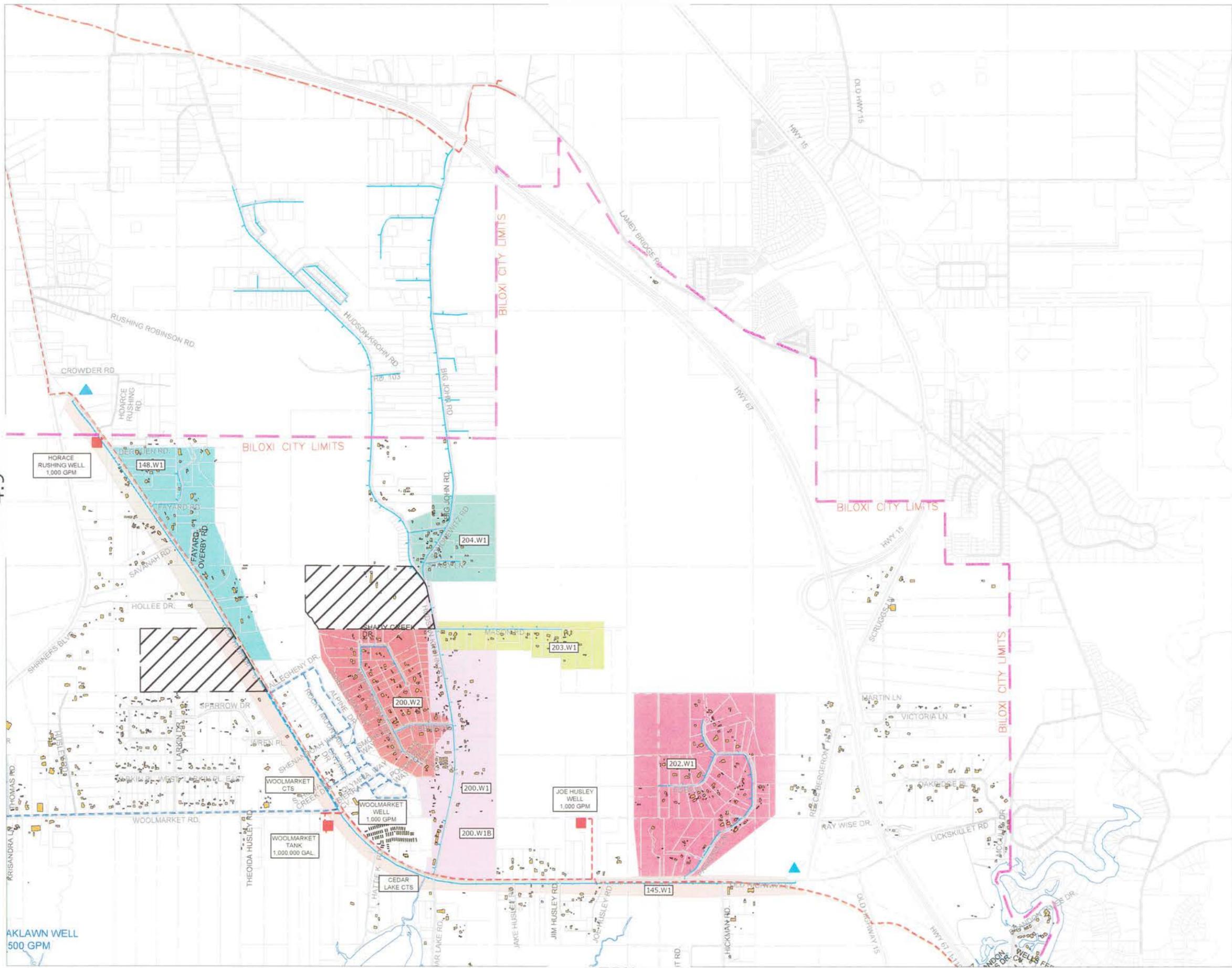
KEY MAP



SCALE	FIGURE NUMBER
1" = 1000'	<b>4.9</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>FUTURE WATER BASINS</b>	

4.10

4.11



4.9

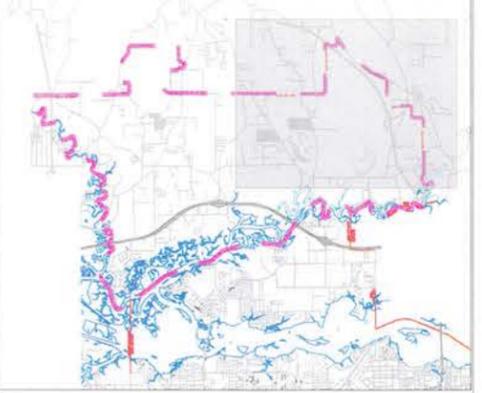
4.12



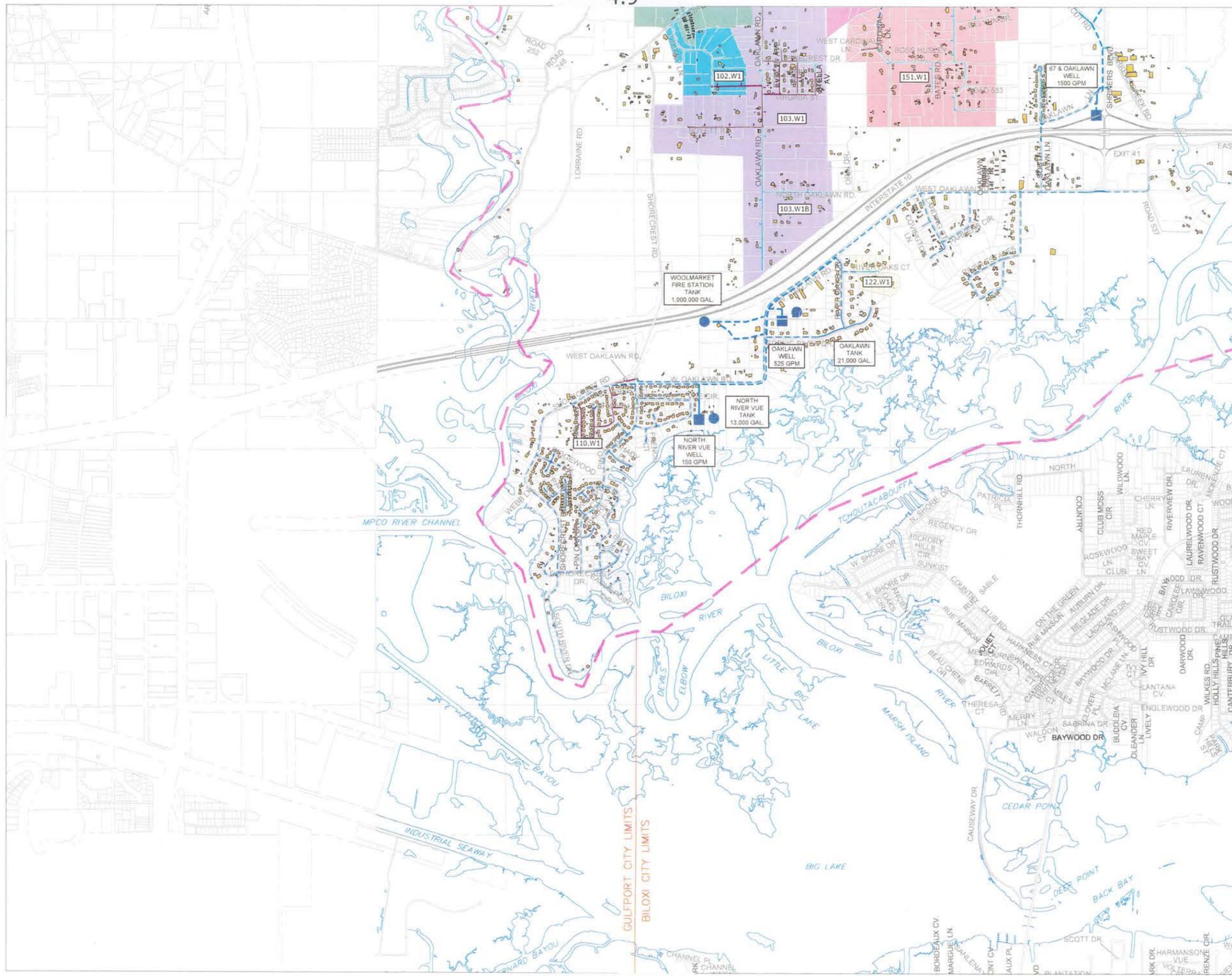
LEGEND

- STUDY AREA
- PROJECT AREA
- EXISTING HCUA WATER MAIN
- EXISTING BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN
- FUTURE BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- EXISTING BUILDING
- PROPERTY LINE

KEY MAP



SCALE	FIGURE NUMBER
1" = 1000'	4.10
PLOT DATE	
6-01-18	
SHEET FILE	
FUTURE WATER BASINS	



**CITY OF BILOXI**

**NEEL-SCHAFFER**  
*Solutions you can build upon*

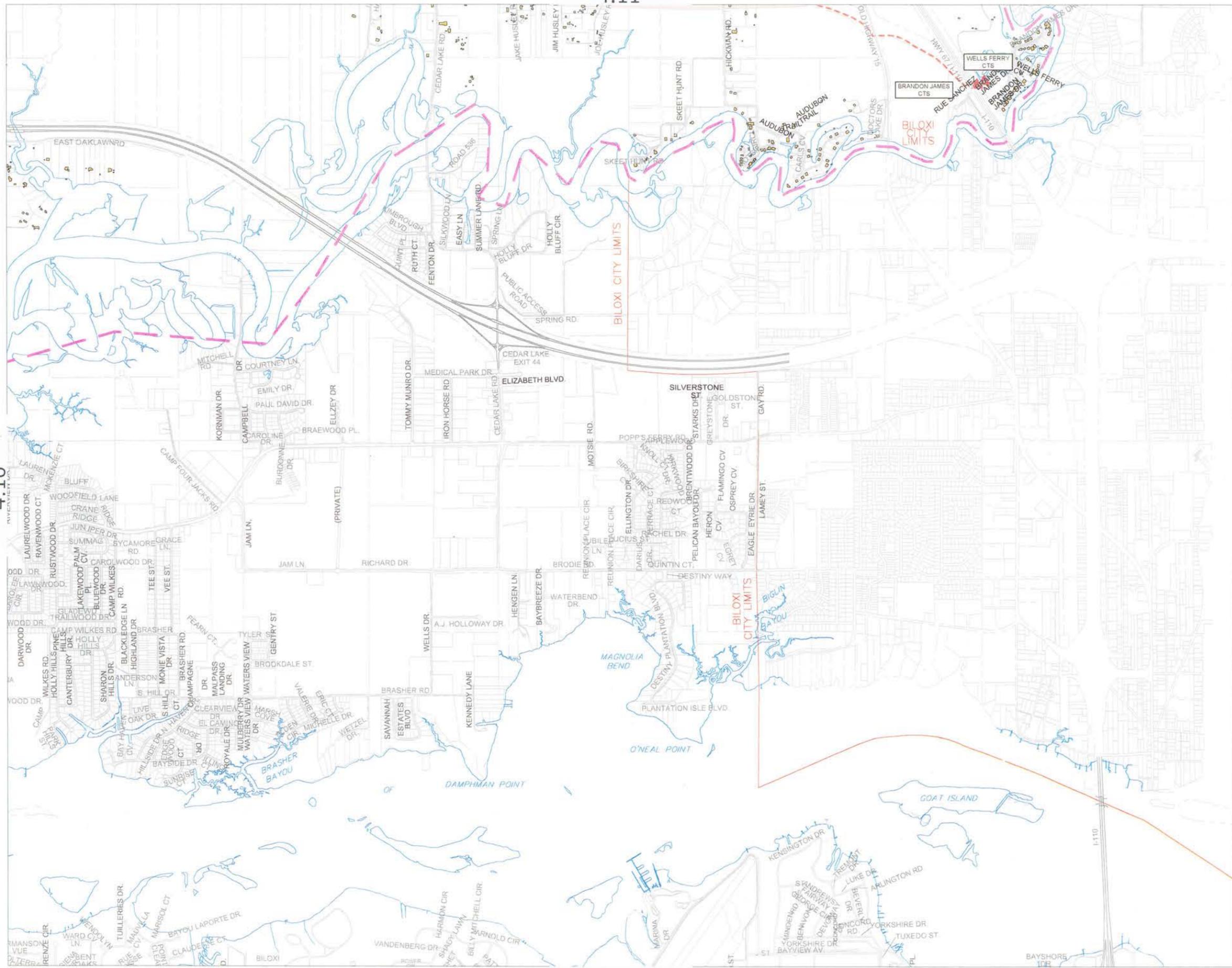
**GR GARNER RUSSELL & ASSOC.**  
**CONSULTING ENGINEERS**

**LEGEND**

- STUDY AREA
- PROJECT AREA
- EXISTING HCUA WATER MAIN
- EXISTING BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN
- FUTURE BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- EXISTING BUILDING
- PROPERTY LINE

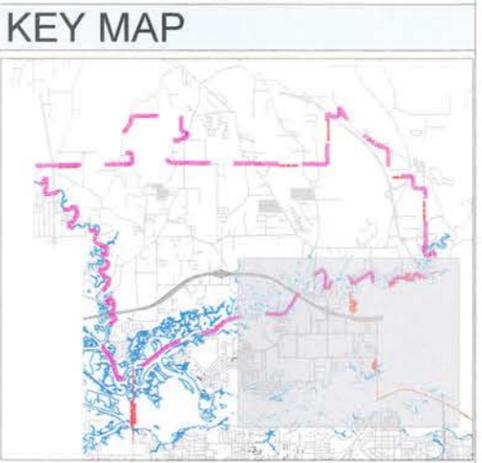
**KEY MAP**

SCALE	FIGURE NUMBER
1" = 1000'	<b>4.11</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>FUTURE WATER BASINS</b>	

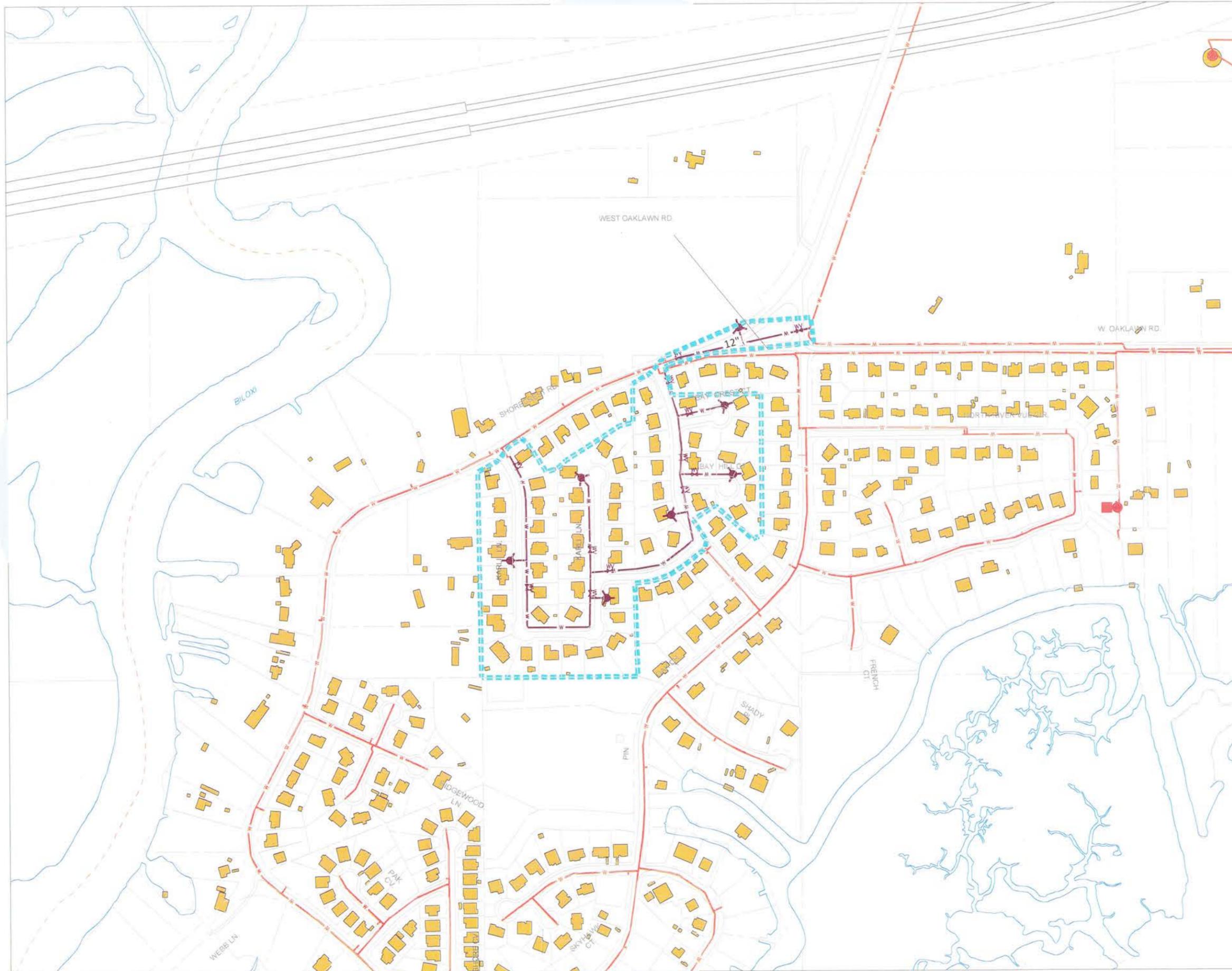


**LEGEND**

- STUDY AREA
- PROJECT AREA
- EXISTING HCUA WATER MAIN
- EXISTING BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN
- FUTURE BILOXI WATER MAIN
- HCUA TANK
- ▲ HCUA CTS
- HCUA WELL
- BILOXI TANK
- BILOXI WELL
- EXISTING BUILDING
- PROPERTY LINE



SCALE	FIGURE NUMBER
1" = 1000'	4.12
PLOT DATE	
6-01-18	
SHEET FILE	
FUTURE WATER BASINS	



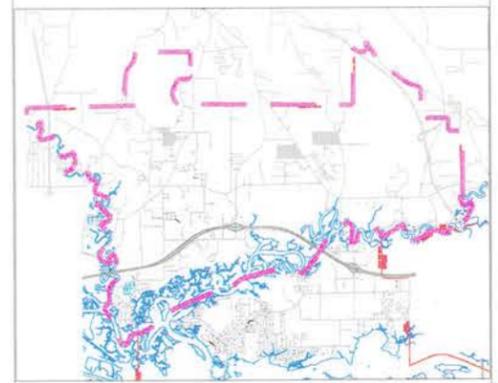
CITY OF BILOXI



LEGEND

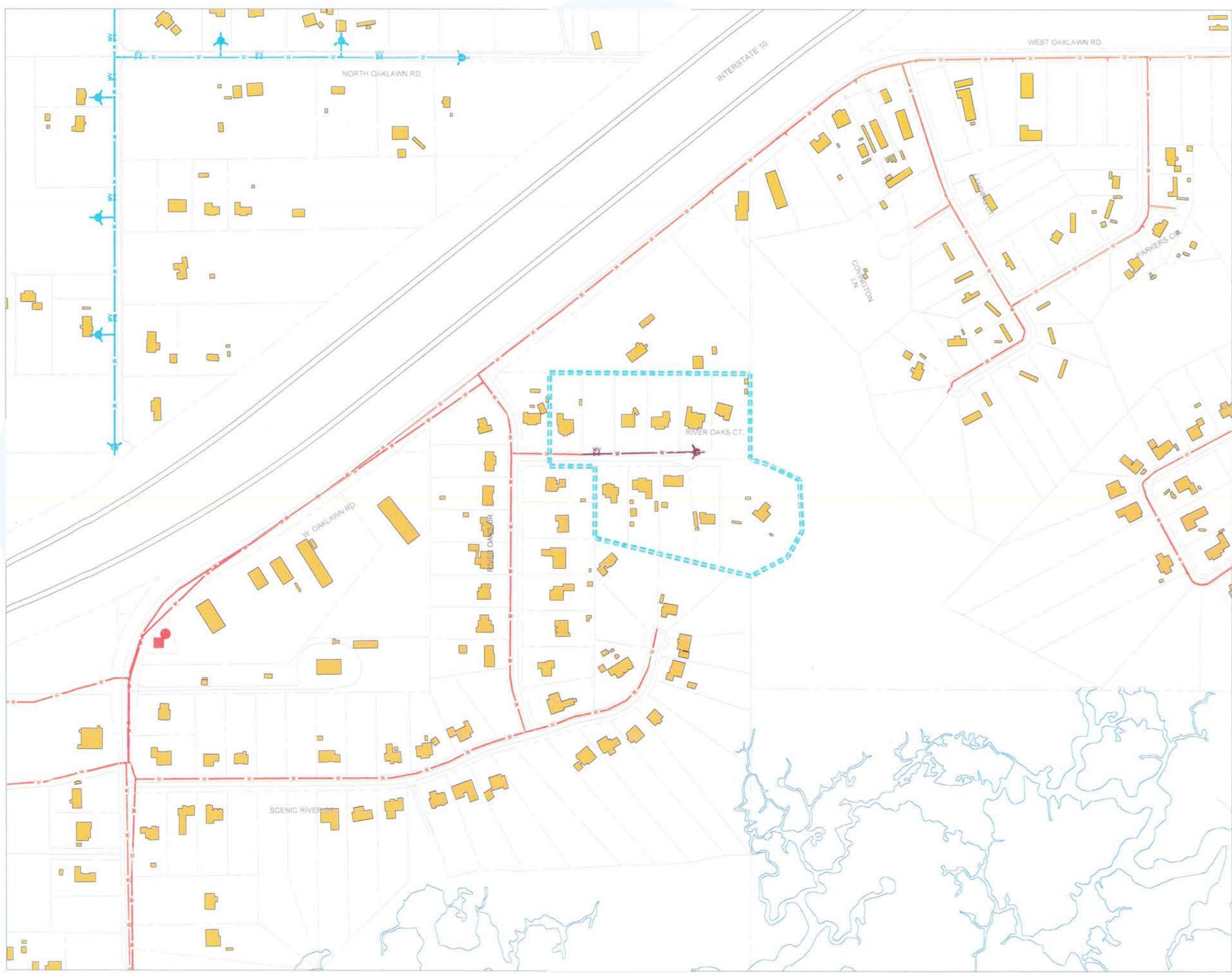
- - - - BAYVIEW - KARLI
- 3197 L.F. 8" WATER MAIN
- 570 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 7 EA. PROPOSED FIRE HYDRANTS
- 12 EA. PROPOSED VALVES
- 21 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	110.W1
PLOT DATE	
6-01-18	
SHEET FILE	
BAYVIEW - KARLI	

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

CITY OF BILOXI



LEGEND

- RIVER OAK COURT
- 474 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 1 EA. PROPOSED FIRE HYDRANTS
- 1 EA. PROPOSED VALVES
- 21 SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



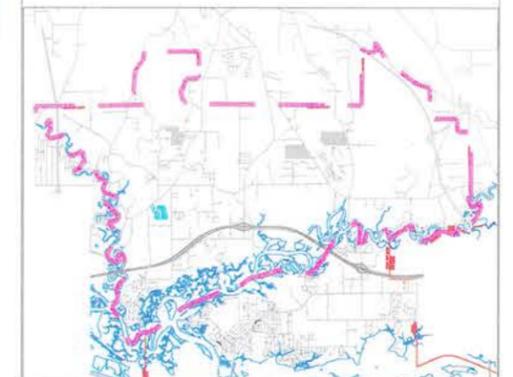
SCALE	FIGURE NUMBER
1" = 200'	122.W1
PLOT DATE	
6-01-18	
SHEET FILE	RIVER OAK COURT



**LEGEND**

- TIFFANY LANE
- 2908 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 5 EA. PROPOSED FIRE HYDRANTS
- 6 EA. PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>102.W1</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>TIFFANY LANE</b>	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

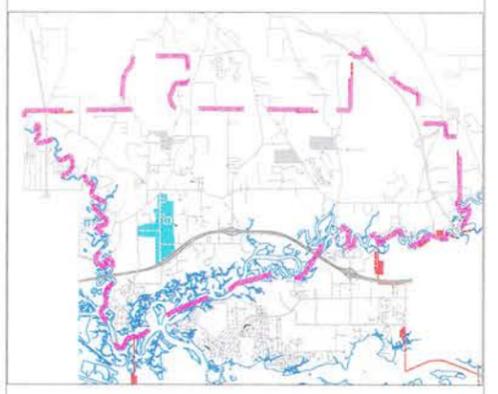
**CITY OF BILOXI**



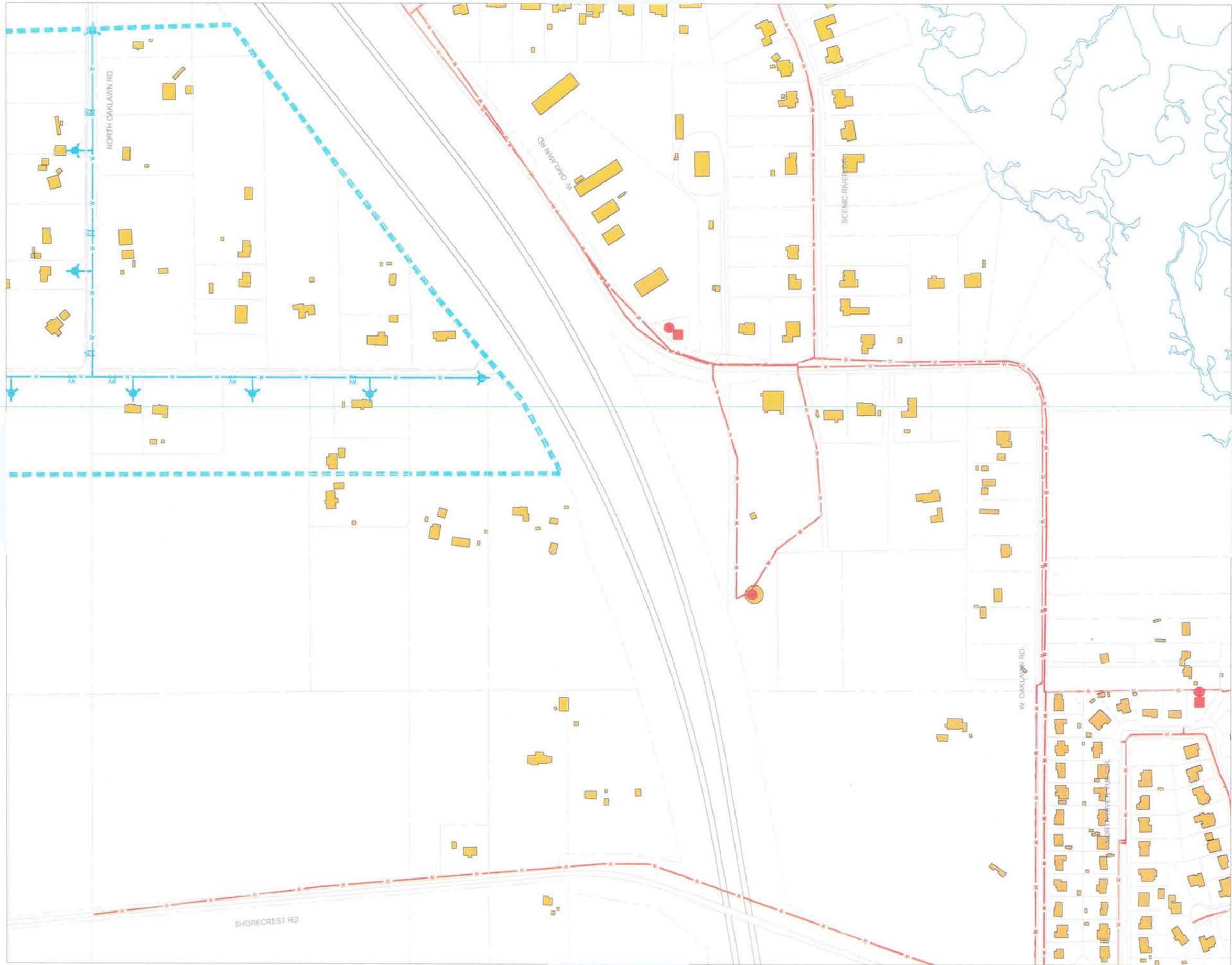
**LEGEND**

- BOYETTE - OAKLAWN 1
- 15124 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- ▲ 31 EA. PROPOSED FIRE HYDRANTS
- V 39 EA. PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>103.W1A</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>BOYETTE - OAKLAWN 1</b>	



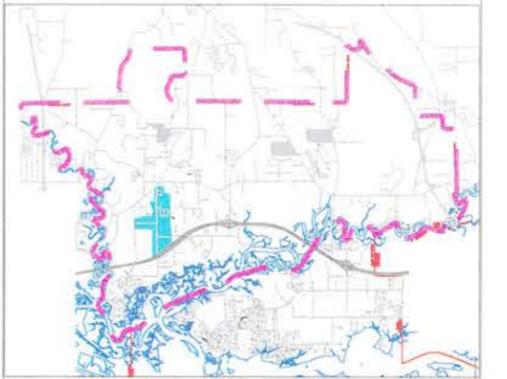
CITY OF BILOXI



LEGEND

- - - - BOYETTE - OAKLAWN 2
- SEE 103.W18" WATER MAIN
- SEE 103.W12" WATER MAIN
- SEE 103.W16" WATER MAIN
- PROPOSED FIRE HYDRANTS
- PROPOSED VALVES
- SEE 103.W SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



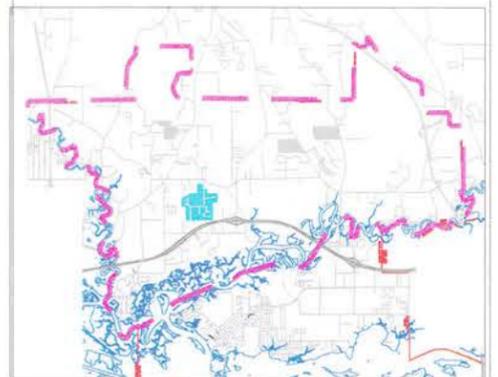
SCALE	FIGURE NUMBER
1" = 200'	<b>103.W1B</b>
PLOT DATE	
6-01-18	
SHEET FILE	
BOYETTE - OAKLAWN 2	

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

**LEGEND**

- - - - - AIRPORT ROAD
- 9133 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 18 EA. PROPOSED FIRE HYDRANTS
- 22 EA. PROPOSED VALVES
- 87 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>151.W1</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>AIRPORT ROAD</b>	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

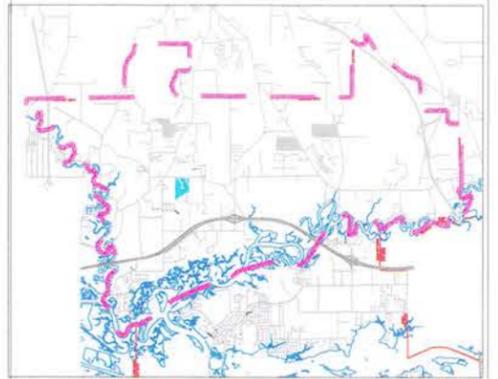
CITY OF BILOXI



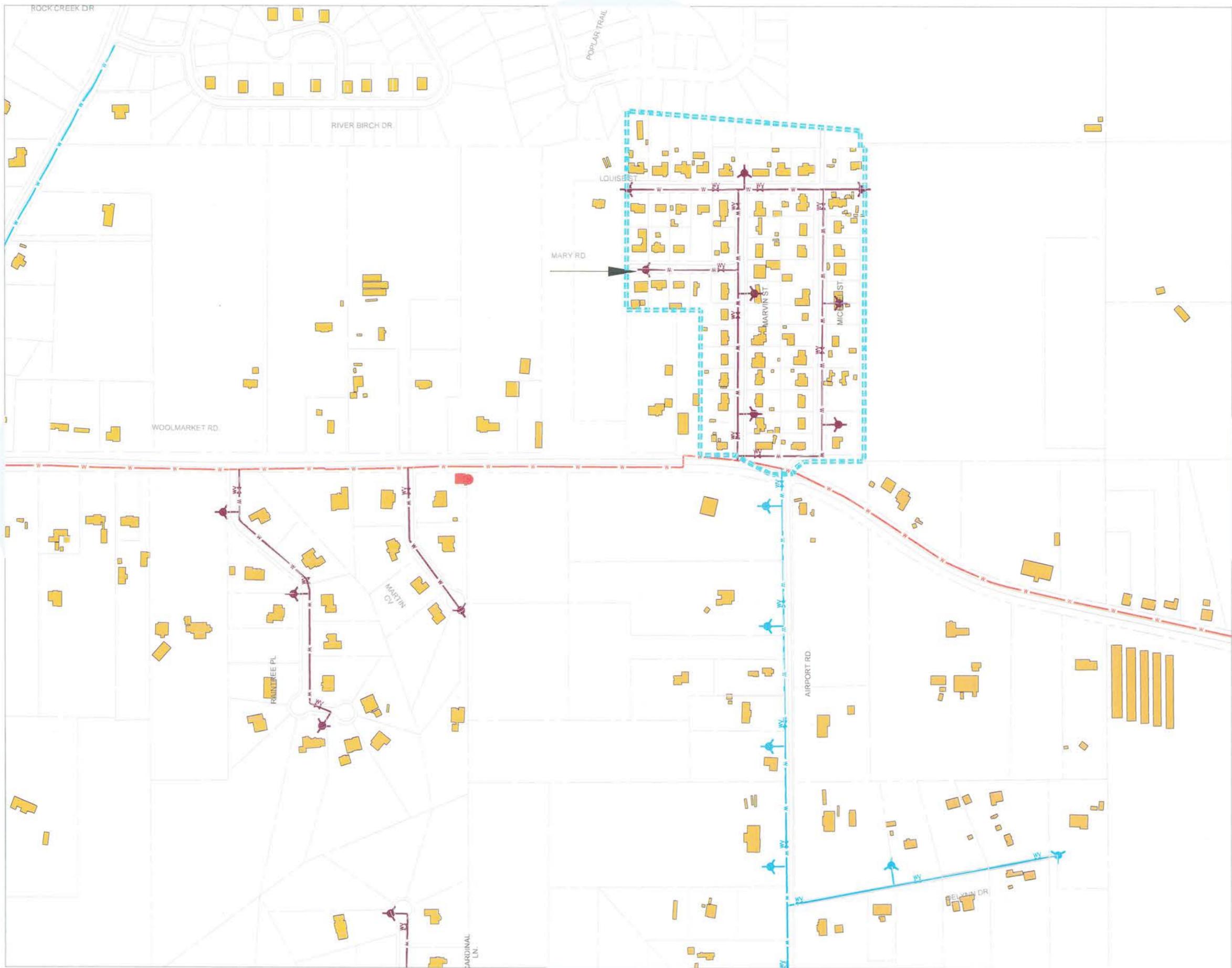
LEGEND

- - - - RAINTREE - MARTIN
- 1863 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 4 EA. PROPOSED FIRE HYDRANTS
- 4 EA. PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	151.W2
PLOT DATE	
6-01-18	
SHEET FILE	
RAINTREE - MARTIN	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

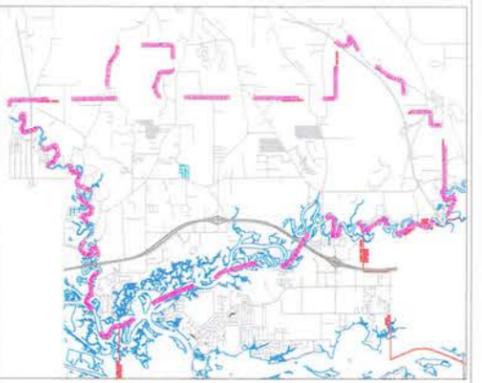
CITY OF BILOXI



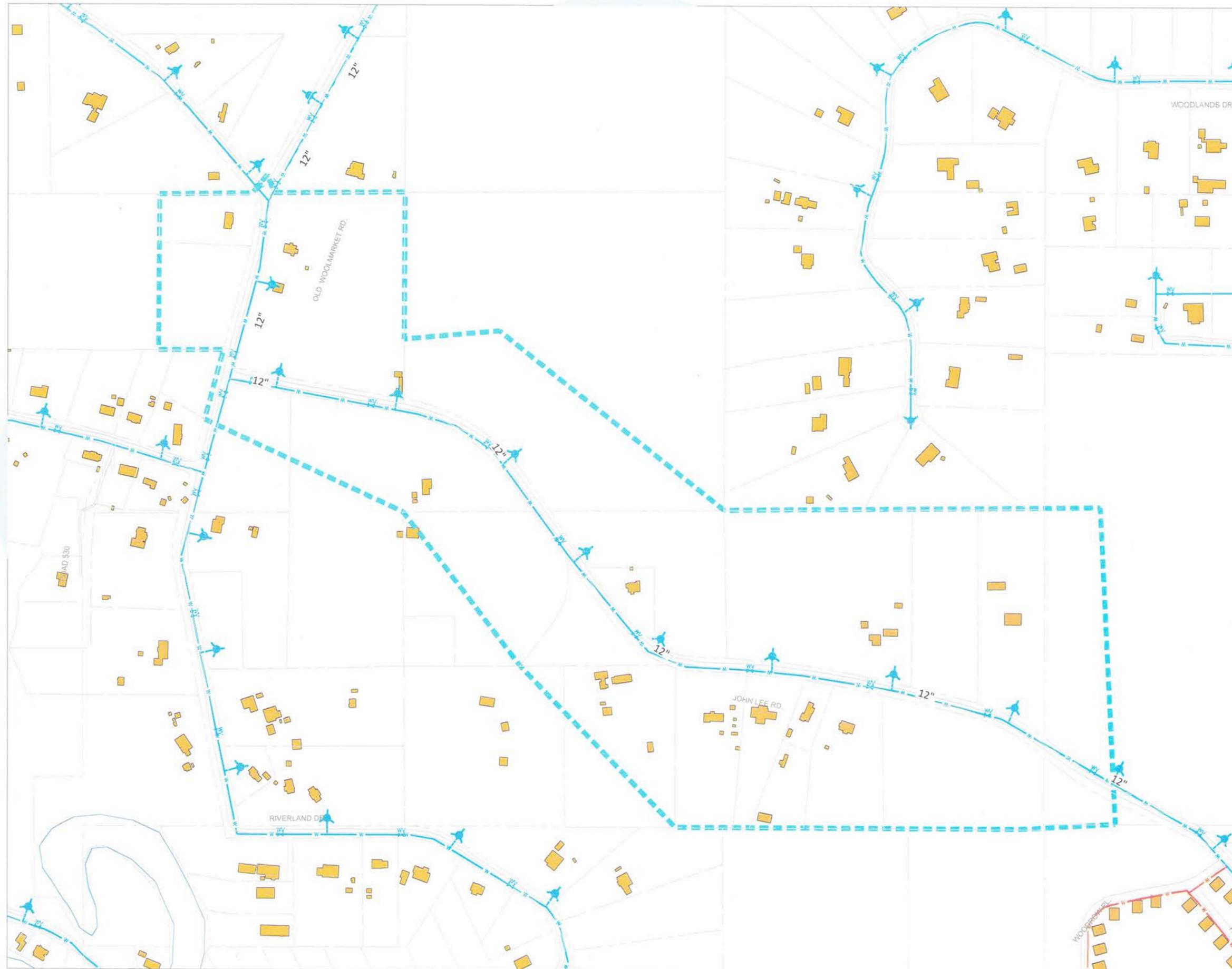
LEGEND

- - - - MARVIN - MICHAEL
- 3934 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 8 EA. PROPOSED FIRE HYDRANTS
- 9 EA. PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	151.W3
PLOT DATE	
6-01-18	
SHEET FILE	
MARVIN - MICHAEL	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

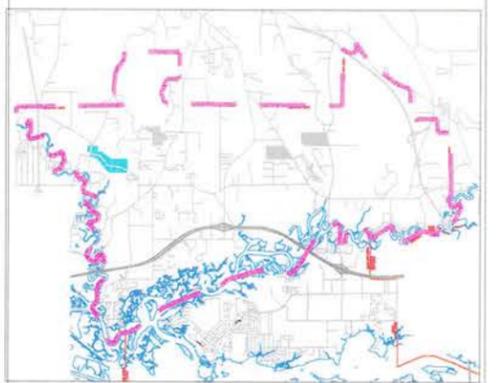
CITY OF BILOXI



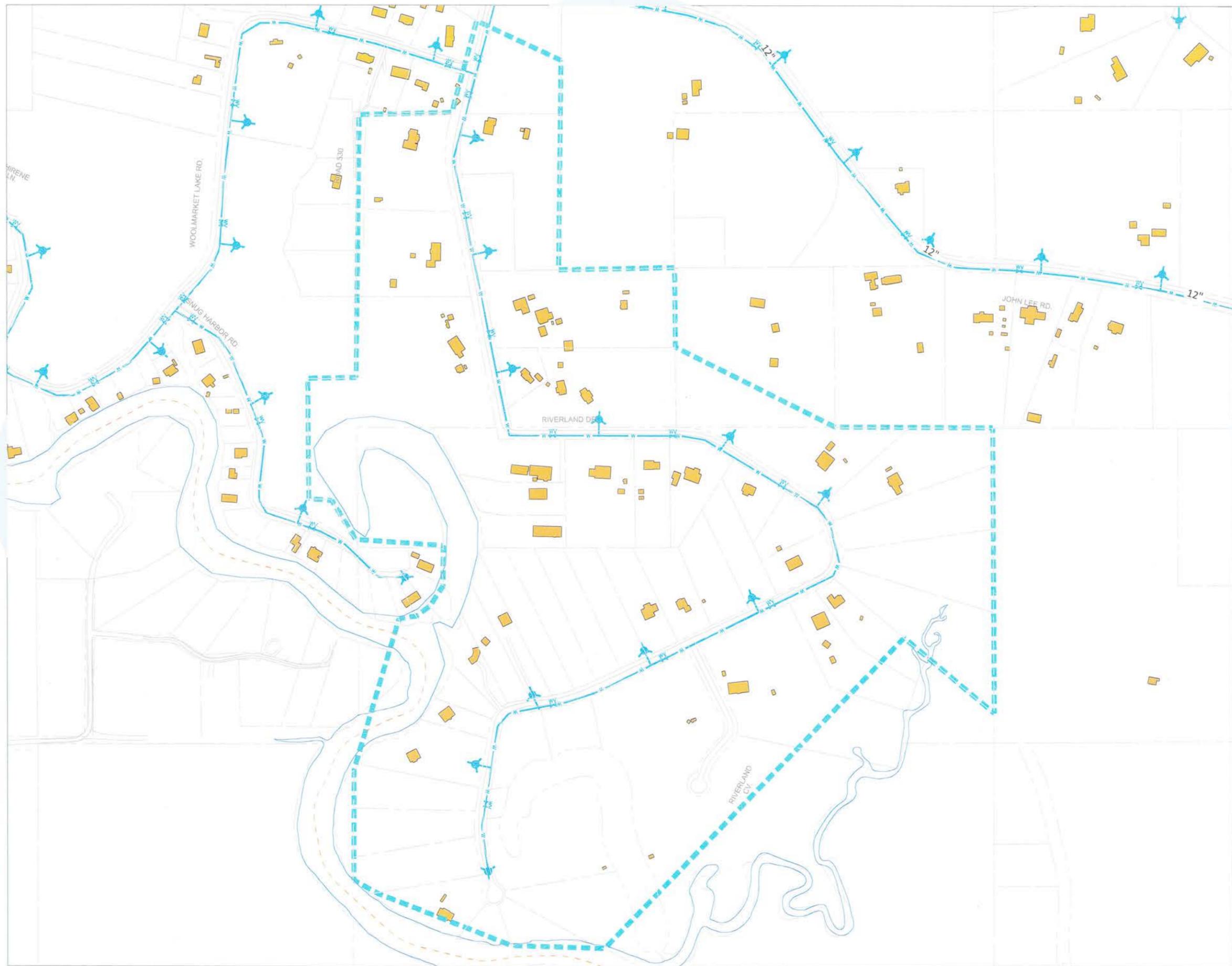
LEGEND

- - - JOHN LEE RD SOUTH
- 0 L.F. 8" WATER MAIN
- 6229 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 12 EA. PROPOSED FIRE HYDRANTS
- 14 EA. PROPOSED VALVES
- 25 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



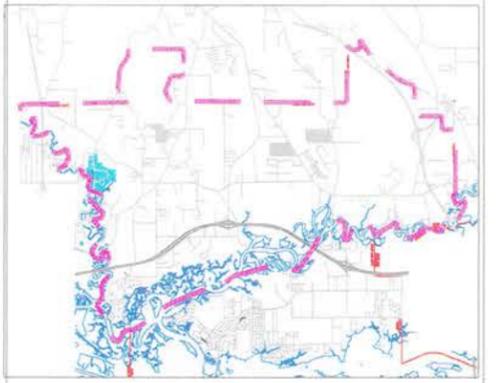
SCALE	FIGURE NUMBER
1" = 200'	170.W1
PLOT DATE	
6-01-18	
SHEET FILE	
JOHN LEE RD SOUTH	



**LEGEND**

- - - - - RIVERLAND DRIVE
- 5766 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 11 EA. PROPOSED FIRE HYDRANTS
- 12 EA. PROPOSED VALVES
- 50 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>177.W1</b>
PLOT DATE	
6-01-18	

SHEET FILE  
**RIVERLAND DRIVE**

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



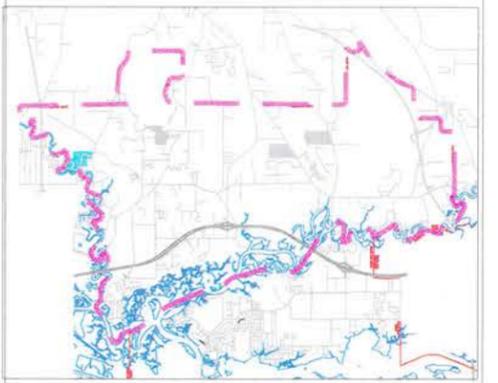
CITY OF BILOXI



LEGEND

- - - - - WOOLMARKET LAKE RD
- 5407 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 11 EA. PROPOSED FIRE HYDRANTS
- 12 EA. PROPOSED VALVES
- 84 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	175.W1
PLOT DATE	
6-01-18	

SHEET FILE  
WOOLMARKET LAKE RD

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

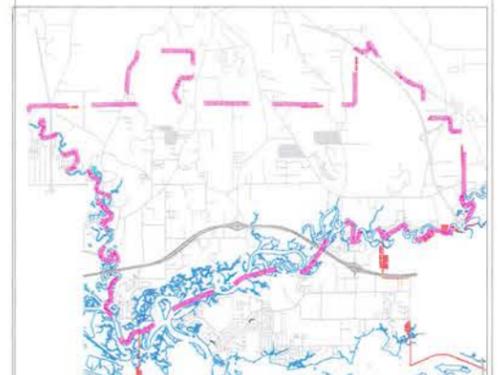
CITY OF BILOXI



LEGEND

- - - - SNUG HARBOR RD
- 1650 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 3 EA. PROPOSED FIRE HYDRANTS
- 3 EA. PROPOSED VALVES
- 84 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	176.W1
PLOT DATE	
6-01-18	
SHEET FILE	
SNUG HARBOR RD	

CITY LIMITS



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

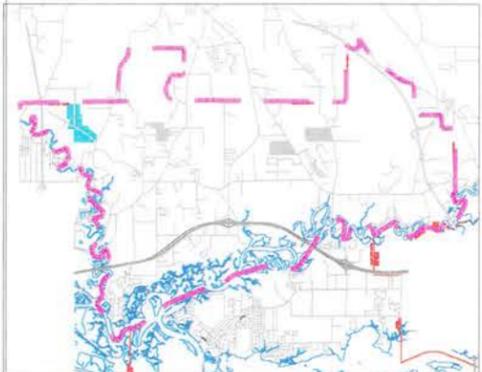
CITY OF BILOXI



LEGEND

- - - - JOHN LEE RD NORTH
- 4833 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 10 EA. PROPOSED FIRE HYDRANTS
- 11 EA. PROPOSED VALVES
- 35 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP

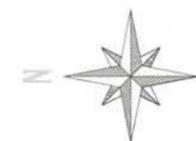
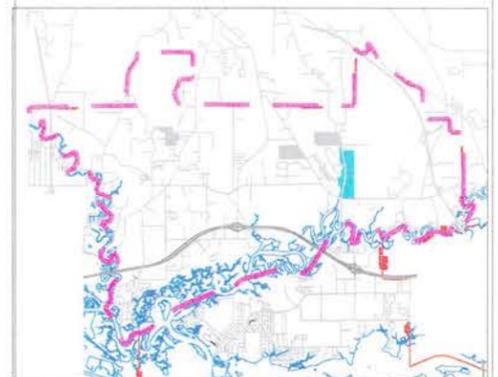


SCALE	FIGURE NUMBER
1" = 200'	174.W1
PLOT DATE	
6-01-18	
SHEET FILE	
JOHN LEE RD NORTH	

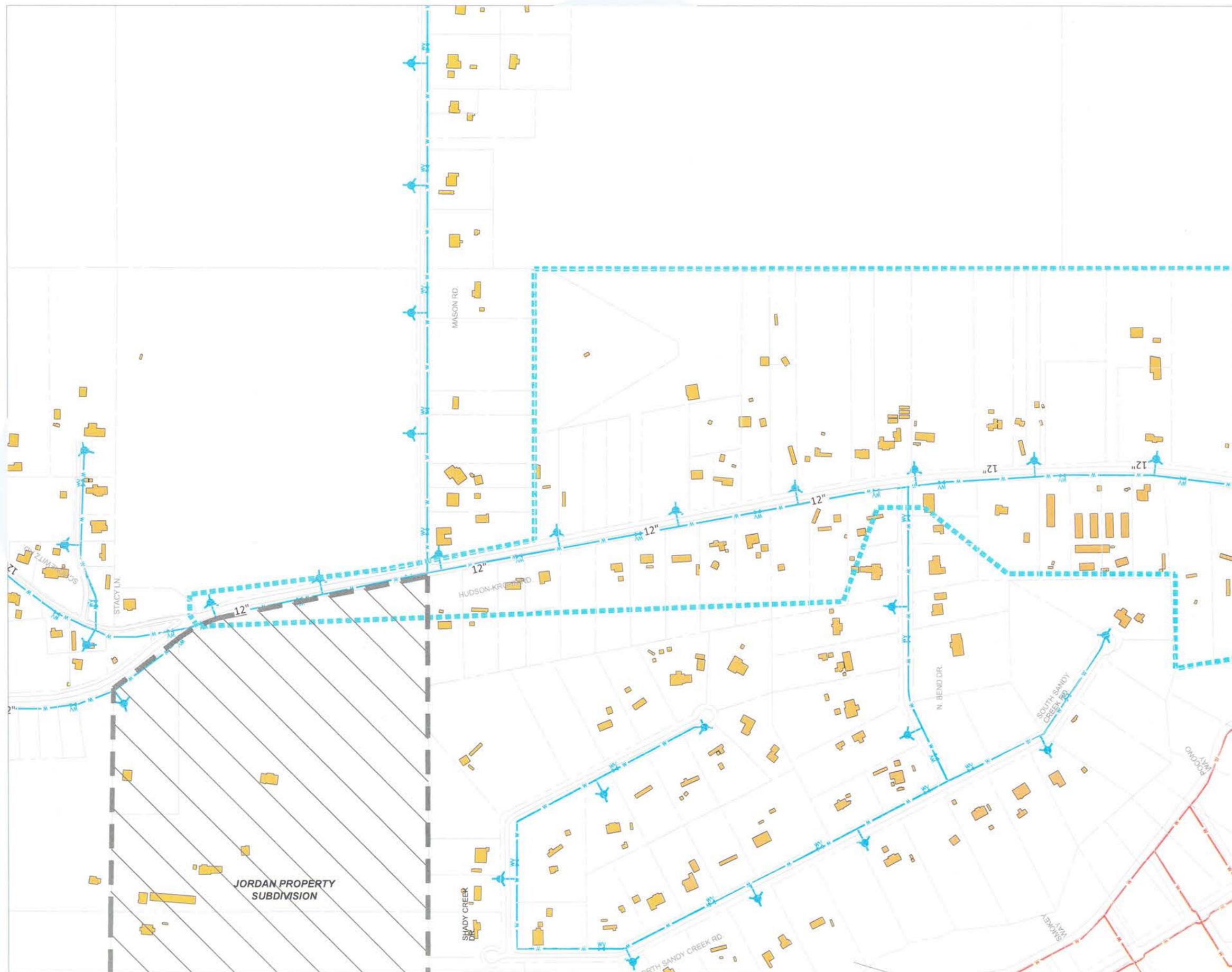
**LEGEND**

- - - - - HUDSON-KROHN RD 1
- 0 L.F. 8" WATER MAIN
- 6209 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 13 EA. PROPOSED FIRE HYDRANTS
- 14 EA. PROPOSED VALVES
- 43 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>200.W1A</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>HUDSON-KROHN RD 1</b>	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

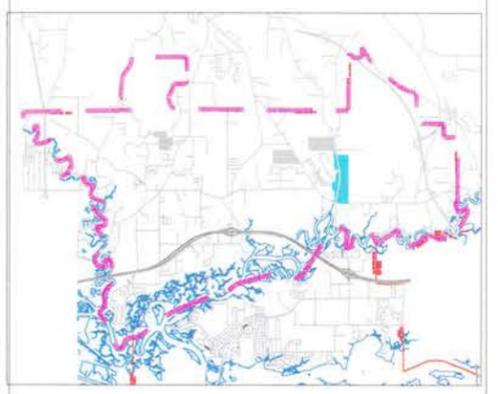
CITY OF BILOXI



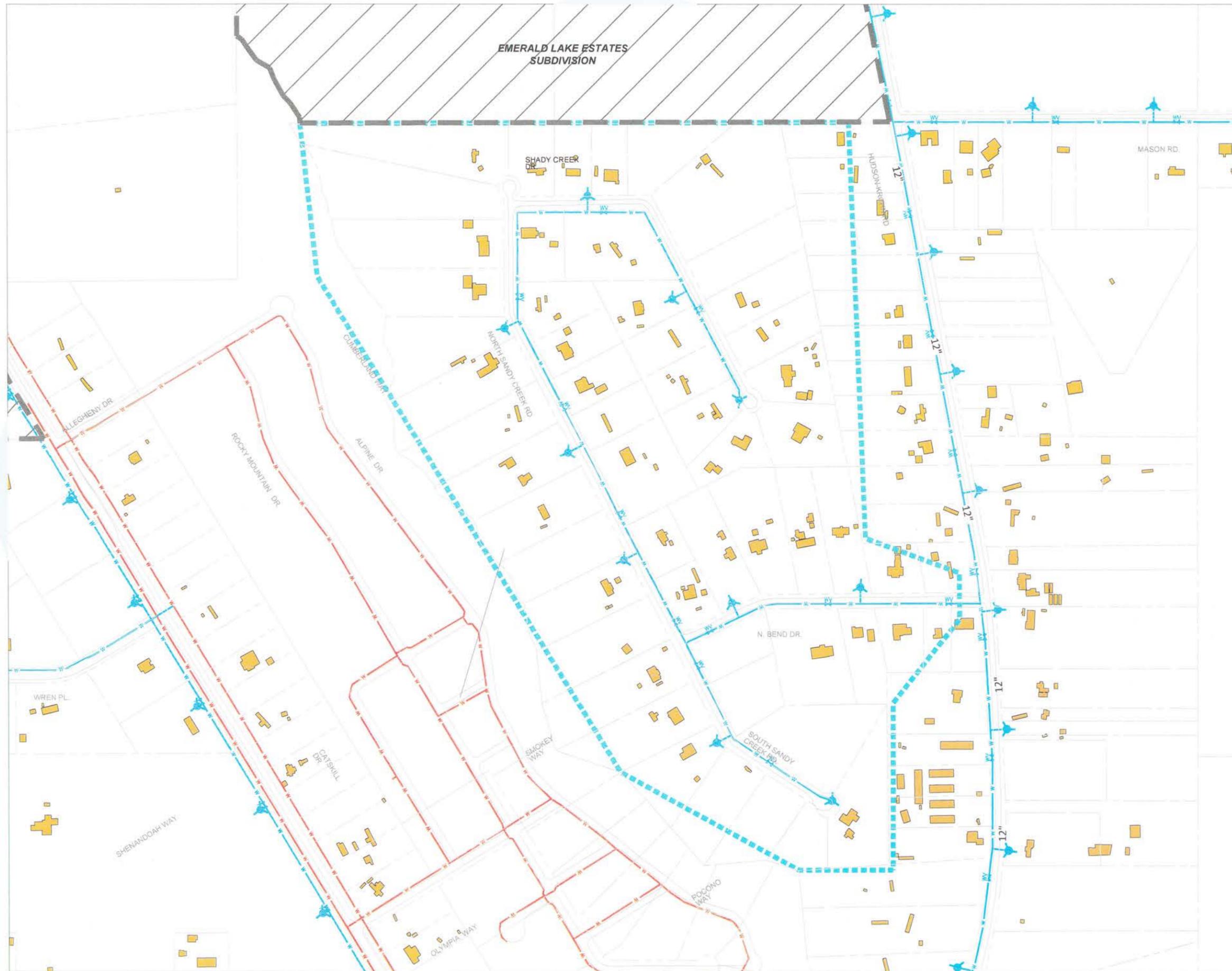
LEGEND

- - - - - HUDSON-KROHN RD 2
- SEE 200.W8" WATER MAIN
- SEE 200.W12" WATER MAIN
- SEE 200.W16" WATER MAIN
- PROPOSED FIRE HYDRANTS
- PROPOSED VALVES
- SEE 200.WSERVICES
- EXISTING BUILDING
- - - - - PROPERTY LINE
- - - - - EXISTING BILOXI WATER MAIN
- - - - - PROPOSED BILOXI WATER MAIN
- - - - - UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	
PLOT DATE	
6-01-18	
SHEET FILE	
HUDSON-KROHN RD 2	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

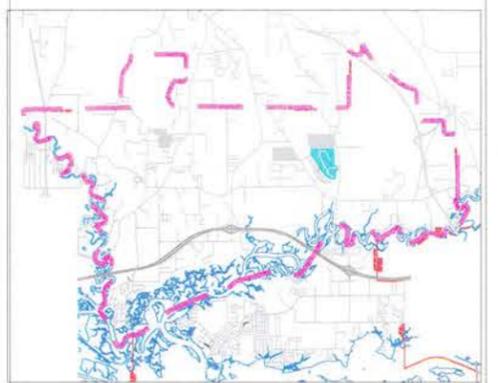
CITY OF BILOXI



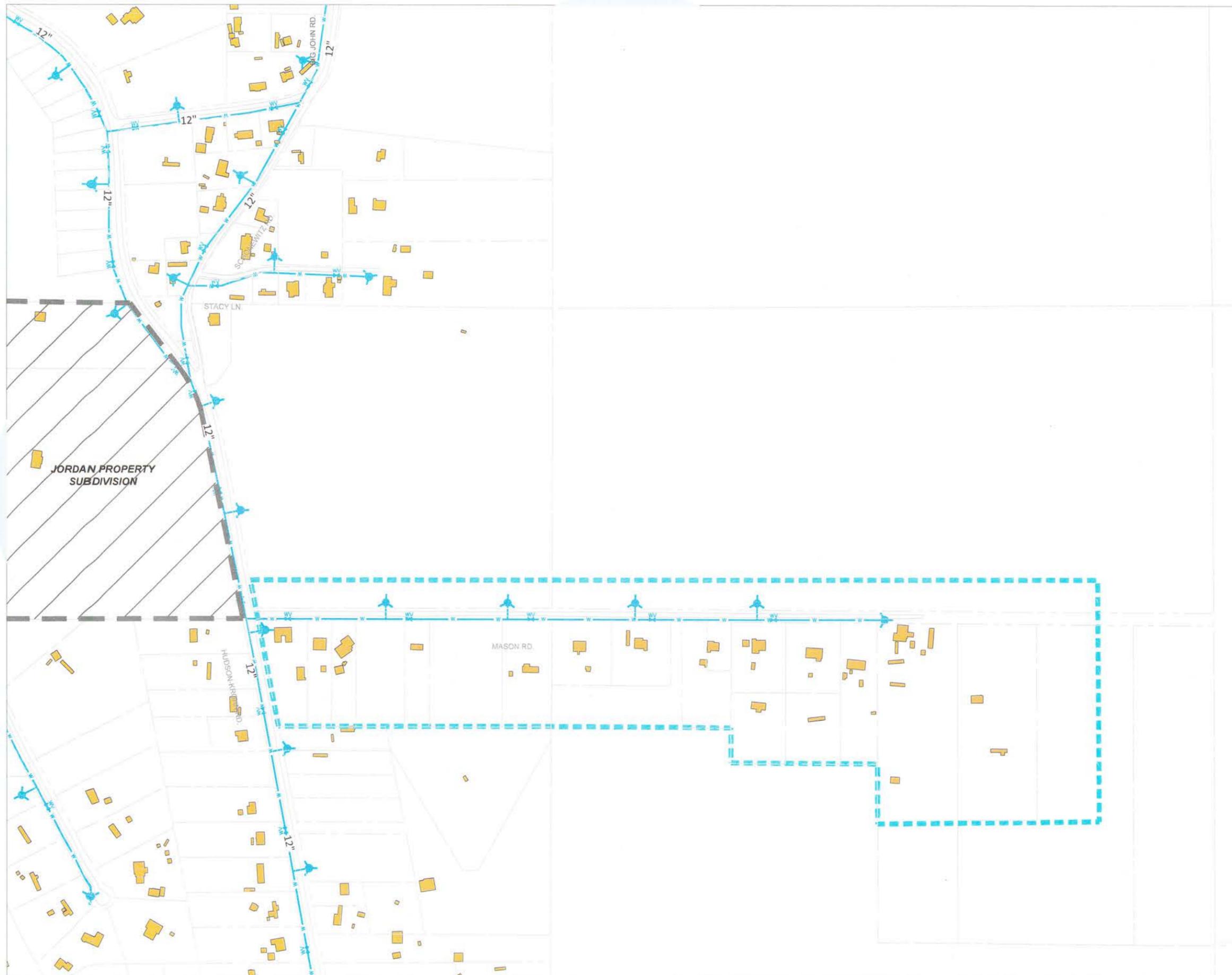
LEGEND

- - - NORTH BEND DRIVE
- 5519 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 10 EA. PROPOSED FIRE HYDRANTS
- 11 EA. PROPOSED VALVES
- 50 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>200.W2</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>NORTH BEND DRIVE</b>	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

**CITY OF BILOXI**



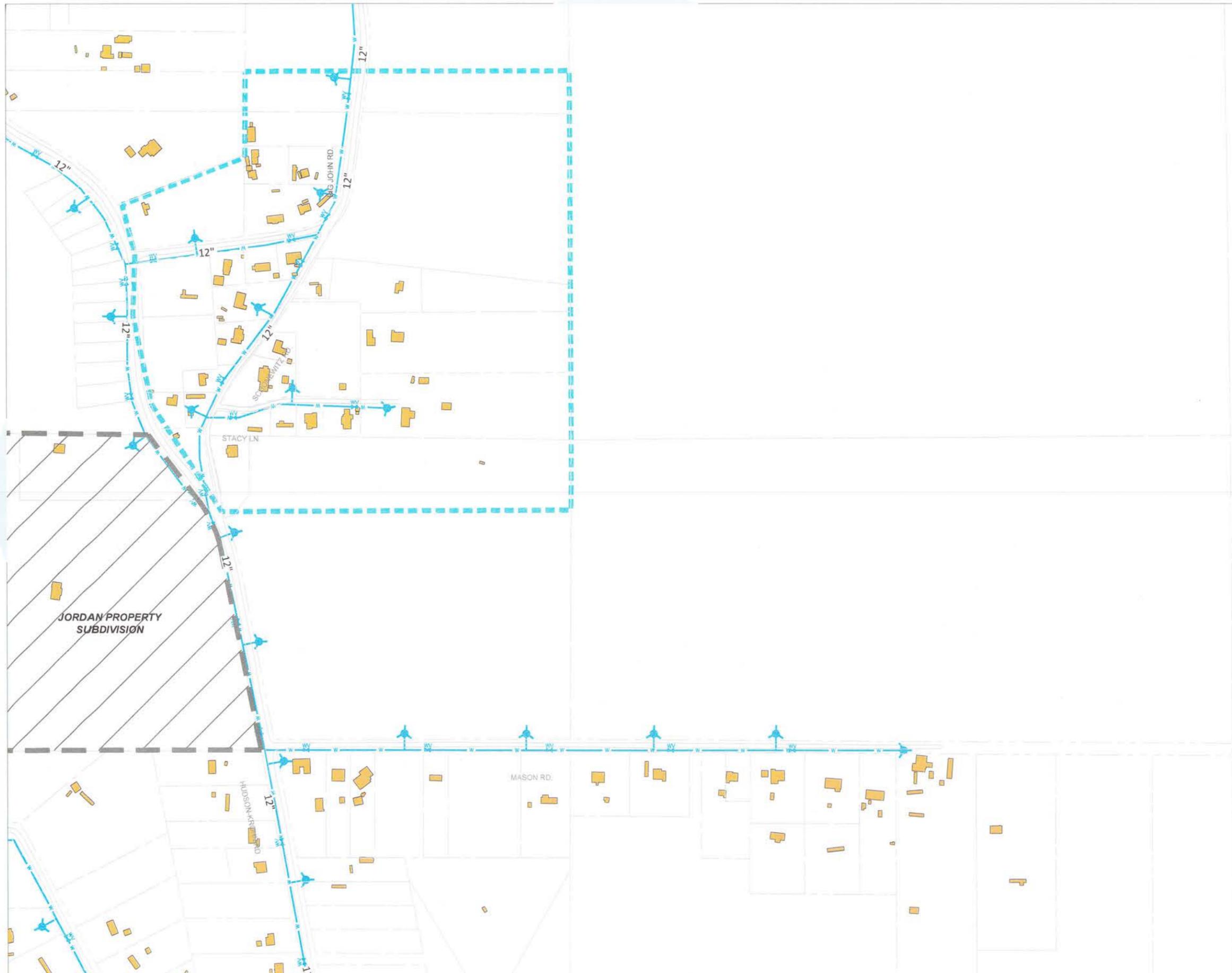
**LEGEND**

- MASON ROAD
- 2626 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 5 EA. PROPOSED FIRE HYDRANTS
- 5 EA. PROPOSED VALVES
- 19 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



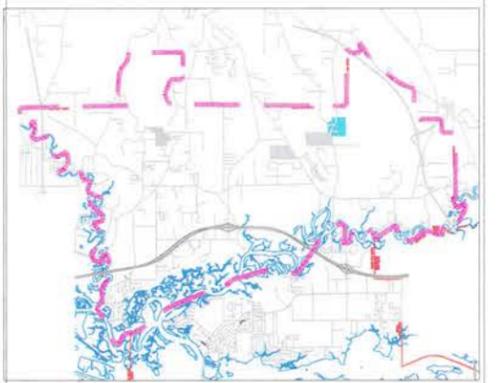
SCALE	FIGURE NUMBER
1" = 200'	<b>203.W1</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>MASON ROAD</b>	



**LEGEND**

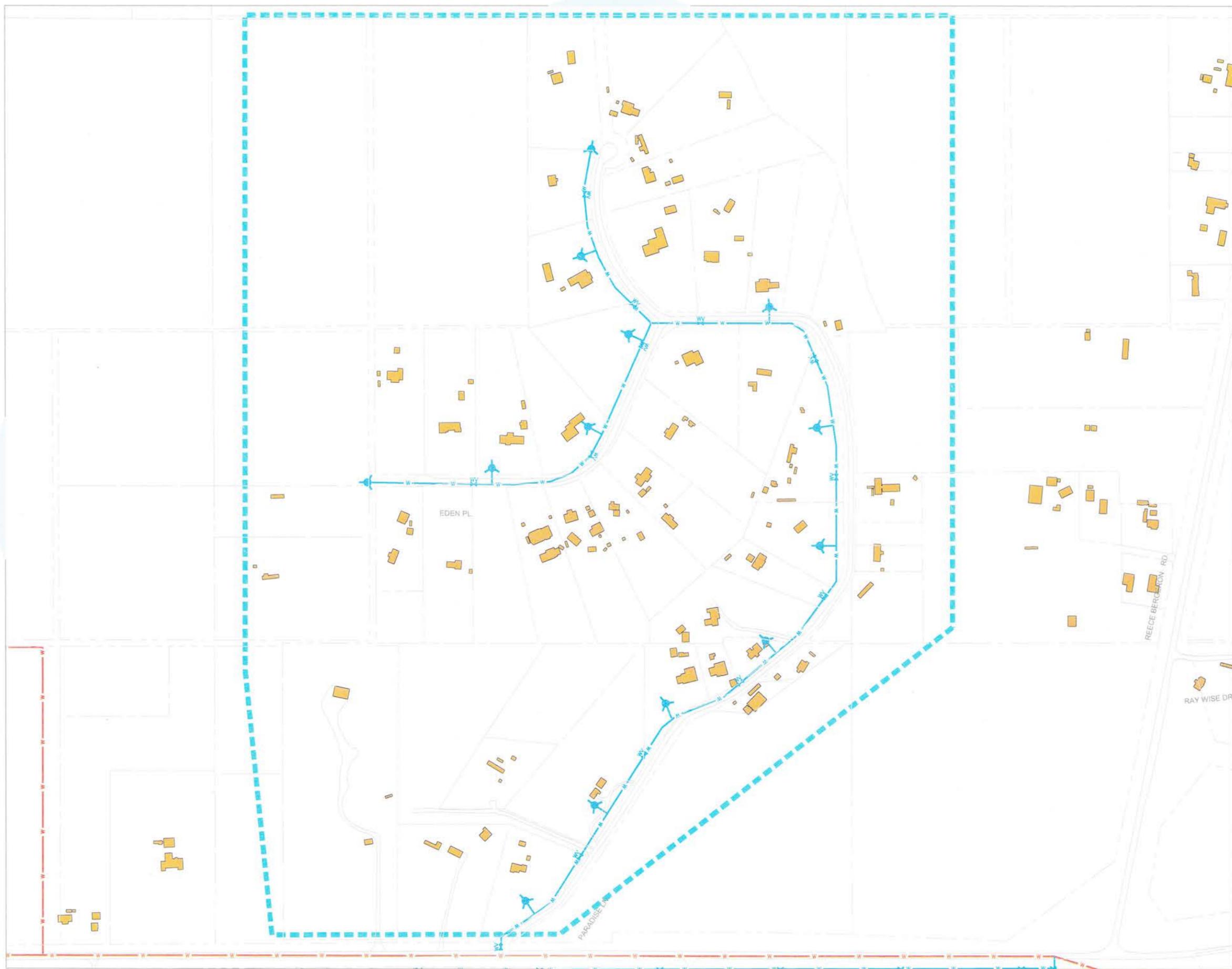
- - - - STACY LANE
- 755 L.F. 8" WATER MAIN
- 2770 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- ▲ 7 EA. PROPOSED FIRE HYDRANTS
- 9 EA. PROPOSED VALVES
- 21 EA. SERVICES
- EXISTING BUILDING
- - - - PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>204.W1</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>STACY LANE</b>	

WATER MAINS ARE 8" UNLESS OTHER WISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

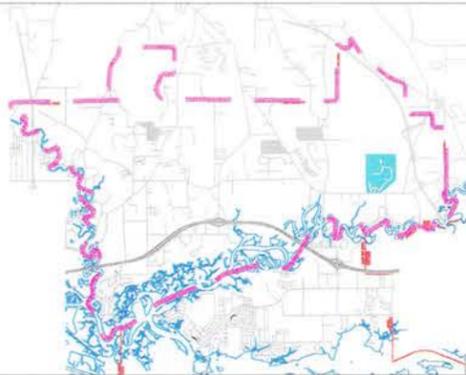
CITY OF BILOXI



LEGEND

- - - - - PARADISE LANE
- 6221 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 13 EA. PROPOSED FIRE HYDRANTS
- 13 EA. PROPOSED VALVES
- 55 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



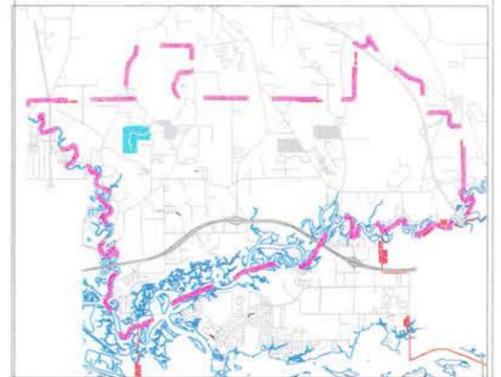
SCALE	FIGURE NUMBER
1" = 200'	<b>202.W1</b>
PLOT DATE	
6-01-18	
SHEET FILE	
PARADISE LANE	



**LEGEND**

- WOODLANDS DRIVE
- 3687 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 8 EA. PROPOSED FIRE HYDRANTS
- 8 EA. PROPOSED VALVES
- 34 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

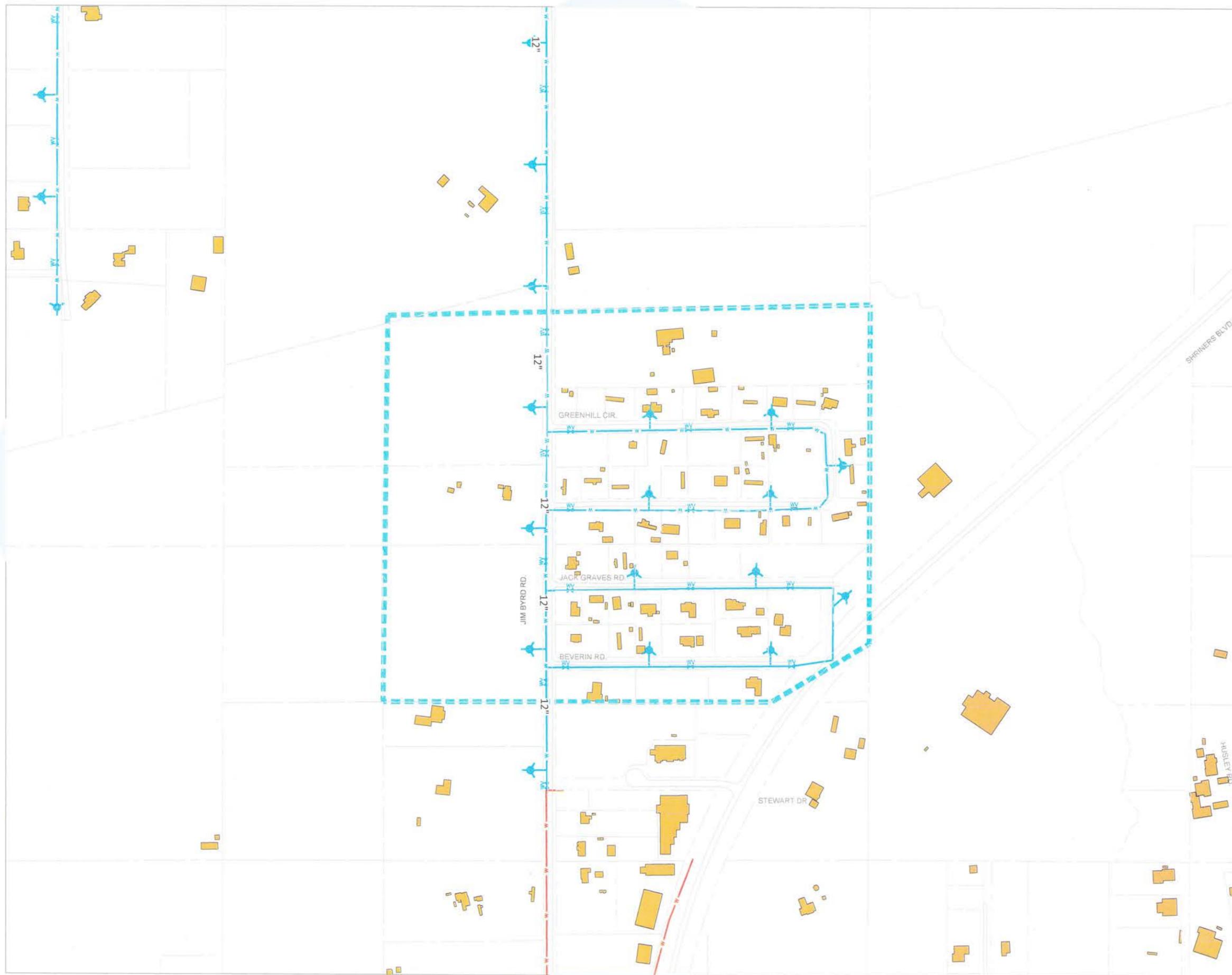
**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>161.W1</b>
PLOT DATE	
6-01-18	
SHEET FILE	<b>WOODLANDS DRIVE</b>



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

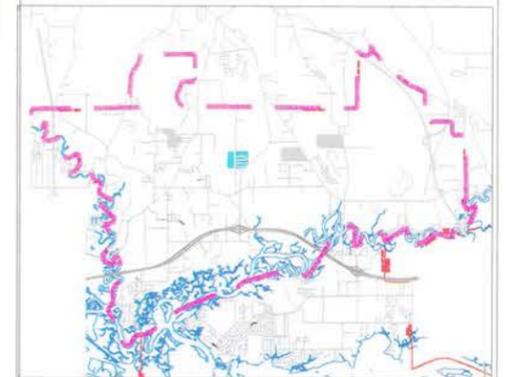
CITY OF BILOXI



LEGEND

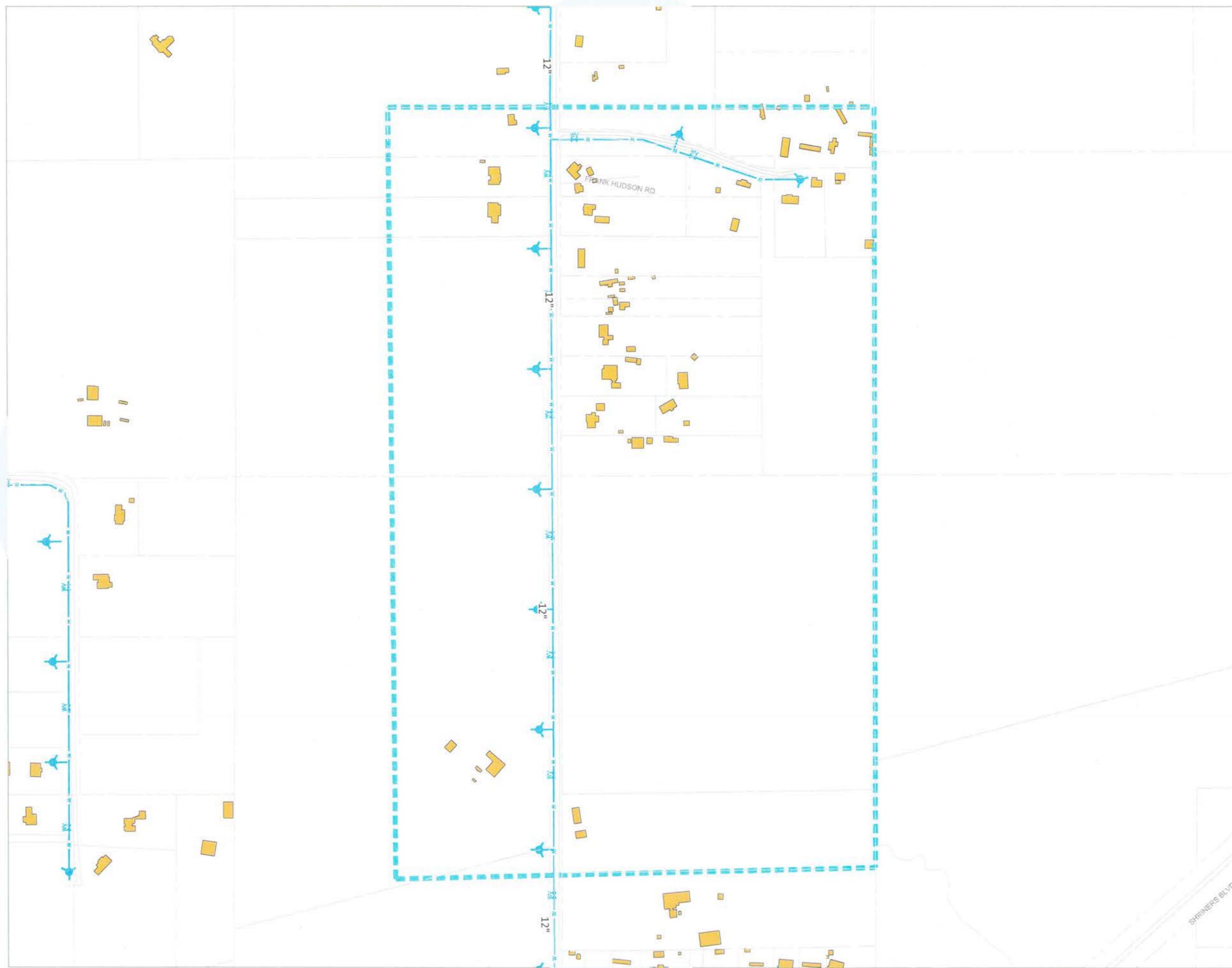
- - - - JIM BYRD SOUTH
- 5271 L.F. 8" WATER MAIN
- 1958 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 14 EA. PROPOSED FIRE HYDRANTS
- 17 EA. PROPOSED VALVES
- 60 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	146.W1
PLOT DATE	
6-01-18	

SHEET FILE  
JIM BYRD SOUTH



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

CITY OF BILOXI



LEGEND

- JIM BYRD NORTH
- 1058 L.F. 8" WATER MAIN
- 3215 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 9 EA. PROPOSED FIRE HYDRANTS
- 9 EA. PROPOSED VALVES
- 15 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP

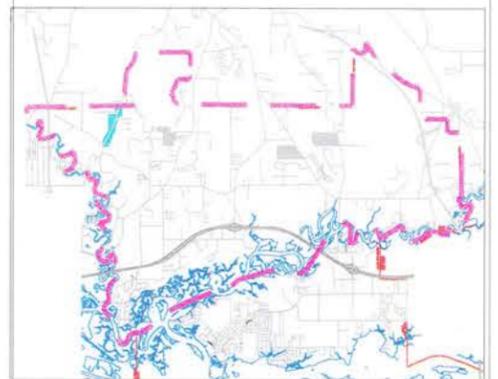


SCALE	FIGURE NUMBER
1" = 200'	147.W1
PLOT DATE	
6-01-18	
SHEET FILE	
JIM BYRD NORTH	

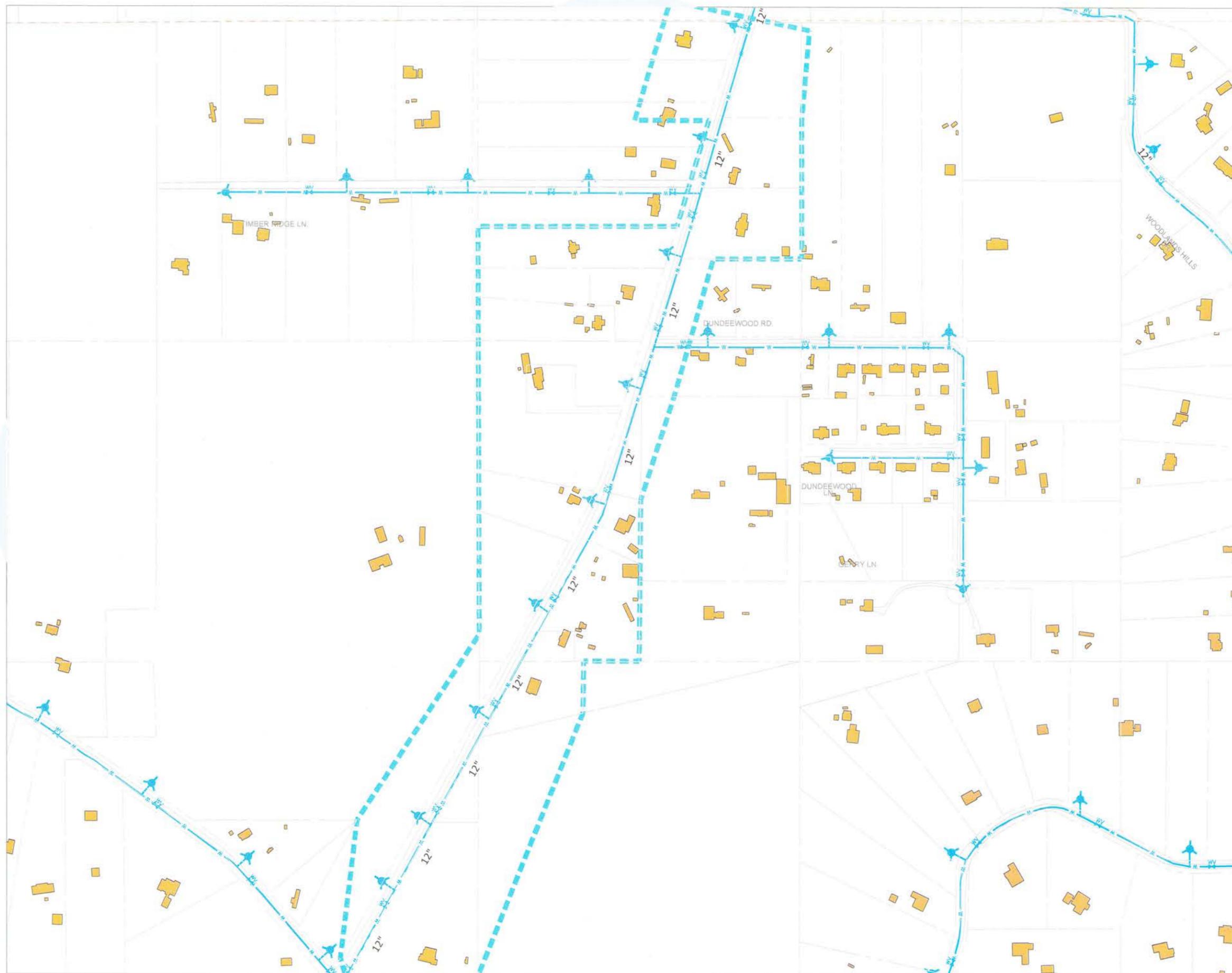
**LEGEND**

- - - - OLD WOOLMARKET RD
- 0 L.F. 8" WATER MAIN
- 4340 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- ▶ 9 EA. PROPOSED FIRE HYDRANTS
- ⊕ 11 EA. PROPOSED VALVES
- 21 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

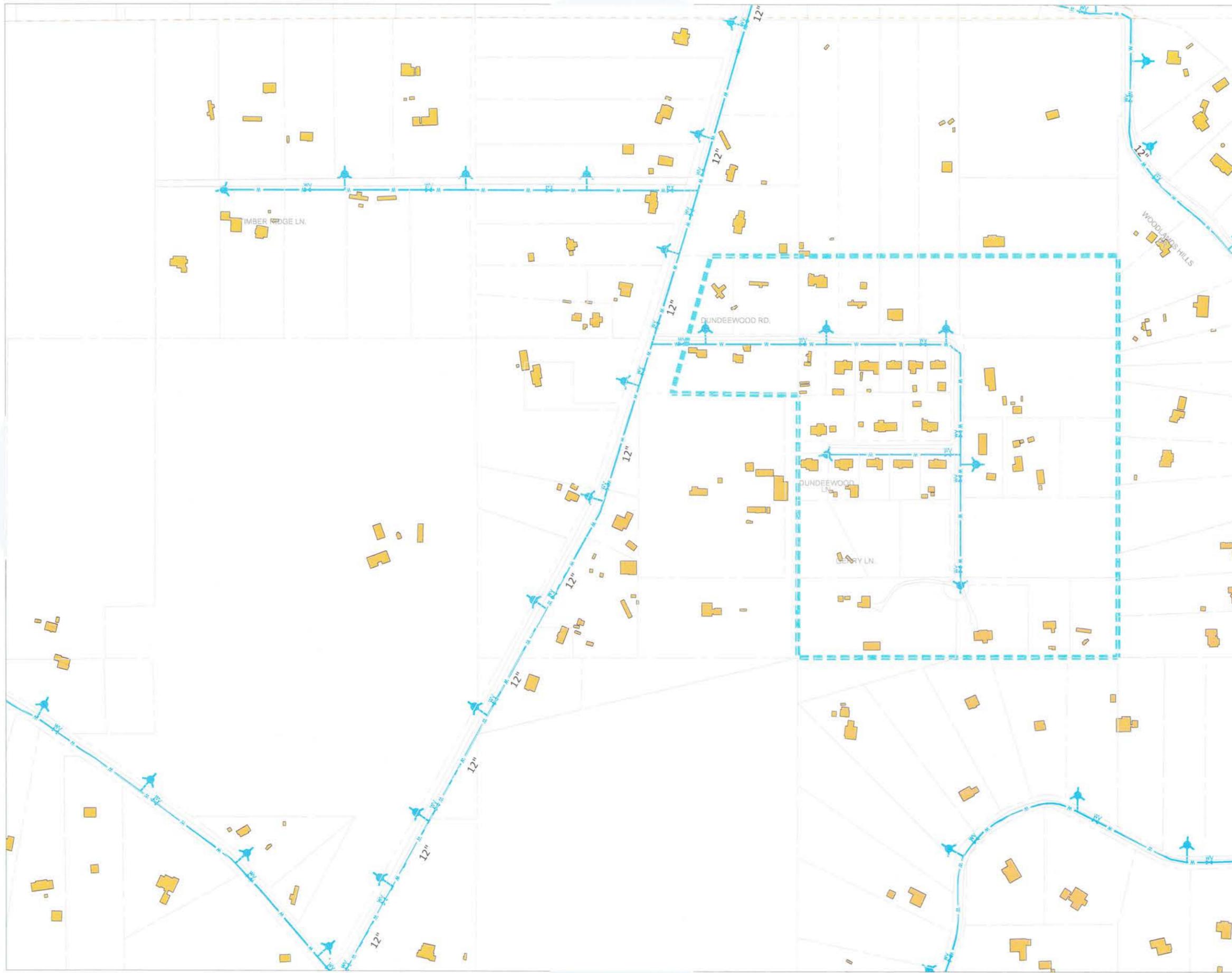
**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	171.W1
PLOT DATE	
6-01-18	
SHEET FILE	
OLD WOOLMARKET RD	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

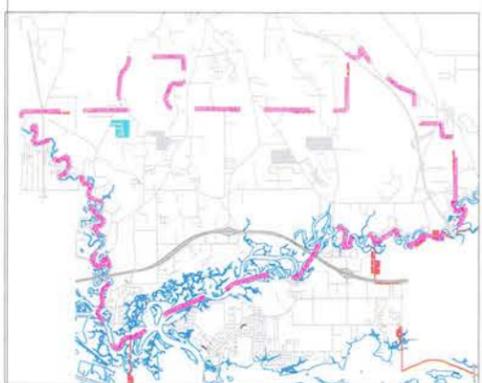
CITY OF BILOXI



LEGEND

- - - - - DUNDEEWOOD ROAD
- 2803 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 6 EA. PROPOSED FIRE HYDRANTS
- 6 EA. PROPOSED VALVES
- 29 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP

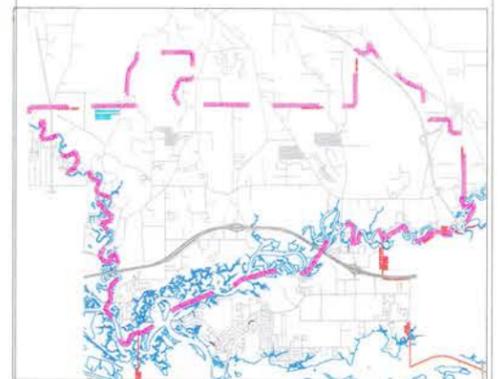


SCALE	FIGURE NUMBER
1" = 200'	172.W1
PLOT DATE	
6-01-18	
SHEET FILE	
DUNDEEWOOD ROAD	

**LEGEND**

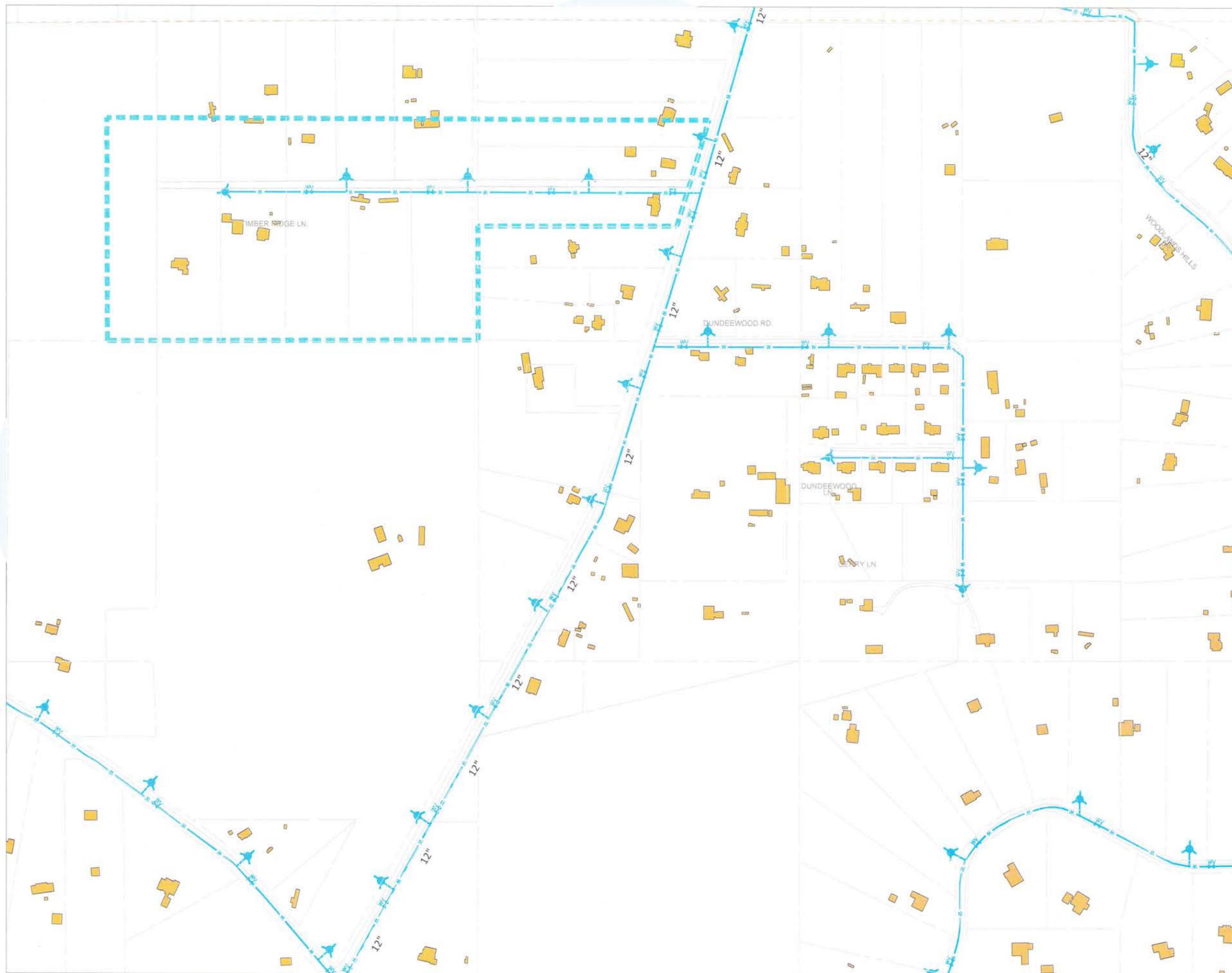
- - - - **TIMBER RIDGE LANE**
- 1961 L.F. **8" WATER MAIN**
- 0 L.F. **12" WATER MAIN**
- 0 L.F. **16" WATER MAIN**
- 4 EA. PROPOSED FIRE HYDRANTS**
- 4 EA. PROPOSED VALVES**
- 11 EA. SERVICES**
- EXISTING BUILDING**
- PROPERTY LINE**
- EXISTING BILOXI WATER MAIN**
- PROPOSED BILOXI WATER MAIN**
- UPGRADED BILOXI WATER MAIN**

**KEY MAP**



<b>SCALE</b>	<b>FIGURE NUMBER</b>
1" = 200'	<b>173.W1</b>
<b>PLOT DATE</b>	
6-01-18	

**SHEET FILE**  
TIMBER RIDGE LANE

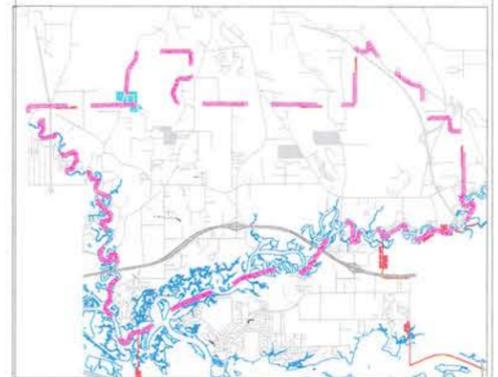


WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

**LEGEND**

- - - - - KAREN LEE COURT
- 678 L.F. 8" WATER MAIN
- 3754 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 9 EA. PROPOSED FIRE HYDRANTS
- 10 EA. PROPOSED VALVES
- 21 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

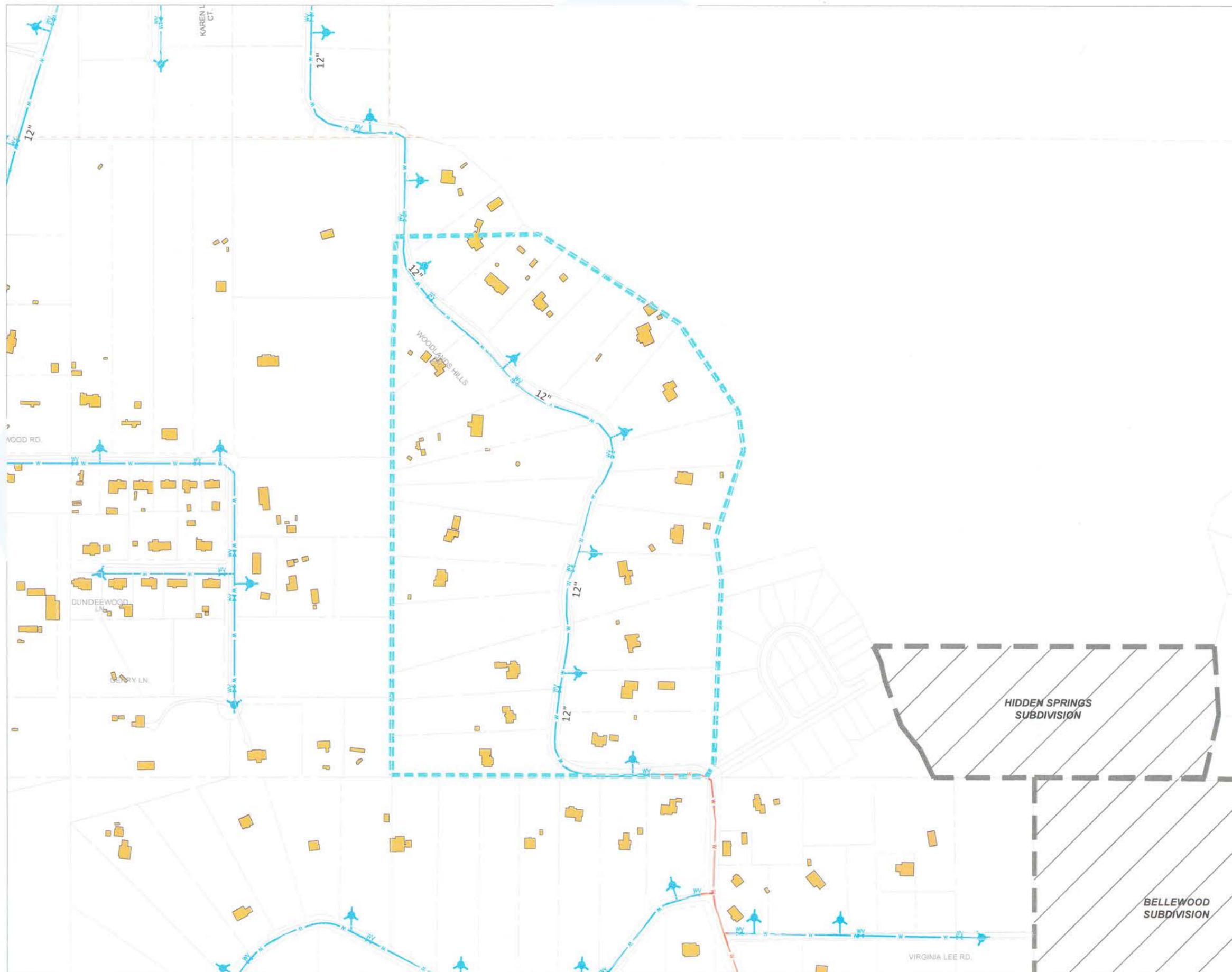
**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>162.W2</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>KAREN LEE COURT</b>	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

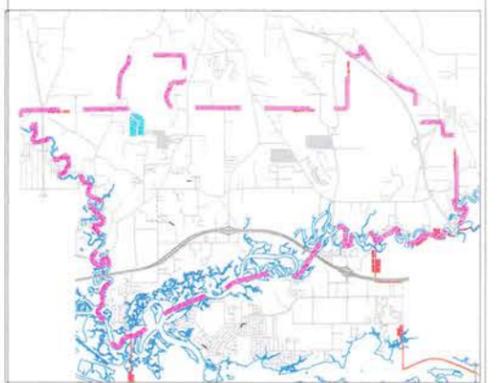
CITY OF BILOXI



LEGEND

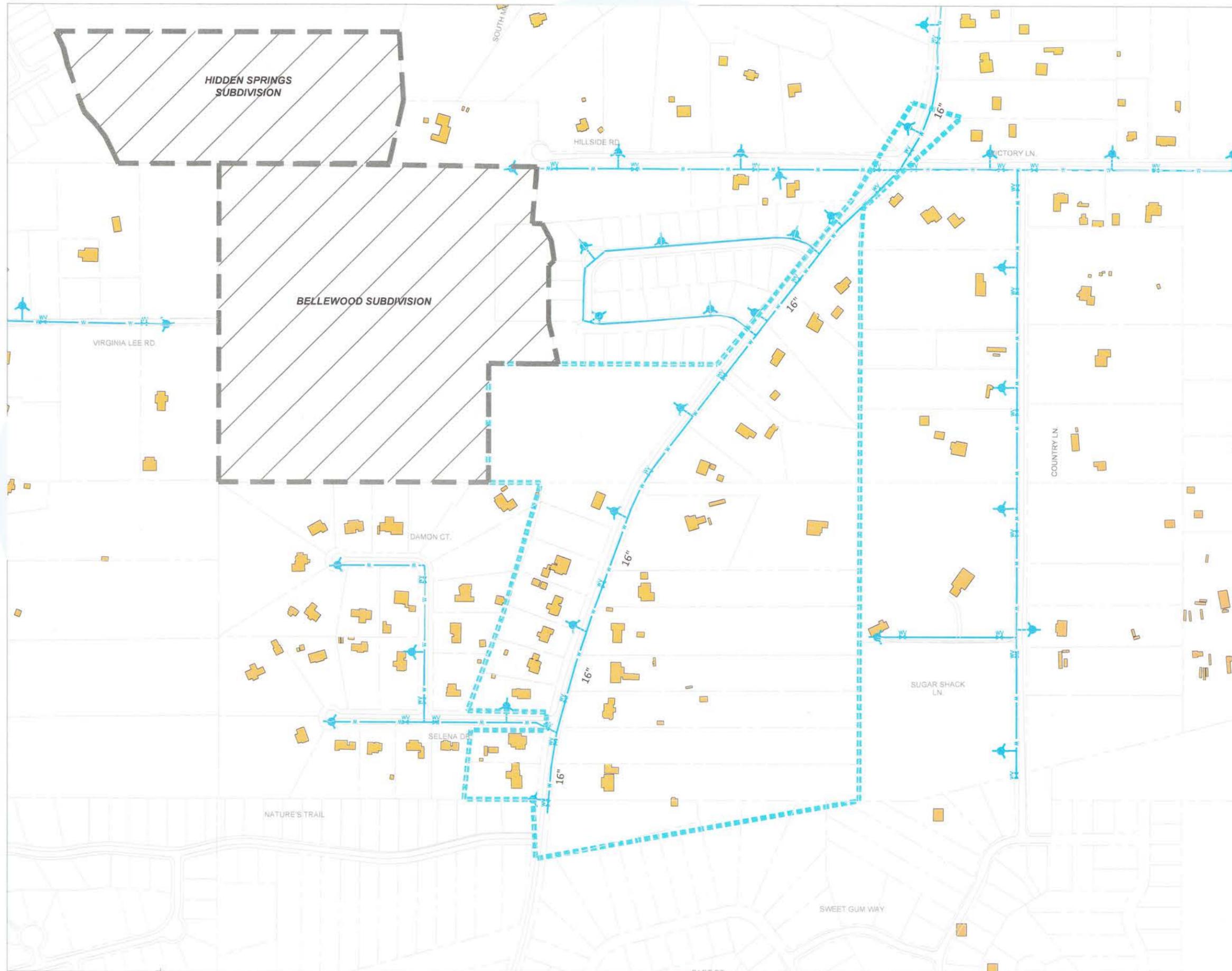
- - - - WOODLANDS HILLS
- 0 L.F. 8" WATER MAIN
- 3003 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 6 EA. PROPOSED FIRE HYDRANTS
- 6 EA. PROPOSED VALVES
- 35 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	162.W1
PLOT DATE	
6-01-18	

SHEET FILE  
WOODLANDS HILLS



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

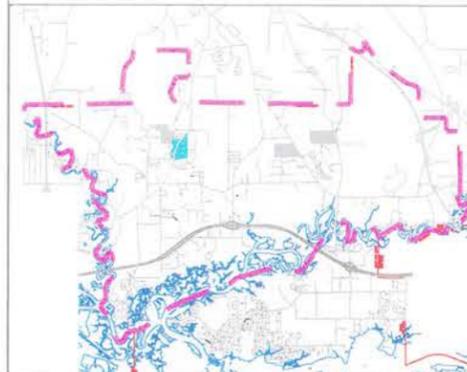
CITY OF BILOXI



LEGEND

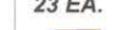
- - - - - LORRAINE ROAD
- 0 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 3388 L.F. 16" WATER MAIN
- ▲ 7 EA. PROPOSED FIRE HYDRANTS
- 9 EA. PROPOSED VALVES
- 20 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- - - - - UPGRADED BILOXI WATER MAIN

KEY MAP

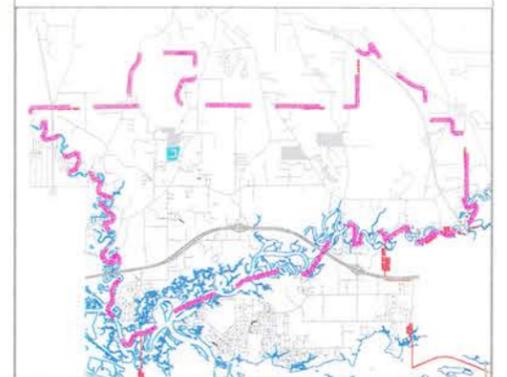


SCALE	FIGURE NUMBER
1" = 200'	105.W2
PLOT DATE	
6-01-18	
SHEET FILE	
LORRAINE ROAD	

**LEGEND**

-  SELENA DRIVE
-  1947 L.F. 8" WATER MAIN
-  0 L.F. 12" WATER MAIN
-  0 L.F. 16" WATER MAIN
-  4 EA. PROPOSED FIRE HYDRANTS
-  5 EA. PROPOSED VALVES
-  23 EA. SERVICES
-  EXISTING BUILDING
-  PROPERTY LINE
-  EXISTING BILOXI WATER MAIN
-  PROPOSED BILOXI WATER MAIN
-  UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	105.W1
PLOT DATE	
6-01-18	
SHEET FILE	SELENA DRIVE

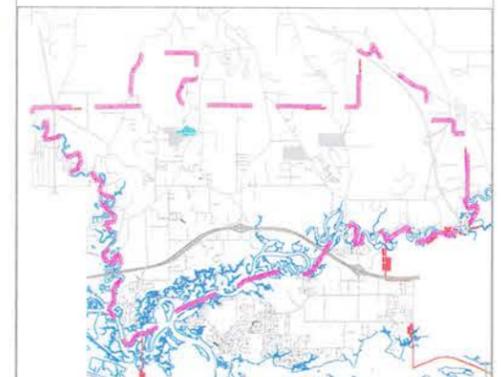


WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

**LEGEND**

-  **HILLSIDE ROAD**
-  **1602 L.F. 8" WATER MAIN**
-  **0 L.F. 12" WATER MAIN**
-  **0 L.F. 16" WATER MAIN**
-  **3 EA. PROPOSED FIRE HYDRANTS**
-  **4 EA. PROPOSED VALVES**
-  **8 EA. SERVICES**
-  **EXISTING BUILDING**
-  **PROPERTY LINE**
-  **EXISTING BILOXI WATER MAIN**
-  **PROPOSED BILOXI WATER MAIN**
-  **UPGRADED BILOXI WATER MAIN**

**KEY MAP**

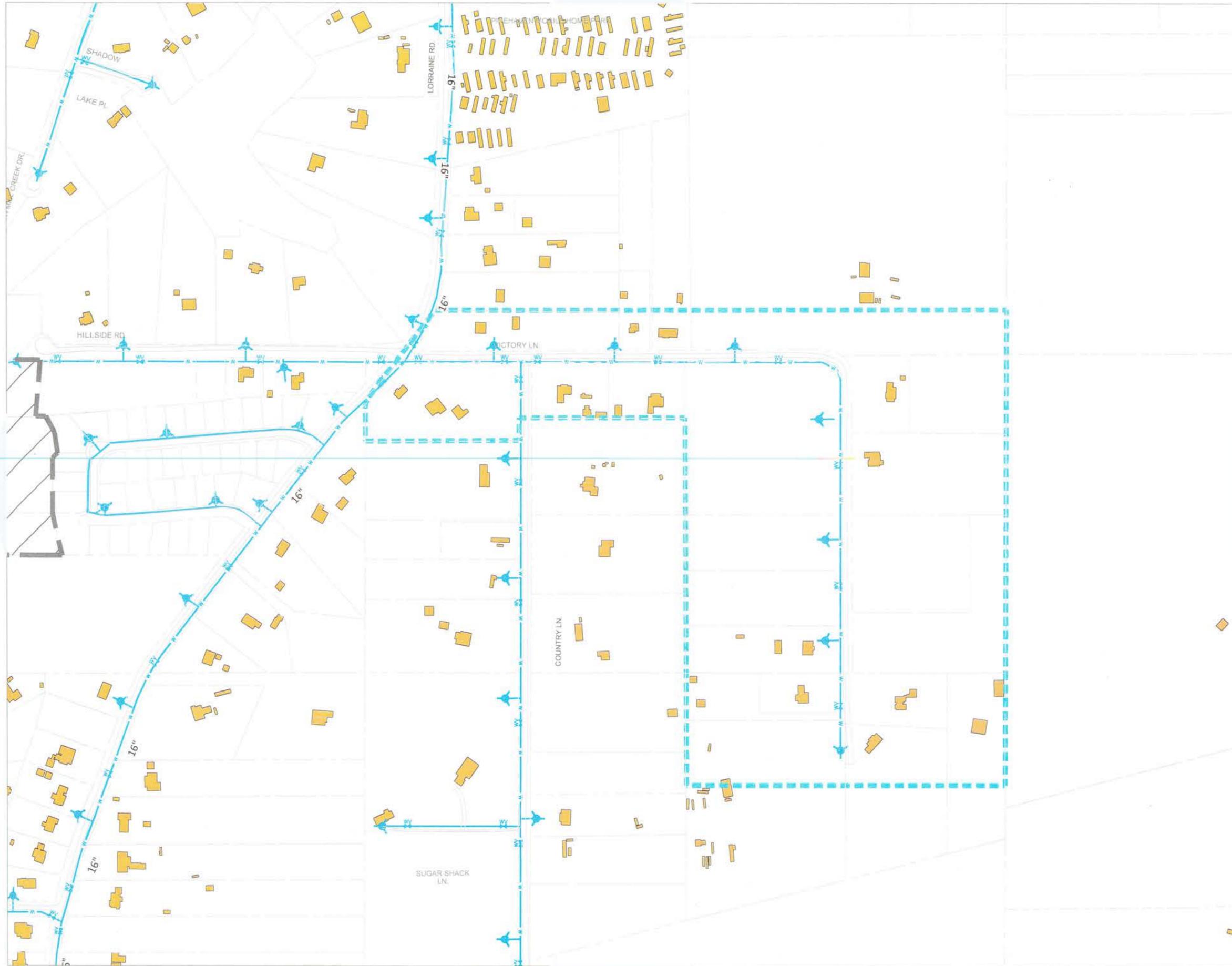


SCALE	FIGURE NUMBER
1" = 200'	<b>105.W3</b>
PLOT DATE	
6-01-18	

SHEET FILE  
**HILLSIDE ROAD**



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

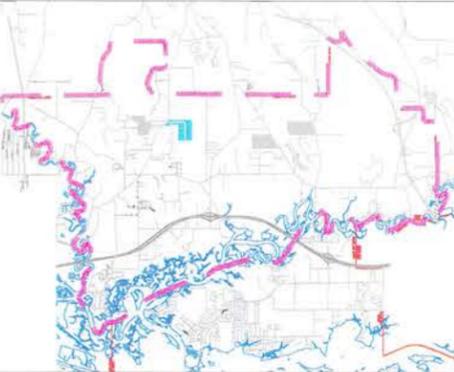
CITY OF BILOXI



LEGEND

- VICTORY LANE
- 3388 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 7 EA. PROPOSED FIRE HYDRANTS
- 8 EA. PROPOSED VALVES
- 19 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	106.W1
PLOT DATE	
6-01-18	
SHEET FILE	VICTORY LANE



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

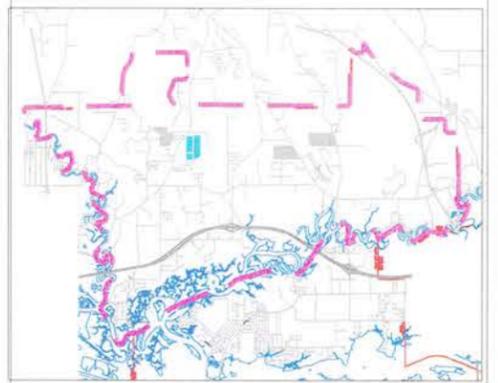
CITY OF BILOXI



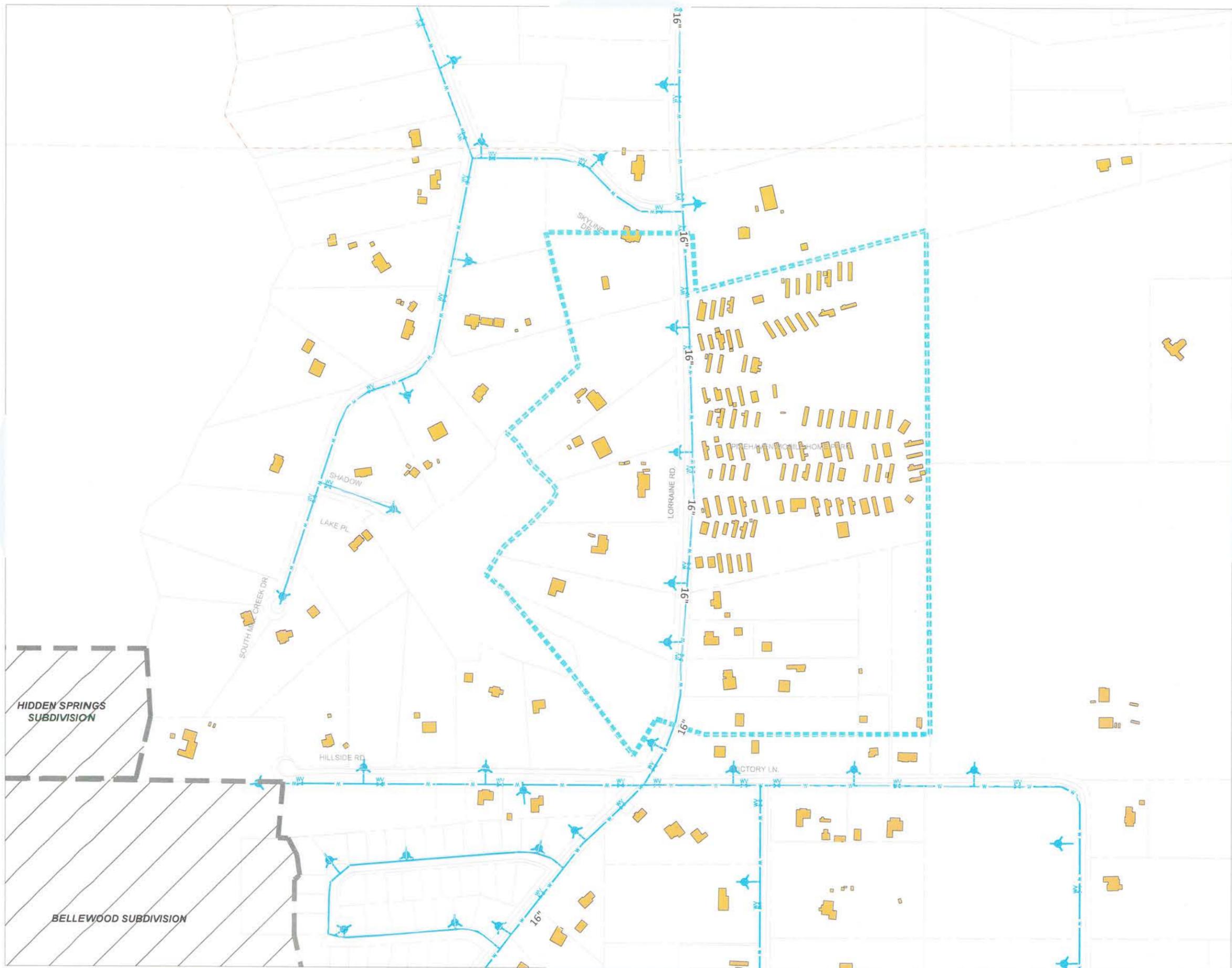
LEGEND

- COUNTRY LANE
- 3077 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 6 EA. PROPOSED FIRE HYDRANTS
- 8 EA. PROPOSED VALVES
- 14 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	152.W1
PLOT DATE	
6-01-18	
SHEET FILE	COUNTRY LANE



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

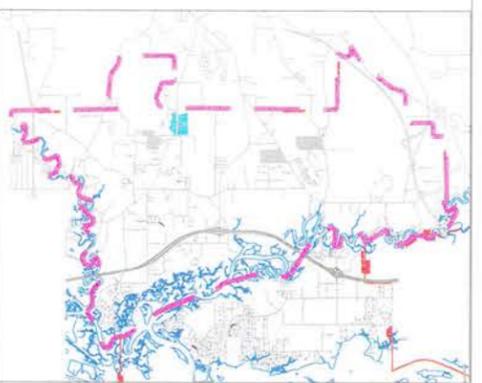
CITY OF BILOXI



LEGEND

- - - - - LORRAINE - PINE HAVEN
- 0 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 2139 L.F. 16" WATER MAIN
- 4 EA. PROPOSED FIRE HYDRANTS
- 6 EA. PROPOSED VALVES
- 125 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



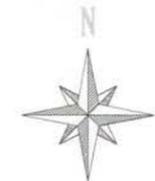
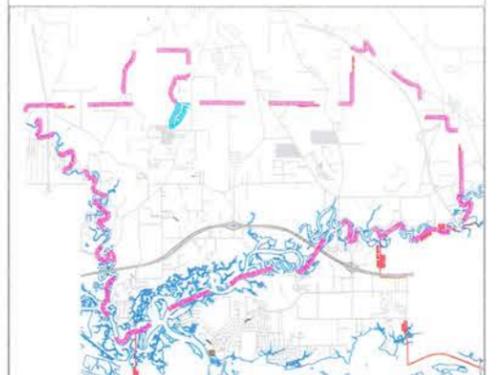
SCALE	FIGURE NUMBER
1" = 200'	105.W4
PLOT DATE	
6-01-18	
SHEET FILE	
LORRAINE - PINE HAVEN	



**LEGEND**

- - - SOUTH MILL CREEK DR
- 3369 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 7 EA. PROPOSED FIRE HYDRANTS
- 9 EA. PROPOSED VALVES
- 18 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	107.W1
PLOT DATE	
6-01-18	
SHEET FILE	
SOUTH MILL CREEK DR	

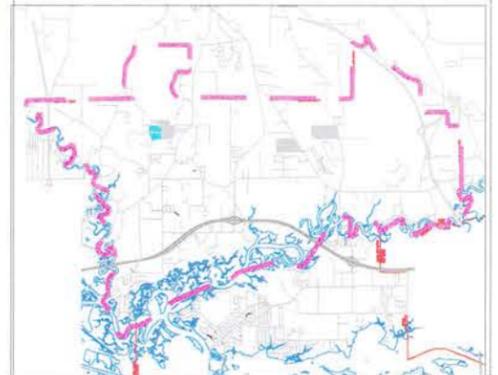


WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

**LEGEND**

-  VIRGINIA LEE ROAD
- 1043 L.F.  8" WATER MAIN
- 0 L.F.  12" WATER MAIN
- 0 L.F.  16" WATER MAIN
-  3 EA. PROPOSED FIRE HYDRANTS
-  3 EA. PROPOSED VALVES
- 6 EA.  SERVICES
-  EXISTING BUILDING
-  PROPERTY LINE
-  EXISTING BILOXI WATER MAIN
-  PROPOSED BILOXI WATER MAIN
-  UPGRADED BILOXI WATER MAIN

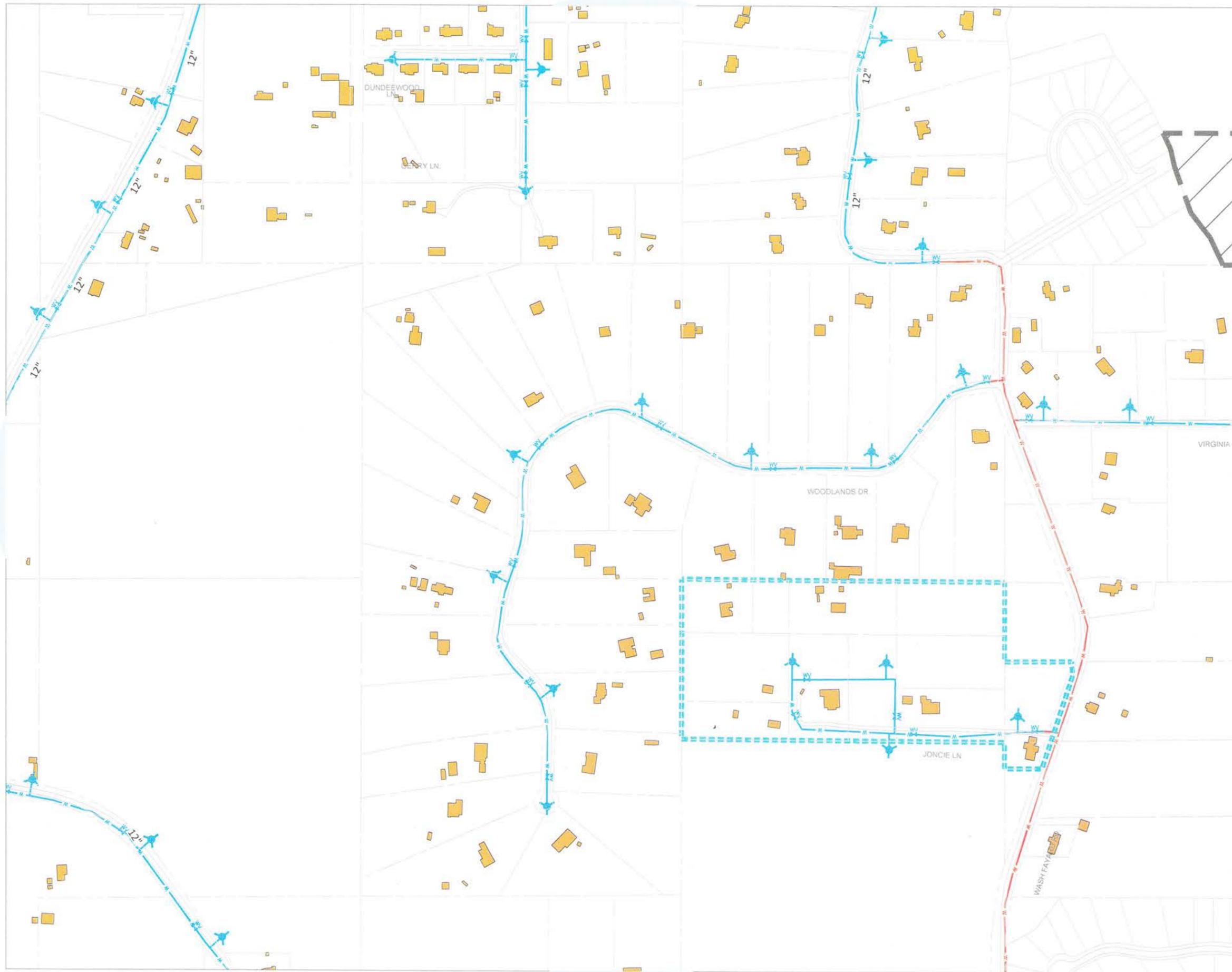
**KEY MAP**



SCALE	FIGURE NUMBER
1" = 200'	<b>161.W3</b>
PLOT DATE	
6-01-18	
SHEET FILE	
<b>VIRGINIA LEE ROAD</b>	



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

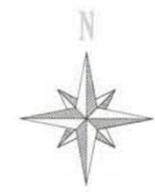
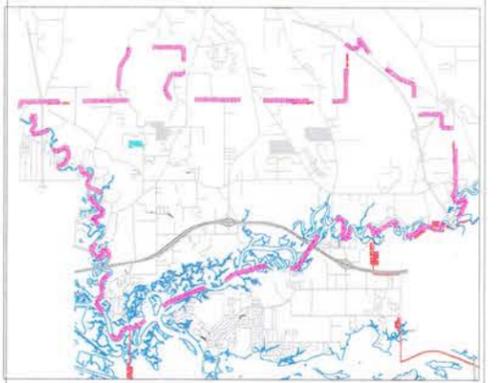
CITY OF BILOXI



LEGEND

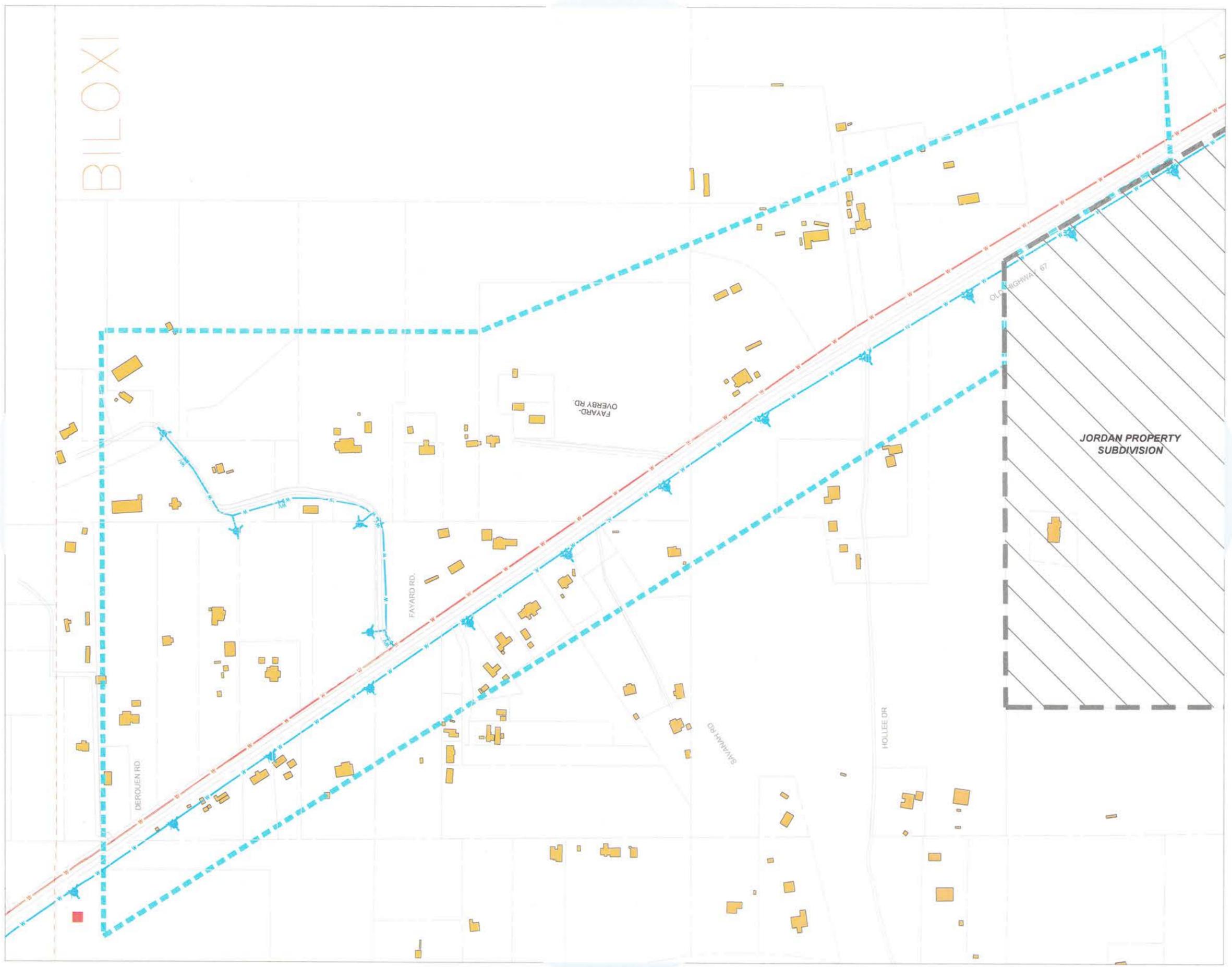
- - - - JONCIE LANE
- 1946 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 4 EA. PROPOSED FIRE HYDRANTS
- 5 EA. PROPOSED VALVES
- 10 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	161.W2
PLOT DATE	
6-01-18	
SHEET FILE	JONCIE LANE

BILOXI

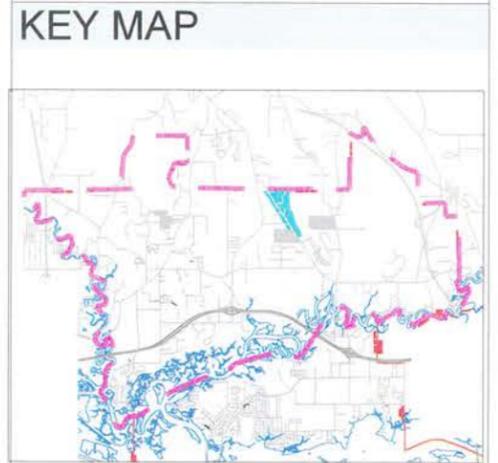


**CITY OF BILOXI**

**NEEL-SCHAFFER**  
Solutions you can build upon

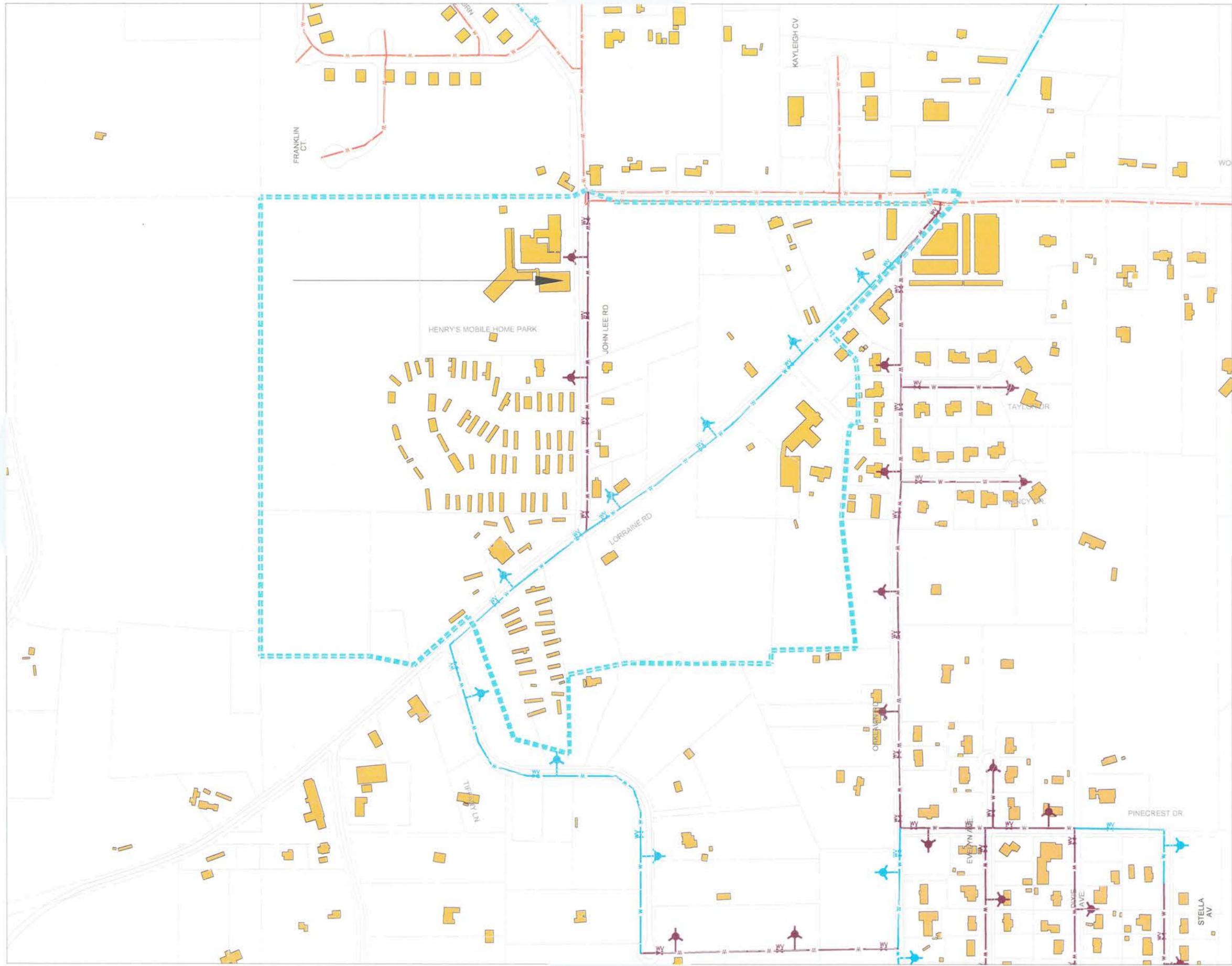
**GR GARNER RUSSELL & ASSOC.**  
CONSULTING ENGINEERS

- LEGEND**
- - - FAYARD RD
  - 1595 L.F. 8" WATER MAIN
  - 0 L.F. 12" WATER MAIN
  - 0 L.F. 16" WATER MAIN
  - 4 EA. PROPOSED FIRE HYDRANTS
  - 4 EA. PROPOSED VALVES
  - 8 EA. SERVICES
  - EXISTING BUILDING
  - PROPERTY LINE
  - EXISTING BILOXI WATER MAIN
  - PROPOSED BILOXI WATER MAIN
  - UPGRADED BILOXI WATER MAIN



SCALE	FIGURE NUMBER
1" = 200'	148.W1
PLOT DATE	
6-01-18	
SHEET FILE	
FAYARD RD	

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

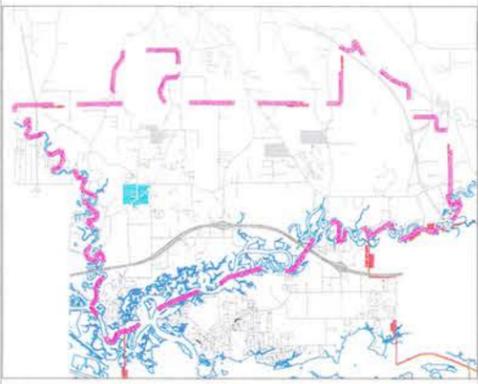
CITY OF BILOXI



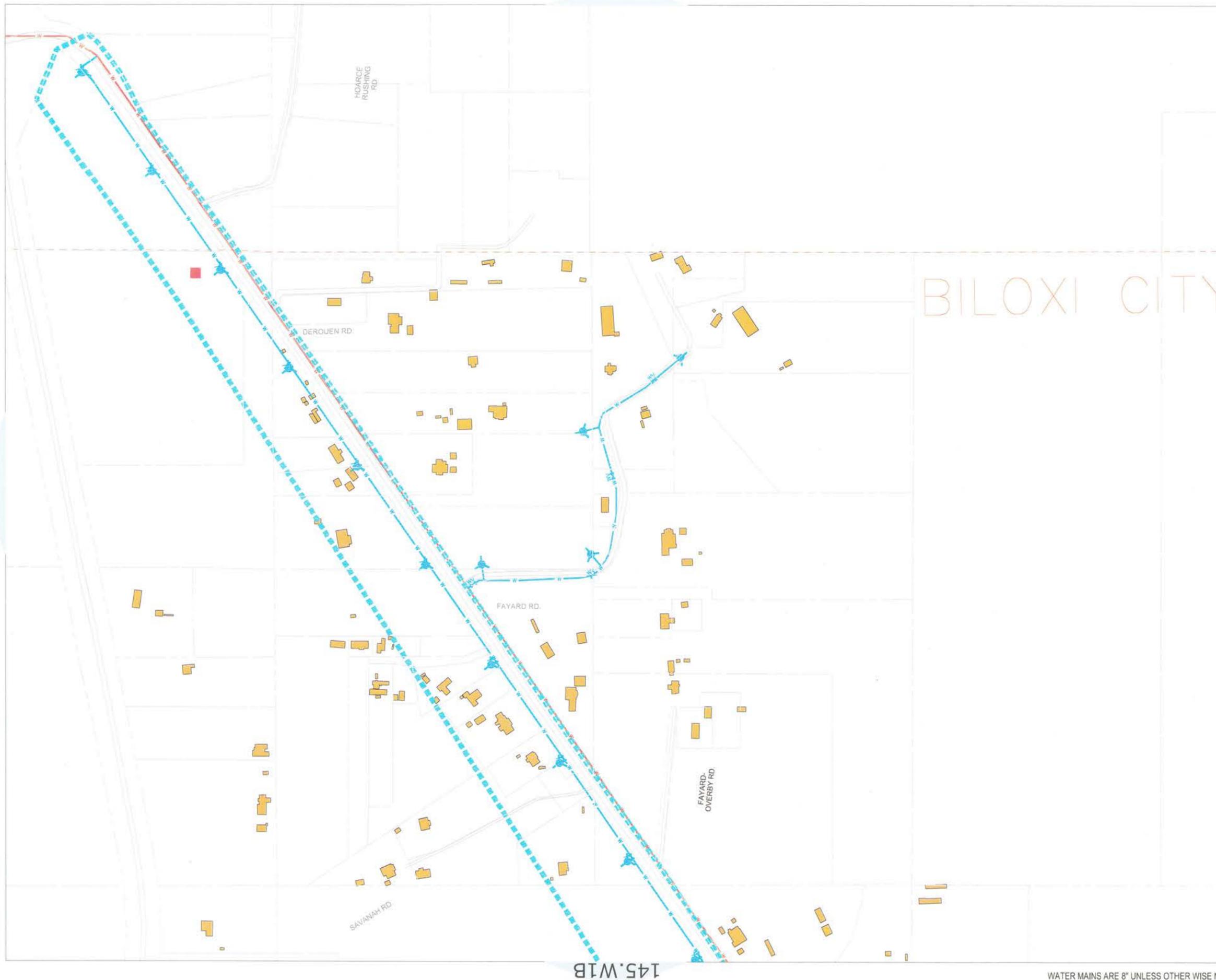
LEGEND

- - - JOHN LEE - LORRAINE
- 4183 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- 7 EA. PROPOSED FIRE HYDRANTS
- 11 EA. PROPOSED VALVES
- 56 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	100.W1
PLOT DATE	
6-01-18	
SHEET FILE	
JOHN LEE - LORRAINE	



145.W1B

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

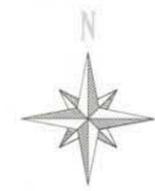
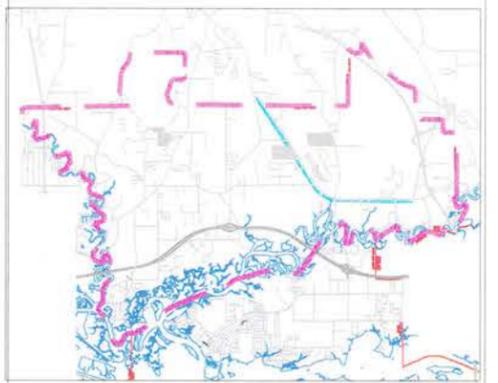
CITY OF BILOXI



LEGEND

- - - - - OLD HIGHWAY 67
- 20285 L.F. 8" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- ▶ 42 EA. PROPOSED FIRE HYDRANTS
- ⊕ 45 EA. PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP

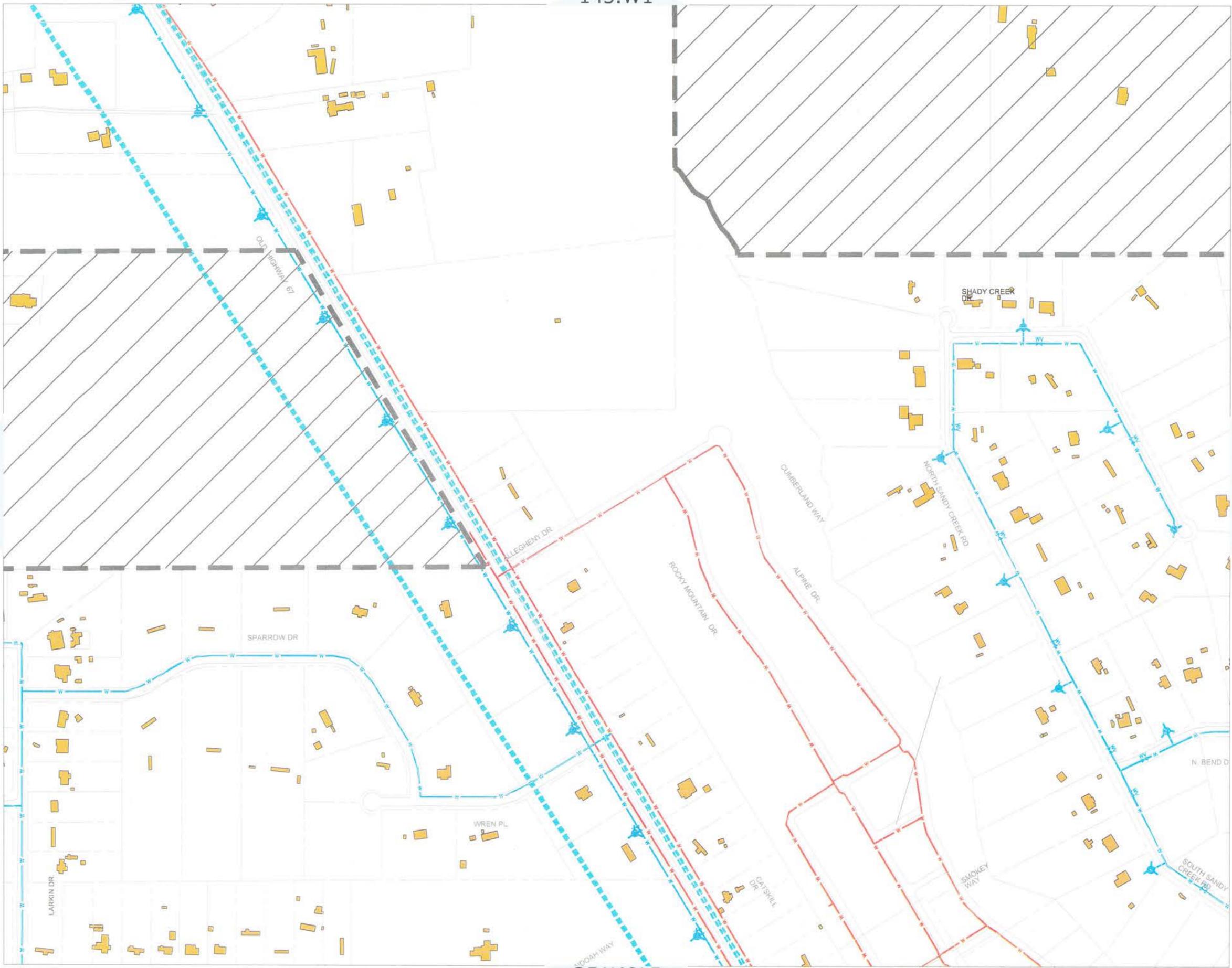


SCALE	FIGURE NUMBER
1" = 200'	145.W1A
PLOT DATE	
6-01-18	

SHEET FILE	OLD HIGHWAY 67
------------	----------------

145.W1

145.W1C



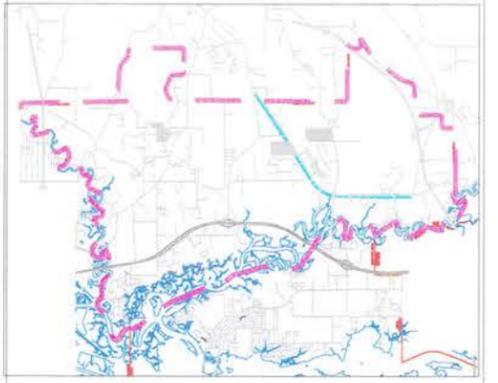
# CITY OF BILOXI



## LEGEND

- OLD HIGHWAY 67 2
- SEE 145.W1B" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- SEE 145.W1B PROPOSED FIRE HYDRANTS
- SEE 145.W1B PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

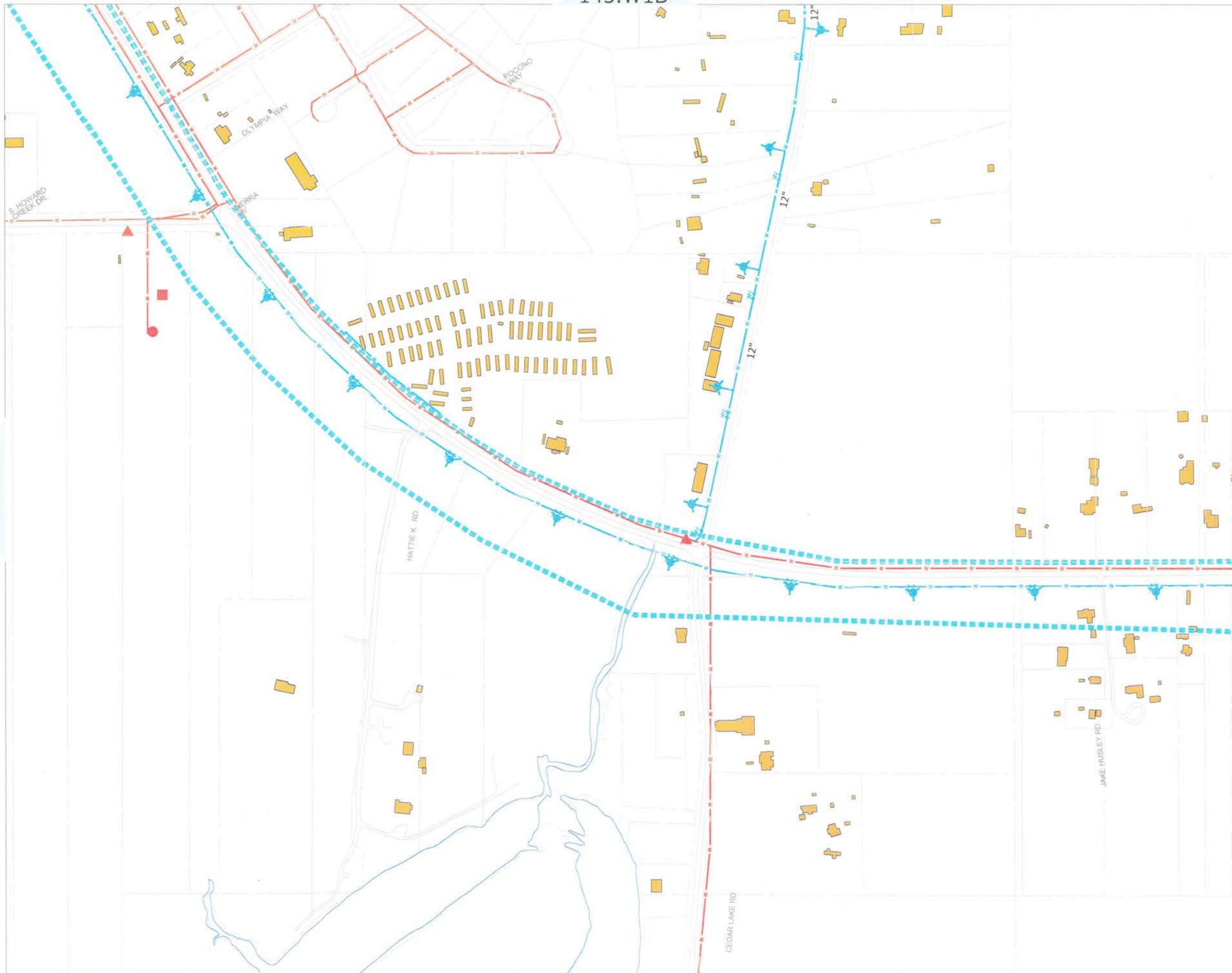
## KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>145.W1B</b>
PLOT DATE	
6-01-18	
SHEET FILE	
OLD HIGHWAY 67 2	

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.

145.W1B



145.W1D

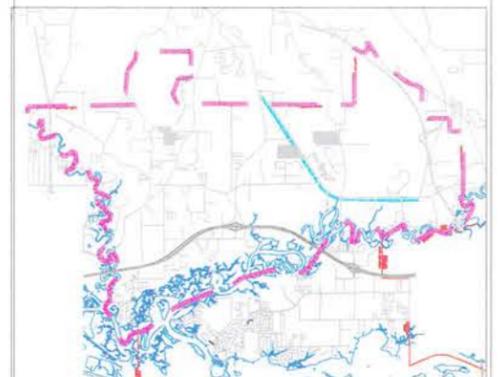
### CITY OF BILOXI



### LEGEND

- - - - - OLD HIGHWAY 67 3
- SEE 145.W1B 12" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- SEE 145.W1B PROPOSED FIRE HYDRANTS
- SEE 145.W1B PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

### KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	<b>145.W1C</b>
PLOT DATE	
6-01-18	

SHEET FILE  
 OLD HIGHWAY 67 3

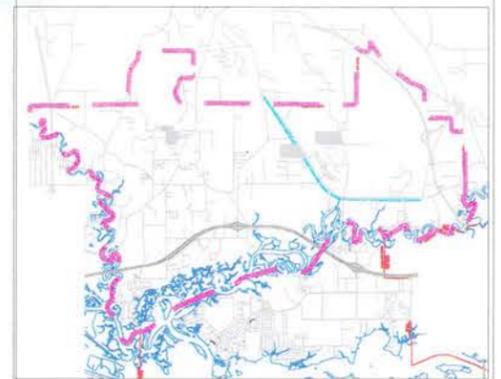
WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



LEGEND

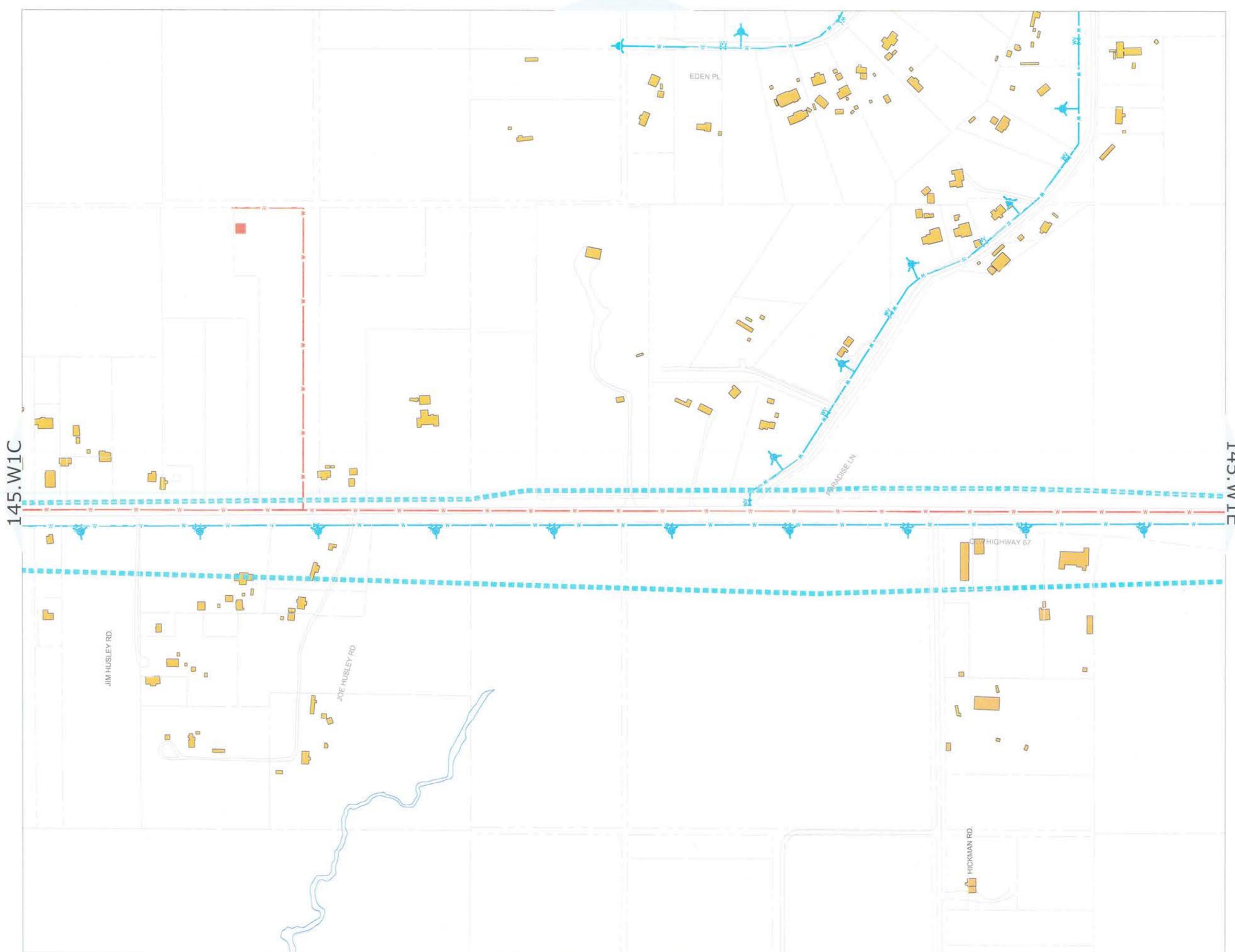
- OLD HIGHWAY 67 4
- SEE 145.W1B" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- SEE 145.W1B" PROPOSED FIRE HYDRANTS
- SEE 145.W1B" PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



SCALE	FIGURE NUMBER
1" = 200'	145.W1D
PLOT DATE	
6-01-18	

SHEET FILE
OLD HIGHWAY 67 4



145.W1C

145.W1E

WATER MAINS ARE 8" UNLESS OTHERWISE NOTED.



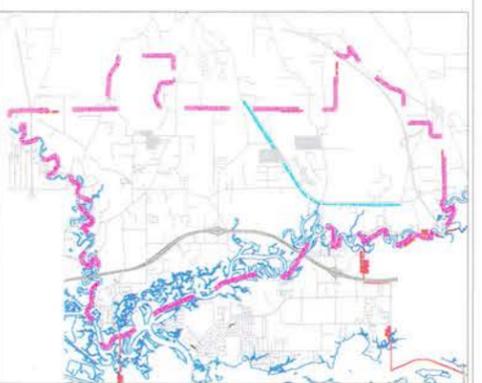
CITY OF BILOXI



LEGEND

- OLD HIGHWAY 67 5
- SEE 145.W18" WATER MAIN
- 0 L.F. 12" WATER MAIN
- 0 L.F. 16" WATER MAIN
- SEE 145.W1 PROPOSED FIRE HYDRANTS
- SEE 145.W1 PROPOSED VALVES
- 0 EA. SERVICES
- EXISTING BUILDING
- PROPERTY LINE
- EXISTING BILOXI WATER MAIN
- PROPOSED BILOXI WATER MAIN
- UPGRADED BILOXI WATER MAIN

KEY MAP



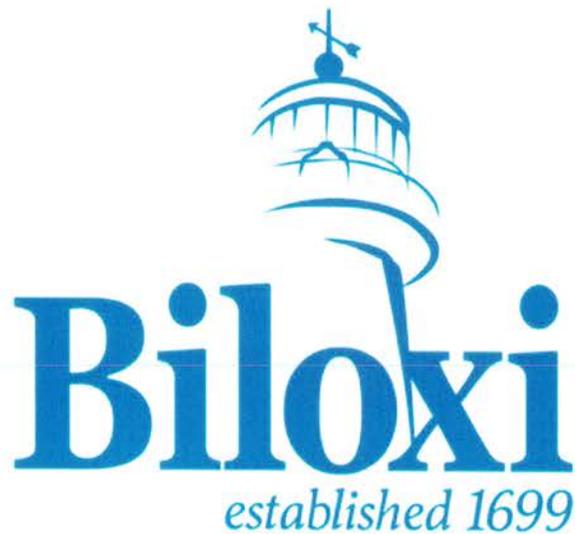
SCALE	FIGURE NUMBER
1" = 200'	145.W1E
PLOT DATE	
6-01-18	
SHEET FILE	
OLD HIGHWAY 67 5	

WATER MAINS ARE 8" UNLESS OTHER WISE NOTED.

# *WOOLMARKET MASTER PLAN*

*City of Biloxi  
Harrison County, Mississippi*

## *APPENDIX "C"*



*May 2018*

**A.M. Gilich, Jr., Mayor**  
**City Council**

George Lawrence

Ward 1 Paul Tisdale

Ward 5

Felix Gines

Ward 2 Kenny Glavan

Ward 6

Dixie Newman

Ward 3 Nathan Barrett

Ward 7

Robert L. Deming III

Ward 4

*Prepared By:*



*In Association With:*







**BRIDGE SURVEY REPORT**

**STRUCTURE NO. SA2400000000051**

**SEC 32 T 6S R10W**

**SA2400000000051**

**Supervisor District 2**

**HARRISON**

12/07/2016



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SKETCHES	19
WATERWAY	20
INSPECTION TEAM	21

Inspector: Darrell Fore  
Inspection Date: 12/07/2016

Structure Number: SA240000000051  
Facility Carried: JOHN LEE ROAD

### Bridge Inspection Report

## Element Inspection

## INSPECTION SUMMARY

Bridge Number SA2400000000051

Report Date 12/07/2016

PICTURES

Bridge Number SA2400000000051

Report Date 12/07/2016



Photo 1	Description
---------	-------------



Photo 2	Description
---------	-------------

PICTURES

Bridge Number SA2400000000051

Report Date 12/07/2016



Photo 3	Description
---------	-------------



Photo 4	Description
---------	-------------

# PICTURES

Bridge Number SA2400000000051  
Report Date 12/07/2016



Photo 5	Description
---------	-------------

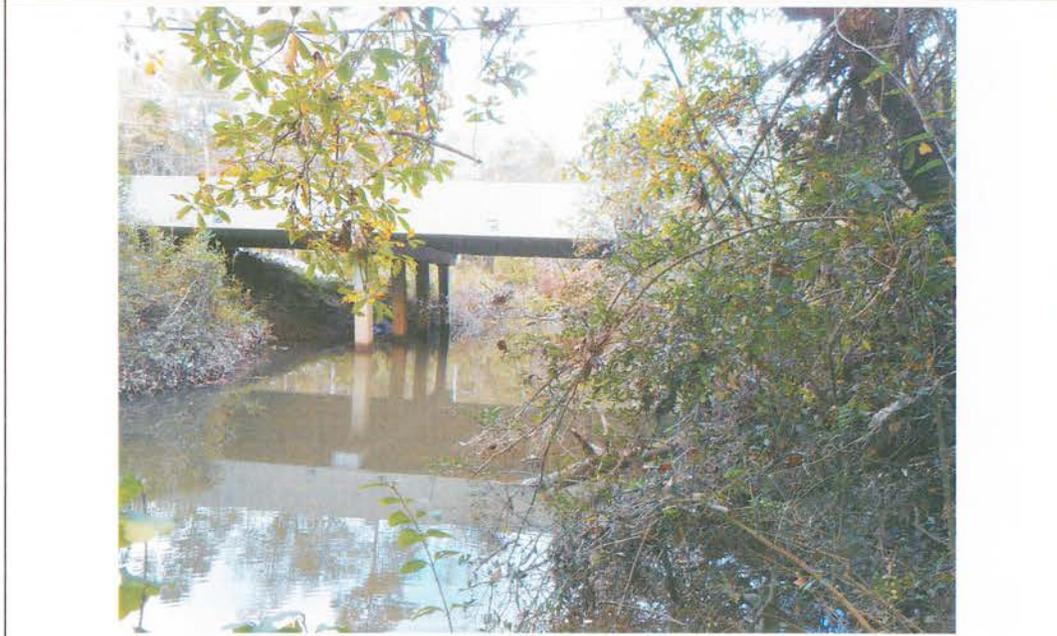


Photo 6	Description
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PICTURES

Bridge Number SA2400000000051

Report Date 12/07/2016



Photo 7	Description	
---------	-------------	--



Photo 9	Description	
---------	-------------	--

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000051

Report Date 12/07/2016

IDENTIFICATION			
1. State Code	284		
8. Structure Number	SA2400000000051		
5. Inventory Route	1 5 1 00 0		
2. MDOT District	06		
3. County Code	047		
4. Place Code	90954		
6. Features intersected	MILL CREEK		
7. Facility Carried	JOHN LEE ROAD		
9. Location	SEC 32 T 6S R10W		
11. Kilometer Point	0000.804		
12. Base Highway Network	0		
13A. LRS Inventory Route			
13B. Subroute Number			
16. Latitude	30	28	34.00
17. Longitude	-089	00	06.00
98A. Border Bridge Code			
98B. Percent			
99. Border Bridge Structure No.			

CLASSIFICATION			
20. Toll Facility	3		
21. Custodian	02		
22. Owner	02		
26. Functional Class	19		
37. Historical Significance	5		
100. Defense Highway	0		
101. Parallel Structure	N		
102. Direction of Traffic	2		
103. Temp Structure			
104. Highway System	0		
105. Federal Lands Highways	0		
110. Designated National Network	0		
112. NBIS Length	Y		

STRUCTURE TYPE AND MATERIAL			
Main Span Unit			
43A. Material Type	1		
43B. Design Type	22		
45. No of Main Spans	003		
Approach Span Unit			
44A. Material Type	0		
44B. Design Type	00		
46. No of Appr Spans	0000		
107. Deck Structure Type	2		
108. Wearing Surface/ Protective System			
108A. Wearing Surface	1		
108B. Type of Membrane	0		
108C. Deck Protection	0		

AGE AND SERVICE			
27. Year Built	2011		
106. Year Reconstructed	0000		
42. Type of Service	1 On	5 Under	
28. Lanes	02 On	00 Under	
29. ADT	000800		
30. Year of ADT	2010		
109. Truck ADT	08		
19. Detour Length			

PROPOSED IMPROVEMENTS			
75. Type of Work			
Proposed	38 - Other		
Work Done By	2 - Work to be		
76. Length of Improvements	003		
94. Bridge Cost	000001	\$ In Thousands	
95. Roadway Cost	000001	\$ In Thousands	
96. Total Cost	000002	\$ In Thousands	
97. Year of Cost Estimate	2011		
114. Future ADT	001200		
115. Year of Future	2030		

INSPECTIONS			
90. Inspection Date	12/07/2016		
91. Designated Inspection Frequency	24		
92. Critical Feature Inspection			
A. Fracture Critical Details			
B. Underwater Inspection			
C. Other Special Inspection			
93. Inspection Interval, Months			
A. Fracture Critical Details			
B. Underwater Inspection			
C. Other Special Inspection			
Sufficiency Rating	92.3		
Unknown Foundation Risk	92		
Unknown Foundation Risk Category			
Structure LSBP Eligible			
Stru. Deficient/Func. Obsolete	0		

GEOMETRIC DATA			
48. Max Span Length		0009.4m	
49. Structure Length		00028.2m	
50. Curb/ Sidewalk Width	Left	00.3m	
	Right	00.3m	
51. Deck Roadway Width		008.8m	
52. Deck Width (out-to-out)		009.4m	
32. Approach Roadway Width		007.6m	
33. Bridge Median		0	
34. Skew		00	
35. Structure Flared		0	
10. Min Vertical Clearance		99.99m	
47. Inv. Route, Total Horizontal Clearance		08.8m	

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000051

Report Date 12/07/2016

NAVIGATION DATA			
38. Navigation Control	0		
111. Pier Protection			
39. Nav Vert Clearance	000.0m		
40. Navigation Horiz Clear	0000.0m		
CONDITION			
58. Deck	8		
59. Superstructure	9		
60. Substructure	8		
61. Channel/Channel	9		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	5		
64. Operating	239	63. Rating	6
66. Inventory	143	65. Rating	6
70. Posting	5		
41. Posting Status	A		

53. Min Vert Clear Over Bridge Rdwy	99.99m
54. Minimum Vertical Underclearance	N 00.00m
55. Minimum Lateral Underclearance on Right	N 00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	5
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	8
71. Waterway Adequacy	8
72. Approach Alignment	8
36A. Bridge Railings	1
36B. Transitions	1
36C. Approach Guardrail	1
36D. Approach GuardRail	1
113. Scour Critical Bridges	U

## DECK

Bridge Number SA2400000000051

SIA Item 58 Deck Condition Rating: 8

Report Date 12/07/2016

CONDITION	COMPONENT	COMMENT
4	Joints	The joints have a small amount of sand and gravel in them.
4	Drains	
4	Rail	
	Sidewalks	None
Light	Vibration	
Light	Debris Accumulation	Light accumulation of dirt and leaves.
4	Overall Structure	
Average	Surface Roughness Rating	

## SUPERSTRUCTURE

Bridge Number SA2400000000051

SIA Item 59 Superstructure Condition Rating: 9

Report Date 12/07/2016

CONDITION	COMPONENT	COMMENT
	Girders	None
	Diaphragms	None
	Stingers	None
	Drains	None
	Rail	None
	Sidewalks	None
	Vibration	None
	Debris Accumulation	None
No	Overall Structure	
	Surface Roughness Rating	

## SUBSTRUCTURE

Bridge Number SA2400000000051  
 Report Date 12/07/2016

SI&A Item 60 Substructure Condition Rating: 8

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Piling/Foundation	
	Back Wall	None
4	Wing Wall	The NE and SE wingwalls are leaning slightly.
4	Embank	
4	Slope Protection	There is minor rip rap displacement on the east embankment.
	Scour	None
	Pile Type(s)	Concrete

## SUBSTRUCTURE

Bridge Number SA2400000000051

SI&A Item 60 Substructure Condition Rating: 8

Report Date 12/07/2016

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	There are minor spalls with exposed rebars on the bottoms of the caps.
4	Columns/Piles	
	Footing	None
	Web Wall	None
	Bracing	None
	Scour	None
	Pile Type(s)	Concrete

## GENERAL COMMENTS

Bridge Number SA2400000000051

Report Date 12/07/2016

### Deck

There are a few minor hairline cracks in the deck surface. There is a moderate sinkhole in the asphalt approach located near the NE corner of the bridge.

### Superstructure

### Substructure

### Bridge Ends

The approach shoulders are all low by 2" and more. The SW shoulder is as much as 8" low, and the SE shoulder has spots that are about 12" low.

### Waterway Appraisal

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000051

Report Date 12/07/2016

Deck

Repair the sinkhole in the asphalt approach near the NE corner of the bridge.

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000051

Report Date 12/07/2016

Deck

Clean the joints. Clean the minor debris accumulation off the deck.

Superstructure

Substructure

Bridge Ends

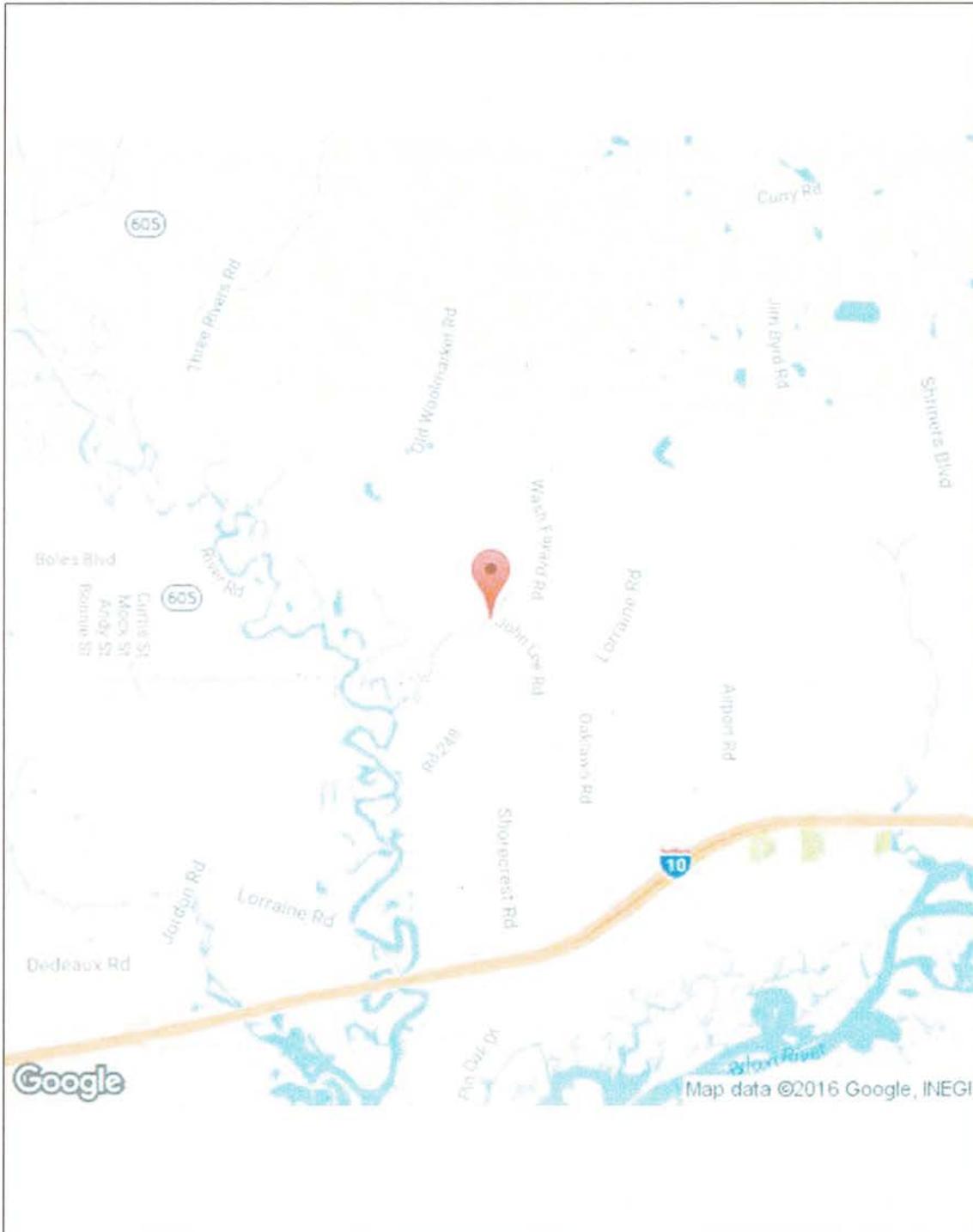
Place fill material on the approach shoulders.

Waterway Appraisal

# LOCATION MAP

Bridge Number SA2400000000051

Report Date 12/07/2016



# STREAM PROFILE REPORT

Bridge Number SA2400000000051

Report Date 12/07/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA2400000000051

Report Date 12/23/2016

(31) Design Load:	5 – MS 18 or HS 20	(65) Method used to Determine Inventory Rating:	6 – Load Factor (LF) Rating reported as Rating Factor (RF)
(41) Open/Posted/Closed:	A - Open	(66) Inventory Rating:	143
(63) Method used to Determine Operating Rating:	6 – Load Factor (LF) Rating reported as Rating	(67) Structural Evaluation:	8 - Equal to present desirable criteria
(64) Operating Rating:	239	(70) Bridge Posting:	5 - Equal to or above legal loads

### Recommended Posting Limits

H Truck (Tons)	Tandem Axle (Tons)
HS Short (Tons)	Single Axle (Tons)
HS Long (Tons)	Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>
H Truck		H Truck	
HS Short		HS Short	
HS Long		HS Long	
Tandem Axle		Tandem Axle	
Single Axle		Single Axle	
Gross		Gross	

### General Comments:

No Posting Required.

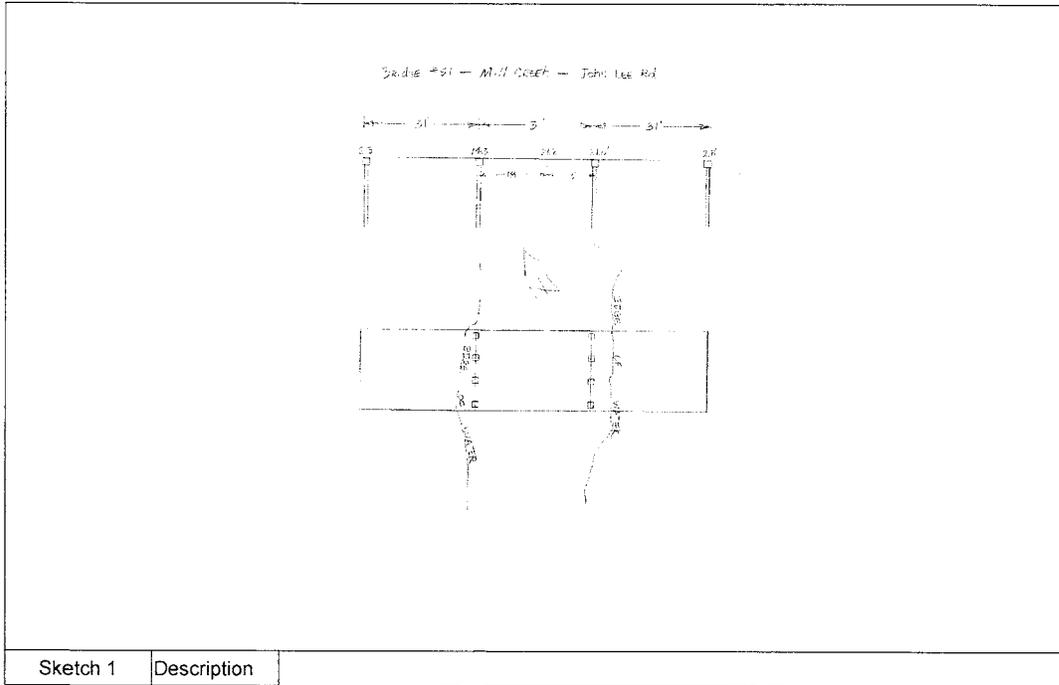
### Urgent Maintenance Noted:

### Routine Maintenance Noted:

# SKETCHES

Bridge Number SA2400000000051

Report Date 12/07/2016



## WATERWAY

Bridge Number SA2400000000051

SIA Item 61 Channel and Channel Protection: 9

Report Date 12/07/2016

(71) Waterway Adequacy	8	Sediment and/or Gravel Accumulation	none
(113) Scour Critical Bridge	U	Obstructions in the Waterway	no
Overall Channel Condition	good	Has Channel Shifted?	No
Bank Protection	good	Bank Erosion <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	No	Streambed Degradation	No
If Yes, Location and Description		Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	No	Scour Countermeasures in Place	No
Streambed Material	sand	If Yes, Condition	
Bank Vegetation	bushes	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	Unknown	Debris/Drift <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Underwater Inspection Required?	No	Unknown Foundation Risk Category	

INSPECTION TEAM SUMMARY

Bridge Number SA2400000000051

Report Date 12/07/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell

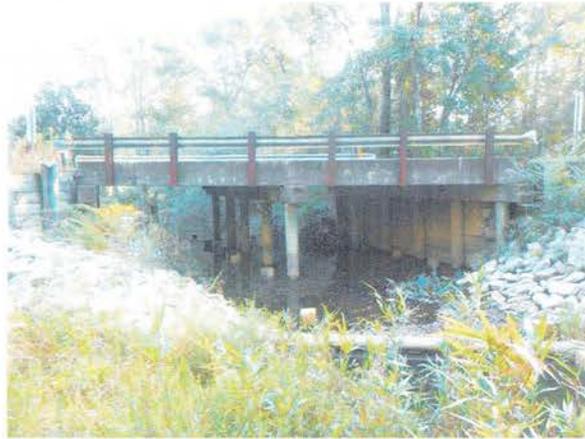
Darrell Fore

Name: \_\_\_\_\_

\_\_\_\_\_  
Signed:

03/22/2017

Date: \_\_\_\_\_



BRIDGE SURVEY REPORT

STRUCTURE NO.  
SEC 33 T 6S R10W  
SA2400000000052

Biloxi  
HARRISON

10/26/2016



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## INSPECTION SUMMARY

Bridge Number SA2400000000052

Report Date 10/26/2016

# PICTURES

Bridge Number SA2400000000052

Report Date 10/26/2016



Photo 1	Description
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Photo 2	Description
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PICTURES

Bridge Number SA2400000000052

Report Date 10/26/2016



Photo 3	Description
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Photo 4	Description
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PICTURES

Bridge Number SA2400000000052

Report Date 10/26/2016



Photo 5	Description
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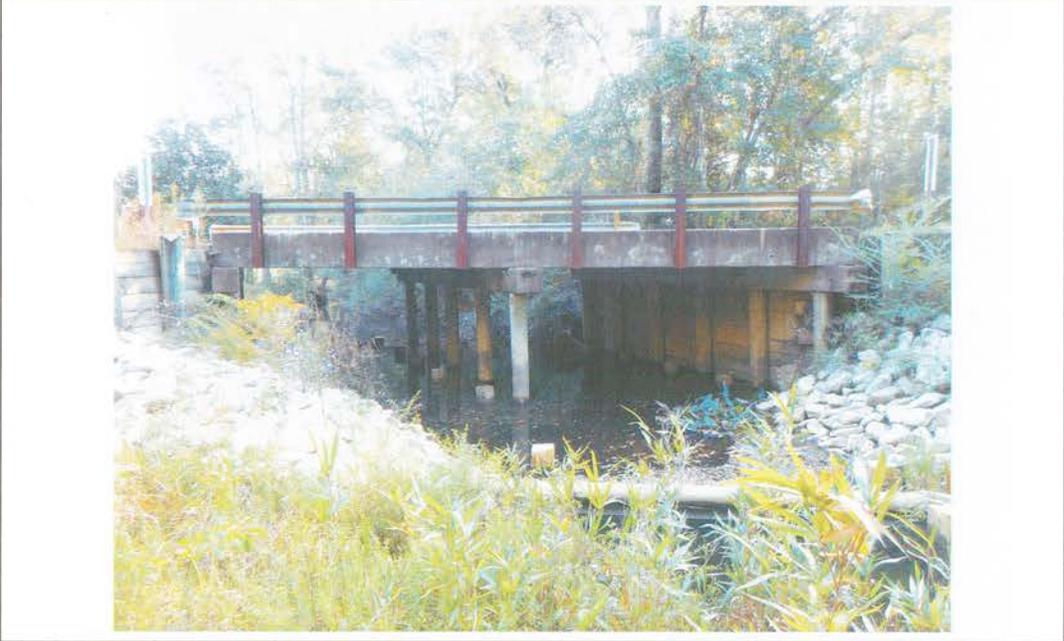


Photo 6	Description
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# PICTURES

Bridge Number SA2400000000052

Report Date 10/26/2016



Photo 7	Description
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Photo 8	Description
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PICTURES

Bridge Number SA2400000000052

Report Date 10/26/2016



Photo 9	Description
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## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA240000000052

Report Date 10/26/2016

IDENTIFICATION				AGE AND SERVICE			
1. State Code	284			27. Year Built	1989		
8. Structure Number	SA240000000052			106. Year Reconstructed	0000		
5. Inventory Route	1 4 1 00 0			42. Type of Service	1 On	5 Under	
2. MDOT District	06			28. Lanes	02 On	00 Under	
3. County Code	047			29. ADT	000600		
4. Place Code	06220			30. Year of ADT	2009		
6. Features Intersected	MILL CREEK			109. Truck ADT	08		
7. Facility Carried	WASH FAYARD ROAD			19. Detour Length			
9. Location	SEC 33 T 6S R10W						
11. Kilometer Point	0000.482						
12. Base Highway Network	0						
13A. LRS Inventory Route							
13B. Subroute Number							
16. Latitude	30	28	43.00				
17. Longitude	-088	59	51.00				
98A. Border Bridge Code							
98B. Percent							
99. Border Bridge Structure No.							
CLASSIFICATION				PROPOSED IMPROVEMENTS			
20. Toll Facility	3			75. Type of Work			
21. Custodian	04			Proposed	38 - Other		
22. Owner	04			Work Done By	2 - Work to be		
26. Functional Class	09			76. Length of Improvements	002		
37. Historical Significance	5			94. Bridge Cost	000003	\$ In Thousands	
100. Defense Highway	0			95. Roadway Cost	000001	\$ In Thousands	
101. Parallel Structure	N			96. Total Cost	000004	\$ In Thousands	
102. Direction of Traffic	2			97. Year of Cost Estimate	2011		
103. Temp Structure				114. Future ADT	000900		
104. Highway System	0			115. Year of Future	2030		
105. Federal Lands Highways	0						
110. Designated National Network	0						
112. NBIS Length	Y						
STRUCTURE TYPE AND MATERIAL				INSPECTIONS			
Main Span Unit				90. Inspection Date	10/26/2016		
43A. Material Type	1			91. Designated Inspection Frequency	24		
43B. Design Type	22			92. Critical Feature Inspection			
45. No of Main Spans	002			A. Fracture Critical Details			
Approach Span Unit				B. Underwater Inspection			
44A. Material Type	0			C. Other Special Inspection			
44B. Design Type	00			93. Inspection Interval, Months			
46. No of Appr Spans	0000			A. Fracture Critical Details			
107. Deck Structure Type	2			B. Underwater Inspection			
108. Wearing Surface/ Protective System				C. Other Special Inspection			
108A. Wearing Surface	1			Sufficiency Rating	87.2		
108B. Type of Membrane	0			Unknown Foundation Risk	0		
108C. Deck Protection	0			Unknown Foundation Risk Category			
				Structure LSBP Eligible			
				Stru. Deficient/Func. Obsolete	0		
STRUCTURE TYPE AND MATERIAL				GEOMETRIC DATA			
Main Span Unit				48. Max Span Length	0005.8m		
43A. Material Type	1			49. Structure Length	00011.6m		
43B. Design Type	22			50. Curb/ Sidewalk Width	Left	00.2m	
45. No of Main Spans	002				Right	00.2m	
Approach Span Unit				51. Deck Roadway Width	007.2m		
44A. Material Type	0			52. Deck Width (out-to-out)	007.6m		
44B. Design Type	00			32. Approach Roadway Width	007.3m		
46. No of Appr Spans	0000			33. Bridge Median	0		
107. Deck Structure Type	2			34. Skew	30		
108. Wearing Surface/ Protective System				35. Structure Flared	0		
108A. Wearing Surface	1			10. Min Vertical Clearance	99.99m		
108B. Type of Membrane	0			47. Inv. Route, Total Horizontal Clearance	07.1m		
108C. Deck Protection	0						

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000052

Report Date 10/26/2016

NAVIGATION DATA			
38. Navigation Control	0		
111. Pier Protection			
39. Nav Vert Clearance	000.0m		
40. Navigation Horiz Clear	0000.0m		
CONDITION			
58. Deck	6		
59. Superstructure	7		
60. Substructure	6		
61. Channel/Channel	6		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	5		
64. Operating	242	63. Rating	6
66. Inventory	145	65. Rating	6
70. Posting	5		
41. Posting Status	A		

53. Min Vert Clear Over Bridge Rdwy	99.99m
54. Minimum Vertical Underclearance	N
	00.00m
55. Minimum Lateral Underclearance on Right	N
	00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	4
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	6
71. Waterway Adequacy	8
72. Approach Alignment	6
36A. Bridge Railings	1
36B. Transitions	N
36C. Approach Guardrail	N
36D. Approach GuardRail	N
113. Scour Critical Bridges	5

## DECK

Bridge Number SA2400000000052

SIA Item 58 Deck Condition Rating: 6

Report Date 10/26/2016

CONDITION	COMPONENT	COMMENT
4	Joints	
2	Drains	The drain holes are clogged up.
3	Rail	
	Sidewalks	None
Light	Vibration	
Light	Debris Accumulation	Dirt and pine straw.
4	Overall Structure	
Smooth	Surface Roughness Rating	

## SUPERSTRUCTURE

Bridge Number SA2400000000052

SIA Item 59 Superstructure Condition Rating: 7

Report Date 10/26/2016

CONDITION	COMPONENT	COMMENT
	Girders	None
	Diaphragms	None
	Stingers	None
	Drains	None
	Rail	None
	Sidewalks	None
	Vibration	None
Light	Debris Accumulation	Drift, small sticks, and leaves on top of the pile caps.
No	Overall Structure	
	Surface Roughness Rating	

## SUBSTRUCTURE

Bridge Number SA2400000000052

SI&A Item 60 Substructure Condition Rating: 6

Report Date 10/26/2016

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Piling/Foundation	
4	Back Wall	
4	Wing Wall	
4	Embank	
	Slope Protection	None
	Scour	None
	Pile Type(s)	Wood

## SUBSTRUCTURE

Bridge Number SA240000000052

SI&A Item 60 Substructure Condition Rating: 6

Report Date 10/26/2016

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Columns/Piles	
	Footing	None
	Web Wall	None
	Bracing	None
	Scour	None
	Pile Type(s)	Wood

## GENERAL COMMENTS

Bridge Number SA2400000000052

Report Date 10/26/2016

### Deck

There are minor section losses in the deck at the joint and in keyways. There is a minor delaminated spot on the deck at the end of span 2, 2.5' right of centerline that is about 20" X 6". There is a minor delaminated spot on the deck at the end of span 2, 9.5' right of centerline that is about 24" X 5'.

### Superstructure

### Substructure

### Bridge Ends

The bridge rail end section is severely bent at the SW corner of the bridge.

### Waterway Appraisal

There is a minor pile of drift in the center of the stream caught at the upstream side of the center pile bent. Old pilings from a previous bridge have been cut off and left laying in the streambed, and creating an obstruction.

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000052

Report Date 10/26/2016

Deck

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000052

Report Date 10/26/2016

Deck

Clean the dirt and pine straw off the deck. Unclog the drain holes. Need to place fill material on all the shoulders near the bridge ends.

Superstructure

Substructure

Remove the light drift from the top of pile caps.

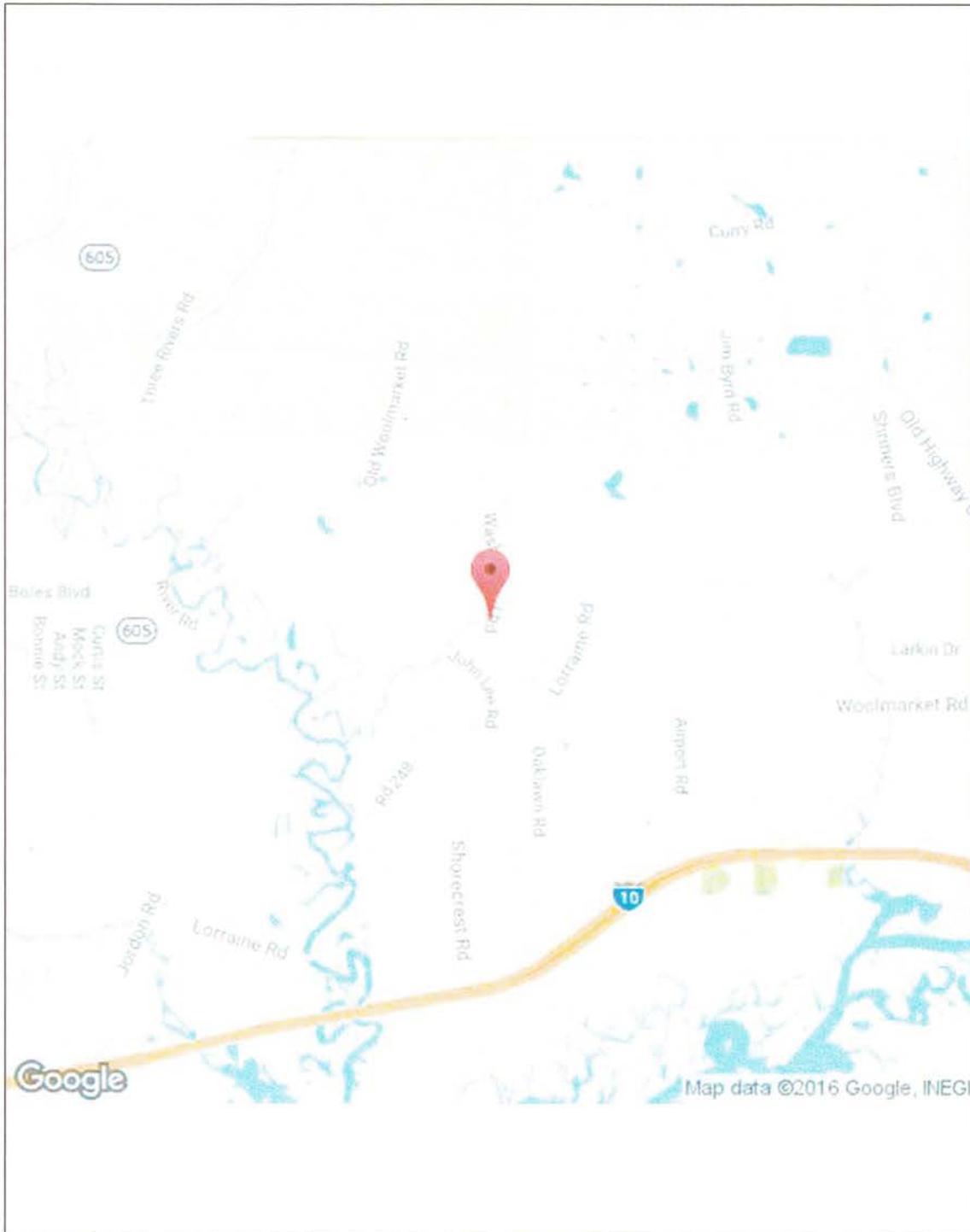
Bridge Ends

Waterway Appraisal

Remove the minor drift pile from the center of the stream. Remove the old pilings which obstruct the flow from the streambed.

# LOCATION MAP

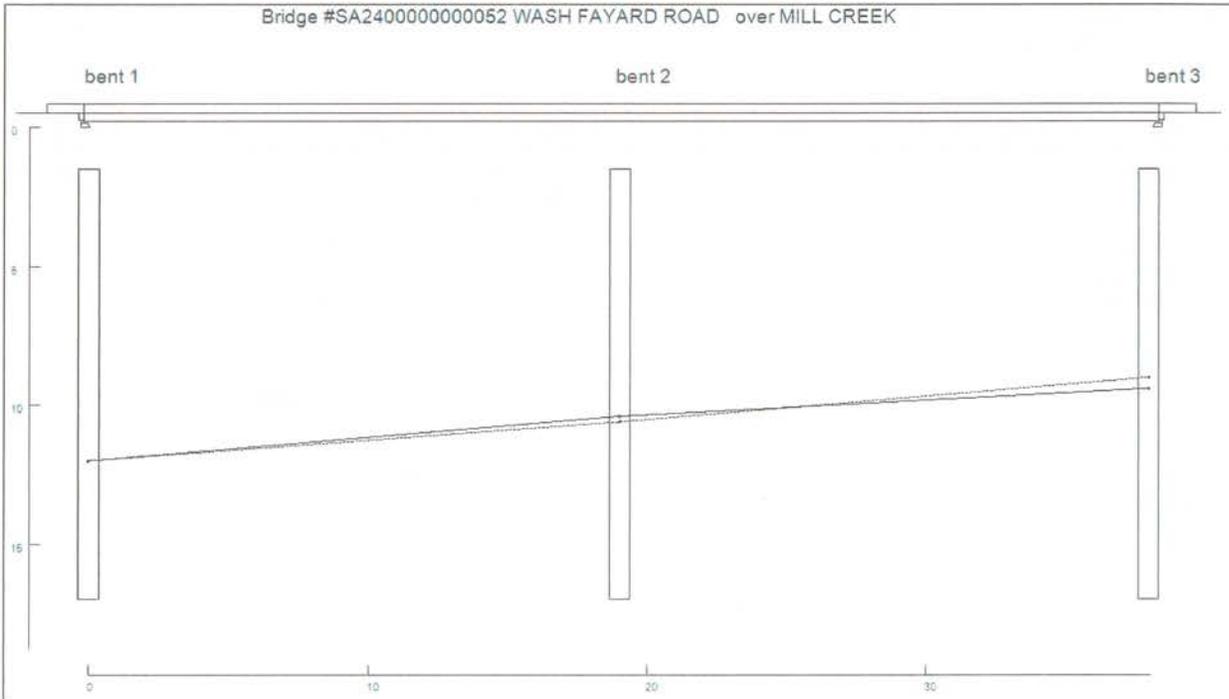
Bridge Number SA2400000000052  
Report Date 10/26/2016



# STREAM PROFILE REPORT

Bridge Number SA2400000000052

Report Date 10/26/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA2400000000052

Report Date 11/08/2016

(31) Design Load:	5 – MS 18 or HS 20	(65) Method used to Determine Inventory Rating:	6 – Load Factor (LF) Rating reported as Rating Factor (RF)
(41) Open/Posted/Closed:	A - Open	(66) Inventory Rating:	145
(63) Method used to Determine Operating Rating:	6 – Load Factor (LF) Rating reported as Rating	(67) Structural Evaluation:	6 - Equal to present minimum criteria
(64) Operating Rating:	242	(70) Bridge Posting:	5 - Equal to or above legal loads

### Recommended Posting Limits

H Truck (Tons)	Tandem Axle (Tons)
HS Short (Tons)	Single Axle (Tons)
HS Long (Tons)	Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>
H Truck		H Truck	
HS Short		HS Short	
HS Long		HS Long	
Tandem Axle		Tandem Axle	
Single Axle		Single Axle	
Gross		Gross	

### General Comments:

No Posting Required

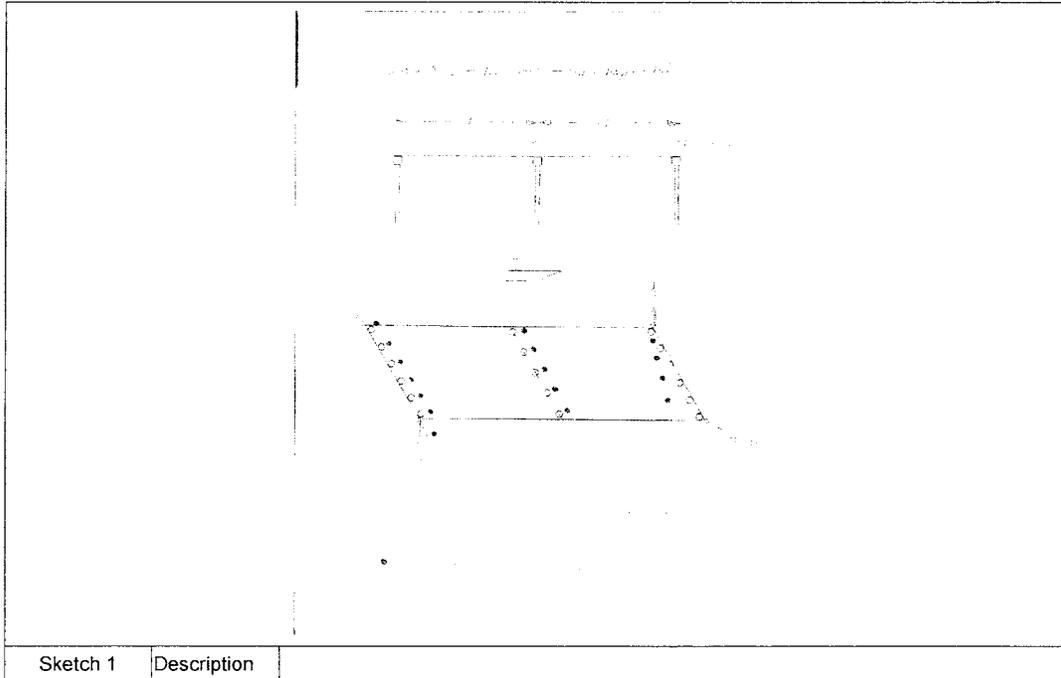
### Urgent Maintenance Noted:

### Routine Maintenance Noted:

# SKETCHES

Bridge Number SA2400000000052

Report Date 10/26/2016



## WATERWAY

Bridge Number SA2400000000052

SIA Item 61 Channel and Channel Protection: 6

Report Date 10/26/2016

(71) Waterway Adequacy	8	Sediment and/or Gravel Accumulation	none
(113) Scour Critical Bridge	5	Obstructions in the Waterway	yes
Overall Channel Condition	good	Has Channel Shifted?	No
Bank Protection	good	Bank Erosion	<input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	No	Streambed Degradation	No
If Yes, Location and Description		Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	No	Scour Countermeasures in Place	No
Streambed Material	sand/mud	If Yes, Condition	
Bank Vegetation	bushes and weeds	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	Rarely	Debris/Drift	<input type="checkbox"/> Upstream <input checked="" type="checkbox"/> Site <input type="checkbox"/> Downstream <input type="checkbox"/> None
Underwater Inspection Required?	No	Unknown Foundation Risk Category	

## INSPECTION TEAM SUMMARY

Bridge Number SA2400000000052

Report Date 10/26/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell  
Overstreet, Daniel

Darrell Fore

Name: \_\_\_\_\_

\_\_\_\_\_  
Signed:

03/22/2017

Date: \_\_\_\_\_



BRIDGE SURVEY REPORT

STRUCTURE NO. SA2400000000053

SEC 35 T 6S R10W B

SA2400000000053

Biloxi

HARRISON

10/26/2016



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## INSPECTION SUMMARY

Bridge Number SA2400000000053  
Report Date 10/26/2016

PICTURES

Bridge Number SA2400000000053

Report Date 10/26/2016



Photo 1	Description	
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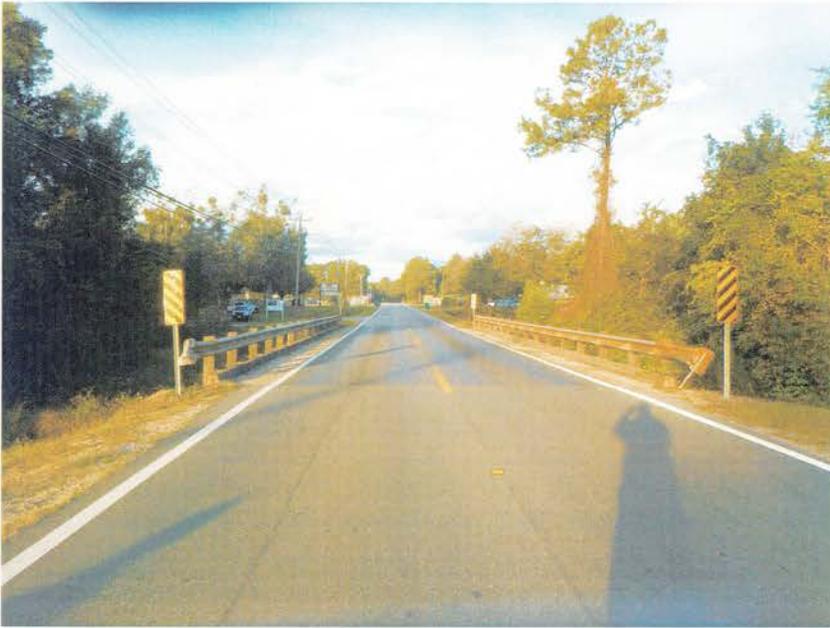


Photo 2	Description	
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PICTURES

Bridge Number SA2400000000053  
Report Date 10/26/2016



Photo 3	Description
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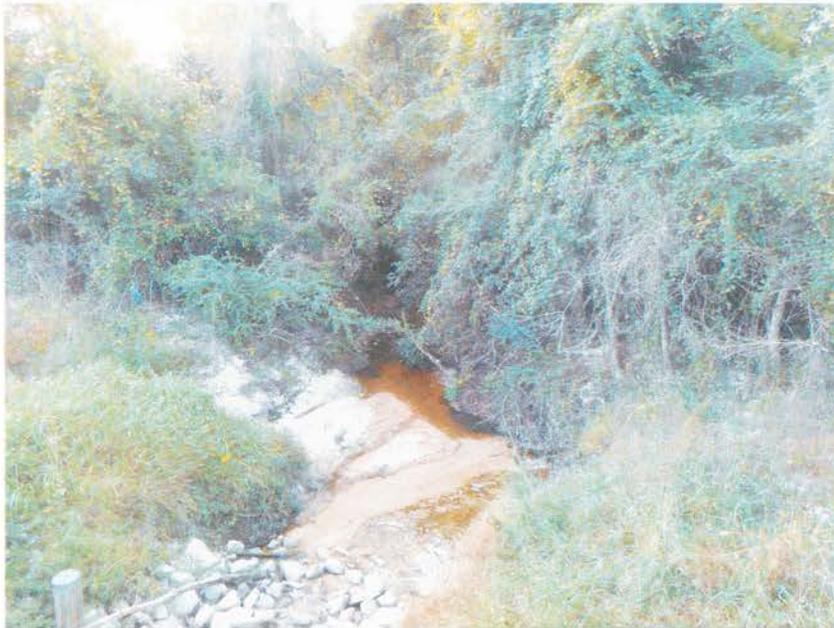


Photo 4	Description
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# PICTURES

Bridge Number SA2400000000053

Report Date 10/26/2016

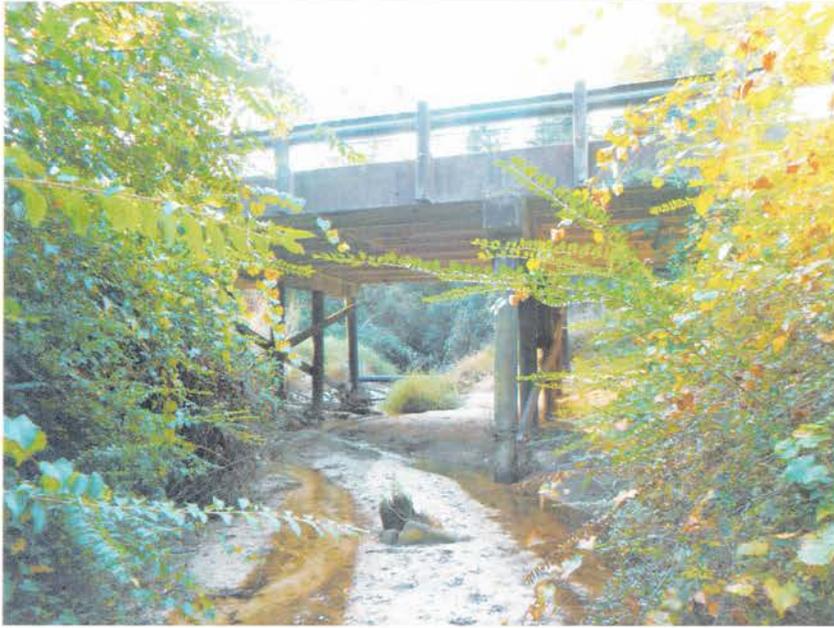


Photo 5	Description	
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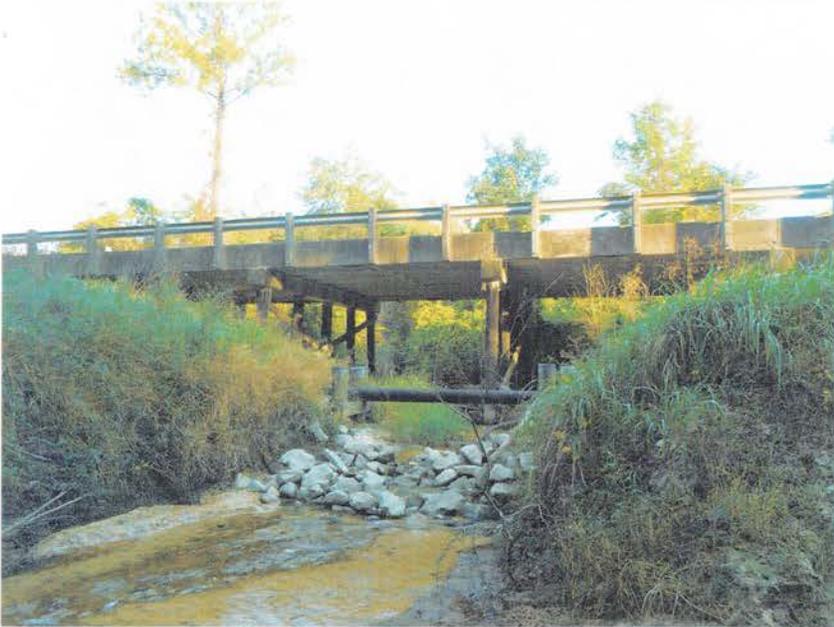


Photo 6	Description	
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PICTURES

Bridge Number SA2400000000053

Report Date 10/26/2016



Photo 7	Description
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Photo 8	Description
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## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000053

Report Date 10/26/2016

IDENTIFICATION				AGE AND SERVICE			
1. State Code	284			27. Year Built	1964		
8. Structure Number	SA2400000000053			106. Year Reconstructed	0000		
5. Inventory Route	1	4	1 00 0	42. Type of Service	1	On	5 Under
2. MDOT District	06			28. Lanes	02	On	00 Under
3. County Code	047			29. ADT	004000		
4. Place Code	06220			30. Year of ADT	2010		
6. Features Intersected	PARKER CREEK			109. Truck ADT	08		
7. Facility Carried	WOOLMARKET RD			19. Detour Length			
9. Location	SEC 35 T 6S R10W	B					
11. Kilometer Point	0003.218						
12. Base Highway Network	0						
13A. LRS Inventory Route							
13B. Subroute Number							
16. Latitude	30	28	19.00				
17. Longitude	-088	57	45.00				
98A. Border Bridge Code							
98B. Percent							
99. Border Bridge Structure No.							
CLASSIFICATION				PROPOSED IMPROVEMENTS			
20. Toll Facility	3			75. Type of Work			
21. Custodian	04			Proposed	38 - Other		
22. Owner	04			Work Done By	2 - Work to be		
26. Functional Class	07			76. Length of Improvements	005		
37. Historical Significance	5			94. Bridge Cost	000030	\$ In Thousands	
100. Defense Highway	0			95. Roadway Cost	000001	\$ In Thousands	
101. Parallel Structure	N			96. Total Cost	000031	\$ In Thousands	
102. Direction of Traffic	2			97. Year of Cost Estimate	2011		
103. Temp Structure				114. Future ADT	006000		
104. Highway System	0			115. Year of Future	2030		
105. Federal Lands Highways	0						
110. Designated National Network	0						
112. NBIS Length	Y						
STRUCTURE TYPE AND MATERIAL				INSPECTIONS			
Main Span Unit				90. Inspection Date	10/26/2016		
43A. Material Type	1			91. Designated Inspection Frequency	24		
43B. Design Type	22			92. Critical Feature Inspection			
45. No of Main Spans	005			A. Fracture Critical Details			
Approach Span Unit				B. Underwater Inspection			
44A. Material Type	0			C. Other Special Inspection			
44B. Design Type	00			93. Inspection Interval, Months			
46. No of Appr Spans	0000			A. Fracture Critical Details			
107. Deck Structure Type	2			B. Underwater Inspection			
108. Wearing Surface/ Protective System				C. Other Special Inspection			
108A. Wearing Surface	6			Sufficiency Rating	67.1		
108B. Type of Membrane	0			Unknown Foundation Risk	0		
108C. Deck Protection	0			Unknown Foundation Risk Category			
				Structure LSBP Eligible			
				Stru. Deficient/Func. Obsolete	2		
STRUCTURE TYPE AND MATERIAL				GEOMETRIC DATA			
Main Span Unit				48. Max Span Length		0005.8m	
43A. Material Type	1			49. Structure Length		00029.0m	
43B. Design Type	22			50. Curb/ Sidewalk Width	Left	00.0m	
45. No of Main Spans	005				Right	00.0m	
Approach Span Unit				51. Deck Roadway Width		008.2m	
44A. Material Type	0			52. Deck Width (out-to-out)		008.6m	
44B. Design Type	00			32. Approach Roadway Width		009.1m	
46. No of Appr Spans	0000			33. Bridge Median		0	
107. Deck Structure Type	2			34. Skew		00	
108. Wearing Surface/ Protective System				35. Structure Flared		0	
108A. Wearing Surface	6			10. Min Vertical Clearance		99.99m	
108B. Type of Membrane	0			47. Inv. Route, Total Horizontal Clearance		08.1m	
108C. Deck Protection	0						

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000053

Report Date 10/26/2016

NAVIGATION DATA			
38. Navigation Control	0		
111. Pier Protection			
39. Nav Vert Clearance	000.0m		
40. Navigation Horiz Clear	0000.0m		
CONDITION			
58. Deck	6		
59. Superstructure	6		
60. Substructure	5		
61. Channel/Channel	5		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	2		
64. Operating	180	63. Rating	6
66. Inventory	108	65. Rating	6
70. Posting	1		
41. Posting Status	P		

53. Min Vert Clear Over Bridge Rdwy	99.99m
54. Minimum Vertical Underclearance	N 00.00m
55. Minimum Lateral Underclearance on Right	N 00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	3
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	5
71. Waterway Adequacy	9
72. Approach Alignment	8
36A. Bridge Railings	1
36B. Transitions	N
36C. Approach Guardrail	N
36D. Approach GuardRail	N
113. Scour Critical Bridges	5

## DECK

Bridge Number SA2400000000053

SIA Item 58 Deck Condition Rating: 6

Report Date 10/26/2016

CONDITION	COMPONENT	COMMENT
4	Joints	Overlaid with asphalt.
4	Drains	The drain holes are clogged .
4	Rail	
	Sidewalks	None
Light	Vibration	
Moderate	Debris Accumulation	Sand, gravel, and pine straw.
4	Overall Structure	
Average	Surface Roughness Rating	Overlaid with asphalt.

## SUPERSTRUCTURE

Bridge Number SA2400000000053

SIA Item 59 Superstructure Condition Rating: 6

Report Date 10/26/2016

CONDITION	COMPONENT	COMMENT
	Girders	None
	Diaphragms	None
	Stingers	None
	Drains	None
	Rail	None
	Sidewalks	None
	Vibration	None
	Debris Accumulation	None
No	Overall Structure	
	Surface Roughness Rating	

## SUBSTRUCTURE

Bridge Number SA2400000000053

SI&A Item 60 Substructure Condition Rating: 5

Report Date 10/26/2016

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
2	Bearings	The tarpaper bearing pads are deteriorated.
4	Cap	The east abutment cap is severely undermined. The west abutment cap has minor undermining.
4	Piling/Foundation	
	Back Wall	None
4	Wing Wall	The NE wingwall is undermined.
2	Embank	
1	Slope Protection	None
Moderate	Scour	There is moderate scour under the abutment caps.
	Pile Type(s)	Wood

## SUBSTRUCTURE

Bridge Number SA2400000000053

SI&A Item 60 Substructure Condition Rating: 5

Report Date 10/26/2016

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
2	Bearings	The tarpaper bearings have deteriorated.
4	Cap	
3	Columns/Piles	Found 4 defective pilings. They are listed below.
	Footing	None
	Web Wall	None
4	Bracing	
Light	Scour	
	Pile Type(s)	Wood

## GENERAL COMMENTS

Bridge Number SA2400000000053

Report Date 10/26/2016

### Deck

There is minor erosion of the approach shoulder at the SE corner of the bridge. The concrete bridge curbs have many minor spalls with exposed rebars.

### Superstructure

About 40% of the bolts at joints through end diaphragms are missing. There are a few minor spalls with exposed rebars on the bottoms of the channel beams.

### Substructure

We found 2 split pilings in bent 5 as shown on the sketch. Found 1 hollow piling in bent 4 as shown on the sketch. Found 1 partially rotten piling in bent 3 as shown on the sketch.

### Bridge Ends

Several of the concrete bridge rail posts have minor spalls with exposed rebars. Three of the bridge rail ends are bent and slightly damaged.

### Waterway Appraisal

There is minor bank erosion under the bridge at both sides of the stream. There is a minor pile of logs and limbs in the stream at the downstream edge of the bridge.

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000053

Report Date 10/26/2016

Deck

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

## ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000053

Report Date 10/26/2016

### Deck

Remove the sand, gravel, and pine straw from the deck. Unclog the drain holes. Repair the minor eroded shoulder at the SE corner of the bridge.

### Superstructure

### Substructure

Need to place fill material under the east abutment cap. Need to place rip rap for erosion control on the abutment slopes.

### Bridge Ends

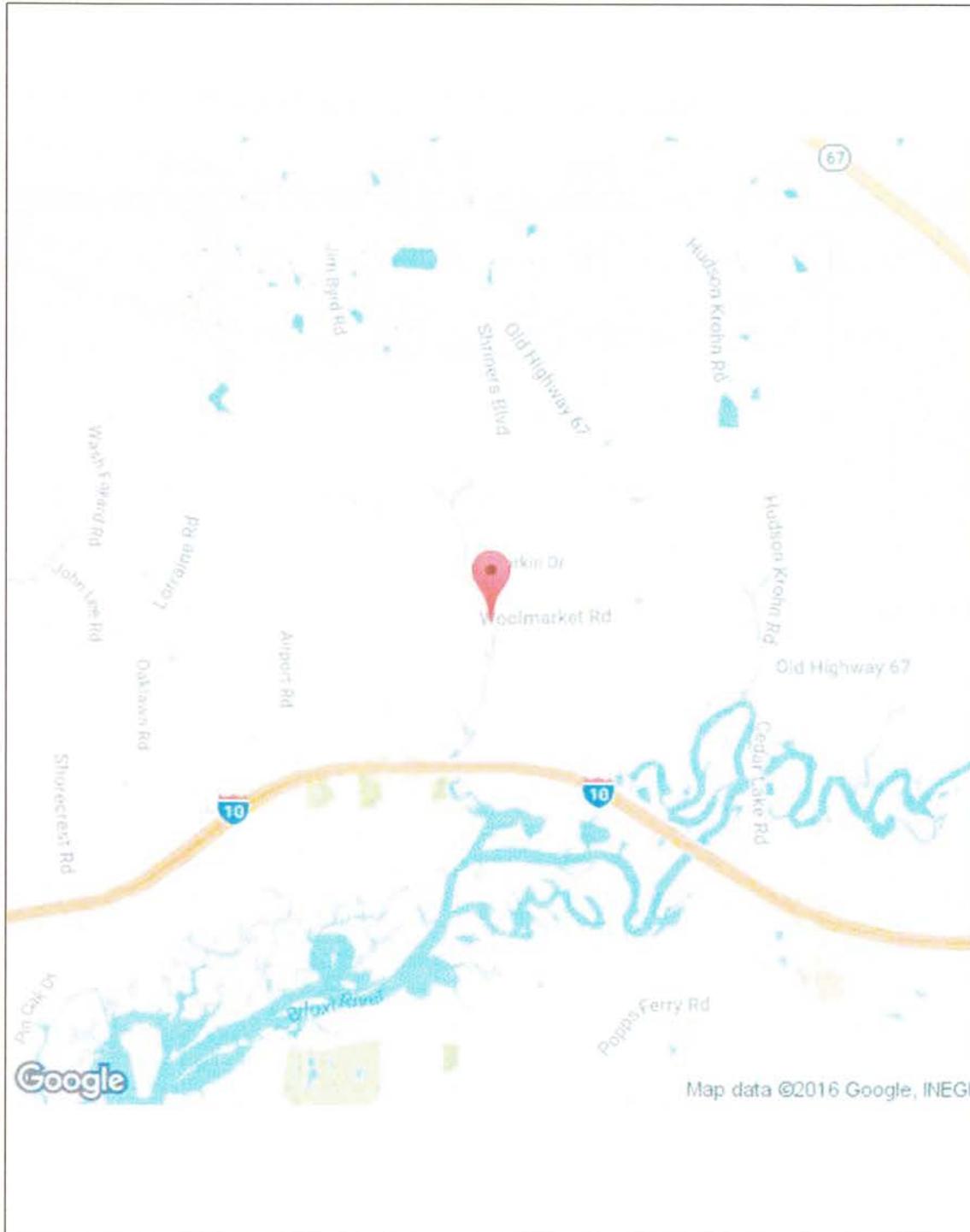
Replace two missing nuts and washers on the bridge rail posts.

### Waterway Appraisal

Remove the minor pile of logs and limbs from the stream.

# LOCATION MAP

Bridge Number SA2400000000053  
Report Date 10/26/2016



# STREAM PROFILE REPORT

Bridge Number SA2400000000053

Report Date 10/26/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA240000000053

Report Date 11/08/2016

(31) Design Load:	2 - M 13.5 or H 15	(65) Method used to Determine Inventory Rating:	6 – Load Factor (LF) Rating reported as Rating Factor (RF)
(41) Open/Posted/Closed:	P - Posted for Load	(66) Inventory Rating:	108
(63) Method used to Determine Operating Rating:	6 – Load Factor (LF) Rating reported as Rating	(67) Structural Evaluation:	5 - Somewhat better than minimum adequacy
(64) Operating Rating:	180	(70) Bridge Posting:	1 - 30.0-39.9% below legal loads

### Recommended Posting Limits

H Truck (Tons)	Tandem Axle (Tons)
HS Short (Tons)	Single Axle (Tons)
HS Long (Tons)	Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>
H Truck		H Truck	
HS Short		HS Short	
HS Long		HS Long	
Tandem Axle		Tandem Axle	
Single Axle		Single Axle	
Gross		Gross	

### General Comments:

Posted by County

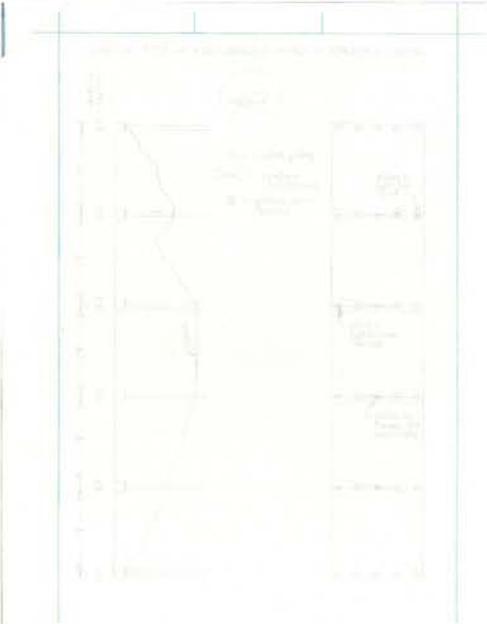
### Urgent Maintenance Noted:

### Routine Maintenance Noted:

# SKETCHES

Bridge Number SA2400000000053

Report Date 10/26/2016

	
Sketch 1	Description

## WATERWAY

Bridge Number SA240000000053

SIA Item 61 Channel and Channel Protection: 5

Report Date 10/26/2016

(71) Waterway Adequacy	9	Sediment and/or Gravel Accumulation	none
(113) Scour Critical Bridge	5	Obstructions in the Waterway	yes
Overall Channel Condition	good	Has Channel Shifted?	No
Bank Protection	poor	Bank Erosion <input type="checkbox"/> Upstream <input checked="" type="checkbox"/> Site <input type="checkbox"/> Downstream <input type="checkbox"/> None	
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	Yes	Streambed Degradation	No
If Yes, Location and Description	Moderate at the east abutment.	Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	No	Scour Countermeasures in Place	No
Streambed Material	sand	If Yes, Condition	
Bank Vegetation	weeds	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	No	Debris/Drift <input type="checkbox"/> Upstream <input checked="" type="checkbox"/> Site <input type="checkbox"/> Downstream <input type="checkbox"/> None	
Underwater Inspection Required?	No	Unknown Foundation Risk Category	

INSPECTION TEAM SUMMARY

Bridge Number SA2400000000053

Report Date 10/26/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell  
Overstreet, Daniel

Darrell Fore

Name: \_\_\_\_\_

\_\_\_\_\_  
Signed:

03/22/2017

Date: \_\_\_\_\_



BRIDGE SURVEY REPORT

STRUCTURE NO. SA2400000000087

SEC 1 T 7S R10W B

SA2400000000087

Biloxi

HARRISON

11/21/2016



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## INSPECTION SUMMARY

Bridge Number SA2400000000087  
Report Date 11/21/2016

PICTURES

Bridge Number SA2400000000087

Report Date 11/21/2016



Photo 1	Description
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Photo 2	Description
---------	-------------

PICTURES

Bridge Number SA2400000000087  
Report Date 11/21/2016



Photo 3	Description
---------	-------------



Photo 4	Description
---------	-------------

# PICTURES

Bridge Number SA2400000000087

Report Date 11/21/2016



Photo 5	Description
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Photo 6	Description
---------	-------------

PICTURES

Bridge Number SA2400000000087

Report Date 11/21/2016



Photo 7	Description
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Photo 8	Description
---------	-------------

PICTURES

Bridge Number SA2400000000087

Report Date 11/21/2016



Photo 9	Description
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## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000087

Report Date 11/21/2016

IDENTIFICATION			
1. State Code	284		
8. Structure Number	SA2400000000087		
5. Inventory Route	1 4 1 00 0		
2. MDOT District	06		
3. County Code	047		
4. Place Code	06220		
6. Features Intersected	HOWARD CREEK		
7. Facility Carried	OLD HWY 67		
9. Location	SEC 1 T 7S R10W	B	
11. Kilometer Point	0003.379		
12. Base Highway Network	0		
13A. LRS Inventory Route			
13B. Subroute Number			
16. Latitude	30	28	07.00
17. Longitude	-088	56	20.00
98A. Border Bridge Code			
98B. Percent			
99. Border Bridge Structure No.			

CLASSIFICATION			
20. Toll Facility	3		
21. Custodian	04		
22. Owner	04		
26. Functional Class	17		
37. Historical Significance	5		
100. Defense Highway	0		
101. Parallel Structure	N		
102. Direction of Traffic	2		
103. Temp Structure			
104. Highway System	0		
105. Federal Lands Highways	0		
110. Designated National Network	0		
112. NBIS Length	Y		

STRUCTURE TYPE AND MATERIAL			
Main Span Unit			
43A. Material Type	3		
43B. Design Type	02		
45. No of Main Spans	003		
Approach Span Unit			
44A. Material Type	0		
44B. Design Type	00		
46. No of Appr Spans	0000		
107. Deck Structure Type	1		
108. Wearing Surface/ Protective System			
108A. Wearing Surface	1		
108B. Type of Membrane	0		
108C. Deck Protection	0		

AGE AND SERVICE			
27. Year Built	1960		
106. Year Reconstructed	0000		
42. Type of Service	1 On	5 Under	
28. Lanes	02 On	00 Under	
29. ADT	005000		
30. Year of ADT	2008		
109. Truck ADT	08		
19. Detour Length			

PROPOSED IMPROVEMENTS			
75. Type of Work			
Proposed	38 - Other		
Work Done By	2 - Work to be		
76. Length of Improvements	003		
94. Bridge Cost	000045	\$ In Thousands	
95. Roadway Cost	000001	\$ In Thousands	
96. Total Cost	000046	\$ In Thousands	
97. Year of Cost Estimate	2011		
114. Future ADT	007500		
115. Year of Future	2030		

INSPECTIONS			
90. Inspection Date	11/21/2016		
91. Designated Inspection Frequency	24		
92. Critical Feature Inspection			
A. Fracture Critical Details			
B. Underwater Inspection			
C. Other Special Inspection			
93. Inspection Interval, Months			
A. Fracture Critical Details			
B. Underwater Inspection			
C. Other Special Inspection			
Sufficiency Rating	14.4		
Unknown Foundation Risk	36		
Unknown Foundation Risk Category			
Structure LSBP Eligible			
Stru. Deficient/Func. Obsolete	2		

GEOMETRIC DATA			
48. Max Span Length		0012.2m	
49. Structure Length		00026.8m	
50. Curb/ Sidewalk Width	Left	00.0m	
	Right	00.0m	
51. Deck Roadway Width		006.7m	
52. Deck Width (out-to-out)		007.5m	
32. Approach Roadway Width		010.1m	
33. Bridge Median		0	
34. Skew		00	
35. Structure Flared		0	
10. Min Vertical Clearance		99.99m	
47. Inv. Route, Total Horizontal Clearance		06.7m	

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000087

Report Date 11/21/2016

NAVIGATION DATA			
38. Navigation Control	0		
111. Pier Protection			
39. Nav Vert Clearance	000.0m		
40. Navigation Horiz Clear	0000.0m		
CONDITION			
58. Deck	5		
59. Superstructure	5		
60. Substructure	5		
61. Channel/Channel	6		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	2		
64. Operating	070	63. Rating	0
66. Inventory	033	65. Rating	0
70. Posting	1		
41. Posting Status	P		

53. Min Vert Clear Over Bridge Rdwy	99.99m
54. Minimum Vertical Underclearance	N 00.00m
55. Minimum Lateral Underclearance on Right	N 00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	2
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	3
71. Waterway Adequacy	9
72. Approach Alignment	8
36A. Bridge Railings	1
36B. Transitions	1
36C. Approach Guardrail	1
36D. Approach GuardRail	1
113. Scour Critical Bridges	U

## DECK

Bridge Number SA2400000000087

SIA Item 58 Deck Condition Rating: 5

Report Date 11/21/2016

CONDITION	COMPONENT	COMMENT
4	Joints	
4	Drains	
4	Rail	
	Sidewalks	None
Light	Vibration	
Light	Debris Accumulation	Light dirt and gravel accumulation.
4	Overall Structure	
Average	Surface Roughness Rating	There is moderate scaling on the entire deck surface.

## SUPERSTRUCTURE

Bridge Number SA2400000000087

SIA Item 59 Superstructure Condition Rating: 5

Report Date 11/21/2016

CONDITION	COMPONENT	COMMENT
4	Girders	Surface rust on the flanges and webs.
4	Diaphragms	Surface rust throughout.
	Stingers	None
	Drains	None
	Rail	None
	Sidewalks	None
2 - Poor	Vibration	
Moderate	Debris Accumulation	Dirt and chunks of concrete on top of the intermediate pile caps.
No	Overall Structure	
	Surface Roughness Rating	

## SUBSTRUCTURE

Bridge Number SA2400000000087

SI&A Item 60 Substructure Condition Rating: 5

Report Date 11/21/2016

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Piling/Foundation	
4	Back Wall	There is not a backwall.
4	Wing Wall	
4	Embank	Embankments are paved with concrete.
4	Slope Protection	
	Scour	None
	Pile Type(s)	Unknown, they are not visible.

## SUBSTRUCTURE

Bridge Number SA2400000000087

SI&A Item 60 Substructure Condition Rating: 5

Report Date 11/21/2016

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
3	Bearings	The bearings are rusty and have dirt piled around them.
4	Cap	
3	Columns/Piles	
	Footing	None
	Web Wall	None
	Bracing	None
Moderate	Scour	The streambanks at both intermediate bents have scour.
	Pile Type(s)	Wood

## GENERAL COMMENTS

Bridge Number SA2400000000087

Report Date 11/21/2016

### Deck

There are minor section losses in the deck at the bridge ends caused by previous milling of asphalt approaches. There are many minor hairline cracks in the deck surface both transverse and longitudinal. The deck has many cracks, mostly transverse, up to 0.90mm in width that are visible at both top and bottom of the deck. There is a section loss in the deck at the joint at end of span 2 ( about 3" long, 15" wide, and 4" deep.) There are moderate section losses in the bottom of the deck slab at joints, at the ends of the steel girders.

### Superstructure

There are section losses in the bottom of the deck slab at the joints at the ends of the steel girders. The main span has several transverse cracks visible on the bottom of the deck slab.

### Substructure

### Bridge Ends

The timber posts on the approach guardrails are very deteriorated.

### Waterway Appraisal

There is minor erosion of the west bank of the stream under the bridge.

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000087

Report Date 11/21/2016

Deck

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000087

Report Date 11/21/2016

Deck

Superstructure

Need to sand blast the girders, diaphragms, and steel bearings and repaint. Remove the dirt and chunks of concrete from the top of interior pile caps.

Substructure

Need to clean the tops of the interior pile caps and the bearings.

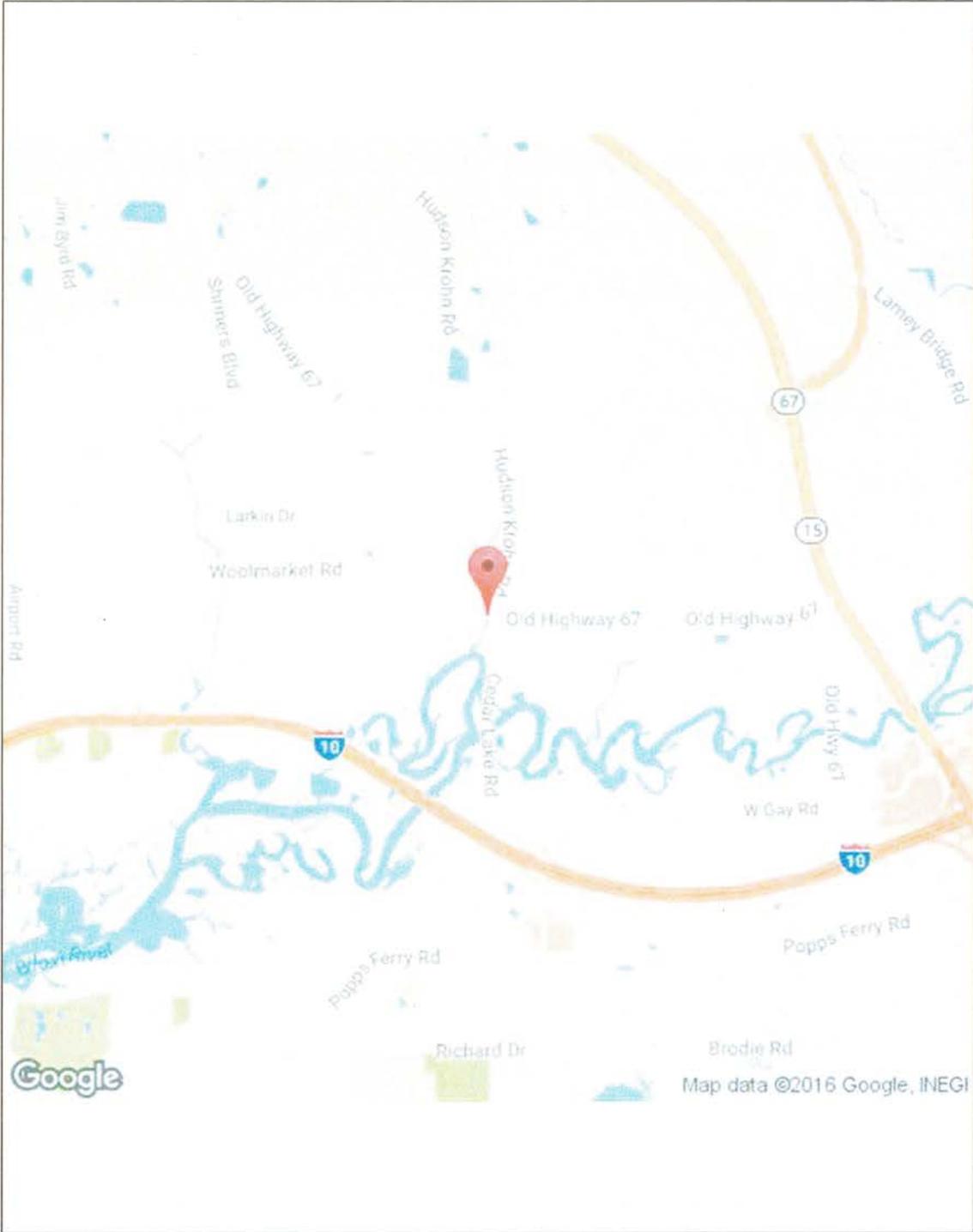
Bridge Ends

Replace the deteriorated timber posts on the approach guardrails. Grade the shoulders for drainage.

Waterway Appraisal

LOCATION MAP

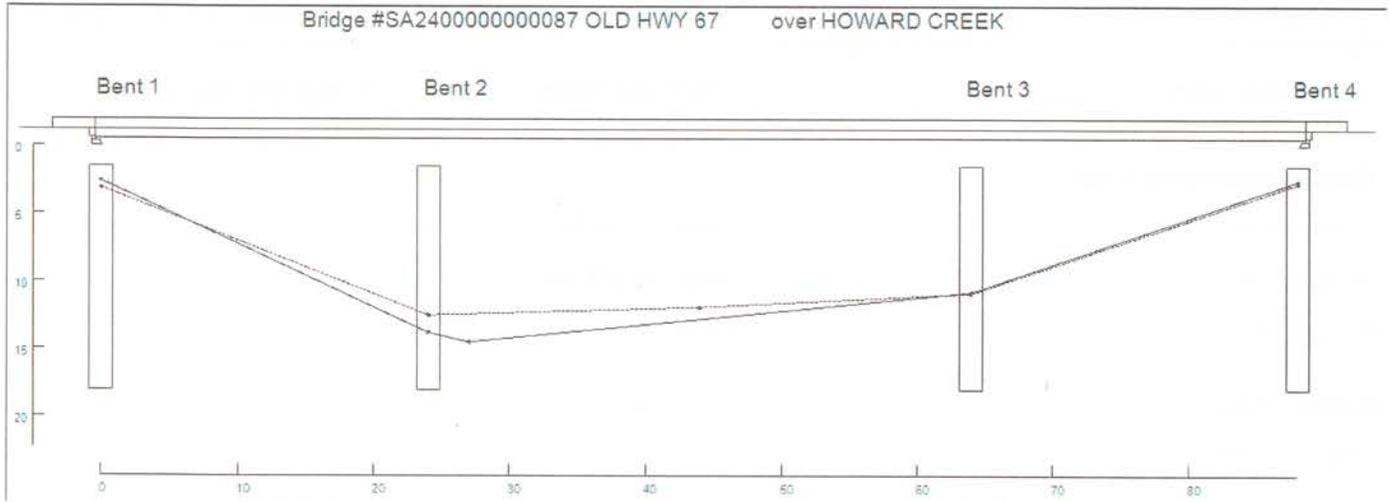
Bridge Number SA2400000000087  
Report Date 11/21/2016



# STREAM PROFILE REPORT

Bridge Number SA2400000000087

Report Date 11/21/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA2400000000087

Report Date 11/30/2016

(31) Design Load:	2 - M 13.5 or H 15	(65) Method used to Determine Inventory Rating:	0 – Field Evaluation and documented engineering
(41) Open/Posted/Closed:	P - Posted for Load	(66) Inventory Rating:	033
(63) Method used to Determine Operating Rating:	0 – Field Evaluation and documented engineering	(67) Structural Evaluation:	3 - Intolerable - high priority of corrective action
(64) Operating Rating:	070	(70) Bridge Posting:	1 - 30.0-39.9% below legal loads

### Recommended Posting Limits

H Truck (Tons)	Tandem Axle (Tons)
HS Short (Tons)	Single Axle (Tons)
HS Long (Tons)	Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>	
H Truck	15	Tons	H Truck	15 Tons
HS Short	18	Tons	HS Short	18 Tons
HS Long	18	Tons	HS Long	18 Tons
Tandem Axle		Tons	Tandem Axle	Tons
Single Axle		Tons	Single Axle	Tons
Gross		Tons	Gross	Tons

### General Comments:

Posting to remain based on condition of substructure

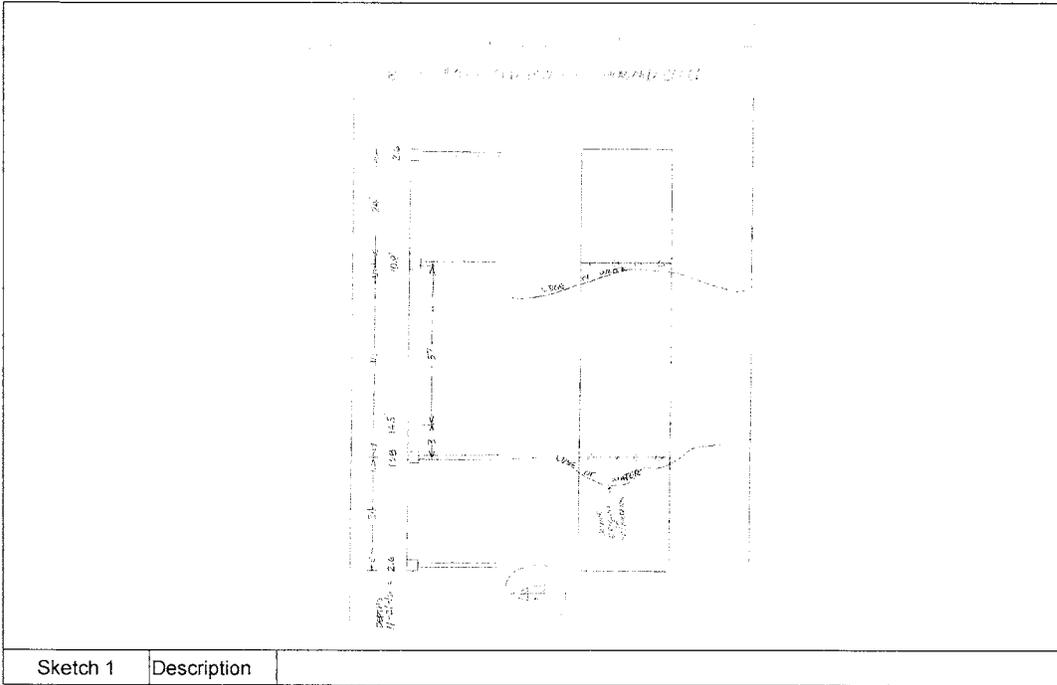
### Urgent Maintenance Noted:

### Routine Maintenance Noted:

# SKETCHES

Bridge Number SA2400000000087

Report Date 11/21/2016



## WATERWAY

Bridge Number SA240000000087

SIA Item 61 Channel and Channel Protection: 6

Report Date 11/21/2016

(71) Waterway Adequacy	9	Sediment and/or Gravel Accumulation	none
(113) Scour Critical Bridge	U	Obstructions in the Waterway	none
Overall Channel Condition	good	Has Channel Shifted?	No
Bank Protection	good	Bank Erosion <input type="checkbox"/> Upstream <input checked="" type="checkbox"/> Site <input type="checkbox"/> Downstream <input type="checkbox"/> None	
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	No	Streambed Degradation	No
If Yes, Location and Description		Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	Yes	Scour Countermeasures in Place	No
Streambed Material	sandy clay	If Yes, Condition	
Bank Vegetation	grass and bushes	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	No	Debris/Drift <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Underwater Inspection Required?	No	Unknown Foundation Risk Category	

## INSPECTION TEAM SUMMARY

Bridge Number SA2400000000087

Report Date 11/21/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell  
Overstreet, Daniel

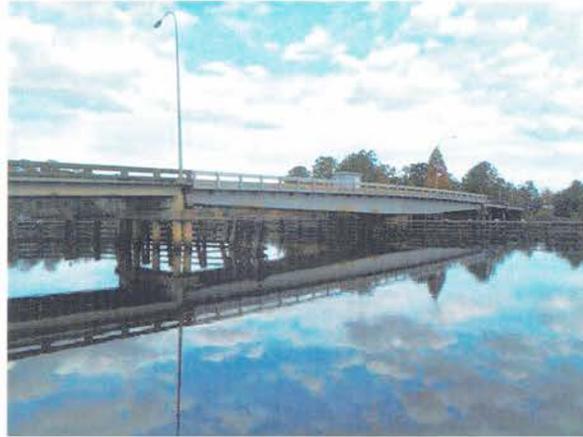
Darrell Fore

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

03/22/2017

Date: \_\_\_\_\_



BRIDGE SURVEY REPORT

STRUCTURE NO.  
SEC 1 T 7S R10W B  
SA2400000000088  
Biloxi  
HARRISON

11/23/2016



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NATIONAL BRIDGE ELEMENTS

FHWA

SA2400000000088

Bridge ID.: SA2400000000088

No Attached Elements

## INSPECTION SUMMARY

Bridge Number SA240000000088

Report Date 11/23/2016

### 2015 Bridge Inspection:

Volkert, Inc.

Matt Burnett, PE, CBI (Lead)

Kyle Strachan

Ken Powers, P.E. (Electrical)

Collins Engineers (Mechanical)

George Pavlakis, P.E.

William Gwaltney, E.I.T.

A routine and fracture critical inspection were conducted along with a mechanical and electrical inspection on the movable swing span as part of the routine inspection.

The swing span bridge on Cedar Lake Road over the Tchoutacabouffa River is in overall fair condition. The approach roadway is cracked and settled at the transitions to the bridge. No approach guardrail is present at the site. The posting signs at the site have lower weights than recommended by the 2014 Load Rating Analysis.

The deck is in satisfactory condition with minor deterioration. The slab spans have longitudinal cracking up to 0.08" wide. The reinforced concrete deck over the pre-stress girders has random cracking up to 0.06" wide. The open grid steel deck on the swing span has cracking in tack welds and repairs welds.

The superstructure is fair condition. The slab spans have longitudinal cracking up to 0.08" wide with some hairline cracking on the bottom side. The pre-stress girders have no known problems. The steel girders, floor beams, and stringers are in fair condition. All steel members have some degree of pitting and section loss in the lower portion of webs and bottom flanges. See Fracture Critical Inspection form for specific deficiencies and condition. The paint is in fair condition with isolated areas of active corrosion.

The substructure is in satisfactory condition with cracking, spalling, scaling in the caps and piles.

The mechanical portion of the swing span is in overall good condition with a few noted problems. The motor brakes were completely disengaged and did not run during the inspection. The wedge locks on the south end were not smooth during operation with a noticeable creaking and groaning sound. See attached Mechanical Inspection Report.

The electrical portion of the bridge is in overall fair condition. The control system for the bridge does not function properly resulting in manual operation of bridge motion and traffic gates. The MCC is poorly secured to the wall of the tender house. The report recommends the electrical system be considered for replacement. See attached Electrical Inspection report.

The noted deficiencies and recommended corrective actions can be found the appropriate section of the report.

# PICTURES

Bridge Number SA2400000000088

Report Date 11/23/2016



Photo 1	Description
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Photo 2	Description
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PICTURES

Bridge Number SA2400000000088

Report Date 11/23/2016



Photo 3	Description
---------	-------------



Photo 4	Description
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PICTURES

Bridge Number SA2400000000088

Report Date 11/23/2016

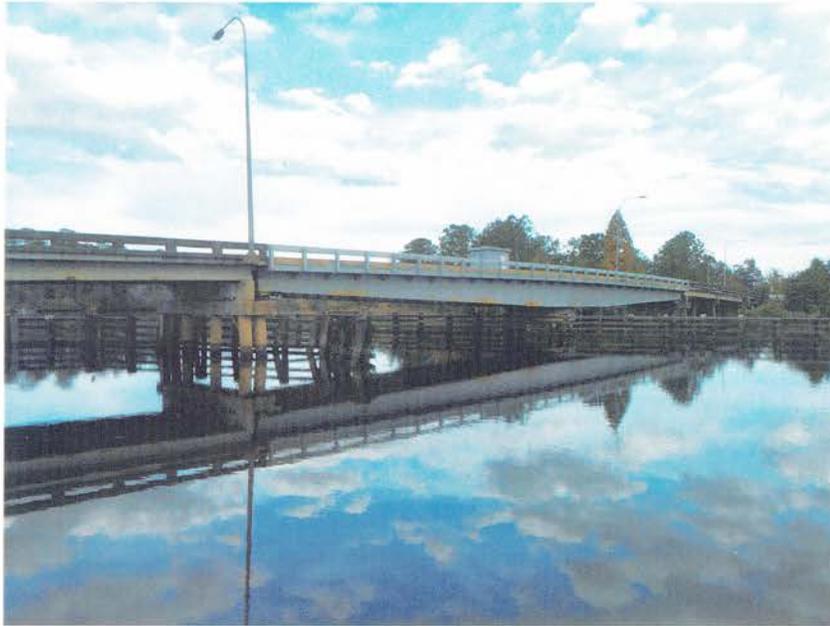


Photo 5	Description
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Photo 6	Description
---------	-------------

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000088

Report Date 11/23/2016

IDENTIFICATION				AGE AND SERVICE			
1. State Code	284			27. Year Built	1973		
8. Structure Number	SA2400000000088			106. Year Reconstructed	0000		
5. Inventory Route	1	4	1 00 0	42. Type of Service	1	On	5 Under
2. MDOT District	06			28. Lanes	02	On	00 Under
3. County Code	047			29. ADT	006000		
4. Place Code	06220			30. Year of ADT	2015		
6. Features Intersected	TCHOUTACABOUFFA RIVER			109. Truck ADT	08		
7. Facility Carried	CEDAR LAKE RD			19. Detour Length			
9. Location	SEC 1 T 7S R10W B			PROPOSED IMPROVEMENTS			
11. Kilometer Point	0000.965			75. Type of Work			
12. Base Highway Network	0			Proposed	38 - Other		
13A. LRS Inventory Route				Work Done By	2 - Work to be		
13B. Subroute Number				76. Length of Improvements	002		
16. Latitude	30	27	34.73	94. Bridge Cost	000100	\$ In Thousands	
17. Longitude	-088	56	20.26	95. Roadway Cost	000001	\$ In Thousands	
98A. Border Bridge Code				96. Total Cost	000130	\$ In Thousands	
98B. Percent				97. Year of Cost Estimate	2011		
99. Border Bridge Structure No.				114. Future ADT	009000		
CLASSIFICATION				115. Year of Future	2035		
20. Toll Facility	3			INSPECTIONS			
21. Custodian	04			90. Inspection Date	11/23/2016		
22. Owner	04			91. Designated Inspection Frequency	24		
26. Functional Class	17			92. Critical Feature Inspection			
37. Historical Significance	5			A. Fracture Critical Details	24		
100. Defense Highway	0			B. Underwater Inspection	60		
101. Parallel Structure	N			C. Other Special Inspection			
102. Direction of Traffic	2			93. Inspection Interval, Months			
103. Temp Structure				A. Fracture Critical Details	11/10/2015		
104. Highway System	0			B. Underwater Inspection	09/21/2015		
105. Federal Lands Highways	0			C. Other Special Inspection			
110. Designated National Network	0			Sufficiency Rating	22.8		
112. NBIS Length	Y			Unknown Foundation Risk	14.7		
STRUCTURE TYPE AND MATERIAL				Unknown Foundation Risk Category			
Main Span Unit				Structure LSBP Eligible			
43A. Material Type	3			Stru. Deficient/Func. Obsolete	S		
43B. Design Type	17			GEOMETRIC DATA			
45. No of Main Spans	002			48. Max Span Length	0054.9m		
Approach Span Unit				49. Structure Length	00144.8m		
44A. Material Type	1			50. Curb/ Sidewalk Width	Left	00.0m	
44B. Design Type	01				Right	00.0m	
46. No of Appr Spans	0010			51. Deck Roadway Width	007.9m		
107. Deck Structure Type	1			52. Deck Width (out-to-out)	008.9m		
108. Wearing Surface/ Protective System				32. Approach Roadway Width	010.4m		
108A. Wearing Surface	1			33. Bridge Median	0		
108B. Type of Membrane	0			34. Skew	00		
108C. Deck Protection	0			35. Structure Flared	0		
				10. Min Vertical Clearance	99.99m		
				47. Inv Route, Total Horizontal Clearance	07.9m		

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000088

Report Date 11/23/2016

NAVIGATION DATA			
38. Navigation Control	1		
111. Pier Protection	2		
39. Nav Vert Clearance	003.0m		
40. Navigation Horiz Clear	0021.6m		
CONDITION			
58. Deck	6		
59. Superstructure	5		
60. Substructure	6		
61. Channel/Channel	6		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	2		
64. Operating	102	63. Rating	6
66. Inventory	034	65. Rating	6
70. Posting	3		
41. Posting Status	P		

53. Min Vert Clear Over Bridge Rdwy	29.99m
54. Minimum Vertical Underclearance	N 00.00m
55. Minimum Lateral Underclearance on Right	N 00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	3
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	3
71. Waterway Adequacy	6
72. Approach Alignment	6
36A. Bridge Railings	0
36B. Transitions	0
36C. Approach Guardrail	0
36D. Approach GuardRail	0
113. Scour Critical Bridges	U

## DECK

Bridge Number SA2400000000088

SIA Item 58 Deck Condition Rating: 6

Report Date 11/23/2016

CONDITION	COMPONENT	COMMENT
4	Joints	All joints are considered open due to sealant failure (see photo 26). The joint at bent 7 between the approach span and swing span has a vertical differential of up to 1" (see photo 11).
4	Drains	Several drains are clogged with debris
4	Rail	The concrete curb and rail system has typical cracking throughout with the swing span curb having several large cracks near the metal rail posts (see photos 14 and 16). The metal bridge rail on the swing span has paint failure resulting in isolated areas of corrosion (see photo 15). The curbs have large cracks that extend down into deck fascia at bents 2 and 12 (see photos 25 and 27).
	Sidewalks	N/A
Light	Vibration	
Light	Debris Accumulation	The curb lines have minor debris accumulation with some large debris on the south end (see photo 4).
3	Overall Structure	Spans 1 thru 3 and 11 thru 12 consist of reinforced concrete slabs that have longitudinal cracking up to 0.08" wide in the deck surface (see photo 7) and isolated hair line cracks on the soffit. Spans 4 thru 6, 9 thru 10, and a portion over the main pier have a reinforced concrete deck with typical random cracking in the deck surface up to 0.06" wide. Spans 8 and 9 have an open grid metal deck for the swing span. The metal deck typically has cracking in tack welds (see photo 24) and cracked repair welds (see photo 22). Several deck haunches have cracking and spalling on the concrete portion of the swing span (see photo 58). The concrete deck over the main pier has minor to moderate edge spalling at the junction with metal decking (see photo 23).
Average	Surface Roughness Rating	

## SUPERSTRUCTURE

Bridge Number SA240000000088

SIA Item 59 Superstructure Condition Rating: 5

Report Date 11/23/2016

CONDITION	COMPONENT	COMMENT
3	Girders	Spans 1 thru 3 and 11 thru 12 consist of reinforced concrete slabs, see deck section for condition. Spans 4 thru 6 and 9 thru 10 have pre-stressed girders. The concrete girders are in good condition but typically have exposed strands at the girder ends (see photo 39). The two (2) steel girders in the swing span are in fair condition with several areas of pitting and section loss ranging from 1/16" to 1/4". The majority of the areas of section loss are located in the interior faces of the lower webs under floor beams. Girder 7-2 at floor beam 2 has advanced section loss with pin holes in the lower web near vertical stiffener (see photos 47 and 48). Girder 7-1 at floor beam 2 has section loss in the lower web up to 1/4" (see photo 49). The bottom flanges of the girders in span 7 have heavy pitting with active corrosion (see photos 45 & 46). Vertical stiffeners exhibit section loss near the bottom flange (see photo 50). Several holes have been drilled through the webs at the pivot pier to accommodate hydraulic lines and conduits. See Fracture Critical Inspection Form for specific condition of members.
4	Diaphragms	Some diaphragms have minor popouts with exposed steel (see photo 40).
3	Stringers	Span 7 has five (5) rows of stringers up to floor beam 4 while span 8 has four (4) rows. All stringers are 14" deep and are in fair condition. Several stringers in span 7 were noted to have 1/16" deep pitting to the bottom and top flanges for full length between floor beams. The stringers in span 8 spanning between floor beams 3 and 4 have severe section loss at the ends with pin holes in the bottom flanges (see photo 52). Due to the severe condition of the stringers, additional floor beams were retrofitted on both sides of existing floor beams 2, 3, and 4 in span 8. Several areas on the stringers have active corrosion.
3	Drains	The original 27" tall floor beams in spans 7 and 8 have pitting and/or section loss up to 1/8" pre-dating paint. Due to deterioration in the span 8 stringers, 21" tall floor beams were retrofitted 2' each direction from the original floor beam. The newer floor beams are in good condition. The 47" tall floor beam at the pivot point of the swing span is in good condition. See Fracture Critical Inspection Form for specific member condition.
4	Rail	The lower lateral bracing connecting to the bottom of the floor beams by a gusset plate are in good condition.
	Sidewalks	N/A
3 - Fair	Vibration	Rusting is beginning to bleed through the paint in randomly located areas with several isolated areas of paint failure on the girders resulting in active corrosion (see photo 46).
Moderate	Debris Accumulation	The cap at bent 11 has moderate debris accumulation (see photo 61).
No	Overall Structure	

# SUPERSTRUCTURE

Bridge Number SA2400000000088

SIA Item 59 Superstructure Condition Rating: 5

Report Date 11/23/2016

	Surface Roughness Rating	
--	--------------------------	--

## SUBSTRUCTURE

Bridge Number SA2400000000088

SI&A Item 60 Substructure Condition Rating: 6

Report Date 11/23/2016

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
	Bearings	N/A - slab spans
4	Cap	
4	Piling/Foundation	Up to 6" of timber pile exposed at abutment 13 (see photo 60).
	Back Wall	N/A
4	Wing Wall	
4	Embank	
	Slope Protection	No slope protection provided. Abutment 1 slope has construction debris under span 1 (see photo 32).
Light	Scour	Up to 6" of scour along End Bent 13 which has fully undermined the cap and exposed the 6" of the timber piles (see photo 60).
	Pile Type(s)	Timber

## SUBSTRUCTURE

Bridge Number SA2400000000088

SI&A Item 60 Substructure Condition Rating: 6

Report Date 11/23/2016

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
3	Bearings	The neoprene bearing pads under the concrete spans are in good condition with no noted defects (see photo 38). The pre-stressed girders at bents 7 and 9 have no bearing pads (see photo 41). The steel swing span is supported by two rocker bearings on the pivot pier. The steel bearing plates have laminated rust with section loss. Each end of the swing span has a bearing under each girder consisting of a wedge driven by a crank between the girder and a fixed plate (see photos 42 and 43).
3	Cap	Notches have been cut into bents 7 and 9 to accommodate the girders (see photo 41). Bent cap 12 has an area of delamination on the south face over pile 1 (see photo 59). Bent cap 2 has an area of delamination on the north face near pile 4 (see photo 34) and on the south face near bent 1 (see photo 35). Bent cap 3 has three (3) areas of spalling with some exposed rebar on the north face (see photo 36).
3	Columns/Piles	The concrete piles in the channel have minor to moderate scaling at the waterline (see photo 37). See general comments for defects noted from Under Water Inspection (UWI).
	Footing	N/A
	Web Wall	N/A
	Bracing	N/A
Light	Scour	5.7 feet of scour has occurred at bent 10 since the 2011 inspection.
	Pile Type(s)	Concrete

# TRUSS

Bridge Number SA240000000088

Report Date 11/23/2016

CONDITION	COMPONENT	COMMENT
4	End Posts	N/A
4	Portals	N/A
4	Chords Top	N/A
4	Chords Bottom	N/A
4	Verticals	N/A
4	Diagonals	N/A
4	Sway Bracing	N/A
4	Top Lateral Struts	N/A
4	Top Lateral X Bracing	N/A
4	Bottom Laterals	N/A

## GENERAL COMMENTS

Bridge Number SA2400000000088

Report Date 11/23/2016

### Deck

### Superstructure

Mold growth is prevalent on the interior superstructure members.

### Substructure

The timber fender system around bent 8 has typical decay with vegetation growth (see photos 56 and 57).  
(UWI) Moderate marine growth was observed from the waterline to 6 feet below the waterline and light marine growth was observed from 6 feet below the waterline to the channel bottom on all piles in bents 4 thru 9 and the pivot pier. Moderate marine growth was observed on the electrical cables for the pivot pier from the water line to the channel bottom.  
(UWI) Moderate scaling with up to 1/4" of penetration was observed on all piles in bents 4 thru 9 and the pivot pier from the channel bottom to 1 foot above the water line.  
(UWI) The electrical cables for the pivot pier were encased in deteriorated jackets from 3 feet below the water line to 10 feet below the water line.  
(UWI) A spall measuring 2"H x 3"W x 1"D was observed 2 feet below the water line on the south face of pile 5AS.  
(UWI) A spall measuring 3" in diameter x 1/2" deep was observed 1.5 feet above the water line on the south face of pile 5D.  
(UWI) Light to moderate timber debris was observed throughout the channel bottom.

### Bridge Ends

Both approach roadways have cracking up to 1/2" wide and up to 1" of settlement at the bridge ends (see photo 3 and 19).  
Object markers do not define the limits of the bridge (see photo 21).  
Approach guardrail is not provided at the site.

### Waterway Appraisal

There is very minor undermining of both abutment caps.

### Fracture Critical

Numerous areas of pitting and section loss predating paint.  
Active corrosion is present in the bottom flange of main girders due to early stages of paint failure.

### Truss

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000088

Report Date 11/23/2016

Deck

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

Fracture Critical

Truss

ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000088

Report Date 11/23/2016

Deck

Clean and seal cracking at west side of Bent 2 and 12.  
Periodically remove soil and debris accumulation from curb lines.  
Clean and seal all open deck joints.

Superstructure

Clean and spot paint areas of active corrosion.

Substructure

Clean and paint bearing plates as necessary.  
Clean and spot/zone paint areas of active rusting.  
Remove soil accumulation from Bent 11.  
Remove delaminated concrete from Bent Cap 2, 3 and 12 and patch.

Bridge Ends

Fill and stabilize undermining of End Bent 13.

Waterway Appraisal

Fracture Critical

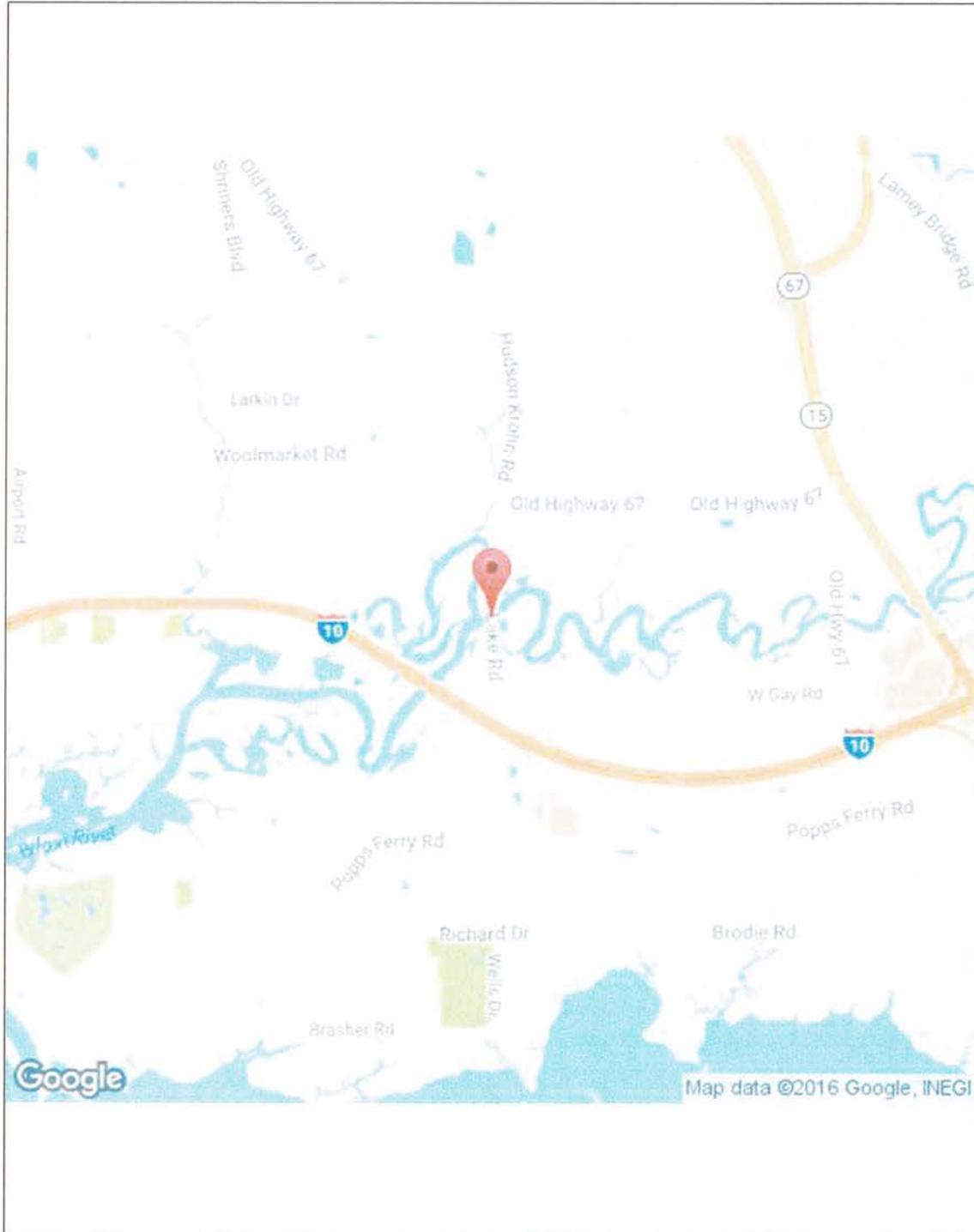
Clean and spot paint as needed.

Truss

# LOCATION MAP

Bridge Number SA2400000000088

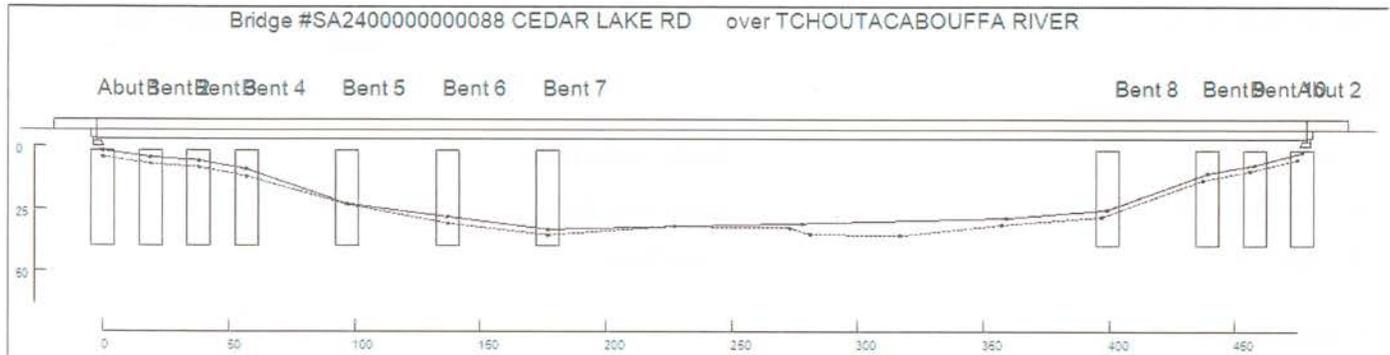
Report Date 11/23/2016



# STREAM PROFILE REPORT

Bridge Number SA2400000000088

Report Date 11/23/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA240000000088

Report Date 11/30/2016

(31) Design Load:	2 - M 13.5 or H 15	(65) Method used to Determine Inventory Rating:	6 – Load Factor (LF) Rating reported as Rating Factor (RF)
(41) Open/Posted/Closed:	P - Posted for Load	(66) Inventory Rating:	034
(63) Method used to Determine Operating Rating:	6 – Load Factor (LF) Rating reported as Rating	(67) Structural Evaluation:	3 - Intolerable - high priority of corrective action
(64) Operating Rating:	102	(70) Bridge Posting:	3 - 10.0-19.9% below legal loads

### Recommended Posting Limits

H Truck (Tons)	25	Tandem Axle (Tons)
HS Short (Tons)		Single Axle (Tons)
HS Long (Tons)		Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>	
H Truck		Tons	H Truck	Tons
HS Short	15	Tons	HS Short	15 Tons
HS Long	18	Tons	HS Long	18 Tons
Tandem Axle	18	Tons	Tandem Axle	18 Tons
Single Axle		Tons	Single Axle	Tons
Gross		Tons	Gross	Tons

### General Comments:

The recommended posting is 25 Tons H-Truck as per the most recent Load Rating Report performed in 2014. The bridge is currently signed for 25 Tons H-Truck, 18 Tons for combination vehicles and tandem combination vehicles at both approaches.

### Urgent Maintenance Noted:

### Routine Maintenance Noted:

Install the correct posting signs.

## SKETCHES

Bridge Number SA2400000000088

Report Date 11/23/2016

## WATERWAY

Bridge Number SA240000000088

SIA Item 61 Channel and Channel Protection: 6

Report Date 11/23/2016

(71) Waterway Adequacy	6	Sediment and/or Gravel Accumulation	no
(113) Scour Critical Bridge	U	Obstructions in the Waterway	no
Overall Channel Condition	good	Has Channel Shifted?	No
Bank Protection	none	Bank Erosion <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	No	Streambed Degradation	No
If Yes, Location and Description		Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	Yes	Scour Countermeasures in Place	No
Streambed Material	sand/muck	If Yes, Condition	
Bank Vegetation	good, bushes and grass	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	Yes	Debris/Drift <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Underwater Inspection Required?	Y24Y60N	Unknown Foundation Risk Category	

INSPECTION TEAM SUMMARY

Bridge Number SA2400000000088

Report Date 11/23/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell  
Overstreet, Daniel

Darrell Fore

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

03/22/2017

Date: \_\_\_\_\_



BRIDGE SURVEY REPORT

STRUCTURE NO. SA2400000000089

SEC 2 T 7S R10W

SA2400000000089

Biloxi

HARRISON

08/30/2016



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## INSPECTION SUMMARY

Bridge Number SA2400000000089

Report Date 08/30/2016

The bridge and guardrails are in good condition. The bridge rails are good, but with a few minor spalls and exposed rebars. The superstructure and substructure are in good condition. There is minor erosion at the east abutment cap area. There is moderate erosion at the west abutment cap area. Both approach roadways have minor settlement and potholes.

PICTURES

Bridge Number SA2400000000089

Report Date 08/30/2016



Photo 1	Description	
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Photo 2	Description	
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# PICTURES

Bridge Number SA240000000089

Report Date 08/30/2016

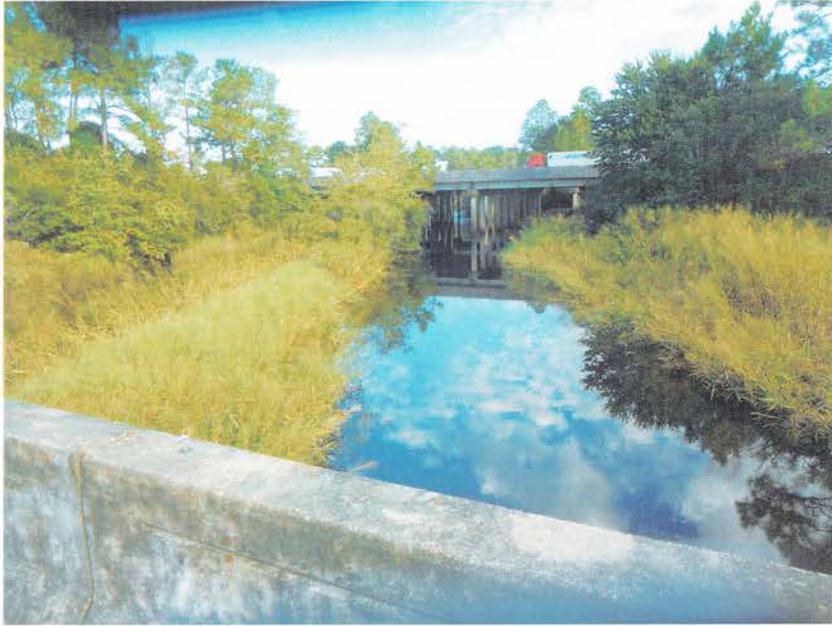


Photo 3	Description
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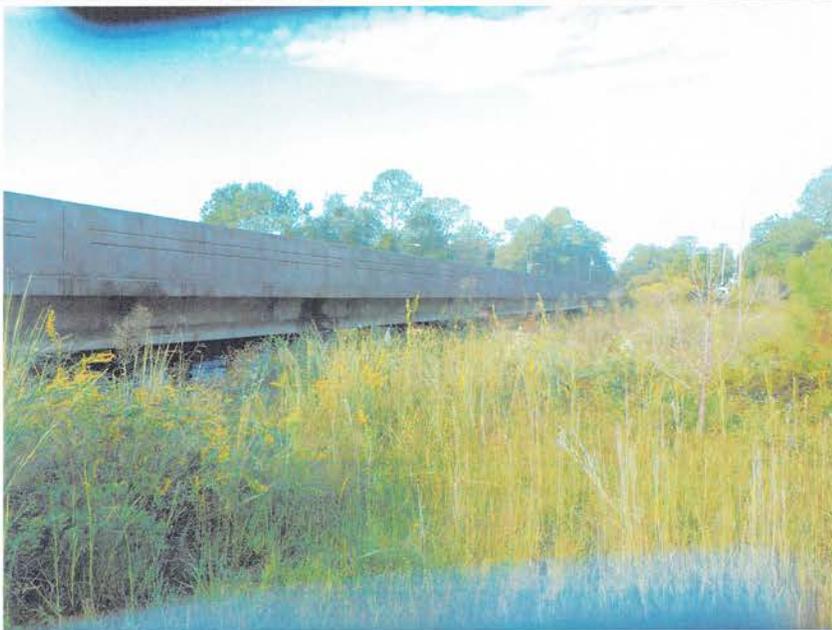


Photo 5	Description
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PICTURES

Bridge Number SA2400000000089

Report Date 08/30/2016



Photo 6	Description
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Photo 7	Description
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PICTURES

Bridge Number SA2400000000089  
Report Date 08/30/2016



Photo 8	Description
---------	-------------



Photo 9	Description
---------	-------------

PICTURES

Bridge Number SA2400000000089

Report Date 08/30/2016



Photo 10

Description



Photo 11

Description

# PICTURES

Bridge Number SA2400000000089

Report Date 08/30/2016



Photo 12	Description
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## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA240000000089

Report Date 08/30/2016

IDENTIFICATION				AGE AND SERVICE			
1. State Code	284			27. Year Built	1970		
8. Structure Number	SA240000000089			106. Year Reconstructed	0000		
5. Inventory Route	1 4 1 00 0			42. Type of Service	1 On	5 Under	
2. MDOT District	06			28. Lanes	02 On	00 Under	
3. County Code	047			29. ADT	000600		
4. Place Code	06220			30. Year of ADT	2011		
6. Features Intersected	PARKERS CREEK			109. Truck ADT	08		
7. Facility Carried	OAKLAWN RD EAST			19. Detour Length			
9. Location	SEC 2 T 7S R10W						
11. Kilometer Point	0000.804						
12. Base Highway Network	0						
13A. LRS Inventory Route							
13B. Subroute Number							
16. Latitude	30	27	36.00				
17. Longitude	-088	57	55.00				
98A. Border Bridge Code							
98B. Percent							
99. Border Bridge Structure No.							
CLASSIFICATION				PROPOSED IMPROVEMENTS			
20. Toll Facility	3			75. Type of Work			
21. Custodian	04			Proposed	31 - Replacement -		
22. Owner	04			Work Done By	2 - Work to be		
26. Functional Class	19			76. Length of Improvements	006		
37. Historical Significance	5			94. Bridge Cost	000001	\$ In Thousands	
100. Defense Highway	0			95. Roadway Cost	000001	\$ In Thousands	
101. Parallel Structure	N			96. Total Cost	000002	\$ In Thousands	
102. Direction of Traffic	2			97. Year of Cost Estimate	2009		
103. Temp Structure				114. Future ADT	000900		
104. Highway System	0			115. Year of Future	2032		
105. Federal Lands Highways	0						
110. Designated National Network	0						
112. NBIS Length	Y						
STRUCTURE TYPE AND MATERIAL				INSPECTIONS			
Main Span Unit				90. Inspection Date	08/30/2016		
43A. Material Type	5			91. Designated Inspection Frequency	24		
43B. Design Type	02			92. Critical Feature Inspection			
45. No. of Main Spans	006			A. Fracture Critical Details			
Approach Span Unit				B. Underwater Inspection			
44A. Material Type	0			C. Other Special Inspection			
44B. Design Type	00			93. Inspection Interval, Months			
46. No. of Appr Spans	0000			A. Fracture Critical Details			
107. Deck Structure Type	1			B. Underwater Inspection			
108. Wearing Surface/ Protective System				C. Other Special Inspection			
108A. Wearing Surface	1			Sufficiency Rating	79.7		
108B. Type of Membrane	0			Unknown Foundation Risk	71.7		
108C. Deck Protection	0			Unknown Foundation Risk Category			
				Structure LSBP Eligible			
				Stru. Deficient/Func. Obsolete			
STRUCTURE TYPE AND MATERIAL				GEOMETRIC DATA			
				48. Max Span Length		0012.2m	
				49. Structure Length		00073.2m	
				50. Curb/ Sidewalk Width	Left	00.0m	
					Right	00.0m	
				51. Deck Roadway Width		008.1m	
				52. Deck Width (out-to-out)		009.1m	
				32. Approach Roadway Width		011.3m	
				33. Bridge Median		0	
				34. Skew		00	
				35. Structure Flared		0	
				10. Min Vertical Clearance		99.99m	
				47. Inv. Route, Total Horizontal Clearance		08.1m	

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA2400000000089

Report Date 08/30/2016

NAVIGATION DATA			
38. Navigation Control	0		
111. Pier Protection			
39. Nav Vert Clearance	000.0m		
40. Navigation Horiz Clear	0000.0m		
CONDITION			
58. Deck	8		
59. Superstructure	8		
60. Substructure	7		
61. Channel/Channel	7		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	6		
64. Operating	199	63. Rating	6
66. Inventory	105	65. Rating	6
70. Posting	5		
41. Posting Status	A		

53. Min Vert Clear Over Bridge Rdwy	99.99m
54. Minimum Vertical Underclearance	N 00.00m
55. Minimum Lateral Underclearance on Right	N 00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	5
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	7
71. Waterway Adequacy	9
72. Approach Alignment	8
36A. Bridge Railings	1
36B. Transitions	1
36C. Approach Guardrail	1
36D. Approach GuardRail	1
113. Scour Critical Bridges	U

DECK

Bridge Number SA240000000089

SIA Item 58 Deck Condition Rating: 8

Report Date 08/30/2016

CONDITION	COMPONENT	COMMENT
4	Joints	
4	Drains	
4	Rail	
	Sidewalks	None
Light	Vibration	
	Debris Accumulation	None
4	Overall Structure	
Average	Surface Roughness Rating	

## SUPERSTRUCTURE

Bridge Number SA2400000000089  
 Report Date 08/30/2016

SIA Item 59 Superstructure Condition Rating: 8

CONDITION	COMPONENT	COMMENT
4	Girders	
4	Diaphragms	
	Stingers	None
	Drains	None
	Rail	None
	Sidewalks	None
	Vibration	None
Light	Debris Accumulation	
No	Overall Structure	
	Surface Roughness Rating	

## SUBSTRUCTURE

Bridge Number SA2400000000089

SI&A Item 60 Substructure Condition Rating: 7

Report Date 08/30/2016

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	Both abutment caps have moderate undermining.
4	Piling/Foundation	
2	Back Wall	
4	Wing Wall	
2	Embank	Moderate erosion at the west end. Minor erosion at the east end.
2	Slope Protection	
Light	Scour	
	Pile Type(s)	Concrete

## SUBSTRUCTURE

Bridge Number SA2400000000089  
 Report Date 08/30/2016

SI&A Item 60 Substructure Condition Rating: 7

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Columns/Piles	
	Footing	None
	Web Wall	None
	Bracing	None
Light	Scour	
	Pile Type(s)	Concrete

## GENERAL COMMENTS

Bridge Number SA240000000089

Report Date 08/30/2016

### Deck

There are random hairline cracks throughout and light to medium scaling throughout the deck surface. The shoulders are high and retaining water. There is minor sinking and minor section loss of the asphalt approach at the west end. There is minor alligating of the asphalt approach at the east end.

### Superstructure

Good condition.

### Substructure

There is minor erosion of the embankment at the east abutment. There is moderate erosion of the embankment at the west abutment. There is minor erosion at the SW wingwall.

### Bridge Ends

The bridge rails are in good condition. There is minor settlement of and minor pothole in the approach roadways at both ends. The approach guardrails and guard rail ends have many deteriorated timber posts and blocks.

### Waterway Appraisal

The west embankment has moderate to severe erosion. The west abutment cap is severely undermined.

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000089

Report Date 08/30/2016

Deck

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000089

Report Date 08/30/2016

Deck

Need to clip the shoulders for drainage.

Superstructure

Substructure

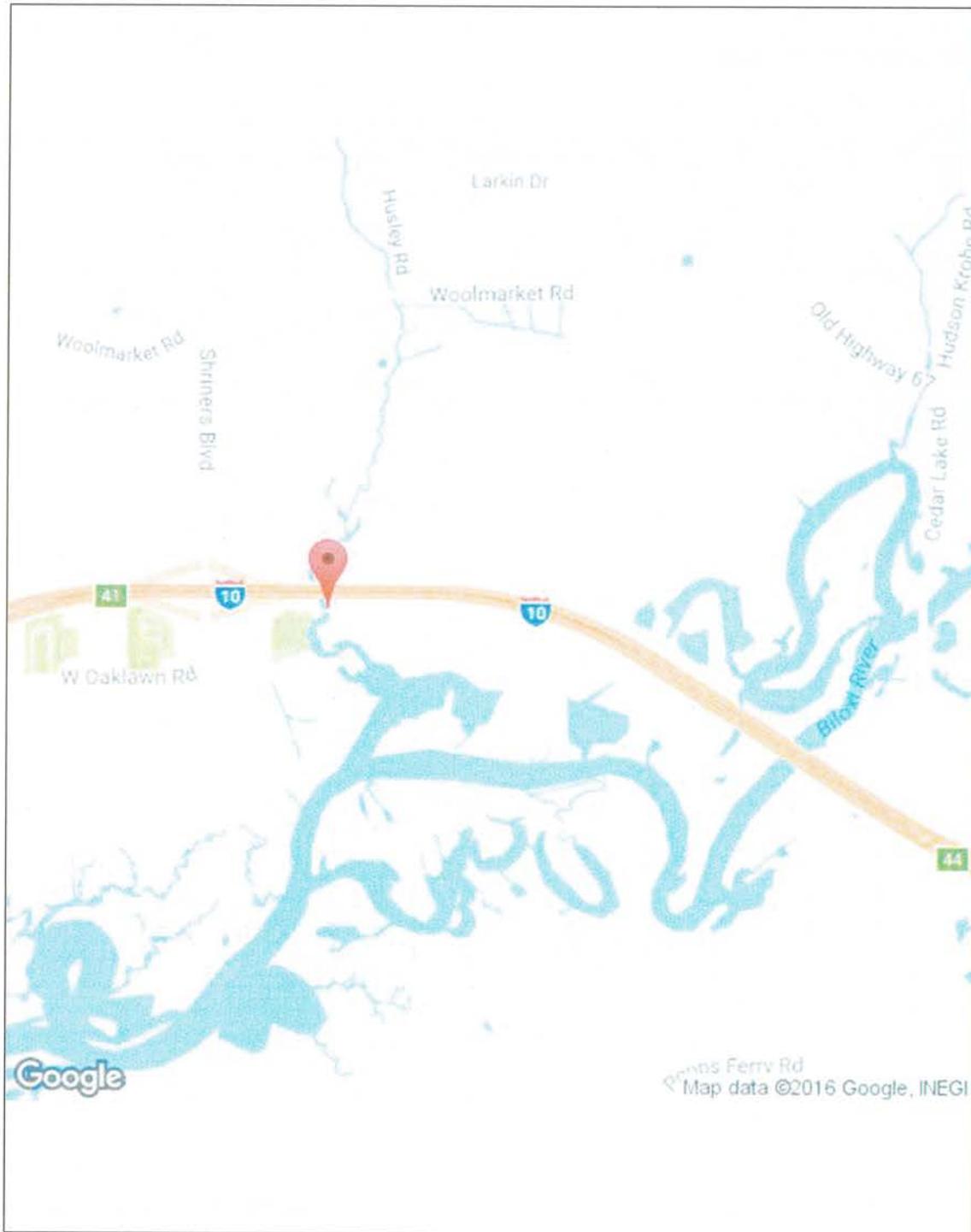
Bridge Ends

Repair the settlement and potholes in the approaches with asphalt leveling. Replace the deteriorated timber guardrail posts.

Waterway Appraisal

# LOCATION MAP

Bridge Number SA2400000000089  
Report Date 08/30/2016



# STREAM PROFILE REPORT

Bridge Number SA2400000000089

Report Date 08/30/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA2400000000089

Report Date 11/18/2016

(31) Design Load:	6 – MS 18 + Mod or HS 20 + Mod	(65) Method used to Determine Inventory Rating:	6 – Load Factor (LF) Rating reported as Rating Factor (RF)
(41) Open/Posted/Closed:	A - Open	(66) Inventory Rating:	105
(63) Method used to Determine Operating Rating:	6 – Load Factor (LF) Rating reported as Rating	(67) Structural Evaluation:	7 - Better than present minimum criteria
(64) Operating Rating:	199	(70) Bridge Posting:	5 - Equal to or above legal loads

### Recommended Posting Limits

H Truck (Tons)	Tandem Axle (Tons)
HS Short (Tons)	Single Axle (Tons)
HS Long (Tons)	Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>
H Truck		H Truck	
HS Short		HS Short	
HS Long		HS Long	
Tandem Axle		Tandem Axle	
Single Axle		Single Axle	
Gross		Gross	

### General Comments:

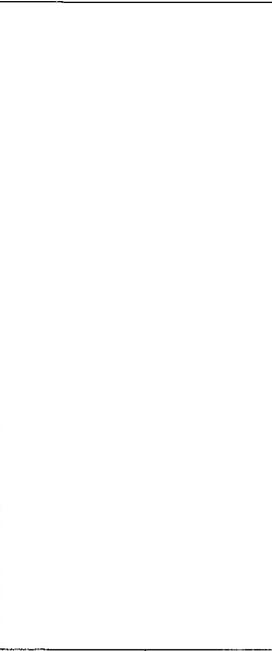
### Urgent Maintenance Noted:

### Routine Maintenance Noted:

# SKETCHES

Bridge Number SA2400000000089

Report Date 08/30/2016

Sketch 1	Description	
		

## WATERWAY

Bridge Number SA240000000089

SIA Item 61 Channel and Channel Protection: 7

Report Date 08/30/2016

(71) Waterway Adequacy	9	Sediment and/or Gravel Accumulation	None
(113) Scour Critical Bridge	U	Obstructions in the Waterway	None
Overall Channel Condition	Good	Has Channel Shifted?	No
Bank Protection	Good	Bank Erosion <input type="checkbox"/> Upstream <input checked="" type="checkbox"/> Site <input type="checkbox"/> Downstream <input type="checkbox"/> None	
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	Yes	Streambed Degradation	No
If Yes, Location and Description	Moderate erosion under the west abutment cap	Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	Yes	Scour Countermeasures in Place	No
Streambed Material	Sand	If Yes, Condition	
Bank Vegetation	Good, grass	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	No	Debris/Drift <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Underwater Inspection Required?	N N N	Unknown Foundation Risk Category	

INSPECTION TEAM SUMMARY

Bridge Number SA2400000000089

Report Date 08/30/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell  
Overstreet, Daniel

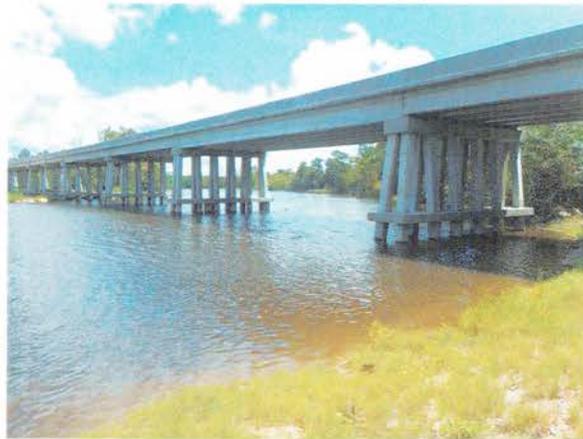
Darrell Fore

\_\_\_\_\_  
Name:

\_\_\_\_\_  
Signed:

03/22/2017

\_\_\_\_\_  
Date:



BRIDGE SURVEY REPORT

STRUCTURE NO. SA2400000000091

SEC 8 T 7S R10W B

SA2400000000091

Gulfport

HARRISON

08/31/2016



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## INSPECTION SUMMARY

Bridge Number SA2400000000091

Report Date 08/31/2016

The bridge was severely deficient and has been demolished. A new bridge is now completely constructed.

PICTURES

Bridge Number SA2400000000091  
Report Date 08/31/2016



Photo 1	Description
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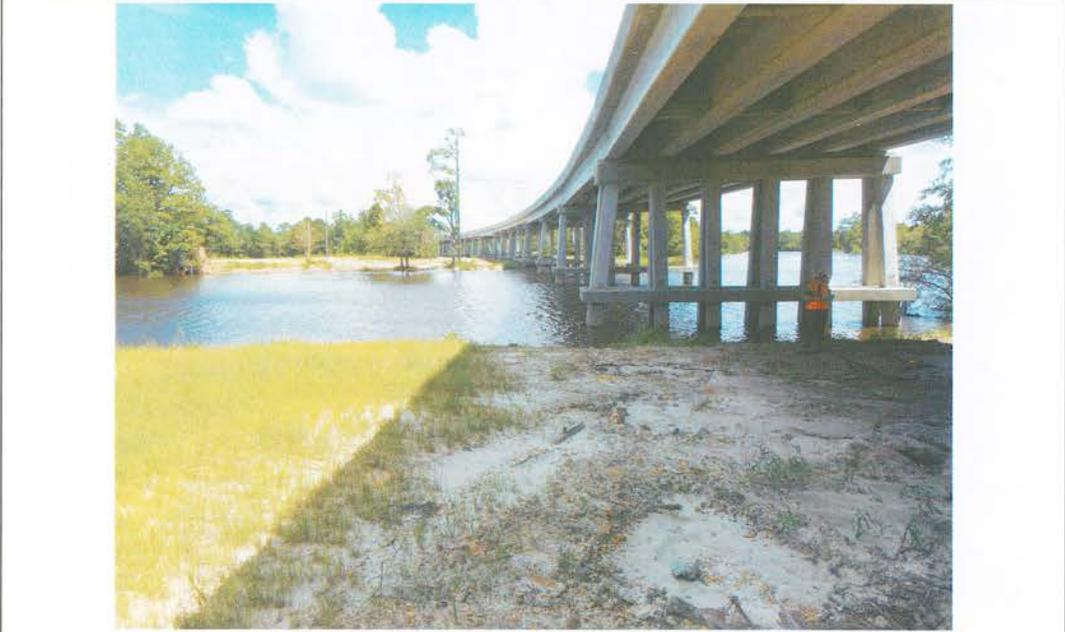


Photo 2	Description
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# PICTURES

Bridge Number SA240000000091

Report Date 08/31/2016

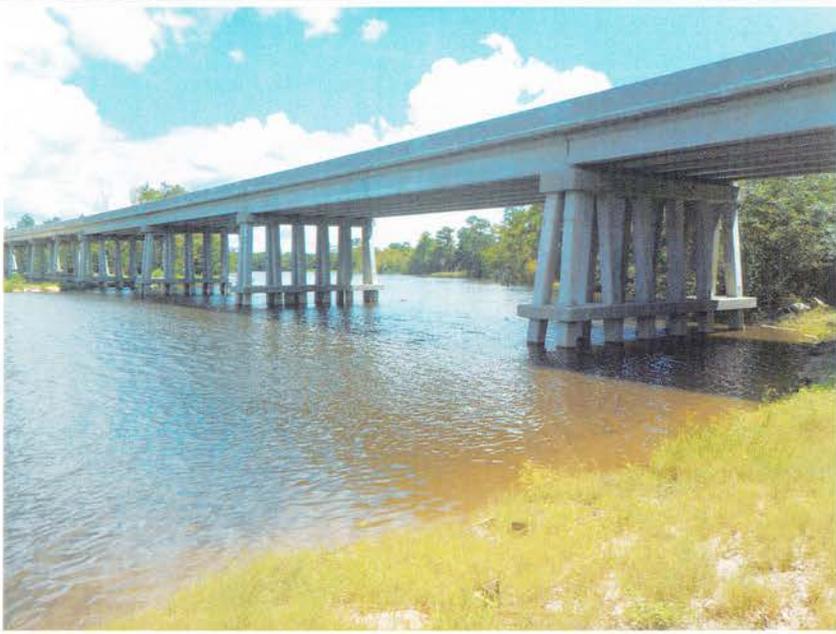


Photo 3	Description
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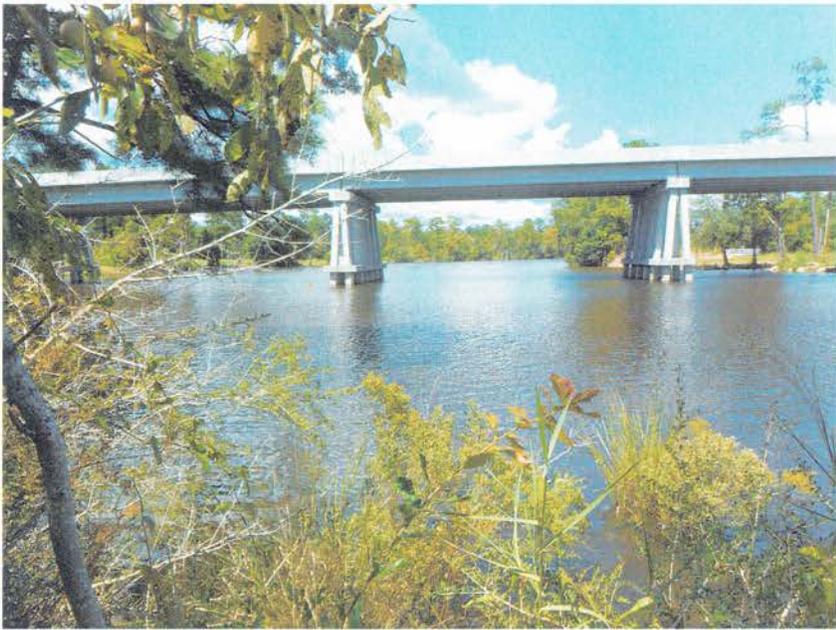


Photo 4	Description
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PICTURES

Bridge Number SA2400000000091

Report Date 08/31/2016



Photo 5	Description
---------	-------------



Photo 6	Description
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# PICTURES

Bridge Number SA2400000000091  
Report Date 08/31/2016



Photo 7	Description	
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Photo 8	Description	
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PICTURES

Bridge Number SA2400000000091  
Report Date 08/31/2016



Photo 9

Description



Photo 10

Description

PICTURES

Bridge Number SA2400000000091

Report Date 08/31/2016



Photo 11	Description
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Photo 12	Description
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# PICTURES

Bridge Number SA2400000000091

Report Date 08/31/2016



Photo 13	Description
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Photo 14	Description
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PICTURES

Bridge Number SA2400000000091

Report Date 08/31/2016



Photo 15	Description
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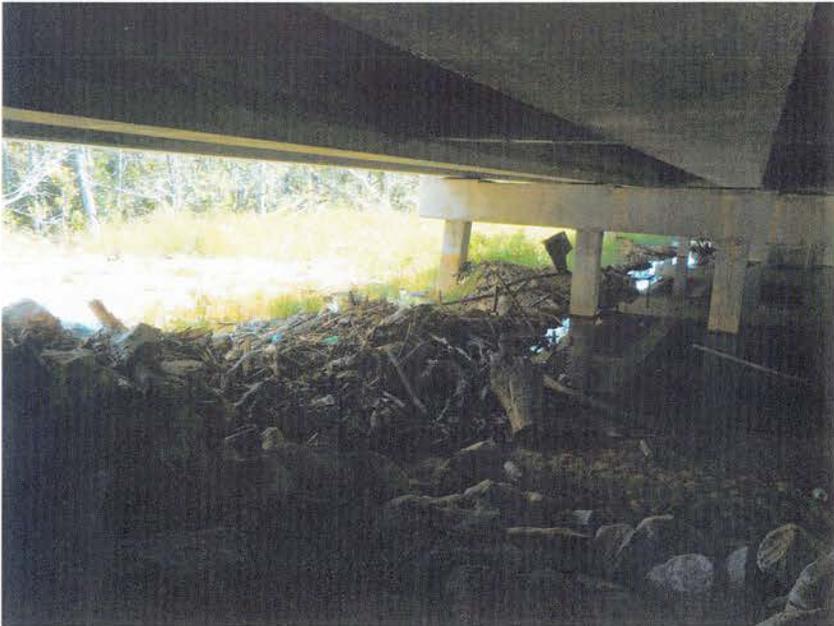


Photo 16	Description
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# PICTURES

Bridge Number SA2400000000091  
Report Date 08/31/2016



## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA240000000091

Report Date 08/31/2016

IDENTIFICATION				AGE AND SERVICE			
1. State Code	284			27. Year Built	2016		
8. Structure Number	SA240000000091			106. Year Reconstructed	0000		
5. Inventory Route	1 4 1 00 0			42. Type of Service	1 On	5 Under	
2. MDOT District	06			28. Lanes	02 On	00 Under	
3. County Code	047			29. ADT	018000		
4. Place Code	29700			30. Year of ADT	2013		
6. Features Intersected	BILOXI RIVER			109. Truck ADT	08		
7. Facility Carried	FAS 139			19. Detour Length			
9. Location	SEC 8 T 7S R10W B						
11. Kilometer Point	0002.092						
12. Base Highway Network	0						
13A. LRS Inventory Route							
13B. Subroute Number							
16. Latitude	30	27	07				
17. Longitude	-089	00	43				
98A. Border Bridge Code							
98B. Percent							
99. Border Bridge Structure No.							
CLASSIFICATION				PROPOSED IMPROVEMENTS			
20. Toll Facility	3			75. Type of Work			
21. Custodian	04			Proposed	No Major Work		
22. Owner	04			Work Done By	1 - Work to be		
26. Functional Class	17			76. Length of Improvements	004		
37. Historical Significance	5			94. Bridge Cost	007500	\$ In Thousands	
100. Defense Highway	0			95. Roadway Cost	001000	\$ In Thousands	
101. Parallel Structure	N			96. Total Cost	009000	\$ In Thousands	
102. Direction of Traffic	2			97. Year of Cost Estimate	2011		
103. Temp Structure				114. Future ADT	027000		
104. Highway System	0			115. Year of Future	2033		
105. Federal Lands Highways	0						
110. Designated National Network	0						
112. NBIS Length	Y						
STRUCTURE TYPE AND MATERIAL				INSPECTIONS			
Main Span Unit				90. Inspection Date	08/31/2016		
43A. Material Type	1			91. Designated Inspection Frequency	24		
43B. Design Type	02			92. Critical Feature Inspection			
45. No of Main Spans	004			A. Fracture Critical Details			
Approach Span Unit				B. Underwater Inspection	60		
44A. Material Type	1			C. Other Special Inspection			
44B. Design Type	02			93. Inspection Interval, Months			
46. No of Appr Spans	0066			A. Fracture Critical Details			
107. Deck Structure Type	1			B. Underwater Inspection	09/01/2015		
108. Wearing Surface/ Protective System				C. Other Special Inspection			
108A. Wearing Surface	1			Sufficiency Rating	7.0		
108B. Type of Membrane	0			Unknown Foundation Risk	0		
108C. Deck Protection	0			Unknown Foundation Risk Category			
				Structure LSBP Eligible			
				Stru. Deficient/Func. Obsolete	S		
STRUCTURE TYPE AND MATERIAL				GEOMETRIC DATA			
				48. Max Span Length		0024.4m	
				49. Structure Length		00088.1m	
				50. Curb/ Sidewalk Width	Left	00.0m	
					Right	00.0m	
				51. Deck Roadway Width		007.3m	
				52. Deck Width (out-to-out)		011.9m	
				32. Approach Roadway Width		010.0m	
				33. Bridge Median		0	
				34. Skew		00	
				35. Structure Flared		0	
				10. Min Vertical Clearance		99.99m	
				47. Inv. Route, Total Horizontal Clearance		11.0m	

## STRUCTURE INVENTORY AND APPRAISAL

Bridge Number SA240000000091

Report Date 08/31/2016

NAVIGATION DATA			
38. Navigation Control	1		
111. Pier Protection	1		
39. Nav Vert Clearance	006.5m		
40. Navigation Horiz Clear	0028.1m		
CONDITION			
58. Deck	9		
59. Superstructure	9		
60. Substructure	9		
61. Channel/Channel	9		
62. Culvert	N		
LOAD RATING AND POSTING			
31. Design Load	5		
64. Operating	000	63. Rating	1
66. Inventory	000	65. Rating	1
70. Posting	0		
41. Posting Status	K		

53. Min Vert Clear Over Bridge Rdwy	99.99m
54. Minimum Vertical Underclearance	N
	00.00m
55. Minimum Lateral Underclearance on Right	N
	00.0m
56. Minimum Lateral UnderClearance on Left	00.0m
68. Deck Geometry	3
69. Underclearance Rating	N
APPRAISAL	
67. Struc Eval	0
71. Waterway Adequacy	9
72. Approach Alignment	8
36A. Bridge Railings	1
36B. Transitions	1
36C. Approach Guardrail	1
36D. Approach GuardRail	1
113. Scour Critical Bridges	U

DECK

Bridge Number SA2400000000091

SIA Item 58 Deck Condition Rating: 9

Report Date 08/31/2016

CONDITION	COMPONENT	COMMENT
4	Joints	
4	Drains	
4	Rail	
	Sidewalks	None
Light	Vibration	
	Debris Accumulation	None
4	Overall Structure	
Average	Surface Roughness Rating	

## SUPERSTRUCTURE

Bridge Number SA2400000000091

SIA Item 59 Superstructure Condition Rating: 9

Report Date 08/31/2016

CONDITION	COMPONENT	COMMENT
4	Girders	
4	Diaphragms	
0	Stingers	None
	Drains	None
	Rail	None
	Sidewalks	None
	Vibration	None
	Debris Accumulation	None
	Overall Structure	None
	Surface Roughness Rating	

## SUBSTRUCTURE

Bridge Number SA2400000000091  
 Report Date 08/31/2016

SI&A Item 60 Substructure Condition Rating: 9

### ABUTMENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Piling/Foundation	
	Back Wall	None
4	Wing Wall	
4	Embank	
4	Slope Protection	
	Scour	None
	Pile Type(s)	Concrete

## SUBSTRUCTURE

Bridge Number SA2400000000091

SI&A Item 60 Substructure Condition Rating: 9

Report Date 08/31/2016

### INTERMEDIATE BENTS

CONDITION	COMPONENT	COMMENT
4	Bearings	
4	Cap	
4	Columns/Piles	
	Footing	None
	Web Wall	None
	Bracing	None
	Scour	None
	Pile Type(s)	Concrete

## GENERAL COMMENTS

Bridge Number SA240000000091

Report Date 08/31/2016

### Deck

This is a new bridge, and it is in excellent condition.

### Superstructure

This is a new bridge, and it is in excellent condition.

### Substructure

This is a new bridge, and it is in excellent condition.

### Bridge Ends

This is a new bridge, and it is in excellent condition.

### Waterway Appraisal

URGENT MAINTENANCE NOTED

Bridge Number SA2400000000091

Report Date 08/31/2016

Deck

Superstructure

Substructure

Bridge Ends

Waterway Appraisal

ROUTINE MAINTENANCE NOTED

Bridge Number SA2400000000091

Report Date 08/31/2016

Deck

Superstructure

Substructure

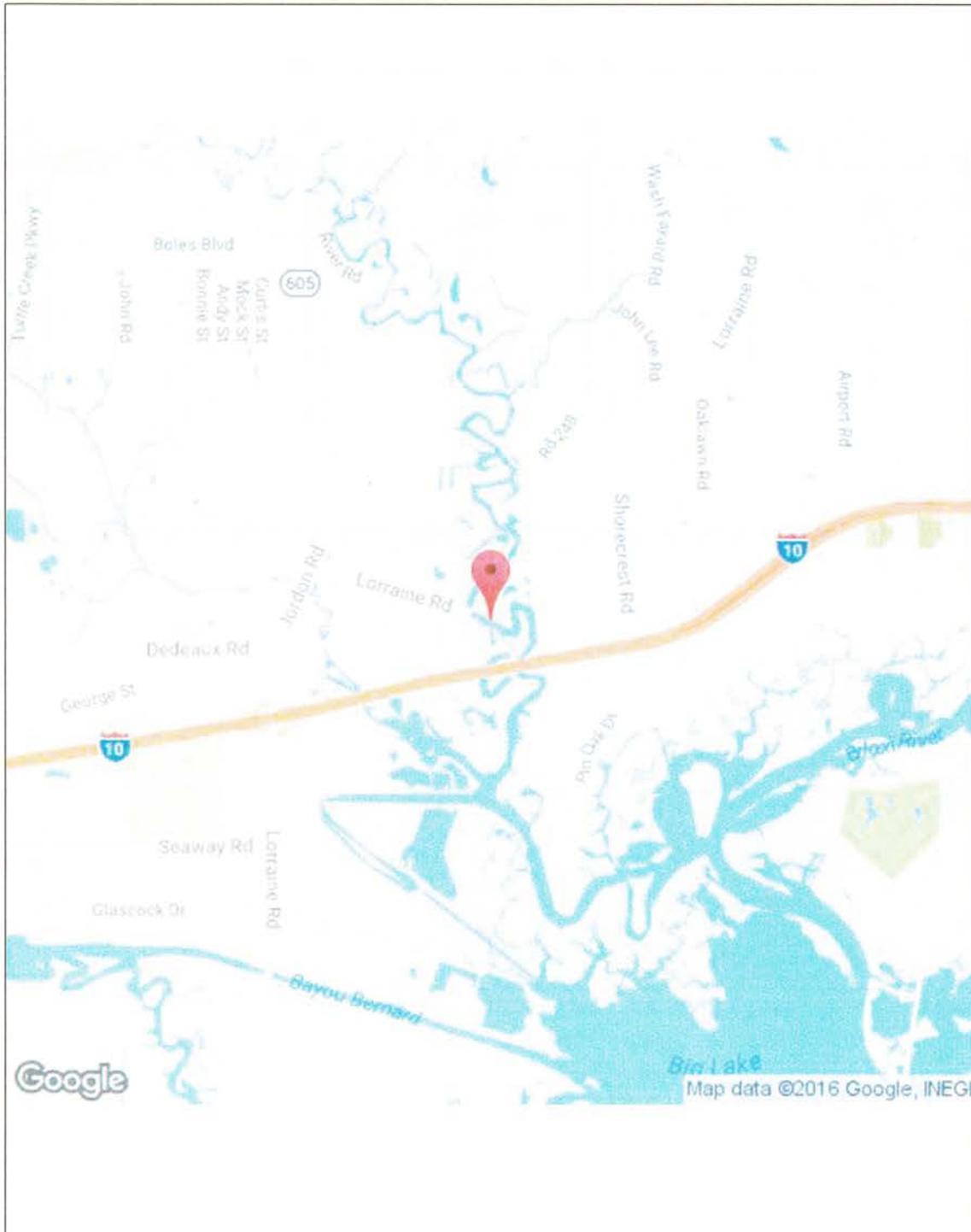
Bridge Ends

Waterway Appraisal

LOCATION MAP

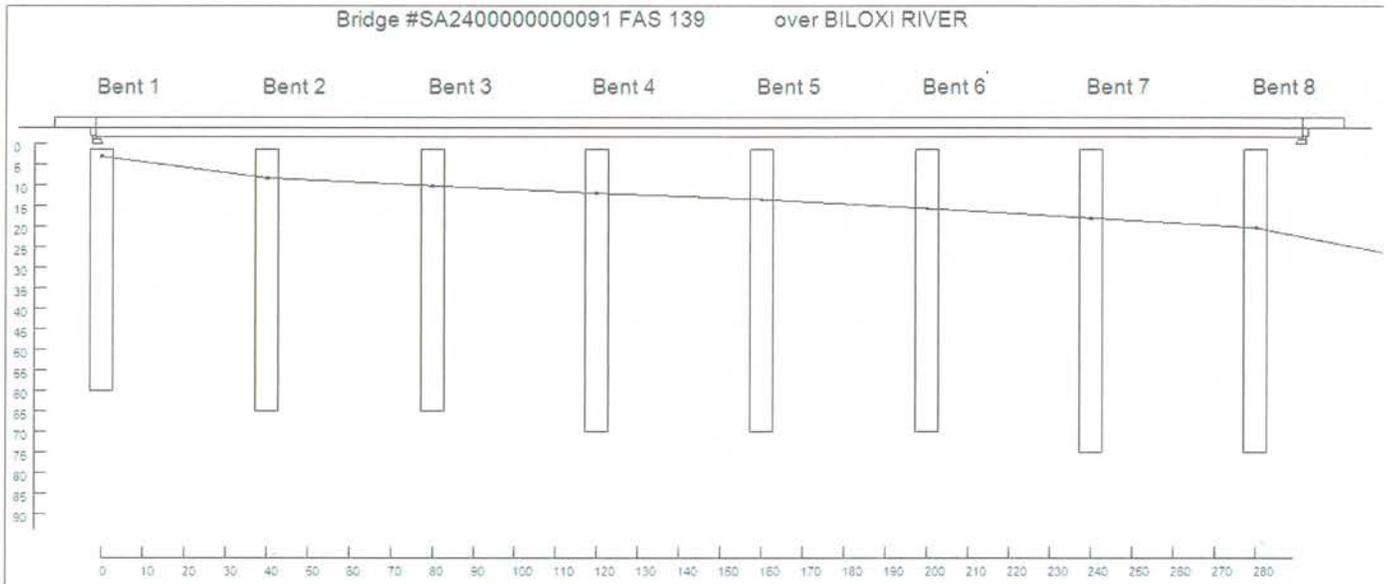
Bridge Number SA2400000000091

Report Date 08/31/2016



# STREAM PROFILE REPORT

Bridge Number SA240000000091  
Report Date 08/31/2016



## LOAD RATING AND POSTING SUMMARY

Bridge Number SA2400000000091

Report Date 11/07/2016

(31) Design Load:	5 – MS 18 or HS 20	(65) Method used to Determine Inventory Rating:	1 – Load Factor (LF)
(41) Open/Posted/Closed:	K - Closed	(66) Inventory Rating:	000
(63) Method used to Determine Operating Rating:	1 – Load Factor (LF)	(67) Structural Evaluation:	0 - Bridge closed
(64) Operating Rating:	000	(70) Bridge Posting:	0 - More than 39.9% below legal loads

### Recommended Posting Limits

H Truck (Tons)	Tandem Axle (Tons)
HS Short (Tons)	Single Axle (Tons)
HS Long (Tons)	Gross (Tons)

### Posting Summary

Bridge is Closed: No

	<u>Bridge Begin</u>		<u>Bridge End</u>
H Truck		H Truck	
HS Short		HS Short	
HS Long		HS Long	
Tandem Axle		Tandem Axle	
Single Axle		Single Axle	
Gross		Gross	

### General Comments:

Based on the 2013 In Depth Inspection and the 2013 LFR Load Rating Analysis, this structure does not require weight restrictions at this time.

### Urgent Maintenance Noted:

### Routine Maintenance Noted:

## SKETCHES

Bridge Number SA2400000000091  
Report Date 08/31/2016

## WATERWAY

Bridge Number SA2400000000091

SIA Item 61 Channel and Channel Protection: 9

Report Date 08/31/2016

(71) Waterway Adequacy	9	Sediment and/or Gravel Accumulation	None
(113) Scour Critical Bridge	U	Obstructions in the Waterway	None
Overall Channel Condition	Good	Has Channel Shifted?	No
Bank Protection	Good	Bank Erosion <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Realignment of Channel	No	Streambed Aggradation	No
Indications of Scour	No	Streambed Degradation	No
If Yes, Location and Description		Abutment(s) Encroach in Channel	No
Structure in Tidal Zone	Yes	Scour Countermeasures in Place	No
Streambed Material	Sand	If Yes, Condition	
Bank Vegetation	Good, woods, and grass	Stream Velocity	Low
Indications that High Waters Overtop Structure and/or Approach Roadway	No	Debris/Drift <input type="checkbox"/> Upstream <input type="checkbox"/> Site <input type="checkbox"/> Downstream <input checked="" type="checkbox"/> None	
Underwater Inspection Required?	No	Unknown Foundation Risk Category	

INSPECTION TEAM SUMMARY

Bridge Number SA2400000000091

Report Date 08/31/2016

Team Leader: Fore, Darrell

Team Members: Fore, Darrell

Darrell Fore

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

03/23/2017

Date: \_\_\_\_\_