CITY OF
FORT LAUDERDALE

All-America City

Memorandum

To: Lee R. Feldman, ICMA-CM, City Manager
From: Hardeep Anand, P.E., Public Works Director
DATE: August 18, 2015

RE: 2015 Canal Dredging Master Plan

Issue:

The purpose of this memorandum is to introduce a canal dredging master plan and offer funding options and program cost estimates.

Background:

Staff calculated 115 miles of canal waterways in the City, and the City-owned canal system consists of 65 miles of interconnected man-made canals. The City's Public Works Department conducted a canal survey of 51 miles (78% of City-owned canals); fourteen miles of canals (22%) were not surveyed. The Engineering team conducted a dredging evaluation of the surveyed canals and developed a preliminary dredging program. It was found that 10 miles (15% of City-owned canals) require dredging work. It is estimated that 5.6 miles of un-surveyed navigable and drainage canals (9% may require dredging at the cost of $3 million. Canals are designated in need of dredging when the canal main channel (defined as the center 1/3 of the canal) does not comply with the City's minimum canal dredging criteria (defined as the canal channel depth to be a minimum of 4-feet below Mean Low Water Elevation (MLW)).

The Engineering team mapped the location of the canals with immediate dredging needs considering the following factors in prioritizing dredging projects:

- Canal condition – magnitude of dredging need;
- Canal dredging complaints;
- Canal location and constructability logistics; and
- A 7-year maintenance dredging cycle.

ECONOMIC IMPACTS

The cost of implementing the proposed plan is $8 million over 7-years with an average annual cost of $1.14 million per year. Funding mechanisms were investigated and an assessment or taxing district is the recommended methodology.

Recommendation:

The next steps are recommended to implement the program:

1. Fund a rate study to recommend a specific funding mechanism, assessment rate or fee, and implementation process. Estimated cost $60,000 ($60,000 of unused funds are expected to rollover from 2015 CIP for this task).
2. Fund a survey and assessment of the remaining 14-miles of navigable and drainage canals. Estimated cost $380,000. (The Stormwater Utility related work is budgeted in 2017 and any unused funds from the 2015 Canal Dredging CIP will be used to survey the navigable canals).
3. Implement selected funding mechanisms (billing, collection and public notices). Estimated cost $60,000. ($60,000 of unused funds are expected to rollover from 2015 CIP for this task).
4. Budget specific design and environmental permitting. Estimated cost $1.5 million.
5. Budget construction. Estimated cost $6 million.

Strategic Connections:

This item is a *Press Play Fort Lauderdale Strategic Plan* initiative, included within the Infrastructure Cylinder of Excellence, specifically advancing:

- Goal 2: Be a sustainable and resilient community
- Objective 2: Objective 1: Proactively maintain our water, wastewater, road and bridge infrastructure;
- strategic initiative 3: Conduct an analysis of canal dredging needs and examine funding scenarios

This item advances the *Fast Forward Fort Lauderdale 2035 Vision Plan*: We Are Connected.

Attachments Canal dredging master plan and engineering report
Supporting maps and power point presentation

CITY OF FORT LAUDERDALE

2015

Canal Dredging Master Plan and Engineering Report

Public Works Department

City of Fort Lauderdale

August 2015

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Executive Summary

City Staff performed a comprehensive analysis of City dredging needs during Fiscal Year (FY) 2015. This report presents conclusions and recommendations of a canal dredging master plan to the Marine Advisory Board (MAB) and City Commission. After surveying 51 miles of canals, which represents 78% of the city-owned canals, it is estimated that 10 miles of canals require immediate dredging needs at the approximate cost of $5 million. Fourteen miles of canals were not surveyed due to lack of funding. However, it is estimated that out of the 14 miles of un-surveyed canals, 5.6 miles may require dredging at the approximate cost of $3 million.

Several funding mechanisms were examined and assessments or taxing districts are the recommended source of funding. A seven-year dredging cycle is recommended with a $1.1 million average annual budget, totaling $8 million. A benefit to cost analysis of design and construction methodologies was performed and favored outsourcing rather than in-house operations.

The next steps are recommended to implement the program:

1. Fund a rate study to recommend a specific funding mechanism, assessment rate or fee, and implementation process. Estimated cost $60,000 ($60,000 of unused funds are expected to rollover from 2015 CIP for this task).

2. Fund a survey and assessment of the remaining 14-miles of navigable and drainage canals. Estimated cost $380,000. (The Stormwater Utility related work is budgeted in 2017; any remaining funds from the 2015 stormwater dredging program will be used for navigable canals).

3. Implement selected funding mechanisms (billing, collection and public notices). Estimated cost $60,000. ($60,000 of unused funds is expected to rollover from the 2015 CIP for this task).

4. Budget specific design and environmental permitting. Estimated cost $1.5 million.

5. Budget construction. Estimated cost $6 million).

Section 1 - Introduction

The 2014 Commission Annual Action Plan (CAAP) identifies the comprehensive canal dredging master plan as a high priority strategic initiative. As such, the following canal dredging engineering analysis report was developed to provide recommendations on canal dredging needs and funding options. This study progresses the 2018 strategic plan "*Press Play Fort Lauderdale*" included within the infrastructure cylinder of excellence, specifically advancing Goal 2: Be a sustainable and resilient community; Objective 1: Proactively maintain our water, wastewater, road and bridge infrastructure; Strategic initiative 3: Conduct an analysis of canal dredging needs and examine funding scenarios.

1.1 Canal Dredging Analysis Goals and Objectives

There are four main objectives of the canal dredging engineering analysis report:

1. The first objective is to describe the canal dredging needs of the City. The dredging needs were developed from evaluating actual surveys completed of the bottom of the City's canal system to determine which canals comply with the minimum depth required by the City's canal dredging cross section required for proper vessel navigation. The canals not in compliance will require dredging work to remove the sand and muck sediments from the canal channel, which is defined as the middle third of the canal width up to a maximum of fifty (50) feet.

2. The second objective is to determine the cost of future dredging needs.

3. The third objective is to examine possible scenarios for design and construction phases.

4. The forth objective is to identify possible funding mechanisms to implement the dredging master plan.

1.2 Canal Inventory

- The City's canal system is composed of sixty (65) miles of interconnected, man-made canals.
- City staff surveyed fifty one (51) miles (78%) of canals in the City to conduct a citywide analysis of all canal dredging needs.
    - Approximately forty one (41) miles (63%) meet the City policy for Canal depth. Therefore, no dredging work is required for these canals.
    - Approximately ten (10) miles (15%) need dredging work because the canal main channel (defined as the middle third of the canal) does not comply with the City's minimum canal dredging criteria (defined as bottom of the canal channel to be four (4) feet minimum below Mean Low Water Elevation).
- The remaining fourteen (14) miles (22%) were not yet surveyed or evaluated, due to a limited budget. These canals are distributed as follows:
    - Eight (8) out of the fourteen (14) miles are hard to reach navigable canals
    - Six (6) out of the fourteen (14) miles are drainage canals or culverts

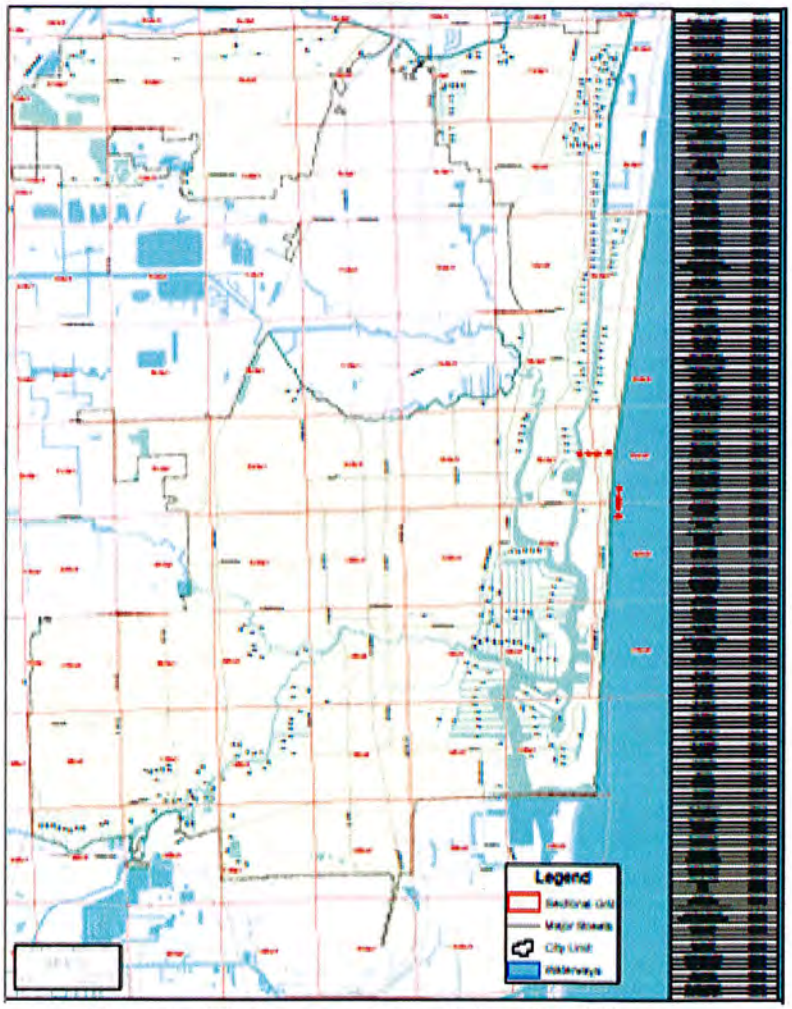
1.3 Canal Datum

- The City's canal bottom elevations were surveyed during FY2015 based on the North American Vertical Datum 1988 (NAVD88).
- The Mean Low Water Elevation (MLW) was determined by the City surveyor. The rounded value of (-) 2.90' NAVD88 was used for the canal dredging analysis.

Section 2 – Data and Methodology

2.1 Existing Canal System

The City's canal system is formed by sixty five (65) miles of interconnected canals as depicted by Waterways Identification Map (See Appendix 1, Map 1). All canals in the city are identified by ID number, which is an eight (8) digit number denoting the Section –Township – Range – and canal number. Some canals are named, but most are only identified by the canal ID number.



Map 1 - Waterways Identification Map
(Legible print included in Appendix 1, Map 1)

2.1.1 Canal Use and General Conditions

The City's canal system serves predominately single and multi-family residential areas. Existing stormwater outfalls pipes discharge stormwater runoff from adjacent City residential streets, nearby County collector roadways, and State highways into the canals. There are multiple private marine structures built in canal waterways such as docks, finger piers, piles, boat lifts, and others. The canals are bounded predominantly by concrete seawalls located at the property lines and maintained by private property owners. Canal widths range between twenty five (25) to over one-hundred fifty (150) feet, but the typical canal width is about one-hundred (100) feet.

2.1.2 Typical Canal Dredging Section

Figure 1 depicts the typical City canal dredging cross section recommended by the City Marine Advisory Board (Appendix 2, Figure 1). The typical City canal dredging cross section determines the target canal dredging depth for which all City navigable canal dredging needs are determined.

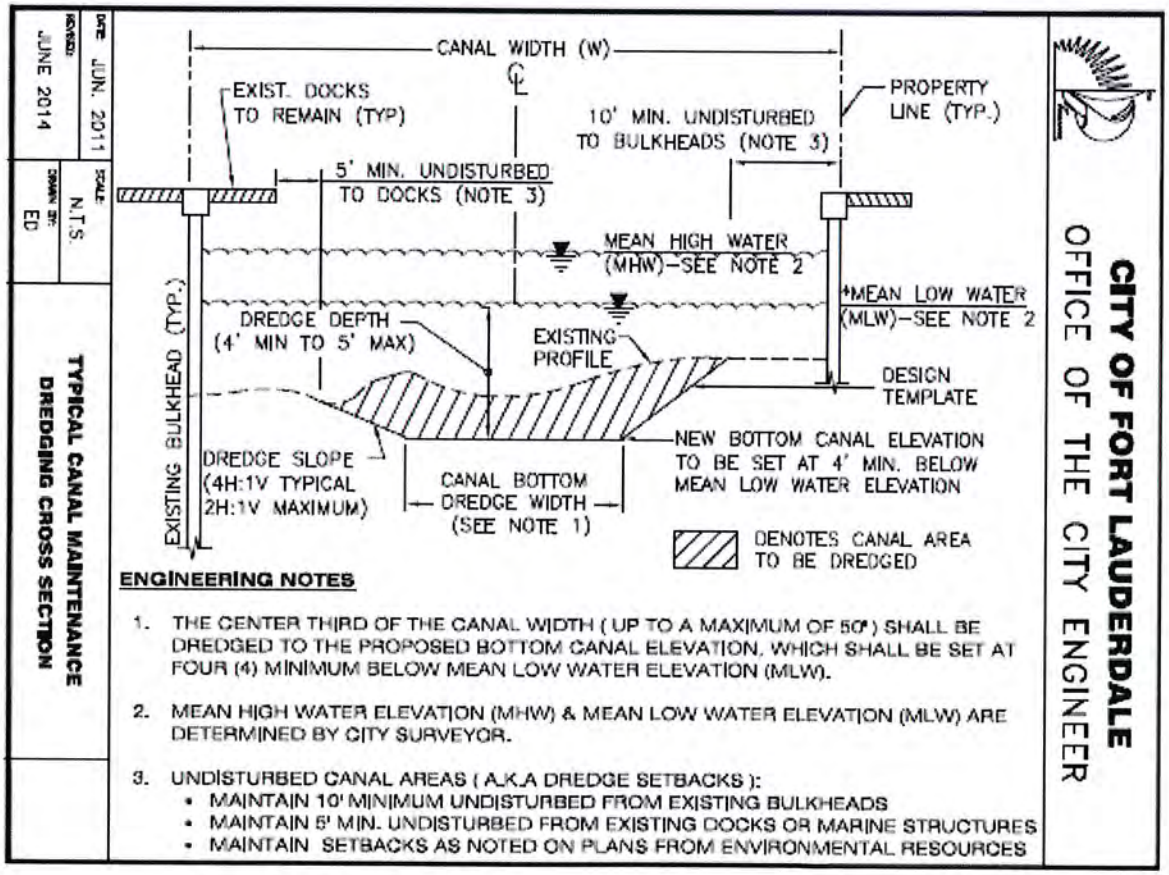


Figure 1
(Legible print included in Appendix 2 Figure 1)

The City's typical canal dredging cross section and canal maintenance dredging management practices were compared against other Florida coastal municipalities', including City of Naples, Punta Gorda, Deerfield Beach, St. Petersburg, Tampa, Pompano Beach, Lighthouse Point, Miami Beach, and Boca Raton. Based on this comparison evaluation, it was determined that the City of Fort Lauderdale's current dredging criteria, as depicted by the typical canal maintenance cross section, is adequate for canal maintenance dredging of navigable man-made residential canals in the City of Fort Lauderdale.

2.1.3 Canal Dredging Setbacks and Slopes

The canal dredging setback is the undisturbed area of the canal bounded by the dredging work limits to existing seawalls, bulkheads or other canal walls to avoid any disturbance of the structural foundations of the existing seawalls. The minimum canal dredging setback is ten (10) feet. In addition, there is a five (5) feet minimum dredging setback to any existing dock, finger pier, piles and similar marine structures. The typical canal dredging slope to be used for canal dredging maintenance projects is four (4) feet horizontal (H) by one (1) foot vertical (V) slope (4H:1V). The maximum canal dredging slope is 2H:1V used in hard to reach areas and a case by case basis only since there is the possibility of overturning of the soils when steep slopes are used.

Canal dredging setbacks and dredging slopes determine the limits of the bottom of the canals as well as the width of the canal channel. For most canals in the City of Fort Lauderdale, the canal setbacks are ten (10) feet and the canal slopes are 4H:1V.

2.1.4 Mean High Water and Mean Low Water Elevations

The water elevations of the canal are tracked by tide charts and vary all year long. For canal vessel navigation purposes, there are two water evaluation values that are important to determine proper canal dredging depth. These are the Mean High Water Elevation (MHW) and Mean Low Water Elevation (MLW).

The MHW and MLW elevations vary slightly from location to location; therefore, the City surveyor evaluates the readings from several tide gages located in the Fort Lauderdale area to determine the MHW & MLW values according to the location of a dredging project. In June 2011, the Marine Advisory Board (MAB) accepted a recommendation by the City Engineer and City surveyor to set the MLW elevation at (-) 2.90' NAVD88 as an average value for the Fort Lauderdale area. Based on this MLW value, the City's dredging criteria requires that the minimum depth of the canal to be four (4) feet below the MLW. Therefore, the minimum bottom elevation of a navigable canal shall be set at (-) 6.90' NAVD88. Furthermore, the maximum canal depth is 5 feet below MLW, so the maximum canal depth per City's current dredging criteria is (-) 7.90 NAVD88.

2.1.5 Canal Bottom Elevation Contours

When canals are surveyed, point elevations of the bottom of the canals are taken on a grid pattern to create contours of common elevation values throughout the length and width of each canal. The contour elevations serve to determine the areas of the canal that do not comply with the minimum canal depth per City's canal dredging section. Furthermore, a

software program (HYPAK) is used to collect the canal point data and draw the profile and cross sections of the contour elevations. Subsequently, a 3D computer-aided design (AutoCAD Civil 3D) engineering software is utilized to produce the engineering design plans and construction documents denoting the dredge areas and the volume of sediments to be dredged from each canal measured in cubic yards (CY).

2.2 Canal Dredging Methodology

There are two methods typically employed to perform canal maintenance dredging, mechanical dredging and hydraulic dredging. In order to decide which dredging method shall be used, a soil test of the canal bottom dredged material is performed and analyzed.

2.2.1 Mechanical Dredging Excavation Method

If the canal soil composition is made out of clay, silts, muck soils, and rocky soils the preferred dredging method is mechanical excavation. The alternative hydraulic pump system will not be able to collect these types of soils. Mechanical excavation involves a bucket excavator and a container both placed on the same barge. The excavator uses a clamshell bucket (or other types of buckets depending on the soil material to be dredged) to extract the sediments from the bottom of the canals. The barge is moved from place to place where dredging is needed along the canal, and the excavated material is placed in the container. Once the container is full, it is towed to shore at a near boat ramp where another excavator uploads the wet sediments from the container into a watertight truck. The process is repeated until the desired canal depth is achieved. The mechanical dredging method requires several pieces of heavy equipment and requires handling of the material multiple times.

Canal Dredging by Mechanical Excavation Method (Picture 1)

Canal Dredging by Mechanical Excavation Method (Picture 2)

Canal Dredging by Mechanical Excavation Method (Picture 3)

2.2.2 Hydraulic Dredging Excavation Method

Hydraulic Dredging excavation is the preferred option for removing loose sandy sediments from the bottom of canals through the use of a hydraulic pump, long hoses and water-tight trucks. A barge maybe used for some applications where access from land is unavailable. When a barge is used, a dredge hydraulic pump is placed on the barge extracting the canal sediments through a temporary pipeline to an offsite location, often several hundred feet away. Hydraulic dredge acts like a vacuum removing sediment very precisely from the bottom of the canal or for tight spots such as stormwater outfall locations, depending on the soil conditions.

A hydraulic dredge is not much larger than a small boat. It uses a discharge line and a return line, which are the only disturbances to the surrounding environment. The lines can easily be run under roads or sidewalks. Hydraulic dredging is an un-obtrusive method that does not require disturbing the shoreline and requires one trip in to put the dredge in the water and one trip out when the project is complete.

Canal Dredging by Hydraulic Method (Picture 4)

Canal Dredging by Hydraulic Method (Picture 5)

2.2.3 Disposal of Dredged Material

After dredge sediment is removed from the bottom of a canal through mechanical or hydraulic methods, it is then transported in water-tight trucks to a temporary settling basin also known as a spoil-drying bed.

Hauling from Barge (Picture 6)

Loading to Water-tight Trucks (Picture 7)

Constructing a temporary settling basin is the least expensive way to separate the sediment from the water, but it requires a permit from the Broward County Environmental Protection Division. The wet dredged material takes two (2) to three (3) days to dry out if no rain events interrupt the drying time. After the sediments are dried, they are loaded into trucks and beneficially deposited at other various sites to fill in low areas, utilized for topsoil, or disposed of in a Class I landfill site, depending on the soil classification and applicable regulatory requirements.

Drying Basin Located at Compost Facility Site, City of Dania Beach (Picture 8)

In order to handle dredged material from City projects, the City permitted and constructed a temporary settling drying bed at the compost facility site located at 4300 State Road 7 in the City of Dania Beach in 2014. Future projects will require similar settling facilities.

Any temporary settling basin requires a permit from Broward County Department of Environmental Protection, which verifies that the basin is constructed to environmental code standards and permit regulations.

Drying basin berms (Picture 9)

Drying basin bottom (Picture 10)

When material is not reused it is disposed of at a landfill. After dredged sediment material dries out, it is hauled away by water-tight trucks to the Monarch Hill regional Class I landfill, which is located in the City of Coconut Creek on Powerline Road and Wiles Road. The City of Fort Lauderdale has an account with the Monarch Hill landfill site to dispose spoils and any other waste materials collected from the various City sanitation programs. The cost to dispose dredge waste at Monarch Hill landfill is $32/ton during FY 2015.

Monarch hill landfill, City of Coconut Creek (Picture 11)

Section 3 – Canal Dredging Permitting Process

3.1 Regulatory Agencies

The number of permit agencies involved in a canal maintenance dredging project varies according to the location of the project and the presence of seagrass or other biological resources. If biological resources are present, dredging is contingent upon a permitted environmental mitigation plan and associated permit conditions. When seagrass resources are present, mitigation may include seagrass transplantation or planting to replace seagrass damaged by dredging operations. Permit conditions may include maintenance of the newly planted seagrass beds for up to five years.

3.1.1 Broward County Environmental Protection and Growth Management Department (BCEPGMD)

A canal maintenance dredging project requires an Environmental Resource License (ERL) from BCEPGMD. The department may provide a permit exemption for canal maintenance dredging projects meeting the following conditions: a) applicant can provide the original canal construction design drawings and specifications, b) applicant can demonstrate the proposed maintenance dredging project is in accordance to the original design specifications regarding depth and canal dredge limits, and c) applicant can demonstrate the proposed canal dredging project does not negatively impact wetland areas. The permit exemption conditions are listed in the Broward County Code of Ordinances Chapter 27-Pollution Control - Article XI: Aquatic and Wetland Resource Protection.

The typical permitting process through BCEPGMD takes four (4) to six (6) months depending on the project location, soil test sampling results and dredging methodology.

3.1.2 U.S. Army USACE of Engineers (USACE)

The USACE requires an Environmental Resource Permit (ERP) for all canal maintenance dredging projects. The typical USACE permitting process takes five (5) to seven (7) months depending on project location, soil test sampling results, proposed dredging methodology, and a determination if the dredged location affects threatened biological species, which typically may add three (3) to six (6) months to the overall permitting process duration. Presence of underwater biological resources can delay permitting even longer.

For all canal maintenance dredging projects, the USACE reviews the effects of the proposed project on endangered and threatened species as required under the Endangered Species Act (ESA). If the USACE determines there is sufficient cause for negative impacts, the USACE initiates consultation with the National Marine Fisheries Services (NMFS), Protected Resource Division (PRD) pursuant to the ESA for the listed species, including swimming sea turtle and Smalltooth sawfish. NMFS provides the USACE with a letter of concurrence allowing the USACE to move toward permit issuance or it can deny the permit.

The USACE may also determine that the proposed project can be permitted under a Regional General Permit, SAJ-05, which may cover work limited to existing residential canals in Florida. A residential canal is defined as a manmade waterway, historically dug from uplands, and surrounded on both sides by uplands adjacent to principally residential

property. If the USACE determines the project falls under the SAJ-05 permit and there are no environmental resources, the permitting process is typically three (3) to five (5) months.

3.1.3 Florida Department of Environmental Protection (FDEP)

The FDEP issues permits for projects proposed in State submerged lands or waterways. Historically, the City has applied for permits to the FDEP for outfall dredge projects discharging to State waterways such as the New River.

The FDEP requires an Environmental Resource Permit (ERP) for all maintenance dredging projects. Instate submerged lands the typical permitting process takes four (4) to six (6) months depending on project location, soil test sampling results, proposed dredging methodology, and a determination if the dredged location affects threatened species. Threatened species may add three (3) to six (6) months to the overall permit process.

The department may provide a permit exemption for maintenance dredging of existing manmade canals, channels, intake and discharge structures, and previously dredged portions of natural water bodies within drainage rights-of-way or drainage easements which have been recorded in the public records of the county under certain circumstances where the spoil material is to be removed and deposited on a self-contained, upland spoil site which will prevent the escape of the spoil material into the waters of the state, provided that no more dredging is to be performed than is necessary to restore the canals, channels, and intake and discharge structures, and previously dredged portions of natural water bodies, to original design specifications or configurations. Exemptions are provided where work is conducted in compliance with s. 379.2431(2)(d), provided that no significant impacts occur to previously undisturbed natural areas, and provided that control devices for return flow and best management practices for erosion and sediment control are utilized to prevent bank erosion and scouring and to prevent turbidity, dredged material, and toxic or deleterious substances from discharging into adjacent waters during maintenance dredging.

3.1.4 National Marine Fisheries Services (NMFS)

The NMFS reviews dredging applications forwarded by the USACE if the reviews the effects of the proposed project on endangered and threatened species as required under the Endangered Species Act (ESA). The coordination with NMFS is required to adhere with the ESA. NMFS does not have a defined time frame it is required to follow to provide the USACE with its findings. However, based on previous experience, NMFS has taken three (3) to six (6) months to provide its evaluation result and issue a letter of concurrence to USACE.

3.2 Environmental Mitigation

Environmental mitigation is a complex process. Essentially, it means that if natural resources or viable ecosystems are destroyed by dredging or other related construction activities, the ecological balance must be restored preferably nearby the project location. Regulatory agencies may permit "mitigation banks" for the restoration of wetlands or preserved habitats and use them as "mitigation credits" toward the development or construction in other areas.

Although mitigation is better than nothing, experts agree that whenever possible, it is best to protect and preserve already active, viable ecosystems. Therefore, permit agencies request avoidance of impacts rather than mitigation.

Section 4 – Citywide Canal Surveying & Evaluation

On February 18, 2014, the City Commission approved an initiative proposed by the City Public Works Department to conduct a citywide canal surveys and analysis to properly evaluate the canal dredging needs and alternative funding scenarios based on actual canal surveys and preliminary engineering evaluation.

4.1 Canals Surveyed in Fiscal Year 2015

The City survey team conducted canal surveys within City limits from February, 2014 through March, 2015. Out of the sixty five (65) miles of City canals surveyed, fifty one (51) miles or (78%) of the canal system were surveyed. The remaining fourteen (14) miles (22%) were not surveyed due to lack of funding. The canal surveys were performed by a two (2) man survey crew, utilizing a single beam scanner mounted to a small boat and navigating the canals on specific pathways to obtain the bottom elevations of the canals. Subsequently, the elevation data was loaded by a computer software (HYPAK) into a 3D computer-aided design (AutoCAD Civil 3D), which created a surface terrain model of the bottom of the canals. The model was reviewed by survey staff and sent to the engineering and CAD team to conduct canal dredging assessment, develop preliminary dredging plans, and provide engineering dredging evaluation of the canals surveyed.

Survey Boat Used for Topographic & Benthic Surveys (Picture 12)

Typical canal bottom survey contour elevations (Picture 13)

4.2 Engineering evaluation of canal dredging needs

The engineering team evaluated the canal survey results and determined which canals met the City's minimum dredging criteria, which is defined by dredging the center third of the width of a canal to be set at a minimum elevation of four (4) feet below Mean Low Water (MLW) to a maximum elevation of five (5) feet below MLW.

Typical canal preliminary engineering evaluation plan (Picture 14)

It is important to note that the canal dredging survey and engineering dredging assessment did not extend to docks or other private marine structures located along the sides of the canals, and the surveys started ten (10) feet away from seawalls in order to prevent undermining of seawall foundations. The only exception to the survey setbacks was for canal areas next to storm water drainage outfall pipes where surveying was performed as feasible.

A Geographic Information System (GIS) canal map database was created to serve as planning & design engineering tool to track completed canal surveying projects as well as needed canal dredging work. The survey maps and the canal drawings are design and construction documents which may be used for future dredge permitting because they depict the canal surveys and maintenance dredging over the years. Proper management of the GIS canal map database will allow the City to maintain proper records and apply for less rigorous canal maintenance dredging permit(s).

4.3 Title Search for Canals not surveyed During FY2015

Staff researched the ownership of the waterways within City boundaries through information obtained from the Broward County Property Appraiser database. The purpose of the search is to identify possible canal maintenance responsibilities by home owner associations (HOAs) or other canal owners. Additional title search and data analysis is recommended during the first year of the proposed canal dredging master plan.

A GIS waterway ownership map was prepared to identify which canals are owned by City or by other entities, including Broward County, South Florida Water Management District (SFWMD), Florida Department of Transportation (FDOT), the State (EDEP), home owner associations (HOA), or corporations. Please refer to the waterway ownership map in the appendix section of this report for the location of the canals owned by others.

4.4 Canal GIS Mapping

A new GIS waterway database was created based on the canal surveys and engineering evaluation. The following list identifies the available maps created which are in the Appendix of this report:

1. Waterways Identification Map (Name and Canal ID) --The waterways map illustrates the canal identification number (Section-Township-Range-Canal ID) and named canals. Un-named canals are identified by the canal ID numbers only. (Appendix 1 Map 1)
2. Canals Survey Map (historical surveys performed on each canal) -- The waterways survey map identifies which canals were surveyed and the year the survey was performed. It also indicates the canals which have not been surveyed as of August 2015. (Appendix 1 Map 2)

3. Waterways Ownership Map -- The waterways ownership map was based on information obtained from the Broward County Property Appraiser, denoting canals belonging to a) City, b) Broward County, c) (SFWMD), FDOT, FDEP state waterways, and private owners (HOAs). (Appendix 1 Map 3).
4. Waterways Classification Map -- The classification map shows the location of low-fixed bridges which restrict the navigation of boats in a particular. The classification map (Appendix 1 Map 4) indicates the following types of canals:

    - Navigable canals - canals not restricted by low fixed bridges
    - Restricted navigation canals - canals restricted by low fixed bridges
    - Drainage canals, lakes and drainage culverts - canals used for drainage purposes only.

5. Evaluation Map -- The waterways evaluation map shows the surveying waterways and engineering evaluation effort conducted during FY 2015 for the entire waterway system within City's boundaries regardless of ownership. It denotes which canals need dredging and which ones are deep enough for navigation purposes based on the City's canal depth cross section. (Appendix 1 Map 5)
6. City-Owned Canals Evaluation Map -- The City-owned canal evaluation map focuses on the evaluation of City-owned canals for dredging needs. (Appendix 1 Map 6)

Section 5 - Canal Dredging Assessment Results

Staff conducted survey and evaluation of dredging needs for fifty one (51) miles (78%) of the sixty five (65) miles of canals within the City limits, excluding Rivers and Intercostal waterways. The remaining fourteen (14) miles (22%) were not surveyed due to lack of funding.

The following table summarizes the City-owned canal dredging assessment results:

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TABLE 1
2015 CITYWIDE CANAL DREDGING ASSESSMENT RESULTS FOR CITY CANALS

DESCRIPTION	NUMBER OF CANAL MILES	NUMBER OF CANALS	PERCENTAGE OF TOTAL CITY CANALS	PROPERTY FRONTAGE (MILES) dredge length xxx	DREDGE VOLUME (CY)
Canals with immediate dredging needs	10	45	15%	9	13,135
Canals Deep Enough (No dredging required)	41	152	63%	77.37	0
Canals not yet evaluated as of March 2015- (Evaluation planned for FY 2016, pending CIP budget approval) [1]	14	63	22%	TBD	TBD
Totals	65	260	100%		

Footnotes: 1. The 14 miles of canals not evaluated on FY 2015 include 8 miles of navigable canals and 6 miles of drainage canals.

COMPREHENSIVE CANAL ASSESSMENT SNAP SHOT

Unknown dredge needs:
8 miles (navigable)
+ 6 miles (drainage)
= 14 miles (of un-surveyed canals)

Unknown dredge forecast:

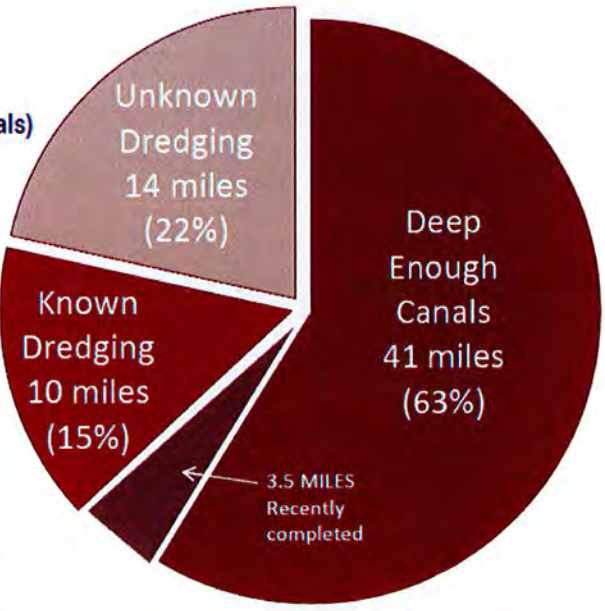
- 40% (5.6 miles) will need dredging
- Survey Cost: $0.50 M
- Design & permit: $0.50 M
- Const. Cost: $2.24 M

$3.24 M

Known dredging needs:
10 miles (navigable)

- Design & Permit: $1.01 M
- Const. Cost: $3.73 M

$4.74 M



Total cost of master plan (forecast of unknown + known dredge needs) = $3.24 M + $4.74 = $8.0 M (Rounded)

(Appendix 2, Figure 2)

The snap shot shown above summarizes the City's 2015 canal assessment and it describes the known dredging needs (10 miles) and costs as well as the forecasted needs and costs for the14 miles of canals that are un-surveyed.

Concurrently with the pie chart shown above, staff analyzed past and future canal dredging needs with the purpose of summarizing the completed & pending dredging work. See next page for past & future canal dredge work (Appendix 2, Figure 3):

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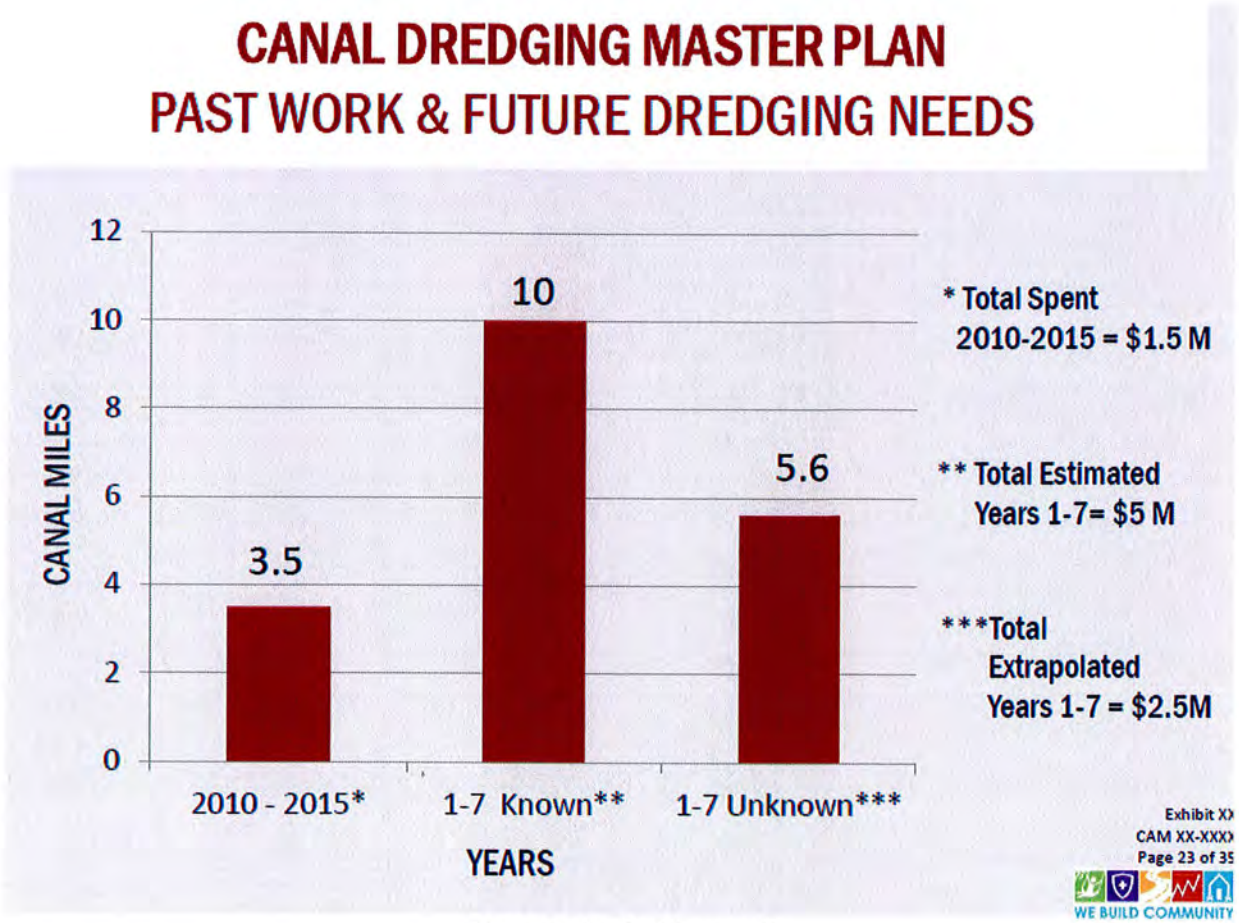

(Appendix 2, Figure 3)

By comparing the past dredging work to the known dredging needs for the following seven (7) years, the City will need to dredge almost 3 times more than what was dredged during the last 5 years (2010 – 2015). The projected work with known dredging needs is approximately 10 miles, and it is estimated that 40% of the canals not yet surveyed will require dredging work as well (about 5.6 miles).

5.1 Canal Maintenance Dredging Master Plan

The Engineering team mapped the location of the canals with immediate dredging needs and considered the following factors in order to prioritize and arrange dredging projects for the annual canal dredging master plan:

- Canal condition - magnitude of dredging need
- Canal dredging complaints
- Canal location and constructability logistics (dredging location, uploading, spoil sediment drying beds, and hauling and disposing to landfill site)
- Funding base rate of approximately $1.1 million per year

Based on the above factors and the results obtained from the assessment of the canals, two canal dredging master plan options were developed. Both options take into consideration a 2% per year cost inflation factor and a staff hourly rate of $146 per hour for planning, consultant management, and construction management services.

The canal dredging master plan options 1 & 2 include a 7-year maintenance cycle after all immediate dredging needs are met, including dredging of canal areas near stormwater outfalls. The importance of clearing and dredging drainage and non-navigable canals cannot be overstated since drainage canals are a major component to the stormwater conveyance system of the City. Therefore, the second 7-year maintenance cycle would require survey re-evaluation of the canals. A maintenance cycle and projection plan forecast analysis may be conducted when the additional canal survey data and tittle search analysis is conducted and evaluated.

The two canal dredging master plan options can be found in Appendix 3 Tables, Tables 6, 7, & 8.

5.1.1 Canal Maintenance Dredging Master Plan Option 1

Develop a 10-year canal dredging master plan by designing and constructing projects in an annual basis.

1. Budgets approximately $1.1 million dollars per year.
2. It is limited to the design, permitting and construction of projects as allowed by an annual budget and permit restrictions.
3. Design and permitting is expected to be done by civil and environmental engineering continuing consultants.
4. The construction phase would start after all permits are obtained for each of the proposed annual project(s).
5. Construction management and inspection services are proposed to be done by City engineering staff.

5.1.2 Canal Maintenance Dredging Master Plan Option 2

Develop a 7-year dredging plan consisting of designing of all the projects first and bidding out the construction of all projects when permits are obtained.

1. Bundles design of all immediate canal dredging needs during the first two years of the canal dredging master plan.
2. Permitting to be done during the first two years. It shall be noted that permits for canal dredging projects usually are issued for a five (5) year span with the possibility of requesting 1-Yr. permits extension(s) if needed.
3. Construction phase(s) to be done after second year depending on budget availability.
4. If design is going to be consulted out, option 2 would require procuring a consultant for all design dredging work through the Consultant's Competitive Negotiation Act (CCNA) since the projected design fee is estimated over $200,000.
5. If construction is going to be bid out, option 2 would also require a RFP for the construction of work if the construction cost exceeds the $2 million dollars.
6. Option 2 includes a seven (7) year maintenance cycle after dredging all canals with known immediate dredging needs, including dredging of canal areas near stormwater outfalls. Therefore, the second seven (7) year maintenance cycle would require survey re-evaluation of the canals. A maintenance cycle and

would require survey re-evaluation of the canals. A maintenance cycle and projection plan forecast analysis may be conducted when the additional canal survey data and tittle search analysis is conducted and evaluated.

The main difference between the two master plan options is that option 2 bundles all designs of the canals with known dredging needs during the first two (2) years of the master plan rather than in an annual basis.

The canal dredging master plan Option 2 is recommended since the City can benefit from economies of scale by obtaining all permits necessary to conduct the dredging construction phase and plan mobilization, hauling, drying of sediments and final disposal of sediments in a more efficient manner. Therefore, option 2 canal dredging master plan was selected to move forward with the canal dredging master plan financial assessment.

5.2 Construction Phase Alternatives

The engineering team compared two alternatives for conducting construction of the canal maintenance dredging:

1) Bidding out construction and select one or more dredging contractors
2) Create an in-house canal dredging utility group that will have the equipment and labor force necessary to conduct annual canal maintenance dredging projects.

5.2.1 Dredging by Contractor(s)

During fiscal year 2015, the canal dredging construction work was performed by annual dredging contractors. A total of four (4) task orders were authorized to dredge 18 canals throughout the City, varying in complexity and dredging quantities. An evaluation of the actual cost per CY of dredged material of the four task orders revealed that City paid approximately $200/CY of material dredged. This cost includes hauling the dredged material to a permitted drying area located at the City's compost facility on SR 441 south of I-595. After spoil material is dried, it was hauled and disposed at the Waste Management Monarch Hill landfill site located at Wiles Road and Powerline Road in the City of Coconut Creek. Although, the cost for future projects may increase due unforeseen conditions (soil material, staging of equipment, presence of seagrass, mitigation costs, etc.), for the purpose of this report, the $200/CY unit price was used as basis of comparison to the cost of dredging utilizing an in-house City utility group.

5.2.2 Dredging by City Dredging Utility Group

The most efficient use for in-house dredging operations is when all labor and equipment is 100% utilized, allowing for normal maintenance and avoiding overtime costs. If the City were to dredge the canals, the optimal dredging work load will be 250 days of dredging activity per year or 2,500 CY of material removed annually. Any volume lower than this would under-utilize the city resources; conversely, any volume larger than this would cost the City in overtime.

The canal dredging summary table for immediate dredging needs (Appendix 3, Table 8) shows that the projected annual dredging activity fluctuates between 1,549 CY to 3,898 CY with an average of 2,496 CY during a five (5) to six (6) year span. Based on this data, there is sufficient dredging work to maintain a City crew efficiently working for approximately 5-6

years from the moment all permits are obtained for the dredging work, assuming an annual material removal rate between 1,750 CY – 2,000 CY per year. However, since dredging construction operations can only start from the date permits are obtained, and permit issuance is determined by environmental factors such as presence of seagrass and other biological resources varying yearly, it is unknown at the present time if the projected construction work load supports the creation of an in-house dredging utility group.

Additional canal dredging forecast analysis may be conducted when the additional canal survey data and title search analysis is evaluated. The additional survey data and title search analysis is pending funding approval in FY 2016 for evaluating the 14 miles of canals not evaluated during FY 2015.

A comparison of the two construction alternatives is shown in Table 2 (See next page).

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TABLE 2 CANAL DREDGING CONSTRUCTION ALTERNATIVES COMPARISON CITY IN-HOUSE UTILITY GROUP VERSUS CONTRACTOR		
DESCRIPTION	**BY CITY CREWS**	**BY CONTRACTOR**
When could dredging construction start?	When permits are obtained, and City utility dredging crew is formed	When permits are obtained, and contract is awarded
How much work is estimated for immediate dredging needs?	Approx. 13,500 CY	Approx. 13,500 CY
How many years of work are estimated for immediate dredging needs?	5 to 6 years, pending funding availability	Depends on number of contractors and funding availability
How much work is estimated AFTER immediate dredging needs?	To be determined. It depends on additional canal survey and tittle search analysis of not surveyed canals and the five year canal maintenance dredging cycle analysis.	To be determined. It depends on additional canal survey and tittle search analysis of not surveyed canals and the five year canal maintenance dredging cycle analysis.
What is the yearly cost to the City if dredge work stopped due to permitting or other reason?	Approx. $399,000/yr. for labor and equipment (see breakdown on table next page)	Minimum cost to City, pending contract specifications.

The preliminary cost estimate for forming a City dredging utility group, including equipment and labor cost is summarized in Table 3 (see next page).

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TABLE 3

SUMMARY TABLE
EQUIPMENT AND LABOR COST FOR CITY DREDGING UTILITY

EQUIPMENT COST

- Mechanical Dredge $100,000
- Mechanical Barge $ 75,000
- Hydraulic Dredge $125,000
- Hydraulic Barge $ 65,000
- 5' Turbidity Curtain at $400/ea. Approx. 200) $ 20,000
- Loader $ 75,000

$ 460,000 (One Time expense)

- Equipment yearly maintenance cost (15%) $ 69,000 (Est. Yr. Cost)
- Replacement cost $ 50,000 (Est. Yr. Cost)
- Total equip. cost for first 6 years ($460,000 + $69,000 * 5 years)..... $ 805,000 (Est. 6 Yr. cost)

DIRECT LABOR COST

- 3 to 4 person crew needed (PADI & Manatee observer certifications required $70,000/ea./yr. assume 4 men crew)
- Yearly Labor Cost (assume 4 person)..... $ 280,000 (Yearly Cost)
- Total Labor cost for first 6 years (4 person @ $70,000/yr. * 6 Years)..... $ 1,680,000 (6 Yr. cost)

TOTAL COSTS

- First year (Equipment).....$ 460,000
- Yearly cost after first year (Labor & Equipment)..... $ 399,000 (Yearly Cost)
- Total cost for 6 years of dredging operation.....$2,485,000 (6 Yr. cost)

- Projected dredging construction cost by In-house... ($2,485,000/13,135 CY of estimated dredge material)..... $189/CY (+/-15% contingency)

From a contractor's perspective, the optimal volume dredged per year equals the average volume requested annually to ensure the availability of long-term work.

The option of having a city dredging utility should be further analyzed when all the canals have been evaluated. However, based on the evaluation of the immediate canal dredging needs and the projected costs per CY of dredge material, it is estimated that there will be sufficient dredging work for an in-house city dredging utility group for a period of five (5) to six (6) years at the approximate rate of 2,225 CY per year. Periodically, additional

evaluation of the resource and crews' idle time shall be completed to determine if an in-house crew is a viable and economically sound option to conduct canal maintenance dredging work.

Section 6 - Summary of the Financial Assessment and Funding Alternatives

The 2015 City Commission Annual Action Plan for canal dredging requires evaluating funding mechanisms (assessment fees or taxing districts) for the City of Fort Lauderdale canal dredging program.

Staff considered a variety of funding mechanisms including dockage fees, dock tax, boater fees stormwater fees, tire disposal fees, grants, assessments, taxing districts, and millage adjustment. Mechanisms that were simple to implement were selected for more detailed analysis.

6.1 Current Funding Mechanism

Historically, most canal maintenance dredging work has been funded from the general fund. Current dredging projects are funded from the general fund or from stormwater fund 472 and 470. In addition, on October 2014, the City received a FDEP legislative grant in the amount of $150,000 for partial funding the FY 2014 Lauderdale Isles canal dredging project.

6.2 Comparison of Municipal Funding Mechanisms

The following table illustrates a comparison of dredging practices and funding mechanisms between the City of Fort Lauderdale and other Florida coastal municipalities.

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TABLE 4
DREDGING PRACTICES AND FUNDING MECHANISMS BETWEEN THE CITY OF FORT LAUDERDALE AND OTHER FLORIDA COASTAL MUNICIPALITIES

ITEM	FORT LAUDERDALE	FORT PIERCE	POMPANO	LIGHT HOUSE POINT	MIAMI BEACH, DEERFIELD, NORTH MIAMI, BOCA
SIMILAR DREDGING CRITERIA	X	X	X	X	X
USE GENERAL FUND	X	X	X	X	X
DREDGE APPROACH ON A CASE BY CASE BASIS	X	X	X	X	X

And,

ITEM	FORT LAUDER-DALE	NAPLES	ST. PETERS-BURG	TAMPA	JACKSON-VILLE	PUNTA GORDA
SPECIAL ASSESSMENTS		X	X		X	X
TAXING DREDGING DISTRICTS		X			X	X
FUNDING ASSISTANCE THROUGH WATER DISTRICT				X		

The X mark denotes in the table above denotes the municipality (shown in columns to the right) that utilizes the item described on the first column. From the above table, the following information is segregated from the following Cities:

City of Naples

Naples conducts dredging by phases on a monitored basis. Additionally, property owners are given the option to have their dock area dredged while the dredging contractor is in

their area. Some areas have localized taxing dredging districts with dredging projects paid by special assessments.

City of St. Petersburg

The City of St. Petersburg council adopted a resolution to distinguish arterial waterways from local waterways. As a result, payment is made through a special assessment district process for local waterways. The special assessment requires 51% of the abutting property owners expressing interest by signature.

City of Tampa

The City of Tampa identified economies of scale in the upfront costs (engineering and mobilization) and the back-end costs (dredging and disposal costs). Therefore, the city consolidated the dredging needs of the entire navigable canal system into one project. This was in part possible due to grant funding. Currently, the city does not have a long-term maintenance program in place.

City of Punta Gorda

Dredging needs are initiated by citizens' complaints, and the City has a maintenance program that addresses several canal maintenance needs: a) canal dredging maintenance, dock dredging maintenance, and canal seawall maintenance. The program is partially paid from Municipal Service Benefit Unit ((MSBU) or separate taxing districts. It is recommended that further analysis of the financial components of such program be conducted during the first year of the master plan to identify potential benefits for the City of Fort Lauderdale.

6.3 Grants and Joint Participation Agreements Opportunities

City staff contacted representatives of the following agencies (summarized in Table 5) to seek funding opportunities, grants, or participation agreements for canal maintenance dredging work:

TABLE 5
SUMMARY OF ALTERNATIVE FUNDING OPPORTUNITIES FOR CANAL MAINTENANCE DREDGING

AGENCY	GRANT	AGREEMENT
Florida Department of Environmental Protection	Legislative grants are available and may contribute to fund future projects. City obtained a $150K grant on Oct. 2014 for $311K project construction cost.	N/A (Not Available)
Broward County Boater Improvement Trust Fund	N/A	Not available for dredging; unless, the project is a public marina and dredging is incidental work only.

Florida Inland Navigation District	N/A. Grants available for Intra Coastal waterway and natural water bodies only	N/A
U.S. Army Corps of Engineers	N/A– only funds federal projects	N/A
South Florida Water Management District	Not Available. Cooperative Funding program may only contribute for pollution control vaults.	N/A
Florida Department of Transportation	N/A	TBD. City shall present project scope and estimates to request FDOT evaluation of JPA agreement.
Broward County Highway and Bridge Maintenance Division	N/A	TBD. City shall present project scope and estimates to request County evaluation of JPA agreement.

6.4 Financial Assessment

The cost to the City for immediate canal dredging needs is estimated at approximately $8 million dollars for the first 7-Year dredging cycle. The forecasted cost of the second 7-Year cycle is $5 million and involves re-survey, design, permitting, and construction. The following table summarizes the estimated costs of the master plan.

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TABLE 6

CANAL DREDGING MASTER PLAN: FINANCIAL SUMMARY

Year	Description	Cost
1	Survey canals of unknown dredge needs	$0.50 M
1	Design & permit of known dredge needs	$1.01 M
2	Design & permit unknown needs	$0.50 M
3 - 7	Construction: known ($3.72 M) & unknown ($2.24 M)	$5.96 M
	TOTAL 7-YEAR MASTER PLAN	$8.0 M* (Rounded)

* Footnote: 7-Year Master Plan yearly cost = $1.14 2 Million per Year.

Based on the initial cost estimate of $8 million for the first 7-year cycle, City staff prepared funding options for the canal dredging program. The funding options are summarized in three categories:

1) Increasing the tax millage rate for all City properties
2) Levying special dredging assessments to neighborhoods
3) Creating special taxing districts

6.5 Funding by Increasing Tax Millage Rate

This funding option applies to all 54,606 taxable properties within City limits. This excludes churches and government properties exempt from property tax. The funding option has the following pros and cons as illustrated by the following table.

INCREASE TAX MILLAGE RATE

PROS:

- Lowest cost per property
- No direct benefit needs to be demonstrated
- It can be used for repetitive dredging needs
- Fewer complaints expected

CONS:

- Applies to all taxable properties in City
- Political opposition by non-canal users
- Millage rate changes

(Appendix 2 Figure 4)

The preliminary calculation of utilizing this funding option reveals that in order to raise $8 million for the first 7-Year dredging cycle of the master plan, an increase in millage rate of 0.0530 will be necessary. The FY2015 City millage rate is 4.1193, so if the millage rate was approved, it would be to 4.1630. Although increasing the tax millage rate is an available mechanism, the City Commission is not considering raising taxes for FY 2016.

6.6 Funding by Levying Special Dredging Assessments

Levying special dredging assessments is a current funding practice used by other Florida coastal municipalities such as City of Naples, City of St. Petersburg, Jacksonville, and City of Punta Gorda. A special assessment requires that a direct benefit be established of the properties assessed for a particular dredging project. Use of the assessment funding mechanism would divide the cost of work solely for those properties affected as one lump sum amount or divided in annual payments. The following table summarizes the pros and cons of this funding option:

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ASSESSMENTS

PROS:	CONS:
• Tailored to a specific group • Benefited parties are easy to identify • May assess government and other non-taxable properties	• Higher cost per property than taxing option • Applies to cost of known work only • A direct benefit must be demonstrated • Collection method more complicated; includes property liens to violators • Financial consultant defines appropriations methodology • Lengthy process • Public hearings/mailing required by Florida statute

(Appendix 2 Figure 5)

6.7 Funding by Creating Dredging Taxing Districts

Creating special dredging taxing districts is a current funding practice used by other Florida coastal municipalities such as City of Naples, Jacksonville, and City of Punta Gorda. This funding option selects a neighborhood or group of neighborhoods and designates a dredging taxing district. The main difference to levying dredging assessments is that taxing districts does not require demonstration of a direct benefit between the properties affected and the dredging work. Taxing districts would allow canal sanitation costs to be incorporated in the budget, so additional analysis by a financial consultant is recommended in the proposed master plan.

This funding option has the pros and cons are illustrated in the following table:

(Remainder of this page left blank intentionally)

TAXING DISTRICTS

PROS:

- A direct benefit does not need to be demonstrated
- Can be tailored to specific neighborhoods or areas
- It can be used for repetitive dredging needs
- Canal sanitation costs can be included
- Simplification of collection of fees

CONS:

- Higher cost per property when compared to tax millage rate option

(Appendix 2 Figure 6)

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Section 7 - Recommendations

The following recommendations are hereby made to plan the canal dredging master plan for the City of Fort Lauderdale based on the completed canal dredging assessment during FY 2015:

1. City shall perform canal surveys and assessment of the remaining canals not surveyed during FY 2015 (Year 1 of the proposed master plan).

2. City shall fund a rate study by a financial consultant to make recommendations for specific funding mechanism, assessment rate or fee, and implementation process. The estimated cost is $60,000 ($60,000 of unused funds are expected to rollover from 2015 CIP for this task).

3. City shall budget for the design and environmental permitting of known dredging needs (Year 2 and 3 of the proposed master plan)

4. City shall fund for construction of dredging projects (Years 3 to 7 of the proposed master plan).

5. City shall conduct canal maintenance dredging design work by engineering and environmental consultants and use dredging contractors for construction rather than by creating an in-house dredging utility group.

Section 8 - Strategic Connections

This item is a Press Play Fort Lauderdale Strategic Plan 2018 initiative, included within the Infrastructure Cylinder of Excellence, specifically advancing:

Goal 2: Be a sustainable and resilient community.
Objective 1: Proactively maintain our water, wastewater, and road and bridge infrastructure.
Strategic Initiative 3: Conduct an analysis of canal dredging needs and examine funding scenarios

FY 2015 Commission Priority Initiative:
Comprehensive Canal Dredging Master Plan (Vision Idea #72)

This item advances the Fast Forward Fort Lauderdale 2035 Vision Plan: We Are Ready

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Section 9 - Appendix

Appendix 1: Maps

1. Waterways Identification Map
2. Canals Survey Map
3. Waterways Ownership Map
4. Waterways Classification Map
5. Evaluation Map
6. City-Owned Canals Evaluation Map

Appendix 2: Figures

1. Typical Canal Maintenance Dredging Cross Section
2. Comprehensive Canal Assessment
3. Canal Dredging Master Plan: Past Work & Future Dredging Needs
4. Increase Tax Millage Rate
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6. Taxing Districts

Appendix 3: Tables

1. 2015 Citywide Canal Dredging Assessment Results for City Canals
2. Canal Dredging Construction Alternatives Comparison City In-house Utility Group Versus Contractor
3. Summary Table: Equipment and Labor Cost For City Dredging Utility
4. Dredging Practices and Funding Mechanisms Between the City of Fort Lauderdale and Other Florida Coastal Municipalities
5. Summary of Funding Opportunities For Canal maintenance Dredging
6. Canal Dredging Master Plan: Financial Summary
7. Canal Dredging Master Plan: Option 1
8. Canal Dredging Master Plan: Option 2
9. Canal Dredging Summary Table for immediate dredging needs

Appendix 4: Picture Locations

Picture 1: Rio Aragon – Lauderdale Isles Canals
Picture 2: Rio Aragon – Lauderdale Isles Canals
Picture 3: Barracuda Canal – Lauderdale Isles Canals
Picture 4 Dolphin Canal – Lauderdale Isles Canals
Picture 6: Dolphin Canal – Lauderdale Isles Canals
Picture 7: Lauderdale Isles Park – Boat Ramp at SR 441/ N. Fork of New River
Picture 8: Lauderdale Isles Park – Boat Ramp at SR 441/ N. Fork of New River
Picture 9: City of Fort Lauderdale's compost facility -4300 State Road 7, City of Dania
Picture 10: City of Fort Lauderdale's compost facility - 4300 State Road 7, City of Dani

Picture 11: City of Fort Lauderdale's compost facility –4300 State Road 7, City of Dania
Picture 12: Class I landfill site – 2700 Wiles Rd, Coconut Creek, FL 33073
Picture 13: Cooley's Landing Park
Picture 14: Turtle Canal – Lauderdale Canal Isles

Appendix 5: Canal Dredging Master Plan PowerPoint Presentation

Section 10 – Acknowledgments

This report is a product of a 1-year community investment project performed by various City Departments. Significant contributions to the report were obtained from staff listed below:

- Hardeep Anand, PE, Public Works Director
- Pedram Zohrevand, P.E, Assistant City Engineer
- Annalise Mannix, PE, Senior Project Manager
- Michael Donaldson, PSM, City Surveyor
- Survey Crews
- John Stahl, GIS Coordinator
- Johnathan Luscomb, Supervisor of Marine Facilities
- Elkin Diaz, P.E., Project Manager
- Craig Barrett, Engineering Cad Coordinator
- Wayne Darby, Engineering Cad Technician
- Alison Canizares, Engineering Cad Technician
- Baret Hazell, Engineering Cad Technician
- Kym Holcombe, Finance Administration Assistant II
- Susan LaSage, Financial Administrator
- Laura Reece, Assistant Manager of CIP/Grants

APPENDIX SECTION

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Appendix 4: Picture Locations

2.2.1 Mechanical Dredging Excavation Method
2.2.2 Hydraulic Dredging Excavation Method
2.2.3 Disposal of dredged material
4.1 Canals surveyed in FY 2015
4.2 Engineering evaluation of canal dredging needs

Appendix 5: Canal Dredging Master Plan PowerPoint Presentation

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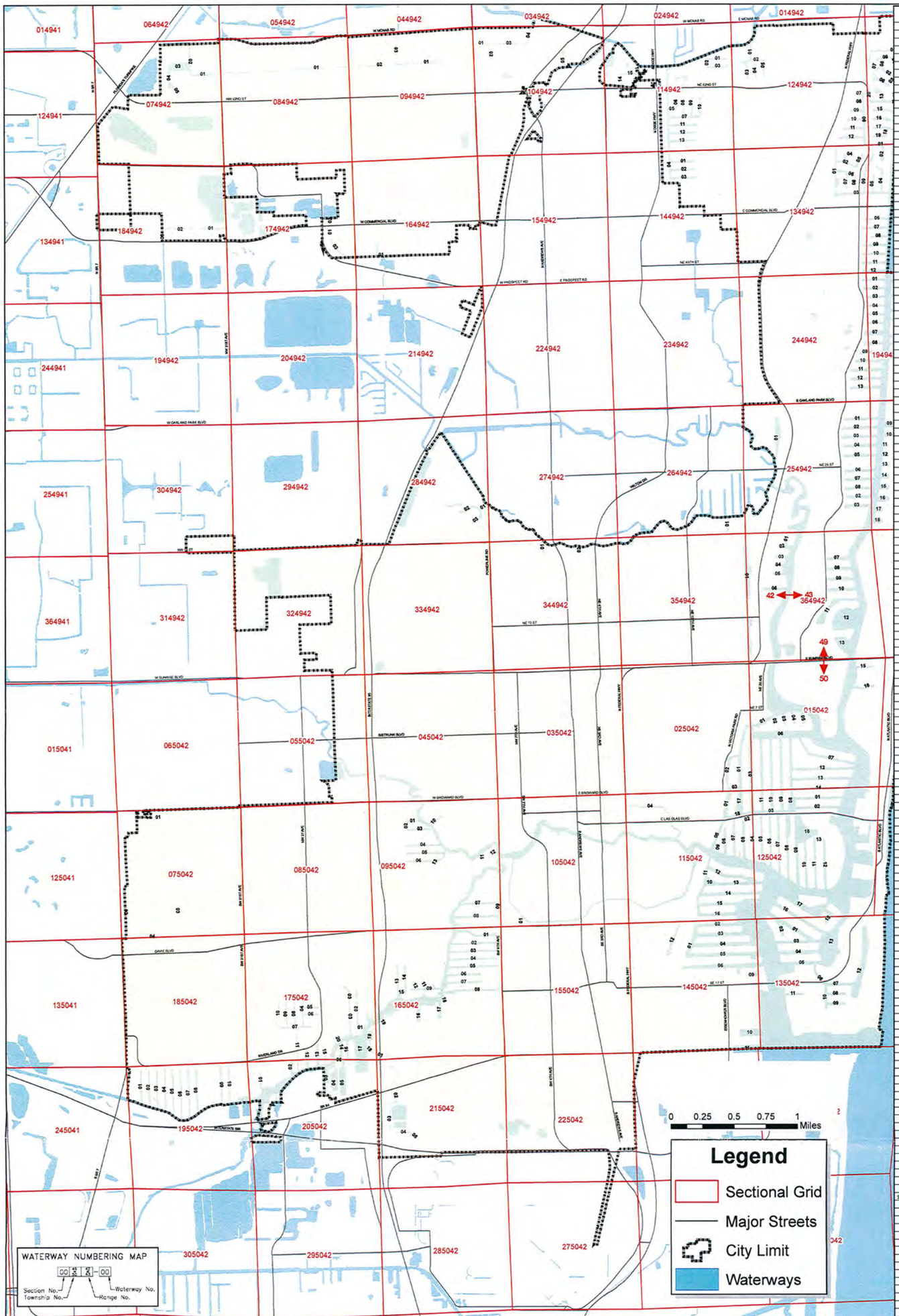

Canal Name	Canal ID
ADMIRALTY PASSAGE	184943-04
ALBACORE CANAL	195042-10
ANTIGUA PASSAGE	134942-08
ANTIGUA PASSAGE	134942-06
BARACUDA CANAL	195042-09
BARBARA RIVER	135042-09
BAYVIEW INLET	074943-19
BENTONO CANAL	115042-07
BIRDS BAY	184943-02
BLUEFISH CANAL	165042-06
BLUEFISH CANAL	195042-06
BLUEGILL CANAL	165042-04
BONITA BAY	304943-17
BOUNTY CHANNEL	134942-09
BRUSSELS WATERWAY	304943-06
BUCCANEER COVE	074943-14
BUCKINGHAM COVE	124942-03
BULLFISH CANAL	165042-03
CARLOTTA RIVER	145042-04
CERO BAY	304943-15
CERRO GORDO CANAL	145042-01
CERRO GORDO RIVER	145042-02
CERRO GORDO RIVER	145042-05
CHARTER PASSAGE	074943-16
CLIFF LAKE	145042-12
COBIA CANAL	195042-08
COMPASS WATERWAY	074943-17
CORAL BAY	364942-13
CORDELIA RIVER	135042-01
CREVALLE CANAL	165042-08
DAVOCK BAY	125042-17A
DAVOCK BAY	125042-17B
DIANE RIVER	135042-03
DOLPHIN CANAL	165042-07
DOLPHIN CANAL	195042-07
DOLPHIN COVE	134942-03
DOLPHIN COVE	134942-04
DOLPHIN LAKE	304943-14
ELIZABETH CANAL	125042-15
EMPRESS WAY	124942-04
ESTELLE RIVER	125042-16
GENEVA WATERWAY	254942-02
GLABRA VILLEA WATERWAY	015042-09
GRACE RIVER	135042-08
GRAND CANAL	205042-01
GRANDE CANAL	115042-08
HIMMARSHEE CANAL	115043-04
IMPERIAL WATERWAY	124942-01
JIB COVE	134942-07
KAREN CANAL	015042-01
KAREN CANAL	025042-01
KINGFISH CANAL	165042-02
LAGO KAREN	115042-17
LAKE ALBACORE	304943-16
LAKE CREVALLE	304943-18
LAKE JUANITA	115042-10
LAKE MELVA	354942-01
LAKE STRANAHAN	025042-02
LANDINGS INLET SOUTH	184943-03
LE HARVE WATERWAY	184943-08
LIDO CANAL	125042-05
LONGBOAT INLET	184943-01
LUCILLE RIVER	135042-04
LUNA CANAL	125042-06
MAINSAIL WATERWAY	184943-05
MARCHETA RIVER	145042-03
MARIETTA RIVER	135042-10
MARION RIVER	135042-06
MARION RIVER	135042-07
MARLIN BAY	304943-10
MARLIN CANAL	195042-05
MAYAN LAKE	135043-12
MERCEDES RIVER	135042-05
MOLA CANAL	115042-06
MONARCH WAY	074943-15
NASSAU CANAL	135042-11
NICE WATERWAY	304943-07
ORIENTE CANAL	125042-08
OSCEOLA CANAL	215042-01
POMPANO BAY	304943-12
POMPANO CANAL	195042-04
RIO ALCAZAR	115042-12
RIO ARAGON	015042-14
RIO AZUL CANAL	364942-08
RIO BALBOA	015042-08
RIO BARCELONA	015042-06
RIO BELL	114942-06
RIO BLANCO CANAL	364942-09
RIO BURKE	114942-07
RIO BURKE	114942-10
RIO CANNES	194943-16
RIO CARMENA	115042-15
RIO CARRICO	194943-24
RIO CASTILLA	125042-01
RIO CATHERINE	194943-07
RIO CERVANTES	015042-11
RIO CHALMONT	194943-18
RIO CHILDERS	144943-02
RIO CORAL	125042-10
RIO CORDOVA	115042-11
RIO CORDOVA	115042-16
RIO DE SOTA	015042-07
RIO DEL MAR	125042-02
RIO DOROTHY	194943-10
RIO EDNA	194943-19
RIO ENCARNADO CANAL	364942-10
RIO FLORENCE	194943-11
RIO GIRALDO	015042-12
RIO GORE	194943-22
RIO GRANADA	115042-14
RIO GRANDE	115043-03
RIO HORTT	194943-21
RIO IDLEWYLD	125042-12
RIO JOHNS	114942-13
RIO JULIA	304943-04
RIO KINNEY	304943-02
RIO KNIGHT	144942-03
RIO LE MARNE	194943-14
RIO LENORA	304943-05
RIO LORENA	304943-03
RIO MARSEILLE	194943-15
RIO MARY RITA	194943-09
RIO NAOMI	194943-13
RIO NAVARRO	025042-03
RIO NAVARRO	115042-01
RIO ODA	194943-08
RIO PLACID	125042-11
RIO REYNOLDS	114942-12
RIO ROSS	144942-01
RIO RUSSEL	114942-11
RIO SALVINO	114942-08
RIO SAXON	114942-09
RIO TERESE	194943-12
RIO TOLEDO	015042-13
RIO TRANQUILLO	175042-13
RIO VALENCIA	115042-13
RIO VERDE CANAL	364942-07
RIO WEILDING	304943-01
RIVA CANAL	115042-09
ROCKFISH CANAL	195042-03
SAIL FISH LAKE	304943-09
SAILFISH CANAL	165042-05
SAILFISH CANAL	195042-02
SAN MARCO CANAL	125042-04
SEABREEZE CANAL	015042-15
SEMINOLE LAKE	364942-11
SEMINOLE RIVER	145042-06
SLIP 1	145042-11
SLIP 2	145042-10
SNOOK BAY	304943-11
SOSPIRO CANAL	115042-05
SOUTH FORK CYPRESS WATERWAY	114942-04
SOVEREIGN PASSAGE	124942-02
SPECTA VILLEA WATERWAY	015042-10
SUNSET CANAL	125042-09
SUNSET LAKE	125042-18
SURREY INLET	124942-05
SYLVAN LAKE	135042-13
TARPON BAY	304943-13
TARPON RIVER CANAL	105042-01
TOULON WATERWAY	194943-17
TRIESTE WATERWAY	254942-03
TURTLE CANAL	195042-01
VENEZIA CANAL	125042-07
WELCOME PASSAGE	134942-01
WINDJAMMER WAY	134942-02
WINDJAMMER WAY	134942-05

CITY OF FORT LAUDERDALE

WATERWAYS IDENTIFICATION MAP

APPENDIX 1
MAP 1
JULY 17, 2015

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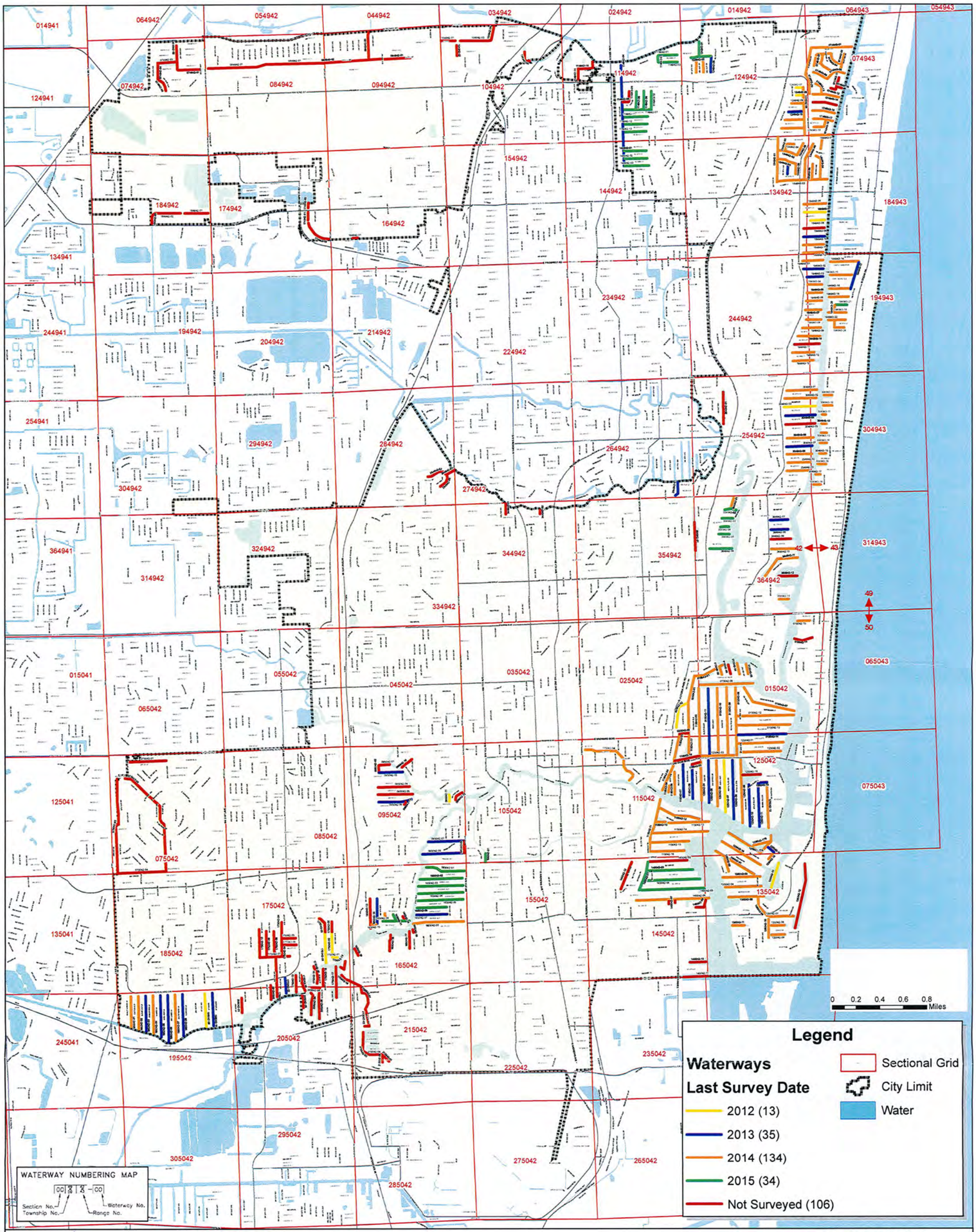
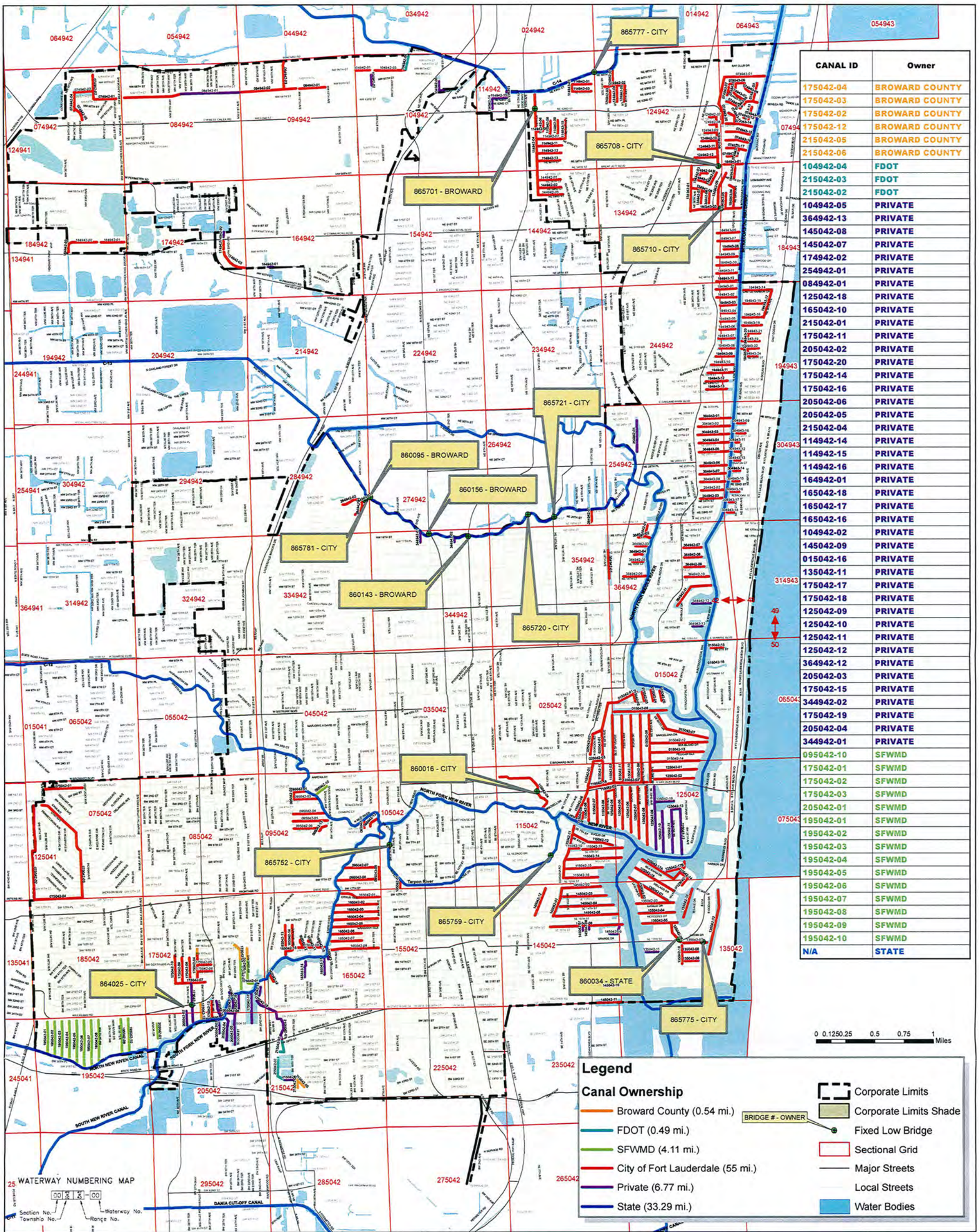


CITY OF FORT LAUDERDALE

CANAL SURVEY MAP

APPENDIX 1
MAP 2
JULY 17, 2015

Z:\GIS\Canals\MAPS\MXD\Evaluation\CFL Canal Survey Dates.mxd WD Reference Source: City Survey Records



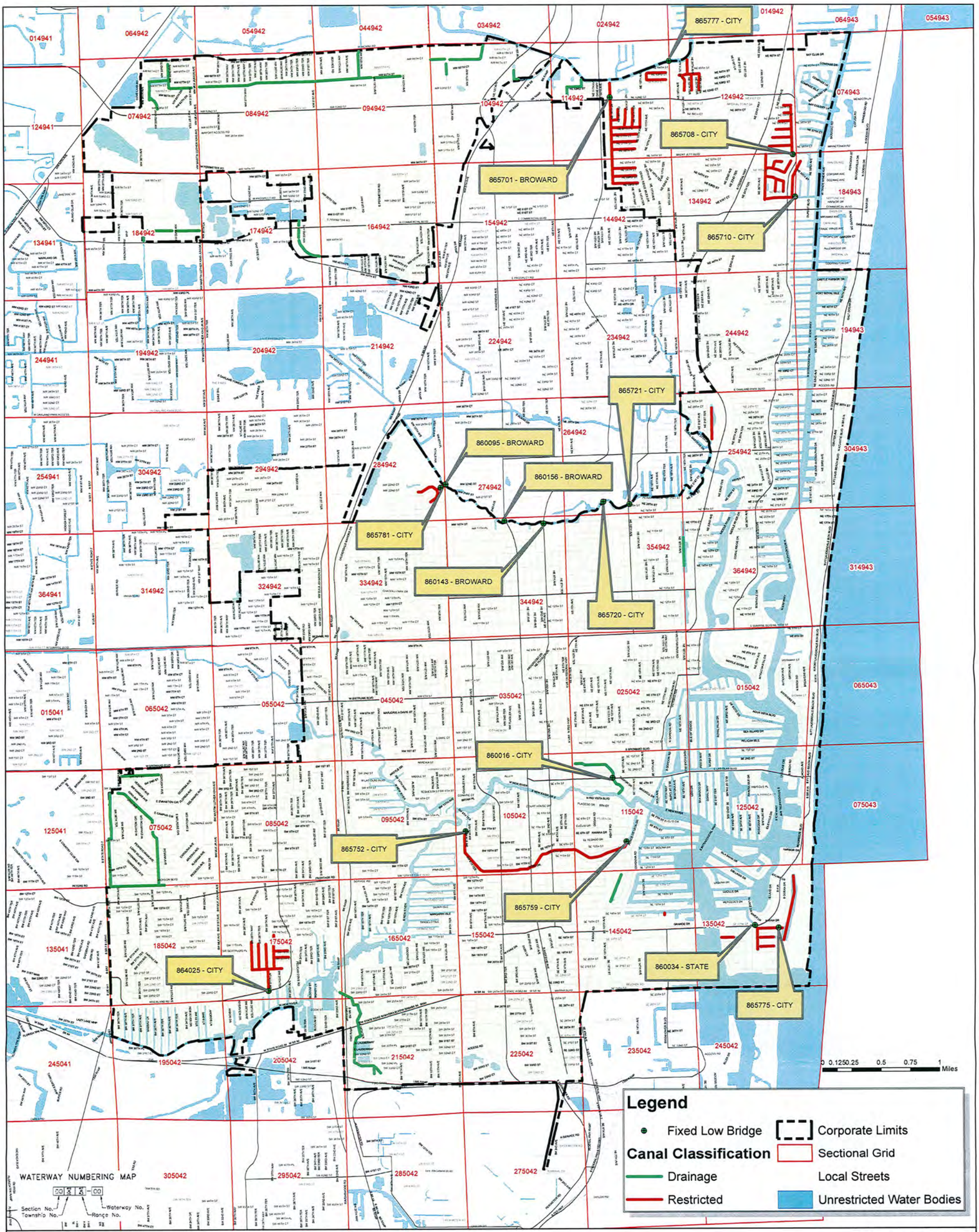
CANAL ID	Owner
175042-04	BROWARD COUNTY
175042-03	BROWARD COUNTY
175042-02	BROWARD COUNTY
175042-12	BROWARD COUNTY
215042-05	BROWARD COUNTY
215042-06	BROWARD COUNTY
104942-04	FDOT
215042-03	FDOT
215042-02	FDOT
104942-05	PRIVATE
364942-13	PRIVATE
145042-08	PRIVATE
145042-07	PRIVATE
174942-02	PRIVATE
254942-01	PRIVATE
084942-01	PRIVATE
125042-18	PRIVATE
165042-10	PRIVATE
215042-01	PRIVATE
175042-11	PRIVATE
205042-02	PRIVATE
175042-20	PRIVATE
175042-14	PRIVATE
175042-16	PRIVATE
205042-06	PRIVATE
205042-05	PRIVATE
215042-04	PRIVATE
114942-14	PRIVATE
114942-15	PRIVATE
114942-16	PRIVATE
164942-01	PRIVATE
165042-18	PRIVATE
165042-17	PRIVATE
165042-16	PRIVATE
104942-02	PRIVATE
145042-09	PRIVATE
015042-16	PRIVATE
135042-11	PRIVATE
175042-17	PRIVATE
175042-18	PRIVATE
125042-09	PRIVATE
125042-10	PRIVATE
125042-11	PRIVATE
125042-12	PRIVATE
364942-12	PRIVATE
205042-03	PRIVATE
175042-15	PRIVATE
344942-02	PRIVATE
175042-19	PRIVATE
205042-04	PRIVATE
344942-01	PRIVATE
095042-10	SFWMD
175042-01	SFWMD
175042-02	SFWMD
175042-03	SFWMD
205042-01	SFWMD
195042-01	SFWMD
195042-02	SFWMD
195042-03	SFWMD
195042-04	SFWMD
195042-05	SFWMD
195042-06	SFWMD
195042-07	SFWMD
195042-08	SFWMD
195042-09	SFWMD
195042-10	SFWMD
N/A	STATE

CITY OF FORT LAUDERDALE

WATERWAYS OWNERSHIP MAP

APPENDIX 1
MAP 3
JULY 17, 2015

Reference Source = BCPA.NET

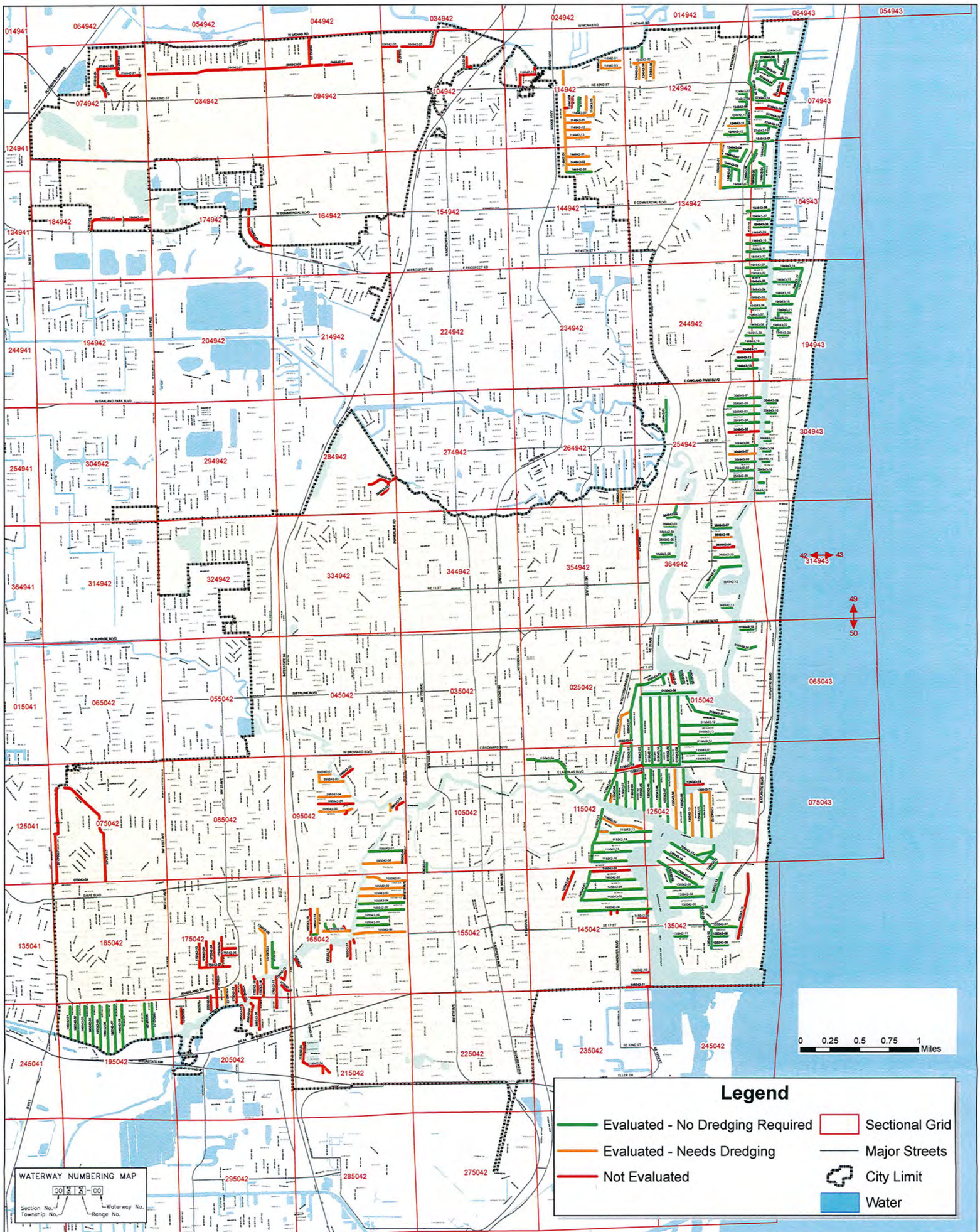


CITY OF FORT LAUDERDALE

WATERWAYS CLASSIFICATION MAP

APPENDIX 1
MAP 4
JULY 17, 2015

Reference Source: City of Fort Lauderdale Records



CITY OF FORT LAUDERDALE

WATERWAYS EVALUATION MAP

APPENDIX 1
MAP 5
JULY 17, 2015

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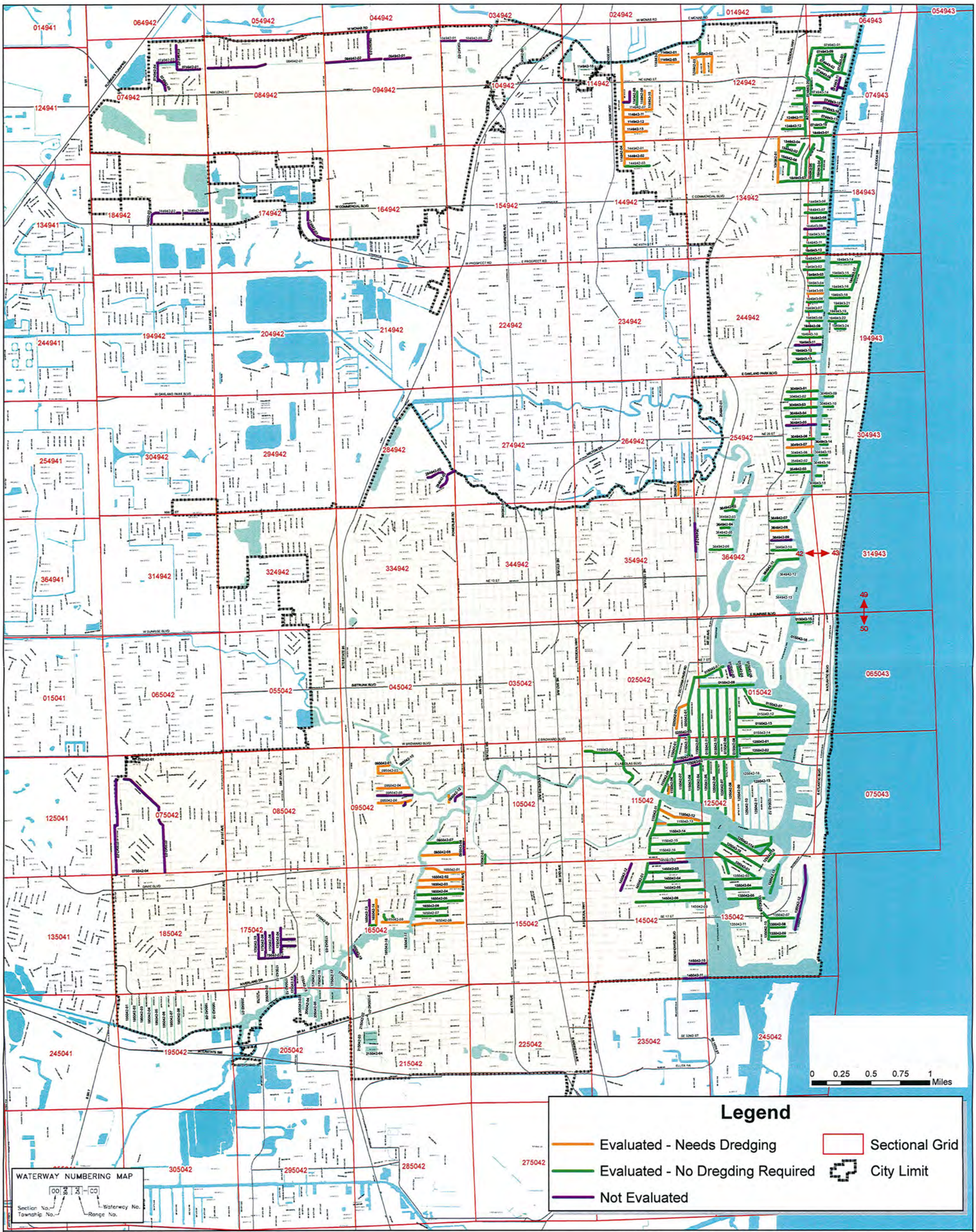


CITY OF FORT LAUDERDALE

CITY OWNED CANAL DREDGING EVALUATION MAP

APPENDIX 1
MAP 6
JULY 17, 2015

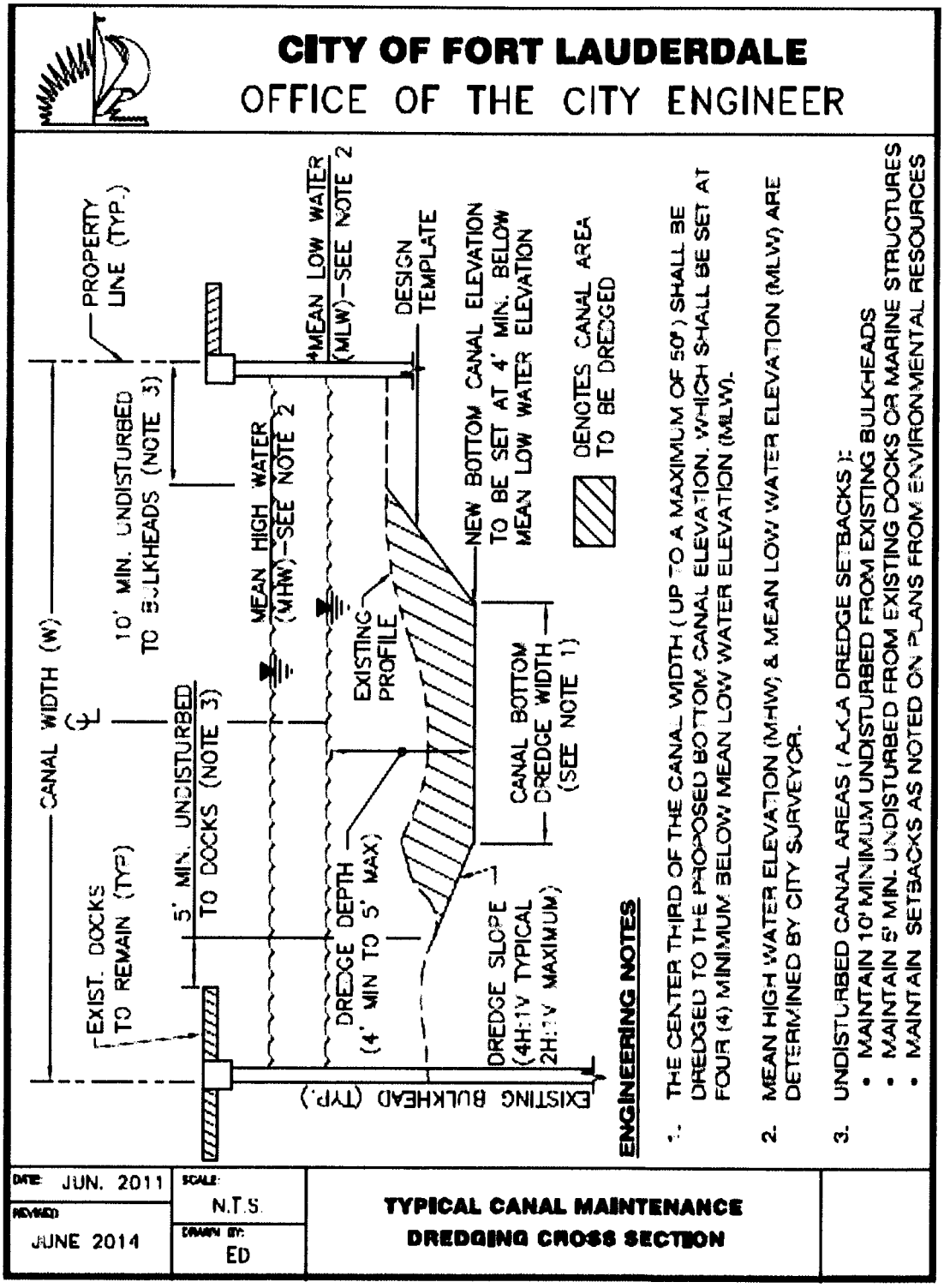
Z:\GIS\Canals\MAPS\MXD\Evaluation\CFL City Owned Canal Evaluation Map.mxd WD

Appendix 2: Figures

1. Typical Canal Maintenance Dredging Cross Section
2. Comprehensive Canal Assessment
3. Canal Dredging Master Plan: Past Work & Future Dredging Needs
4. Increase Tax Millage Rate
5. Assessments
6. Taxing Districts

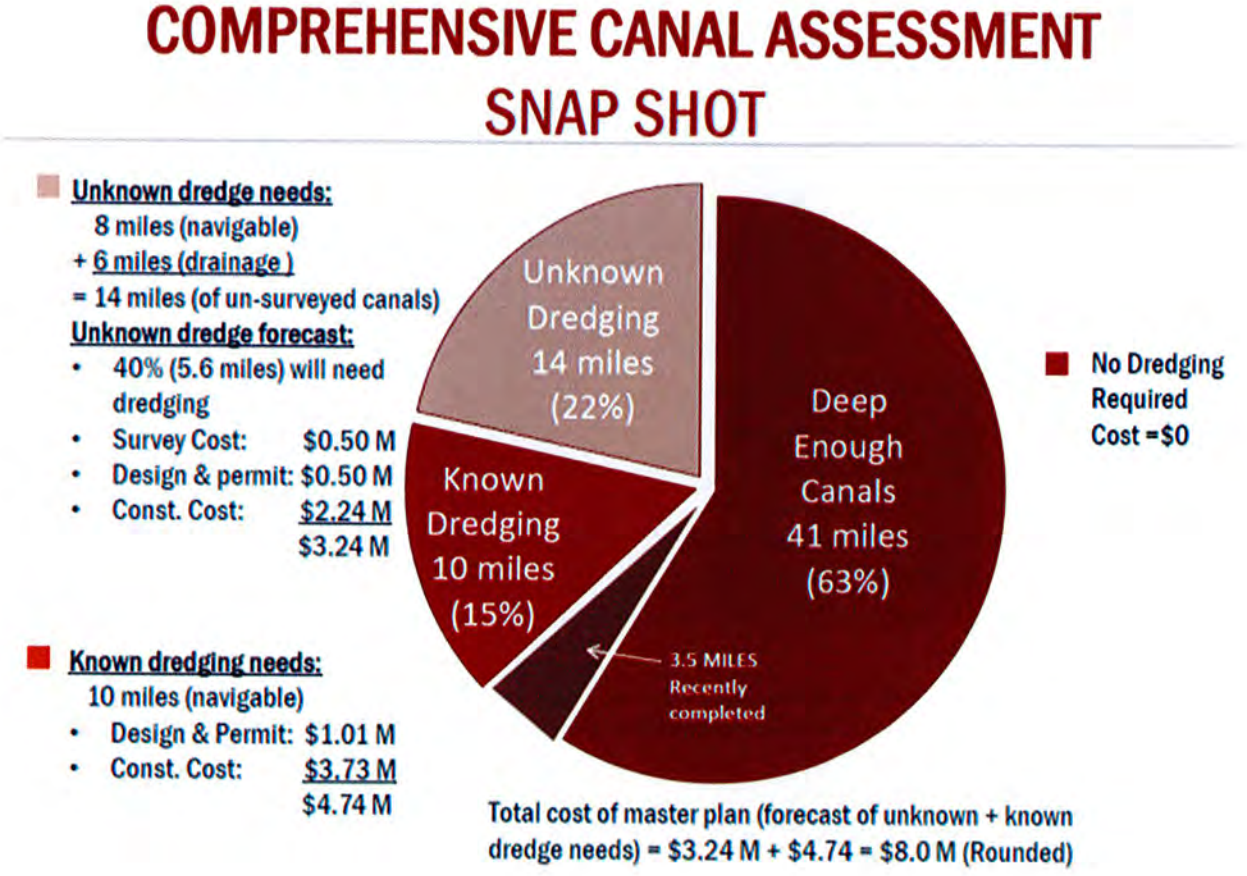
Appendix 2 Figure 1

Typical Canal Maintenance Dredging Cross Section



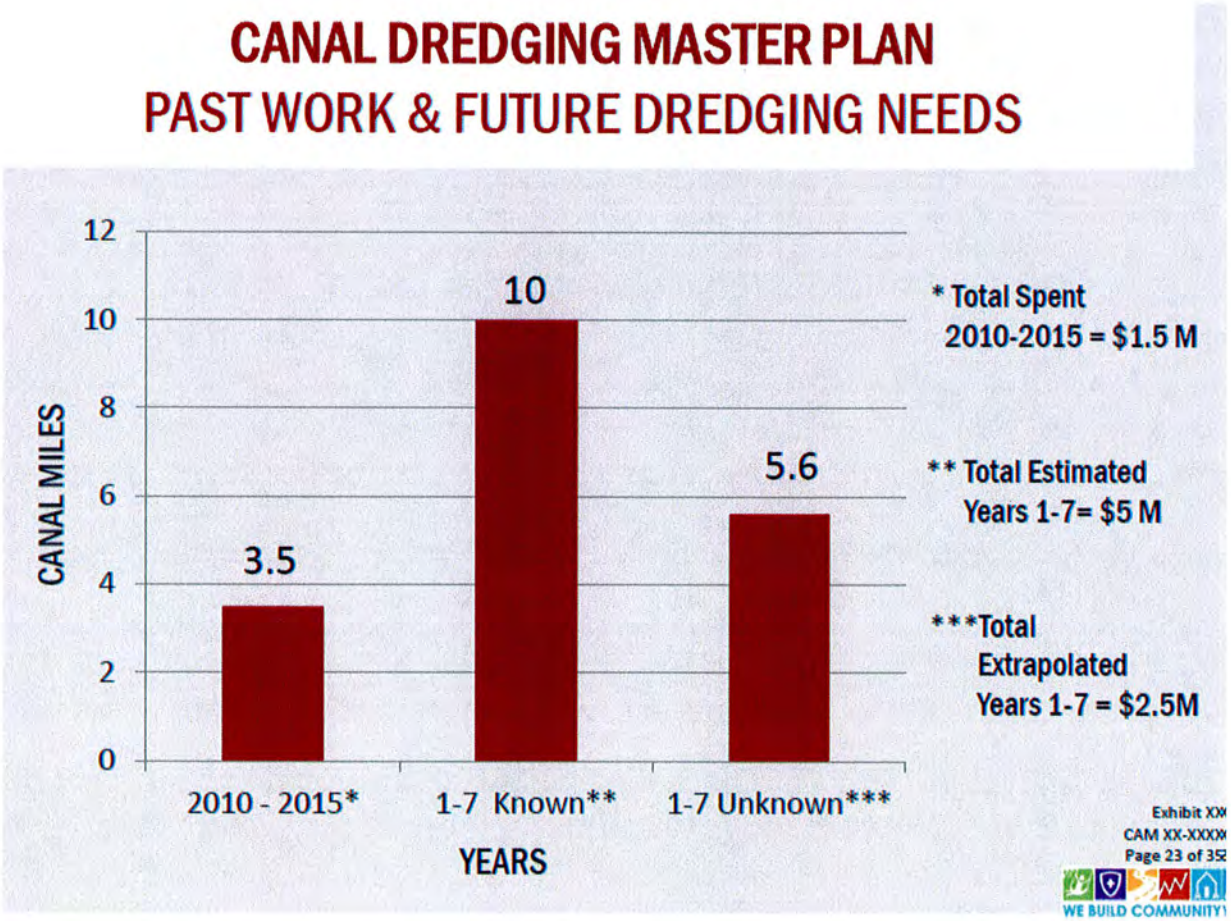
Appendix 2: Figure 2

Comprehensive Canal Assessment



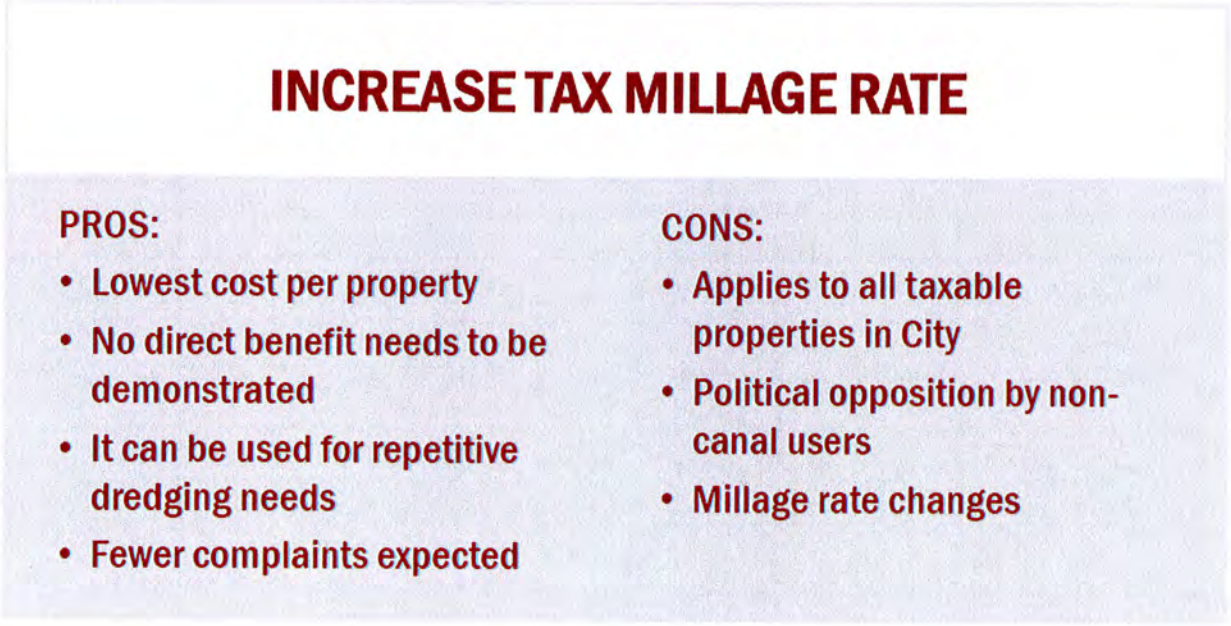
Appendix 2: Figure 3

Canal Dredging Master Plan: Past Work & Future Dredging Needs



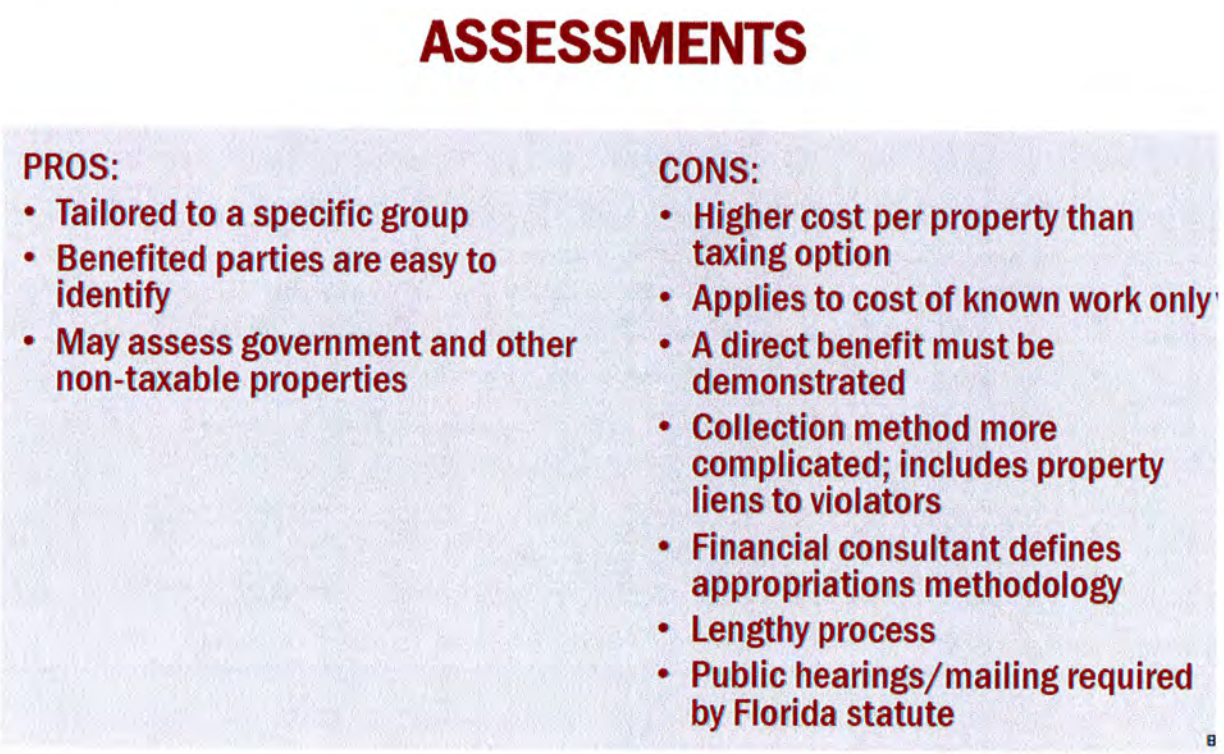
Appendix 2: Figure 4

Increase Tax Millage Rate



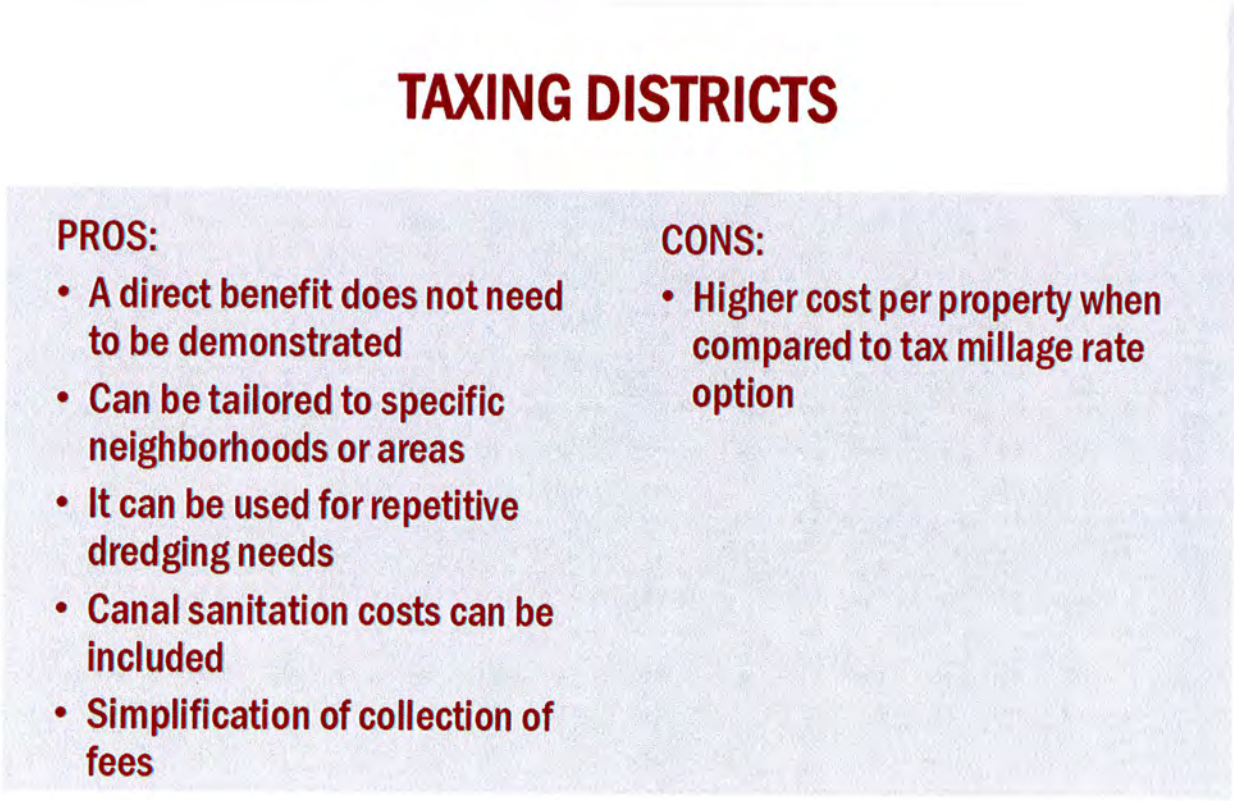
Appendix 2: Figure 5

Assessments



Appendix 2: Figure 6

Taxing Districts



Appendix 3: Tables

1. 2015 Citywide Canal Dredging Assessment Results for City Canals
2. Canal Dredging Construction Alternatives Comparison City In-house Utility Group Versus Contractor
3. Summary Table: Equipment and Labor Cost For City Dredging Utility
4. Dredging Practices and Funding Mechanisms Between the City of Fort Lauderdale and Other Florida Coastal Municipalities
5. Summary of Funding Opportunities For Canal maintenance Dredging
6. Canal Dredging Master Plan: Financial Summary
7. Canal Dredging Master Plan: Option 1
8. Canal Dredging Master Plan: Option 2
9. Canal Dredging Summary Table for immediate dredging needs

Appendix 3: Table 1

2015 Citywide Canal Dredging Assessment Results for City Canals

TABLE 1 2015 CITYWIDE CANAL DREDGING ASSESSMENT RESULTS FOR CITY CANALS					
DESCRIPTION	NUMBER OF CANAL MILES	NUMBER OF CANALS	PERCENTAGE OF TOTAL CITY CANALS	PROPERTY FRONTAGE ADJACENT TO DREDGING (MILES)	DREDGE VOLUME (CY)
Canals with immediate dredging needs	10	45	15%	9	13,135
Canals Deep Enough (No dredging required)	41	152	63%	77.37	0
Canals not yet evaluated as of March 2015- (Evaluation planned for FY 2016, pending CIP budget approval) [1]	14	63	22%	TBD	TBD
Totals	65	260	100%		

Appendix 3: Table 2

Canal Dredging Construction Alternatives Comparison City In-house Utility Group Versus Contractor

TABLE 2 CANAL DREDGING CONSTRUCTION ALTERNATIVES COMPARISON CITY IN-HOUSE UTILITY GROUP VERSUS CONTRACTOR		
DESCRIPTION	**BY CITY CREWS**	**BY CONTRACTOR**
When could dredging construction start?	When permits are obtained, and City utility dredging crew is formed	When permits are obtained, and contract is awarded
How much work is estimated for immediate dredging needs?	Approx. 13,500 CY	Approx. 13,500 CY
How many years of work are estimated for immediate dredging needs?	5 to 6 years, pending funding availability	Depends on number of contractors and funding availability
How much work is estimated AFTER immediate dredging needs?	To be determined. It depends on additional canal survey and tittle search analysis of not surveyed canals and the five year canal maintenance dredging cycle analysis.	To be determined. It depends on additional canal survey and tittle search analysis of not surveyed canals and the five year canal maintenance dredging cycle analysis.
What is the yearly cost to the City for idle time?	Approx. $399,000/yr. for labor and equipment (see breakdown on table next page)	Minimum cost to City, pending contract specifications.

Appendix 3: Table 3

Summary Table: Equipment and Labor Cost For City Dredging Utility

TABLE 3

SUMMARY TABLE
EQUIPMENT AND LABOR COST FOR CITY DREDGING UTILITY

EQUIPMENT COST

- Mechanical Dredge $100,000
- Mechanical Barge $ 75,000
- Hydraulic Dredge $125,000
- Hydraulic Barge $ 65,000
- 5' Turbidity Curtain at $400/ea. Approx. 200) $ 20,000
- Loader $ 75,000

$ 460,000 (One Time expense)

- Equipment yearly maintenance cost (15%) $ 69,000 (Est. Yr. Cost)
- Replacement cost $ 50,000 (Est. Yr. Cost)
- Total equip. cost for first 6 years ($460,000 + $69,000 * 5 years)..... $ 805,000 (Est. 6 Yr. cost)

DIRECT LABOR COST

- 3 to 4 person crew needed (PADI & Manatee observer certifications required $70,000/ea./yr. assume 4 men crew)
- Yearly Labor Cost (assume 4 person)..... $ 280,000 (Yearly Cost)
- Total Labor cost for first 6 years (4 person @ $70,000/yr. * 6 Years)..... $ 1,680,000 (6 Yr. cost)

TOTAL COSTS

- First year (Equipment).....$ 460,000
- Yearly cost after first year (Labor & Equipment)..... $ 399,000 (Yearly Cost)
- Total cost for 6 years of dredging operation.....$2,485,000 (6 Yr. cost)

- Projected dredging construction cost by In-house... ($2,485,000/13,135 CY of estimated dredge material)..... $189/CY (+/-15% contingency)

Appendix 3: Table 4

Dredging Practices and Funding Mechanisms Between the City of Fort Lauderdale and Other Florida Coastal Municipalities

TABLE 4
DREDGING PRACTICES AND FUNDING MECHANISMS
BETWEEN THE CITY OF FORT LAUDERDALE
AND OTHER FLORIDA COASTAL MUNICIPALITIES

ITEM	FORT LAUDERDALE	FORT PIERCE	POMPANO	LIGHT HOUSE POINT	MIAMI BEACH, DEERFIELD, NORTH MIAMI, BOCA
SIMILAR DREDGING CRITERIA	X	X	X	X	X
USE GENERAL FUND	X	X	X	X	X
DREDGE APPROACH ON A CASE BY CASE BASIS	X	X	X	X	X

And,

ITEM	FORT LAUDER-DALE	NAPLES	ST. PETERS-BURG	TAMPA	JACKSON-VILLE	PUNTA GORDA
SPECIAL ASSESSMENTS		X	X		X	X
TAXING DREDGING DISTRICTS		X			X	X
FUNDING ASSISTANCE THROUGH WATER DISTRICT				X		

Appendix 3: Table 5

Summary of Funding Opportunities for Canal maintenance Dredging

TABLE 5 SUMMARY OF FUNDING OPPORTUNITIES FOR CANAL MAINTENANCE DREDGING		
AGENCY	**GRANT**	**AGREEMENT**
Florida Department of Environmental Protection	Legislative grants are available and may contribute to fund future projects. City obtained a $150K grant on Oct. 2014 for $311K project construction cost.	N/A (Not Available)
Broward County Boater Improvement Trust Fund	N/A	Not available for dredging; unless, the project is a public marina and dredging is incidental work only.
Florida Inland Navigation District	N/A. Grants available for Intra Coastal waterway and natural water bodies only	N/A
U.S. Army Corps of Engineers	N/A– only funds federal projects	N/A
South Florida Water Management District	Not Available. Cooperative Funding program may only contribute for pollution control vaults.	N/A
Florida Department of Transportation	N/A	TBD. City shall present project scope and estimates to request FDOT evaluation of JPA agreement.
Broward County Highway and Bridge Maintenance Division	N/A	TBD. City shall present project scope and estimates to request County evaluation of JPA agreement.

Appendix 3: Table 6

Canal Dredging Master Plan: Financial Summary

TABLE 6

CANAL DREDGING MASTER PLAN: FINANCIAL SUMMARY

Year	Description	Cost
1	Survey remaining canals	$0.5 M
1	Design & permit known dredging needs	$1.0 M
2	Design & permit unknown needs	$0.5 M
3 - 7	Construction – known ($4.0 M) & unknown ($1.5 M) - (approx. $1.83 M /Yr.)	$5.5 M
	First 7 Year dredging cycle - Sub Total	**$7.5 M**
Second 7 Yr. cycle	Re-survey, design, permit and construction (forecasted @ $0.71 M / Yr.)	$5.0 M
	TOTAL	**$12.5 Million**

Appendix 3: Table 7

Canal Dredging Master Plan: Option 1 (see next pages for Microsoft Excel sheets)

CANAL DREDGING MASTER PLAN (Option 1)
Updated: August 2015

CITY CANAL DREDGING MASTER PLAN

OPTION 1 - 10-year canal dredging plan formed by two (2) 5-year phases

	Canal Dredging Projects[9]			A	B	C	(D)=A-B-C							FY 16						
														17%	15%		17%			
														Design				Construction		
														In-house	Outsource					
	Project No.	Project Name	Phase / PM / InHouse (I) or Consultant (Co)	BUDGET IN FAMIS (FEB 2015)	EXPENDITURES TO DATE (FEB 2015)	ENCUM-BRANCES (FEB 2015)	AVAILABLE BALANCE (FEB 2015)	FY 16 COST	FY 17 COST	FY 18 COST	FY 19 COST	FY 20 COST	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
	11729	ANNUAL DREDGING 2012/13 (11729.331)	Construction	$587,481	$299,299	$332,496	-$44,314													
	11907	WATERWAY DREDGING (11907.331)	Construction	$837,000	$63,352		$773,648													
	12045	CITYWIDE CANAL SURVEYS MASTERPLAN[8]	Design	$400,000	$268,409		$131,591													
1	tbd	2016 CANAL SURVEYING (For Canals Not surveyed in FY 15)	Planning					$489,000					$489,000		$25,000	$100,000			$364,000	$489,000
2	tbd	2016 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning					$533,150					$533,150		$60,829	$53,673		$60,829	$357,819	$533,150
3	tbd	2017 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning						$1,207,543				$1,207,543							
4	tbd	2018 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning							$948,720			$948,720							
5	tbd	2019 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning								$985,464		$985,464							
6	tbd	2020 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning									$581,570	$581,570							
7																				
8																				
35																				
Total				$1,824,481	$631,060	$332,496	$860,925	$1,022,150	$1,207,543	$948,720	$985,464	$581,570	$4,745,447		$85,829	$153,673		$60,829	$721,819	$1,022,150

FY 2016 TOTAL DESIGN SERVICES: $239,502

Notes:

1. Schedule assumes design and permiting by current engineering consultants with the exception of few (emergency) projects that will be designed by City Staff.
2. Dredging projects propose 17% in design fees and 17% in construction services for chargebacks.
3. Projects with designs by outside consultants include 15% consultant design fees, and 17% construction services. Consultant management and construction services cover chargebacks by staff.
4. The total cost for chargebacks is divided by 1600 hours, which is the estimate number of hours per staff member, to determine the staff required for the completion of each project.
5. Forecast estimates include design and construction costs
6. Construction phase can be awarded to curent annual contractor for FY 16 & FY 17 work or placed for bids pending funding availability
7. Costs take into account cost increase factors such as a 2% Per Year inflation factor and a staff hourly rate of $146/hr.
8. Canal surveys will be done by City Surveying Department since consultant's cost are approx. three times more expensive
9. Annual Schedule assumes 6 month

DESCRIPTION OF COLUMN HEADINGS:

In-house Design:

This Project would involve City staff to do all aspects of project management, design, permitting and bidding/award phases. This would include:

- Creating a project charter, initial schedule and cost estimate. Making a site visit and taking photographs.
- Requesting a survey and reviewing it when complete.
- Updating the City's project management software (ETS, Smartsheet, Oracle, etc).
- Creating and managing staff hours with project budgets.
- Engineering design would be designed by the Project Manager, drafted by the City's CADD department, and peer reviewed by the Construction/QA/QC Department at various stages of the design, including the Conceptual, 30%, 60%, 90%, and 100% Design Phases.
- Preparation of cost estimate, design calculations and specifications.
- Preparing and submitting applications and design calculations for permitting with Broward County, Army Corp of Engineers and as needed.
- Coordinating and assisting Procurement with the preparation of bid documents.
- Reviewing bids and assisting Procurement with the CAM preparation for the contract award.

Consultant Management (outsource design):

This Project would involve City staff to do all aspects of project and consultant management during the design, permitting and bidding/award phases. This would include:

- Creating a project charter, initial schedule and cost estimate.
- Requesting a survey and reviewing it when complete.
- Updating the City's project management software (ETS, Smartsheet, Oracle, etc).
- Creating Scope of Services, Task Orders, and/or Requests for Qualifications to obtain a design consultant for the design.
- Negotiating fees with design consultant.
- Preparing CAMs to award contracts to CCNA consultants or approvals of task orders to Continuing Services Contract consultants.
- Providing the consultant with existing utility atlases, GIS information and other records as needed to assist in their design.
- Reviewing plans during the Conceptual, 30%, 60%, 90%, and 100% Design Phases.
- Attending progress and design meetings between each phase.
- Reviewing cost estimates, design calculations and specifications.
- Reviewing and approving invoices.
- Reviewing applications prepared by the Consultant for permitting with Broward County, Army Corp of Engineers and as needed.
- Coordinating and assisting Procurement with the preparation of bid documents.
- Reviewing bids and assisting Procurement with the CAM preparation for the contract award.

CANAL DREDGING MASTER PLAN (Option 1)
Updated: August 2015

CITY CANAL DREDGING MASTER PLAN

OPTION 1 - 10-year canal dredging plan formed by two (2) 5-year phases

	Canal Dredging Projects[9]			A	B	C	(D)=A-B-C							FY 17						
														17%	15%			17%		
														In-house	Design: Outsource			Construction		
	Project No.	Project Name	Phase / PM / InHouse (I) or Consultant (Co)	BUDGET IN FAMIS (FEB 2015)	EXPENDITURES TO DATE (FEB 2015)	ENCUM-BRANCES (FEB 2015)	AVAILABLE BALANCE (FEB 2015)	FY 16 COST	FY 17 COST	FY 18 COST	FY 19 COST	FY 20 COST	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
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3	tbd	2017 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning						$1,207,543				$1,207,543		$137,773	$121,565		$137,773	$810,432	$1,207,543
4	tbd	2018 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning							$948,720			$948,720							
5	tbd	2019 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning								$985,464		$985,464							
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FY 2017 TOTAL DESIGN SERVICES: $259,338

Notes:

1. Schedule assumes design and permiting by current engineering consultants with the exception of few (emergency) projects that will be designed by City Staff.
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- Updating the City's project management software (ETS, Smartsheet, Oracle, etc).
- Creating and managing staff hours with project budgets.
- Engineering design would be designed by the Project Manager, drafted by the City's CADD department, and peer reviewed by the Construction/QA/QC Department at various stages of the design, including the Conceptual, 30%, 60%, 90%, and 100% Design Phases.
- Preparation of cost estimate, design calculations and specifications.
- Preparing and submitting applications and design calculations for permitting with Broward County, Army Corp of Engineers and as needed.
- Coordinating and assisting Procurement with the preparation of bid documents.
- Reviewing bids and assisting Procurement with the CAM preparation for the contract award.

Consultant Management (outsource design):

This Project would involve City staff to do all aspects of project and consultant management during the design, permitting and bidding/award phases. This would include:

- Creating a project charter, initial schedule and cost estimate.
- Requesting a survey and reviewing it when complete.
- Updating the City's project management software (ETS, Smartsheet, Oracle, etc).
- Creating Scope of Services, Task Orders, and/or Requests for Qualifications to obtain a design consultant for the design.
- Negotiating fees with design consultant.
- Preparing CAMs to award contracts to CCNA consultants or approvals of task orders to Continuing Services Contract consultants.
- Providing the consultant with existing utility atlases, GIS information and other records as needed to assist in their design.
- Reviewing plans during the Conceptual, 30%, 60%, 90%, and 100% Design Phases.
- Attending progress and design meetings between each phase.
- Reviewing cost estimates, design calculations and specifications.
- Reviewing and approving invoices.
- Reviewing applications prepared by the Consultant for permitting with Broward County, Army Corp of Engineers and as needed.
- Coordinating and assisting Procurement with the preparation of bid documents.
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CANAL DREDGING MASTER PLAN (Option 1)
Updated: August 2015

CITY CANAL DREDGING MASTER PLAN

OPTION 1 - 10-year canal dredging plan formed by two (2) 5-year phases

		Canal Dredging Projects[9]			A	B	C	(D)=A-B-C							FY 18							
															17%	15%			17%			
															Design				Construction			
															In-house	Outsource						
	Project No.	Project Name	Phase / PM / InHouse (I) or Consultant (Co)	BUDGET IN FAMIS (FEB 2015)	EXPENDITURES TO DATE (FEB 2015)	ENCUM-BRANCES (FEB 2015)	AVAILABLE BALANCE (FEB 2015)	FY 16 COST	FY 17 COST	FY 18 COST	FY 19 COST	FY 20 COST	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
	11729	ANNUAL DREDGING 2012/13 (11729.331)	Construction	$587,481	$299,299	$332,496	-$44,314														
	11907	WATERWAY DREDGING (11907.331)	Construction	$837,000	$63,352		$773,648														
	12045	CITYWIDE CANAL SURVEYS MASTERPLAN[8]	Design	$400,000	$268,409		$131,591														
1	tbd	2016 CANAL SURVEYING (For Canals Not surveyed in FY 15)	Planning					$489,000					$489,000								
2	tbd	2016 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning					$533,150					$533,150								
3	tbd	2017 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning						$1,207,543				$1,207,543								
4	tbd	2018 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning							$948,720			$948,720		$108,243	$95,509		$108,243	$636,725	$948,720
5	tbd	2019 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning								$985,464		$985,464								
6	tbd	2020 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning									$581,570	$581,570								
7																					
8																					
35																					
Total				$1,824,481	$631,060	$332,496	$860,925	$1,022,150	$1,207,543	$948,720	$985,464	$581,570	$4,745,447	$0	$108,243	$95,509	$0	$108,243	$636,725	$948,720

FY 2018 TOTAL DESIGN SERVICES: $203,752

Notes:

1. Schedule assumes design and permiting by current engineering consultants with the exception of few (emergency) projects that will be designed by City Staff.
2. Dredging projects propose 17% in design fees and 17% in construction services for chargebacks.
3. Projects with designs by outside consultants include 15% consultant design fees, and 17% construction services. Consultant management and construction services cover chargebacks by staff.
4. The total cost for chargebacks is divided by 1600 hours, which is the estimate number of hours per staff member, to determine the staff required for the completion of each project.
5. Forecast estimates include design and construction costs
6. Construction phase can be awarded to curent annual contractor for FY 16 & FY 17 work or placed for bids pending funding availability
7. Costs take into account cost increase factors such as a 2% Per Year inflation factor and a staff hourly rate of $146/hr.
8. Canal surveys will be done by City Surveying Department since consultant's cost are approx. three times more expensive
9. Annual Schedule assumes 6 month

DESCRIPTION OF COLUMN HEADINGS:

In-house Design:

This Project would involve City staff to do all aspects of project management, design, permitting and bidding/award phases. This would include:

- Creating a project charter, initial schedule and cost estimate. Making a site visit and taking photographs.
- Requesting a survey and reviewing it when complete.
- Updating the City's project management software (ETS, Smartsheet, Oracle, etc).
- Creating and managing staff hours with project budgets.
- Engineering design would be designed by the Project Manager, drafted by the City's CADD department, and peer reviewed by the Construction/QA/QC Department at various stages of the design, including the Conceptual, 30%, 60%, 90%, and 100% Design Phases.
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- Coordinating and assisting Procurement with the preparation of bid documents.
- Reviewing bids and assisting Procurement with the CAM preparation for the contract award.

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- Reviewing and approving invoices.
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CANAL DREDGING MASTER PLAN (Option 1)
Updated: August 2015

CITY CANAL DREDGING MASTER PLAN

OPTION 1 - 10-year canal dredging plan formed by two (2) 5-year phases

	Canal Dredging Projects[9]			A	B	C	(D)=A-B-C							FY 19						
														17%	15%			17%		
														In-house	Design: Outsource			Construction		
	Project No.	Project Name	Phase / PM / InHouse (I) or Consultant (Co)	BUDGET IN FAMIS (FEB 2015)	EXPENDITURES TO DATE (FEB 2015)	ENCUM-BRANCES (FEB 2015)	AVAILABLE BALANCE (FEB 2015)	FY 16 COST	FY 17 COST	FY 18 COST	FY 19 COST	FY 20 COST	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
	11729	ANNUAL DREDGING 2012/13 (11729.331)	Construction	$587,481	$299,299	$332,496	-$44,314													
	11907	WATERWAY DREDGING (11907.331)	Construction	$837,000	$63,352		$773,648													
	12045	CITYWIDE CANAL SURVEYS MASTERPLAN[8]	Design	$400,000	$268,409		$131,591													
1	tbd	2016 CANAL SURVEYING (For Canals Not surveyed in FY 15)	Planning					$489,000					$489,000							
2	tbd	2016 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning					$533,150					$533,150							
3	tbd	2017 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning						$1,207,543				$1,207,543							
4	tbd	2018 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning							$948,720			$948,720							
5	tbd	2019 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning								$985,464		$985,464		$112,435	$99,208		$112,435	$661,385	$985,464
6	tbd	2020 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning									$581,570	$581,570							
7																				
8																				
35																				
Total				$1,824,481	$631,060	$332,496	$860,925	$1,022,150	$1,207,543	$948,720	$985,464	$581,570	$4,745,447	$0	$112,435	$99,208	$0	$112,435	$661,385	$985,464

FY 2019 TOTAL DESIGN SERVICES: $211,643

Notes:

1. Schedule assumes design and permiting by current engineering consultants with the exception of few (emergency) projects that will be designed by City Staff.
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4. The total cost for chargebacks is divided by 1600 hours, which is the estimate number of hours per staff member, to determine the staff required for the completion of each project.
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6. Construction phase can be awarded to curent annual contractor for FY 16 & FY 17 work or placed for bids pending funding availability
7. Costs take into account cost increase factors such as a 2% Per Year inflation factor and a staff hourly rate of $146/hr.
8. Canal surveys will be done by City Surveying Department since consultant's cost are approx. three times more expensive
9. Annual Schedule assumes 6 month

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CANAL DREDGING MASTER PLAN (Option 1)
Updated: August 2015

CITY CANAL DREDGING MASTER PLAN

OPTION 1 - 10-year canal dredging plan formed by two (2) 5-year phases

		Canal Dredging Projects[9]			A	B	C	(D)=A-B-C							FY 20							
															17%	15%			17%			
															Design					Construction		
															In-house	Outsource						
	Project No.	Project Name	Phase / PM / InHouse (I) or Consultant (Co)	BUDGET IN FAMIS (FEB 2015)	EXPENDITURES TO DATE (FEB 2015)	ENCUM-BRANCES (FEB 2015)	AVAILABLE BALANCE (FEB 2015)	FY 16 COST	FY 17 COST	FY 18 COST	FY 19 COST	FY 20 COST	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
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	11907	WATERWAY DREDGING (11907.331)	Construction	$837,000	$63,352		$773,648														
	12045	CITYWIDE CANAL SURVEYS MASTERPLAN[8]	Design	$400,000	$268,409		$131,591														
1	tbd	2016 CANAL SURVEYING (For Canals Not surveyed in FY 15)	Planning					$489,000					$489,000								
2	tbd	2016 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning					$533,150					$533,150								
3	tbd	2017 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning						$1,207,543				$1,207,543								
4	tbd	2018 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning							$948,720			$948,720								
5	tbd	2019 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning								$985,464		$985,464								
6	tbd	2020 ANNUAL CANAL DREDGING (DESIGN &CONSTRUCTION)	Planning									$581,570	$581,570		$66,354	$58,547		$66,354	$390,315	$581,570	
7																					
8																					
35																					
Total				$1,824,481	$631,060	$332,496	$860,925	$1,022,150	$1,207,543	$948,720	$985,464	$581,570	$4,745,447	$0	$66,354	$58,547	$0	$66,354	$390,315	$581,570	

FY 2019 TOTAL DESIGN SERVICES: $124,901

Notes:

1. Schedule assumes design and permiting by current engineering consultants with the exception of few (emergency) projects that will be designed by City Staff.
2. Dredging projects propose 17% in design fees and 17% in construction services for chargebacks.
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8. Canal surveys will be done by City Surveying Department since consultant's cost are approx. three times more expensive
9. Annual Schedule assumes 6 month

DESCRIPTION OF COLUMN HEADINGS:

In-house Design:

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Appendix 3: Table 8

Canal Dredging Master Plan: Option 2 (see next pages for Microsoft Excel sheets)

This is the recommended option of the canal dredging master plan.

CANAL DREDGING MASTER PLAN (Option 2)
Updated: 8/1/2015

CITY CANAL DREDGING MASTER PLAN

OPTION 2 - A seven (7)-year Canal Maintenance Dredging Plan

	Canal Dredging Projects[9]										YEAR 3						
												17%	15%		17%		
												Design			Construction		
											In-house	Outsource					
	PROJECT No.	PROJECT NAME	PHASE	YEAR 1 SURVEY / DESIGN	YEAR 2 DESIGN	YEAR 3 CONSTRUCTION	YEAR 4 CONSTRUCTION	YEAR 5 CONSTRUCTION	YEAR 6 CONSTRUCTION	YEAR 7 CONSTRUCTION	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
1	tbd	CANAL SURVEYING (For canals not surveyed)	Planning	$489,000							$489,000							
2	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 1)	Planning	$119,128		$435,562					$554,690					$63,287	$372,275	$435,562
3	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 2)	Planning	$264,525		$967,169					$1,231,694				$405,054	$140,529	$826,640	$1,372,222
4	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 3)	Planning		$205,649		$759,767				$965,416							
5	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 4)	Planning		$300,431			$1,098,452			$1,398,883							
6	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 5)	Planning		$127,399				$465,802		$593,201							
7	tbd	ANNUAL CANAL DREDGING (Forecast of **unknown** dredging needs from Year 1 surveys)	Planning		$160,000					$500,000	$660,000							
				$872,653	$793,479	$1,402,731	$759,767	$1,098,452	$465,802	$500,000	$5,892,884	$0	$0	$0	$405,054	$203,816	$1,198,915	$1,807,784

Design and Permit cost of **known** dredge needs:	**$1,017,132**
Const. cost of **known** dredge needs:	**$3,726,751**
Total cost of **known** dredge needs:	**$4,743,884**

Notes:
1. Schedule assumes design and permiting by consultants with the exception of emergency projects that may be designed by City Staff.
2. Dredging projects propose 17% in design fees and 17% in construction services for staff chargebacks.
3. Projects with designs by outside consultants include 15% consultant design fees, and 17% construction services. Consultant management and construction services cover chargebacks by staff.
4. The projected costs are based on a $200/CY average unit price, which was the total average historical unit price paid to annual contractors for work completed between 2010 - 2015.
5. Forecast estimates include design and construction costs, including hauling, drying, and final disposal costs
6. Construction phase can be awarded to curent annual contractor for FY 16 & FY 17 work or placed for bids pending funding availability
7. Costs take into account cost increase factors such as a 2% Per Year inflation factor and a staff hourly rate of $146/hr.
8. Canal surveys performed by City Surveying Department since consultant's proposals were three times more expensive

DESCRIPTION OF COLUMN HEADINGS:

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CANAL DREDGING MASTER PLAN (Option 2)
Updated: 8/1/2015

CITY CANAL DREDGING MASTER PLAN

OPTION 2 - A seven (7)-year Canal Maintenance Dredging Plan

	Canal Dredging Projects[9]											YEAR 4						
													17%	15%	17%			
													Design			Construction		
												In-house	Outsource					
	PROJECT No.	PROJECT NAME	PHASE	YEAR 1 SURVEY / DESIGN	YEAR 2 DESIGN	YEAR 3 CONSTRUCTION	YEAR 4 CONSTRUCTION	YEAR 5 CONSTRUCTION	YEAR 6 CONSTRUCTION	YEAR 7 CONSTRUCTION	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
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5	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 4)	Planning		$300,431			$1,098,452			$1,398,883							
6	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 5)	Planning		$127,399				$465,802		$593,201							
7	tbd	ANNUAL CANAL DREDGING (Forecast of **unknown** dredging needs from Year 1 surveys)	Planning		$160,000					$500,000	$660,000							
				$872,653	$793,479	$1,402,731	$759,767	$1,098,452	$465,802	$500,000	$5,892,884	$0	$0	$0	$0	$110,393	$649,373	$759,767

Design and Permit cost of **known** dredge needs:	**$1,017,132**
Const. cost of **known** dredge needs:	**$3,726,751**
Total cost of **known** dredge needs:	**$4,743,884**

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- Preparing CAMs to award contracts to CCNA consultants or approvals of task orders to Continuing Services Contract consultants.
- Providing the consultant with existing utility atlases, GIS information and other records as needed to assist in their design.
- Reviewing plans during the Conceptual, 30%, 60%, 90%, and 100% Design Phases.
- Attending progress and design meetings between each phase.
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CANAL DREDGING MASTER PLAN (Option 2)
Updated: 8/1/2015

CITY CANAL DREDGING MASTER PLAN

OPTION 2 - A seven (7)-year Canal Maintenance Dredging Plan

Canal Dredging Projects[9]

	PROJECT No.	PROJECT NAME	PHASE	YEAR 1 SURVEY / DESIGN	YEAR 2 DESIGN	YEAR 3 CONSTRUCTION	YEAR 4 CONSTRUCTION	YEAR 5 CONSTRUCTION	YEAR 6 CONSTRUCTION	YEAR 7 CONSTRUCTION	TOTAL UNFUNDED COST[7]	YEAR 5						
													17%	15%		17%		
												Design				Construction		
												In-house	Outsource					
												Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
1	tbd	CANAL SURVEYING (For canals not surveyed)	Planning	$489,000							$489,000							
2	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 1)	Planning	$119,128		$435,562					$554,690							
3	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 2)	Planning	$264,525		$967,169					$1,231,694							
4	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 3)	Planning		$205,649		$759,767				$965,416							
5	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 4)	Planning		$300,431			$1,098,452			$1,398,883					$159,604	$938,848	$1,098,452
6	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 5)	Planning		$127,399				$465,802		$593,201							
7	tbd	ANNUAL CANAL DREDGING (Forecast of **unknown** dredging needs from Year 1 surveys)	Planning		$160,000					$500,000	$660,000							
				$872,653	$793,479	$1,402,731	$759,767	$1,098,452	$465,802	$500,000	$5,892,884	$0	$0	$0	$0	$159,604	$938,848	$1,098,452

Design and Permit cost of **known** dredge needs:	**$1,017,132**
Const. cost of **known** dredge needs:	**$3,726,751**
Total cost of **known** dredge needs:	**$4,743,884**

Notes:
1. Schedule assumes design and permiting by consultants with the exception of emergency projects that may be designed by City Staff.
2. Dredging projects propose 17% in design fees and 17% in construction services for staff chargebacks.
3. Projects with designs by outside consultants include 15% consultant design fees, and 17% construction services. Consultant management and construction services cover chargebacks by staff.
4. The projected costs are based on a $200/CY average unit price, which was the total average historical unit price paid to annual contractors for work completed between 2010 - 2015.
5. Forecast estimates include design and construction costs, including hauling, drying, and final disposal costs
6. Construction phase can be awarded to curent annual contractor for FY 16 & FY 17 work or placed for bids pending funding availability
7. Costs take into account cost increase factors such as a 2% Per Year inflation factor and a staff hourly rate of $146/hr.
8. Canal surveys performed by City Surveying Department since consultant's proposals were three times more expensive

DESCRIPTION OF COLUMN HEADINGS:

In-house Design:

This Project would involve City staff to do all aspects of project management, design, permitting and bidding/award phases. This

- Creating a project charter, initial schedule and cost estimate. Making a site visit and taking photographs.
- Requesting a survey and reviewing it when complete.
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CANAL DREDGING MASTER PLAN (Option 2)
Updated: 8/1/2015

CITY CANAL DREDGING MASTER PLAN

OPTION 2 - A seven (7)-year Canal Maintenance Dredging Plan

	Canal Dredging Projects[9]											YEAR 6						
													17%	15%		17%		
													Design			Construction		
												In-house	Outsource					
	PROJECT No.	PROJECT NAME	PHASE	YEAR 1 SURVEY / DESIGN	YEAR 2 DESIGN	YEAR 3 CONSTRUCTION	YEAR 4 CONSTRUCTION	YEAR 5 CONSTRUCTION	YEAR 6 CONSTRUCTION	YEAR 7 CONSTRUCTION	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
1	tbd	CANAL SURVEYING (For canals not surveyed)	Planning	$489,000							$489,000							
2	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 1)	Planning	$119,128		$435,562					$554,690							
3	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 2)	Planning	$264,525		$967,169					$1,231,694							
4	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 3)	Planning		$205,649		$759,767				$965,416							
5	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 4)	Planning		$300,431			$1,098,452			$1,398,883							
6	tbd	ANNUAL CANAL DREDGING (KNOWN DREDGE AREA 5)	Planning		$127,399				$465,802		$593,201					$67,681	$398,122	$465,802
7	tbd	ANNUAL CANAL DREDGING (Forecast of **unknown** dredging needs from Year 1 surveys)	Planning		$160,000					$500,000	$660,000							
				$872,653	$793,479	$1,402,731	$759,767	$1,098,452	$465,802	$500,000	$5,892,884	$0	$0	$0	$0	$67,681	$398,122	$465,802

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Const. cost of **known** dredge needs:	**$3,726,751**
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CANAL DREDGING MASTER PLAN (Option 2)
Updated: 8/1/2015

CITY CANAL DREDGING MASTER PLAN

OPTION 2 - A seven (7)-year Canal Maintenance Dredging Plan

Canal Dredging Projects[9]

												YEAR 7						
												17%	15%		17%			
												Design				Construction		
												In-house	Outsource					
	PROJECT No.	PROJECT NAME	PHASE	YEAR 1 SURVEY / DESIGN	YEAR 2 DESIGN	YEAR 3 CONSTRUCTION	YEAR 4 CONSTRUCTION	YEAR 5 CONSTRUCTION	YEAR 6 CONSTRUCTION	YEAR 7 CONSTRUCTION	TOTAL UNFUNDED COST[7]	Staff Design	Staff Consultant Management	Consultant Design	Staff Agency Oversight	Staff Construction Management	Construction	Total Cost
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				$872,653	$793,479	$1,402,731	$759,767	$1,098,452	$465,802	$500,000	$5,892,884	$0	$0	$0	$0	$85,000	$500,000	$585,000

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Appendix 3: Table 9

Canal Dredging Summary Table for immediate dredging needs

CANAL DREDGING PLAN - SUMMARY TABLE OF KNOWN AREAS WITH DREDGING NEEDS

Prepared By: ED
Updated: 8/1/2015

AREA 1 - RIVEROAKS, SHADY BANKS & RIVERLAND NEIGHBORHOODS

Canal ID	Canal Name	Canal Length (mi.)	Total Number of properties on Canal	Total Property Frontage (mi.)	Dredge Area (SY)	Dredge Volume (CY)	Number of properties to Dredge	Property frontage adjacent to dredging (mi.)	DREDGE COST PER CY (@ $200/CY)
165042-01	Unidentified	0.32	54	0.64	13338	32	2	0.01	$6,720
165042-02	KINGFISH CANAL	0.36	57	0.72	1612	132	36	0.4	$27,720
165042-03	BULLFISH CANAL	0.39	62	0.78	448	31	19	0.18	$6,510
165042-08	CREVALLE CANAL	0.43	64	0.85	1525	624	49	0.28	$131,040
165042-09	Unidentified	0.24	22	0.45	175	45	5	0.04	$9,450
165042-14	Unidentified	0.21	39	0.42	473	65	26	0.13	$13,650
175042-03	Unidentified, sfwmd owned	0.41	62	0.83	2903	540	43	0.52	$113,400
175042-12	Unidentified, sfwmd owned	0.13	10	0.26	323	80	2	0.03	$16,800
		2.49	370	4.95	20,797	1,549	182	1.59	$325,290

Construction Cost (w/ 20% Contingency) =	$357,819
Construction Cost (+2% Per Yr. inflation) =	$372,275
Design, Permit & Const. Management Fees= =	$182,415
Total cost Area 1 =	$554,690
Assessment per property =	$1,499.2
Assessment per Canal Mile =	$222,767.0
Assessment per Canal Foot =	$42.2

AREA 2 - RIVERSIDE PARK & TARPON RIVER NEIGHBORHOODS

Canal ID	Canal Name	Canal Length (mi.)	Total Number of properties on Canal	Total Property Frontage (mi.)	Dredge Area (SY)	Dredge Volume (CY)	Number of properties to Dredge	Property frontage adjacent to dredging (mi.)	DREDGE COST PER CY (@ $200/CY)
025042-02	LAKE STRANAHAN	0.27	7	0.33	1251	466	15	0.51	$97,860
095042-01	Unidentified	0.11	16	0.22	1137	271	16	0.22	$54,200
095042-02	Unidentified	0.03	4	0.05	354	153	4	0.05	$30,600
095042-03	Unidentified	0.23	30	0.46	2421	715	30	0.39	$150,150
095042-04	Unidentified	0.27	41	0.55	2969	383	37	0.50	$76,600
095042-06	Unidentified	0.36	50	0.72	3894	1035	44	0.68	$217,350
095042-08	Unidentified	0.4	5	0.17	336	197	2	0.03	$41,370
095042-11	Unidentified	0.08	11	0.17	725	258	10	0.13	$54,180
		1.75	164	2.67	13,087	3,478	158	2.51	$722,310

Construction Cost (includes 20% continency) =	$794,541
Construction Cost (+2% Per Yr. inflation) =	$826,640
Design, Permit & Const. Management Fees= =	$405,054
Total cost Area 2 =	$1,231,694
Assessment per property =	$7,510.3
Assessment per Canal Mile =	$703,825.4
Assessment per Canal Foot =	$133.3

AREA 3 - RIO VISTA, LAS OLAS ISLES NEIGHBORHOODS

Canal ID	Canal Name	Canal Length (mi.)	Total Number of properties on Canal	Total Property Frontage (mi.)	Dredge Area (SY)	Dredge Volume (CY)	Number of properties to Dredge	Property frontage adjacent to dredging (mi.)	DREDGE COST PER CY (@ $200/CY)
115042-09	RIVA CANAL	0.08	3	0.16	646	351	3	0.12	$73,710
115042-10	LAKE JUANITA	0.11	12	0.22	674	23	3	0.04	$4,830
115042-12	RIO ALCAZAR	0.37	33	0.67	1560	107	12	0.21	$22,470
125042-08	ORIENTE CANAL	0.51	47	0.58	4894	2010	14	0.31	$422,100
125042-10	RIO CORAL (Owned By Riviera Isles HOA)	0.34	37	0.68	452	44	17	0.21	$9,240
125042-12	RIO IDDLEWYLD	0.42	47	0.84	327	14	29	0.27	$2,940
125042-13	Unidentified	0.07	3	0.07	422	100	4	0.11	$21,000
		1.90	182	3.22	8,975	2,649	82	1.27	$556,290

Construction Cost (includes 20% continency) =	$611,919
Construction Cost (+2% Per Yr. inflation) =	$649,373
Design, Permit & Const. Management Fees= =	$316,043
Total cost Area 3 =	$965,416
Assessment per property =	$5,304.5
Assessment per Canal Mile =	$508,113.7
Assessment per Canal Foot =	$96.2

AREA 4 - CORAL RIDGE ISLES NEIGHBORHOOD

Canal ID	Canal Name	Canal Length (mi.)	Total Number of properties on Canal	Total Property Frontage (mi.)	Dredge Area (SY)	Dredge Volume (CY)	Number of properties to Dredge	Property frontage adjacent to dredging (mi.)	DREDGE COST PER CY (@ $200/CY)
114942-01	Unidentified	0.17	23	0.34	880	103	19	0.23	$21,630
114942-02	Unidentified	0.07	9	0.12	228	23	9	0.06	$4,830
114942-03	Unidentified	0.18	28	0.34	212	49	10	0.03	$10,290
114942-04	SOUTH FORK CYPRESS WATERWAY	0.71	146	0.62	826	1431	2	0.08	$286,200
114942-07	RIO BURKE	0.24	28	0.41	339	38	9	0.19	$7,980
114942-09	RIO SAXON	0.16	23	0.32	421	44	14	0.17	$9,240
114942-10	RIO BURKE (EXTENSION)	0.15	25	0.33	1685	435	19	0.21	$91,350
114942-11	RIO RUSSEL	0.23	32	0.45	2067	304	28	0.4	$63,840
114942-12	RIO REYNOLDS	0.21	30	0.42	3975	1040	30	0.42	$218,400
114942-13	RIO JOHNS	0.2	29	0.4	3407	338	30	0.34	$70,980
144942-01	RIO ROSS	0.2	27	0.39	805	61	10	0.13	$12,810
144942-02	RIO CHILDERS	0.2	28	0.4	112	32	4	0.01	$6,720
		2.72	428	4.54	14,957	3,898	184	2.27	$804,270

Construction Cost (includes 20% continency) =	$884,697
Construction Cost (+2% Per Yr. inflation) =	$938,848
Design, Permit & Const. Management Fees= =	$460,035
Total cost Area 4 =	$1,398,883
Assessment per property =	$3,268.42
Assessment per Canal Mile =	$1,538,771
Assessment per Canal Foot =	$97.40

AREA 5 - IMPERIAL POINT & ADJACENT NEIGHBORHOODS

Canal ID	Canal Name	Canal Length (mi.)	Total Number of properties on Canal	Total Property Frontage (mi.)	Dredge Area (SY)	Dredge Volume (CY)	Number of properties to Dredge	Property frontage adjacent to dredging (mi.)	DREDGE COST PER CY (@ $200/CY)
124942-02	SOVEREIGN PASSAGE	0.11	12	0.2	465	36	7	0.1	$7,560
124942-03	BUCKINGHAM COVE	0.14	22	0.28	368	66	5	0.04	$13,860
124942-04	EMPRESS WAY	0.14	21	0.29	1665	112	21	0.28	$23,520
124942-05	SURREY INLET	0.15	23	0.31	452	32	16	0.2	$6,720
124942-11	Unidentified	0.16	23	0.33	929	60	9	0.03	$12,600
134942-01	WELCOME PASSAGE	0.15	17	0.28	437	20	4	0.03	$4,200
194943-05	Unidentified	0.13	18	0.27	279	62	8	0.05	$13,020
264942-01	Unidentified	0.12	14	0.25	1350	622	15	0.25	$130,620
304943-07	NICE WATERWAY	0.23	27	0.46	1200	517	13	0.47	$108,570
364942-08	RIO AZUL CANAL	0.2	20	0.4	126	34	2	0.05	$7,140
		1.53	197	3.07		1,561	100	1.50	$327,810

Construction Cost (includes 20% continency) =	$360,591
Construction Cost (+2% Per Yr. inflation) =	$398,121.60
Design, Permit & Const. Management Fees= =	$195,079.6
Total cost Area 5 =	$593,201.2
Assessment per property =	$3,011.17
Assessment per Canal Mile =	$387,713.2
Assessment per Canal Foot =	$73.4

ENGINEERING NOTES

1	ALL DREDGING WORK IS CONTINGENT UPON NO SEAGRASS FOUND IN THE DREDGING AREA. A SEAGRASS SURVEY IS REQUIRED PRIOR TO FINAL ENGINEERING DESIGN. IF SEAGRASSES ARE FOUND IN A DREDGING AREA, MITIGATION OF SEAGRASS IS REQUIRED AS REQUIRED BY PERMITTING AGENCIES. IF MITIGATION IS REQUIRED, THE PROJECT SCOPE, COST & FEASIBILITY NEEDS TO BE RE-EVALUATED AT APPROPRITE TIME.
2	ALL DREDGING WORK IS CONDITIONED TO PERMIT APPROVALS FROM 1) BROWARD COUNTY DEPT. OF ENVIRONMENTAL PROTECTION, 2) FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION, 3) U. S. ARMY CORPS OF ENGINEERS AND OTHER AGENCIES.
3	ANNUAL DREDGING WORK IS ARRANGED CONSIDERING CONSTRUCTIBILITY FACTORS SUCH AS UPLOADING, SPOIL SEDIMENTS DRYING, AND HAULING TO LANDFILL SITE TO OBTAIN THE GREATEST EFFICIENCY FROM THE CONTRACTOR(S).
4	CANAL DATA COLLECTED IN 2015 REFLECTS A PRELIMINARY ENGINEERING ANALYSIS OF CANAL MAINTENANCE DREDGING WORK PER CITY CANAL DREDGING CRITERIA. A 5% - 10% MARGIN OF ERROR IS EXPECTED FOR FULL ENGINEERING DESIGN

SUMMARY OF RESULTS FOR KNOWN AREAS WITH DREDGING NEEDS

DESCRIPTION	No. Canals	Properties On Canal	Properties To Dredge	Canal Length (Miles)	Dredge Length (Miles)	Dredge Volume (CY)	Dredge Construction Cost ($)	Dredge Engineering Fees ($)	Total Dredge Cost Areas 1 - 5 ($)	Avg. Cost/LF ($/LF)	Average Assessment Per Canal Mile ($/Mile)	Average Assessment Per Property ($/Property)
TOTAL CANALS WITH DREDGING	45	1,341	706	10.39	9	13,135	$3,185,258	$1,558,627	$4,743,885	$89	$672,238	$6,719

Appendix 4: Picture Locations Sites and Addresses

2.2.1 Mechanical Dredging Excavation Method

- Picture 1: Rio Aragon – Lauderdale Isles Canals
- Picture 2: Rio Aragon – Lauderdale Isles Canals
- Picture 3: Barracuda Canal – Lauderdale Isles Canals

2.2.2 Hydraulic Dredging Excavation Method

- Picture 1: Dolphin Canal – Lauderdale Isles Canals
- Picture 2: Dolphin Canal – Lauderdale Isles Canals

2.2.3 Disposal of dredged material

- Picture 1: Lauderdale Isles Park –
  - Boat Ramp at SR 441/ N. Fork of New River
- Picture 2: Lauderdale Isles Park –
  - Boat Ramp at SR 441/ N. Fork of New River
- Picture 3: City of Fort Lauderdale's compost facility -
  - 4300 State Road 7, City of Dania Beach.
- Picture 4: City of Fort Lauderdale's compost facility -
  - 4300 State Road 7, City of Dania Beach.
- Picture 5: City of Fort Lauderdale's compost facility –
  - 4300 State Road 7, City of Dania Beach.
- Picture 6: Class I landfill site –
  - 2700 Wiles Rd, Coconut Creek, FL 33073

4.1 Canals surveyed in FY 2015

- Picture 1: Cooley's Landing Park
- Picture 2: Turtle Canal – Lauderdale Canal Isles

4.2 Engineering evaluation of canal dredging needs

- Picture 1: Boulevard Park Isles canal 11494201

Appendix 5: Canal Dredging Master Plan PowerPoint Presentation

CANAL DREDGING MASTER PLAN

DEPARTMENT OF PUBLIC WORKS - CITY OF FORT LAUDERDALE

Appendix 5
CAM 15-0732

WE BUILD COMMUNITY

CURRENT CITY CANAL SYSTEM

- Navigable Canals
- Navigation Restricted
- Drainage Canals
- Natural Rivers Excluded
- Intracoastal Excluded

WE BUILD COMMUNITY

AGENDA

- Why is canal dredging important?
- Background
- Current challenges
- Comprehensive canal assessment
- Dredging master plan costs
- Funding options
- Q & A

WE BUILD COMMUNITY

WHY IS CANAL DREDGING IMPORTANT?

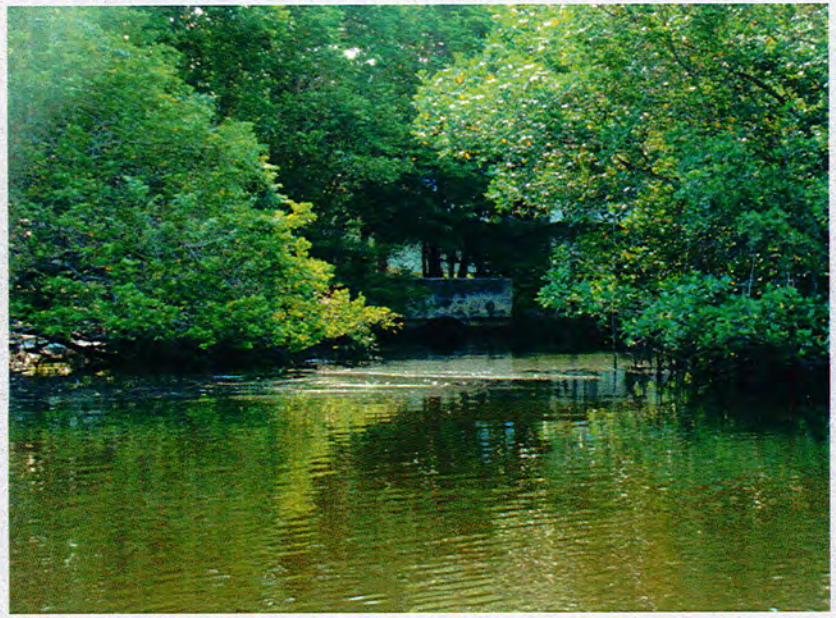
Allows Safe Navigation Of Vessels Through Canal System

Luna Canal at Las Olas Isles.

WE BUILD COMMUNITY

WHY IS CANAL DREDGING IMPORTANT?

Maintains Proper Depth Of Canals At Stormwater Outfalls



Outfall to North Fork New River – Progresso Neighborhood

Outfall to Navigable Canal – Tarpon River

WE BUILD COMMUNITY

WHY IS CANAL DREDGING IMPORTANT?

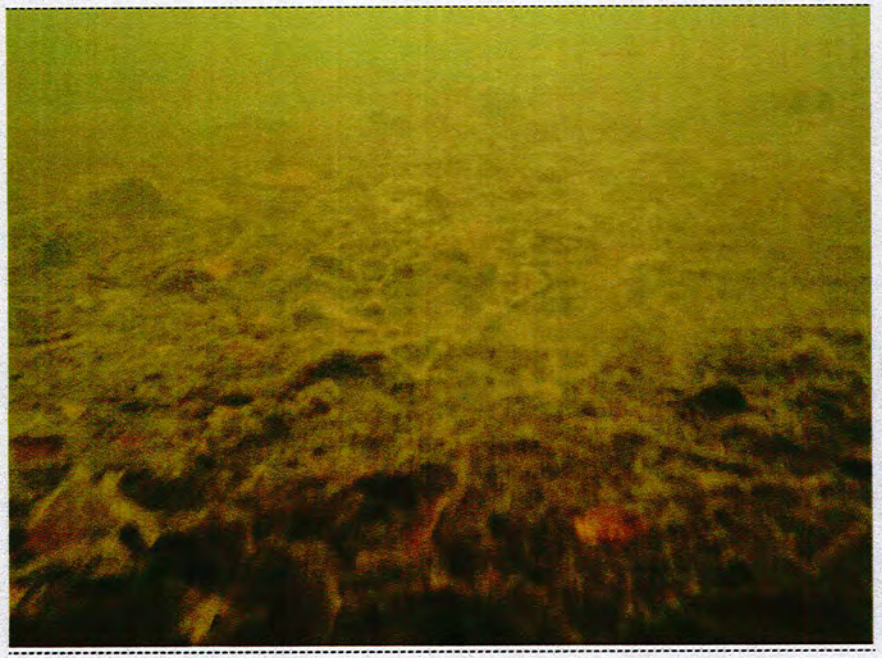
Supports a Thriving Marine and Recreation Industry

Harbor Isles

WE BUILD COMMUNITY

WHY IS CANAL DREDGING IMPORTANT?

Fosters Unpolluted Waterway Environments



Canal bed after dredge –
Rio Verde Canal

Canal estuary –
Progresso Neighborhood

WE BUILD COMMUNITY

BACKGROUND

CANALS INVENTORY	
OWNER	CANAL MILES
CITY	65
STATE (FDEP)	35
BROWARD COUNTY	1
SOUTH FLORIDA WATER MANAGEMENT DISTRICT (SFWMD)	5
FDOT	1
PRIVATE (Property Owners/HOA's)	8
TOTAL	115

WE BUILD COMMUNITY

BACKGROUND

CITY CANALS	
CLASSIFICATION	CANAL MILES
OPEN ACCESS[1]	43
RESTRICTED[2]	12
DRAINAGE[3]	10
TOTAL	65

Notes:

1. Open Access = Navigable Canals with Intracoastal Access
2. Restricted = Navigation restricted by Low Fixed Bridges (< 6 feet)
3. Drainage = Canals or Culverts used for drainage only

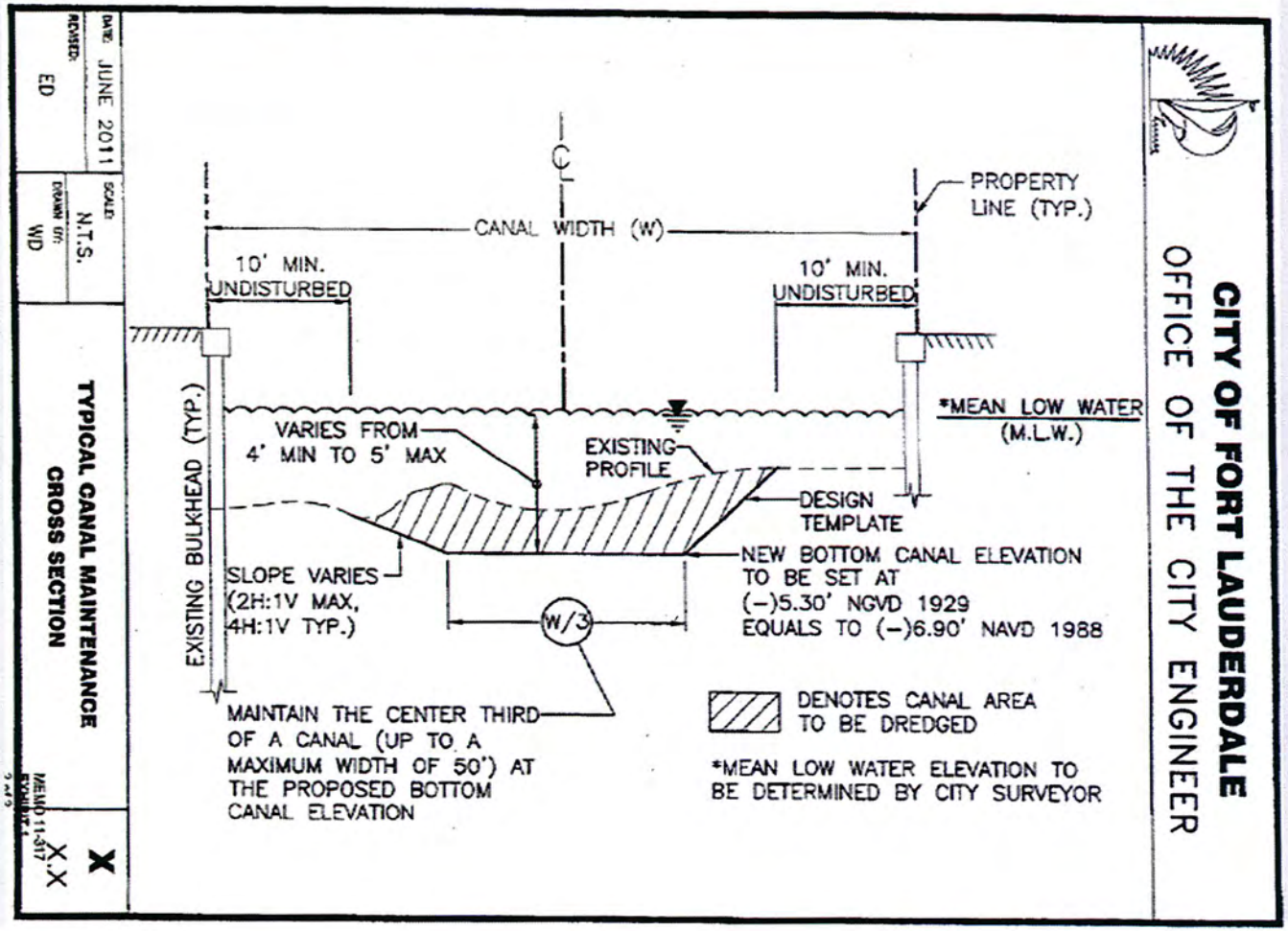
BACKGROUND
RELATED ORDINANCE

- Chapter 8, Article II, Section 8-34 states:

"Th*e Marine Advisory Board (MAB) may consider any subject matter it considers appropriate; and in addition, it's specifically directed to consider and make recommendations on the conditions of waterways and needed corrections, including a study of the most feasible and economical method of maintaining the depths of waterways within the city."*

BACKGROUND
CANAL DREDGING CRITERIA

- 2011 MAB accepted Canal Dredging criteria (CAR 11-1705):



WE BUILD COMMUNITY

BACKGROUND

WHAT OTHER COMMUNITIES ARE DOING

ITEM	FORT LAUDERDALE	FORT PIERCE	POMPANO	LIGHT HOUSE POINT	MIAMI BEACH, DEERFIELD, NORTH MIAMI, BOCA
SIMILAR DREDGING CRITERIA	X	X	X	X	X
USE GENERAL FUND	X	X	X	X	X
DREDGE APPROACH ON A CASE BY CASE BASIS	X	X	X	X	X

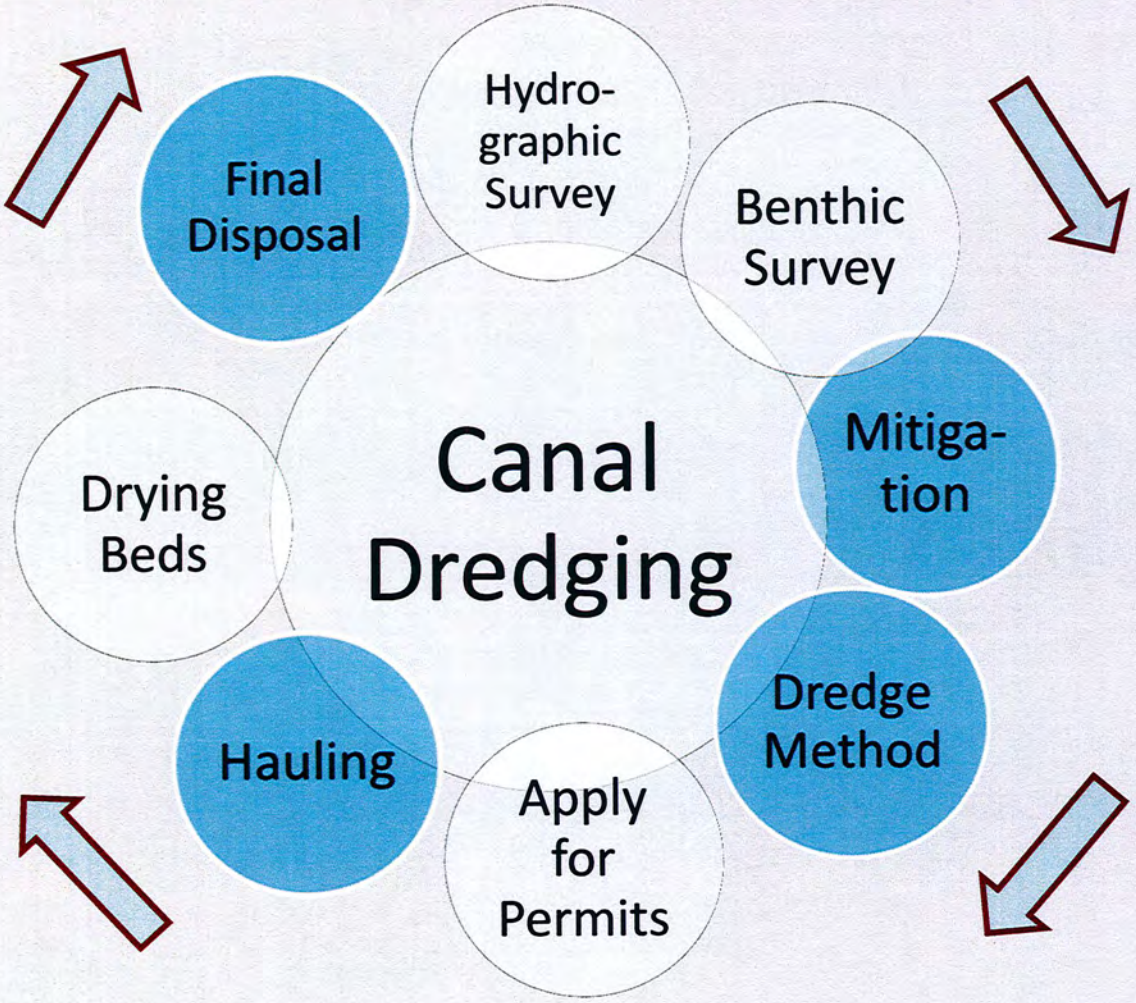
WE BUILD COMMUNITY

BACKGROUND
WHAT OTHER COMMUNITIES ARE DOING

ITEM	FORT LAUDER-DALE	NAPLES	ST. PETERS-BURG	TAMPA	JACKSON-VILLE	PUNTA GORDA
SPECIAL ASSESSMENTS		X	X		X	X
TAXING DREDGING DISTRICTS		X			X	X
FUNDING ASSISTANCE THROUGH WATER DISTRICT				X		

WE BUILD COMMUNITY

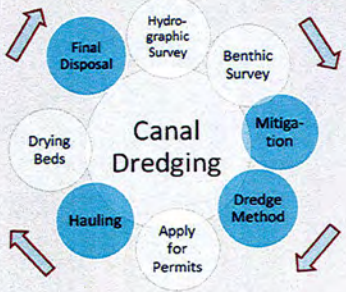
CHALLENGES:
COMPLICATED DREDGING LIFE CYCLE



WE BUILD COMMUNITY

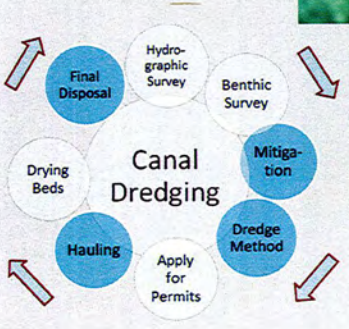
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE

HYDROGRAPHIC SURVEY



WE BUILD COMMUNITY

CHALLENGES: COMPLICATED DREDGING LIFE CYCLE
BENTHIC SURVEY



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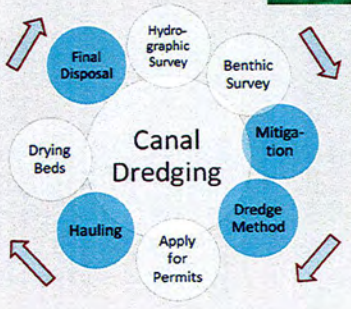
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE MITIGATION



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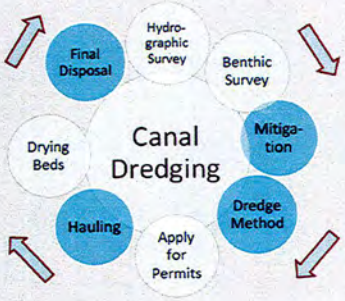
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE DREDGE METHOD



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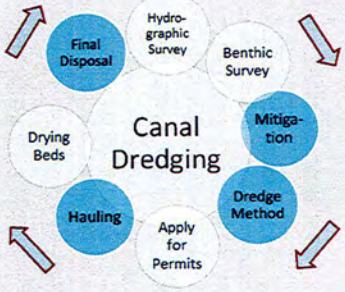
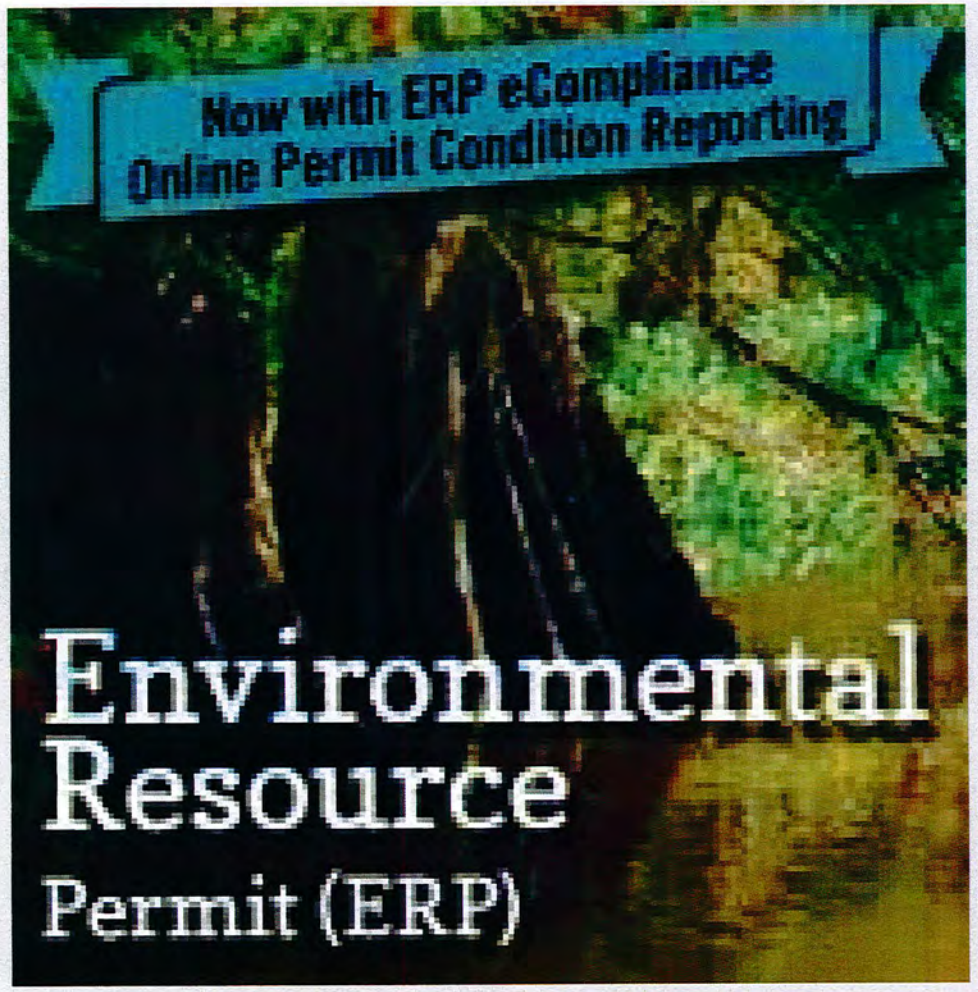
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE

APPLY FOR PERMITS





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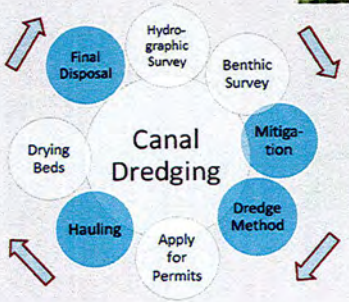
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE HAULING



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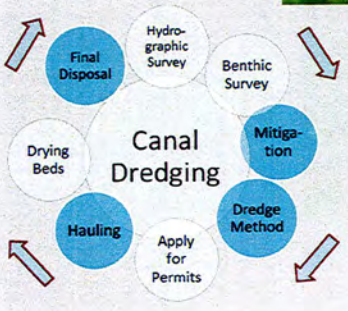
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE DRYING BEDS



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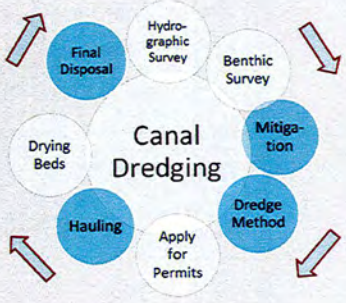
CHALLENGES: COMPLICATED DREDGING LIFE CYCLE
FINAL DISPOSAL



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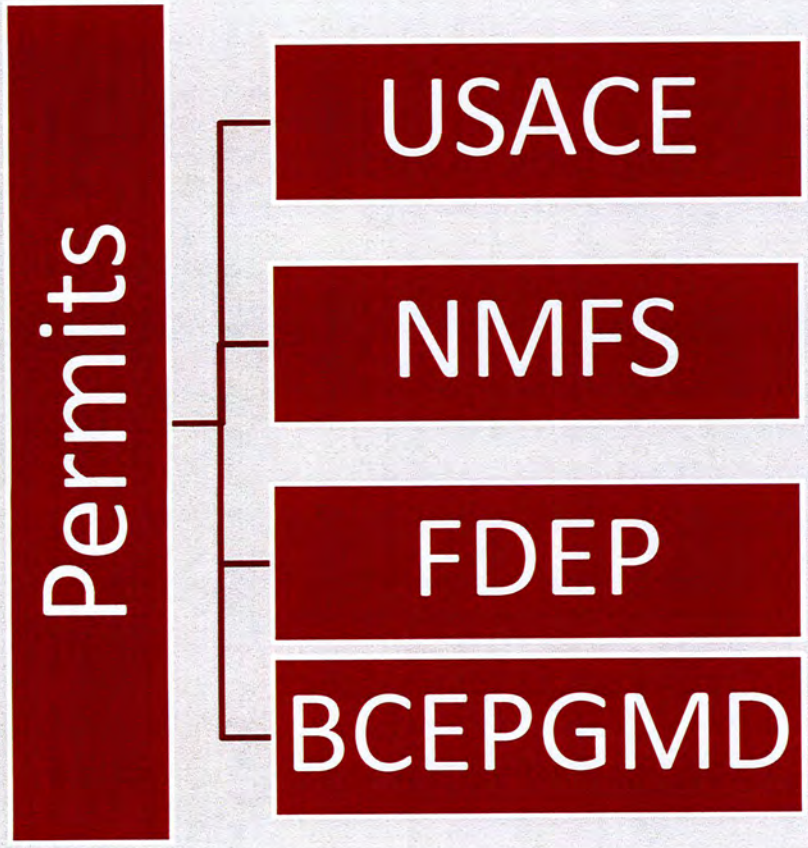
CHALLENGES
ENVIRONMENTAL PERMITTING



U.S. Army Corps of Engineers

National Marine Fisheries Services (NMFS)

Florida Department of Environmental Protection

Broward County Environmental Protection and Growth Management Department (BCEPGMD)

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CHALLENGES

MULTIPLE HYDROGRAPHIC SURVEYS REQUIRED

Planning	1st Time – Determine if Dredging is Required
Design	2nd Time– Design & Permitting if 1st Survey is Older than 2 yrs.
Pre-construction	3rd Time – Verify Proposed Dredge Quantities and Location
Post-construction	4th Time – As-built and Verify Dredge Quantities
Permit Requirements	5th Time - If Mitigation Verification Required (up to 5-years)

WE BUILD COMMUNITY

FAST FORWARD: FORT LAUDERDALE 2035
WE ARE CONNECTED

Boats move seamlessly and easily through a safe canal system connected to the Intracoastal Waterway.

WE BUILD COMMUNITY

PRESS PLAY FORT LAUDERDALE

STRATEGIC PLAN 2018

COMPREHENSIVE CANAL ASSESSMENT

Infrastructure Goal # 2 — Be a sustainable and resilient community

Objective # 1 — Proactively maintain our water, wastewater, road and bridge infrastructure

Strategic Initiative — Conduct an analysis of canal dredging needs and examine funding scenarios

CAAP High Priority — Comprehensive Canal Dredging Master Plan

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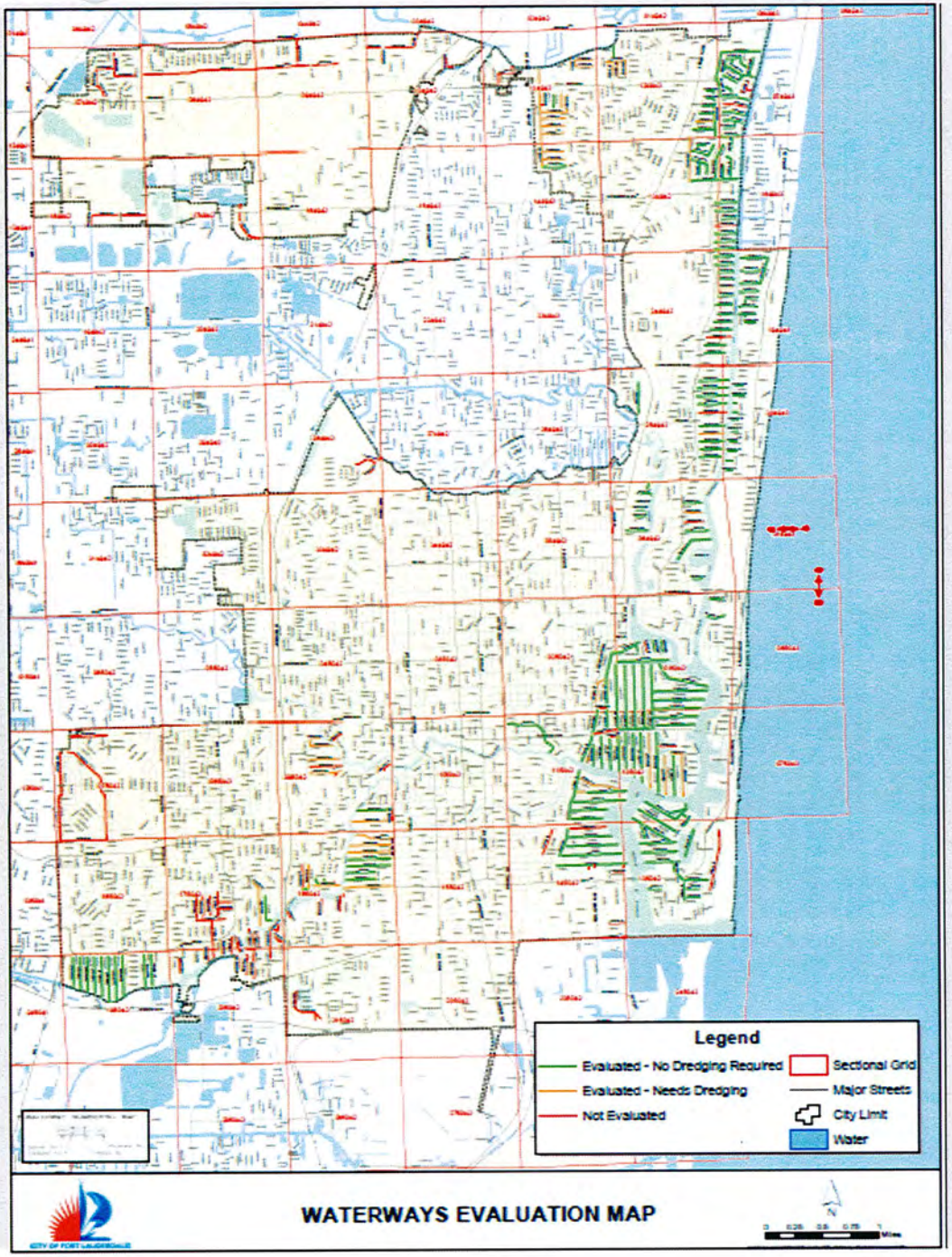


COMPREHENSIVE CANAL ASSESSMENT

DELIVERABLES:

- New GIS Waterways Database & Maps
- Report

WE BUILD COMMUNITY

COMPREHENSIVE CANAL ASSESSMENT SNAP SHOT

Unknown dredge needs:

8 miles (navigable)
+ 6 miles (drainage)
= 14 miles (of un-surveyed canals)

Unknown dredge forecast:

- 40% (5.6 miles) will need dredging
- Survey Cost: $0.50 M
- Design & permit: $0.50 M
- Const. Cost: $2.24 M

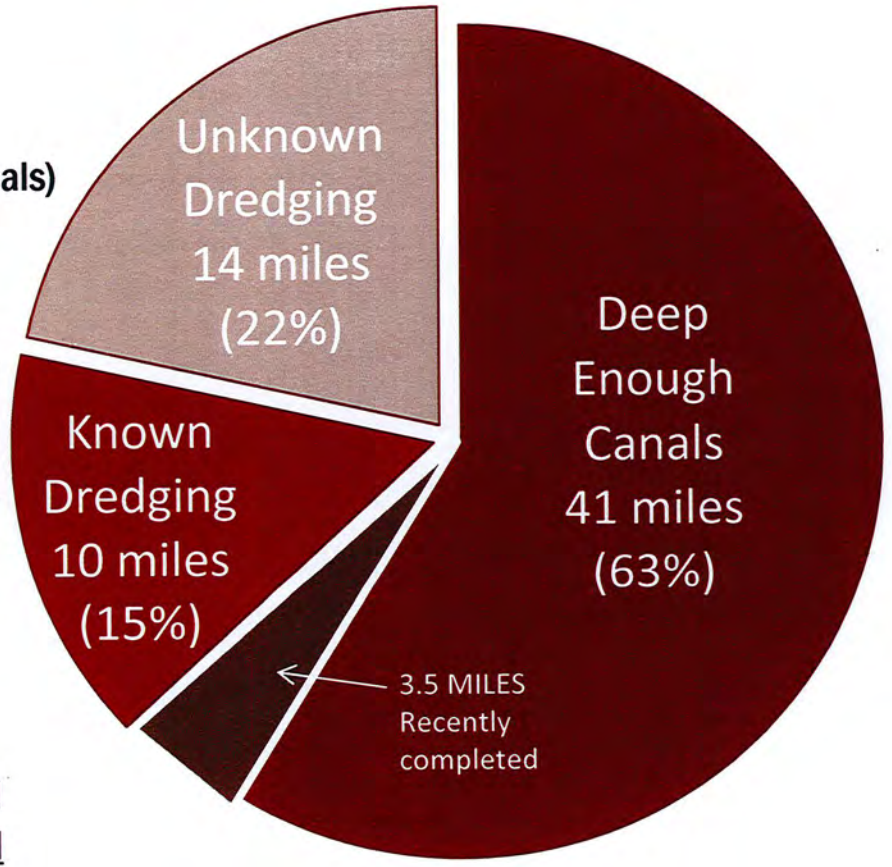
$3.24 M

Known dredging needs:

10 miles (navigable)

- Design & Permit: $1.01 M
- Const. Cost: $3.73 M

$4.74 M



Total cost of master plan (forecast of unknown + known dredge needs) = $3.24 M + $4.74 = $8.0 M (Rounded)

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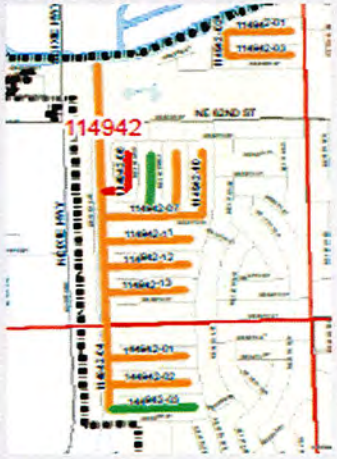
COMPREHENSIVE CANAL ASSESSMENT
NEIGHBORHOODS WITH DREDGING NEEDS (10 MILES)

River Oaks, Shady Banks,
Riverland Neighborhoods (2.5 miles)

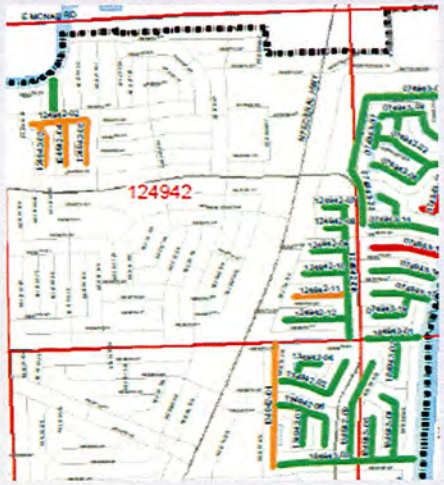
Riverside Park,
Tarpon River Neighborhoods (1.75 miles)

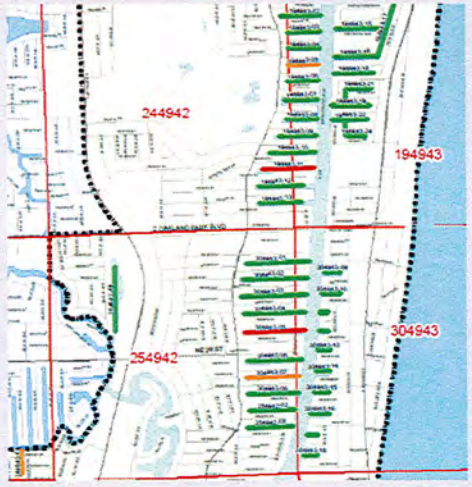
Rio Vista, Las Olas Isles
Neighborhoods (1.90 miles)



Coral Ridge Isles (2.72 miles)

YELLOW
CANALS
NEED
DREDGING





Imperial Point & Adjacent Neighborhoods (1.53 miles)

WE BUILD COMMUNITY

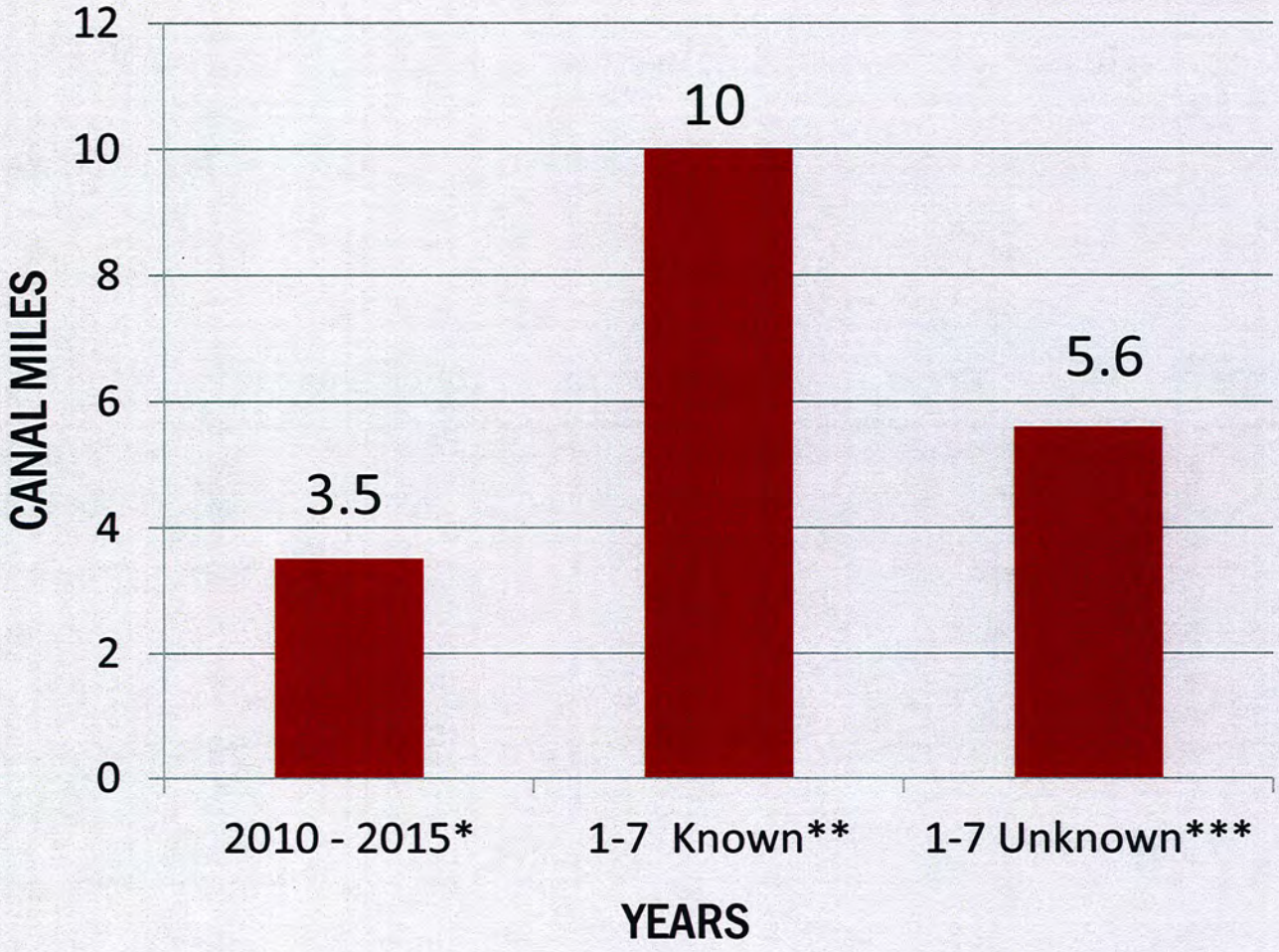
CANAL DREDGING MASTER PLAN: FINANCIAL SUMMARY

Year	Description	Cost
1	Survey canals of <u>unknown</u> dredge needs	$0.50 M
1	Design & permit of <u>known</u> dredge needs	$1.01 M
2	Design & permit <u>unknown</u> needs	$0.50 M
3 - 7	Construction: known ($3.72 M) & unknown ($2.24 M)	$5.96 M
	TOTAL 7-YEAR MASTER PLAN	**$8.0 M* (Rounded)**

<u>* Footnote:</u> 7-Year Master Plan yearly cost = $1.142 Million per Year.

WE BUILD COMMUNITY

CANAL DREDGING MASTER PLAN
PAST WORK & FUTURE DREDGING NEEDS



* Total funded
2010-2015 = $1.5 M

** Total known
Years 1-7= $4.74 M

***Total unknown
(forecast)
Years 1-7 = $3.24 M

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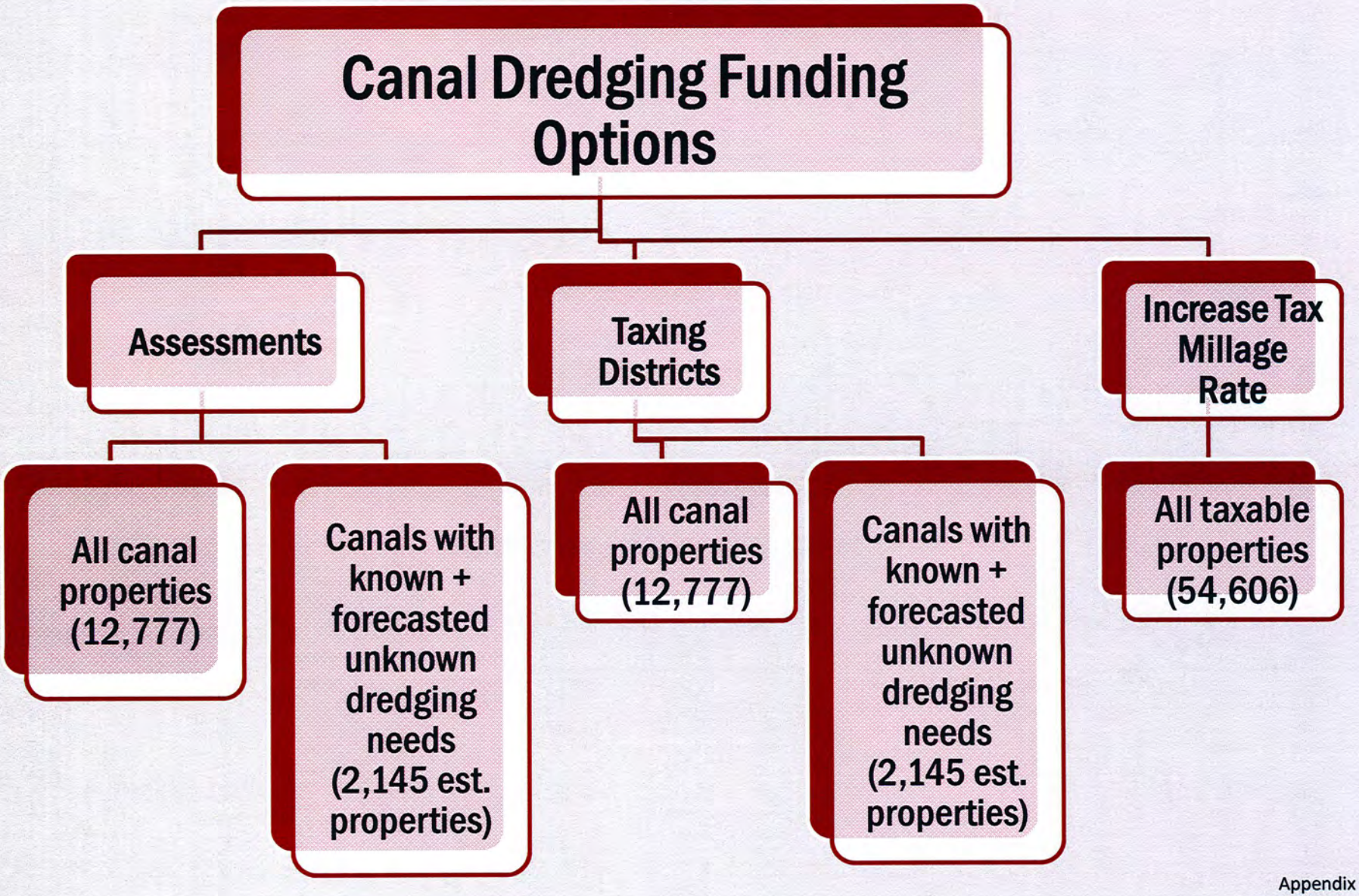

WE BUILD COMMUNITY

ASSESSMENTS

PROS:

- Tailored to a specific group
- Benefited parties are easy to identify
- May assess government and other non-taxable properties

CONS:

- Higher cost per property than taxing option
- Applies to cost of known work only
- A direct benefit must be demonstrated
- Collection method more complicated; includes property liens to violators
- Financial consultant defines appropriations methodology
- Lengthy process
- Public hearings/mailing required by Florida statute

WE BUILD COMMUNITY

TAXING DISTRICTS

PROS:

- A direct benefit does not need to be demonstrated
- Can be tailored to specific neighborhoods or areas
- It can be used for repetitive dredging needs
- Canal sanitation costs can be included
- Simplification of collection of fees

CONS:

- Higher cost per property when compared to tax millage rate option

WE BUILD COMMUNITY

INCREASE TAX MILLAGE RATE

PROS:

- Lowest cost per property
- No direct benefit needs to be demonstrated
- It can be used for repetitive dredging needs
- Fewer complaints expected

CONS:

- Applies to all taxable properties in City
- Political opposition by non-canal users
- Millage rate changes

WE BUILD COMMUNITY

FUNDING OPTIONS: ASSESSMENTS

Option 1 :

Assess all canal properties in City limits:

- 12,777 properties
- 607,200 feet of total property canal frontage
- 7-Year master plan total cost = $8.0 M ($1.142 M/Yr)
- Annual assessment per linear feet = $1.88/ft
- Direct benefit needs to be demonstrated.

WE BUILD COMMUNITY

FUNDING OPTIONS: ASSESSMENTS

Option 2:

Assess properties with known + forecasted unknown dredging needs:

- 2,145 canal properties (1,341 known + 804 estimated unknown)
- 102,554 feet of total property canal frontage
- 7-Year master plan cost = $8.0 M ($1.142M/Yr)
- Annual assessment per linear feet = $11.13/ft
- Direct benefit needs to be demonstrated.

WE BUILD COMMUNITY

FUNDING OPTIONS
TAXING DISTRICT

Option 1:
All properties on a canal:

- 12,777 canal properties
- 607,200 feet of property frontage
- Estimated expenses $1.142 M/Yr.
- Annual cost per linear feet = $1.88/ft
- No direct benefit needs to be demonstrated.

WE BUILD COMMUNITY

FUNDING OPTIONS
TAXING DISTRICT

Option 2:

Assess properties with known + forecasted unknown dredging needs:

- 2,145 canal properties (1,341 known + 804 estimated unknown)
- 102,554 feet of total property canal frontage
- 7-Year master plan cost = $8.0 M ($1.142M/Yr)
- Annual cost per linear feet = $11.13/ft
- No direct benefit needs to be demonstrated.

WE BUILD COMMUNITY

NEXT STEPS

- Determine funding source
- Task financial consultant with specific rate study
- Implement methodology to initiate fund
- Collect revenue
- Initiate 7-year master plan

WE BUILD COMMUNITY

SUMMARY

- Canal Dredging is Important
- Historical Management was Examined
- Current & Future Challenges are Now Known
- Comprehensive Canal Assessment is Complete
- Dredging Master Plan & Costs Identified
- Funding Options Identified
- Next Steps
- Q & A

WE BUILD COMMUNITY

Q&A

BEFORE DREDGING

AFTER DREDGING

WE BUILD COMMUNITY

THANK YOU

WE BUILD COMMUNITY