TECHNICAL MEMORANDUM

MICA West Neighborhood Infrastructure Improvement Plan (NIIP)
(aka Phase 2 MICA West Water Quality Improvements)

TO:	Dan Clark, PE Town of Lake Clarke Shores
FROM:	Donald Sheldon, PE; Bill Lynch, PE
DATE:	October 19, 2021
SUBJECT:	Basis of Design Technical Memorandum Jones Edmunds Project No. 12055-003-01

1 INTRODUCTION

1.1 BACKGROUND

The 2019 Master Plan prepared for the Town of Lake Clarke Shores conceptualized options and presented associated opinions of cost for the Northern Utility Service Area (NUSA) septic to sewer (S2S) conversion program. NUSA includes 696 single-family residential lots, 19 multi-family dwellings, and 20,853 square feet of commercial/non-residential buildings resulting in a build-out estimated total average daily flow of 144,000 gallons per day (gpd) to Palm Beach County (PBC) Water Utilities for treatment, reuse, and disposal.

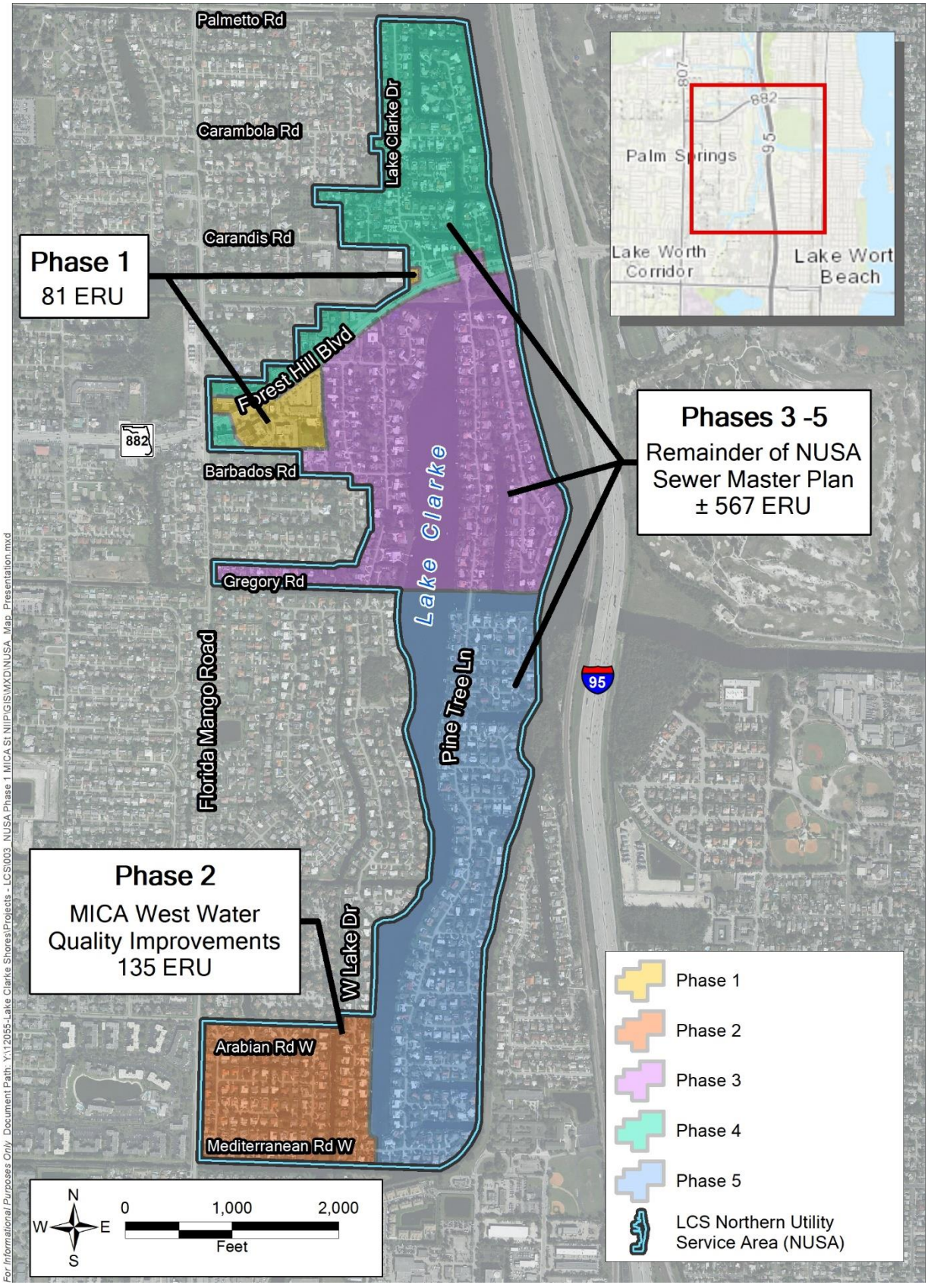
In 2016, the Town began the phased S2S conversion program by converting commercial/ non-residential buildings from on-site sewage treatment and disposal systems (OSTDS = septic systems) to a central sanitary sewer system. Phases 1A, 1B, and 1C focused on the commercial corridor along Forest Hill Boulevard. Fully implemented Phase 1 removed commercial septic systems with equivalent residential units (ERU) totaling 81 homes.

1.2 PROJECT DESCRIPTION

This Phase 2 project of the NUSA S2S conversion program will provide a central sanitary sewer system that will serve approximately 135 homes, allowing for removal of their individual OSTDS. The project, when constructed, will serve homes along Mediterranean Road West, Indian Road West, Caribbean Road West, Arabian Road, and the associated streets of Wilton Drive, Waterway Drive, and West Lake Drive West (collectively referred to as MICA West). Figure 1-1 shows the MICA West NIIP project area location.

This project is estimated to provide a load reduction of approximately 2,025 pounds of nitrogen and 189 pounds of phosphorus each year based on criteria provided by Dr. Xueqing Gao, an environmental consultant with the Florida Department of Environmental Protection (FDEP) On-Site Sewage Program.

Figure 1-1 Project Area Location and S2S Conversion Plan Phasing



The proposed collection system will consist of gravity mains, a duplex lift station, a force main, and a connection to the existing Lake Worth Beach (LWB) force main in the right-of-way (ROW) of Florida Mango Road. The wastewater will ultimately be treated by the PBC central sewer system.

In addition to the wastewater system improvements, the Town is capitalizing on construction efficiency by replacing the 6-inch asbestos-cement (AC) potable water mains with 8-inch polyvinyl chloride (PVC) water mains and rehabilitating the streets and drainage swales included in the project area as a part of this MICA West project.

1.3 PURPOSE

This Basis of Design Technical Memorandum (BODTM) establishes the Town's project and design objectives, outlines regulatory requirements as they relate to the project, and establishes the design criteria and methodology used by Jones Edmunds to meet all project objectives set by both the Town and regulatory agencies.

2 INFRASTRUCTURE IMPROVEMENTS

2.1 EXISTING FACILITIES

Approximately 135 individual onsite septic tanks are within the MICA West NIIP project area (Figure 1-1). Additionally, a 36-inch prestressed concrete cylinder pipe (PCCP) wastewater force main owned and operated by the City of Lake Worth Beach is in the east ROW of Florida Mango Road. The project area currently does not have any connection to this force main or any other centralized sewer system.

Potable water service to the project area is supplied by the Village of Palm Springs and is metered via a 4-inch water meter near the intersection of Florida Mango Road and Arabian Road West. Within the project area, residences are supplied by 6-inch AC water mains.

Rehabilitation of the streets and drainage swales will be incidental to the project wastewater collection system and water system design. Rehabilitation is generally expected to result from restoring and resurfacing the streets and adjacent swales within the project area; therefore, these rehabilitation activities are not described further in this BODTM.

In addition to existing water infrastructure, limited drainage structures and pipes are also present within the project area along Waterway Drive and Mediterranean Road, receiving runoff from the streets and adjacent swales. Electrical and communication services within the project area are primarily installed overhead in easements along the back of lots. Based on above-grade survey, significant utility conflicts do not appear to be within the ROW in the project area; however, subsurface utility location will be performed before construction.

2.2 PROPOSED IMPROVEMENTS

Attachment A shows the proposed infrastructure improvements and the following sections detail those improvements.

2.2.1 WASTEWATER COLLECTION AND TRANSMISSION SYSTEM

Figure 2-1 shows the proposed gravity system, lift station, force main, and LWB force main connection point.

Figure 2-1 Proposed Wastewater Improvements

2.2.1.1 Lift Station

- Install a new lift station with an 8-foot-diameter wet well and duplex submersible pumps based on PBC standards and input from the Town.
- Connect electrical infrastructure and associated power, lighting, and appurtenances.

- Provide a potable water connection with a backflow preventer and hose bib for wash down at the lift station.
- Install pavers around the wet well and valve vault to remain consistent with the aesthetics of the surrounding neighborhood.
- Install a meter vault and flow meter (manhole) on the wastewater force main following LWB requirements.

2.2.1.2 Gravity Collection System and Force Main

- Install approximately 7,330 linear feet of 8-inch gravity sewer, including 30 new 4-foot-diameter manholes.
- Install 134 6-inch individual gravity service laterals for each home to connect to the sewer system.
- Install approximately 1,490 linear feet of 4-inch force main.
- Connect the proposed Town force main to the LWB's 36-inch PCCP force main in the ROW of Florida Mango Road near Arabian Road West.

PBC is nearing the end of the design phase for a road-widening project along Florida Mango Road {PBC Project No. 2016500 - Florida Mango Road from 10th Avenue N to Edgewater Drive [over L-9 and L-10]), including the portion that is adjacent to the MICA West project area. For efficiency of construction and to minimize disruption in the area, the wet tapping of the 36-inch PCCP force main in the Florida Mango Road ROW is included and is to be contracted under the PBC roadway project. Jones Edmunds provided a limited design package for the wet tap and approximately 40 linear feet of 4-inch PVC force main to be included in the County's roadway project bid package. Once constructed, the 4-inch PVC section terminated east of the Florida Mango Road ROW line will serve as the point of connection for the remainder of the force main associated with this project, which will be constructed following its own discrete bidding and construction process.

2.2.1.3 Water Distribution System

- Install approximately 7,870 linear feet of 8-inch PVC water main.
- Install approximately 134 water service laterals with replacement meter boxes and appurtenances.
- Evaluate trenchless (pipe bursting) installation via pre-chlorinated pipe bursting as the preferred installation method following geotechnical investigations. This method will reduce the amount of restoration required for water main installation compared to open-trench installation.
    - If pipe bursting installation is feasible, minimal removal and proper disposal of existing AC pipe will be required. If another installation method is selected, the existing water pipe will be filled with grout and abandoned in place.
- Connect the proposed 8-inch water main to the existing 4-inch water meter near the intersection of Florida Mango Road and Arabian Road West.

The 4-inch water meter supplying the project area is fed by a 6-inch AC water main from the Village's potable water system. Coordination with the Village indicates an average supply pressure of approximately 59 pounds per square inch (psi) upstream of the 4-inch

meter. The Town has requested that the proposed Village water main be upsized 8-inch PVC from the existing 6-inch AC water mains within the project area. Since the supply main from the Village is not expected to be upsized at this time, static or residual water pressures and available fire flow are not expected to significantly change within the project area. Upsizing the existing mains from 6 inches to 8 inches will reduce local headlosses and provide nominal increases in available fire flow. Figure 2-2 shows pressure and fire flow data based on hydrant tests performed by the Town on June 23, 2020.

Figure 2-2 Proposed Distribution System and Available Fire Flow

3 LIFT STATION BASIS OF DESIGN

3.1 WASTEWATER HYDRAULIC MODELING

To establish the hydraulic requirements for the proposed lift station and force main, the population estimates were based on available 2020 Census data. The project area is fully developed and unlikely to see any significant increase in population.

3.1.1 POPULATION AND FLOW PROJECTIONS

The topographic survey indicates 134 single family homes will be connected to centralized sewer within the project area. Table 3-1 shows the projected sewage flows based on PBC development design standards and the FDEP requirement of 100 gallons of wastewater per capita per day.

Table 3-1 Projected Wastewater Flows

Number of Single-Family Homes	Persons Per Household (2020 Census)	Average Daily Flow (ADF)		Peak Hour Factor	Peak Hourly Flow (PHF)
		gpd	gpm		gpm
134	2.32	31,088	21.6	4.07	88

Note: gpm = gallons per minute.

A Peak Hour Factor of 4.07 was calculated based on the population of the project area and applying the peaking factor methodology in the *10-States Standards*. Applying the peak hour factor to the ADF, the PHF then results in 88 gpm.

3.1.2 PROPOSED CONNECTION

Jones Edmunds developed a steady-state hydraulic model of the wastewater system using Bentley SewerGEMs software to establish the pumping requirements and to size the proposed lift station and force main. The proposed 4-inch force main from the proposed lift station on Waterway Drive will manifold into the existing 36-inch PCCP LWB force main in the east ROW of Florida Mango Road via a specialized wet tapping saddle and valve.

The City of Lake Worth Beach has performed pressure tests on the 36-inch force main and indicates that pressures range from 4.3 psi to 20.1 psi. During extreme wet-weather events, pressures may exceed this range. The LWB force main will convey the wastewater to the PBC wastewater treatment system. Preliminary discussions with County staff indicate that the treatment system has sufficient capacity to treat the additional flow from the project area.

3.1.3 Modeling Simulations for the Proposed Lift Station

Table 3-2 shows the model conditions that were assessed to establish system curves for the proposed lift station and force main:

Table 3-2 Hydraulic Model Parameters

Scenario	Static Head (feet)	Connection Pressure Head (feet)	Hazen-William C Factor
Mininum Head Condition	12.84	9.93	150
Maximum Head Condition	51.09	46.43	120

3.1.3.1 Summary of the Proposed Lift Station System Sizes

Table 3-3 summarizes the proposed diameters, lengths, and materials for the gravity and pressurized systems.

Table 3-3 Proposed Sanitary Sewer and Force Main System Sizes

Segment	Description	Length (LF)	Size (inches)	Material
Gravity	New Gravity Mains	7,330	8	PVC SDR-26
Force Main	Below-Grade Piping	1,490	4	C900 DR-18 PVC
Pump Riser	Inside Wet well	20	4	Stainless Steel Type 316

Notes: LF = linear foot; SDR = Standard Dimensional Ratio.

3.2 Lift Station Design Criteria

3.2.1 Lift Station Design Flow Range

Table 3-4 lists the flow range used to design the proposed lift station.

Table 3-4 Design Flows for Lift Station

Design Flows	gpd	gpm
ADF	31,090	22
PHF	126,720	88

3.2.2 Summary of Proposed Lift Station and Force Main Sizing

3.2.2.1 Lift Station Discharge and Force Main

The pump discharge piping begins at the pump connection (elbow base) and ends at the manifold within the lift station valve vault. The force main runs from the lift station to the point of connection. Table 3-5 summarizes the lift station discharge and force main piping size. The pump discharge and force main will be 4-inch-diameter pipes. Minimum velocities exceed 2 feet per second (fps) to achieve scour and resuspension velocity in the force main.

Table 3-5 Pump Discharge and Force Main Pipe Sizing

Location	Pipe Material[1]	Nominal Pipe Size (inches)	Inside Diameter (inches)	Flow Velocity[2] (fps)	
				Minimum (122 gpm)	Maximum (248 gpm)
Pump Riser	SS	4	4.026	3.07	6.25
Lift Station Discharge	DIP	4	4.15	2.89	5.88
Force Main	PVC	4	4.23	2.79	5.66

[1]Refer to Table 3-3 for additional information on pipe material.
[2]Based on flows from the selected pump.
Notes: SS = stainless steel; DIP = Ductile Iron Pipe.

3.2.2.2 Pump-Out Emergency Connection

The lift station will be provided with a pump-out emergency (lift station by-pass) connection, the same size as the force main. This connection will allow by-pass of the pumps in the wet well using an external self-priming pump. A special connector and a plug valve will allow for quick coupling and control.

3.2.3 WET WELL

The proposed wet well will be an 8-foot-diameter wet well with a high-density polyethylene (HDPE) liner. Access to the wet-well interior will be through a traffic-rated hatch. Wastewater will enter the wet well from the side through an 8-inch-diameter PVC pipe. A rubber connector boot will be used as a seal between the wall and the inflow pipe. Due to the highly corrosive environment, all hardware used inside the wet well will be Schedule 40 SS Type 316.

3.2.3.1 Size and Dimensions

The wet well is sized to meet FDEP wastewater permitting requirements. Table 3-6 shows the critical design elements within the wet well.

Table 3-6 Wet Well Design Components

Pump and Flow	
Daily Average Inflow	22 gpm
Design Peak Inflow	88 gpm
Basis of Design Pump Manufacturer/Model	Flygt NP 3127 HT3~ Adaptive 488
Pump Configuration	Duplex, Alternating Operation
Design Starts Per Hour	10
Design Pumping Capacity (Mininum Head Condition)	248 gpm
Wet Well	
Wet Well Diameter	8 feet
Lowest Influent Sewer Elevation	-1.41 feet

Working Depth and Volume	
Required Minimum Working Volume	372 gallons
Required Minimum Working Depth	0.99 foot
Design Working Volume	564 gallons
Design Working Depth	1.50 feet
Cycle Time	
Minimum Allowable Cycle Time	6 minutes
Time to Fill (Daily Average Inflow)	26.12 minutes
Time to Empty (Minimum Head Condition)	2.49 minutes
Cycle Time	28.61 minutes
Preliminary Operational Levels	
Ground Elevation	11.70 feet
Wet Well Bottom	-6.91 feet
Pump Off Elevation	-4.41 feet
Lead Pump On Elevation	-2.91 feet
Stand-by Pump On Elevation	-2.41 feet
Alarm Elevation	-1.91 feet
Control Elevation (Influent)	-1.41 feet

3.2.3.2 Air Vent and Odor Control

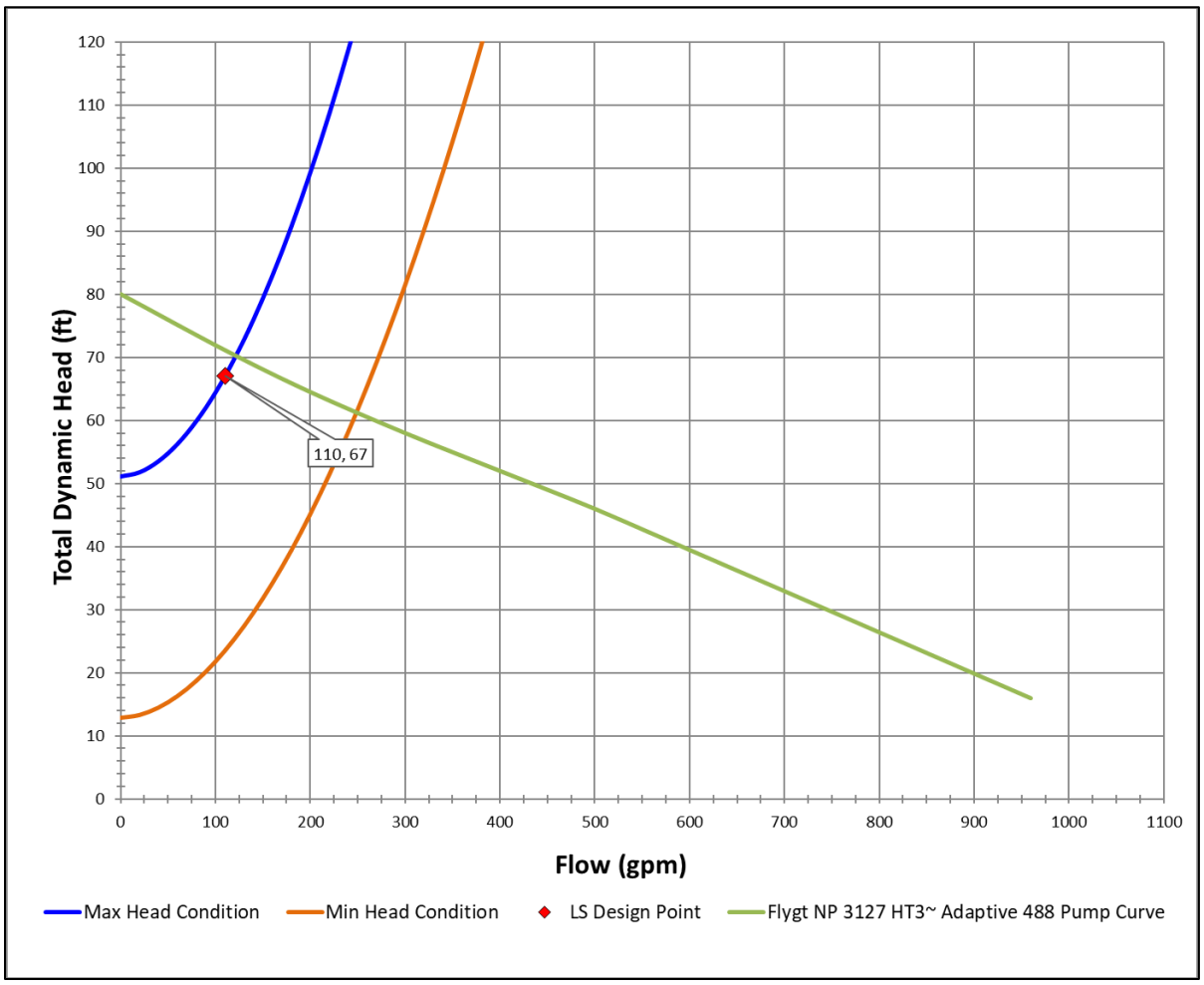
The wet well will be provided with a 4-inch PVC air vent. The air vent will allow passive air changes inside the wet well and proper pump operation. A carbon filter and a screen will be provided with the air vent for odor and insect control.

3.2.4 Pump Design Criteria

3.2.4.1 System and Pump Curves

Table 3-2 shows the hydraulic model criteria used to develop system curves for the proposed lift station. Figure 3-1 shows the system curves relative to the design point and the selected pump curve. The design point of 110 gpm is based on the velocity required to produce a minimum velocity of 2 fps in the effluent force main. This value is greater than the PHF, creating a factor-of-safety for intermittent high-flow or high-discharge head events. The intersection of the curves represents the points of operation.

Figure 3-1 System and Pump Curves for Proposed Lift Station



3.2.4.2 Pump Selection

The basis of design for the proposed lift station is Flygt; however, alternatives may be proposed by the Contractor during construction. Table 3-7 shows the basis of design for the pump that was selected by Jones Edmunds. In the duplex pump configuration, two of the same pumps will be installed in the wet well in parallel. The pumps will alternate between cycles. However, as a resiliency measure, both pumps will operate simultaneously should the inflow exceed the design capacity.

Table 3-7 Lift Station Pump Selection

Pump Manufacturer	Xylem/Flygt
Pump Type	Submersible
Pump Model	NP 3127 HT 3~ Adaptive 488
Inlet Diameter	3.94 inches
Discharge Diameter	4 inches
Pump Speed	1,745 RPM
Impeller Diameter	8.31 inches
Best Efficiency Point	69.2 percent at 490 gpm
Efficiency at Design Point	34.7 percent at 113 gpm

NPSHr at Minimum Pump Total Head	15.2 feet at 113 gpm
Shutoff Head	80 feet
Runout Flow/Head	960 gpm/16 feet
Motor Power	10 HP
Motor Voltage	240 volts
Maximum Starts per Hour	30

Notes: RPM = revolutions per minute; NPSHr = Net Positive Suction Head Required; HP = horsepower.

3.2.5 Wastewater Flow Measurement

An electromagnetic flow meter will be installed in the force main at the proposed lift station site following American Water Works Association (AWWA) C751, *Magnetic Inductive Flowmeters*, and the manufacturer's recommendations. The flow meter will conform to the City of LWB's standards.

3.2.6 Potable Water Service

The lift station will be provided with potable water for washdown activities. A 1-inch PVC Schedule 40 water service will be tapped from the nearest water main to the proposed lift station site. A 3/4-inch backflow preventer will be installed to avoid any possible contact between contaminated water and the potable water system in accordance with Rule 62-555.360, Florida Administration Code (FAC), and a new 5/8-inch water meter will be installed at the lift station site.

3.2.7 Site Design

The layout of the lift station will be generally based on PBC standards, with a few notable exceptions to be implemented at the Town's request. To minimize aesthetic disturbance to the area, no fence is proposed around the lift station. The wet well, valve vault, and control panels will all independently lock to maintain the safety and security of the station. All components of the lift station will be constructed below grade, except for the control panel, which will be a free-standing unit away from the wet well, near an adjacent privacy wall. The pad surrounding the wet well is conceptually planned to be constructed of permeable pavers instead of a more traditional concrete slab to better blend with the surrounding neighborhood. Since the lift station is to be constructed with no fence and adjacent to a roadway, all hatches shall be appropriately traffic rated.

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) indicate that the lift station site is not within a floodplain; therefore, inundation by a 1-percent annual chance flood event is not expected. The nearest flooplain to the lift station site has a listed base flood elevation (BFE) of 11.0 feet North American Vertical Datum of 1988 (NAVD88), which is below the designed top-of-slab elevation of the lift station wet well. Attachment B presents the annotated FIRM Panel 12099C0589F, effective October 5, 2017, showing the floodplain extents and BFEs in and around the project area.

4 WATER DISTRIBUTION SYSTEM BASIS OF DESIGN

The water distribution system is to be replaced and upsized by one nominal diameter (from 6-inch to 8-inch) using trenchless installation methods. As noted above, water flow and pressure are expected to be similar to the existing conditions. The method of construction is expected to be via pipe bursting, a method of replacing a water main in the exact location of the existing water main without removing the existing pipe, minimizing surface disruptions and service downtime of the main.

A typical pipe bursting installation is set up by digging pits on each end of the segment of pipe to be replaced. In one pit, a machine pulls the new pipe through the center of the existing pipe, using a specialized cutting device attached to the pipe to burst the existing pipe at the same time as laying the new pipe. The new pipe, typically HDPE or fusible PVC, is pre-fused, laid out, and pulled into the pit at the opposite end of the project segment. Once in place and pressure tested, the Contractor is able to dig down at service connection locations to make service connections to the new pipe. The advantage of pipe bursting is to minimize the excavation required to install a new pipe, resulting in faster construction schedules and less surface restoration costs.

5 PERMITTING

The following permits are expected to be required for the MICA West NIIP:

- FDEP General Permit for Construction of a Domestic Wastewater Collection/Transmission System.
- FDEP General Permit for Construction of a Water Main Extension for PWSs:
  - This permit may not be required if the water main is replaced in the same location and does not increase in size by more than one nominal diameter size.
- City of LWB approval to connect to the existing force main (already received).
- Town of Lake Clarke Shores ROW use permit (if required).

Required permits will be prepared and submitted in subsequent tasks of this project. The data and calculations presented in this Basis of Design Technical Memorandum sufficiently address the requirements of the expected permits.

Attachment A

Conceptual Design Drawings

Tap into existing
Lake Worth Beach
36" PCCP force main

Tie into existing
Village of Palm Springs
Water Meter

Proposed Lift Station
(Location Approximate)
Approximate Depth: ±18.6'

MH-09
Depth: 13.30'

MH-30
Depth: 10.30'

MH-08
Depth: 13.33'

MH-10
Depth: 13.37'

MH-22
Depth: 5.00'

MH-23
Depth: 5.00'

MH-24
Depth: 5.00'

West Ct

Central Ct

East Ct

Arabian Road W

MH-07
Depth: 12.78'

MH-19
Depth: 5.68'

MH-20
Depth: 6.86'

MH-21
Depth: 7.87'

MH-18
Depth: 5.00'

MH-01
Depth: 5.00'

MH-16
Depth: 5.00'

MH-17
Depth: 7.04'

MH-29
Depth: 8.41'

Caribbean Rd W

MH-06
Depth: 11.50'

Florida Mango Road

Wilton Dr

Waterway Dr

W Lake Dr

MATCH LINE - SEE FIGURE 2

Notes:

1. Proposed water mains are shown at approximate location of existing water mains based on survey of surface features such as valves and fire hydrants.

2. The preliminary method of new water main installation will be via pipe bursting. Further analysis will be conducted to determine the feasibility of this approach.

3. All pipe sizing is based on preliminary calculations. Further modeling will be conducted to confirm all pipe sizes.

4. Lift station location is approximate and will be finalized once the site layout and easements have been finalized.

Figure 1

Preliminary Project Layout

MICA West Water Quality Improvement Project - Lake Clarke Shores S2S Phase 2

- Proposed Lift Station
- Proposed Manhole
- Proposed 8" Gravity Main
- Proposed 4" Force Main
- Fire Hydrant
- Proposed 8" PVC Water Main
- Existing Lake Worth Beach Force Main (36" PCCP)

N
W E
S

0 60 120
Feet
1 inch = 120 feet

JonesEdmunds

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Notes:

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4. Lift station location is approximate and will be finalized once the site layout and easements have been finalized.

MATCH LINE - SEE FIGURE 1

Wilton Dr

Waterway Dr

W Lake Dr

Indian Rd W

Mediterranean Rd W

MH-02
Depth: 6.47'

MH-03
Depth: 7.77'

MH-04
Depth: 8.60'

MH-05
Depth: 9.37'

MH-11
Depth: 5.00'

MH-12
Depth: 5.00'

MH-13
Depth: 6.97'

MH-14
Depth: 8.62'

MH-15
Depth: 8.97'

MH-25
Depth: 5.00'

MH-26
Depth: 5.79'

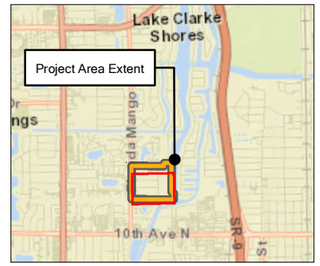
MH-27
Depth: 5.65'

MH-28
Depth: 7.02'

Figure 2

Preliminary Project Layout

MICA West Water Quality Improvement Project - Lake Clarke Shores S2S Phase 2



- Proposed Manhole
- Fire Hydrant
- Proposed 8" Gravity Main
- Proposed 8" PVC Water Main

N
W E
S

0 60 120
Feet
1 inch = 120 feet

JonesEdmunds

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Attachment B

Annotated FIRM Panel 12099C0589F

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded tenth-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Transverse Mercator State Plane Florida East FIPS Zone 0901 Feet. The **horizontal datum** was NAD83 HARN, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

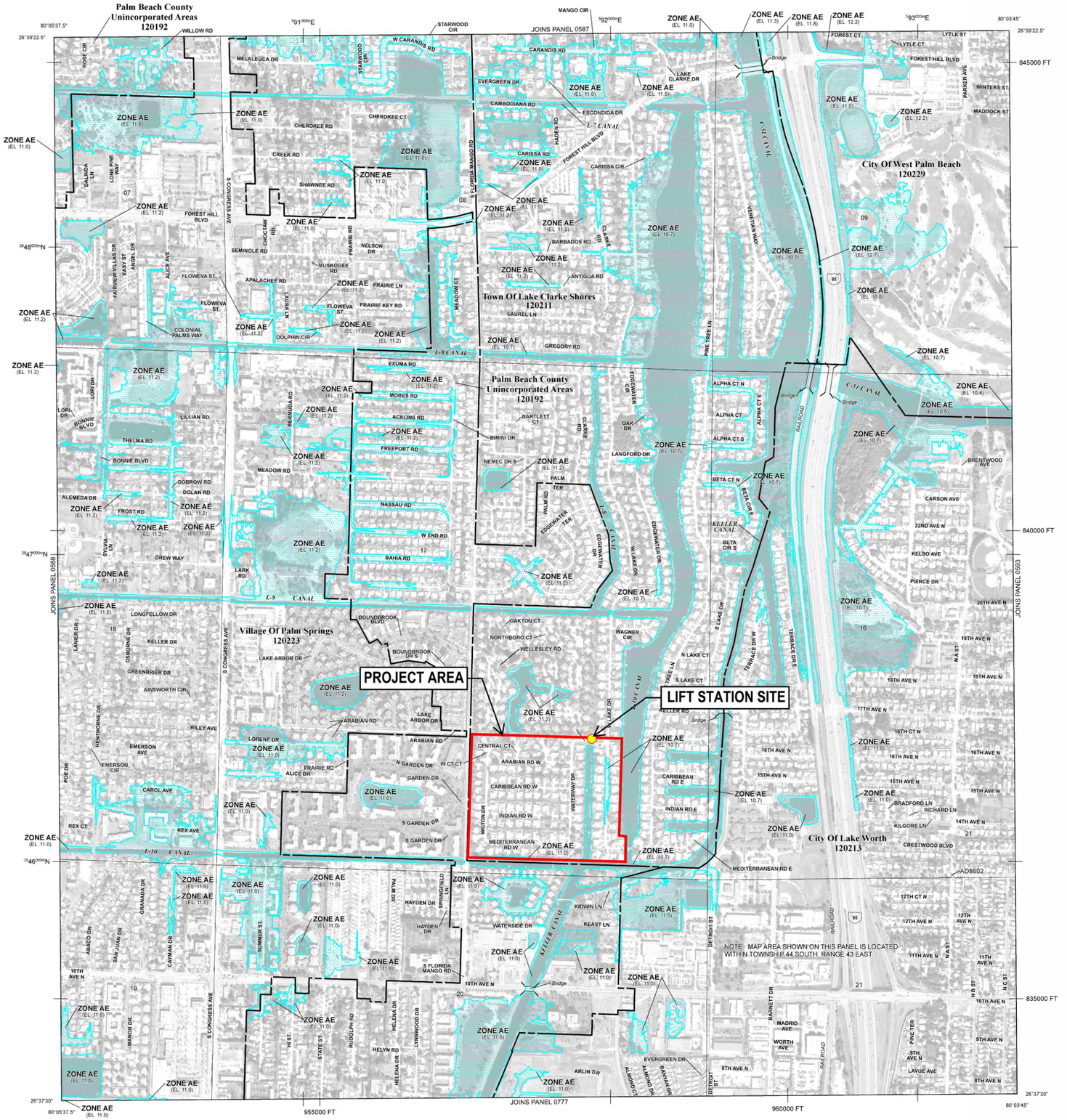
Base map information shown on this FIRM was provided in digital format by Palm Beach County. The original orthophotographic base imagery was provided in color with a one-foot pixel resolution at a scale of 1" = 200' from photography flown November 2010 - January 2011.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities

513 (EL 987) Base Flood Elevation line and value; elevation in feet*

Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A–A Cross section line

23–23 Transect line

97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

4275000mE 1000-meter Universal Transverse Mercator grid ticks, zone 17

6000000 FT 5000-foot grid values: Florida State Plane coordinate system, East Zone (FIPSZONE = 901), Transverse Mercator projection

DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories List on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
OCTOBER 5, 2017

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0589F

FIRM

FLOOD INSURANCE RATE MAP

PALM BEACH COUNTY, FLORIDA AND INCORPORATED AREAS

PANEL 589 OF 1200

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAKE CLARKE SHORES, TOWN OF	120211	0589	F
LAKE WORTH, CITY OF	120213	0589	F
PALM BEACH COUNTY	120192	0589	F
PALM SPRINGS, VILLAGE OF	120223	0589	F
WEST PALM BEACH, CITY OF	120229	0589	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
12099C0589F

EFFECTIVE DATE
OCTOBER 5, 2017

Federal Emergency Management Agency