APPENDIX B

West Hollywood Septic Conversion Pre-Design Technical Memorandum

4321-004R1_Final

Hazen *Technical Memorandum*

SOUTHERN REGIONAL WWTP COLLECTION SYSTEM

West Hollywood Septic Conversion Pre-Design

Date: September 22, 2017

To: Clece Aurelus

From: J. McMahon, P. Cooke

1.0 Preface

The City of Hollywood owns and operates the Hollywood Southern Regional Wastewater Treatment Plant (SRWWTP), and provides wastewater collection, treatment, and disposal services to over 24,000 retail customers within the City. Currently, about 57 percent of the City's water customers receive wastewater services from the City. The rest rely on septic systems for wastewater treatment and disposal. In accordance with the City-wide Master Plan, the City is investigating the implementation of sanitary sewers in the west Hollywood areas of Driftwood and portions of Boulevard Heights.

The purpose of this Technical Memorandum (TM) is to summarize a basis of design for providing sanitary sewer service to this area and to provide an opinion of probable cost for the purposes of planning and budgeting. The scope of this TM includes the following:

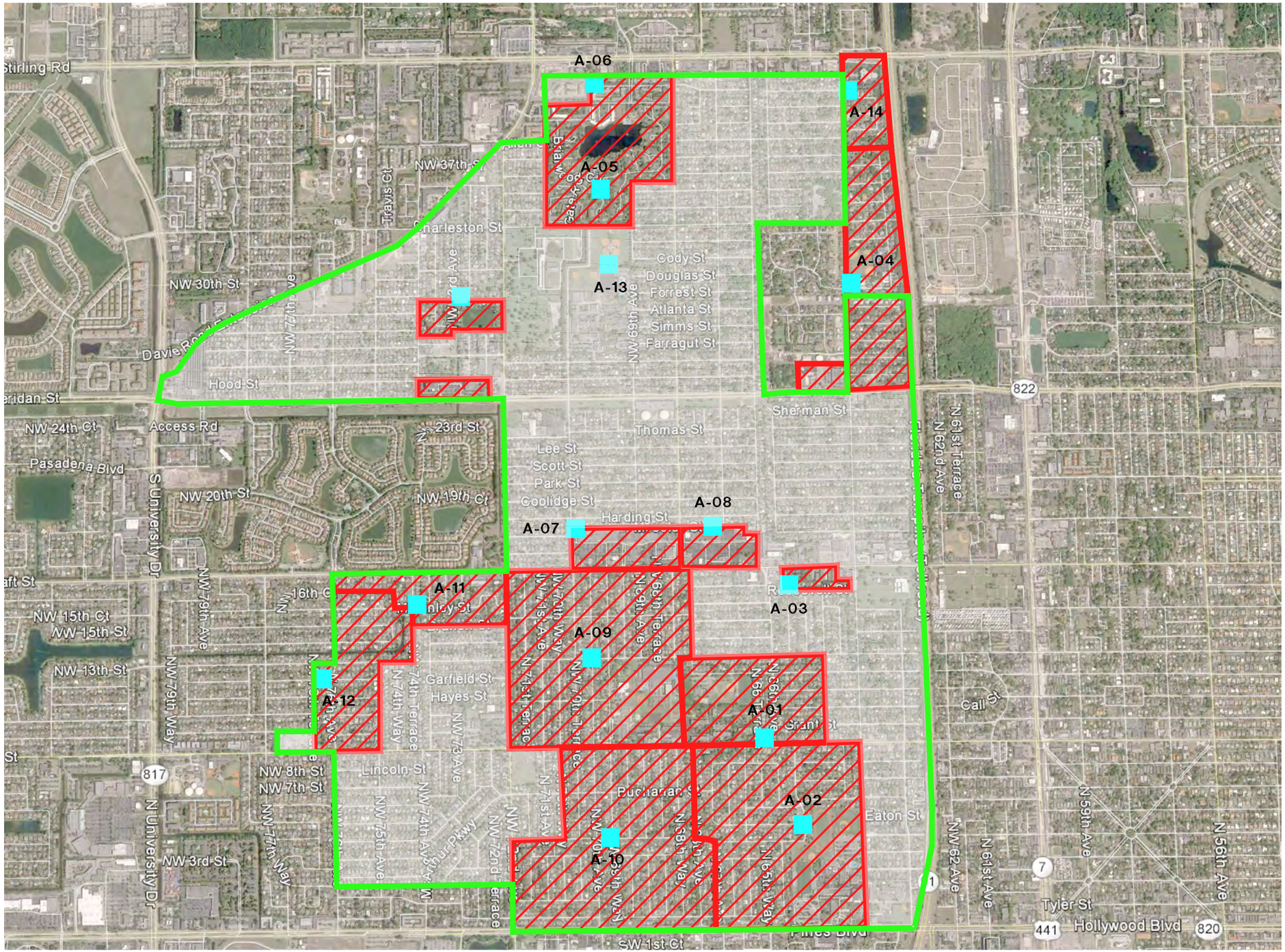
- Summarizes the area of study and estimate wastewater flow contributions
- Provides a conceptual layout of a sewer collection and transmission system in service areas of interest
- Provides preliminary opinions of probable cost for the proposed work

2.0 Area of Study and Flow Estimates

The areas of Driftwood and Boulevard Heights are located west of the Turnpike within City limits. Portions of these areas are already sewered. Figure 2-1 shows the unsewered areas under consideration for this evaluation as well as the locations of existing sewered areas and associated lift stations.

Wastewater volume is primarily a function of potable water usage; however, depending upon the integrity of the collection system, rainfall, groundwater elevation, and even tidal elevation can impact collected volumes. Projections for wastewater generation are frequently based on projected water demand with an additional factor for Infiltration and Inflow (I/I). For this study, wastewater generation for customers currently serviced by septic systems was determined by the following method:

1. A GIS map of the City's wastewater sub-basins for the area was developed based on the Water and Sewer Atlas.



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WEST HOLLYWOOD SEPTIC CONVERSION PRE-DESIGN

WEST HOLLYWOOD SERVICE AREA EXISTING

FIGURE
2-1

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2. The City's water customer account meter database was obtained for the years 2012 through 2016. Separate irrigation meters were not considered since customers in the western portion of the City typically use well water for irrigation.

3. Water meter data were geo-coded using the parcel polygon situs fields for the primary address locator. Street centerlines were used for secondary address locators.

4. Geo-coded water meter data was merged with a GIS map of the City's wastewater sub-basins. Water meters of customers located within the wastewater sub-basins were identified as wastewater customers. All other meters were then coded as non-sewer customer meters.

5. Account parcels were classified by Land Use based on the Broward County Future Land Use layer using consecutive GIS overlays.

6. Ambiguous land uses (Transit Oriented Corridor and Regional Activity Center) were classified as residential or non-residential visually using aerial photography. Non-residential customers in affected areas were easily identifiable within commercial and industrial areas.

7. Non-sewer customer account parcels were coded as Residential and Non-residential based on assigned future land use to facilitate the subsequent assignment of wastewater flow factors.

8. Water consumption was determined for each user category based on identification of water meter units.

9. Estimates of wastewater flow were determined by applying wastewater generation rate factors to water consumption rates. Residential flow was calculated by multiplying water consumption rates by 0.85 (assumes no potable water use for irrigation). Non-residential flow was calculated by multiplying water consumption rates by 0.95.

Table 2.1 presents the estimated wastewater flows over time for the unsewered areas of West Hollywood. Assuming proper construction of a new sewer system, no I/I impacts were considered for the first ten years of operation. After ten years of operations, average daily flows were estimated to increase by 1% per year through Year 30.

Table 2.1
Estimated Unsewered Area Wastewater Flow Projections

	Year 1	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
Average Day Flow (mgd)	1.04	1.04	1.04	1.09	1.15	1.20	1.27

3.0 Proposed Collection and Transmission System

The introduction of sanitary sewers into unsewered areas must take into account a number of different factors, with site conditions being the most important. Common approaches to sewer collection would involve either the use of gravity collectors or a vacuum sewer system. Site conditions such as customer density, existing infrastructure, groundwater, soil type, and topography typically dictate the selection of a specific collection technology for a given area. Previous studies for the City have found that the least costly method of sewage collection and transmission is to utilize gravity flow through the collection of sloped collectors. As the depth of the collector increases relative to existing grade, it becomes more cost effective to centrally locate a lift station and provide a force main to discharge the collected wastewater. The use of gravity sewers has been well established within the City of Hollywood and the City's entire existing sewer infrastructure consists of conventional gravity collection and force main transmission.

3.1 Existing Facilities

As shown in Figure 2-1, some of the areas west of the Turnpike within City limits are currently sewered. These areas comprise the wastewater collection system Basin A. Basin A includes fourteen City-owned lift stations and a number of small private lift stations which ultimately discharge to the City sewer system. Operational information regarding the existing City-owned lift stations is provided in Table 3.1.

Pump run time refers to the hours per day of pump operation in a lift station. Pump run times provide a measure of lift station capacity. Many utilities in Florida, including all municipalities located in Miami Dade County by Consent Decree, consider the Nominal Average Pump Operating Time (NAPOT) when assessing lift station capacity. NAPOT is defined as the rolling average of daily average pump operating time for the previous year, divided by one less than the total number of pumps installed at that station. NAPOT criteria limits pump run time to ten hours per day for a duplex station. For this preliminary design effort, the NAPOT criterion was used to determine the need for expansion of existing lift stations due to the addition of flows from septic system conversions. As shown in Table 3.1, run times for the lift stations in West Hollywood indicate available capacity based on this criteria.

Table 3.1
West Hollywood Municipal Lift Station Summary Information

Lift Station	Address	Number of Pumps	Lift Station Capacity[1] (One Pump Running)		Average Daily Run Time between 9/2015 and 5/2017
			(gpm)	(mgd)	(hrs/day)
A-01	901 N 66th Terrace	2	550	0.792	1.58
A-02	520 N 65th Avenue	2	310	0.446	4.10
A-03	6580 Taft Street	2	200	0.288	0.66
A-04	2930 N 64th Avenue	2	250	0.360	3.35
A-05	333 Briarwood Circle	2	500	0.720	7.00
A-06	300 Ashbury Road	2	343	0.494	3.80
A-07	1751 N 70th Terrace	2	500	0.720	2.61
A-08	6777 Taft Street	2	125	0.180	5.03
A-09	6960 Arthur Street	2	480	0.691	4.23
A-10	6951 Filmore Street	2	420	0.605	2.44
A-11	7415 McKinley Street	2	270	0.389	2.41
A-12	1209 N 76th Terrace	2	310	0.446	8.86
A-13	Driftwood Community Center	2	40	0.058	0.16
A-14	4101 64th Avenue	2	330	0.475	1.21

[1]*Capacity for one pump running as reported by City of Hollywood*

A network of force mains in Basin A transmits wastewater from existing sewered areas to the SRWWTP. A 30-inch force main on Taft Street and an 18-inch force main on Johnson Street transmit wastewater east of the Turnpike for ultimate treatment at the SRWWTP. It was assumed that any expansion of the service area under consideration would utilize these force mains. No new Turnpike crossing was considered.

Although surveying was not performed as a part of this evaluation, available topographic information provided by the City and compiled from recent stormwater studies was used to determine the depth of burial with respect to existing infrastructure. West Hollywood has relatively level terrain, primarily varying between elevation 4.0 and elevation 6.0.

In many locations, existing gravity collectors in Basin A are installed in the rear of sewered properties. It should be noted that septic tank locations for existing properties may not be uniform. Septic tanks and drainfields may reside in the front, middle, or rear of unsewered properties. Exact placement of the gravity collectors, laterals, and manholes associated with this project should be addressed during detailed design.

3.2 Design Criteria

Design criteria relevant to the preliminary layout and sizing of gravity collectors and force mains are provided in Table 3.2.

Table 3.2
Preliminary Design Criteria

Parameter	Value	Comments
Flow Rate (AADF)	1.27 mgd	Build-out flow rate.
Velocity		
Gravity Collectors	≥2 fps at ½ full pipe	Desired velocity ≥2 ft/s to prevent deposition of solids. Velocities above 10 ft/s may cause erosion and damage to sewers and manholes. However, existing physical constraints control actual velocities.
Force Mains	2 – 8 fps	
Pipe Diameter		
Gravity Collectors	8-inch minimum	Per *Recommended Standards for Wastewater Facilities* to allow for ease of maintenance and reduced clogging.
Manning's Roughness Coefficient	n = 0.013	Per *Recommended Standards for Wastewater Facilities*
Slope	8-inch ≥0.004 ft/ft 10-inch ≥0.0028 ft/ft	Minimum slopes based on Manning's "n" value per *Recommended Standards for Wastewater Facilities*
Manhole Spacing	≤400 feet	At the end of each line, at all intersections and all changes in size per *Recommended Standards for Wastewater Facilities*
Pipe Cover	3 ft ≤ Depth ≤ 18 ft	3' minimum depth of crown for pipe protection, 20' maximum allowable depth of pipe invert (economic constraint given high water table)

3.3 Proposed Layout

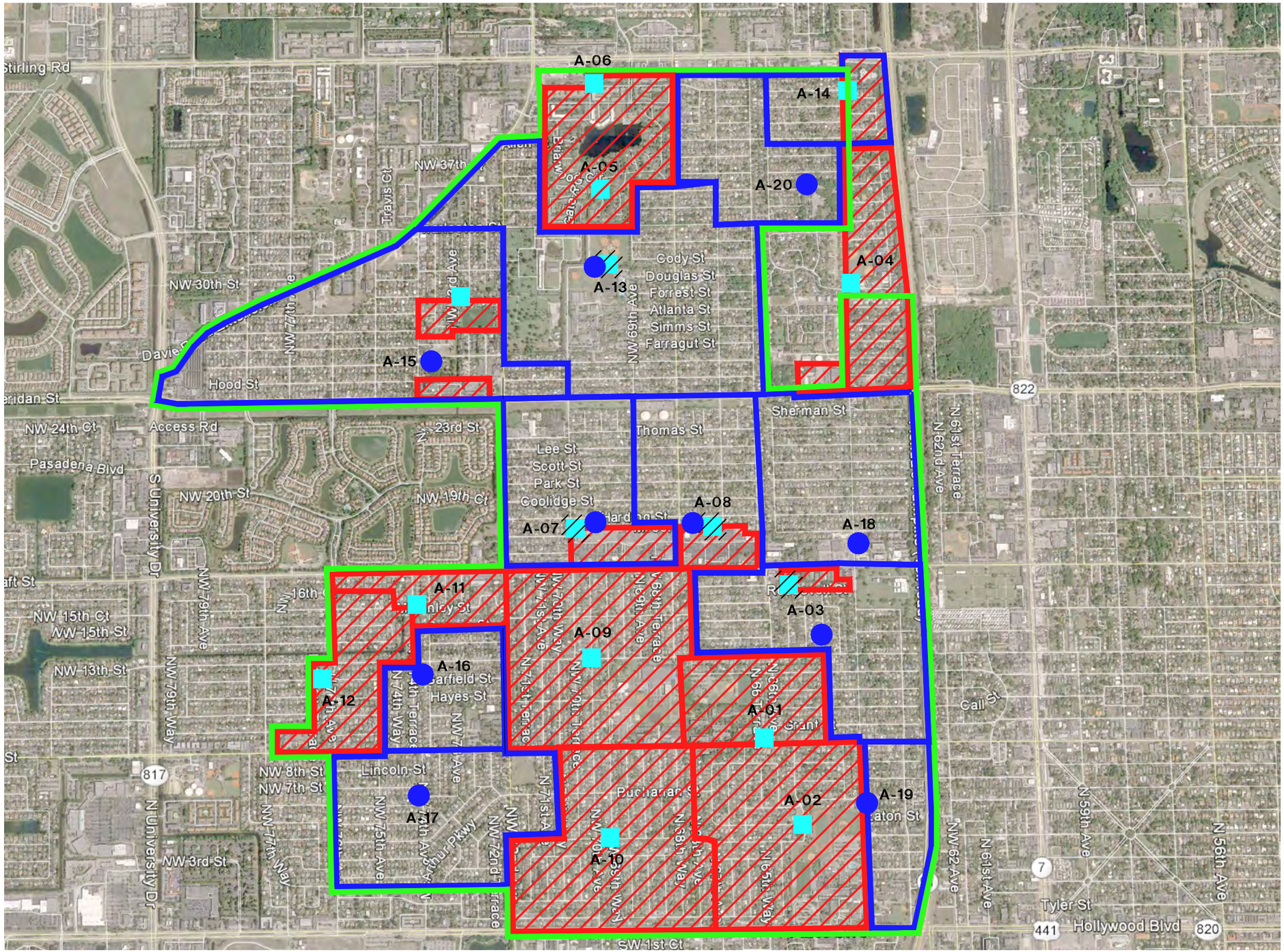
Although pump run times indicate that many of the existing lift stations have spare capacity, geographic limitations preclude the expansion of lift station basins in many cases. West Hollywood has relatively level terrain and a high ground water table, typical of many areas in South Florida. Depths of existing lift station wet wells and potential tie-in manholes are set. Combined with minimum slope requirements for gravity collectors, lengths of new gravity collectors within existing lift station basins are limited.

Since a gravity system cannot provide the sole means of collection and transmission for the unsewered areas of interest, new lift stations and/or expansions of existing lift stations within the proposed service area will allow for complete coverage. Utilizing the previously outlined design criteria, the study area was divided into sub-basins based upon the existing topography and other logical construction impediments (such as crossing parks or major roadways). Figure 3-1 presents the proposed sub-basins for the West Hollywood area. Six new lift station sub-basins are proposed, A-15, A-16, A-17, A-18, A-19, and A-20. Existing sub-basins A-03, A-07, A-08, A-13, and A-14 are recommended for expansion of collection areas and/or replacement of lift stations. No changes to sub-basins A-01, A-02, A-04, A-05, A-06, A-09, A-10, A-11, or A-12 are proposed; however, it is noted that Lift Stations A-05 and A-12 are likely to require an increase in pumping capacity to accommodate increased system pressures. The proposed gravity collection systems and associated lift stations for new and expanded sub basins are provided in Figures 3-2 through 3-11. Proposed discharge force mains from proposed lift stations are assumed to connect to the closest existing force main. Although individual manholes are not shown on these figures, spacing is assumed in accordance with the criteria listed in Table 3.2.

It is recommended that the City of Hollywood develop a hydraulic model of the wastewater system to fully ascertain the impacts of expanding the existing collection and transmission system. This model should be developed prior to detailed design of proposed sewered areas. It is possible that existing lift stations in addition to Lift Stations A-05 and A-12 will be impacted by increased system pressures and require up-grades to existing pumping capacity.

3.4 Proposed Sub-Basin Flow Projections

A breakdown of previously provided flow projections for proposed new and/or expanded sub-basins in currently unsewered areas of West Hollywood are presented in Table 3.3. For purposes of this evaluation, it was assumed that all private lift stations within the new basins would be removed, abandoned, or re-routed such that all properties would be serviced by the proposed new or expanded lift stations. Therefore, these existing sewered flows were included as part of the projections in Table 3.3. As a conservative assumption, Year 30 flow projections were used along with the 10-hr NAPOT criterion to determine the need for existing lift station expansion.



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WEST HOLLYWOOD SERVICE AREA PROPOSED

FIGURE
3-1

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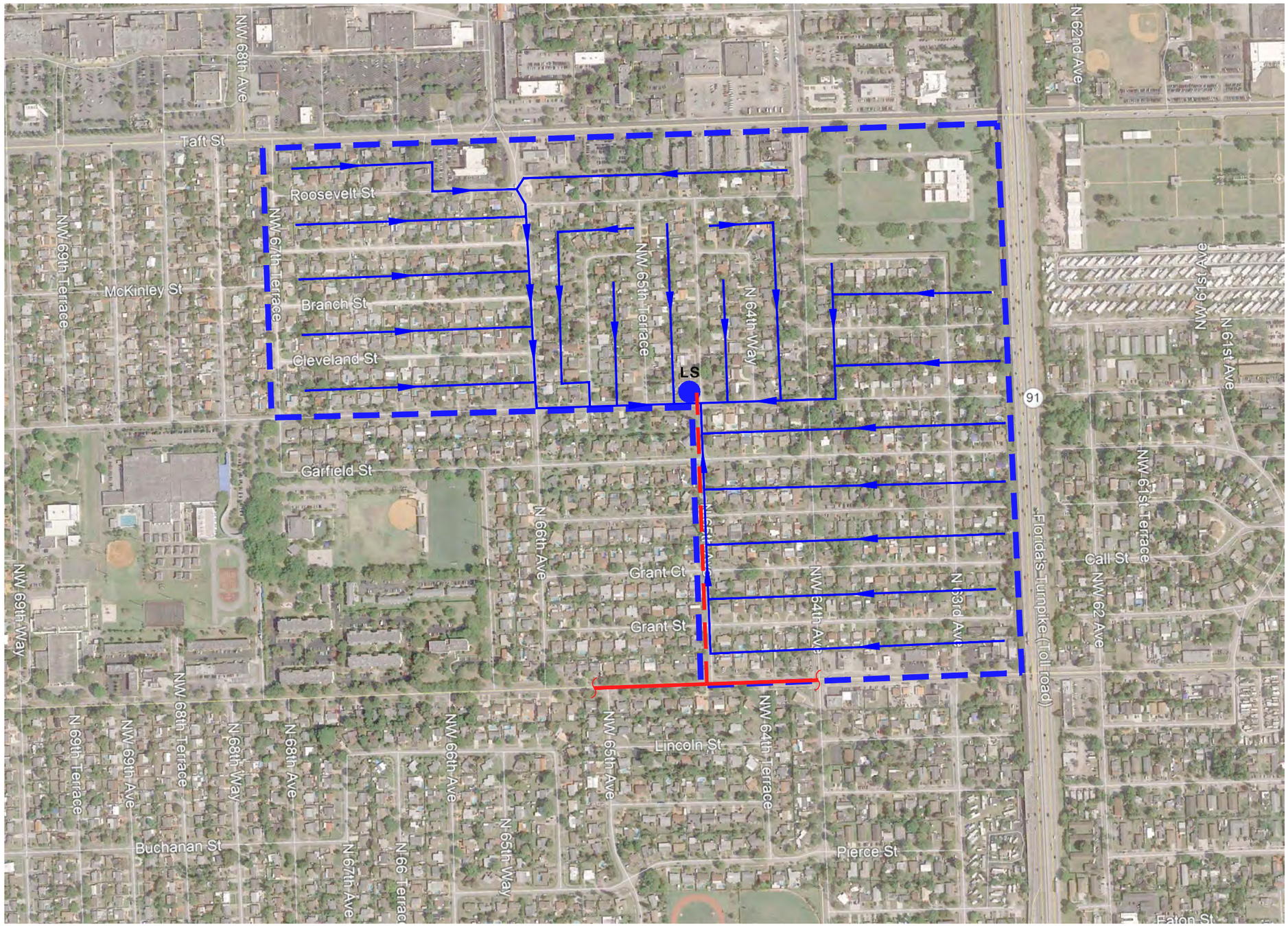

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PROPOSED LIFT STATION BASIN A-03

FIGURE
3-2

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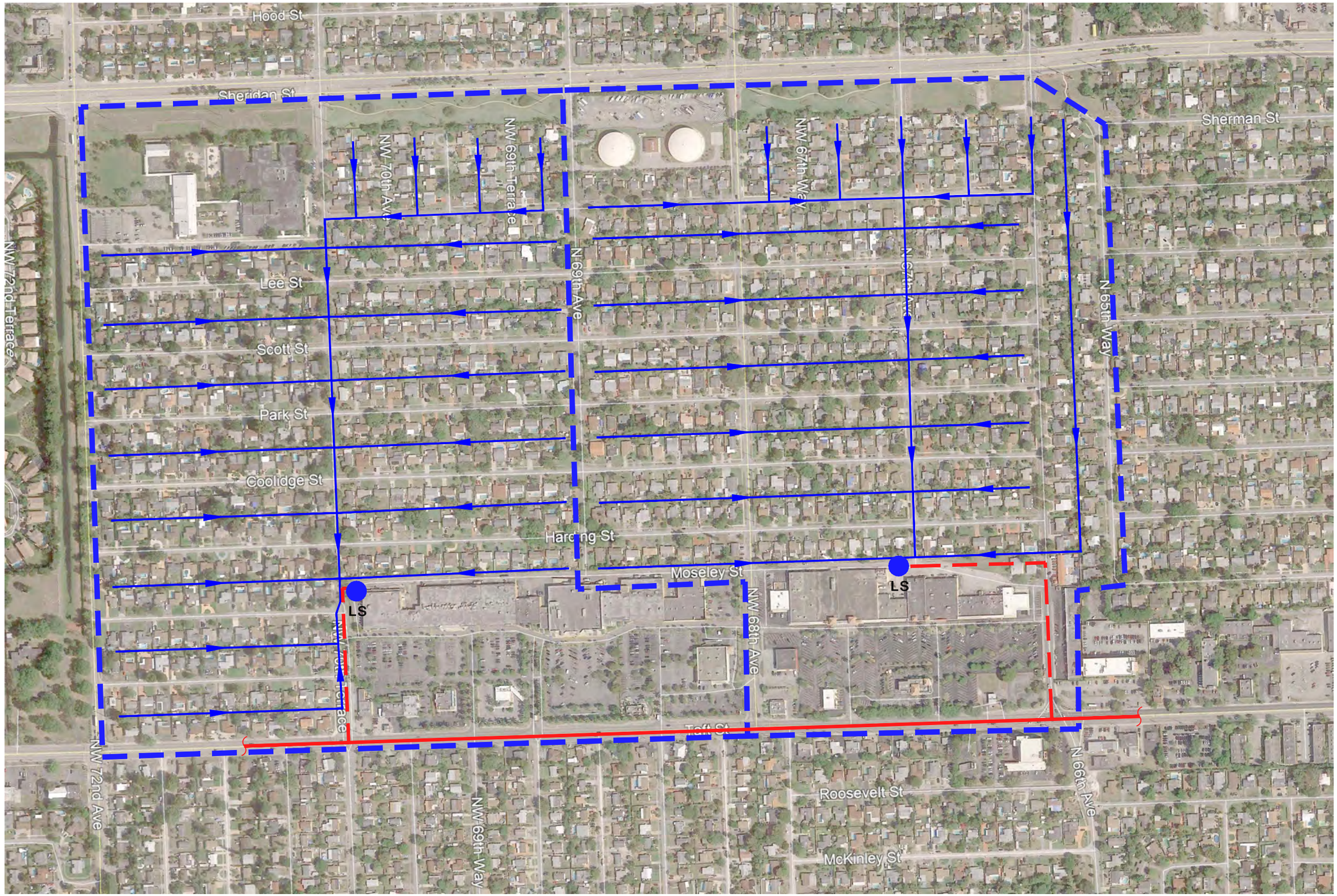

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PROPOSED LIFT STATION BASIN A-07 AND A-08

FIGURE
3-3

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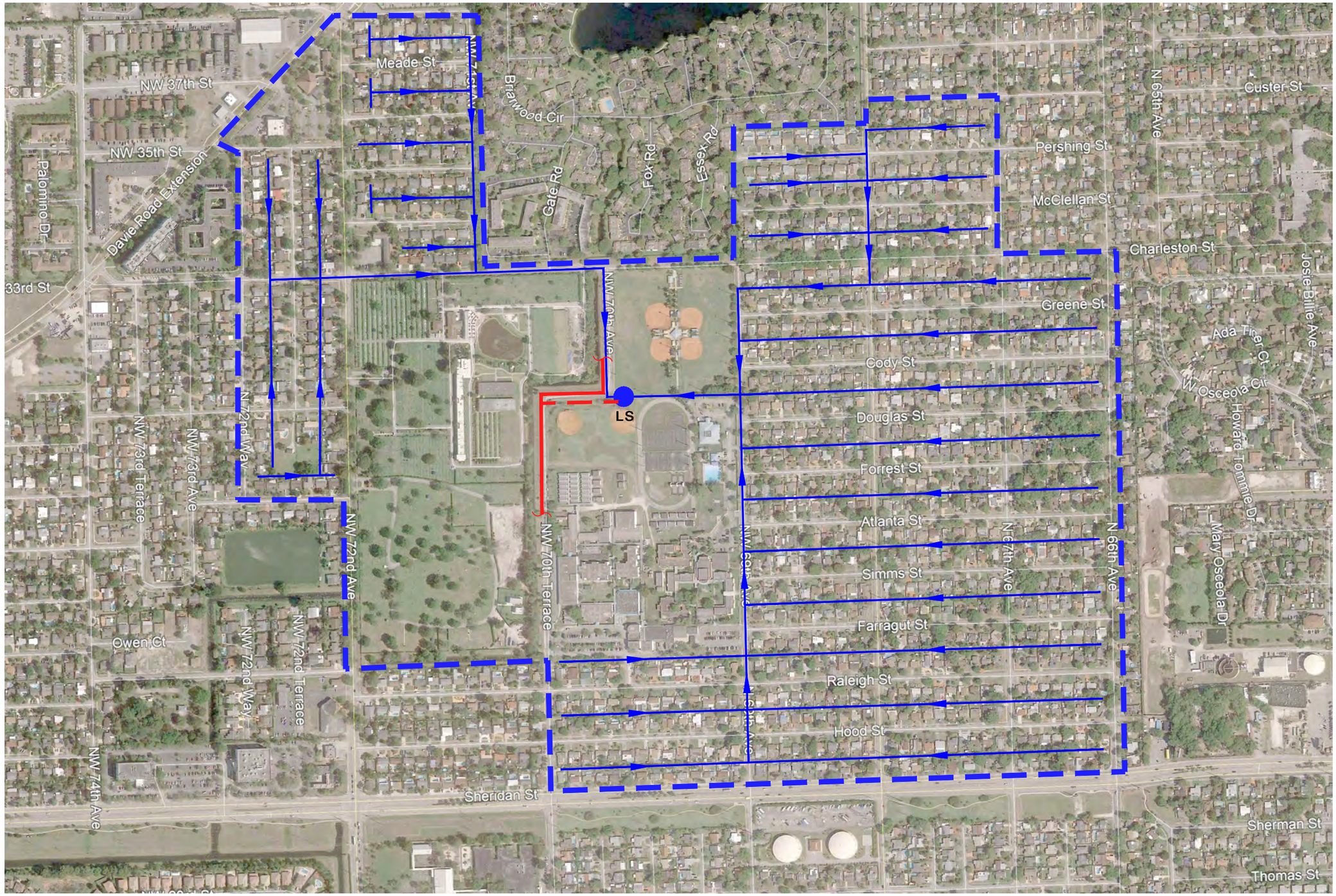

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PROPOSED LIFT STATION BASIN A-13

FIGURE
3-4

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PROPOSED GRAVITY SEWER

LIFT STATION BASIN BOUNDARIES

EXISTING LIFT STATION

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PROPOSED LIFT STATION BASIN A-14

FIGURE
3-5

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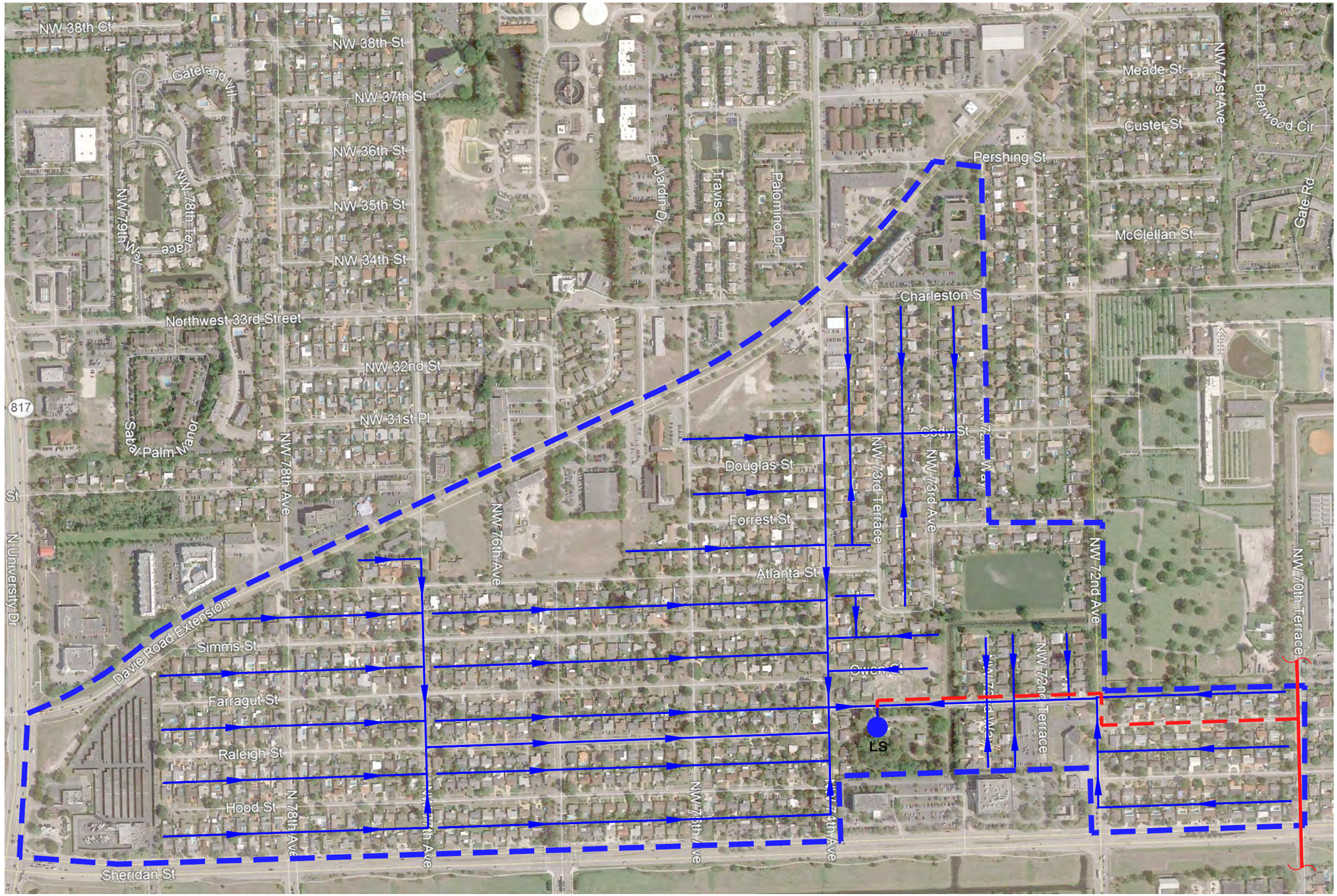

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PROPOSED LIFT STATION BASIN A-15

FIGURE
3-6

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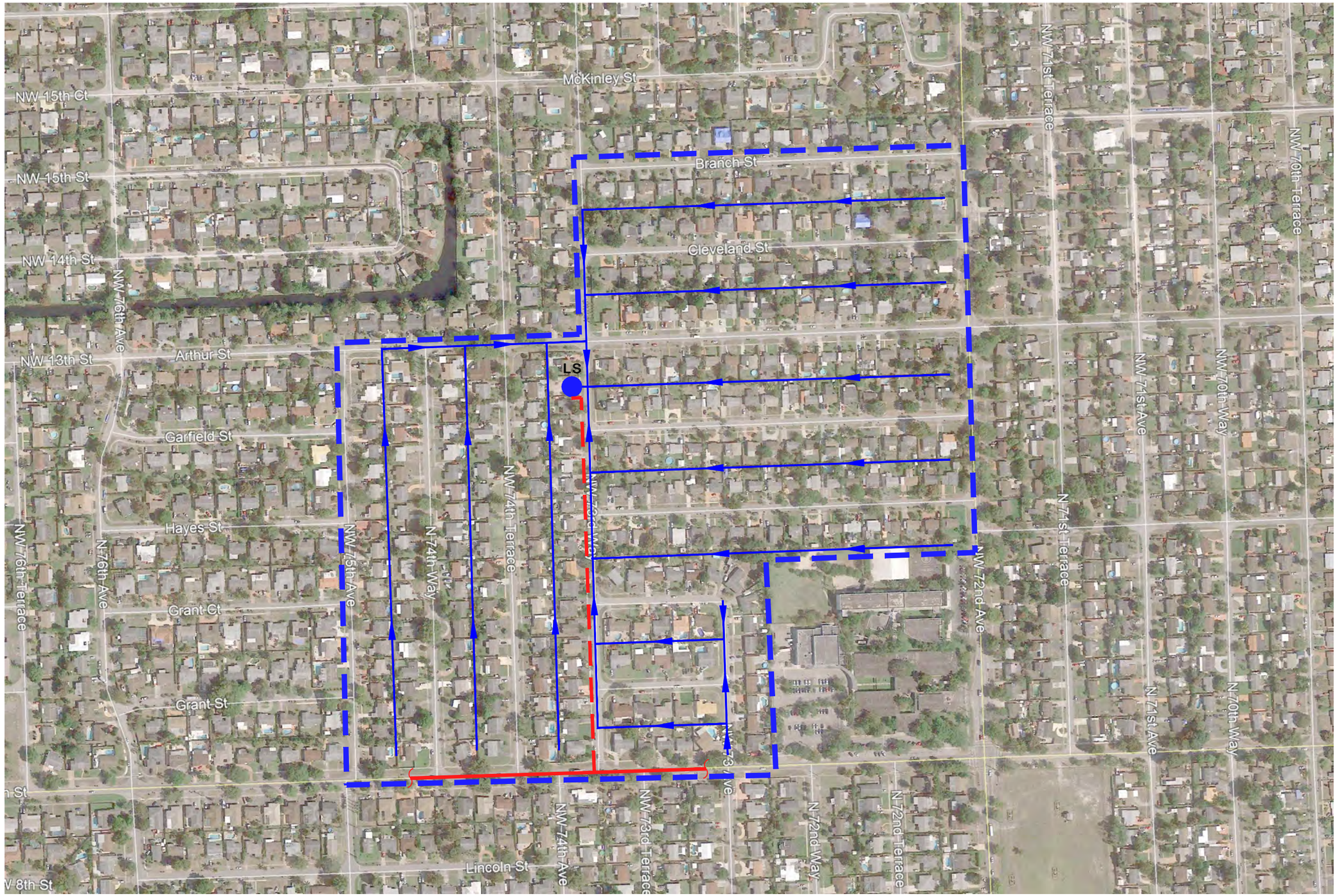

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PROPOSED LIFT STATION BASIN A-16

FIGURE
3-7

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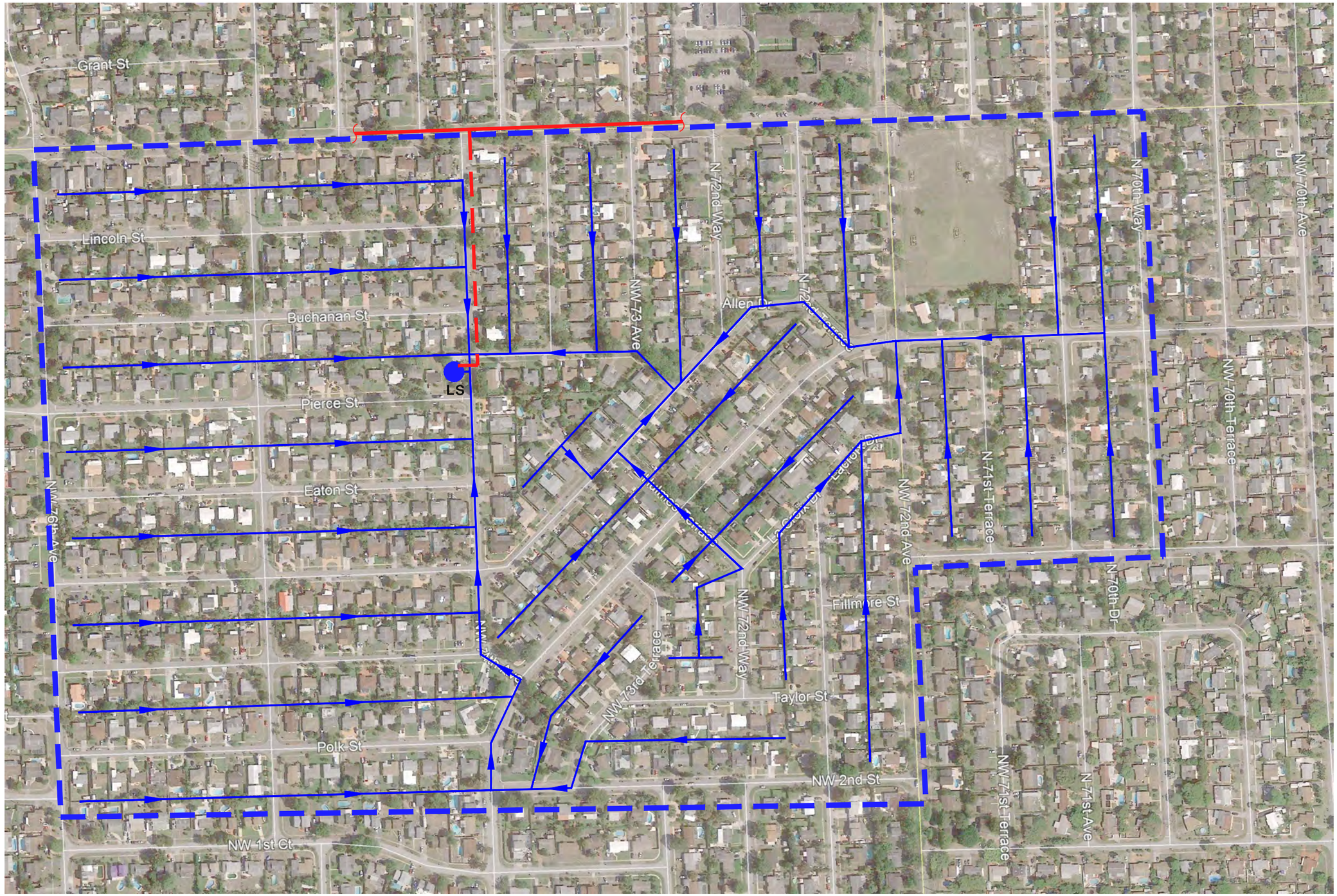

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PROPOSED LIFT STATION BASIN A-17

FIGURE
3-8

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PROPOSED FORCE MAIN

PROPOSED GRAVITY SEWER

LIFT STATION BASIN BOUNDARIES

PROPOSED LIFT STATION

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PROPOSED LIFT STATION BASIN A-18

FIGURE
3-9

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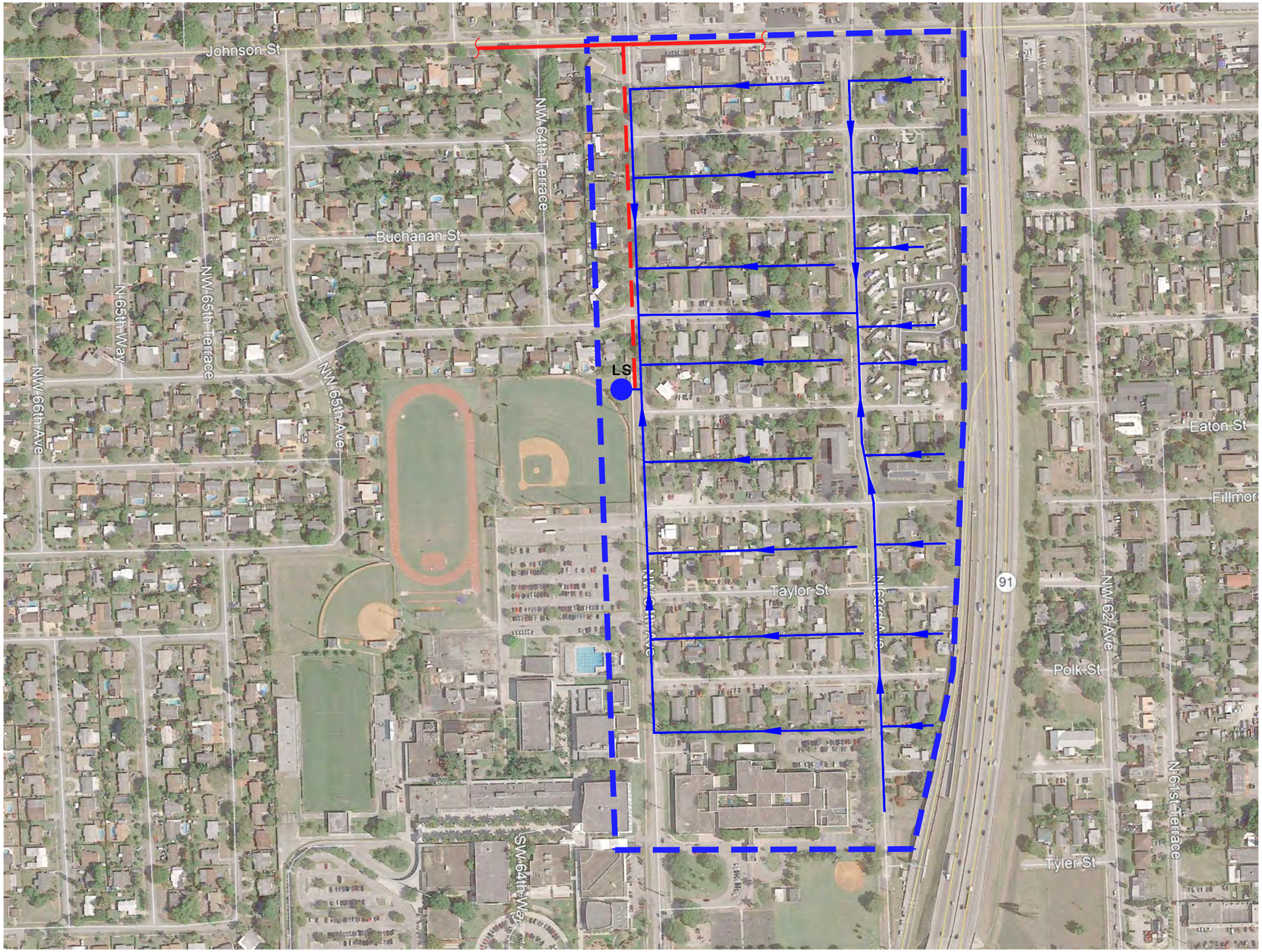

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PROPOSED LIFT STATION BASIN A-19

FIGURE
3-10

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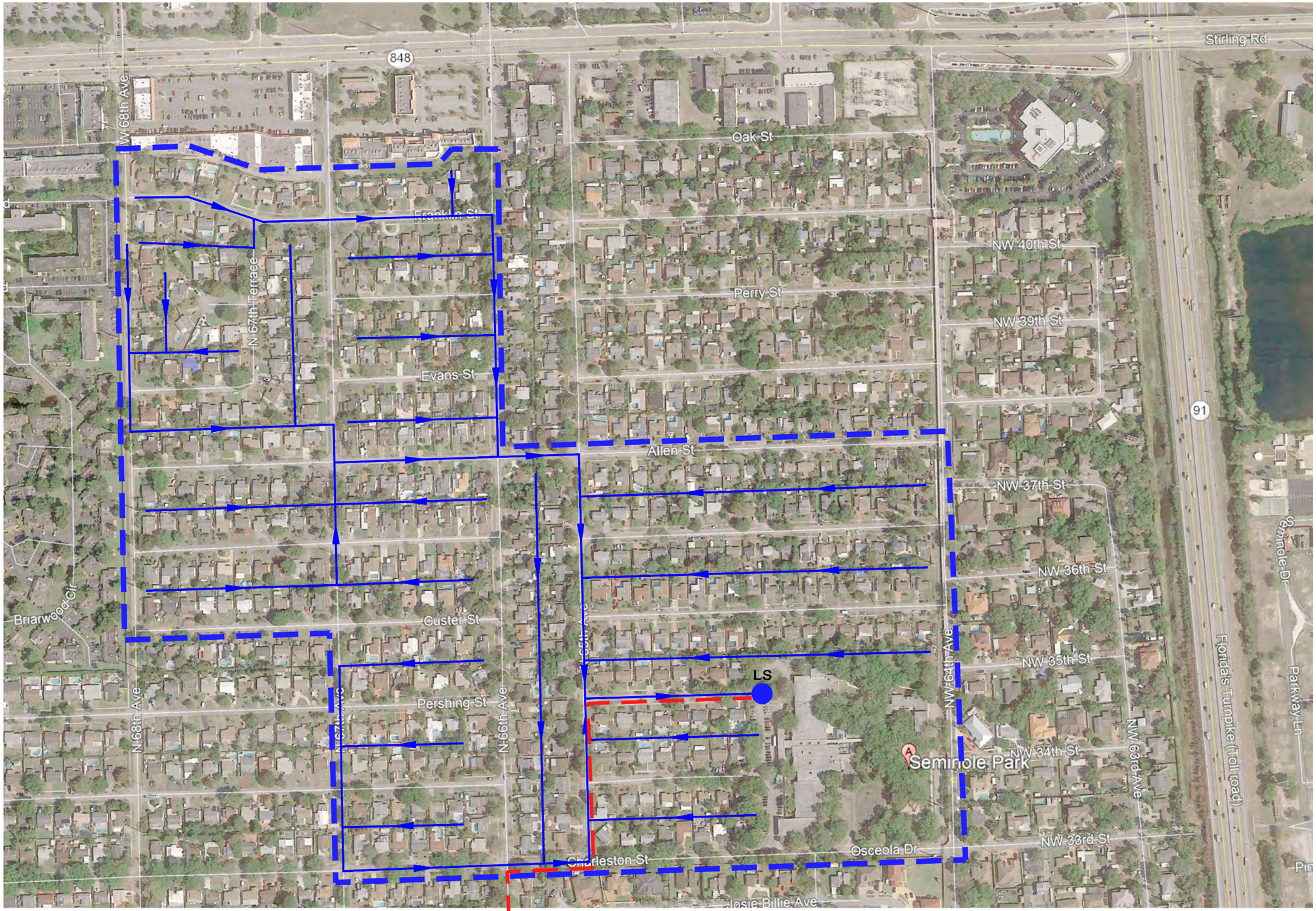

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PROPOSED LIFT STATION BASIN A-20

FIGURE
3-11

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Table 3.3
New / Expanded Sub-Basin Wastewater Flow Projections

Sub-Basin	Year 1 ADF Flow (gpm)	Year 5 ADF Flow (gpm)	Year 10 ADF Flow (gpm)	Year 15 ADF Flow (gpm)	Year 20 ADF Flow (gpm)	Year 25 ADF Flow (gpm)	Year 30 ADF Flow (gpm)
A-03*	75.43	75.43	75.43	79.28	83.32	87.57	92.04
A-07*	62.46	62.46	62.46	65.65	68.99	72.51	76.21
A-08*	48.27	48.27	48.27	50.73	53.32	56.04	58.90
A-13*	122.14	122.14	122.14	128.37	134.92	141.80	149.03
A-14	17.65	17.65	17.65	18.55	19.50	20.49	21.54
A-15*	116.73	116.73	116.73	122.68	128.94	135.52	142.43
A-16	40.78	40.78	40.78	42.86	45.05	47.34	49.76
A-17	65.64	65.64	65.64	68.99	72.51	76.21	80.09
A-18	70.13	70.13	70.13	73.71	77.47	81.42	85.57
A-19	43.15	43.15	43.15	45.35	47.66	50.10	52.65
A-20	57.93	57.93	57.93	60.89	63.99	67.25	70.69
Total (gpm)	720.31	720.31	720.31	757.05	795.67	836.26	878.92
Total (mgd)	1.04	1.04	1.04	1.09	1.15	1.20	1.27

** Due to the relative size of existing sewered areas within the sub-basin, projections shown include existing flow.*

4.0 Cost Opinion

This section provides opinions of probable project cost for the improvements identified in the previous sections. The opinions of probable cost presented have been prepared based upon master plan level information. Because of the level of scope development at this stage, the opinions are Class 5 estimates as defined by the Association for the Advancement of Cost Engineering International (AACE). The expected accuracy range for this type of opinion is +100 percent to -50 percent. Final costs of the project will depend on final project scope, actual labor and material costs, competitive market conditions, implementation schedule, and other variable conditions.

The cost opinions are inclusive of the following:

- Construction costs, including sanitary sewers, transmission systems, restoration, contractor overhead and profit, and general conditions
- Allowance for permitting fees (5%)
- Unforeseen conditions (20%)
- Estimating contingency (20%)

- Engineering design and services during construction (20%)

These costs are based upon year 2017 dollars and do not include escalation for inflation. The City should increase budget estimates by approximately 3% per year to the mid-point of planned construction for budget purposes. Project costs are inclusive of capacity improvements only and do not consider rehabilitation of existing lift stations to address renewal and/or replacement needs. In addition, total project costs do not include costs associated with property or easement acquisition. It is anticipated that existing lift stations recommended for expansion and/or replacement will be sited on existing property where practical. For new sub-basins A-15, A-16, A-17, A-18, A-19, and A-20, property will have to be acquired to site new lift stations. Property will also have to be acquired for sub-basins A-03, A-07, A-08, and A-13 to site lift stations to a more centralized location within the basin. Existing lift stations for these sub-basins are assumed to be de-commissioned and abandoned. It is noted that proposed Lift Station A-13 is located within City-owned Driftwood Park and proposed Lift Station A-15 is located within City-owned Bicentennial Park.

Table 4.1 provides a summary of work and the opinion of probable cost for improvements related to each sub-basin.

Table 4.1
West Hollywood Septic Conversion – Opinion of Probable Cost

Sub-Basin	Summary of Work	Opinion of Probable Cost (2017)
A-01	No changes to this sub-basin	$0
A-02	No changes to this sub-basin	$0
A-03	Expand gravity collection system; demolish existing lift station and replace with new, larger station	$8,744,000
A-04	Expand gravity collection system; lift station appears adequate to accommodate additional flows	$0
A-05	No changes to gravity collection system; lift station is anticipated to have capacity issues to accommodate increase in system operating pressure at receiving force main	$374,00
A-06	No changes to this sub-basin	$0
A-07	Expand gravity collection system; demolish existing lift station and replace with new, larger station	$5,423,000
A-08	Expand gravity collection system; demolish existing lift station and replace with new, larger station	$5,773,000
A-09	No changes to this sub-basin	$0
A-10	No changes to this sub-basin	$0
A-11	No changes to this sub-basin	$0
A-12	No changes to gravity collection system; lift station is anticipated to have capacity issues to accommodate increase in system operating pressure at receiving force main.	$374,000
A-13	Expand gravity collection system; demolish existing lift station and replace with new, larger station	$12,846,000
A-14	Expand gravity collection system; lift station appears adequate to accommodate additional flows	$1,637,000
A-15	New gravity collection system with new lift station	$11,721,000
A-16	New gravity collection system with new lift station	$4,363,000
A-17	New gravity collection system with new lift station	$8,354,000
A-18	New gravity collection system with new lift station	$6,315,000
A-19	New gravity collection system with new lift station	$3,947,000
A-20	New gravity collection system with new lift station	$7,411,000
TOTAL		**$69,870,000**

5.0 Key Assumptions

In addition to those previously noted, this study includes the key assumptions described below.

- The condition of current wastewater transmission infrastructure such as existing lift stations or force mains was not evaluated.
- No system hydraulic model was available. Capacity evaluations for existing force mains on Taft Street or Johnson Street were not performed.
- Regulatory driven improvements such as emergency power requirements or lighting/surge protection requirements were not evaluated for existing lift stations. The applicability of these regulations, both to existing and expanded lift stations, should be evaluated further during detailed design.
- It is assumed that the existing area of West Hollywood is built out. Flow projections do not consider additional population growth in this area.
- Easements or rights-of-way requirements were not evaluated as part of this study.
- Property acquisition costs were not included as part of this study.