



APPENDIX A
Royal Poinciana Sewer Expansion Preliminary Design
and Recommendations Draft – City Project No: 16-
7077 Technical Memorandum

4321-004R1_Final

TECHNICAL MEMORANDUM

To: Wilhelmina Montero, P.E., MS, Project Manager
City of Hollywood
Clece Aurelus, Engineering Manager
City of Hollywood

From: Janine Alexander, P.E.

Reviewed by: Ken Caban, P.E., BCEE

Subject: **City of Hollywood – Royal Poinciana Sewer Expansion Preliminary Design and Recommendations Draft – City Project No: 16-7077**

Date: January 21, 2018

Tt #: 200-16428-17002

1.0 BACKGROUND

Portions of the area between Taft Street and Sheridan Street are not sewered. The City of Hollywood is implementing a water main replacement program within this same area. To increase utility services to City residents, improve groundwater quality, and to combine projects within areas to reduce costs and disturbances within the area, the City of Hollywood requested that Tetra Tech provide this scope of services to provide engineering services under the General Engineering Consulting Services contract (City Project No. 02-1214). This project will include utility coordination, flow determination, preliminary design and recommendations, final design, permitting, bidding, and construction administration and inspection services for:

- Extensions to the existing gravity sewers along N. 21st Avenue,
- New gravity sewers in the unsewered areas between Taft and Sheridan Streets and N. 21st Avenue and Federal Highway (US1),
- Rehabilitation of Lift Station E-22 and its discharge force main (if required), and/or
- A new force main from a proposed lift station located at 1913 Coolidge St to the existing 60-inch diameter gravity interceptor along Taft Street.

The City owns and operates various water, wastewater and stormwater utility infrastructure within the project right-of-way. Other existing utilities that typically share the right-of-way include power, telephone, cable, gas utilities, and others. The City would like to implement the utility improvements, while avoiding relocation of existing utilities, if possible. Survey and utilities verifications have been completed within the City's rights-of-way in this area as part of the water main replacement program and will be utilized for this project. In addition, water main relocations will be required to allow for the new gravity sewer infrastructure while meeting required separation distances.

2.0 SCOPE

Tetra Tech's scope of services is divided into the following tasks:

- A. **Kickoff Meeting, Data Collection, and Review**
- B. **Preliminary Design and Recommendations**
- C. Surveying
- D. Geotechnical Investigation
- E. Gravity Sewer System Final Design
- F. Lift Station E22 Rehabilitation and Discharge Force Main Design
- G. Coolidge Street Lift Station and Force Main Design
- H. Permitting
- I. Bidding and Award
- J. Construction Administration
- K. Additional Design and Other Services Allowance
- L. Reimbursable Expenses

This memorandum is intended to be the deliverable for Task A and B and will estimate wastewater flows, include new gravity sewer piping, laterals and manholes, the location(s) of proposed lift station(s) and their associated force mains for tie-ins to the City's existing gravity trunk line, connections for existing private lift stations abandoned by others, and the advantages and disadvantages for the various scenarios including preliminary costs related to the various options. After City review, Tetra Tech will meet with the City to obtain approval of the recommended improvements, prior to final design and due to the expedited design requirements.

This memo evaluates three (3) different options for the layout of the gravity sewer system, force main and sewer lift station location(s). Gravity sewers, force mains, and lift stations will be evaluated in accordance with the following alternatives:

1. Routing all flows to Lift Station E22 and rehabilitation of this Lift Station,
2. Routing all flows to a new Lift Station located at 1913 Coolidge Street, or
3. Routing all flows to Lift Station E22, and a new Lift Station located at 1913 Coolidge Street.

Tetra Tech has included recommendations related to the consolidation of the existing and proposed lift stations, the gravity sewer collection system, and discharge force main(s). The final memo will also consider the need for a building and odor control facilities to determine if odors could be expected at the proposed or rehabilitated lift station site because air quality samples are still being collected at Lift Station E22.

Water billing data provided by the City has been utilized to quantify existing water usage and to estimate the existing wastewater flows within the project area. However, it was recommended by the City that the wastewater flows be estimated using Broward County's **Guidelines for Determining Ability to Provide Water and Wastewater Service** which uses the land use and associated wastewater flow factor to determine the average day demand for the wastewater flow calculations and which includes a 10-percent estimate for infiltration. Peaked wastewater flows

using the cumulative peaking factor in the guidelines were then calculated for each of the three design alternatives and to ensure that the gravity sewer mains were adequately sized for this preliminary analysis.

Tetra Tech reviewed as-built data for the existing gravity sewer system along N. 21st Avenue to determine where gravity sewers could be extended from this existing system and to tie-into the new gravity sewer system.

3.0 DATA COLLECTION SUMMARY

3.1 KICKOFF MEETING

Tetra Tech received the Notice to Proceed (NTP) on October 17, 2017, with the project kick-off meeting being held on November 17, 2017. In general, the kick-off meeting discussed the project scope, data requests, and the methodology for flow calculations.

3.2 DATA COLLECTION AND REVIEW

Tetra Tech requested existing information from the City and obtained readily available data including the following:

- **As-built drawings for Lift Station E-22 and the associated gravity sewer system:** The City has provided these as-builts, which Tetra Tech has reviewed.
- **Lift station flows, run times, SCADA information, and permits for Lift Station E-22:** The City has provided these, which Tetra Tech has reviewed. Detailed pump design, lift station and force main sizing will follow once the preferred alternative route is selected.
- **Annual water meter billing data:** The City provided data from 2013 to Oct 2017. The annual average for 2017 was projected as November and December 2017 data was not available at the time of this report. This data is summarized in **Table 3-1** below.

Table 3-1. Annual Water Meter Billing Data

Year	Billed Usage (Cu.Ft.)
2013	6,191,438
2014	6,028,886
2015	6,295,689
2016	5,879,320
2017 (Jan. to Oct.)	4,223,253
2017 (Projected)	5,067,904
Projected Annual Average	5,892,647

- **City water, wastewater and stormwater GIS data:** The City has provided GIS data, which Tetra Tech is utilizing.
- **Existing data on septic tanks in the project area:** The City provided survey with limited existing cleanouts and septic tank locations being identified within the project area.
- **Maintenance reports or existing system repair information:** The City has indicated that there are none within the project area.
- **Updates on new developments/future land use changes:** The City has indicated that they have no knowledge of new developments or future development within the project area.
- **Proposed drainage improvements:** The City has indicated that they will be adding some drainfields on Lee Street between N. 20th Avenue and N. 21st Avenue. This information will be provided to Tetra Tech prior to final design.
- **Public works improvements proposed in the area:** The City has indicated that there are no anticipated public works improvement projects within the project area.
- **Existing easement documents:** The City has existing easement data within the GIS that they have provided to Tetra Tech.
- **City standard details:** The City provided their latest City standard details and specifications. In addition, Tetra Tech provided the City with other sanitary details for their review and potential use and is awaiting City feedback.
- **City standards for residential and multi-family water demand and wastewater flow calculations:** The City directed Tetra Tech to use Broward County standards and/or 10 States Standards.
- **Recent building department submittals:** The City is not aware of any recent building department submittals
- **Private Lift Stations in the area that will need to tie-in to the gravity system:** This information was included in the GIS data provided by the City. Tetra Tech has reviewed this data, conducted site visits to each of the Lift Stations and coordinated with their surveyor to pick up existing invert elevations. Additional details are noted below and will be confirmed with the follow up surveying for each station:
 - E105-01 – Located at 1835 Wilson Street, this station services both the Bernard Apartments complex as well as the neighboring Merriment Manor assisted living facility. GIS data indicates that this lift station is a grinder lift station with a rim elevation of 8.42 feet NAVD88 and an inflow invert elevation of 4.42 feet NAVD88.

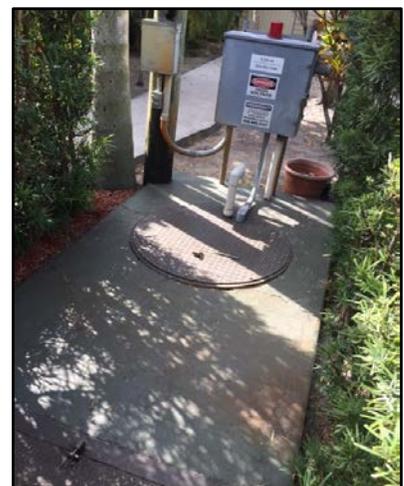


Photo 3-1. Private Lift Station E105-01

- E114-01 – Located at 1901 N. Federal Highway (US 1), this station services the Dollar Tree retail store. GIS data indicates that this is a submersible lift station with a rim elevation of 8.87 feet NAVD88 and an inflow invert elevation of 5.34 feet NAVD88.



Photo 3-2. Private Lift Station E114-01

- E127-01 – Located at 2025 Taft Street, this station services CenturyLink and is an office/warehouse facility. GIS data indicates that this station has a rim elevation of 11.42 feet NAVD88 and an inflow invert elevation of 6.92 feet NAVD88. Tetra Tech requested as-builts from CenturyLink for this station during their field review but has not yet been provided them.



Photo 3-3. Private Lift Station E127-01

- E139-01 – Located at 2038 Scott Street, this station services the Miami Rescue Mission DBA Broward Outreach Center. GIS data indicates that this is a submersible lift station; however, elevation data is not available.



Photo 3-4. Private Lift Station E139-01

- E163-01 – Located at 1960 Sherman Street, this station services the Salvation Army Plymouth Colony Apartments. GIS data for this station was limited and elevation data was not available.



Photo 3-5. Private Lift Station E163-01

4.0 SEWER SYSTEM ALTERNATIVES

Tetra Tech will evaluate different options for the layout of sewer system, force main and sewer lift station(s) location(s). Gravity sewers, force mains, and lift stations will be evaluated in accordance with the following three project alternatives:

1. Routing all flows to Lift Station E22 and rehabilitation of this Lift Station,
2. Routing all flows to a new Lift Station located at 1913 Coolidge Street, or
3. Routing all flows to Lift Station E22 and a new Lift Station located at 1913 Coolidge Street.

The following assumptions were used for these evaluations:

- Existing pavement elevations equal the rim elevations at the proposed manhole locations. A minimum of 5-feet of depth at the terminal manholes is required. Less than 5-feet of depth may not allow for existing discharge locations to be tied-into the new gravity sewer infrastructure if located further from the roadway. Of the septic tanks that the surveyor was able to locate, many are located at the back of the parcels/near the alleyways such that the new gravity sewer system being installed within the main roadways would need to allow for the parcel(s) to be traversed for future tie-ins. Unfortunately, the gravity sewer systems cannot be installed within the alleyways due to existing utilities congestion/conflicts and required separation distances from water main infrastructure.
- Manholes are placed at a maximum distance of 400 feet, at intersections of gravity mains, and at terminal points in the system.
- Gravity sewer mains are a minimum of 8-inches in diameter with trunklines being 12-inches in diameter. 10-inch mains are not common within the City and not feasible for future operation and maintenance considerations, thus they were not used for the alternatives per the City's directive.

- Slopes shown in the table below are derived from 10 State Standards. (Note that these slopes are the minimum design slopes. The minimum constructed slopes therefore have a slight buffer which allows for field adjustments and maintains the minimum slope requirements once constructed).

Table 4-1. Recommended Minimum Slope

Nominal Sewer Size	Min. Design Slope (Ft. /100 Ft.)	Min. Constructed Slope (Ft./100 Ft.)
8-inch	0.42	0.40
10-inch	0.30	0.28
12-inch	0.24	0.22
15-inch	0.15	0.13

Source: Based on 10 State Standards and adjusted per email with Clece Aurelus.

- It was assumed that each parcel within the project area would require a service lateral and cleanout installed to the Right-of-Way line. Single versus double laterals and placement will be determined during final design
- In general, straight or flow-through runs of gravity sewer piping maintained the same 'in' and 'out' inverts with increases in invert elevations of 0.05 feet being made at perpendicular flows or connections to the gravity sewer.
- The maximum depth of the proposed lift station should not exceed 25-feet in depth such that it can be adequately maintained by City operations staff and equipment.
- All existing private lift stations shall be placed out of service by others, and the design of the gravity sewer system shall allow for direct connection to the gravity sewer system with the existing force main infrastructure from each private lift station being either removed or abandoned in place and grouted as applicable.

Each of the conceptual alternatives is detailed in the following subsections and as shown in the following Figures.

4.1 ROUTING ALL FLOWS TO LIFT STATION E-22 AND REHABILITATION

Tetra Tech has evaluated two options for routing all the flow to Lift Station E-22, as follows:

- Gravity System Expansion without Lift Station E-22 upgrade.
- Gravity System Expansion with Lift Station E-22 upgrade.

4.1.1 Gravity System Expansion without Lift Station E-22 Upgrade

This option was evaluated by using the existing elevation of the inflow invert at Lift Station E-22 (-5.93 feet NAVD88) to calculate the pipe cover at each manhole, and continuing upstream to the terminal manholes at the distant ends of the project area. Based on this methodology, it was determined that the existing system is too shallow to reach the northern ends of the project and maintain the required minimum of 5-feet of pipe cover at the terminal manholes. This alternative consists of 22,885 linear feet of 8- and 12-inch diameter gravity sewers, 1,800 linear feet of 12-inch diameter force main, and 94 standard 4-foot diameter manholes. **Figure 4-1** shows the layout for this option. Since this alternative is not feasible without modifications to Lift Station E-22, re-evaluation was completed as described

in **Section 4.1.2**. Further, Lift Station E-22 was rehabilitated previously by the City and is currently in good working condition.

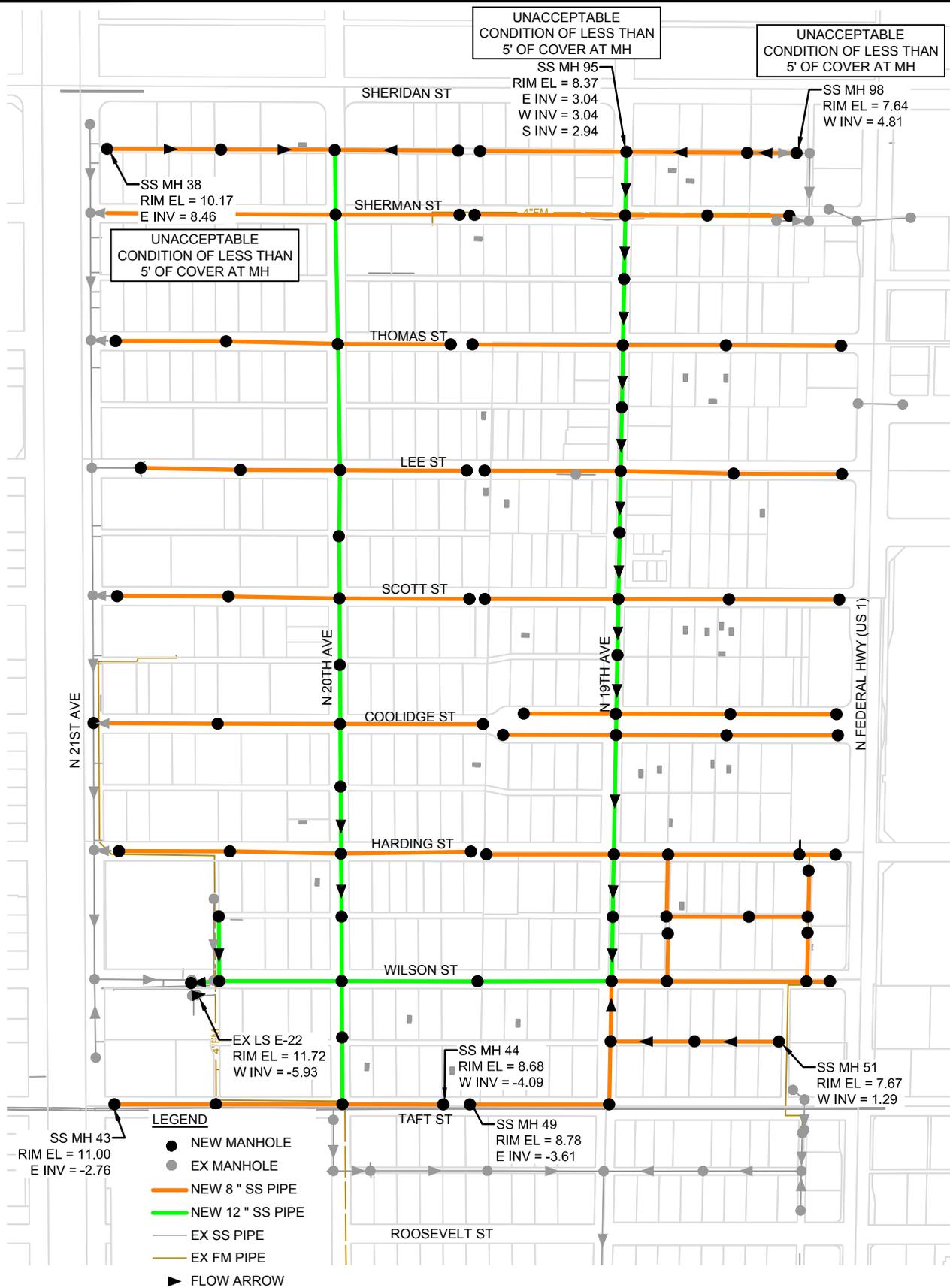


Photo 4-2. View of City Lift Station E-22 Wetwell

4.1.2 Gravity System Expansion with Lift Station E-22 Upgrade

Taking the opposite approach, the depth of the lift station required to reach the terminal manholes at the distant ends of the project area was determined. Starting with the minimum invert elevation required to maintain 5-feet of pipe cover at the terminal manholes located at the distant ends of the project area, the required invert at each manhole downstream, to the existing Lift Station E-22 site, was calculated. The depth of the lift station required to reach the distant ends of the project area was over 25 feet, assuming the same storage volume as the existing station, and an invert elevation of (-9.41 feet NAVD88). This alternative thus adds the costs of the existing Lift Station E-22 being upgraded, as well as including the above referenced 22,885 linear feet of 8- and 12-inch diameter gravity sewers, approximately 1,500 linear feet of force main, and 94 standard 4-foot diameter manholes. **Figure 4-2** shows the layout for this option. Conceptual opinions of probable costs for the collection and transmission piping and pump station were prepared for this alternative, as shown in **Table 4-2**.

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450 N. PARK ROAD, SUITE 502
HOLLYWOOD, FLORIDA 33021
PHONE: (954) 364-1753 FAX: (954) 308-3512

CITY OF HOLLYWOOD
ROYAL POINCIANA SEWER EXPANSION

ROUTING ALL FLOWS TO
LIFT STATION E-22

Project No.: 200-16428-17002

Date:

Designed By: JMA

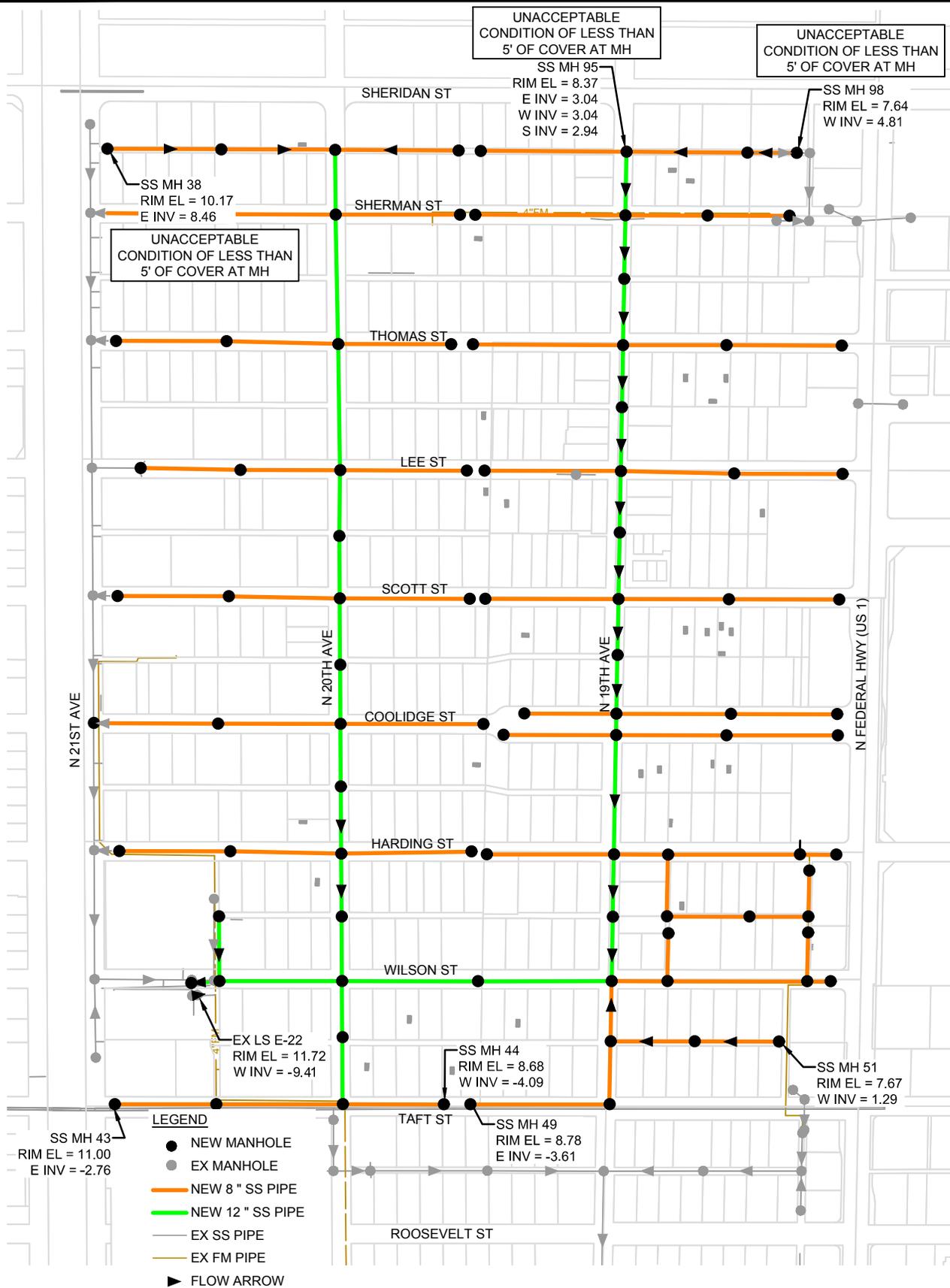
FIGURE

4.1

Bar Measures 1 inch

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450 N. PARK ROAD, SUITE 502
HOLLYWOOD, FLORIDA 33021
PHONE: (954) 364-1753 FAX: (954) 308-3512

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ROYAL POINCIANA SEWER EXPANSION

ROUTING ALL FLOWS TO
LIFT STATION E-22
AND REHABILITATION

Project No.: 200-16428-17002

Date:

Designed By: JMA

FIGURE

4.1

Bar Measures 1 inch

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TABLE 4-2. Lift Station E-22
Royal Poinciana Sewer Extension Project
Conceptual Opinion of Probable Construction Cost

WASTEWATER COLLECTION AND TRANSMISSION ITEMS	Estimated Quantity	Unit	Unit Cost	Total Cost
General Requirements				
Mobilization, Demobilization, Bonds, and Permits (10%)	1	LS	\$ 779,857	\$ 779,857
Maintenance of Traffic (by Contractor)(5%)	1	LS	\$ 389,929	\$ 389,929
Site Work				
Concrete Sidewalk, Curb, and/or Gutter Replacement (assumes 10' per lateral)	4,000	LF	\$ 170	\$ 680,000
Sod Restoration (assumes 100 sf per lateral)	39,500	SY	\$ 4	\$ 158,000
Sanitary Sewer Main by Diameter-Depth Interval				
8" SDR 26 PVC <= 15-feet deep	13,317	LF	\$ 103	\$ 1,371,676
8" SDR 26 PVC > 15-feet deep	3,637	LF	\$ 122	\$ 443,716
12" SDR 26 PVC <= 15-feet deep	3,341	LF	\$ 150	\$ 501,164
12" SDR 26 PVC > 15-feet deep	2,589	LF	\$ 185	\$ 479,043
Abandon existing gravity main piping and manholes	1	LS	\$ 50,000	\$ 50,000
Standard 4' Ø Manholes by Depth Interval				
< 6'	1	EA	\$ 7,760	\$ 7,760
6' - 8'	4	EA	\$ 8,700	\$ 34,800
8' - 10'	6	EA	\$ 9,900	\$ 59,400
10' - 12'	9	EA	\$ 11,300	\$ 101,700
12' - 14'	23	EA	\$ 13,100	\$ 301,300
14' - 16'	24	EA	\$ 15,300	\$ 367,200
16' - 18'	14	EA	\$ 19,000	\$ 266,000
> 18'	13	EA	\$ 22,000	\$ 286,000
TOTAL	94	EA		
Sanitary Service Laterals				
Furnish & Install Sewer Lateral (assume 50 LF each) w/ Cleanout	19,750	LF	\$ 75	\$ 1,481,250
Pressure Pipe with Fittings and Restrained Joints				
12" PVC Force Main w/ fittings & RJs (open cut construction)	1,800	LF	\$ 100	\$ 180,000
Abandon or Remove Existing Force Main - 4"	2,403	LF	\$ 15	\$ 36,045
Abandon or Remove Existing Force Main - 6"	1,666	LF	\$ 20	\$ 33,320
Valves				
12" Plug Valve with Box	3	EA	\$ 8,400	\$ 25,200
Connection to Existing Force Main				
Furnish & Install Tapping Sleeve and Valve	1	EA	\$ 15,000	\$ 15,000
Wet Tap	1	EA	\$ 20,000	\$ 20,000
Utility Relocation/Reconstruction (as required)	1	LS	\$ 100,000	\$ 100,000
Duplex Pump Station				
Duplex Pump Station	1	LS	\$ 500,000	\$ 500,000
Bypass Pumping, Dewatering, Shoring/Bracing and Demo of Exist. E-22 LS	1	LS	\$ 300,000	\$ 300,000
SUBTOTAL				\$ 8,968,359
CONTINGENCY				\$ 2,690,508
BUDGETED TOTAL COST				\$ 11,660,000

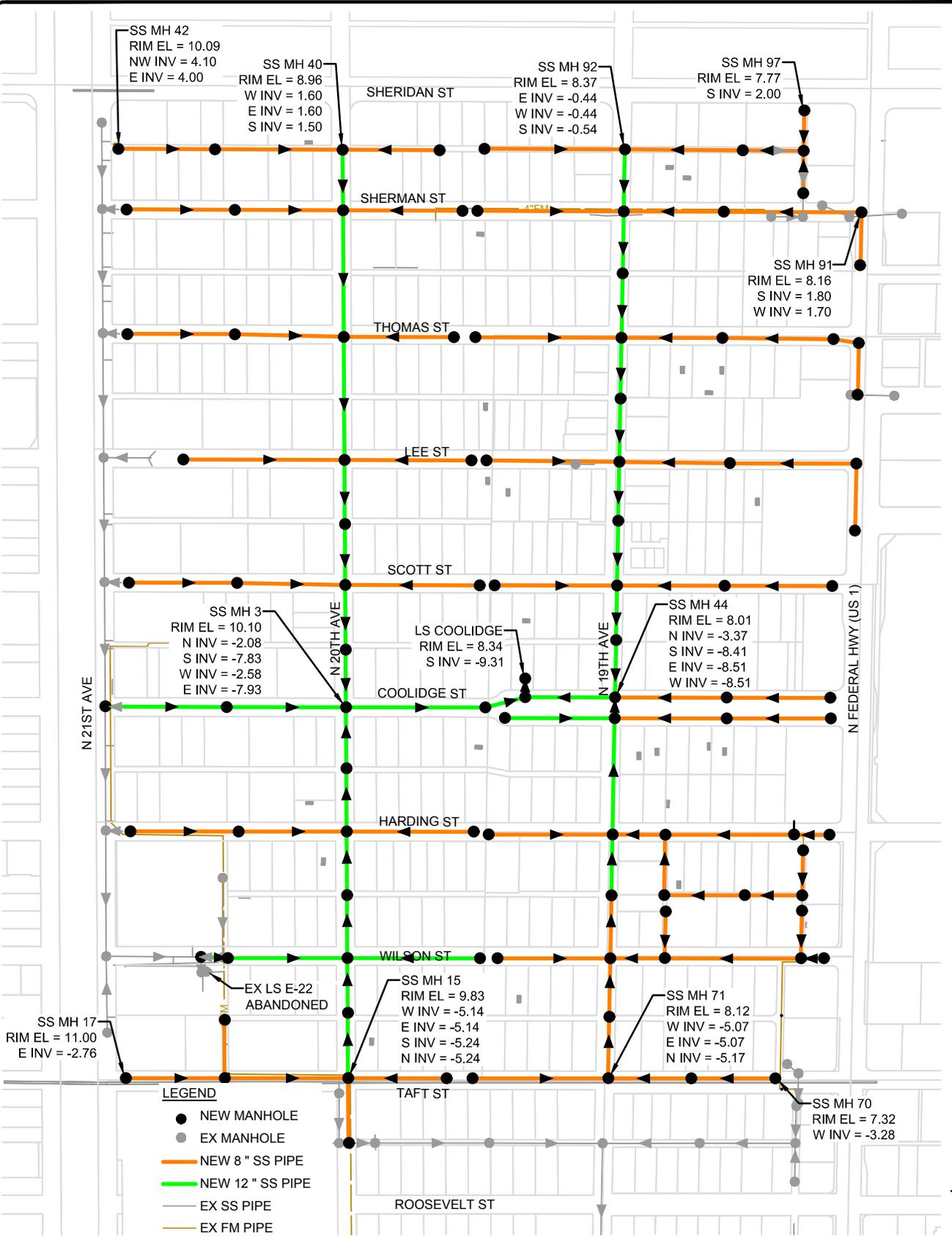
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4.2 ROUTING ALL FLOWS TO NEW LIFT STATION AT 1913 COOLIDGE ST

Tetra Tech has evaluated an alternative for routing all the flow for unsewered parcels within the project area to a new lift station located at 1913 Coolidge Street, decommissioning the existing Lift Station E-22 and routing all wastewater flows to the new lift station on the Coolidge site. This alternative consists of a new duplex lift station, 23,727 linear feet of 8-, 12-, and 15-inch diameter gravity sewer mains, 101 standard 4-foot diameter manholes, and approximately 1,800 linear feet of force main flowing from 1913 Coolidge St. to mid-way between N 19th and 20th Ave. on Taft St. via N 19th Ave. The new lift station is expected to have a rim elevation of 8.34 feet, an invert elevation of -9.31 feet, and a maximum depth of 25 feet once float elevations and storage volume is taken into consideration. **Figure 4-3** shows the layout for this option. Conceptual opinions of probable costs were prepared for this alternative, as shown on **Table 4-3**.

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450 N. PARK ROAD, SUITE 502
HOLLYWOOD, FLORIDA 33021
PHONE: (954) 364-1753 FAX: (954) 308-3512

CITY OF HOLLYWOOD
ROYAL POINCIANA SEWER EXPANSION
**ROUTING ALL FLOWS TO
NEW LIFT STATION
AT 1913 COOLIDGE ST**

Project No.:	200-16428-17002
Date:	
Designed By:	JMA
FIGURE	
4.3	

Bar Measures 1 inch

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**TABLE 4-3. Coolidge Lift Station Alternative
Royal Poinciana Sewer Extension Project
Conceptual Opinion of Probable Construction Cost**

WASTEWATER COLLECTION AND TRANSMISSION ITEMS	Estimated Quantity	Unit	Unit Cost	Total Cost
General Requirements				
Mobilization, Demobilization, Bonds, and Permits (10%)	1	LS	\$ 815,782	\$ 815,782
Maintenance of Traffic (5%)	1	LS	\$ 407,891	\$ 407,891
Site Work				
Concrete Sidewalk, Curb, and/or Gutter Replacement (assumes 10' per lateral)	4,000	LF	\$ 170	\$ 680,000
Sod Restoration (assumes 100 sf per lateral)	39,500	SY	\$ 4	\$ 158,000
Sanitary Sewer Main				
8" SDR 26 PVC <= 15-feet deep	14,283	LF	\$ 103	\$ 1,471,198
8" SDR 26 PVC > 15-feet deep	2,218	LF	\$ 122	\$ 270,544
12" SDR 26 PVC <= 15-feet deep	4,296	LF	\$ 150	\$ 644,424
12" SDR 26 PVC > 15-feet deep	2,880	LF	\$ 185	\$ 532,848
15" SDR 26 PVC > 15-feet deep	50	LF	\$ 190	\$ 9,500
Abandon existing gravity main piping and manholes	1	LS	\$ 50,000	\$ 50,000
Standard 4' Ø Manholes				
6' - 8'	8	EA	\$ 8,700	\$ 69,600
8' - 10'	8	EA	\$ 9,900	\$ 79,200
10' - 12'	26	EA	\$ 11,300	\$ 293,800
12' - 14'	17	EA	\$ 13,100	\$ 222,700
14' - 16'	16	EA	\$ 15,300	\$ 244,800
16' - 18'	20	EA	\$ 19,000	\$ 380,000
> 18'	6	EA	\$ 22,000	\$ 132,000
TOTAL	101	EA		
Sanitary Service Laterals				
Furnish & Install Sewer Lateral (assume 50 LF each) w/ Cleanout	19,750	LF	\$ 75	\$ 1,481,250
Pressure Pipe with Fittings and Restrained Joints				
12" PVC Force Main w/ fittings & RJs (open cut construction)	1,800	LF	\$ 100	\$ 180,000
Abandon or Remove Existing Force Main - 4"	2,403	LF	\$ 15	\$ 36,045
Abandon or Remove Existing Force Main - 6"	1,666	LF	\$ 20	\$ 33,320
Valves				
12" Plug Valve with Box	3	EA	\$ 8,400	\$ 25,200
Connection to Existing Force Main				
Furnish & Install Tapping Sleeve and Valve	1	EA	\$ 15,000	\$ 15,000
Core Drill and Connect to Gravity Sewer	1	EA	\$ 20,000	\$ 20,000
Utility Relocation/Reconstruction (as required)	1	LS	\$ 100,000	\$ 100,000
Duplex Pump Station				
Duplex Pump Station	1	LS	\$ 500,000	\$ 500,000
Demolition of LS E-22	1	LS	\$ 50,000	\$ 50,000
SUBTOTAL				\$ 8,903,102
CONTINGENCY				\$ 2,670,931
BUDGETED COST				\$ 11,570,000

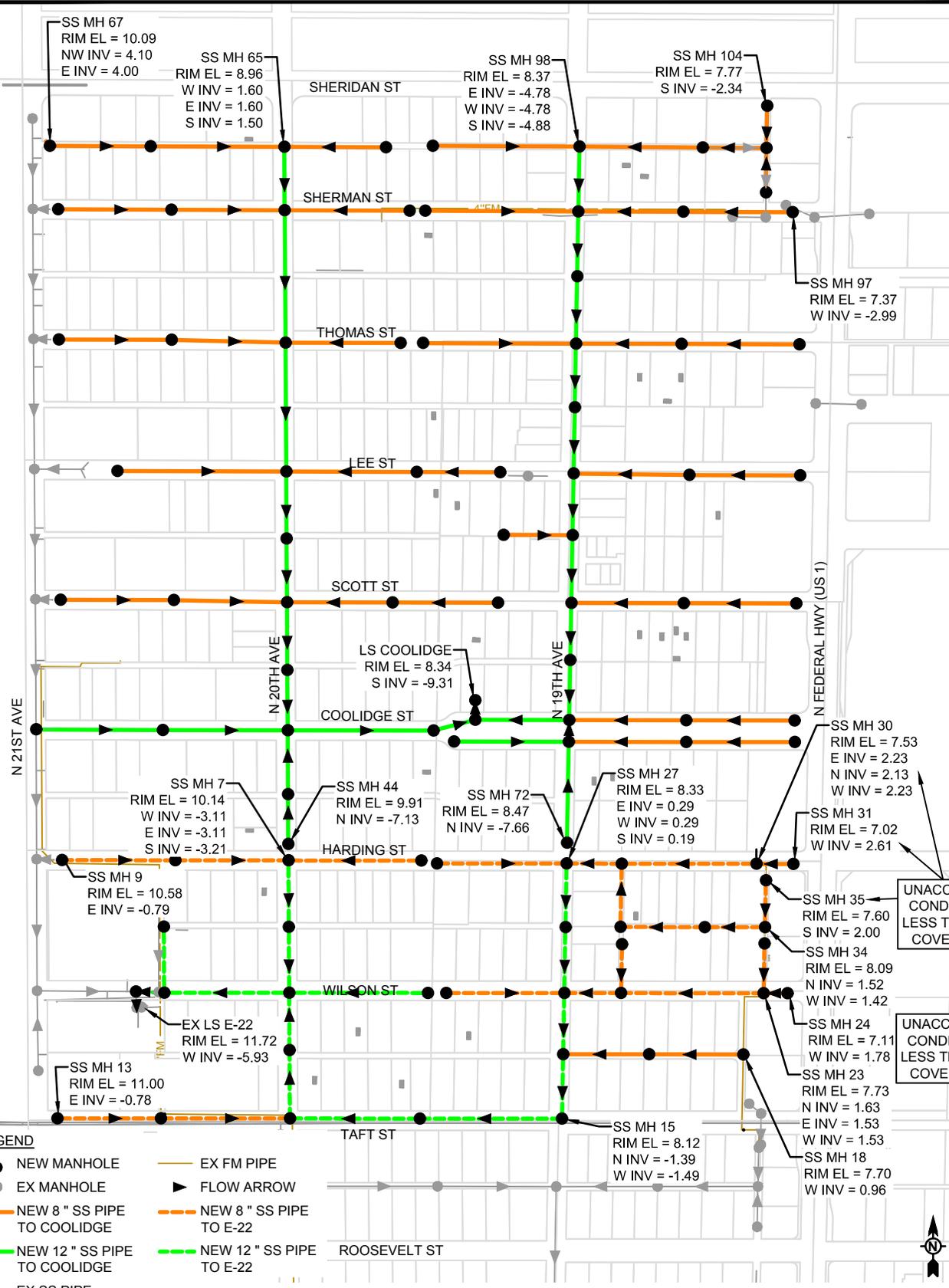
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4.3 ROUTING ALL FLOWS TO LIFT STATION E-22 AND NEW LIFT STATION AT 1913 COOLIDGE STREET

Tetra Tech has also evaluated a combination of the first two alternatives. It consists of dividing the project area along Harding Street into two service areas. The southern service area will be served by the expansion of the existing Lift Station E-22 system for parcels south of Harding Street and constructing 4,619 linear feet of 8- and 12-inch diameter gravity sewers, approximately 1,500 linear feet of force main, and 35 standard 4-foot diameter manholes. The northern service area will be served by a new duplex lift station located at 1913 Coolidge Street for parcels north of Harding Street. The northern service area consists of a new duplex lift station, 23,095 linear feet of 8-, 12-, and 15-inch diameter gravity sewer main, approximately 1,800 linear feet of force main, and 100 standard 4-foot diameter manholes. The new duplex lift station is expected to have a rim elevation of approximately 8.34 feet, an invert elevation of -9.31 feet, and a maximum depth based on future design float elevations that will be less than 25 feet in total depth. **Figure 4-4** shows the layout for this option. A conceptual opinion of probable costs were prepared for this alternative, as shown in **Table 4-4**.

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UNACCEPTABLE CONDITION OF LESS THAN 5' OF COVER AT MH

UNACCEPTABLE CONDITION OF LESS THAN 5' OF COVER AT MH

LEGEND

● NEW MANHOLE	— EX FM PIPE
● EX MANHOLE	▶ FLOW ARROW
— NEW 8" SS PIPE TO COOLIDGE	— NEW 8" SS PIPE TO E-22
— NEW 12" SS PIPE TO COOLIDGE	— NEW 12" SS PIPE TO E-22
— EX SS PIPE	

Tt TETRA TECH
 www.tetrattech.com
 450 N. PARK ROAD, SUITE 502
 HOLLYWOOD, FLORIDA 33021
 PHONE: (954) 364-1753 FAX: (954) 308-3512

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**ROUTING ALL FLOWS TO
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 AT 1913 COOLIDGE ST**

Project No.:	200-16428-17002
Date:	
Designed By:	JMA
FIGURE	4.4

Bar Measures 1 inch

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**TABLE 4-4. Lift Station E-22 and Coolidge Lift Station Alternative
Royal Poinciana Sewer Extension Project
Conceptual Opinion of Probable Construction Cost**

WASTEWATER COLLECTION AND TRANSMISSION ITEMS	Estimated Quantity	Unit	Unit Cost	Total Cost
General Requirements				
Mobilization, Demobilization, Bonds, and Permits (10%)	1	LS	\$ 844,176	\$ 844,176
Maintenance of Traffic (5%)	1	LS	\$ 422,088	\$ 422,088
Site Work				
Concrete Sidewalk, Curb, and/or Gutter Replacement (assumes 10' per lateral)	4,000	LF	\$ 170	\$ 680,000
Sod Restoration (assumes 100 sf per lateral)	39,500	SY	\$ 4	\$ 158,000
Sanitary Sewer Main by Diameter-Depth Interval				
8" SDR 26 PVC <= 15-feet deep	13,820	LF	\$ 103	\$ 1,423,488
8" SDR 26 PVC > 15-feet deep	1,064	LF	\$ 122	\$ 129,820
12" SDR 26 PVC <= 15-feet deep	6,062	LF	\$ 150	\$ 909,348
12" SDR 26 PVC > 15-feet deep	2,098	LF	\$ 185	\$ 388,067
15" SDR 26 PVC <= 15-feet deep	0	LF	\$ 130	\$ -
15" SDR 26 PVC > 15-feet deep	50	LF	\$ 190	\$ 9,500
Abandon existing gravity main piping and manholes	1	LS	\$ 50,000	\$ 50,000.00
Standard 4' Ø Manholes				
6' - 8'	7	EA	\$ 8,700	\$ 60,900
8' - 10'	19	EA	\$ 9,900	\$ 188,100
10' - 12'	16	EA	\$ 11,300	\$ 180,800
12' - 14'	18	EA	\$ 13,100	\$ 235,800
14' - 16'	18	EA	\$ 15,300	\$ 275,400
16' - 18'	15	EA	\$ 19,000	\$ 285,000
> 18'	7	EA	\$ 22,000	\$ 154,000
TOTAL	100	EA		
Sanitary Service Laterals				
Furnish & Install Sewer Lateral (assume 50 LF each) w/ Cleanout	19,750	LF	\$ 75	\$ 1,481,250
Pressure Pipe with Fittings and Restrained Joints				
12" PVC Force Main w/ fittings & RJs (open cut construction)	1,800	LF	\$ 100	\$ 180,000
12" PVC Force Main w/ fittings & RJs (open cut construction)	1,500	LF	\$ 100	\$ 150,000
Abandon or Remove Existing Force Main - 4"	2,403	LF	\$ 15	\$ 36,045
Abandon or Remove Existing Force Main - 6"	1,666	LF	\$ 20	\$ 33,320
Valves				
12" Plug Valve with Box	6	EA	\$ 8,400	\$ 50,400
Connection to Existing Force Main				
Furnish & Install Tapping Sleeve and Valve	1	EA	\$ 15,000	\$ 15,000
Wet Tap	1	EA	\$ 20,000	\$ 20,000
Utility Relocation/Reconstruction (as required)	1	LS	\$ 100,000	\$ 100,000
Duplex Pump Station				
Duplex Pump Station	1	LS	\$ 500,000	\$ 500,000
Pump Station Upgrade (E-22)	1	LS	\$ 400,000	\$ 400,000
SUBTOTAL				
				\$ 9,784,262
CONTINGENCY				
	30	%		\$ 2,935,279
BUDGETED TOTAL COST				
				\$ 12,720,000

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4.4 ALTERNATIVES COMPARISON AND RECOMMENDATIONS

The three alternatives and their subsequent preliminary opinions of probable costs are summarized in **Table 4-5**:

Table 4-5. Alternatives Cost Comparison

Alternative	Preliminary Opinion of Probable Cost, \$
Routing All Flows to LS E-22 & Rehabilitation of LS E-22	\$ 11,660,000
Routing All Flows to New LS at Coolidge Street	\$ 11,570,000
Routing all Flows to LS E-22 and a New LS at Coolidge Street	\$ 12,720,000

As shown in **Table 4-5** above, the most cost effective alternative is the routing of all flows to a new lift station at 1913 Coolidge Street. This cost savings is even more substantial when operation and maintenance and long-term costs for system upgrades are taken into consideration over the lifespan of the facilities if two lift stations were operational. During the final design phase, additional cost savings measures and value engineering will be taken into consideration to further reduce the costs for the preferred alternative.

4.4.1 ALTERNATIVES EVALUATION

Table 4-6 identifies the advantages and disadvantages of each alternative.

Table 4-6. Alternatives Advantages and Disadvantages

Alternative	Advantages	Disadvantages
Routing All flows to LS E-22 & Rehabilitation of LS E-22	<ul style="list-style-type: none"> - One lift station - Proximity to underground utilities office - Existing lift station is in good working condition - City parcel at Coolidge could be used for another City function 	<ul style="list-style-type: none"> - Not central to the wastewater service area - Utilizes space at underground utilities offices which could be used for other purposes - Demolition/construction of a new lift station requires substantial sheeting and dewatering due to existing station location - Limited space to construct a new lift station and keep the existing LS E-22 in service - Inability to route existing gravity sewer heading east to the west as desired by the City - Lift station will be deeper than a new station elsewhere to correct other system deficiencies - Significant bypass pumping
Routing All Flows to New LS at Coolidge Street	<ul style="list-style-type: none"> - One lift station - Central to wastewater basin - City Parcel is available for use/no additional easement or land costs - Doesn't utilize space at underground utilities offices - Space for a generator building or odor control facilities, if required - Due to split in gravity flow direction, a good part of the system is more shallow saving on costs and time for installation (less dewatering, etc.) - Existing gravity sewer system that heads to the east can be redirected to the west as desired by City 	<ul style="list-style-type: none"> - Existing LS E-22 is decommissioned - Lift station sited within a residential street versus existing LS E-22 which is in an industrial area
Routing all Flows to LS E-22 and a New LS at 1913 Coolidge Street	<ul style="list-style-type: none"> - Existing gravity sewer system that heads to the east can be redirected to the west as desired by City - Force main(s) reduction in diameter if flows are split - Redundancy if system issues 	<ul style="list-style-type: none"> - Two lift stations requiring City operation and maintenance which are not preferred - Added City operation and maintenance costs as well as staff resources - Additional costs for a second lift station - City parcel could be more well suited for another function - Not cost effective

4.4.2 RECOMMENDATIONS

The recommended alternative for this project includes a new duplex lift station located at 1913 Coolidge Street, approximately 24,000 linear feet of gravity sewers ranging from 8- to 12-inches in diameter, 395 laterals with cleanouts to serve the parcels, approximately 100 standard 4-foot diameter manholes and 1,800 linear feet 12-inch diameter force main for a preliminary cost estimated at \$11,354,945.

4.4.3 ADDITIONAL EVALUATIONS AND TASKS

Alternatives were evaluated based on preliminary data and assumptions. Utility conflicts will be identified and resolved during detailed design and with information obtained from subsurface utility evaluations (SUEs), which have not been completed during this preliminary evaluation of alternatives. General assumptions for pipe sizing are based on preliminary wastewater flow estimates. Additional evaluations and tasks to be completed prior to or during design include the following:

- Finalize wastewater flow calculations,
- Obtain surveying for private lift stations,
- Perform SUEs,
- Obtain and review air quality data collected,
- Develop a phasing plan for the construction of the water and wastewater infrastructure due to presence of multiple underground and overhead utilities,
- Coordinate with Public Works to identify any proposed roadway improvements,
- Obtain City design for drainfields on Lee Street between N. 20th Avenue and N. 21st Avenue and resolve conflicts as applicable,
- Continue with air quality collections and evaluation,
- Have pre-application meetings with Broward County and permitting discussions,
- Develop preliminary site design for the Coolidge Lift Station,
- Initiate basis of design, and
- Initiate final design for the preferred alternative alignment.