TECHNICAL MEMORANDUM

Date: May 1, 2019

Project: Basalt Creek and Coffee Creek Sanitary Sewer Concept Plan

To: Zach Weigel, PE
Matt Palmer, PE
City of Wilsonville

From: Yarrow Murphy, PE
Shad Roundy, PE
Murraysmith

Re: Basalt Creek and Coffee Creek Sanitary Sewer Concept Plan

Introduction

The City of Wilsonville (City) is developing sanitary sewer concepts for Basalt Creek and Coffee Creek development areas based on the adopted jurisdictional boundary between the Cities of Wilsonville and Tualatin (*Basalt Creek Utility Infrastructure Concept Plan, 2017)*. Murraysmith performed an analysis to evaluate sanitary sewer alternatives and to assist the City in selecting a preferred alternative. This document presents alternatives, capital and life cycle cost analysis, preliminary pipeline sizing, and pipeline alignments and profiles for the recommended alternative.

Study Area

The study area includes the entire Coffee Creek Industrial Planning Area and the Basalt Creek Planning Area south of the future alignment of Basalt Creek Parkway and SW Greenhill Lane, extending south to Ridder Road. The study area also includes the area bounded by SW Greenhill Lane, Day Road, Boones Ferry Road and Interstate-5. The West Railroad area is considered for future sewer service to size downstream infrastructure, but development of concept-level local sewer infrastructure is excluded.

Flow Development

Flows were developed based on the assumption that the land use designation will be industrial within the service area. In addition to the flows based on area served, each pipeline was sized for

an additional 2 million gallons per day (mgd) from potential future wet industry. Flow development assumptions are outlined below.

- Average dry weather flow loading rate = 1,000 gallons per net acre per day (gpnad)
- Net acre factor = 0.65 to reflect the actual area developed versus the total land area
- Dry weather peaking factor = 1.8 to reflect diurnal peak, multiplied by average dry weather flow
- Wet weather peak flow = 1,800 gpnad to account for rainfall derived inflow and infiltration
- Total peak flow in pipe = wet weather peak flow + dry weather peak + 2 mgd wet industry

Design Criteria

The sewer concepts and alternatives were developed to provide each property in the study area access to connect to an adjacent sewer pipe with sufficient slope to discharge wastewater via gravity. The sewer pipes are to be constructed within the right-of-way or along the alignment of future roadways, where possible. Some areas are constrained by open water, steep slopes, Metro Title 13 protection or other infrastructure. In cases where no right-of-way or road alignment is available, or the right-of-way is constrained, the preferred alignment follows a property line. In areas that are constrained such that service cannot be provided via right-of-way, future roadway or along a property line, future easements may be required.

The pipes in each alternative conform to the hydraulic design criteria outlined in **Table 1** and based on the City's Sanitary Sewer Standards specified in Section 401.2.00 to 401.2.03 of the *2015 Public Works Standards*.

Table 1. Sewer Design Criteria

Parameter	Criterion	Description
Flow depth, d/D	<0.67	Design flow depth/ pipe inside diameter is less than 0.67
Velocity, v	> 2 fps	Mean velocity is greater than 2 ft per second when full or half full.
Cover	5 ft minimum 8 ft typical	Any pipe with less than 5 ft of cover must be protected. Pipes with 5 to 8 ft of cover require approval.
Parallel water line horizontal clearance[1]	Water pipe bottom higher than sewer pipe top: 5 ft Water pipe bottom lower than sewer pipe top: 10 ft	The sewer pipe must not be within 5 horizontal ft of a parallel water line. Sewer pipe top must not be higher than the bottom of the water pipe when parallel within 10 horizontal ft.

Parameter	Criterion	Description
Vertical clearance at water line crossing[1]	18”	The top of the sewer pipe must be least 18” below the bottom of the water line at a crossing.

Notes:

[1] This sewer concept is based on design criteria in the City of Wilsonville’s Sanitary Sewer Standards. Design criteria specific to the Willamette Water Supply Pipe were not incorporated into this evaluation. During design, it is recommended that design criteria specific to sewer crossing or paralleling the Willamette Water Supply Pipe be incorporated into the determination of necessary sewer pipe elevations and depths.

Alternative Descriptions

Two routing alternatives were considered in this analysis as described below. Each alternative also includes a pumping option to avoid deep gravity pipes. All piping and pumping infrastructure are sized with adequate capacity to convey additional wet industry assumed to equal a maximum flow of 2 mgd.

Alternative 1 – East Coffee Creek Conveyance

Conveys all flow from Day Road and north to a pipe east of Garden Acres Road. There is no connection to the Garden Acres Road Extension south of Day Road.

- 1A – All conveyance is by gravity.
- 1B – Pump Station on Day Road east of Boones Ferry Road.

Figure 1 illustrates the layout for Alternatives 1A and 1B. Profiles for Alternatives 1A and 1B are provided in Appendix A.

Alternative 2 – Garden Acres Road Conveyance

Connects Day Road and Garden Acres Road pipes to Garden Acres Road extension. Properties east of Garden Acres Road and south of Day Road will be served by the existing and future pipes in Garden Acres Road.

- 2A – All conveyance is by gravity.
- 2B – Same pipe alignments as 2A, with pump Station on Day Road east of Boone’s Ferry.

Figure 2 illustrates the layout for Alternatives 2A and 2B. Profiles for Alternatives 2A and 2B are provided in Appendix A.

Cost Evaluation

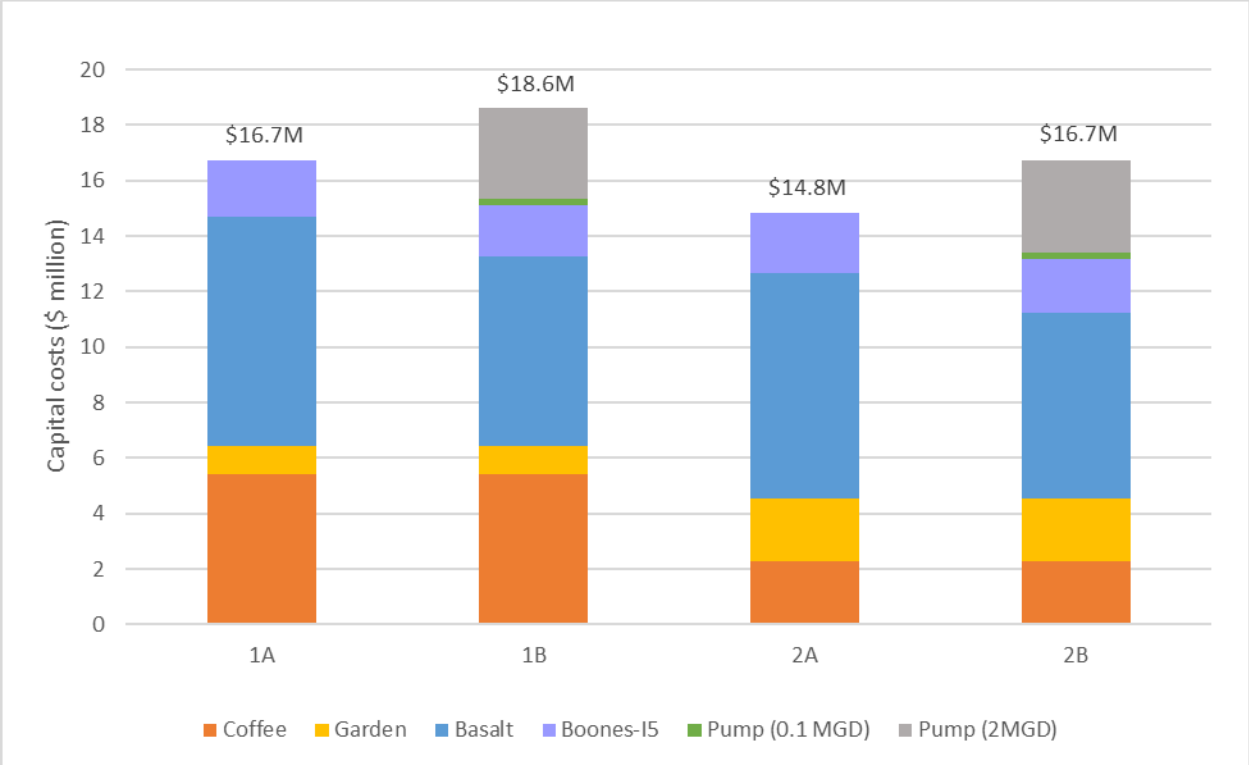
Murraysmith performed a present value capital and life cycle cost evaluation for the alternatives. The cost evaluation is consistent with Class 5 budget estimates, as established by the American Association of Cost Engineers (AACE). This preliminary estimate class is used for conceptual screening and assumes project definition maturity level below two percent. The expected accuracy range is -20 to -50 percent on the low end, and +30 to +100 percent on the high end. Estimates exclude land acquisition, financing, and inflation. The estimated capital costs for each alternative are summarized in **Table 2** and **Figure 3**.

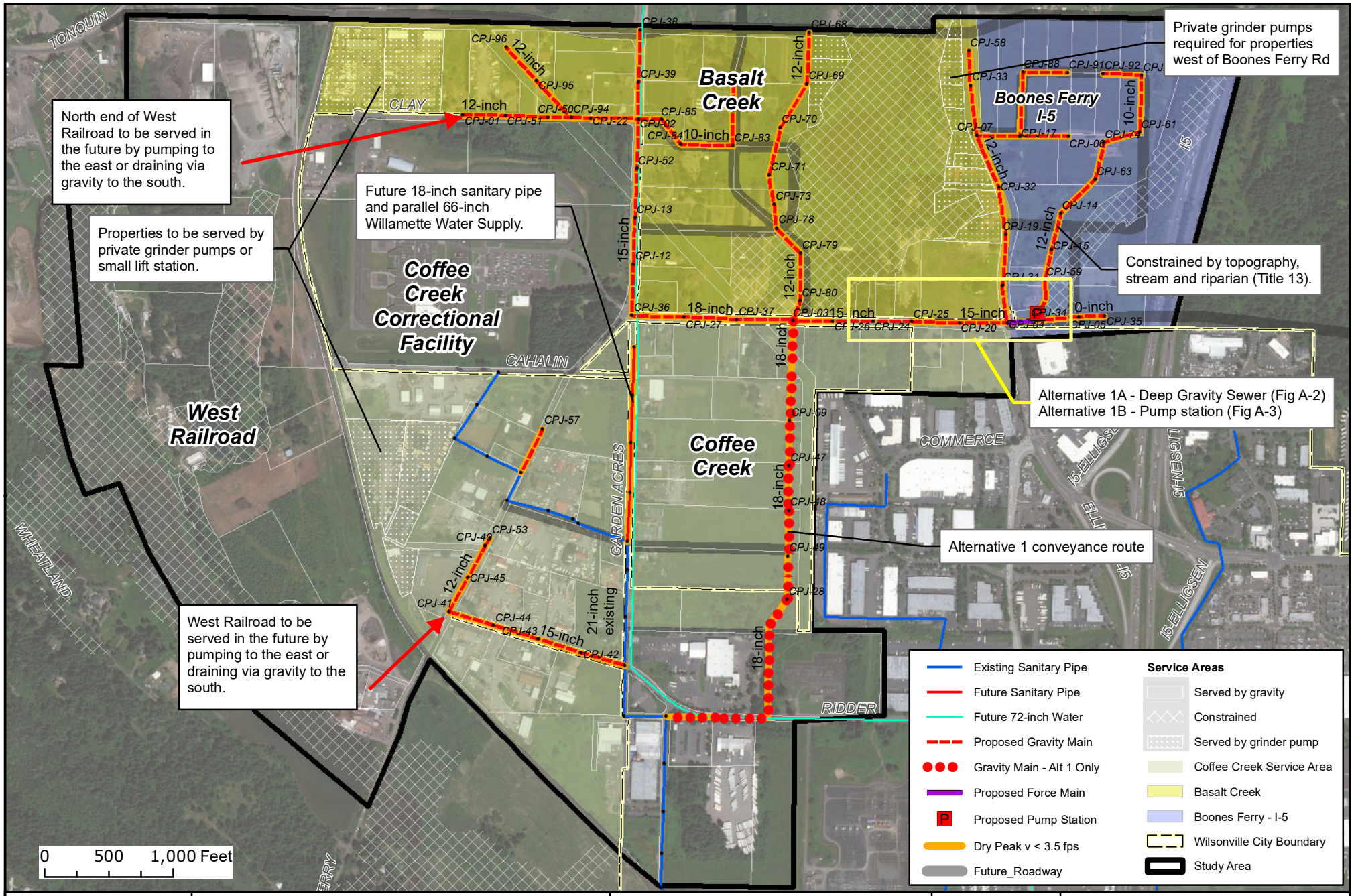
Table 2. Estimated Capital Cost Summary

Alternative	Basalt	Coffee	Boones-I5	Garden Acres Rd Extension	Pump Station (0.1 mgd)	Pump Station (+2 mgd wet industry)	Total Capital
1A	$ 8.3M	$ 5.4M	$ 2.0M	$ 1.0M	$ -	$ -	$ 16.7M
1B	$ 6.8M	$ 5.4M	$ 1.8M	$ 1.0M	$ 0.23M	$ 3.3M	$ 18.6M
2A	$ 8.1M	$ 2.3M	$ 2.2M	$ 2.3M	$ -	$ -	$ 14.8M
2B	$ 6.7M	$ 2.3M	$ 2.0M	$ 2.3M	$ 0.23M	$ 3.3M	$ 16.7M

M = million, mgd = million gallons per day

Figure 3. Capital Cost Estimate





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Coffee Creek and Basalt Creek Sanitary Sewer Concept Plan

Figure 1. Alternative 1 East Coffee Creek Conveyance

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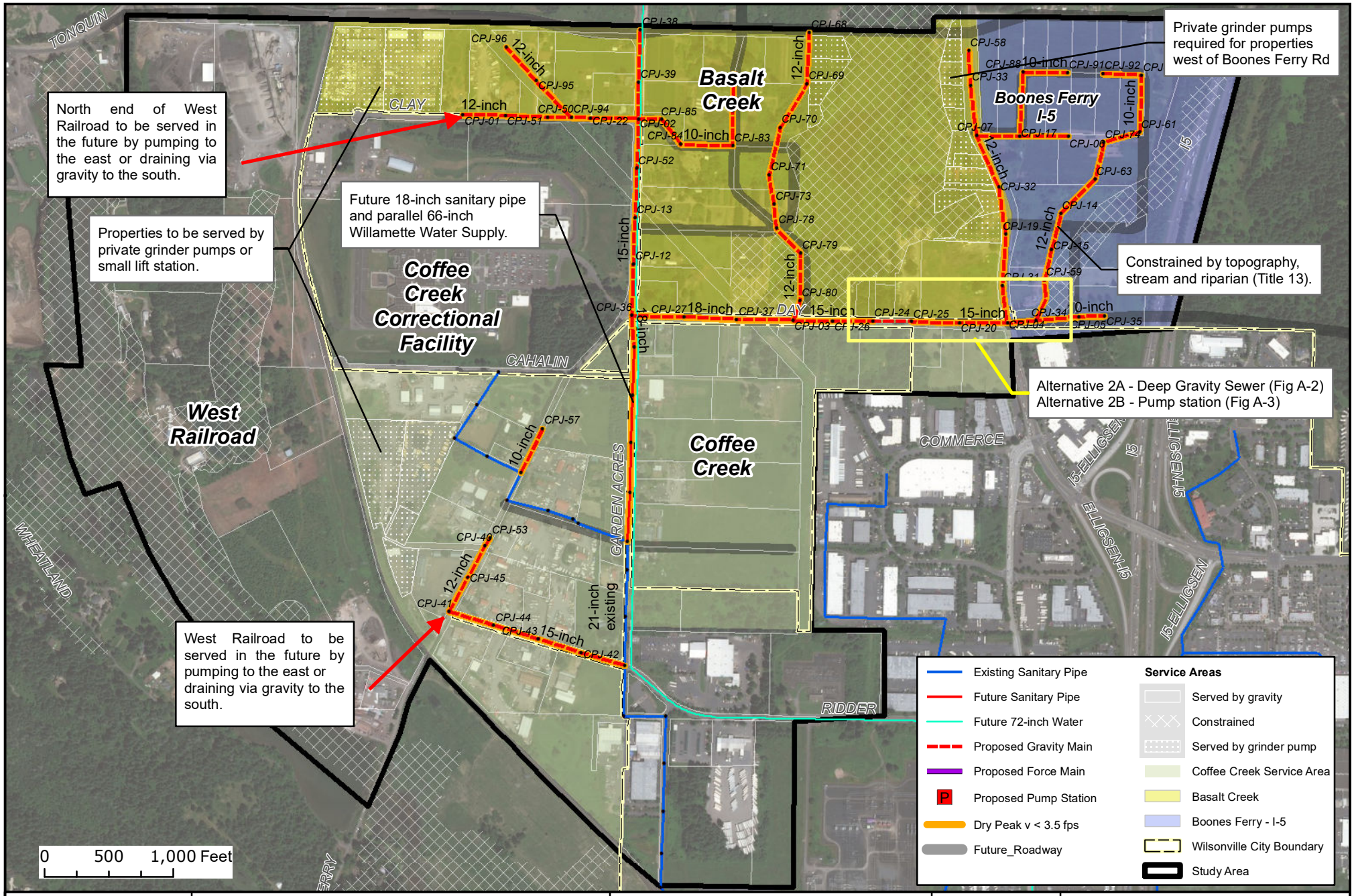

Coffee Creek and Basalt Creek Sanitary Sewer Concept Plan

Figure 2. Alternative 2 Garden Acres Road Conveyance

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The life cycle costs utilized an Equivalent Uniform Annual Cost (EUAC) approach. The EUAC methodology estimates the present value of constructing, operating, and maintaining the collection system converted to an annualized cost. EUAC costs for each alternative include initial and replacement costs of capital, annual operations and maintenance (O&M) costs (non-replacement), and annual electrical costs. The approach considers varied life spans for infrastructure replacement as listed below:

- Gravity Interceptors – 80 years
- Force mains – 50 years
- Wet Well (structure) – 50 years
- Pump Station Mechanical and Electrical – 20 years

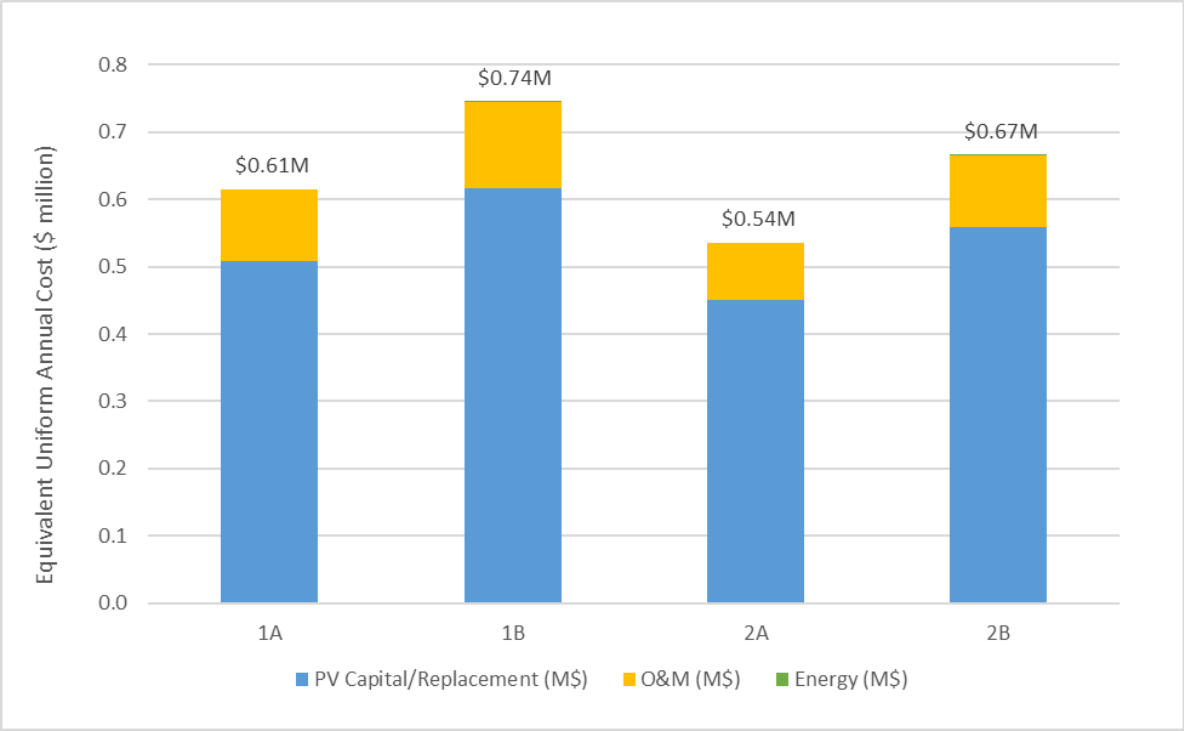
The estimated EUAC for each alternative are presented in **Table 3** and **Figure 4**.

Table 3. Equivalent Uniform Annual Cost Summary

Alternative	Capital/Replacement	O&M	Energy	Total EUAC
1A	$0.51M	$0.11M	$0	$0.61M
1B	$0.62M	$0.13M	$0.001M	$0.74M
2A	$0.45M	$0.09M	$0	$0.54M
2B	$0.56M	$0.11M	$0.001M	$0.67M

M = million, mgd = million gallons per day

Figure 4. Equivalent Uniform Annual Costs



Considerations for Alternative Selection

Alternative 1 - East Coffee Creek Conveyance

- **Pipe Depth** – Due to the alignment of the future Willamette Water Supply Pipe, the sanitary sewer pipe downstream of Garden Acres Road requires additional depth for adequate separation between the infrastructure. It is assumed that the new sanitary pipe would be constructed to the west of the Willamette Water Supply Pipe in Graham's Ferry Road. The depth of the sanitary sewer exceeds 25 feet for approximately 100 linear feet. Pipes deeper than 25 feet were assumed to require trenchless construction. The profiles shown in **Figure A-1**, **Figure A-2** and **Figure A-3** in the Appendix highlight some of the depth considerations.
- **Utility Conflicts -** Further evaluation during pipeline design may be necessary to account for potential utility conflicts associated with sanitary sewer.
- **Groundwater** - The initial geotechnical investigation conducted as part of the Willamette Water Supply Program found depth to groundwater between 13 and 20 feet below ground surface in Garden Acres Road. Groundwater may be an issue for the pipe segments below 13 feet for this alternative.
- **Future road alignments** – The proposed pipe alignment between Day Road and Ridder Road is unlikely to be in a future road alignment due to established Bonneville Power Administration easements and other federally owned property. Constructing a pipe in this alignment may be difficult from a permitting perspective.
- **Pump Station Option B** - The pump station option B provides service for 2 mgd of additional flow from future wet industry. Pumping peak wet flows and an additional 2 mgd for a wet industry increases total capital costs by $1.9 million overall and increases equivalent uniform annual costs by $130,000 per year. Pumping for dry industry without the 2 mgd for potential wet industry would significantly lower capital costs and EUAC.

Alternative 2 – Garden Acres Road Conveyance

- **Pipe Depth –** This alternative concept avoids deep pipes in Day Road downstream to Ridder Road. Due to the alignment of the future Willamette Water Supply Pipe, the sanitary sewer pipe downstream of Garden Acres Road requires additional depth for adequate separation between the infrastructure. It is assumed that the new sanitary pipe would be constructed to the west of the Willamette Water Supply Pipe in Graham's Ferry and Garden Acres Roads. The depth for pipes in Garden Acres Road is illustrated on **Figure A-4**.
- **Utility Conflicts -** Further evaluation during pipeline design may be necessary to account for potential utility conflicts associated with sanitary sewer.
- **Groundwater** - The initial geotechnical investigation conducted as part of the Willamette Water Supply Program found depth to groundwater between 13 and 20 feet below ground surface in Garden Acres Road. Groundwater may be an issue for the pipe segments below 13 feet for this alternative.

- **Pump Station -** Pump station options would have similar relative impacts on capital and equivalent uniform annual costs, as outlined above under Alternative 1.

Recommendations

The recommended alternative is Alternative 2A, which favors conveyance via gravity over pumping and connects Day Road and Garden Acres Road to the Garden Acres Road Sanitary Sewer Extension. This alternative represents the lowest capital and equivalent uniform annual cost. This option will satisfy the City's desire to avoid the installation of new pump stations. Profiles and alignments of the proposed pipelines are included in **Appendix B** of this document.

This alternative further extends and connects to the Garden Acres Road sanitary sewer extension. The connection will require a revision of a partially completed design in order to attain the necessary vertical clearance below or horizontal separation from the Willamette Water Supply Pipe north of Day Road. The Willamette Water Supply Pipe alignment, elevations, approximate diameters and design criteria for parallel sewer pipes should be confirmed during the design process and the alignment and profiles of these pipes designed accordingly.

APPENDIX A – ALTERNATIVE ALIGNMENTS AND PROFILES

(PRELIMINARY ALTERNATIVES EVALUATION)

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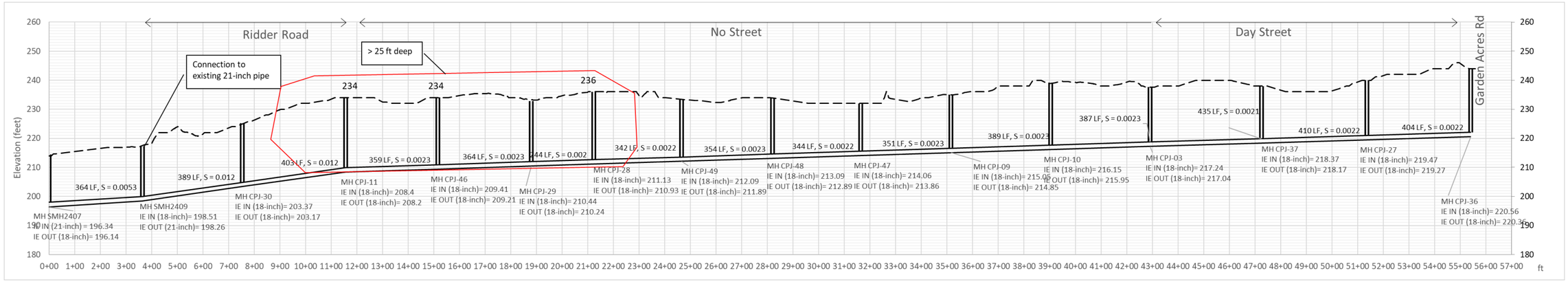
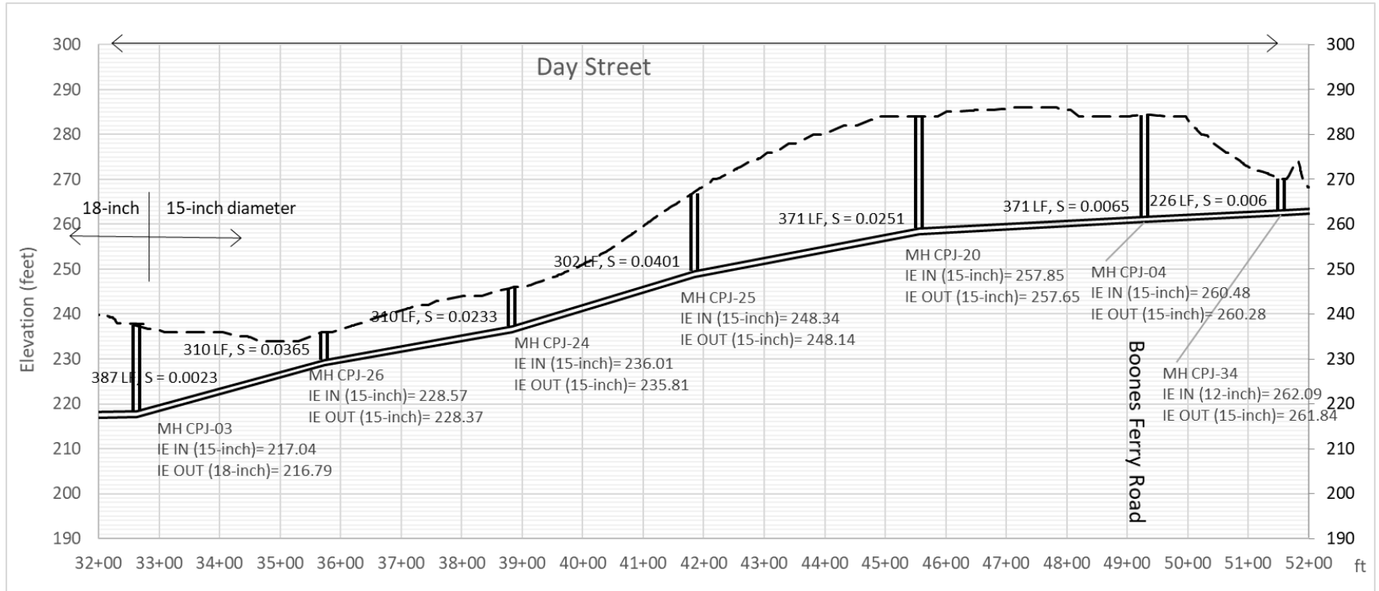
Figure A-1. Alternative 1A and 1B - Sewer Profile on Day Road from Garden Acres Road, then from Day Road to Ridder Road



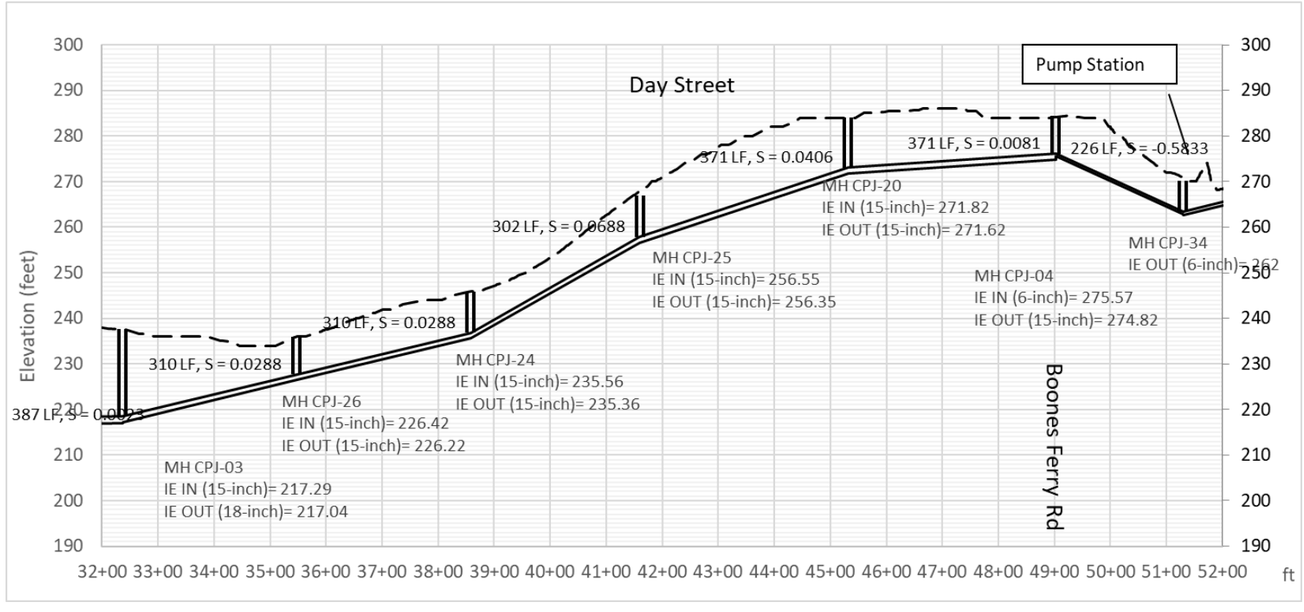
(Plan View)

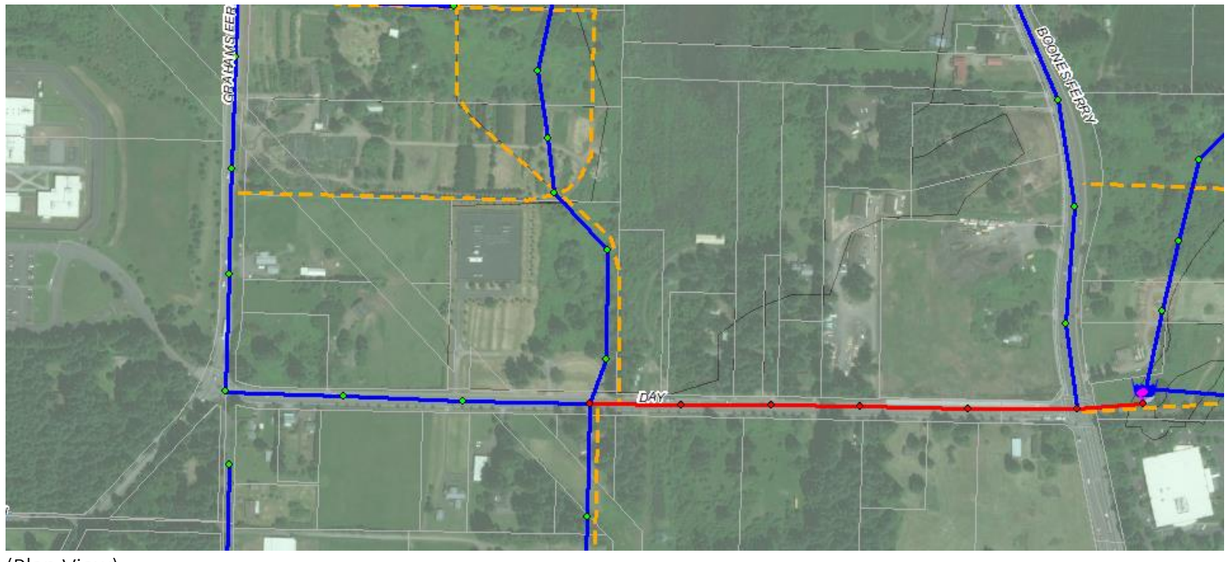
Figure A-2. Alternatives 1A and 2A - Profile for deep gravity pipes on Day Road from East of Boones Ferry Road



(Plan View)

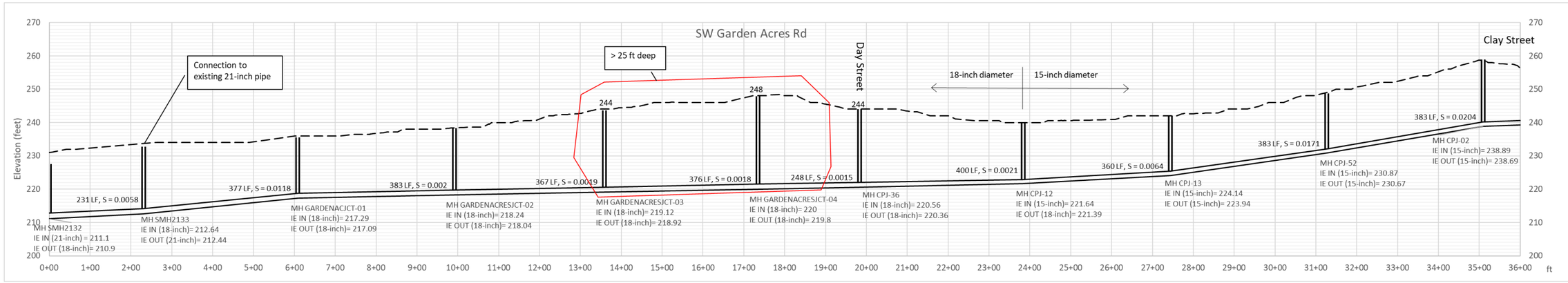
Figure A-3. Alternatives 1B and 2B – Profile for force main and gravity pipe on Day Road from east of Boones Ferry Rd

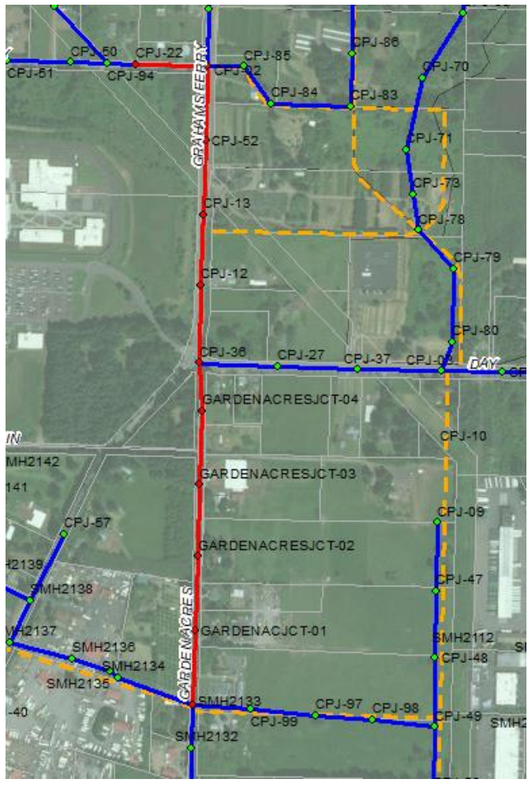




(Plan View)

Figure A-4. Alternatives 2A and 2B - Profile of Garden Acres Road Sewer Connecting to Existing 21-inch pipe





(Plan View)

APPENDIX B – RECOMMENDED ALIGNMENTS AND PROFILES

(RECOMMENDED ALTERNATIVE)

Notes

Elevations provided are relative to NAVD88 vertical datum. This is assumed to be 3.43 ft higher than the NGVD29 vertical datum.

Figure B-1. Key to Alignment Maps

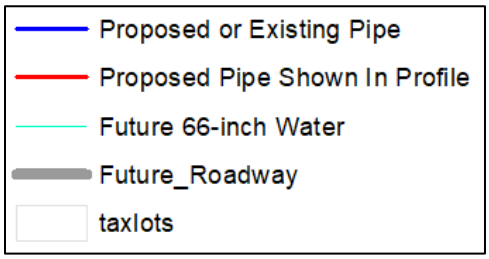


Figure B-2. Sheet Index for Alignments and Profiles

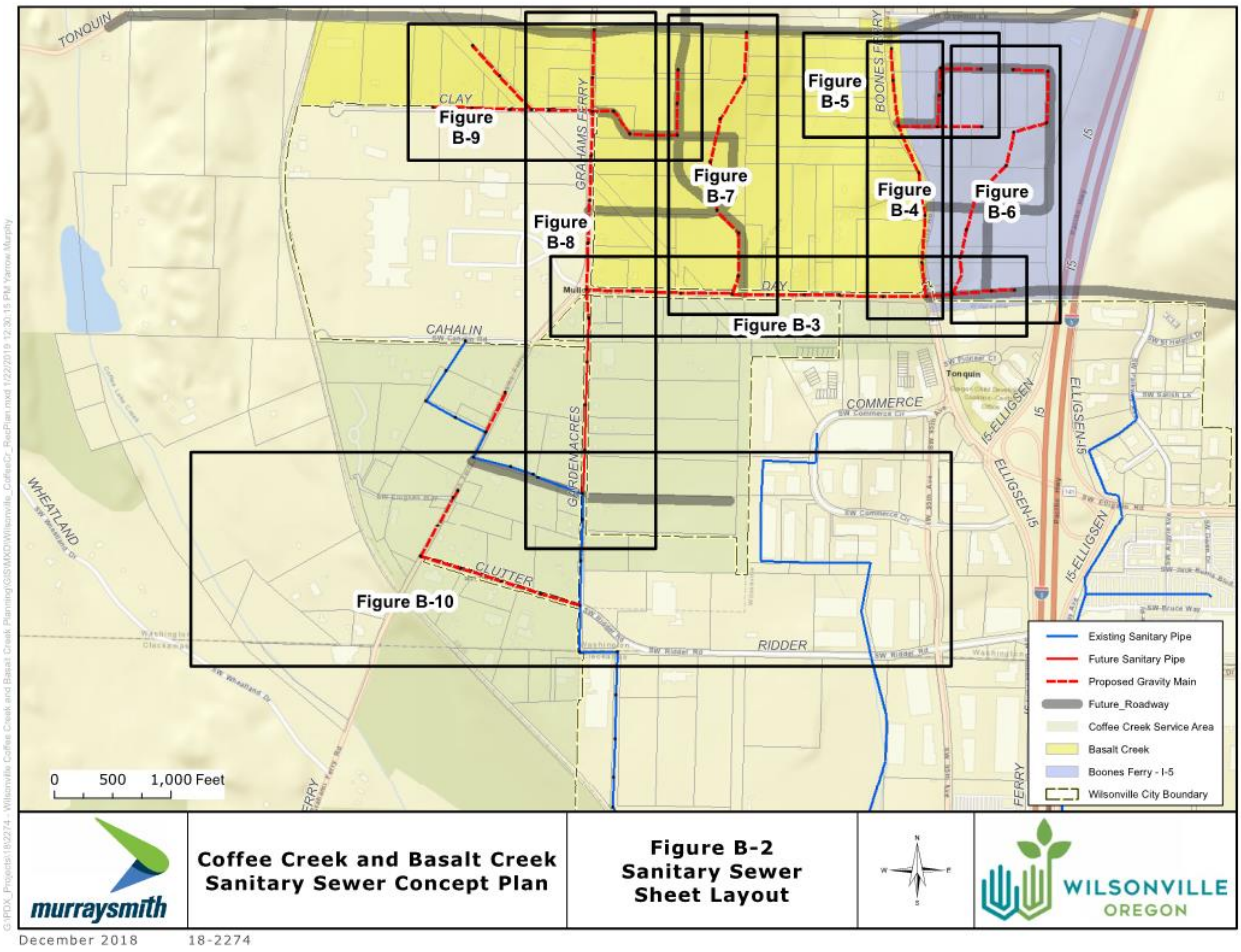


Table B.1 Cost Summary for Recommended Alternative

Figure and Location Description	Cost[1] ($ million)
B-10 Clutter	$1.2
B-3 Day Road	$3.4
B-4 Boones Ferry Rd	$1.0
B-5 East of Boones Ferry	$0.7
B-6 Unnamed Road to Future Day Rd	$1.1
B-7 East of Graham's Ferry to Day Road	$0.9
B-8 Grahams-Ferry/Gardne Acres Rd	$4.9
B-9 Clay	$1.5
No Figure	$0.2
Grand Total	**$14.8**

1. Costs are AACE Class 5 concept level costs with accuracy -50% to +100%.

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Figure B-3. Profile and alignment of proposed sanitary sewer pipes on Day Road from east of Boones Ferry Road to Grahams Ferry Road

See revised figure in Addendum.

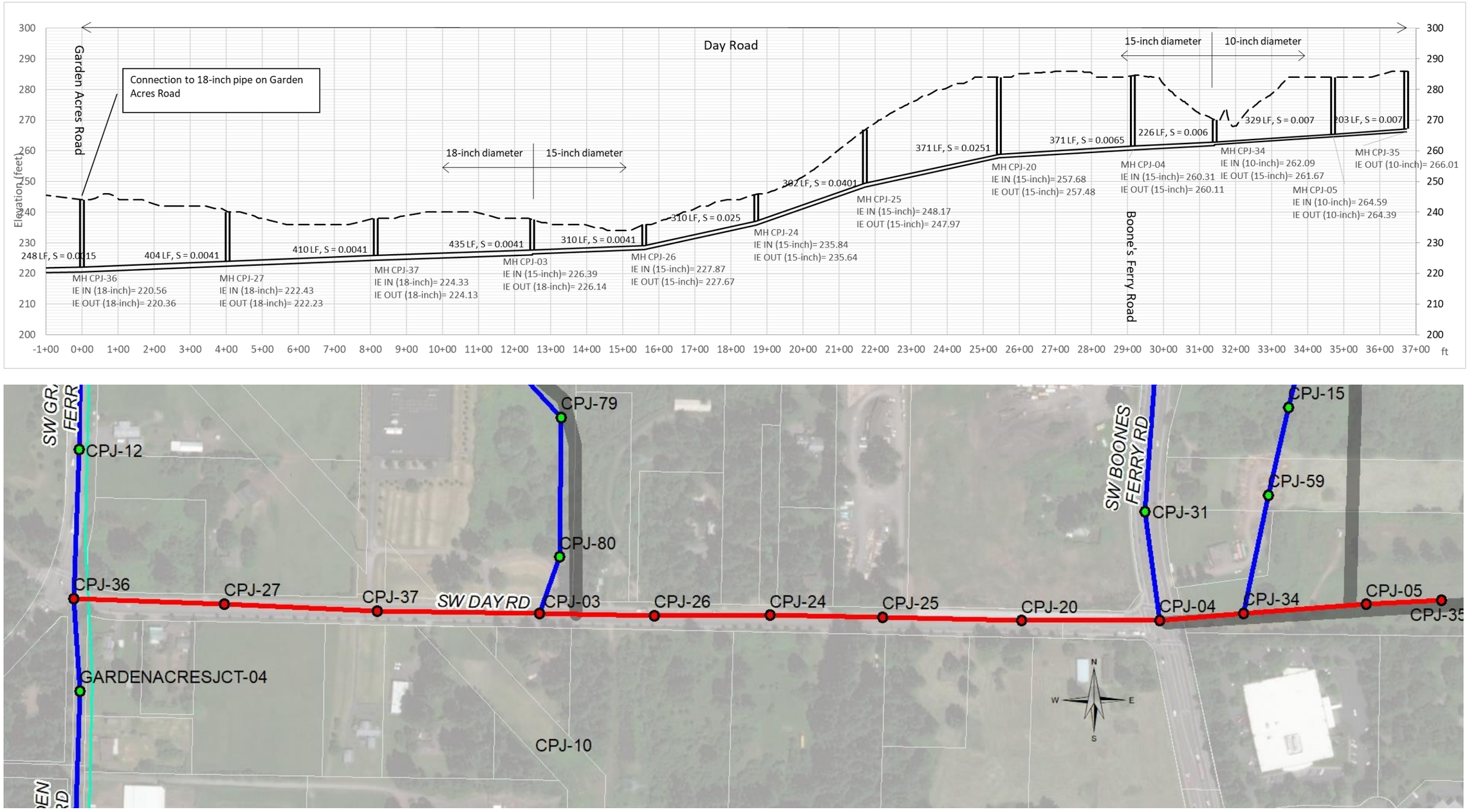


Figure B-4. Alignment and profile of proposed sanitary sewer pipes in Boones Ferry Road

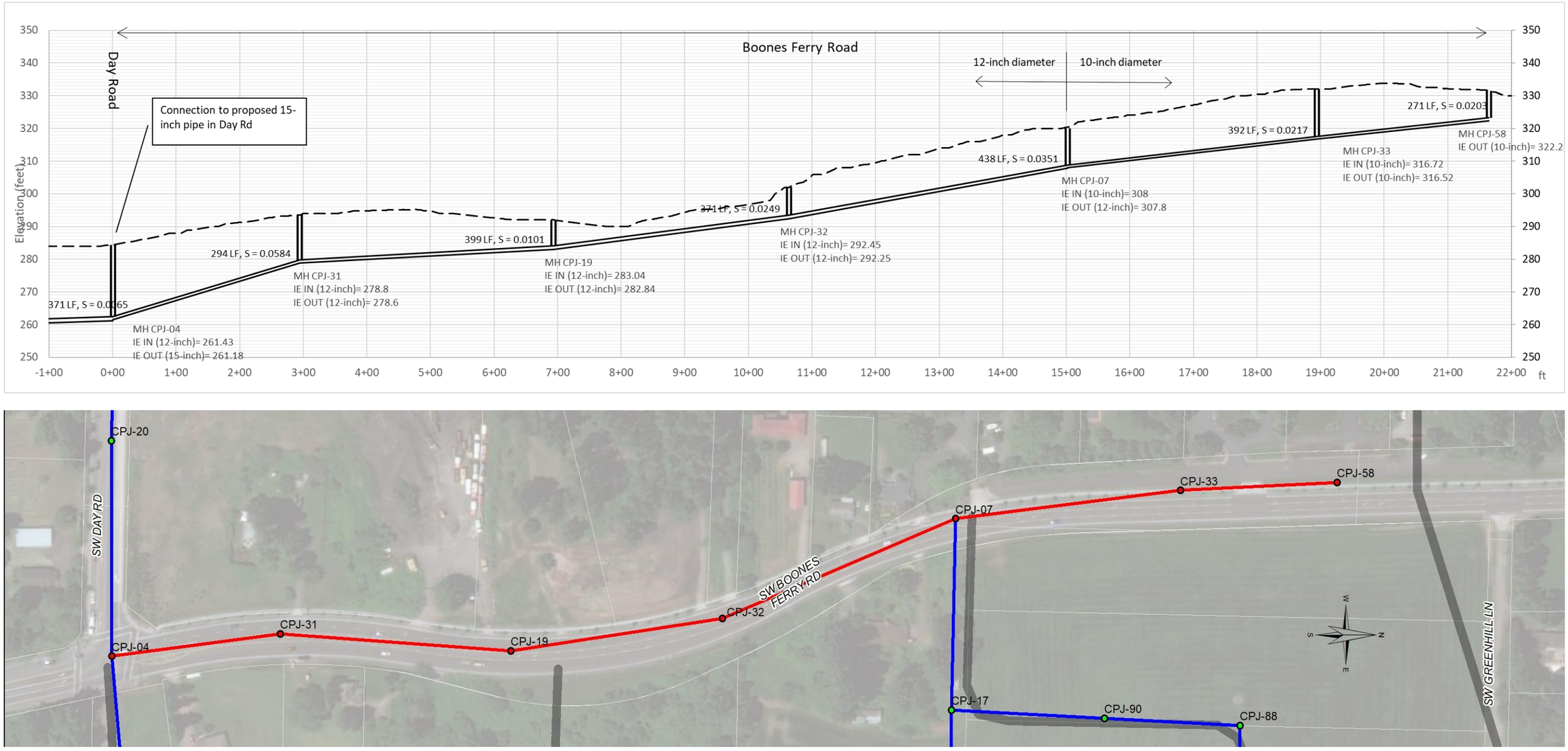
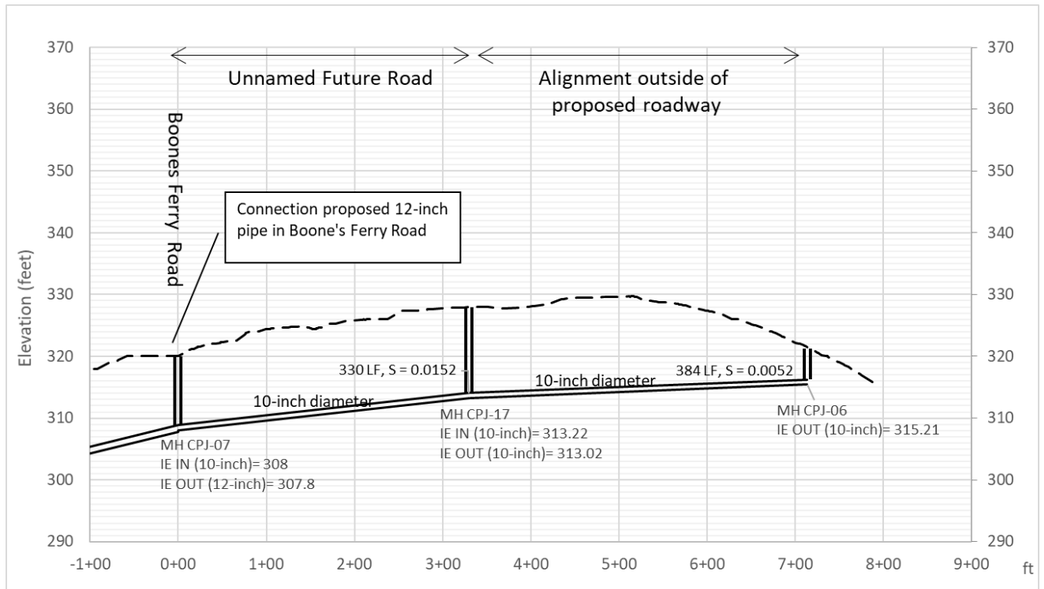
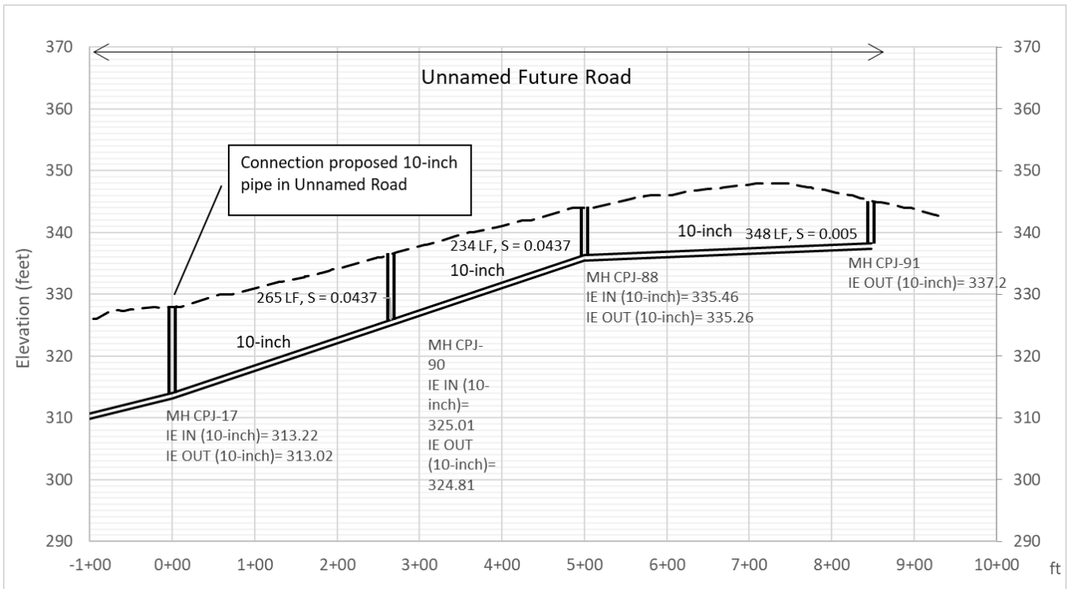


Figure B-5. Alignment and profile of proposed sanitary sewer pipes east of Boones Ferry Road near Greenhill Road





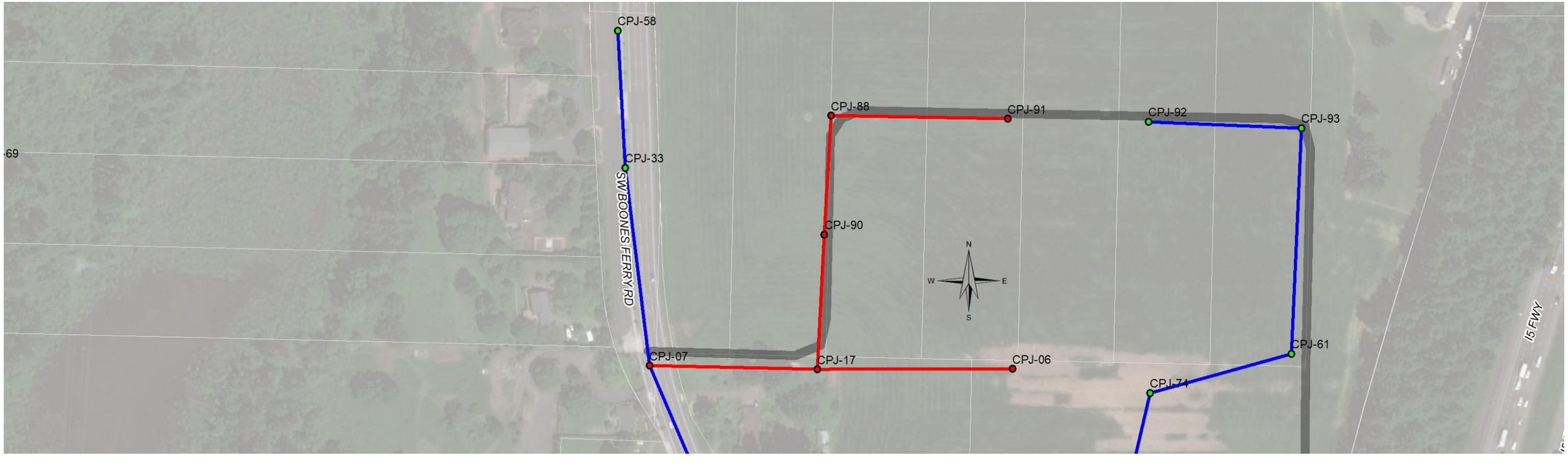


Figure B-6. Alignment and profile of proposed sanitary sewer pipes east of Boone's Ferry Road

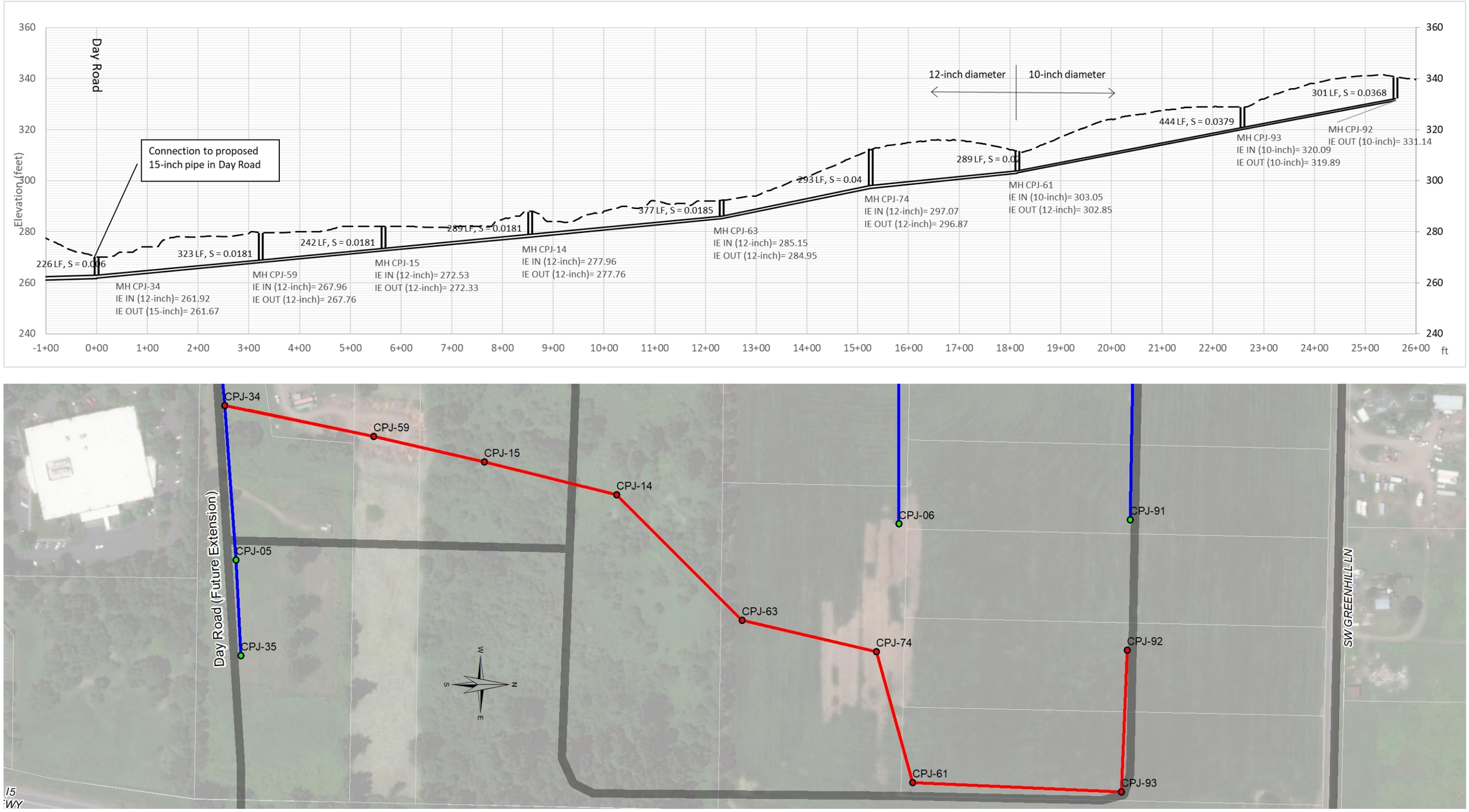
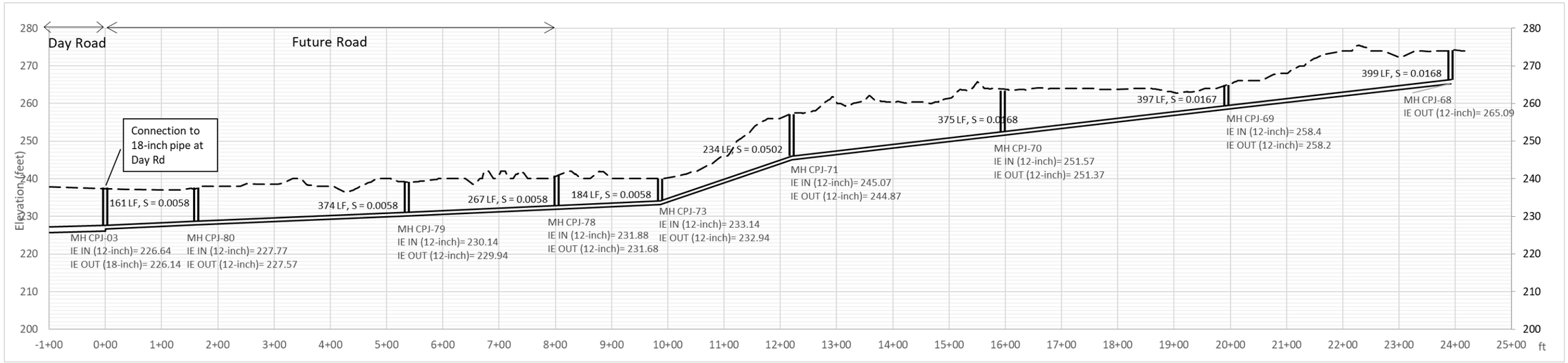


Figure B-7. Alignment and profile of proposed sanitary sewer pipes in future roadway east of Graham's Ferry Road to Day Road



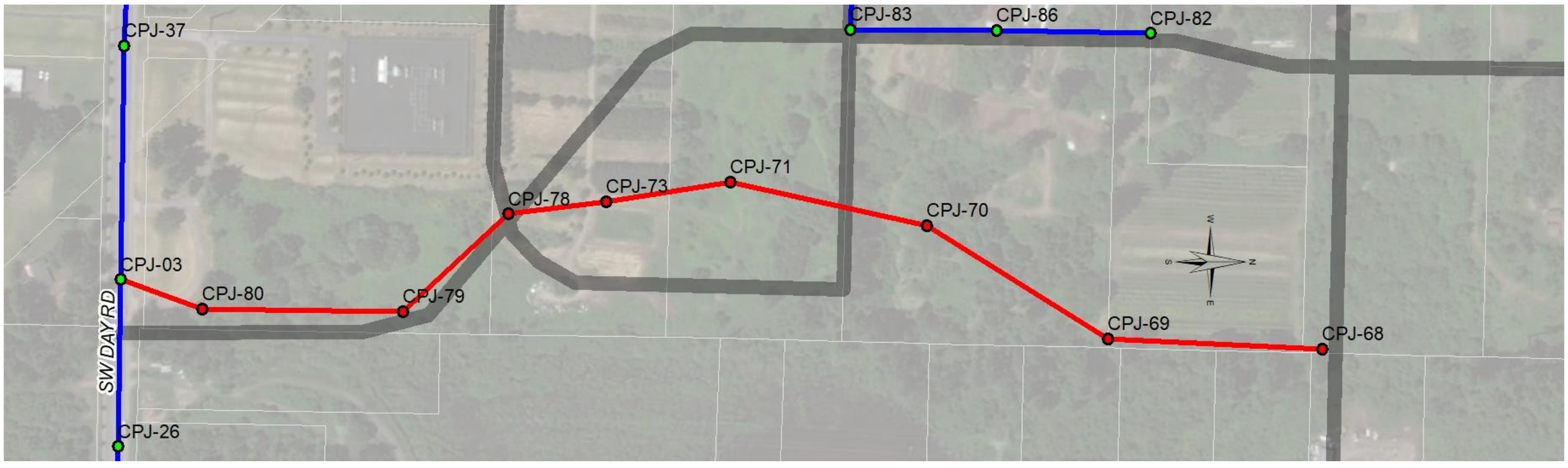


Figure B-8. Alignment and profile of proposed sanitary sewer pipes in Garden Acres Road connecting to Existing 21-inch pipe

See revised figure in Addendum.

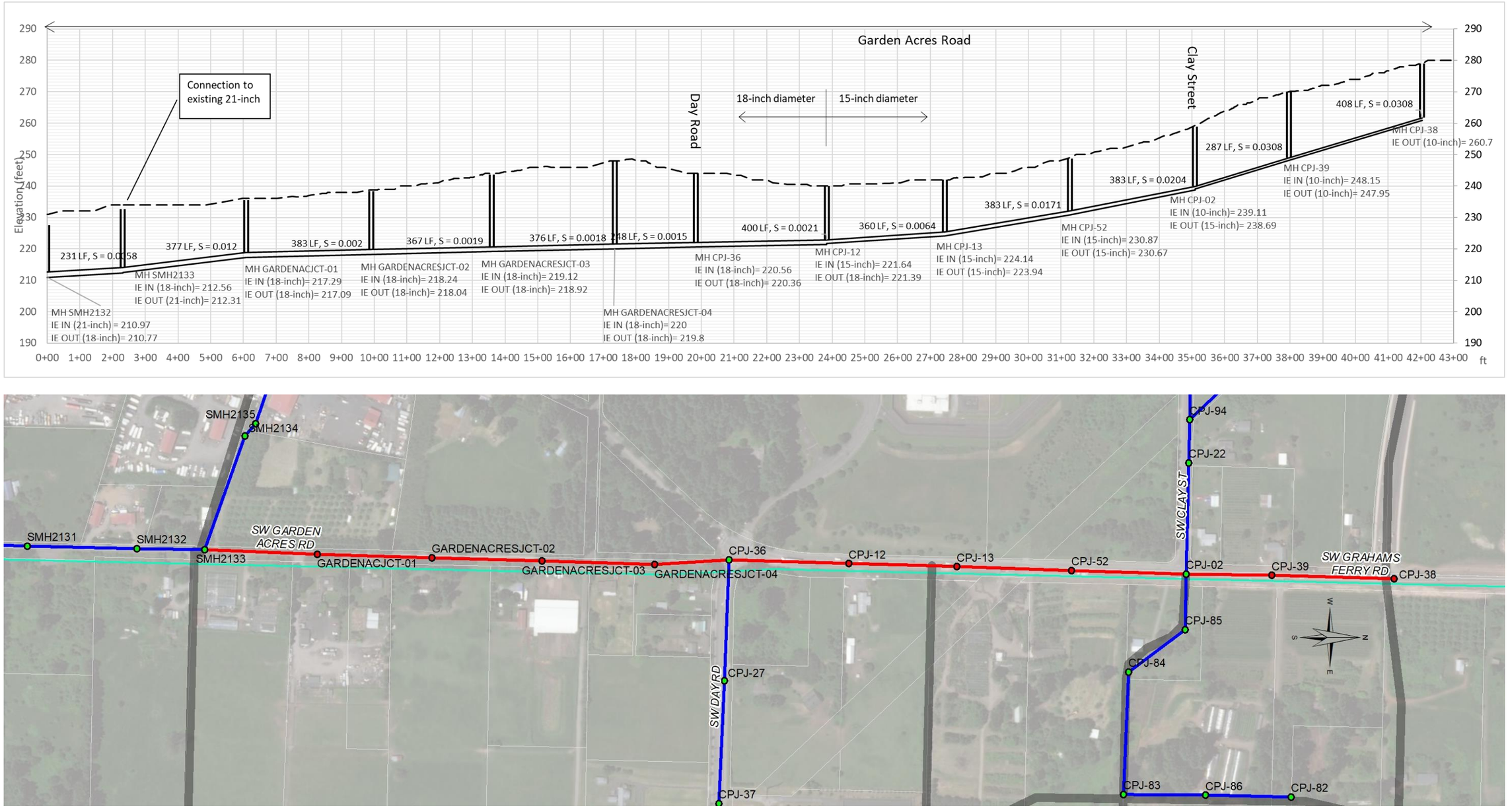
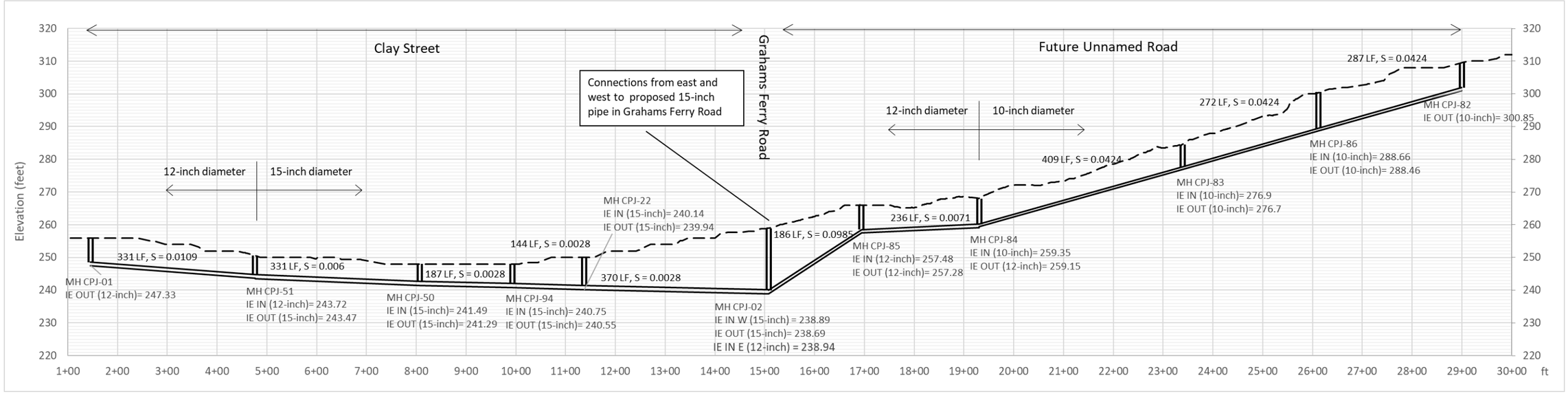
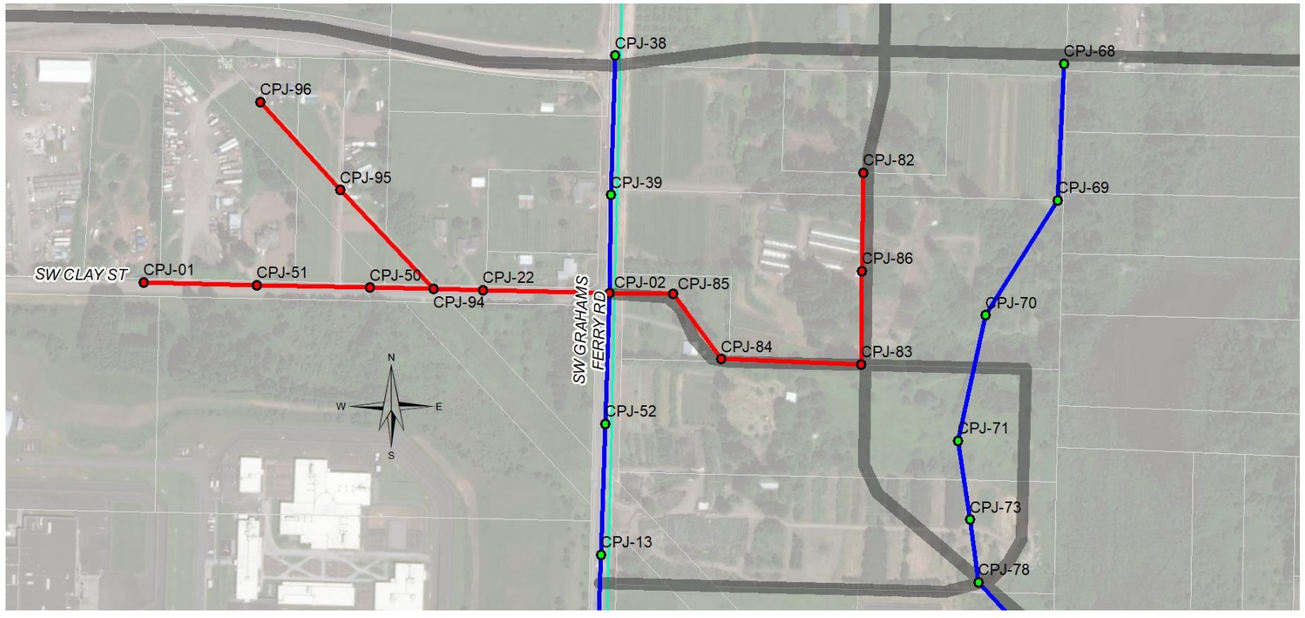


Figure B-9. Alignment and profile of proposed sanitary sewer pipes in Clay Street connecting at Grahams Ferry Road

See revised figure in Addendum.





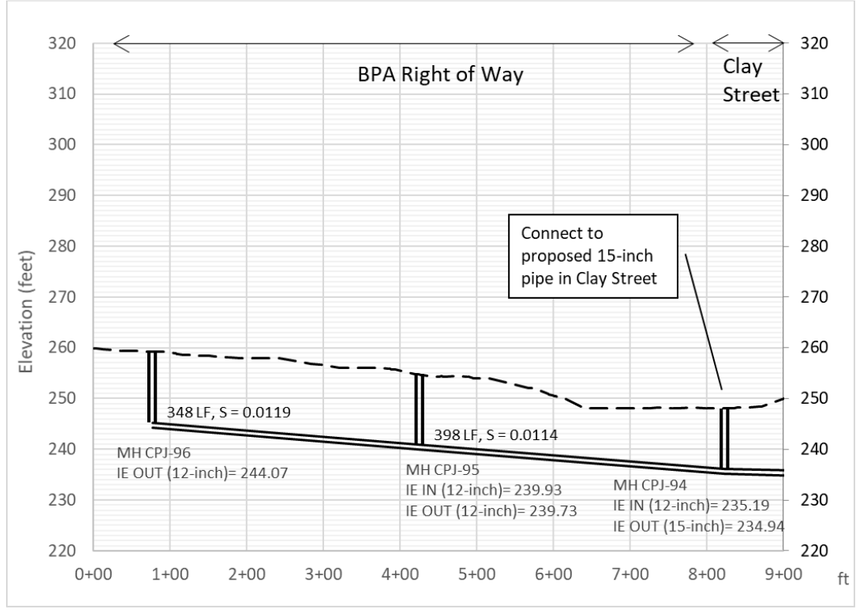
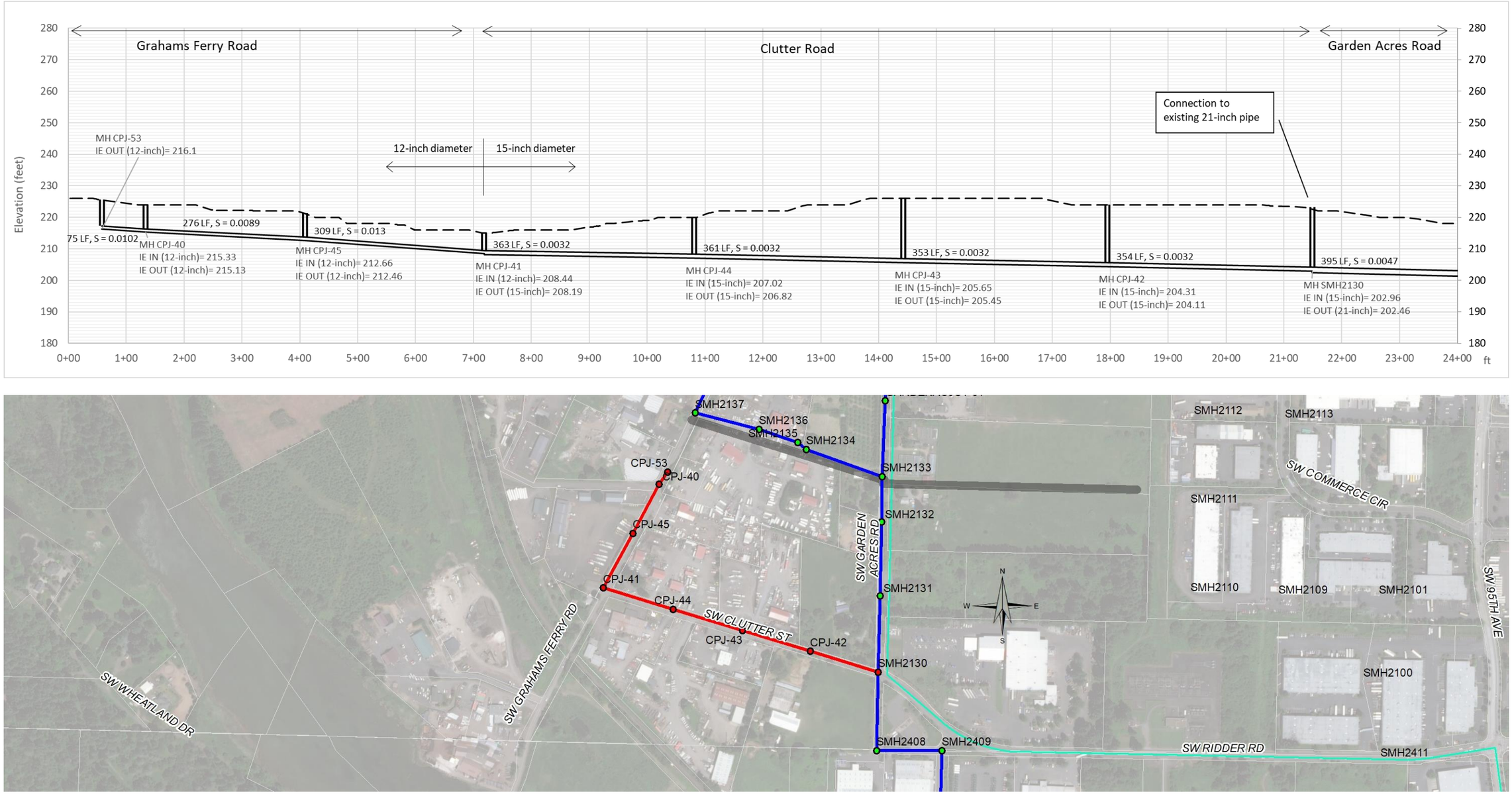


Figure B-10. Alignment and profile of proposed sanitary sewer pipes in Grahams Ferry Road and Clutter Road



ADDENDUM – REVISED ALIGNMENTS AND PROFILES

DAY ROAD AND GRAHAM'S FERRY ROAD

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Figure B-3. (Revised 2/26/2019) Profile and alignment of proposed sanitary sewer pipes on Day Road from east of Boones Ferry Road to Grahams Ferry Road

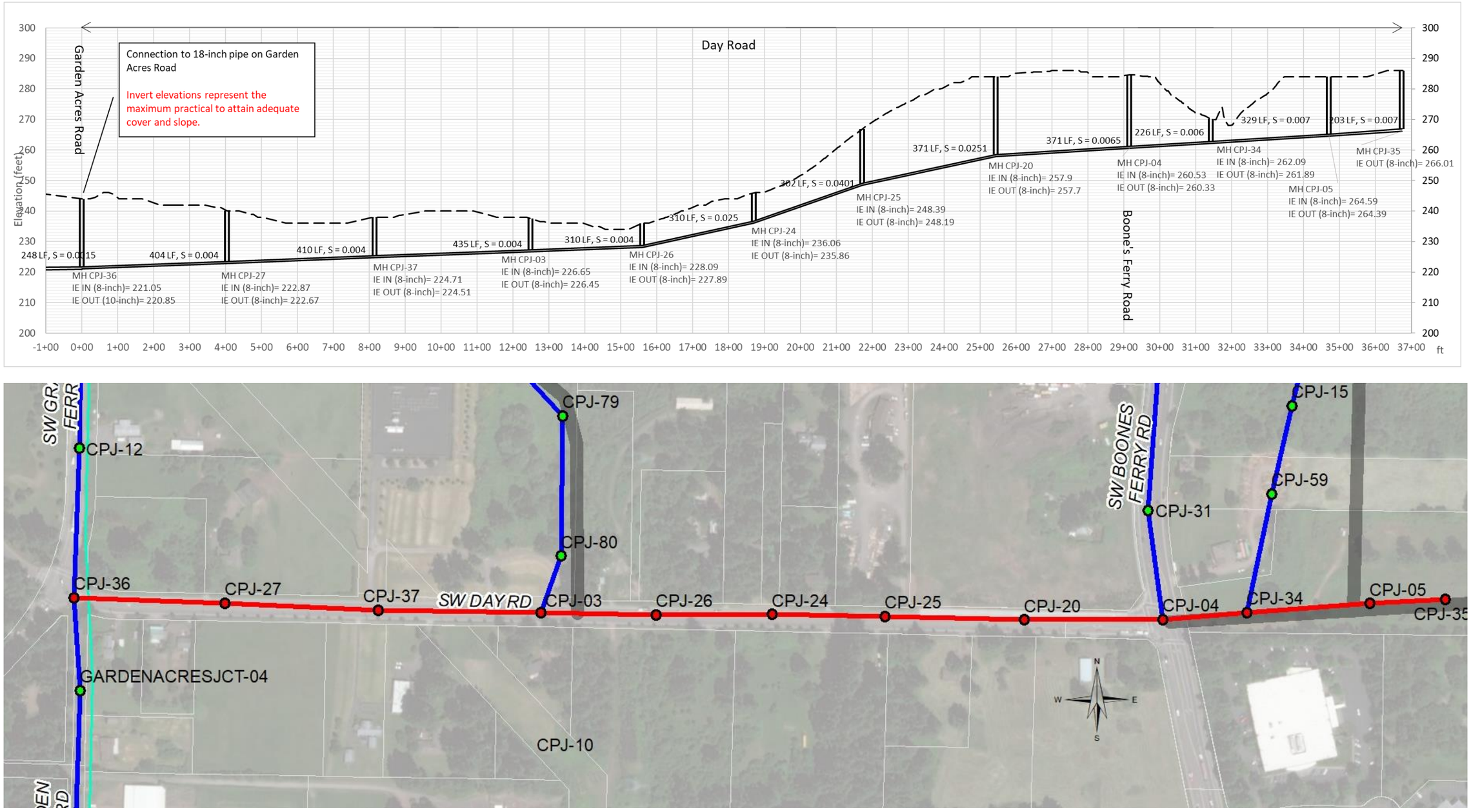

Figure B-8. (Revised 2/26/2019) Alignment and profile of proposed sanitary sewer pipes in Garden Acres Road connecting to Existing 21-inch pipe

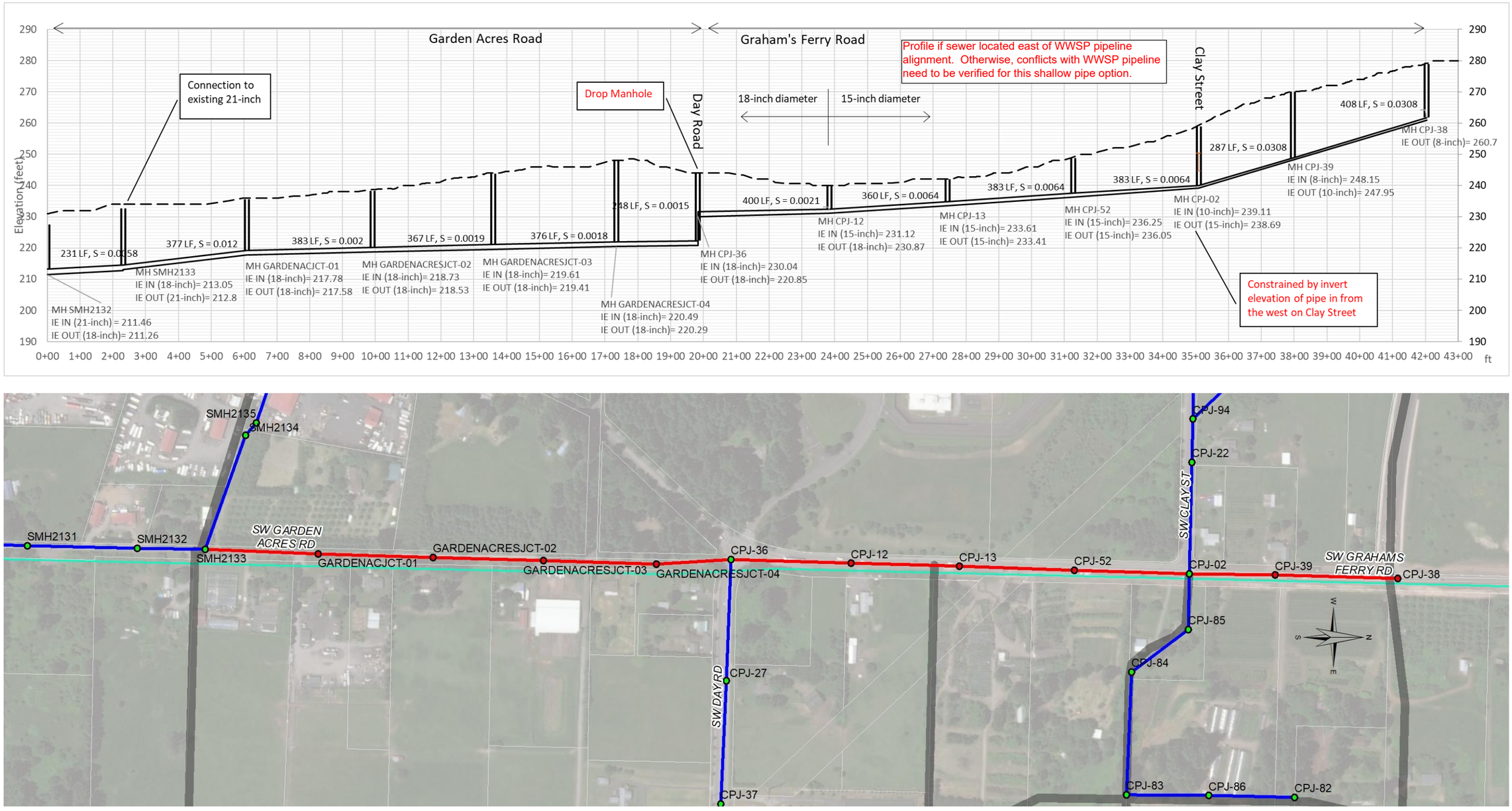

Figure B-9. (Revised 2/26/2019) Alignment and profile of proposed sanitary sewer pipes in Clay Street connecting at Grahams Ferry Road