Evaluation of Collection System

Technical Memorandum #3

Paradise Sewer Project

November 11, 2020

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1. Introduction

The Town of Paradise (Town) is implementing the Paradise Sewer Project (Project), which involves identifying and implementing a long-term solution for collection, treatment, and reuse/disposal of its wastewater. HDR is under contract to assist the Town with the first two phases of the Project—final selection of a wastewater alternative (Phase 1), and preparation of an Environmental Impact Report (EIR) covering the selected alternative (Phase 2). This technical memorandum (TM) is part of the Phase 1 effort.

The purpose of this TM #3 is to evaluate two alternatives for collecting and transporting wastewater from Paradise to either a local wastewater treatment plant (WWTP) or via a regional pipeline to the Chico Water Pollution Control Plant (WPCP). Included in the evaluation, conceptual construction costs, 20-year operations and maintenance (O&M) costs, and net present values will be determined to compare the two alternatives. The two collection system alternatives are:

- Alternative A: Collection of Sewer Flow to Neal Road Corridor
- Alternative B: Collection of Sewer Flow to Clark Road Corridor

These two collection system alternatives align with the local and regional alternatives in the following way:

- Alternative A: Collection of Sewer Flow to Neal Road Corridor could connect to the regional pipeline or to a local WWTP along Neal Road, as shown in Figure 1.

- Alternative B: Collection of Sewer Flow to Clark Road Corridor could connect to a local WWTP along Clark Road, as shown in Figure 2.

This TM is organized as follows:

- Section 1: Introduction
- Section 2: Background
- Section 3: Collection System Evaluation
- Section 4: Opinion of Probable Construction Costs
- Section 5: Operations and Maintenance Costs
- Section 6: Net Present Value Costs
- Section 7: Conclusion

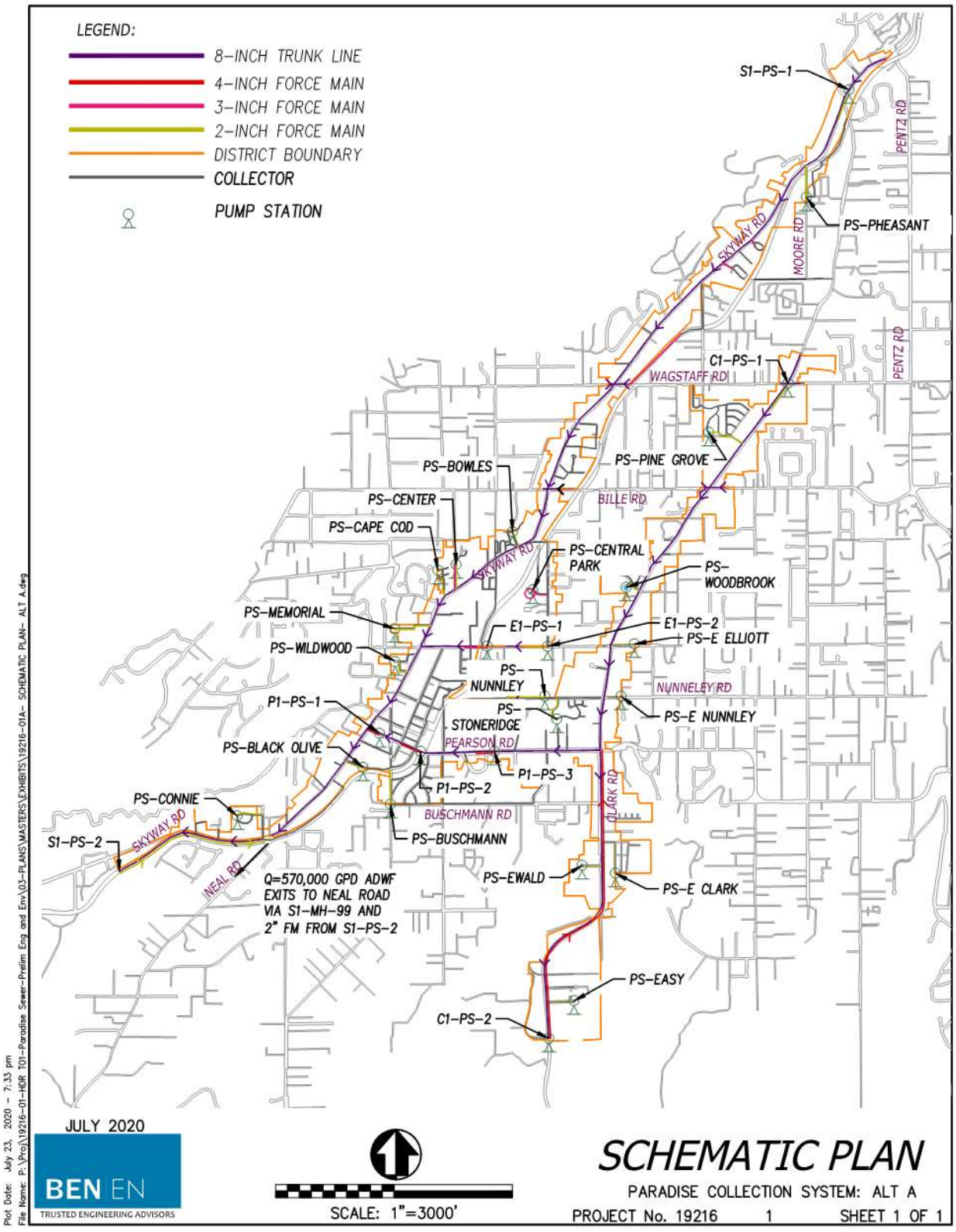


Figure 1. Schematic Collection Plan – Alternative A

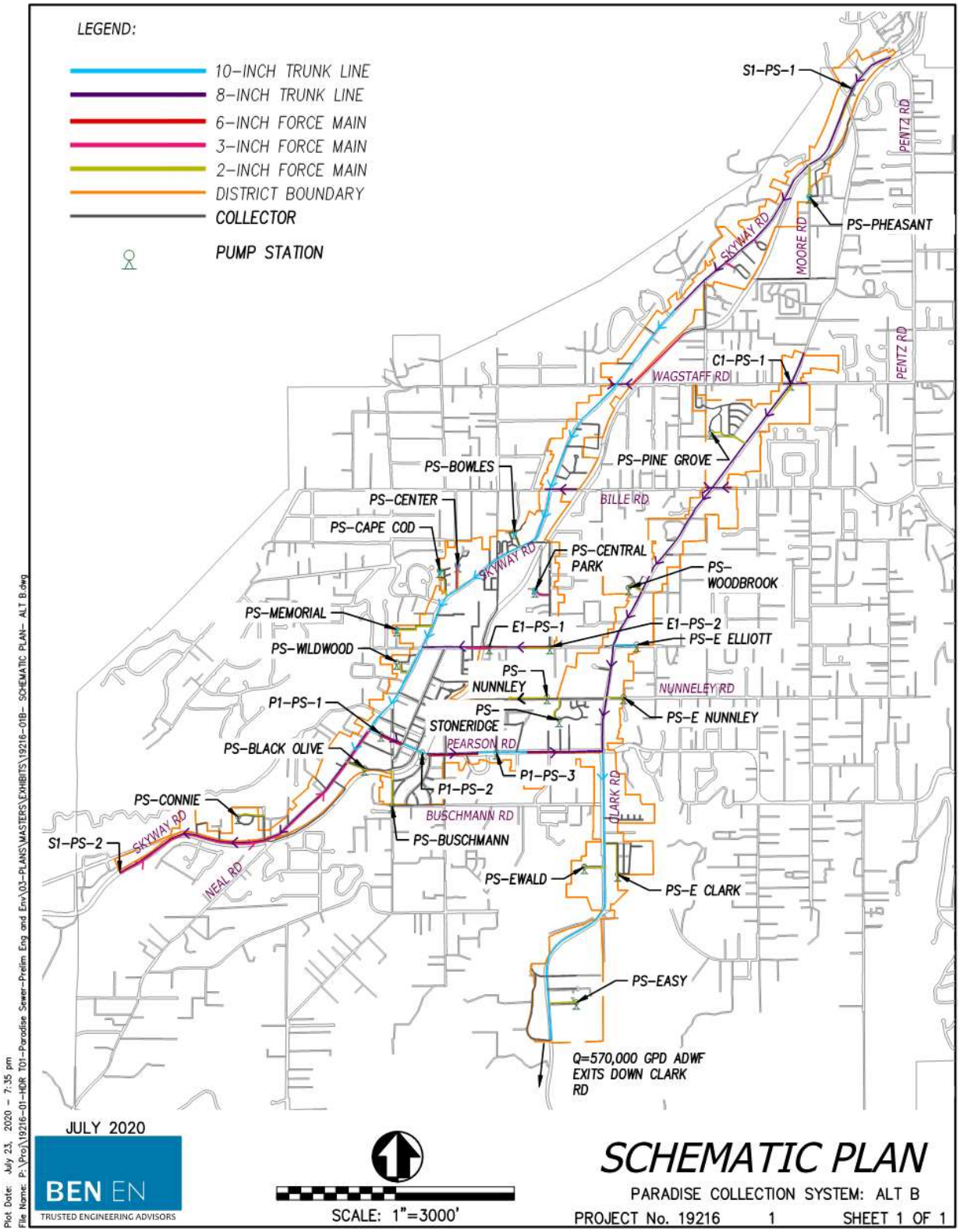


Figure 2. Schematic Collection Plan – Alternative B

2. Background

Prior to the Camp Fire, Paradise was the largest unsewered community in California. A new wastewater management solution is needed to improve the local economy (e.g., encourage opening of new businesses) and to stop degradation of groundwater quality caused by failed or failing septic systems.

The need for a centralized wastewater treatment solution for Paradise has been studied in seven prior reports. The most recent study was prepared by Bennett Engineering in June 2017, *Town of Paradise Sewer Project, Alternative Analysis and Feasibility Report: Determining a Preferred Option for Implementation* (2017 Report). Figure 3 presents the proposed sewer service area (SSA) identified in the 2017 Report; the Town has directed that this be the proposed SSA for this effort. A new collection system will be constructed in the proposed SSA to convey wastewater collected in the area to a new local WWTP (see TM #4 – Local Wastewater Treatment and Disposal Alternatives) or to a pipeline to the Chico WPCP (see TM #5 – Regional Alternative). Based on the 2017 Report, the proposed SSA was defined to represent the area that had the most septic systems that had failed or were projected to fail within the next 5 years. The proposed SSA will serve 1,469 parcels through the Skyway, Clark Road, and Pearson Road corridors. (There are 11,000 total parcels in Paradise.) The SSA also would serve most businesses in Paradise and provide for future development of more multi-family residences, which is currently limited because of septic system constraints.

Some of the challenges in constructing a new collection system for Paradise include the topography and the geology. The geology underlying Paradise is primarily Tuscan Formation made up of lava cap (andesite) and clays. The amount of permeable soil above the andesite varies throughout Paradise. Boulders can also be present. The unweathered state of the Tuscan Formation results in hard rock and course rock fragments that make trenching with a traditional bucket excavator difficult. Sections of trenching in this material may require a rock trencher, which can be efficient but is limited in depth of cut. Soils of this type will typically stand well and provide time for shoring to be placed.

As the Tuscan Formation materials are weathered, they form a red clay with hard fragments that can be excavated using traditional trenching methods and would stand well while shoring is placed for pipeline installation.

The 2017 Report suggested the use of a combination of shallow gravity sewer, pump stations, and septic tank effluent pumping (STEP) for a low-pressure collection system. This would allow the Town to build a system with shallower, smaller pipelines to reduce capital costs of the collection system. Town leadership has heard from many stakeholders in Paradise that their preference would be to not maintain a septic tank or pump on their property; instead they would prefer to use a traditional lateral connection and have most connections drain reliably by gravity. Both collection system alternatives evaluated in this TM are laid out to meet the gravity flow needs.

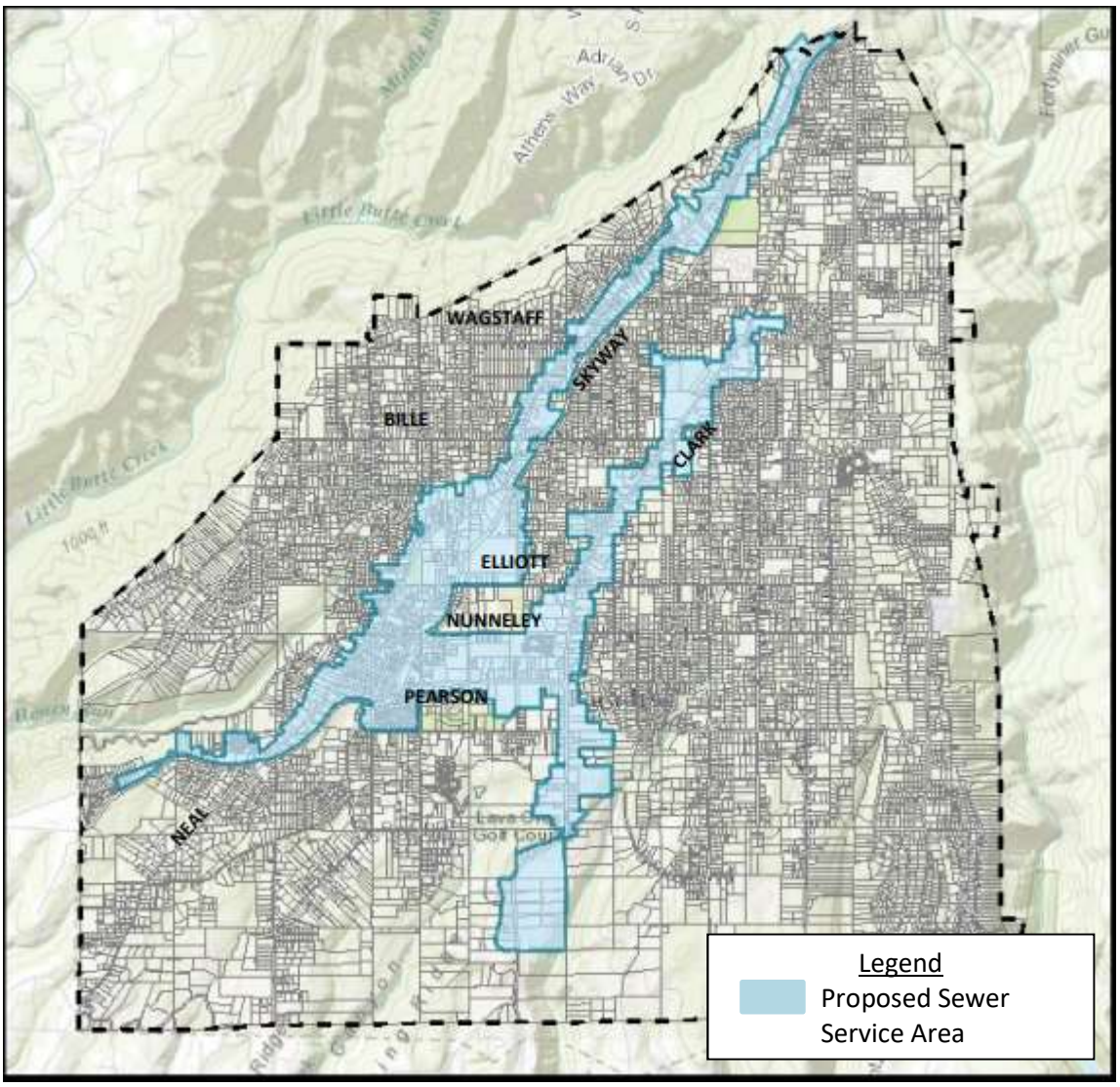


Figure 3. Proposed Town of Paradise Sewer Service Area

The Project intent as it relates to the collection system is to provide sewer service to the 1,469 parcels in the SSA. The resulting sewer system would provide wastewater collection to most of the commercial and multi-family parcels in Paradise and to many single-family homes as well. The remainder of Paradise (over 9,500 parcels) would continue to have their wastewater needs met with septic tank and leach field systems where the soils and land area are adequate to do so.

3. Collection System Evaluation

The 2017 Report recommended a low-pressure STEP system for individual service connections, as discussed in Section 2, with some gravity trunk lines conveying flow to a main pump station. While a STEP system has the potential to reduce capital costs of the collection system, it also requires multiple upgrades at each service connection to build new tanks or convert most existing septic

tanks into tanks/wet wells for low-pressure pumping systems. Such a system would require power modifications at each residential and commercial connection. It also leaves the individual landowners with septic tanks that have to be pumped out periodically and small pumps to maintain. The total cost of the system (i.e., equipment, land, and power supply) for both construction and ongoing O&M would be the responsibility of the individual homeowner. This cost to the landowner would traditionally be on top of a connection fee and monthly sewer rate.

Another option not evaluated for cost is a grinder pump for each connection that connects to a gravity collector sewer. While this option could facilitate keeping the collectors and trunk lines shallow and less costly, it would not eliminate all the manholes associated with a gravity sewer system as the STEP system would. Grinder pumps also place a similar burden on the landowner to install a power connection and for on-site maintenance of the wet well and pump. However, grinder pumps would eliminate the settling tank component of a STEP system that would periodically need to be pumped out by septage haulers.

One change since the 2017 Report that recommended a STEP system is that many of the existing buried septic tanks in the proposed SSA were damaged or otherwise compromised due to the November 2018 Camp Fire. In addition, most businesses and homes targeted for re-building due to fire destruction would need new septic tanks and eventual conversion to a low-pressure pumping system if this were still the approach to the collection. The project team re-evaluated the proposed SSA parcel by parcel and defined how each area may be served with a gravity connection. Except for a few isolated parcels (because of their elevation relative to adjacent collectors and trunk lines), most parcels can be served via a 4-inch lateral connection (with cleanout) to a 6-inch collector sewer per modern building codes.

This re-evaluation resulted in two collection system alternatives that have sewer lines that are generally deeper than those in the 2017 Report and require many more manholes and small pump stations throughout the proposed SSA. The small pump stations are needed to pump flows out of the valleys and swales, and back up to an adjacent gravity sewer that directs flow either to another pump station or to a main trunk line, which in turn conveys flow from Paradise to a local WWTP (under Alternative A: Collection of Sewer Flow to Neal Road Corridor or Alternative B: Collection of Sewer Flow to Clark Road Corridor) or to the Chico WPCP (under Alternative A only). Much of the collection system layout is the same between Alternatives A and B. The difference between the two is primarily in the southern portion of Paradise along Pearson Road, where flow is directed to either Neal Road or Clark Road.

Appendix A provides schematic flow diagrams showing how the collection system would be integrated for each alternative. The diagrams also show conceptual locations of pump stations and force mains. Profiles of all collectors and trunk lines are shown. Manholes are also shown.

The effort to lay out a system of collectors and trunk lines that serve every parcel within the SSA and are at depths less than or equal to 15 feet yields a significant number of pump stations throughout the proposed SSA (see Appendix A for plans and profiles of the collection system alternatives). The collectors and trunk lines were laid out in AutoCAD using existing parcel data and topography to determine each parcel's serviceability by gravity flow and the necessary depths of the collectors and trunk lines to maximize gravity flow and minimize construction depths.

4. Opinion of Probable Construction Costs

Opinions of Probable Construction Costs (cost estimates) were prepared for both collection system alternatives. The estimates are Class 4, associated with a 1 to 15 percent level of project definition. When needed, the 20-Cities Average version of the Engineering News-Record Construction Cost Index (ENR CCI) was used to update costs.

The cost of developing a relatively shallow gravity system with multiple pump stations to serve the majority of connections in the SSA is shown in the cost estimates. Cost estimates for both collection system alternatives were developed with unit costs for open cut construction of the gravity sewer lines, reflecting the potential higher cost of relatively deep sewers (15 to 20 feet below grade in some cases) in challenging geology (hard rock). Unit costs have also been escalated since the 2017 Report. The cost estimates for Alternative A: Collection of Sewer Flow to Neal Road Corridor and Alternative B: Collection of Sewer Flow to Clark Road Corridor are close because much of the collection system is the same in layout in both alternatives, as discussed in Section 3.

The cost estimates include the cost of collectors, trunk lines, small force mains, trunk force mains, pump stations, and manholes. The cost estimates also include the cost of lateral installation. The laterals connect the house or business to the nearest collector sewer. Connection lengths vary depending on the position of the home or business on a given parcel, but for the purposes of the cost estimate, 130 feet per 4-inch lateral connection was used to estimate this cost component.

Because of a lack of site-specific geotechnical information, lack of detailed survey data, and unknown construction challenges in the field, the collection system construction cost estimates include a 30 percent scope contingency and a 10 percent construction contingency. The capital cost estimates also assume that soft costs for the collection system will be 43 percent of the escalated construction cost estimate. Tables 1 and 2 summarize the sewer component quantities and costs. A more detailed cost estimate is provided in Appendix A that breaks out the sewer components further to account for different sizes, and shallower or deeper sewer pipelines and manholes.

Table 1. Capital Cost Estimate for Alternative A: Collection of Sewer Flow to Neal Road Corridor

Sewer Component	Length (ft)	Quantity	Construction Cost ($)
Collector	95,327		16,964,000
Trunk Line	61,330		12,386,000
Collector Force Main	12,889		2,178,000
Trunk Force Main	16,189		2,825,000
Pump Stations		28	2,400,000
Manholes		786	6,412,000
Lateral Connections		1,469	15,278,000
Subtotal			**58,443,000**
Undefined Scope (30%)			17,532,900
Subtotal			**75,975,900**
Contingency (10%)			7,597,590
Soft Costs (43%)			35,936,601

Sewer Component	Length (ft)	Quantity	Construction Cost ($)
TOTAL			**119,510,190**

Table 2. Capital Cost Estimate for Alternative B: Collection of Sewer Flow to Clark Road Corridor

Sewer Component	Length (ft)	Quantity	Construction Cost ($)
Collector	92,888		16,379,000
Trunk Line	61,253		13,248,000
Collector Force Main	12,889		2,146,000
Trunk Force Main	14,365		2,668,000
Pump Stations		27	2,370,000
Manholes		791	6,384,000
Lateral Connections		1,469	15,278,000
Subtotal			**58,473,000**
Undefined Scope (30%)			17,541,900
Subtotal			**76,014,900**
Contingency (10%)			7,601,490
Soft Costs (43%)			35,955,048
TOTAL			**119,571,438**

The 2017 Report estimated a capital cost of nearly $35M and a cost of $47M with lower contingencies and lower soft costs (design, permitting, and environmental). That conceptual system eliminated a considerable number of manholes, used smaller and shallower pipelines, and aggregated flows to fewer (although larger) pump stations for conveyance out of Paradise. As mentioned in Section 3, it also left landowners with the cost of installing and maintaining individual tanks and pumps.

As construction funding is identified and more detailed design is developed, the Project's contingency should decrease, and updated unit costs for construction could be used. To accomplish more accurate estimating, borings and geotechnical analysis along the pipeline alignment at depth are necessary. This would assist estimators in evaluating appropriate shoring systems and pipeline installation production rates.

The collection system cost estimates have assumed the use of prefabricated pump stations with submersible non-ragging pumps. These pump stations are mostly serviceable from above grade without confined space entry required. They have a relatively small footprint and can be installed adjacent to existing parcels, and along road frontages and existing easements depending on frontage or easement width and adjacent power drop availability. However, right-of-way acquisition costs have not been included in the construction cost estimates. Small pump stations such as these often do not have a standalone stand-by power source, and operations staff typically rely on trailer-mounted generators to service the pump stations during power outages. Approximately 27 or 28 small pump stations disbursed throughout Paradise means that several standby generators would

be needed to maintain the system during a power outage. Mobile generators are not included in the current cost estimates.

5. Operations and Maintenance Costs

The assumed costs for O&M are similar to those in the 2017 Report, with few changes. Staffing and labor for a new sewer district are included as before, with additional costs compiled based on anticipated power demands for the multiple pump stations in the collection system. See Appendix A for a detailed evaluation of the components of the annual O&M costs for the sewer system, including staffing, management, and operations costs including energy. Table 3 summarizes the O&M costs and conversion of annual costs to present value for the two collection system alternatives.

Table 3. Annual Operations and Maintenance Costs

Alternative	Annual O&M ($)	Present Value, 2020, 0.3%, 20 years ($)
A: Collection of Sewer Flow to Neal Road Corridor	1,019,918	19,769,701
B: Collection of Sewer Flow to Clark Road Corridor	1,022,144	19,812,853

6. Net Present Value Costs

To compare overall costs of Alternative A: Collection of Sewer Flow to Neal Road Corridor and Alternative B: Collection of Sewer Flow to Clark Road Corridor (i.e., combining construction and O&M costs), a net present value cost analysis was done using a 20-year planning period. The net present value analysis also requires establishing a discount rate. A real discount rate of 0.3 percent was used, following the US Department of Agriculture (USDA) Bulletin 1780-2, which in turn refers to the real discount rate in the US Office of Management and Budget's Circular A-94 (see Appendix B).

Salvage value is the residual value of an asset after a certain time span up to the length of its useful life. Because the life spans of the collection system components exceed 20 years, salvage values were estimated based on the life span of the asset and a straight-line depreciation of the value of the asset over the analysis period of 20 years (per USDA Bulletin 1780-2 guidance for analysis of wastewater projects).

Assumed asset life spans and salvage values are shown in Tables 4 and 5. Cumulative salvage values for the two alternatives are shown.

Table 4. Asset Life Span and Salvage Value for Alternative A: Collection of Sewer Flow to Neal Road Corridor

Asset	Life Span (yrs)	Salvage Value, 2040 ($)
Sewer – Public Right-of-Way	50	20,611,800
Pump Stations	50	1,440,000
Manholes	50	3,847,200
Connections (Laterals)	50	9,166,800
TOTAL		**35,065,800**

Table 5. Asset Life Span and Salvage Value for Alternative B: Collection of Sewer Flow to Clark Road Corridor

Asset	Life Span (yrs)	Salvage Value, 2040 ($)
Sewer – Public Right-of-Way	50	20,664,600
Pump Stations	50	1,422,000
Manholes	50	3,830,400
Connections (Laterals)	50	9,166,800
TOTAL		**35,083,800**

Calculations of the net present value of Alternative A: Collection of Sewer Flow to Neal Road Corridor and Alternative B: Collection of Sewer Flow to Clark Road Corridor are included in Table 6. The total net present value of each alternative is the capital cost of the alternative's construction plus the present value of the annual O&M cost over the time span minus the present value of the salvage value at the end of the time span. This methodology is consistent with USDA Bulletin 1780-2.

The net present value of the two alternatives is almost indiscernible with the accuracy of the cost estimating effort to generate capital and O&M costs.

Table 6. 20-year Net Present Value of Collection System Alternatives

Alternative	Capital Cost ($) (A)	Present Value O&M, 0.3%, 20-yr ($) (B)	PW Salvage Value, 0.3%, 20-yr ($) (C)	Net Present Value ($) (A+B-C)
A: Collection of Sewer Flow to Neal Road Corridor	119,510,190	19,769,701	33,026,693	106,253,198
B: Collection of Sewer Flow to Clark Road Corridor	119,571,440	19,812,853	33,043,646	106,340,647

The capital costs for Alternatives A and B are in stark contrast to the capital cost of the STEP collection system promoted in 2017. The base construction cost of Alternative A is $58.4M, and the base construction cost of the STEP system was $37.8M. However, to compare the 2017 cost estimate to this 2020 effort, the cost estimates must be placed on equal footing. Therefore, the 2017 cost estimates have been escalated to 2020 levels, and the approach to contingencies, soft costs,

and net present value has been made equivalent. The base construction cost of the STEP system includes soft costs added to its raw construction cost for comparison to Alternative A, which is a gravity system that had those elements built into the unit costs used to prepare the cost estimate. As shown in Table 7, Alternative A, a gravity system, has a total construction cost of $119.5M versus $101.6M for the STEP system. A comparison of net present value brings the gravity and STEP system closer because of the significance of the salvage value of the numerous pump stations in the gravity system for Alternative A.

Table 7. 20-year Net Present Value of Alternative A (Gravity System) versus STEP System from 2017 Report

Component	Deep Gravity System		STEP/STEG System (1)	
	Factor (%)	Amount ($)	Factor (%)	Amount ($)
Construction Costs				
Base Construction Cost		58,443,000		37,871,000
Undefined Scope	30	17,532,900	30	11,361,300
Subtotal		**75,975,900**		**49,232,300**
Mobilization/Demobilization	0	--	5	2,461,615
Sales Tax	0	--	9.25	4,553,988
Contractor Profit	0	--	15	7,384,845
Bonds & Insurance	0	--	2	984,646
Subtotal	**0**	**75,975,900**	**31**	**64,617,394**
Construction Contingency	10	7,597,590	10	6,461,739
CONSTRUCTION COST TOTAL		**83,573,490**		**71,079,133**
Implementation (Soft) Costs				
Project Administration	5	4,178,675	5	3,553,957
Legal Counsel/Bond Counsel	1	835,735	1	710,791
Planning	3	2,507,205	3	2,132,374
Design	13	10,864,554	13	9,240,287
Environmental Documentation/Permitting	3	2,507,205	3	2,132,374
Right-of-Way Acquisition	3	2,507,205	3	2,132,374
Construction Management	8	6,685,879	8	5,686,331
Engineering Services During Construction	4	3,342,940	4	2,843,165
Env. Monitoring/Regulatory Compliance	1	835,735	1	710,791
Environmental Mitigation	2	1,671,470	2	1,421,583
IMPLEMENTATION COST TOTAL	**43**	**35,936,601**	**43**	**30,564,027**
TOTAL CAPITAL COST		**119,510,190**		**101,643,160**
O&M Cost (annual)		1,019,918		1,019,918
O&M Cost Net Present Value (20 yrs, 0.3%)		19,769,701		19,769,701
Salvage Value Net Present Value (20 yrs, 0.3%)		33,026,693		19,421,100
TOTAL NET PRESENT VALUE		**106,253,198**		**101,992,000**

(1) STEG = septic tank effluent gravity

7. Conclusion

It is feasible to construct a gravity system to serve the urban core of Paradise. However, a significant number of pump stations (27 to 28) is required to serve the 1,469 parcels in the proposed SSA. This number may be slightly reduced in final design by placing some of the collection system in easements and out of the available streets and public right-of-way. However, the topography of Paradise still requires multiple pump stations, which will come with significant monitoring and maintenance over their life cycle.

A part of the evaluation of the local WWTP option is deciding whether to locate the local WWTP on Neal Road or Clark Road. With costs so similar between the two collection system alternatives, it appears that the collection system will not be a significant factor in determining the WWTP location. The selection of the local WWTP location will likely be determined by other factors such as land cost and compatible land uses.

It is also clear that providing gravity sewer connections to most sewer customers will be more expensive in construction cost to the Town than a low-pressure STEP or septic tank effluent gravity (STEG) system. However, the gravity system puts most of the control of the system and maintenance onto the Town and does not defer as much maintenance responsibility to the sewer customer via on-site systems.

A

Cost Tables and Collection System Plans

Opinion of Probable Construction Cost - Capital and O&M

Town of Paradise

Paradise - Sewer Feasibility - Alternative A - Neal Road

BEN|EN TRUSTED ENGINEERING ADVISORS

Location		**QTY. BY**	**ESTIMATE LEVEL**
Town of Paradise - Collection System		L. Edwards	**CONCEPT**
Limits		**QTY. CHCK**	**PRICED BY**
Proposed Paradise Sewer Service Area		M.Massaro	L.Edwards
BEN|EN PROJECT NO.		**AGENCY**	
19-216 TO1		Town of Paradise	7/17/2020

Item No.	Item	Estimated Quantity	Unit	Unit Price	Total	Salvage Value at 20 yrs
SEWER-Public ROW						
1	Collector - 6 inch less than 16 feet depth	88,948	LF	$176	$15,641,000	
2	Collector - 6 inch 16 to 20 feet depth	6,379	LF	$207	$1,323,000	
3	Trunk - 8 inch less than 16 feet depth	59,439	LF	$201	$11,946,000	
4	Trunk - 8 inch 16 to 20 feet depth	1,891	LF	$232	$440,000	
5	Trunk - 10 inch less than 16 feet depth	0	LF	$239	$0	
6	Trunk - 10 inch 16 to 20 feet depth	0	LF	$264	$0	
7	Collector Forcemain- 2 inch less than 10 feet depth	12,022	LF	$163	$1,964,000	
8	Collector Forcemain- 2 inch 10 to 16 feet depth	452	LF	$245	$111,000	
9	Collector Forcemain- 3 inch less than 10 feet depth	0	LF	$170	$0	
10	Collector Forcemain- 3 inch 10 to 16 feet depth	415	LF	$247	$103,000	
11	Collector Forcemain- 4 inch less than 10 feet depth	0	LF	$176	$0	
12	Collector Forcemain- 4 inch 10 to 16 feet depth	0	LF	$251	$0	
13	Trunk Forcemain- 2 inch less than 10 feet depth	6,271	LF	$163	$1,024,000	
14	Trunk Forcemain- 2 inch 10 to 16 feet depth	0	LF	$245	$0	
15	Trunk Forcemain- 3 inch less than 10 feet depth	580	LF	$170	$99,000	
16	Trunk Forcemain- 3 inch 10 to 16 feet depth	0	LF	$247	$0	
17	Trunk Forcemain- 4 inch less than 10 feet depth	8,556	LF	$176	$1,505,000	
18	Trunk Forcemain- 4 inch 10 to 16 feet depth	782	LF	$251	$197,000	
19	Trunk Forcemain- 6 inch less than 10 feet depth	0	LF	$188	$0	
20	Trunk Forcemain- 6 inch 10 to 16 feet depth	0	LF	$257	$0	
	Subtotal	185,736	LF		$34,353,000	$20,611,800
PUMP STATIONS						
21	Collector PS 10 to 50 GPM	18	EA	$80,000	$1,440,000	
22	Collector PS 100 to 180 GPM	1	EA	$100,000	$100,000	
23	Trunk PS 10 to 50 GPM	4	EA	$80,000	$320,000	
24	Trunk PS 100 to 180 GPM	1	EA	$100,000	$100,000	
25	Trunk PS 180 to 300 GPM	4	EA	$110,000	$440,000	
26	Trunk PS 350 to 750 GPM	0	EA	$130,000	$0	
	Subtotal	28			$2,400,000	$1,440,000
MANHOLES						
27	Collector 48" MH less than 16 feet depth	521	EA	$8,000	$4,168,000	
28	Collector 48" MH 16 to 20 feet depth	23	EA	$12,000	$276,000	
29	Trunk 48" MH less than 16 feet depth	234	EA	$8,000	$1,872,000	
30	Trunk 48" MH 16 to 20 feet depth	8	EA	$12,000	$96,000	
	Subtotal	786			$6,412,000	$3,847,200
CONNECTIONS						
31	Total Number of Service Laterals	1,469				
32	Total 4" ABS Lateral (Assume 130 LF per connection)	190,970	LF	$80	$15,278,000	
	Subtotal	190,970			$15,278,000	$9,166,800

Estimated Construction Cost	**$58,443,000**	
Contingency (30%)	*$17,532,900*	
Construction Contingency (10%)	*$7,597,590*	
Estimated Construction Total	**$83,573,490**	
Soft Costs (43%)	$35,936,700	
Total Collection System Cost	**$119,510,190**	
Total Collection System Salvage Value (20-yr)		$35,065,800

BENNETT ENGINEERING SERVICES ASSUMES NO RESPONSIBILITY FOR DIFFERENCES BETWEEN THESE QUANTITIES AND FINAL PAY QUANTITIES.

ANNUAL OPERATIONS AND MAINTENANCE COST - SERVICE AREA

Item No.	Item	Estimated Quantity	Unit	List Price	Total Annual Cost
1	General Manager	1	LS	$150,000	$150,000
2	Receptionist (Assume 1 full 1 part time employee)	2	LS	$60,000	$90,000
3	Accountant	1	LS	$100,000	$100,000
4	Operations - Collection System				
5	Operations Manager	1	LS	$130,000	$130,000
6	Field Crew/Utility Worker (assume 3)	3	LS	$65,000	$195,000
7	On-Site Service Tech.	1	LS	$65,000	$65,000
8	PS Power Requirements ($/yr)				
9	Collector PS 10 to 50 GPM	18	EA	$2,226	$40,072
10	Collector PS 100 to 180 GPM	1	EA	$3,339	$3,339
11	Trunk PS 10 to 50 GPM	4	EA	$2,226	$8,905
12	Trunk PS 100 to 180 GPM	1	EA	$3,339	$3,339
13	Trunk PS 180 to 300 GPM	4	EA	$5,566	$22,262
14	Trunk PS 350 to 750 GPM	0	EA	$7,792	$0
15	Miscellaneous PS Repairs ($/yr)	1	LS	$10,000	$10,000
16	Annual Maintenance ($/yr)	1	LS	$50,000	$50,000
17	Septage Hauling (Vactor)	100	EA	$1,000	$100,000
18	Building Cost (assumed service district housed at City Hall)	0	LS	$18,000	$0
19	IT Support ($/yr)	12	LS	$1,000	$12,000
20	Planning ($/yr)	1	LS	$30,000	$30,000
21	Miscellaneous Expenses ($/yr)	1	LS	$10,000	$10,000
	Total Annual O&M				**$1,019,918**

All staff costs are based on total pay + benefits (Transparent California) similar agencies (PID, TOP, GV, PCWA)

NET PRESENT VALUE

Capital Cost	Annual O&M	PW O&M P/A, 0.3%, 20 yrs	Salvage Value (2040)	PW Salvage P/F, 0.3%, 20 yrs (2040)	Net Present Worth
$119,510,190	**$1,019,918**	**$19,769,701**	**$35,065,800**	**$33,026,693**	**$106,254,000**

Opinion of Probable Construction Cost - Capital and O&M						
Town of Paradise						
Paradise - Sewer Feasibility Alternative B - Clark Road						
Location				**QTY. BY**		**ESTIMATE LEVEL**
Town of Paradise - Collection System				L. Edwards		**CONCEPT**
Limits				**QTY. CHCK**		**PRICED BY**
Proposed Paradise Sewer Service Area				M.Massaro		L.Edwards
BEN|EN PROJECT NO.				**AGENCY**		
19-216 TO1				Town of Paradise		7/17/2020

Item No.	Item	Estimated Quantity	Unit	Unit Price	Total	Salvage Value at 20 yrs
SEWER-Public ROW						
1	Collector - 6 inch less than 16 feet depth	91,465	LF	$176	$16,084,000	
2	Collector - 6 inch 16 to 20 feet depth	1,423	LF	$207	$295,000	
3	Trunk - 8 inch less than 16 feet depth	36,878	LF	$201	$7,412,000	
4	Trunk - 8 inch 16 to 20 feet depth	611	LF	$232	$143,000	
5	Trunk - 10 inch less than 16 feet depth	22,928	LF	$239	$5,472,000	
6	Trunk - 10 inch 16 to 20 feet depth	835	LF	$264	$221,000	
7	Collector Forcemain- 2 inch less than 10 feet depth	12,022	LF	$163	$1,964,000	
8	Collector Forcemain- 2 inch 10 to 16 feet depth	452	LF	$245	$111,000	
9	Collector Forcemain- 3 inch less than 10 feet depth	415	LF	$170	$71,000	
10	Collector Forcemain- 3 inch 10 to 16 feet depth	0	LF	$247	$0	
11	Collector Forcemain- 4 inch less than 10 feet depth	0	LF	$176	$0	
12	Collector Forcemain- 4 inch 10 to 16 feet depth	0	LF	$251	$0	
13	Trunk Forcemain- 2 inch less than 10 feet depth	1,965	LF	$163	$321,000	
14	Trunk Forcemain- 2 inch 10 to 16 feet depth		LF	$245	$0	
15	Trunk Forcemain- 3 inch less than 10 feet depth	8,639	LF	$170	$1,465,000	
16	Trunk Forcemain- 3 inch 10 to 16 feet depth	0	LF	$247	$0	
17	Trunk Forcemain- 4 inch less than 10 feet depth	0	LF	$176	$0	
18	Trunk Forcemain- 4 inch 10 to 16 feet depth	0	LF	$251	$0	
19	Trunk Forcemain- 6 inch less than 10 feet depth	1,275	LF	$188	$241,000	
20	Trunk Forcemain- 6 inch 10 to 16 feet depth	2,486	LF	$257	$641,000	
	Subtotal	181,396	LF		$34,441,000	$20,664,600
PUMP STATIONS						
21	Collector PS 10 to 50 GPM	18	EA	$80,000	$1,440,000	
22	Collector PS 100 to 180 GPM	1	EA	$100,000	$100,000	
23	Trunk PS 10 to 50 GPM	3	EA	$80,000	$240,000	
24	Trunk PS 100 to 180 GPM	2	EA	$100,000	$200,000	
25	Trunk PS 180 to 300 GPM	0	EA	$110,000	$0	
26	Trunk PS 350 to 750 GPM	3	EA	$130,000	$390,000	
	Subtotal	27			$2,370,000	$1,422,000
MANHOLES						
27	Collector 48" MH less than 16 feet depth	542	EA	$8,000	$4,336,000	
28	Collector 48" MH 16 to 20 feet depth	6	EA	$12,000	$72,000	
29	Trunk 48" MH less than 16 feet depth	235	EA	$8,000	$1,880,000	
30	Trunk 48" MH 16 to 20 feet depth	8	EA	$12,000	$96,000	
	Subtotal	791			$6,384,000	$3,830,400
CONNECTIONS						
31	Total Number of Service Laterals	1,469				
32	**Total 4" ABS Lateral (Assume 130 LF per connection)**	190,970	LF	$80	$15,278,000	
	Subtotal	190,970			$15,278,000	$9,166,800
				Estimated Construction Cost	**$58,473,000**	
				Contingency (30%)	$17,541,900	
				Construction Contingency (10%)	$7,601,490	
				Estimated Construction Total	**$83,616,390**	
				Soft Costs (43%)	$35,955,050	
BENNETT ENGINEERING SERVICES ASSUMES NO RESPONSIBILITY FOR				**Total Collection System Cost**	**$119,571,440**	
DIFFERENCES BETWEEN THESE QUANTITIES AND FINAL PAY QUANTITIES.				**Total Collection System Salvage Value (2040)**		**$35,083,800**

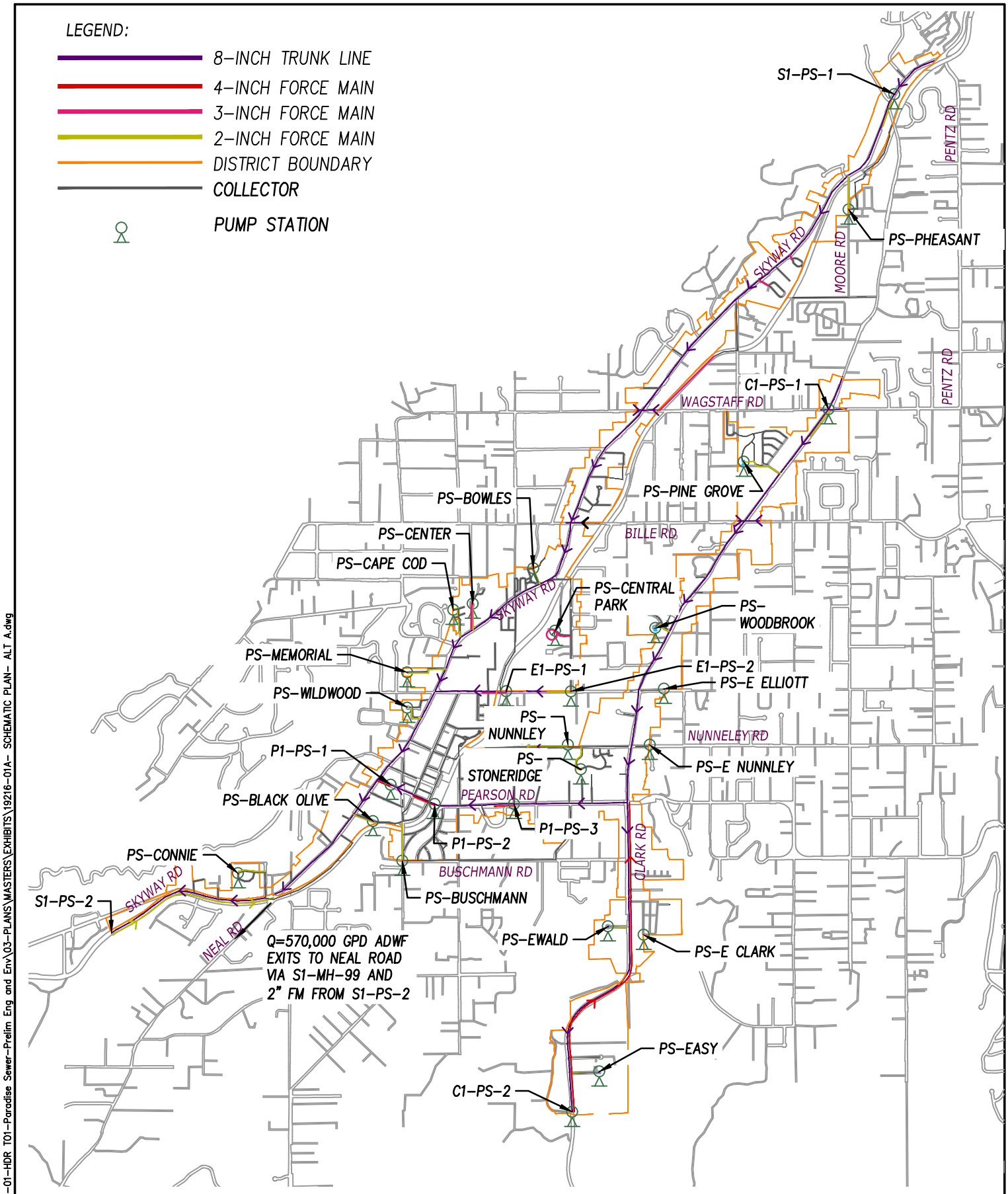
ANNUAL OPERATIONS AND MAINTENANCE COST - SERVICE AREA

Item No.	Item	Estimated Quantity	Unit	List Price	Total
1	General Manager	1	LS	$150,000	$150,000
2	Receptionist (Assume 1 full 1 part time employee)	2	LS	$60,000	$90,000
3	Accountant	1	LS	$100,000	$100,000
4	Operations - Collection System				
5	Operations Manager	1	LS	$130,000	$130,000
6	Field Crew/Utility Worker (assume 3)	3	LS	$65,000	$195,000
7	On-Site Service Tech.	1	LS	$65,000	$65,000
8	PS Power Requirements ($/yr)				
9	Collector PS 10 to 50 GPM	18	EA	$2,226	$40,072
10	Collector PS 100 to 180 GPM	1	EA	$3,339	$3,339
11	Trunk PS 10 to 50 GPM	3	EA	$2,226	$6,679
12	Trunk PS 100 to 180 GPM	2	EA	$3,339	$6,679
13	Trunk PS 180 to 300 GPM	0	EA	$5,566	$0
14	Trunk PS 350 to 750 GPM	3	EA	$7,792	$23,375
15	Miscellaneous PS Repairs ($/yr)	1	LS	$10,000	$10,000
16	Annual Maintenance ($/yr)	1	LS	$50,000	$50,000
17	Septage Hauling	100	EA	$1,000	$100,000
18	Building Cost (assumed service district housed at City Hall)	0	LS	$18,000	$0
19	IT Support ($/yr)	12	LS	$1,000	$12,000
20	Planning ($/yr)	1	LS	$30,000	$30,000
21	Miscellaneous Expenses ($/yr)	1	LS	$10,000	$10,000
	Total Annual O&M				**$1,022,144**

All Staff is basied on total pay + benefits (transparent california) similar agencies (PID, TOP, GV, PCWA)

NET PRESENT VALUE

Capital Cost	Annual O&M	PW O&M P/A, 0.3%, 20 yrs	Salvage Value (2040)	PW Salvage P/F, 0.3%, 20 yrs (2040)	Net Present Worth
$119,571,440	**$1,022,144**	**$19,812,853**	**$35,083,800**	**$33,043,646**	**$106,340,647**



JULY 2020

BEN EN
TRUSTED ENGINEERING ADVISORS

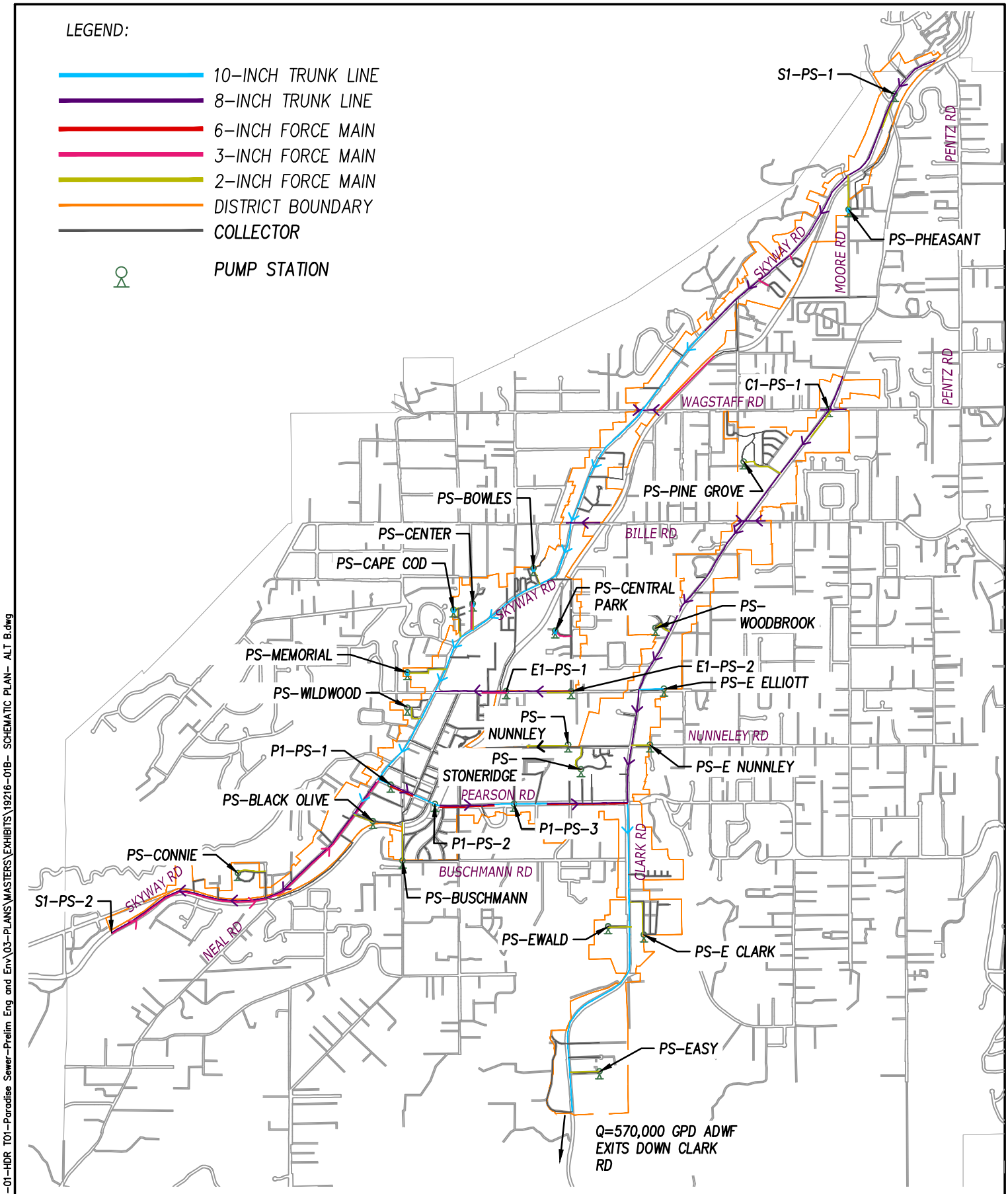
SCALE: 1"=3000'

SCHEMATIC PLAN

PARADISE COLLECTION SYSTEM: ALT A

PROJECT No. 19216 1 SHEET 1 OF 1

Plot Date: July 23, 2020 - 7:33 pm
File Name: P:\Proj\19216-01-HDR T01-Paradise Sewer-Prelim Eng and Env\03-PLANS\MASTERS\EXHIBITS\19216-01A- SCHEMATIC PLAN- ALT A.dwg



JULY 2020

BEN EN
TRUSTED ENGINEERING ADVISORS

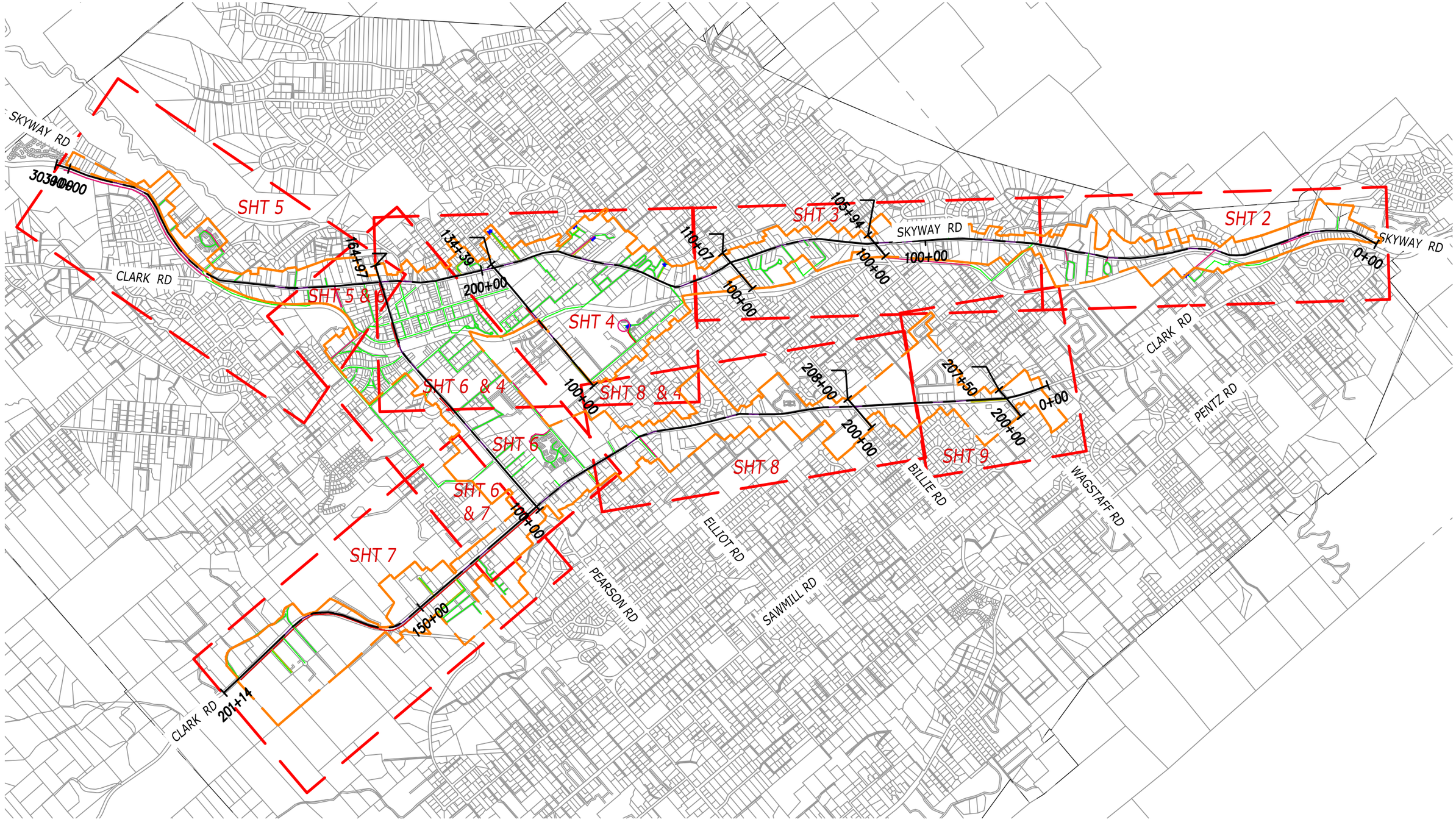
SCALE: 1"=3000'

SCHEMATIC PLAN

PARADISE COLLECTION SYSTEM: ALT B

PROJECT No. 19216 1 SHEET 1 OF 1

Plot Date: July 23, 2020 - 7:35 pm
File Name: P:\Proj\19216-01-HDR T01-Paradise Sewer-Prelim Eng and Env\03-PLANS\MASTERS\EXHIBITS\19216-01B- SCHEMATIC PLAN- ALT B.dwg



JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=2000'

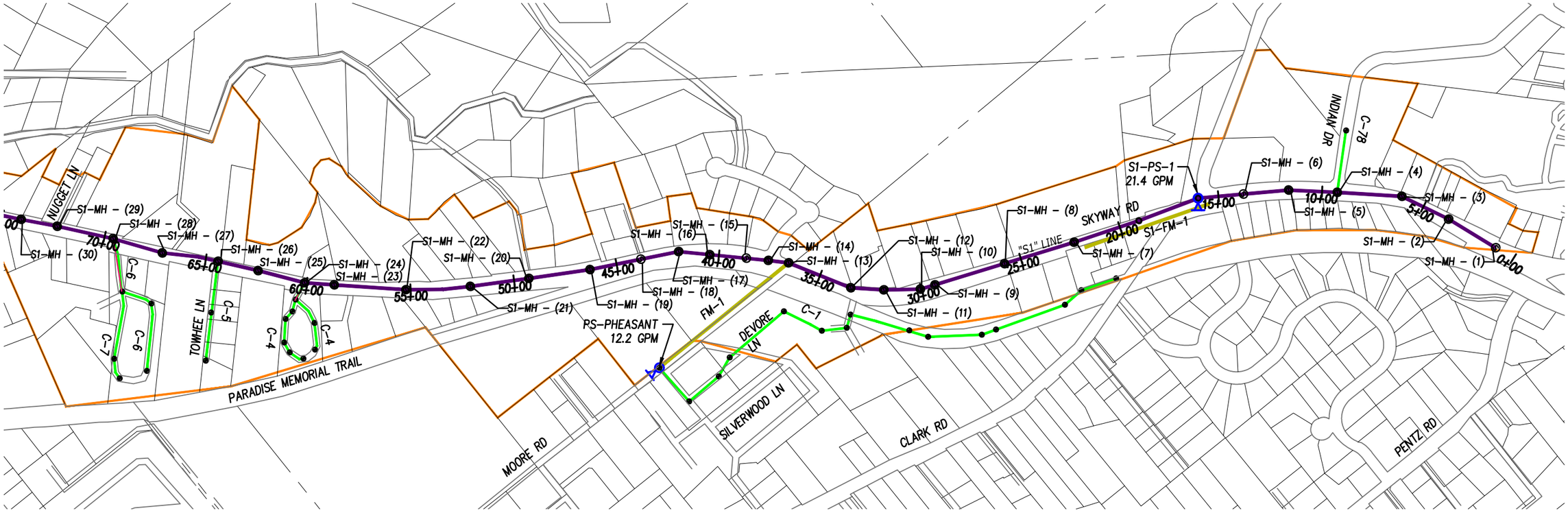
KEY SHEET

Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 1 OF 20

MATCH LINE "S1" 72+00 / SEE SHEET 3



LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=500'

UPPER SKYWAY RD - PLAN (1 of 2)

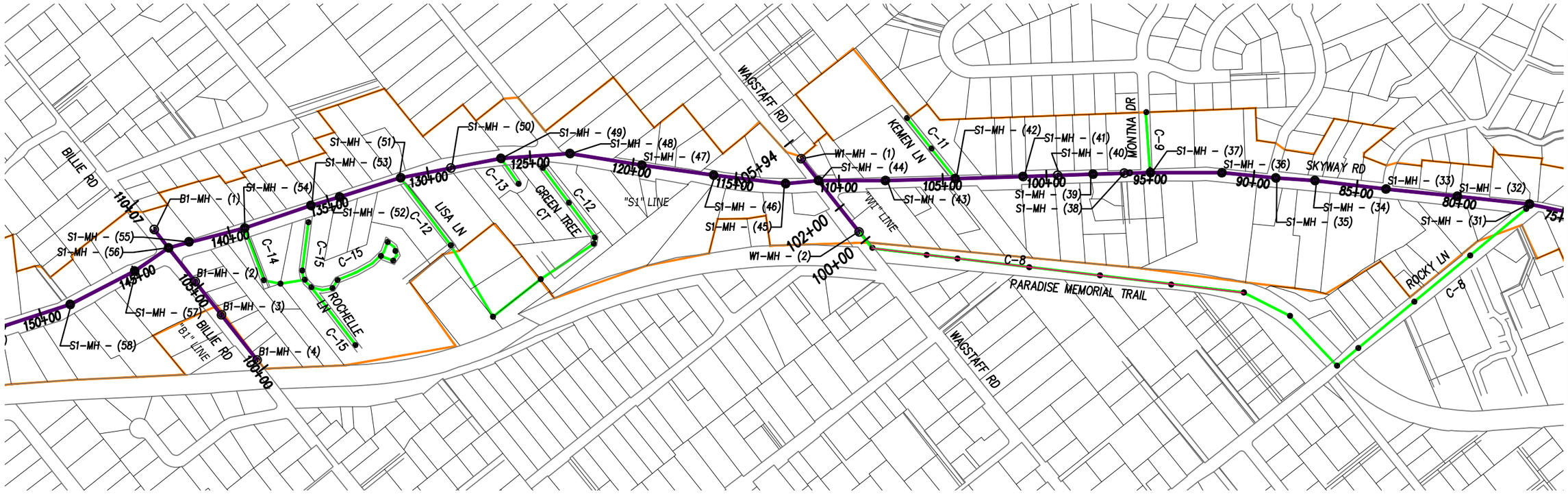
Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 2 OF 20

MATCH LINE "S1" 152+00 / SEE SHEET 4

MATCH LINE "S1" 72+00 / SEE SHEET 2



LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

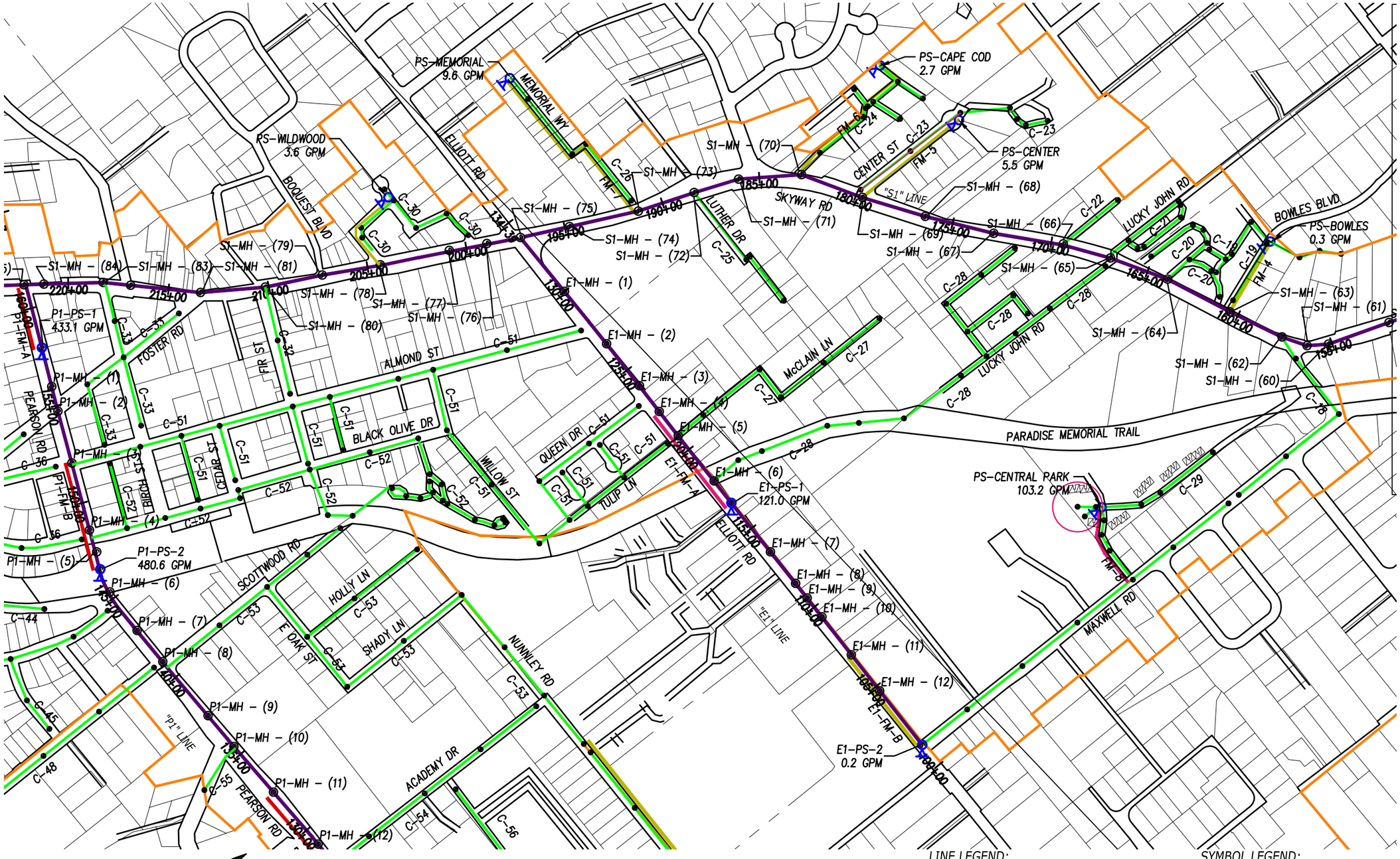
BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=500'

UPPER SKYWAY RD - PLAN (2 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216



JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=500'

LOWER SKYWAY RD- PLAN (1 of 2)

Paradise Collection System: Alt A

LINE LEGEND:

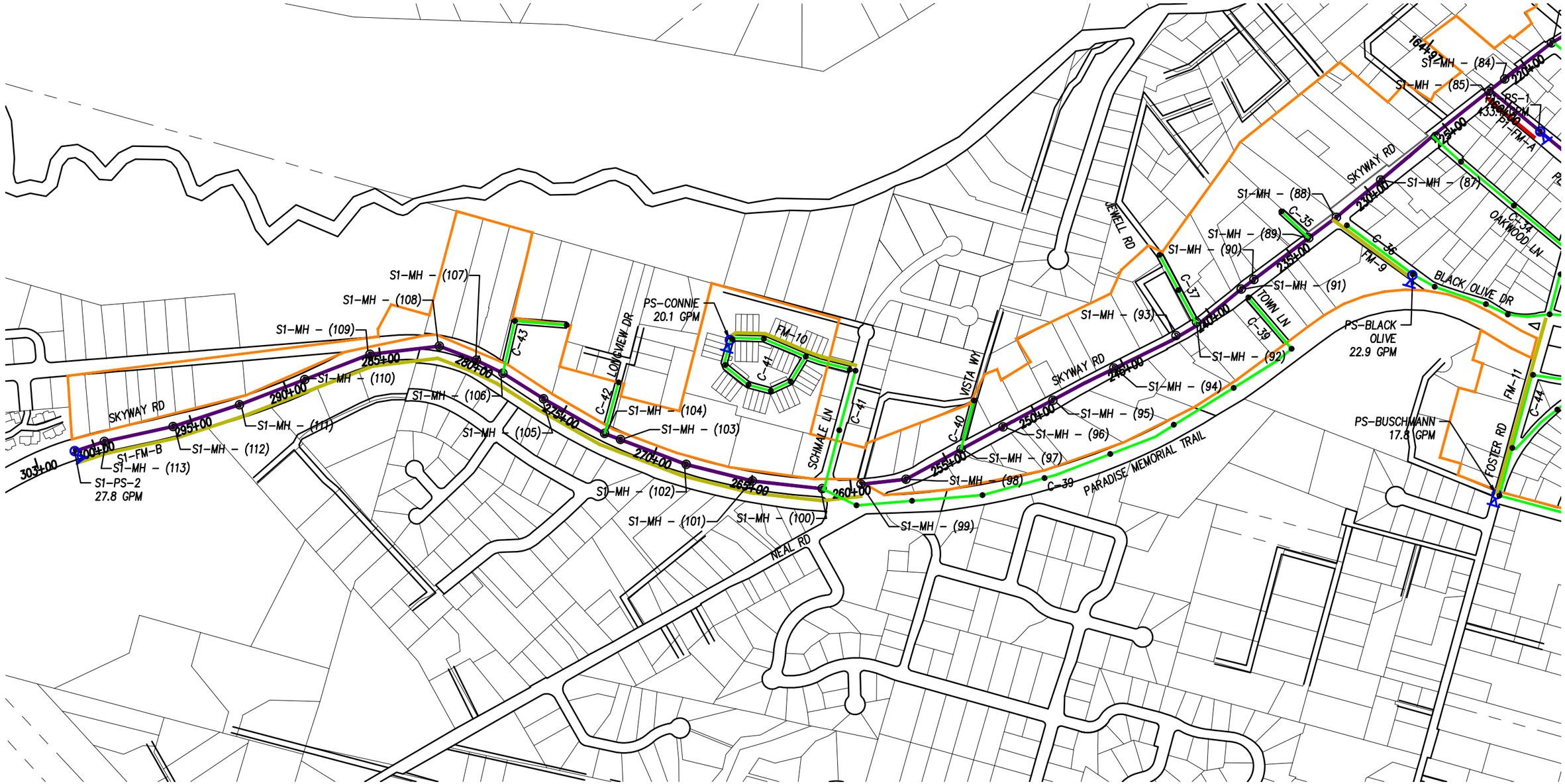
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

PROJECT No. 19216

SHEET 4 OF 20



LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=500'

LOWER SKYWAY RD- PLAN (2 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216

MATCH LINE "S1"LINE 205+00/ SEE SHEET 4

MATCH LINE "C1"LINE 115+00/ SEE SHEET 8

MATCH LINE "S1"LINE 235+00/ SEE SHEET 5

MATCH LINE "C1"LINE 135+00/ SEE SHEET 7

S1-MH - (79)
S1-MH - (80)
S1-MH - (81)
S1-MH - (82)
S1-MH - (83)
S1-MH - (84)
S1-MH - (85)
S1-MH - (86)
S1-MH - (87)
S1-MH - (88)
S1-MH - (89)
S1-MH - (90)
S1-MH - (91)
P1-MH - (1)
P1-MH - (2)
P1-MH - (3)
P1-MH - (4)
P1-MH - (5)
P1-MH - (6)
P1-MH - (7)
P1-MH - (8)
P1-MH - (9)
P1-MH - (10)
P1-MH - (11)
P1-MH - (12)
P1-MH - (13)
P1-MH - (14)
P1-MH - (15)
P1-MH - (16)
P1-MH - (17)
P1-MH - (18)
P1-MH - (19)
P1-MH - (20)
P1-MH - (21)
C1-MH - (39)
C1-MH - (40)
C1-MH - (41)
C1-MH - (42)
C1-MH - (43)
C1-MH - (44)
C1-MH - (45)
C1-MH - (46)
C1-MH - (47)
C1-MH - (48)
C1-MH - (49)
C1-MH - (50)
C1-MH - (51)

P1-PS-1
305.6 GPM

P1-PS-2
269.6 GPM

P1-PS-3
222.8 GPM

PS-BLACK OLIVE
24.6 GPM

PS-BUSCHMANN
18.9 GPM

PS-NUNNLEY
31.8 GPM

PS-STONERIDGE
230 GPM

P1-FM-A
P1-FM-B
P1-FM-C
FM-9
FM-11
FM-12
FM-13

C-32
C-33
C-34
C-35
C-36
C-39
C-44
C-45
C-46
C-47
C-48
C-49
C-51
C-52
C-53
C-54
C-55
C-56
C-57
C-58
C-59
C-60
C-68

SKYWAY RD
S1ST LINE
E OAK ST
SCOTTWOOD RD
ACADEMY DR
CHAPEL DR
P1-MH - (13) PEARSON RD
"P1" LINE
CHURCHILL RD
SYDNEY LN
SUSIE LN
RECREATION DR
NUNNLEY RD
CLARK RD
"C1" LINE
LINRICH LN
BUSCHMANN RD

100+00
105+00
110+00
115+00
120+00
125+00
130+00
135+00

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=500'

LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

CENTRAL PEARSON- PLAN

Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 6 OF 20

OLD CLARK RD

C-61

C1-MH – (72)

C1-MH – (71)

C1-MH – (70)

C1-MH – (69)

C-62

C1-MH – (68)

C1-MH – (67)

C1-MH – (66)

C1-MH – (65)

C1-MH – (64)

C1-MH – (63)

C1-MH – (62)

C1-MH – (61)

C1-MH – (60)

C1-MH – (59)

C1-MH – (57)

"C1" LINE

C1-MH – (58)

C1-MH – (55)

C1-MH – (56)

C1-MH – (54)

C1-MH – (53)

C1-MH – (52)

C1-MH – (51)

C1-MH – (50)

C1-MH – (49)

C1-MH – (48)

C1-MH – (47)

C1-MH – (46)

C1-MH – (45)

C1-PS-2
192.5 GPM

C1-FM-B

CLARK RD

FM-14

C-63

EASY ST

McKALE RD

C-64

AMERICAN WAY

C-65

PS-EASY
1.4 GPM

EWALD CT

PS-EWALD
1.4 GPM

FM-15

C-66

PS-E CLARK
1.7 GPM

FM-16

C-67

C-67

CLARK RD

C-68

C-68

BUSCHMANN RD

P1-MH – (14)

P1-MH – (15)

P1-MH – (16)

P1-MH – (17)

P1-MH – (18)

"P1" LINE

P1-MH – (19)

P1-MH – (20)

P1-MH – (21)

PEARSON RD

MATCH LINE STA "C1" 115+00 / SEE SHEET 8

LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

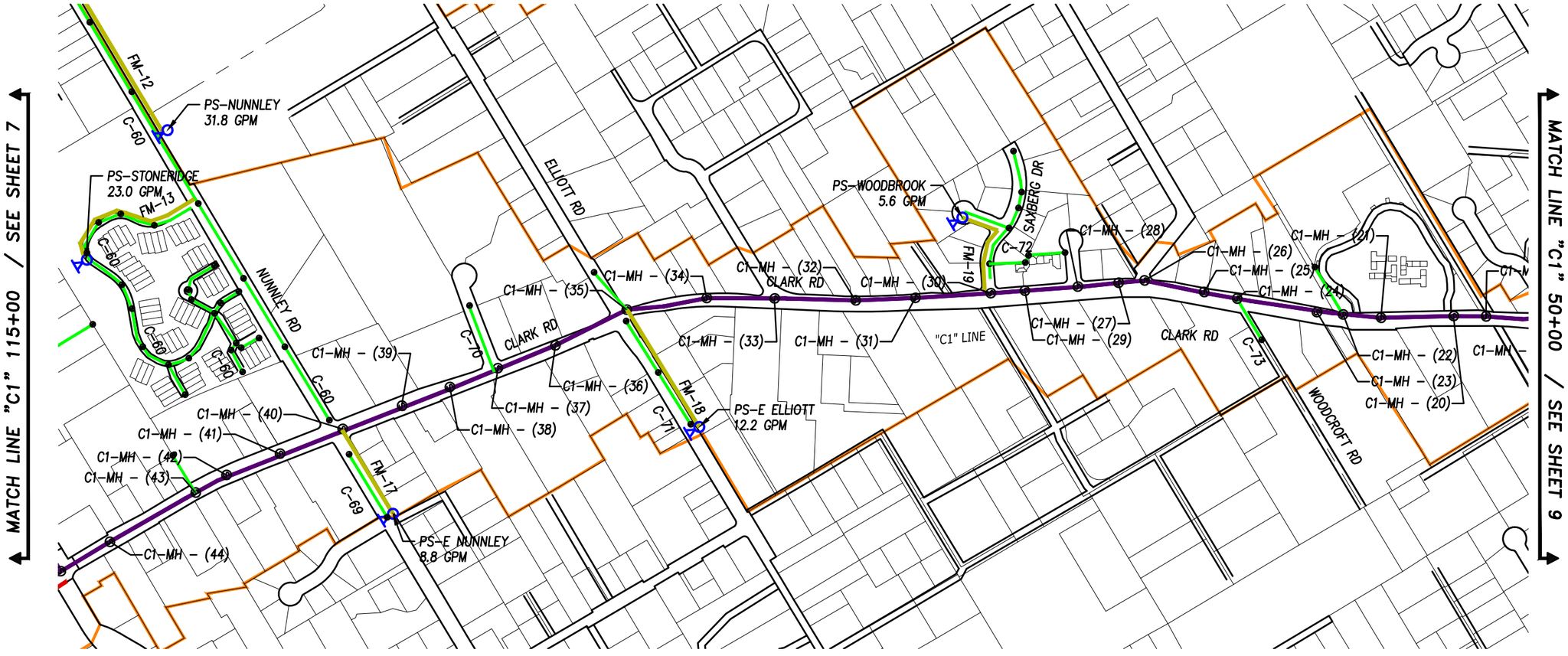
SCALE: 1"=500'

LOWER CLARK RD - PLAN

Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 7 OF 20



LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

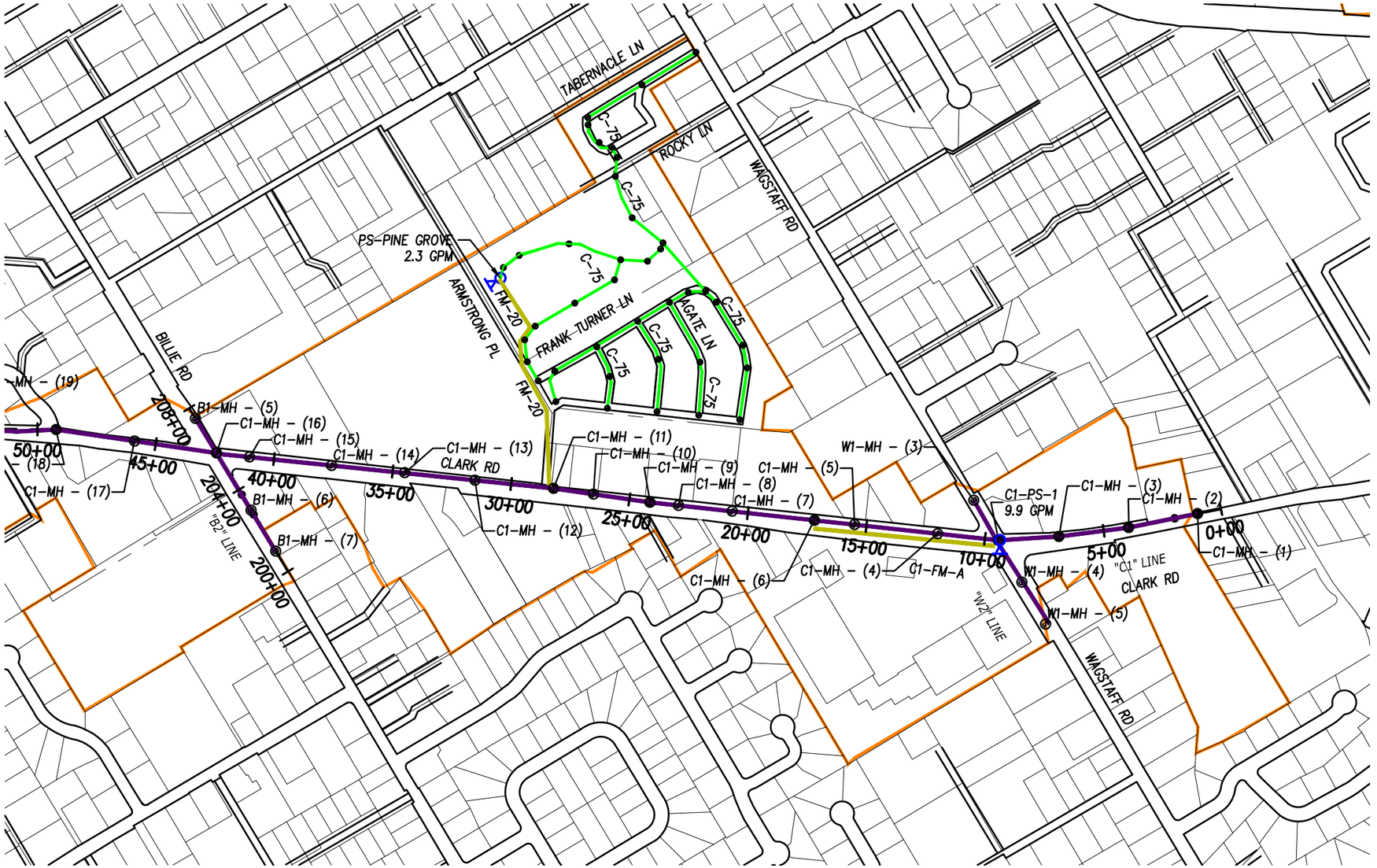
SCALE: 1"=500'

UPPER CLARK RD- PLAN (1 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216

MATCH LINE "C1" 50+00 / SEE SHEET 8



LINE LEGEND:

- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

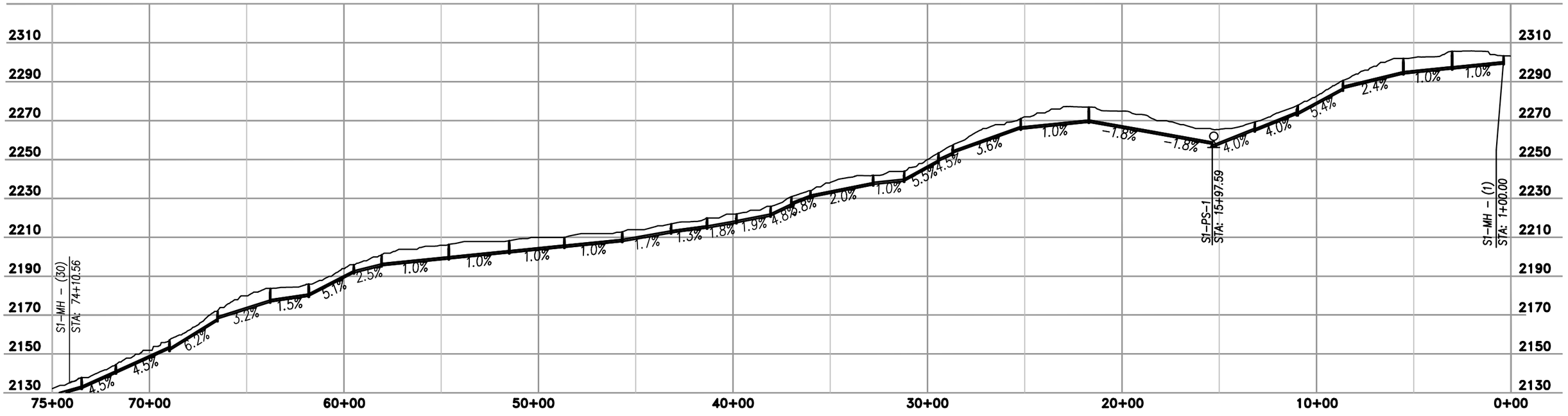
BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: 1"=500'

UPPER CLARK- PLAN (2 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216



"S1" LINE
SKYWAY RD
STA 0+00 to STA 75+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

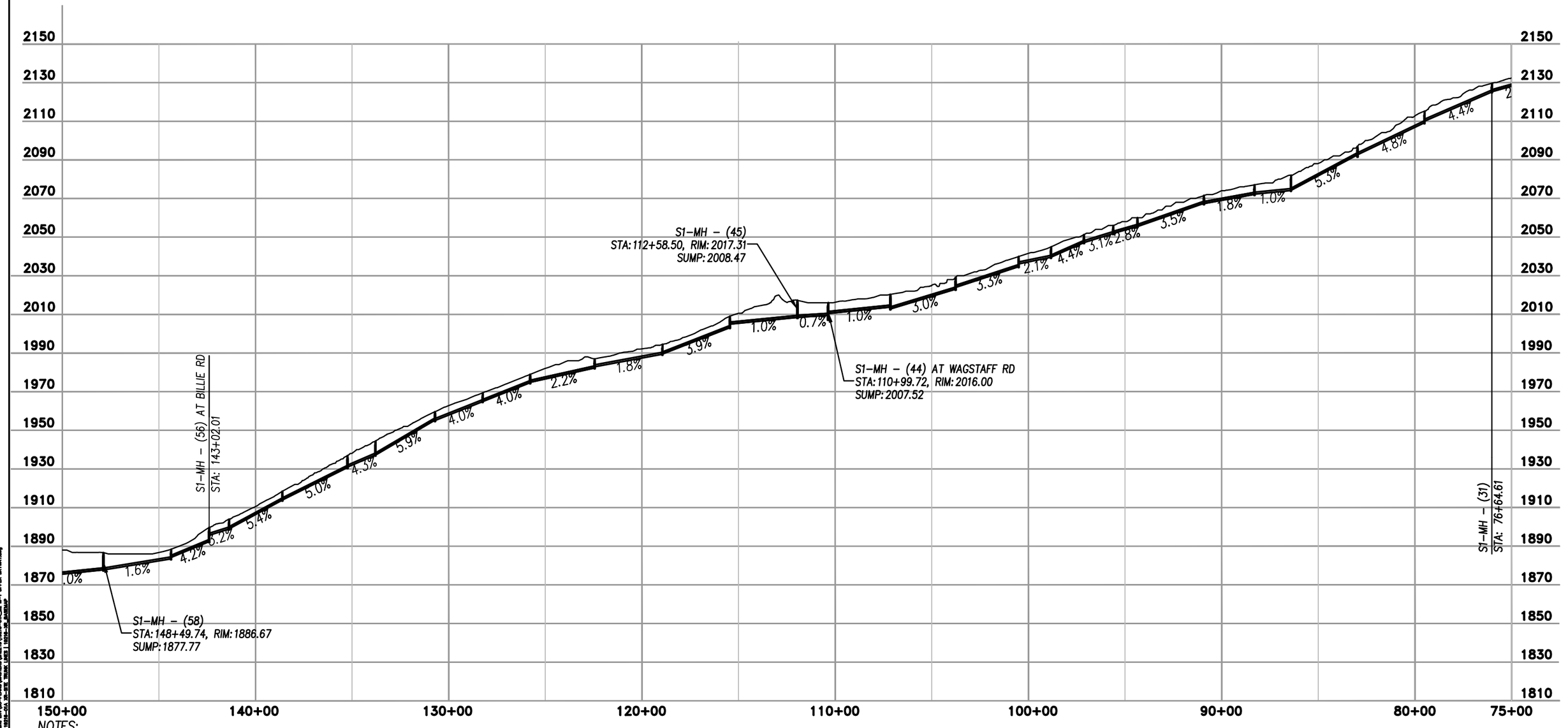
VERTICAL SCALE: 1"=50'

SCALE: 1"=500'

UPPER SKYWAY RD- PROFILE (1 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

"S1" LINE
SKYWAY RD
STA 75+00 to STA 150+00

BEN|EN
TRUSTED ENGINEERING ADVISORS

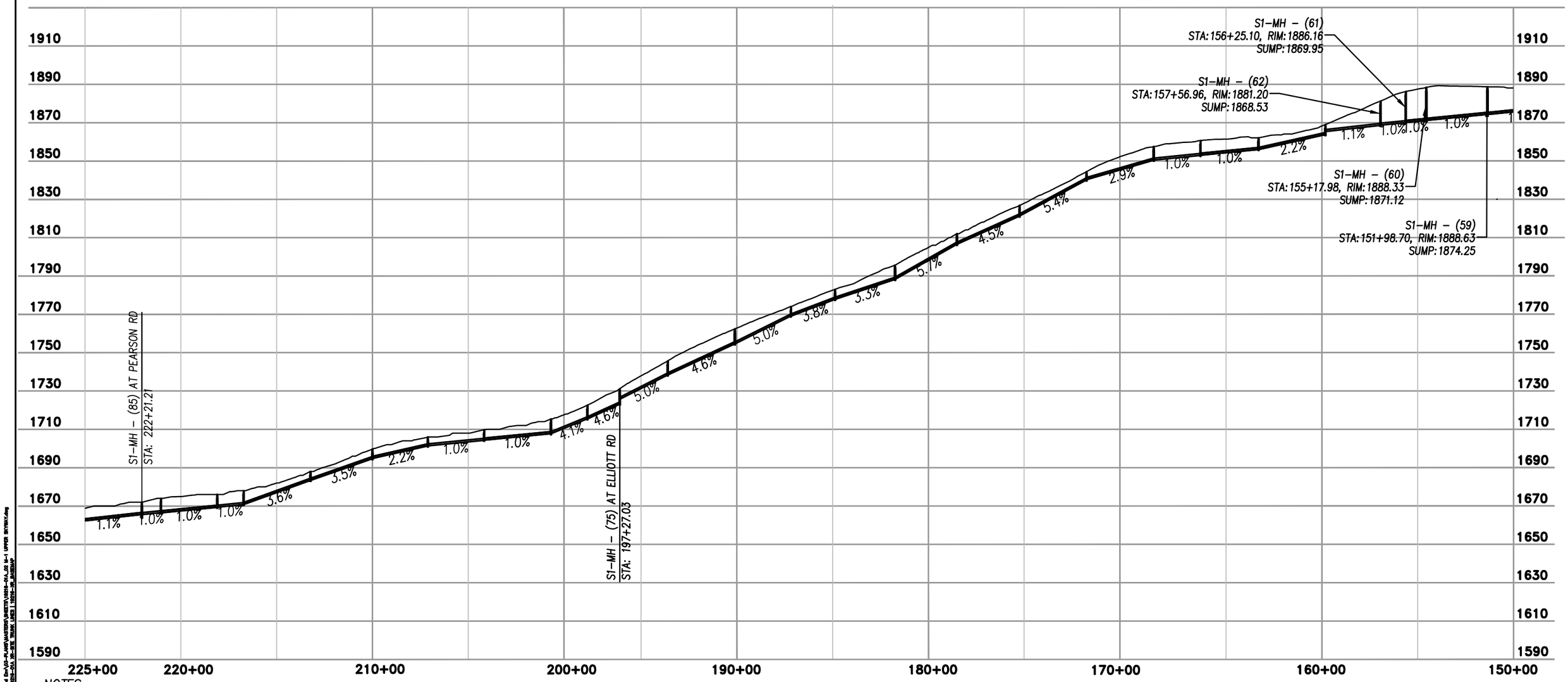
VERTICAL SCALE: 1"=50'

SCALE: 1"=500'

UPPER SKYWAY RD- PROFILE (2 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

"S1" LINE
SKYWAY RD
STA 150+00 TO 225+00

BEN|EN
TRUSTED ENGINEERING ADVISORS

VERTICAL SCALE: 1"=50'

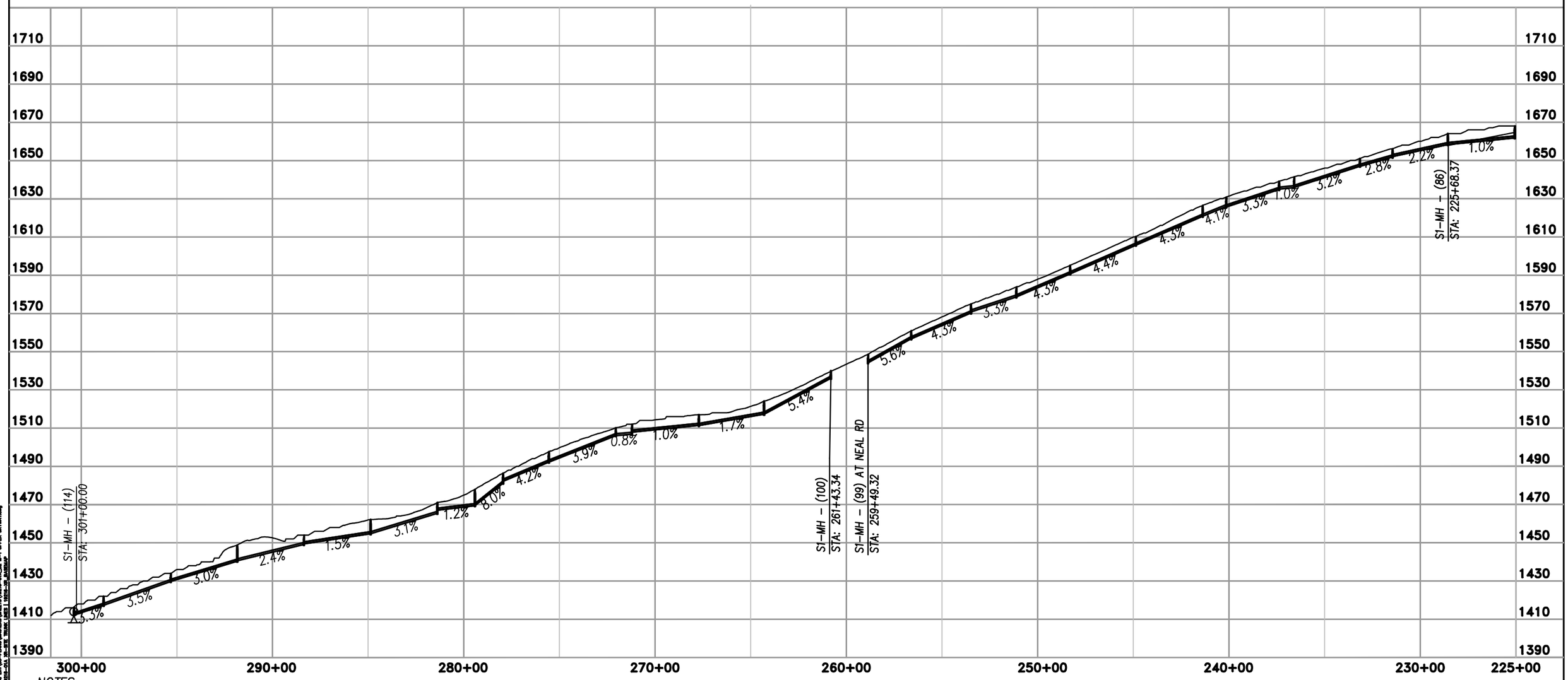
SCALE: 1"=500'

LOWER SKYWAY RD- PROFILE (1 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 12 OF 20



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

"S1" LINE
SKYWAY RD
STA 225+00 TO 300+00

BEN|EN
TRUSTED ENGINEERING ADVISORS

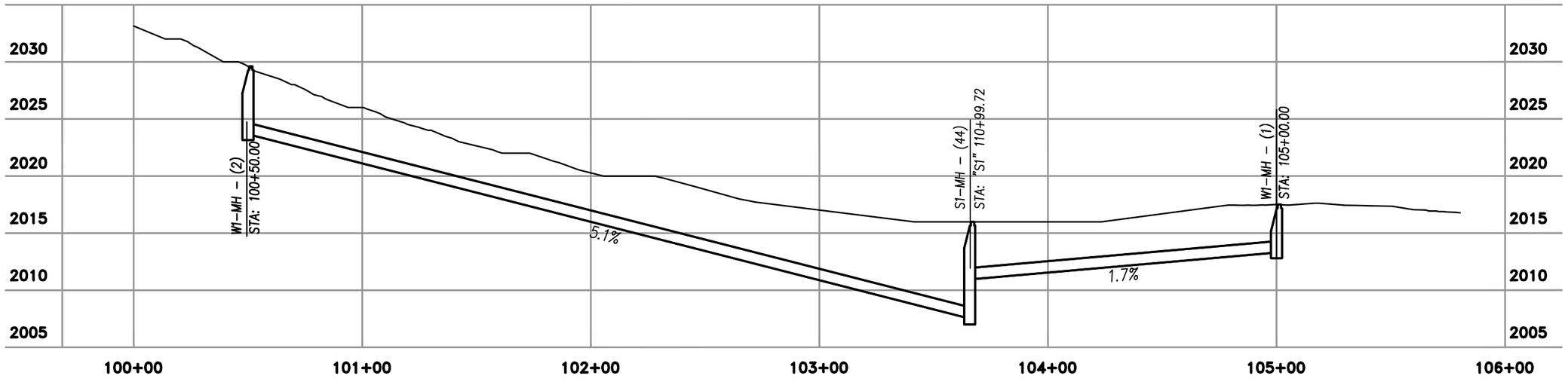
VERTICAL SCALE: 1"=50'

SCALE: 1"=500'

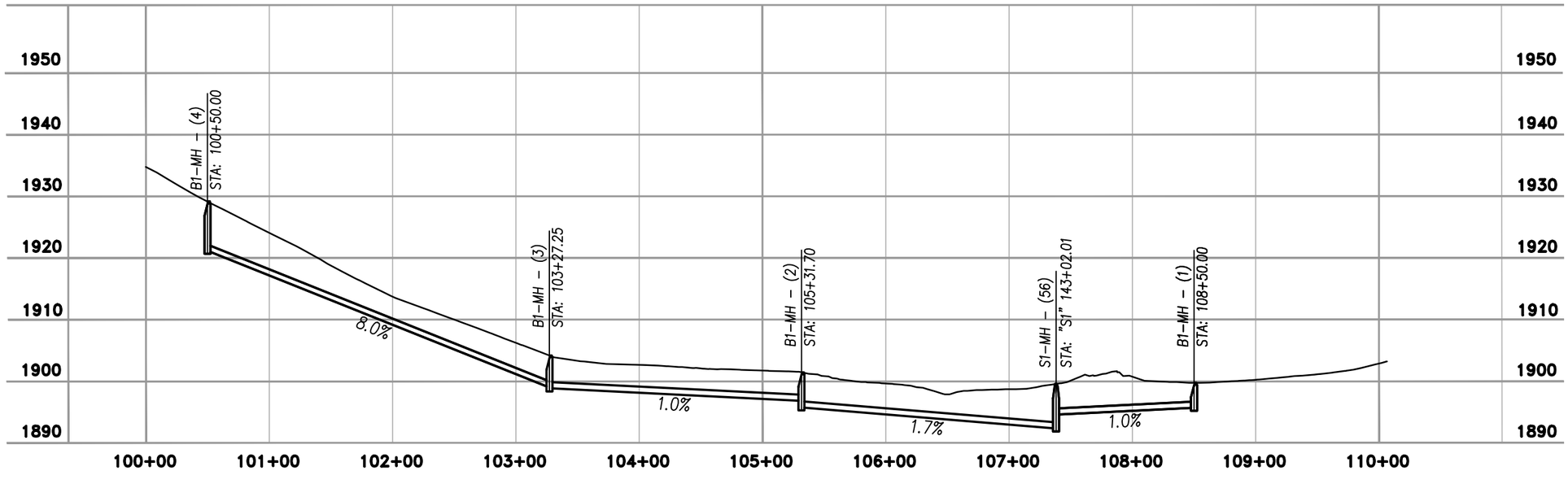
LOWER SKYWAY RD- PROFILE (2 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216



"W1" LINE
WAGSTAFF RD
STA 100+00 TO 106+00
VERTICAL SCALE: 1"=10'
HORIZONTAL SCALE: 1"=50'



"B1" LINE
BILLIE RD
STA 100+00 TO 110+00
VERTICAL SCALE: 1"=20'
HORIZONTAL SCALE: 1"=100'

JUNE 2020

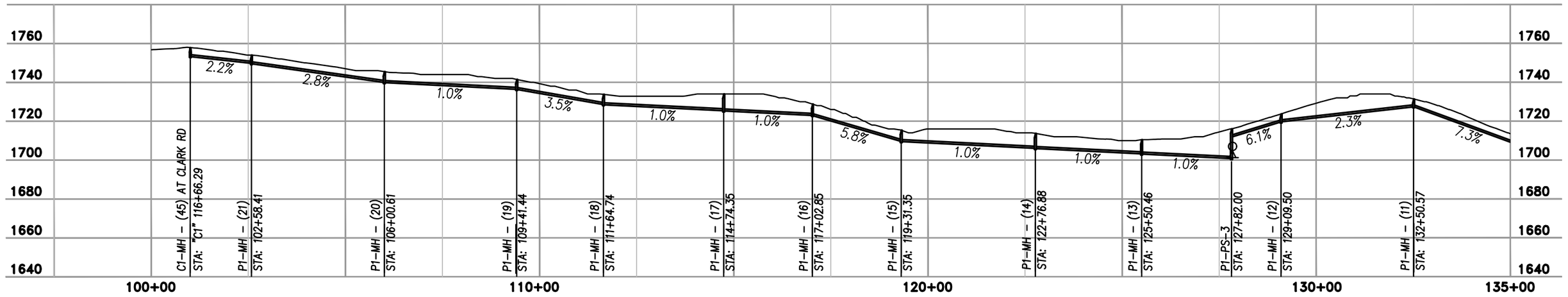
BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: SEE DTL

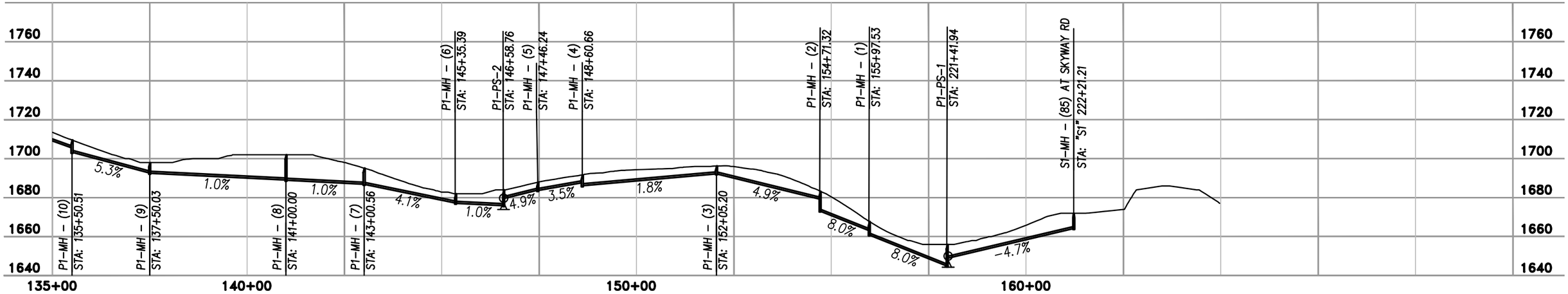
WEST WAGSTAFF RD & WEST BILLIE RD- PROFILE

Paradise Collection System: Alt A

PROJECT No. 19216



"P1" LINE
PEARSON RD



"P1" LINE
PEARSON RD

VERTICAL SCALE: 1"=50'
HORIZONTAL SCALE: 1"=250'

JUNE 2020

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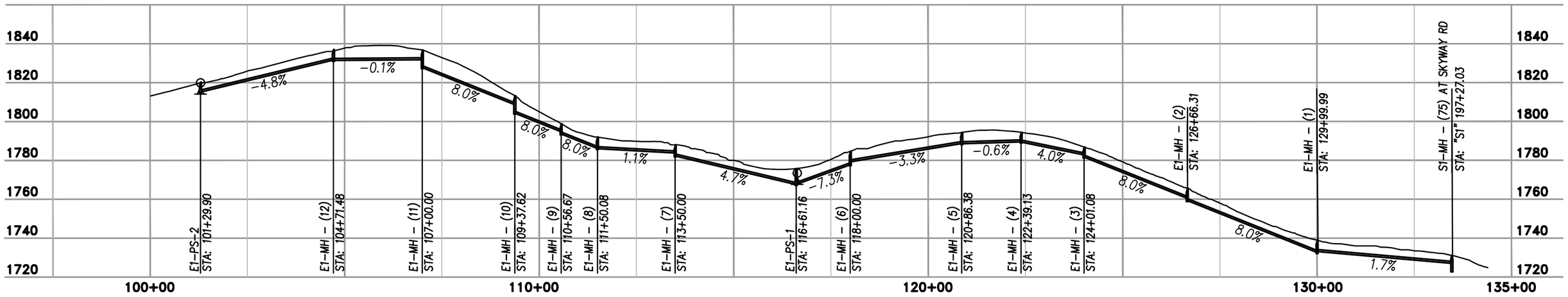
SCALE: SEE DTL

CENTRAL PEARSON- PROFILE

Paradise Collection System: Alt A

PROJECT No. 19216



"E1" LINE
ELLIOTT RD
VERTICAL SCALE: 1"=50'
HORIZONTAL SCALE: 1"=250'

JUNE 2020

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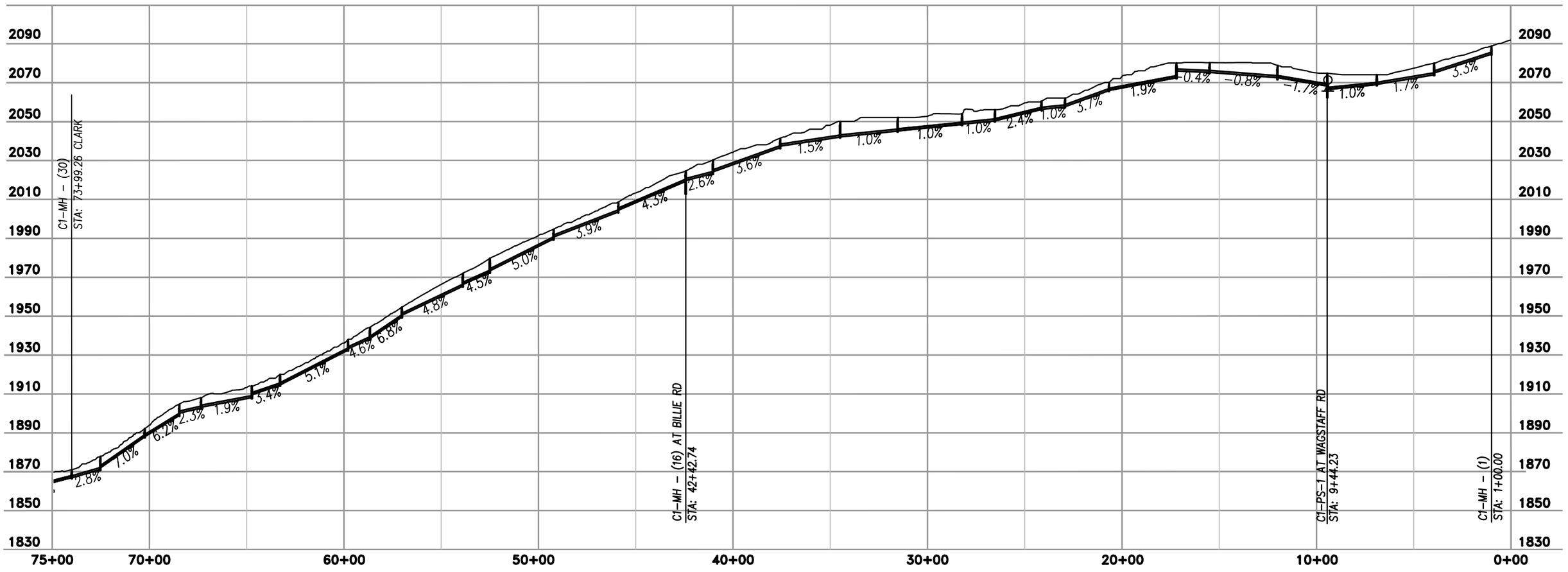
TRUSTED ENGINEERING ADVISORS

SCALE: *SEE DTL*

ELLIOTT RD- PROFILE

Paradise Collection System: Alt A

PROJECT No. 19216



"C1" LINE
CLARK RD
STA 0+00 TO STA 75+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

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VERTICAL SCALE: 1"=50'

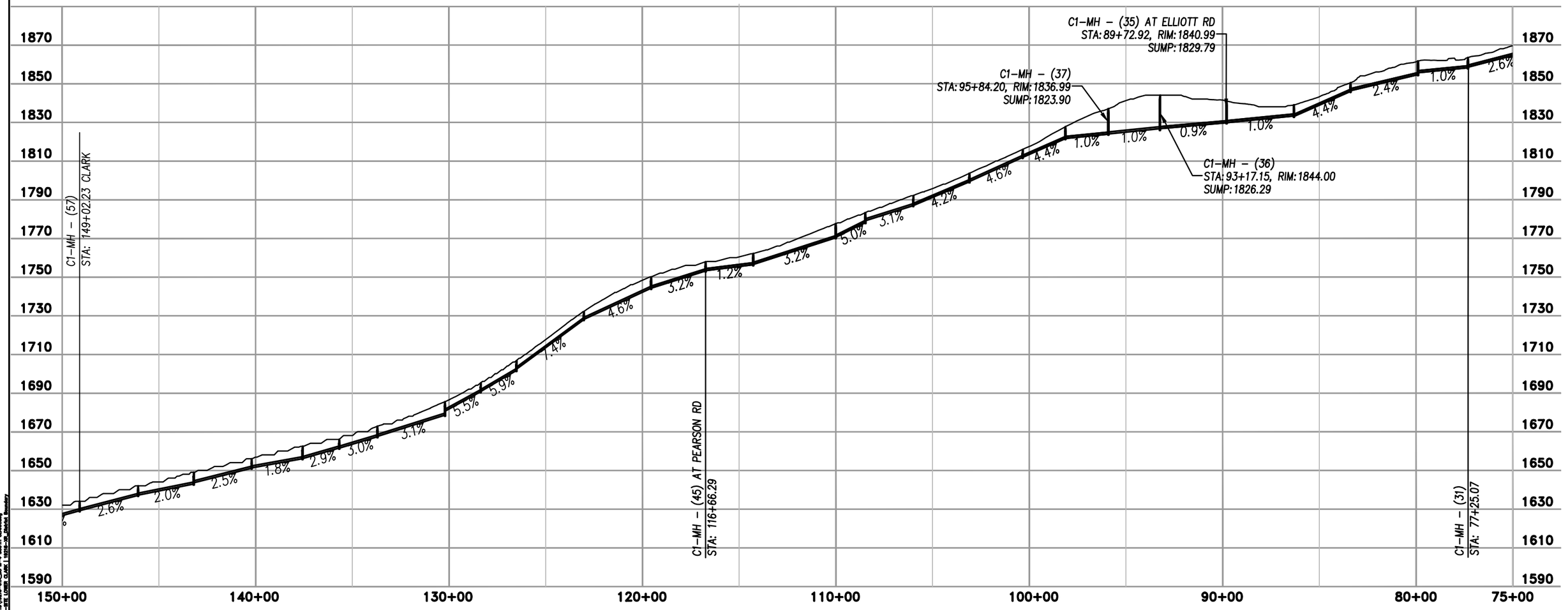
SCALE: 1"=500'

UPPER CLARK- PROFILE (1 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 17 OF 20



"C1" LINE
CLARK RD
STA 75+00 TO STA 150+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

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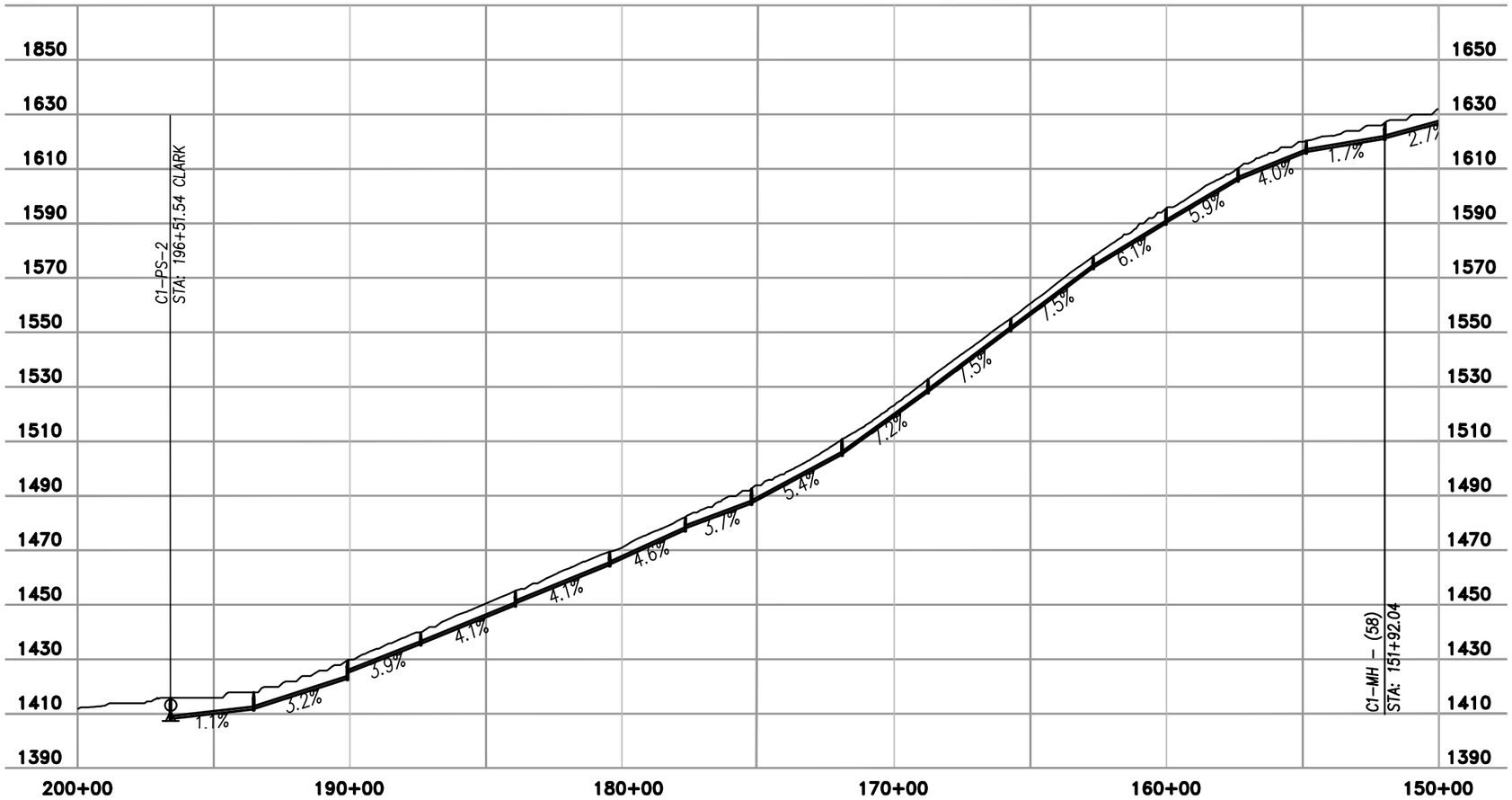
VERTICAL SCALE: 1"=50'

SCALE: 1"=500'

UPPER CLARK- PROFILE (2 of 2)

Paradise Collection System: Alt A

PROJECT No. 19216



"C1" LINE
CLARK RD
STA 150+00 TO STA 200+00

NOTES:
1. *ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.*

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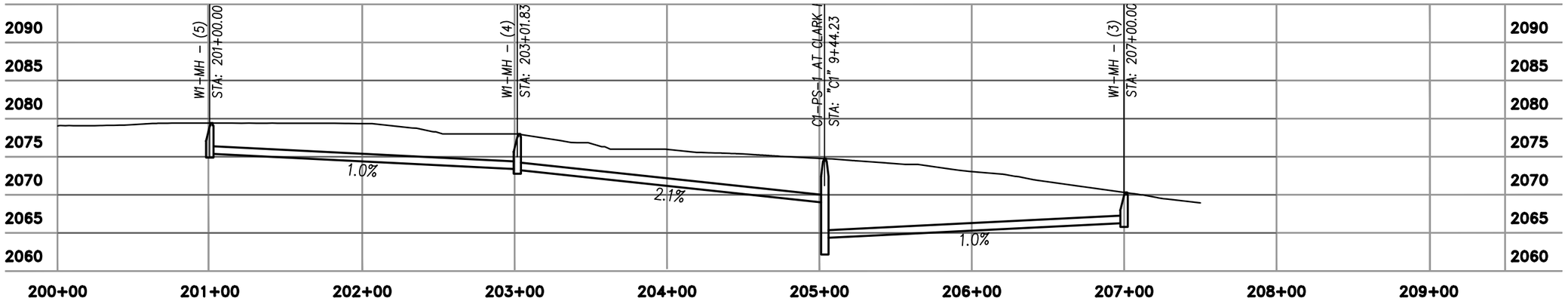
VERTICAL SCALE: 1"=50'

SCALE: 1"=500'

LOWER CLARK- PROFILE

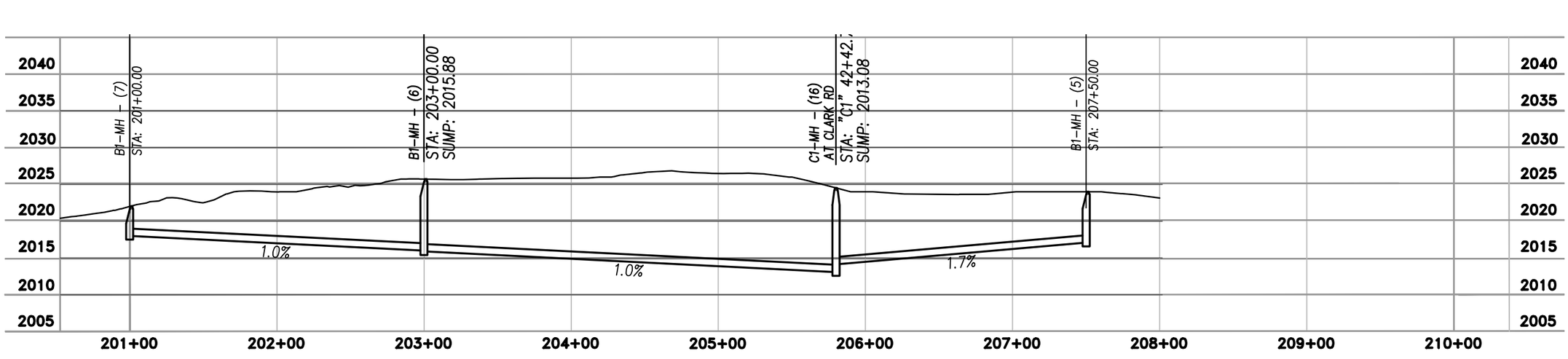
Paradise Collection System: Alt A

PROJECT No. 19216



"W2" LINE
WAGSTAFF RD
STA 200+00 TO STA 208+00

VERTICAL SCALE: 1"=15'
HORIZONTAL SCALE: 1"=75'



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

"B2" LINE
BILLIE RD
STA 201+00 TO STA 208+00

VERTICAL SCALE: 1"=15'
HORIZONTAL SCALE: 1"=75'

JUNE 2020

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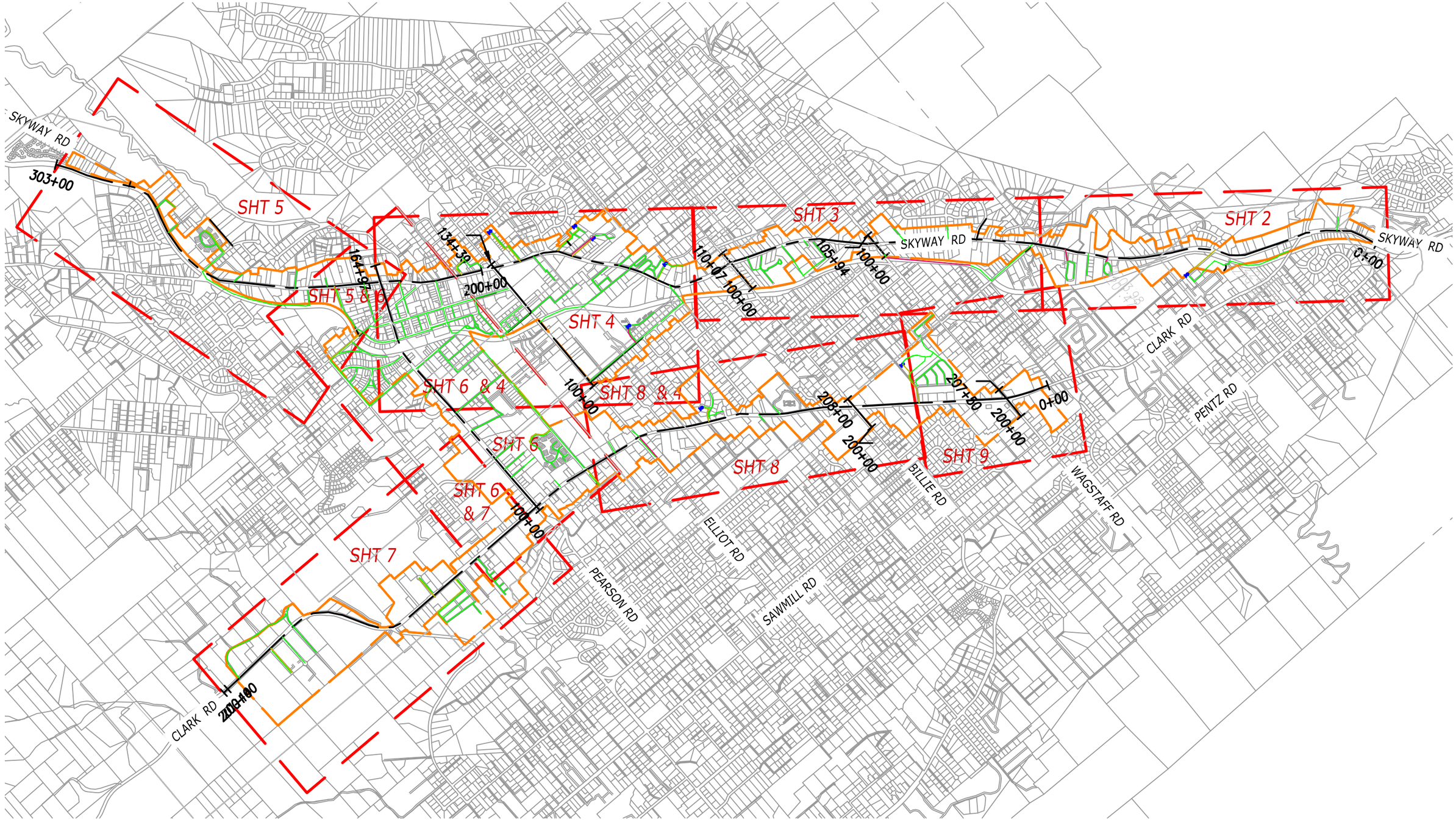
SCALE: SEE DTL

EAST WAGSTAFF RD & EAST BILLIE RD- PROFILE

Paradise Collection System: Alt A

PROJECT No. 19216

SHEET 20 OF 20



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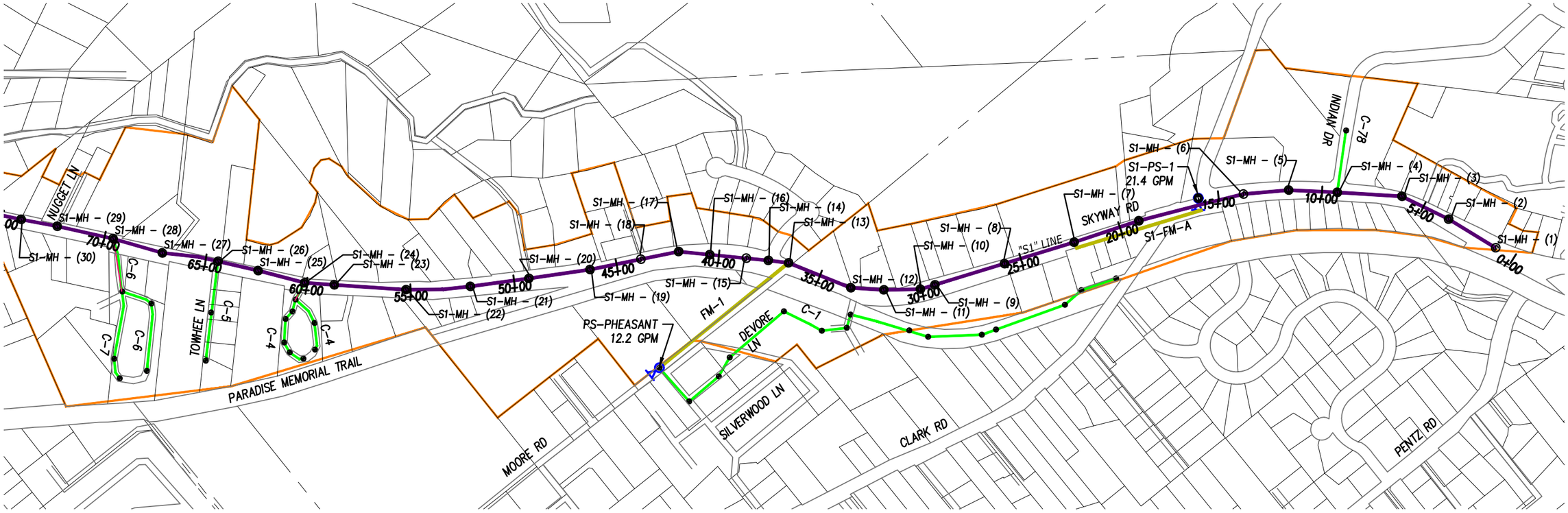
SCALE: 1"=2000'

KEY SHEET

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 1 OF 20



LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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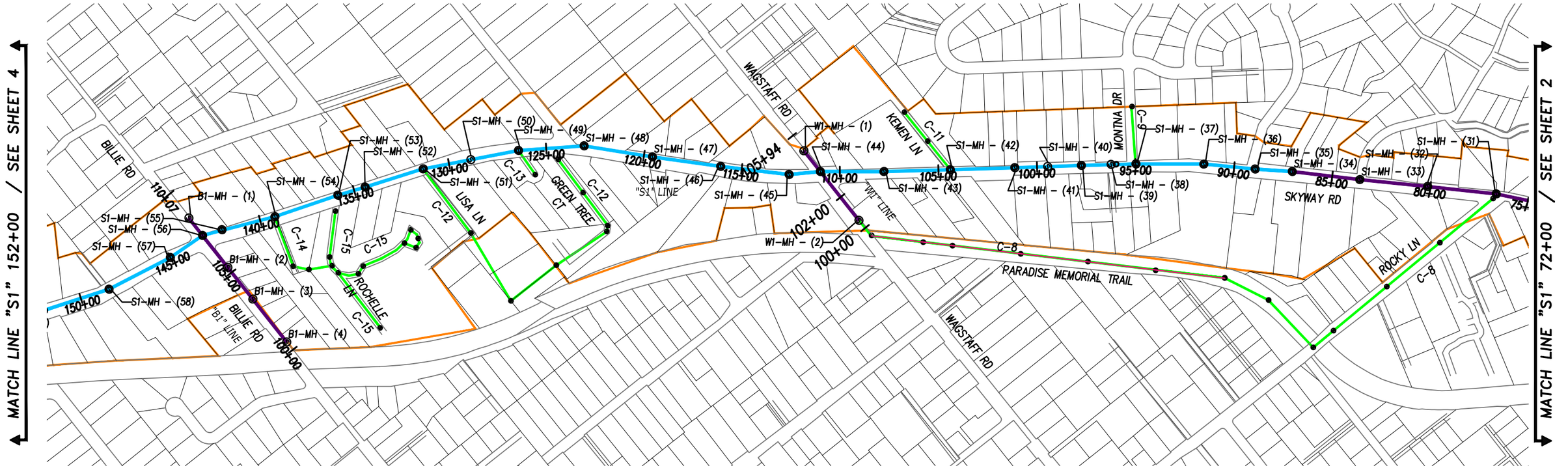
SCALE: 1"=500'

UPPER SKYWAY RD- PLAN (1 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 2 OF 20



LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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SCALE: 1"=500'

UPPER SKYWAY RD- PLAN (2 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 3 OF 20

MATCH LINE "S1" 220+00 / SEE SHEET 5

MATCH LINE "S1" 150+00 / SEE SHEET 3

PS-MEMORIAL 9.6 GPM
MEMORIAL WY
PS-WILDWOOD 3.6 GPM
BOQUEST BLVD
ELLIOTT RD
PS-CAPE COD 2.7 GPM
CENTER ST
FM-5
PS-CENTER 5.5 GPM
"S1" LINE
SKYWAY RD
LUTHER DR
LUCKY JOHN RD
BOWLES BLVD
PS-BOWLES 0.3 GPM
FM-4
FOSTER RD
ALMOND ST
McCLAIN LN
PARADISE MEMORIAL TRAIL
PS-CENTRAL PARK 103.2 GPM
P1-PS-1 433.1 GPM
BLACK OLIVE DR
QUEEN DR
TULIP LN
WILLOW ST
PEARSON RD
SCOTTWOOD RD
HOLLY LN
SHADY LN
E OAK ST
NUNNLEY RD
ACADEMY DR
"P1" LINE
P1-PS-2 480.6 GPM
E1-PS-1 121.0 GPM
E1-FM-A
E1-FM-B
"E1" LINE
MAXWELL RD
E1-PS-2 0.2 GPM

JUNE 2020

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SCALE: 1"=500'

LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

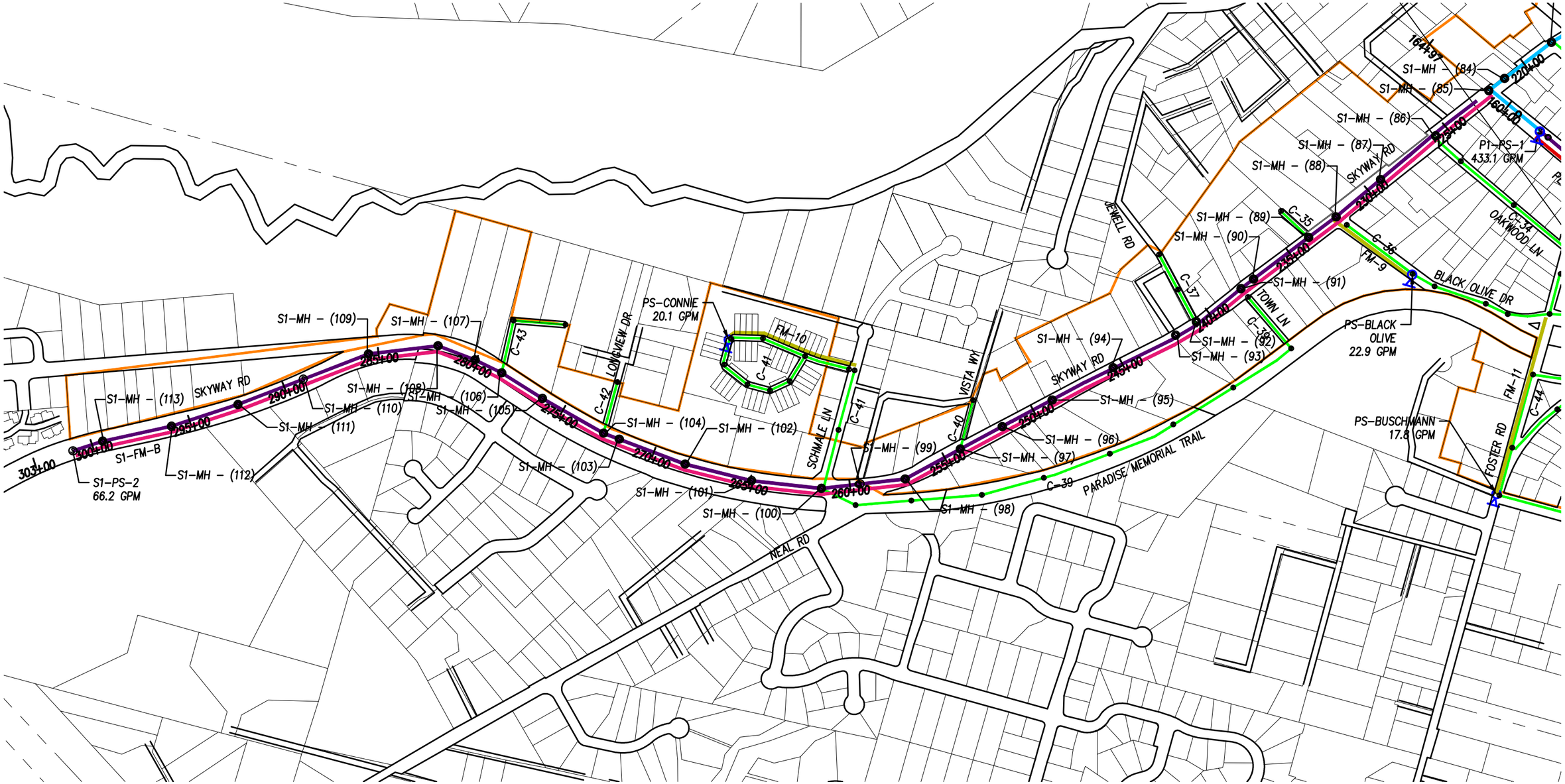
SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

LOWER SKYWAY RD- PLAN (1 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01



LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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SCALE: 1"=500'

LOWER SKYWAY - PLAN (2 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 5 OF 20

MATCH LINE "S1"LINE 205+00/ SEE SHEET 4

MATCH LINE "C1"LINE 115+00/ SEE SHEET 8

MATCH LINE "S1"LINE 235+00/ SEE SHEET 5

MATCH LINE "C1"LINE 135+00/ SEE SHEET 7

S1-MH - (79)
S1-MH - (80)
S1-MH - (81)
S1-MH - (82)
S1-MH - (83)
S1-MH - (84)
S1-MH - (85)
S1-MH - (86)
S1-MH - (87)
S1-MH - (88)
S1-MH - (89)
S1-MH - (90)
S1-MH - (91)
210+00
215+00
220+00
225+00
230+00
235+00
164+97
160+00
155+00
150+00
145+00
140+00
135+00
130+00
125+00
120+00
115+00
110+00
105+00
100+00
95+00
90+00
C-51
C-52
C-53
C-54
C-55
C-56
C-57
C-58
C-59
C-60
C-32
C-33
C-34
C-35
C-36
C-39
C-44
C-45
C-46
C-47
C-48
P1-PS-1
433.1 GPM
P1-PS-2
480.6 GPM
P1-PS-3
510.9 GPM
P1-FM-A
P1-FM-B
P1-FM-C
FM-9
FM-11
FM-12
FM-13
PS-BLACK OLIVE
22.9 GPM
PS-BUSCHMANN
17.8 GPM
PS-NUNNLEY
31.8 GPM
PS-STONERIDGE
230 GPM
P1-MH - (1)
P1-MH - (2)
P1-MH - (3)
P1-MH - (4)
P1-MH - (5)
P1-MH - (6)
P1-MH - (7)
P1-MH - (8)
P1-MH - (9)
P1-MH - (10)
P1-MH - (11)
P1-MH - (12)
P1-MH - (13)
P1-MH - (14)
P1-MH - (15)
P1-MH - (16)
P1-MH - (17)
P1-MH - (18)
P1-MH - (19)
P1-MH - (20)
P1-MH - (21)
C1-MH - (39)
C1-MH - (40)
C1-MH - (41)
C1-MH - (42)
C1-MH - (43)
C1-MH - (44)
C1-MH - (45)
C1-MH - (46)
C1-MH - (47)
C1-MH - (48)
C1-MH - (49)
C1-MH - (50)
C1-MH - (51)
C1-MH - (52)
SCOTTWOOD RD
E OAK ST
ACADEMY DR
CHAPEL DR
PEARSON RD
CHURCHILL RD
SYDNEY LN
SUSIE LN
NUNNLEY RD
CLARK RD
LINRICH LN
BUSCHMANN RD
SKYWAY RD
"SL" LINE
"P1" LINE
"C1" LINE

LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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SCALE: 1"=500'

CENTRAL PEARSON RD- PLAN

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 6 OF 20

OLD CLARK RD
CLARK RD
McKALE RD
AMERICAN WAY
EASY ST
FM-14
FM-15
FM-16
EWALD CT
BUSCHMANN RD
PEARSON RD
"C1" LINE
"P1" LINE
C-61
C-62
C-63
C-64
C-65
C-66
C-67
C-68
C-69
C1-MH
C1-MH – (72)
C1-MH – (73)
C1-MH – (71)
C1-MH – (70)
C1-MH – (69)
C1-MH – (67)
C1-MH – (66)
C1-MH – (68)
C1-MH – (65)
C1-MH – (64)
C1-MH – (63)
C1-MH – (62)
C1-MH – (61)
C1-MH – (60)
C1-MH – (59)
C1-MH – (58)
C1-MH – (57)
C1-MH – (56)
C1-MH – (55)
C1-MH – (54)
C1-MH – (53)
C1-MH – (52)
C1-MH – (51)
C1-MH – (50)
C1-MH – (49)
C1-MH – (48)
C1-MH – (47)
C1-MH – (46)
C1-MH – (45)
P1-MH – (16)
P1-MH – (17)
P1-MH – (18)
P1-MH – (19)
P1-MH – (20)
P1-MH – (21)
P1-PS-3
22.0 GPM
PS-EASY
1.0 GPM
PS-EWALD
1.4 GPM
PS-E CLARK
1.7 GPM
195+00
190+00
185+00
180+00
175+00
170+00
165+00
160+00
155+00
150+00
145+00
140+00
135+00
130+00
125+00
120+00
115+00
110+00
105+00
100+00
MATCH LINE STA "C1" 115+00 / SEE SHEET 8

LINE LEGEND:
- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 4-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:
- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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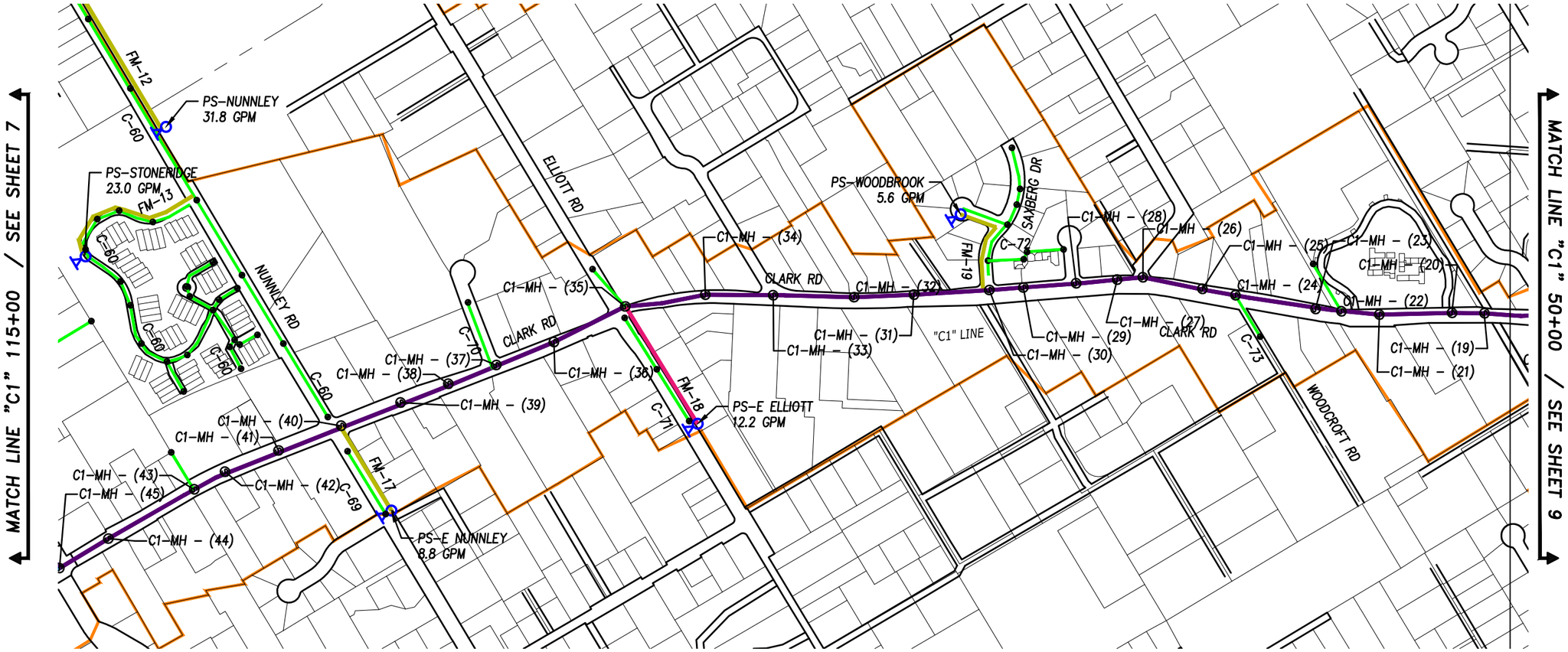
SCALE: 1"=500'

LOWER CLARK RD- PLAN

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 7 OF 20



LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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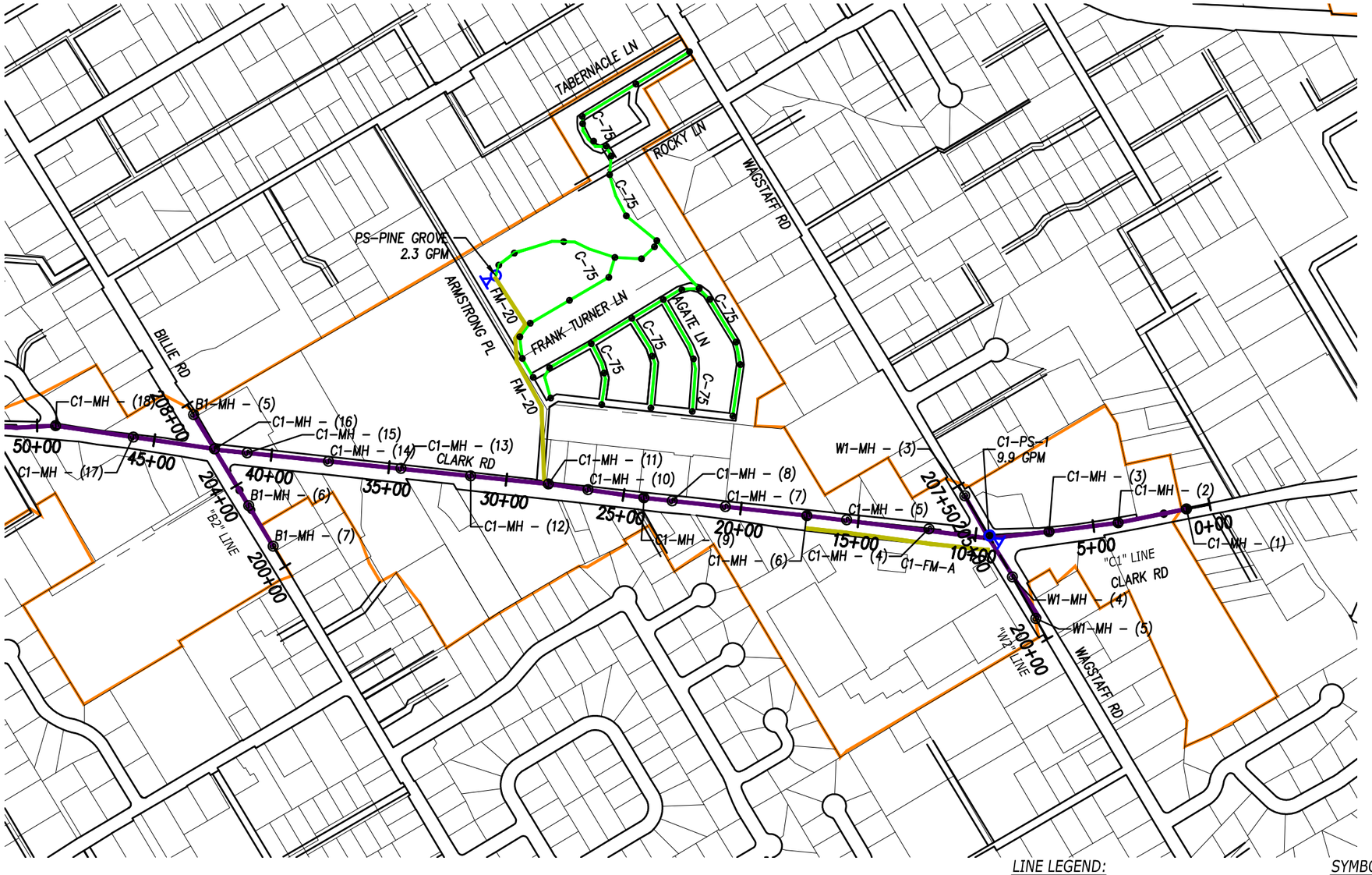
SCALE: 1"=500'

UPPER CLARK RD- PLAN (1 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01

MATCH LINE "C1" 50+00 / SEE SHEET 8



LINE LEGEND:

- 10-INCH TRUNK LINE
- 8-INCH TRUNK LINE
- 6-INCH COLLECTOR
- 6-INCH FORCE MAIN
- 3-INCH FORCE MAIN
- 2-INCH FORCE MAIN
- DISTRICT BOUNDARY

SYMBOL LEGEND:

- PUMP STATION
- TRUNK LINE MH
- COLLECTOR MH

JUNE 2020

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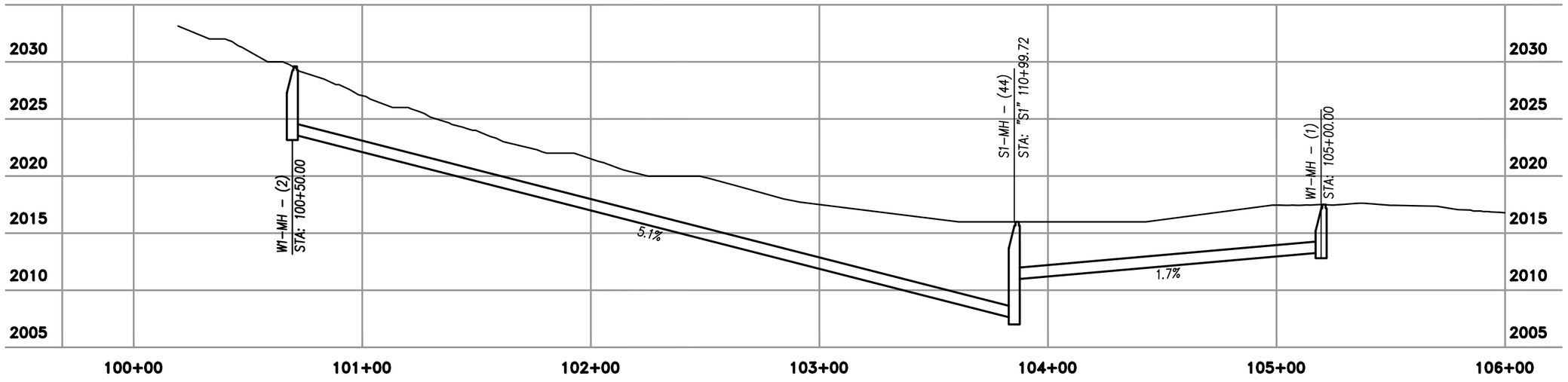
SCALE: 1"=500'

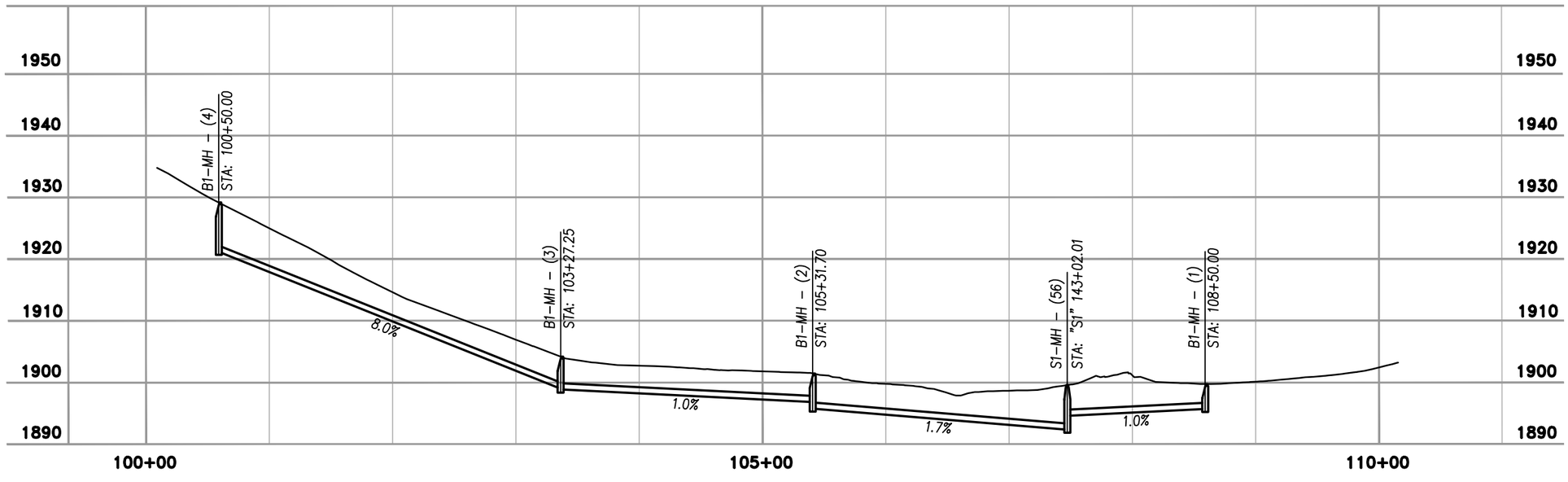
UPPER CLARK RD- PLAN (2 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01



"W1" LINE
WAGSTAFF RD
STA 100+00 TO 106+00
VERTICAL SCALE: 1"=10'
HORIZONTAL SCALE: 1"=50'



"B1" LINE
BILLIE RD
STA 100+00 TO 110+00
VERTICAL SCALE: 1"=20'
HORIZONTAL SCALE: 1"=100'

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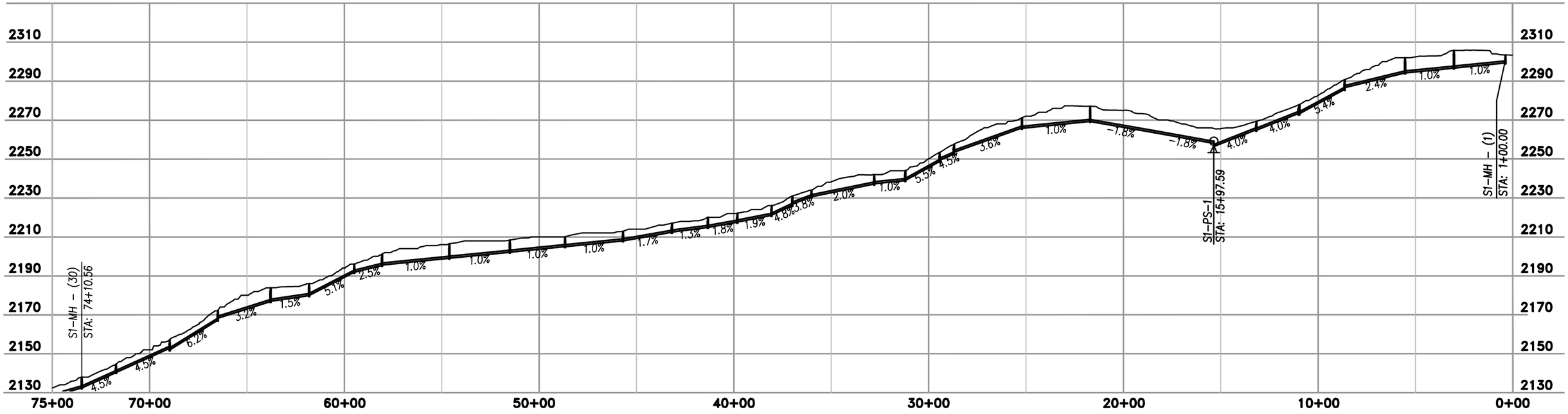
SCALE: SEE DTL

WEST WAGSTAFF & WEST BILLIE RD- PROFILE

Paradise Collection System: Alt B

PROJECT No. 19216-01



"S1" LINE
SKYWAY RD
STA 0+00 to STA 75+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

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VERTICAL SCALE: 1"=50'

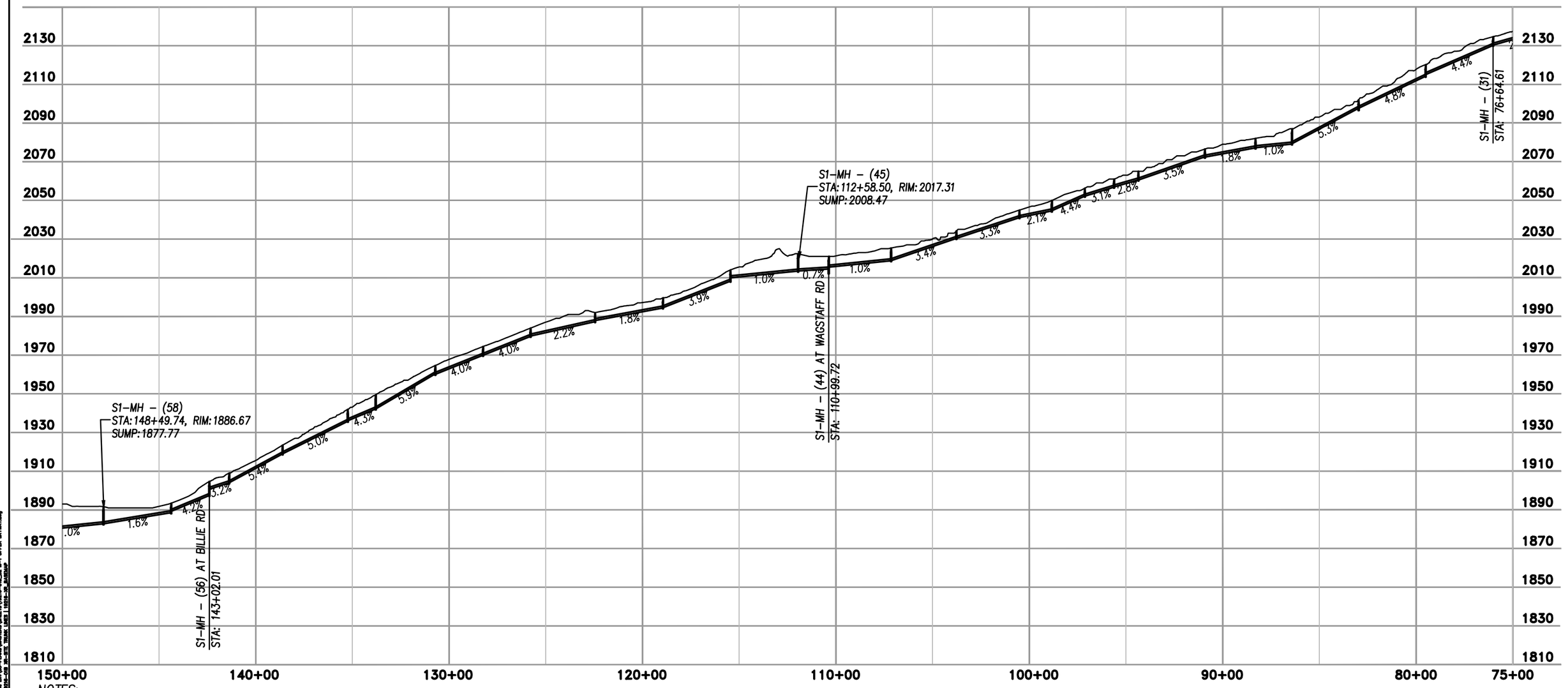
SCALE: 1"=500'

UPPER SKYWAY RD- PROFILE (1 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 10 OF 20



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

"S1" LINE
SKYWAY RD
STA 75+00 to STA 150+00

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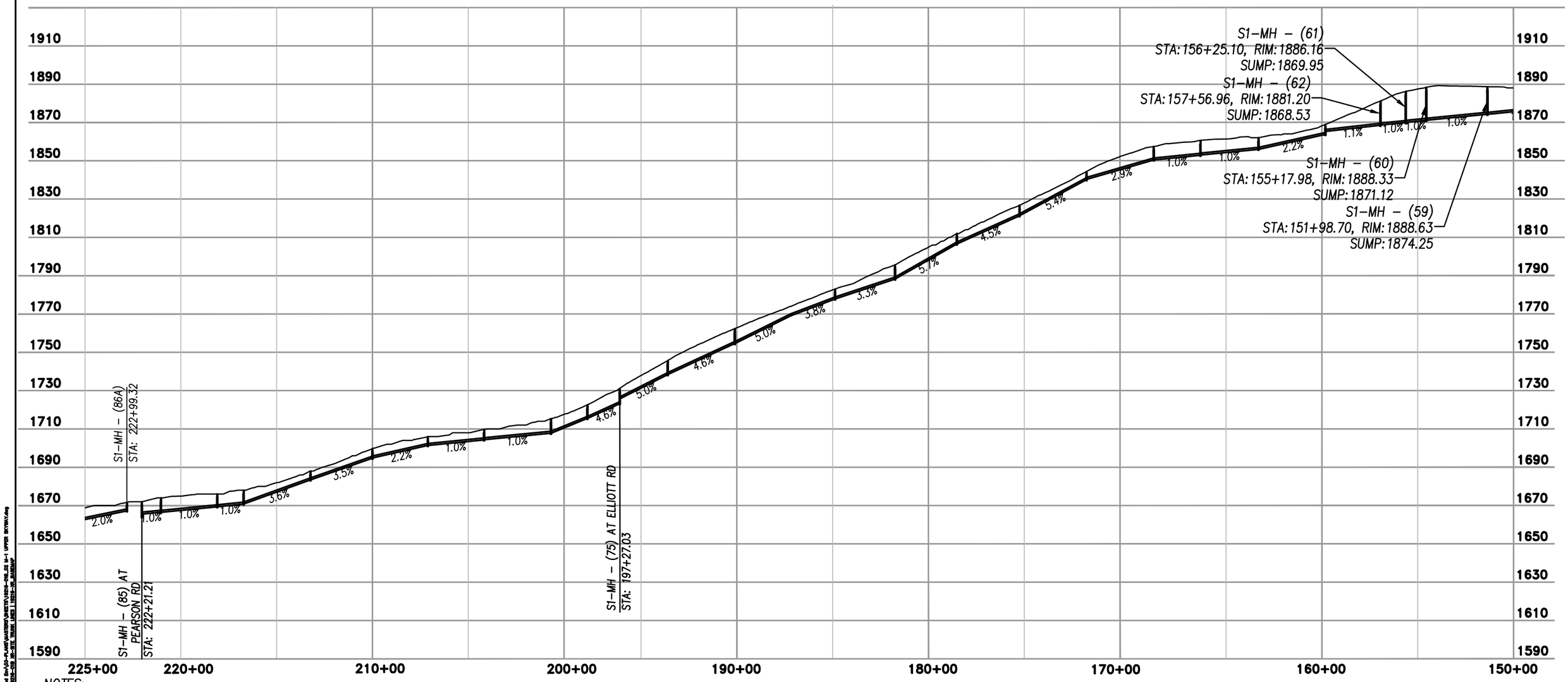
VERTICAL SCALE: 1"=50'

SCALE: 1"=500'

UPPER SKYWAY RD- PROFILE (2 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216–01



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

"S1" LINE
SKYWAY RD
STA 150+00 TO 225+00

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TRUSTED ENGINEERING ADVISORS

VERTICAL SCALE: 1"=50'

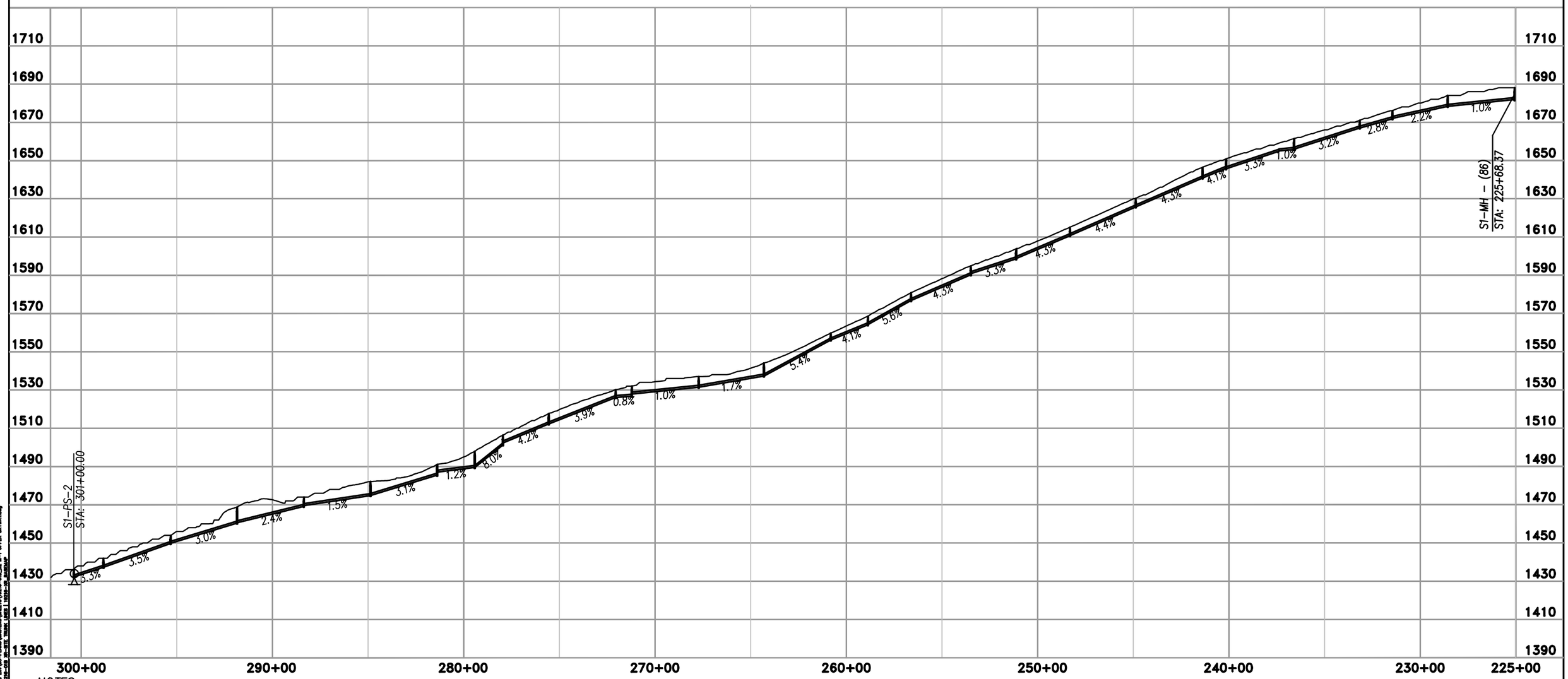
SCALE: 1"=500'

LOWER SKYWAY RD- PROFILE (1 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216–01

SHEET 12 OF 20



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

"S1" LINE
SKYWAY RD
STA 225+00 TO 300+00

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VERTICAL SCALE: 1"=50'

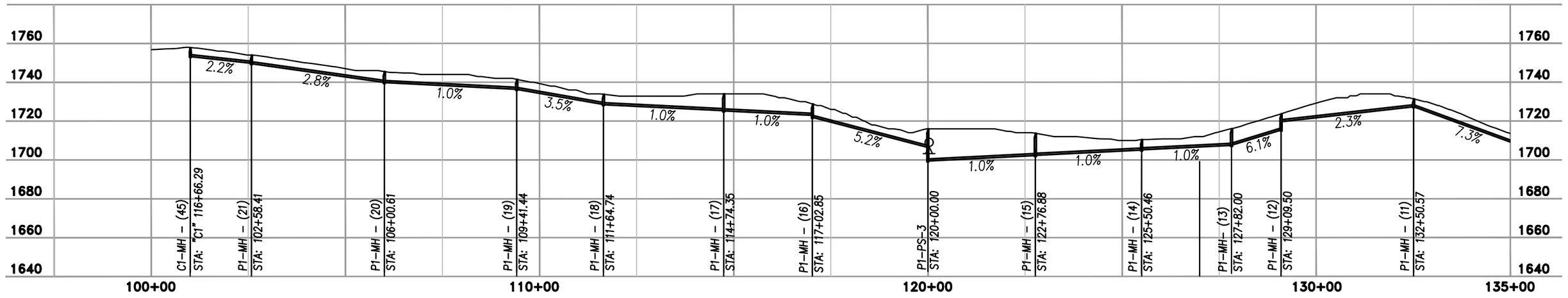
SCALE: 1"=500'

LOWER SKYWAY RD- PROFILE (2 of 2)

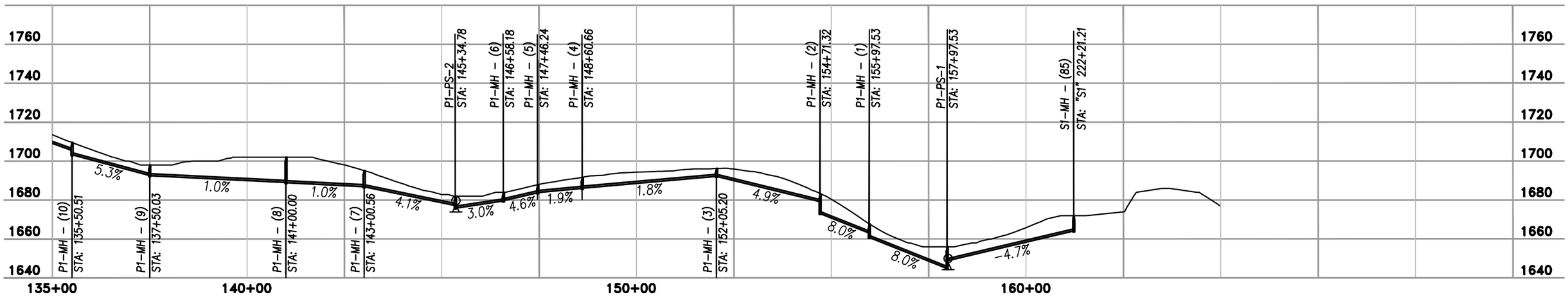
Paradise Collection System: Alt B

PROJECT No. 19216–01

SHEET 13 OF 20



"P1" LINE
PEARSON RD



"P1" LINE
PEARSON RD

VERTICAL SCALE: 1"=50'
HORIZONTAL SCALE: 1"=250'

JUNE 2020

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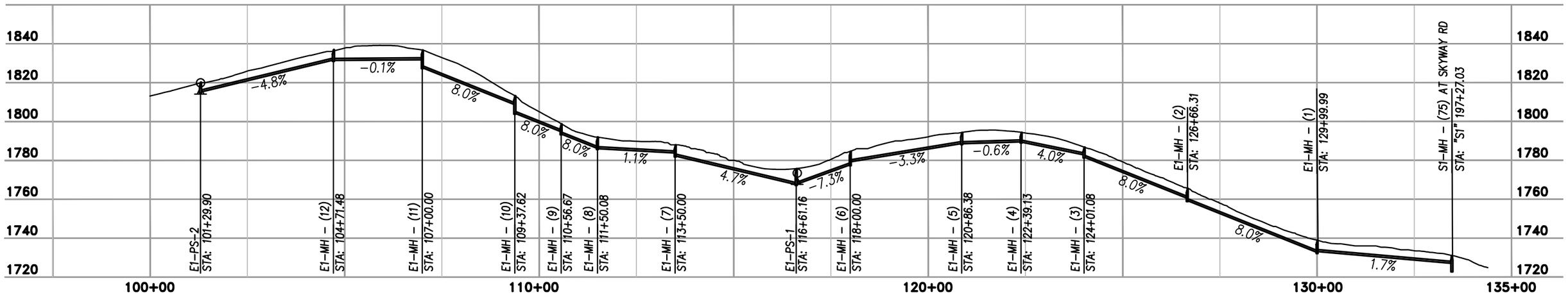
SCALE: SEE DTL

CENTRAL PEARSON RD- PROFILE

Paradise Collection System: Alt B

PROJECT No. 19216–01

SHEET 15 OF 20



"E1" LINE
ELLIOTT RD
VERTICAL SCALE: 1"=50'
HORIZONTAL SCALE: 1"=250'

JUNE 2020

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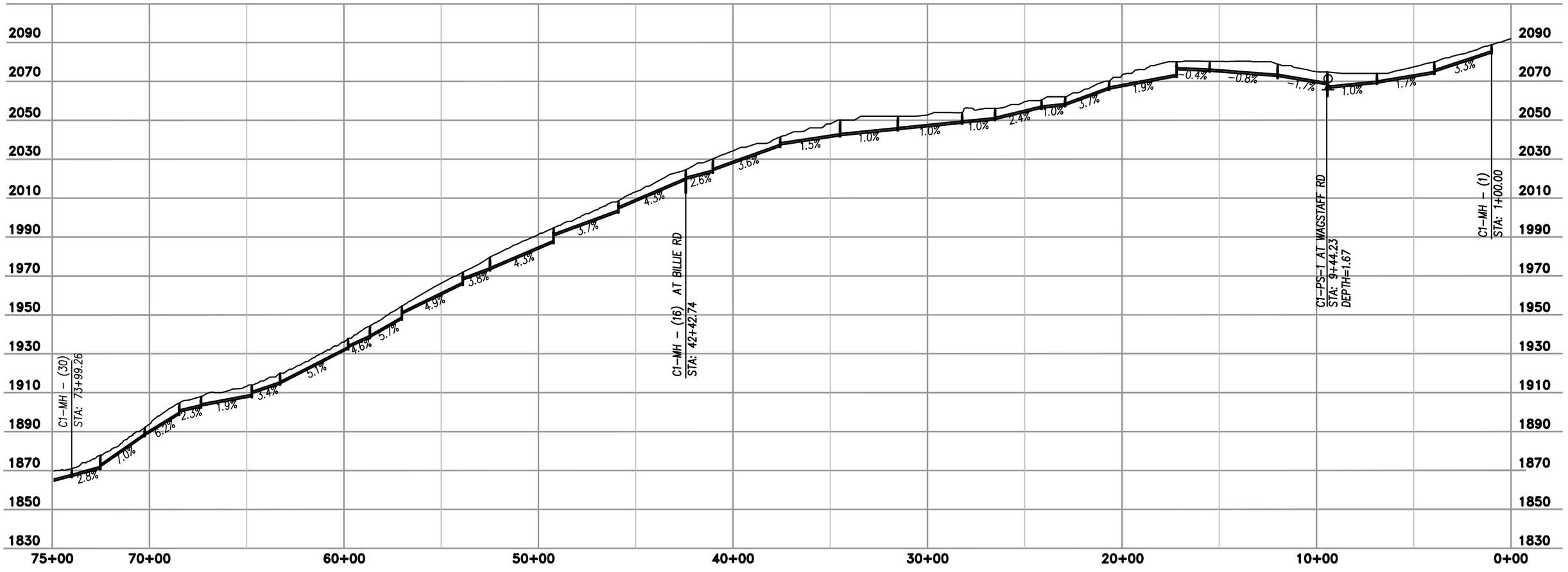
SCALE: *SEE DTL*

ELLIOTT RD-PROFILE

Paradise Collection System: Alt B

PROJECT No. 19216-01



"C1" LINE
CLARK RD
STA 0+00 TO STA 75+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

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VERTICAL SCALE: 1"=50'

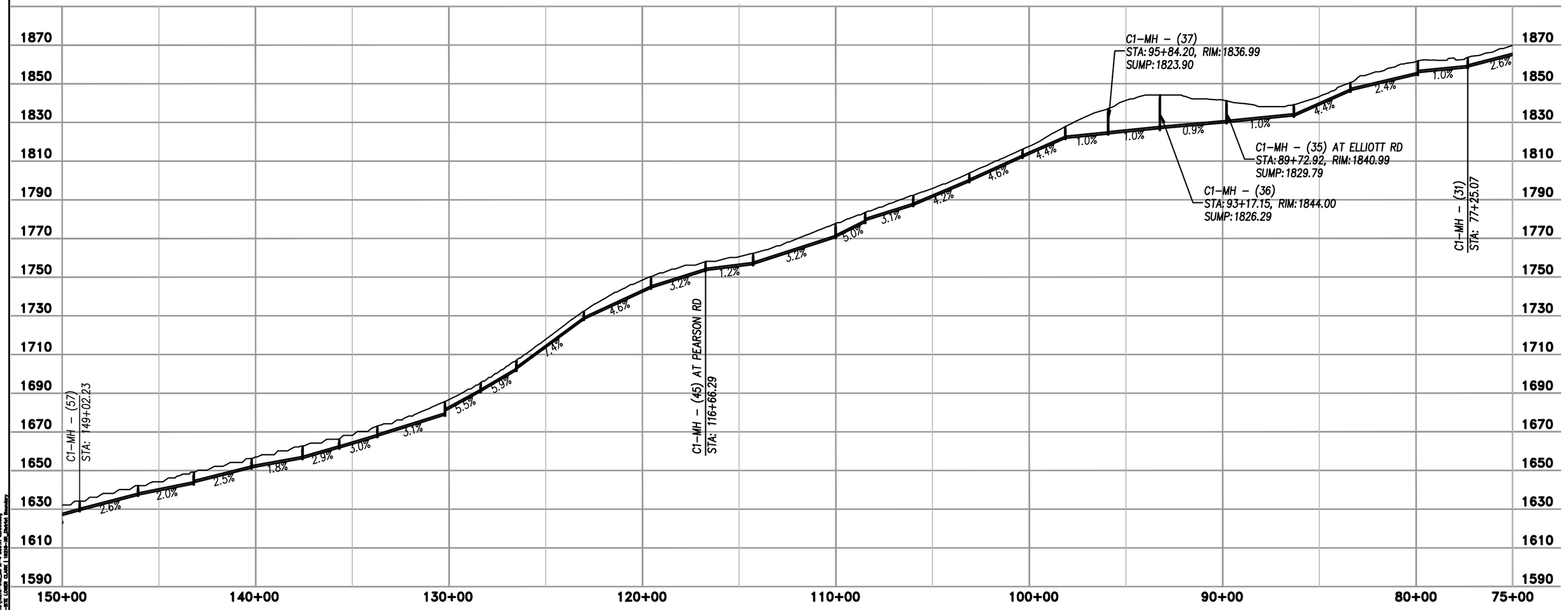
SCALE: 1"=500'

UPPER CLARK RD- PROFILE (1 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216-01

SHEET 17 OF 20



"C1" LINE
CLARK RD
STA 75+00 TO STA 150+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

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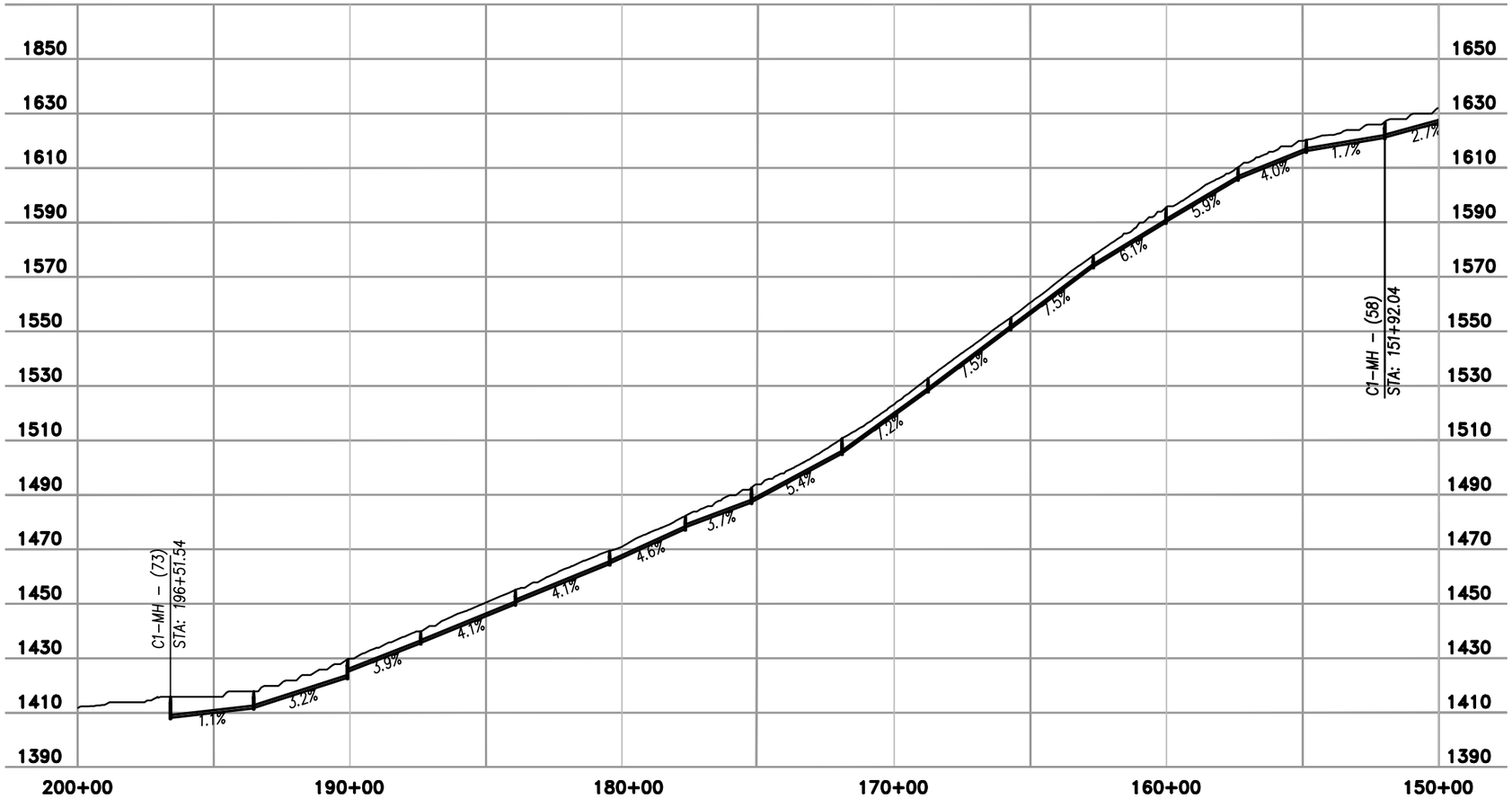
VERTICAL SCALE: 1"=50'

SCALE: 1" = 500'

UPPER CLARK RD- PROFILE (2 of 2)

Paradise Collection System: Alt B

PROJECT No. 19216–01



"C1" LINE
CLARK RD
STA 150+00 TO STA 200+00

NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

JUNE 2020

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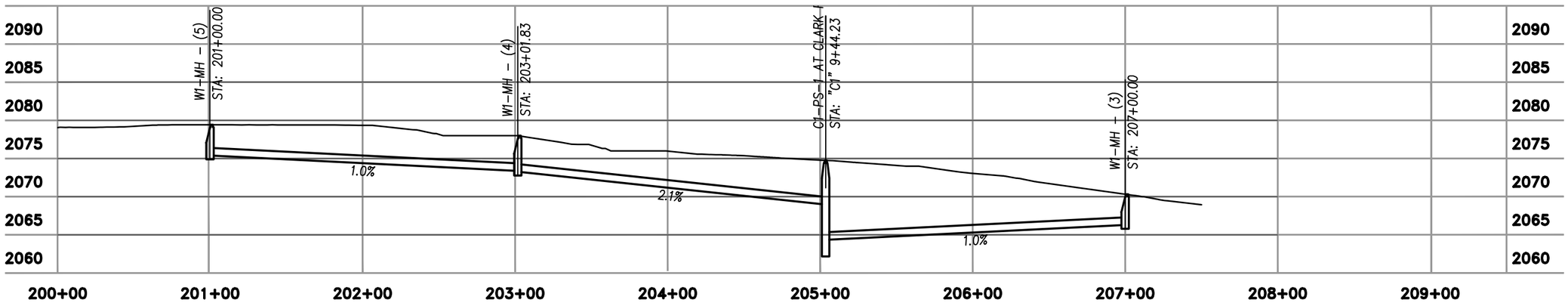
VERTICAL SCALE: 1"=50'

SCALE: 1"= 500'

LOWER CLARK RD- PROFILE

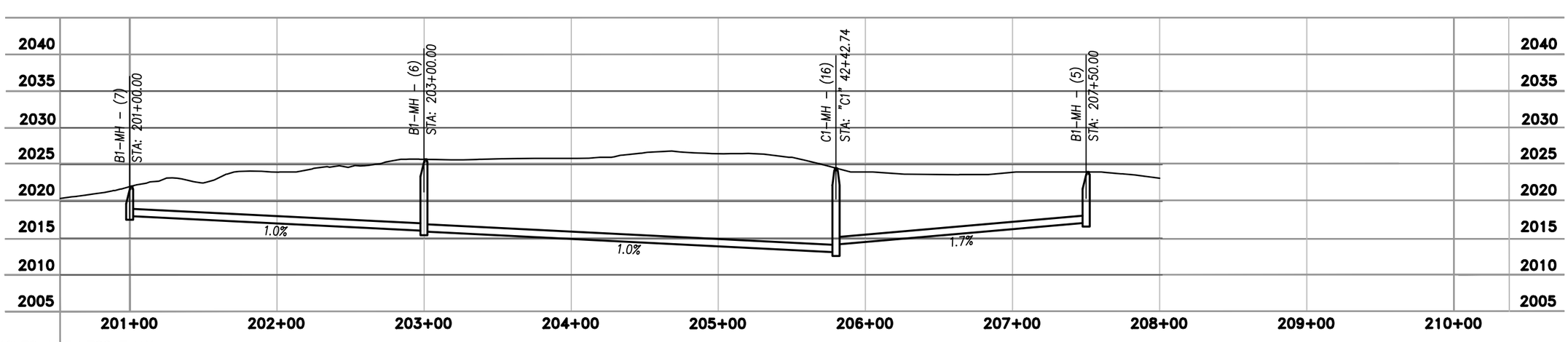
Paradise Collection System: Alt B

PROJECT No. 19216-01



"W2" LINE
WAGSTAFF RD
STA 200+00 TO STA 208+00

VERTICAL SCALE: 1"=15'
HORIZONTAL SCALE: 1"=75'



NOTES:
1. ALL MANHOLES ARE LESS THAN 10 FEET DEEP UNLESS SPECIFIED.

"B2" LINE
BILLIE RD
STA 201+00 TO STA 208+00

VERTICAL SCALE: 1"=15'
HORIZONTAL SCALE: 1"=75'

JUNE 2020

BEN|EN
TRUSTED ENGINEERING ADVISORS

SCALE: SEE DTL

EAST WAGSTAFF & EAST BILLIE RD- PROFILE

Paradise Collection System: Alt B

PROJECT No. 19216-01

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B

OMB Circular

APPENDIX C
(Revised November 2019)

DISCOUNT RATES FOR COST-EFFECTIVENESS, LEASE PURCHASE, AND RELATED ANALYSES

Effective Dates. This appendix is updated annually. This version of the appendix is valid for calendar year 2020. A copy of the updated appendix can be obtained in electronic form through the OMB home page at https://www.whitehouse.gov/wp-content/uploads/2019/12/Appendix-C.pdf. The text of the Circular is found at https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A94/a094.pdf, and a table of past years' rates is located at https://www.whitehouse.gov/wp-content/uploads/2019/12/discount-history.pdf. Updates of the appendix are also available upon request from OMB's Office of Economic Policy (202-395-3585).

Nominal Discount Rates. A forecast of nominal or market interest rates for calendar year 2020 based on the economic assumptions for the 2021 Budget is presented below. These nominal rates are to be used for discounting nominal flows, which are often encountered in lease-purchase analysis.

Nominal Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
1.6	1.7	1.8	2.0	2.3	2.4

Real Discount Rates. A forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the 2021 Budget is presented below. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
-0.4	-0.3	-0.2	0.0	0.3	0.4

Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.

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