AGENDA ITEM 6f
Treasure Island Development Authority
City and County of San Francisco
Meeting of June 14, 2023

Subject: Resolution Authorizing the Treasure Island Director to execute an Agreement for Sharing Maintenance Cost of State Highway Outfall (for the Southgate Road Realignment Project) between Treasure Island Development Authority and State of California

Contact: Robert Beck, Treasure Island Director

BACKGROUND

The Treasure Island Development Authority (TIDA) has been working with the San Francisco County Transportation Authority (SFCTA) on the development of the I-80/Yerba Buena Island Interchange Improvement Project since 2008. TIDA initially requested the SFCTA, in its capacity as the Congestion Management Agency (CMA), lead the effort to prepare and obtain approval for all required technical documentation for the I-80/YBI Interchange Improvement Project, because of its experience in project finance and interacting with the California Department of Transportation (Caltrans) on design aspects of the project. The scope of the I-80/YBI Interchange Improvement Project (the Project) includes two major components: 1) The YBI Ramps Improvement Project, which includes constructing new westbound on and off ramps (on the east side of YBI) to the new Eastern Span of the San Francisco-Oakland Bay Bridge (SFOBB); and 2) seismic retrofit of the existing YBI Bridge Structures on the west side of the island, a critical component of island traffic circulation leading to and from SFOBB.

In May 2019, the TIDA Board of Directors approved an Amendment to the Memoranda of Agreement #12/13-18 to incorporate the Southgate Road Realignment Improvement Project (the Southgate Project) within the overall scope of YBI Ramps Improvement Project.

In May 2023, the SFCTA and its contractor for the Southgate Project has completed the construction and successfully opened the improvement to public service.

Two maintenance agreements are proposed to be part of the Southgate Project to lay out maintenance and operation. One is between the City of San Francisco and the State for the Freeway Maintenance Agreement that generally describes ownership and maintenance responsibility of the Southgate Project. San Francisco Public Works staff are taking the lead to finalize this agreement with the State.

The second one is between TIDA and the State for sharing maintenance cost of an existing storm outfall (the Outfall Agreement). It is the subject matter at hand for discussion.

The Outfall Agreement before the Board of Director today would allow the TIDA and City storm water runoff, runoff generated within the TIDA and City portion of the Southgate Project, to be discharged through existing Caltrans storm drain facility and to this existing Caltrans storm outfall.

DISCUSSION

As part of design for the Southgate Project, SFCTA has engaged WRECO as consultant to compile a drainage report. The purpose of the drainage report is to evaluate the hydrologic and hydraulic conditions of the drainage system proposed under the Southgate Project to accommodate the improvements. The WRECO drainage report describes the existing Caltrans storm drain facility as an 18-inch Alternative Pipe Culvert (APC) and further downstream, increasing to 36-inch APC and a storm outfall to the San Francisco Bay. In the report, the capacity of the existing Caltrans system is estimated as 48 cfs at the 18-inch connection and 78 cfs at the 36-inch outfall. The total Southgate Project area that would be connected to the Caltrans existing system is approximately 8.9 acres, which results in a peak flow rate of 22.8 cfs for the 25- year design storm based on Caltrans HDM design criteria. Based on estimations of the existing watershed for the system and the additional watershed that would be captured from a connection to the Southgate Project area, the existing Caltrans drainage system has sufficient capacity with the connection to the Southgate Project system to meet Caltrans' HDM (2016) design criteria.

ROW	Caltrans System Capture				
	Area (ac)	C-Value	Q_{25} (cfs)	Flow Ratio (%)	
Caltrans	1.99	0.94	6.38	16%	42.6%
Caltrans Off-site	3.08	1.00	10.53	27%	
TIDA Roadway	3.51	1.00	12.00	30%	57.4%
TIDA Hillside	4.19	0.56	8.01	20%	
TIDA Responsibility	1.22	0.67	2.80	7%	
Total	13.98		39.73		

Based on the total flow contribution as indicated by the flow ratio in the above chart, the Outfall Agreement would commit TIDA to share the maintenance cost of the existing Caltrans storm outfall by equal percentage, which is 57.4%.

The Outfall Agremeent would also commit Caltrans to maintain the outfall per published Caltrans facility mainteneance standards. Caltrans will submit to TIDA quarterly invoice for maintenance work performed on the existing storm outfall. The initial estaimate of TIDA share of annual cost for maintenenace for the outfall is estimated to be $18,000.

RECOMMENDATION

Staff recommends approval of the Resolution Authorizing the Treasure Island Director to execute an Agreement for Sharing Maintenance Cost of State Highway Outfall (for the Southgate Road Realignment Project) between Treasure Island Development Authority and State of California

EXHIBITS

A. Agreement for Sharing Maintenance Cost of State Highway Outfall (for the Southgate Road Realignment Project) between Treasure Island Development Authority and State of California
B. Southgate Project Drainage Report

AGREEMENT FOR SHARING MAINTENANCE COST OF STATE HIGHWAY OUTFALL WITH TREASURE ISLAND DEVELOPMENT AUTHORITY

THIS AGREEMENT is made effective this _____ day of _____, 20_____, by and between the State of California, acting by and through the Department of Transportation, hereinafter referred to as "STATE," and the Treasure Island Development Authority, a California non-profit, public benefit corporation and agency of the City and County of San Francisco, hereinafter referred to as "TIDA," and collectively referred to as “PARTIES”

SECTION I

RECITALS

1. WHEREAS, TIDA owns hillside and roadway property on Yerba Buena Island in the City and County of San Francisco (“TIDA PROPERTY”) as shown on Exhibit A, attached to this Agreement and incorporated herein by reference; and

2. WHEREAS, STATE owns watershed and right of way property (“STATE PROPERTY”) that is adjacent to the TIDA PROPERTY and improved with a drainage system and an outfall (“OUTFALL”) within STATE watershed jurisdiction, now in place, just south of State Highway Route 80, as shown on Exhibit A; and

3. WHEREAS, the drainage system on the TIDA PROPERTY connects to the drainage system on the STATE PROPERTY, which is the means of egress of the watershed to the OUTFALL; and

4. WHEREAS, TIDA, pursuant to Sections 100.25 and 131 of the Streets and Highways Code, has requested that STATE maintain the OUTFALL to support the drainage systems on the TIDA PROPERTY and the STATE PROPERTY; and

5. WHEREAS, STATE has qualified personnel available to perform said maintenance of said OUTFALL within STATE right of way; and

6. WHEREAS, TIDA will benefit from said maintenance by utilizing STATE facilities for egress of water flows,; and

7. WHEREAS, TIDA and STATE do mutually desire to cooperate and to specify herein the conditions and the terms under which said maintenance is to be done.

NOW THEREFORE, IT IS AGREED AS FOLLOWS:

SECTION II

AGREEMENT

For and in consideration of the covenants and conditions to be kept and performed by the parties as set forth herein, TIDA and STATE agree as follows:

1. STATE will maintain the OUTFALL in accordance with the scope of maintenance herein and shown in the attachment to this Agreement as Exhibit A and incorporated herein by reference. The degree or extent of maintenance work to be performed, and the standards therefore, will be in accordance with the provisions of current edition of the State Maintenance Manual.

2. The cost of operating and maintaining the OUTFALL will be shared as shown in Exhibit B, attached to this Agreement and incorporated herein by reference, to reimburse STATE for the actual cost of said operation and maintenance of the OUTFALL from the point where TIDA's drainage system enters the STATE right of way to the final point of egress of the watershed, including assessments for indirect charges at rates in effect at the time said maintenance is performed. The functions and levels of maintenance service described in Exhibit B have been considered in setting authorized total dollar limits, and TIDA will have no obligation to reimburse STATE for work in excess of the authorized dollar limits established in this Agreement. It is agreed that during any fiscal year, the maximum expenditure under this Agreement will not exceed the amount shown on Exhibit C unless such expenditure is mutually agreed upon in an amendment to this Agreement approved by STATE and TIDA. Subject to Sections 12 and 13 below, additional expenditures, or an adjustment of expenditures, once authorized, will apply during the fiscal year designated therein and will not be deemed to permanently modify the basic maximum expenditure described in Exhibit B unless mutually agreed by TIDA and STATE.

3. Maintenance will be provided in a manner conforming to STATE's standard practices and procedures using only available STATE resources.

4. Maintenance will be done as the work load of STATE's forces allow, and if said workload becomes too great, this Agreement may be terminated upon timely prior written notice to TIDA from STATE.

5. TIDA will maintain, at TIDA's sole expense, its drainage system on the TIDA PROPERTY with respect to flows from the TIDA PROPERTY that traverse the STATE PROPERTY to the OUTFALL, as shown in Exhibit A. The STATE will maintain the existing drainage system on STATE PROPERTY as shown in Exhibit A.

6. TIDA will not exceed the respective flows shown in Exhibit A.

7. Basis for Billing:

   7.1. It is agreed that quarterly billings for OUTFALL maintenance shall be based on actual maintenance costs, which are as follows:

      7.1.1. Maintenance Labor, including overhead assessment, other expenses including, equipment, materials, and miscellaneous expenses.

   7.2. It is agreed that quarterly billings invoiced to TIDA for State-owned and maintained OUTFALL identified in Exhibit A will be based on actual costs paid by STATE, when derived from STATE billings. STATE will bill TIDA quarterly for any TIDA share of

drainage facilities expenses shown in Exhibit B. TIDA will reimburse STATE within 30 days of receipt of invoice.

8. Exhibit B will be amended, as necessary by written concurrence of both parties, to reflect changes to the billing system.

9. If STATE reasonably determines that the OUTFALL needs to be replaced, STATE and TIDA will meet and confer in good faith regarding the design and financing of a new outfall or other drainage system for the TIDA PROPERTY and STATE PROPERTY.

10. LEGAL RELATIONS AND RESPONSIBILITIES

10.1. Nothing within the provisions of this Agreement is intended to create duties or obligations to or rights in third parties not parties to this Agreement or to affect the legal liability of a PARTY to this Agreement by imposing any standard of care with respect to the operation and maintenance of STATE highways and local facilities different from the standard of care imposed by law.

10.2. Neither TIDA nor any officer or employee thereof is responsible for any injury, damage or liability occurring by reason of anything done or omitted to be done by STATE, under or in connection with any work, authority or jurisdiction conferred upon STATE under this Agreement. It is understood and agreed that STATE shall fully defend, indemnify and save harmless TIDA and all of their officers and employees from all claims, suits or actions of every name, kind and description brought forth under this Section, including, but not limited to, tortious, contractual, inverse condemnation or other theories or assertions of liability occurring by reason of anything done or omitted to be done by STATE under this Agreement.

10.3. Neither STATE nor any officer or employee thereof is responsible for any injury, damage or liability occurring by reason of anything done or omitted to be done by TIDA under or in connection with any work, authority or jurisdiction conferred upon TIDA under this Agreement. It is understood and agreed that TIDA shall fully defend, indemnify and save harmless STATE and all of its officers and employees from all claims, suits or actions of every name, kind and description brought forth under this Section, including, but not limited to, tortious, contractual, inverse condemnation or other theories or assertions of liability occurring by reason of anything done or omitted to be done by TIDA under this Agreement.

10.4. In the event of concurrent negligence of TIDA, its officers, employees and agents, and STATE, its officers, employees and agents, the liability for any and all claims for injuries or damages to persons and/or property shall be apportioned under the California theory of comparative negligence as presently established or as may hereafter be modified.

11. TERMINATION - This Agreement may be terminated by mutual written consent by PARTIES. STATE may terminate the Agreement for cause TIDA’s failure to comply with the provisions of this Agreement may be grounds for a Notice of Termination by STATE, and

STATE's failure to comply with the provisions of this Agreement may be grounds for termination by TIDA.

12. TERM OF AGREEMENT - This Agreement shall become effective on the date first shown on its face sheet and shall remain in full force and effect until amended or terminated at any time upon mutual consent of the PARTIES or until terminated by STATE or TIDA for cause.

13. CERTIFICATION OF FUNDS; BUDGET AND FISCAL PROVISIONS; TERMINATION IN THE EVENT OF NON-APPROPRIATION. This Agreement is subject to the budget and fiscal provisions of the City's Charter. Charges will accrue only after prior written authorization certified by the Controller, and the amount of TIDA's obligation hereunder shall not at any time exceed the amount certified for the purpose and period stated in such advance authorization. This Agreement will terminate without penalty, liability of any kind to TIDA at the end of any fiscal year if funds are not appropriated for the next succeeding fiscal year. If funds are appropriated for a portion of the fiscal year, this Agreement will terminate, without penalty, liability of any kind at the end of the term for which funds are appropriated. TIDA has no obligation to make appropriations for this Agreement in lieu of appropriations for new or other agreements. TIDA budget decisions are subject to the discretion of the Mayor and the Board of Supervisors.

THIS SECTION CONTROLS AGAINST ANY AND ALL OTHER PROVISIONS OF THIS AGREEMENT.

14. GUARANTEED MAXIMUM COSTS. TIDA's payment obligation to STATE cannot at any time exceed the amount certified by City's Controller for the purpose and period stated in such certification. Absent an authorized Emergency per the City Charter or applicable Code, no TIDA or City representative is authorized to offer or promise, nor is TIDA or the City required to honor, any offered or promised payments to STATE under this Agreement in excess of the certified maximum amount without the Controller having first certified the additional promised amount and the Parties having modified this Agreement as provided in Section 11.5, "Modification of this Agreement."

15. SUNSHINE ORDINANCE. STATE acknowledges that this Agreement and all records related to its formation, STATE's performance of services, and TIDA's payment are subject to the California Public Records Act (California Government Code §6250 et. seq.), and the San Francisco Sunshine Ordinance (San Francisco Administrative Code Chapter 67). Such records are subject to public inspection and copying unless exempt from disclosure under federal, state or local law.

PARTIES are empowered by Streets and Highways Code section 114 and 130 to enter into this Agreement and have delegated to the undersigned the authority to execute this Agreement on behalf of the respective agencies and covenants to have followed all the necessary legal requirements to validly execute this Agreement.

IN WITNESS WHEREOF, PARTIES hereto have set their hands and seals the day and year first above written.

TREASURE ISLAND DEVELOPMENT AUTHORITY

By: _____
Director

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TONY TAVARES
Director of Transportation

By: _____
LEAH BUDU
Deputy District Director
Maintenance District 04

APPROVED AS TO FORM:

DENNIS J. HERRERA,
City Attorney

By: _____
Name: _____
Deputy City Attorney

EXHIBIT A

DIAGRAM OF TIDA PROPERTY, STATE PROPERTY AND OUTFALL

EXHIBIT B

OUTFALL Agreement
STATE and TIDA
Effective _____, 20____

BASIS OF COST DISTRIBUTION
State-Owned and State Maintained
Billed by the State

Route	Location PM	Type of Facility	Estimated Annual Total $30,000	Cost Distribution	
				STATE	TIDA
	Yerba Buena Island				
80	7.9- 7.95	OUTFALL		40	60

LEGEND:

TIDA ROADWAY

TIDA HILLSIDE

CALTRANS

OFF-SITE CALTRANS

CALTRANS EXISTING STORM DRAIN MAIN PIPE/FACILITY

CALTRANS EXISTING STORM DRAIN OUTFALL STRUCTURE, SUBJECT TO MAINTENANCE COST SHARING

STATE R/W

STATE R/W

STATE R/W

STATE R/W

STATE R/W

18" ACP 71'

18" ACP 160'

24" ACP 150'

18" ACP 95'

36" ACP 313'

TIDA/CITY STORM DRAIN CONNECTION TO EXISTING CALTRANS STORM DRAIN FACILITY

EXISTING CALTRANS STORM DRAIN PIPE/FACILITY

EXISTING CALTRANS OUTFALL STRUCTURE

ROW	Caltrans System Capture				
	Area (ac)	C-Value	Q_{25} (cfs)	Flow Ratio (%)	
Caltrans	1.99	0.94	6.38	16%	42.6%
Caltrans Off-site	3.08	1.00	10.53	27%	
TIDA Roadway	3.51	1.00	12.00	30%	57.4%
TIDA Hillside	4.19	0.56	8.01	20%	
TIDA Responsibility	1.22	0.67	2.80	7%	
Total	13.98		39.73		

EXHIBIT "A"

STATE OF CALIFORNIA
CALIFORNIA STATE TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION

FREEWAY MAINTENANCE
—
HYDRAULIC MAINTENANCE SHARING

YERBA BUENA ISLAND RAMPS (FMA)
04-SF-80 PM 7.6R/8.3R

NO SCALE

June 7, 2023

Yerba Buena Island - Southgate Realignment Project
San Francisco County, California
Project ID: 0400020507, EA 04-3A6401
04-SF-80, PM 7.8/8.0

Drainage Report

Prepared for:

Caltrans

San Francisco County Transportation Authority

HDR

Prepared by:

WRECO

July 2019

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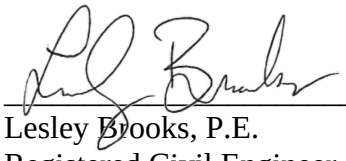
Yerba Buena Island - Southgate Realignment Project
San Francisco County, California
Project ID: 0400020507, EA 04-3A6401
04-SF-80, PM 7.8/8.0

Drainage Report

Submitted to:
California Department of Transportation
San Francisco County Transportation Authority

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.



Lesley Brooks, P.E.
Registered Civil Engineer

July 23, 2019
Date

July 2019

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Executive Summary

The San Francisco County Transportation Authority (SFCTA) and the California Department of Transportation (Caltrans) have been undertaking the Yerba Buena Island Southgate Realignment Ramps Improvement Project, which is replacing the westbound Interstate 80 (I-80) on- and off-ramps to the east span of the San Francisco-Oakland Bay Bridge (SFOBB) on the east side of Yerba Buena Island (YBI). The SFCTA and Caltrans now also propose a realignment of Southgate Road and Hillcrest Road, as well as the construction of the previously approved eastbound off-ramp south of I-80 and bicycle/pedestrian facilities. These project changes are referred to as the Southgate Road realignment improvements (Project).

The purpose of this Drainage Report is to evaluate the hydrologic and hydraulic conditions of the drainage system proposed to accommodate the Project roadway improvements. The report documents the hydrologic and hydraulic design criteria used for the drainage design.

The Project area spans Caltrans', Treasure Island Development Authority's (TIDA), and United States Coast Guard's (USCG) right-of-way (R/W). Caltrans' drainage facilities design for the Project is based on procedures presented in the updated sixth edition of the Caltrans *Highway Design Manual* (2012) and in the *Hydraulic Engineering Circular No. 22* (2001). Drainage facilities within the TIDA's R/W will follow the Department of Public Works City and County of San Francisco's *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016). The USCG requires the most stringent criteria be used in analyzing changes to their systems, which in this area, is the Caltrans criteria. The overall drainage pattern of the area will be maintained and the proposed drainage facilities will meet design standards.

The existing drainage system consists of grate inlets and concrete-lined channels. Historically, the majority of the runoff around the Project area was collected by grate inlets at a low point east of the Quarters 8 building and conveyed through a pipe system past the Quarters 9 building to the east side of the island and into the San Francisco Bay (Bay). Temporary construction drainage was installed in October 2017 as part of Caltrans' Project No. 04-0120T1. The temporary construction condition redirects the local drainage that was being captured by the Quarters 9 drainage system to an existing Caltrans system that discharges into the Bay, approximately 700 feet north of the Quarters 9 discharge location.

Several meetings between November 2017 and February 2018 were held with representatives from Caltrans, TIDA, and USCG regarding the drainage plan for the Project. It was the preferred approach of all parties to separate the jurisdictional runoff to the maximum extent practical. After reviewing several alternatives and considering the deteriorated condition of the existing Quarters 9 pipe, it was concluded that all runoff would be directed to the existing Caltrans system. TIDA is in the process of acquiring R/W from the USCG on the hillside east of Hillcrest Avenue. The hillside runoff will be connected directly to the Caltrans system and does not require stormwater treatment. The proposed TIDA drainage system will connect to the existing Caltrans system after going through a stormwater treatment area. This connection will require a maintenance agreement between Caltrans and TIDA that is currently under negotiation.

The majority of the proposed system consists of local drainage systems. The proposed drainage located within the Caltrans' R/W consists of an inlet along the proposed bike path. There is no off-site Caltrans drainage.

The proposed local drainage system will separate the USCG's R/W runoff and connect to the existing Caltrans system through channels, inlets, and a storm drain that connects downstream of the stormwater treatment area. TIDA's R/W runoff will be collected in a proposed storm drain system that consists of pipes and inlets, and will be conveyed to a stormwater treatment area. Once treated, the runoff will be conveyed through a storm drain and connect to the existing Caltrans drainage system that discharges on the east side of the island into the Bay.

Acronyms

APC	Alternative Pipe Culvert
BMP	Best Management Practice
Caltrans	California Department of Transportation
CMP	Corrugated Metal Pipe
DPP	Design Pollution Prevention
DTM	Digital Terrain Model
FHWA	Federal Highway Administration
HDM	Highway Design Manual
HEC	Hydraulic Engineering Circular
HSG	Hydrologic Soil Group
IDF	Intensity Duration Frequency
LOS	Level of Service
MHHW	Mean Higher High Water
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Science
RCP	Reinforced Concrete Pipe
R/W	Right-of-Way
RWQCB	Regional Water Quality Control Board
SFCTA	San Francisco County Transportation Authority
SFOBB	San Francisco-Oakland Bay Bridge
SWDR	Stormwater Drainage Report
SWPP	Stormwater Pollution Prevention
TIDA	Treasure Island Development Authority
TOC	Time of Concentration
USCG	United States Coast Guard
USDA	United States Department of Agriculture
YBI	Yerba Buena Island

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1 GENERAL DESCRIPTION

1.1 Project Description

The San Francisco County Transportation Authority (SFCTA) and the California Department of Transportation (Caltrans) have been undertaking the Yerba Buena Island Southgate Realignment Ramps Improvement Project, which is replacing the westbound Interstate 80 (I-80) on- and off-ramps to the east span of the San Francisco-Oakland Bay Bridge (SFOBB) on the east side of Yerba Buena Island (YBI). The SFCTA and Caltrans now also propose a realignment of Southgate Road and Hillcrest Road, as well as the construction of the previously approved eastbound off-ramp south of I-80 and bicycle/pedestrian facilities. These project changes are referred to as the Southgate Road realignment improvements (Project). Figure 1 and Figure 2 show the Project location and the Project limit map, respectively.

YBI lies between Oakland and San Francisco in the San Francisco Bay, in the City and County of San Francisco (City, County), and is the connecting point for the west and east spans of the SFOBB. The SFOBB is a critical link in the interstate network, providing access between San Francisco and the East Bay.

The Yerba Buena Island Southgate Realignment Ramps Improvement Project recently upgraded the westbound YBI ramps that were originally constructed in the early 1960s. This work was conducted to improve safety, geometric configuration, and traffic operations between YBI and westbound I-80. The new westbound YBI on- and off-ramps were opened to traffic in November 2016. To complete the improvements on the east side of YBI, roadway realignments and construction of the eastbound YBI off-ramp and bicycle/pedestrian facilities are necessary to improve traffic operations, safety, and access on YBI. The anticipated traffic volumes related to the planned development of Treasure Island increase the need to improve access and traffic operations on the east side of YBI.

The westbound YBI ramps were designed and constructed with the expectation that access to and from the westbound YBI ramps would be provided via the eastbound I-80 off-ramp and Southgate Road that was planned to be constructed on the south side of I-80. However, the alignment designed at that time for Southgate Road and its intersection with Hillcrest Road resulted in major deficiencies that did not provide adequate access to the westbound on-ramp. The stop-controlled intersection could not accommodate CA Legal or STAA trucks, would operate at Level of Service (LOS) “F”, and would result in queue backups along the eastbound I-80 off-ramp, spilling back onto the eastbound I-80 mainline, as well as extensive on-island queues for vehicles accessing the westbound and eastbound I-80 on-ramps.

The proposed Project would extend the approach to the westbound on-ramp and eliminate stop-control access, which allows the I-80 westbound on-ramp to function as designed. The Project would:

- grade separate the eastbound I-80 off-ramp and Hillcrest Road to eliminate a major point of conflict through braided geometry, eliminating the LOS "F" intersection and queue spillback onto I-80;
- separate westbound and eastbound traffic further south on Hillcrest Road, thereby allowing more traffic to access the westbound and eastbound on-ramps to I-80;
- provide roadway facilities that accommodate all truck-turning movements;
- eliminate the conflict between bicycles/pedestrians near the I-80 off-ramp; and
- provide access to YBI and the United States Coast Guard (USCG) Station.

With the new braided geometry, the eastbound YBI off-ramp would cross over Southgate Road and then under the eastbound YBI off-ramp and the I-80 SFOBB East Span before connecting to Macalla Road on the north side of I-80. To accommodate the realignment and the necessary braiding to eliminate intersection conflicts, the grade of Southgate Road would be lowered, varying from 0 to 25 feet below its existing elevation. Retaining walls (both for embankment and excavation) would be constructed, and the eastbound I-80 YBI off-ramp would be constructed to include a structure undercrossing for Southgate Road. The roadway profiles would require fill embankment retaining walls varying from 0 to approximately 30 feet above the existing elevation in the vicinity of the Quarters 8.

The realignment of Southgate Road to the north of Quarters 8 in conjunction with the large change in elevation necessary to eliminate the intersection of Southgate Road and Hillcrest Road would require the demolition of Quarters 8.

Hillcrest Road would be widened from its current 24 feet to 40 feet from approximately 100 feet south of its intersection with Forest Road to the separation of Hillcrest Road and Southgate Road, converted to one-way northbound traffic, and reconfigured. The right lane of Hillcrest Road would connect to the eastbound I-80 on-ramp. The left lane would travel on a structure over Southgate Road then under the I-80 eastbound off-ramp and the I-80 East Span structure. It would connect with Macalla Road immediately past the I-80 East Span structure and provide access to the USCG facility through an intersection with Northgate Road. Minor improvements to the USCG driveway at Hillcrest Road would also be made.

In addition, a new bicycle/pedestrian path connection would be constructed between the SFOBB East Span Bicycle/Pedestrian Path Landing and Macalla Road, completing the path from Oakland to YBI. The grading necessary to accommodate the new roadway profile would result in lowering the elevation at and around the Southgate Road loop by 0 to 20 feet. Stormwater treatment areas would be developed in and around the Southgate Road loop.

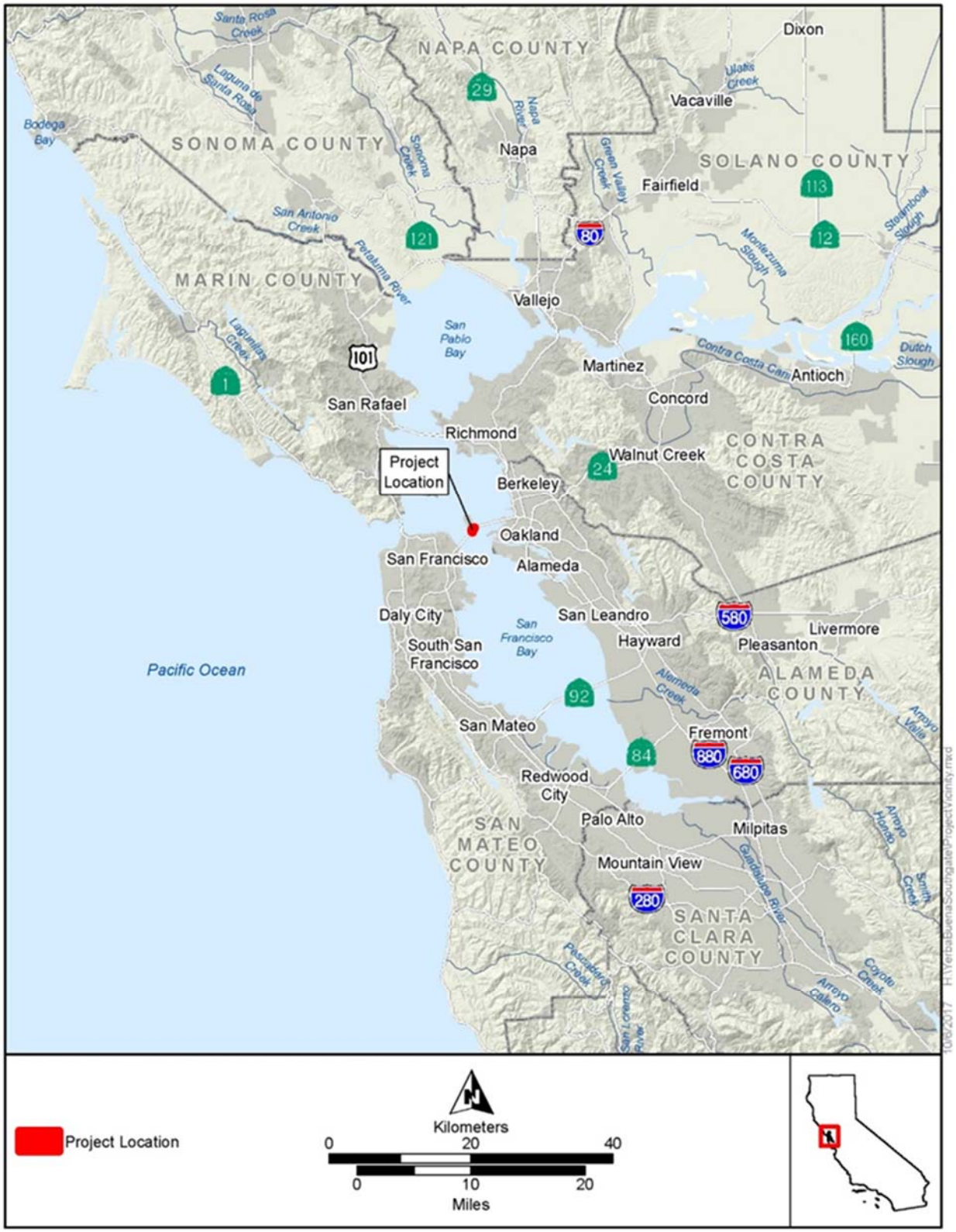

Figure 1. Project Location Map

Source: HDR

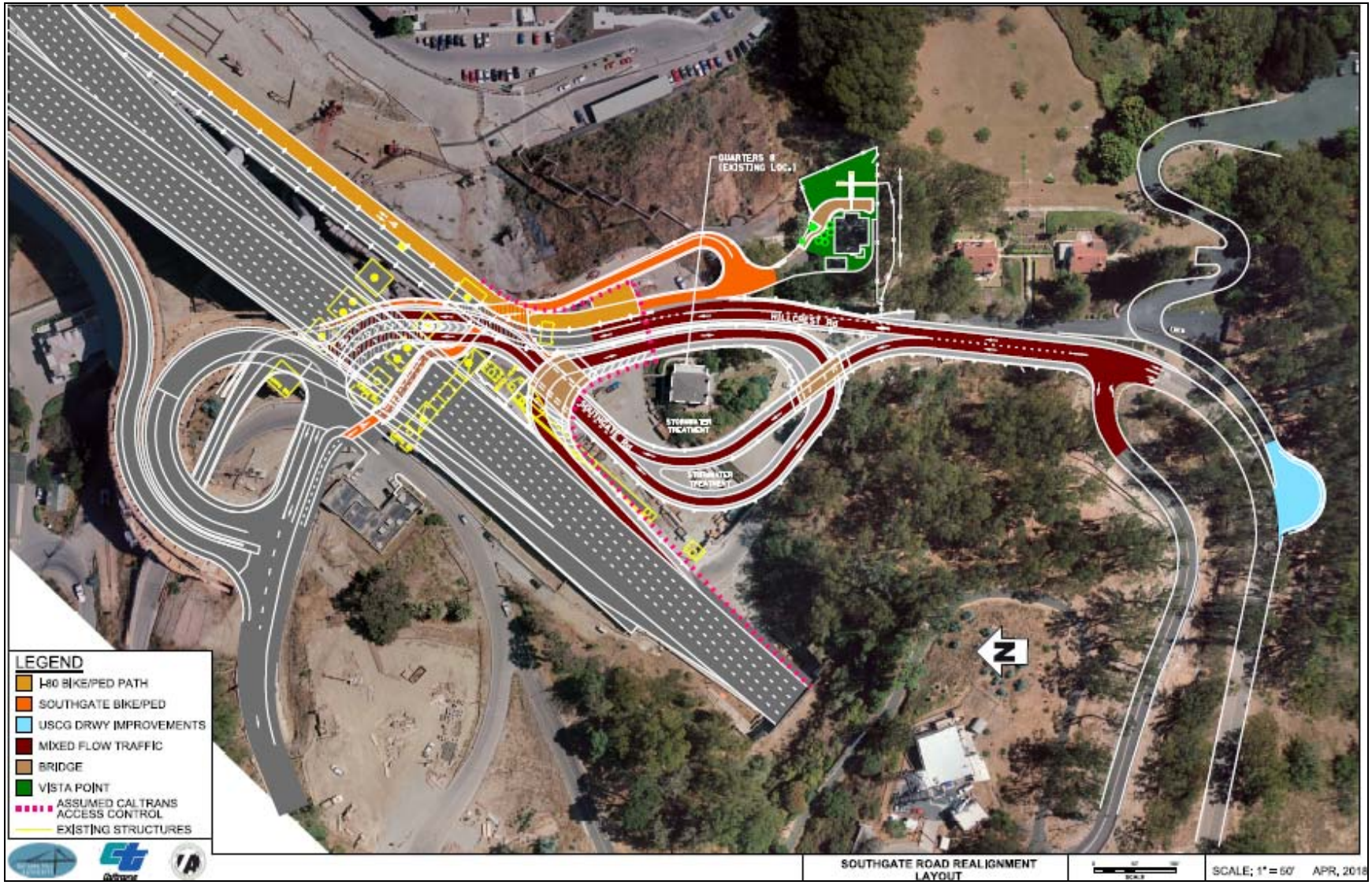

Figure 2. Project Limit Map

Source: HDR

1.2 Reference Documents

The following reference documents were used to perform the analysis contained in this report:

1.2.1 As-Built Record Documents

As-built drainage plans from previous projects along the corridor were obtained from the Caltrans database to locate and identify existing drainage information.

These files were reviewed and used as a basis for the drainage design. A summary of the as-built documents available from the Caltrans database are shown in Table 1.

Table 1. As-Built Records

Project No.	Date	Location
04-3A6404	08-30-2013	04-SF-80 PM 12.3/13.2
04-0120T1	02-21-2012	04-SF-80 PM 12.6/13.9
04-0120S4	06-23-2008	04-SF-80 PM 12.7/13.2

Additional drainage plans were obtained from the Treasure Island Development Authority (TIDA) for the Forest Road Detour developed by BKF dated March 29, 2018.

1.2.2 Preliminary Layout Sheets

Drainage plans are shown in Appendix A.

1.3 Soil Characteristics

The United States Department of Agriculture's (USDA) Natural Resource Conservation Science (NRCS) Web Soil Survey (2018) states YBI consists of Candlestick-Kron-Buriburi complex (30 to 75 percent slopes), Ortehents, cut and fill-Urban land complex (5 to 75 percent slopes), Urban land, and Urban land-Orthents reclaimed complex (0 to 2 percent slopes). The Hydrological Soil Group (HSG) within the Project limits is HSG C. HSG C soils have low infiltration rates and high erosion potential. A geotechnical investigation is currently being performed to determine site-specific soil types, and the findings will be documented in the Project's Geotechnical Report.

1.4 Land Use

The existing land uses adjacent to the Project is a mixture of open space and developed areas. Within the Project area all on-site areas will be developed roadway improvements. The majority of the adjacent off-site area is undeveloped hillside with a few existing USCG buildings.

1.5 Creeks, Streams, and River Crossings

The Caltrans *Water Quality Planning Tool* (2012) identifies the Project as within the South Bay Hydrologic Unit and the Bay Channel Hydrologic Area. The Project site is located within undefined hydrologic sub-area 204.10.

The nearest receiving water body is the San Francisco Bay, which surrounds YBI. The Mean Higher High Water (MHHW) level is approximately 6.2 feet based on the National Oceanic and Atmospheric Administration (NOAA) datum station at Yerba Buena Island. The segment of the San Francisco Bay that receives discharges from the Project is identified by the San Francisco Bay Regional Water Quality Control Board (RWQCB) as the San Francisco Bay Central. The San Francisco Bay ultimately flows west towards the Pacific Ocean.

1.6 Agencies Impacting Design

The Project is located within on YBI in San Francisco County, California within Caltrans', TIDA's, and USCG's jurisdictional R/W.

Any drainage improvements proposed for the local roads by the Project will conform to the local agency's requirements outlined in the *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016).

The proposed drainage design includes a connection to an existing Caltrans drainage system, which is analyzed using Caltrans' design criteria standards from the HDM (2016).

The USCG does not have its own requirements for drainage but requires that the most stringent regulations for the area be used in analyzing impacts to their system. The Caltrans HDM (2016) has the most stringent regulations and is therefore, used when analyzing impacts to the USCG drainage system.

Incorporation of permanent treatment best management practices (BMPs) is required for this Project. The design of these BMPs considers both Caltrans and local criteria (Stormwater Data Report, WRECO 2018) and the San Francisco Bay RWQCB requirements.

1.7 Drainage Design Criteria

The majority of the proposed system consists of local drainage systems. The proposed drainage located within Caltrans' R/W consists of an inlet along the proposed bike path. There is no off-site Caltrans drainage.

The drainage design for the local drainage system is based on procedures presented in the updated *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016). The proposed drainage design connects to the existing Caltrans storm drain system. The Caltrans HDM (2016) hydrology criteria were used to determine the impact of the proposed drainage design at the connection.

Improvements are proposed within USCG's R/W. The USCG criteria require that the most stringent criteria be used in analyzing changes to their systems, which is the Caltrans criterion.

Table 2 provides the selected relevant HDM sections and City & County design criteria pertinent to the hydrology and hydraulics of the drainage design.

Table 2. Selected Hydraulics Criteria

Criteria	Caltrans	City & County
Inlet Capacity	25-year	5-yr and 100-yr
Maximum allowable flow spread width	Shoulder or half outer lane width	5-yr flows within the pipe 100-yr flows within the curb
Minimum allowable pipe diameter under roadbed	18 in.	8 in. inside diameter for lateral 11.1 in. inside diameter for main
Depth and Cover	Table 856.5	Main line - Minimum of 5 feet for main storm drains and 3 feet for landscaped area Laterals - Minimum of 3 feet from pipe centerline to the top of the curb
Pipe Slope	Minimum velocity of 3 feet per second when flowing half full	< 30% with a minimum velocity of 2 feet per second and a maximum velocity of 10 feet per second

Source: Caltrans HDM and Subdivision Regulations for Treasure Island and Yerba Buena Island

1.7.1 Intensity-Duration-Frequency (IDF)

Intensity-duration-frequency (IDF) curves and rainfall intensities for the 25-year storm event were obtained from the NOAA Atlas 14 with pre-approval from Caltrans. The IDF curves and rainfall intensities for local drainage was obtained from *Subdivision Regulations for Treasure Island and Yerba Buena Island* (Section XI, Table 2.1). The intensities used for the Project are shown in Table 3 and Table 4.

Table 3. YBI IDF Summary

Duration (min)	Intensity (in./hr)	
	5-yr	100-yr
5	3.126	4.92
22	1.428	2.69

Source: Subdivision Regulations for Treasure Island and Yerba Buena Island

Table 4. NOAA IDF Summary

Duration (min)	25-yr Intensity (in/hr)
5	3.42

Source: NOAA Atlas 14

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2 DRAINAGE DESIGN APPROACH

2.1 Existing Drainage

The existing drainage system consists of grate inlets and concrete-lined channels. Runoff from a steep hillside area adjacent to the Project area is captured within existing concrete-lined channels. Historically, the majority of the runoff around the Project area was collected by grate inlets at a low point east of the Quarters 8 building and conveyed through a pipe system past the Quarters 9 building and into the Bay. Runoff from the hillside to the west was captured by a concrete-lined channel that ran along an abandoned off-ramp of I-80 and captured in a grate inlet that was connected to an existing Caltrans drainage system.

Temporary construction drainage was installed in October 2017 as part of Caltrans Project No. 04-0120T1. The temporary construction condition redirects the local drainage that was being captured by the Quarters 9 drainage system to an existing Caltrans system that discharges into the Bay approximately 700 feet north of the Quarters 9 discharge location.

A small portion of Hillcrest Road and surrounding hillside that lies outside of the Project area is captured by a small storm drain system that discharges on the south side of the island.

2.2 Drainage Design Approach and Alternatives to Drainage Design Considered

Several meetings between November 2017 and February 2018 were held with representatives from Caltrans, TIDA, and USCG regarding the drainage plan for the Project. It was the preferred approach of all parties to separate the jurisdictional runoff to the maximum extent practical.

Caltrans and the USCG own existing drainage systems with discharges into the San Francisco Bay on the east side of the island in close proximity to the Project area. TIDA owns a drainage system on the west side of I-80 that is currently under design to extend to a proposed biofiltration swale at the parade grounds located on the northwest side of the island and then discharge into the Bay. Figure 3 shows the location of the existing outfalls.

The existing Quarters 9 storm drain system underwent repairs in June 1995 due to the deteriorating condition of the pipe. Portions of the existing pipe were sliplined which resulted in reduced capacity. Due to this reduced capacity and the unknown condition of portions of the remaining pipe, the USCG requested that no connections are to be made to this system.

Several alternatives were considered for the discharge of the TIDA R/W runoff within the Project area. A summary of the alternatives is provided in the following sections.

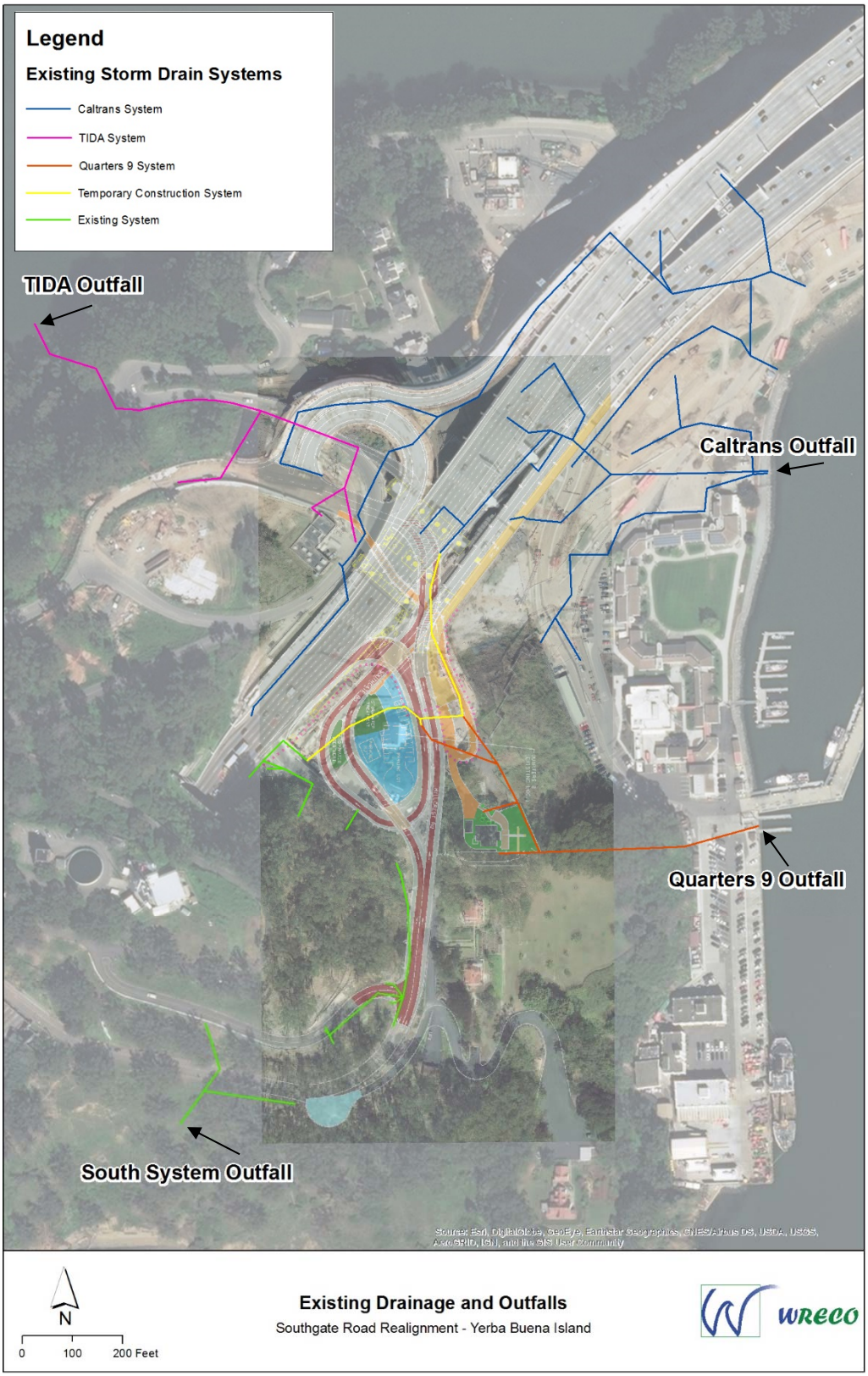


Figure 3. Existing Storm Drain Systems and Outfalls

2.2.1 Construct a New TIDA Discharge into the Bay

The only discharge locations in proximity to the Project area are for systems owned by Caltrans and the USCG. The option of installing a new discharge location into the Bay that would be owned by TIDA was discussed but was not considered viable due to the regulatory requirements of adding a new discharge location into the Bay and the delay in construction that would result.

2.2.2 Connect to the Existing TIDA Drainage System

The closest TIDA-owned drainage system is on the west side of I-80 along Macalla Road. Connecting across I-80 is likely to involve several utility conflicts and require significant trenching to connect the Project area low point to a tie-in location with a low enough invert elevation. Additionally, it would require removing and reconstructing a section of the newly constructed Macalla Road.

Currently, the existing TIDA drainage system connects to an existing pipe that discharges into the Bay on the west side of the island. Improvements are currently under final design that would abandon that existing outfall can continue the TIDA storm drain down Northgate Road to a stormwater treatment area that did not anticipate any runoff from the Southgate Project area. Final design for the extension of the TIDA system is almost complete, and there is not sufficient space to accommodate treatment of runoff from the Southgate Project area.

2.2.3 Detain and Connect to Quarters 9 Drainage System

The closest and historical outfall for the majority of the Project area is the Quarters 9 system outfall. The main line of the system is a 12-inch CMP that discharges into a parking lot where it is immediately picked up by a 10-inch RCP headwall that continues under the parking lot and discharges into the Bay.

The existing Quarters 9 storm drain system underwent repairs in June 1995 due to the deteriorating condition of the pipe. Portions of the existing pipe were sliplined which resulted in reduced capacity. Due to this reduced capacity and the unknown condition of portions of the remaining pipe, the USCG requested that no connections are to be made to this system.

The existing system does not have the capacity for all of the on-site and off-site flows from the Project area. Detention could be an option to reduce the release rates to the existing capacity, but the most likely place for a detention facility would be in the historical orchard behind Quarters 9 that would need to be purchased and maintained by TIDA.

USCG hillside which is in the process of being acquired by TIDA and the TIDA roadway flows would still need to be separated since only the TIDA roadway runoff requires stormwater treatment. The current location of the stormwater treatment area is at a significantly lower elevation than the closest connection to the Quarters 9 system and significant trenching would be required around Quarters 9 to reach a point on the existing system with an invert elevation low enough to join the two systems.

2.2.4 Connect to the Existing Caltrans Drainage System

The existing Caltrans drainage system was updated through the 04-3A6404, 04-0120T1, and 04-0120S4 contracts. The proposed connection would occur at the existing 18-inch Alternative Pipe Culvert (APC) under I-80 along the Southgate Road alignment. The existing Caltrans drainage system increases as it conveys runoff to the north and discharges as a 36-inch APC into the Bay. The capacity of the existing Caltrans system is estimated as 48 cfs at the 18-inch connection and 78 cfs at the 36-inch outfall. The total Project area that would be connected to the Caltrans existing system is approximately 10.9 acres, which results in a peak flow rate of 30 cfs for the 25-year design storm based on Caltrans HDM design criteria. Based on estimations of the existing watershed for the system and the additional watershed that would be captured from a connection to the Project area, the existing Caltrans drainage system has sufficient capacity with the connection to the proposed Project system to meet Caltrans' HDM (2016) design criteria.

Estimated runoff to the existing Caltrans system based on jurisdiction is provided below in Table 5. Flows shown are for the 25-year storm event based on Caltrans HDM standards.

A watershed map of the area by jurisdiction is provided in Figure 4. For a detailed watershed map, see Appendix C.

Table 5. Connection to Existing Caltrans System

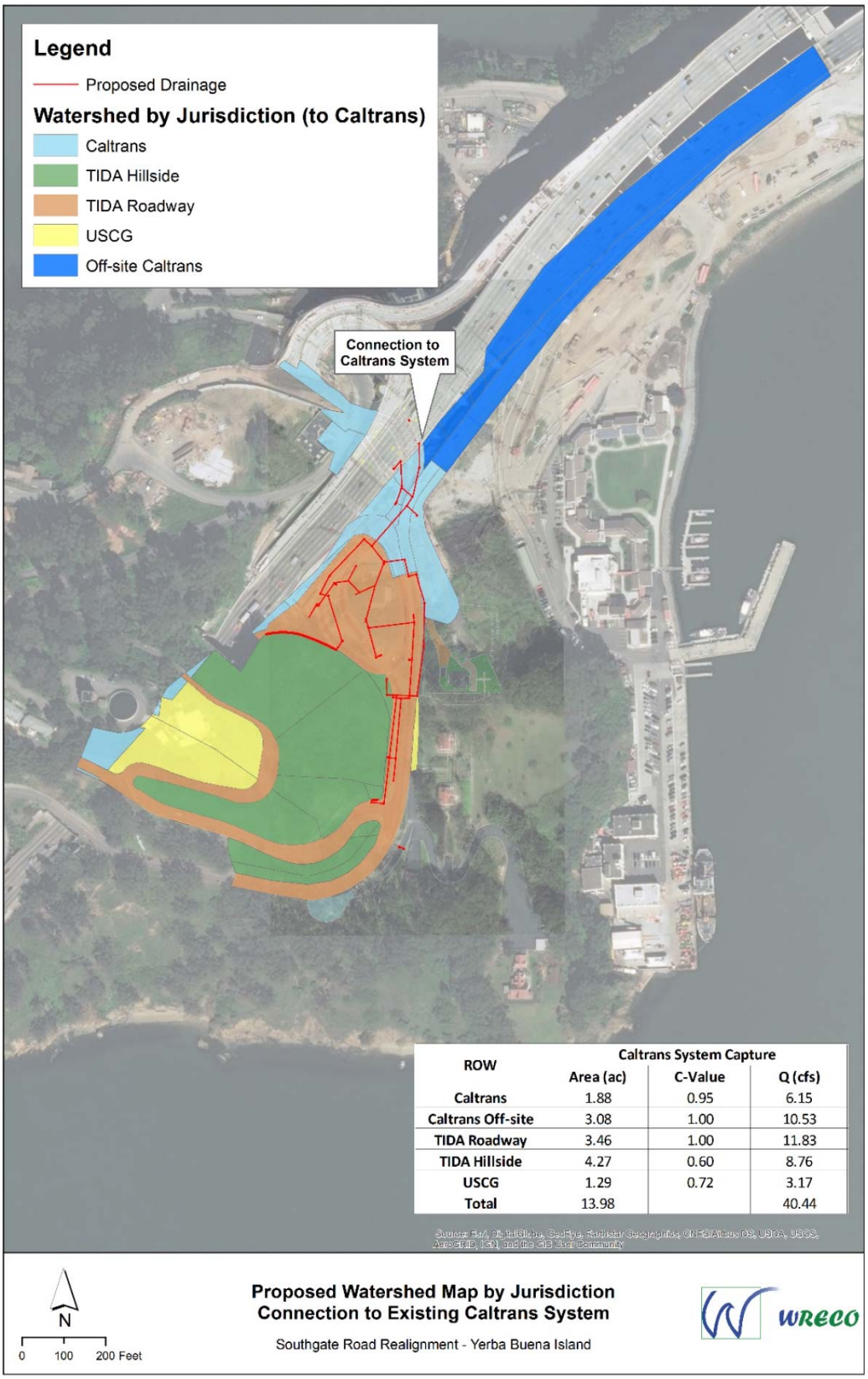
Jurisdiction	Project Area (ac)	Project 25-yr Flow (cfs)	Off-Site Area (ac)	Off-Site 25-yr Flow (cfs)	Total Flow Distribution
Caltrans	1.88	6.15	3.08	10.53	41%
TIDA Roadway	3.46	11.83	---	---	29%
TIDA Hillside (to be acquired from USCG)	4.27	8.76	---	---	22%
Coast Guard	1.29	3.17	---	---	8%
Totals	**10.90**	**29.91**	**3.08**	**10.53**	**100%**

Before connecting the Project area to the Caltrans drainage system, the TIDA roadway runoff will be treated in the stormwater treatment area to the maximum extent practical.

2.2.5 Summary of Alternatives and Chosen Alternative

A summary of the analyzed alternatives is provided below in Table 6.

After discussing the alternatives with all of the impacted agencies, it was concluded that connection to the existing Caltrans system provides the best option. This connection will require a maintenance agreement between Caltrans and TIDA that is currently under negotiation.



ROW	Caltrans System Capture		
	Area (ac)	C-Value	Q (cfs)
Caltrans	1.88	0.95	6.15
Caltrans Off-site	3.08	1.00	10.53
TIDA Roadway	3.46	1.00	11.83
TIDA Hillside	4.27	0.60	8.76
USCG	1.29	0.72	3.17
Total	13.98		40.44

Figure 4. Proposed Watershed Map by Jurisdiction

Table 6. Summary of Drainage Design Alternatives

Alternative	Pros	Cons
Construct a New TIDA Discharge into Bay	▪ No agreements needed ▪ Water will already be treated for discharge into Bay	▪ Regulatory requirements would result in a delay in construction of several years
Connect to Existing TIDA System	▪ No agreements needed ▪ Water will already be treated for discharge into Bay	▪ Connection has to go under I-80 to the west side and is likely to encounter several utility conflicts ▪ Would require removal and reconstruction of a segment of the new Macalla Road ▪ Future improvements did not account for additional runoff and would not have adequate capacity
Detain and Connect to Quarters 9 System	▪ Matches historical drainage patterns ▪ Outfall in close proximity	▪ Requires an agreement with USCG ▪ Q9 outfall (12-inch CMP) does not have capacity for the 25-yr storm event when TIDA flows are added ▪ Would require detention in historical orchard ▪ Deteriorating condition of USCG pipe
Connect to the Existing Caltrans System	▪ Least likely to involve utility adjustments ▪ Caltrans system has capacity	▪ Requires a maintenance agreement between Caltrans and TIDA

2.3 Impacts of Future Improvements

Additional future improvements are planned within the Project watershed, which include the addition of a 28-foot widening of Hillcrest Road south of Forest Road. These future improvements will result in additional impervious area and higher flows to the Project stormwater treatment area. These improvements were taken into consideration when sizing the proposed drainage system and stormwater treatment area under the assumption that the runoff from the surrounding USCG hillside would be separated from the stormwater treatment area to the maximum extent practical.

The stormwater treatment area will be sized to accommodate runoff from the Project and from the Forest Road Detour which will be captured in the Southgate Project storm drain system. Sufficient space to treat runoff from the future projects is provided, but the design and expansion

of the stormwater treatment area will be the responsibility of the design team for those improvements.

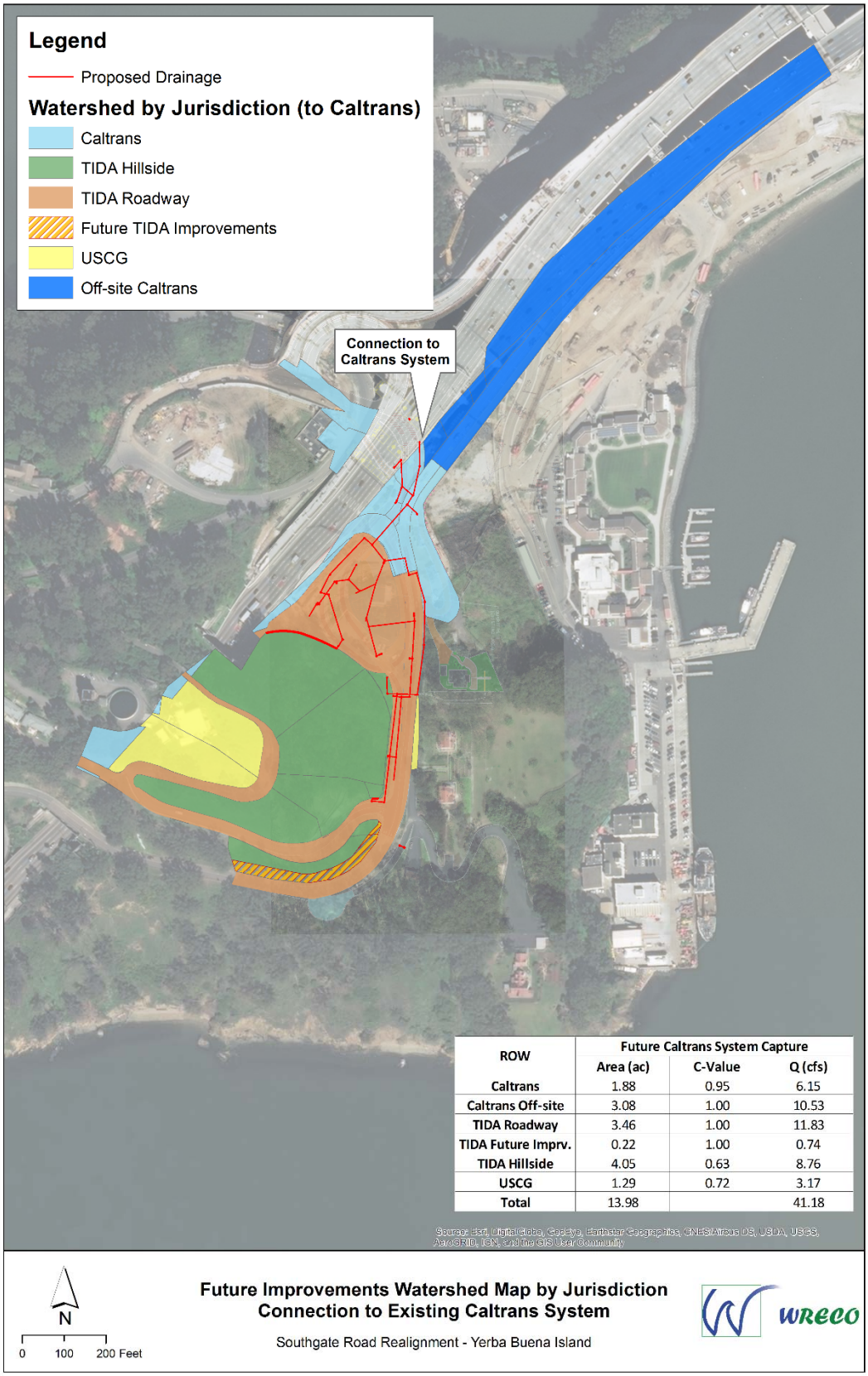
The impacts of the future improvements to the connection with the existing Caltrans drainage system was also taken into consideration. The future improvements are assumed to be TIDA's R/W. The updated flow distribution with the proposed future improvements is provided in Table 7.

A watershed map of the area by jurisdiction including potential future improvements is provided in Figure 5.

Table 7. Future Improvements Connection to Existing Caltrans System

Jurisdiction	Project Area (ac)	Project 25-yr Flow (cfs)	Off-Site Area (ac)	Off-Site 25-yr Flow (cfs)	Total Flow Distribution
Caltrans	1.88	6.15	3.08	10.53	40.5%
TIDA Roadway	3.68	12.57	---	---	30.5%
TIDA Hillside (to be acquired from USCG)	4.05	8.76	---	---	21%
Coast Guard	1.29	3.17	---	---	8%
Totals	**10.90**	**30.65**	**3.08**	**10.53**	**100%**

Note: It is assumed that with the future improvements the expanded roadway will be connected to the Project area drainage system



ROW	Future Caltrans System Capture		
	Area (ac)	C-Value	Q (cfs)
Caltrans	1.88	0.95	6.15
Caltrans Off-site	3.08	1.00	10.53
TIDA Roadway	3.46	1.00	11.83
TIDA Future Imprv.	0.22	1.00	0.74
TIDA Hillside	4.05	0.63	8.76
USCG	1.29	0.72	3.17
Total	13.98		41.18

Figure 5. Proposed Watershed Map by Jurisdiction with Future Improvements

2.4 Points of Concentration and Outfalls

The points of concentration for the Project are defined at the stormwater treatment area and at the confluence with the existing Caltrans drainage system.

The proposed drainage improvements convey the treated roadway runoff and untreated hillside runoff to the existing Caltrans drainage system. Each system discharges into the same location within the Bay.

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3 CALTRANS ONSITE ROADWAY DRAINAGE

On-site roadway drainage analysis includes: calculations of flows over impervious pavement areas, estimations of spread flow widths at proposed inlets, and design of roadway-drainage pipe systems connecting to inlets. Drainage design capacity will follow the procedures in the HDM and the FHWA Hydraulic Engineering Circular No. 22 (HEC-22) (2011). Capacity analysis for the inlet and pipe systems will be performed using Hydraflow Storm Sewer Extension by Autodesk (Version 10.40).

Drainage watershed maps (including on-site and off-site watersheds) are included in Appendix C of this report.

The Caltrans on-site roadway drainage consists of two inlets on the proposed bike path (inlets 1ak and 6a) and three inlets on Southgate Road (inlets 6aa, 6ac, and 7c), which will be located in Caltrans' R/W and an analysis of the proposed connection of the local TIDA drainage system to the existing Caltrans drainage system.

3.1 Recurrence Interval

Per Table 831.3 of the HDM (2016), roadway drainage systems for through-traffic lanes, branch connections, and other major ramp connections will be designed using the 25-year design discharge with permissible water spread to be within the shoulder width.

3.2 Time of Concentration

The time of concentration estimates were made following the procedures in Section 816.6 in the Caltrans HDM. The HDM also recommends a minimum time of concentration of 5 minutes for paved areas and steep unpaved areas, which includes all of the proposed catchments in the Project that drain to the existing Caltrans system.

3.3 Estimating Design Discharge

The design discharge was calculated using the Rational Method for on-site watersheds. The discharge calculations are described below.

The equation of the Rational Method is:

$$Q = C\ i\ A$$

Where:

Q = design discharge (cfs)

C = runoff coefficient for Rational Method

- Caltrans calculations include a design storm frequency of 1.1 for 25-year storm. C-value calculations are provided in Appendix D.

i = average rainfall intensity for the selected frequency and for a duration equal to the time of concentration (TOC) (in./hr)

A = drainage area (ac)

A summary of the peak flows for the 25-year design storm using the Caltrans HDM design standards are shown below in Table 8.

Table 8. Rational Method Peak Flows for Caltrans Criteria

Watershed ID	Capture Location ID	Area (ac)	C-value	TOC (min)	I_{25} (in/hr)	Q_{25} (cfs)
OS-RW7	1a	1.20	0.57	5	3.42	2.35
OS-F1	1aa	0.44	0.57	5	3.42	0.86
OS-F1-b	1aa	0.03	0.57	5	3.42	0.06
OS-F2	1aa	0.72	0.51	5	3.42	1.25
OS-F3	1aa	0.82	0.59	5	3.42	1.65
BR	1ai	0.52	0.46	5	3.42	0.82
BP-a	1ak	0.44	1.00	5	3.42	1.50
F-1	2a	0.57	1.00	5	3.42	1.94
HC-2	2a	0.28	1.00	5	3.42	0.97
OS-HC3	2a	0.55	0.52	5	3.42	0.97
HC1-a	2aa	0.30	1.00	5	3.42	1.02
HC1-b	2ac	0.16	1.00	5	3.42	0.54
RW-5	2ae	0.03	1.00	5	3.42	0.12
R2-b	2ag	0.24	1.00	5	3.42	0.83
R2-a	2ag	0.19	1.00	5	3.42	0.65
R1-a	3a	0.39	1.00	5	3.42	1.32
R1-b	3a	0.03	1.00	5	3.42	0.10
F-3	4a	0.43	1.00	5	3.42	1.47
OS-1	4a	0.18	1.00	5	3.42	0.60
R1-c	4aa	0.25	1.00	5	3.42	0.86
HC1-c	4ac	0.24	1.00	5	3.42	0.81
RW-2	4c	0.24	1.00	5	3.42	0.80
OS-BP	6a	0.16	1.00	5	3.42	0.53
RW-3	6a	0.10	1.00	5	3.42	0.35
SG1-a	6aa	0.09	1.00	5	3.42	0.31
SG1-b	6ac	0.11	1.00	5	3.42	0.38
OS-SG1	7c	0.27	1.00	5	3.42	0.92
OS-RW2-a	8b	0.65	0.73	5	3.42	1.61
OS-RW2-b	8b	1.29	0.59	5	3.42	2.62
OS-CG	9a	0.24	1.00	5	3.42	0.82
HC-1	South Sys.	0.29	1.00	5	3.42	0.98
OS-HC1	South Sys.	0.31	0.51	5	3.42	0.53
OS-HC2	South Sys.	0.58	0.51	5	3.42	1.00

*Blue highlight indicates watershed for inlet within Caltrans' R/W

3.4 Grate Interception and Gutter Capacity

Grate interception, bypass, and gutter spread calculations were based on formulas and procedures from HEC-22. These calculations can be found in Appendix D. According to Section 1003.1 (16) of the HDM, the drainage design for a bike path should include catch basins and drains, where necessary in such a way that no undue obstacle is presented to bicyclists. There are no specific water spread, by-pass, or depth of flow design criteria provided for bike paths.

Calculations show that the proposed bike path inlets within Caltrans' R/W results in a water spread width of approximately half of the bike path width during the 25-year design storm. This should be sufficient to avoid any undue obstacles for bicyclists.

The remaining roadway inlets within the Caltrans' R/W meet the design requirements of maintaining a water spread width within the shoulder or half outer lane width.

3.5 Hydraulic Grade Line Calculations

Analysis of the hydraulic grade lines for the proposed systems was done using Hydraflow; the Hydraflow outputs are included in Appendix F. A pipe size is assigned for each drainage pipe. For the proposed drainage system that connects the stormwater treatment area to the existing Caltrans system, the minimum size of the proposed system is 18 inches within the Caltrans R/W to meet the Caltrans minimum pipe requirements.

The Hydraflow model includes the existing Caltrans pipe system that extends to the outfall into the Bay. Information for the existing pipe system was obtained from the as-builts listed in Table 1. A detailed drainage report was not available for the existing pipe system; therefore, off-site drainage areas were estimated based on available topography and site assessments. The starting hydraulic grade line at the pipe outfall was set at the MHHW of 6.2 feet which was obtained from the NOAA datum station at Yerba Buena Island.

The results show that the proposed local drainage system will contribute 20.1 cfs at the connection to the existing Caltrans drainage system during the 25-year design storm. The flow rate at the pipe system outfall based on off-site drainage area assumptions is approximately 26.2 cfs.

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4 LOCAL USCG HYDROLOGY AND HYDRAULICS

4.1 Watershed and Basin Characteristics

The only USCG R/W within the Project area is located on the steep sloped hillside east of Hillcrest Avenue and within the Forest Road loop. The hillside area is currently under negotiations to be acquired by TIDA and is considered TIDA R/W for the purpose of this drainage report. The portion of the hillside located within the Forest Road loop will remain USCG R/W. Additional improvements to the Coast Guard driveway located east of Hillcrest Road were also analyzed. Watersheds for the area were delineated based on the most up-to-date topo maps, DTM surfaces, and contract documents for the Forest Road Detour, submitted by BKF, dated March 29, 2018.

Under existing conditions, portions of the hillside runoff flow onto Hillcrest Road while the northern portion of the hillside runoff is collected in an existing concrete channel and conveyed to an existing inlet on the abandoned off-ramp of I-80. That inlet is then conveyed through the temporary construction drainage system that currently connects to the existing Caltrans drainage system.

To separate the future TIDA hillside R/W and the TIDA roadway R/W, a proposed channel along the northwest edge of the Project and proposed retaining wall gutters at the bottom of the hillside will direct runoff into separate pipe systems that connect downstream of the stormwater treatment area. A small portion of the TIDA hillside R/W located south of Forest Road and north of Hillcrest Road will not be separated and will runoff onto Hillcrest Road and enter the roadway drainage system.

Minor roadway work on the Coast Guard driveway located east of Hillcrest Avenue will require the existing inlet to be removed and a new inlet placed upstream and connected to an existing system that discharges to the south. The existing culvert size, material, and condition is unknown at the time of this report.

4.2 Estimating Design Discharge

The design discharge was calculated using the Rational Method for local USCG watersheds. The USCG criteria require that the most stringent criteria be used in analyzing changes to their systems, which is the Caltrans criterion. The discharge calculations and criteria followed the Caltrans criteria and formulas provided in Section 3.3 and Appendix D.

A summary of the peak flows for the 25-year design storm using the Caltrans HDM design standards are shown below in Table 9.

Table 9. Rational Method Peak Flows for USCG Local Areas

Watershed ID	Capture Location ID	Area (ac)	C-value	TOC (min)	I_{25} (in/hr)	Q_{25} (cfs)
OS-F3	1aa	0.82	0.59	5	3.42	1.65
OS-RW2-a	8b	0.65	0.73	5	3.42	1.61
OS-CG	9a	0.24	1.00	5	3.42	0.82

*Orange highlight indicates watersheds that are conveyed to the existing Caltrans system

All but one USCG local areas are conveyed by existing drainage facilities either off-site or towards the hillside area that is to be acquired by TIDA. The only drainage facility to be constructed on USCG property will be the System 9 improvements on the Coast Guard driveway.

4.3 Grate Interception, Culvert Material, and Capacity

Minor roadway work on the Coast Guard driveway located east of Hillcrest Avenue will require the existing inlet to be removed and a new inlet placed upstream and connected to an existing system that discharges to the south. The existing culvert size, material, and condition is unknown.

Grate interception, bypass, and gutter spread calculations were based on formulas and procedures from HEC-22. These calculations can be found in Appendix D. Calculations show that the Coast Guard driveway inlet within USCG's R/W results in a water spread width of approximately 3.9 feet during the 25-year design storm.

The grate inlet and manhole depths will need to be field verified and based on the elevation of the existing culvert.

5 LOCAL TIDA ROADWAY DRAINAGE

On-site roadway drainage analysis includes: calculations of flows over impervious pavement areas, estimations of spread flow widths at proposed inlets, and design of roadway-drainage pipe systems connecting to inlets. Drainage design capacity will follow the procedures in the HDM (2016) and the FHWA Hydraulic Engineering Circular No. 22 (HEC-22) (2001). Capacity analysis for the inlet and pipe systems will be performed using Hydraflow Storm Sewer Extension by Autodesk (Version 10.40).

Drainage watershed maps (including on-site and off-site watersheds) are included in Appendix C of this report.

5.1 Recurrence Interval

The design storm and design spread for the Project were determined using guidelines presented in the design criteria of the *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016). The criteria require the 5-yr design storm to be conveyed within the pipe and the 100-yr design storm depth to not exceed street curb line.

5.2 Time of Concentration

The time of concentration and intensity estimates were made following the procedures in Table 2.1 and 2.3 of the *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016). The minimum time of concentration shall be 5 for streets and paved areas. The time of concentration for open space is 22 minutes.

5.3 Estimating Design Discharge

The design discharge was calculated using the Rational Method (provided in Section 3.3) for on-site and local TIDA watersheds. The discharge calculations for TIDA watersheds used parameters provided in the *Subdivision Regulations for Treasure Island and Yerba Buena Island*

Coefficients for on-site runoff from are found in Table 2.3 of the *Subdivision Regulations for Treasure Island and Yerba Buena Island* and include a C-value of 0.95 for roadways, 0.60 for industrial areas, and 0.30 for open space.

A summary of the peak flows for the 5-year and 100-year design storms calculated using the *Subdivision Regulations for Treasure Island and Yerba Buena Island* design standards is shown below in Table 10.

Table 10. Rational Method Peak Flows for City and County Criteria

Watershed ID	Capture Location ID	Area (ac)	C-value	TOC (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (cfs)	Q_{100} (cfs)
OS-RW7	1a	1.20	0.30	22	1.428	2.69	0.52	0.97
OS-F1	1aa	0.44	0.30	5	3.126	4.92	0.41	0.65
OS-F1-b	1aa	0.03	0.30	5	3.126	4.92	0.03	0.04
OS-F2	1aa	0.72	0.30	22	1.428	2.69	0.31	0.58
OS-F3	1aa	0.82	0.60	5	3.126	4.92	1.55	2.43
BR	1ai	0.52	0.30	5	3.126	4.92	0.49	0.77
BP-a	1ak	0.44	0.95	5	3.126	4.92	1.29	2.03
F-1	2a	0.57	0.95	5	3.126	4.92	1.68	2.65
OS-HC3	2a	0.55	0.30	5	3.126	4.92	0.51	0.81
HC-2	2a	0.28	0.95	5	3.126	4.92	0.84	1.32
HC1-a	2aa	0.30	0.95	5	3.126	4.92	0.88	1.39
HC1-b	2ac	0.16	0.95	5	3.126	4.92	0.47	0.74
RW-5	2ae	0.03	0.95	5	3.126	4.92	0.10	0.16
R2-b	2ag	0.24	0.95	5	3.126	4.92	0.72	1.14
R2-a	2ag	0.19	0.95	5	3.126	4.92	0.57	0.89
R1-a	3a	0.39	0.95	5	3.126	4.92	1.15	1.81
R1-b	3a	0.03	0.95	5	3.126	4.92	0.08	0.13
F-3	4a	0.43	0.95	5	3.126	4.92	1.28	2.01
OS-1	4a	0.18	0.95	5	3.126	4.92	0.52	0.82
R1-c	4aa	0.25	0.95	5	3.126	4.92	0.74	1.17
HC1-c	4ac	0.24	0.95	5	3.126	4.92	0.70	1.11
RW-2	4c	0.24	0.95	5	3.126	4.92	0.70	1.10
OS-BP	6a	0.16	0.95	5	3.126	4.92	0.46	0.73
RW-3	6a	0.10	0.95	5	3.126	4.92	0.30	0.48
SG1-a	6aa	0.09	0.95	5	3.126	4.92	0.27	0.42
SG1-b	6ac	0.11	0.95	5	3.126	4.92	0.33	0.52
OS-SG1	7c	0.27	0.95	5	3.126	4.92	0.80	1.26
OS-RW2-a	8b	0.65	0.60	5	3.126	4.92	1.21	1.90
OS-RW2-b	8b	1.29	0.30	22	1.428	2.69	0.55	1.04
OS-CG	9a	0.24	0.95	5	3.126	4.92	0.71	1.12
HC-1	South Sys.	0.29	0.95	5	3.126	4.92	0.85	1.33
OS-HC1	South Sys.	0.31	0.30	5	3.126	4.92	0.29	0.46
OS-HC2	South Sys.	0.58	0.30	5	3.126	4.92	0.54	0.85

*Blue highlight indicates watershed for inlet within Caltrans' R/W

5.4 Grate Interception and Gutter Capacity

Grate interception, bypass, and gutter spread calculations were based on formulas and procedures from HEC-22. These calculations can be found in Appendix D. According to the *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016), the depth of flow shall remain within the curb during the 100-yr storm event. There are no requirements provided for spread during the 5-yr storm event. At sag locations, a single sag inlet is proposed based on the San Francisco Public Utilities Commission (SFPUC) requesting that no daisy-chained flanking inlets be within the TIDA right-of-way. The calculations were provided upstream of the sag from both flow directions to ensure that flow depths from either direction would not exceed the curb line. Longitudinal slopes and shoulder cross slopes were measured from proposed roadway geometry and digital terrain model (DTM) surfaces, where available.

Additional proposed inlets were included at areas before a super elevation transition, before a bridge approach, and under the I-80 overpass to capture bypass flows that may occur from Macalla Road and Northgate Road. Inlet calculations show that the depth of flow adheres to the local requirements of not exceeding the curb during the 100-yr storm event.

Retaining wall inlets are provided at low points in the retaining wall gutters. These inlets consist of modified boxes that connect to a vertical welded steel pipe and discharge into an inlet or manhole after passing under the retaining wall. The retaining wall inlet 8b requires a vertical drop within a welded steel pipe of 35 feet before crossing under the proposed retaining wall. Maintenance for the pipe behind the wall can be accessed through the manhole 8d. In the chance that the welded steel pipe behind the retaining wall fails, a replacement alternative could consist of a pipe that goes from the bottom of the retaining wall inlet, through the retaining wall at a depth of 4 to 5 feet, and then down the outside face of the retaining wall into the manhole 8d.

Gutter flow calculations for the proposed concrete lined channels are provided in Appendix E.

5.5 Hydraulic Grade Line Calculations

Analysis of the hydraulic grade lines for the proposed systems was conducted using Hydraflow; the Hydraflow outputs are included in Appendix F. A pipe size is assigned for each drainage pipe, with a minimum inner diameter of 8 inches for laterals and 11.1 inches for main lines per the *Subdivision Regulations for Treasure Island and Yerba Buena Island* (2016). For the proposed system that connects to the existing Caltrans system, the size of the proposed system is 24 inches which helps to provide some pipe storage to meet the Caltrans hydraulic gradient requirements.

Table 11. Alternative Pipe Culvert Allowable Material

Designation	RCP	Plastic Pipe	
		HDPE	PVC
10-inch APC	Yes	Yes	No
12-inch APC	Yes	Yes	No
18-inch APC	Yes	Yes	Yes
24-inch APC	Yes	Yes	Yes

The results show that the proposed drainage system meets the local requirements of the 5-yr storm event being contained within the pipe. A few sections of the proposed storm drain section do not meet the minimum velocity requirement of 2 feet per second. This is a result of high hydraulic grade lines at system connections which limit the velocity.

The 5-year design storm flow at the connection to the existing Caltrans system is approximately 7.5 cfs. The 100-year design storm flow at the connection to the existing Caltrans system is approximately 13.7 cfs.

The Hydraflow model includes the existing Caltrans pipe system that extends to the outfall into the Bay. Information for the existing pipe system was obtained from the as-builts listed in Table 1. A detailed drainage report was not available for the existing pipe system; therefore, off-site drainage areas were estimated based on available topography and site assessments. The starting hydraulic grade line at the pipe outfall was set at the MHHW of 6.2 feet which was obtained from the NOAA datum station at Yerba Buena Island.

5.6 Temporary Drainage Systems

The construction staging for the Project will take place in large sections. A drainage outfall will constantly be provided during construction therefore it is not anticipated that temporary drainage will be required and no temporary drainage is included in the cost estimate. The contractor will be required to submit sub-staging plans for drainage as necessary.

5.7 Stormwater Best Management Practices

The Project disturbs more than one acre of soil and therefore, a SWPPP must be prepared by the Contractor and approved by the Caltrans Resident Engineer and TIDA prior to the start of construction. The SWPPP includes the development of a Construction Site Monitoring Program that documents procedures and methods related to the visual monitoring and sampling and analysis plans for non-visible pollutants, sediment, and turbidity.

Permanent BMPs are strategies and measures to minimize and avoid water quality impacts in the post construction condition. Permanent BMPs include design pollution prevention (DPP) and treatment BMP strategies.

Discussion of the temporary construction-site, design pollution prevention, and stormwater treatment BMPs are found in the Stormwater Data Report (SWDR, WRECO 2018). In relation to drainage features, permanent treatment BMPS will include biofiltration in areas of proposed depressed concentrated flow conveyances.

6 COST ESTIMATE

Based on quantities and price information obtained from the Caltrans Cost Data website, the estimated cost for the drainage portion of the Project is $1,623,000.

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7 REFERENCES

Autodesk. (2017). *Hydraflow Storm Sewers*. Software.

California Department of Transportation. (2016). *Highway Design Manual, Sixth Edition*.

California Department of Transportation. Caltrans Water Quality Planning Tool. <http://svctenvims.dot.ca.gov/wqpt/wqpt.aspx > (Last Accessed: April 2018)

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National Oceanic and Atmospheric Administration. Precipitation Frequency Data Server. <http://hdsc.nws.noaa.gov/hdsc/pfds/> (Last Accessed: November 2017).

WRECO. (2018). *Storm Water Data Report*.

Department of Public Works City and County of San Francisco. (2016). *Subdivision Regulations for Treasure Island and Yerba Buena Island*

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Appendix A Drainage Plans

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0	77	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

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TRANSPORTATION AUTHORITY
1455 MARKET St, Ste 2200
SAN FRANCISCO, CA 94103

NOTES:

1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
2. STATION & OFFSET TIES TO DRAINAGE STRUCTURES ARE MEASURED PER DETAILS ON SHEET DD-1.
3. FOR FINISHED GRADE ELEVATIONS, SEE PROFILES AND CONSTRUCTION DETAILS SHEETS.
4. LOCATIONS OF EXISTING DRAINAGE FACILITIES ARE APPROXIMATE. FIELD VERIFY LOCATION AND ELEVATION OF EXISTING DRAINAGE FACILITIES BEFORE MODIFYING.
5. UNLESS NOTED OTHERWISE, STANDARD INLET DEPRESSIONS, PER STANDARD PLAN D78B, MUST BE PROVIDED FOR ALL INLETS. INLET DEPRESSIONS MUST BE CONSTRUCTED OF 8" THICK PORTLAND CEMENT CONCRETE. ASPHALT INLET DEPRESSIONS ARE NOT ALLOWED. WHERE LOCATED WITHIN ASPHALT SHOULDERS, ISOLATION JOINTS ARE NOT REQUIRED.

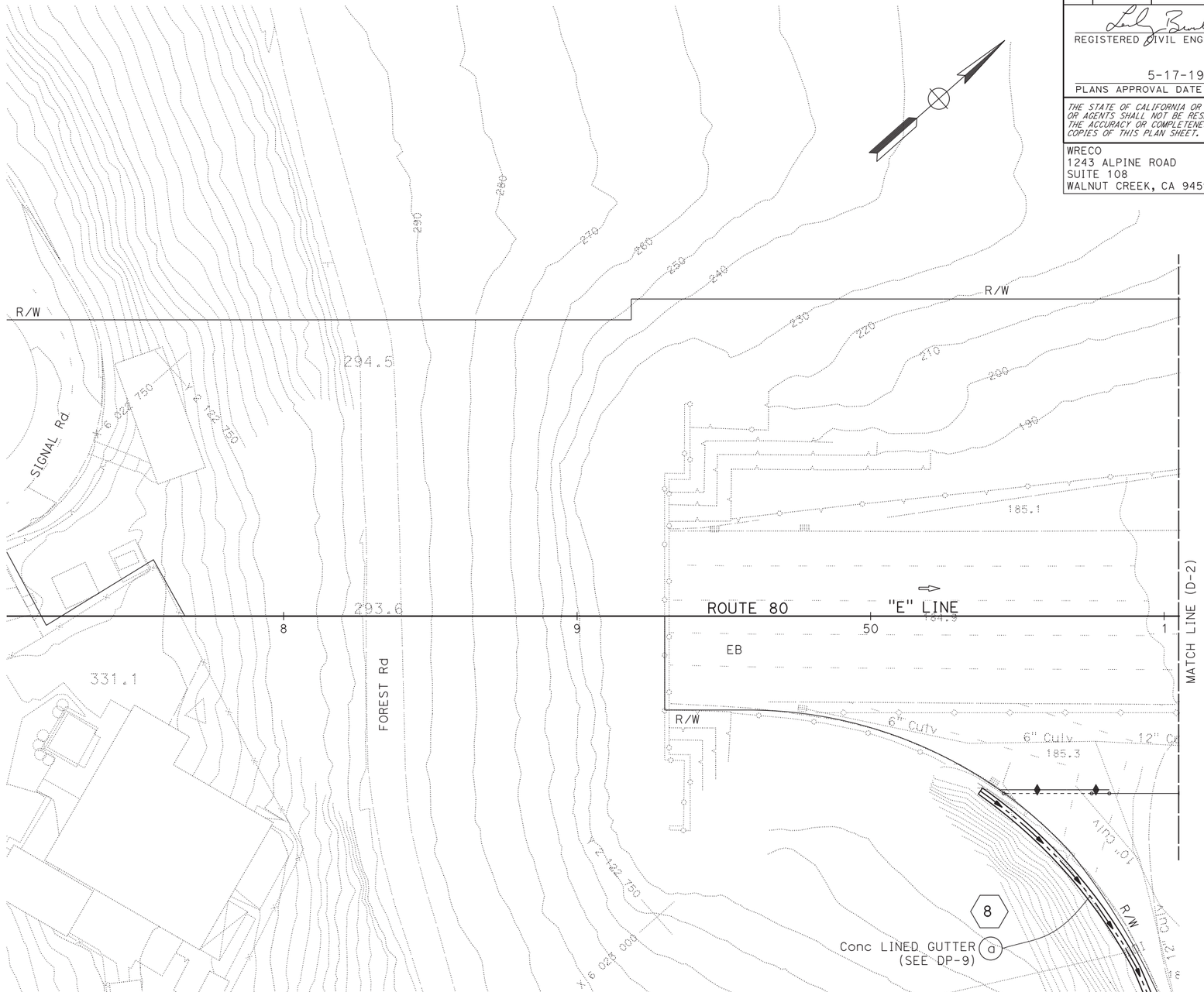
LEGEND:

AFES

ROCK SLOPE PROTECTION

ABBREVIATIONS:

BOW BOTTOM OF WALL



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DRAINAGE PLAN

SCALE: 1" = 20'

D-1

	REVISED BY	DATE REVISED
	LB	5-17-19
	LB	2-18-19
	LB	11-12-18

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UNIT 0728
PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0	78	436

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LB	2-18-19
LB	5-17-19

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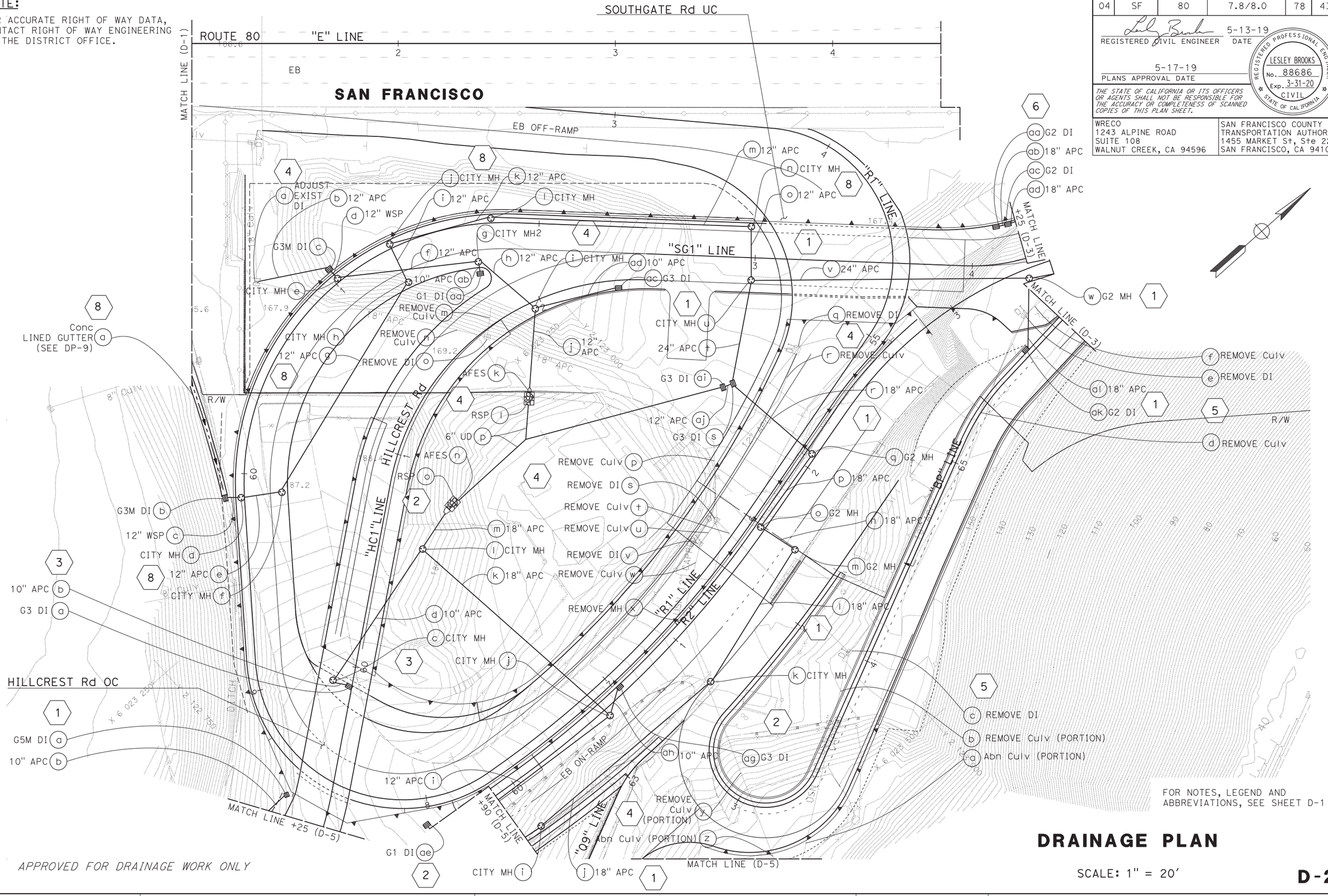

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DRAINAGE PLAN

SCALE: 1" = 20'

D-2

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UNIT 0728
PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0	79	436

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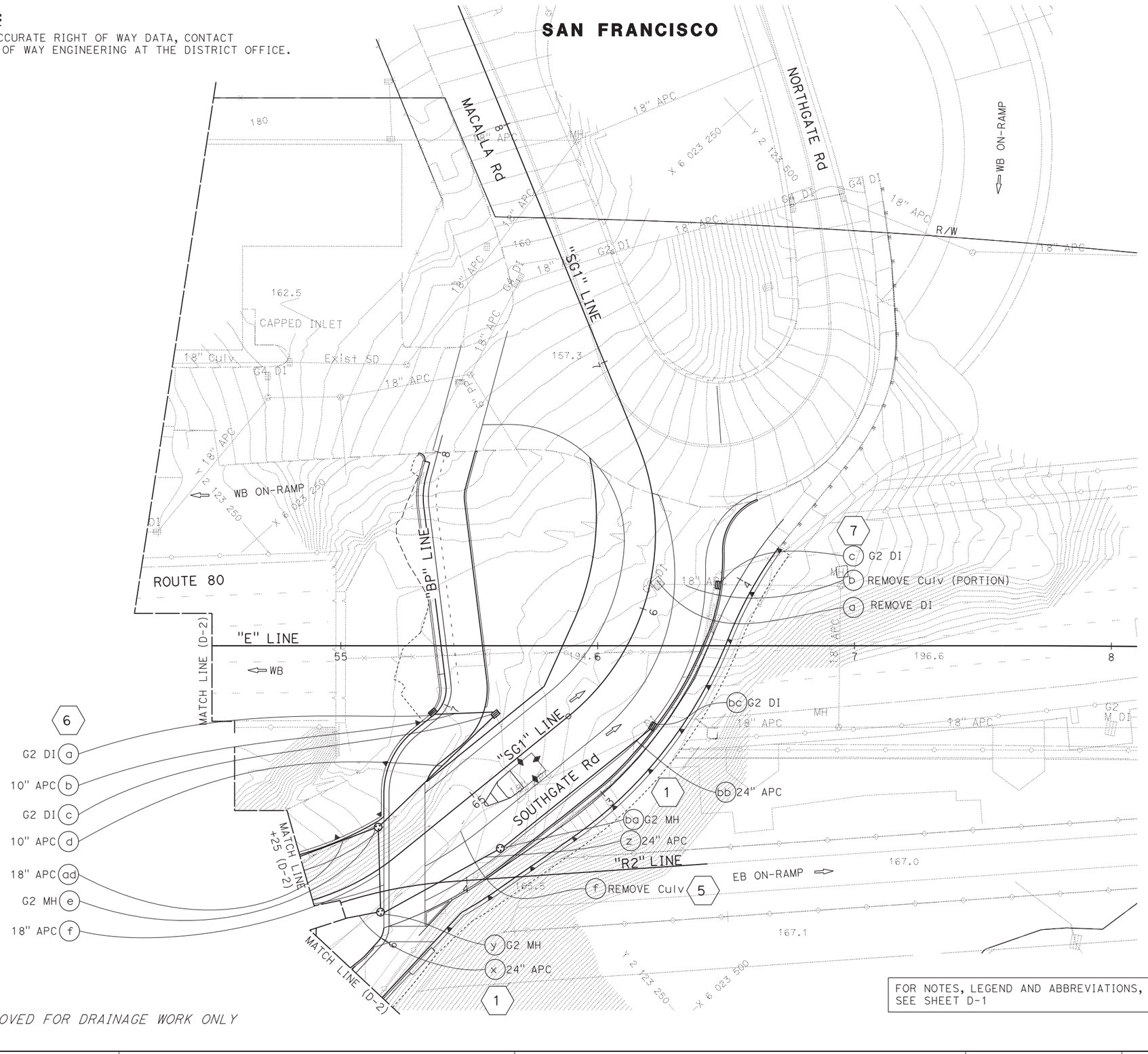

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET D-1

DRAINAGE PLAN

SCALE: 1" = 20'

D-3

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LB	5-17-19

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UNIT 0728
PROJECT NUMBER & PHASE 04000205071

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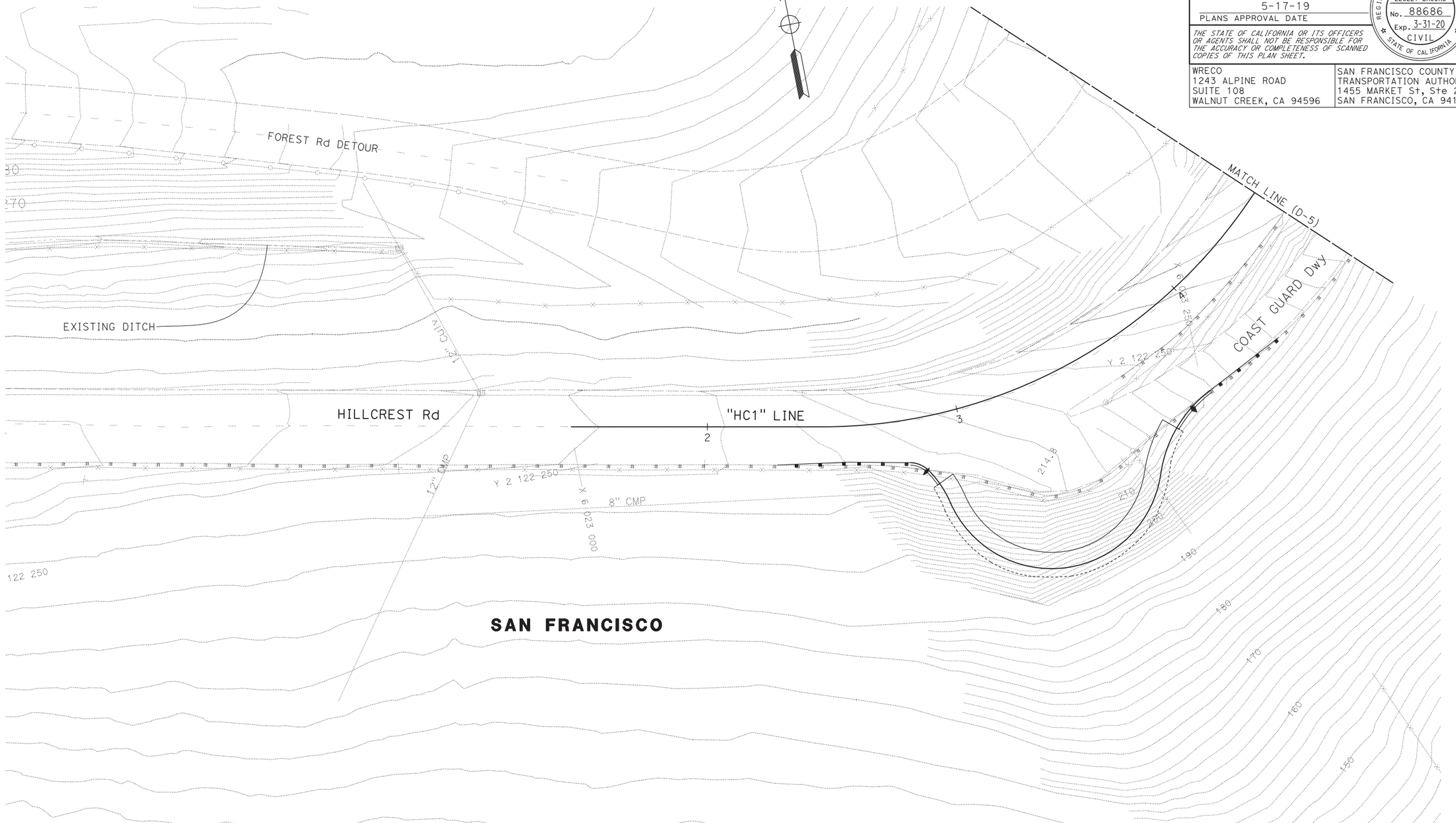

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DRAINAGE PLAN

SCALE: 1" = 20'

D-4

LB	LB	LB
5-17-19	2-18-19	11-12-18

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UNIT 0728

PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0	81	436

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PLANS APPROVAL DATE — 5-17-19

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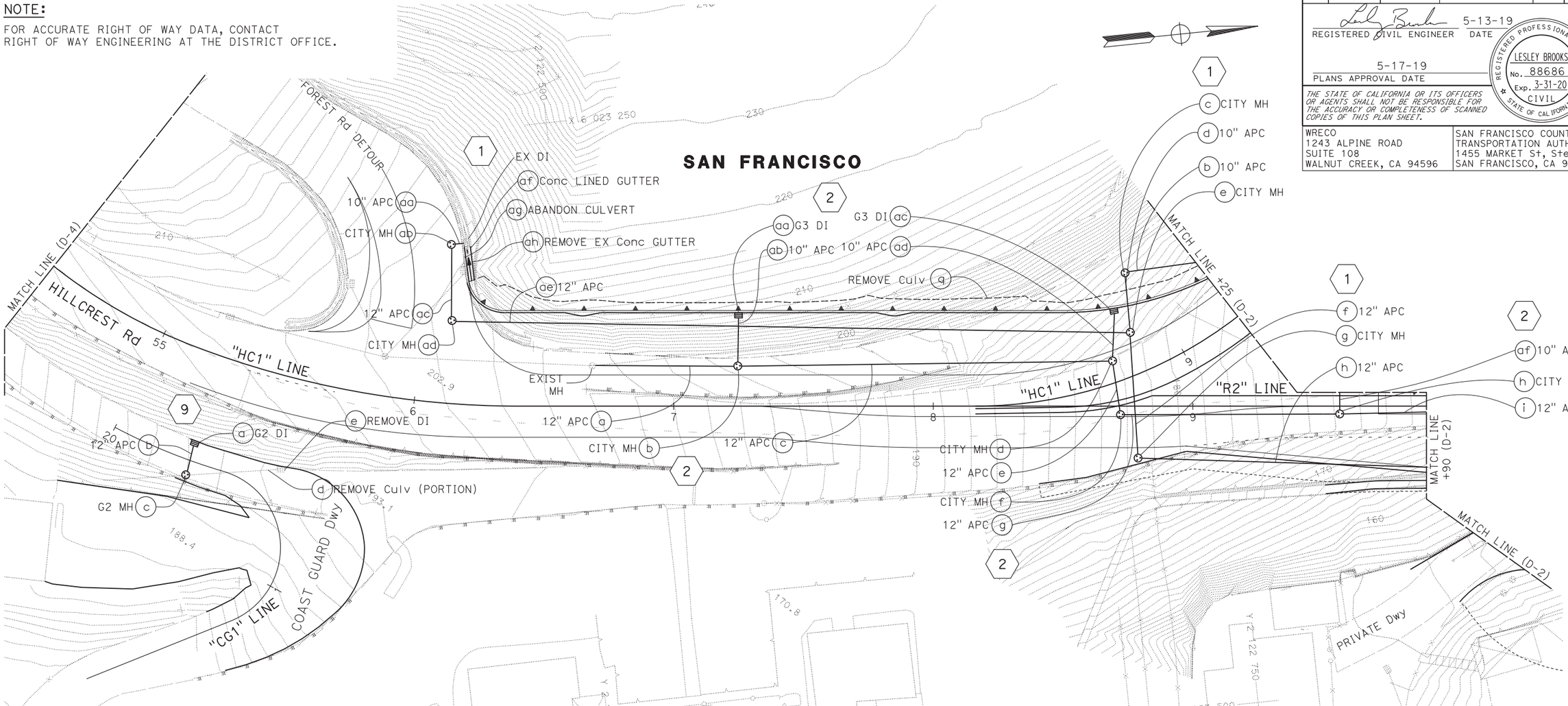

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DRAINAGE PLAN

SCALE: 1" = 20'

D-5

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LB	2-18-19
LB	5-17-19

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UNIT 0728
PROJECT NUMBER & PHASE 04000205071

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
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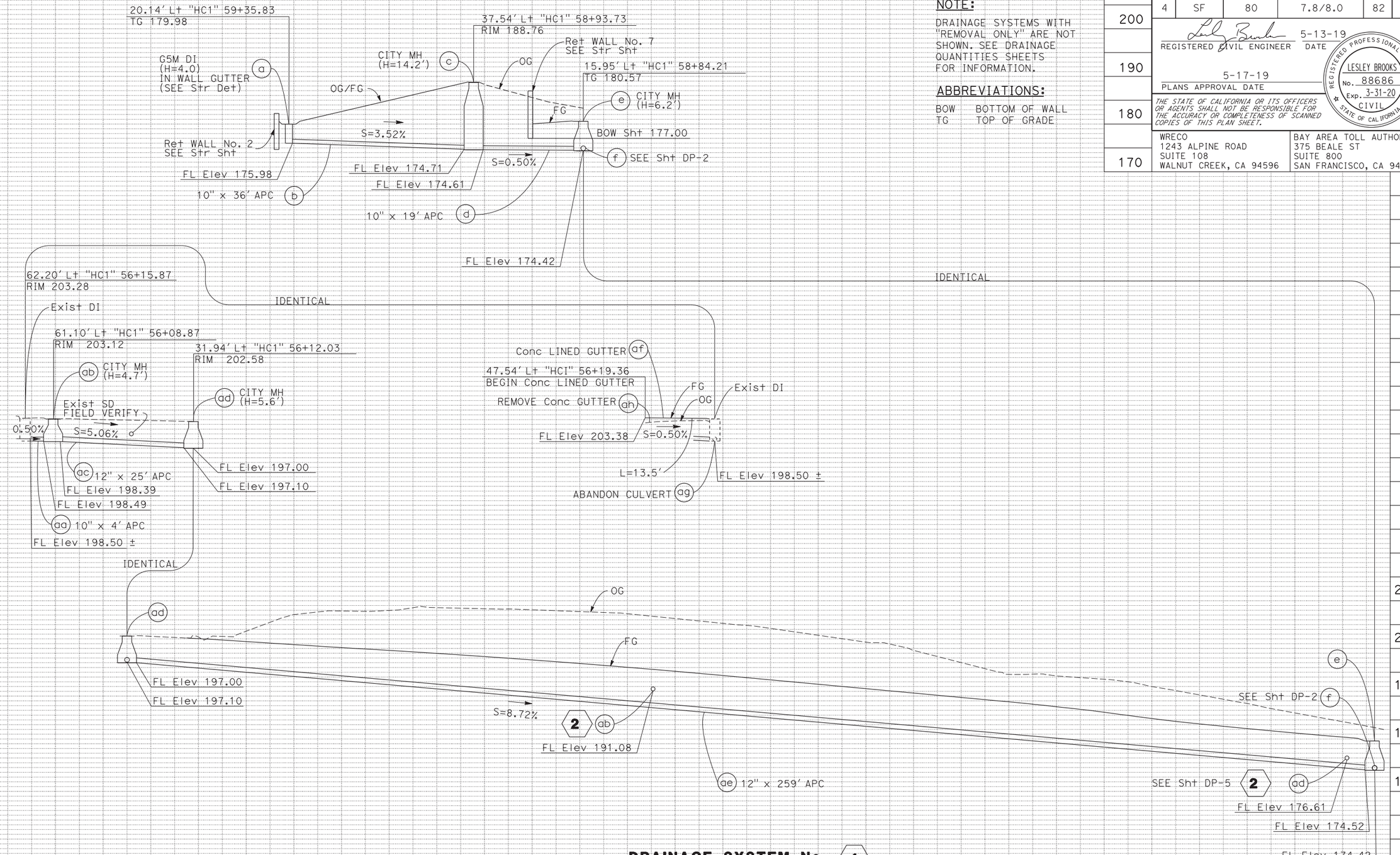
NOTE:

DRAINAGE SYSTEMS WITH "REMOVAL ONLY" ARE NOT SHOWN. SEE DRAINAGE QUANTITIES SHEETS FOR INFORMATION.

ABBREVIATIONS:

BOW BOTTOM OF WALL
TG TOP OF GRADE



DRAINAGE SYSTEM No. 1

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP-1

REVISED BY	DATE REVISED
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LB	2-18-19
LB	11-12-18

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	83	436

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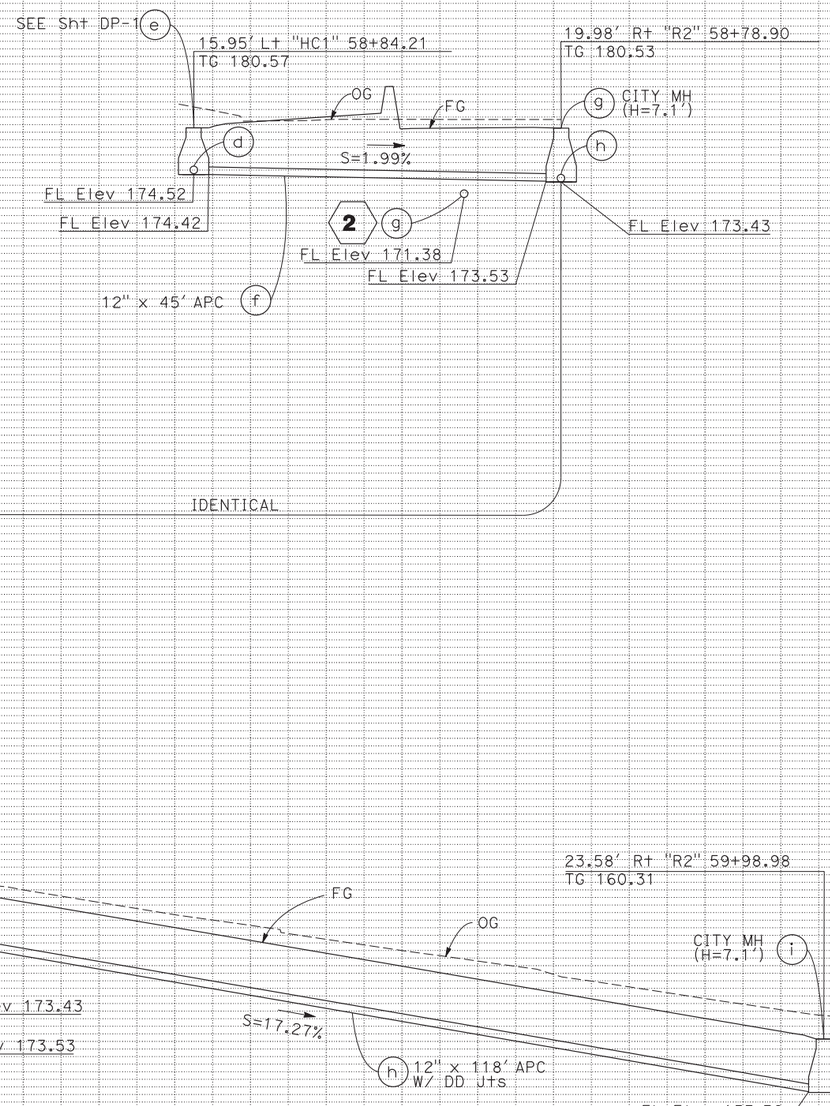

DRAINAGE SYSTEM No. 1

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DP- 2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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REVISED BY	DATE REVISED
LB	11-12-18
LB	2-18-19
LB	5-17-19

LAST REVISION DATE PLOTTED => 16-JUL-2019
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	84	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

PLANS APPROVAL DATE — 5-17-19

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375 BEALE ST
SUITE 800
SAN FRANCISCO, CA 94105

REVISED BY	DATE REVISED
LB	11-12-18
LB	2-18-19
LB	5-17-19

LESLEY BROOKS
ANALETTE OCHOA

CALCULATED-DESIGNED BY
CHECKED BY

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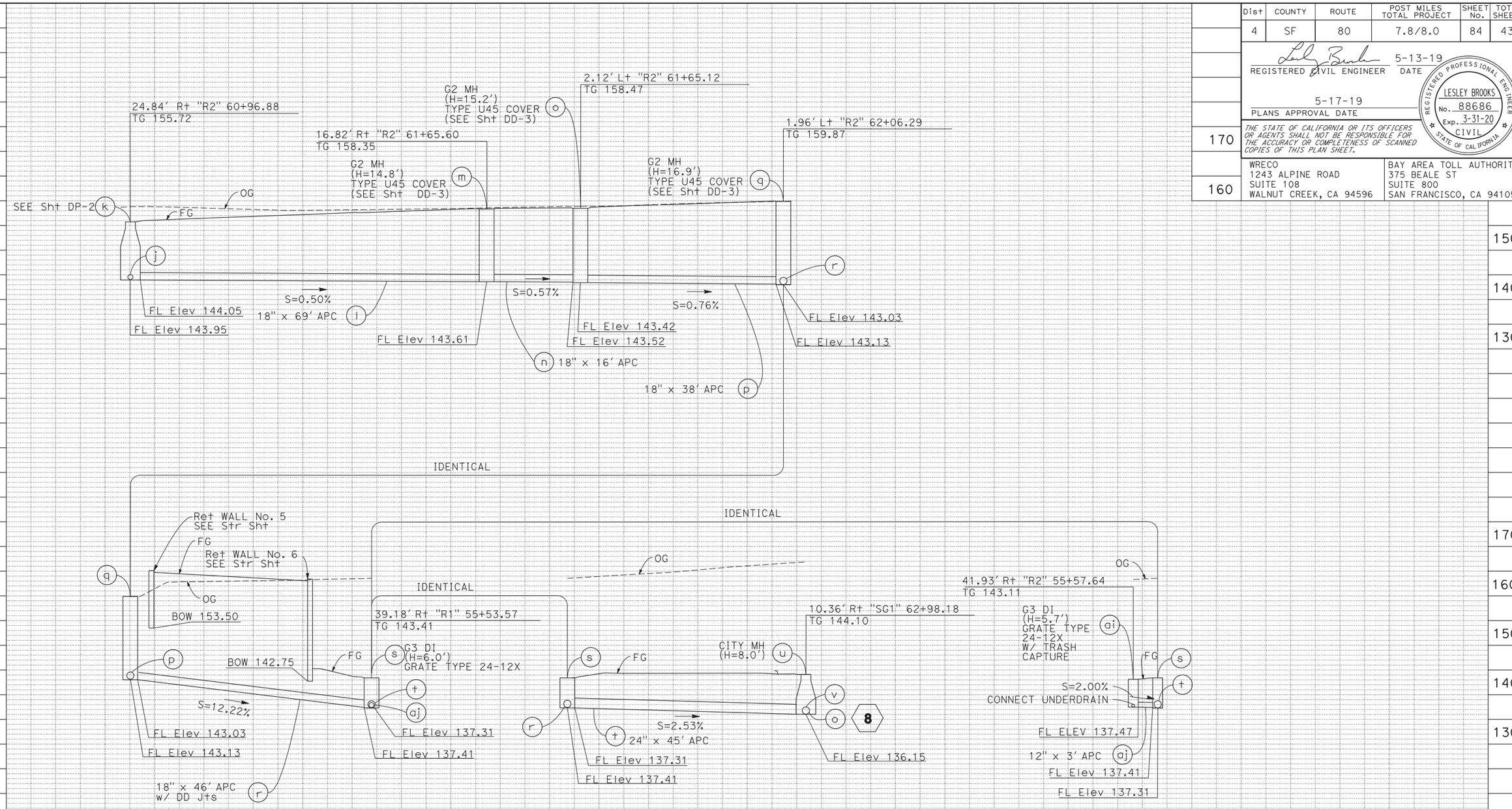

DRAINAGE SYSTEM No. 1

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 3

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UNIT 0728

PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	85	436

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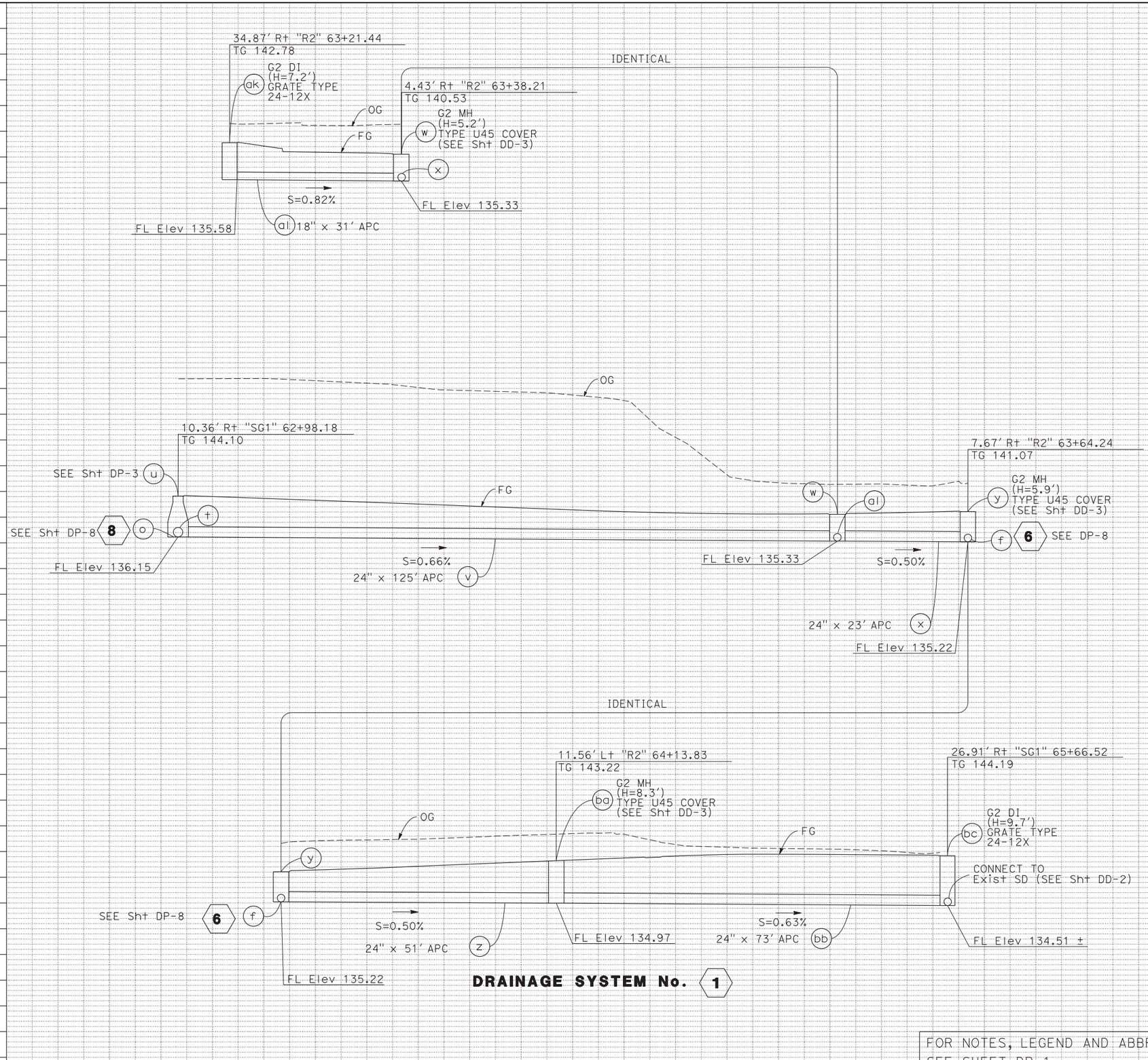
SUITE 800
SAN FRANCISCO, CA 94105



DRAINAGE SYSTEM No. 1

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 4

LB 5-17-19 — LB 2-18-19 — LB 11-12-18 — REVISED BY — DATE REVISED

LESLEY BROOKS — ANALETTE OCHOA — CALCULATED-DESIGNED BY — CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: HAN-BIN LIANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans®

LAST REVISION 00-00-00 — DATE PLOTTED => 16-JUL-2019 — TIME PLOTTED => 10:25

BORDER LAST REVISED 7/2/2010 — USERNAME => Peter_Bonneau — DGN FILE => 0400020507ib004.dgn — RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 — UNIT 0728 — PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	86	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

5-17-19
PLANS APPROVAL DATE

LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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WALNUT CREEK, CA 94596

BAY AREA TOLL AUTHORITY
375 BEALE ST
SUITE 800
SAN FRANCISCO, CA 94105

4.07' Lt "R2" 60+66.35
TG 154.19

(ag) G3 DI (H=6.0')
GRATE TYPE 24-12X

3.56' Rt "R2" 60+54.15
RIM 154.71

OG

FG

(j) CITY MH (H=12.3')

8.90%

FL Elev 147.30

FL Elev 147.30

FL Elev 142.39

(k) SEE Sht DP-6

FL Elev 148.19

10" x 10' APC (ah)

S=13.91%

12" x 96' APC
W/ DD Jts (i)

FL Elev 160.50

3.00' Rt "R2" 59+56.58
RIM 167.28

CITY MH (H=6.8') (h)

7.55' Lt "R2" 59+56.54
TG 168.00

(ae) G1 DI (H=6.0')
GRATE TYPE 24-12X

S=15.56%

(g)

FL Elev 162.00

FL Elev 160.50

(af) 10" x 9' APC

FL Elev 160.60

IDENTICAL

CITY MH (H=9.4') (f)

3.29' Rt "R2" 58+72.13
RIM 181.33

IDENTICAL

(e)

OG

FG

(h)

(i)

S=13.87%

FL Elev 160.60

FL Elev 160.50

12" x 83' APC
W/ DD Jts (g)

1 (f)

FL Elev 173.80

FL Elev 172.04

FL Elev 171.94

(d)

IDENTICAL

(f)

OG

FG

(c)

S=26.92%

(g)

FL Elev 176.32

FL Elev 176.22

FL Elev 172.04

FL Elev 171.94

(e) 12" x 17' APC
W/ DD JTS

8.25' Lt "HC1" 58+72.92
RIM 182.12

(d) CITY MH (H=5.9')

(ad)

OG

FG

S=10.39%

FL Elev 176.32

FL Elev 176.32

FL Elev 176.22

12" x 142' APC (c)

A

A

IDENTICAL

15.47' Lt "HC1" 57+24.71
RIM 195.62

CITY MH (H=4.7') (b)

FG

OG

(ab)

S=10.38%

FL Elev 191.00

S=10.39%

12" x 54' APC
w/ DD Jts (a)

12" x 142' APC
w/ DD Jts (c)

FL Elev 190.90

15.55' Lt "HC1" 56+68.64
RIM 200.54

Exist MH

FL Elev 196.50 ±

CONNECT TO Exist MH (SEE Sht DD-2)

FL Elev 190.90

FL Elev 191.00

10" x 17' APC (ab)

OG

36.00' Lt "HC1" 57+24.92
RIM 195.34

(aa) G3 DI (H=4.3')
GRATE TYPE 24-12X

FG

(b)

(c)

S=0.51%

FL Elev 191.10

(ae) 1

FL Elev 187.53

IDENTICAL

26.97' Lt "HC1" 58+81.27
TG 180.65

(ac) G3 DI (H=4.0')
GRATE TYPE 24-12X

OG

CITY MH (d)

FG

(c)

S=2.05%

FL Elev 176.65

(ae) 1

FL Elev 174.88

FL Elev 176.22

FL Elev 176.32

10" x 16' APC (ad)

DRAINAGE SYSTEM No. 2

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 5

REVISED BY	DATE REVISED
LB	5-17-19
LB	2-18-19
LB	11-12-18

LESLEY BROOKS — ANALETTE OCHOA

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR — HAN-BIN LIANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION — DATE PLOTTED => 16-JUL-2019
00-00-00 — TIME PLOTTED => 10:25

BORDER LAST REVISED 7/2/2010 | USERNAME => Peter_Bonneau | DGN FILE => 0400020507ib005.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0728 | PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	87	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

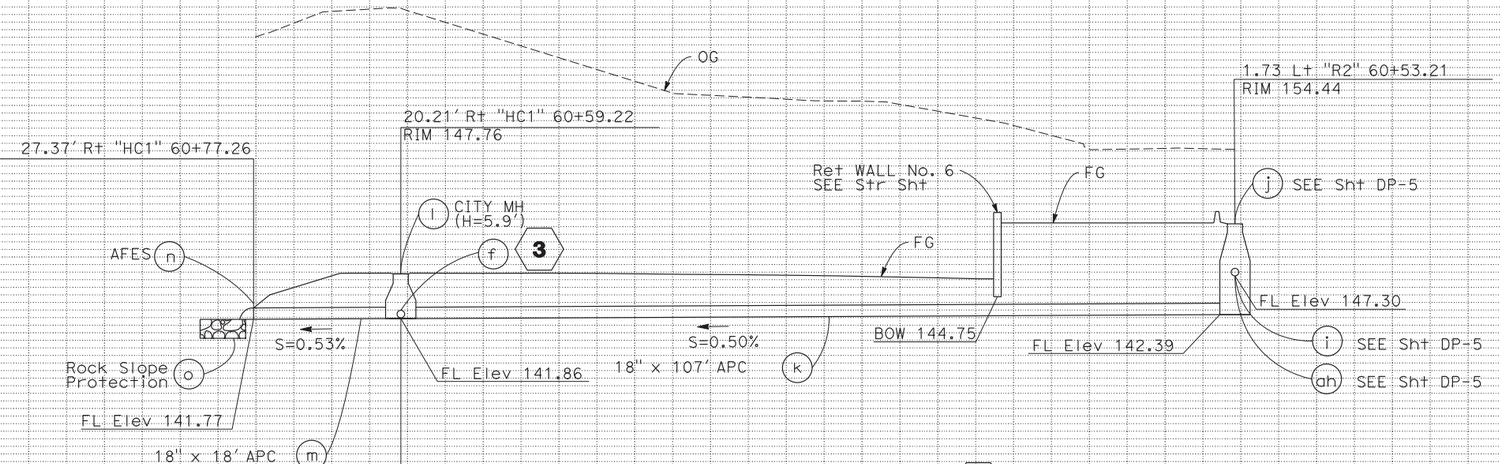
LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

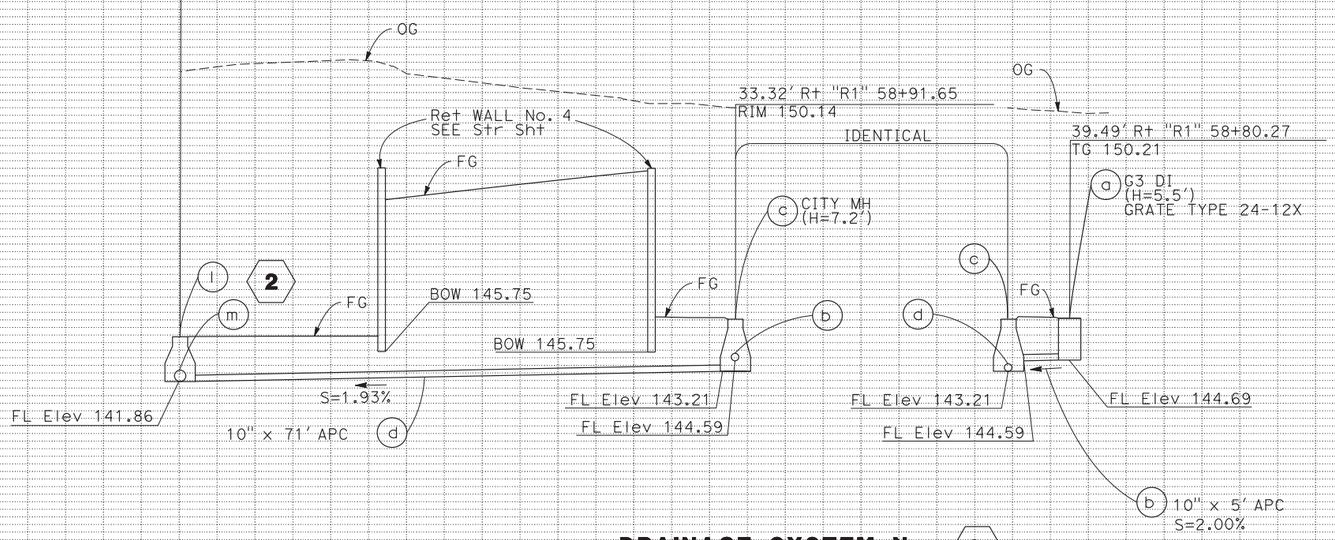
WRECO
1243 ALPINE ROAD
SUITE 108
WALNUT CREEK, CA 94596

BAY AREA TOLL AUTHORITY
375 BEALE ST
SUITE 800
SAN FRANCISCO, CA 94105



DRAINAGE SYSTEM No. 2

IDENTICAL



DRAINAGE SYSTEM No. 3

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 6

LAST REVISION 00-00-00 | DATE PLOTTED => 16-JUL-2019 | TIME PLOTTED => 10:26

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: HAN-BIN LIANG

CALCULATED-DESIGNED BY: LESLEY BROOKS
CHECKED BY: ANALETTE OCHOA

DATE REVISED	REVISED BY
11-12-18	LB
2-18-19	LB
5-17-19	LB

BORDER LAST REVISED 7/2/2010 | USERNAME => Peter_Bonneau | DGN FILE => 04000205071b006.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0728 | PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	88	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

REGISTERED PROFESSIONAL ENGINEER — LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

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WALNUT CREEK, CA 94596

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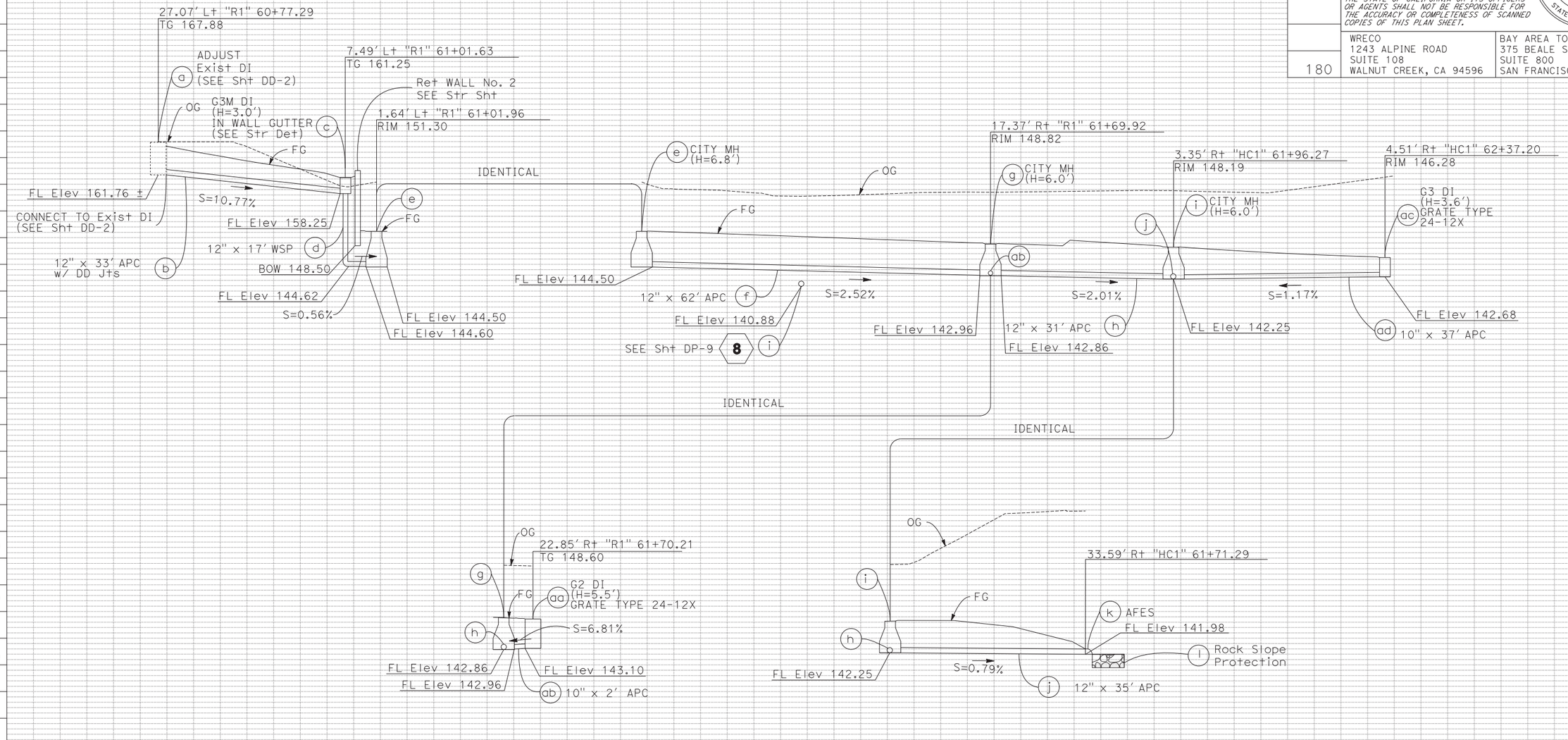
375 BEALE ST
SUITE 800
SAN FRANCISCO, CA 94105



DRAINAGE SYSTEM No. 4

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 7

REVISED BY	DATE REVISED
LB	5-17-19
LB	2-18-19
LB	11-12-18

LESLEY BROOKS — CALCULATED-DESIGNED BY
ANALETTE OCHOA — CHECKED BY
HAN-BIN LIANG — CONSULTANT FUNCTIONAL SUPERVISOR
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

LAST REVISION 00-00-00 DATE PLOTTED => 16-JUL-2019 TIME PLOTTED => 10:25

BORDER LAST REVISED 7/2/2010 | USERNAME => Peter_Bonneau | DGN FILE => 0400020507ib007.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0728 | PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	89	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

WRECO
1243 ALPINE ROAD
SUITE 108
WALNUT CREEK, CA 94596

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375 BEALE ST
SUITE 800
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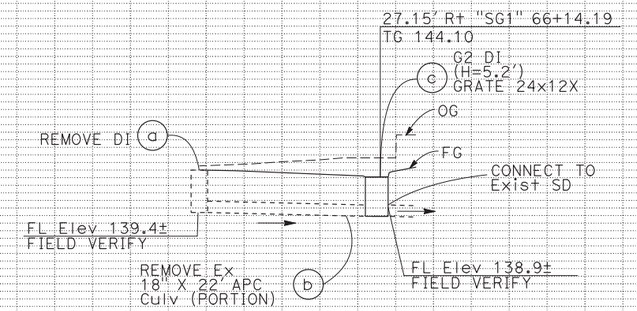
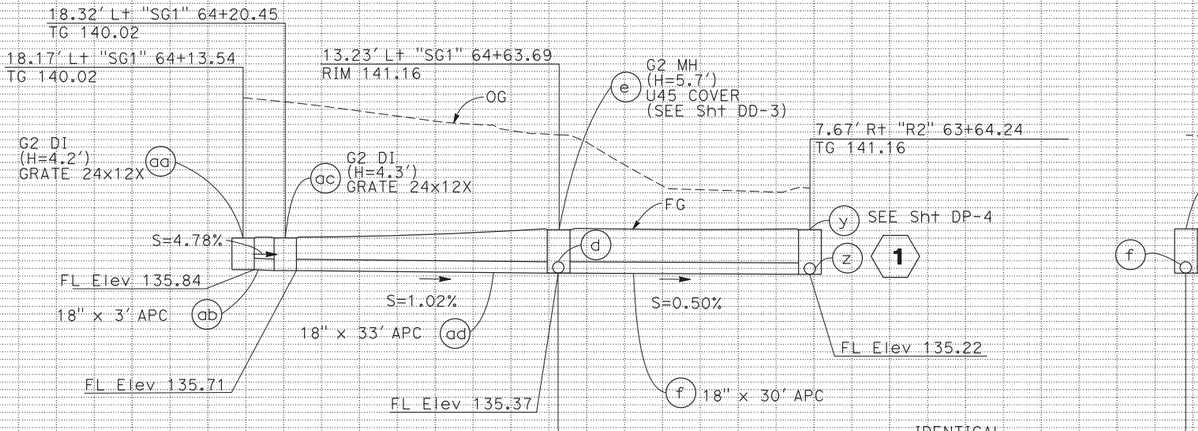
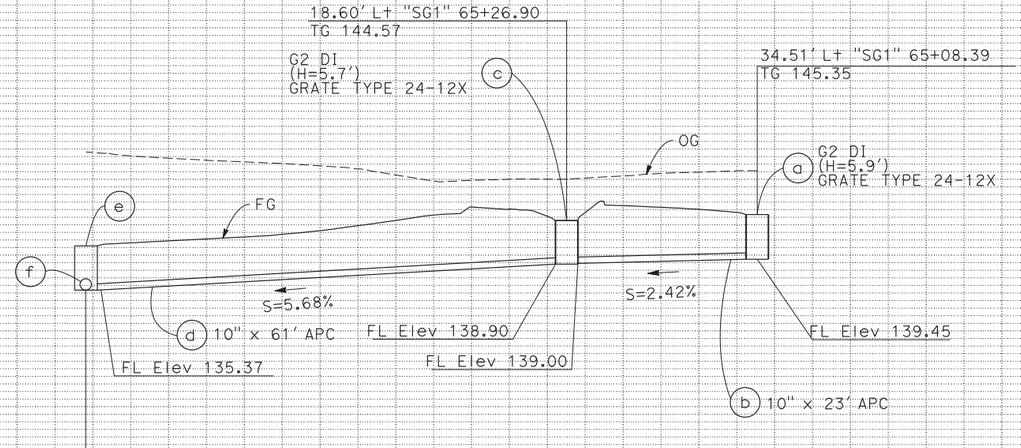


DRAINAGE SYSTEM No. 7



DRAINAGE SYSTEM No. 6



FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 8

REVISED BY	DATE REVISED
LB	5-17-19
LB	2-18-19
LB	11-12-18

LESLEY BROOKS — CALCULATED-DESIGNED BY
ANALETTE OCHOA — CHECKED BY
HAN-BIN LIANG — CONSULTANT FUNCTIONAL SUPERVISOR
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

LAST REVISION DATE PLOTTED => 16-JUL-2019
00-00-00 TIME PLOTTED => 10:26

BORDER LAST REVISED 7/2/2010 | USERNAME => Peter_Bonneau | DGN FILE => 0400020507ib008.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0728 | PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
4	SF	80	7.8/8.0	90	436

REGISTERED CIVIL ENGINEER — 5-13-19 DATE

LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

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WALNUT CREEK, CA 94596

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375 BEALE ST
SUITE 800
SAN FRANCISCO, CA 94105

59.60' Rt "E" 50+37.41
BEGIN Conc LINED GUTTER

8.83' Lt "R1" 59+89.21
END Conc LINED GUTTER

(a) Conc LINED GUTTER

(b) G3M DI (H=3.0')
IN WALL GUTTER
(SEE Str Det)

FG

OG

FL Elev 186.00

S=1.00%

L=173'

Exist 12" CULV TO BE FIELD VERIFIED

FL Elev 184.14

FL Elev 181.14

IDENTICAL

(b) G3M DI (H=3.0')
IN WALL GUTTER
(SEE Str Det)

OG

FL Elev 184.14

FL Elev 181.14

1.50' Lt "R1" 59+89.02
RIM 151.69

(d) CITY MH (H=5.9')

17.31' Rt "R1" 59+90.70
RIM 150.92

(f) CITY MH (H=5.9')

FG

12" x 41' WSP (c)

BOW 149.50

S=1.03%

S=4.14%

FL Elev 145.08

FL Elev 145.18

S=3.69%

(g) 12" x 110' APC

FL Elev 145.94

FL Elev 145.89

FL Elev 145.79

(e) 12" x 15' APC

17.48' Rt "R1" 61+30.62
RIM 149.94

OG

2.06' Lt "R1" 61+30.32
RIM 150.63

CITY MH (H=9.0') (h)

FG

(j) CITY MH (H=9.9')

S=0.50%

(k)

FL Elev 141.04

FL Elev 140.94

FL Elev 143.71

FL Elev 140.73

SEE Sht DP-7 4 (f)

12" x 16' APC (i)

FL Elev 140.83

IDENTICAL

2.05' Lt "R1" 61+77.86
RIM 149.32

OG

(j)

(i) CITY MH (H=8.9')

FG

(i)

S=0.47%

FL Elev 140.52

FL Elev 140.42

FL Elev 140.73

(k) 12" x 45' APC

S=2.45%

(m) 12" x 117' APC

14.30' Lt "SG1" 62+97.71
RIM 144.45

CITY MH (H=7.0') (n)

10.36' Rt "SG1" 62+98.18
TG 144.10

(u) CITY MH (H=8.1')

1

(v)

FL Elev 137.55

FL Elev 137.45

S=6.19%

FL Elev 136.05

FL Elev 136.15

12" x 21' APC (o)

DRAINAGE SYSTEM No. 8

5.76' Rt "CG1" 1+68.07
RIM 195.75

6.83' Rt "CG1" 1+68.93
RIM 195.97

G2 MH
(H=FIELD VERIFY)
TYPE U45 COVER
(SEE Sht DD-3) (c)

OG

(a) G2 DI (H=3.9')
GRATE TYPE 24-12X

S= 0.50%

FL Elev 192.07

CONNECT TO
Exist SD (FIELD VERIFY)

(b) 12" x 10' APC

DRAINAGE SYSTEM No. 9

FOR NOTES, LEGEND AND ABBREVIATIONS, SEE SHEET DP-1.

DRAINAGE PROFILES

SCALE: HORIZ 1" = 10'
VERT 1" = 10'

DP- 9

LAST REVISION 00-00-00 | DATE PLOTTED => 16-JUL-2019 | TIME PLOTTED => 10:26

REVISED BY	DATE REVISED
LB	11-12-18
LB	2-18-19
LB	5-17-19

LESLEY BROOKS — ANALETTE OCHOA

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR — HAN-BIN LIANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

BORDER LAST REVISED 7/2/2010

USERNAME => Peter_Bonneau
DGN FILE => 04000205071b009.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0728

PROJECT NUMBER & PHASE 04000205071

Appendix B Precipitation Intensity

Appendix B.1 NOAA Precipitation Intensity

Appendix B.2 City and County of San Francisco Precipitation Intensity

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NOAA Atlas 14, Volume 6, Version 2
Location name: San Francisco, California, USA*
Latitude: 37.8103°, Longitude: -122.3672°
Elevation: 287.99 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.56** (1.39-1.76)	**1.93** (1.73-2.20)	**2.44** (2.16-2.77)	**2.84** (2.51-3.28)	**3.42** (2.89-4.10)	**3.88** (3.18-4.76)	**4.34** (3.47-5.50)	**4.82** (3.72-6.32)	**5.50** (4.04-7.56)	**6.04** (4.25-8.64)
10-min	**1.12** (0.996-1.27)	**1.39** (1.24-1.57)	**1.75** (1.55-1.99)	**2.04** (1.79-2.35)	**2.45** (2.07-2.94)	**2.78** (2.28-3.41)	**3.11** (2.48-3.94)	**3.46** (2.67-4.53)	**3.94** (2.90-5.42)	**4.32** (3.05-6.19)
15-min	**0.904** (0.804-1.02)	**1.12** (0.996-1.27)	**1.41** (1.25-1.60)	**1.65** (1.45-1.89)	**1.98** (1.67-2.37)	**2.24** (1.84-2.75)	**2.51** (2.00-3.17)	**2.79** (2.15-3.65)	**3.18** (2.34-4.37)	**3.48** (2.46-4.99)
30-min	**0.620** (0.552-0.702)	**0.768** (0.684-0.872)	**0.968** (0.858-1.10)	**1.13** (0.994-1.30)	**1.36** (1.15-1.63)	**1.54** (1.26-1.89)	**1.72** (1.38-2.18)	**1.92** (1.48-2.51)	**2.18** (1.60-3.00)	**2.40** (1.69-3.43)
60-min	**0.439** (0.391-0.497)	**0.544** (0.484-0.617)	**0.685** (0.607-0.780)	**0.801** (0.703-0.921)	**0.962** (0.811-1.15)	**1.09** (0.895-1.34)	**1.22** (0.973-1.54)	**1.36** (1.05-1.78)	**1.55** (1.14-2.13)	**1.70** (1.20-2.43)
2-hr	**0.315** (0.281-0.357)	**0.388** (0.345-0.440)	**0.485** (0.430-0.552)	**0.566** (0.496-0.650)	**0.678** (0.571-0.812)	**0.766** (0.629-0.940)	**0.856** (0.684-1.08)	**0.952** (0.734-1.25)	**1.08** (0.795-1.49)	**1.19** (0.836-1.70)
3-hr	**0.261** (0.233-0.296)	**0.321** (0.286-0.365)	**0.402** (0.356-0.458)	**0.469** (0.411-0.539)	**0.561** (0.473-0.672)	**0.634** (0.521-0.779)	**0.710** (0.566-0.898)	**0.789** (0.609-1.03)	**0.898** (0.660-1.24)	**0.985** (0.694-1.41)
6-hr	**0.181** (0.162-0.206)	**0.224** (0.199-0.254)	**0.281** (0.249-0.320)	**0.328** (0.288-0.378)	**0.394** (0.332-0.472)	**0.446** (0.367-0.549)	**0.500** (0.399-0.633)	**0.557** (0.430-0.729)	**0.636** (0.467-0.875)	**0.699** (0.493-1.00)
12-hr	**0.117** (0.104-0.132)	**0.146** (0.130-0.166)	**0.186** (0.165-0.212)	**0.220** (0.193-0.253)	**0.267** (0.225-0.320)	**0.304** (0.250-0.374)	**0.343** (0.274-0.434)	**0.384** (0.296-0.502)	**0.441** (0.324-0.607)	**0.487** (0.343-0.698)
24-hr	**0.076** (0.069-0.086)	**0.097** (0.087-0.110)	**0.125** (0.112-0.142)	**0.149** (0.133-0.170)	**0.182** (0.157-0.214)	**0.208** (0.177-0.250)	**0.236** (0.196-0.290)	**0.265** (0.214-0.334)	**0.306** (0.238-0.401)	**0.339** (0.256-0.458)
2-day	**0.048** (0.043-0.054)	**0.061** (0.055-0.069)	**0.078** (0.070-0.089)	**0.092** (0.082-0.106)	**0.112** (0.097-0.133)	**0.128** (0.109-0.154)	**0.145** (0.120-0.178)	**0.163** (0.132-0.205)	**0.187** (0.146-0.245)	**0.207** (0.156-0.280)
3-day	**0.037** (0.033-0.041)	**0.046** (0.041-0.052)	**0.059** (0.053-0.067)	**0.069** (0.062-0.079)	**0.084** (0.073-0.099)	**0.096** (0.081-0.115)	**0.108** (0.090-0.133)	**0.121** (0.098-0.152)	**0.138** (0.108-0.181)	**0.153** (0.115-0.206)
4-day	**0.030** (0.027-0.034)	**0.038** (0.034-0.043)	**0.049** (0.044-0.055)	**0.057** (0.051-0.066)	**0.069** (0.060-0.082)	**0.079** (0.067-0.095)	**0.089** (0.074-0.109)	**0.099** (0.080-0.125)	**0.113** (0.088-0.148)	**0.125** (0.094-0.169)
7-day	**0.022** (0.019-0.024)	**0.027** (0.024-0.031)	**0.035** (0.031-0.039)	**0.041** (0.036-0.046)	**0.049** (0.042-0.058)	**0.055** (0.047-0.067)	**0.062** (0.051-0.076)	**0.069** (0.056-0.087)	**0.078** (0.061-0.102)	**0.085** (0.065-0.116)
10-day	**0.017** (0.015-0.019)	**0.022** (0.019-0.024)	**0.027** (0.025-0.031)	**0.032** (0.029-0.037)	**0.039** (0.034-0.046)	**0.044** (0.037-0.053)	**0.049** (0.040-0.060)	**0.054** (0.044-0.068)	**0.061** (0.047-0.080)	**0.066** (0.050-0.090)
20-day	**0.011** (0.010-0.013)	**0.014** (0.013-0.016)	**0.018** (0.017-0.021)	**0.022** (0.019-0.025)	**0.026** (0.022-0.030)	**0.029** (0.024-0.035)	**0.032** (0.027-0.039)	**0.035** (0.028-0.044)	**0.039** (0.030-0.051)	**0.042** (0.032-0.057)
30-day	**0.009** (0.008-0.010)	**0.012** (0.011-0.013)	**0.015** (0.013-0.017)	**0.018** (0.016-0.020)	**0.021** (0.018-0.025)	**0.023** (0.020-0.028)	**0.026** (0.021-0.032)	**0.028** (0.023-0.035)	**0.031** (0.024-0.041)	**0.033** (0.025-0.045)
45-day	**0.007** (0.007-0.008)	**0.010** (0.009-0.011)	**0.012** (0.011-0.014)	**0.014** (0.013-0.016)	**0.017** (0.015-0.020)	**0.019** (0.016-0.022)	**0.020** (0.017-0.025)	**0.022** (0.018-0.028)	**0.024** (0.019-0.032)	**0.026** (0.020-0.035)
60-day	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.011** (0.010-0.012)	**0.013** (0.011-0.014)	**0.015** (0.013-0.018)	**0.016** (0.014-0.020)	**0.018** (0.015-0.022)	**0.019** (0.016-0.025)	**0.021** (0.017-0.028)	**0.023** (0.017-0.031)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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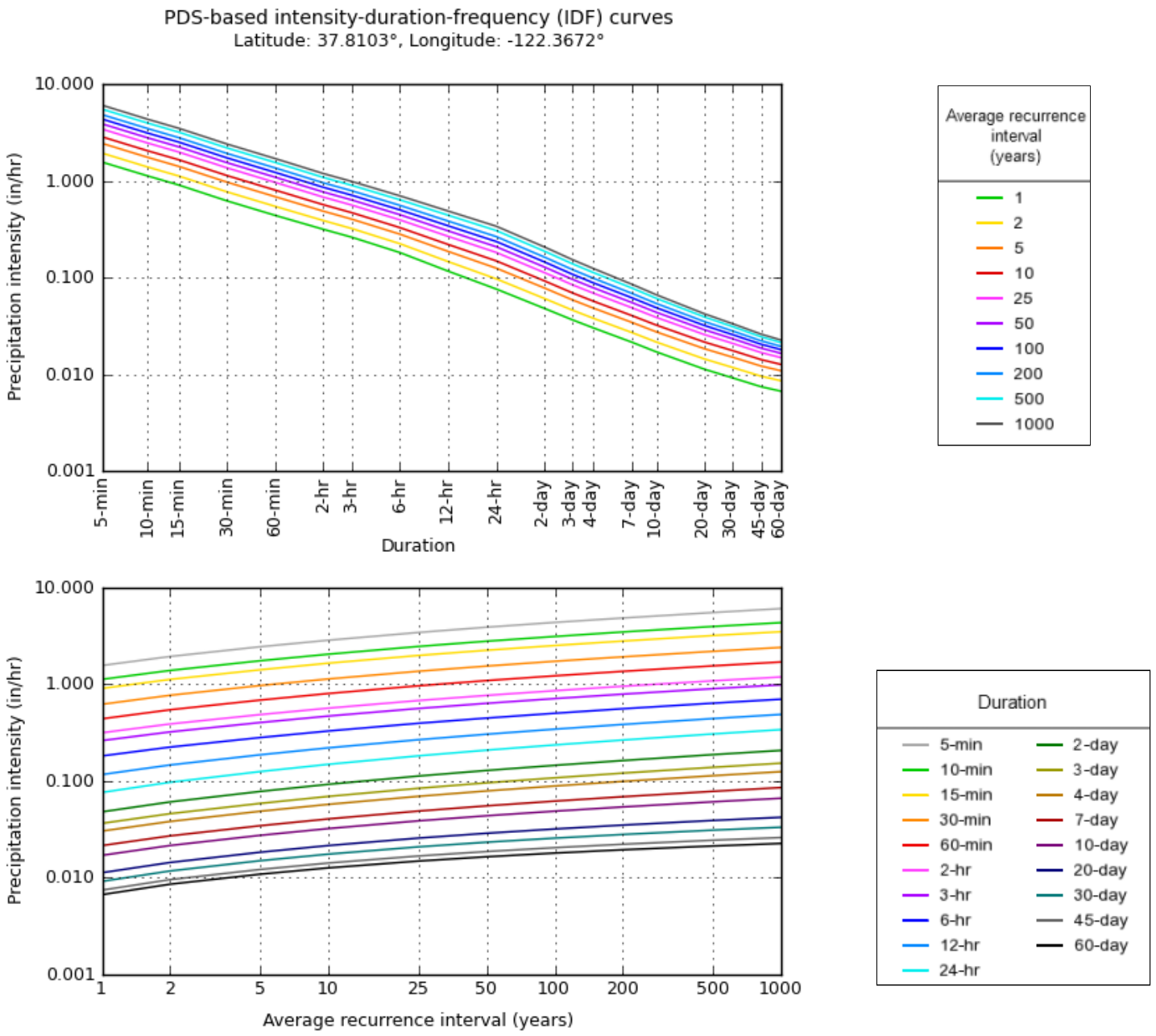
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed Nov 1 18:02:07 2017

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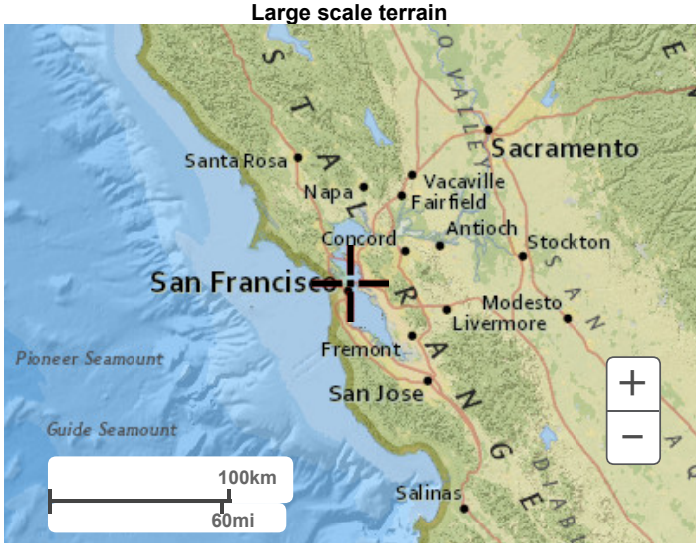
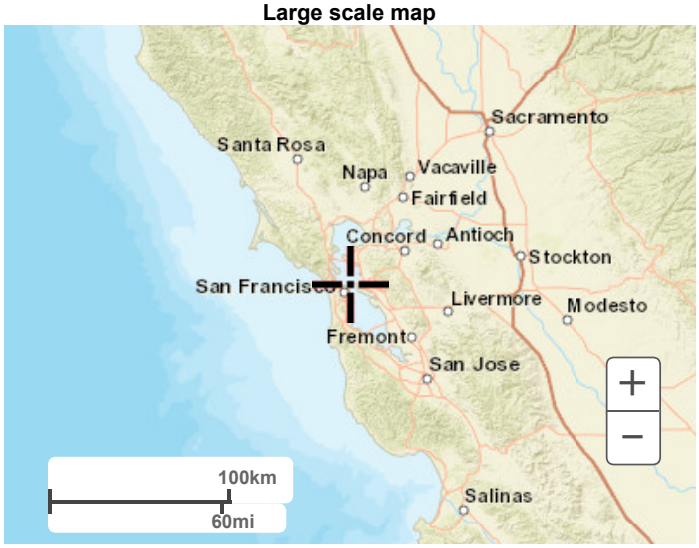
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Table 2.1 Rainfall Intensity/Duration/Frequency Table		
Duration (min)	Intensity (in/hr)	
	5-yr	100-yr
5	3.126	4.92
7	2.742	4.464
10	2.316	3.78
15	1.84	3.24
22	1.428	2.69
30	1.137	2.06
45	0.856	1.675
60	0.723	1.29

The 100-year Intensity-Duration-Frequency ("IDF") curve equation for overland flow shall be the following:

$$I = \frac{11.802}{t_c^{0.54}}$$

The 100-year IDF curve equation is the best fit log-linear line of the Rainfall Depth-Duration-Frequency table for the San Francisco City Station E70 7772 00 published by the California Department of Water Resources. See Table 2.1.

Area (A) – The Subdivider shall use the total area tributary to the point under consideration in design.

Time of Concentration and Inlet Time – Time of concentration at any given point is the time required for the run-off from the most remote point in the drainage area to

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Appendix C Watershed Maps

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		436

5-13-19
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
LESLEY BROOKS
No. 88686
Exp. 3-31-20
CIVIL
STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

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SUITE 108
WALNUT CREEK, CA 94596

SAN FRANCISCO COUNTY
TRANSPORTATION AUTHORITY
1455 MARKET St, Ste 2200
SAN FRANCISCO, CA 94103

NOTES:

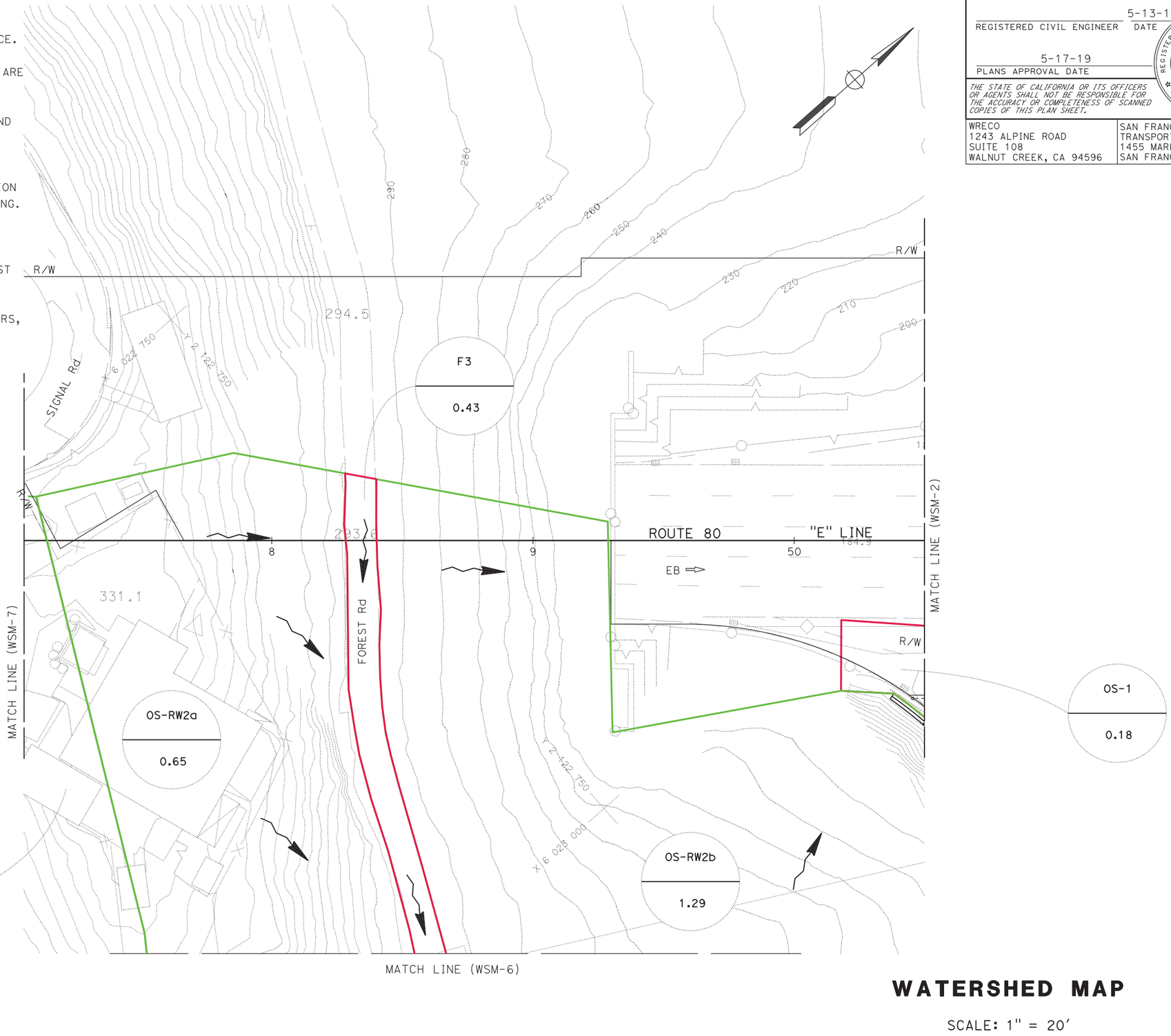
1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
2. STATION & OFFSET TIES TO DRAINAGE STRUCTURES ARE MEASURED PER DETAILS ON SHEET DD-1.
3. FOR FINISHED GRADE ELEVATIONS, SEE PROFILES AND CONSTRUCTION DETAILS SHEETS.
4. LOCATIONS OF EXISTING DRAINAGE FACILITIES ARE APPROXIMATE. FIELD VERIFY LOCATION AND ELEVATION OF EXISTING DRAINAGE FACILITIES BEFORE MODIFYING.
5. UNLESS NOTED OTHERWISE, STANDARD INLET DEPRESSIONS, PER STANDARD PLAN D78B, MUST BE PROVIDED FOR ALL INLETS. INLET DEPRESSIONS MUST BE CONSTRUCTED OF 8" THICK PORTLAND CEMENT CONCRETE. ASPHALT INLET DEPRESSIONS ARE NOT ALLOWED. WHERE LOCATED WITHIN ASPHALT SHOULDERS, ISOLATION JOINTS ARE NOT REQUIRED.

LEGEND:

- FES
- CAP DI
- BIORETENTION BASIN

DRAINAGE SYSTEM ID / AREA (ac)

- IMPERVIOUS WATERSHED
- PERVIOUS WATERSHED
- FLOW DIRECTION



WATERSHED MAP

SCALE: 1" = 20'

WSM-1

HAN-BIN LIANG — CONSULTANT FUNCTIONAL SUPERVISOR
LESLEY BROOKS — CALCULATED-DESIGNED BY
ANALETTE OCHOA — CHECKED BY
LB 2-18-19 — REVISED BY / DATE REVISED
LB 11-12-18

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 00-00-00
DATE PLOTTED => 16-JUL-2019
TIME PLOTTED => 11:14

BORDER LAST REVISED 7/2/2010
USERNAME => Peter_Bonneau
DGN FILE => wsm001.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0728
PROJECT NUMBER & PHASE 04000205071

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		436

5-13-19
REGISTERED CIVIL ENGINEER — DATE

LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

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TRANSPORTATION AUTHORITY
1455 MARKET St, Ste 2200
SAN FRANCISCO, CA 94103

SAN FRANCISCO

SOUTHGATE Rd OC

ROUTE 80 "E" LINE

EB

MATCH LINE (WSM-1)

OS-1 0.18

R1-c 0.25

HC1-c 0.24

R1-a 0.39

EB OFF-RAMP

"RT" LINE

RW-2 0.24

"SG1" LINE

MATCH LINE +25 (WSM-3)

MATCH LINE (WSM-3)

HILLCREST Rd

BR 0.52

"PL" LINE

"HC1" LINE

"R1" LINE

"R2" LINE

"BP" LINE

SG1-a 0.09

R2-b 0.24

R1-b 0.03

OS-RW2b 1.29

MATCH LINE (WSM-6)

HILLCREST Rd OC

OS-RW7 1.20

MATCH LINE +25 (WSM-5)

EB ON-RAMP

MATCH LINE +90 (WSM-5)

MATCH LINE (WSM-5)

R2-a 0.19

BP-a 0.44

R/W

NOTES:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

FOR NOTES AND LEGEND, SEE SHEET WSM-1

WATERSHED MAP

SCALE: 1" = 20'

WSM-2

REVISED BY	DATE REVISED
LB	11-12-18
LB	2-18-19

LESLEY BROOKS — ANALETTE OCHOA

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR — HAN-BIN LIANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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BORDER LAST REVISED 7/2/2010

USERNAME => Peter_Bonneau
DGN FILE => wsm002.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0728

PROJECT NUMBER & PHASE 04000205071

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

SAN FRANCISCO

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		436

5-13-19
REGISTERED CIVIL ENGINEER — DATE

LESLEY BROOKS
No. 88686
Exp. 3-31-20
CIVIL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

5-17-19
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SAN FRANCISCO COUNTY
TRANSPORTATION AUTHORITY
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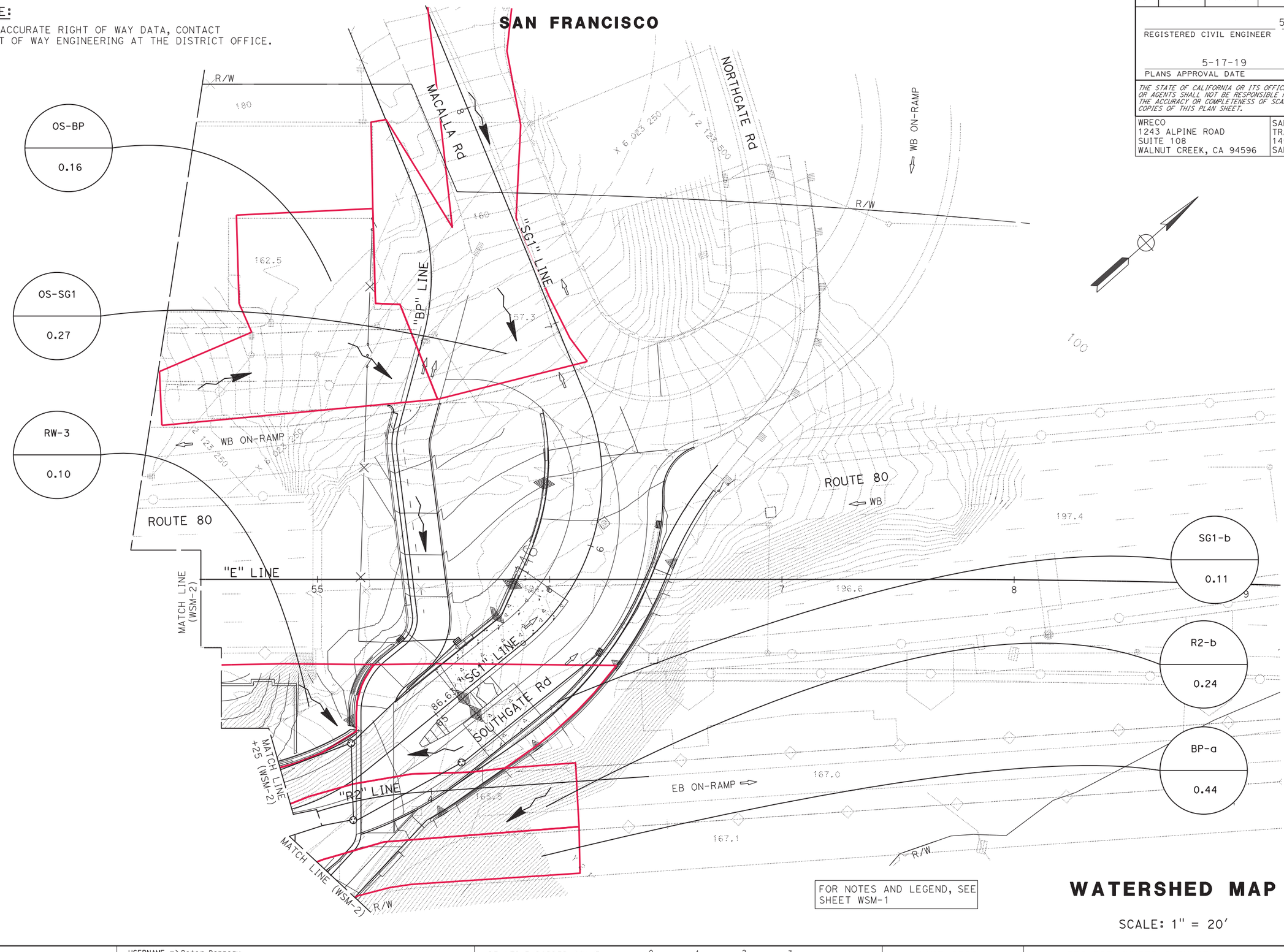
SAN FRANCISCO, CA 94103



FOR NOTES AND LEGEND, SEE SHEET WSM-1

WATERSHED MAP

SCALE: 1" = 20'

WSM-3

		LB	2-18-19	CALCULATED-DESIGNED BY	LESLEY BROOKS	STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
		LB	11-12-18	CHECKED BY	ANALETTE OCHOA	Caltrans
		REVISED BY	DATE REVISED	CONSULTANT FUNCTIONAL SUPERVISOR	HAN-BIN LIANG	

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		436

5-13-19
REGISTERED CIVIL ENGINEER — DATE

LESLEY BROOKS No. 88686 Exp. 3-31-20 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

5-17-19
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SAN FRANCISCO COUNTY
TRANSPORTATION AUTHORITY
1455 MARKET St, Ste 2200
SAN FRANCISCO, CA 94103

NOTE:

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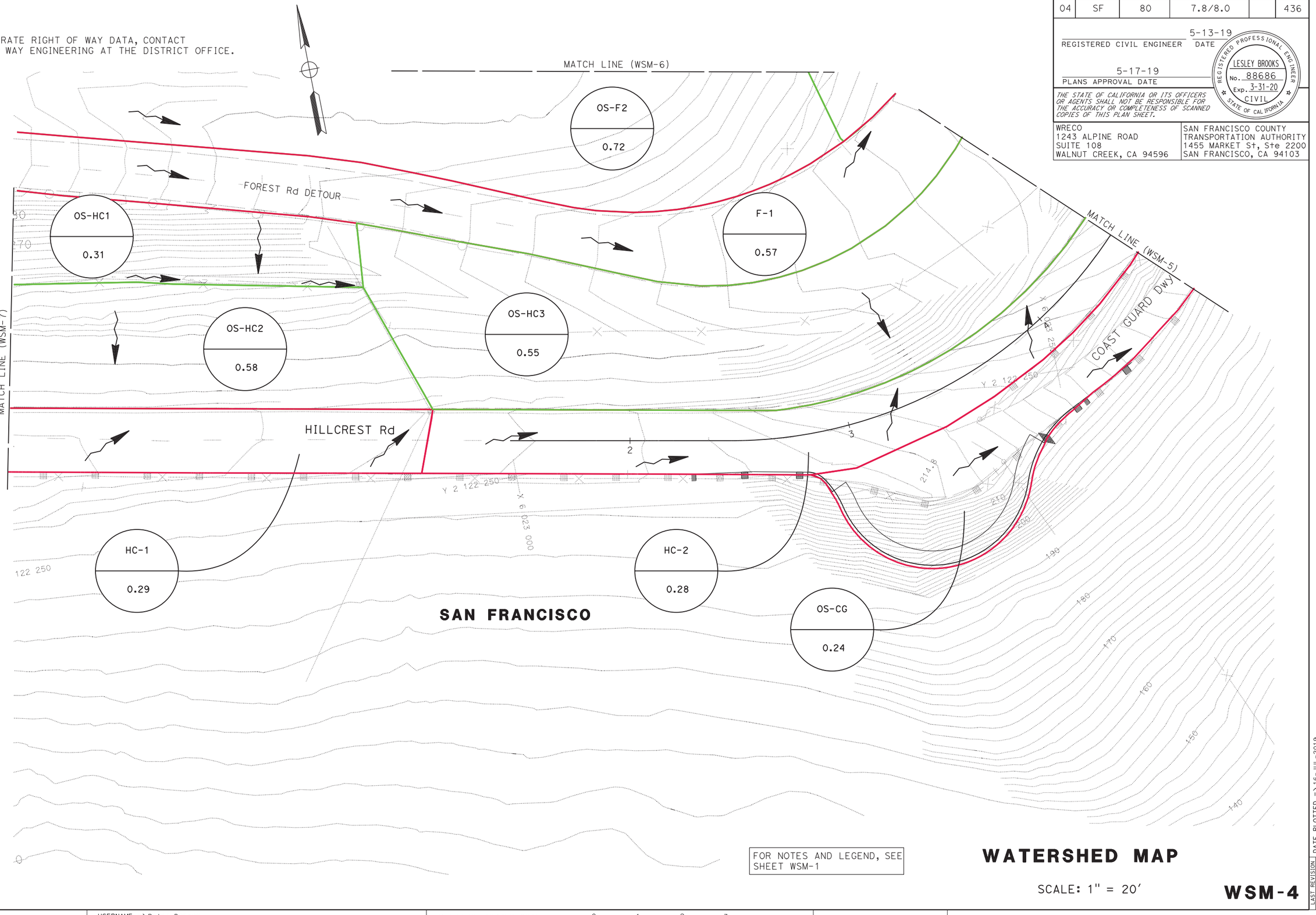

FOR NOTES AND LEGEND, SEE SHEET WSM-1

WATERSHED MAP

SCALE: 1" = 20'

WSM-4

LB	2-18-19		
LB	11-12-18		
REVISED BY	DATE REVISED		
LESLEY BROOKS	ANALETTE OCHOA		
CALCULATED-DESIGNED BY	CHECKED BY		
CONSULTANT FUNCTIONAL SUPERVISOR			
HAN-BIN LIANG			

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		436

5-13-19
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
LESLEY BROOKS
No. 88686
Exp. 3-31-20
CIVIL
STATE OF CALIFORNIA

5-17-19
PLANS APPROVAL DATE

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SAN FRANCISCO, CA 94103

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

FOR NOTES AND LEGEND, SEE SHEET WSM-1

WATERSHED MAP

SCALE: 1" = 20'

WSM-5

REVISED BY	LB	LB	
DATE REVISED	11-12-18	2-18-19	
CALCULATED-DESIGNED BY	LESLEY BROOKS		
CHECKED BY	ANALETTE OCHOA		
CONSULTANT FUNCTIONAL SUPERVISOR	HAN-BIN LIANG		

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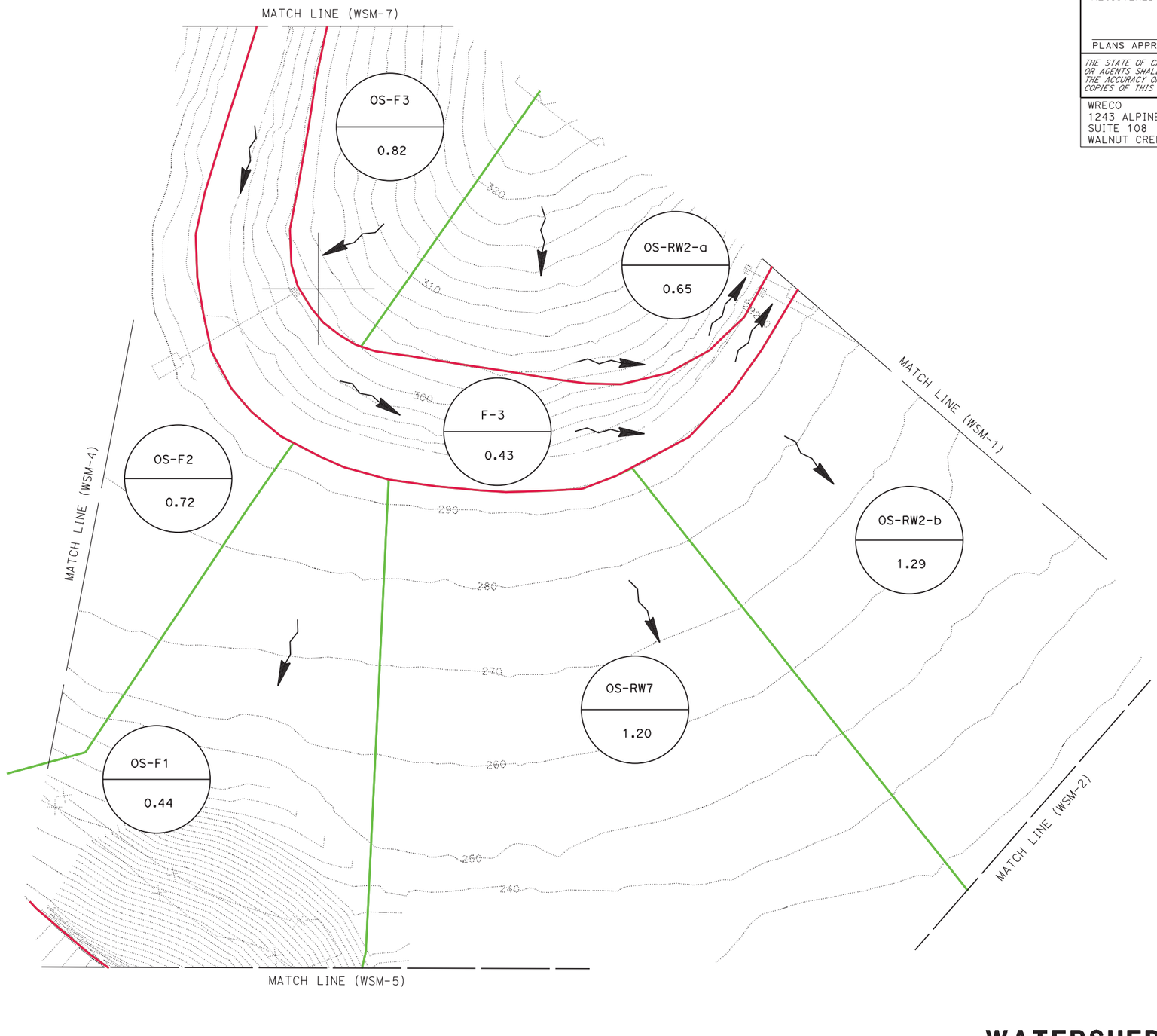

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET WSM-1

WATERSHED MAP

SCALE: 1" = 20'

WSM-6

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — No. Exp. CIVIL — STATE OF CALIFORNIA

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SUITE 108
WALNUT CREEK, CA 94596

BAY AREA TOLL AUTHORITY
375 BEALE St, SUITE 800
SAN FRANCISCO, CA 94105

DATE REVISED	REVISED BY

LESLEY BROOKS
ANALETTE OCHOA

CALCULATED-DESIGNED BY
CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR
HAN-BIN LIANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

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USERNAME => Peter_Bonneau
DGN FILE => wsm006.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0728

PROJECT NUMBER & PHASE 04000205071

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET WSM-1

WATERSHED MAP

SCALE: 1" = 20'

WSM-7

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	SF	80	7.8/8.0		

REGISTERED CIVIL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER — No. Exp. CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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SUITE 108
WALNUT CREEK, CA 94596

BAY AREA TOLL AUTHORITY
375 BEALE St, SUITE 800
SAN FRANCISCO, CA 94105

REVISED BY | DATE REVISED

LESLEY BROOKS | ANALETTE OCHOA

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR | HAN-BIN LIANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

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Appendix D Inlet and Spread Calculations

Appendix D.1 5-yr Calculations

Appendix D.2 100-yr Calculations

Appendix D.3 Caltrans C-Value Calculations

Appendix D.4 25-yr Calculations

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Southgate Road Realignment - Yerba Buena Island

Drainage Inlet Capacity and Roadway Spread Calculations: 5-yr Storm Event

Job: Southgate Road, Yerba Buena Island

Designed by: Lesley Brooks ☐ Date:

Checked by: ☐ Date:

	Layout Line:		HIGH POINT	R1	HIGH POINT	SG1-FLIP	SG1	SG1	SG1	SG1-FLIP	SG1	CG
In#	**Inlet Number:**			3a			6aa		6ac		7c	9a
		(Input Data Required)										
HYDROLOGY COMPUTATION:												
	Begin Station	>>										
	End Station	>>										
St	Structure location station:	>>	54+10	58+80	60+26	63+29	64+15	64+20	64+20	65+18	66+14	
N	Notes		HP	LP Inlet	HP	Flip	>> Flank Inlet	LP	<< Flank Inlet	Flip	<<	Coast Guard Driveway Inlet
	Off-site contributing watershed area (acres):	>>		0.00			0.00		0.00		0.27	0.24
	On-site contributing watershed area (acres):	>>		0.42			0.09		0.11		0.00	0.00
Ar	Contributing watershed area (acres):			0.42			0.09		0.11		0.27	0.24
C	Composite Runoff Coefficient "C":	>>		0.95			0.95		0.95		0.95	0.95
Ic	Precipitation intensity (in/hr):	>>		3.126			3.126		3.126		3.126	3.126
Qa	Subarea discharge Q (ft^3/s):			1.25			0.27		0.33		0.80	0.71
qq	Previous by-pass flow (ft^3/s):	>					0.08		0.81			
Qadd	Discharge added by operator (ft^3/s):	>										
Qt	Total discharge Q (ft^3/s):			1.25			0.35		1.14		0.80	0.71
SHOULDER AND GUTTER CONFIGURATION:												
n	Manning's n:	>>		0.015			0.015		0.015		0.015	0.015
S	Longitudinal slope S (ft/ft):	>>		0.000			0.000		0.000		0.100	0.160
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>		1			1		1		1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>		2			2		2		1	1
ID	Inlet description:	>										
	Grate Type:	>>		24-12X			24-12X		24-12X		24-12X	24-12X
Gw	Grate width (in):	>		24.0			24.0		24.0		24.0	24.0
Gl	Grate length (in):	>		36.0			36.0		36.0		36.0	36.0
	3 or 4 sided weir?	>		3			3		3		3	3
Lco	Curb opening length provided (ft):	>										
Ls	Slotted drain length provided: (ft)	>										
Sx	Shoulder cross-slope Sx (ft/ft):	>>		0.0400			0.0200		0.0200		0.0200	0.0200
W	Width of gutter from flowline (in):	>		0.0			0.0		0.0		0.0	0.0
a(t)	Gutter depth from horizontal (in):	>		0.0			0.0		0.0		0.0	0.0
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)			0.040			0.020		0.020		0.020	0.020
	Available Flooded Width (ft)	>		33.10			34.36		35.04		43.72	8.00
Tu/s	Flooded Width from flowline (ft):			-----			-----		-----		4.21	3.69
Tu/s	Flooded Width from flowline with gutter (ft):			-----			-----		-----		4.21	3.69
Du/s	Depth at flowline before inlet (ft):			-----			-----		-----		0.08	0.07
Au/s	Water cross-area before inlet (ft^2):			-----			-----		-----		0.18	0.14
Vu/s	Velocity for total discharge before inlet (ft/s):			-----			-----		-----		4.53	5.25
Eod	Ratio of gutter depression flow to total Q (Eod):			-----			-----		-----		-----	-----
Se	Equivalent cross-slope (ft/ft):			0.040			0.020		0.020		0.020	0.020
GRATE INLETS ON-GRADE:												
Eog	Ratio of grate frontal flow to total flow:			-----			-----		-----		82%	88%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression			-----			-----		-----		0.66	0.62
Vo	Vo for effective length (P-50, Chart 5) (ft/s):			-----			-----		-----		5.05	5.05
Rf	Fraction of frontal flow intercepted (Rf):			-----			-----		-----		1.00	0.98
Qs	Side flow in ft^3/s (Qs):			-----			-----		-----		0.14	0.09
Gle	Effective grate length w/ 25% clogging (in):			-----			-----		-----		27	27
Rs	Fraction of side flow interception (Rs):			-----			-----		-----		5%	4%
E	Grate Efficiency (E):			-----			-----		-----		83%	87%
Qi	Total flow intercepted (ft^3/s):			-----			-----		-----		0.67	0.62
Qb	Grate flow-by (ft^3/s):			-----			-----		-----		0.14	0.10
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)												
Lt	Length required for total interception (ft):			-----			-----		-----		-----	-----
Ci	Interception for provided length L (ft^3/s):			-----			-----		-----		-----	-----
El	Efficiency for provided length L:			-----			-----		-----		-----	-----
Qs	Slotted drain or side opening flow-by (ft^3/s):			-----			-----		-----		-----	-----
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:												
	Grate Inlets											
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			0.20			0.09		0.19		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			0.24			0.10		0.23		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			4.97			4.28		9.37		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			6.04			5.21		11.39		-----	-----
	Slotted drains											
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
	Curb opening inlets											
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft):			-----			-----		-----		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
Lc	Length of the vertical curve (ft):	>										
g1	approach grade #1 (%):	>										
g2	approach grade #2 (%):	>										
K	K = Min(Lc/Diff(g1,g2),167) (Table 4-7, HEC-22):			-----			-----		-----		-----	-----
Df	Flanking inlets distance (ft):			-----			-----		-----		-----	-----

Southgate Road Realignment - Yerba Buena Island

Drainage Inlet Capacity and Roadway Spread Calculations: 5-yr Storm Event

Job: Southgate Road, Yerba Buena Island

Designed by: Lesley Brooks ☐ Date:

Checked by: ☐ Date:

	Layout Line:		HC1	HC1	HC1	HC1	HC1	R2	BP	BP
In#	**Inlet Number:**		HC-1, left	HC-2, left	2aa	2ac	4ac	2ag	1ak	6a
		(Input Data Required)								
	HYDROLOGY COMPUTATION:									
	Begin Station	>>								
	End Station	>>								
St	Structure location station:	>>		55+21	57+25	58+81	62+37	60+66	65+75	70+00
N	Notes		Existing Inlet >>	Existing Inlet >>	>>	>> to SG1 64+15	>> to SG1 64+15	LP Inlet	>> to SG1 64+20	<< to SG1 64+20
	Off-site contributing watershed area (acres):	>>	0.58	0.55	0	0	0	0	0	0.16
	On-site contributing watershed area (acres):	>>	0.29	0.28	0.30	0.16	0.24	0.43	0.44	0.10
Ar	Contributing watershed area (acres):		0.87	0.83	0.30	0.16	0.24	0.43	0.44	0.26
C	Composite Runoff Coefficient "C":	>>	0.52	0.52	0.95	0.95	0.95	0.95	0.95	0.95
Ic	Precipitation intensity (in/hr):	>>	3.126	3.126	3.126	3.126	3.126	3.126	3.126	3.126
Qa	Subarea discharge Q (ft^3/s):		1.41	1.35	0.89	0.48	0.71	1.28	1.31	0.77
qq	Previous by-pass flow (ft^3/s):	>		1.26	0.76	0.51	0.09			
Qadd	Discharge added by operator (ft^3/s):	>								
Qt	Total discharge Q (ft^3/s):		1.41	2.60	1.65	0.98	0.80	1.28	1.31	0.77
	SHOULDER AND GUTTER CONFIGURATION:									
n	Manning's n:	>>	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
S	Longitudinal slope S (ft/ft):	>>	0.035	0.035	0.093	0.093	0.040	0.000	0.048	0.111
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>	2	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>	1	1	1	1	1	2	1	1
ID	Inlet description:	>								
	Grate Type:	>>	24-12	24-12X	24-12X	24-12X	24-12X	24-12X	24-12X	24-12X
Gw	Grate width (in):	>	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	24.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>	3	3	3	3	3	3	3	3
Lco	Curb opening length provided (ft):	>	2.00							
Ls	Slotted drain length provided: (ft)	>								
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0340	0.0200	0.0400	0.0330	0.0300	0.0150	0.0150
W	Width of gutter from flowline (in):	>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a(t)	Gutter depth from horizontal (in):	>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)		0.020	0.034	0.020	0.040	0.033	0.030	0.015	0.015
	Available Flooded Width (ft)	>	25.00	25.00	25.40	25.40	32.07	30.30	15.04	17.19
Tu/s	Flooded Width from flowline (ft):		6.32	5.72	5.59	2.99	3.65	-----	6.95	4.87
Tu/s	Flooded Width from flowline with gutter (ft):		6.32	5.72	5.59	2.99	3.65	-----	6.95	4.87
Du/s	Depth at flowline before inlet (ft):		0.13	0.19	0.11	0.12	0.12	-----	0.10	0.07
Au/s	Water cross-area before inlet (ft^2):		0.40	0.56	0.31	0.18	0.22	-----	0.36	0.18
Vu/s	Velocity for total discharge before inlet (ft/s):		3.52	4.69	5.27	5.51	3.64	-----	3.60	4.34
Eod	Ratio of gutter depression flow to total Q (Eod):		-----	-----	-----	-----	-----	-----	-----	-----
Se	Equivalent cross-slope (ft/ft):		0.020	0.034	0.020	0.040	0.033	0.030	0.015	0.015
	GRATE INLETS ON-GRADE:									
Eog	Ratio of grate frontal flow to total flow:		-----	68%	69%	95%	88%	-----	59%	76%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		-----	1.78	1.14	0.93	0.70	-----	0.78	0.58
Vo	Vo for effective length (P-50, Chart 5) (ft/s):		-----	5.05	5.05	5.05	5.05	-----	5.05	5.05
Rf	Fraction of frontal flow intercepted (Rf):		-----	1.00	0.98	0.96	1.00	-----	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		-----	0.83	0.51	0.05	0.10	-----	0.53	0.19
Gle	Effective grate length w/ 25% clogging (in):		-----	27	27	27	27	-----	27	27
Rs	Fraction of side flow interception (Rs):		-----	8%	4%	7%	12%	-----	6%	4%
E	Grate Efficiency (E):		-----	71%	69%	91%	89%	-----	62%	77%
Qi	Total flow intercepted (ft^3/s):		-----	1.85	1.14	0.90	0.71	-----	0.81	0.59
Qb	Grate flow-by (ft^3/s):		-----	0.76	0.51	0.09	0.08	-----	0.50	0.18
	SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)									
Lt	Length required for total interception (ft):		32.90	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		0.2	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L:		11%	-----	-----	-----	-----	-----	-----	-----
Qs	Slotted drain or side opening flow-by (ft^3/s):		1.3	-----	-----	-----	-----	-----	-----	-----
	INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
	Grate Inlets									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	0.20	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	0.25	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	6.73	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	8.18	-----	-----
	Slotted drains									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets									
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft):	>								
g1	approach grade #1 (%):	>								
g2	approach grade #2 (%):	>								
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22):		-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	-----	-----

Southgate Road Realignment - Yerba Buena Island

Drainage Inlet Capacity and Roadway Spread Calculations: 100-yr Storm Event

Job: Southgate Road, Yerba Buena Island

Designed by: Lesley Brooks ☐ Date:

Checked by: ☐ Date:

	Layout Line:		HIGH POINT	R1	HIGH POINT	SG1-FLIP	SG1	SG1	SG1	SG1-FLIP	SG1	CG
In#	**Inlet Number:**			3a			6aa		6ac		7c	9a
		(Input Data Required)										
HYDROLOGY COMPUTATION:												
	Begin Station	>>										
	End Station	>>										
St	Structure location station:	>>	54+10	58+80	60+26	63+29	64+15	64+20	64+20	65+18	66+14	
N	Notes		HP	LP Inlet	HP	Flip	>> Flank Inlet	LP	<< Flank Inlet	Flip	<<	Coast Guard Driveway Inlet
	Off-site contributing watershed area (acres):	>>		0.00			0.00		0.00		0.27	0.24
	On-site contributing watershed area (acres):	>>		0.42			0.09		0.11		0.00	0.00
Ar	Contributing watershed area (acres):			0.42			0.09		0.11		0.27	0.24
C	Composite Runoff Coefficient "C":	>>		0.95			0.95		0.95		0.95	0.95
Ic	Precipitation intensity (in/hr):	>>		4.92			4.92		4.92		4.92	4.92
Qa	Subarea discharge Q (ft^3/s):			1.96			0.42		0.51		1.26	1.12
qq	Previous by-pass flow (ft^3/s):	>					0.37		1.62			
Qadd	Discharge added by operator (ft^3/s):	>										
Qt	Total discharge Q (ft^3/s):			1.96			0.79		2.13		1.26	1.12
SHOULDER AND GUTTER CONFIGURATION:												
n	Manning's n:	>>		0.015			0.015		0.015		0.015	0.015
S	Longitudinal slope S (ft/ft):	>>		0.000			0.000		0.000		0.100	0.160
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>		1			1		1		1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>		2			2		2		1	1
ID	Inlet description:	>										
	Grate Type:	>>		24-12X			24-12X		24-12X		24-12X	24-12X
Gw	Grate width (in):	>		24.0			24.0		24.0		24.0	24.0
Gl	Grate length (in):	>		36.0			36.0		36.0		36.0	36.0
	3 or 4 sided weir?	>		3			3		3		3	3
Lco	Curb opening length provided (ft):	>										
Ls	Slotted drain length provided: (ft)	>										
Sx	Shoulder cross-slope Sx (ft/ft):	>>		0.0400			0.0200		0.0200		0.0200	0.0200
W	Width of gutter from flowline (in):	>		0.0			0.0		0.0		0.0	0.0
a(t)	Gutter depth from horizontal (in):	>		0.0			0.0		0.0		0.0	0.0
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)			0.040			0.020		0.020		0.020	0.020
	Available Flooded Width (ft)	>		35.14			34.36		35.04		43.72	8.00
Tu/s	Flooded Width from flowline (ft):			-----			-----		-----		4.99	4.37
Tu/s	Flooded Width from flowline with gutter (ft):			-----			-----		-----		4.99	4.37
Du/s	Depth at flowline before inlet (ft):			-----			-----		-----		0.10	0.09
Au/s	Water cross-area before inlet (ft^2):			-----			-----		-----		0.25	0.19
Vu/s	Velocity for total discharge before inlet (ft/s):			-----			-----		-----		5.07	5.88
Eod	Ratio of gutter depression flow to total Q (Eod):			-----			-----		-----		-----	-----
Se	Equivalent cross-slope (ft/ft):			0.040			0.020		0.020		0.020	0.020
GRATE INLETS ON-GRADE:												
Eog	Ratio of grate frontal flow to total flow:			-----			-----		-----		74%	80%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression			-----			-----		-----		0.94	0.90
Vo	Vo for effective length (P-50, Chart 5) (ft/s):			-----			-----		-----		5.05	5.05
Rf	Fraction of frontal flow intercepted (Rf):			-----			-----		-----		1.00	0.93
Qs	Side flow in ft^3/s (Qs):			-----			-----		-----		0.32	0.22
Gle	Effective grate length w/ 25% clogging (in):			-----			-----		-----		27	27
Rs	Fraction of side flow interception (Rs):			-----			-----		-----		4%	3%
E	Grate Efficiency (E):			-----			-----		-----		75%	75%
Qi	Total flow intercepted (ft^3/s):			-----			-----		-----		0.95	0.84
Qb	Grate flow-by (ft^3/s):			-----			-----		-----		0.31	0.28
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)												
Lt	Length required for total interception (ft):			-----			-----		-----		-----	-----
Ci	Interception for provided length L (ft^3/s):			-----			-----		-----		-----	-----
El	Efficiency for providged length L:			-----			-----		-----		-----	-----
Qs	Slotted drain or side opening flow-by (ft^3/s):			-----			-----		-----		-----	-----
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:												
	Grate Inlets											
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			0.27			0.15		0.28		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			0.33			0.18		0.35		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			6.73			7.32		14.23		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			8.17			8.90		17.29		-----	-----
	Slotted drains											
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
	Curb opening inlets											
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft):			-----			-----		-----		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
Lc	Length of the vertical curve (ft):	>										
g1	approach grade #1 (%):	>										
g2	approach grade #2 (%):	>										
K	K = Min(Lc/Diff(g1,g2),167) (Table 4-7, HEC-22):			-----			-----		-----		-----	-----
Df	Flanking inlets distance (ft):			-----			-----		-----		-----	-----

Southgate Road Realignment - Yerba Buena Island

Drainage Inlet Capacity and Roadway Spread Calculations: 100-yr Storm Event

Job: Southgate Road, Yerba Buena Island

Designed by: Lesley Brooks ☐ Date:

Checked by: ☐ Date:

	Layout Line:		HC1	HC1	HC1	HC1	HC1	R2	BP	BP
In#	**Inlet Number:**		HC-1, left	HC-2, left	2aa	2ac	4ac	2ag	1ak	6a
		(Input Data Required)								
HYDROLOGY COMPUTATION:										
	Begin Station	>>								
	End Station	>>								
St	Structure location station:	>>		55+21	57+25	58+81	62+37	60+66	65+75	70+00
N	Notes		Existing Inlet >>	Existing Inlet >>	>>	>>	>> to SG1 64+15	LP Inlet	>> to SG1 64+20	<< to SG1 64+20
	Off-site contributing watershed area (acres):	>>	0.58	0.55	0	0	0	0	0	0.16
	On-site contributing watershed area (acres):	>>	0.29	0.28	0.30	0.16	0.24	0.43	0.44	0.10
Ar	Contributing watershed area (acres):		0.87	0.83	0.30	0.16	0.24	0.43	0.44	0.26
C	Composite Runoff Coefficient "C":	>>	0.52	0.52	0.95	0.95	0.95	0.95	0.95	0.95
Ic	Precipitation intensity (in/hr):	>>	4.92	4.92	4.92	4.92	4.92	4.92	4.92	4.92
Qa	Subarea discharge Q (ft^3/s):		2.21	2.12	1.40	0.75	1.12	2.01	2.06	1.22
qq	Previous by-pass flow (ft^3/s):	>		2.02	1.57	1.34	0.56			
Qadd	Discharge added by operator (ft^3/s):	>								
Qt	Total discharge Q (ft^3/s):		2.21	4.14	2.97	2.08	1.68	2.01	2.06	1.22
SHOULDER AND GUTTER CONFIGURATION:										
n	Manning's n:	>>	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
S	Longitudinal slope S (ft/ft):	>>	0.035	0.035	0.093	0.093	0.040	0.000	0.048	0.111
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>	2	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>	1	1	1	1	1	2	1	1
ID	Inlet description:	>								
	Grate Type:	>>	24-12	24-12X	24-12X	24-12X	24-12X	24-12X	24-12X	24-12X
Gw	Grate width (in):	>	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	24.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>	3	3	3	3	3	3	3	3
Lco	Curb opening length provided (ft):	>	2.00							
Ls	Slotted drain length provided: (ft)	>								
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0340	0.0200	0.0400	0.0330	0.0300	0.0150	0.0150
W	Width of gutter from flowline (in):	>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a(t)	Gutter depth from horizontal (in):	>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)		0.020	0.034	0.020	0.040	0.033	0.030	0.015	0.015
	Available Flooded Width (ft)	>	25.00	25.00	25.40	25.40	32.07	30.30	15.04	17.19
Tu/s	Flooded Width from flowline (ft):		7.49	6.80	6.97	3.96	4.82	-----	8.24	5.77
Tu/s	Flooded Width from flowline with gutter (ft):		7.49	6.80	6.97	3.96	4.82	-----	8.24	5.77
Du/s	Depth at flowline before inlet (ft):		0.15	0.23	0.14	0.16	0.16	-----	0.12	0.09
Au/s	Water cross-area before inlet (ft^2):		0.56	0.79	0.49	0.31	0.38	-----	0.51	0.25
Vu/s	Velocity for total discharge before inlet (ft/s):		3.94	5.26	6.11	6.65	4.38	-----	4.04	4.86
Eod	Ratio of gutter depression flow to total Q (Eod):		-----	-----	-----	-----	-----	-----	-----	-----
Se	Equivalent cross-slope (ft/ft):		0.020	0.034	0.020	0.040	0.033	0.030	0.015	0.015
GRATE INLETS ON-GRADE:										
Eog	Ratio of grate frontal flow to total flow:		-----	61%	59%	85%	76%	-----	52%	68%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		-----	2.50	1.76	1.76	1.28	-----	1.08	0.82
Vo	Vo for effective length (P-50, Chart 5) (ft/s):		-----	5.05	5.05	5.05	5.05	-----	5.05	5.05
Rf	Fraction of frontal flow intercepted (Rf):		-----	0.98	0.90	0.86	1.00	-----	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		-----	1.63	1.21	0.32	0.40	-----	0.98	0.39
Gle	Effective grate length w/ 25% clogging (in):		-----	27	27	27	27	-----	27	27
Rs	Fraction of side flow interception (Rs):		-----	7%	3%	5%	9%	-----	5%	4%
E	Grate Efficiency (E):		-----	62%	55%	73%	78%	-----	55%	69%
Qi	Total flow intercepted (ft^3/s):		-----	2.57	1.64	1.53	1.31	-----	1.12	0.84
Qb	Grate flow-by (ft^3/s):		-----	1.57	1.34	0.56	0.37	-----	0.93	0.38
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)										
Lt	Length required for total interception (ft):		39.80	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		0.2	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L:		9%	-----	-----	-----	-----	-----	-----	-----
Qs	Slotted drain or side opening flow-by (ft^3/s):		2.0	-----	-----	-----	-----	-----	-----	-----
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:										
	Grate Inlets									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	0.27	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	0.33	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	9.11	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	11.07	-----	-----
	Slotted drains									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets									
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft):	>								
g1	approach grade #1 (%):	>								
g2	approach grade #2 (%):	>								
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22):		-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	-----	-----

Appendix D.3: Caltrans C-Value Calculations

Watershed ID	Capture Location ID	Area (ac)	C-value	Time of Concentration (min)	I_{25} (in/hr)	Q_{25} (cfs)
OS-RW7	1a	1.20	0.57	5	3.42	2.35
OS-F1	1aa	0.44	0.57	5	3.42	0.86
OS-F1-b	1aa	0.03	0.57	5	3.42	0.06
OS-F2	1aa	0.72	0.51	5	3.42	1.25
OS-F3	1aa	0.82	0.59	5	3.42	1.65
BR	1ai	0.52	0.46	5	3.42	0.82
BP-a	1ak	0.44	1.00	5	3.42	1.50
F-1	2a	0.57	1.00	5	3.42	1.94
HC-2	2a	0.28	1.00	5	3.42	0.97
OS-HC3	2a	0.55	0.52	5	3.42	0.97
HC1-a	2aa	0.30	1.00	5	3.42	1.02
HC1-b	2ac	0.16	1.00	5	3.42	0.54
RW-5	2ae	0.03	1.00	5	3.42	0.12
R2-b	2ag	0.24	1.00	5	3.42	0.83
R2-a	2ag	0.19	1.00	5	3.42	0.65
R1-a	3a	0.39	1.00	5	3.42	1.32
R1-b	3a	0.03	1.00	5	3.42	0.10
F-3	4a	0.43	1.00	5	3.42	1.47
OS-1	4a	0.18	1.00	5	3.42	0.60
R1-c	4aa	0.25	1.00	5	3.42	0.86
HC1-c	4ac	0.24	1.00	5	3.42	0.81
RW-2	4c	0.24	1.00	5	3.42	0.80
OS-BP	6a	0.16	1.00	5	3.42	0.53
RW-3	6a	0.10	1.00	5	3.42	0.35
SG1-a	6aa	0.09	1.00	5	3.42	0.31
SG1-b	6ac	0.11	1.00	5	3.42	0.38
OS-SG1	7c	0.27	1.00	5	3.42	0.92
OS-RW2-a	8b	0.65	0.73	5	3.42	1.61
OS-RW2-b	8b	1.29	0.59	5	3.42	2.62
OS-CG	9a	0.24	1.00	5	3.42	0.82
HC-1	South Sys.	0.29	1.00	5	3.42	0.98
OS-HC1	South Sys.	0.31	0.51	5	3.42	0.53
OS-HC2	South Sys.	0.58	0.51	5	3.42	1.00

Slope (%)	Relief C	Soil Infil C	Vegetal Cover C	Surface Storage C	Pervious C	Percent Imperv.	Total C25
30%	0.28	0.08	0.06	0.10	0.52	0%	0.57
33%	0.28	0.08	0.06	0.10	0.52	0%	0.57
33%	0.28	0.08	0.06	0.10	0.52	0%	0.57
14%	0.22	0.08	0.06	0.10	0.46	0%	0.51
14%	0.22	0.08	0.06	0.10	0.46	15%	0.59
5%	0.14	0.08	0.06	0.08	0.36	10%	0.46
						100%	1.00
						100%	1.00
						100%	1.00
15%	0.23	0.08	0.06	0.10	0.47	0%	0.52
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
						100%	1.00
43%	0.30	0.08	0.06	0.10	0.54	30%	0.73
43%	0.30	0.08	0.06	0.10	0.54	0%	0.59
						100%	1.00
						100%	1.00
15%	0.22	0.08	0.06	0.10	0.46	0%	0.51
14%	0.22	0.08	0.06	0.10	0.46	0%	0.51

Factors obtained from Figure 819.2A Runoff Coefficients for Undeveloped Areas of the Caltrans HDM
Final C-value multiplied by a factor of 1.1 for the 25-yr design storm

Southgate Road Realignment - Yerba Buena Island

Drainage Inlet Capacity and Roadway Spread Calculations: 25-yr Storm Event

Job: Southgate Road, Yerba Buena Island

Designed by: Lesley Brooks ☐ Date:

Checked by: ☐ Date:

	Layout Line:		HIGH POINT	R1	HIGH POINT	SG1-FLIP	SG1	SG1	SG1	SG1-FLIP	SG1	CG
In#	**Inlet Number:**			3a			6aa		6ac		7c	9a
		(Input Data Required)										
HYDROLOGY COMPUTATION:												
	Begin Station	>>										
	End Station	>>										
St	Structure location station:	>>	54+10	58+80	60+26	63+29	64+15	64+20	64+20	65+18	66+14	
N	Notes		HP	LP Inlet	HP	Flip	>> Flank Inlet	LP	<< Flank Inlet	Flip	<<	Coast Guard Driveway Inlet
	Off-site contributing watershed area (acres):	>>		0.00			0.00		0.00		0.27	0.24
	On-site contributing watershed area (acres):	>>		0.42			0.09		0.11		0.00	0.00
Ar	Contributing watershed area (acres):			0.42			0.09		0.11		0.27	0.24
C	Composite Runoff Coefficient "C":	>>		1			1		1		1	1
Ic	Precipitation intensity (in/hr):	>>		3.42			3.42		3.42		3.42	3.42
Qa	Subarea discharge Q (ft^3/s):			1.44			0.31		0.38		0.92	0.82
qq	Previous by-pass flow (ft^3/s):	>					0.18		1.01			
Qadd	Discharge added by operator (ft^3/s):	>										
Qt	Total discharge Q (ft^3/s):			1.44			0.48		1.39		0.92	0.82
SHOULDER AND GUTTER CONFIGURATION:												
n	Manning's n:	>>		0.015			0.015		0.015		0.015	0.015
S	Longitudinal slope S (ft/ft):	>>		0.000			0.000		0.000		0.100	0.160
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>		1			1		1		1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>		2			2		2		1	1
ID	Inlet description:	>										
	Grate Type:	>>		24-12X			24-12X		24-12X		24-12X	24-12X
Gw	Grate width (in):	>		24.0			24.0		24.0		24.0	24.0
Gl	Grate length (in):	>		36.0			36.0		36.0		36.0	36.0
	3 or 4 sided weir?	>		3			3		3		3	3
Lco	Curb opening length provided (ft):	>										
Ls	Slotted drain length provided: (ft)	>										
Sx	Shoulder cross-slope Sx (ft/ft):	>>		0.0400			0.0200		0.0200		0.0200	0.0200
W	Width of gutter from flowline (in):	>		0.0			0.0		0.0		0.0	0.0
a(t)	Gutter depth from horizontal (in):	>		0.0			0.0		0.0		0.0	0.0
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)			0.040			0.020		0.020		0.020	0.020
	Available Flooded Width (ft)	>		35.14			34.36		35.04		43.72	8.00
Tu/s	Flooded Width from flowline (ft):			-----			-----		-----		4.44	3.89
Tu/s	Flooded Width from flowline with gutter (ft):			-----			-----		-----		4.44	3.89
Du/s	Depth at flowline before inlet (ft):			-----			-----		-----		0.09	0.08
Au/s	Water cross-area before inlet (ft^2):			-----			-----		-----		0.20	0.15
Vu/s	Velocity for total discharge before inlet (ft/s):			-----			-----		-----		4.69	5.43
Eod	Ratio of gutter depression flow to total Q (Eod):			-----			-----		-----		-----	-----
Se	Equivalent cross-slope (ft/ft):			0.040			0.020		0.020		0.020	0.020
GRATE INLETS ON-GRADE:												
Eog	Ratio of grate frontal flow to total flow:			-----			-----		-----		80%	85%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression			-----			-----		-----		0.74	0.70
Vo	Vo for effective length (P-50, Chart 5) (ft/s):			-----			-----		-----		5.05	5.05
Rf	Fraction of frontal flow intercepted (Rf):			-----			-----		-----		1.00	0.97
Qs	Side flow in ft^3/s (Qs):			-----			-----		-----		0.19	0.12
Gle	Effective grate length w/ 25% clogging (in):			-----			-----		-----		27	27
Rs	Fraction of side flow interception (Rs):			-----			-----		-----		5%	4%
E	Grate Efficiency (E):			-----			-----		-----		81%	83%
Qi	Total flow intercepted (ft^3/s):			-----			-----		-----		0.75	0.68
Qb	Grate flow-by (ft^3/s):			-----			-----		-----		0.18	0.14
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)												
Lt	Length required for total interception (ft):			-----			-----		-----		-----	-----
Ci	Interception for provided length L (ft^3/s):			-----			-----		-----		-----	-----
El	Efficiency for providged length L:			-----			-----		-----		-----	-----
Qs	Slotted drain or side opening flow-by (ft^3/s):			-----			-----		-----		-----	-----
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:												
	Grate Inlets											
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			0.22			0.11		0.21		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			0.27			0.13		0.26		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			5.46			5.30		10.69		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			6.64			6.44		13.00		-----	-----
	Slotted drains											
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
	Curb opening inlets											
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft):			-----			-----		-----		-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):			-----			-----		-----		-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):			-----			-----		-----		-----	-----
Lc	Length of the vertical curve (ft):	>										
g1	approach grade #1 (%):	>										
g2	approach grade #2 (%):	>										
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22):			-----			-----		-----		-----	-----
Df	Flanking inlets distance (ft):			-----			-----		-----		-----	-----

Southgate Road Realignment - Yerba Buena Island

Drainage Inlet Capacity and Roadway Spread Calculations: 25-yr Storm Event

Job: Southgate Road, Yerba Buena Island

Designed by: Lesley Brooks ☐ Date:

Checked by: ☐ Date:

	Layout Line:		HC1	HC1	HC1	HC1	HC1	R2	BP	BP
In#	**Inlet Number:**		HC-1, left	HC-2, left	2aa	2ac	4ac	2ag	1ak	6a
		(Input Data Required)								
HYDROLOGY COMPUTATION:										
	Begin Station	>>								
	End Station	>>								
St	Structure location station:	>>		55+21	57+25	58+81	62+37	60+66	65+75	70+00
N	Notes		Existing Inlet >>	Existing Inlet >>	>>	>> to SG1 64+15	>> to SG1 64+15	LP Inlet	>> to SG1 64+20	<< to SG1 64+20
	Off-site contributing watershed area (acres):	>>	0.58	0.55	0	0	0	0	0	0.16
	On-site contributing watershed area (acres):	>>	0.29	0.28	0.30	0.16	0.24	0.43	0.44	0.10
Ar	Contributing watershed area (acres):		0.87	0.83	0.30	0.16	0.24	0.43	0.44	0.26
C	Composite Runoff Coefficient "C":	>>	0.71	0.73	1	1	1	1	1	1
Ic	Precipitation intensity (in/hr):	>>	3.42	3.42	3.42	3.42	3.42	3.42	3.42	3.42
Qa	Subarea discharge Q (ft^3/s):		2.11	2.07	1.03	0.55	0.82	1.47	1.50	0.89
qq	Previous by-pass flow (ft^3/s):	>		1.92	1.48	1.03	0.31			
Qadd	Discharge added by operator (ft^3/s):	>								
Qt	Total discharge Q (ft^3/s):		2.11	3.99	2.51	1.58	1.13	1.47	1.50	0.89
SHOULDER AND GUTTER CONFIGURATION:										
n	Manning's n:	>>	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
S	Longitudinal slope S (ft/ft):	>>	0.035	0.035	0.093	0.093	0.040	0.000	0.048	0.111
IT	Inlet type (1=grate, 2=curb opening, 3=slotted):	>>	2	1	1	1	1	1	1	1
LP	Longitudinal profile (1=on-grade, 2=sag):	>>	1	1	1	1	1	2	1	1
ID	Inlet description:	>								
	Grate Type:	>>	24-12	24-12X	24-12X	24-12X	24-12X	24-12X	24-12X	24-12X
Gw	Grate width (in):	>	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Gl	Grate length (in):	>	24.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
	3 or 4 sided weir?	>	3	3	3	3	3	3	3	3
Lco	Curb opening length provided (ft):	>	2.00							
Ls	Slotted drain length provided: (ft)	>								
Sx	Shoulder cross-slope Sx (ft/ft):	>>	0.0200	0.0340	0.0200	0.0400	0.0330	0.0300	0.0150	0.0150
W	Width of gutter from flowline (in):	>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
a(t)	Gutter depth from horizontal (in):	>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sw	Gutter cross-slope Sw (ft/ft): (S'w=Sw-Sx) (Sw=Sx if no gutter)		0.020	0.034	0.020	0.040	0.033	0.030	0.015	0.015
	Available Flooded Width (ft)	>	25.00	25.00	25.40	25.40	32.07	30.30	15.04	17.19
Tu/s	Flooded Width from flowline (ft):		7.36	6.71	6.54	3.56	4.16	-----	7.33	5.13
Tu/s	Flooded Width from flowline with gutter (ft):		7.36	6.71	6.54	3.56	4.16	-----	7.33	5.13
Du/s	Depth at flowline before inlet (ft):		0.15	0.23	0.13	0.14	0.14	-----	0.11	0.08
Au/s	Water cross-area before inlet (ft^2):		0.54	0.77	0.43	0.25	0.28	-----	0.40	0.20
Vu/s	Velocity for total discharge before inlet (ft/s):		3.89	5.22	5.86	6.20	3.97	-----	3.73	4.50
Eod	Ratio of gutter depression flow to total Q (Eod):		-----	-----	-----	-----	-----	-----	-----	-----
Se	Equivalent cross-slope (ft/ft):		0.020	0.034	0.020	0.040	0.033	0.030	0.015	0.015
GRATE INLETS ON-GRADE:										
Eog	Ratio of grate frontal flow to total flow:		-----	61%	62%	89%	83%	-----	57%	73%
Qw	Inlet frontal flow in ft^3/s (Qw): at inlet w/ gutter depression		-----	2.44	1.56	1.40	0.93	-----	0.86	0.65
Vo	Vo for effective length (P-50, Chart 5) (ft/s):		-----	5.05	5.05	5.05	5.05	-----	5.05	5.05
Rf	Fraction of frontal flow intercepted (Rf):		-----	0.99	0.93	0.90	1.00	-----	1.00	1.00
Qs	Side flow in ft^3/s (Qs):		-----	1.55	0.95	0.18	0.20	-----	0.64	0.24
Gle	Effective grate length w/ 25% clogging (in):		-----	27	27	27	27	-----	27	27
Rs	Fraction of side flow interception (Rs):		-----	7%	3%	6%	11%	-----	6%	4%
E	Grate Efficiency (E):		-----	63%	59%	80%	84%	-----	60%	74%
Qi	Total flow intercepted (ft^3/s):		-----	2.51	1.48	1.27	0.95	-----	0.90	0.66
Qb	Grate flow-by (ft^3/s):		-----	1.48	1.03	0.31	0.18	-----	0.61	0.23
SLOTTED DRAINS AND CURB OPENING INLETS ON-GRADE: (No clogging factor)										
Lt	Length required for total interception (ft):		39.04	-----	-----	-----	-----	-----	-----	-----
Ci	Interception for provided length L (ft^3/s):		0.2	-----	-----	-----	-----	-----	-----	-----
El	Efficiency for providged length L:		9%	-----	-----	-----	-----	-----	-----	-----
Qs	Slotted drain or side opening flow-by (ft^3/s):		1.9	-----	-----	-----	-----	-----	-----	-----
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:										
	Grate Inlets									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	0.22	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	0.27	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	7.40	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	8.99	-----	-----
	Slotted drains									
d_{33}	Depth of ponding at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
	Curb opening inlets									
d_{33}	Depth of ponding at inlet (Weir, 33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
d_{50}	Depth of ponding at inlet (Weir, 50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{33}	Ponded width at inlet (33% Clogging - Freeway)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
w_{50}	Ponded width at inlet (50% Clogging City St)(ft):		-----	-----	-----	-----	-----	-----	-----	-----
Lc	Length of the vertical curve (ft):	>								
g1	approach grade #1 (%):	>								
g2	approach grade #2 (%):	>								
K	K = Min(Lc/(Diff(g1,g2),167) (Table 4-7, HEC-22):		-----	-----	-----	-----	-----	-----	-----	-----
Df	Flanking inlets distance (ft):		-----	-----	-----	-----	-----	-----	-----	-----

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Appendix E Gutter Flow Calculations

Appendix E.1 8a Gutter Calculations

Appendix E.2 1ah Gutter Calculations

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Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 6 2019

8a - Concrete Lined Gutter (25-yr Storm Event)

Trapezoidal

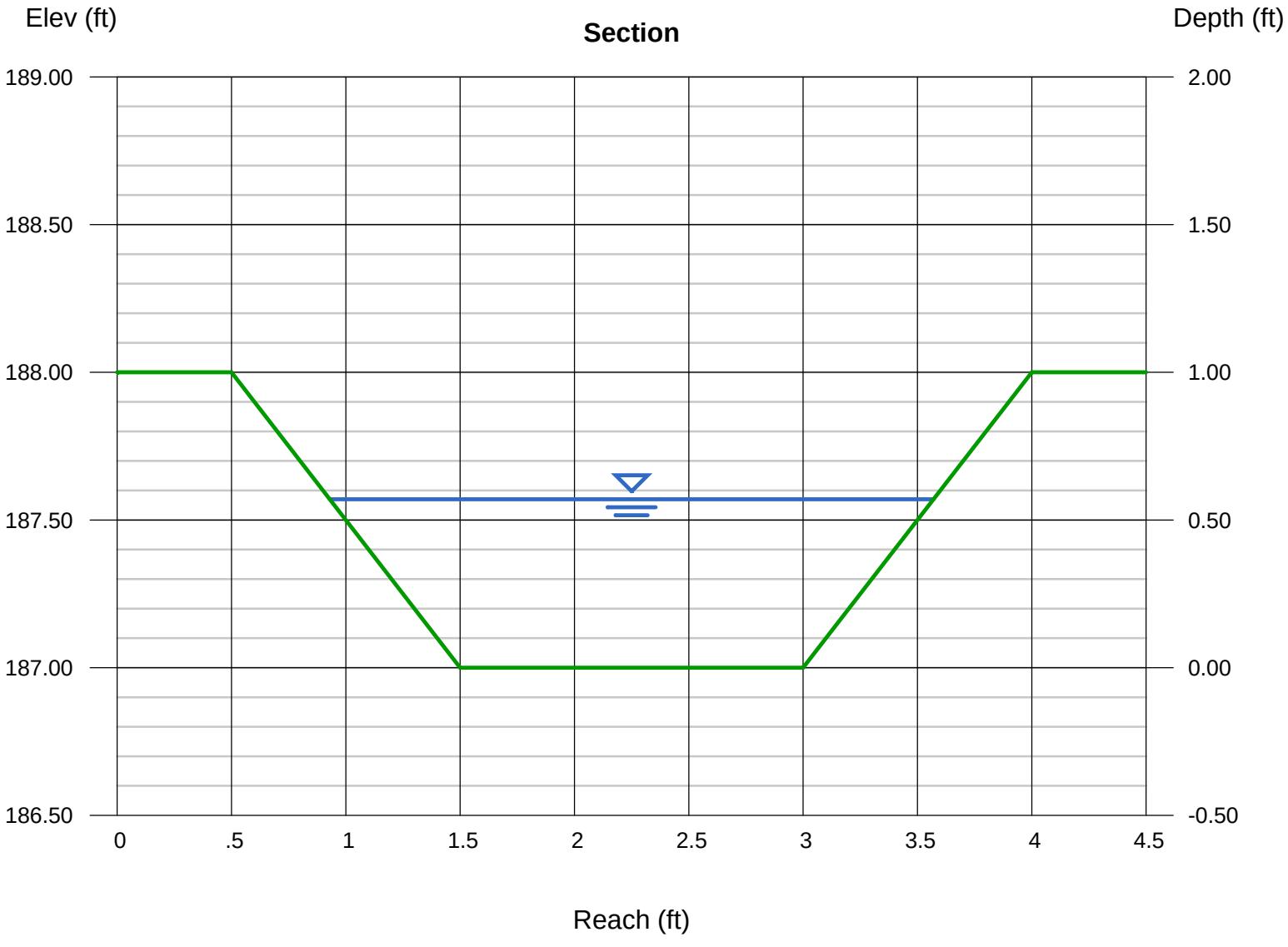
Bottom Width (ft)	= 1.50
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 187.00
Slope (%)	= 0.50
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.23

Highlighted

Depth (ft)	= 0.57
Q (cfs)	= 4.230
Area (sqft)	= 1.18
Velocity (ft/s)	= 3.59
Wetted Perim (ft)	= 3.11
Crit Depth, Yc (ft)	= 0.56
Top Width (ft)	= 2.64
EGL (ft)	= 0.77



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 6 2018

1ah - Concrete Lined Gutter (25-yr Storm Event)

Triangular

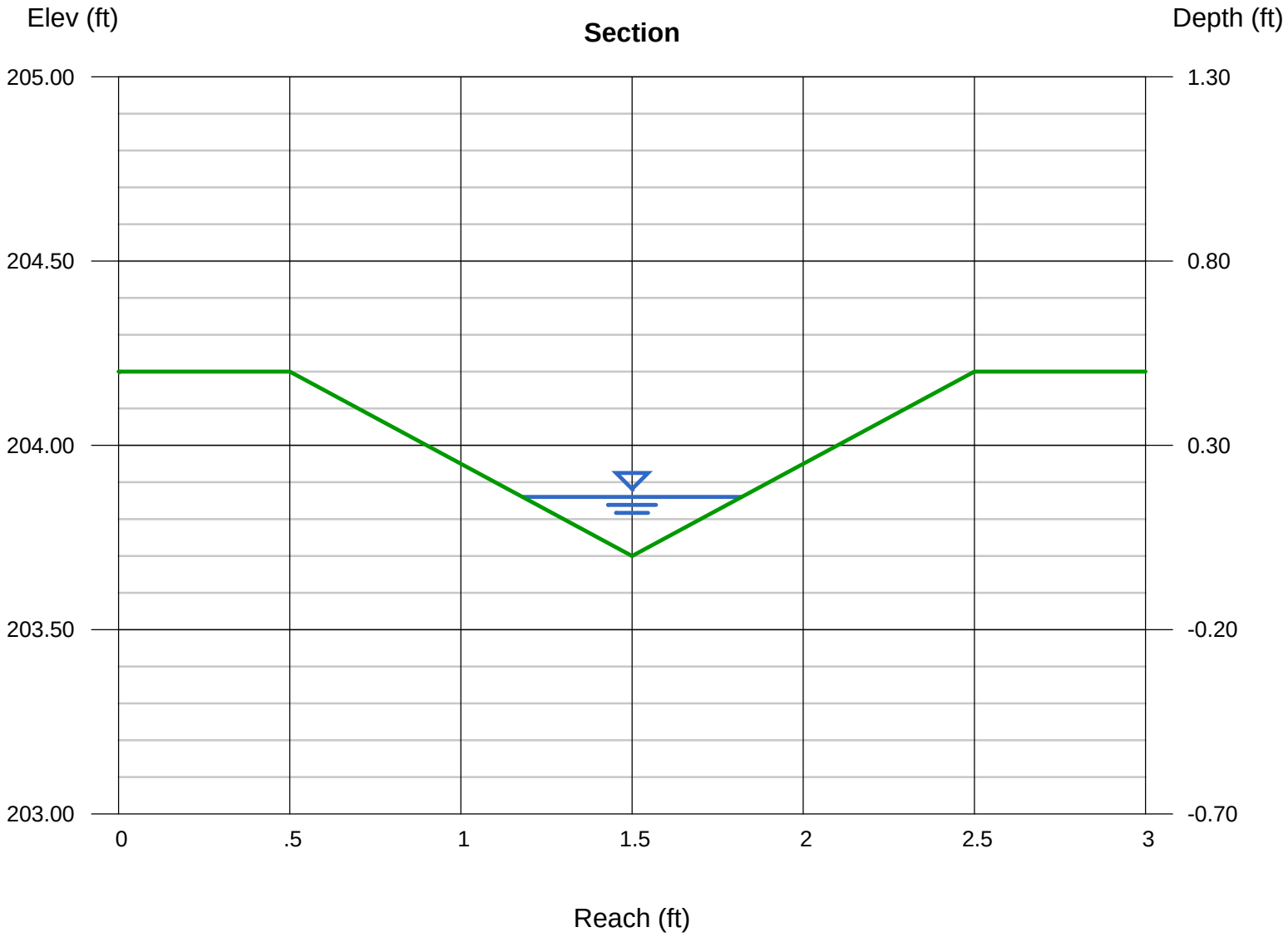
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 203.70
Slope (%)	= 0.50
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.06

Highlighted

Depth (ft)	= 0.16
Q (cfs)	= 0.060
Area (sqft)	= 0.05
Velocity (ft/s)	= 1.17
Wetted Perim (ft)	= 0.72
Crit Depth, Yc (ft)	= 0.15
Top Width (ft)	= 0.64
EGL (ft)	= 0.18



Appendix F Hydraflow Input and Results

Appendix F.1 Pipe Line Layout Map

Appendix F.2 5-yr Summary Report

Appendix F.3 5-yr Storm Sewer Tabulation

Appendix F.4 5-yr Profiles

Appendix F.5 25-yr Summary Report

Appendix F.6 25-yr Storm Sewer Tabulation

Appendix F.7 25-yr Profiles

Appendix F.8 100-yr Summary Report

Appendix F.9 100-yr Storm Sewer Tabulation

Appendix F.10 100-yr Profiles

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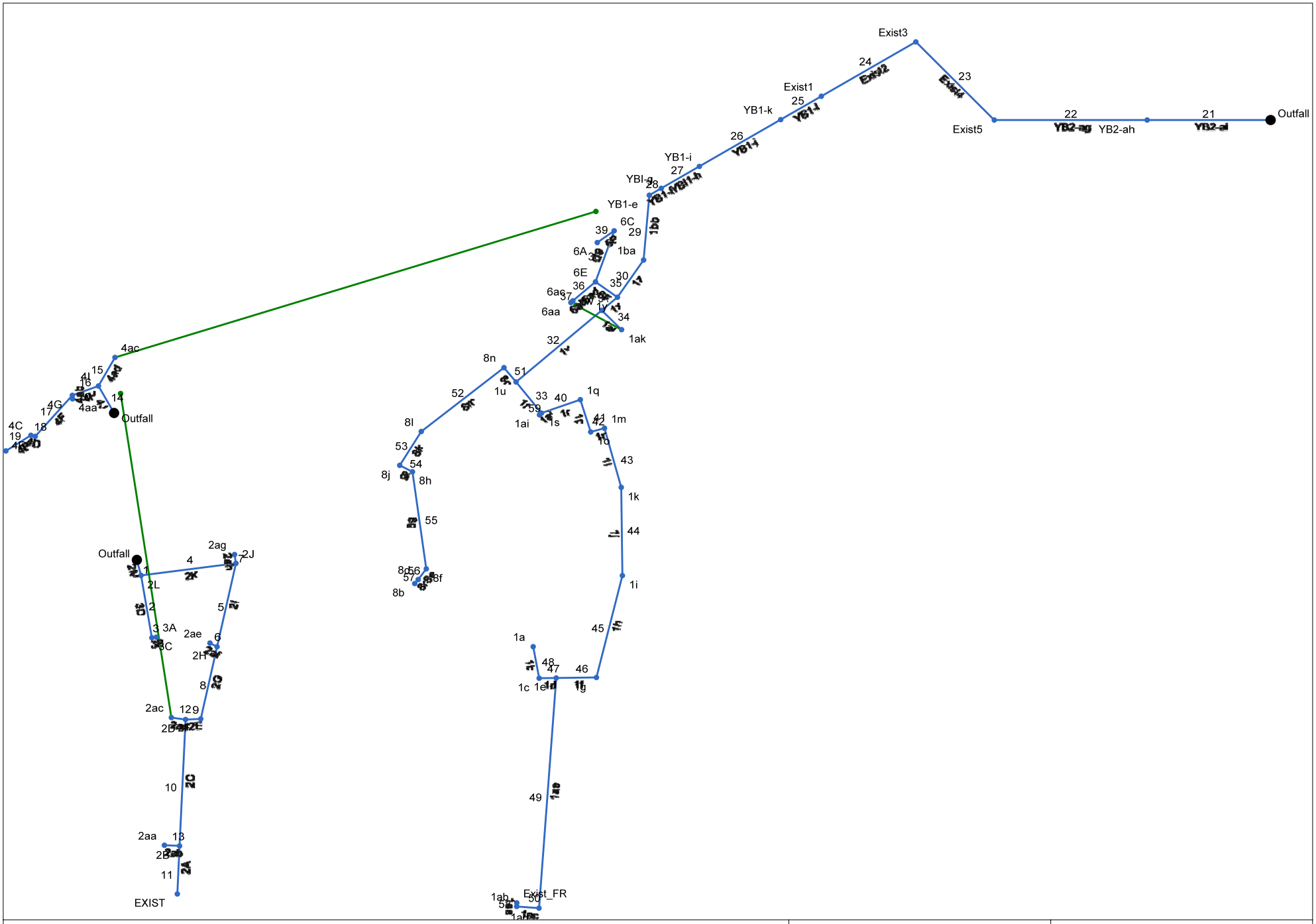
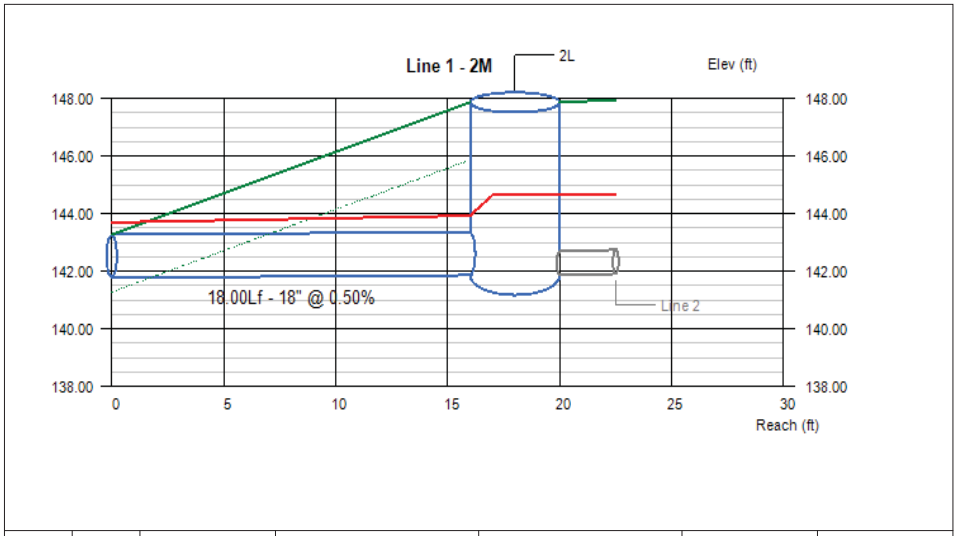
YBI-Southgate



Project File: YBI-SouthgateCaltrans_100%_201907.stm	Number of lines: 59	Date: 7/19/2019

Line Profile (Line 1) - 2M

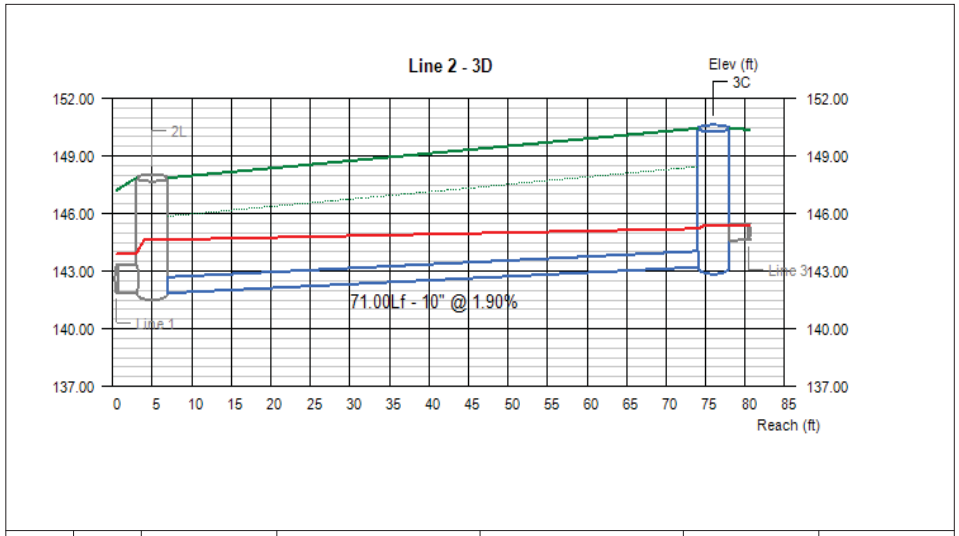


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	12.05	141.77	141.86	1.50	1.50	2.78	143.69	143.93	144.64	6.82	6.82	0.00	4.50

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 2) - 3D

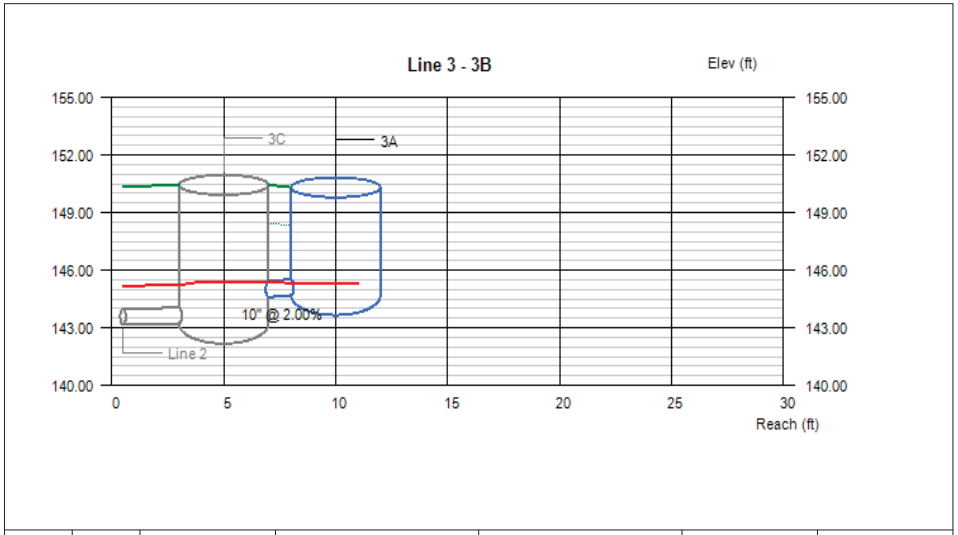


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	1.96	141.86	143.21	0.83	0.83	2.20	144.64	145.21	145.41	3.59	3.59	5.17	6.40

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 3) - 3B

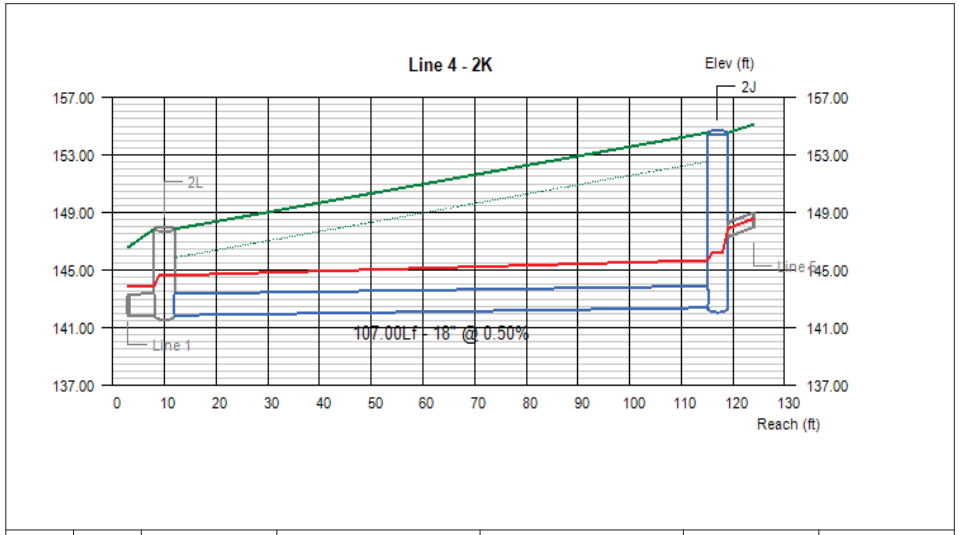


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	1.96	144.59	144.69	0.82	0.63	0.63	145.41	145.32	145.32	3.61	4.45	5.02	4.79

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 4) - 2K

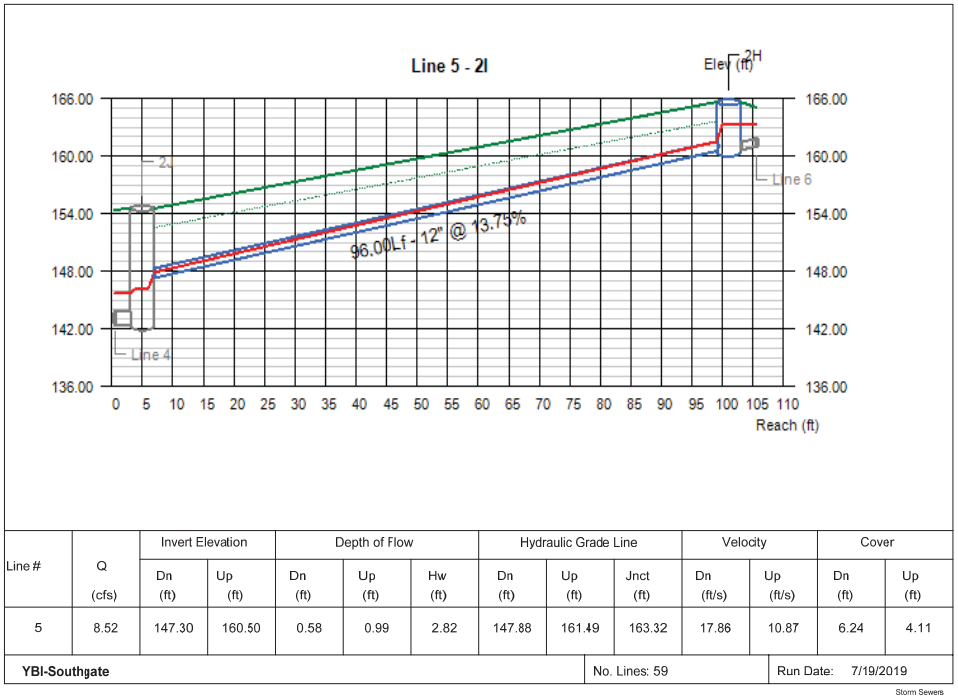


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	10.38	141.86	142.39	1.50	1.50	3.84	144.64	145.69	146.23	5.88	5.88	4.50	10.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 5) - 2I

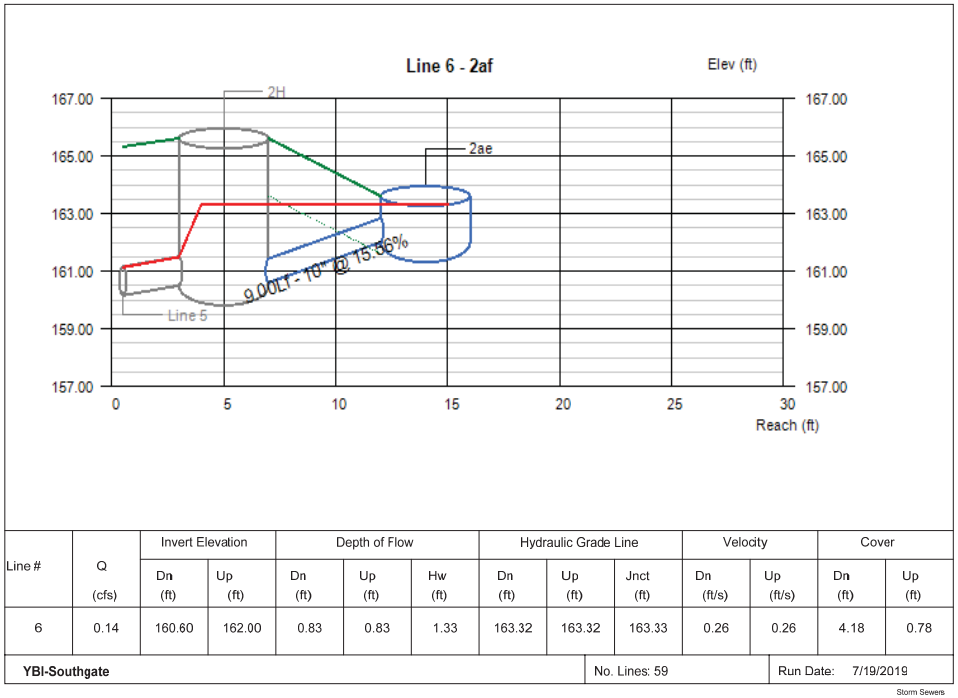


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
5	8.52	147.30	160.50	0.58	0.99	2.82	147.88	161.49	163.32	17.86	10.87	6.24	4.11

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 6) - 2af

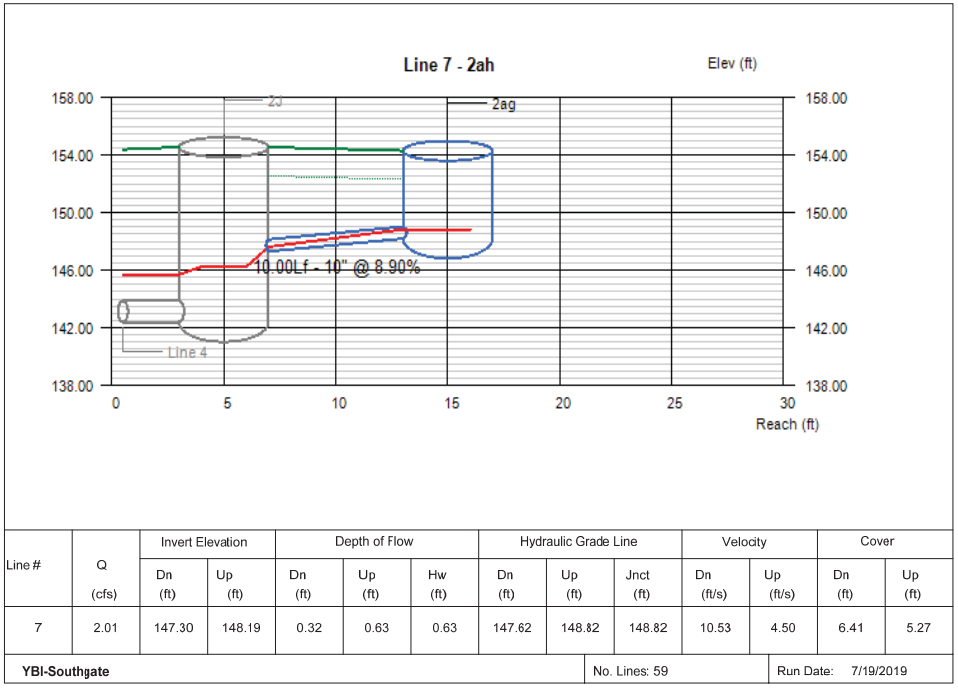


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
6	0.14	160.60	162.00	0.83	0.83	1.33	163.32	163.32	163.33	0.26	0.26	4.18	0.78

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 7) - 2ah

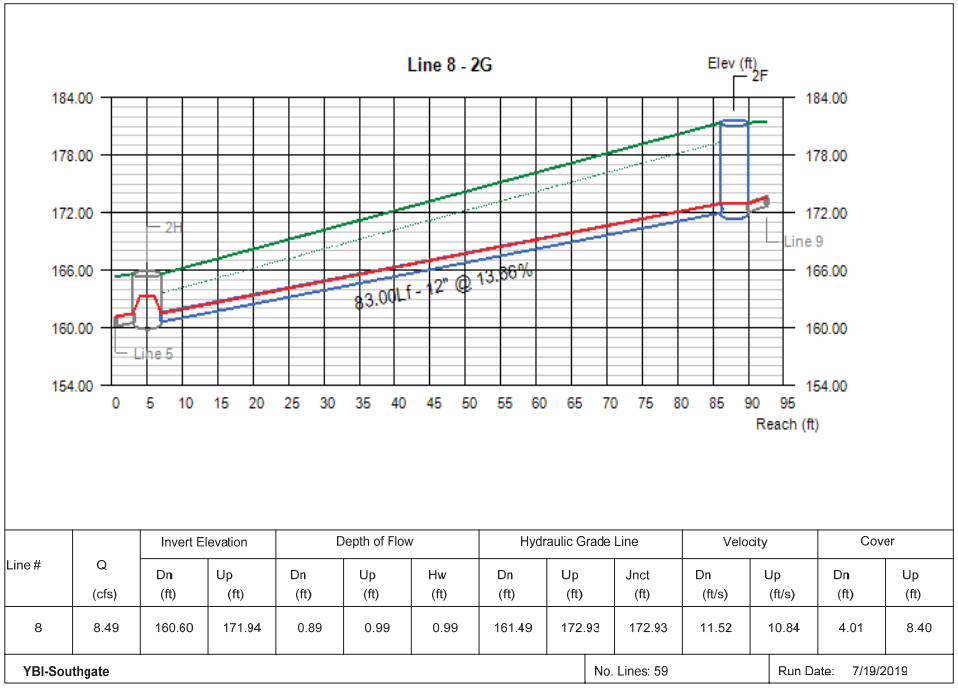


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
7	2.01	147.30	148.19	0.32	0.63	0.63	147.62	148.82	148.82	10.53	4.50	6.41	5.27

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 8) - 2G

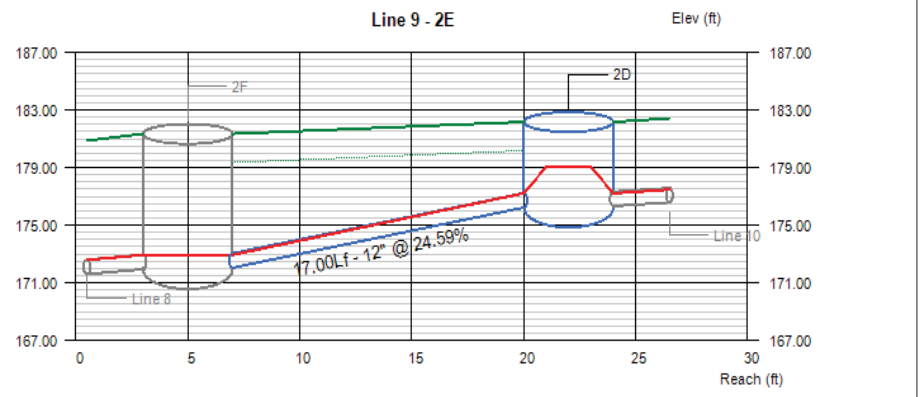


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
8	8.49	160.60	171.94	0.89	0.99	0.99	161.49	172.93	172.93	11.52	10.84	4.01	8.40

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

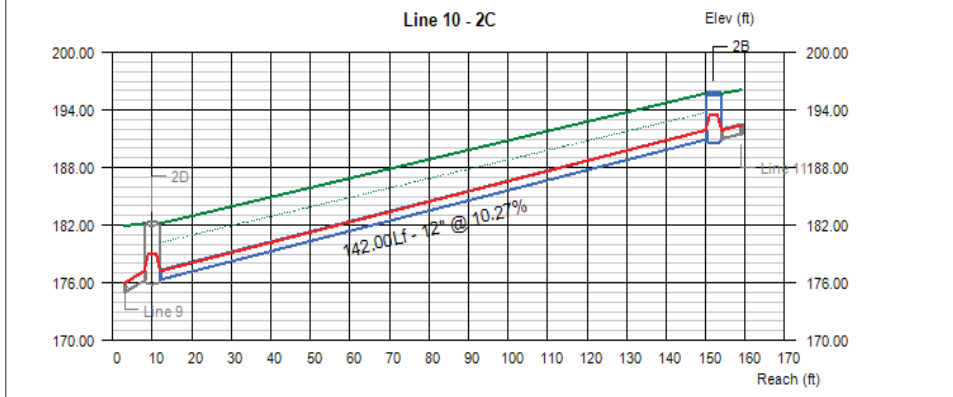
Storm Sewers

Line Profile (Line 9) - 2E



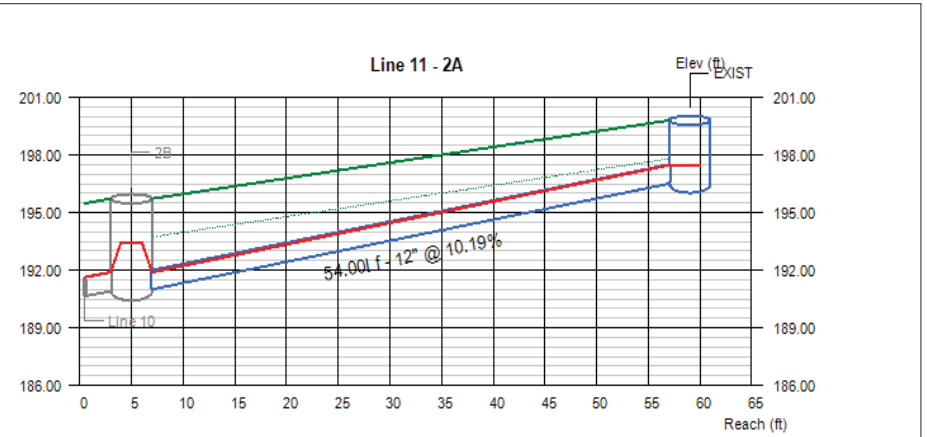
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
9	8.51	172.04	176.22	0.89	0.99	2.82	172.93	177.21	179.04	11.54	10.85	8.30	4.95

Line Profile (Line 10) - 2C



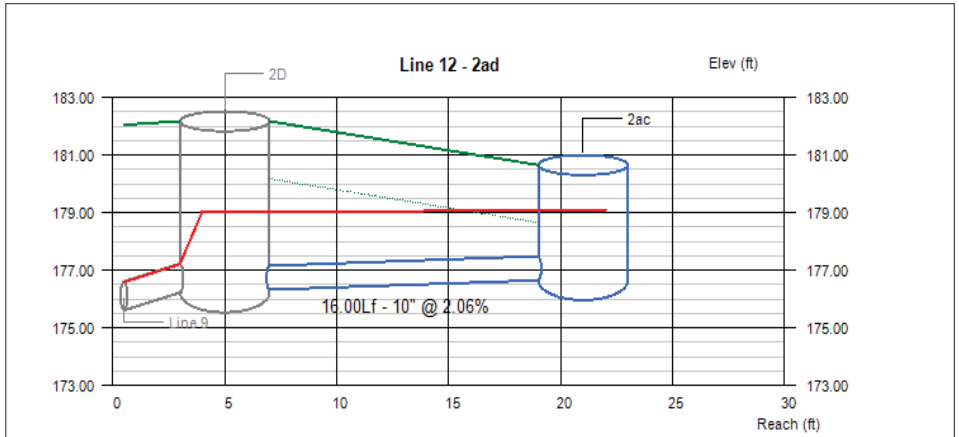
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
10	7.89	176.32	190.90	0.89	0.98	2.56	177.21	191.88	193.46	10.69	10.07	4.85	3.82

Line Profile (Line 11) - 2A



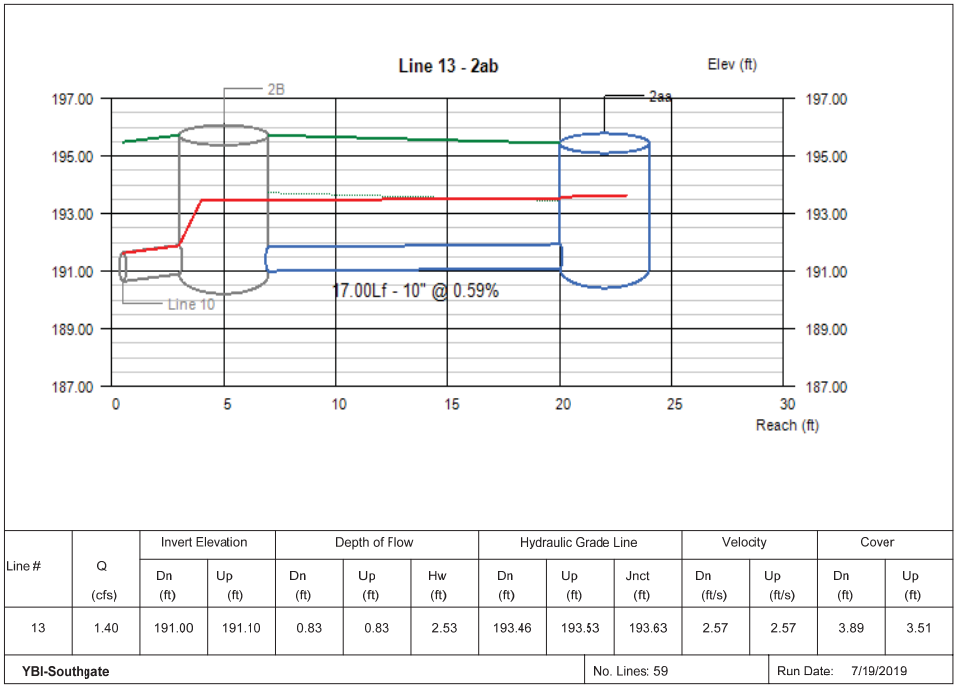
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
11	6.54	191.00	196.50	0.88	0.97	0.97	191.88	197.47	197.47	8.90	8.41	3.72	2.30

Line Profile (Line 12) - 2ad



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
12	0.75	176.32	176.65	0.83	0.83	2.44	179.04	179.06	179.09	1.37	1.37	5.02	3.17

Line Profile (Line 13) - 2ab

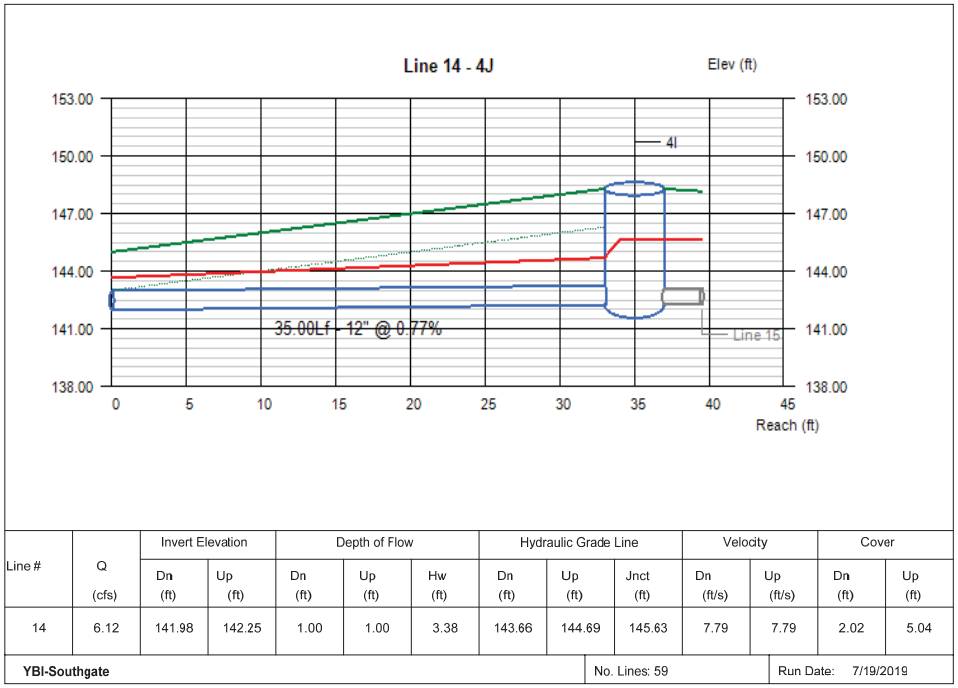


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
13	1.40	191.00	191.10	0.83	0.83	2.53	193.46	193.53	193.63	2.57	2.57	3.89	3.51

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 14) - 4J

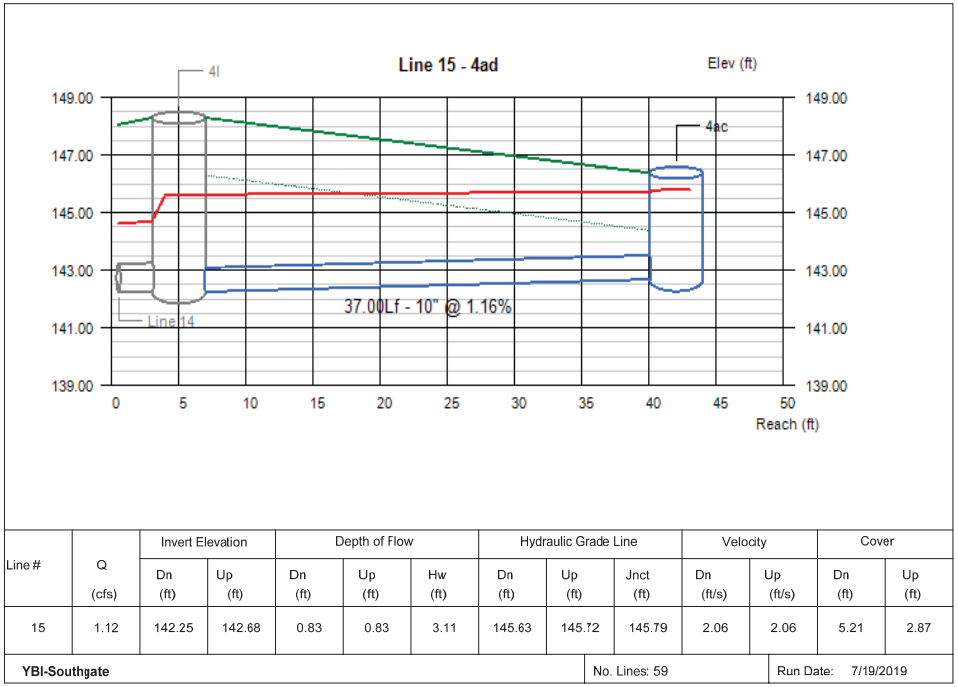


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
14	6.12	141.98	142.25	1.00	1.00	3.38	143.66	144.69	145.63	7.79	7.79	2.02	5.04

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 15) - 4ad

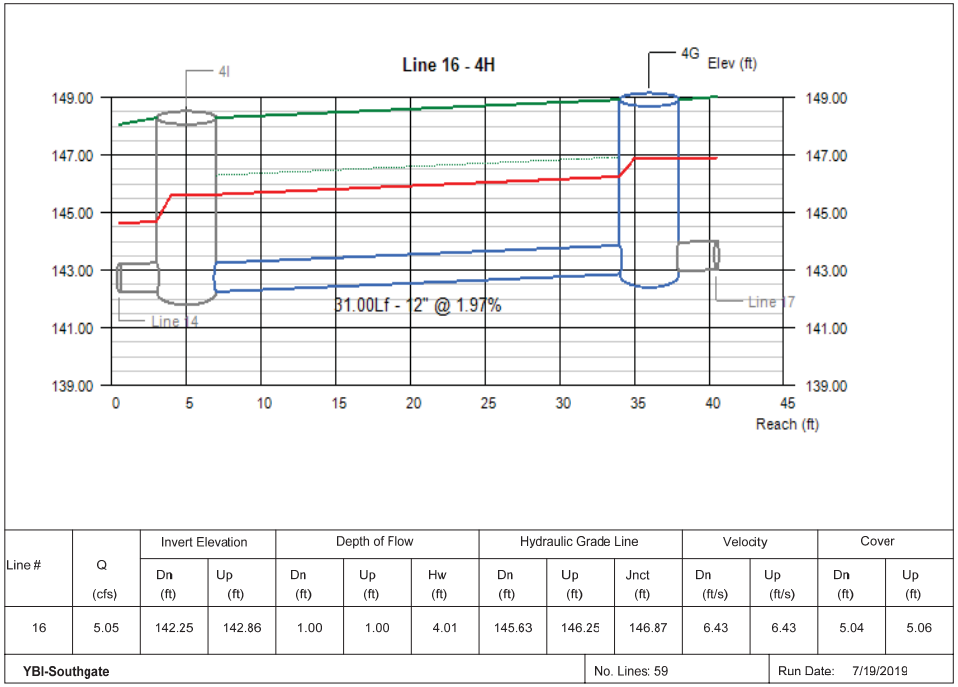


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
15	1.12	142.25	142.68	0.83	0.83	3.11	145.63	145.72	145.79	2.06	2.06	5.21	2.87

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 16) - 4H

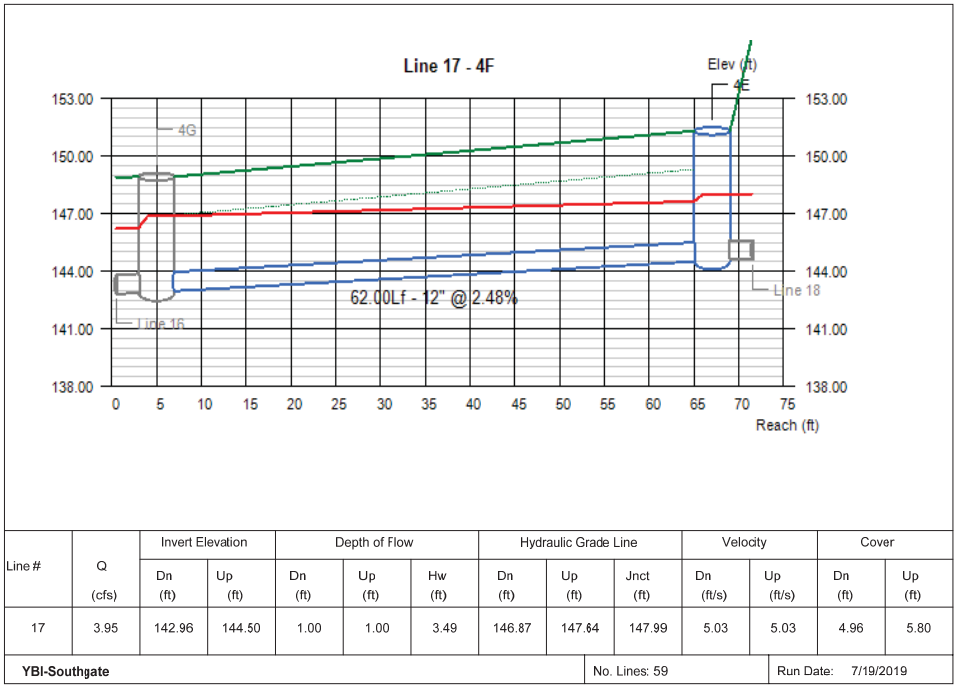


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
16	5.05	142.25	142.86	1.00	1.00	4.01	145.63	146.25	146.87	6.43	6.43	5.04	5.06

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 17) - 4F

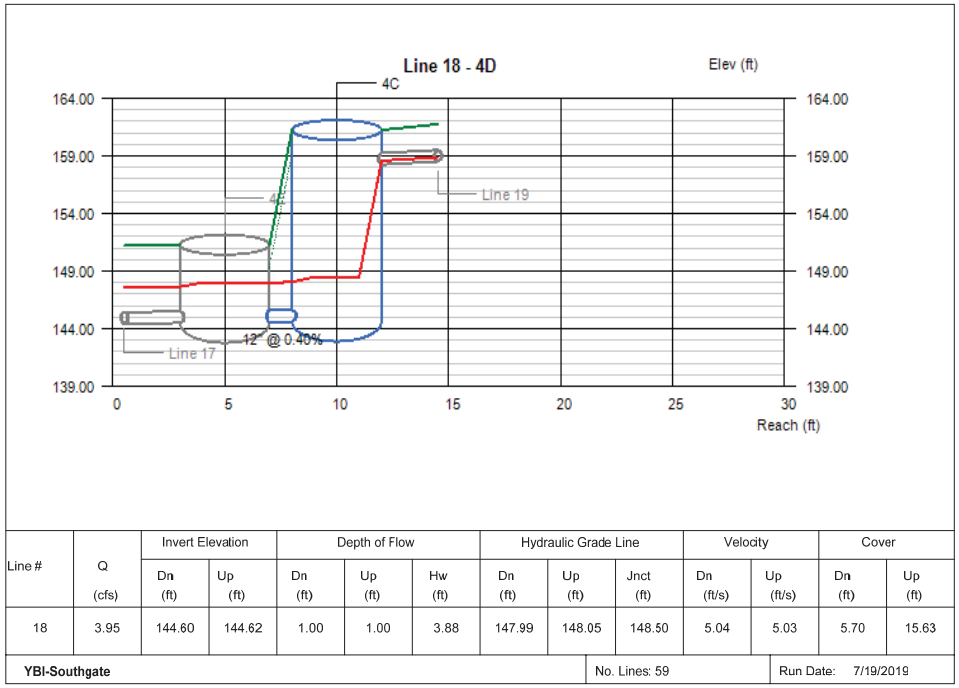


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
17	3.95	142.96	144.50	1.00	1.00	3.49	146.87	147.64	147.99	5.03	5.03	4.96	5.80

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 18) - 4D

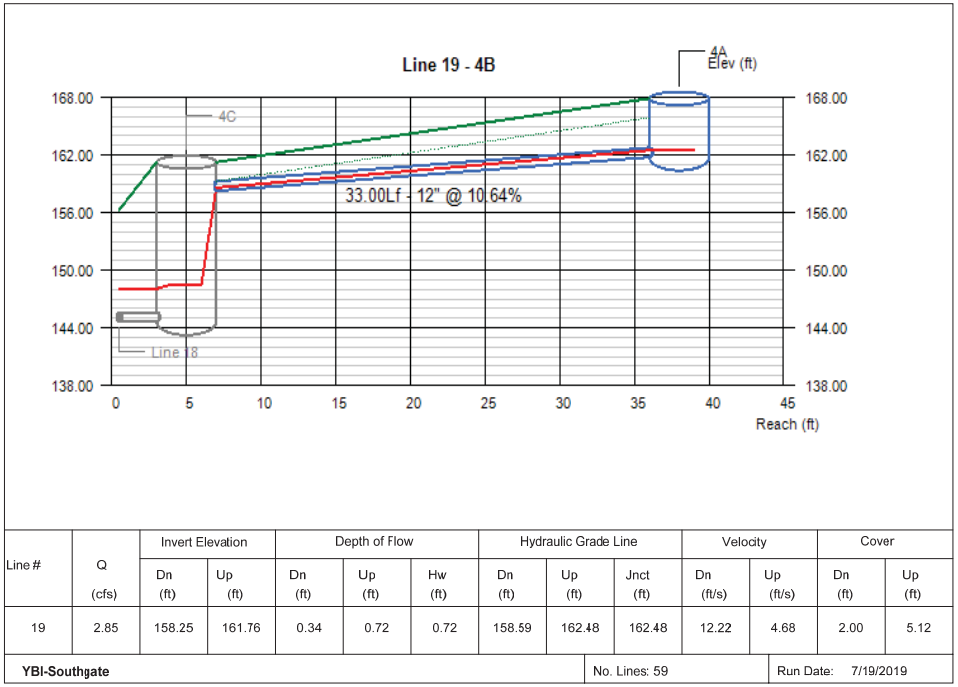


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
18	3.95	144.60	144.62	1.00	1.00	3.88	147.99	148.05	148.50	5.04	5.03	5.70	15.63

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 19) - 4B

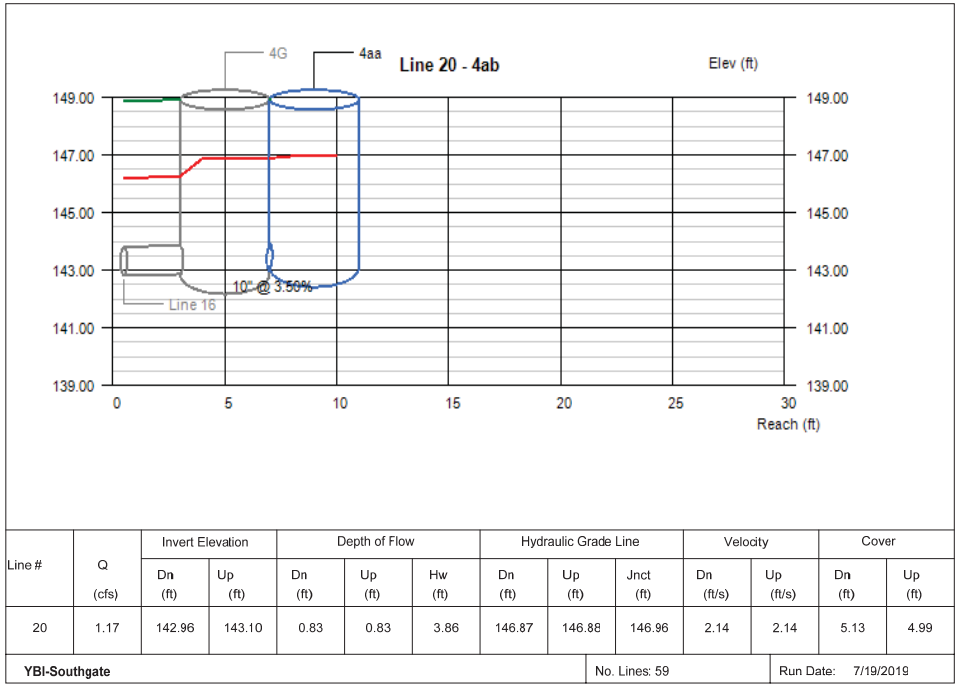


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
19	2.85	158.25	161.76	0.34	0.72	0.72	158.59	162.48	162.48	12.22	4.68	2.00	5.12

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 20) - 4ab

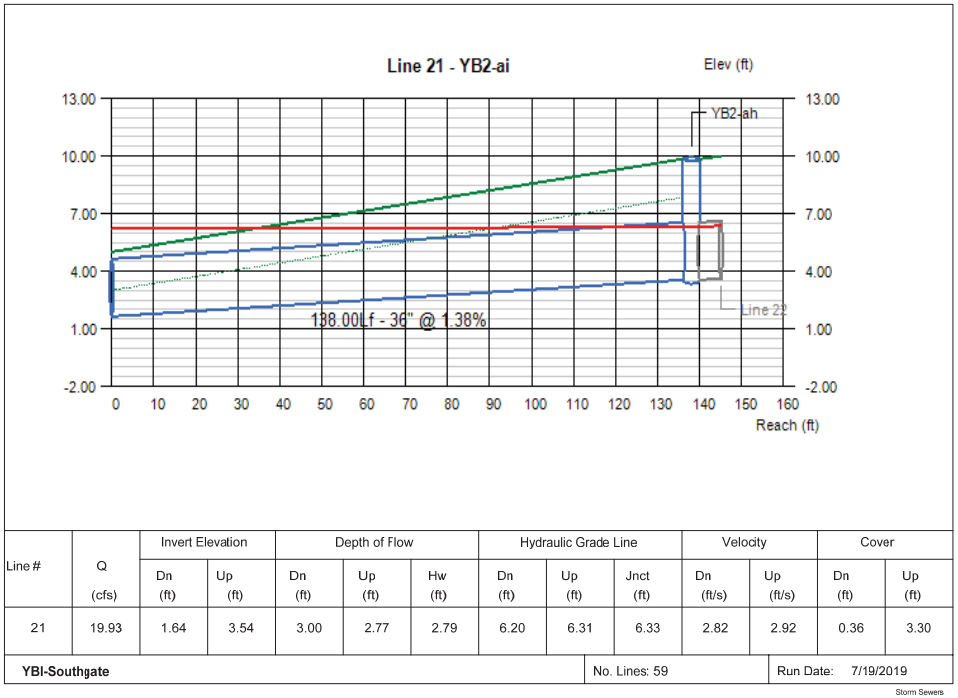


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
20	1.17	142.96	143.10	0.83	0.83	3.86	146.87	146.88	146.96	2.14	2.14	5.13	4.99

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 21) - YB2-ai

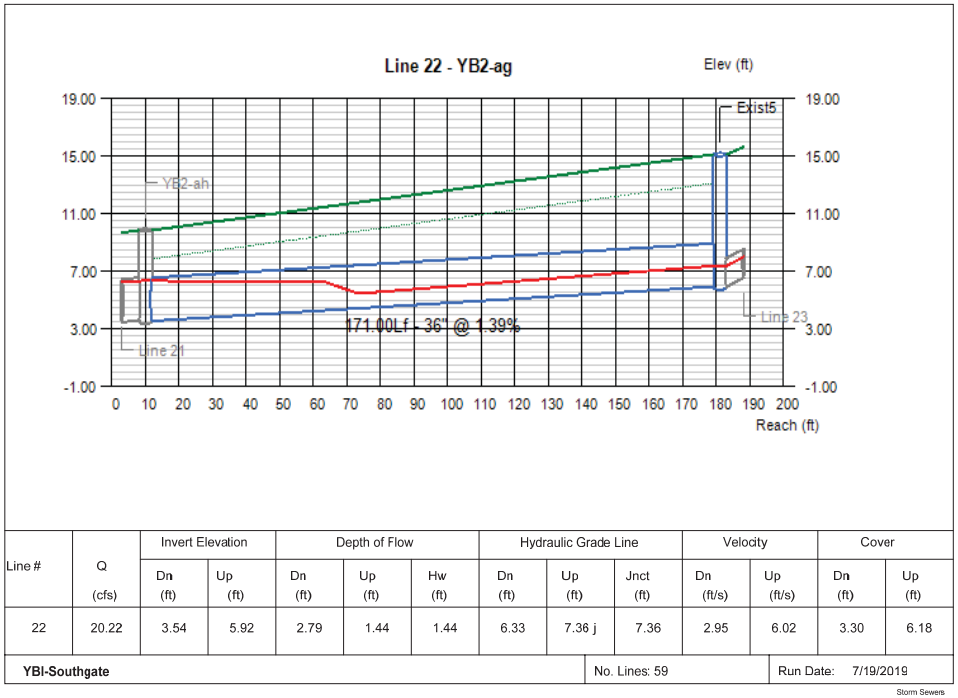


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
21	19.93	1.64	3.54	3.00	2.77	2.79	6.20	6.31	6.33	2.82	2.92	0.36	3.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 22) - YB2-ag

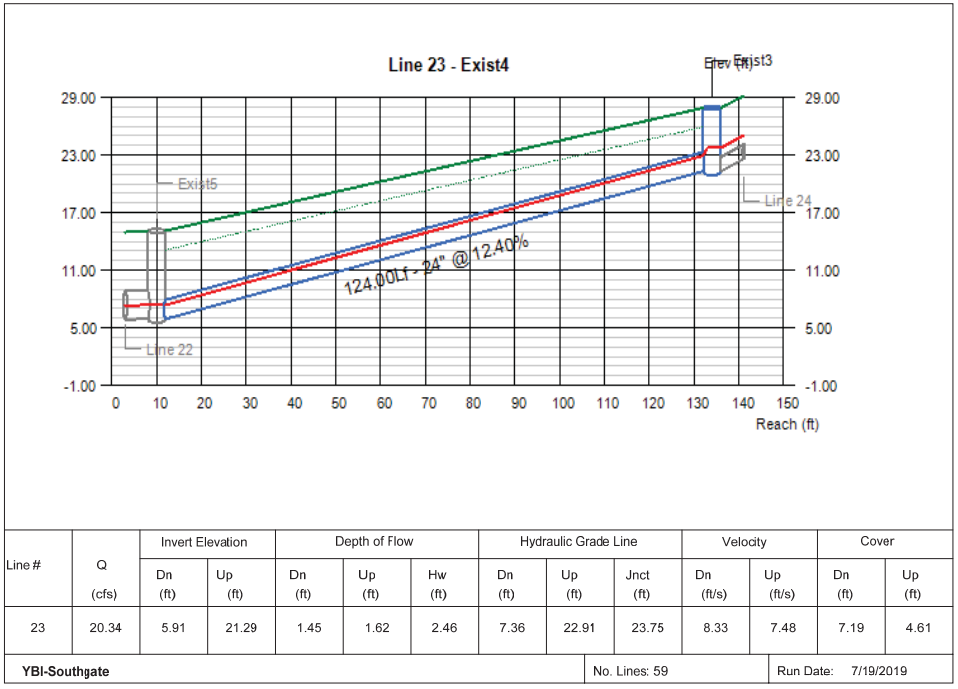


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
22	20.22	3.54	5.92	2.79	1.44	1.44	6.33	7.36 j	7.36	2.95	6.02	3.30	6.18

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 23) - Exist4

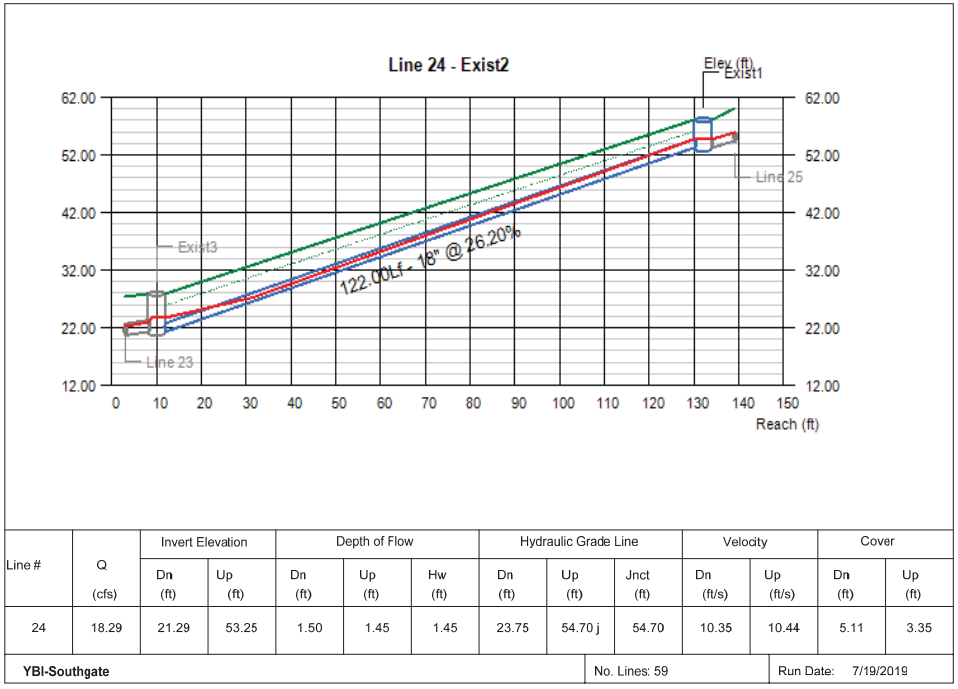


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
23	20.34	5.91	21.29	1.45	1.62	2.46	7.36	22.91	23.75	8.33	7.48	7.19	4.61

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 24) - Exist2

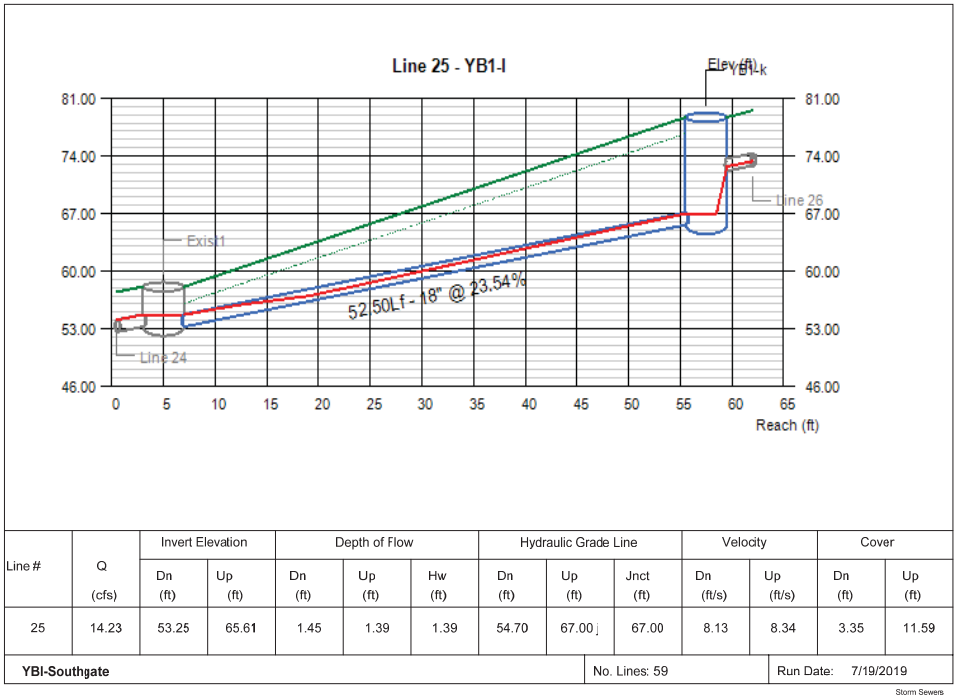


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
24	18.29	21.29	53.25	1.50	1.45	1.45	23.75	54.70 j	54.70	10.35	10.44	5.11	3.35

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 25) - YB1-l

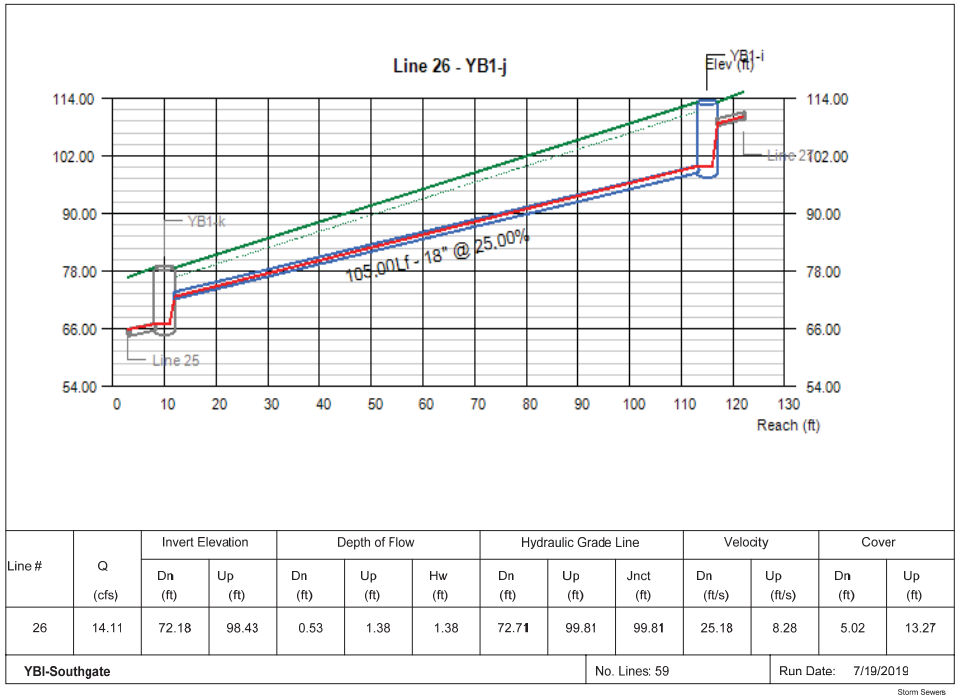


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
25	14.23	53.25	65.61	1.45	1.39	1.39	54.70	67.00	67.00	8.13	8.34	3.35	11.59

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 26) - YB1-j

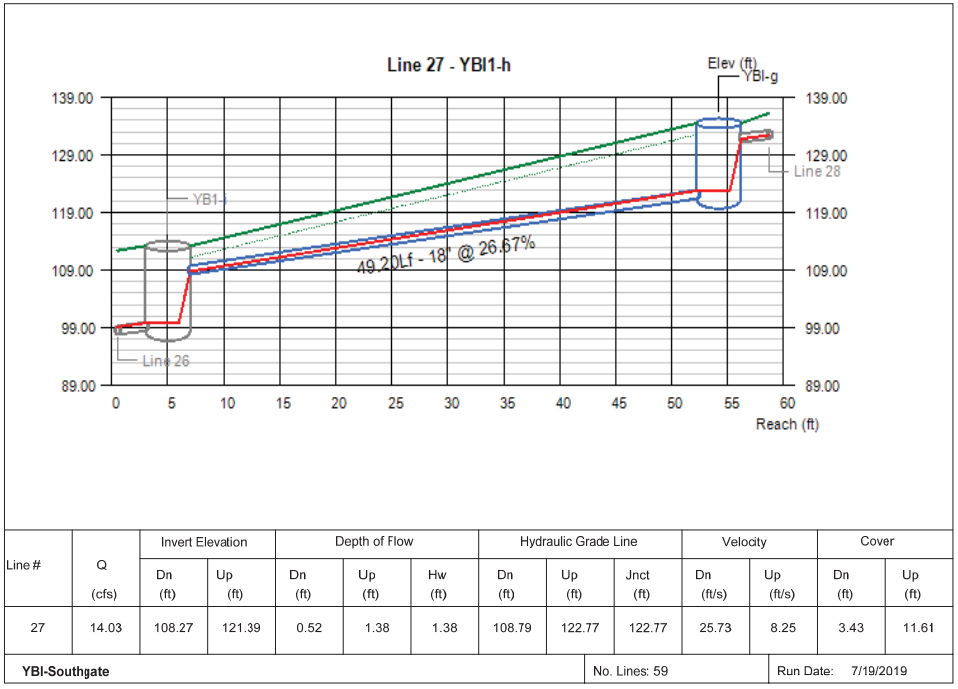


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
26	14.11	72.18	98.43	0.53	1.38	1.38	72.71	99.81	99.81	25.18	8.28	5.02	13.27

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 27) - YBI1-h

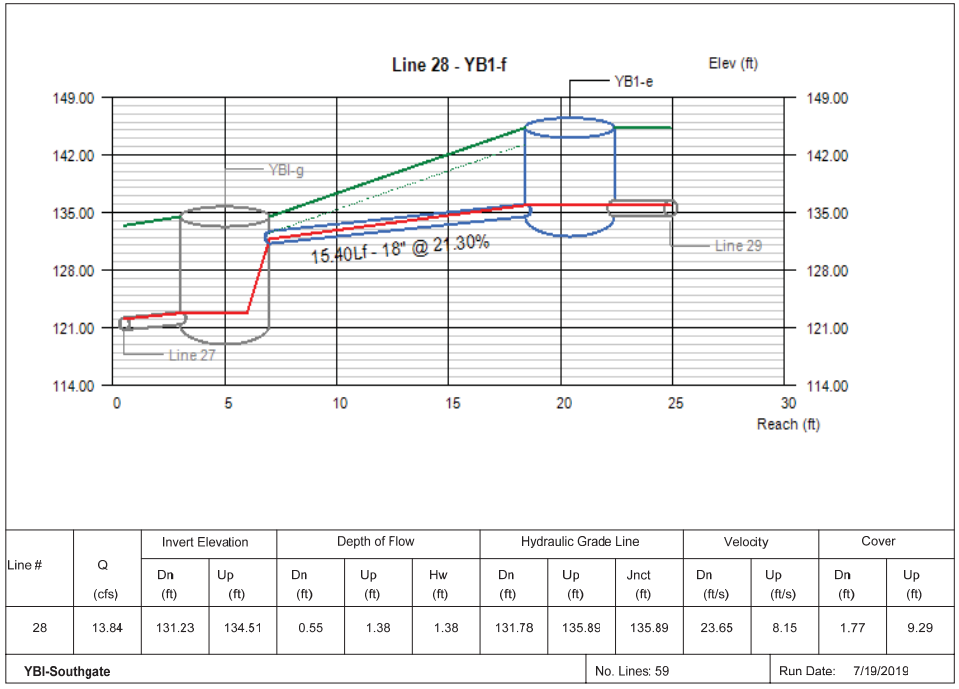


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
27	14.03	108.27	121.39	0.52	1.38	1.38	108.79	122.77	122.77	25.73	8.25	3.43	11.61

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 28) - YB1-f

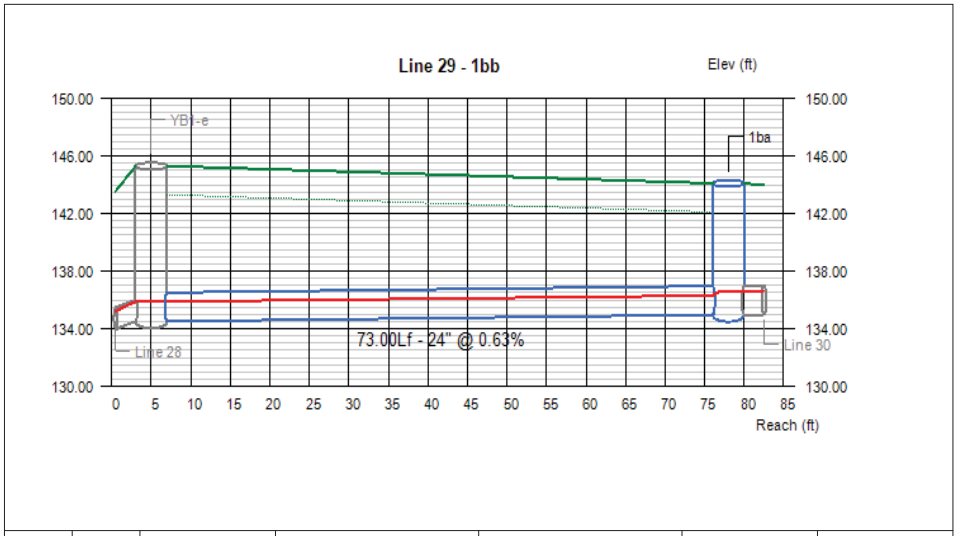


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
28	13.84	131.23	134.51	0.55	1.38	1.38	131.78	135.89	135.89	23.65	8.15	1.77	9.29

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 29) - 1bb

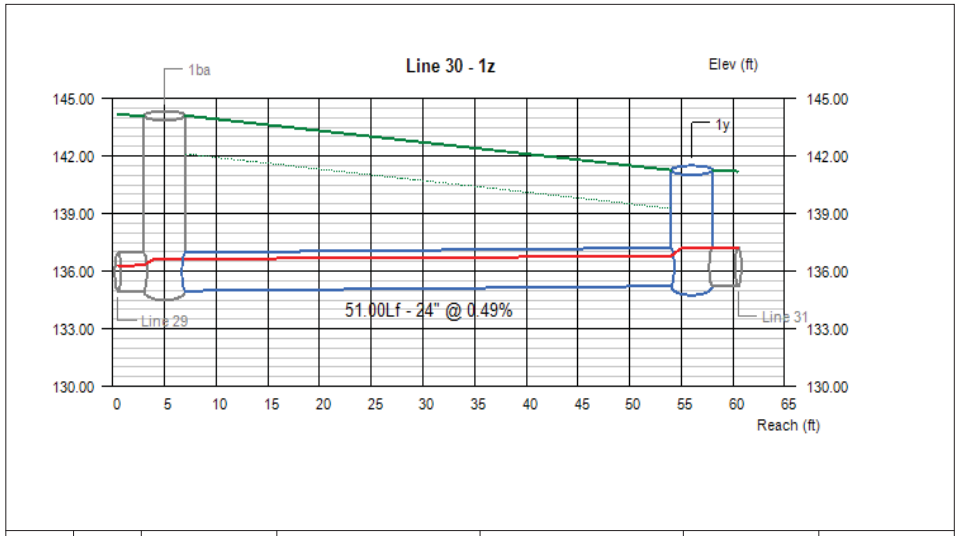


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
29	13.70	134.51	134.97	1.38	1.33	1.66	135.89	136.30	136.63	5.94	6.17	8.79	7.13

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 30) - 1z

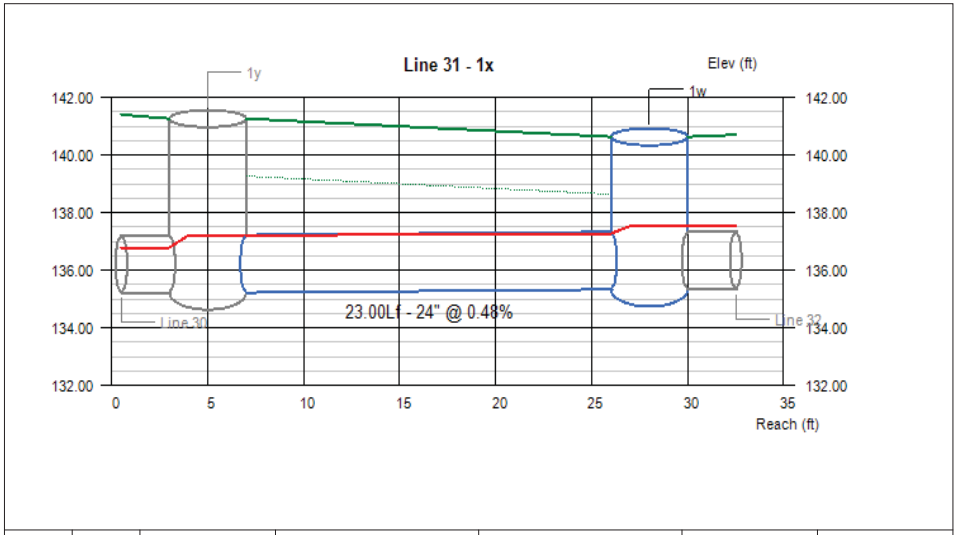


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
30	13.76	134.97	135.22	1.66	1.56	1.99	136.63	136.78	137.21	4.93	5.23	7.13	4.04

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 31) - 1x

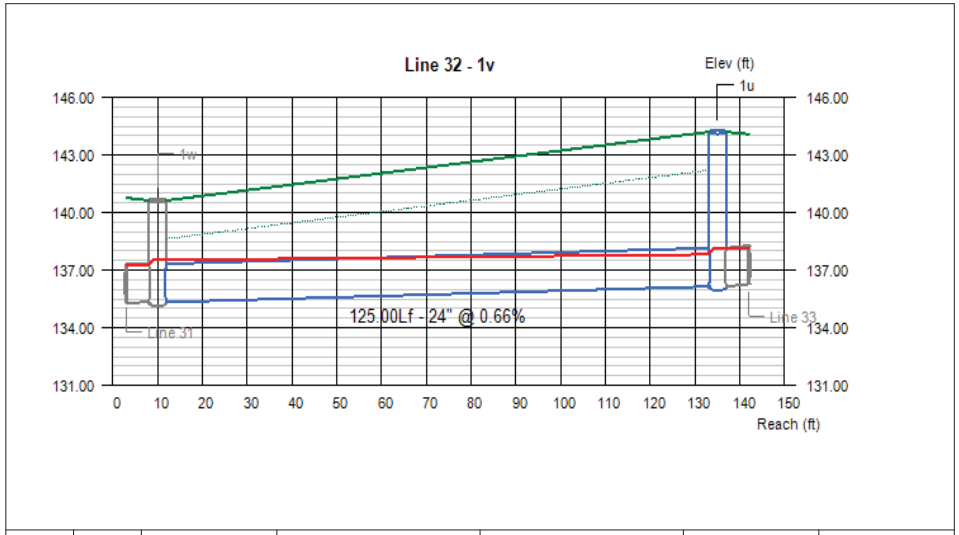


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
31	12.79	135.22	135.33	1.99	1.94	2.20	137.21	137.27	137.53	4.08	4.11	4.04	3.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 32) - 1v

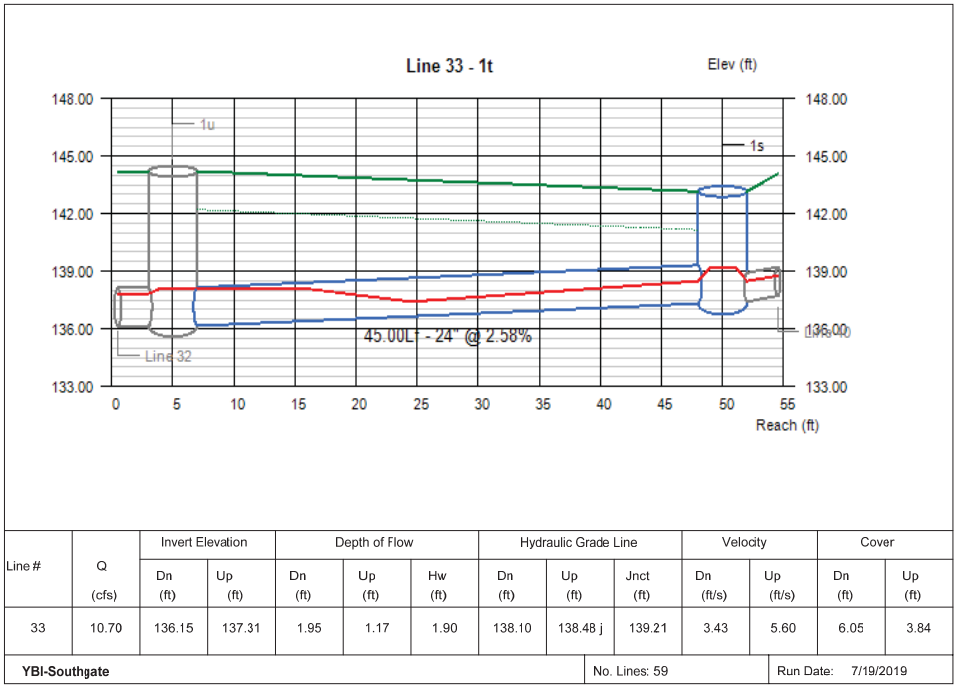


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
32	11.99	135.33	136.15	2.00	1.67	1.95	137.53	137.82	138.10	3.82	4.28	3.30	6.05

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 33) - 1t

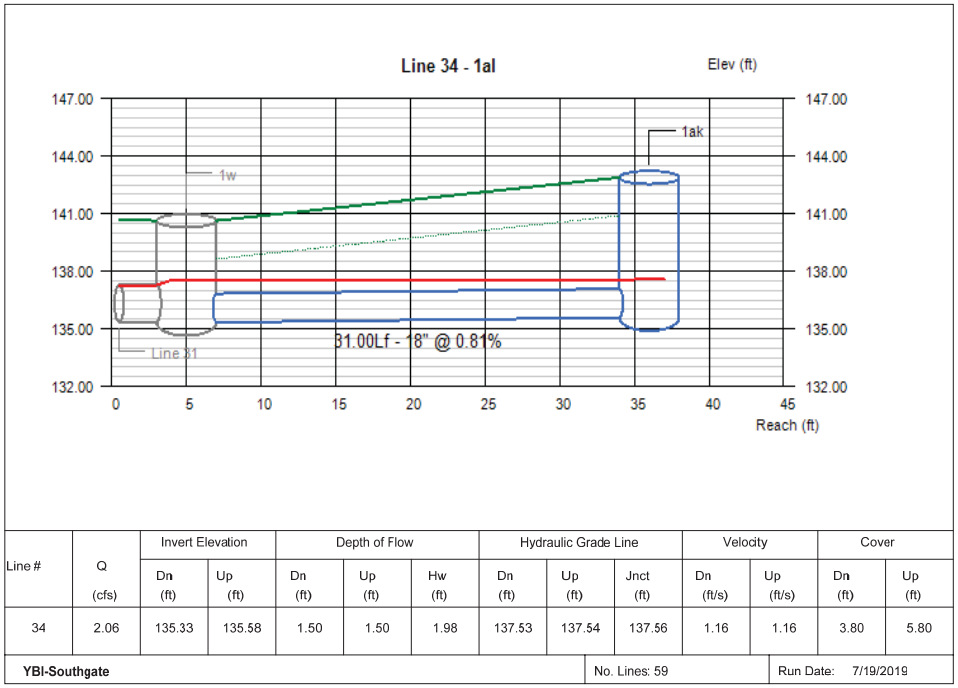


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
33	10.70	136.15	137.31	1.95	1.17	1.90	138.10	138.48 j	139.21	3.43	5.60	6.05	3.84

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 34) - 1al

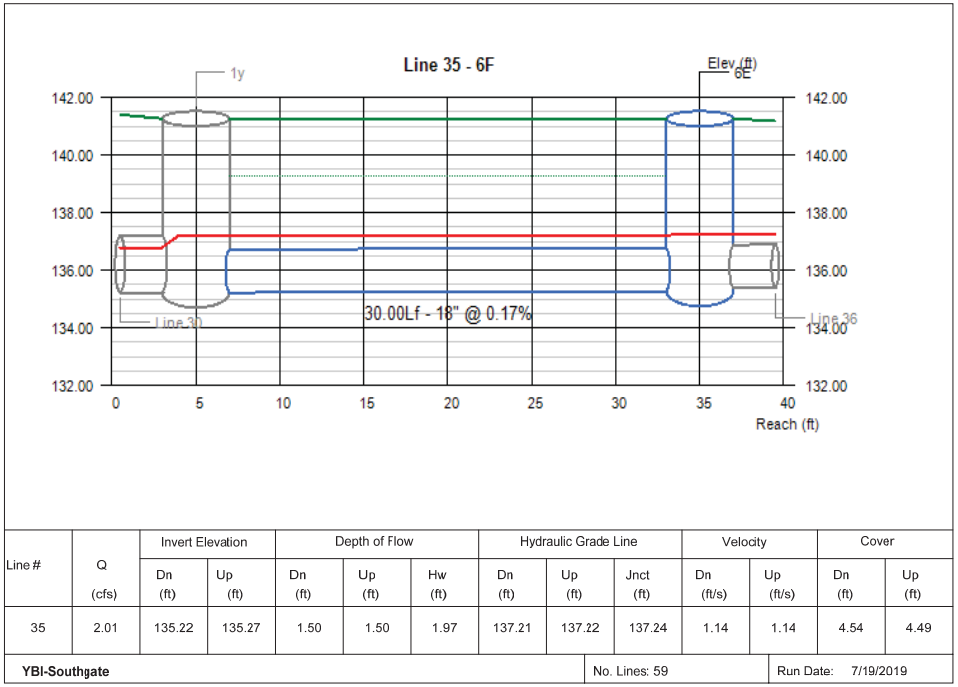


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
34	2.06	135.33	135.58	1.50	1.50	1.98	137.53	137.54	137.56	1.16	1.16	3.80	5.80

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 35) - 6F



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
35	2.01	135.22	135.27	1.50	1.50	1.97	137.21	137.22	137.24	1.14	1.14	4.54	4.49

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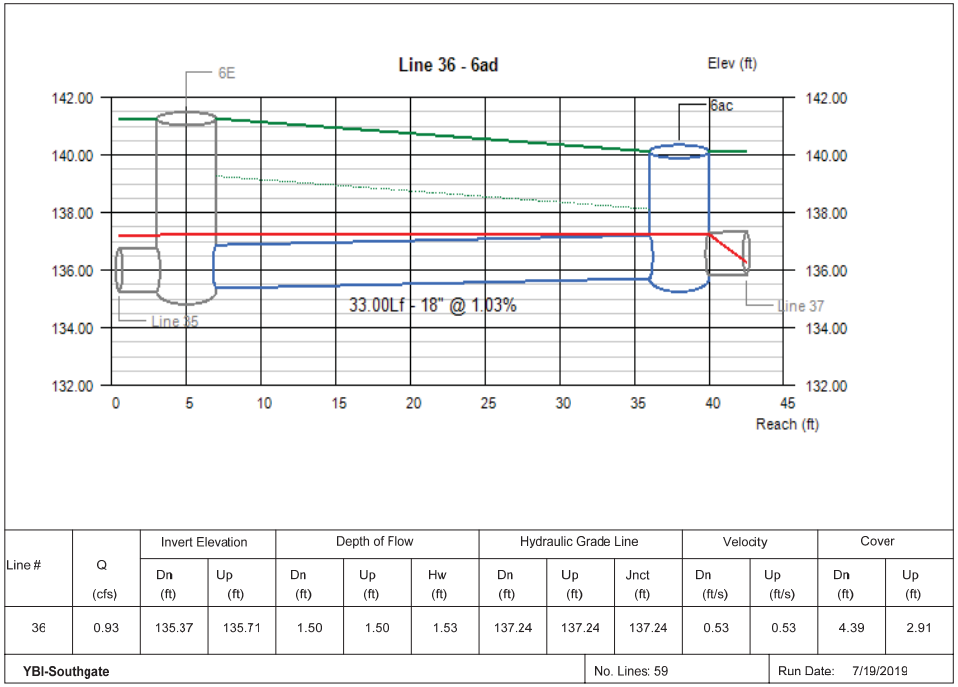
Storm Sewers

Line Profile (Line 36) - 6ad

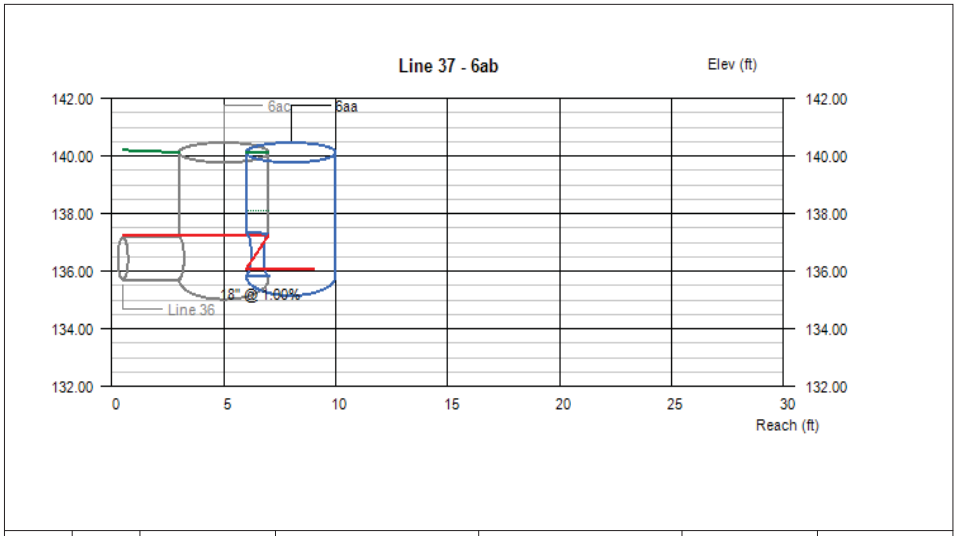


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
36	0.93	135.37	135.71	1.50	1.50	1.53	137.24	137.24	137.24	0.53	0.53	4.39	2.91

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 37) - 6ab

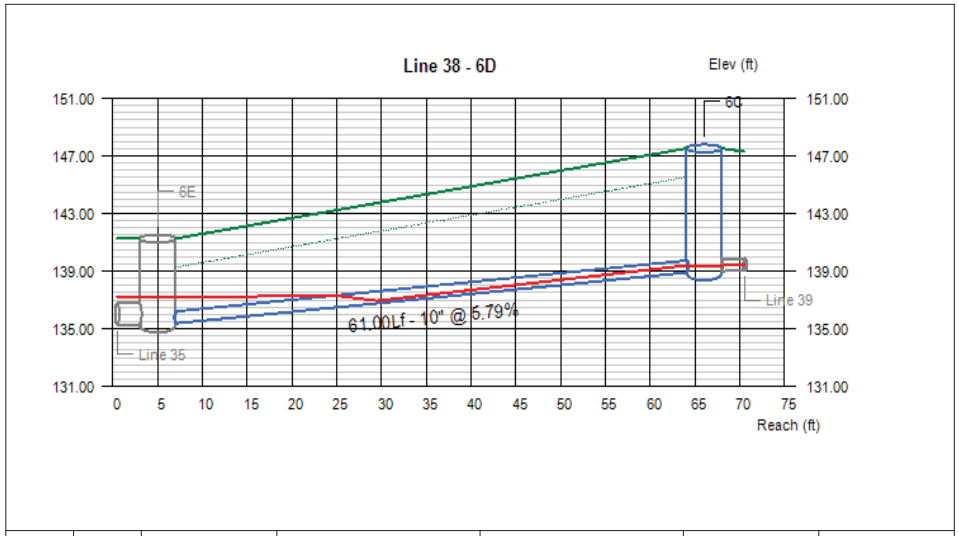


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
37	0.42	135.81	135.84	1.43	0.24	0.24	137.24	136.08	136.08	0.24	2.31	2.81	2.78

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 38) - 6D



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
38	1.21	135.37	138.90	0.83	0.49	0.49	137.24	139.39 j	139.39	2.21	3.62	5.06	7.79

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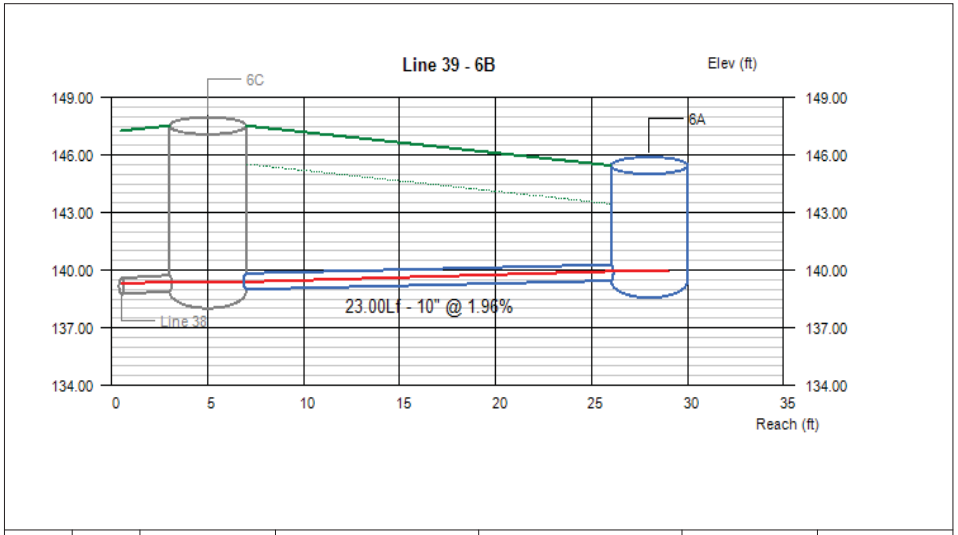
Storm Sewers

Line Profile (Line 39) - 6B



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
39	1.21	139.00	139.45	0.39	0.49	0.49	139.39	139.94	139.94	4.85	3.63	7.69	5.17

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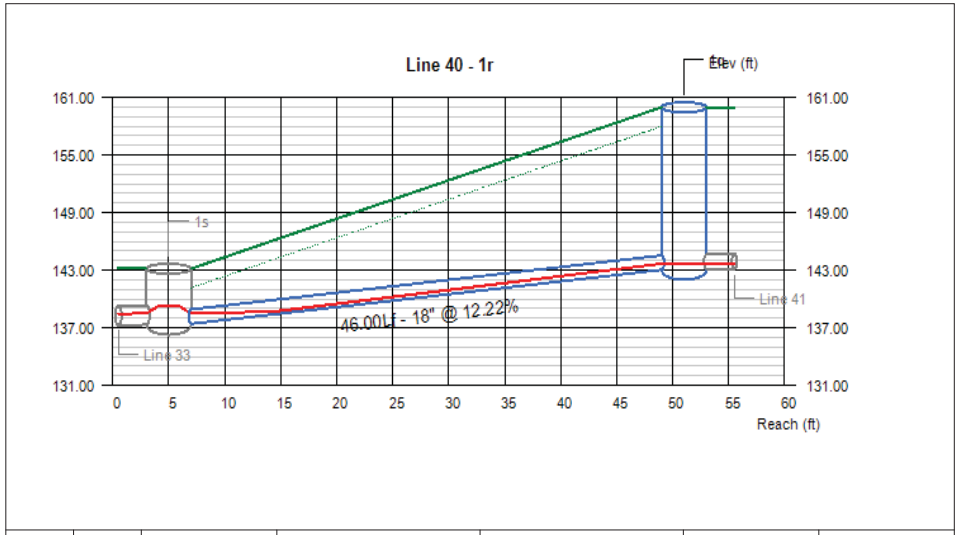
Storm Sewers

Line Profile (Line 40) - 1r

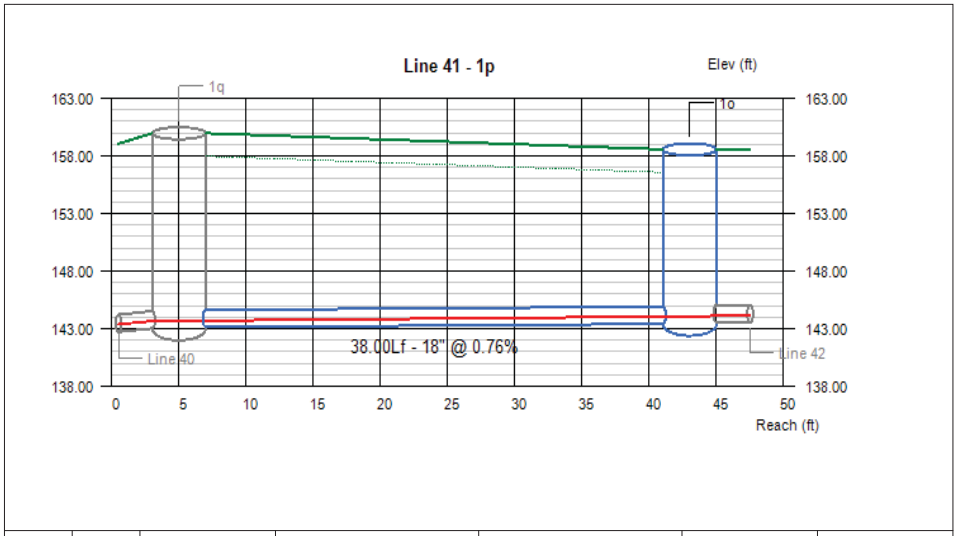


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
40	2.82	137.41	143.03	1.07	0.64	0.64	138.48	143.67 j	143.67	2.09	3.94	4.24	15.44

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 41) - 1p

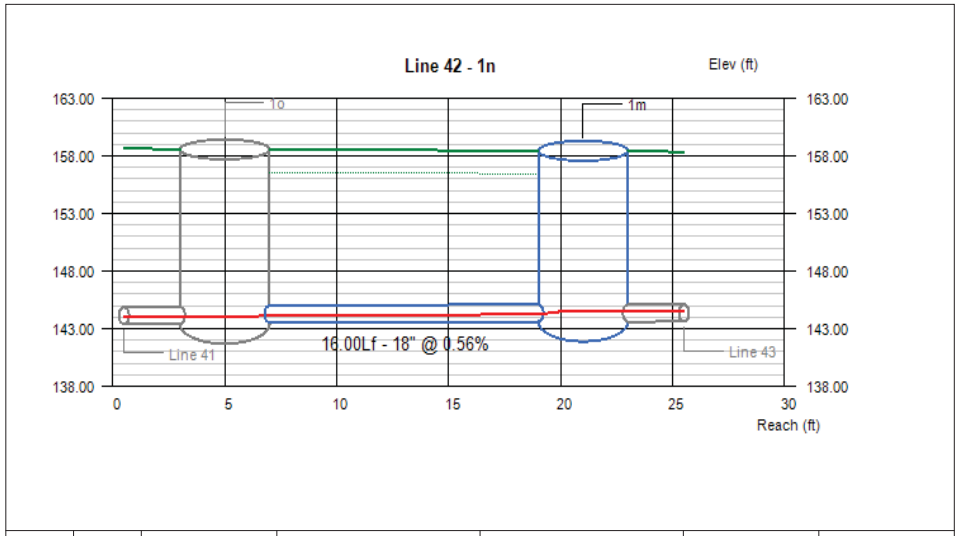


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
41	2.83	143.13	143.42	0.57	0.64	0.64	143.70	144.06	144.06	4.57	3.95	15.34	13.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 42) - 1n

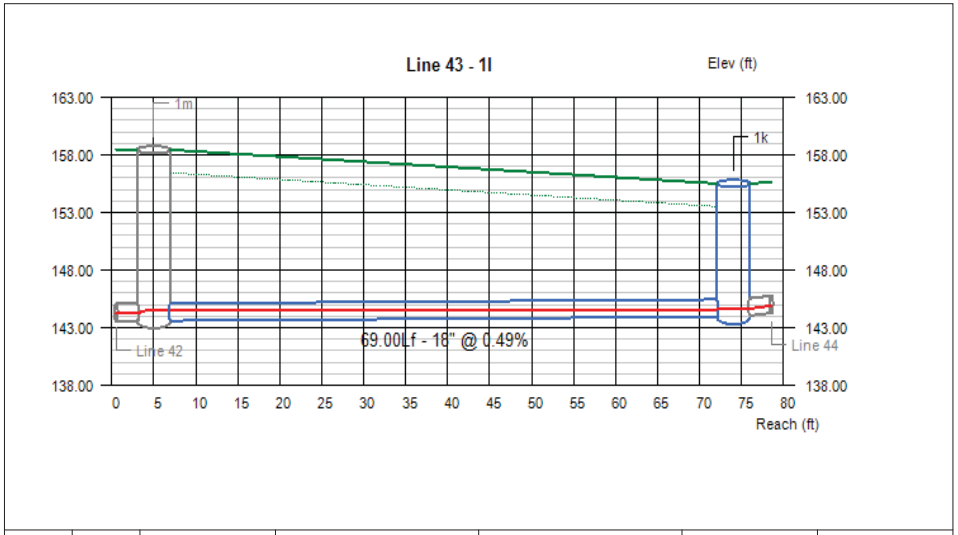


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
42	2.83	143.52	143.61	0.62	0.64	0.88	144.14	144.25	144.49	4.09	3.95	13.55	13.34

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 43) - 1l

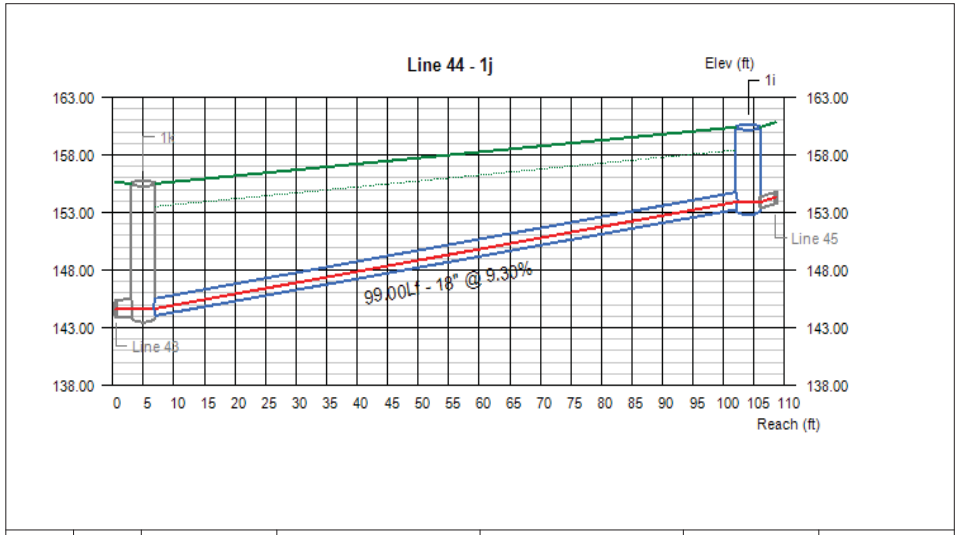


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
43	2.85	143.61	143.95	0.88	0.64	0.72	144.49	144.59	144.67	2.65	3.93	13.34	10.07

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 44) - 1j

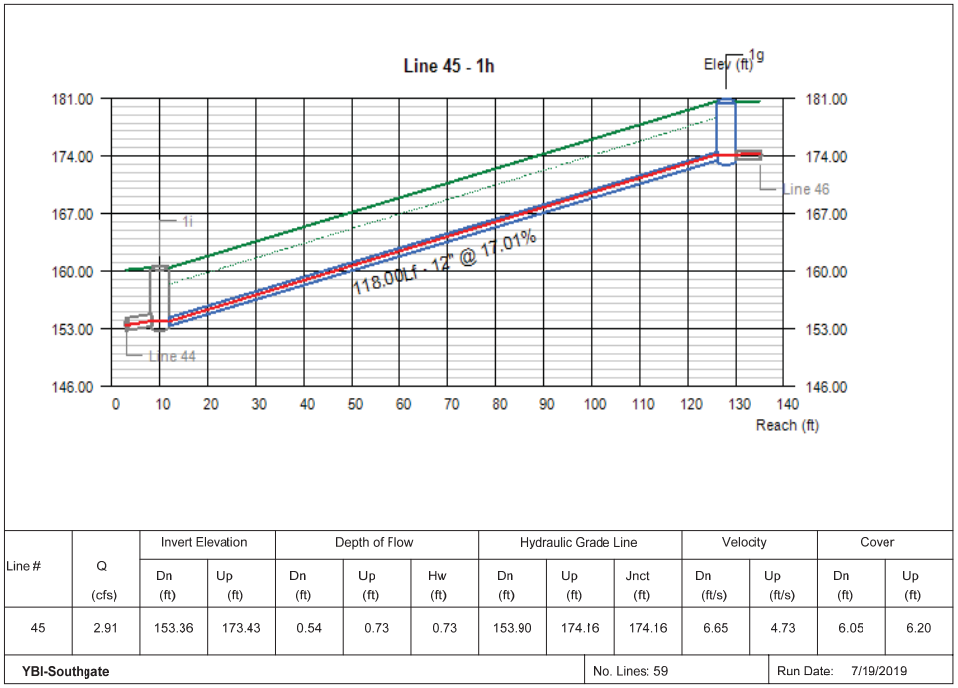


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
44	2.88	144.05	153.26	0.62	0.64	0.64	144.67	153.90	153.90	4.19	3.97	9.97	5.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 45) - 1h

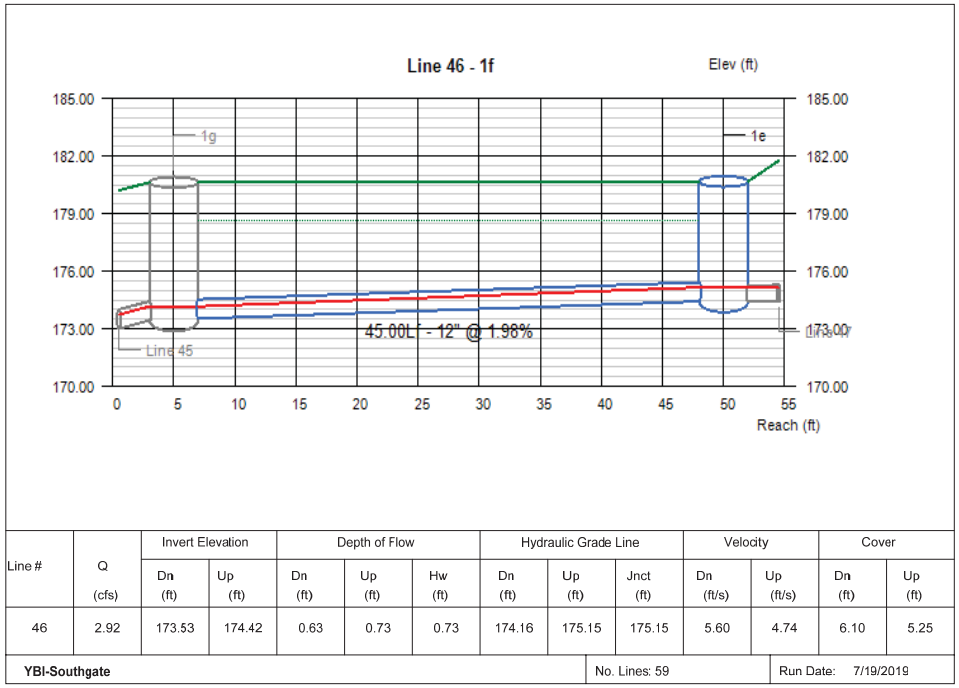


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
45	2.91	153.36	173.43	0.54	0.73	0.73	153.90	174.16	174.16	6.65	4.73	6.05	6.20

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 46) - 1f

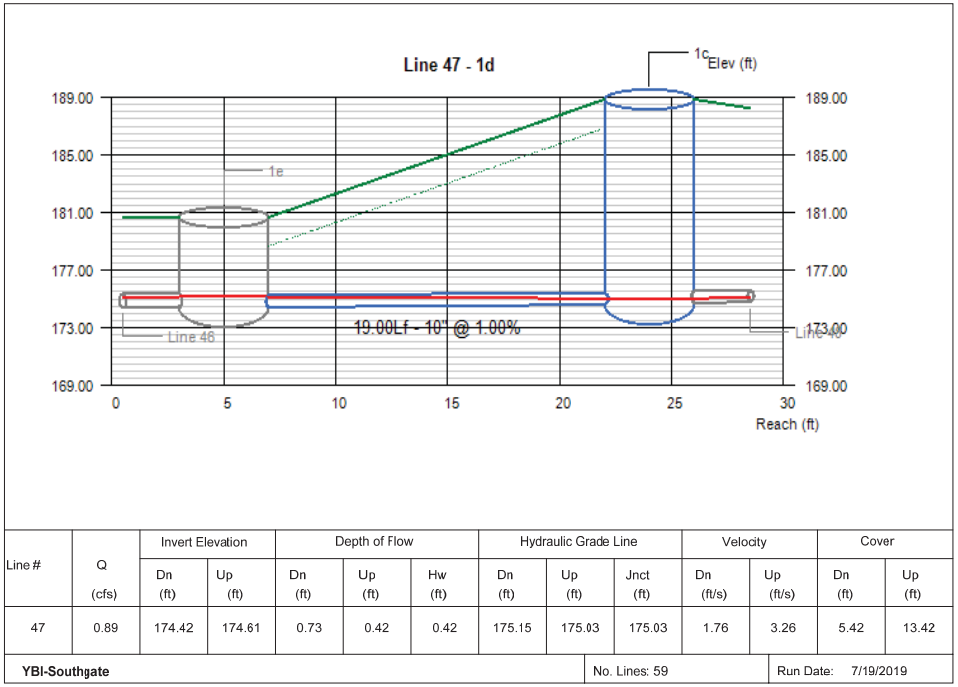


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
46	2.92	173.53	174.42	0.63	0.73	0.73	174.16	175.15	175.15	5.60	4.74	6.10	5.25

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 47) - 1d

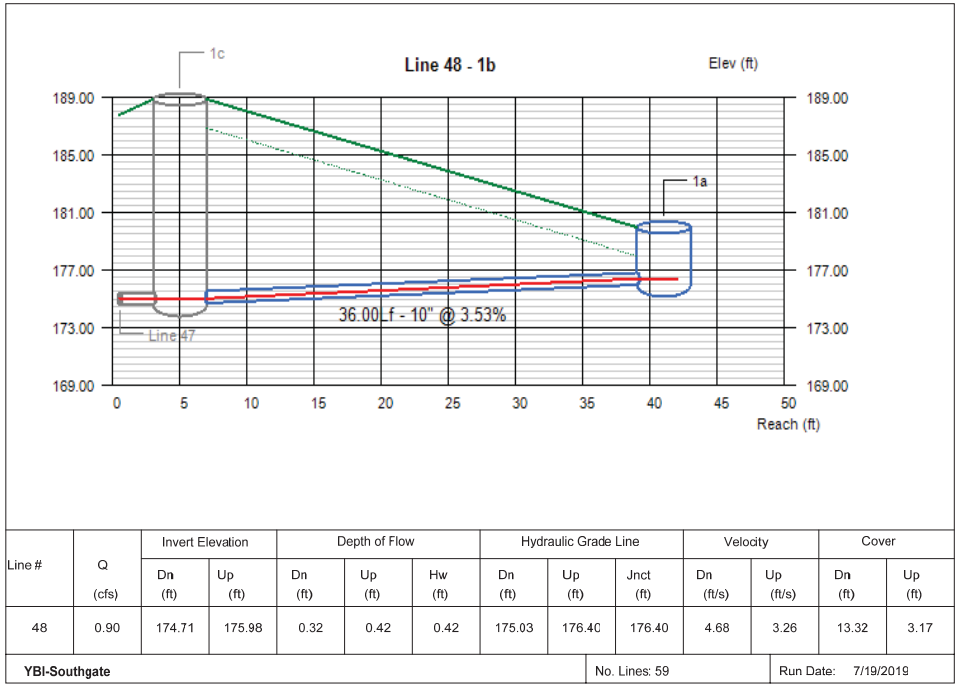


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
47	0.89	174.42	174.61	0.73	0.42	0.42	175.15	175.03	175.03	1.76	3.26	5.42	13.42

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 48) - 1b

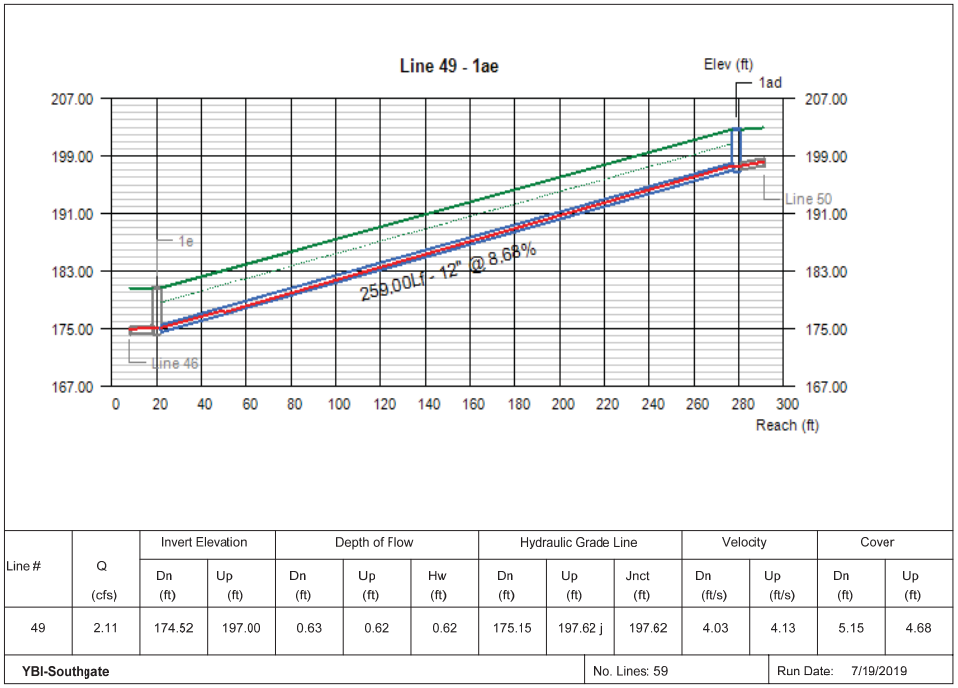


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
48	0.90	174.71	175.98	0.32	0.42	0.42	175.03	176.40	176.40	4.68	3.26	13.32	3.17

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 49) - 1ae

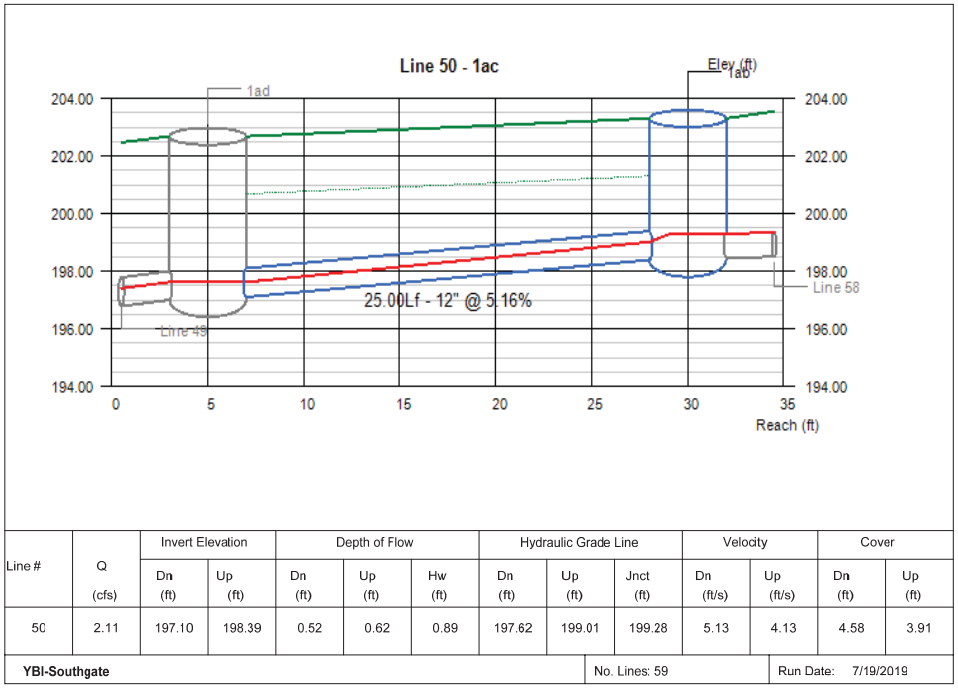


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
49	2.11	174.52	197.00	0.63	0.62	0.62	175.15	197.62 j	197.62	4.03	4.13	5.15	4.68

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 50) - 1ac

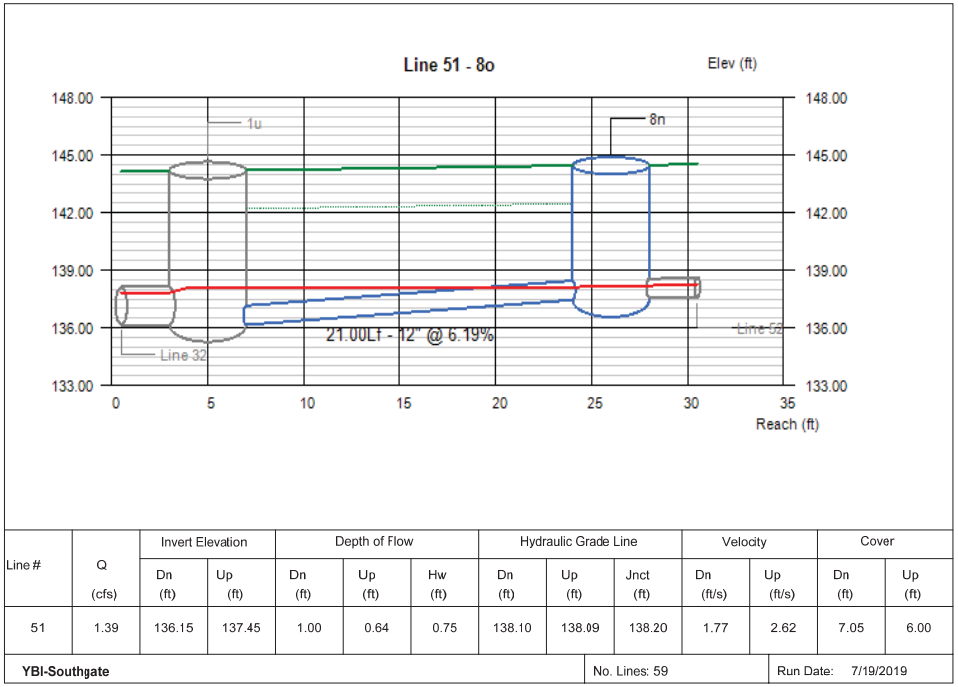


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
50	2.11	197.10	198.39	0.52	0.62	0.89	197.62	199.01	199.28	5.13	4.13	4.58	3.91

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 51) - 8o

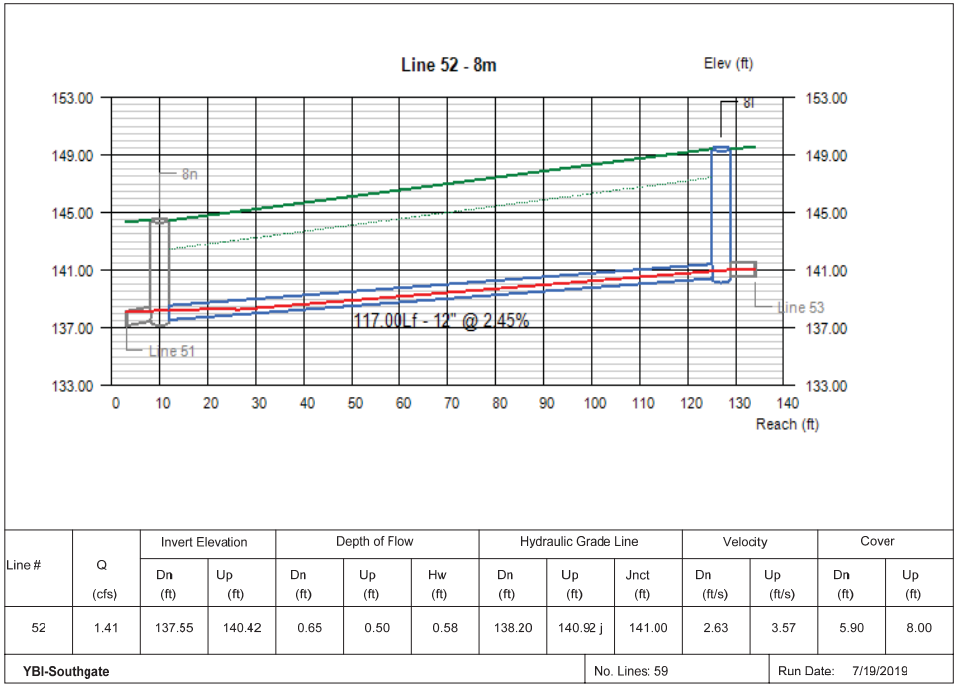


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
51	1.39	136.15	137.45	1.00	0.64	0.75	138.10	138.09	138.20	1.77	2.62	7.05	6.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 52) - 8m

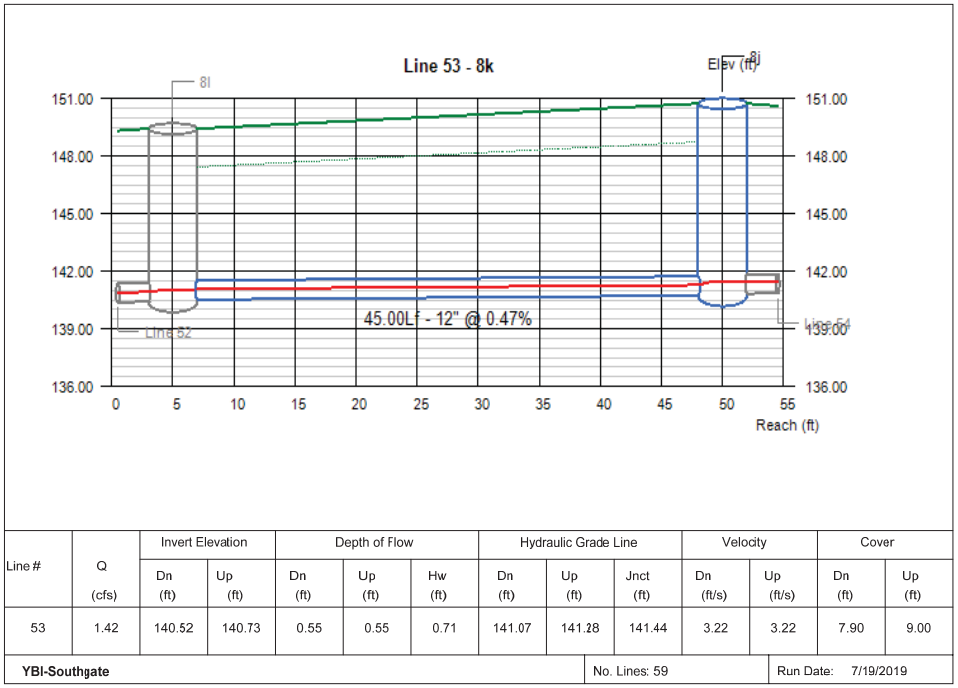


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
52	1.41	137.55	140.42	0.65	0.50	0.58	138.20	140.92 j	141.00	2.63	3.57	5.90	8.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 53) - 8k

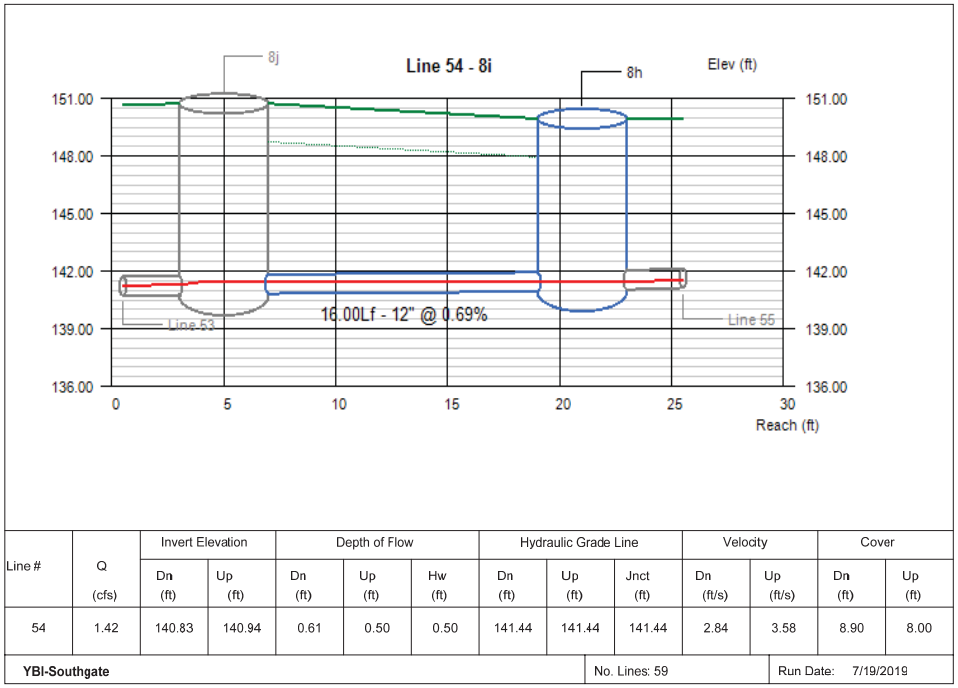


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
53	1.42	140.52	140.73	0.55	0.55	0.71	141.07	141.28	141.44	3.22	3.22	7.90	9.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 54) - 8i

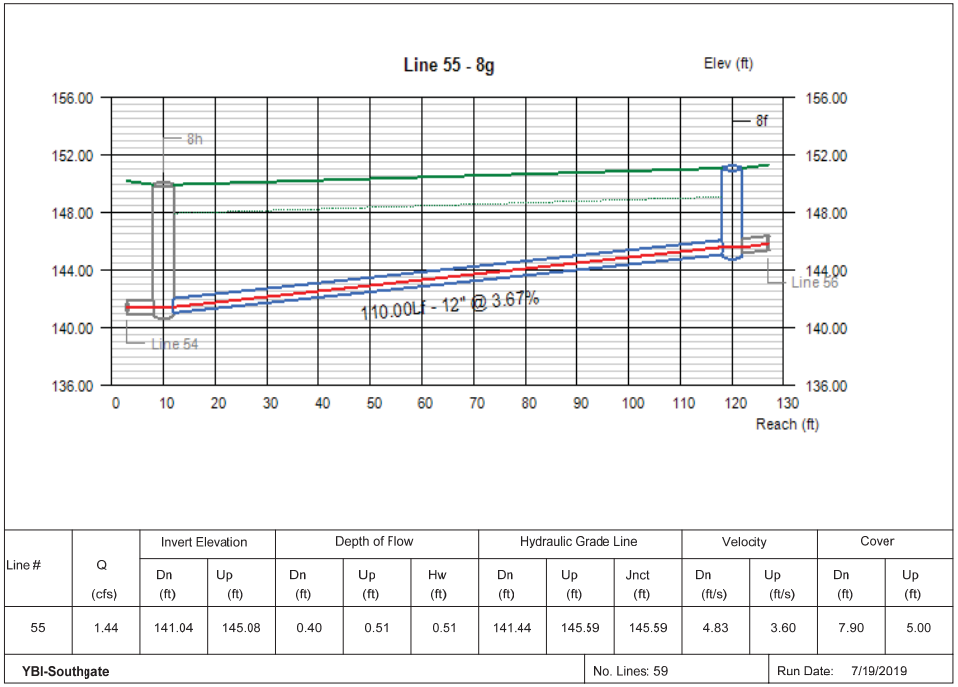


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
54	1.42	140.83	140.94	0.61	0.50	0.50	141.44	141.44	141.44	2.84	3.58	8.90	8.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 55) - 8g

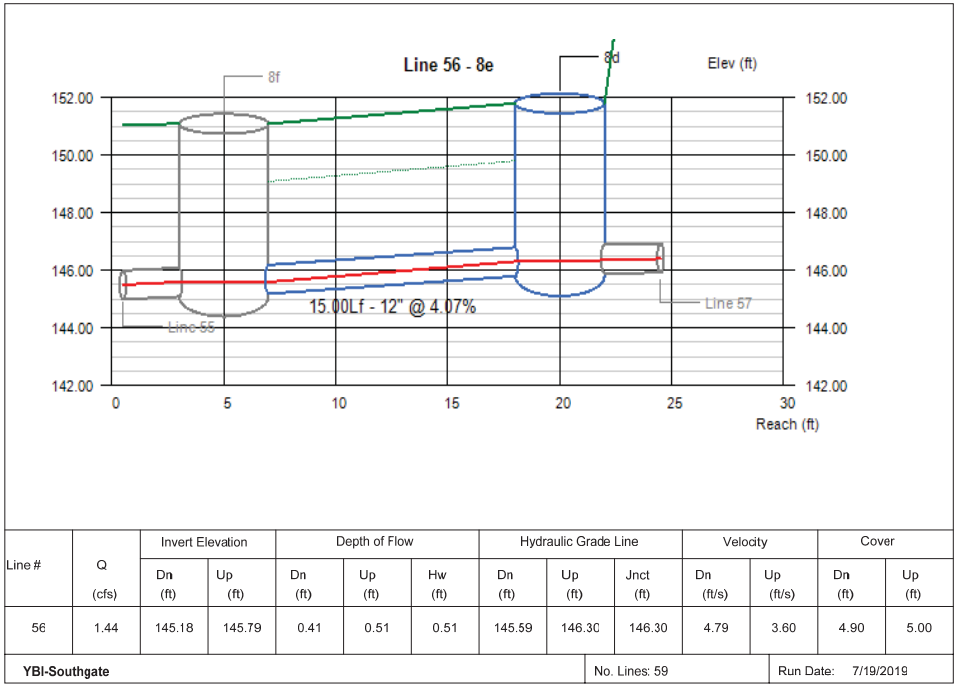


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
55	1.44	141.04	145.08	0.40	0.51	0.51	141.44	145.59	145.59	4.83	3.60	7.90	5.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 56) - 8e

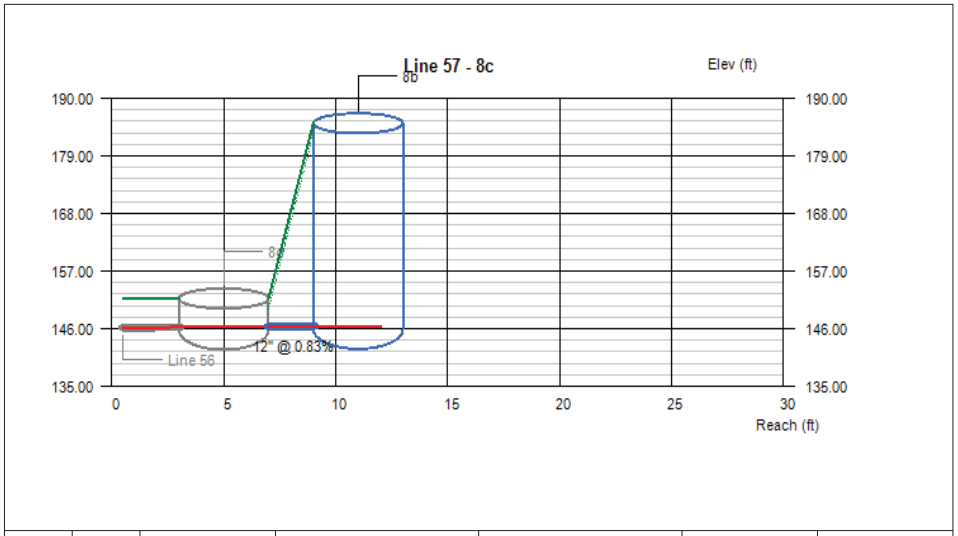


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
56	1.44	145.18	145.79	0.41	0.51	0.51	145.59	146.30	146.30	4.79	3.60	4.90	5.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 57) - 8c

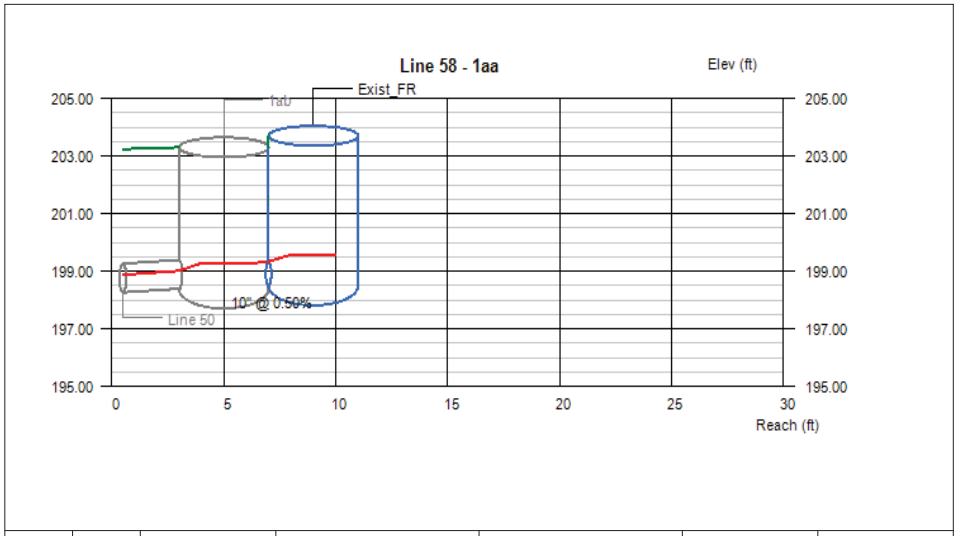


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
57	1.44	145.89	145.94	0.47	0.51	0.51	146.36	146.45	146.45	4.01	3.60	4.90	38.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 58) - 1aa

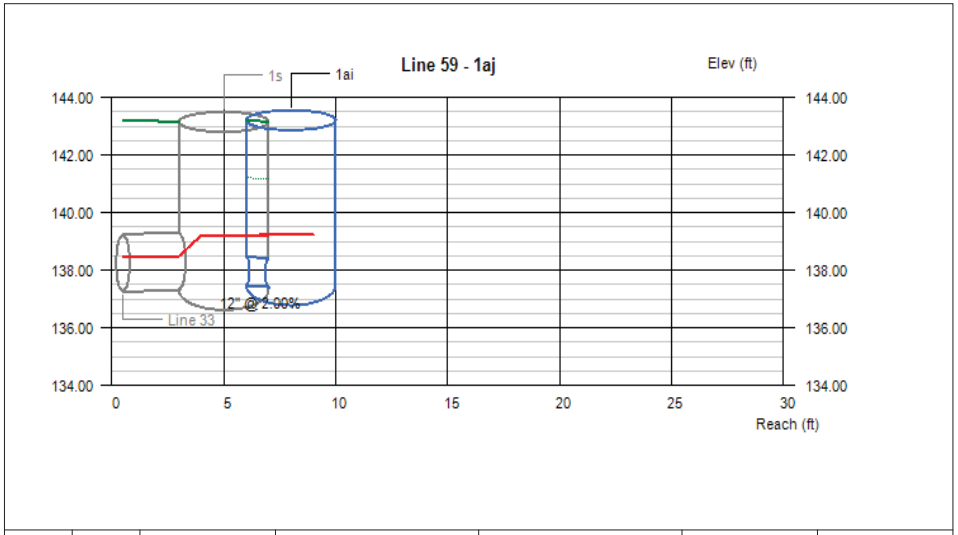


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
58	2.11	198.48	198.50	0.83	0.83	1.07	199.31	199.33	199.57	3.88	3.88	3.99	4.37

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 59) - 1aj



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
59	0.77	137.41	137.47	1.00	1.00	1.76	139.21	139.21	139.23	0.98	0.98	4.74	4.74

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	2M	7.24	18	Cir	18.00	141.77	141.86	0.500	143.69*	143.78*	0.26	144.03	End	Manhole
2	3D	1.24	10	Cir	71.00	141.86	143.21	1.901	144.03*	144.26*	0.08	144.34	1	Manhole
3	3B	1.25	10	Cir	5.00	144.59	144.69	2.000	144.96	145.19	n/a	145.19	2	Grate
4	2K	6.37	18	Cir	107.00	141.86	142.39	0.495	144.03*	144.43*	0.20	144.63	1	Manhole
5	2I	5.25	12	Cir	96.00	147.30	160.50	13.750	147.74	161.43	0.74	161.43	4	Manhole
6	2af	0.09	10	Cir	9.00	160.60	162.00	15.555	161.43	162.13	n/a	162.13 j	5	Grate
7	2ah	1.28	10	Cir	10.00	147.30	148.19	8.900	147.55	148.69	n/a	148.69	4	Grate
8	2G	5.25	12	Cir	83.00	160.60	171.94	13.663	161.43	172.87	0.72	172.87	5	Manhole
9	2E	5.27	12	Cir	17.00	172.04	176.22	24.588	172.87	177.15	n/a	177.15	8	Manhole
10	2C	4.97	12	Cir	142.00	176.32	190.90	10.268	177.15	191.81	0.68	192.49	9	Manhole
11	2A	4.15	12	Cir	54.00	191.00	196.50	10.185	191.81	197.36	0.52	197.36	10	Manhole
12	2ad	0.47	10	Cir	16.00	176.32	176.65	2.062	177.15	176.95	n/a	176.95	9	Grate
13	2ab	0.89	10	Cir	17.00	191.00	191.10	0.588	192.49*	192.52*	0.04	192.56	10	Grate
14	4J	3.80	12	Cir	35.00	141.98	142.25	0.771	143.66*	144.06*	0.36	144.42	End	Manhole
15	4ad	0.71	10	Cir	37.00	142.25	142.68	1.162	144.42*	144.46*	0.03	144.49	14	Grate
16	4H	3.16	12	Cir	31.00	142.25	142.86	1.968	144.42*	144.66*	0.24	144.91	14	Manhole
17	4F	2.50	12	Cir	62.00	142.96	144.50	2.484	144.91	145.18	n/a	145.45 j	16	Manhole
18	4D	2.50	12	Cir	5.00	144.60	144.62	0.400	145.60	145.62	0.18	145.80	17	Grate
19	4B	1.81	12	Cir	33.00	158.25	161.76	10.636	158.52	162.33	n/a	162.33	18	Manhole
20	4ab	0.74	10	Cir	4.00	142.96	143.10	3.500	144.91*	144.91*	0.03	144.94	16	Grate
21	YB2-ai	10.72	36	Cir	138.00	1.64	3.54	1.377	6.20	6.23	0.01	6.24	End	Manhole
22	YB2-ag	10.93	36	Cir	171.00	3.54	5.92	1.392	6.24	6.97	n/a	6.97 j	21	Manhole
23	Exist4	11.01	24	Cir	124.00	5.91	21.29	12.403	6.97	22.48	n/a	22.48	22	Manhole
24	Exist2	9.93	18	Cir	122.00	21.29	53.25	26.197	22.48	54.46	n/a	54.46	23	Manhole

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	YB1-l	7.73	18	Cir	52.50	53.25	65.61	23.543	54.46	66.69	n/a	66.69 j	24	Manhole
26	YB1-j	7.67	18	Cir	105.00	72.18	98.43	25.000	72.57	99.50	n/a	99.50	25	Manhole
27	YBI1-h	7.63	18	Cir	49.20	108.27	121.39	26.667	108.65	122.46	0.07	122.46	26	Manhole
28	YB1-f	7.53	18	Cir	15.40	131.23	134.51	21.299	131.63	135.57	0.42	135.57	27	Manhole
29	1bb	7.46	24	Cir	73.00	134.51	134.97	0.630	135.57	135.94	n/a	135.94 j	28	Manhole
30	1z	7.49	24	Cir	51.00	134.97	135.22	0.490	135.94	136.19	n/a	136.57	29	Manhole
31	1x	6.97	24	Cir	23.00	135.22	135.33	0.478	136.19	136.27	0.36	136.27	30	Manhole
32	1v	6.54	24	Cir	125.00	135.33	136.15	0.656	136.27	137.06	n/a	137.06 j	31	Manhole
33	1t	5.84	24	Cir	45.00	136.15	137.31	2.578	137.06	138.16	n/a	138.16 j	32	Grate
34	1al	1.31	18	Cir	31.00	135.33	135.58	0.806	136.27	136.01	0.15	136.01	31	Grate
35	6F	1.30	18	Cir	30.00	135.22	135.27	0.167	136.57	136.58	0.01	136.59	30	Manhole
36	6ad	0.59	18	Cir	33.00	135.37	135.71	1.030	136.59	136.00	n/a	136.00	35	Grate
37	6ab	0.27	18	Cir	3.00	135.81	135.84	1.000	136.00	136.03	0.07	136.03	36	Grate
38	6D	0.76	10	Cir	61.00	135.37	138.90	5.787	136.59	139.29	n/a	139.29 j	35	Grate
39	6B	0.77	10	Cir	23.00	139.00	139.45	1.957	139.29	139.84	n/a	139.84	38	Grate
40	1r	1.54	18	Cir	46.00	137.41	143.03	12.217	138.16	143.50	n/a	143.50 j	33	Manhole
41	1p	1.55	18	Cir	38.00	143.13	143.42	0.763	143.55	143.89	n/a	143.89	40	Manhole
42	1n	1.55	18	Cir	16.00	143.52	143.61	0.562	143.97	144.08	n/a	144.25	41	Manhole
43	1l	1.57	18	Cir	69.00	143.61	143.95	0.493	144.25	144.42	0.05	144.47	42	Manhole
44	1j	1.58	18	Cir	99.00	144.05	153.26	9.303	144.47	153.73	0.05	153.73	43	Manhole
45	1h	1.60	12	Cir	118.00	153.36	173.43	17.008	153.73	173.97	n/a	173.97	44	Manhole
46	1f	1.61	12	Cir	45.00	173.53	174.42	1.978	173.97	174.96	0.22	174.96	45	Manhole
47	1d	0.50	10	Cir	19.00	174.42	174.61	1.000	174.96	174.92	n/a	174.92	46	Manhole
48	1b	0.50	10	Cir	36.00	174.71	175.98	3.528	174.92	176.29	0.11	176.29	47	Grate

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	1ae	1.17	12	Cir	259.00	174.52	197.00	8.680	174.96	197.46	0.18	197.46	46	Manhole
50	1ac	1.17	12	Cir	25.00	197.10	198.39	5.160	197.46	198.85	0.18	199.02	49	Manhole
51	8o	0.77	12	Cir	21.00	136.15	137.45	6.190	137.06	137.82	n/a	137.82 j	32	Manhole
52	8m	0.78	12	Cir	117.00	137.55	140.42	2.453	137.82	140.79	n/a	140.84	51	Manhole
53	8k	0.79	12	Cir	45.00	140.52	140.73	0.467	140.91	141.12	0.12	141.24	52	Manhole
54	8i	0.79	12	Cir	16.00	140.83	140.94	0.688	141.24	141.31	n/a	141.31 j	53	Manhole
55	8g	0.80	12	Cir	110.00	141.04	145.08	3.673	141.31	145.45	n/a	145.45	54	Manhole
56	8e	0.80	12	Cir	15.00	145.18	145.79	4.067	145.45	146.16	n/a	146.16	55	Manhole
57	8c	0.80	12	Cir	6.00	145.89	145.94	0.833	146.23	146.31	0.14	146.31	56	Grate
58	1aa	1.17	10	Cir	4.00	198.48	198.50	0.500	199.02	199.04	0.15	199.19	50	Grate
59	1aj	0.49	12	Cir	3.00	137.41	137.47	2.000	138.16	137.76	0.10	137.76	33	Grate

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	18.00	0.00	2.74	0.00	0.00	2.60	0.0	6.4	2.8	7.24	7.43	4.10	18	0.50	141.77	141.86	143.69	143.78	143.27	147.86	2M
2	1	71.00	0.00	0.42	0.00	0.00	0.40	0.0	5.0	3.1	1.24	3.02	2.28	10	1.90	141.86	143.21	144.03	144.26	147.86	150.44	3D
3	2	5.00	0.42	0.42	0.95	0.40	0.40	5.0	5.0	3.1	1.25	3.10	4.52	10	2.00	144.59	144.69	144.96	145.19	150.44	150.31	3B
4	1	107.00	0.00	2.32	0.00	0.00	2.20	0.0	5.9	2.9	6.37	7.39	3.61	18	0.50	141.86	142.39	144.03	144.43	147.86	154.54	2K
5	4	96.00	0.00	1.89	0.00	0.00	1.80	0.0	5.7	2.9	5.25	13.21	11.38	12	13.75	147.30	160.50	147.74	161.43	154.54	165.61	2I
6	5	9.00	0.03	0.03	0.95	0.03	0.03	5.0	5.0	3.1	0.09	8.64	0.92	10	15.56	160.60	162.00	161.43	162.13	165.61	163.61	2af
7	4	10.00	0.43	0.43	0.95	0.41	0.41	5.0	5.0	3.1	1.28	6.53	6.49	10	8.90	147.30	148.19	147.55	148.69	154.54	154.29	2ah
8	5	83.00	0.00	1.86	0.00	0.00	1.77	0.0	5.6	3.0	5.25	13.16	7.23	12	13.66	160.60	171.94	161.43	172.87	165.61	181.34	2G
9	8	17.00	0.00	1.86	0.00	0.00	1.77	0.0	5.5	3.0	5.27	17.66	7.25	12	24.59	172.04	176.22	172.87	177.15	181.34	182.17	2E
10	9	142.00	0.00	1.70	0.00	0.00	1.62	0.0	5.2	3.1	4.97	11.41	6.86	12	10.27	176.32	190.90	177.15	191.81	182.17	195.72	2C
11	10	54.00	1.40	1.40	0.95	1.33	1.33	5.0	5.0	3.1	4.15	11.37	5.92	12	10.19	191.00	196.50	191.81	197.36	195.72	199.80	2A
12	9	16.00	0.16	0.16	0.95	0.15	0.15	5.0	5.0	3.1	0.47	3.14	1.77	10	2.06	176.32	176.65	177.15	176.95	182.17	180.65	2ad
13	10	17.00	0.30	0.30	0.95	0.29	0.29	5.0	5.0	3.1	0.89	1.68	1.63	10	0.59	191.00	191.10	192.49	192.52	195.72	195.44	2ab
14	End	35.00	0.00	1.34	0.00	0.00	1.27	0.0	5.5	3.0	3.80	3.13	4.84	12	0.77	141.98	142.25	143.66	144.06	145.00	148.29	4J
15	14	37.00	0.24	0.24	0.95	0.23	0.23	5.0	5.0	3.1	0.71	2.36	1.31	10	1.16	142.25	142.68	144.42	144.46	148.29	146.38	4ad
16	14	31.00	0.00	1.10	0.00	0.00	1.05	0.0	5.4	3.0	3.16	5.00	4.02	12	1.97	142.25	142.86	144.42	144.66	148.29	148.92	4H
17	16	62.00	0.00	0.85	0.00	0.00	0.81	0.0	5.1	3.1	2.50	5.61	3.79	12	2.48	142.96	144.50	144.91	145.18	148.92	151.30	4F
18	17	5.00	0.24	0.85	0.95	0.23	0.81	5.0	5.1	3.1	2.50	2.25	3.19	12	0.40	144.60	144.62	145.60	145.62	151.30	161.25	4D
19	18	33.00	0.61	0.61	0.95	0.58	0.58	5.0	5.0	3.1	1.81	11.61	7.32	12	10.64	158.25	161.76	158.52	162.33	161.25	167.88	4B
20	16	4.00	0.25	0.25	0.95	0.24	0.24	5.0	5.0	3.1	0.74	4.10	1.36	10	3.50	142.96	143.10	144.91	144.91	148.92	148.92	4ab
21	End	138.00	0.00	13.72	0.00	0.00	9.13	0.0	28.6	1.2	10.72	78.26	1.56	36	1.38	1.64	3.54	6.20	6.23	5.00	9.84	YB2-ai
22	21	171.00	0.00	13.72	0.00	0.00	9.13	0.0	27.7	1.2	10.93	78.68	3.30	36	1.39	3.54	5.92	6.24	6.97	9.84	15.10	YB2-ag

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 12.76 / (Inlet time + 2.60) ^ 0.69; Return period =Yrs. 5 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	22	124.00	0.96	13.72	1.00	0.96	9.13	5.0	27.4	1.2	11.01	79.66	6.10	24	12.40	5.91	21.29	6.97	22.48	15.10	27.90	Exist4
24	23	122.00	1.83	12.76	1.00	1.83	8.17	5.0	27.0	1.2	9.93	53.75	6.54	18	26.20	21.29	53.25	22.48	54.46	27.90	58.10	Exist2
25	24	52.50	0.07	10.93	1.00	0.07	6.34	5.0	26.9	1.2	7.73	50.95	5.37	18	23.54	53.25	65.61	54.46	66.69	58.10	78.70	YB1-l
26	25	105.00	0.04	10.86	1.00	0.04	6.27	5.0	26.8	1.2	7.67	52.51	13.44	18	25.00	72.18	98.43	72.57	99.50	78.70	113.20	YB1-j
27	26	49.20	0.09	10.82	1.00	0.09	6.23	5.0	26.7	1.2	7.63	54.23	13.66	18	26.67	108.27	121.39	108.65	122.46	113.20	134.50	YBI1-h
28	27	15.40	0.09	10.73	1.00	0.09	6.14	5.0	26.7	1.2	7.53	48.46	12.77	18	21.30	131.23	134.51	131.63	135.57	134.50	145.30	YB1-f
29	28	73.00	0.00	10.64	0.00	0.00	6.05	0.0	26.4	1.2	7.46	17.95	4.67	24	0.63	134.51	134.97	135.57	135.94	145.30	144.10	1bb
30	29	51.00	0.00	10.64	0.00	0.00	6.05	0.0	26.2	1.2	7.49	15.84	4.95	24	0.49	134.97	135.22	135.94	136.19	144.10	141.26	1z
31	30	23.00	0.00	10.18	0.00	0.00	5.62	0.0	26.1	1.2	6.97	15.64	4.72	24	0.48	135.22	135.33	136.19	136.27	141.26	140.63	1x
32	31	125.00	0.00	9.74	0.00	0.00	5.20	0.0	25.6	1.3	6.54	18.32	4.63	24	0.66	135.33	136.15	136.27	137.06	140.63	144.20	1v
33	32	45.00	4.07	7.81	0.80	3.26	4.62	5.0	25.4	1.3	5.84	36.31	4.40	24	2.58	136.15	137.31	137.06	138.16	144.20	143.15	1t
34	31	31.00	0.44	0.44	0.95	0.42	0.42	5.0	5.0	3.1	1.31	9.43	2.14	18	0.81	135.33	135.58	136.27	136.01	140.63	142.88	1al
35	30	30.00	0.00	0.46	0.00	0.00	0.44	0.0	5.6	3.0	1.30	4.29	0.79	18	0.17	135.22	135.27	136.57	136.58	141.26	141.26	6F
36	35	33.00	0.11	0.20	0.95	0.10	0.19	5.0	5.0	3.1	0.59	10.66	1.46	18	1.03	135.37	135.71	136.59	136.00	141.26	140.12	6ad
37	36	3.00	0.09	0.09	0.95	0.09	0.09	5.0	5.0	3.1	0.27	10.50	2.09	18	1.00	135.81	135.84	136.00	136.03	140.12	140.12	6ab
38	35	61.00	0.00	0.26	0.00	0.00	0.25	0.0	5.1	3.1	0.76	5.27	2.25	10	5.79	135.37	138.90	136.59	139.29	141.26	147.52	6D
39	38	23.00	0.26	0.26	0.95	0.25	0.25	5.0	5.0	3.1	0.77	3.06	3.89	10	1.96	139.00	139.45	139.29	139.84	147.52	145.45	6B
40	33	46.00	0.00	3.22	0.00	0.00	1.21	0.0	25.1	1.3	1.54	36.71	2.51	18	12.22	137.41	143.03	138.16	143.50	143.15	159.97	1r
41	40	38.00	0.00	3.22	0.00	0.00	1.21	0.0	24.9	1.3	1.55	9.17	3.58	18	0.76	143.13	143.42	143.55	143.89	159.97	158.57	1p
42	41	16.00	0.00	3.22	0.00	0.00	1.21	0.0	24.8	1.3	1.55	7.88	3.38	18	0.56	143.52	143.61	143.97	144.08	158.57	158.45	1n
43	42	69.00	0.00	3.22	0.00	0.00	1.21	0.0	24.4	1.3	1.57	7.37	2.74	18	0.49	143.61	143.95	144.25	144.42	158.45	155.52	1l
44	43	99.00	0.00	3.22	0.00	0.00	1.21	0.0	24.0	1.3	1.58	32.03	3.59	18	9.30	144.05	153.26	144.47	153.73	155.52	160.41	1j

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 12.76 / (Inlet time + 2.60) ^ 0.69; Return period =Yrs. 5 ; c = cir e = ellip b = box

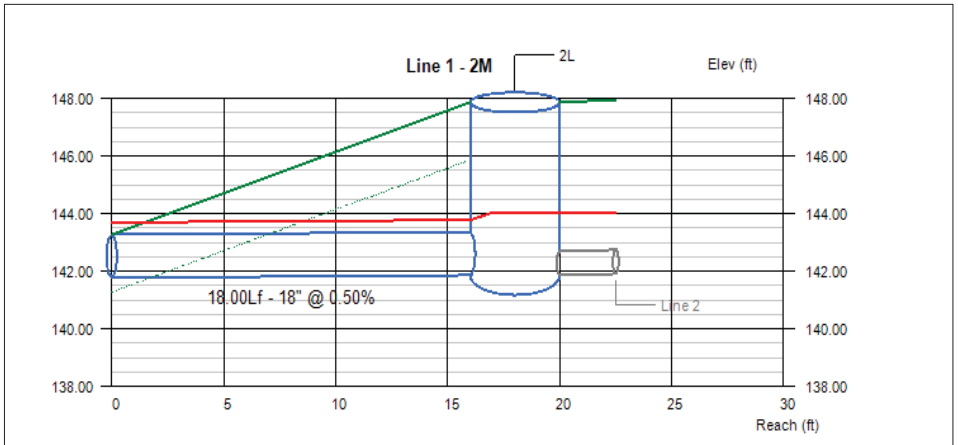
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
45	44	118.00	0.00	3.22	0.00	0.00	1.21	0.0	23.6	1.3	1.60	14.69	4.87	12	17.01	153.36	173.43	153.73	173.97	160.41	180.63	1h
46	45	45.00	0.00	3.22	0.00	0.00	1.21	0.0	23.4	1.3	1.61	5.01	4.31	12	1.98	173.53	174.42	173.97	174.96	180.63	180.67	1f
47	46	19.00	0.00	1.20	0.00	0.00	0.36	0.0	22.2	1.4	0.50	2.19	2.02	10	1.00	174.42	174.61	174.96	174.92	180.67	188.86	1d
48	47	36.00	1.20	1.20	0.30	0.36	0.36	22.0	22.0	1.4	0.50	4.11	3.70	10	3.53	174.71	175.98	174.92	176.29	188.86	179.98	1b
49	46	259.00	0.00	2.02	0.00	0.00	0.85	0.0	22.1	1.4	1.17	10.49	3.45	12	8.68	174.52	197.00	174.96	197.46	180.67	202.68	1ae
50	49	25.00	0.00	2.02	0.00	0.00	0.85	0.0	22.0	1.4	1.17	8.09	4.03	12	5.16	197.10	198.39	197.46	198.85	202.68	203.30	1ac
51	32	21.00	0.00	1.93	0.00	0.00	0.58	0.0	23.5	1.3	0.77	8.86	1.99	12	6.19	136.15	137.45	137.06	137.82	144.20	144.45	8o
52	51	117.00	0.00	1.93	0.00	0.00	0.58	0.0	22.9	1.3	0.78	5.58	3.81	12	2.45	137.55	140.42	137.82	140.79	144.45	149.42	8m
53	52	45.00	0.00	1.93	0.00	0.00	0.58	0.0	22.7	1.4	0.79	2.43	2.77	12	0.47	140.52	140.73	140.91	141.12	149.42	150.73	8k
54	53	16.00	0.00	1.93	0.00	0.00	0.58	0.0	22.6	1.4	0.79	2.95	2.79	12	0.69	140.83	140.94	141.24	141.31	150.73	149.94	8i
55	54	110.00	0.00	1.93	0.00	0.00	0.58	0.0	22.1	1.4	0.80	6.82	3.82	12	3.67	141.04	145.08	141.31	145.45	149.94	151.08	8g
56	55	15.00	0.00	1.93	0.00	0.00	0.58	0.0	22.0	1.4	0.80	7.18	3.79	12	4.07	145.18	145.79	145.45	146.16	151.08	151.79	8e
57	56	6.00	1.93	1.93	0.30	0.58	0.58	22.0	22.0	1.4	0.80	3.25	3.21	12	0.83	145.89	145.94	146.23	146.31	151.79	185.24	8c
58	50	4.00	2.02	2.02	0.42	0.85	0.85	22.0	22.0	1.4	1.17	1.55	3.12	10	0.50	198.48	198.50	199.02	199.04	203.30	203.70	1aa
59	33	3.00	0.52	0.52	0.30	0.16	0.16	5.0	5.0	3.1	0.49	5.04	1.68	12	2.00	137.41	137.47	138.16	137.76	143.15	143.21	1aj

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 12.76 / (Inlet time + 2.60) ^ 0.69; Return period =Yrs. 5 ; c = cir e = ellip b = box

Line Profile (Line 1) - 2M

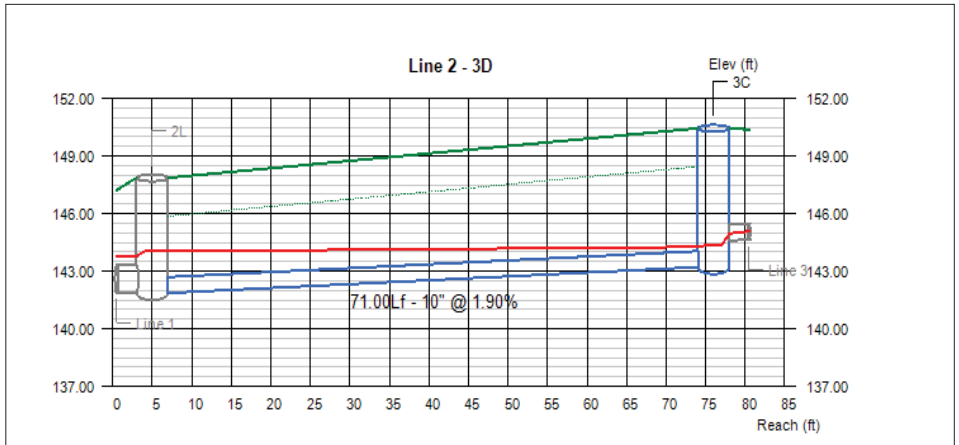


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	7.24	141.77	141.86	1.50	1.50	2.17	143.69	143.78	144.03	4.10	4.10	0.00	4.50

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 2) - 3D

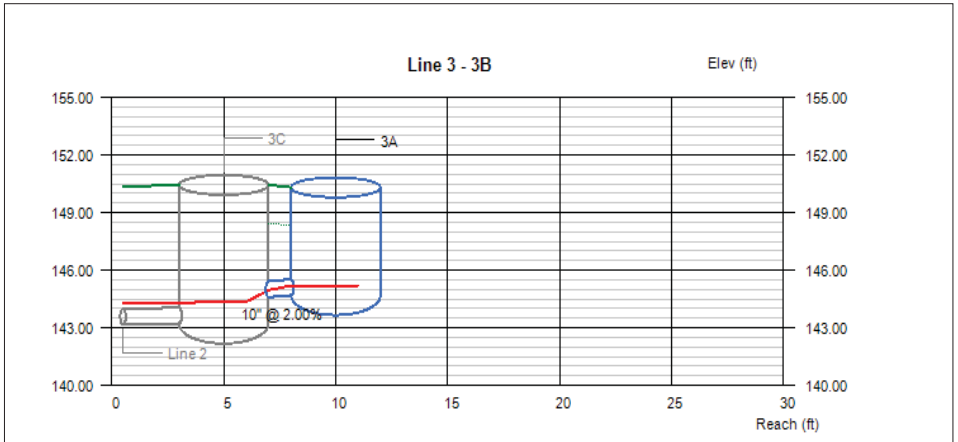


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	1.24	141.86	143.21	0.83	0.83	1.13	144.03	144.26	144.34	2.28	2.28	5.17	6.40

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 3) - 3B

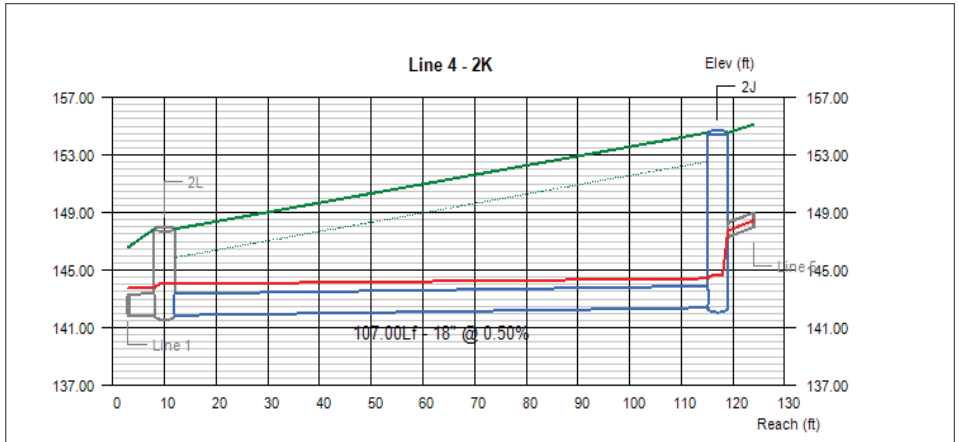


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	1.25	144.59	144.69	0.37	0.50	0.50	144.96	145.19	145.19	5.37	3.67	5.02	4.79

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 4) - 2K

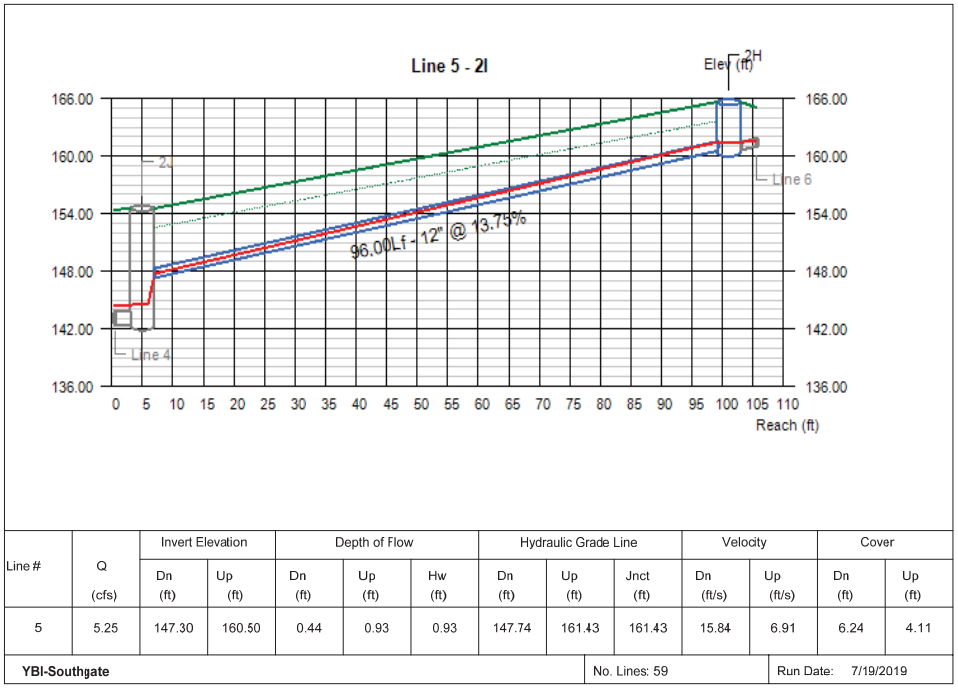


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	6.37	141.86	142.39	1.50	1.50	2.24	144.03	144.43	144.63	3.61	3.61	4.50	10.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 5) - 2I

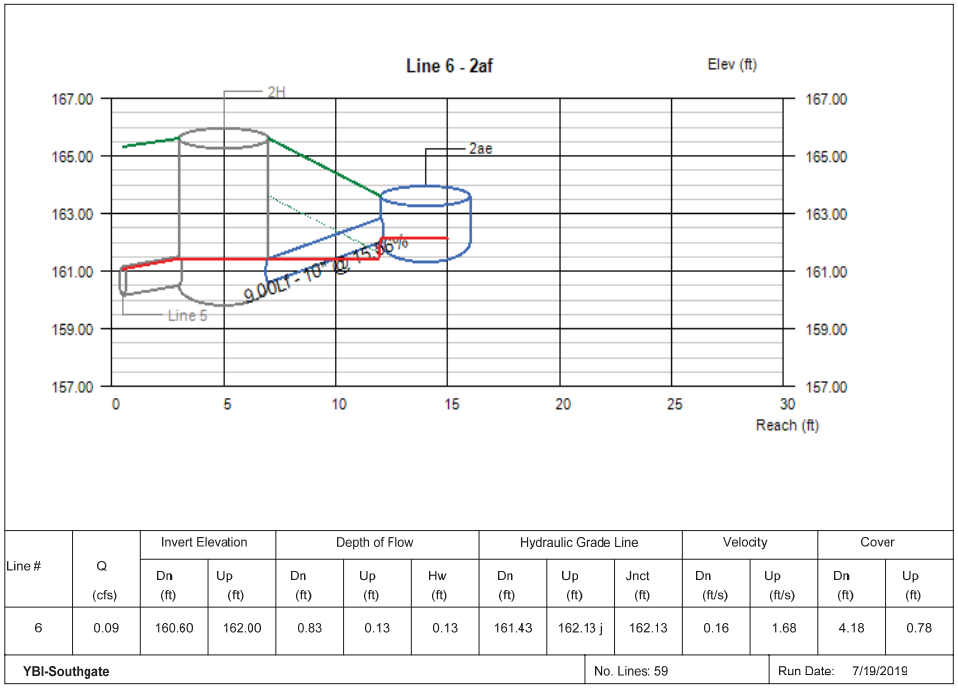


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
5	5.25	147.30	160.50	0.44	0.93	0.93	147.74	161.43	161.43	15.84	6.91	6.24	4.11

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 6) - 2af



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
6	0.09	160.60	162.00	0.83	0.13	0.13	161.43	162.13 j	162.13	0.16	1.68	4.18	0.78

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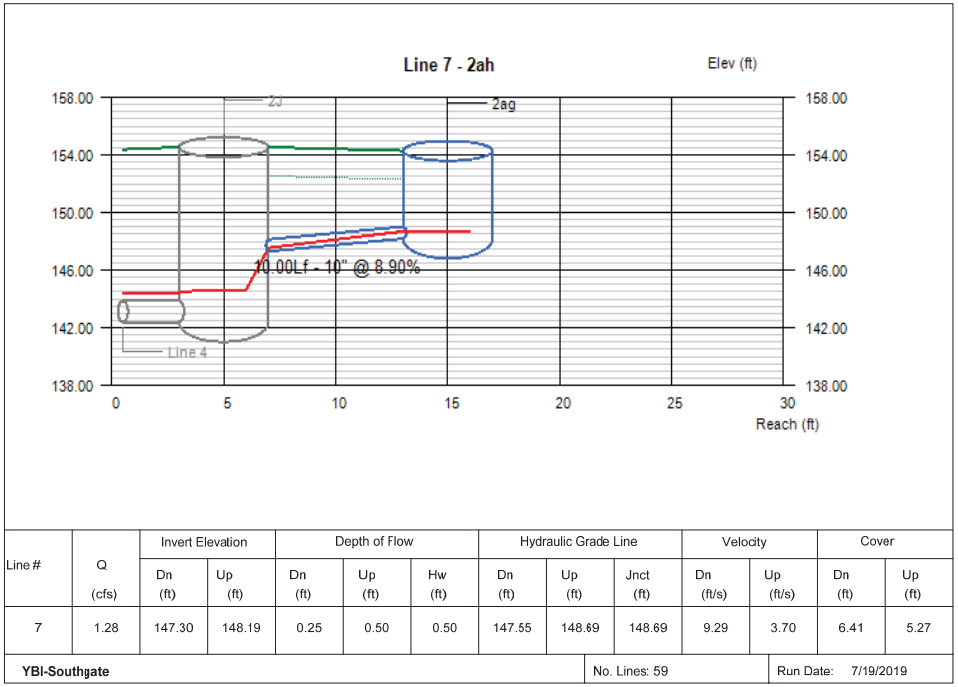
Storm Sewers

Line Profile (Line 7) - 2ah



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
7	1.28	147.30	148.19	0.25	0.50	0.50	147.55	148.69	148.69	9.29	3.70	6.41	5.27

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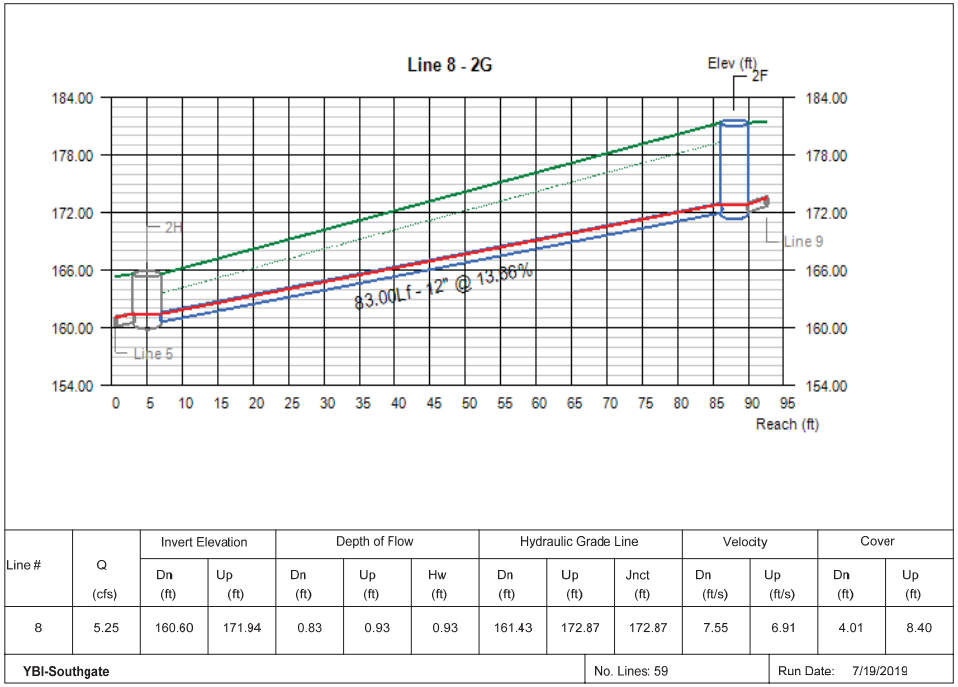
Storm Sewers

Line Profile (Line 8) - 2G

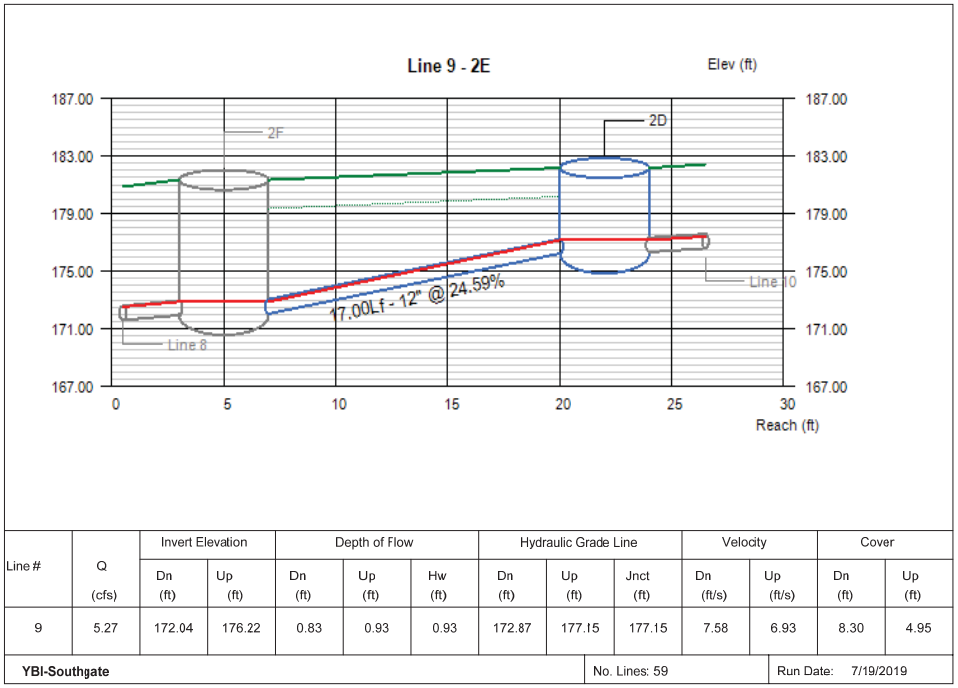


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
8	5.25	160.60	171.94	0.83	0.93	0.93	161.43	172.87	172.87	7.55	6.91	4.01	8.40

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 9) - 2E



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
9	5.27	172.04	176.22	0.83	0.93	0.93	172.87	177.15	177.15	7.58	6.93	8.30	4.95

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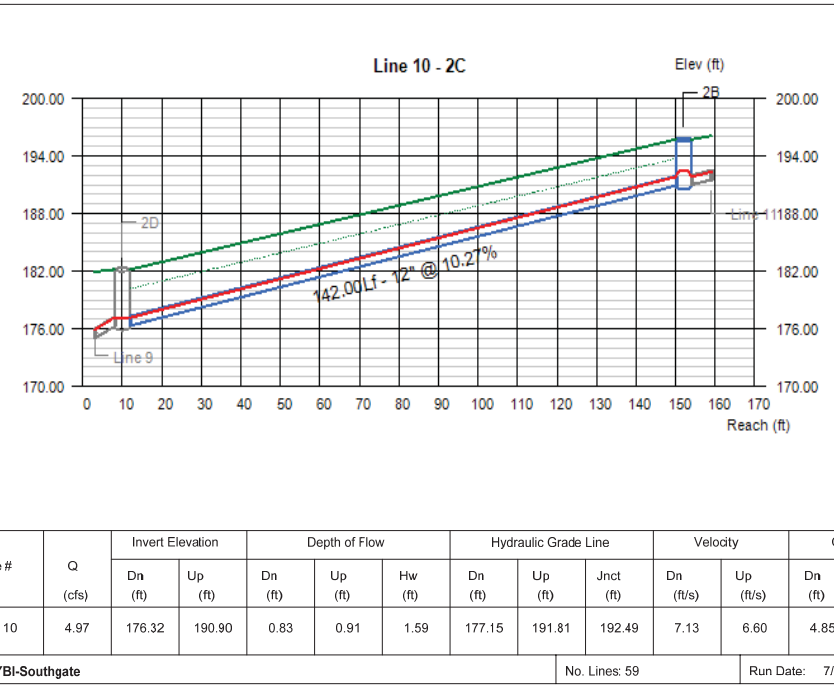
Line Profile (Line 10) - 2C



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
10	4.97	176.32	190.90	0.83	0.91	1.59	177.15	191.81	192.49	7.13	6.60	4.85	3.82

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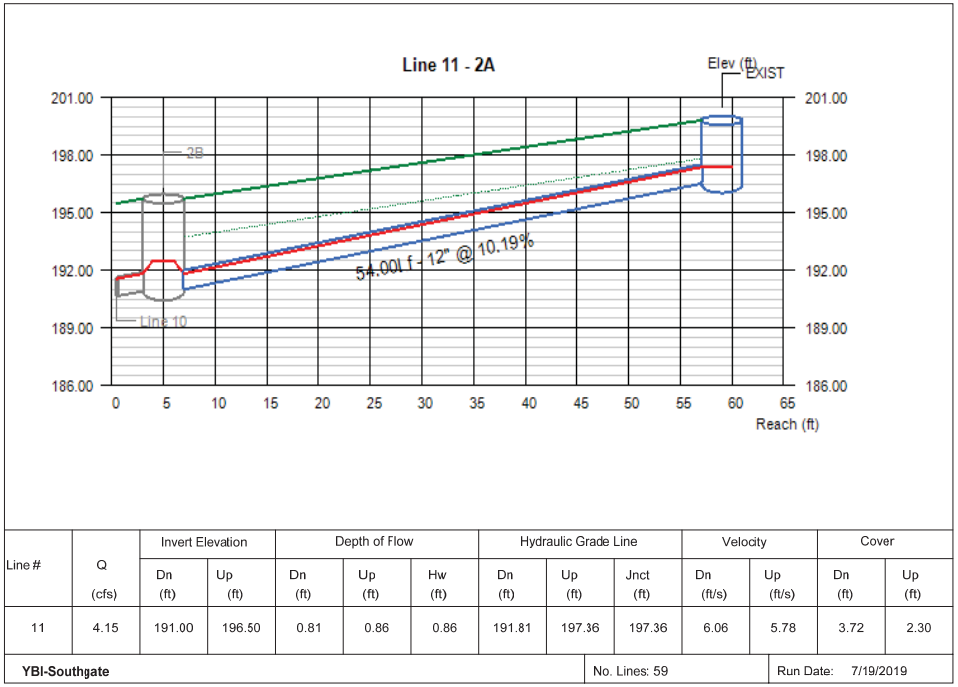
Line Profile (Line 11) - 2A



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
11	4.15	191.00	196.50	0.81	0.86	0.86	191.81	197.36	197.36	6.06	5.78	3.72	2.30

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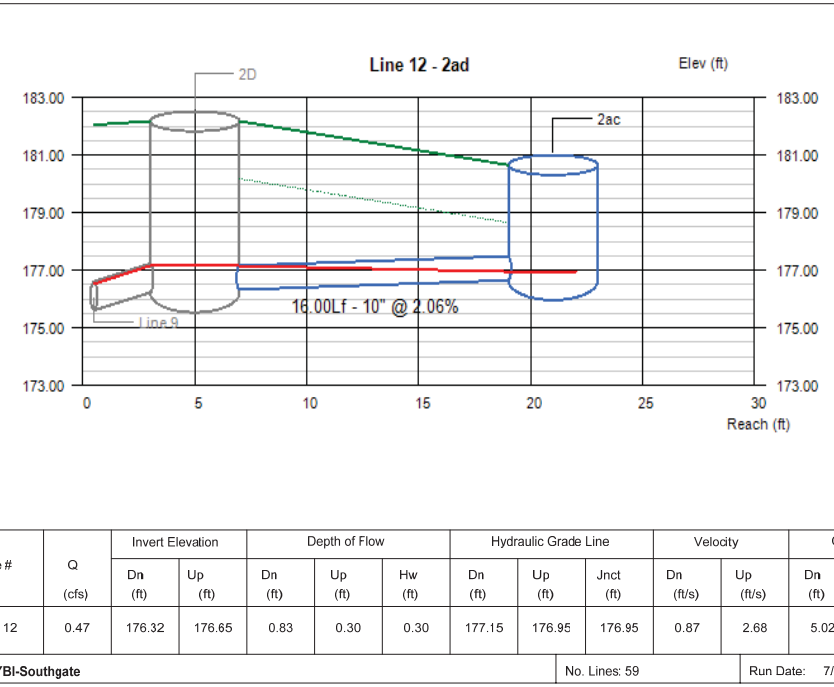
Line Profile (Line 12) - 2ad



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
12	0.47	176.32	176.65	0.83	0.30	0.30	177.15	176.95	176.95	0.87	2.68	5.02	3.17

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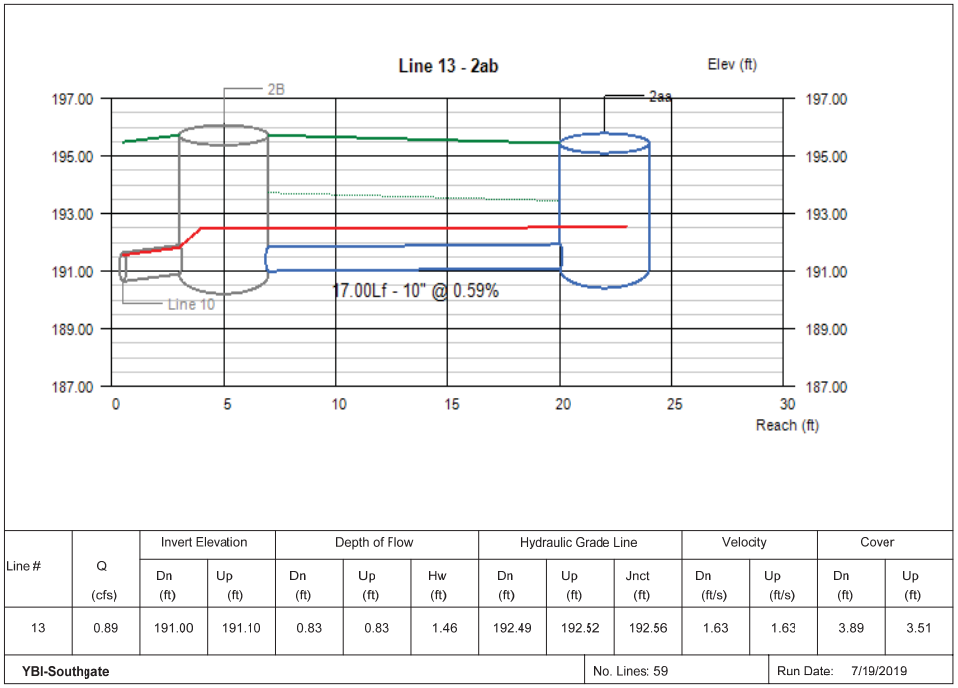
Line Profile (Line 13) - 2ab

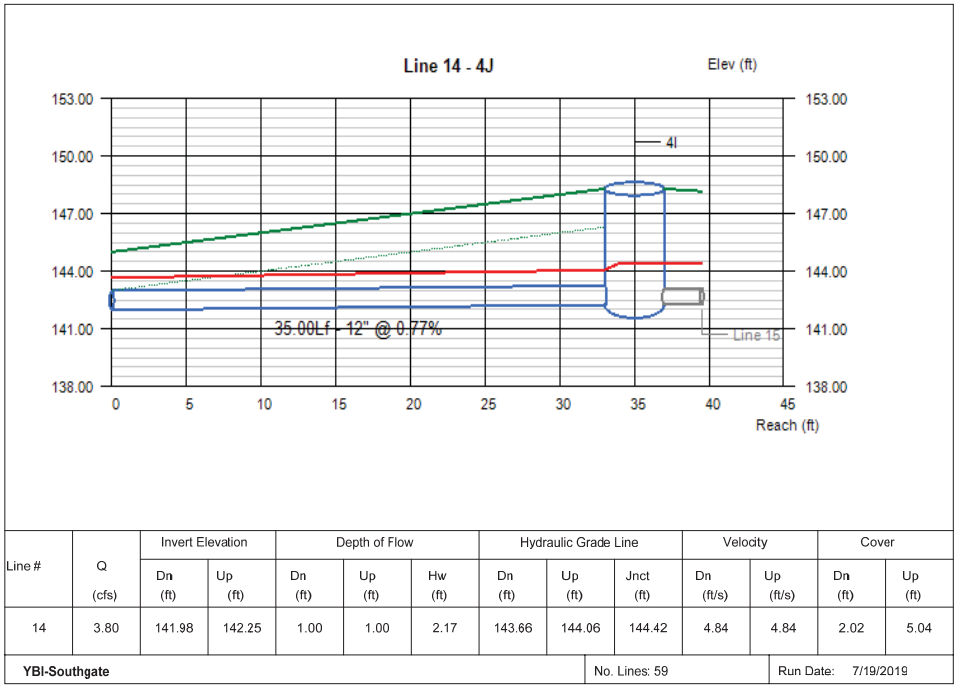


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
13	0.89	191.00	191.10	0.83	0.83	1.46	192.49	192.52	192.56	1.63	1.63	3.89	3.51

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 14) - 4J

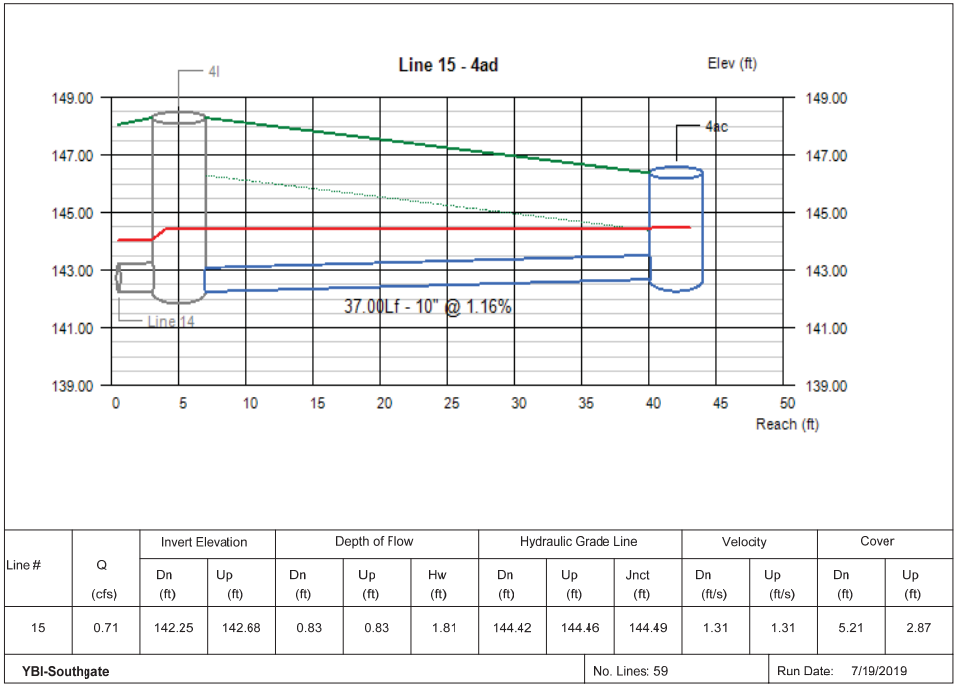


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
14	3.80	141.98	142.25	1.00	1.00	2.17	143.66	144.06	144.42	4.84	4.84	2.02	5.04

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 15) - 4ad

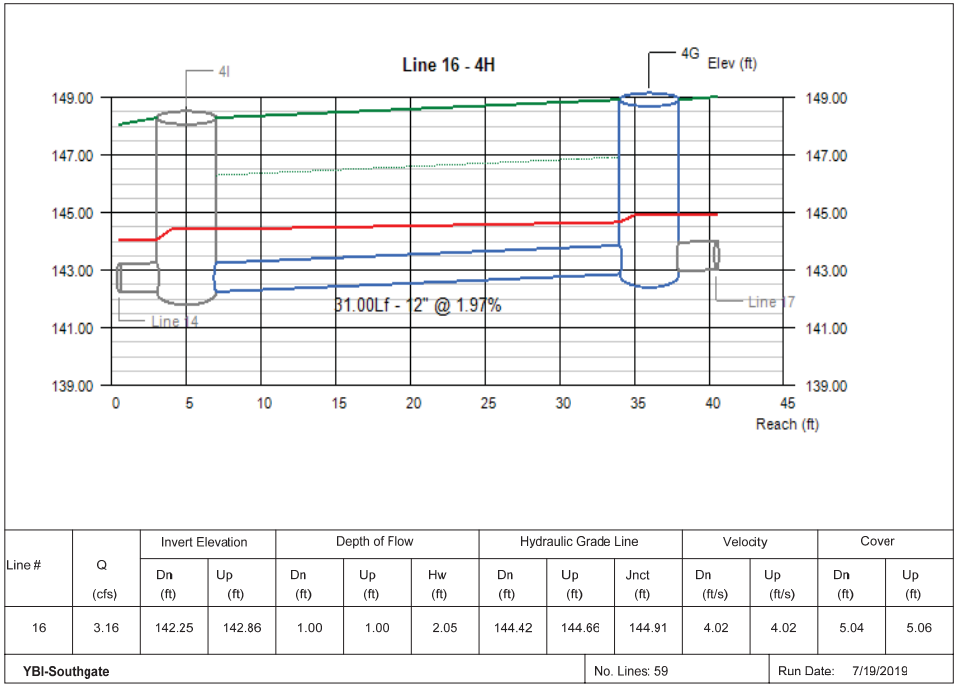


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
15	0.71	142.25	142.68	0.83	0.83	1.81	144.42	144.46	144.49	1.31	1.31	5.21	2.87

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 16) - 4H



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
16	3.16	142.25	142.86	1.00	1.00	2.05	144.42	144.66	144.91	4.02	4.02	5.04	5.06

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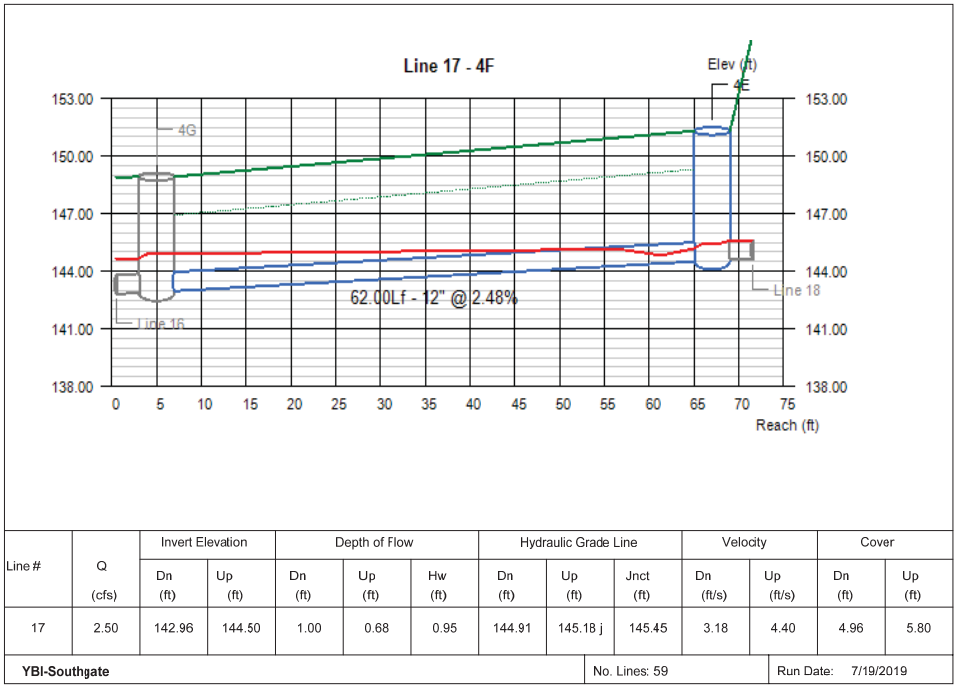
Storm Sewers

Line Profile (Line 17) - 4F

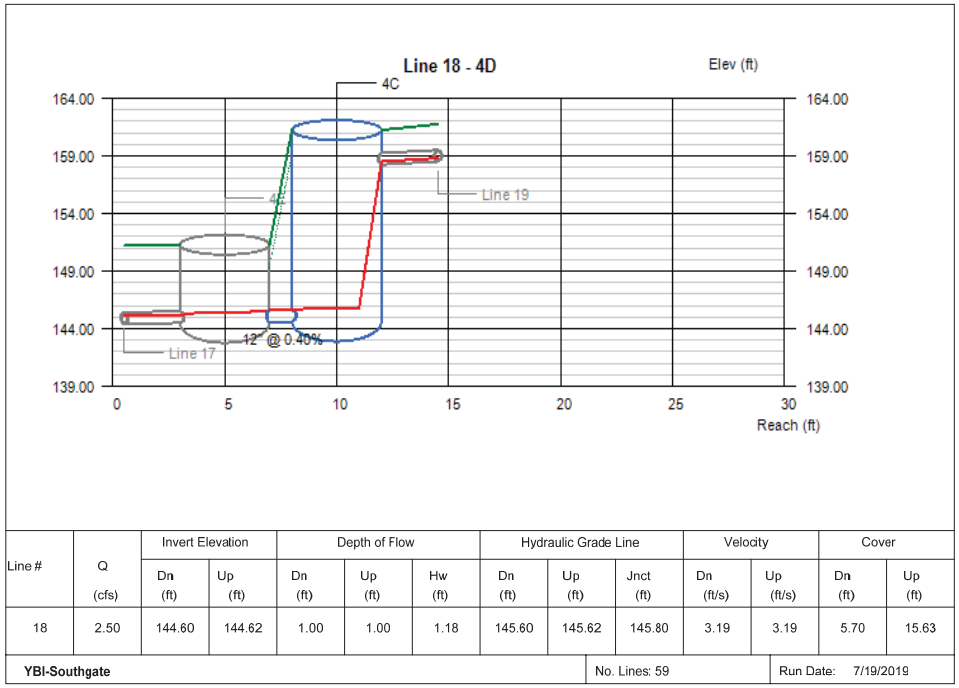


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
17	2.50	142.96	144.50	1.00	0.68	0.95	144.91	145.18 j	145.45	3.18	4.40	4.96	5.80

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 18) - 4D

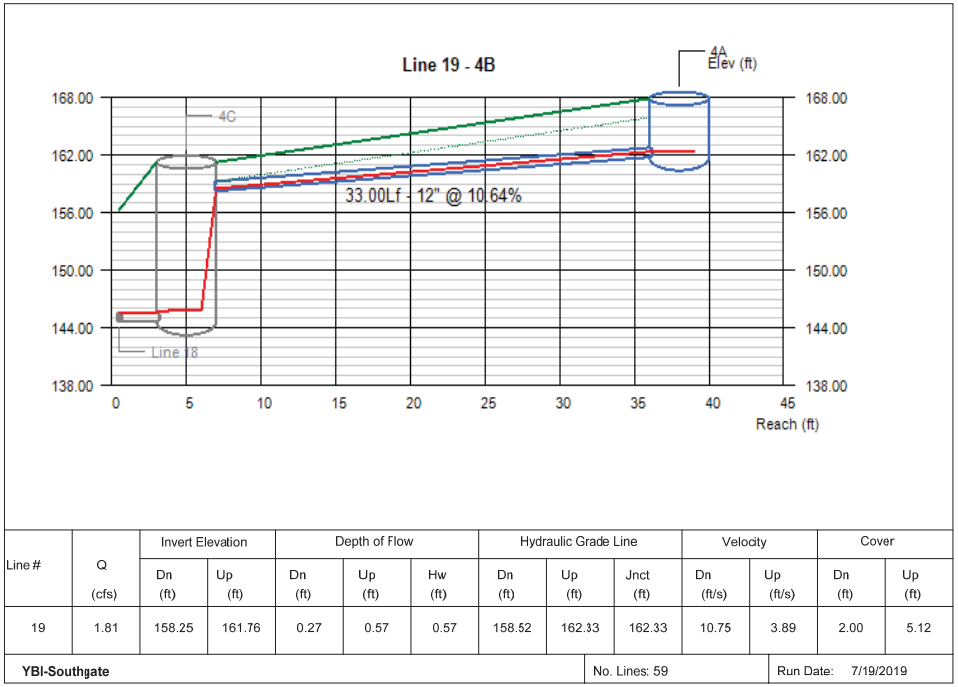


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
18	2.50	144.60	144.62	1.00	1.00	1.18	145.60	145.62	145.80	3.19	3.19	5.70	15.63

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 19) - 4B

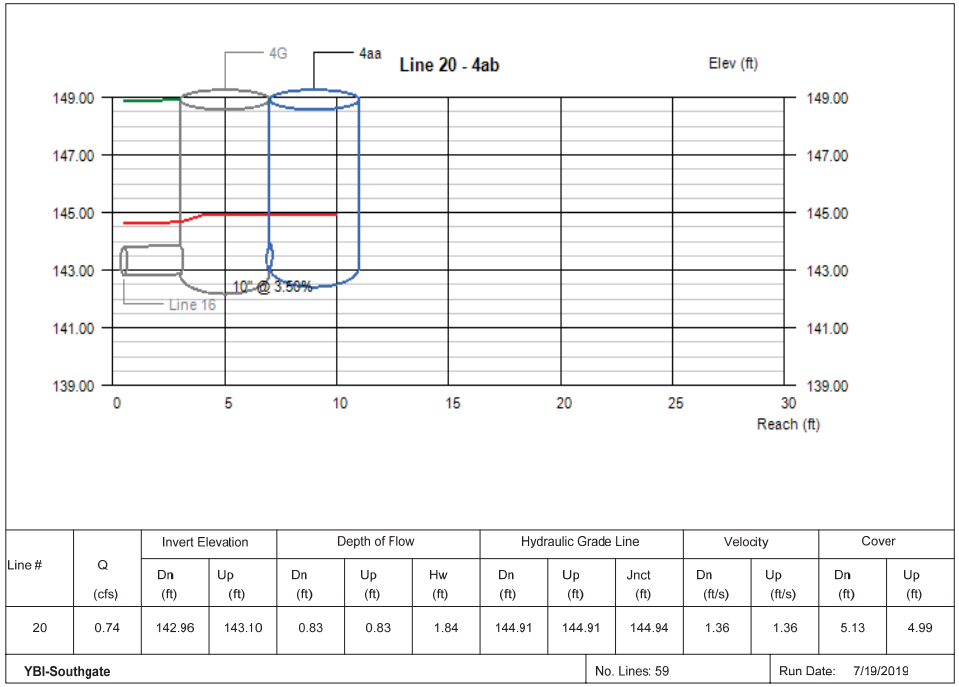


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
19	1.81	158.25	161.76	0.27	0.57	0.57	158.52	162.33	162.33	10.75	3.89	2.00	5.12

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 20) - 4ab



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
20	0.74	142.96	143.10	0.83	0.83	1.84	144.91	144.91	144.94	1.36	1.36	5.13	4.99

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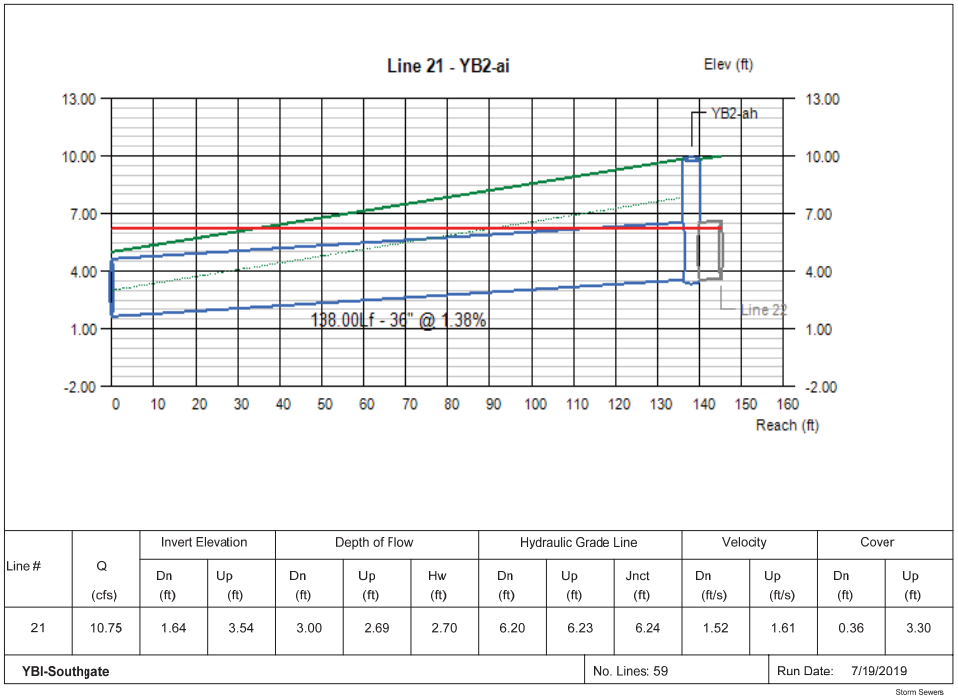
Storm Sewers

Line Profile (Line 21) - YB2-ai



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
21	10.75	1.64	3.54	3.00	2.69	2.70	6.20	6.23	6.24	1.52	1.61	0.36	3.30

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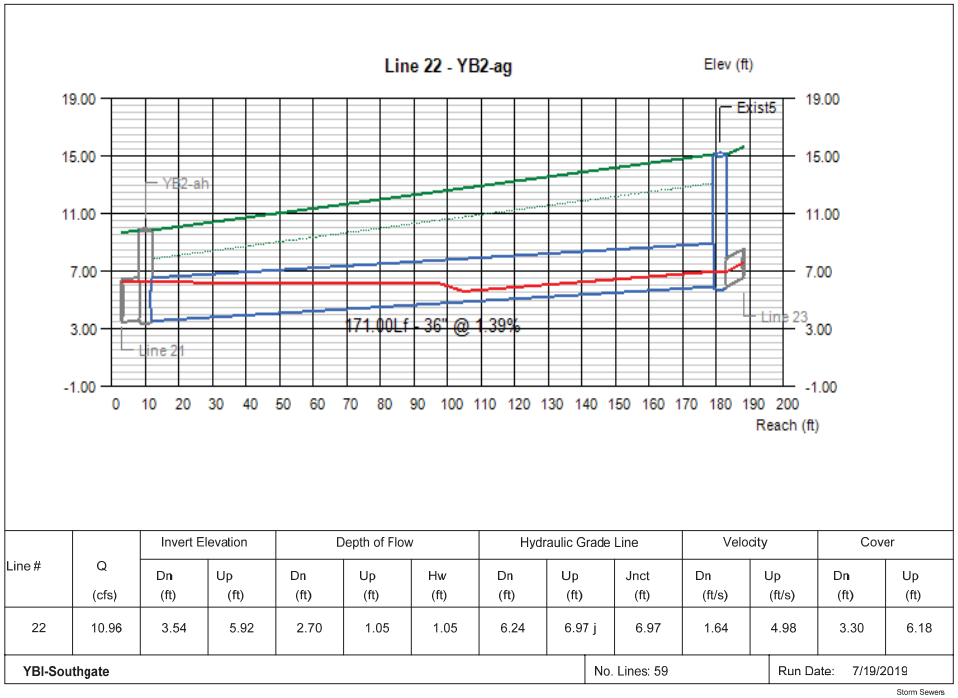
Storm Sewers

Line Profile (Line 22) - YB2-ag



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
22	10.96	3.54	5.92	2.70	1.05	1.05	6.24	6.97 j	6.97	1.64	4.98	3.30	6.18

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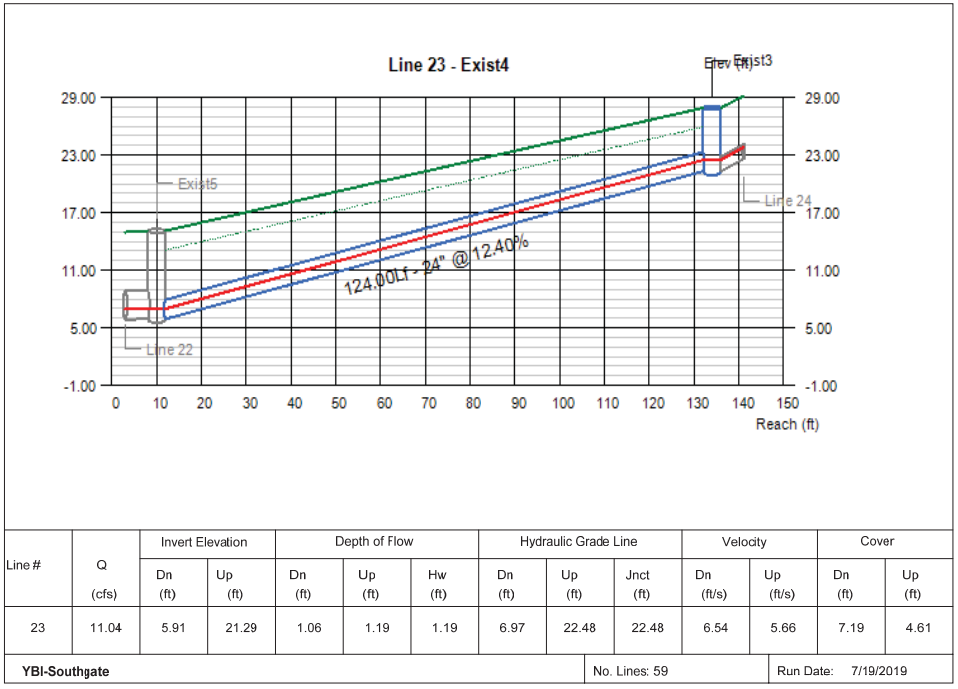
Storm Sewers

Line Profile (Line 23) - Exist4



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
23	11.04	5.91	21.29	1.06	1.19	1.19	6.97	22.48	22.48	6.54	5.66	7.19	4.61

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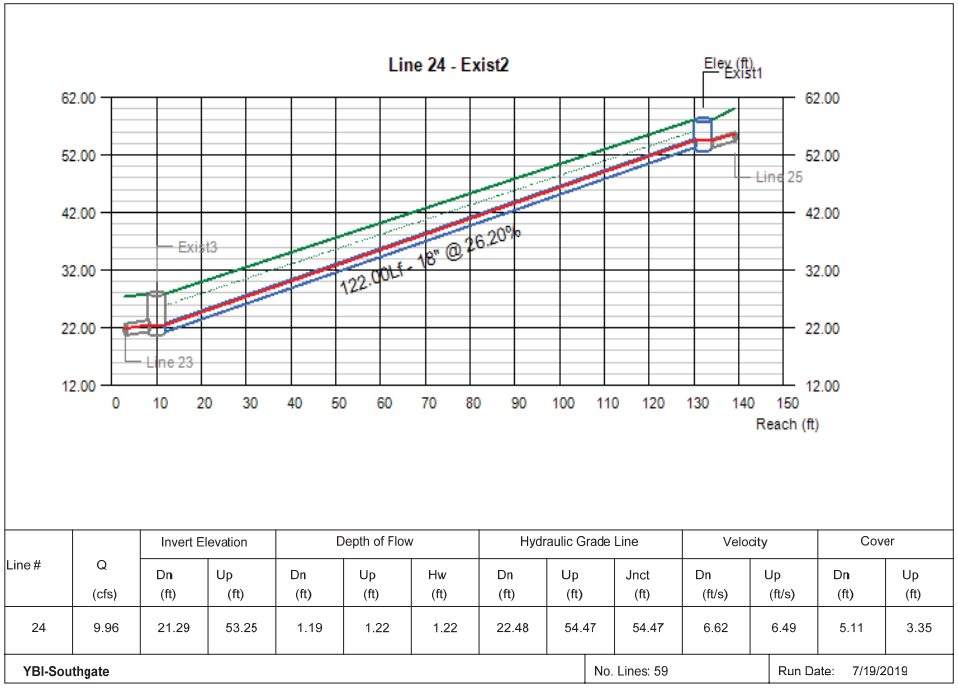
Line Profile (Line 24) - Exist2



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
24	9.96	21.29	53.25	1.19	1.22	1.22	22.48	54.47	54.47	6.62	6.49	5.11	3.35

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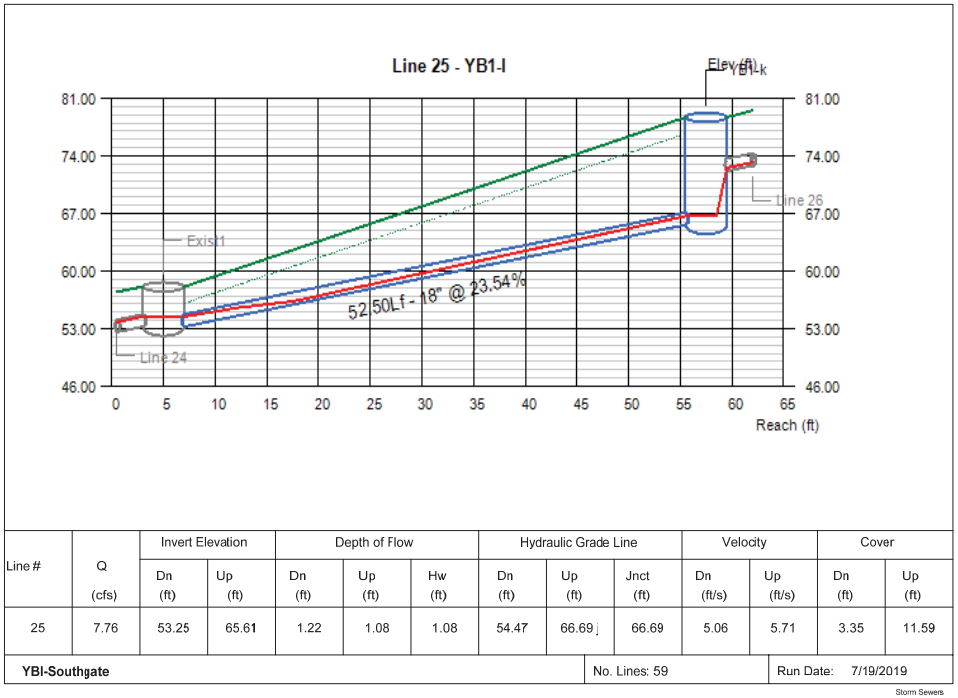
Storm Sewers

Line Profile (Line 25) - YB1-l



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
25	7.76	53.25	65.61	1.22	1.08	1.08	54.47	66.69	66.69	5.06	5.71	3.35	11.59

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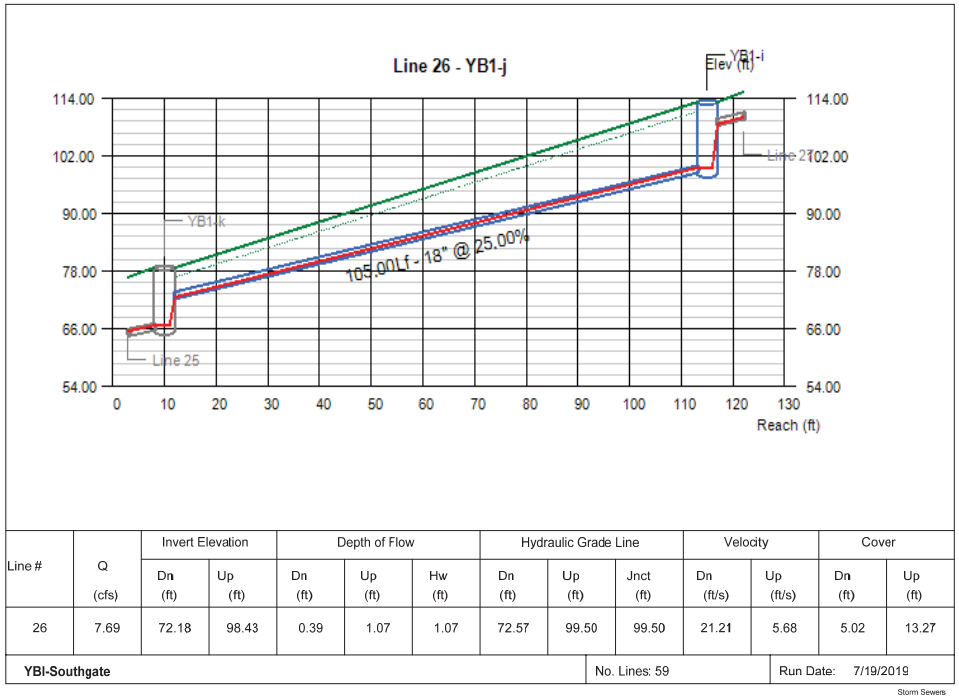
Storm Sewers

Line Profile (Line 26) - YB1-j



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
26	7.69	72.18	98.43	0.39	1.07	1.07	72.57	99.50	99.50	21.21	5.68	5.02	13.27

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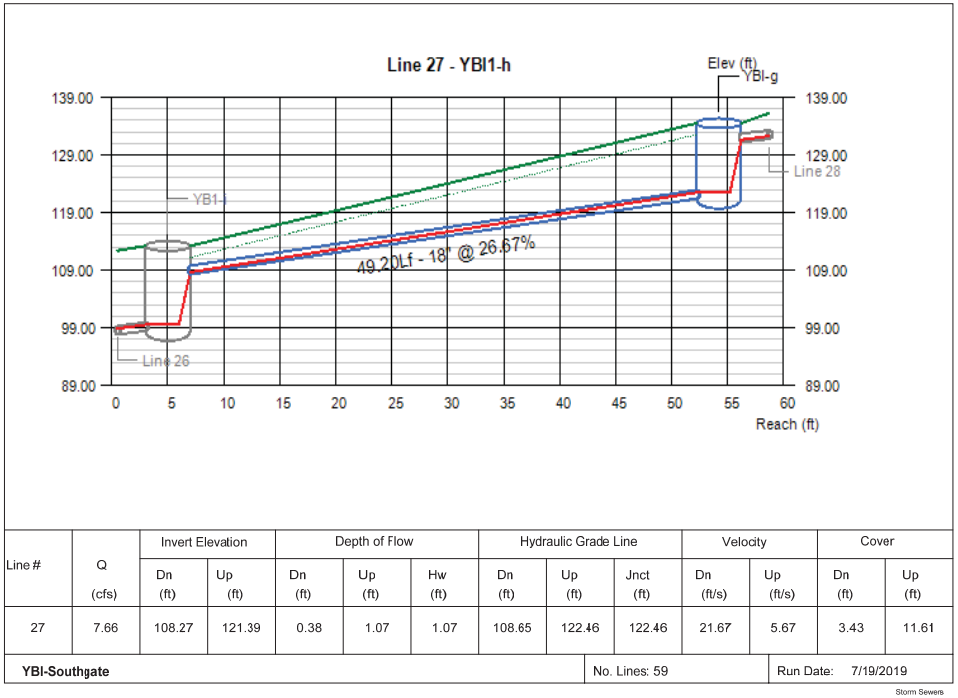
Storm Sewers

Line Profile (Line 27) - YBI1-h



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
27	7.66	108.27	121.39	0.38	1.07	1.07	108.65	122.46	122.46	21.67	5.67	3.43	11.61

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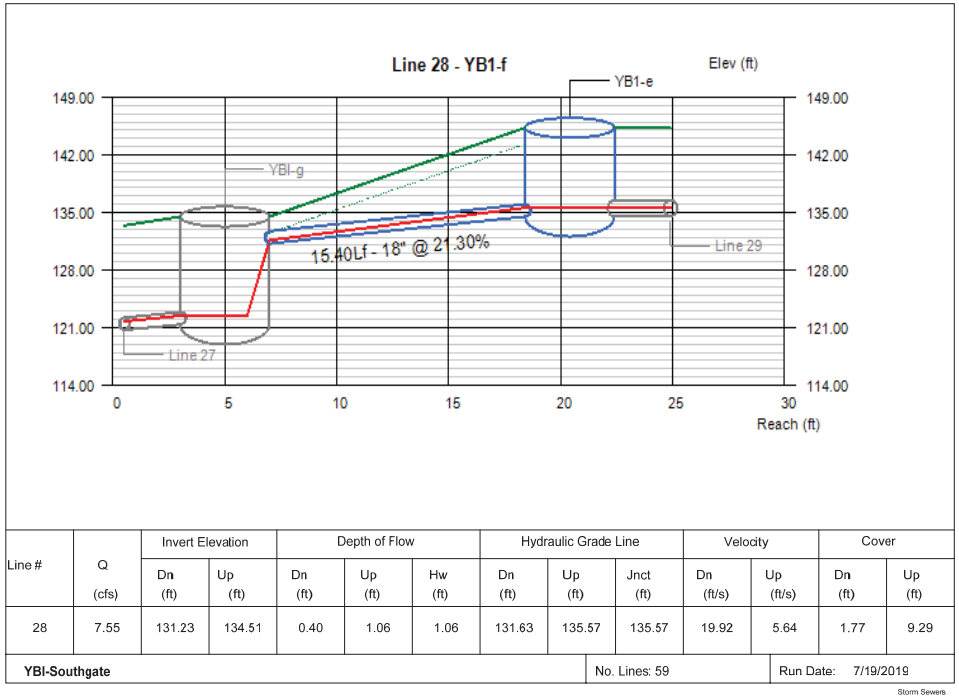
Storm Sewers

Line Profile (Line 28) - YB1-f

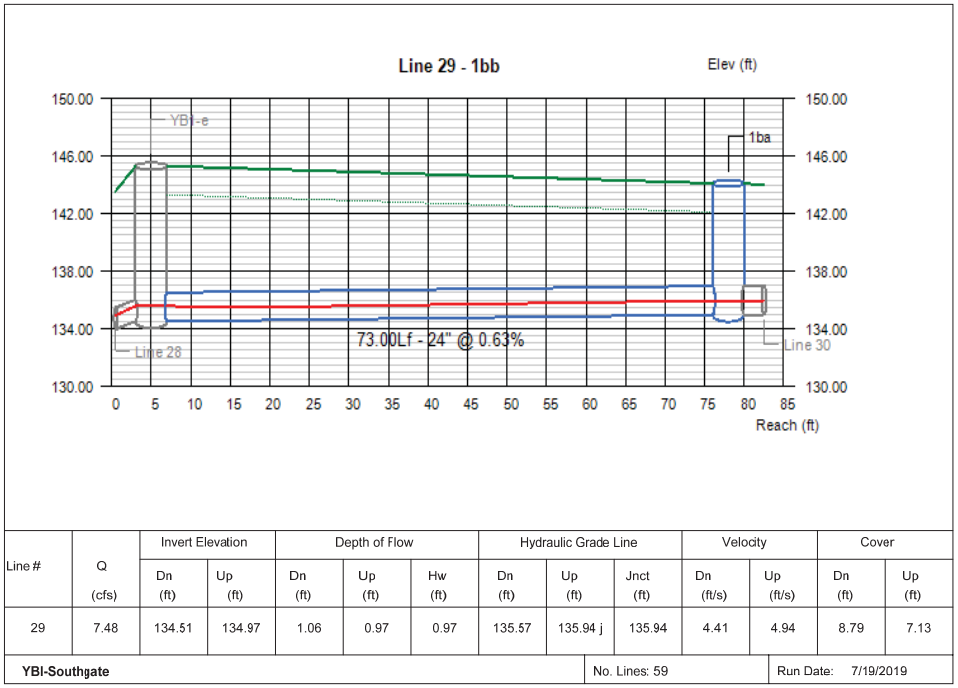


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
28	7.55	131.23	134.51	0.40	1.06	1.06	131.63	135.57	135.57	19.92	5.64	1.77	9.29

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 29) - 1bb

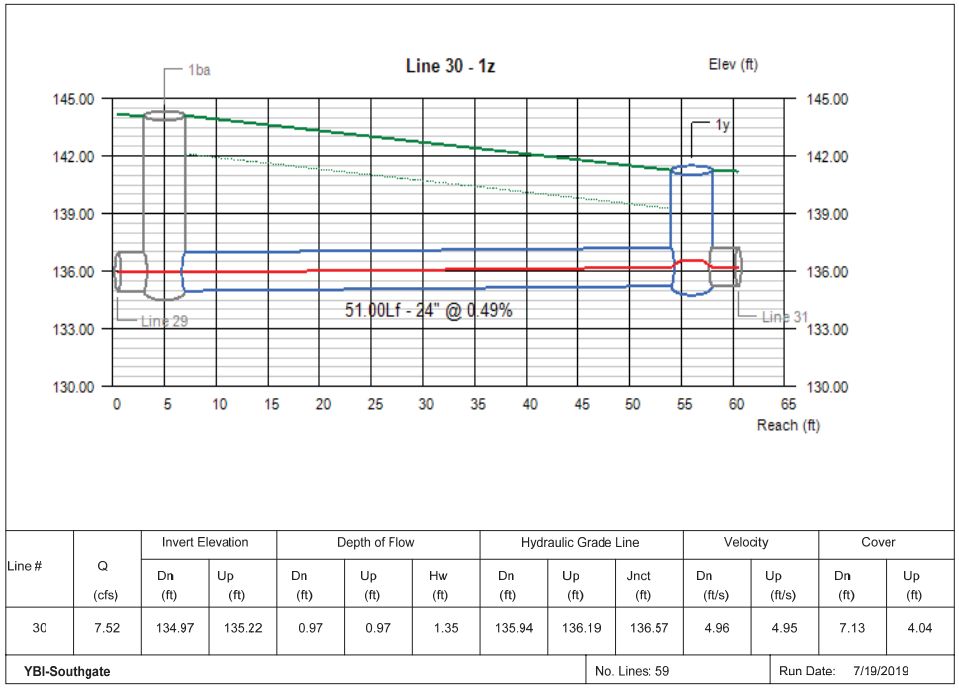


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
29	7.48	134.51	134.97	1.06	0.97	0.97	135.57	135.94 j	135.94	4.41	4.94	8.79	7.13

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 30) - 1z

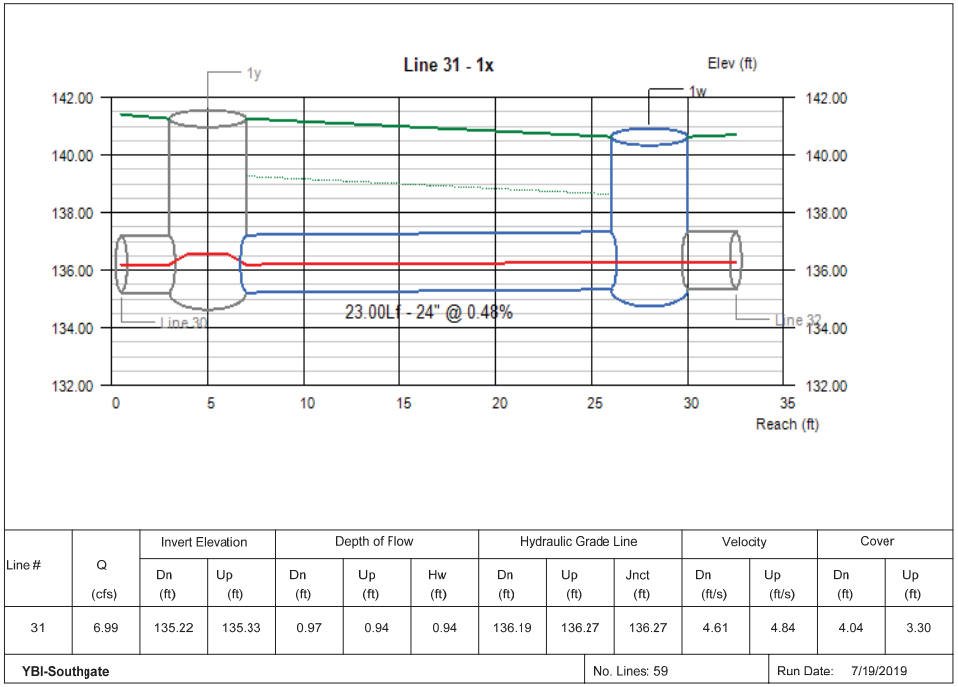


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
30	7.52	134.97	135.22	0.97	0.97	1.35	135.94	136.19	136.57	4.96	4.95	7.13	4.04

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 31) - 1x

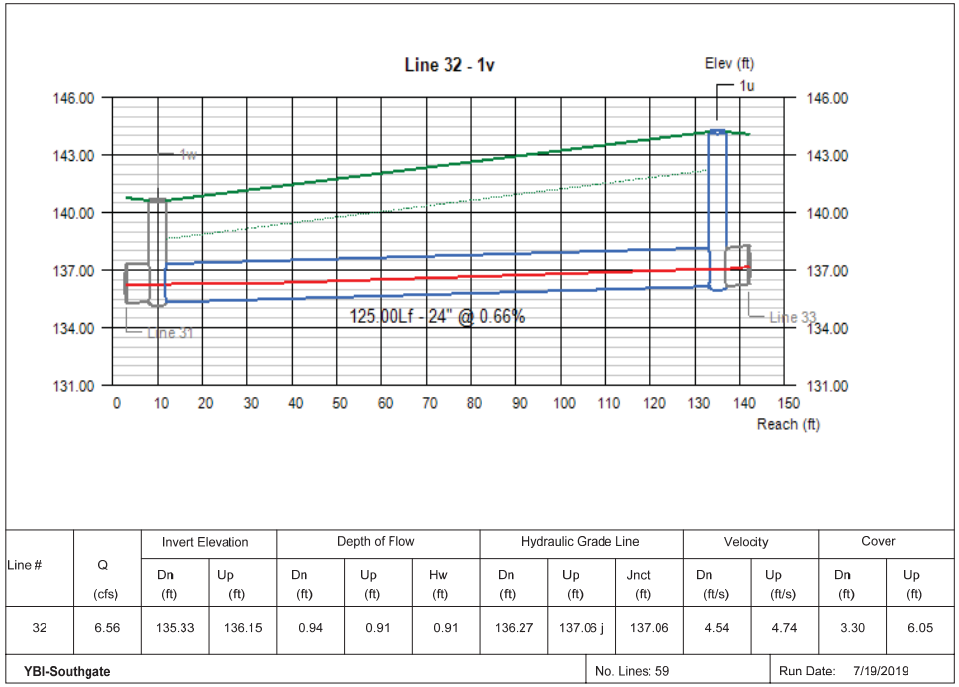


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
31	6.99	135.22	135.33	0.97	0.94	0.94	136.19	136.27	136.27	4.61	4.84	4.04	3.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 32) - 1v

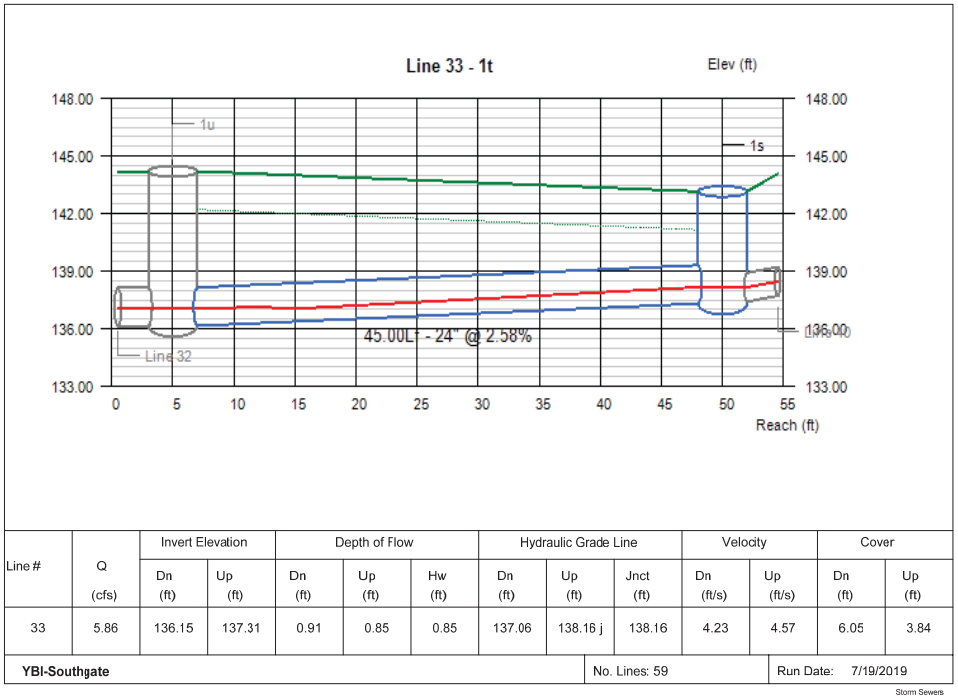


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
32	6.56	135.33	136.15	0.94	0.91	0.91	136.27	137.06 j	137.06	4.54	4.74	3.30	6.05

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 33) - 1t

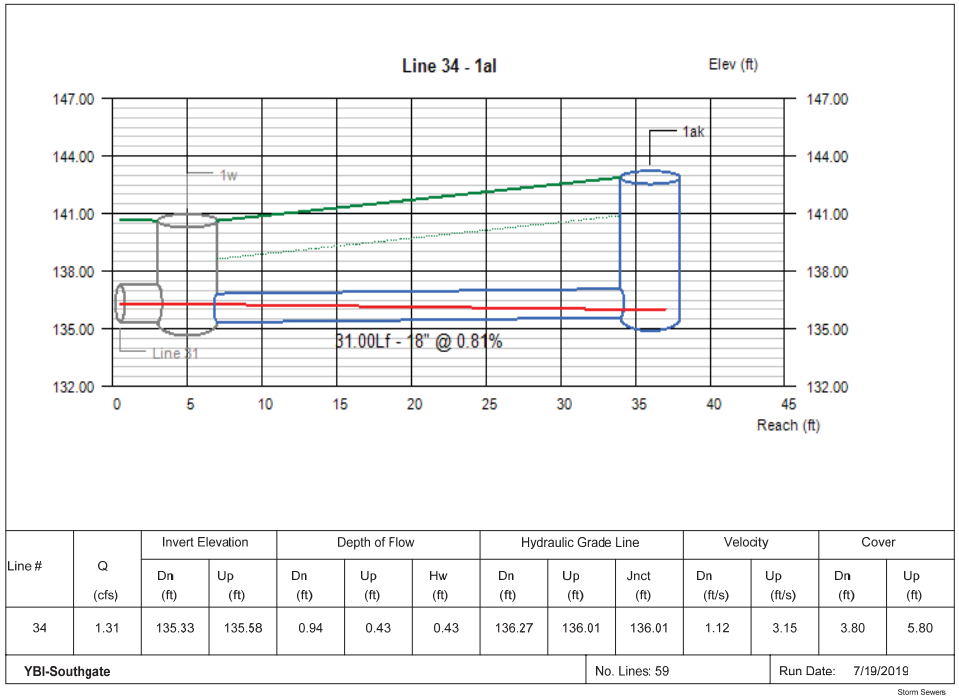


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
33	5.86	136.15	137.31	0.91	0.85	0.85	137.06	138.16 j	138.16	4.23	4.57	6.05	3.84

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 34) - 1al

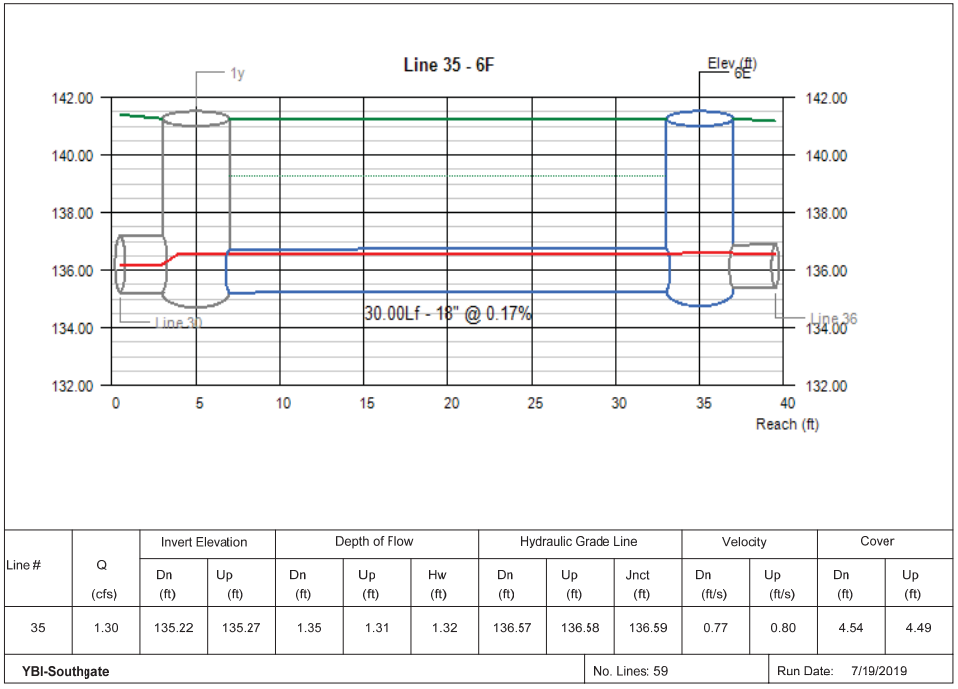


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
34	1.31	135.33	135.58	0.94	0.43	0.43	136.27	136.01	136.01	1.12	3.15	3.80	5.80

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 35) - 6F

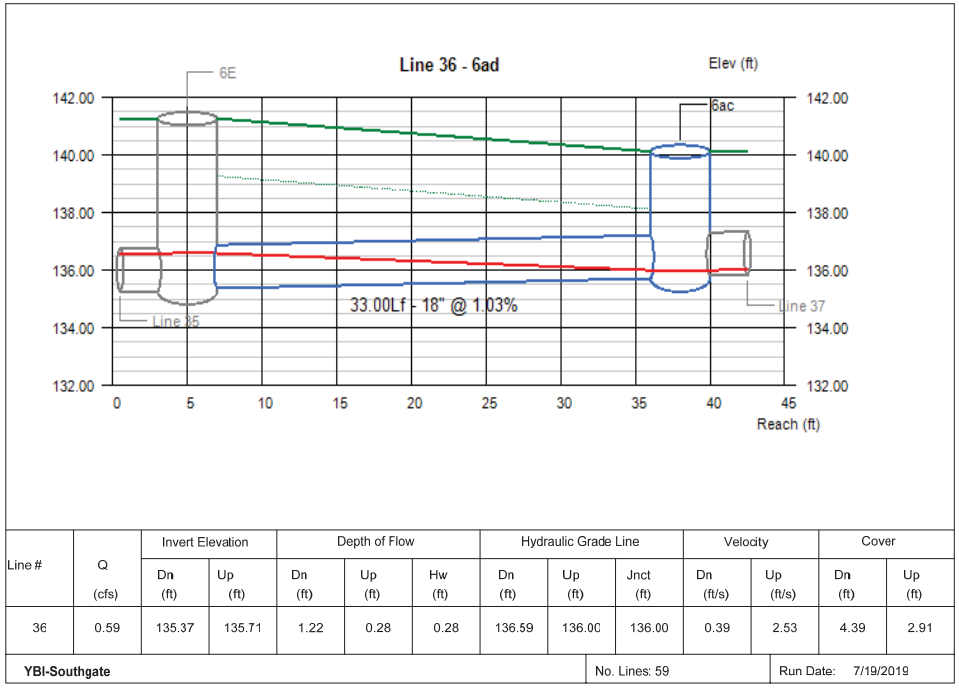


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
35	1.30	135.22	135.27	1.35	1.31	1.32	136.57	136.58	136.59	0.77	0.80	4.54	4.49

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 36) - 6ad

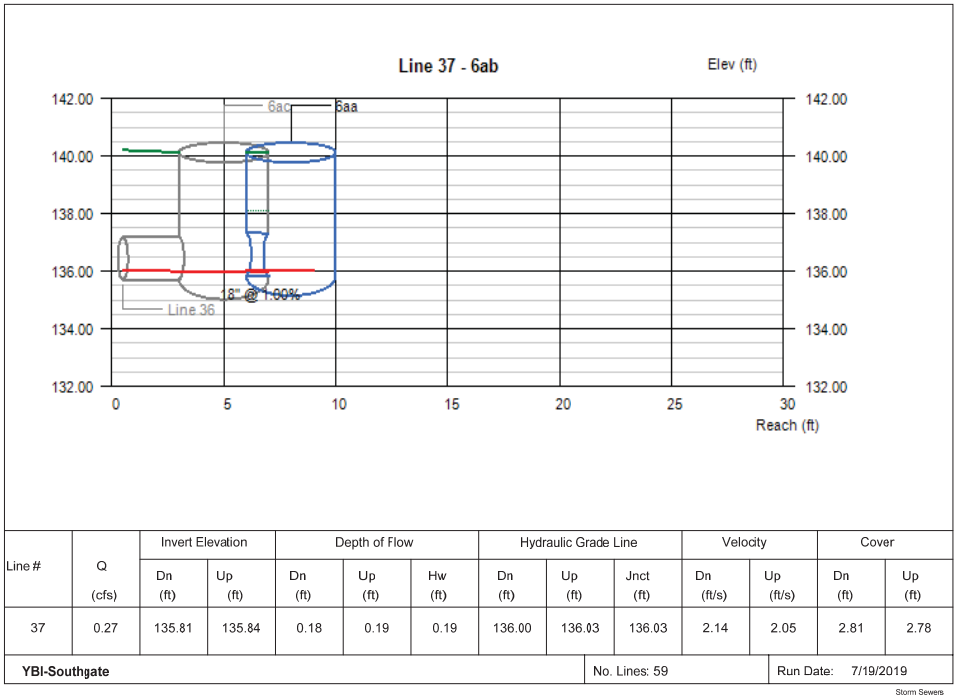


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
36	0.59	135.37	135.71	1.22	0.28	0.28	136.59	136.00	136.00	0.39	2.53	4.39	2.91

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 37) - 6ab

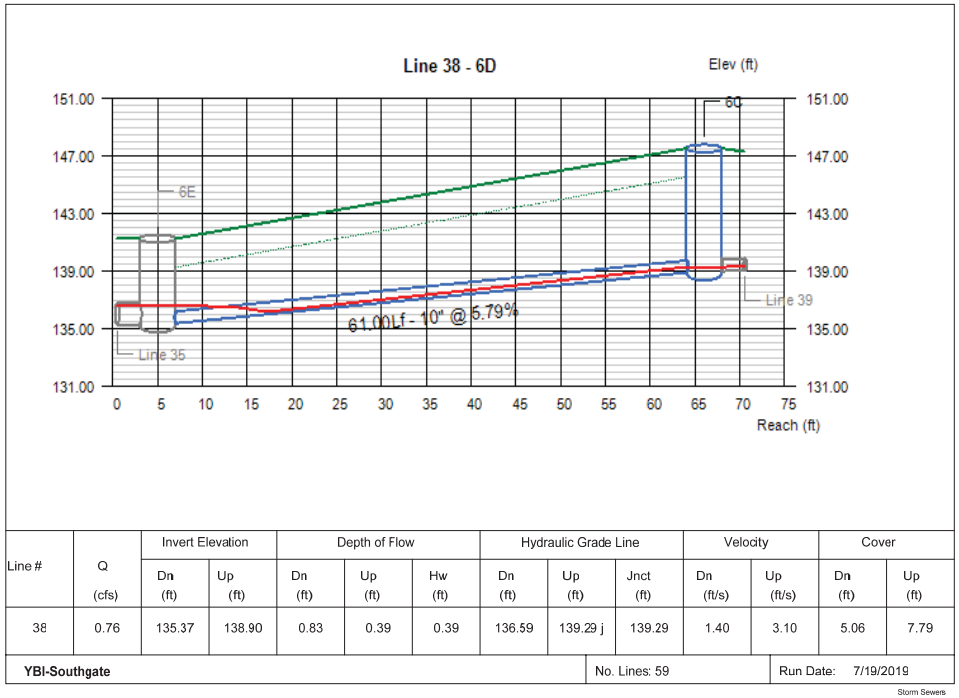


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
37	0.27	135.81	135.84	0.18	0.19	0.19	136.00	136.03	136.03	2.14	2.05	2.81	2.78

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 38) - 6D

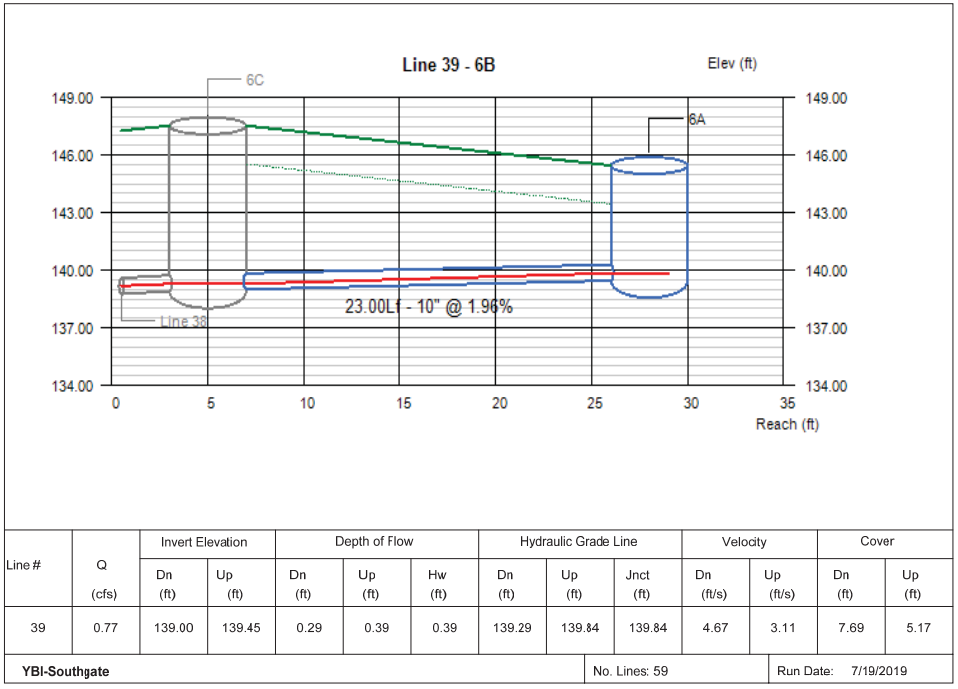


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
38	0.76	135.37	138.90	0.83	0.39	0.39	136.59	139.29 j	139.29	1.40	3.10	5.06	7.79

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 39) - 6B

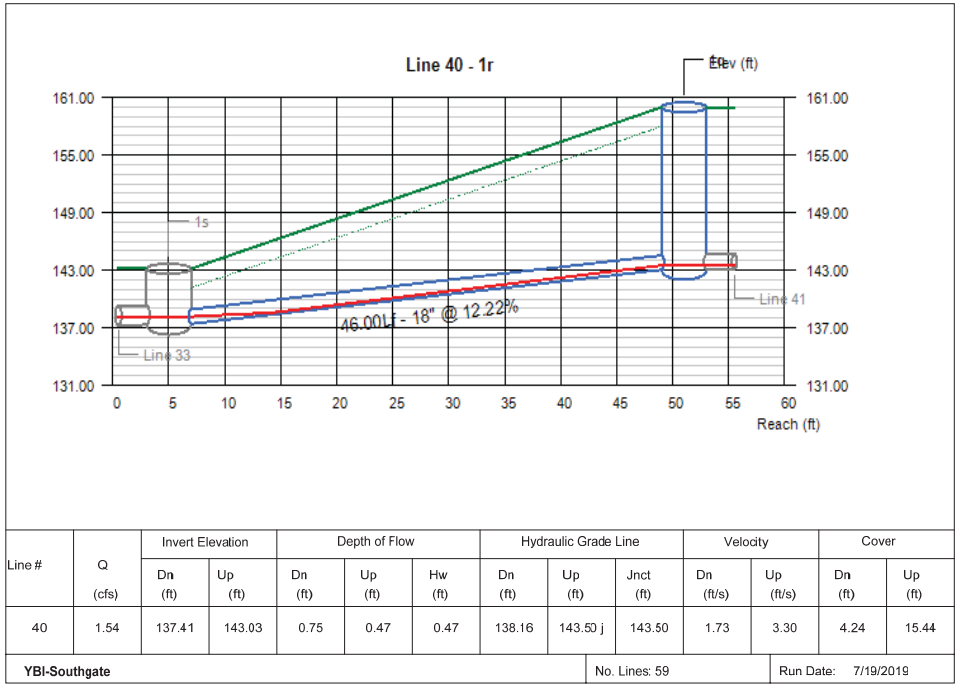


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
39	0.77	139.00	139.45	0.29	0.39	0.39	139.29	139.84	139.84	4.67	3.11	7.69	5.17

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 40) - 1r

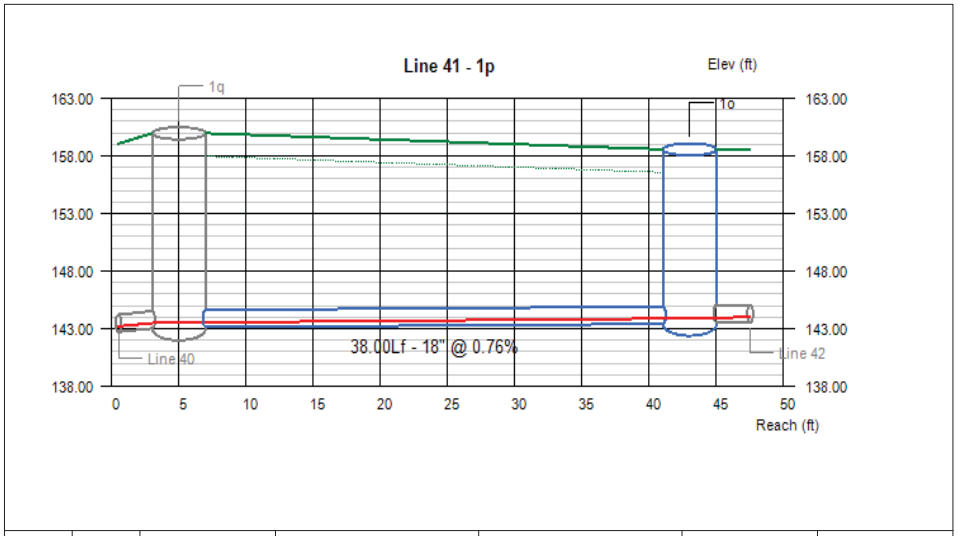


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
40	1.54	137.41	143.03	0.75	0.47	0.47	138.16	143.50 j	143.50	1.73	3.30	4.24	15.44

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 41) - 1p

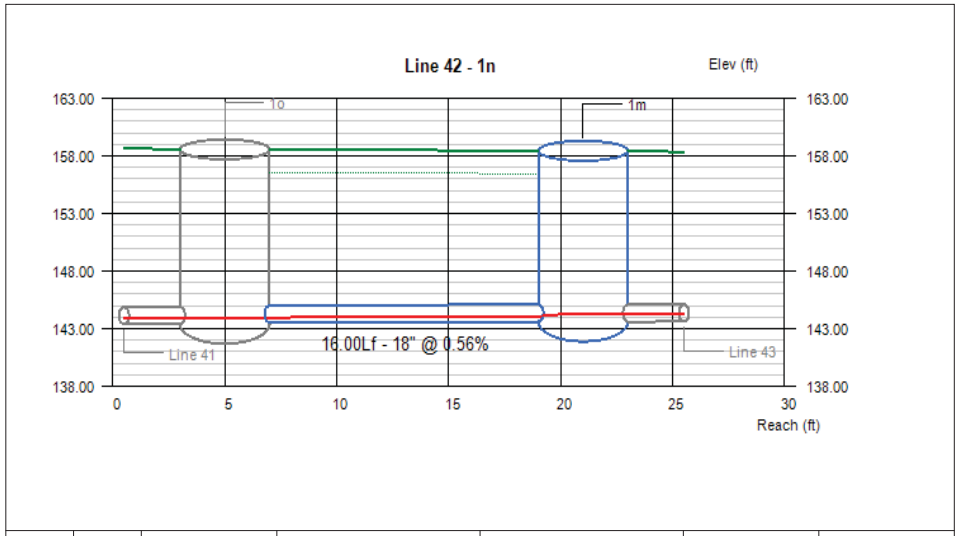


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
41	1.55	143.13	143.42	0.42	0.47	0.47	143.55	143.89	143.89	3.86	3.30	15.34	13.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 42) - 1n

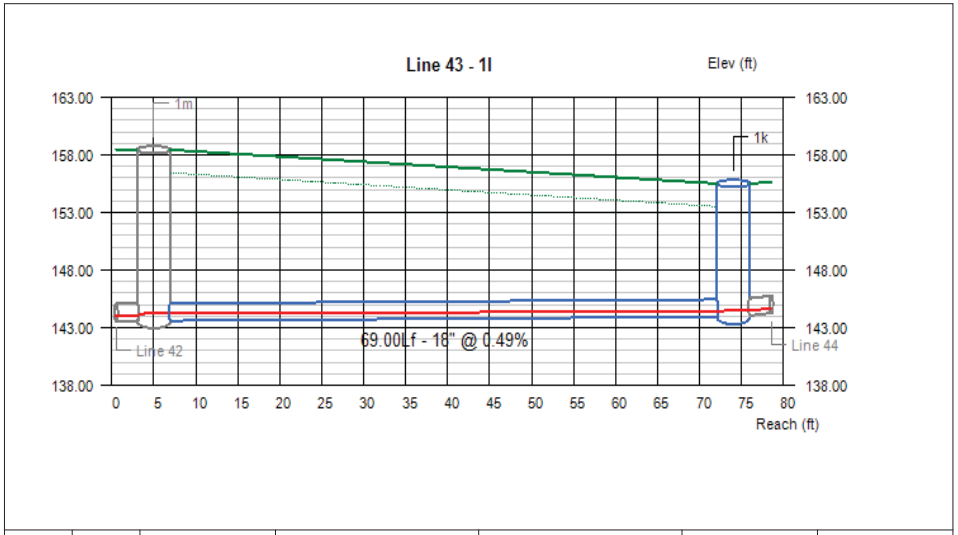


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
42	1.55	143.52	143.61	0.45	0.47	0.64	143.97	144.08	144.25	3.46	3.30	13.55	13.34

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 43) - 1l

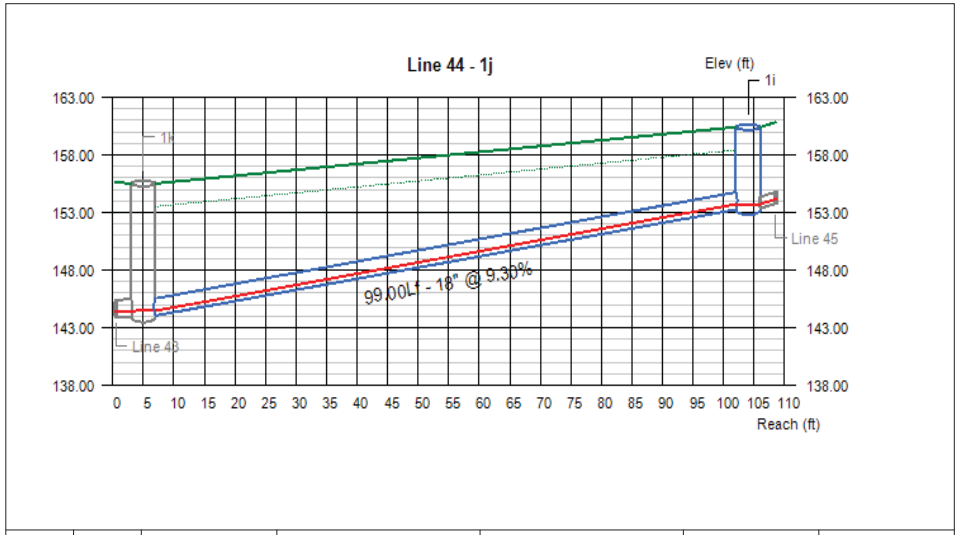


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
43	1.57	143.61	143.95	0.64	0.47	0.53	144.25	144.42	144.48	2.20	3.28	13.34	10.07

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 44) - 1j

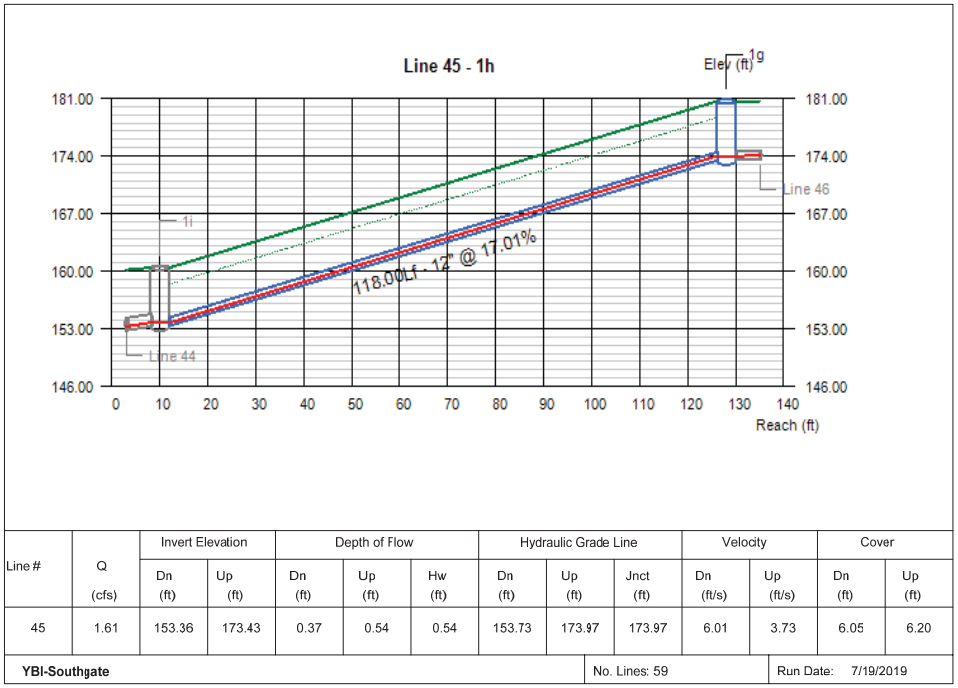


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
44	1.59	144.05	153.26	0.43	0.47	0.47	144.48	153.73	153.73	3.85	3.33	9.97	5.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 45) - 1h

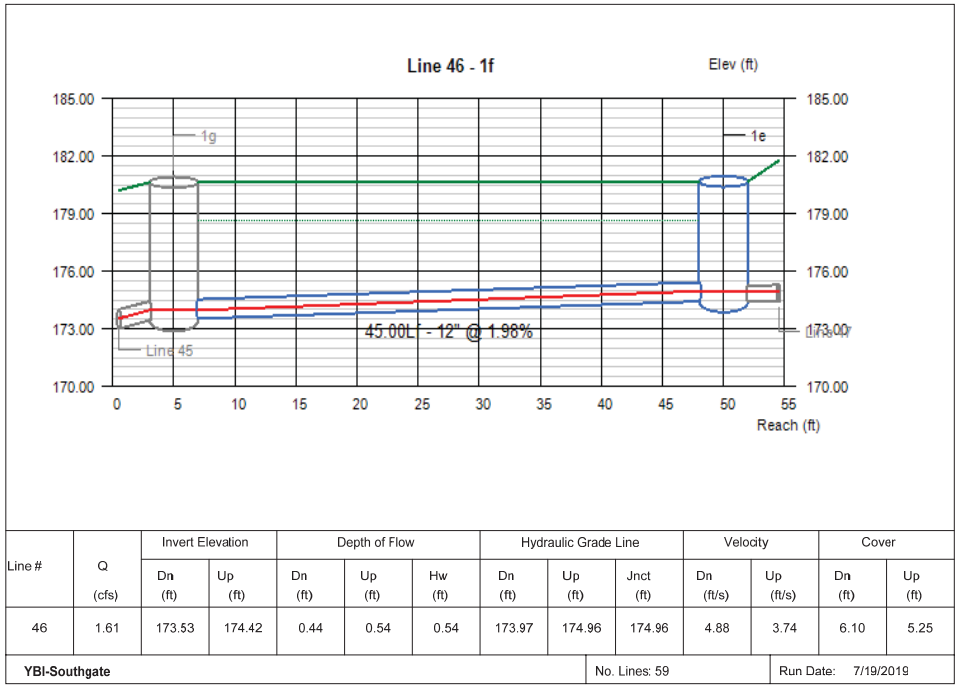


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
45	1.61	153.36	173.43	0.37	0.54	0.54	153.73	173.97	173.97	6.01	3.73	6.05	6.20

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 46) - 1f

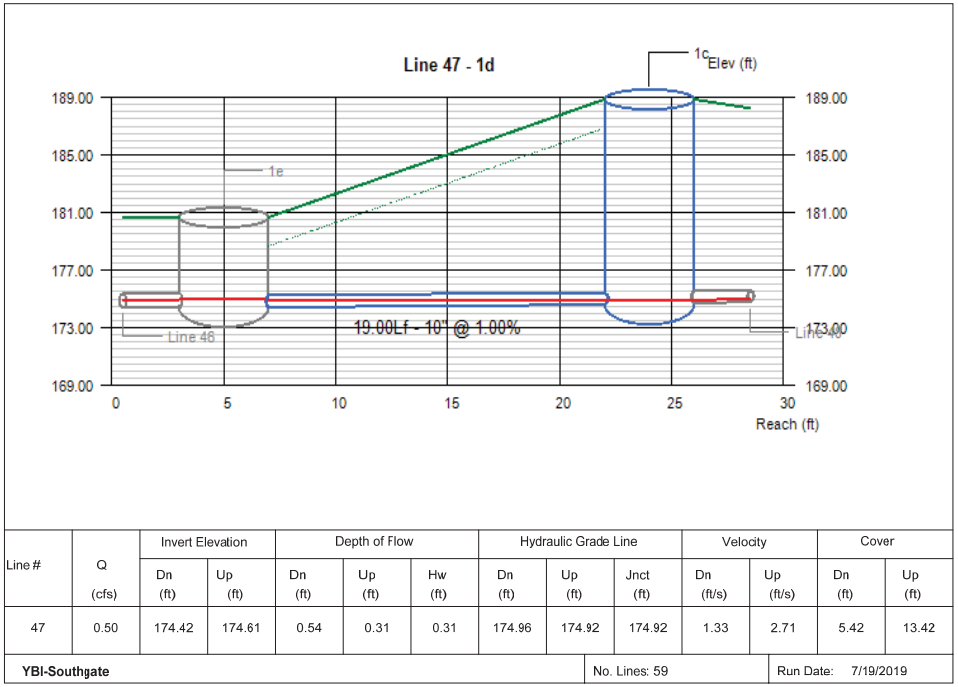


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
46	1.61	173.53	174.42	0.44	0.54	0.54	173.97	174.96	174.96	4.88	3.74	6.10	5.25

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 47) - 1d

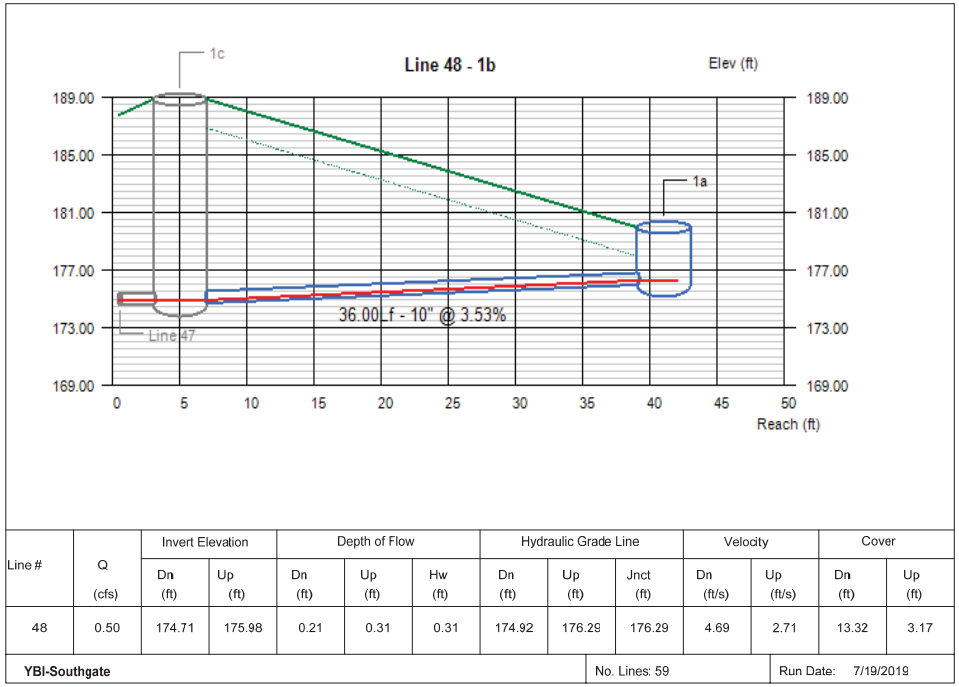


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
47	0.50	174.42	174.61	0.54	0.31	0.31	174.96	174.92	174.92	1.33	2.71	5.42	13.42

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 48) - 1b

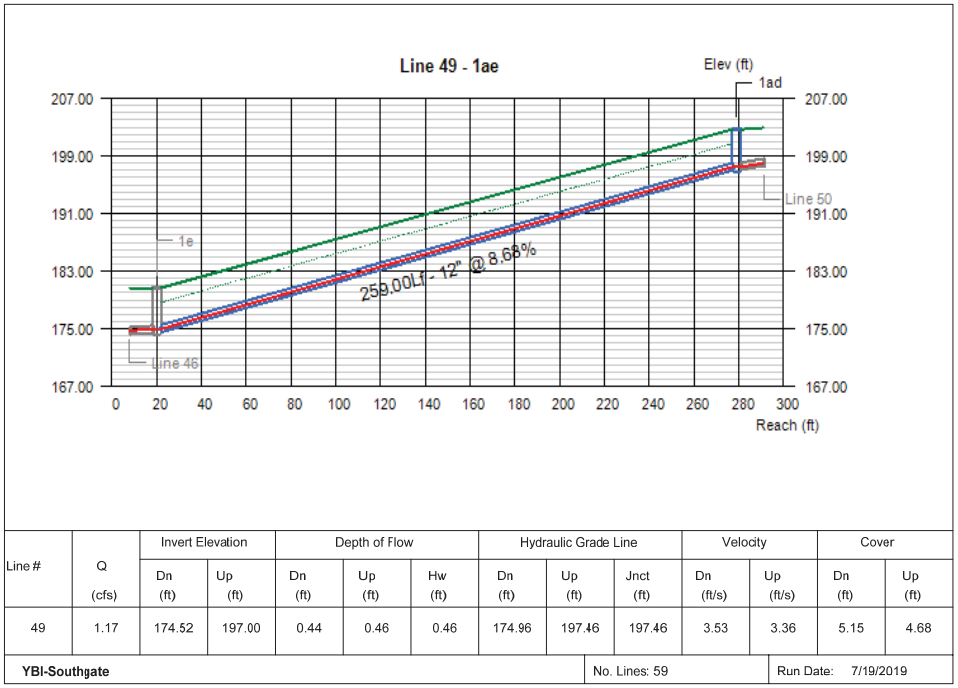


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
48	0.50	174.71	175.98	0.21	0.31	0.31	174.92	176.29	176.29	4.69	2.71	13.32	3.17

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 49) - 1ae

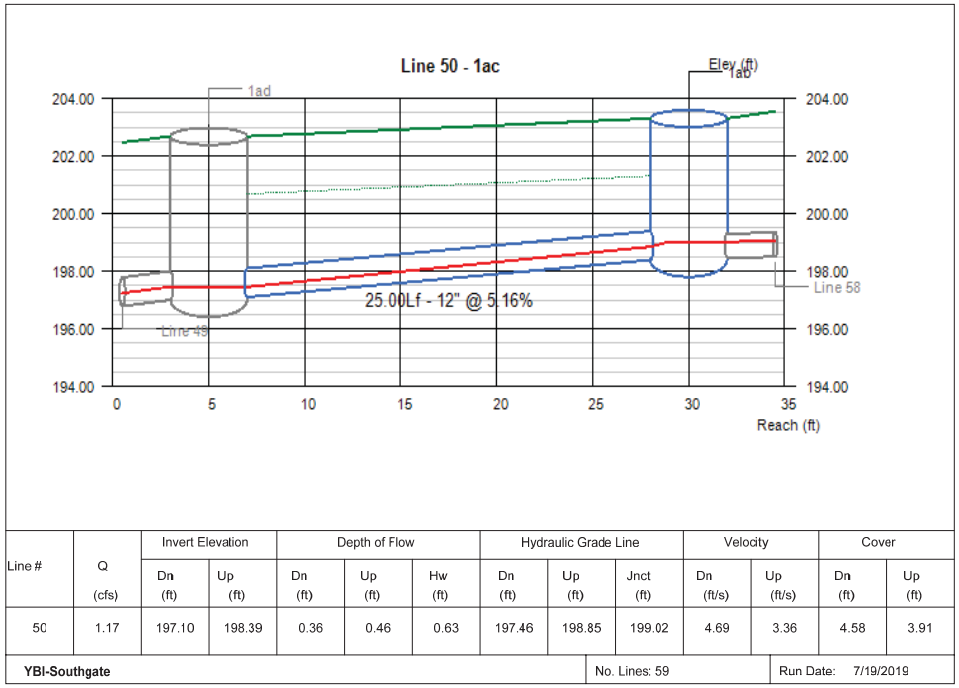


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
49	1.17	174.52	197.00	0.44	0.46	0.46	174.96	197.46	197.46	3.53	3.36	5.15	4.68

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 50) - 1ac

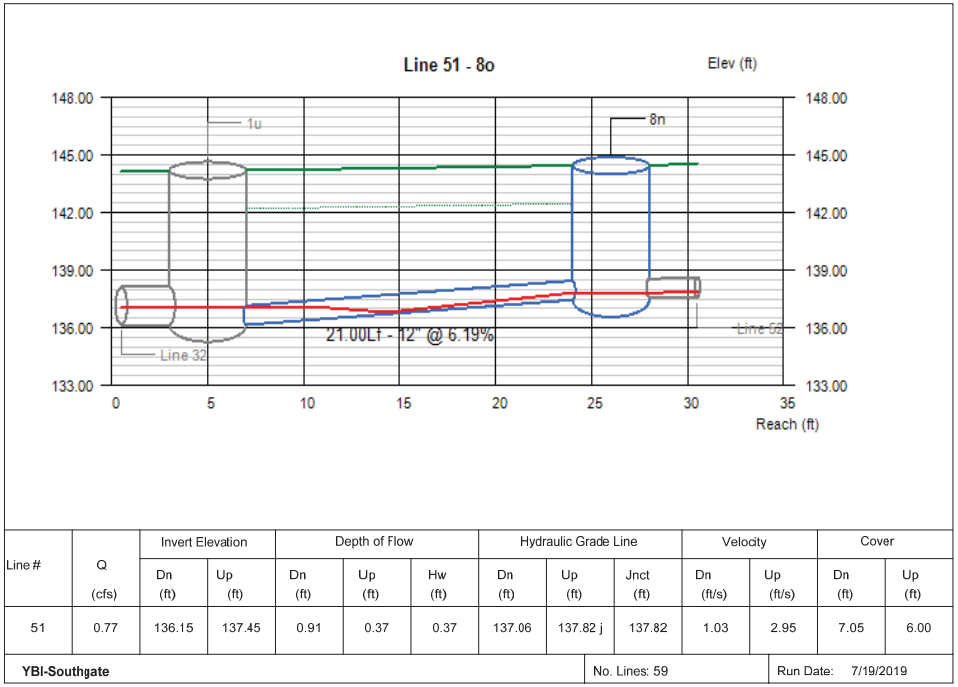


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
50	1.17	197.10	198.39	0.36	0.46	0.63	197.46	198.85	199.02	4.69	3.36	4.58	3.91

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 51) - 8o

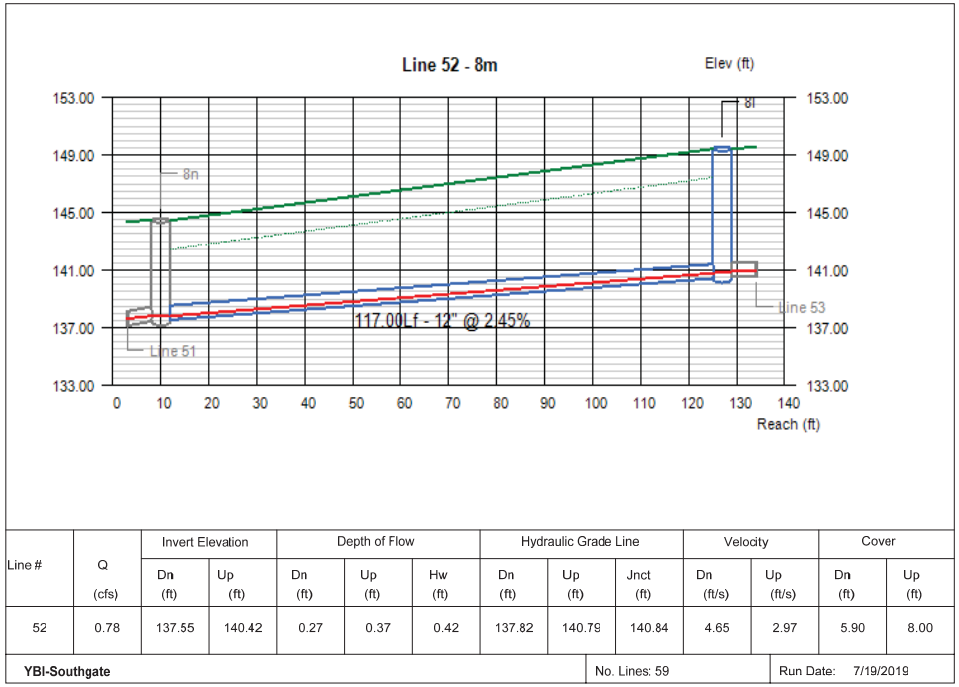


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
51	0.77	136.15	137.45	0.91	0.37	0.37	137.06	137.82 j	137.82	1.03	2.95	7.05	6.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 52) - 8m

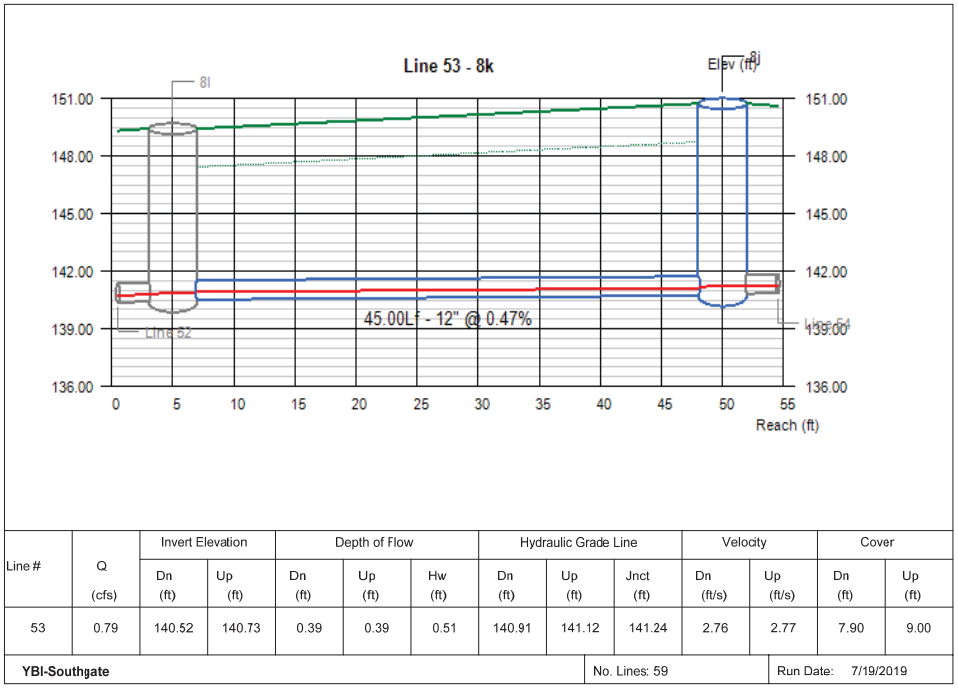


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
52	0.78	137.55	140.42	0.27	0.37	0.42	137.82	140.79	140.84	4.65	2.97	5.90	8.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 53) - 8k

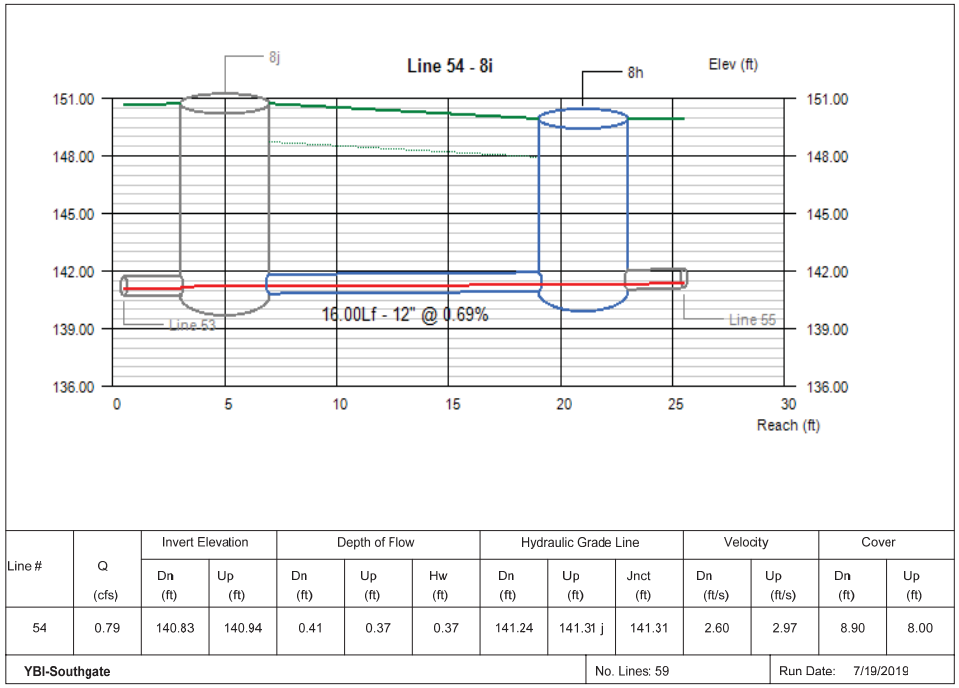


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
53	0.79	140.52	140.73	0.39	0.39	0.51	140.91	141.12	141.24	2.76	2.77	7.90	9.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 54) - 8i

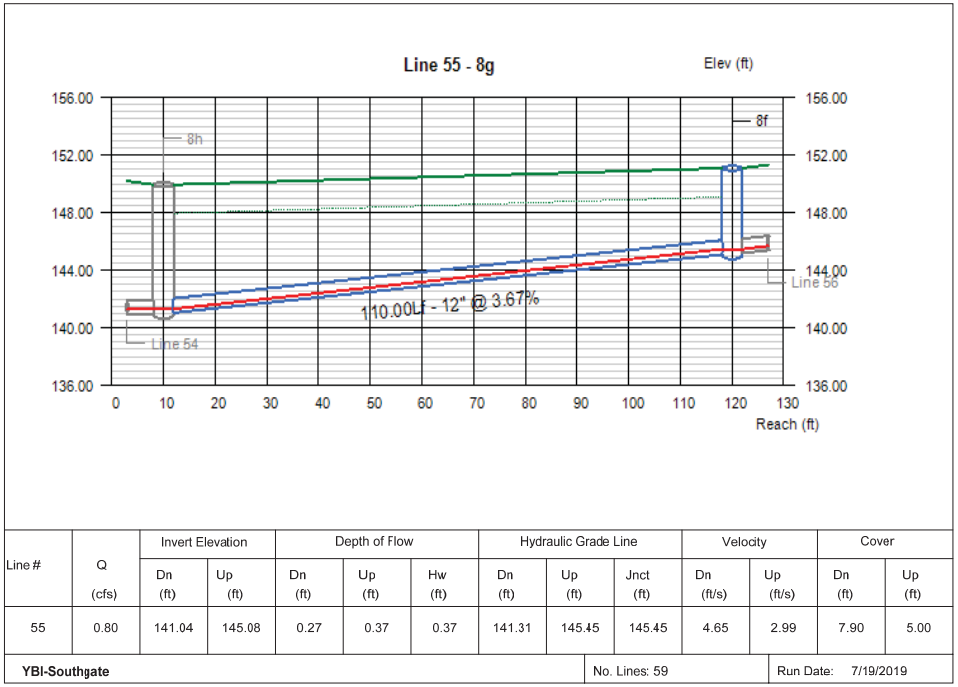


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
54	0.79	140.83	140.94	0.41	0.37	0.37	141.24	141.31 j	141.31	2.60	2.97	8.90	8.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 55) - 8g

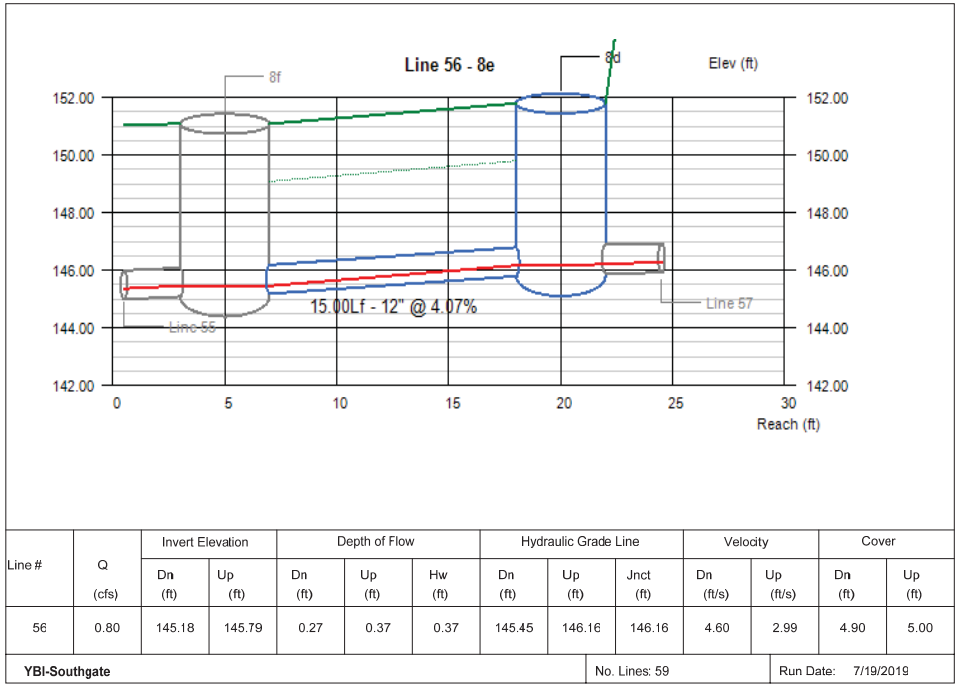


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
55	0.80	141.04	145.08	0.27	0.37	0.37	141.31	145.45	145.45	4.65	2.99	7.90	5.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 56) - 8e

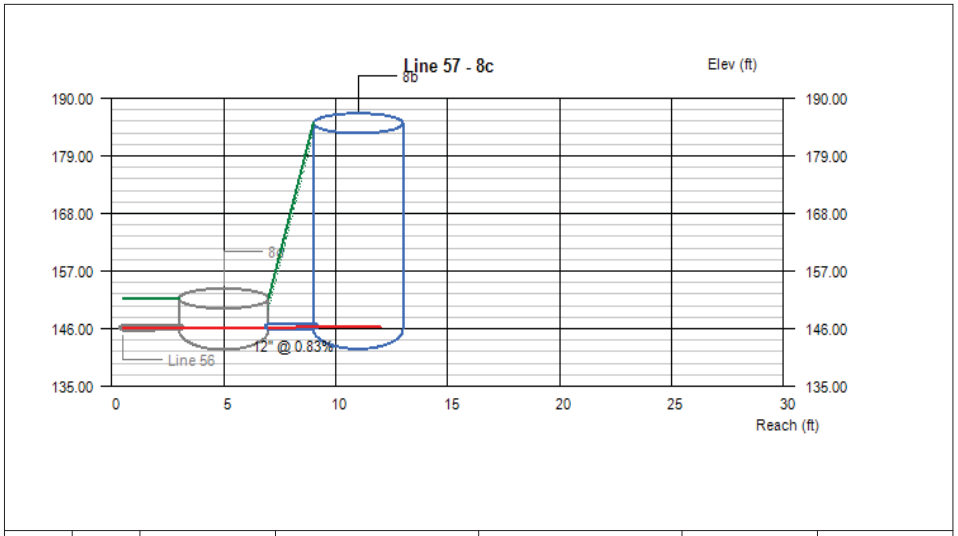


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
56	0.80	145.18	145.79	0.27	0.37	0.37	145.45	146.16	146.16	4.60	2.99	4.90	5.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 57) - 8c

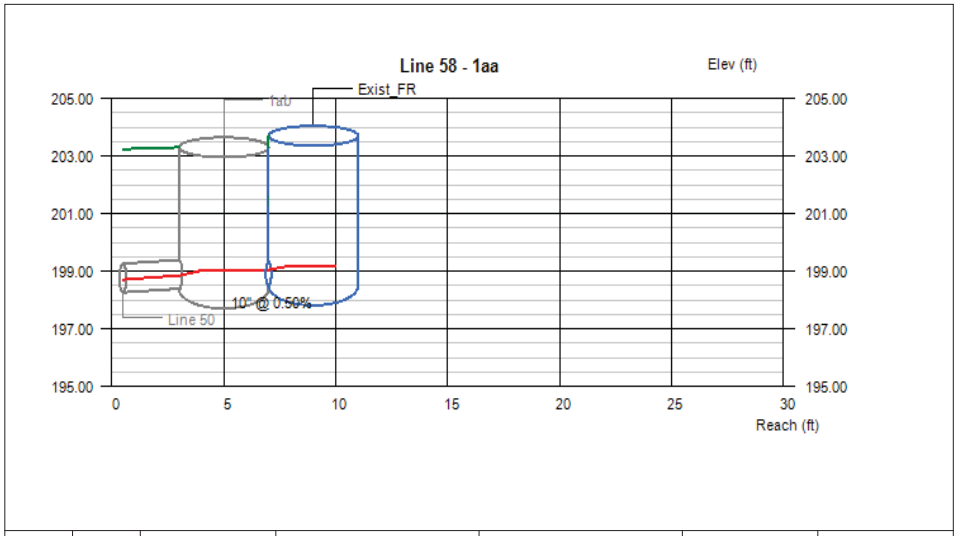


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
57	0.80	145.89	145.94	0.34	0.37	0.37	146.23	146.31	146.31	3.43	2.99	4.90	38.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 58) - 1aa

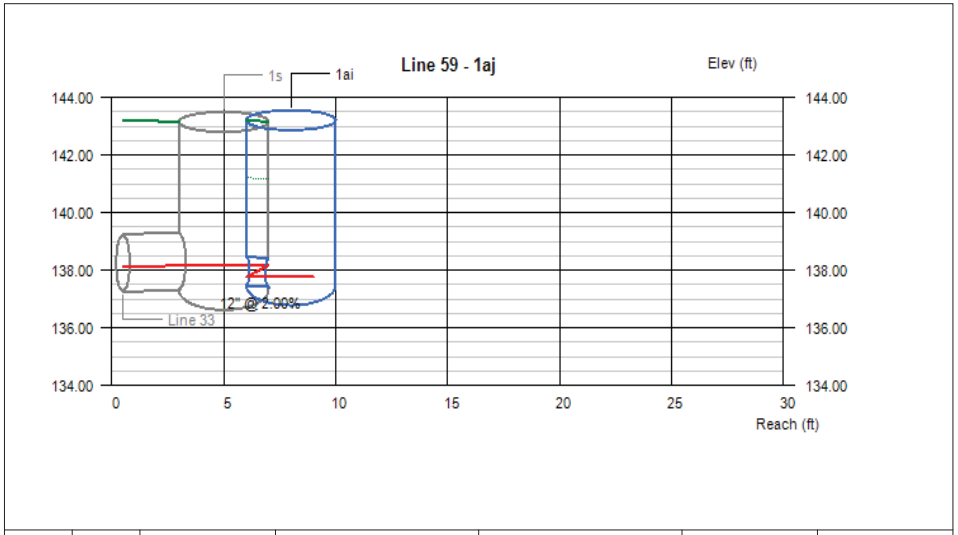


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
58	1.17	198.48	198.50	0.54	0.54	0.69	199.02	199.04	199.19	3.12	3.12	3.99	4.37

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 59) - 1aj



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
59	0.49	137.41	137.47	0.75	0.29	0.29	138.16	137.76	137.76	0.77	2.59	4.74	4.74

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	2M	8.09	18	Cir	18.00	141.77	141.86	0.500	143.69*	143.80*	0.32	144.12	End	Manhole
2	3D	1.35	10	Cir	71.00	141.86	143.21	1.901	144.12*	144.39*	0.10	144.49	1	Manhole
3	3B	1.36	10	Cir	5.00	144.59	144.69	2.000	144.98	145.21	n/a	145.21	2	Grate
4	2K	7.13	18	Cir	107.00	141.86	142.39	0.495	144.12*	144.61*	0.25	144.86	1	Manhole
5	2I	5.87	12	Cir	96.00	147.30	160.50	13.750	147.77	161.45	n/a	162.35	4	Manhole
6	2af	0.10	10	Cir	9.00	160.60	162.00	15.555	162.35	162.35	0.00	162.35	5	Grate
7	2ah	1.42	10	Cir	10.00	147.30	148.19	8.900	147.56	148.72	n/a	148.72	4	Grate
8	2G	5.87	12	Cir	83.00	160.60	171.94	13.663	161.45	172.89	0.87	172.89	5	Manhole
9	2E	5.89	12	Cir	17.00	172.04	176.22	24.588	172.89	177.17	n/a	178.08	8	Manhole
10	2C	5.54	12	Cir	142.00	176.32	190.90	10.268	177.17	191.84	n/a	192.65	9	Manhole
11	2A	4.63	12	Cir	54.00	191.00	196.50	10.185	191.84	197.39	0.61	197.39	10	Manhole
12	2ad	0.53	10	Cir	16.00	176.32	176.65	2.062	178.08*	178.09*	0.01	178.10	9	Grate
13	2ab	0.99	10	Cir	17.00	191.00	191.10	0.588	192.65*	192.69*	0.05	192.74	10	Grate
14	4J	4.23	12	Cir	35.00	141.98	142.25	0.771	143.66*	144.15*	0.45	144.60	End	Manhole
15	4ad	0.79	10	Cir	37.00	142.25	142.68	1.162	144.60*	144.65*	0.03	144.68	14	Grate
16	4H	3.51	12	Cir	31.00	142.25	142.86	1.968	144.60*	144.90*	0.30	145.20	14	Manhole
17	4F	2.79	12	Cir	62.00	142.96	144.50	2.484	145.20*	145.58*	0.18	145.76	16	Manhole
18	4D	2.79	12	Cir	5.00	144.60	144.62	0.400	145.76*	145.79*	0.22	146.01	17	Grate
19	4B	2.02	12	Cir	33.00	158.25	161.76	10.636	158.53	162.37	n/a	162.37	18	Manhole
20	4ab	0.83	10	Cir	4.00	142.96	143.10	3.500	145.20*	145.21*	0.04	145.24	16	Grate
21	YB2-ai	25.78	36	Cir	138.00	1.64	3.54	1.377	6.20	6.38	0.03	6.42	End	Manhole
22	YB2-ag	26.56	36	Cir	171.00	3.54	5.92	1.392	6.42	7.58	n/a	7.58 j	21	Manhole
23	Exist4	26.89	24	Cir	124.00	5.91	21.29	12.403	7.58	23.09	n/a	24.32	22	Manhole
24	Exist2	24.68	18	Cir	122.00	21.29	53.25	26.197	24.32	54.74	n/a	54.74 j	23	Manhole

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	YB1-l	20.13	18	Cir	52.50	53.25	65.61	23.543	54.74	67.08	n/a	67.08 j	24	Manhole
26	YB1-j	20.05	18	Cir	105.00	72.18	98.43	25.000	72.82	99.90	0.30	99.90	25	Manhole
27	YBI1-h	20.00	18	Cir	49.20	108.27	121.39	26.667	108.90	122.86	0.30	122.86	26	Manhole
28	YB1-f	19.78	18	Cir	15.40	131.23	134.51	21.299	131.90	135.98	n/a	137.65	27	Manhole
29	1bb	19.78	24	Cir	73.00	134.51	134.97	0.630	137.65*	138.21*	0.35	138.56	28	Manhole
30	1z	19.95	24	Cir	51.00	134.97	135.22	0.490	138.56*	138.95*	0.63	139.58	29	Manhole
31	1x	18.82	24	Cir	23.00	135.22	135.33	0.478	139.58*	139.74*	0.56	140.30	30	Manhole
32	1v	18.07	24	Cir	125.00	135.33	136.15	0.656	140.30*	141.10*	0.51	141.61	31	Manhole
33	1t	14.89	24	Cir	45.00	136.15	137.31	2.578	141.61*	141.80*	0.52	142.33	32	Grate
34	1al	1.46	18	Cir	31.00	135.33	135.58	0.806	140.30*	140.30*	0.01	140.31	31	Grate
35	6F	1.31	18	Cir	30.00	135.22	135.27	0.167	139.58*	139.58*	0.01	139.59	30	Manhole
36	6ad	0.64	18	Cir	33.00	135.37	135.71	1.030	139.59*	139.59*	0.00	139.59	35	Grate
37	6ab	0.30	18	Cir	3.00	135.81	135.84	1.000	139.59*	139.60*	0.00	139.60	36	Grate
38	6D	0.85	10	Cir	61.00	135.37	138.90	5.787	139.59	139.68	0.06	139.74	35	Grate
39	6B	0.86	10	Cir	23.00	139.00	139.45	1.957	139.74	139.86	n/a	139.86 j	38	Grate
40	1r	4.96	18	Cir	46.00	137.41	143.03	12.217	142.33	143.89	n/a	143.89 j	33	Manhole
41	1p	5.00	18	Cir	38.00	143.13	143.42	0.763	143.92	144.28	0.35	144.63	40	Manhole
42	1n	5.03	18	Cir	16.00	143.52	143.61	0.562	144.63	144.65	0.23	144.88	41	Manhole
43	1l	5.15	18	Cir	69.00	143.61	143.95	0.493	144.88	145.01	0.07	145.08	42	Manhole
44	1j	5.29	18	Cir	99.00	144.05	153.26	9.303	145.08	154.15	n/a	154.15 j	43	Manhole
45	1h	5.40	12	Cir	118.00	153.36	173.43	17.008	154.15	174.37	0.75	175.12	44	Manhole
46	1f	5.45	12	Cir	45.00	173.53	174.42	1.978	175.12*	176.18*	0.75	176.92	45	Manhole
47	1d	2.23	10	Cir	19.00	174.42	174.61	1.000	176.92*	177.12*	0.26	177.38	46	Manhole
48	1b	2.26	10	Cir	36.00	174.71	175.98	3.528	177.38*	177.76*	0.27	178.03	47	Grate

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	1ae	3.65	12	Cir	259.00	174.52	197.00	8.680	176.92	197.81	n/a	197.81 j	46	Manhole
50	1ac	3.67	12	Cir	25.00	197.10	198.39	5.160	197.81	199.21	n/a	199.65	49	Manhole
51	8o	3.73	12	Cir	21.00	136.15	137.45	6.190	141.61*	141.84*	0.35	142.19	32	Manhole
52	8m	3.86	12	Cir	117.00	137.55	140.42	2.453	142.19*	143.56*	0.15	143.71	51	Manhole
53	8k	3.91	12	Cir	45.00	140.52	140.73	0.467	143.71*	144.25*	0.38	144.64	52	Manhole
54	8i	3.93	12	Cir	16.00	140.83	140.94	0.688	144.64*	144.83*	0.33	145.16	53	Manhole
55	8g	4.06	12	Cir	110.00	141.04	145.08	3.673	145.16*	146.59*	0.31	146.90	54	Manhole
56	8e	4.08	12	Cir	15.00	145.18	145.79	4.067	146.90*	147.10*	0.06	147.16	55	Manhole
57	8c	4.09	12	Cir	6.00	145.89	145.94	0.833	147.16*	147.24*	0.42	147.66	56	Grate
58	1aa	3.68	10	Cir	4.00	198.48	198.50	0.500	199.65*	199.76*	0.71	200.47	50	Grate
59	1aj	1.36	12	Cir	3.00	137.41	137.47	2.000	142.33*	142.33*	0.05	142.38	33	Grate

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	18.00	0.00	2.73	0.00	0.00	2.73	0.0	6.3	3.0	8.09	7.43	4.58	18	0.50	141.77	141.86	143.69	143.80	143.27	147.86	2M
2	1	71.00	0.00	0.41	0.00	0.00	0.41	0.0	5.0	3.3	1.35	3.02	2.48	10	1.90	141.86	143.21	144.12	144.39	147.86	150.44	3D
3	2	5.00	0.41	0.41	1.00	0.41	0.41	5.0	5.0	3.3	1.36	3.10	4.64	10	2.00	144.59	144.69	144.98	145.21	150.44	150.31	3B
4	1	107.00	0.00	2.32	0.00	0.00	2.32	0.0	5.8	3.1	7.13	7.39	4.03	18	0.50	141.86	142.39	144.12	144.61	147.86	154.54	2K
5	4	96.00	0.00	1.89	0.00	0.00	1.89	0.0	5.7	3.1	5.87	13.21	11.96	12	13.75	147.30	160.50	147.77	161.45	154.54	165.61	2I
6	5	9.00	0.03	0.03	1.00	0.03	0.03	5.0	5.0	3.3	0.10	8.64	0.32	10	15.56	160.60	162.00	162.35	162.35	165.61	163.61	2af
7	4	10.00	0.43	0.43	1.00	0.43	0.43	5.0	5.0	3.3	1.42	6.53	6.71	10	8.90	147.30	148.19	147.56	148.72	154.54	154.29	2ah
8	5	83.00	0.00	1.86	0.00	0.00	1.86	0.0	5.5	3.2	5.87	13.16	7.92	12	13.66	160.60	171.94	161.45	172.89	165.61	181.34	2G
9	8	17.00	0.00	1.86	0.00	0.00	1.86	0.0	5.5	3.2	5.89	17.66	7.95	12	24.59	172.04	176.22	172.89	177.17	181.34	182.17	2E
10	9	142.00	0.00	1.70	0.00	0.00	1.70	0.0	5.2	3.3	5.54	11.41	7.50	12	10.27	176.32	190.90	177.17	191.84	182.17	195.72	2C
11	10	54.00	1.40	1.40	1.00	1.40	1.40	5.0	5.0	3.3	4.63	11.37	6.41	12	10.19	191.00	196.50	191.84	197.39	195.72	199.80	2A
12	9	16.00	0.16	0.16	1.00	0.16	0.16	5.0	5.0	3.3	0.53	3.14	0.97	10	2.06	176.32	176.65	178.08	178.09	182.17	180.65	2ad
13	10	17.00	0.30	0.30	1.00	0.30	0.30	5.0	5.0	3.3	0.99	1.68	1.82	10	0.59	191.00	191.10	192.65	192.69	195.72	195.44	2ab
14	End	35.00	0.00	1.34	0.00	0.00	1.34	0.0	5.5	3.2	4.23	3.13	5.38	12	0.77	141.98	142.25	143.66	144.15	145.00	148.29	4J
15	14	37.00	0.24	0.24	1.00	0.24	0.24	5.0	5.0	3.3	0.79	2.36	1.46	10	1.16	142.25	142.68	144.60	144.65	148.29	146.38	4ad
16	14	31.00	0.00	1.10	0.00	0.00	1.10	0.0	5.4	3.2	3.51	5.00	4.47	12	1.97	142.25	142.86	144.60	144.90	148.29	148.92	4H
17	16	62.00	0.00	0.85	0.00	0.00	0.85	0.0	5.1	3.3	2.79	5.61	3.55	12	2.48	142.96	144.50	145.20	145.58	148.92	151.30	4F
18	17	5.00	0.24	0.85	1.00	0.24	0.85	5.0	5.1	3.3	2.79	2.25	3.56	12	0.40	144.60	144.62	145.76	145.79	151.30	161.25	4D
19	18	33.00	0.61	0.61	1.00	0.61	0.61	5.0	5.0	3.3	2.02	11.61	7.57	12	10.64	158.25	161.76	158.53	162.37	161.25	167.88	4B
20	16	4.00	0.25	0.25	1.00	0.25	0.25	5.0	5.0	3.3	0.83	4.10	1.52	10	3.50	142.96	143.10	145.20	145.21	148.92	148.92	4ab
21	End	138.00	0.00	13.72	0.00	0.00	10.68	0.0	9.5	2.4	25.78	78.26	3.68	36	1.38	1.64	3.54	6.20	6.38	5.00	9.84	YB2-ai
22	21	171.00	0.00	13.72	0.00	0.00	10.68	0.0	8.9	2.5	26.56	78.68	5.21	36	1.39	3.54	5.92	6.42	7.58	9.84	15.10	YB2-ag

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 7.48 / (Inlet time + 0.10) ^ 0.50; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	22	124.00	0.96	13.72	1.00	0.96	10.68	5.0	8.7	2.5	26.89	79.66	9.30	24	12.40	5.91	21.29	7.58	23.09	15.10	27.90	Exist4
24	23	122.00	1.83	12.76	1.00	1.83	9.72	5.0	8.5	2.5	24.68	53.75	13.98	18	26.20	21.29	53.25	24.32	54.74	27.90	58.10	Exist2
25	24	52.50	0.07	10.93	1.00	0.07	7.89	5.0	8.5	2.6	20.13	50.95	11.43	18	23.54	53.25	65.61	54.74	67.08	58.10	78.70	YB1-l
26	25	105.00	0.04	10.86	1.00	0.04	7.82	5.0	8.4	2.6	20.05	52.51	19.55	18	25.00	72.18	98.43	72.82	99.90	78.70	113.20	YB1-j
27	26	49.20	0.09	10.82	1.00	0.09	7.78	5.0	8.3	2.6	20.00	54.23	19.87	18	26.67	108.27	121.39	108.90	122.86	113.20	134.50	YBI1-h
28	27	15.40	0.09	10.73	1.00	0.09	7.69	5.0	8.3	2.6	19.78	48.46	18.65	18	21.30	131.23	134.51	131.90	135.98	134.50	145.30	YB1-f
29	28	73.00	0.00	10.64	0.00	0.00	7.60	0.0	8.1	2.6	19.78	17.95	6.30	24	0.63	134.51	134.97	137.65	138.21	145.30	144.10	1bb
30	29	51.00	0.00	10.64	0.00	0.00	7.60	0.0	8.0	2.6	19.95	15.84	6.35	24	0.49	134.97	135.22	138.56	138.95	144.10	141.26	1z
31	30	23.00	0.00	10.18	0.00	0.00	7.14	0.0	7.9	2.6	18.82	15.64	5.99	24	0.48	135.22	135.33	139.58	139.74	141.26	140.63	1x
32	31	125.00	0.00	9.74	0.00	0.00	6.70	0.0	7.6	2.7	18.07	18.32	5.75	24	0.66	135.33	136.15	140.30	141.10	140.63	144.20	1v
33	32	45.00	4.07	7.81	0.80	3.26	5.46	5.0	7.4	2.7	14.89	36.31	4.74	24	2.58	136.15	137.31	141.61	141.80	144.20	143.15	1t
34	31	31.00	0.44	0.44	1.00	0.44	0.44	5.0	5.0	3.3	1.46	9.43	0.82	18	0.81	135.33	135.58	140.30	140.30	140.63	142.88	1al
35	30	30.00	0.00	0.46	0.00	0.00	0.46	0.0	6.8	2.8	1.31	4.29	0.74	18	0.17	135.22	135.27	139.58	139.58	141.26	141.26	6F
36	35	33.00	0.11	0.20	1.00	0.11	0.20	5.0	5.3	3.2	0.64	10.66	0.36	18	1.03	135.37	135.71	139.59	139.59	141.26	140.12	6ad
37	36	3.00	0.09	0.09	1.00	0.09	0.09	5.0	5.0	3.3	0.30	10.50	0.17	18	1.00	135.81	135.84	139.59	139.60	140.12	140.12	6ab
38	35	61.00	0.00	0.26	0.00	0.00	0.26	0.0	5.2	3.3	0.85	5.27	1.58	10	5.79	135.37	138.90	139.59	139.68	141.26	147.52	6D
39	38	23.00	0.26	0.26	1.00	0.26	0.26	5.0	5.0	3.3	0.86	3.06	2.45	10	1.96	139.00	139.45	139.74	139.86	147.52	145.45	6B
40	33	46.00	0.00	3.22	0.00	0.00	1.80	0.0	7.2	2.8	4.96	36.71	3.78	18	12.22	137.41	143.03	142.33	143.89	143.15	159.97	1r
41	40	38.00	0.00	3.22	0.00	0.00	1.80	0.0	7.1	2.8	5.00	9.17	5.04	18	0.76	143.13	143.42	143.92	144.28	159.97	158.57	1p
42	41	16.00	0.00	3.22	0.00	0.00	1.80	0.0	7.0	2.8	5.03	7.88	3.71	18	0.56	143.52	143.61	144.63	144.65	158.57	158.45	1n
43	42	69.00	0.00	3.22	0.00	0.00	1.80	0.0	6.7	2.9	5.15	7.37	3.55	18	0.49	143.61	143.95	144.88	145.01	158.45	155.52	1l
44	43	99.00	0.00	3.22	0.00	0.00	1.80	0.0	6.3	2.9	5.29	32.03	4.49	18	9.30	144.05	153.26	145.08	154.15	155.52	160.41	1j

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 7.48 / (Inlet time + 0.10) ^ 0.50; Return period =Yrs. 25 ; c = cir e = ellip b = box

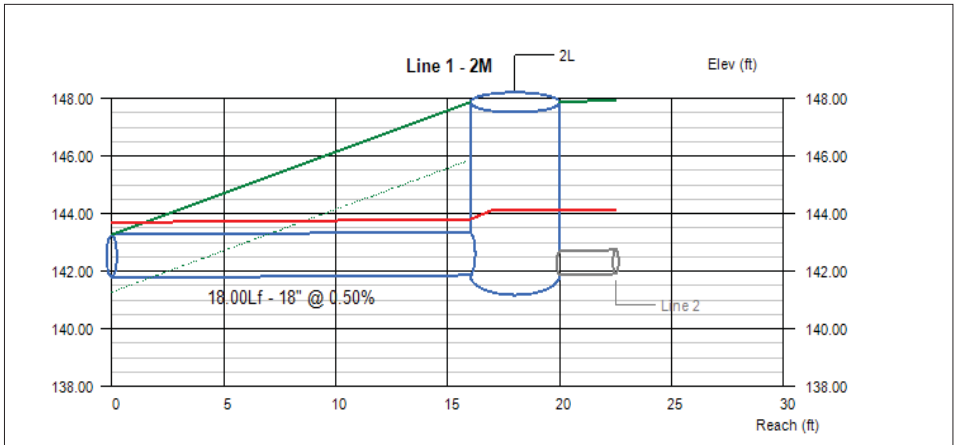
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
45	44	118.00	0.00	3.22	0.00	0.00	1.80	0.0	6.1	3.0	5.40	14.69	7.62	12	17.01	153.36	173.43	154.15	174.37	160.41	180.63	1h
46	45	45.00	0.00	3.22	0.00	0.00	1.80	0.0	5.9	3.0	5.45	5.01	6.94	12	1.98	173.53	174.42	175.12	176.18	180.63	180.67	1f
47	46	19.00	0.00	1.20	0.00	0.00	0.68	0.0	5.1	3.3	2.23	2.19	4.09	10	1.00	174.42	174.61	176.92	177.12	180.67	188.86	1d
48	47	36.00	1.20	1.20	0.57	0.68	0.68	5.0	5.0	3.3	2.26	4.11	4.15	10	3.53	174.71	175.98	177.38	177.76	188.86	179.98	1b
49	46	259.00	0.00	2.02	0.00	0.00	1.11	0.0	5.1	3.3	3.65	10.49	4.99	12	8.68	174.52	197.00	176.92	197.81	180.67	202.68	1ae
50	49	25.00	0.00	2.02	0.00	0.00	1.11	0.0	5.0	3.3	3.67	8.09	5.74	12	5.16	197.10	198.39	197.81	199.21	202.68	203.30	1ac
51	32	21.00	0.00	1.93	0.00	0.00	1.24	0.0	6.0	3.0	3.73	8.86	4.75	12	6.19	136.15	137.45	141.61	141.84	144.20	144.45	8o
52	51	117.00	0.00	1.93	0.00	0.00	1.24	0.0	5.6	3.1	3.86	5.58	4.91	12	2.45	137.55	140.42	142.19	143.56	144.45	149.42	8m
53	52	45.00	0.00	1.93	0.00	0.00	1.24	0.0	5.5	3.2	3.91	2.43	4.98	12	0.47	140.52	140.73	143.71	144.25	149.42	150.73	8k
54	53	16.00	0.00	1.93	0.00	0.00	1.24	0.0	5.4	3.2	3.93	2.95	5.00	12	0.69	140.83	140.94	144.64	144.83	150.73	149.94	8i
55	54	110.00	0.00	1.93	0.00	0.00	1.24	0.0	5.1	3.3	4.06	6.82	5.17	12	3.67	141.04	145.08	145.16	146.59	149.94	151.08	8g
56	55	15.00	0.00	1.93	0.00	0.00	1.24	0.0	5.0	3.3	4.08	7.18	5.19	12	4.07	145.18	145.79	146.90	147.10	151.08	151.79	8e
57	56	6.00	1.93	1.93	0.64	1.24	1.24	5.0	5.0	3.3	4.09	3.25	5.20	12	0.83	145.89	145.94	147.16	147.24	151.79	185.24	8c
58	50	4.00	2.02	2.02	0.55	1.11	1.11	5.0	5.0	3.3	3.68	1.55	6.74	10	0.50	198.48	198.50	199.65	199.76	203.30	203.70	1aa
59	33	3.00	0.52	0.52	0.79	0.41	0.41	5.0	5.0	3.3	1.36	5.04	1.73	12	2.00	137.41	137.47	142.33	142.33	143.15	143.21	1aj

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 7.48 / (Inlet time + 0.10) ^ 0.50; Return period =Yrs. 25 ; c = cir e = ellip b = box

Line Profile (Line 1) - 2M



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	8.09	141.77	141.86	1.50	1.50	2.26	143.69	143.80	144.12	4.58	4.58	0.00	4.50

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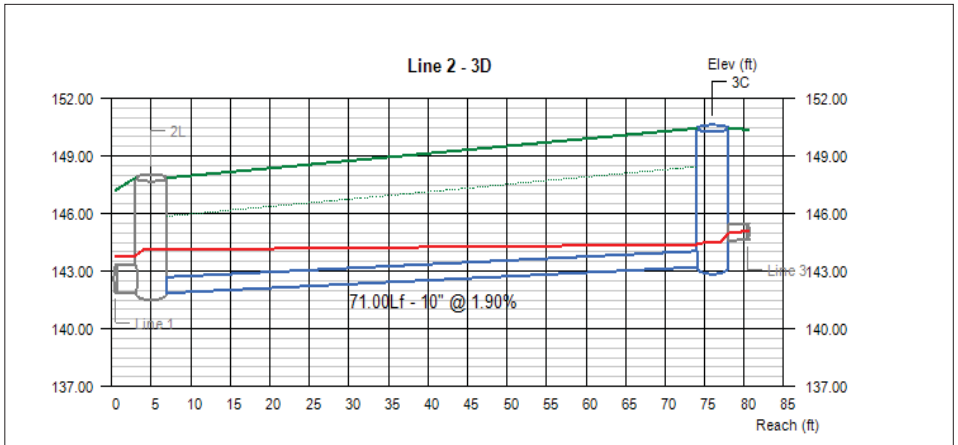
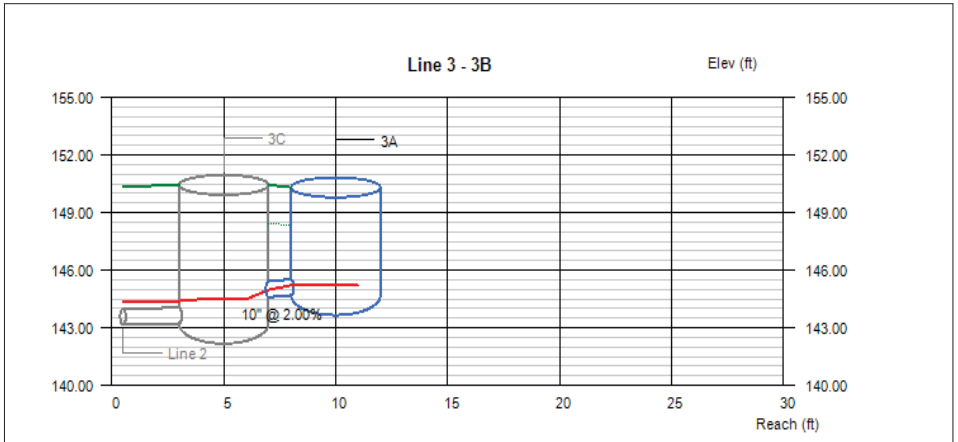
Line Profile (Line 2) - 3D



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	1.35	141.86	143.21	0.83	0.83	1.28	144.12	144.39	144.49	2.48	2.48	5.17	6.40

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

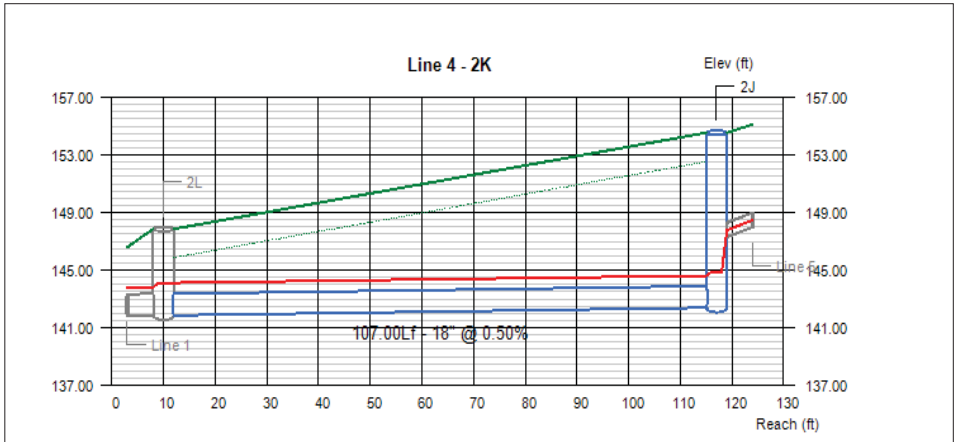
Line Profile (Line 3) - 3B



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	1.36	144.59	144.69	0.39	0.52	0.52	144.98	145.21	145.21	5.49	3.79	5.02	4.79

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Line Profile (Line 4) - 2K



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	7.13	141.86	142.39	1.50	1.50	2.47	144.12	144.61	144.86	4.03	4.03	4.50	10.65

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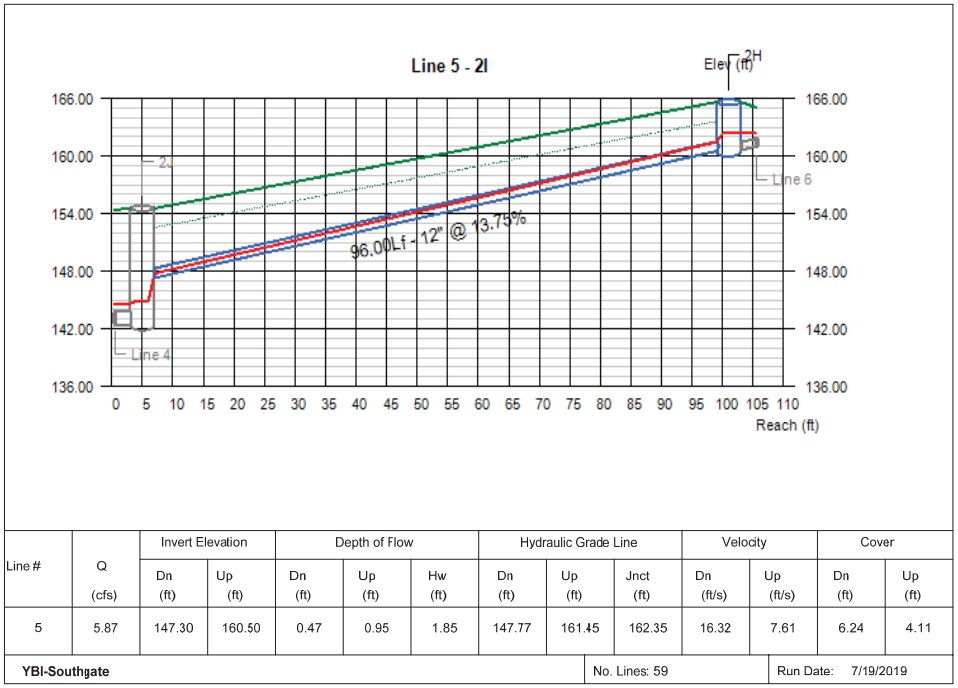
Line Profile (Line 5) - 2I



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
5	5.87	147.30	160.50	0.47	0.95	1.85	147.77	161.45	162.35	16.32	7.61	6.24	4.11

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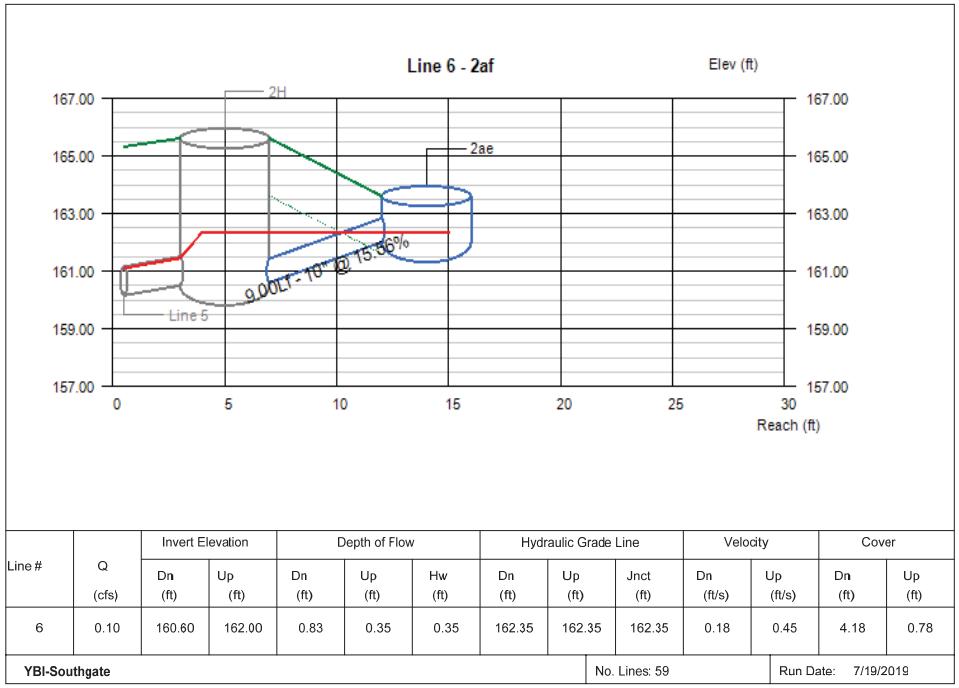
Storm Sewers

Line Profile (Line 6) - 2af



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
6	0.10	160.60	162.00	0.83	0.35	0.35	162.35	162.35	162.35	0.18	0.45	4.18	0.78

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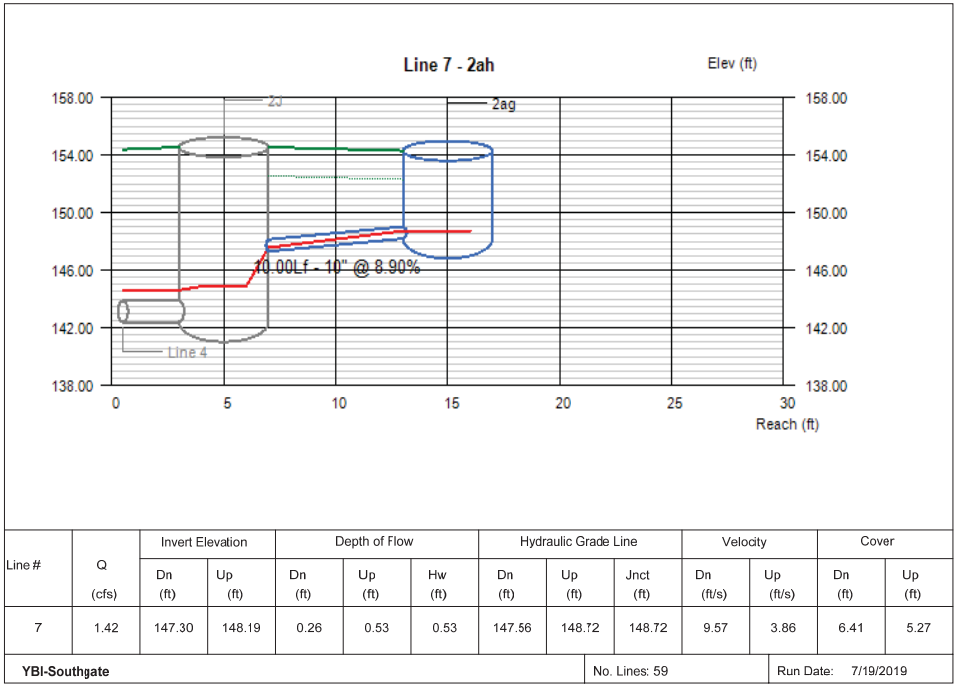
Storm Sewers

Line Profile (Line 7) - 2ah



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
7	1.42	147.30	148.19	0.26	0.53	0.53	147.56	148.72	148.72	9.57	3.86	6.41	5.27

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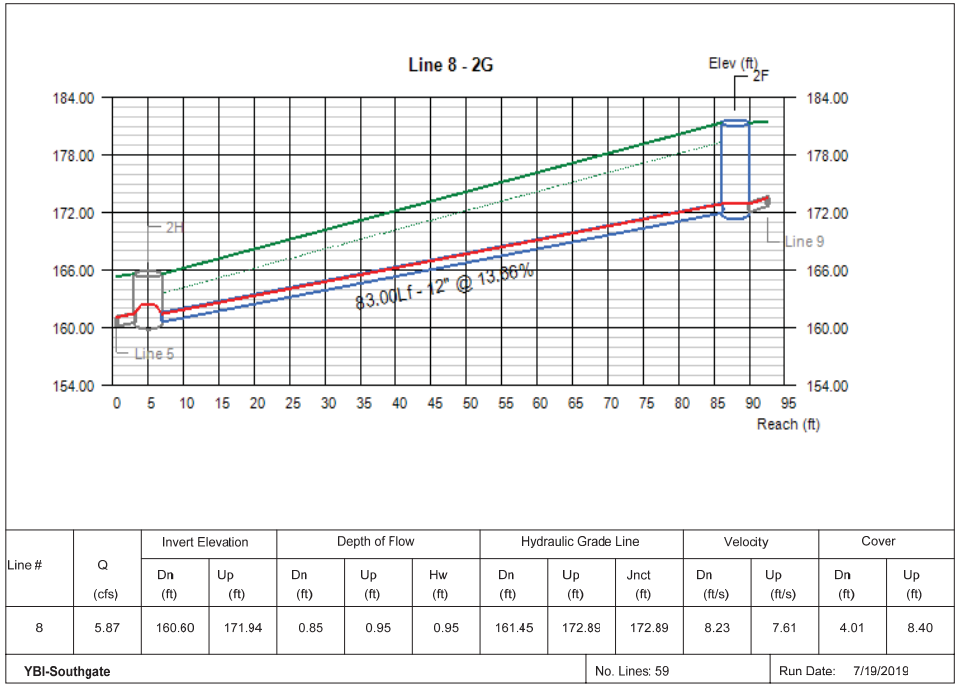
Storm Sewers

Line Profile (Line 8) - 2G



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn	Up	Dn	Up	Hw	Dn	Up	Jnct	Dn	Up	Dn	Up
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft/s)	(ft)	(ft)
8	5.87	160.60	171.94	0.85	0.95	0.95	161.45	172.89	172.89	8.23	7.61	4.01	8.40

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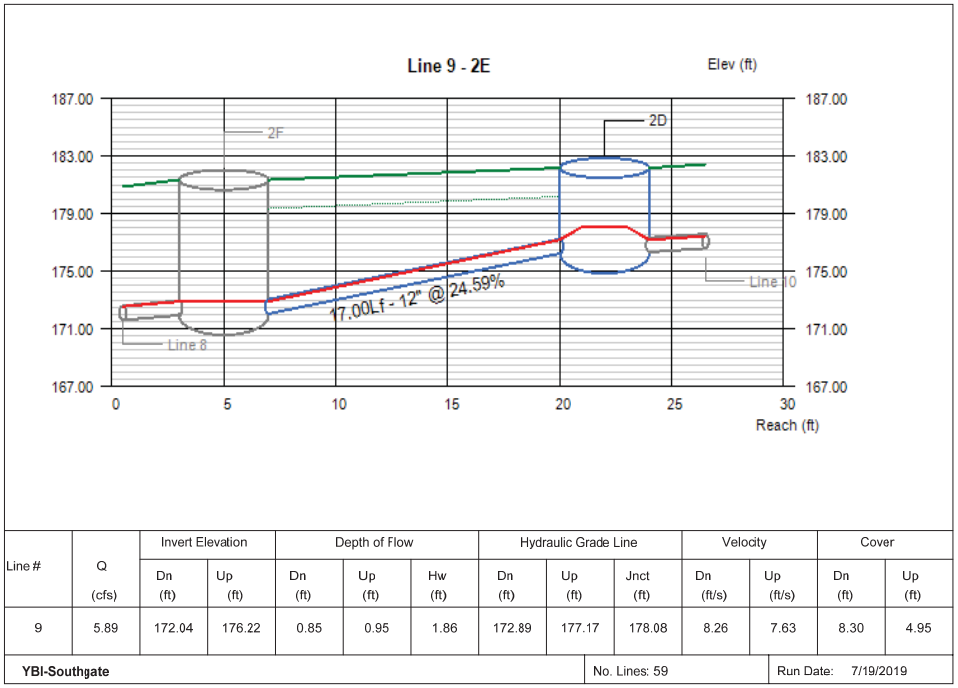
Storm Sewers

Line Profile (Line 9) - 2E



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
9	5.89	172.04	176.22	0.85	0.95	1.86	172.89	177.17	178.08	8.26	7.63	8.30	4.95

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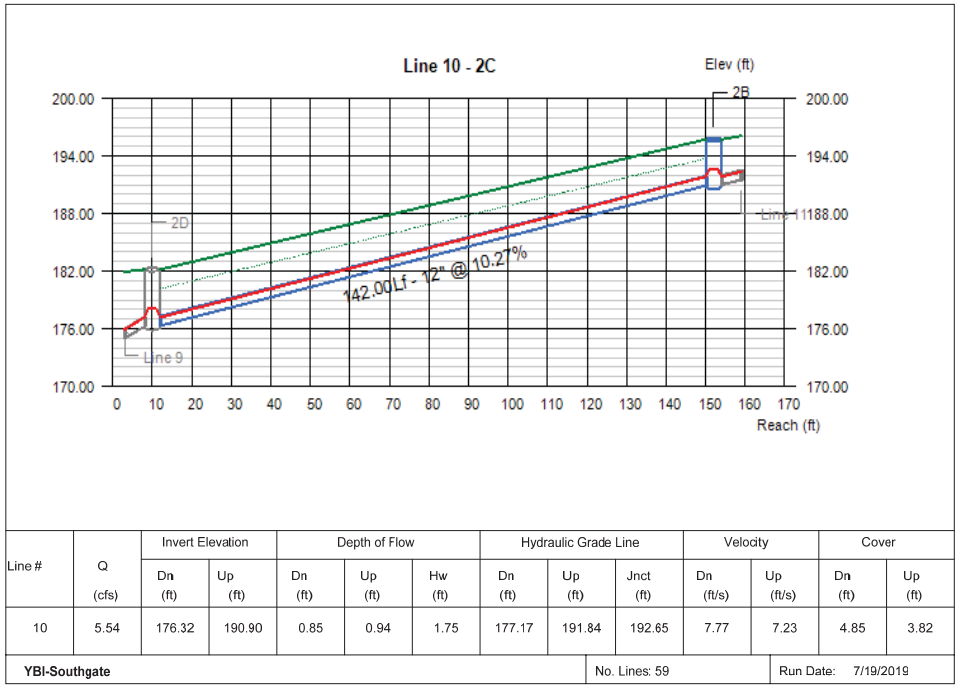
Line Profile (Line 10) - 2C



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
10	5.54	176.32	190.90	0.85	0.94	1.75	177.17	191.84	192.65	7.77	7.23	4.85	3.82

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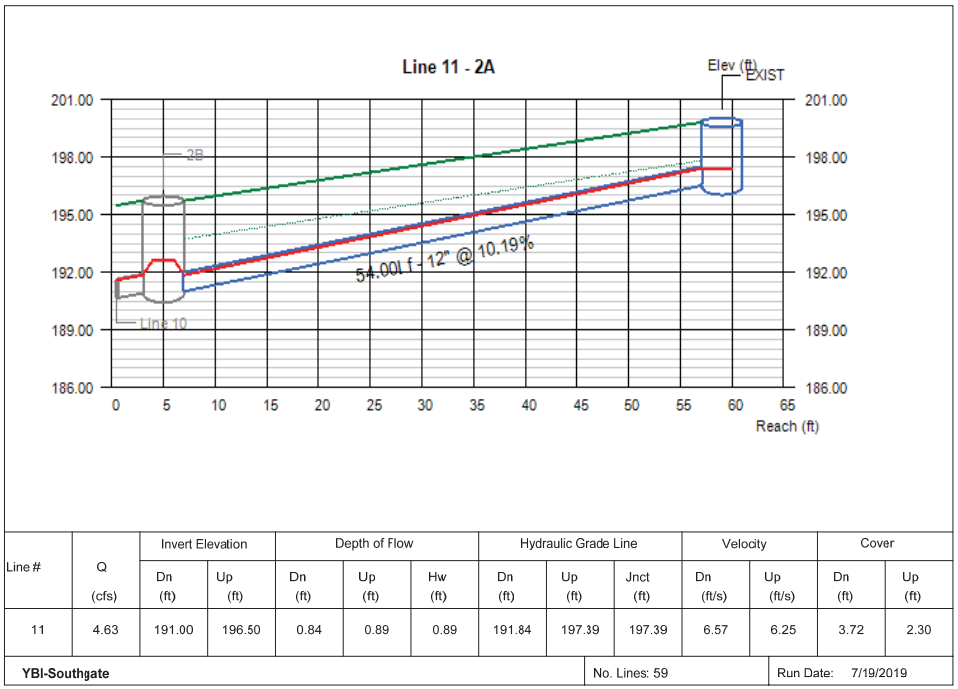
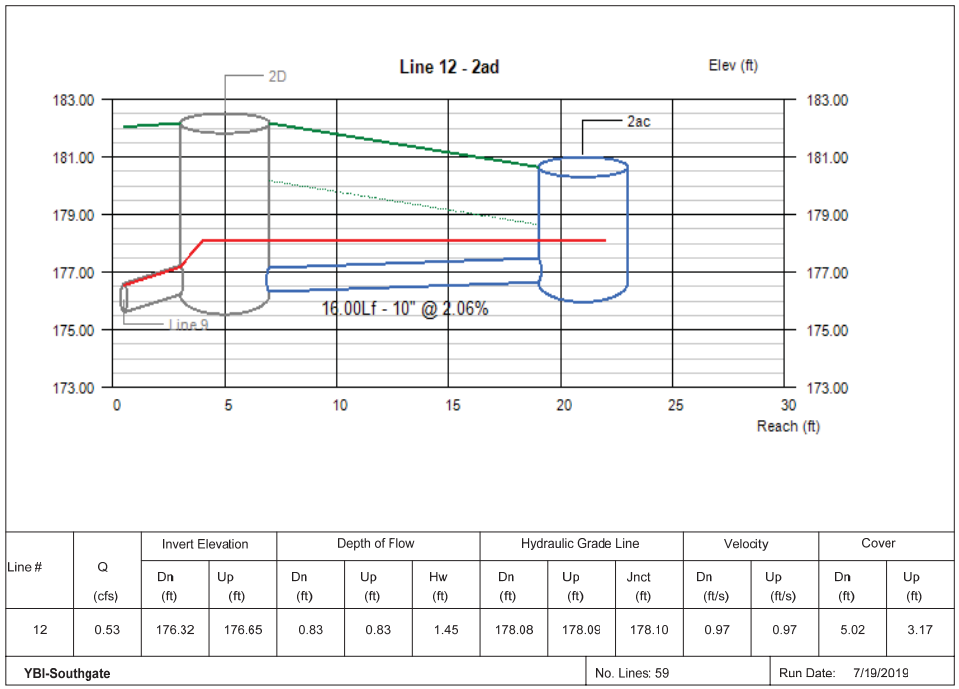
Line Profile (Line 11) - 2A



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
11	4.63	191.00	196.50	0.84	0.89	0.89	191.84	197.39	197.39	6.57	6.25	3.72	2.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Line Profile (Line 12) - 2ad



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
12	0.53	176.32	176.65	0.83	0.83	1.45	178.08	178.09	178.10	0.97	0.97	5.02	3.17

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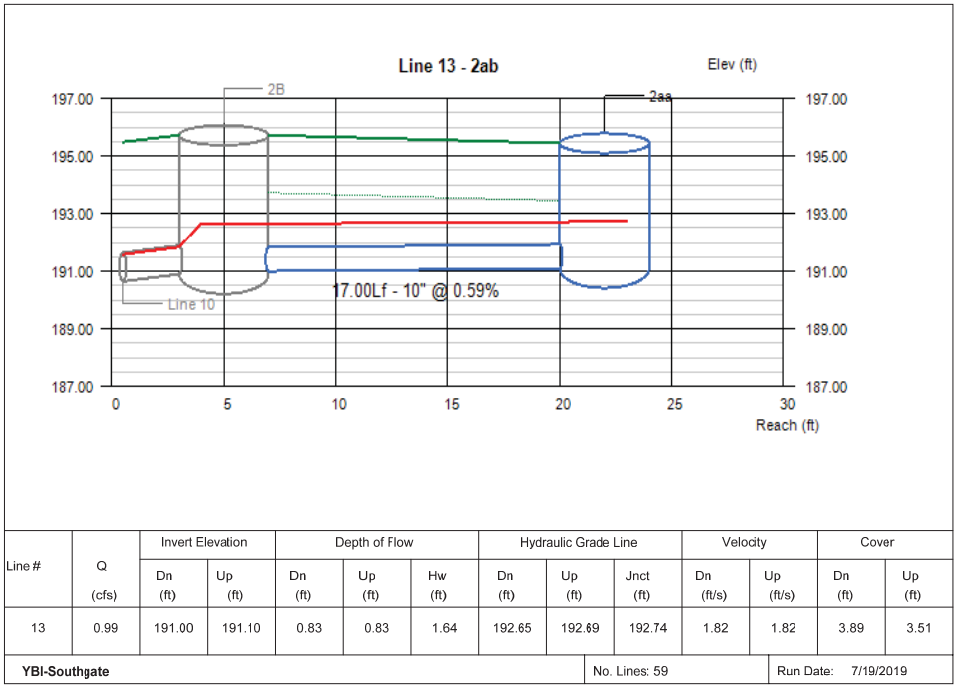
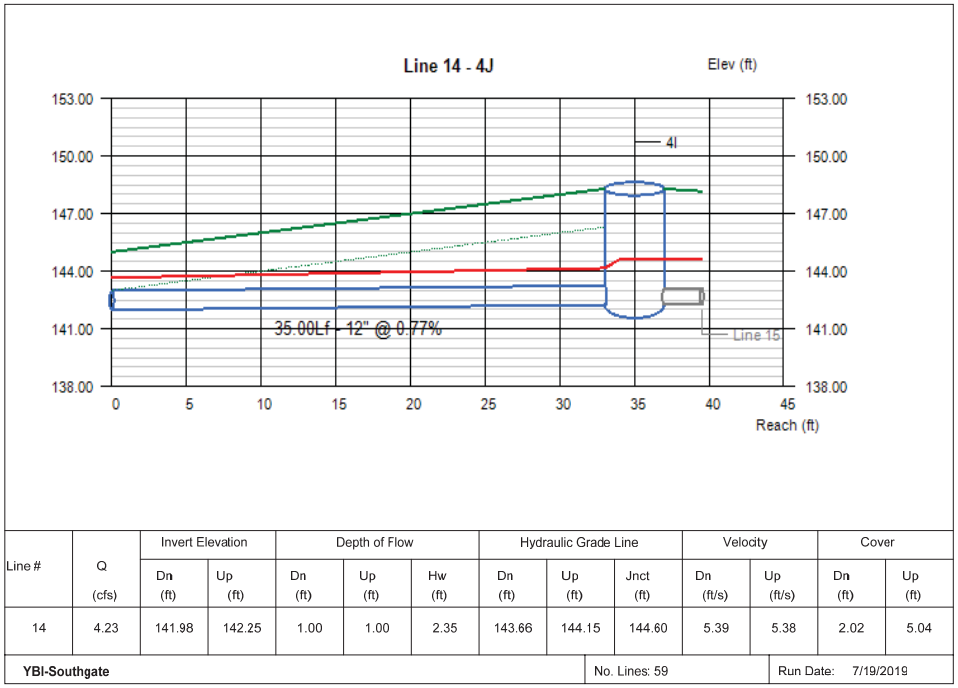
Line Profile (Line 13) - 2ab



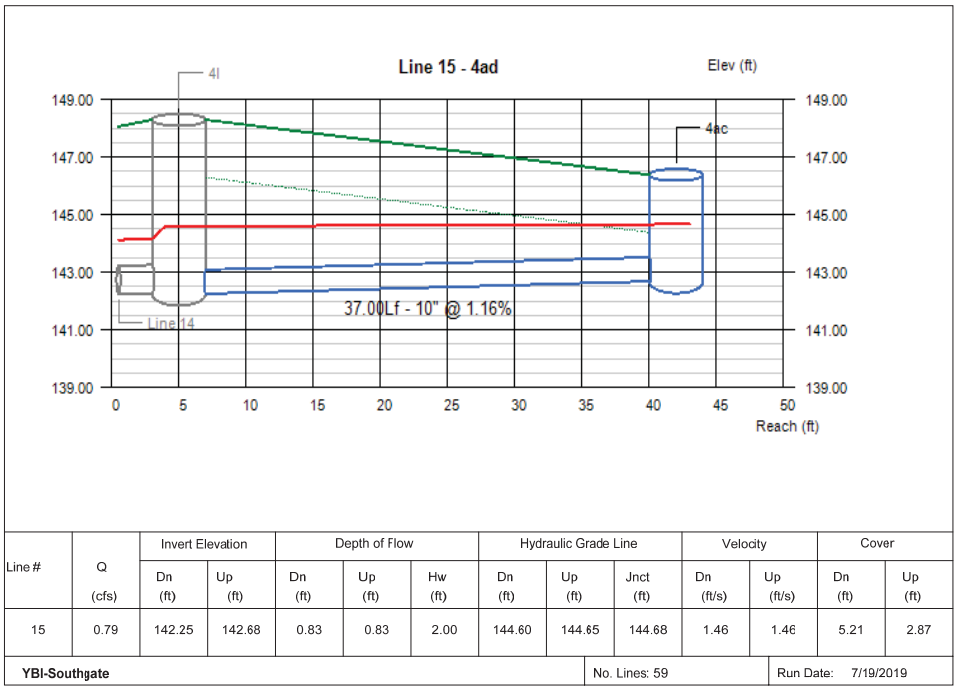
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
13	0.99	191.00	191.10	0.83	0.83	1.64	192.65	192.69	192.74	1.82	1.82	3.89	3.51

Line Profile (Line 14) - 4J



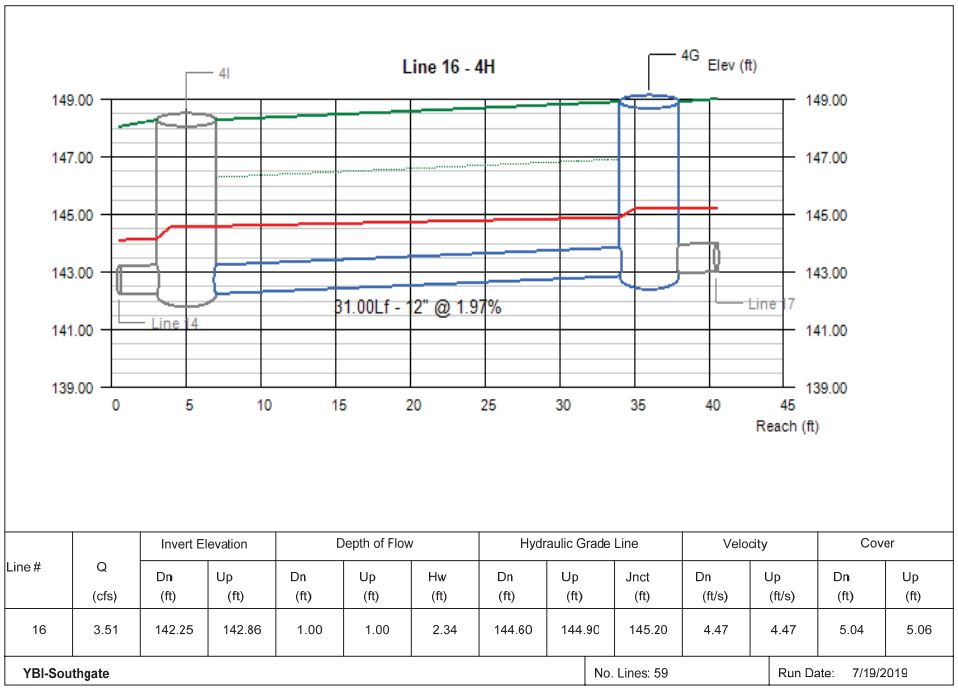
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
14	4.23	141.98	142.25	1.00	1.00	2.35	143.66	144.15	144.60	5.39	5.38	2.02	5.04

Line Profile (Line 15) - 4ad



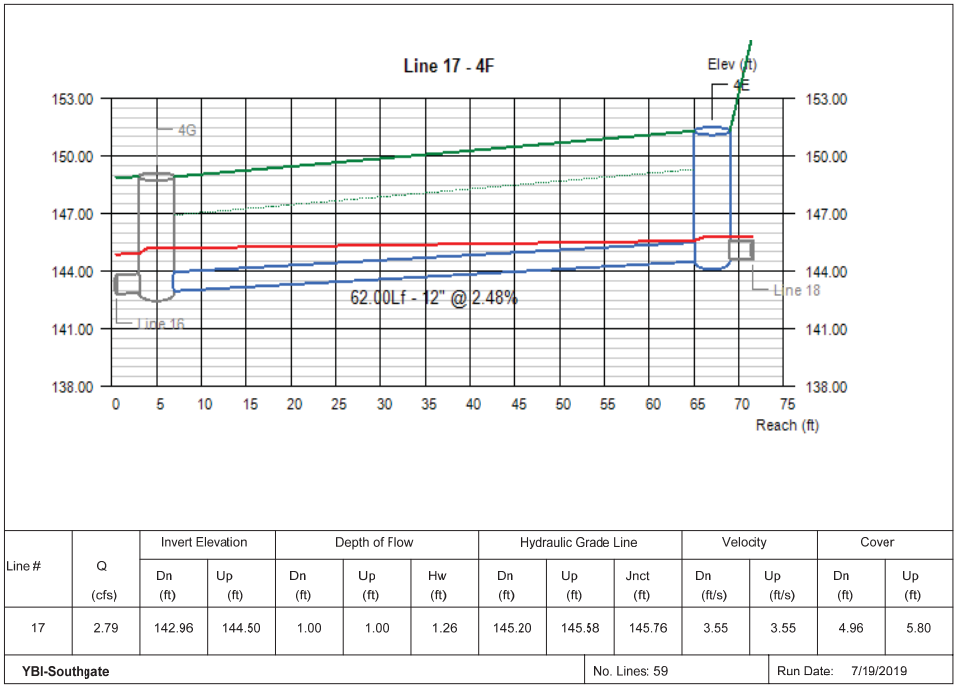
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
15	0.79	142.25	142.68	0.83	0.83	2.00	144.60	144.65	144.68	1.46	1.46	5.21	2.87

Line Profile (Line 16) - 4H



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
16	3.51	142.25	142.86	1.00	1.00	2.34	144.60	144.90	145.20	4.47	4.47	5.04	5.06

Line Profile (Line 17) - 4F



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
17	2.79	142.96	144.50	1.00	1.00	1.26	145.20	145.58	145.76	3.55	3.55	4.96	5.80

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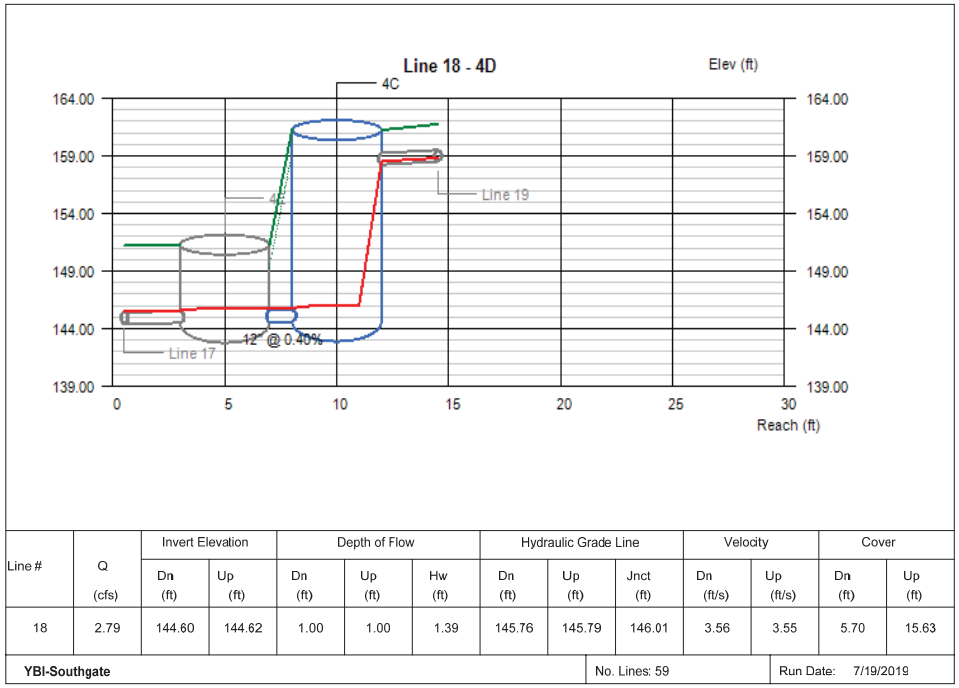
Line Profile (Line 18) - 4D



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
18	2.79	144.60	144.62	1.00	1.00	1.39	145.76	145.79	146.01	3.56	3.55	5.70	15.63

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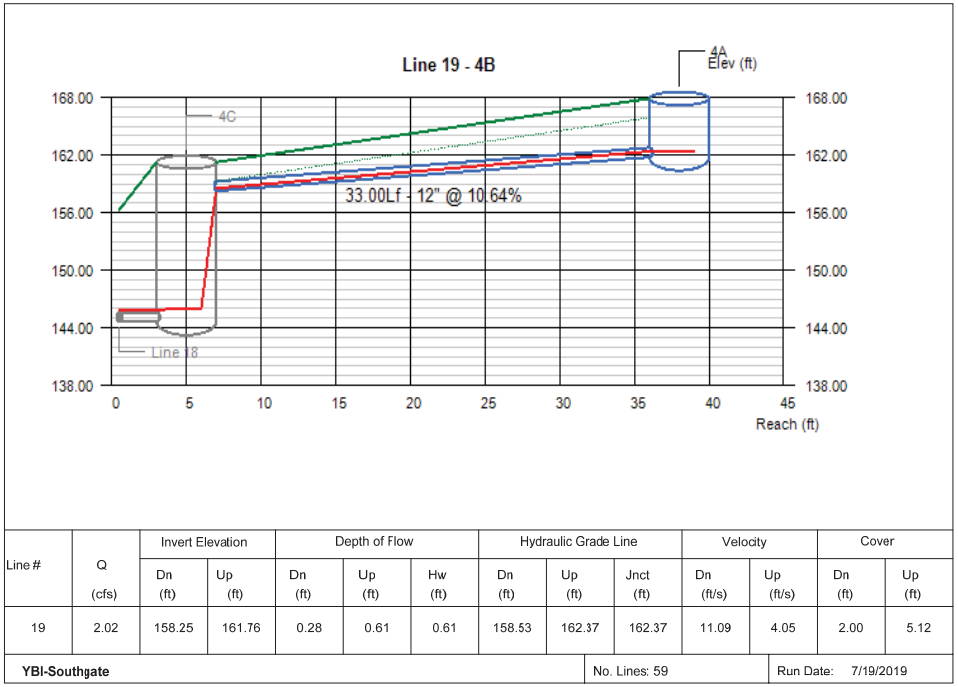
Line Profile (Line 19) - 4B



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
19	2.02	158.25	161.76	0.28	0.61	0.61	158.53	162.37	162.37	11.09	4.05	2.00	5.12

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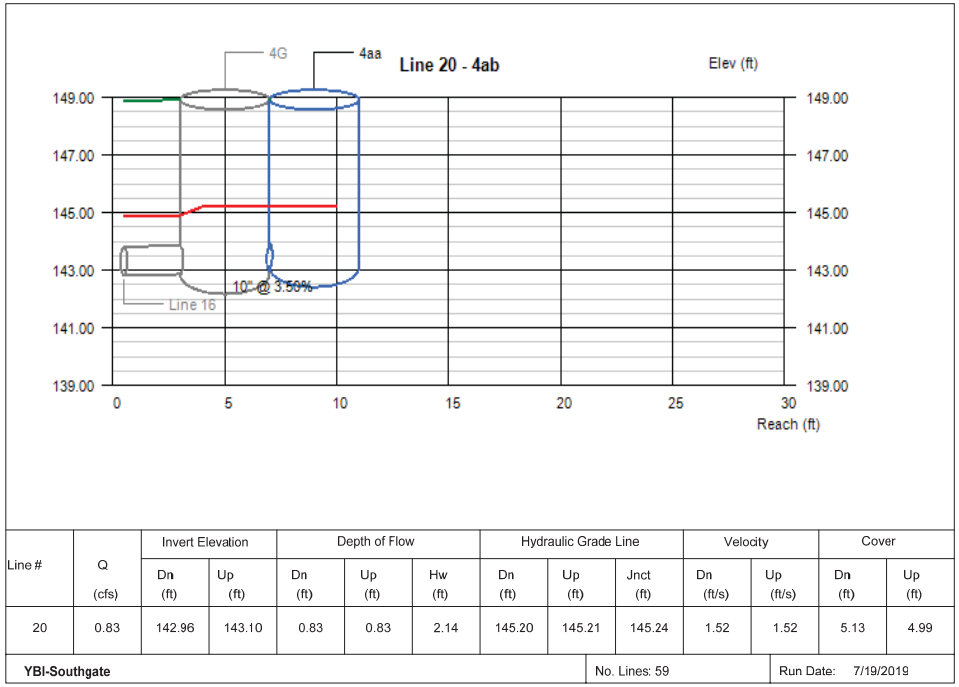
Line Profile (Line 20) - 4ab



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
20	0.83	142.96	143.10	0.83	0.83	2.14	145.20	145.21	145.24	1.52	1.52	5.13	4.99

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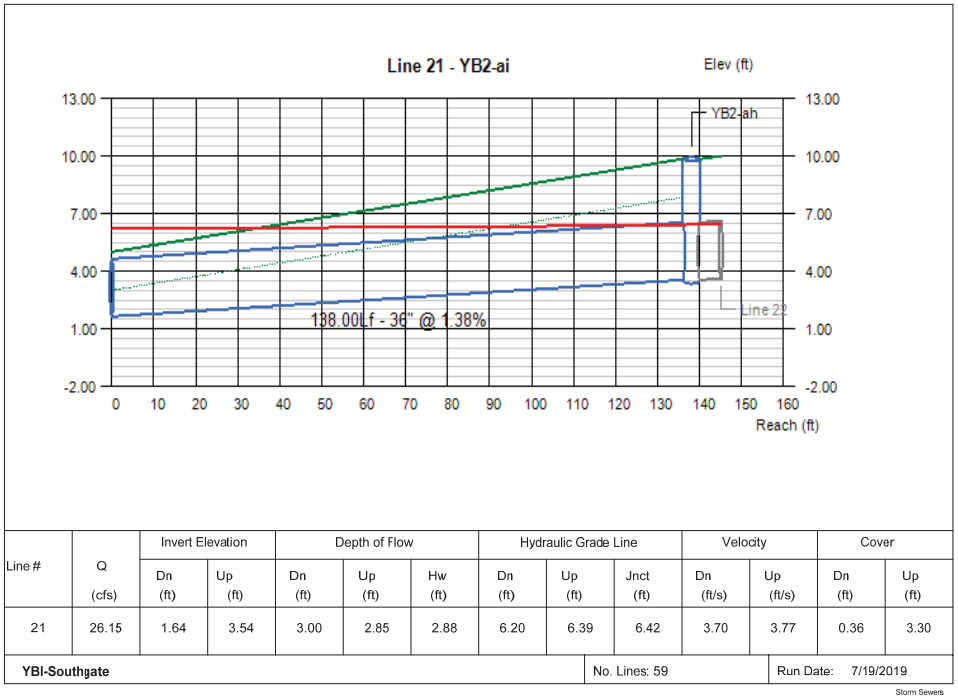
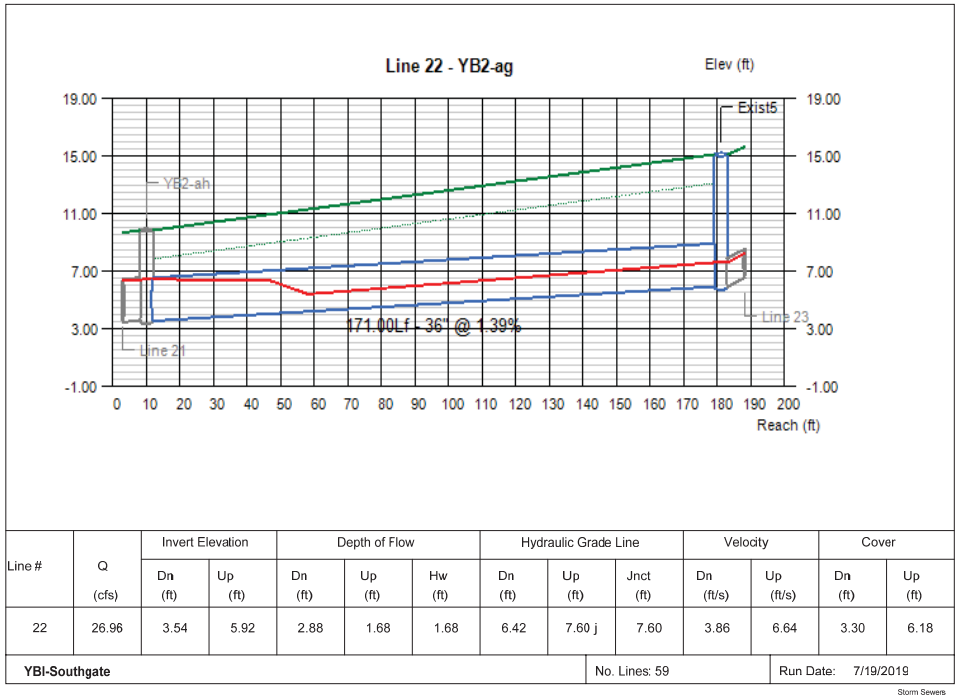
Line Profile (Line 21) - YB2-ai



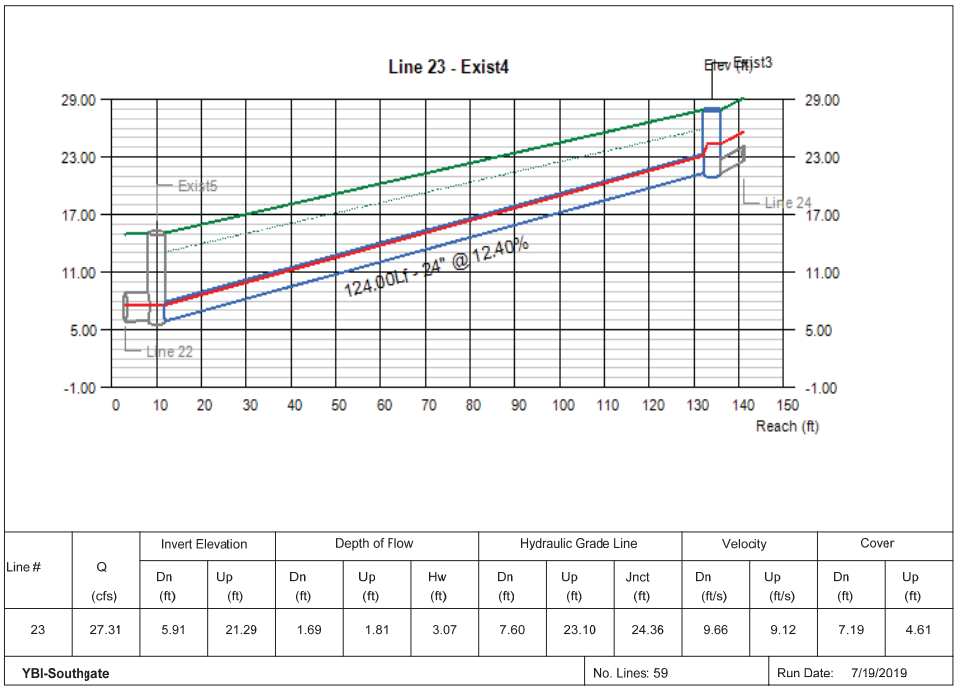
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
21	26.15	1.64	3.54	3.00	2.85	2.88	6.20	6.39	6.42	3.70	3.77	0.36	3.30

Line Profile (Line 22) - YB2-ag



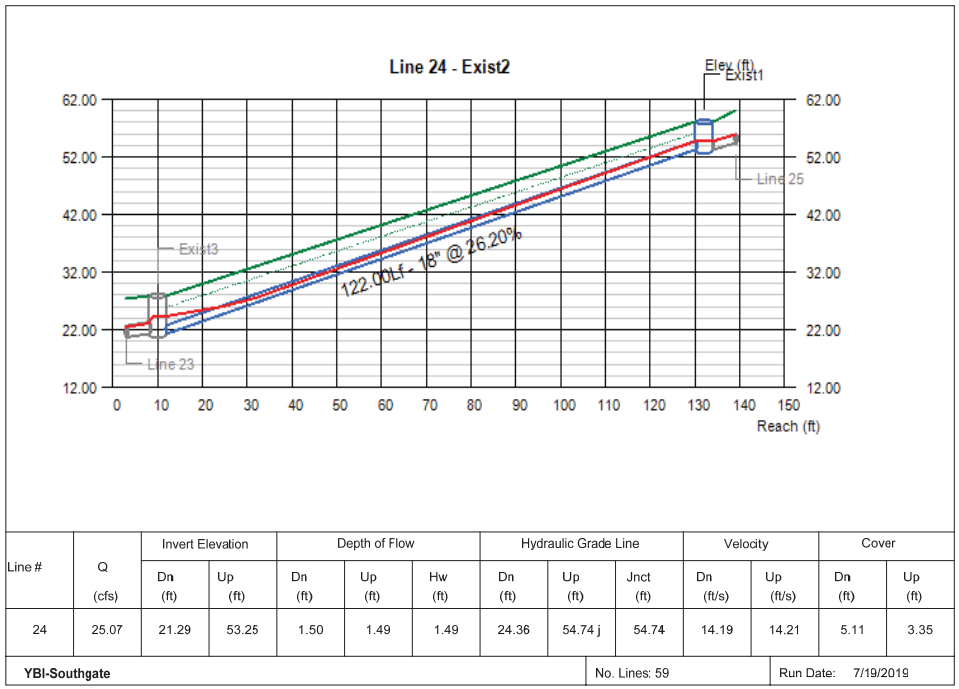
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
22	26.96	3.54	5.92	2.88	1.68	1.68	6.42	7.60 j	7.60	3.86	6.64	3.30	6.18

Line Profile (Line 23) - Exist4



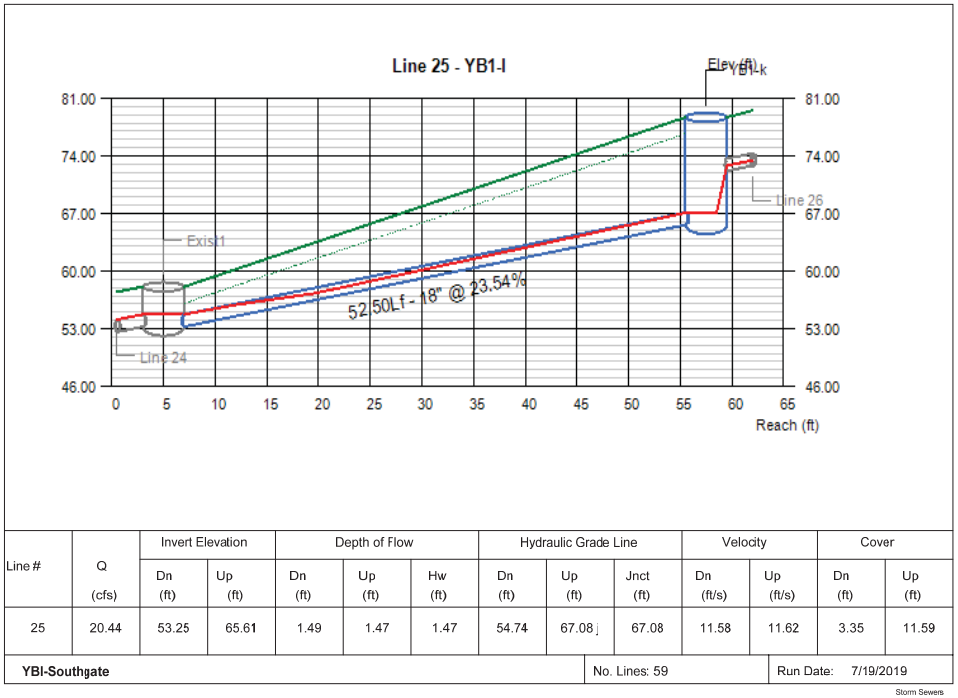
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
23	27.31	5.91	21.29	1.69	1.81	3.07	7.60	23.10	24.36	9.66	9.12	7.19	4.61

Line Profile (Line 24) - Exist2



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
24	25.07	21.29	53.25	1.50	1.49	1.49	24.36	54.74 j	54.74	14.19	14.21	5.11	3.35

Line Profile (Line 25) - YB1-l



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
25	20.44	53.25	65.61	1.49	1.47	1.47	54.74	67.08	67.08	11.58	11.62	3.35	11.59

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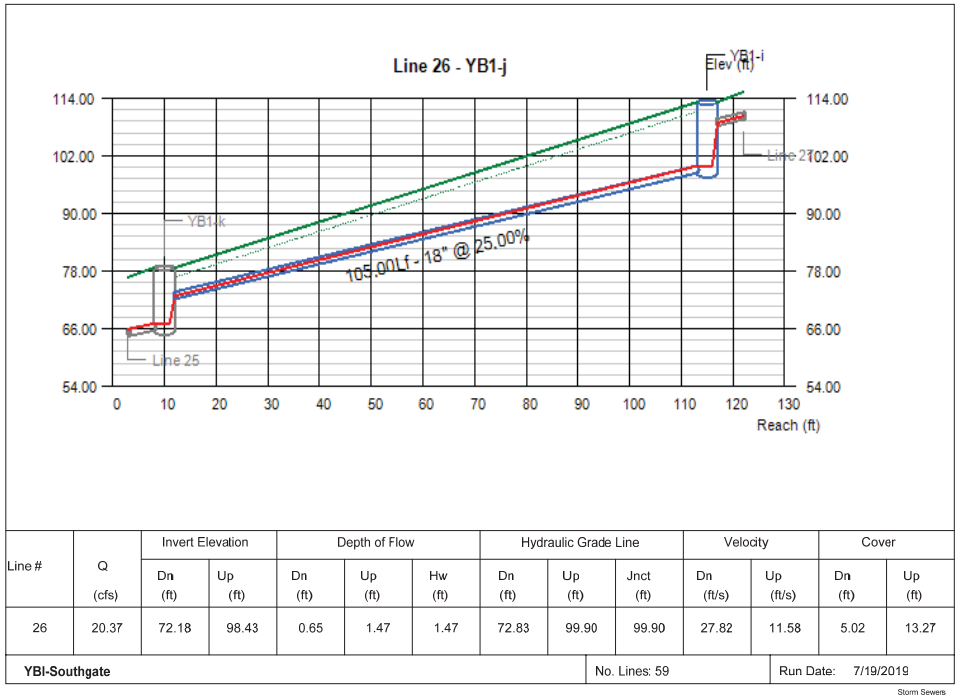
Line Profile (Line 26) - YB1-j



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
26	20.37	72.18	98.43	0.65	1.47	1.47	72.83	99.90	99.90	27.82	11.58	5.02	13.27

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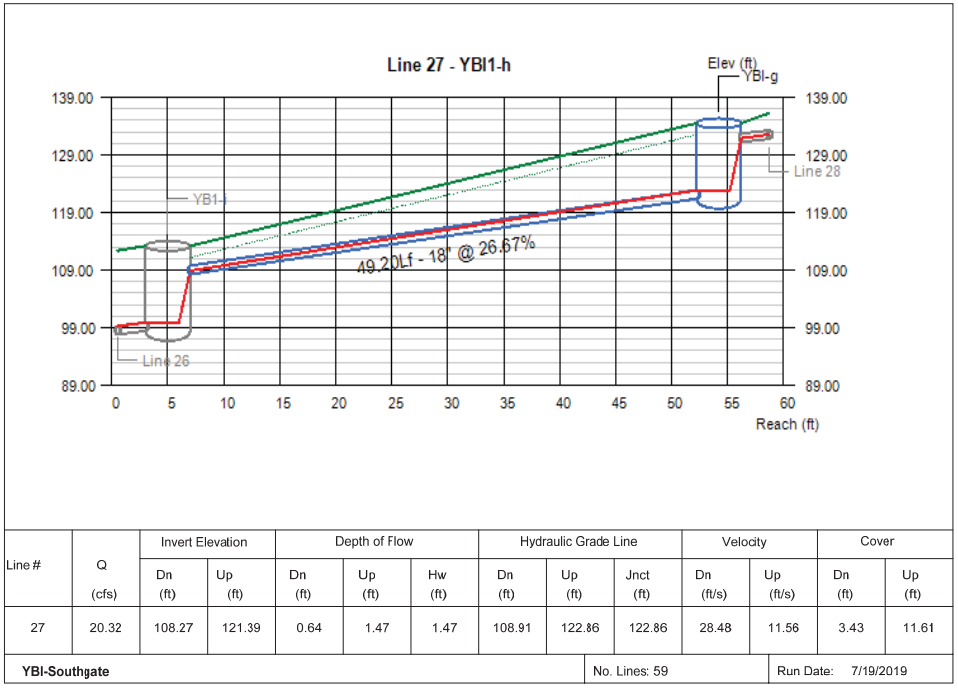
Line Profile (Line 27) - YBI1-h



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
27	20.32	108.27	121.39	0.64	1.47	1.47	108.91	122.86	122.86	28.48	11.56	3.43	11.61

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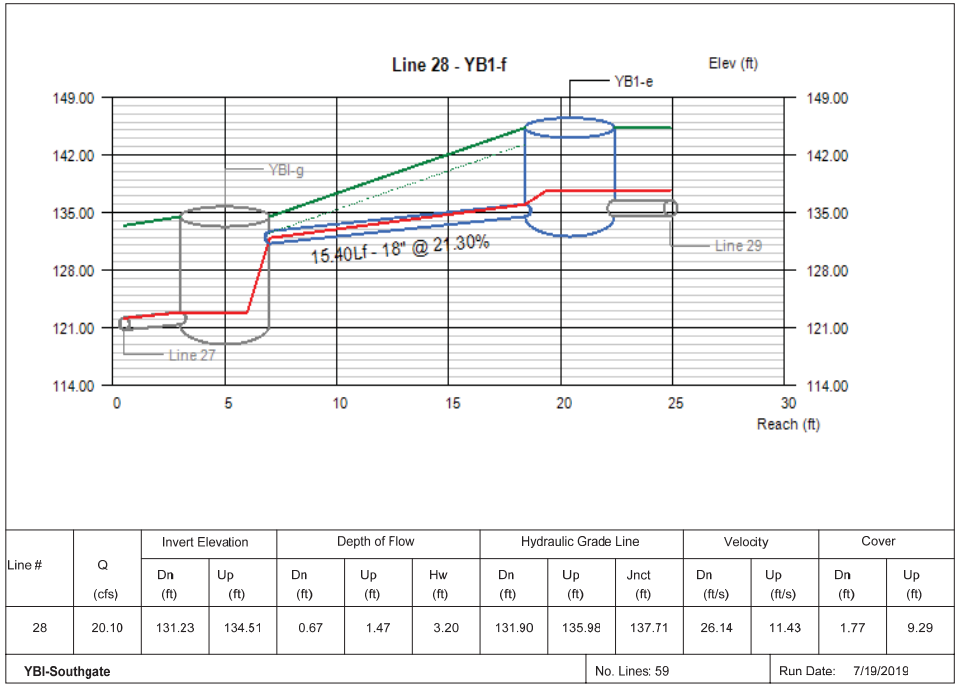
Line Profile (Line 28) - YB1-f



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
28	20.10	131.23	134.51	0.67	1.47	3.20	131.90	135.98	137.71	26.14	11.43	1.77	9.29

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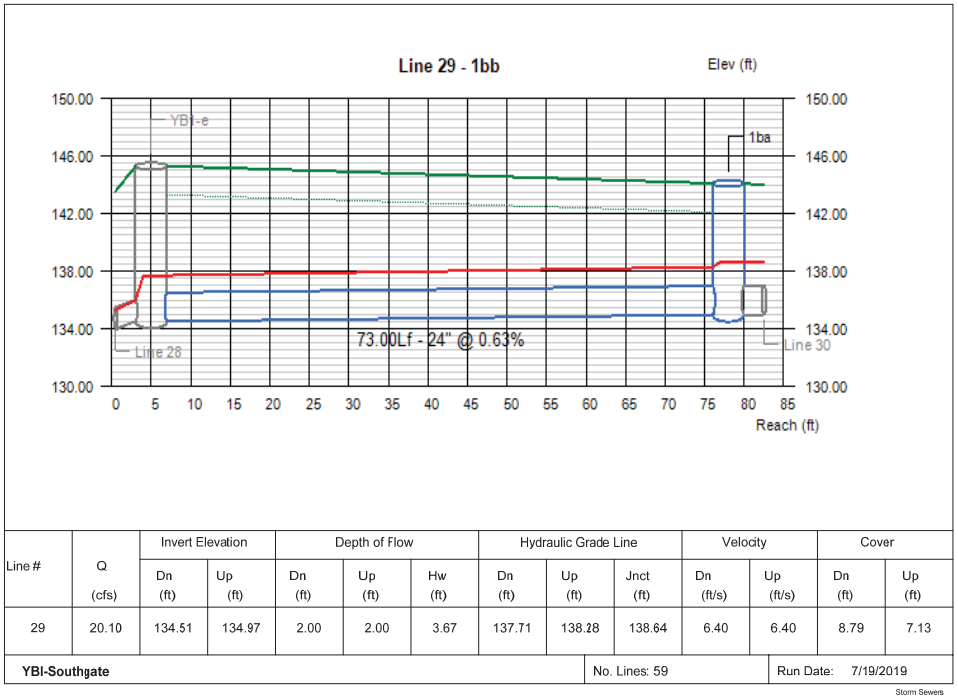
Line Profile (Line 29) - 1bb



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
29	20.10	134.51	134.97	2.00	2.00	3.67	137.71	138.28	138.64	6.40	6.40	8.79	7.13

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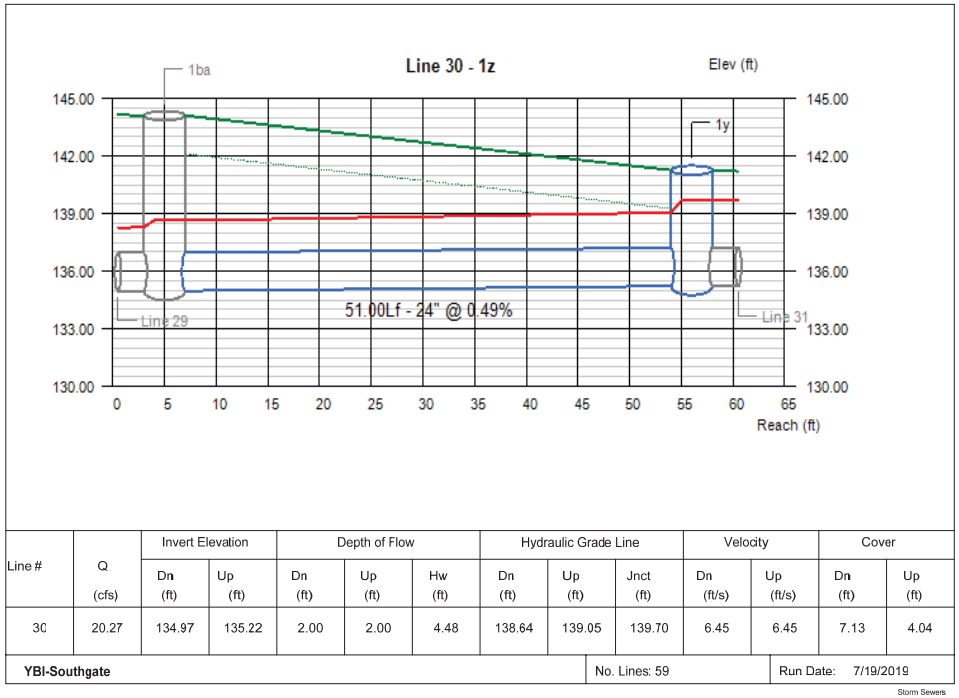
Line Profile (Line 30) - 1z



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
30	20.27	134.97	135.22	2.00	2.00	4.48	138.64	139.05	139.70	6.45	6.45	7.13	4.04

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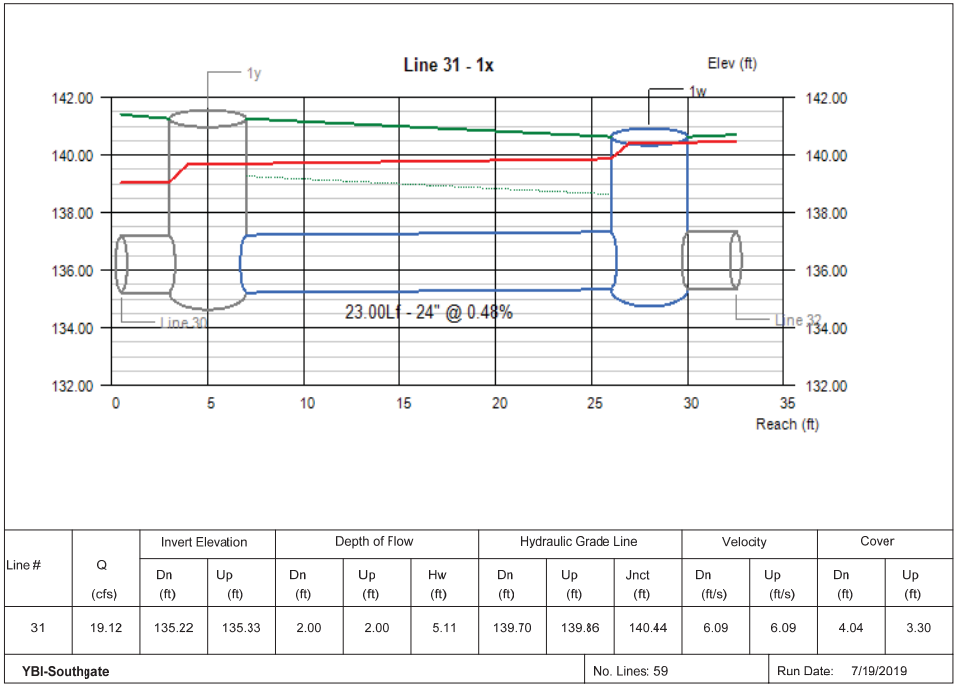
Line Profile (Line 31) - 1x



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
31	19.12	135.22	135.33	2.00	2.00	5.11	139.70	139.86	140.44	6.09	6.09	4.04	3.30

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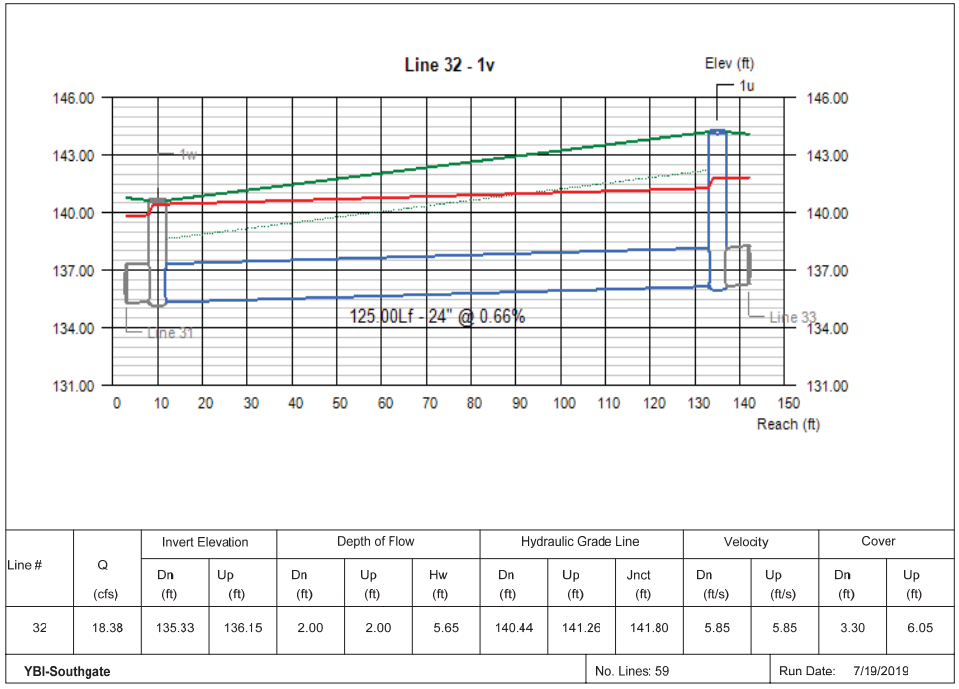
Line Profile (Line 32) - 1v



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
32	18.38	135.33	136.15	2.00	2.00	5.65	140.44	141.26	141.80	5.85	5.85	3.30	6.05

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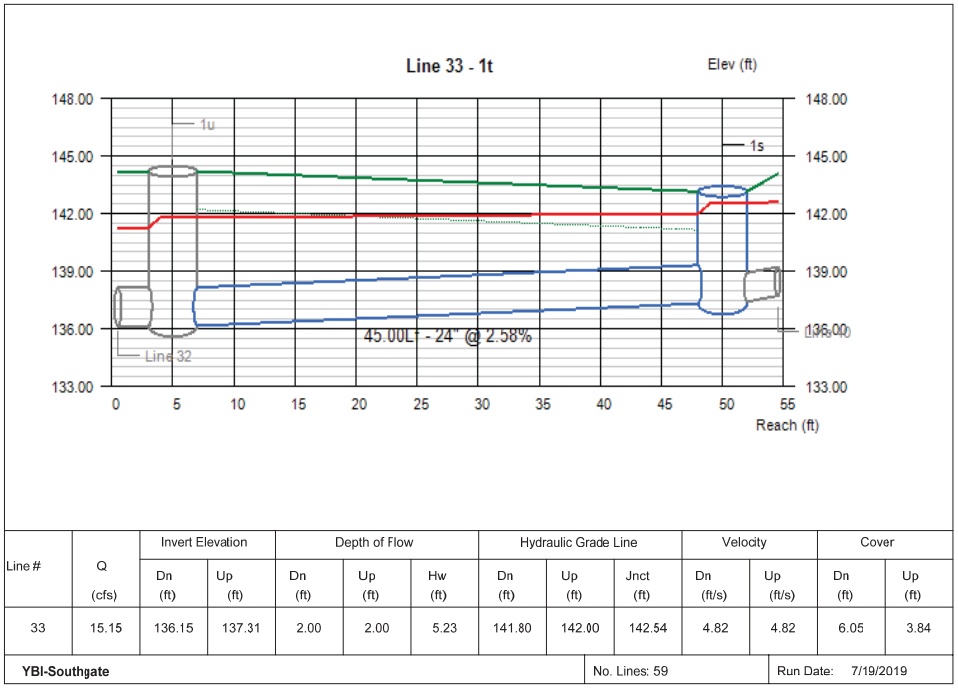
Line Profile (Line 33) - 1t



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
33	15.15	136.15	137.31	2.00	2.00	5.23	141.80	142.00	142.54	4.82	4.82	6.05	3.84

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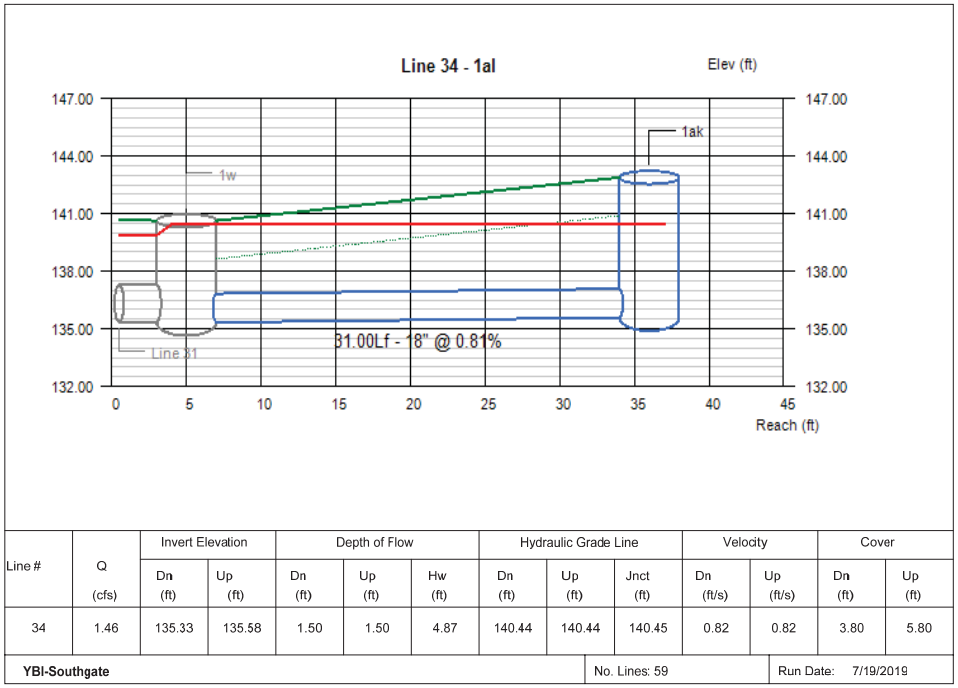
Line Profile (Line 34) - 1al



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
34	1.46	135.33	135.58	1.50	1.50	4.87	140.44	140.44	140.45	0.82	0.82	3.80	5.80

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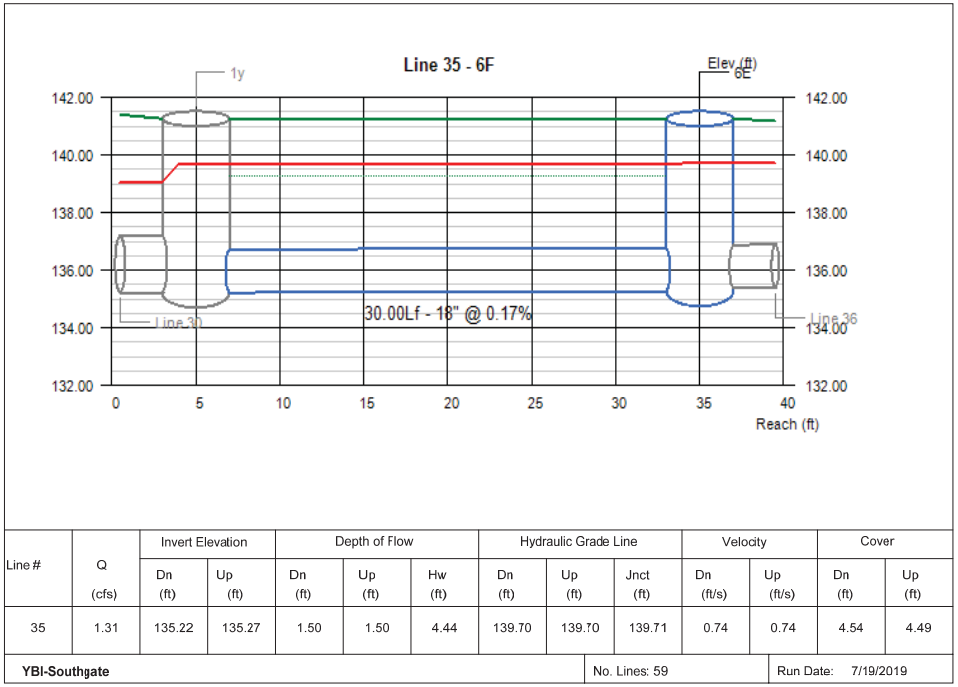
Line Profile (Line 35) - 6F



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
35	1.31	135.22	135.27	1.50	1.50	4.44	139.70	139.70	139.71	0.74	0.74	4.54	4.49

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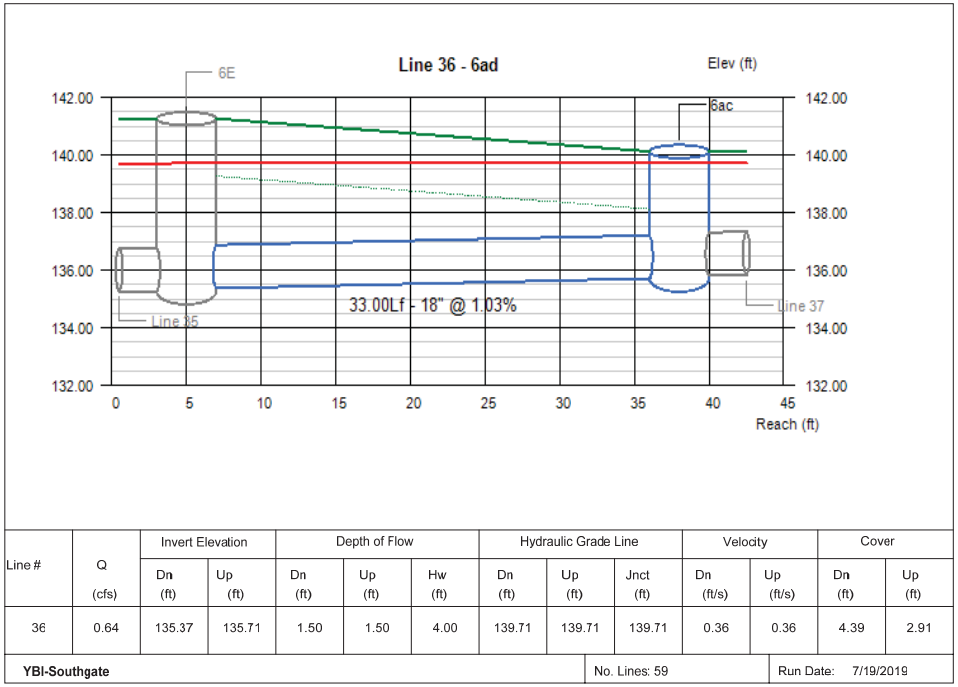
Line Profile (Line 36) - 6ad



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
36	0.64	135.37	135.71	1.50	1.50	4.00	139.71	139.71	139.71	0.36	0.36	4.39	2.91

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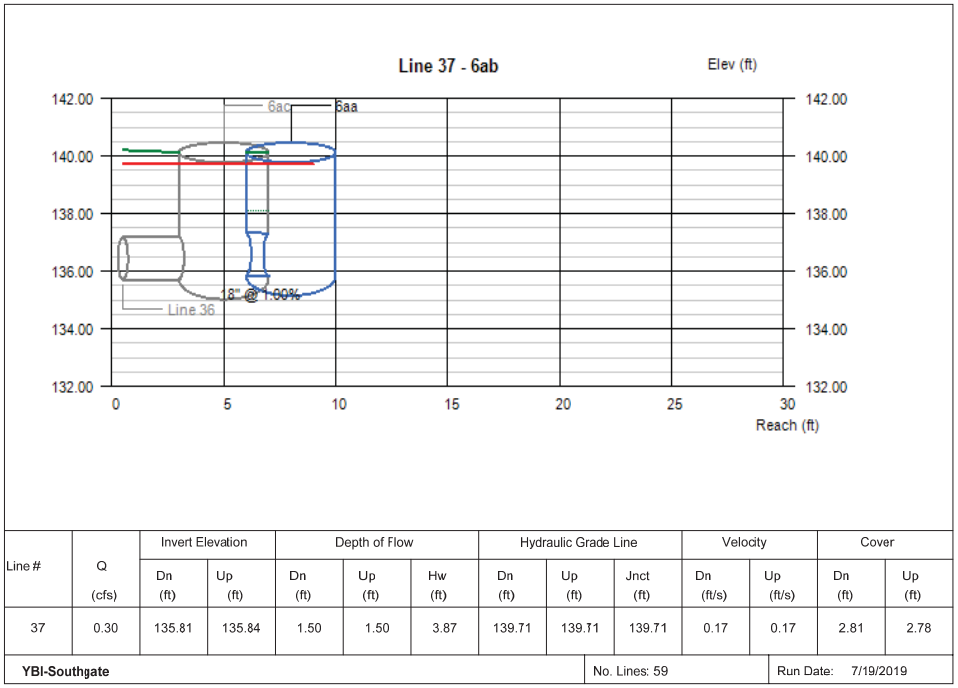
Line Profile (Line 37) - 6ab



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
37	0.30	135.81	135.84	1.50	1.50	3.87	139.71	139.71	139.71	0.17	0.17	2.81	2.78

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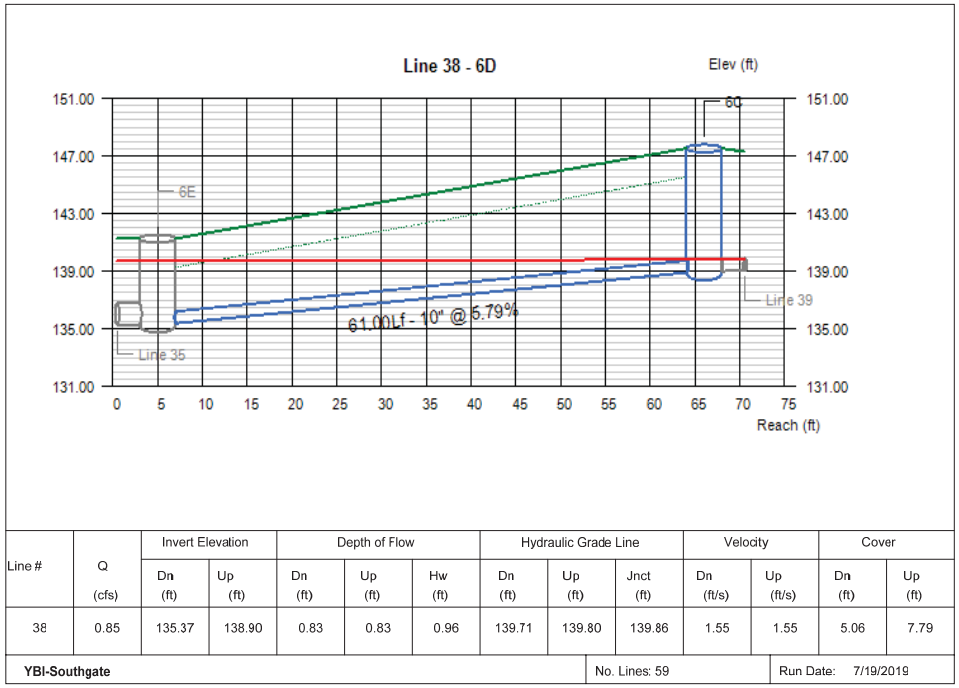
Storm Sewers

Line Profile (Line 38) - 6D

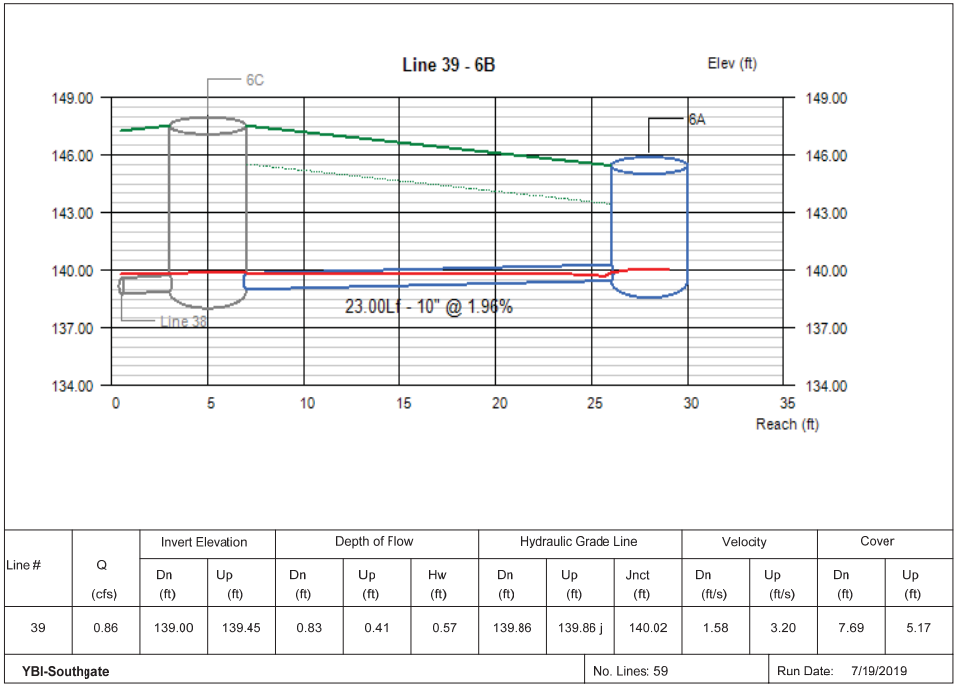


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
38	0.85	135.37	138.90	0.83	0.83	0.96	139.71	139.80	139.86	1.55	1.55	5.06	7.79

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 39) - 6B

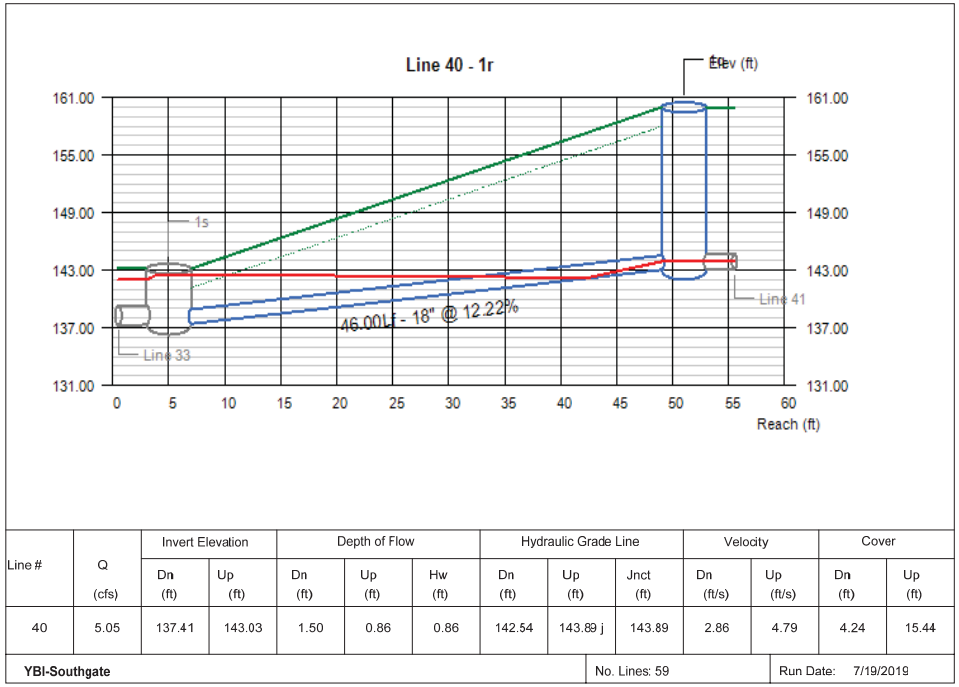


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
39	0.86	139.00	139.45	0.83	0.41	0.57	139.86	139.86 j	140.02	1.58	3.20	7.69	5.17

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 40) - 1r

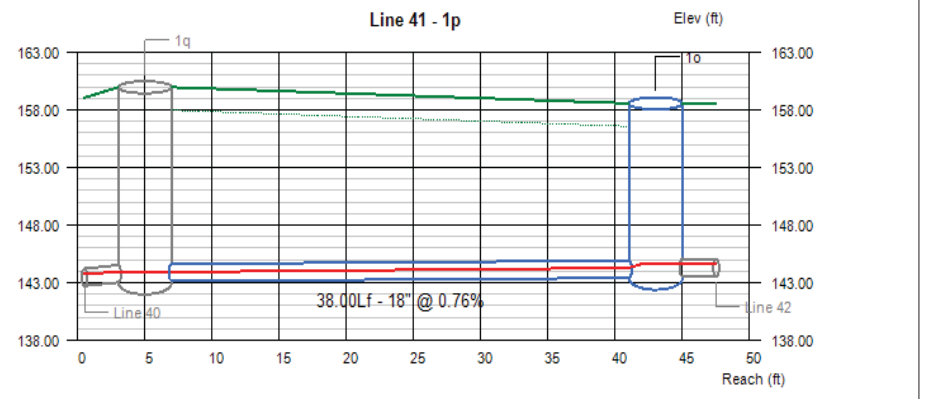


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
40	5.05	137.41	143.03	1.50	0.86	0.86	142.54	143.89 j	143.89	2.86	4.79	4.24	15.44

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 41) - 1p

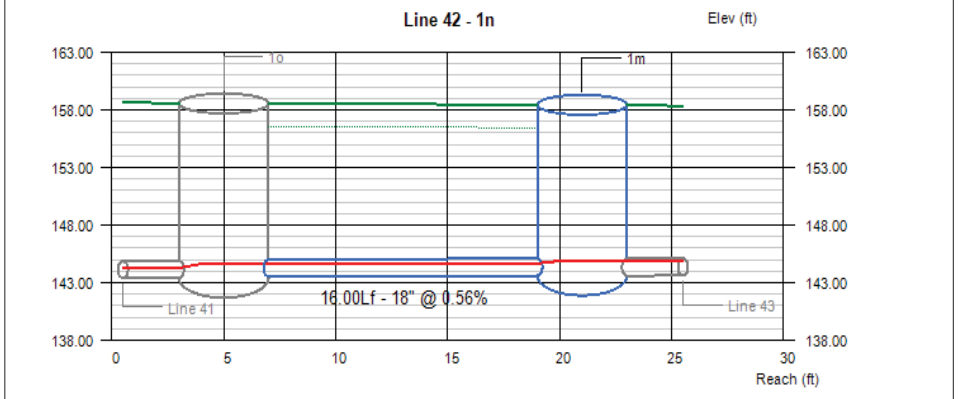


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
41	5.09	143.13	143.42	0.80	0.87	1.23	143.93	144.29	144.65	5.32	4.81	15.34	13.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 42) - 1n

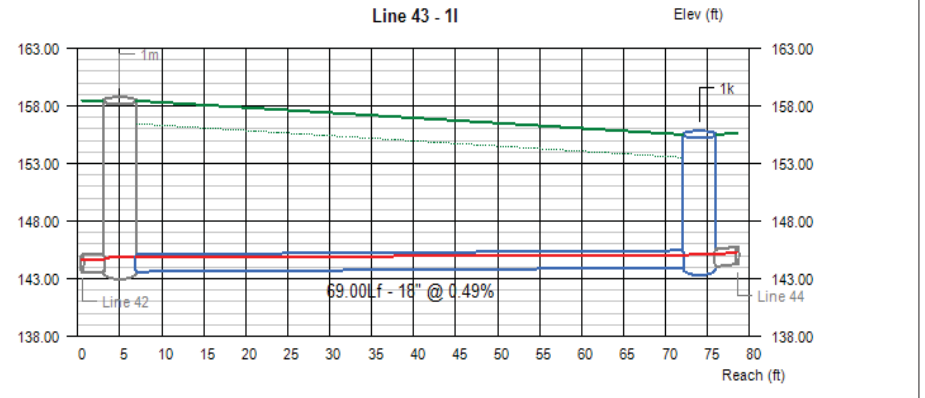


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
42	5.12	143.52	143.61	1.13	1.06	1.29	144.65	144.67	144.90	3.59	3.85	13.55	13.34

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 43) - 1l

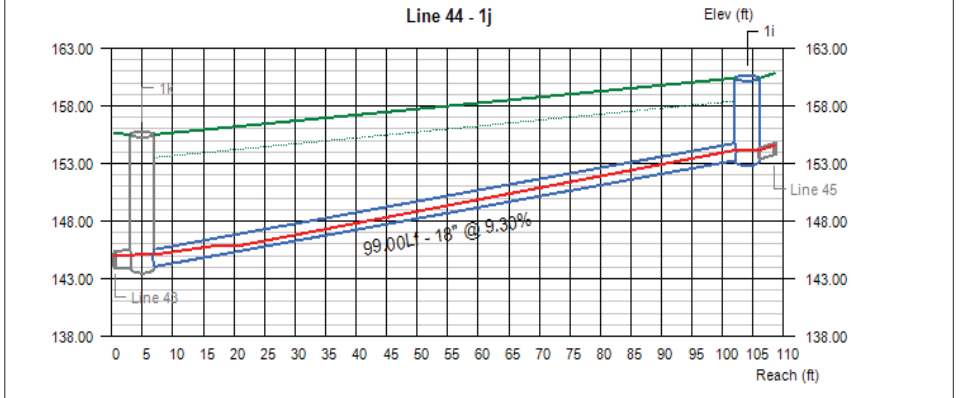


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
43	5.25	143.61	143.95	1.29	1.07	1.15	144.90	145.02	145.10	3.25	3.88	13.34	10.07

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 44) - 1j

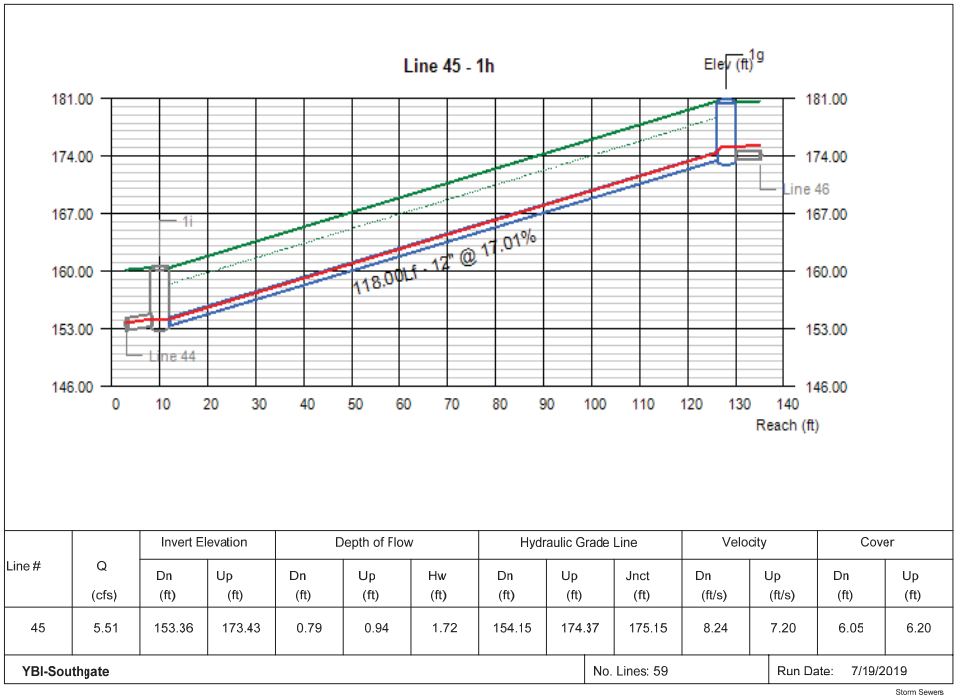


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
44	5.40	144.05	153.26	1.05	0.89	0.89	145.10	154.15 j	154.15	4.10	4.91	9.97	5.65

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 45) - 1h

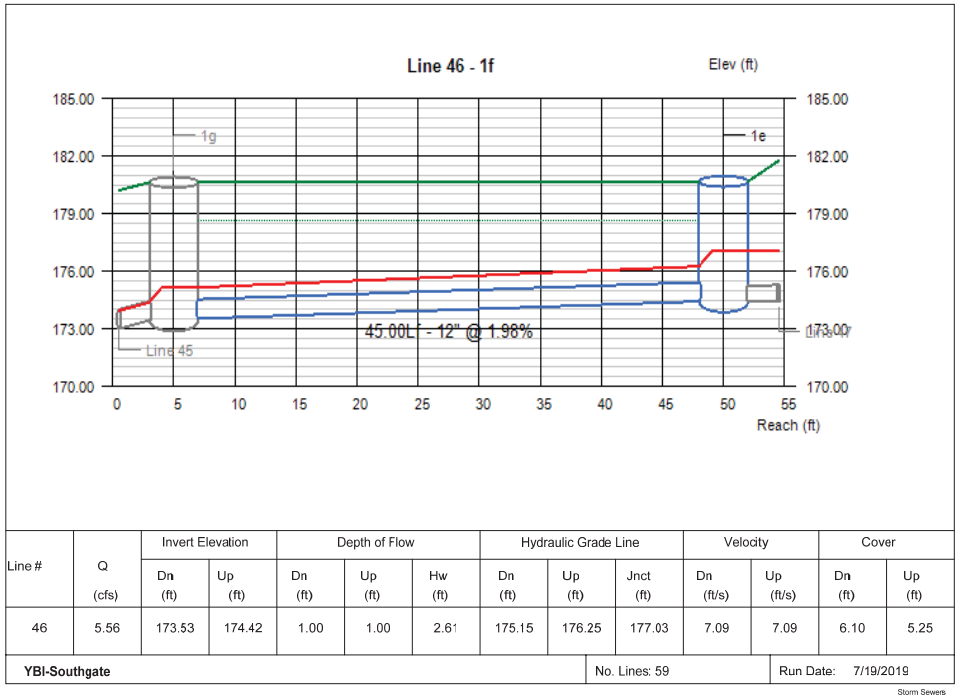


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
45	5.51	153.36	173.43	0.79	0.94	1.72	154.15	174.37	175.15	8.24	7.20	6.05	6.20

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 46) - 1f

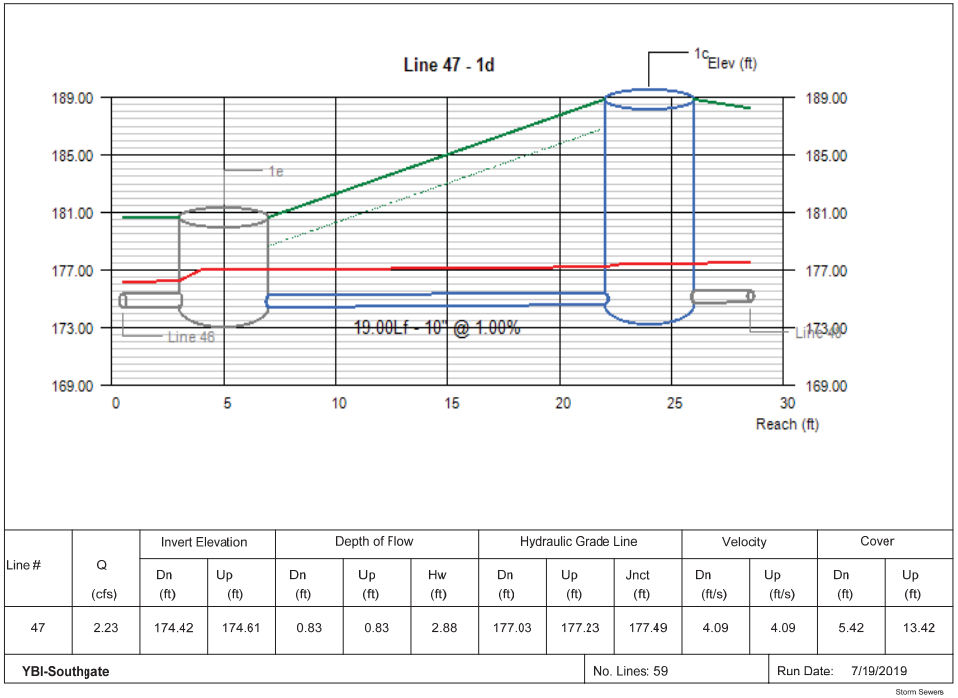


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
46	5.56	173.53	174.42	1.00	1.00	2.61	175.15	176.25	177.03	7.09	7.09	6.10	5.25

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 47) - 1d

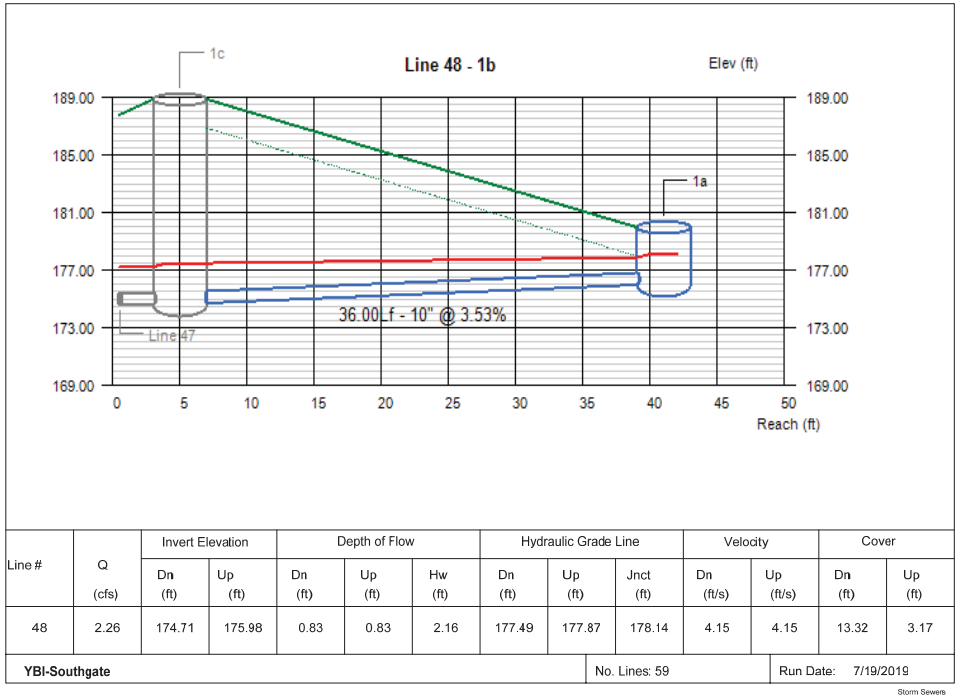


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
47	2.23	174.42	174.61	0.83	0.83	2.88	177.03	177.23	177.49	4.09	4.09	5.42	13.42

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 48) - 1b

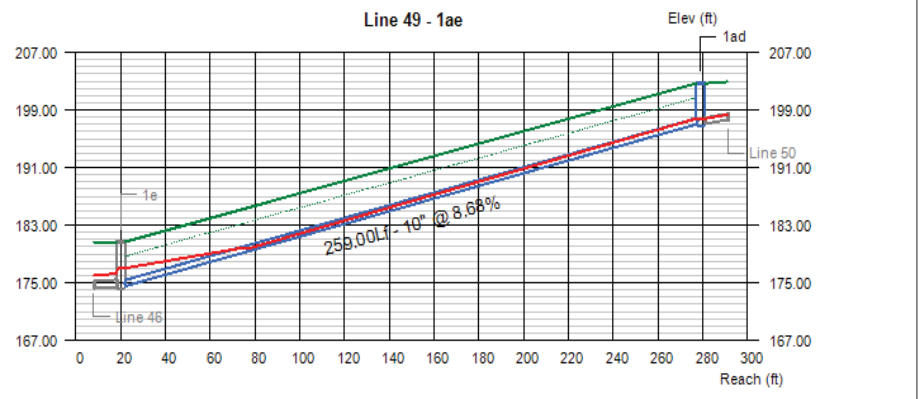


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
48	2.26	174.71	175.98	0.83	0.83	2.16	177.49	177.87	178.14	4.15	4.15	13.32	3.17

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 49) - 1ae

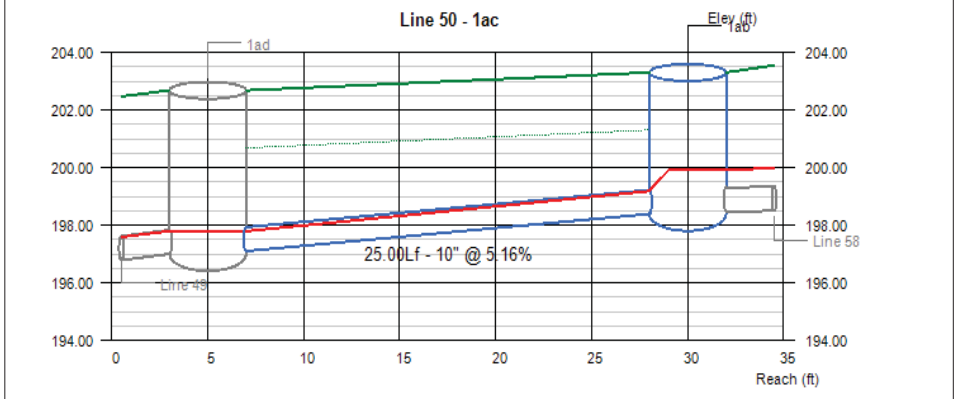


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
49	3.65	174.52	197.00	0.83	0.79	0.79	177.03	197.79 j	197.79	6.70	6.83	5.32	4.85

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 50) - 1ac

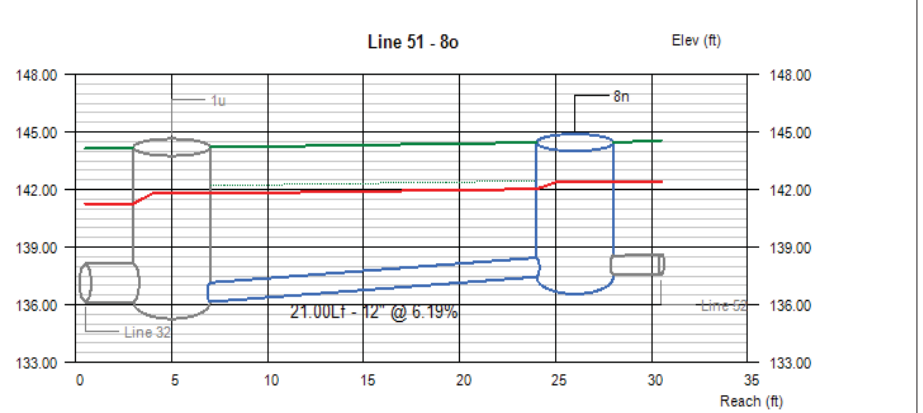


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
50	3.67	197.10	198.39	0.69	0.79	1.52	197.79	199.18	199.91	7.60	6.86	4.75	4.08

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 51) - 8o

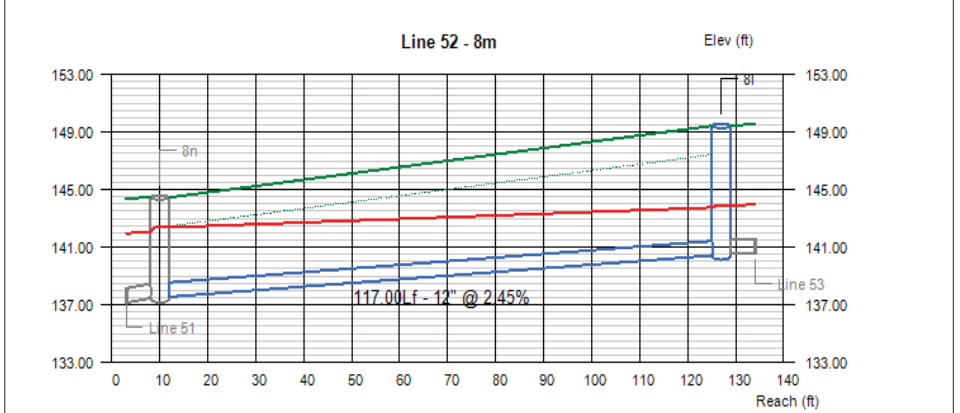


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
51	3.73	136.15	137.45	1.00	1.00	4.93	141.80	142.03	142.38	4.75	4.75	7.05	6.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 52) - 8m

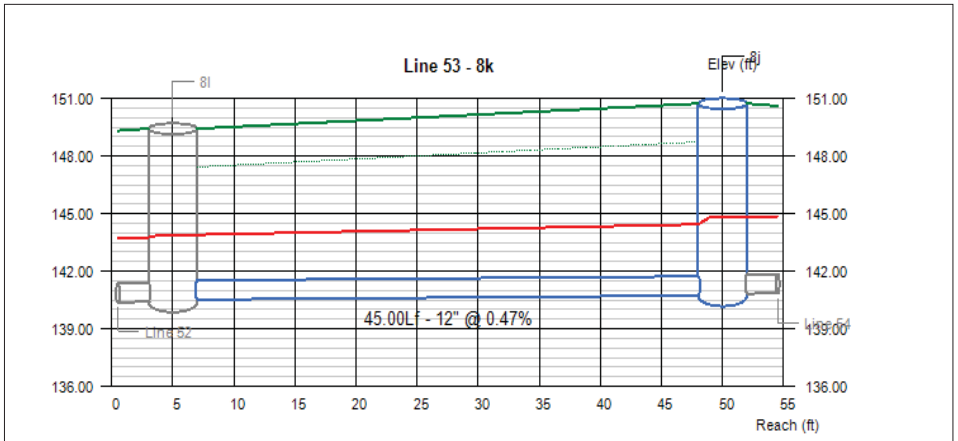


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
52	3.86	137.55	140.42	1.00	1.00	3.47	142.38	143.75	143.89	4.91	4.91	5.90	8.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 53) - 8k

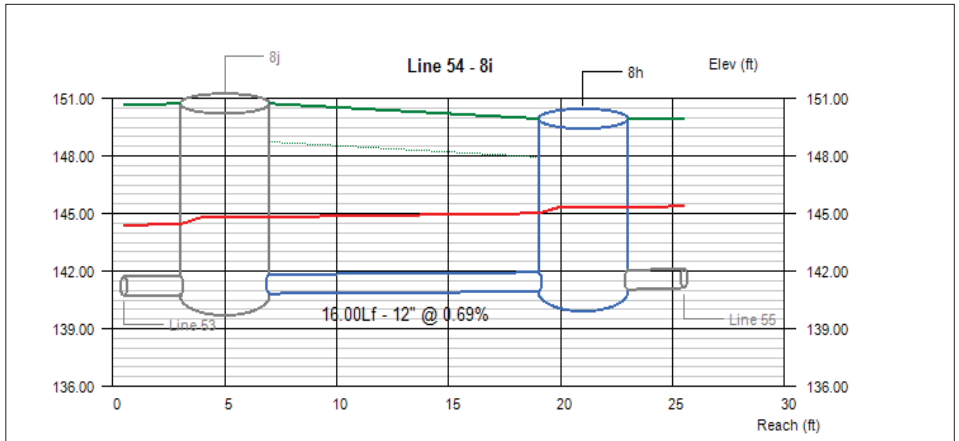


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
53	3.91	140.52	140.73	1.00	1.00	4.09	143.89	144.44	144.82	4.98	4.98	7.90	9.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 54) - 8i

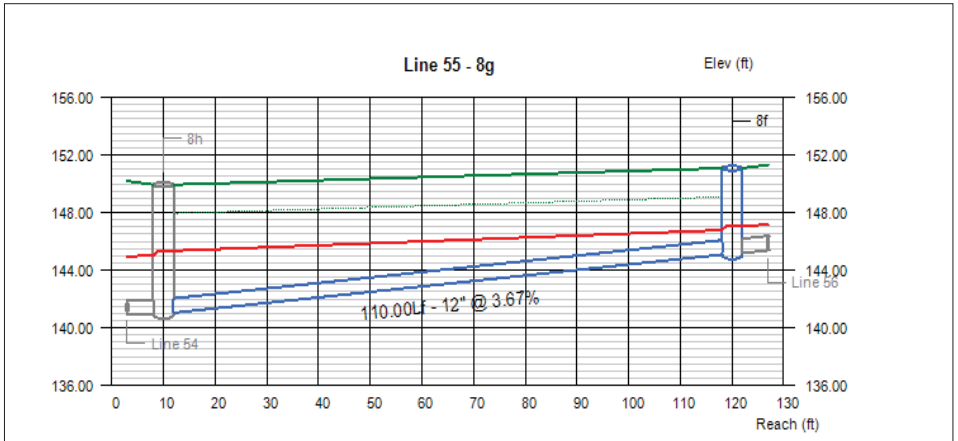


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
54	3.93	140.83	140.94	1.00	1.00	4.41	144.82	145.02	145.35	5.00	5.00	8.90	8.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 55) - 8g

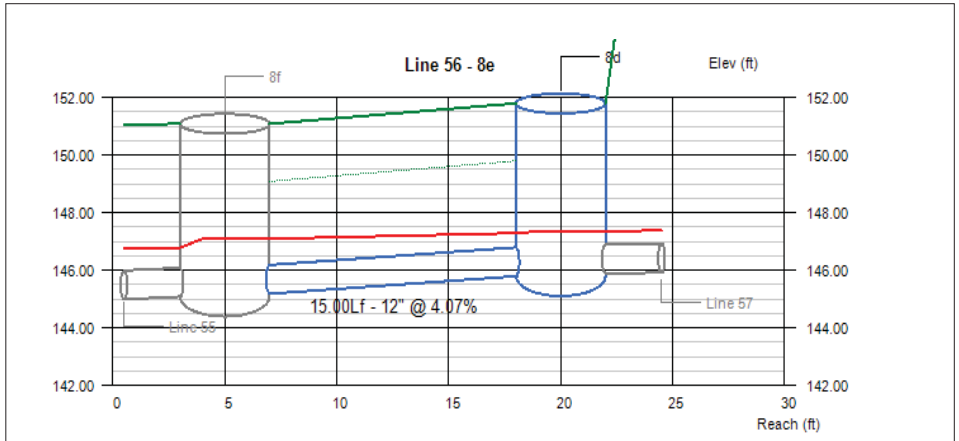


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
55	4.06	141.04	145.08	1.00	1.00	2.01	145.35	146.78	147.09	5.17	5.17	7.90	5.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 56) - 8e

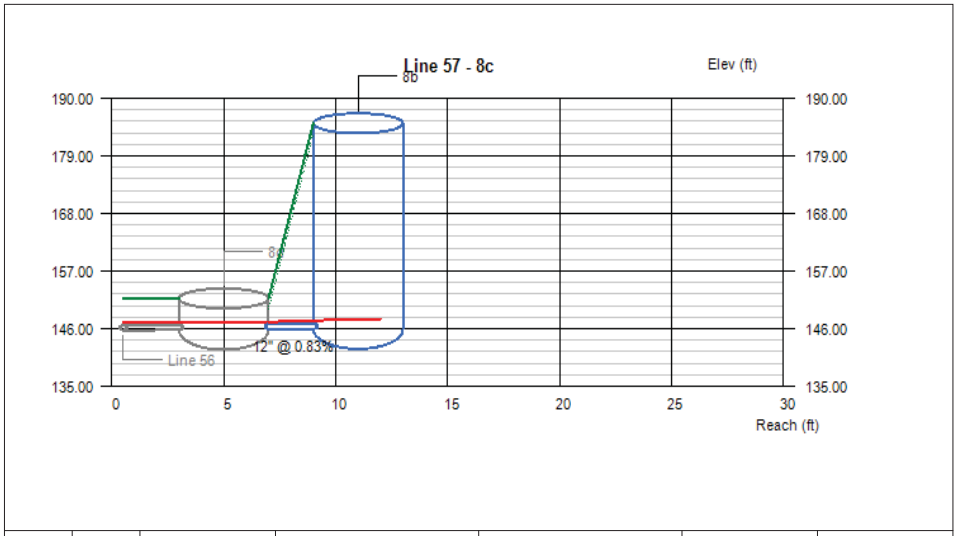


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
56	4.08	145.18	145.79	1.00	1.00	1.56	147.09	147.28	147.35	5.19	5.19	4.90	5.00

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 57) - 8c

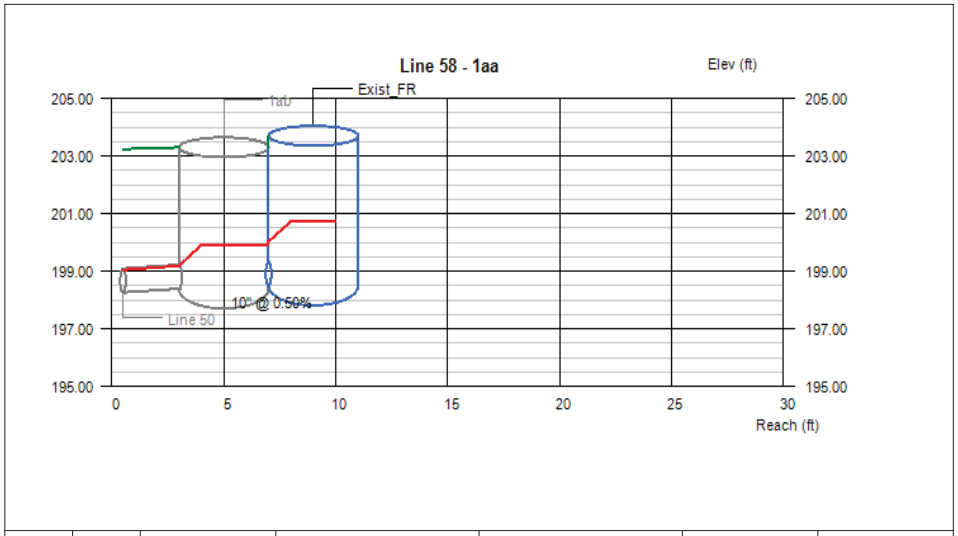


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
57	4.09	145.89	145.94	1.00	1.00	1.91	147.35	147.43	147.85	5.20	5.20	4.90	38.30

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 58) - 1aa

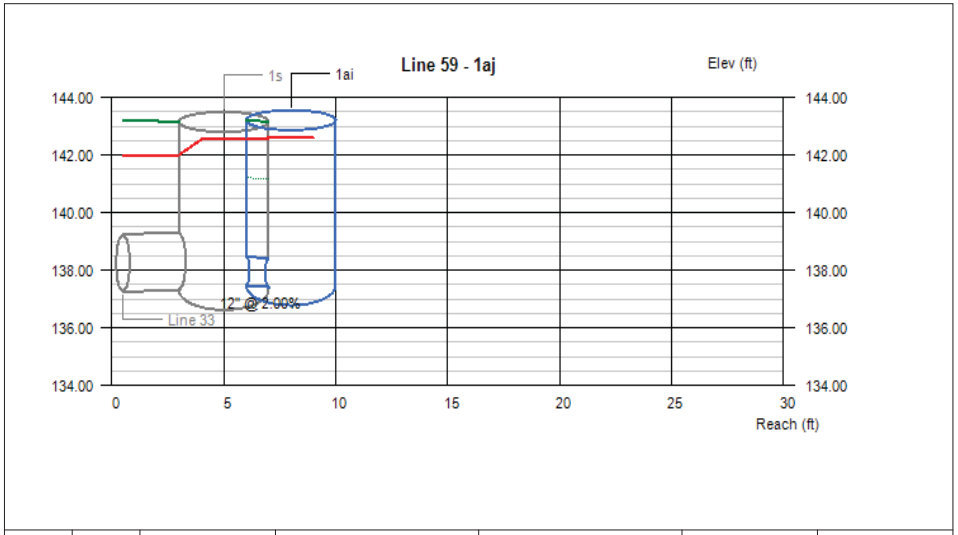


Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
58	3.68	198.48	198.50	0.83	0.83	2.23	199.91	200.03	200.73	6.74	6.74	3.99	4.37

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Line Profile (Line 59) - 1aj



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
59	1.36	137.41	137.47	1.00	1.00	5.12	142.54	142.54	142.59	1.73	1.73	4.74	4.74

YBI-Southgate | No. Lines: 59 | Run Date: 7/19/2019

Storm Sewers

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	2M	12.05	18	Cir	18.00	141.77	141.86	0.500	143.69*	143.93*	0.72	144.64	End	Manhole
2	3D	1.96	10	Cir	71.00	141.86	143.21	1.901	144.64*	145.21*	0.20	145.41	1	Manhole
3	3B	1.96	10	Cir	5.00	144.59	144.69	2.000	145.41	145.32	n/a	145.32	2	Grate
4	2K	10.38	18	Cir	107.00	141.86	142.39	0.495	144.64*	145.69*	0.54	146.23	1	Manhole
5	2I	8.52	12	Cir	96.00	147.30	160.50	13.750	147.88	161.49	1.84	163.32	4	Manhole
6	2af	0.14	10	Cir	9.00	160.60	162.00	15.555	163.32*	163.32*	0.00	163.33	5	Grate
7	2ah	2.01	10	Cir	10.00	147.30	148.19	8.900	147.62	148.82	n/a	148.82	4	Grate
8	2G	8.49	12	Cir	83.00	160.60	171.94	13.663	161.49	172.93	n/a	172.93	5	Manhole
9	2E	8.51	12	Cir	17.00	172.04	176.22	24.588	172.93	177.21	n/a	179.04	8	Manhole
10	2C	7.89	12	Cir	142.00	176.32	190.90	10.268	177.21	191.88	n/a	193.46	9	Manhole
11	2A	6.54	12	Cir	54.00	191.00	196.50	10.185	191.88	197.47	n/a	197.47	10	Manhole
12	2ad	0.75	10	Cir	16.00	176.32	176.65	2.062	179.04*	179.06*	0.03	179.09	9	Grate
13	2ab	1.40	10	Cir	17.00	191.00	191.10	0.588	193.46*	193.53*	0.10	193.63	10	Grate
14	4J	6.12	12	Cir	35.00	141.98	142.25	0.771	143.66*	144.69*	0.93	145.63	End	Manhole
15	4ad	1.12	10	Cir	37.00	142.25	142.68	1.162	145.63*	145.72*	0.07	145.79	14	Grate
16	4H	5.05	12	Cir	31.00	142.25	142.86	1.968	145.63*	146.25*	0.62	146.87	14	Manhole
17	4F	3.95	12	Cir	62.00	142.96	144.50	2.484	146.87*	147.64*	0.35	147.99	16	Manhole
18	4D	3.95	12	Cir	5.00	144.60	144.62	0.400	147.99*	148.05*	0.45	148.50	17	Grate
19	4B	2.85	12	Cir	33.00	158.25	161.76	10.636	158.59	162.48	0.34	162.48	18	Manhole
20	4ab	1.17	10	Cir	4.00	142.96	143.10	3.500	146.87*	146.88*	0.07	146.96	16	Grate
21	YB2-ai	19.93	36	Cir	138.00	1.64	3.54	1.377	6.20	6.31	0.02	6.33	End	Manhole
22	YB2-ag	20.22	36	Cir	171.00	3.54	5.92	1.392	6.33	7.36	n/a	7.36 j	21	Manhole
23	Exist4	20.34	24	Cir	124.00	5.91	21.29	12.403	7.36	22.91	n/a	23.75	22	Manhole
24	Exist2	18.29	18	Cir	122.00	21.29	53.25	26.197	23.75	54.70	n/a	54.70 j	23	Manhole

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	YB1-l	14.23	18	Cir	52.50	53.25	65.61	23.543	54.70	67.00	n/a	67.00 j	24	Manhole
26	YB1-j	14.11	18	Cir	105.00	72.18	98.43	25.000	72.71	99.81	0.16	99.81	25	Manhole
27	YBI1-h	14.03	18	Cir	49.20	108.27	121.39	26.667	108.79	122.77	0.16	122.77	26	Manhole
28	YB1-f	13.84	18	Cir	15.40	131.23	134.51	21.299	131.78	135.89	n/a	135.89	27	Manhole
29	1bb	13.70	24	Cir	73.00	134.51	134.97	0.630	135.89	136.30	n/a	136.63	28	Manhole
30	1z	13.76	24	Cir	51.00	134.97	135.22	0.490	136.63	136.78	0.42	137.21	29	Manhole
31	1x	12.79	24	Cir	23.00	135.22	135.33	0.478	137.21	137.27	0.26	137.53	30	Manhole
32	1v	11.99	24	Cir	125.00	135.33	136.15	0.656	137.53	137.82	0.29	138.10	31	Manhole
33	1t	10.70	24	Cir	45.00	136.15	137.31	2.578	138.10	138.48	n/a	139.21 j	32	Grate
34	1al	2.06	18	Cir	31.00	135.33	135.58	0.806	137.53*	137.54*	0.02	137.56	31	Grate
35	6F	2.01	18	Cir	30.00	135.22	135.27	0.167	137.21*	137.22*	0.02	137.24	30	Manhole
36	6ad	0.93	18	Cir	33.00	135.37	135.71	1.030	137.24*	137.24*	0.00	137.24	35	Grate
37	6ab	0.42	18	Cir	3.00	135.81	135.84	1.000	137.24	136.08	0.08	136.08	36	Grate
38	6D	1.21	10	Cir	61.00	135.37	138.90	5.787	137.24	139.39	n/a	139.39 j	35	Grate
39	6B	1.21	10	Cir	23.00	139.00	139.45	1.957	139.39	139.94	0.20	139.94	38	Grate
40	1r	2.82	18	Cir	46.00	137.41	143.03	12.217	138.48	143.67	n/a	143.67 j	33	Manhole
41	1p	2.83	18	Cir	38.00	143.13	143.42	0.763	143.70	144.06	0.24	144.06	40	Manhole
42	1n	2.83	18	Cir	16.00	143.52	143.61	0.562	144.14	144.25	n/a	144.49	41	Manhole
43	1l	2.85	18	Cir	69.00	143.61	143.95	0.493	144.49	144.59	0.07	144.67	42	Manhole
44	1j	2.88	18	Cir	99.00	144.05	153.26	9.303	144.67	153.90	0.08	153.90	43	Manhole
45	1h	2.91	12	Cir	118.00	153.36	173.43	17.008	153.90	174.16	n/a	174.16	44	Manhole
46	1f	2.92	12	Cir	45.00	173.53	174.42	1.978	174.16	175.15	n/a	175.15	45	Manhole
47	1d	0.89	10	Cir	19.00	174.42	174.61	1.000	175.15	175.03	0.16	175.03	46	Manhole
48	1b	0.90	10	Cir	36.00	174.71	175.98	3.528	175.03	176.40	n/a	176.40	47	Grate

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	1ae	2.11	12	Cir	259.00	174.52	197.00	8.680	175.15	197.62	n/a	197.62 j	46	Manhole
50	1ac	2.11	12	Cir	25.00	197.10	198.39	5.160	197.62	199.01	0.26	199.28	49	Manhole
51	8o	1.39	12	Cir	21.00	136.15	137.45	6.190	138.10	138.09	0.11	138.20	32	Manhole
52	8m	1.41	12	Cir	117.00	137.55	140.42	2.453	138.20	140.92	n/a	141.00 j	51	Manhole
53	8k	1.42	12	Cir	45.00	140.52	140.73	0.467	141.07	141.28	0.16	141.44	52	Manhole
54	8i	1.42	12	Cir	16.00	140.83	140.94	0.688	141.44	141.44	0.17	141.44	53	Manhole
55	8g	1.44	12	Cir	110.00	141.04	145.08	3.673	141.44	145.59	0.15	145.59	54	Manhole
56	8e	1.44	12	Cir	15.00	145.18	145.79	4.067	145.59	146.30	n/a	146.30	55	Manhole
57	8c	1.44	12	Cir	6.00	145.89	145.94	0.833	146.36	146.45	0.20	146.45	56	Grate
58	1aa	2.11	10	Cir	4.00	198.48	198.50	0.500	199.31	199.33	0.23	199.57	50	Grate
59	1aj	0.77	12	Cir	3.00	137.41	137.47	2.000	139.21*	139.21*	0.01	139.23	33	Grate

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	18.00	0.00	2.74	0.00	0.00	2.60	0.0	6.0	4.6	12.05	7.43	6.82	18	0.50	141.77	141.86	143.69	143.93	143.27	147.86	2M
2	1	71.00	0.00	0.42	0.00	0.00	0.40	0.0	5.0	4.9	1.96	3.02	3.59	10	1.90	141.86	143.21	144.64	145.21	147.86	150.44	3D
3	2	5.00	0.42	0.42	0.95	0.40	0.40	5.0	5.0	4.9	1.96	3.10	4.03	10	2.00	144.59	144.69	145.41	145.32	150.44	150.31	3B
4	1	107.00	0.00	2.32	0.00	0.00	2.20	0.0	5.7	4.7	10.38	7.39	5.88	18	0.50	141.86	142.39	144.64	145.69	147.86	154.54	2K
5	4	96.00	0.00	1.89	0.00	0.00	1.80	0.0	5.6	4.7	8.52	13.21	14.37	12	13.75	147.30	160.50	147.88	161.49	154.54	165.61	2I
6	5	9.00	0.03	0.03	0.95	0.03	0.03	5.0	5.0	4.9	0.14	8.64	0.26	10	15.56	160.60	162.00	163.32	163.32	165.61	163.61	2af
7	4	10.00	0.43	0.43	0.95	0.41	0.41	5.0	5.0	4.9	2.01	6.53	7.52	10	8.90	147.30	148.19	147.62	148.82	154.54	154.29	2ah
8	5	83.00	0.00	1.86	0.00	0.00	1.77	0.0	5.4	4.8	8.49	13.16	11.18	12	13.66	160.60	171.94	161.49	172.93	165.61	181.34	2G
9	8	17.00	0.00	1.86	0.00	0.00	1.77	0.0	5.3	4.8	8.51	17.66	11.20	12	24.59	172.04	176.22	172.93	177.21	181.34	182.17	2E
10	9	142.00	0.00	1.70	0.00	0.00	1.62	0.0	5.1	4.9	7.89	11.41	10.38	12	10.27	176.32	190.90	177.21	191.88	182.17	195.72	2C
11	10	54.00	1.40	1.40	0.95	1.33	1.33	5.0	5.0	4.9	6.54	11.37	8.65	12	10.19	191.00	196.50	191.88	197.47	195.72	199.80	2A
12	9	16.00	0.16	0.16	0.95	0.15	0.15	5.0	5.0	4.9	0.75	3.14	1.37	10	2.06	176.32	176.65	179.04	179.06	182.17	180.65	2ad
13	10	17.00	0.30	0.30	0.95	0.29	0.29	5.0	5.0	4.9	1.40	1.68	2.57	10	0.59	191.00	191.10	193.46	193.53	195.72	195.44	2ab
14	End	35.00	0.00	1.34	0.00	0.00	1.27	0.0	5.4	4.8	6.12	3.13	7.79	12	0.77	141.98	142.25	143.66	144.69	145.00	148.29	4J
15	14	37.00	0.24	0.24	0.95	0.23	0.23	5.0	5.0	4.9	1.12	2.36	2.06	10	1.16	142.25	142.68	145.63	145.72	148.29	146.38	4ad
16	14	31.00	0.00	1.10	0.00	0.00	1.05	0.0	5.3	4.8	5.05	5.00	6.43	12	1.97	142.25	142.86	145.63	146.25	148.29	148.92	4H
17	16	62.00	0.00	0.85	0.00	0.00	0.81	0.0	5.1	4.9	3.95	5.61	5.03	12	2.48	142.96	144.50	146.87	147.64	148.92	151.30	4F
18	17	5.00	0.24	0.85	0.95	0.23	0.81	5.0	5.1	4.9	3.95	2.25	5.03	12	0.40	144.60	144.62	147.99	148.05	151.30	161.25	4D
19	18	33.00	0.61	0.61	0.95	0.58	0.58	5.0	5.0	4.9	2.85	11.61	8.45	12	10.64	158.25	161.76	158.59	162.48	161.25	167.88	4B
20	16	4.00	0.25	0.25	0.95	0.24	0.24	5.0	5.0	4.9	1.17	4.10	2.14	10	3.50	142.96	143.10	146.87	146.88	148.92	148.92	4ab
21	End	138.00	0.00	13.72	0.00	0.00	9.13	0.0	27.4	2.2	19.93	78.26	2.87	36	1.38	1.64	3.54	6.20	6.31	5.00	9.84	YB2-ai
22	21	171.00	0.00	13.72	0.00	0.00	9.13	0.0	26.8	2.2	20.22	78.68	4.49	36	1.39	3.54	5.92	6.33	7.36	9.84	15.10	YB2-ag

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 37.51 / (Inlet time + 7.70) ^ 0.80; Return period =Yrs. 100 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	22	124.00	0.96	13.72	1.00	0.96	9.13	5.0	26.5	2.2	20.34	79.66	7.90	24	12.40	5.91	21.29	7.36	22.91	15.10	27.90	Exist4
24	23	122.00	1.83	12.76	1.00	1.83	8.17	5.0	26.3	2.2	18.29	53.75	10.40	18	26.20	21.29	53.25	23.75	54.70	27.90	58.10	Exist2
25	24	52.50	0.07	10.93	1.00	0.07	6.34	5.0	26.2	2.2	14.23	50.95	8.23	18	23.54	53.25	65.61	54.70	67.00	58.10	78.70	YB1-l
26	25	105.00	0.04	10.86	1.00	0.04	6.27	5.0	26.1	2.2	14.11	52.51	16.73	18	25.00	72.18	98.43	72.71	99.81	78.70	113.20	YB1-j
27	26	49.20	0.09	10.82	1.00	0.09	6.23	5.0	26.0	2.3	14.03	54.23	16.99	18	26.67	108.27	121.39	108.79	122.77	113.20	134.50	YBI1-h
28	27	15.40	0.09	10.73	1.00	0.09	6.14	5.0	26.0	2.3	13.84	48.46	15.90	18	21.30	131.23	134.51	131.78	135.89	134.50	145.30	YB1-f
29	28	73.00	0.00	10.64	0.00	0.00	6.05	0.0	25.8	2.3	13.70	17.95	6.05	24	0.63	134.51	134.97	135.89	136.30	145.30	144.10	1bb
30	29	51.00	0.00	10.64	0.00	0.00	6.05	0.0	25.7	2.3	13.76	15.84	5.08	24	0.49	134.97	135.22	136.63	136.78	144.10	141.26	1z
31	30	23.00	0.00	10.18	0.00	0.00	5.62	0.0	25.6	2.3	12.79	15.64	4.09	24	0.48	135.22	135.33	137.21	137.27	141.26	140.63	1x
32	31	125.00	0.00	9.74	0.00	0.00	5.20	0.0	25.0	2.3	11.99	18.32	4.05	24	0.66	135.33	136.15	137.53	137.82	140.63	144.20	1v
33	32	45.00	4.07	7.81	0.80	3.26	4.62	5.0	24.9	2.3	10.70	36.31	4.51	24	2.58	136.15	137.31	138.10	138.48	144.20	143.15	1t
34	31	31.00	0.44	0.44	0.95	0.42	0.42	5.0	5.0	4.9	2.06	9.43	1.16	18	0.81	135.33	135.58	137.53	137.54	140.63	142.88	1al
35	30	30.00	0.00	0.46	0.00	0.00	0.44	0.0	6.1	4.6	2.01	4.29	1.14	18	0.17	135.22	135.27	137.21	137.22	141.26	141.26	6F
36	35	33.00	0.11	0.20	0.95	0.10	0.19	5.0	5.0	4.9	0.93	10.66	0.53	18	1.03	135.37	135.71	137.24	137.24	141.26	140.12	6ad
37	36	3.00	0.09	0.09	0.95	0.09	0.09	5.0	5.0	4.9	0.42	10.50	1.28	18	1.00	135.81	135.84	137.24	136.08	140.12	140.12	6ab
38	35	61.00	0.00	0.26	0.00	0.00	0.25	0.0	5.1	4.9	1.21	5.27	2.92	10	5.79	135.37	138.90	137.24	139.39	141.26	147.52	6D
39	38	23.00	0.26	0.26	0.95	0.25	0.25	5.0	5.0	4.9	1.21	3.06	4.24	10	1.96	139.00	139.45	139.39	139.94	147.52	145.45	6B
40	33	46.00	0.00	3.22	0.00	0.00	1.21	0.0	24.6	2.3	2.82	36.71	3.01	18	12.22	137.41	143.03	138.48	143.67	143.15	159.97	1r
41	40	38.00	0.00	3.22	0.00	0.00	1.21	0.0	24.5	2.3	2.83	9.17	4.26	18	0.76	143.13	143.42	143.70	144.06	159.97	158.57	1p
42	41	16.00	0.00	3.22	0.00	0.00	1.21	0.0	24.4	2.3	2.83	7.88	4.02	18	0.56	143.52	143.61	144.14	144.25	158.57	158.45	1n
43	42	69.00	0.00	3.22	0.00	0.00	1.21	0.0	24.1	2.4	2.85	7.37	3.29	18	0.49	143.61	143.95	144.49	144.59	158.45	155.52	1l
44	43	99.00	0.00	3.22	0.00	0.00	1.21	0.0	23.7	2.4	2.88	32.03	4.08	18	9.30	144.05	153.26	144.67	153.90	155.52	160.41	1j

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 37.51 / (Inlet time + 7.70) ^ 0.80; Return period =Yrs. 100 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
45	44	118.00	0.00	3.22	0.00	0.00	1.21	0.0	23.3	2.4	2.91	14.69	5.69	12	17.01	153.36	173.43	153.90	174.16	160.41	180.63	1h
46	45	45.00	0.00	3.22	0.00	0.00	1.21	0.0	23.2	2.4	2.92	5.01	5.17	12	1.98	173.53	174.42	174.16	175.15	180.63	180.67	1f
47	46	19.00	0.00	1.20	0.00	0.00	0.36	0.0	22.2	2.5	0.89	2.19	2.51	10	1.00	174.42	174.61	175.15	175.03	180.67	188.86	1d
48	47	36.00	1.20	1.20	0.30	0.36	0.36	22.0	22.0	2.5	0.90	4.11	3.97	10	3.53	174.71	175.98	175.03	176.40	188.86	179.98	1b
49	46	259.00	0.00	2.02	0.00	0.00	0.85	0.0	22.1	2.5	2.11	10.49	4.08	12	8.68	174.52	197.00	175.15	197.62	180.67	202.68	1ae
50	49	25.00	0.00	2.02	0.00	0.00	0.85	0.0	22.0	2.5	2.11	8.09	4.63	12	5.16	197.10	198.39	197.62	199.01	202.68	203.30	1ac
51	32	21.00	0.00	1.93	0.00	0.00	0.58	0.0	23.5	2.4	1.39	8.86	2.20	12	6.19	136.15	137.45	138.10	138.09	144.20	144.45	8o
52	51	117.00	0.00	1.93	0.00	0.00	0.58	0.0	22.8	2.4	1.41	5.58	3.10	12	2.45	137.55	140.42	138.20	140.92	144.45	149.42	8m
53	52	45.00	0.00	1.93	0.00	0.00	0.58	0.0	22.6	2.5	1.42	2.43	3.22	12	0.47	140.52	140.73	141.07	141.28	149.42	150.73	8k
54	53	16.00	0.00	1.93	0.00	0.00	0.58	0.0	22.5	2.5	1.42	2.95	3.21	12	0.69	140.83	140.94	141.44	141.44	150.73	149.94	8i
55	54	110.00	0.00	1.93	0.00	0.00	0.58	0.0	22.1	2.5	1.44	6.82	4.21	12	3.67	141.04	145.08	141.44	145.59	149.94	151.08	8g
56	55	15.00	0.00	1.93	0.00	0.00	0.58	0.0	22.0	2.5	1.44	7.18	4.19	12	4.07	145.18	145.79	145.59	146.30	151.08	151.79	8e
57	56	6.00	1.93	1.93	0.30	0.58	0.58	22.0	22.0	2.5	1.44	3.25	3.81	12	0.83	145.89	145.94	146.36	146.45	151.79	185.24	8c
58	50	4.00	2.02	2.02	0.42	0.85	0.85	22.0	22.0	2.5	2.11	1.55	3.88	10	0.50	198.48	198.50	199.31	199.33	203.30	203.70	1aa
59	33	3.00	0.52	0.52	0.30	0.16	0.16	5.0	5.0	4.9	0.77	5.04	0.98	12	2.00	137.41	137.47	139.21	139.21	143.15	143.21	1aj

YBI-Southgate | Number of lines: 59 | Run Date: 7/19/2019

NOTES:Intensity = 37.51 / (Inlet time + 7.70) ^ 0.80; Return period =Yrs. 100 ; c = cir e = ellip b = box

RESOLUTION NO. _____

[Outfall Agreement Between Treasure Island Development Authority and the State of California]

RESOLUTION AUTHORIZING THE TREASURE ISLAND DIRECTOR TO EXECUTE AN AGREEMENT FOR SHARING MAINTENANCE COST OF STATE HIGHWAY OUTFALL (FOR THE SOUTHGATE ROAD REALIGNMENT PROJECT) BETWEEN THE TREASURE ISLAND DEVELOPMENT AUTHORITY AND THE STATE OF CALIFORNIA

WHEREAS, The Former Naval Station Treasure Island on Treasure Island and Yerba Buena Island (together, the "Base") was selected for closure and disposition by the Base Realignment and Closure Commission in 1993, acting under Public Law 101-510, and its subsequent amendments; and,

WHEREAS, Under the Treasure Island Conversion Act of 1997, which amended Section 33492.5 of the California Health and Safety Code and added Section 2.1 to Chapter 1333 of the Statutes of 1968 (the “Act”), the California Legislature (i) designated the Authority as a redevelopment agency under California redevelopment law with authority over the Base upon approval of the City’s Board of Supervisors, and (ii) with respect to those portions of the Base which are subject to Tidelands Trust, vested in the Authority the authority to administer the public trust for commerce, navigation and fisheries as to such property; and,

WHEREAS, The Treasure Island Transportation Management Act of 2008 (“AB 981”) authorized the creation or designation of a Treasure Island-specific transportation management agency for Treasure Island, and authorized the Board of Supervisors of the City and County of San Francisco (“BOS”) to designate a board or agency to act as a transportation management agency for Treasure Island; and,

WHEREAS, In April and June 2011, the TIDA Board and the BOS approved numerous transactions and entitlement documents related to the Project, including the Treasure Island Transportation Implementation Plan (“TITIP”); and,

WHEREAS, The San Francisco County Transportation Authority ("SFCTA") is the congestion management agency for San Francisco, and the SFCTA has an ongoing, positive relationship with TIDA, including planning, design and implementation of the Treasure Island/Yerba Buena Island Ramps Project (the "Project"); and,

WHEREAS, The Project included constructing new westbound on- and off-ramps (on the east side of YBI) to the new Eastern Span of the San Francisco-Oakland Bay Bridge and seismically retrofitting or reconstructing the YBI Westside Bridges; and,

WHEREAS, In July 2013 the TIDA Board of Directors approved two memoranda of agreement between TIDA and the SFCTA ("MOA"), (I) one for design and Right of Way Services, and (II) one to complete the Construction Phases of the Yerba Buena Island Ramps Improvement Projects, authorizing the SFCTA to take actions necessary to satisfy right of way certification conditions and provide project management and administrative services during the construction phase for the Project; and,

WHEREAS, The SFCTA has assumed responsibility for the completion of the YBI Southgate Road Realignment Improvements ("Southgate Project") which convey traffic to the now completed new westbound on- and off-ramps; and,

WHERAS, in May 2019, the TIDA Board of Directors approved amendments to the two aforementioned MOAs to incorporate the Southgate Project to the overall scope of Yerba Buena Island Ramps Improvement Projects; and,

WHEREAS, the design of the Southgate Project calls for the conveyance of storm water runoff generated within the local jurisdiction to an existing storm drain system and outfall owned and maintained by the California Department of Transportation ("Caltrans, or the State, or the State of California") for draining storm water runoff from the Bay Bridge Highway to San Francisco Bay; and,

WHEREAS, Caltrans has reviewed and approved the Southgate Project design and associated storm water drainage report and issued an encroachment permit to SFCTA to construct the Southgate Project on November 26, 2019; and,

WHEREAS, as part of Caltrans approval and as part of the process for determine maintenance and ownership of the Southgate Project, TIDA must enter into an agreement ("Outfall Agreement") with Caltrans to allow local storm water runoff within the Southgate Project to be discharged via the existing Caltrans drainage system including the existing outfall to the Bay; and;

WHEREAS, the approved project drainage report has studied and determined the tributary areas and contributing flows to the existing Caltrans drainage system and the outfall, and the cost share of the maintenance of the outfall structure as described in the Outfall Agreement is based on the contributing flows accordingly; and.

WHEREAS, the Outfall Agreement as presented shows TIDA's cost share is set at 57.4% of the total cost of the maintenance for the existing Caltrans outfall, and Caltrans is responsible for maintenance of the outfall in accordance to applicable standards and will invoice TIDA periodically for TIDA's share of the maintenance cost accordingly; and be it;

RESOLVED, That the TIDA Board of Directors hereby approves the Agreement for Sharing Maintenance Cost for State Highway Outfall (for the Southgate Road Realignment Project) between Treasure Island Development Authority and the State of California in substantially the form attached hereto as Exhibits A; and, be it

FURTHER RESOLVED, That the TIDA Board of Directors hereby authorizes the Treasure Island Director to enter into any additions, amendments or other modifications to the Outfall Agreement that the Treasure Island Director determines in consultation with the City Attorney are in the best interests of the Authority, that do not materially increase the obligations or liabilities of the Authority, that do not materially reduce the rights of the

Authority, and are necessary or advisable to complete the preparation and approval of the Outfall Agreement, such determination to be conclusively evidenced by the execution and delivery by the Treasure Island Director of the documents and any amendments thereto.

CERTIFICATE OF SECRETARY

I hereby certify that I am the duly elected Secretary of the Treasure Island Development Authority, a California nonprofit public benefit corporation, and that the above Resolution was duly adopted and approved by the Board of Directors of the Authority at a properly noticed meeting on May 8, 2023.

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Mark Dunlop, Secretary