APPENDIX H1:
EBPSP PRELIMINARY HYDROLOGY



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PRELIMINARY HYDROLOGY STUDY FOR ONTARIO RANCH

CITY OF ONTARIO
CALIFORNIA

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EXECUTIVE SUMMARY

This report has been prepared to support the conceptual design for the Ontario Ranch project, located in the City of Ontario. The project is located within the City of Ontario's Master Drainage Plan (MDP). The project proposes to construct four segments of the MDP storm drain facilities. These facilities are located in Walker Avenue, Grove Avenue, Bon View Avenue, and Campus Avenue between Eucalyptus Avenue and Edison Avenue. The purpose of this report is to provide documentation that the conceptual design for the project is in compliance with the Master Drainage Plan.

The project site is broken up into four main watersheds, each one tributary to a proposed mainline storm drain system. Each watershed area is documented in a separate section of this report. The following table documents the report sections and storm drain systems:

Report Section	Storm Drain Facility Name	Street Location	City of Ontario Master Drainage Plan Facility Name
Section C	Walker Storm Drian System	Walker Avenue	WLKR-XII-1
Section D	Grove Storm Drain System	Grove Avenue	GROV-XIII-1
Section E	Bon View Storm Drain System	Bon View Avenue	BNVW-XIV-1
Section F	Campus Storm Drain System	Campus Avenue	MERL-XIV-2

In order to demonstrate compliance, this report utilizes four compliance points for comparison, located at the downstream end of each proposed mainline storm drain system. The design flow rates from the Master Drainage Plan were compared to the proposed flow rates calculated within this report.

The findings of the analysis are that the Grove Storm Drain and Bon View Storm Drain have proposed flow rates lower than the MDP design flow rates. The Walker Storm Drain and Campus Storm Drain have flow rates less than 5% higher than the MDP design flow rates. This increase can be considered negligible and is within the acceptable hydrology error tolerance. Therefore, the conclusion is that project will be compliant with the Master Drainage Plan.

SECTION A

INTRODUCTION

A.1 PURPOSE AND SCOPE

The purpose of this study is to perform a preliminary hydrology assessment of the conceptual design for the Ontario Ranch development. This report demonstrates that the project can be developed to mitigate increased runoff impacts and maintain consistency with the City of Ontario Master Drainage Plan (MDP) to the maximum extent practicable

The scope of the study includes the following:

1. Determine the design MDP flow rates for each mainline storm drain system.
2. Assess compliance requirements for each discharge point.
3. Analyze four distinct tributary areas based on ultimate discharge points.
4. Calculate required storage volumes and mitigated outflow rates.
5. Demonstrate regulatory compliance for each tributary area.
6. Preparation of a hydrology and hydraulics report, which consists of hydrological and analytical results and exhibits.

A.2 PROJECT SITE AND DRAINAGE AREA OVERVIEW

Ontario Ranch is a proposed development in the City of Ontario, County of San Bernardino. The project site is bounded by Campus Avenue to the west, Walker Avenue to the east, Edison Avenue to the north, and Eucalyptus Avenue to the south. A Vicinity Map has been included as Figure 1. The overall project area is approximately 400 acres.

The project site is being developed with a residential development in the northern portion, commercial/industrial developments in the southern portion, and a park along the center which separates the residential and commercial/industrial areas. The following notes are provided about the land uses:

1. The MDP models Mixed Use land uses as Commercial, so a singular hatch representation has been used for both on the figures.
2. The residential areas are modeled as 11+ du/ac in the MDP, as apartments in the Fuscoe Report. The hydrology manuals calls this land use type as 10+ du/ac. All three labels have the same impervious fraction and runoff index values in the hydrology manual.

The City of Ontario Master Drainage Plan Land Use Map has been included in Excerpt D. A figure showing the MDP land uses and the project boundary has been included as Figure 2. A figure showing the proposed land use for Ontario Ranch has been included as Figure 3.

The existing condition within the project site boundary consists of dairy farms and undeveloped areas. The existing topography is relatively flat with a north-to-south sheet flow drainage pattern.

The project site is located within three City of Ontario Master Drainage Plan (MDP) areas: Area XII, Area XIII, and Area XIV. The MDP areas and project boundary are shown on Figure 4. The MDP area boundaries are shown on the MDP Hydrology Map and the MDP Planned Facilities Map, included as Excerpt B and Excerpt C.

The project proposes to construct portions of four MDP facilities: WLKR-XII-1 located in Walker Avenue, GROV-XIII-1 located in Grove Avenue, BNVW-XIV-1 located in Bon View Avenue, and MERL-XIV-2 located in Campus Avenue. This report is organized with four sections, one for each of the proposed MDP systems. The location of the proposed MDP facilities is shown on Figure 7. The MDP Planned Facilities Map is included as Excerpt C.

The City of Ontario Master Drainage Plan was completed by Hunsaker and Associates with updates in 2017 (Reference 2). The MDP was used to establish compliance information for the storm drain systems in Campus, Bon View, and Grove. Excerpts from the MDP are included in Excerpt B through Excerpt E.

In 2021, JLC Engineering prepared a report for the Merrill Commerce Center (MCC) which remodeled the MDP and assessed the Merrill Commerce Center Development (Reference 3). This report was approved in 2022. The MCC development is located to the south and east of the Ontario Ranch project site. The MCC report remodeled the MDP facilities, including the segment of the Walker storm drain located downstream of the Ontario Ranch project site. The MCC analysis of the MDP included revisions to the watershed boundaries. These revisions are shown on Figure 5. The MCC analysis of the MDP was used to establish compliance information for the storm drain system in Walker. Excerpts from the Merrill Commerce Center have been included in Expert F.

This report assumes that all downstream MDP mainline systems will be in place at the time Ontario Ranch begins constructions. The downstream systems are shown on Figure 7. The following table documents the downstream systems:

Table A.1 Downstream Systems

Storm Drain System Name	Downstream System Name	Approval/Construction Status	Plans Location
Walker Storm Drian System	Line C per PM-20273	Approved Constructed or In Construction	Excerpt H
Grove Storm Drain System	Line C per PM-20537	Approved Constructed or In Construction	Excerpt I
Bon View Storm Drain System	Line D per PM-20161	In Review or Approved	Excerpt J
Campus Storm Drain System	Line E per PM-20517	In Review or Approved	Excerpt K

The downstream systems for the Walker and Grove storm drains are approved and either constructed on in construction. The downstream systems for Bon View and Campus are currently either in review or approved, and it is expected that they will be in place at the time when Ontario Ranch is constructed.

A.3 REGULATORY FRAMEWORK AND COMPLIANCE STRATEGY

In order to demonstrate compliance with the Master Drainage Plan, the proposed flow rate for each mainline storm drain system will be compared to the MDP design flow rate. The downstream end of each mainline system, at Eucalyptus Avenue, is being used as the compliance point for comparison. The compliance points are shown on Figure 8 and documented in the table below.

Table A.1: Compliance Point Documentation

Storm Drain System Name	Street Location	City of Ontario Master Drainage Plan Facility Name	Compliance Source	Design Flow Rate (ft^3/s)
Walker Storm Drian System	Walker Avenue	WLKR-XII-1	MDP-MCC*	928
Grove Storm Drain System	Grove Avenue	GROV-XIII-1	MDP	1050
Bon View Storm Drain System	Bon View Avenue	BNVW-XIV-1	MDP	746
Campus Storm Drain System	Campus Avenue	MERL-XIV-2	MDP	124

*MDP-MCC=Merrill Commerce Center analysis of the Master Drainage Plan

The flow rates noted in the table above were used to as the design flow rates for comparison with the proposed project outflow rates. This was done in order to demonstrate that the project is in compliance with the City of Ontario Master Drainage Plan.

The following method was used to establish mitigation criteria:

1. Establish the design flow rate per the Master Drainage Plan
2. Create a rational method model for the mainline system which includes all unmitigated tributary areas.
3. Create a rational method model and unit hydrograph model for the onsite area which will be mitigated. Perform a storage analysis to determine the mitigated flowrate leaving this area.
4. Calculate the sum the flow rates from Step 2 and Step 3 to calculate a proposed flow rate at the downstream end of proposed mainline system. This is a conservative

approach since it does not take into consideration any potential differences in timing between the two peak flow rates.

5. Evaluate how the proposed downstream flow rate compares to the design flow rate from the MDP.

SECTION B

METHODOLOGY

B.1 HYDROLOGIC ANALYSIS METHOD

The analysis prepared for this report is broken into four separate analyses and sections based on the four mainline systems being assessed. A rational method analysis was prepared for each of the mainline systems which confluences the various areas tributary to the mainline system. The table below documents the different types of areas tributary to the mainline, listed approximately from north to south.

Table B.1 Mainline System Tributary Areas

Area Description	Onsite or Offsite	Location in Mainline	Source for information
Area upstream of the project site	Offsite	Upstream end of the mainline, at Edison Avenue	City of Ontario MDP
Residential Area and Northern Portion of Park Area	Onsite	Northern portion	Fuscoe Engineering
Southern Portion of Park Area	Onsite	Middle portion	This report
Commercial Area, unmitigated	Onsite	Southern portion	This report
Commercial Area, mitigated	Onsite	Southern portion	This report
Street areas adjacent to project site	Offsite	Southern portion	This report
East/West MDP area (1)	Offsite	Southern portion	City of Ontario MDP

(1) East/West MDP area is only applicable to the Walker and Campus storm drain systems.

The following method was used to create a rational method for each mainline system:

1. Define a flow rate and time of concentration at the upstream end of the mainline based on the City of Ontario Master Drainage Plan
2. Use a mix of pipe flow, confluences, and initial areas to add the following into the model throughout the system:
    a. Results from the rational method model for the onsite residential area. This will be a user defined entry.
    b. Create an initial area for the onsite park area
    c. Create an initial area for the unmitigated onsite commercial area.
    d. Create an initial area for the street areas adjacent to the project site, if not included in another area.

e. Values from the Master Drainage Plan for the area to the east/west of the mainline. This applies only to the Walker storm drain and Campus storm drain. This will be a user defined entry.

A rational method analysis and unit hydrograph analysis were prepared separately for the onsite commercial area which is being mitigated. A storage analysis was performed on these areas to determine the proposed mitigated outflow. The following process was used for the storage analysis:

1. Storage volumes for each basin were provided as part of the conceptual plan for the project site.
2. The unit hydrograph was assessed to determine the location and magnitude of the peak flow.
3. Two time steps were determined, one before the peak flow rate and one after the peak flow rate. The cumulative volume and flow rate at each time step were noted.
    a. The difference in cumulative volume between the two time steps was checked to ensure that the volume was less than or equal to the conceptual volumes for the basins.
    b. The higher of the two flow rates was used as the mitigated outflow rate.

A graphical representation of the above process has been included as Figure 10. A detailed basin routing analysis will be performed during final engineering when comprehensive data is available for the proposed design. This storage calculation does not take into account storage requirements needed for the storage and treatment of the water quality volume. The water quality treatment will be assessed by a future Water Quality Management Plan (WQMP). The storage analysis is based on a unit hydrograph calculation; therefore it is not possible to confluence the mitigated outflows into the mainline rational method analysis.

The onsite residential areas were assessed by Fuscoe Engineering. Excerpts from the Fuscoe Engineering analysis are included in Excerpt G. JLC recreated the models for the areas with the following notes:

1. All model data, including elevations, areas, flow lengths, land use, and soils were not changed.
2. Fuscoe Engineering models contained multiple streams that were not confluenced. JLC separated each stream into its own model.
3. The rainfall values were changed to match the rainfall values per the City of Ontario Master Drainage Plan. The Fuscoe Engineering models used rainfall from NOAA Atlas 14. This change was made to be in compliance with the Master Drainage Plan.

The onsite park and commercial areas were assessed using simple models consisting of initial areas, pipe flows, and add areas. The project does not have conceptual grading at this time or an onsite storm drain design, so the following assumptions were made:

1. The longest flow path was assumed.
2. Elevations were based on a slope of 1%. This is to ensure surfaces drain appropriately.
3. A single inlet was assumed for each area. The hydrology does not account for all potential inlets or storm drain laterals.

B.2 HYDROLOGIC PARAMETERS

The San Bernardino County Hydrology Manual (Reference 1) and the MDP Hydrology (Reference 2) were used to develop the hydrological parameters for the hydrology analyses. The rational method and unit hydrograph method were used for the analyses and the computations were performed using the computer program developed by Civil Cadd/Civil Design.

Rainfall depths were obtained from the City of Ontario Master Drainage Plan analysis. The rainfall depths used in the hydrology calculations are as follows:

Table B.2 Rainfall Information

Storm Event & Duration	Rainfall (inches)
10-Year, 1-Hour	0.8
100-Year, 1-Hour	1.2
100-Year, 6-Hour	3.00
100-Year, 24-Hour	6.00
Slope of Intensity	0.6

The existing soil classification for the project site consists of Hydraulic Soil Groups "A", "B", and "C", as shown in Excerpt A. Excerpt A is a Soils Map obtained from the National Resource Conservation Service Websoil Survey.

The hydrology calculations were performed for the 100-year storm event. And Antecedent Moisture Condition of II was used for the calculations to remain consistent with the City of Ontario Master Drainage Plan analysis.

A land cover type of "Commercial" was used for the commercial and street areas. A land cover type of "Park" was used for the proposed park area. The following table documents the land uses parameters:

Table B.3 Land Use Information

Land Use	Runoff Index (for AMC II)				Impervious Ratio	Pervious Ratio
	Soil A	Soil B	Soil C	Soil D		
Commercial	32	56	69	75	0.9	0.1
Park	32	56	69	75	0.15	0.85

SECTION C

WALKER AVENUE STORM DRAIN

C.1 DRAINAGE AREA CHARACTERISTICS

The project proposes to construct the portion of the MDP system WLKR-XII-1 located on Walker Avenue between Eucalyptus Avenue and Edison Avenue. Within this report, the system is referred to as the Walker Ave Storm Drain or Walker Storm Drain system.

The tributary area to the Walker storm drain consists of the areas to the east and west of Walker Avenue and is bounded by Edison Avenue to the north and Eucalyptus Avenue to the south.

The onsite areas tributary to the Walker storm drain differs from the Master Drainage Plan areas within the project site. All changes to watershed boundary areas are located within the project site area. The project proposes mitigation measures and documentation to demonstrate that the project is consistent with the MDP at the downstream compliance points. Figure 6 shows the revised watershed boundaries. The following table documents the difference

Table C.1 Walker Storm Drain Tributary Area

Land Cover	Area Increase or Decrease (acres)
Residential/Park (Fuscoe Report)	Increase 19.9 (from Grove)
Commercial	Increase 1.6 (from Grove) Decrease 4.6 (to Grove)

Overall, there is an increase of 16.9 acres of area that's being redirected to the Walker storm drain. The approved Merrill Commerce Center analysis of the MDP included area changes within the MCC project site, as shown on Figure 5. However, during final engineering for the Grove storm drain, this boundary was revised and 21.2 acres was diverted from the Walker watershed to the Grove watershed. This change was allowable since the area is tributary to a proposed basin which provides increased runoff mitigation. The mainline system in Walker per MCC, which is downstream of the proposed Walker storm drain per this report, is designed based on a flow rate that assumes this 21.2 acres of area in tributary.

The Walker storm drain discharges into the approved MDP system located in Eucalyptus Avenue. The downstream system is shown on Figure 7. The downstream storm drain is constructed or in construction based on approved storm drain improvement plans. The downstream storm drain is referred to as Line C per PM-20273. The storm drain improvement plans for the downstream system are included as Excerpt H.

C.2 REGULATORY AND COMPLIANCE REQUIREMENTS

The compliance requirements for the Walker storm drain are based on Merrill Commerce Center analysis of the Master Drainage Plan (MCC-MDP). The walker storm drain discharges into a mainline system that was assessed and constructed as part of the Merrill Commerce Center. Based on the MCC-MDP analysis, the design flow rate for the Walker Storm drain at the intersection of Walker and Eucalyptus is 928 ft^3/s.

In order to assess compliance with the Master Drainage Plan, a rational method analysis was performed for the areas tributary to the mainline which are not being mitigated. A separate rational method analysis and unit hydrograph analysis were prepared for the onsite area which is being mitigated. A storage assessment was performed to determine storage requirements and the proposed mitigated outflow value.

C.3 HYDROLOGIC ANALYSIS

A rational method analysis was prepared for the mainline system and the areas tributary to the mainline which are not being mitigated. This analysis includes the offsite MDP area to the east of Walker Avenue. The offsite area matches the watershed sub-boundary per the Master Drainage Plan, so area, flow rate, and time of concentration information from the MDP was entered using a user entry command into the model. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table C.2 Mainline Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area D (excludes Area D2)	940.8	31.7

*Results have been rounded to the nearest tenth

A rational method analysis was prepared for the onsite commercial area which will be mitigated before discharging into the mainline system. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table C.3 Onsite Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area D2	53.0	10.4

*Results have been rounded to the nearest tenth

A unit hydrograph analysis was prepared for the onsite commercial area which will be mitigated. The area, runoff index value, impervious area ratio, and time of concentration from the rational method analysis were used for the unit hydrograph calculations. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table C.4 Onsite Unit Hydrograph Results

Area	Peak Flow Rate (ft^3/s)	Total Volume (ac-ft)
Area D2	48.6	7.8

*Results have been rounded to the nearest tenth

The hydrology map for the Walker Avenue storm drain is included as Exhibit A. The rerun Fuscoe engineering models, mainline rational method model, onsite commercial area rational method and unit hydrograph models are included in Appendix A.

C.4 STORAGE AND COMPLIANCE ANALYSIS

The proposed basin has a storage capacity of approximately 2.5 ac-ft. Using this value, the unit hydrograph output data was assessed to determine how much runoff could be mitigated by the basin. Two time steps were picked, one on either side of the peak flow rate, which have a difference in volume approximately equal to the proposed basin volume. The following table documents the two time steps:

Table C.5 Unit Hydrograph Values for Storage Analysis

Time (hour+min)	Volume (ac-ft)	Flow Rate (ft^3/s)	Peak Flow Rate (ft^3/s)	Volume Required (ac-ft)
T1	**V1**	**Q1**	6.5	2.43
14+45	3.61	6.47		
T2	**V2**	**Q2**		
17+00	6.04	6.28		

A more detailed basin analysis will be performed during final engineering. The above analysis does not take into account storage requirements for the water quality volume which will be addressed as part of a future WQMP.

In order to demonstrate compliance with the Master Drainage Plan, the proposed condition flow rate was compared to the MDP flow rate at the compliance point. The proposed downstream flow rate was calculated based on the sum of the mainline rational method analysis (excluding the onsite area to be mitigated) and the outflow from the mitigated onsite

area. This is a conservative approach as it does not account for potential timing differences between the peak flow rates. The proposed condition flow rate is 947.3 ft^3/s (940.8+6.5).

The MDP design flow rate at the point of compliance is 928 ft^3/s per the Merrill Commerce Center analysis of the Master Drainage Plan. The proposed condition flow rate of 947.3 ft^3/s is 19.3 ft^3/s higher than the design flow rate. This is approximately 2% of the design flow rate and can be considered negligible. Furthermore, this is within the acceptable range for hydrology error tolerances. The Regional Water Quality Board allows for 10% error on hydromodification criteria. The project site is mitigating the onsite area to the maximum extent practicable. During final engineering additional calculations will be performed to ensure no adverse impacts.

An exhibit was developed to document flow rates tributary to and along the mainline storm drain system. The Walker Avenue storm drain flow rate exhibit is included as Exhibit B. The proposed outflow values are shown on Figure 9.

C.5 FINDINGS & RECOMMENDATIONS

The hydrology analysis evaluated the tributary area to the proposed Walker Avenue Storm Drain. The following findings and recommendations have been developed based on the findings of the analysis:

1. During development of the Merrill Commerce Center, the MCC project made modifications to the Master Drainage Plan hydrology. These revisions have been approved. Due to this, the MCC report was used for compliance comparison for the Walker storm drain.
2. The compliance point being used is located at the downstream end of the proposed Walker storm drain, at the intersection of Walker Avenue and Eucalyptus Avenue.
3. The Merrill Commerce Center analysis of the Master Drainage Plan found a flow rate of 928 ft^3/s at the compliance point.
4. The proposed outflow rate from the project site is 947.3 ft^3/s at the compliance point.
5. The project is mitigating outflow to the maximum extent practicable.
6. The proposed outflow is approximately 2% higher than the MDP design flow rate. This value can be considered negligible and within acceptable error tolerance.
7. During final engineering, additional calculations will be performed to ensure no adverse impacts from the increase in flow rate.

SECTION D

GROVE AVENUE STORM DRAIN

D.1 DRAINAGE AREA CHARACTERISTICS

The project proposes to construct the portion of the MDP system GROV-XII-1 located on Grove Avenue between Eucalyptus Avenue and Edison Avenue. Within this report, the system is referred to as the Grove Ave Storm Drain or Grove Storm Drain system.

The tributary area to the grove storm drain consists of the areas to the east and west of Grove Avenue and is bounded by Edison Avenue to the north and Eucalyptus Avenue to the south.

The onsite areas tributary to the Grove storm drain differs from the Master Drainage Plan areas within the project site. All changes to watershed boundary areas are located within the project site area. The project proposes mitigation measures and documentation to demonstrate that the project is consistent with the MDP at the downstream compliance points. Figure 6 shows the revised watershed boundaries. The following table documents the difference

Table D.1 Grove Storm Drain Tributary Area

Land Cover	Area Increase or Decrease (acres)
Residential and Park (Fuscoe Report)	Decrease 19.9 (to Walker)
Commercial	Decrease 1.6 (to Walker) Increase 4.6 (from Walker) Increase 4.8 (from Bon View)

Overall this is a 12.1 acre decrease in the tributary area to the Grove Storm Drain.

The Grove storm drain discharges into the approved MDP system located in Grove Avenue. The downstream system is shown on Figure 7. The downstream storm drain is constructed or in construction based on approved storm drain improvement plans. The downstream storm drain is referred to as Line C per PM-20537. The storm drain improvement plans for the downstream system are included as Excerpt I.

D.2 REGULATORY AND COMPLIANCE REQUIREMENTS

The compliance requirements for the Grove storm drain are based on the City of Ontario Master Drainage Plan. The Grove storm drain discharges into a mainline system that was assessed and constructed based on the MDP design. Based on the MDP analysis, the design flow rate for the Grove storm drain at the intersection of Grove and Eucalyptus is 1050 ft^3/s.

In order to assess compliance with the Master Drainage Plan, a rational method analysis was performed for the areas tributary to the mainline which are not being mitigated. A separate

rational method analysis and unit hydrograph analysis were prepared for the onsite area which is being mitigated. A storage assessment was performed to determine storage requirements and the proposed mitigated outflow value.

D.3 HYDROLOGIC ANALYSIS

A rational method analysis was prepared for the mainline system and the areas tributary to the mainline which are not being mitigated. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table D.2 Mainline Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area E (excludes Area E3 and Area E4)	1001.9	33.5

*Results have been rounded to the nearest tenth

A rational method analysis was prepared for the onsite commercial area which will be mitigated before discharging into the mainline system. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table D.3 Onsite Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area E3	67.5	10.3
Area E4	77.0	10.6

*Results have been rounded to the nearest tenth

A unit hydrograph analysis was prepared for the onsite mitigated commercial area. The area, runoff index value, impervious area ratio, and time of concentration from the rational method analysis were used for the unit hydrograph calculations. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table D.4 Onsite Unit Hydrograph Results

Area	Peak Flow Rate (ft^3/s)	Total Volume (ac-ft)
Area E3	63.6	10.0
Area E4	69.7	11.2

*Results have been rounded to the nearest tenth

The hydrology map for the Grove Avenue storm drain is included as Exhibit C. The rerun Fuscoe engineering models, mainline rational method model, onsite commercial area rational method and unit hydrograph models are included in Appendix B.

D.4 STORAGE AND COMPLIANCE ANALYSIS

The project proposes two basins, one on the eastern side of Grove Avenue and one on the western side of Grove Avenue. Both basins have a proposed storage capacity of approximately 2.5 ac-ft. Rational method Area E3 is tributary to the eastern basin. Rational method Area E4 is tributary to the western basin. Using the proposed volumes, the unit hydrograph output data was assessed to determine how much runoff could be mitigated by each basin. Two time steps were picked, one on either side of the peak flow rate, which have a difference in volume approximately equal to the proposed basin volume. The following tables documents the two time steps:

Table D.5 Unit Hydrograph Values for Storage Analysis – Eastern Basin (Area E3)

Time (hour+min)	Volume (ac-ft)	Flow Rate (ft^3/s)	Peak Flow Rate (ft^3/s)	Volume Required (ac-ft)
T1	**V1**	**Q1**	10.8	2.42
15+20	5.12	10.72		
T2	**V2**	**Q2**		
16+40	7.54	10.58		

Table D.6 Unit Hydrograph Values for Storage Analysis – Western Basin (Area E4)

Time (hour+min)	Volume (ac-ft)	Flow Rate (ft^3/s)	Peak Flow Rate (ft^3/s)	Volume Required (ac-ft)
T1	**V1**	**Q1**	12.9	2.28
15+40	6.03	12.22		
T2	**V2**	**Q2**		
16+35	8.31	12.83		

A more detailed basin analysis will be performed during final engineering. The above analysis does not take into account storage requirements for the water quality volume which will be addressed as part of a future WQMP.

In order to demonstrate compliance with the Master Drainage Plan, the proposed condition flow rate was compared to the MDP flow rate at the compliance point. The proposed downstream flow rate was calculated based on the sum of the mainline rational method

analysis (excluding the onsite area to be mitigated) and the outflow from the mitigated onsite areas. This is a conservative approach as it does not account for potential timing differences between the peak flow rates. The proposed condition flow rate is 1025.6 ft^3/s (1001.9+10.8+12.9).

The design flow rate at the point of compliance is 1050 ft^3/s per the City of Ontario Master Drainage Plan. The proposed condition flow rate is less than the design flow rate. Therefore, the project is in compliance with the Master Drainage Plan

An exhibit was developed to document flow rates tributary to and along the mainline storm drain system. The Grove Avenue storm drain flow rate exhibit is included as Exhibit D. The proposed outflow values are shown on Figure 9.

D.5 FINDINGS & RECOMMENDATIONS

The hydrology analysis evaluated the tributary area to the proposed Grove Avenue Storm Drain. The following findings and recommendations have been developed based on the findings of the analysis:

1. The City of Ontario Master Drainage Plan was used to determine compliance information.
2. The compliance point being used is located at the downstream end of the proposed Grove storm drain, at the intersection of Grove Avenue and Eucalyptus Avenue.
3. The City of Ontario Master Drainage Plan defines a design flow rate of 1050 ft^3/s at the compliance point.
4. The proposed outflow rate from the project site is 1025.6 ft^3/s at the compliance point.
5. The proposed outflow is less than the design flow rate at the compliance point.
6. The project is in compliance with the Master Drainage Plan.

SECTION E

BON VIEW AVENUE STORM DRAIN

E.1 DRAINAGE AREA CHARACTERISTICS

The project proposes to construct the portion of the MDP system BNVW-XIV-1 located on Bon View Avenue between Eucalyptus Avenue and Edison Avenue. Within this report, the system is referred to as the Bon View Ave Storm Drain or Bon View Storm Drain system.

The tributary area to the Bon View storm drain consists of the areas to the east and west of Bon View Avenue and is bounded by Edison Avenue to the north and Eucalyptus Avenue to the south.

The onsite areas tributary to the Bon View storm drain differs from the Master Drainage Plan areas within the project site. All changes to watershed boundary areas are located within the project site area. The project proposes mitigation measures and documentation to demonstrate that the project is consistent with the MDP at the downstream compliance points. Figure 6 shows the revised watershed boundaries. The following table documents the difference

Table E.1 Bon View Storm Drain Tributary Area

Land Cover	Area Increase or Decrease (acres)
Commercial	Decrease 4.8 acres (to Bon View)

Overall, this is a decrease in the area tributary to the Bon View storm drain.

The Bon View storm drain discharges into the proposed MDP system located in Bon View Avenue. The downstream system is shown on Figure 7. The downstream storm drain is referred to as Line D per PM-20161. The storm drain improvement plans for the downstream system are included as Excerpt J. The storm drain plans are in review or approved. It is assumed that the downstream system will be constructed and in place prior to the construction of the Ontario Ranch project. Please note that the Bon View mainline is tributary to the Line I MDP system in the City of Chino which is not yet constructed. If the system is not constructed prior to the development of this project, the project will be required to mitigate the post-project flow rate to 80% of the pre-project flow rate.

E.2 REGULATORY AND COMPLIANCE REQUIREMENTS

The compliance requirements for the Bon View storm drain are based on the City of Ontario Master Drainage Plan. The Bon View storm drain discharges into a mainline system that was assessed and constructed based on the MDP design. Based on the MDP analysis, the design

flow rate for the Bon View storm drain at the intersection of Bon View and Eucalyptus is 746 ft^3/s.

In order to assess compliance with the Master Drainage Plan, a rational method analysis was performed for the areas tributary to the mainline which are not being mitigated. A separate rational method analysis and unit hydrograph analysis were prepared for the onsite area which is being mitigated. A storage assessment was performed to determine storage requirements and the proposed mitigated outflow value.

E.3 HYDROLOGIC ANALYSIS

A rational method analysis was prepared for the mainline system and the areas tributary to the mainline which are not being mitigated. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table E.2 Mainline Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area F (excludes Area F2 and Area F3)	719.6	29.0

*Results have been rounded to the nearest tenth

A rational method analysis was prepared for the onsite commercial area which will be mitigated before discharging into the mainline system. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table E.3 Onsite Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area F2	68.3	10.6
Area F3	30.0	9.0

*Results have been rounded to the nearest tenth

A unit hydrograph analysis was prepared for the onsite commercial area which will be mitigated. The area, runoff index value, impervious area ratio, and time of concentration from the rational method analysis were used for the unit hydrograph calculations. The analysis was performed for the 100-year storm event.

The results of the analysis are as follows:

Table E.4 Onsite Unit Hydrograph Results

Area	Peak Flow Rate (ft^3/s)	Total Volume (ac-ft)
Area F2	60.2	9.7
Area F3	29.3	4.2

*Results have been rounded to the nearest tenth

The hydrology map for the Bon View Avenue storm drain is included as Exhibit E. The rerun Fuscoe engineering models, mainline rational method model, onsite commercial area rational method and unit hydrograph models are included in Appendix C.

E.4 STORAGE AND COMPLIANCE ANALYSIS

The project proposes two basins, one on the eastern side of Bon View Avenue and one on the western side of Bon View Avenue. The eastern basin has a proposed storage capacity of 4.1 ac-ft and the western basin has a proposed storage capacity of 2.5 ac-ft. Rational method Area F2 is tributary to the eastern basin. Rational method Area F3 is tributary to the western basin. Using these values, the unit hydrograph output data was assessed to determine how much runoff could be mitigated by each basin. Two time steps were picked, one on either side of the peak flow rate, which have a difference in volume approximately equal to the proposed basin volume. The following tables document the two time steps:

TableE.5 Unit Hydrograph Values for Storage Analysis – Eastern Basin (Area F2)

Time (hour+min)	Volume (ac-ft)	Flow Rate (ft^3/s)	Peak Flow Rate (ft^3/s)	Volume Required (ac-ft)
T1	**V1**	**Q1**	6.0	4.04
13+30	3.78	5.94		
T2	**V2**	**Q2**		
17+35	7.82	5.93		

Table E.6 Unit Hydrograph Values for Storage Analysis – Western Basin (Area F3)

Time (hour+min)	Volume (ac-ft)	Flow Rate (ft^3/s)	Peak Flow Rate (ft^3/s)	Volume Required (ac-ft)
T1	**V1**	**Q1**	2.0	2.22
11+50	1.33	2.00		
T2	**V2**	**Q2**		
18+25	3.54	1.98		

A more detailed basin analysis will be performed during final engineering. The above analysis does not take into account storage requirements for the water quality volume which will be addressed as part of a future WQMP.

In order to demonstrate compliance with the Master Drainage Plan, the proposed condition flow rate was compared to the MDP flow rate at the compliance point. The proposed downstream flow rate was calculated based on the sum of the mainline rational method analysis (excluding the onsite area to be mitigated) and the outflow from the mitigated onsite areas. This is a conservative approach as it does not account for potential timing differences between the peak flow rates. The proposed condition flow rate is 727.6 ft^3/s (719.6+6.0+2.0).

The design flow rate at the point of compliance is 746.0 ft^3/s per the City of Ontario Master Drainage Plan. The proposed condition flow rate is less than the design flow rate. Therefore, the project is in compliance with the Master Drainage Plan

An exhibit was developed to document flow rates tributary to and along the mainline storm drain system. The Bon View Avenue storm drain flow rate exhibit is included as Exhibit F. The proposed outflow values are shown on Figure 9.

E.5 FINDINGS & RECOMMENDATIONS

The hydrology analysis evaluated the tributary area to the proposed Bon View Avenue Storm Drain. The following findings and recommendations have been developed based on the findings of the analysis:

1. The City of Ontario Master Drainage Plan was used to determine compliance information.
2. The compliance point being used is located at the downstream end of the proposed Bon View storm drain, at the intersection of Bon View Avenue and Eucalyptus Avenue.
3. The City of Ontario Master Drainage Plan defines a design flow rate of 746 ft^3/s at the compliance point.
4. The proposed outflow rate from the project site is 727.6 ft^3/s at the compliance point.
5. The proposed outflow is less than the design flow rate at the compliance point.
6. The project is in compliance with the Master Drainage Plan.

SECTION F

CAMPUS AVENUE STORM DRAIN

F.1 DRAINAGE AREA CHARACTERISTICS

The project proposes to construct the portion of the MDP system MERL-XIV-2 located on Campus Avenue between Eucalyptus Avenue and Edison Avenue. Within this report, the system is referred to as the Campus Ave Storm Drain or Campus Storm Drain system.

The tributary area to the Campus storm drain consists of the areas to the east and west of Campus Avenue and is bounded by Edison Avenue to the north and Eucalyptus Avenue to the south.

The onsite areas tributary to the Campus storm drain do not differ from the Master Drainage Plan areas within the project site. This is shown on Figure 6.

The Campus storm drain discharges into the proposed MDP system located in Campus Avenue. The downstream system is shown on Figure 7. The downstream storm drain is referred to as Line E per PM-20517. The storm drain improvement plans for the downstream system are included as Excerpt K. The storm drain plans are in review or approved. It is assumed that the downstream system will be constructed and in place prior to the construction of the Ontario Ranch project. Please note that the Campus mainline is tributary to the Line I MDP system in the City of Chino which is not yet constructed. If the system is not constructed prior to the development of this project, the project will be required to mitigate the post-project flow rate to 80% of the pre-project flow rate.

F.2 REGULATORY AND COMPLIANCE REQUIREMENTS

The compliance requirements for the Campus storm drain are based on the City of Ontario Master Drainage Plan. The Campus storm drain discharges into a mainline system that was assessed and constructed based on the MDP design. Based on the MDP analysis, the design flow rate for the Campus storm drain at the intersection of Campus and Eucalyptus is 124 ft^3/s.

In order to assess compliance with the Master Drainage Plan, a rational method analysis was performed for the areas tributary to the mainline which are not being mitigated. A separate rational method analysis and unit hydrograph analysis were prepared for the onsite area which is being mitigated. A storage assessment was performed to determine storage requirements and the proposed mitigated outflow value.

F.3 HYDROLOGIC ANALYSIS

A rational method analysis was prepared for the mainline system and the areas tributary to the mainline which are not being mitigated. The tributary area includes offsite area to the west of Campus Avenue. The watershed boundary for this area does not match the boundary

from the MDP, since the MDP area includes the onsite area. Initial areas were used to model the offsite area. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table F.1 Mainline Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area G (excludes Area G2)	128.0	16.0

*Results have been rounded to the nearest tenth

A rational method analysis was prepared for the onsite commercial area which will be mitigated before discharging into the mainline system. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table F.2 Onsite Rational Method Results

Area	Peak Flow Rate (ft^3/s)	Time of Concentration (min)
Area G2	31.2	8.3

*Results have been rounded to the nearest tenth

A unit hydrograph analysis was prepared for the onsite commercial area which will be mitigated. The area, runoff index value, impervious area ratio, and time of concentration from the rational method analysis were used for the unit hydrograph calculations. The analysis was performed for the 100-year storm event. The results of the analysis are as follows:

Table F.3 Onsite Unit Hydrograph Results

Area	Peak Flow Rate (ft^3/s)	Total Volume (ac-ft)
Area G2	30.8	4.2

*Results have been rounded to the nearest tenth

The hydrology map for the Campus Avenue storm drain is included as Exhibit G. The rerun Fuscoe engineering models, mainline rational method model, onsite commercial area rational method and unit hydrograph models are included in Appendix D.

F.4 STORAGE AND COMPLIANCE ANALYSIS

The proposed basin has a storage capacity of approximately 3.5 ac-ft. Using this value, the unit hydrograph output data was assessed to determine how much runoff could be mitigated by the basin. Two time steps were picked, one on either side of the peak flow rate, which have a difference in volume approximately equal to the proposed basin volume. The following table documents the two time steps:

Table F.4 Unit Hydrograph Values for Storage Analysis

Time (hour+min)	Volume (ac-ft)	Flow Rate (ft^3/s)	Peak Flow Rate (ft^3/s)	Volume Required (ac-ft)
T1	**V1**	**Q1**	1.5	2.98
8+20	0.84	1.5		
T2	**V2**	**Q2**		
20+10	3.82	1.49		

A more detailed basin analysis will be performed during final engineering. The above analysis does not take into account storage requirements for the water quality volume which will be addressed as part of a future WQMP.

In order to demonstrate compliance with the Master Drainage Plan, the proposed condition flow rate was compared to the MDP flow rate at the compliance point. The proposed downstream flow rate was calculated based on the sum of the mainline rational method analysis (excluding the onsite area to be mitigated) and the outflow from the mitigated onsite area. This is a conservative approach as it does not account for potential timing differences between the peak flow rates. The proposed condition flow rate is 129.5 ft^3/s (128.0+1.5).

The MDP design flow rate at the point of compliance is 124 ft^3/s per the City of Ontario Master Drainage Plan. The proposed condition flow rate of 129.5 ft^3/s is 5.5 ft^3/s higher than the design flow rate. This is approximately 4% of the design flow rate and can be considered negligible. Furthermore, this is within the acceptable range for hydrology error tolerances. The Regional Water Quality Board allows for 10% error on hydromodification criteria The project site is mitigating the onsite area to the maximum extent practicable. During final engineering, an analysis of the downstream systems will be performed to ensure no adverse impacts.

An exhibit was developed to document flow rates tributary to and along the mainline storm drain system. The Campus Avenue storm drain flow rate exhibit is included as Exhibit H. The proposed outflow values are shown on Figure 9.

F.5 FINDINGS & RECOMMENDATIONS

The hydrology analysis evaluated the tributary area to the proposed Campus Avenue Storm Drain. The following findings and recommendations have been developed based on the findings of the analysis:

1. The City of Ontario Master Drainage Plan was used to determine compliance information.
2. The compliance point being used is located at the downstream end of the proposed Campus storm drain, at the intersection of Campus Avenue and Eucalyptus Avenue.
3. The City of Ontario Master Drainage Plan defines a design flow rate of 124 ft^3/s at the compliance point.
4. The proposed outflow rate from the project site is 129.5 ft^3/s at the compliance point.
5. The project is mitigating outflow to the maximum extent practicable.
6. The proposed outflow is less than the design flow rate at the compliance point.
7. The project is in compliance with the Master Drainage Plan.
8. The proposed outflow is approximately 4% higher than the MDP design flow rate. This value can be considered negligible and within acceptable error tolerance.
9. During final engineering, additional calculations will be performed to ensure no adverse impacts from the increase in flow rate.

SECTION G

CONCLUSION AND REFERRENCES

G.1 CONCLUSION AND SUMMARY

The hydrology report evaluated the tributary areas to the four proposed mainline systems that will be constructed as part of the Ontario Ranch project. The following summarizes the report:

1. Ontario Ranch is a proposed development which consists of Residential, Park, and Commercial areas. The project proposes to construct portions of four City of Ontario Master Drainage Plan systems, which are located within the project site.
2. The purpose of this report is to demonstrate that the conceptual design for the mainline systems and watersheds within the project site is consistent with the City of Ontario Master Drainage Plan.
3. In order to demonstrate compliance with the Master Drainage Plan, a proposed downstream flow rate for the project site was compared to the design flow rates from the Master Drainage Plan. The comparison point is located at the downstream end of each proposed storm drain.
4. The storm drain systems in Grove Avenue, Bon View Avenue, and Campus Avenue were compared to the design flow rate from the City of Ontario Master Drainage Plan.
5. The storm drain system in Walker Avenue was compared to the design flow rate from the Merrill Commerce Center analysis of the Master Drainage Plan. This approved report remodeled a port of the MDP, including the section located downstream of the Walker storm drain.
6. Each mainline has tributary areas consisting of unmitigated onsite residential area, unmitigated onsite park area, unmitigated onsite commercial area, and mitigated onsite park area. The Walker and Campus storm drain systems have additional tributary area from the offsite area across the street from the project site.
7. The residential area and northern potion of the park area were assessed by Fuscoe Engineering. These models were rerun as a part of this report with a revision to the rainfall information to match the rainfall used in the Master Drainage Plan.
8. Proposed onsite basins will mitigate increased runoff from a portion of the commercial area. The analysis in this report does not take into consideration storage requirements for water quality.
9. One rational method analysis was prepared for the systems tributary to the mainline storm drain, excluding the onsite area which was being mitigated. A separate rational method analysis and unit hydrograph analysis were prepared for the onsite area which is being mitigated. A storage analysis was prepared for each basin to determine the mitigated outflow rate.
10. The sum of the mainline rational method and mitigated basin outflow rate was used as the proposed downstream flow rate at the compliance point. This is a conservative approach as it does not take into account any timing differences between the two flow rates.

The MDP design flow rates and the project proposed outflow rates are shown on Figure 9. The following table documents the compliance for the project:

Table G.1 Compliance Summary Table

Storm Drain System Name	Master Drainage Plan Facility Name	Compliance Source	MDP/ MDP-MCC Design Flow Rate (ft^3/s)	Proposed Flow Rate (ft^3/s)
Walker Storm Drian System	WLKR-XII-1	MDP-MCC*	928	947.3
Grove Storm Drain System	GROV-XIII-1	MDP	1050	1025.6
Bon View Storm Drain System	BNVW-XIV-1	MDP	746	727.6
Campus Storm Drain System	MERL-XIV-2	MDP	124	129.5

*MDP-MCC=Merrill Commerce Center analysis of the Master Drainage Plan

The Walker Avenue storm drain has a proposed flow rate that is 2% higher than the MDP-MCC flow rate. This can be considered negligible and within acceptable error tolerance; therefore, the proposed flow rate can be considered within reasonable compliance.

The Grove Avenue Storm Drain has a proposed flow rate that is lower than the design flow rate. Therefore, the system is in compliance with the City of Ontario Master Drainage Plan.

The Bon View Avenue Storm Drain has a proposed flow rate that is lower than the design flow rate. Therefore, the system is in compliance with the City of Ontario Master Drainage Plan.

The Campus Avenue Storm Drain has a proposed flow rate that is 4% higher than the design flow rate. This can be considered negligible and within acceptable error tolerance; therefore, the proposed flow rate can be considered within reasonable compliance.

In conclusion, this report demonstrates that the conceptual design for the Ontario Ranch project is in compliance with the City of Ontario Master Drainage Plan.

G.2 REFERENCES

1. San Bernardino Flood Control Hydrology Manual, August 1986.
2. Master Plan of Drainage, City of Ontario, June 2017
3. Merrill Avenue Commerce Center Hydrology and Hydraulics Study for Merrill Avenue Storm Drian System (WLKR-XII-1 and MERL-XI-1) PM-20273, JLC Engineering, February 2021, revised December 2021

FIGURES

FIGURE 1: VICINITY MAP

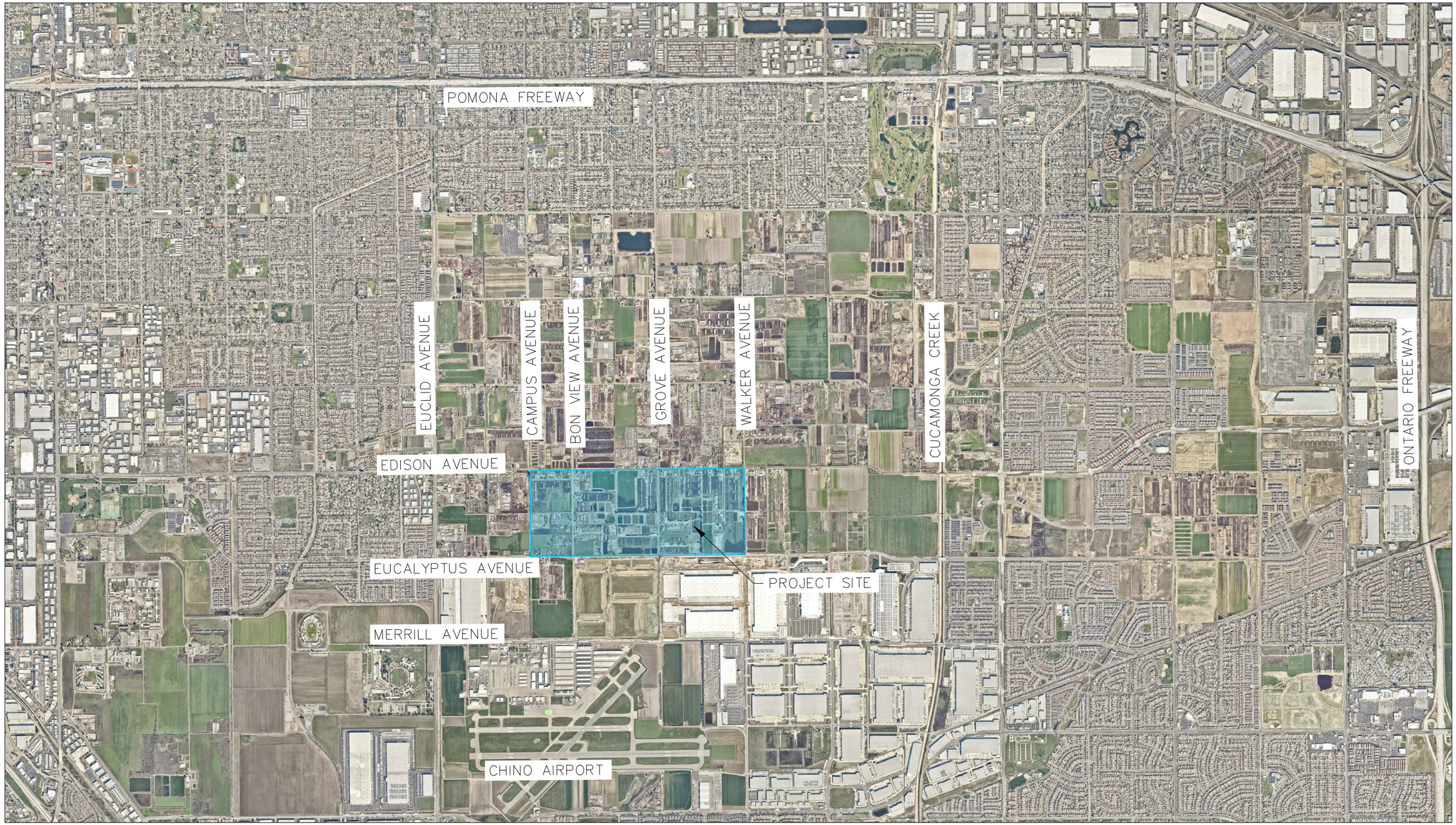

FIGURE 1 - VICINITY MAP

GRAPHIC SCALE

3000' 0 1500' 3000' 6000'

1" = 3000'

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MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

Drawing Name: O:\108.43.25\Engineering\Hydrology_Plan\Exhibits\Figure_1-Vicinity_Map.dwg
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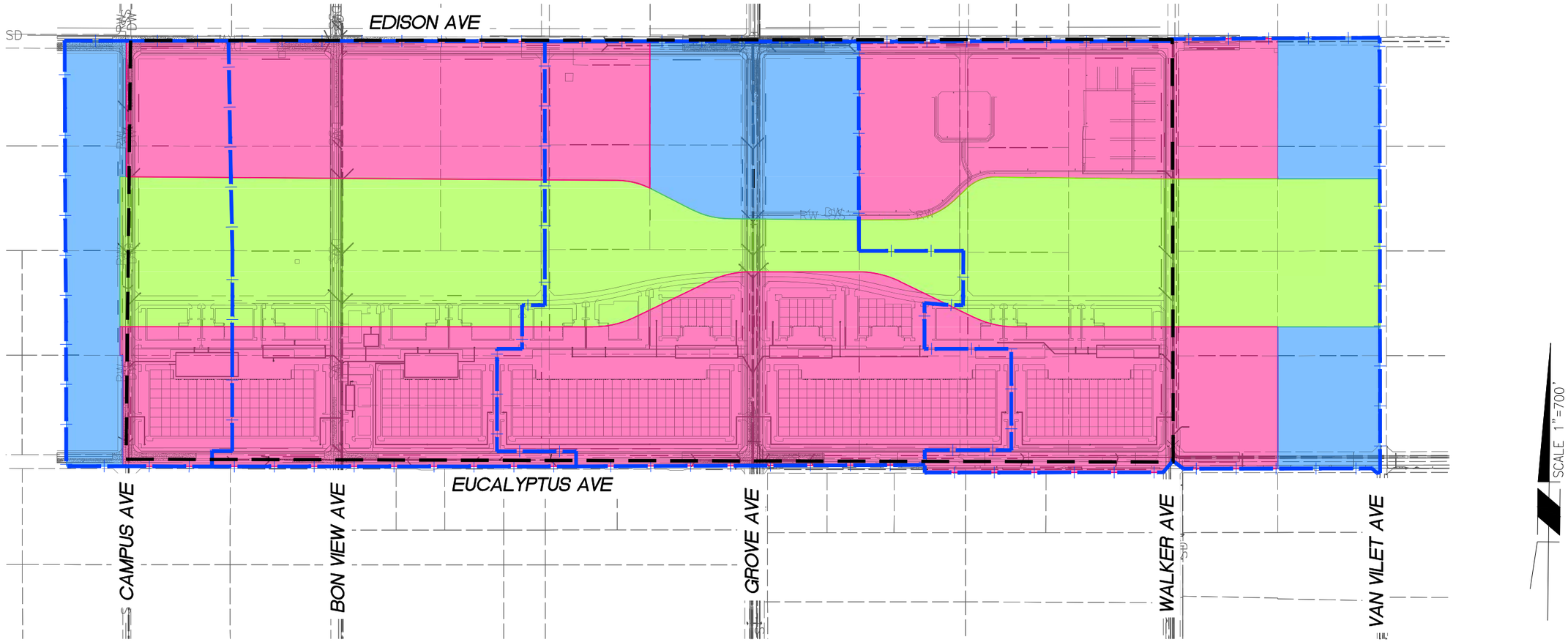
FIGURE 2: MDP LAND USE MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

ONTARIO MDP LAND USE MAP



LEGEND:

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- RESIDENTIAL 10+/11+ DU/AC (80% IMPERVIOUS)
- PARK (15% IMPERVIOUS)
- COMMERCIAL/MIXED-USE (90% IMPERVIOUS)

DESIGN NOTES:

1. COMMERCIAL & MIXED USE LAND USES COMBINED SINCE MDP ANALYSIS USES COMMERCIAL DESIGNATION IN MODEL.
2. RESIDENTIAL MODELED AS 11+ DU/AC IN MDP, APARTMENTS IN FUSCOE REPORT. HYDROLOGY MANUAL CALLS THIS 10+ DU/AC. ALL HAVE SAME IMPERVIOUS FRACTION AND RUNOFF INDEX IN HYDROLOGY MANUAL

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FIGURE 2

ONTARIO RANCH

ONTARIO MDP LAND USE MAP

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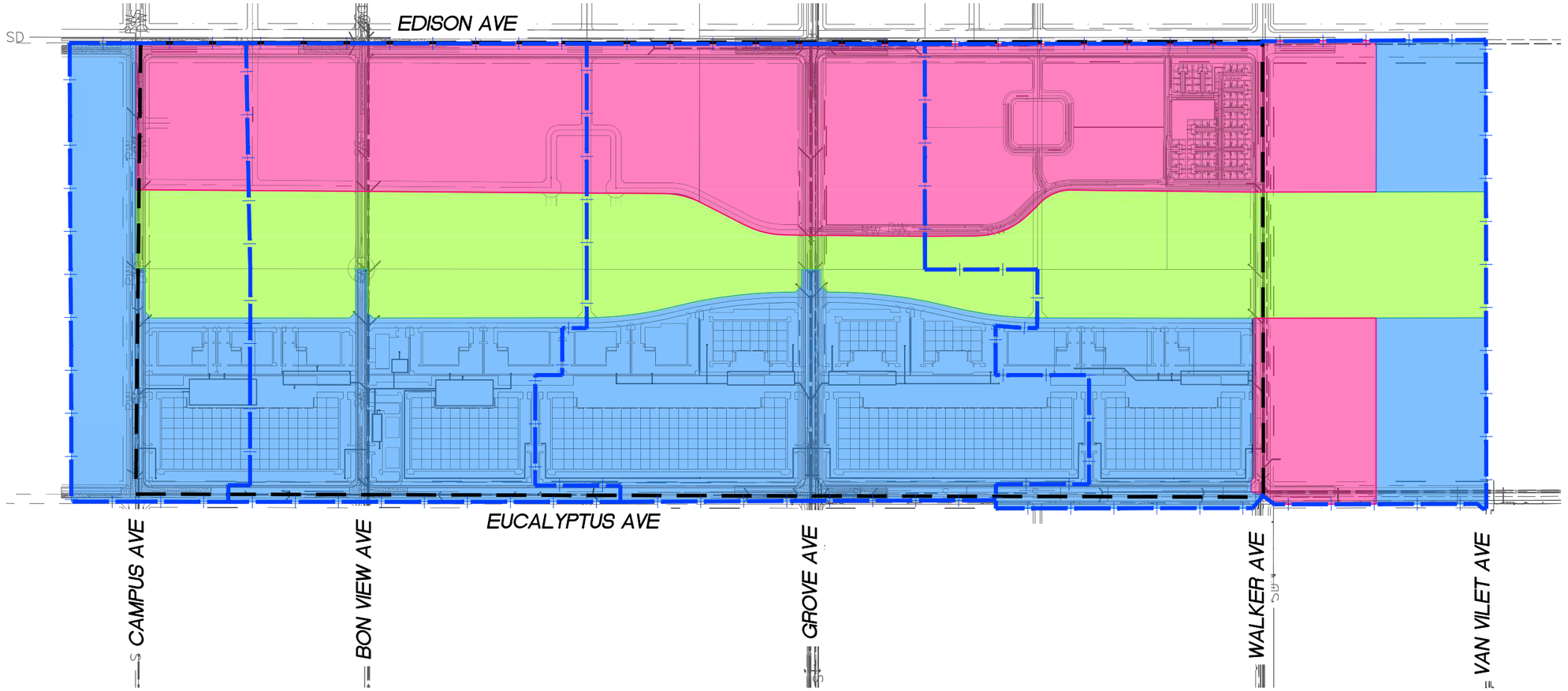
FIGURE 3: PROPOSED LAND USE MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

SITE SPECIFIC LAND USE MAP



LEGEND:

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- RESIDENTIAL 10+/11+ DU/AC (80% IMPERVIOUS)
- PARK (15% IMPERVIOUS)
- COMMERCIAL/MIXED-USE (90% IMPERVIOUS)

DESIGN NOTES:

1. COMMERCIAL & MIXED USE LAND USES COMBINED SINCE MDP ANALYSIS USES COMMERCIAL DESIGNATION IN MODEL.
2. RESIDENTIAL MODELED AS 11+ DU/AC IN MDP, APARTMENTS IN FUSCOE REPORT. HYDROLOGY MANUAL CALLS THIS 10+ DU/AC. ALL HAVE SAME IMPERVIOUS FRACTION AND RUNOFF INDEX IN HYDROLOGY MANUAL

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FIGURE 3

ONTARIO RANCH

SITE SPECIFIC LAND USE MAP

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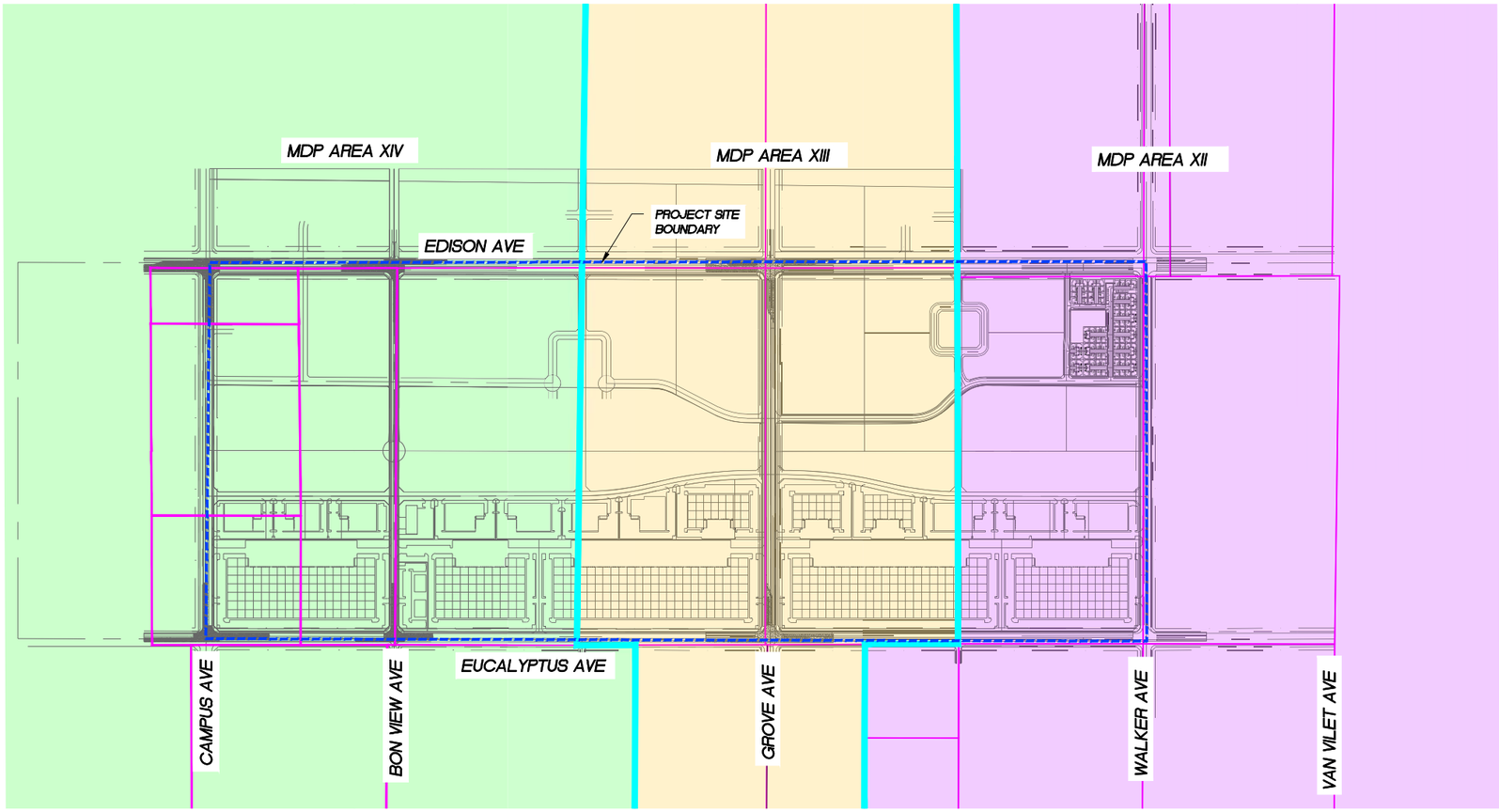
FIGURE 4: MDP WATERSHED LOCATIONS MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

MDP WATERSHED LOCATIONS



SCALE 1" = 1000'

LEGEND:

- PROJECT SITE
- CITY OF ONTARIO MDP MAJOR WATERSHED BOUNDARY
- CITY OF ONTARIO MDP MINOR WATERSHED BOUNDARY
- MDP AREA XII
- MDP AREA XIII
- MDP AREA XIV

NOTES:

1. THE MDP WATERSHED LOCATIONS ARE SHOWN AS IS BASED ON THE CITY OF ONTARIO MDP.

FIGURE 4

ONTARIO RANCH

MDP LOCATION MAP

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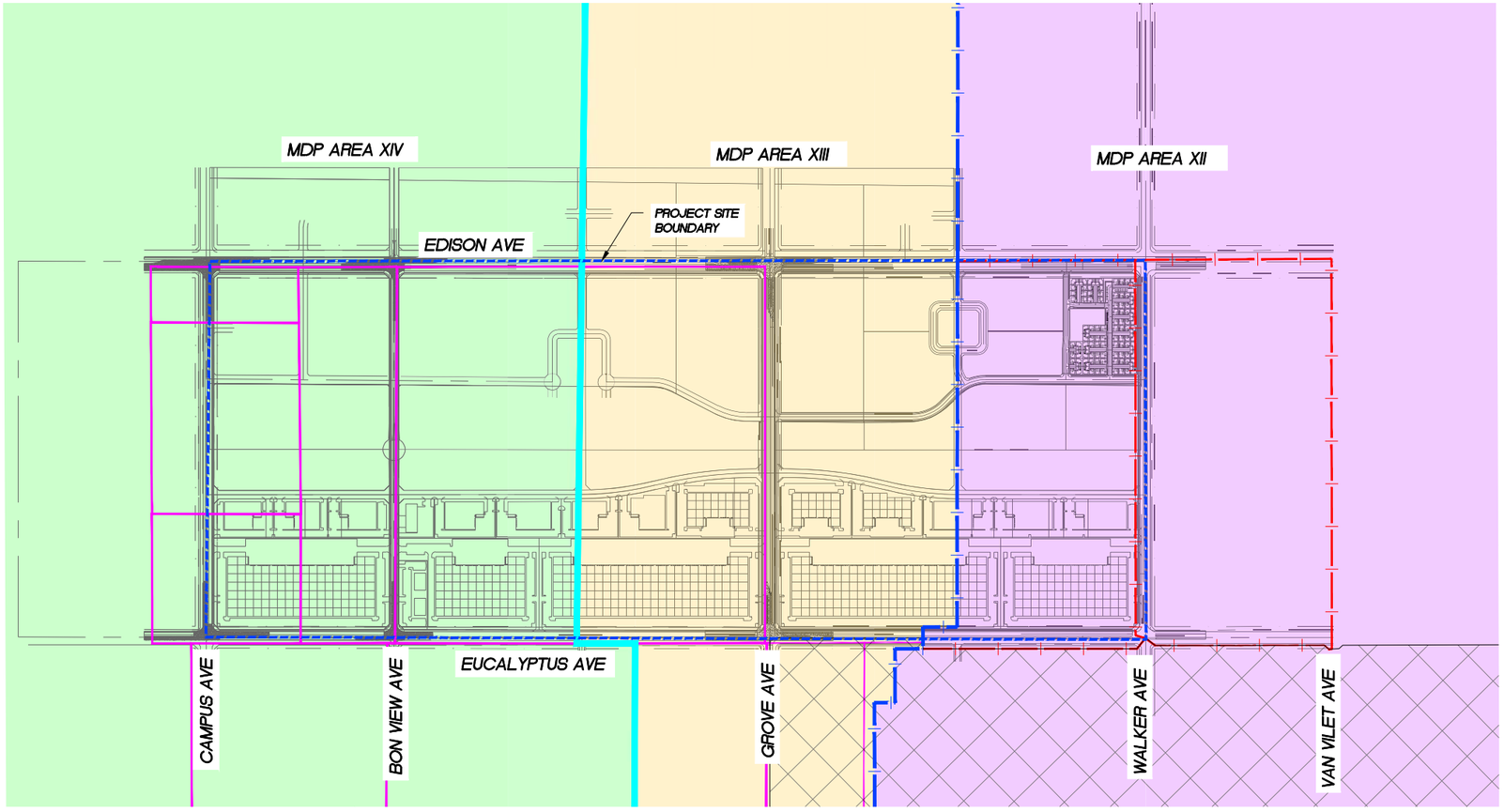
FIGURE 5: ADJUSTED MDP WATERSHED LOCATIONS MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

ADJUSTED MDP WATERSHED LOCATIONS



NOTES:

1. THE MDP WATERSHED LOCATIONS ARE SHOWN AS IS BASED ON THE CITY OF ONTARIO MDP WITH ADJUSTMENT TO AREA XII.
   1.1. AREA XII HAS ADJUSTMENTS BASED ON THE REVISED MDP AREAS DOCUMENTED IN THE APPROVED MCC H&H REPORT IN SUPPORT OF THE MERRILL AVENUE STORM DRAIN SYSTEM. SPECIFICALLY, THIS REPORT SUPPORTS THE BUILT (OR OTHERWISE IN-CONSTRUCTION) REACHES OF WLKR-XII-1. WLKR-XII-1 HAS APPROVED PLANS (PM-20273) UP TO WALKER AVE / EUCALYPTUS AVE INTERSECTION.

SCALE 1" = 1000'

LEGEND:

- PROJECT SITE
- CITY OF ONTARIO MDP MAJOR WATERSHED BOUNDARY
- CITY OF ONTARIO MDP MINOR WATERSHED BOUNDARY
- REVISED MCC MDP MAJOR WATERSHED BOUNDARY AREA XII
- REVISED MCC MDP MINOR WATERSHED BOUNDARY AREA XII
- MDP AREA XII
- MDP AREA XIII
- MDP AREA XIV
- MCC PROJECT SITE

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FIGURE 5

ONTARIO RANCH

ADJUSTED MDP LOCATION MAP

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Last Opened: May 10, 2025 - 3:58pm by jacob

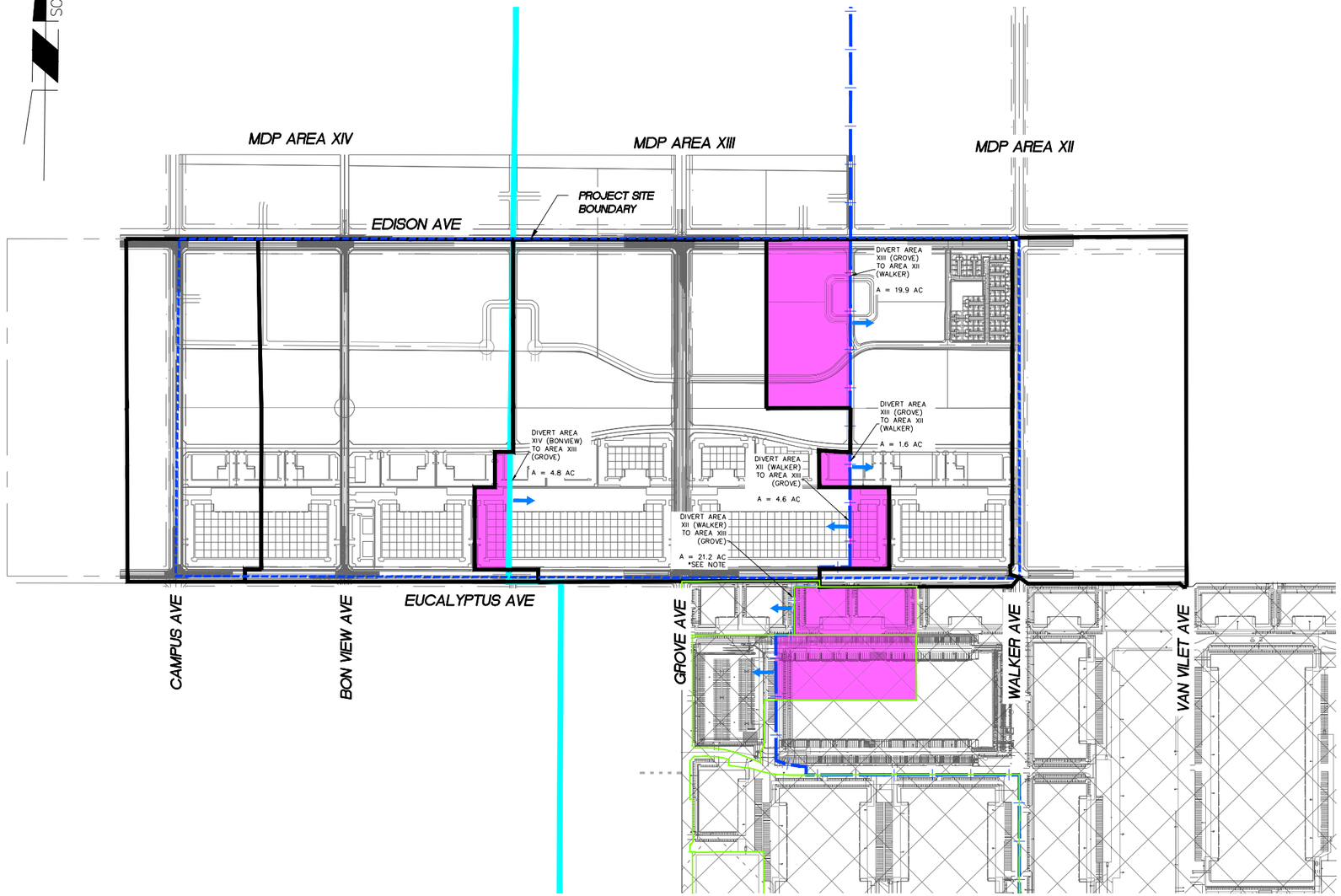
FIGURE 6: PROJECT ADJUSTED MDP WATERSHED LOCATIONS

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

ADJUSTED MDP WATERSHED LOCATIONS

SCALE 1" = 1000'



LEGEND:

- PROJECT SITE
- CITY OF ONTARIO MDP MAJOR WATERSHED BOUNDARY
- REVISED MCC MDP MAJOR WATERSHED BOUNDARY AREA XII
- ONTARIO RANCH POST-PROJECT WATERSHED BOUNDARY
- MCC/GROVE BASIN WATERSHED BOUNDARY
- MCC PROJECT SITE
- DIVERTED MDP AREA
- MDP AREA DIVERSION DIRECTION

NOTES:

1. THE MDP WATERSHED LOCATIONS ARE SHOWN AS IS BASED ON THE CITY OF ONTARIO MDP WITH ADJUSTMENT TO AREA XII.
   1.1. AREA XII HAS ADJUSTMENTS BASED ON THE REVISED MDP AREAS DOCUMENTED IN THE APPROVED MCC H&H REPORT IN SUPPORT OF THE MERRILL AVENUE STORM DRAIN SYSTEM. SPECIFICALLY, THIS REPORT SUPPORTS THE BUILT (OR OTHERWISE IN-CONSTRUCTION) REACHES OF WLKR-XII-1. WLKR-XII-1 HAS APPROVED PLANS (PM-20273) UP TO WALKER AVE / EUCALYPTUS AVE INTERSECTION.
2. OVERALL WATERSHED BOUNDARY ONTARIO RANCH SHOWN. DIVIDED BASED ON MDP MAINLINE THEY ARE TRIBUTARY TO.
3. APPROVED & CONSTRUCTED MCC SITE ONSITE HYDROLOGY BOUNDARY SHOWN. DEMONSTRATES THAT IN PRELIMINARY STAGES REVISED MDP BOUNDARY FOR MCC ALLOCATED PORTION OF SITE TO DRAIN TO AREA XII. HOWEVER, IN FINAL ENGINEERING PART OF THIS WAS SENT TO AREA XIII INSTEAD AND WAS ALLOWABLE SINCE PASSED THROUGH THE GROVE BASIN.
4. THERE IS NET DIVERSION FROM WALKER TO GROVE OF ~4.3 ACRES. THERE IS A NET DIVERSION FROM BON VIEW TO GROVE OF ~ 4.8 ACRES. GROVE RECEIVES ADDITIONAL AREA OF ~9.1 ACRES.

FIGURE 6

ONTARIO RANCH

ADJUSTED MDP LOCATION MAP

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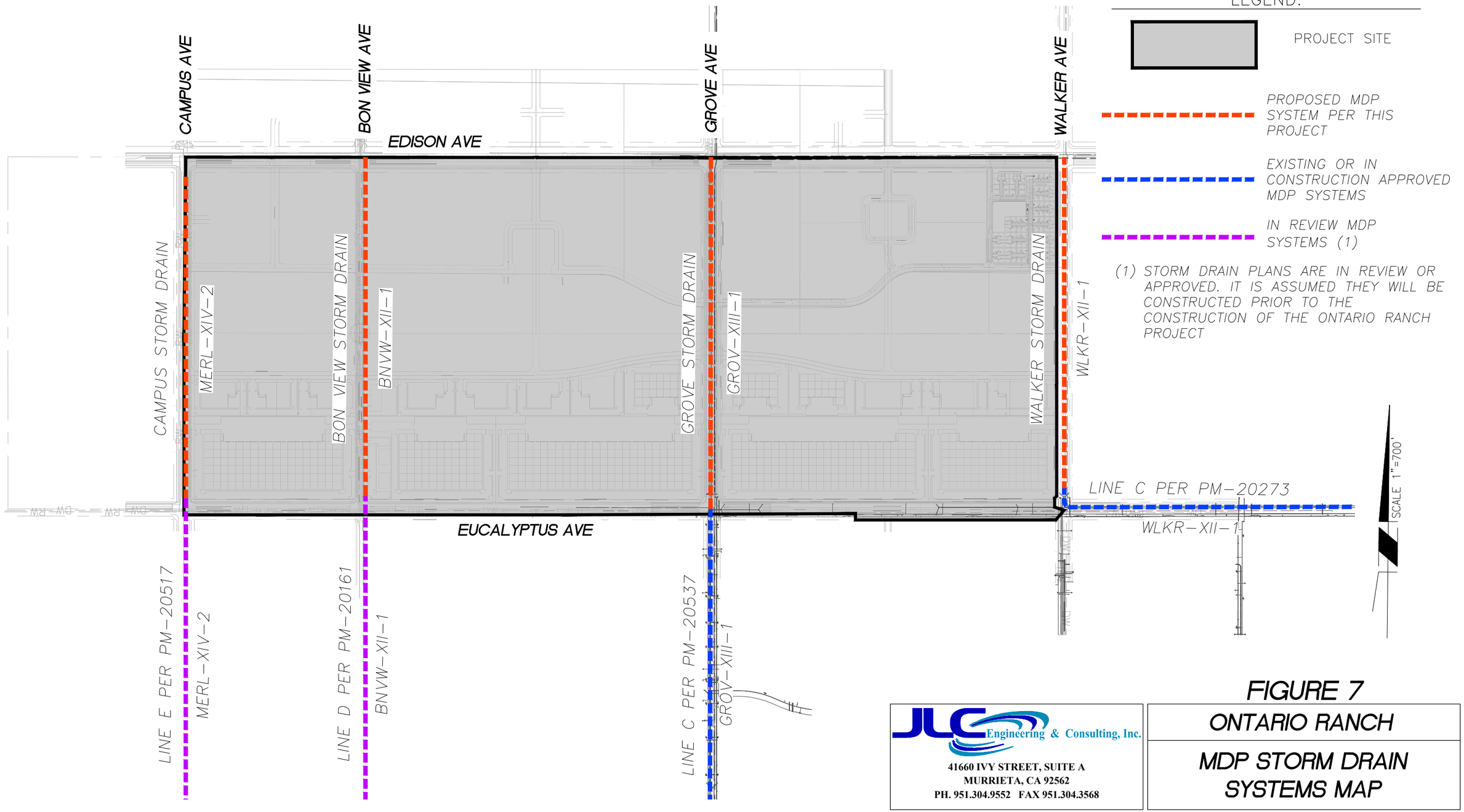
FIGURE 7: MDP STORM DRAIN SYSTEM MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

MDP STORM DRAIN SYSTEMS MAP



LEGEND:

- PROJECT SITE
- PROPOSED MDP SYSTEM PER THIS PROJECT
- EXISTING OR IN CONSTRUCTION APPROVED MDP SYSTEMS
- IN REVIEW MDP SYSTEMS (1)

(1) STORM DRAIN PLANS ARE IN REVIEW OR APPROVED. IT IS ASSUMED THEY WILL BE CONSTRUCTED PRIOR TO THE CONSTRUCTION OF THE ONTARIO RANCH PROJECT

FIGURE 7

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ONTARIO RANCH

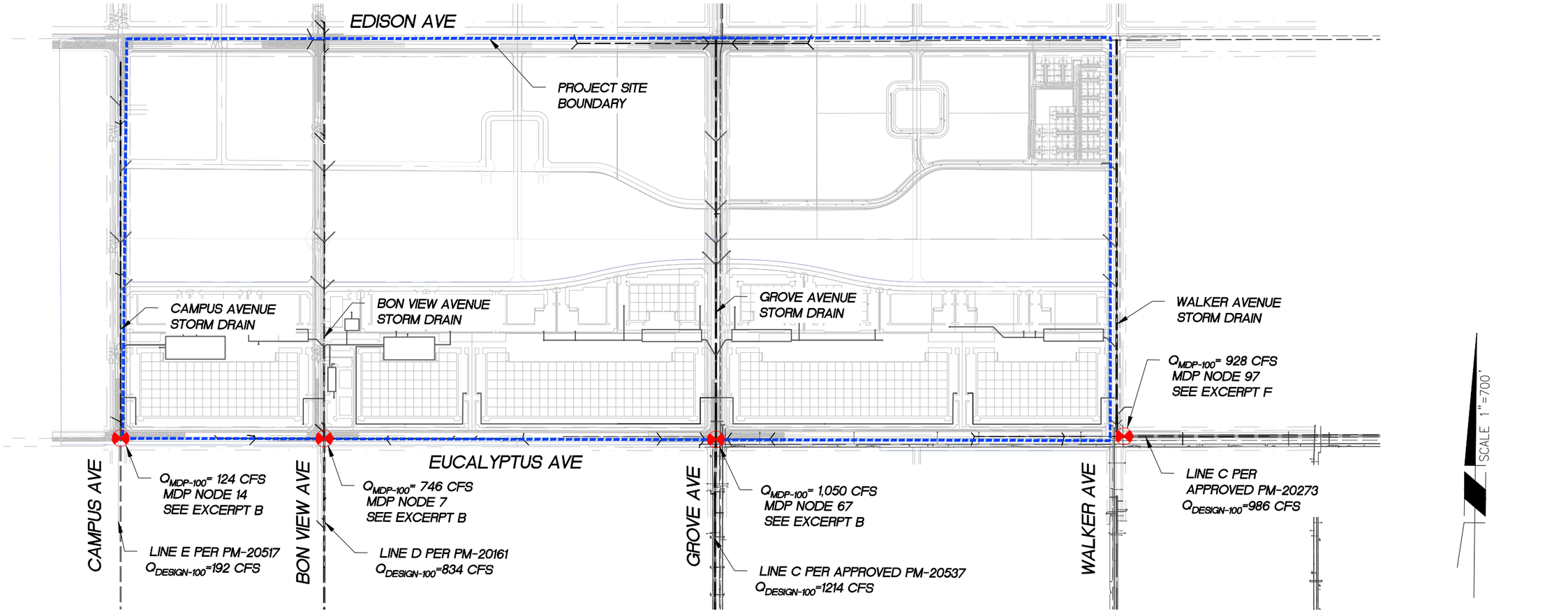
MDP STORM DRAIN SYSTEMS MAP

FIGURE 8: MDP STORM DRAIN AND COMPLIANCE POINT MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

MDP STORM DRAIN AND COMPLIANCE POINT MAP



LEGEND:

PROJECT SITE

COMPLIANCE POINT

NOTES:

1. EACH COMPLIANCE POINT IS AT THE UPSTREAM END OF AN APPROVED SD PLAN OR SD PLAN IN ACTIVE REVIEW W/ CITY OF ONTARIO.
2. $Q_{DESIGN-100}$ INDICATES THE DESIGN FLOW RATE DEFINED AT UPSTREAM END OF SD TO ESTABLISH HGL FOR SYSTEM. DESIGN FLOW RATE FOR EACH SYSTEM VALID TO EUCALYPTUS INTERSECTION.
3. $Q_{MDP-100}$ INDICATES THE MDP FLOW RATE DEFINED AT COMPLIANCE POINT WHICH COINCIDES WITH NODE FROM MDP
4. NOTE THAT MAINLINES HAVE A DESIGN FLOW RATE HIGHER THAN Q_{100} DEFINED BY MDP AT THE SAME POINT. THIS IS DUE TO MAINLINE SYSTEMS BEING MODELED WITH DOWNSTREAM

FIGURE 8

ONTARIO RANCH

MDP SD AND COMPLIANCE POINT MAP

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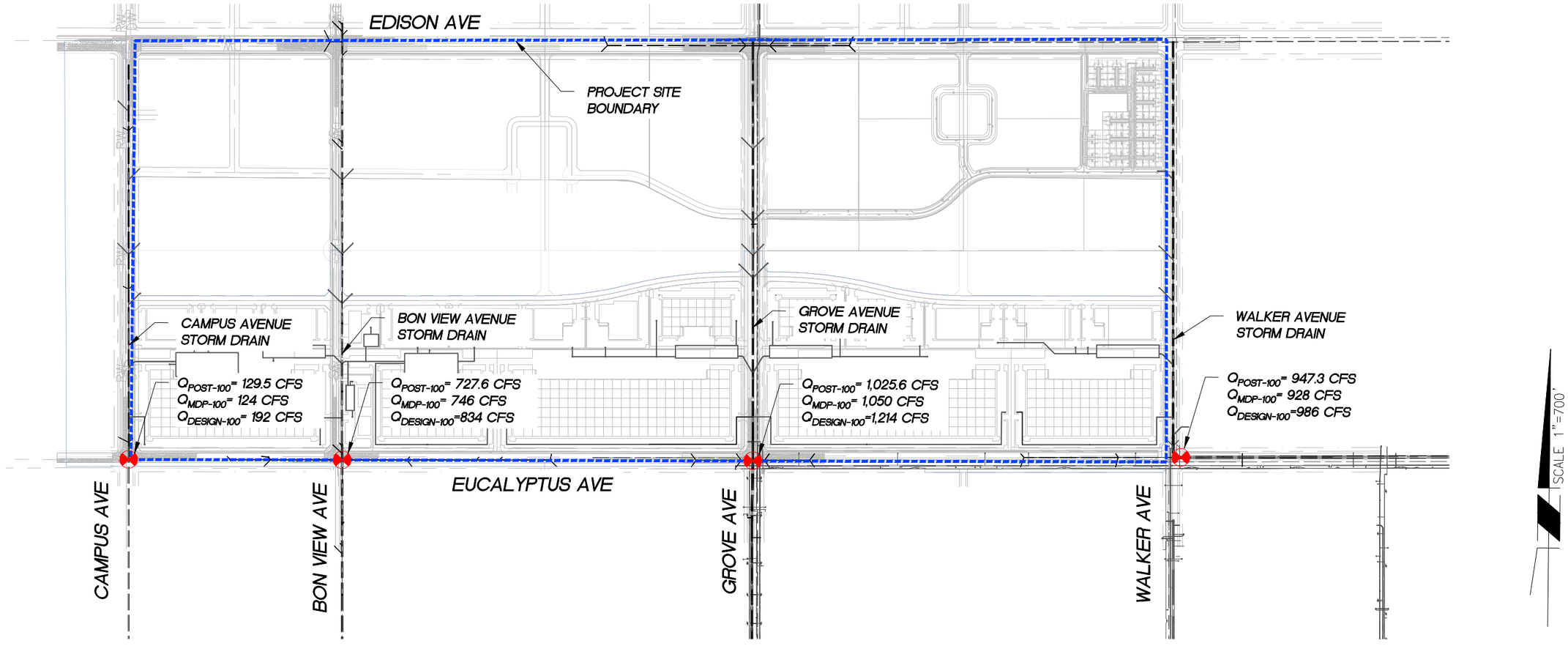
FIGURE 9: PROPOSED OUTFLOW MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

PROPOSED OUTFLOW MAP



NOTES:

1. EACH COMPLIANCE POINT IS AT THE UPSTREAM END OF AN APPROVED SD PLAN OR SD PLAN IN ACTIVE REVIEW W/ CITY OF ONTARIO.
2. $Q_{DESIGN-100}$ INDICATES THE DESIGN FLOW RATE DEFINED AT UPSTREAM END OF SD TO ESTABLISH HGL FOR SYSTEM. DESIGN FLOW RATE FOR EACH SYSTEM VALID TO EUCALYPTUS INTERSECTION.
3. $Q_{MDP-100}$ INDICATES THE MDP FLOW RATE DEFINED AT COMPLIANCE POINT WHICH COINCIDES WITH NODE FROM MDP
4. $Q_{POST-100}$ INDICATES THE PROPOSED MITIGATED OUTFLOW FOR ONTARIO RANCH TO EACH MAINLINE SD.
5. NOTE THAT MAINLINES HAVE A DESIGN FLOW RATE HIGHER THAN Q_{100} DEFINED BY MDP AT THE SAME POINT. THIS IS DUE TO MAINLINE SYSTEMS BEING MODELED WITH DOWNSTREAM MDP FLOWRATE DUE TO UNCERTAIN LOCATION OF FUTURE MAINLINE CONFLUENCE POINTS.

LEGEND:

PROJECT SITE

COMPLIANCE POINT

FIGURE 9

ONTARIO RANCH

PROPOSED OUTFLOW MAP

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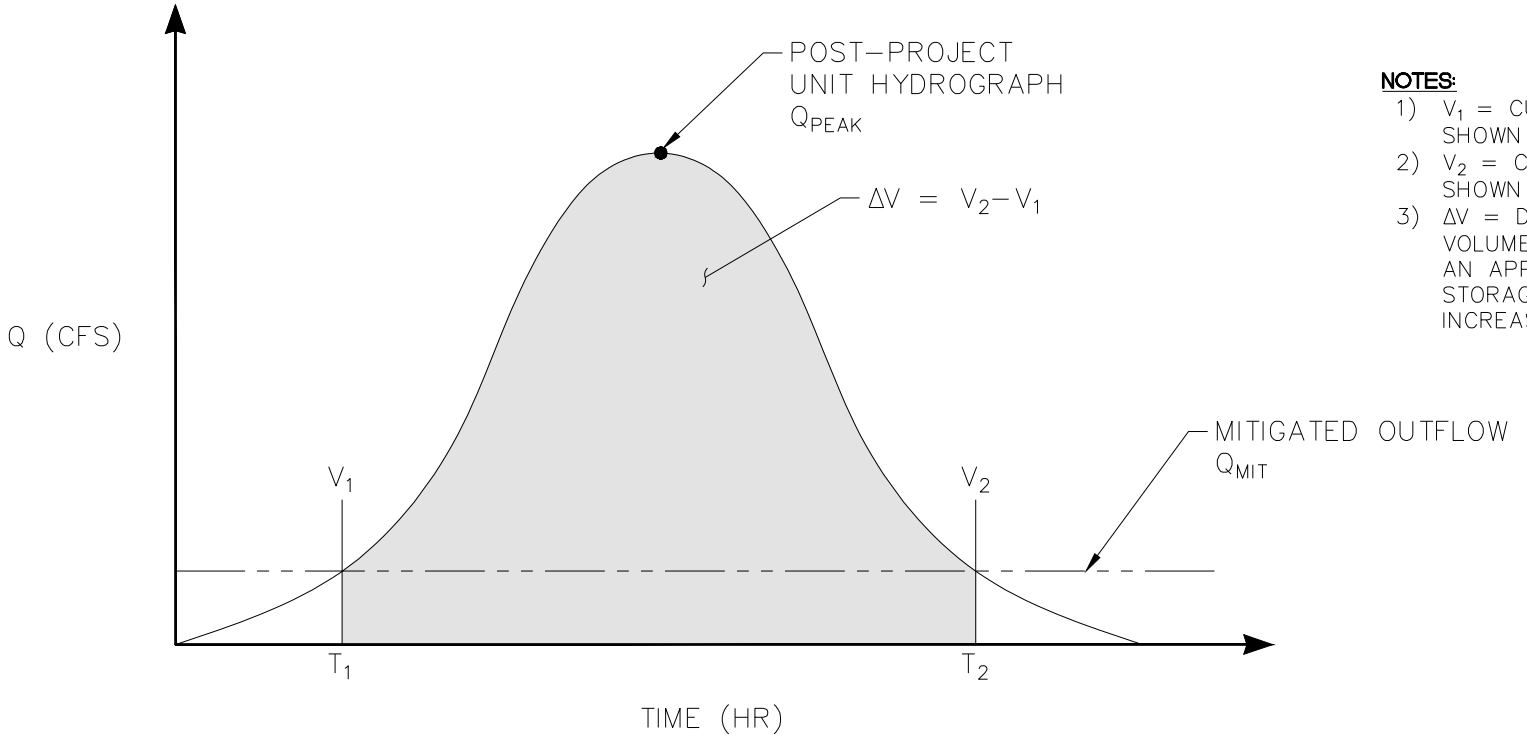
FIGURE 10: CONCEPTUAL GRAPHIC FOR STORAGE MITIGATION

FIGURE 10 - CONCEPTUAL ROUTING OF POST-PROJECT UNIT HYDROGRAPH



NOTES:

1) V_1 = CUMULATIVE VOLUME AT T_1 AS SHOWN ON CIVILD OUTPUT
2) V_2 = CUMULATIVE VOLUME AT T_2 AS SHOWN ON CIVILD OUTPUT
3) ΔV = DIFFERENCE IN CUMULATIVE VOLUME BETWEEN T_1 AND T_2 AND IS AN APPROXIMATION OF THE REQUIRED STORAGE VOLUME TO MITIGATE INCREASED RUNOFF

ONSITE COMMERCIAL MITIGATED OUTFLOW - STORAGE ANALYSIS

MAINLINE SD	AREA NAME	T_1 (HR+MIN)	T_2 (HR+MIN)	V_1 (AC-FT)	V_2 (AC-FT)	ΔV (AC-FT)	Q_{MIT} (CFS)
WALKER	D2	8+20	8+20	0.15	2.36	2.21	6.5
GROVE	E4	15+40	16+40	6.03	8.31	2.28	12.9
GROVE	E3	15+20	16+40	5.12	7.54	2.42	10.8
BON VIEW	F3	11+50	18+25	1.33	3.54	2.22	2.0
BON VIEW	F2	13+30	17+35	3.78	7.82	4.04	6.0
CAMPUS	G2	8+20	20+10	0.84	3.82	2.98	1.5

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APPENDICES

APPENDIX A: WALKER AVE STORM DRAIN HYDROLOGY CALCULATIONS

APPENDIX A.1: RATIONAL METHOD ANALYSIS, RERUN FUSCOE MODELS TO WALKER

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/05/25

PORTION OF MPD DA XII - UPSTREAM
PROPOSED DEV DA C
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 974.000(Ft.)
Top (of initial area) elevation = 700.000(Ft.)
Bottom (of initial area) elevation = 693.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.00719 s(%)= 0.72
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 13.635 min.
Rainfall intensity = 2.919(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.840
Subarea runoff = 24.513(CFS)
Total initial stream area = 10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   693.000(Ft.)
End of street segment elevation =   689.000(Ft.)
Length of street segment  =   607.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     40.434(CFS)
Depth of flow =   0.650(Ft.), Average velocity =   3.180(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  24.914(Ft.)
Flow velocity =   3.18(Ft/s)
Travel time =    3.18 min.     TC =   16.82  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      2.574(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.832
Subarea runoff =     31.701(CFS) for   16.260(Ac.)
Total runoff =     56.214(CFS)
Effective area this stream =       26.26(Ac.)
Total Study Area (Main Stream No. 1) =       26.26(Ac.)
Area averaged Fm value =    0.196(In/Hr)
Street flow at end of street =     56.214(CFS)
Half street flow at end of street =     28.107(CFS)
Depth of flow =   0.727(Ft.), Average velocity =   3.296(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    3.03(Ft.)
Flow width (from curb towards crown)=  28.781(Ft.)
End of computations, Total Study Area =           26.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number = 32.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/05/25

PORTION OF MPD DA XII - DOWNSTREAM
PROPOSED DEV DA C
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 4.000 to Point/Station 5.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 933.000(Ft.)
Top (of initial area) elevation = 696.000(Ft.)
Bottom (of initial area) elevation = 691.000(Ft.)
Difference in elevation = 5.000(Ft.)
Slope = 0.00536 s(%)= 0.54
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.213 min.
Rainfall intensity = 2.848(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.838
Subarea runoff = 23.867(CFS)
Total initial stream area = 10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        6.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   691.000(Ft.)
End of street segment elevation =   689.000(Ft.)
Length of street segment  =   288.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     30.508(CFS)
Depth of flow =   0.594(Ft.), Average velocity =   3.026(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  22.113(Ft.)
Flow velocity =   3.03(Ft/s)
Travel time =    1.59 min.     TC =   15.80  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      2.672(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.834
Subarea runoff =     13.113(CFS) for    6.590(Ac.)
Total runoff =     36.981(CFS)
Effective area this stream =       16.59(Ac.)
Total Study Area (Main Stream No. 1) =       16.59(Ac.)
Area averaged Fm value =    0.196(In/Hr)
Street flow at end of street =     36.981(CFS)
Half street flow at end of street =     18.490(CFS)
Depth of flow =   0.628(Ft.), Average velocity =   3.172(Ft/s)
Flow width (from curb towards crown)=  23.826(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        7.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
```

```
Top of street segment elevation =   689.000(Ft.)
End of street segment elevation =   687.000(Ft.)
Length of street segment  =   353.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  14.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     38.439(CFS)
Depth of flow =   0.639(Ft.), Average velocity =   3.379(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   3.38(Ft/s)
Travel time =    1.74 min.     TC =   17.54  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Rainfall intensity =      2.510(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.791
Subarea runoff =      2.756(CFS) for    3.430(Ac.)
Total runoff =     39.737(CFS)
Effective area this stream =       20.02(Ac.)
Total Study Area (Main Stream No. 1) =       20.02(Ac.)
Area averaged Fm value =    0.304(In/Hr)
Street flow at end of street =     39.737(CFS)
Half street flow at end of street =     19.868(CFS)
Depth of flow =   0.646(Ft.), Average velocity =   3.423(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  18.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation =   675.000(Ft.)
Downstream point/station elevation =   666.750(Ft.)
```

```
Pipe length  =  1327.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    39.737(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    39.737(CFS)
Normal flow depth in pipe =   21.02(In.)
Flow top width inside pipe =   42.00(In.)
Critical Depth =   23.53(In.)
Pipe flow velocity =      8.25(Ft/s)
Travel time through pipe =    2.68 min.
Time of concentration (TC) =    20.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     20.020(Ac.)
Runoff from this stream =     39.737(CFS)
Time of concentration =   20.22 min.
Rainfall intensity =     2.305(In/Hr)
Area averaged loss rate (Fm) =    0.3045(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3114
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        8.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Initial subarea data:
Initial area flow distance =   997.000(Ft.)
Top (of initial area) elevation =   689.000(Ft.)
Bottom (of initial area) elevation =   685.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00401  s(%)=       0.40
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   23.054 min.
Rainfall intensity =      2.130(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.549
Subarea runoff =     11.399(CFS)
Total initial stream area =        9.750(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.831(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   685.000(Ft.)
End of street segment elevation =   683.000(Ft.)
Length of street segment  =   393.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  16.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     12.886(CFS)
Depth of flow =   0.487(Ft.), Average velocity =   2.180(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.743(Ft.)
Flow velocity =   2.18(Ft/s)
Travel time =    3.00 min.     TC =   26.06  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Rainfall intensity =      1.979(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.522
Subarea runoff =      2.850(CFS) for    4.040(Ac.)
Total runoff =     14.249(CFS)
Effective area this stream =       13.79(Ac.)
Total Study Area (Main Stream No. 2) =       33.81(Ac.)
Area averaged Fm value =    0.831(In/Hr)
Street flow at end of street =     14.249(CFS)
Half street flow at end of street =      7.125(CFS)
Depth of flow =   0.500(Ft.), Average velocity =   2.234(Ft/s)
Flow width (from curb towards crown)=  17.428(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
```

```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     13.790(Ac.)
Runoff from this stream =     14.249(CFS)
Time of concentration =   26.06 min.
Rainfall intensity =     1.979(In/Hr)
Area averaged loss rate (Fm) =    0.8311(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     39.74    20.020     20.22    0.304      2.305
2     14.25    13.790     26.06    0.831      1.979
Qmax(1) =
         1.000 *    1.000 *    39.737) +
         1.283 *    0.776 *    14.249) + =      53.927
Qmax(2) =
         0.837 *    1.000 *    39.737) +
         1.000 *    1.000 *    14.249) + =      47.524

Total of 2 main streams to confluence:
Flow rates before confluence point:
      40.737      15.249
Maximum flow rates at confluence using above data:
       53.927       47.524
Area of streams before confluence:
       20.020       13.790
Effective area values after confluence:
       30.721       33.810


Results of confluence:
Total flow rate =     53.927(CFS)
Time of concentration =    20.222 min.
Effective stream area after confluence  =     30.721(Ac.)
Study area average Pervious fraction(Ap) =  0.531
Study area average soil loss rate(Fm) =    0.519(In/Hr)
Study area total =      33.81(Ac.)
End of computations, Total Study Area =           33.81 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.531
Area averaged SCS curve number =  32.0
```

APPENDIX A.2: RATIONAL METHOD ANALYSIS, WALKER MAINLINE, AREA D (EXCLUDES D2)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/05/25

WALKER SD TRIBUTARY AREA
OVERALL: JLC-MCC-MDP REV + ONTARIO RANCH

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 91.000 to Point/Station 91.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.391(In/Hr)
Rainfall intensity = 1.854(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 29.07 min. Rain intensity = 1.85(In/Hr)
Total area this stream = 687.62(Ac.)
Total Study Area (Main Stream No. 1) = 687.62(Ac.)
Total runoff = 789.47(CFS)

++

Process from Point/Station 91.000 to Point/Station 91.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 670.000(Ft.)
Downstream point/station elevation = 665.600(Ft.)
Pipe length = 872.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 789.468(CFS)
Nearest computed pipe diameter = 105.00(In.)

```
Calculated individual pipe flow  =   789.468(CFS)
Normal flow depth in pipe =   82.50(In.)
Flow top width inside pipe =   86.17(In.)
Critical Depth =   83.75(In.)
Pipe flow velocity =     15.58(Ft/s)
Travel time through pipe =    0.93 min.
Time of concentration (TC) =    30.00 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       91.000 to Point/Station       91.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    687.620(Ac.)
Runoff from this stream =    789.468(CFS)
Time of concentration =   30.00 min.
Rainfall intensity =     1.819(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station       91.100
**** USER DEFINED FLOW INFORMATION AT A POINT ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 31.61
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      2.574(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  16.82 min.  Rain intensity =       2.57(In/Hr)
Total area this stream =        26.26(Ac.)
Total Study Area (Main Stream No. 2) =      713.88(Ac.)
Total runoff =     56.21(CFS)


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Process from Point/Station        3.000 to Point/Station       91.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     26.260(Ac.)
Runoff from this stream =     56.214(CFS)
Time of concentration =   16.82 min.
Rainfall intensity =     2.574(In/Hr)
Area averaged loss rate (Fm) =    0.1960(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    789.47   687.620     30.00    0.391      1.819
2     56.21    26.260     16.82    0.196      2.574
Qmax(1) =
         1.000 *    1.000 *   789.468) +
         0.683 *    1.000 *    56.214) + =     827.836
Qmax(2) =
         1.529 *    0.561 *   789.468) +
         1.000 *    1.000 *    56.214) + =     732.905

Total of 2 main streams to confluence:
Flow rates before confluence point:
     790.468      57.214
Maximum flow rates at confluence using above data:
      827.836      732.905
Area of streams before confluence:
      687.620       26.260
Effective area values after confluence:
      713.880      411.815


Results of confluence:
Total flow rate =    827.836(CFS)
Time of concentration =    29.998 min.
Effective stream area after confluence  =    713.880(Ac.)
Study area average Pervious fraction(Ap) =  0.393
Study area average soil loss rate(Fm) =    0.384(In/Hr)
Study area total =     713.88(Ac.)


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Process from Point/Station       91.100 to Point/Station       91.200
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   665.600(Ft.)
Downstream point/station elevation =   663.100(Ft.)
Pipe length  =   510.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   827.836(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =   827.836(CFS)
Normal flow depth in pipe =   83.81(In.)
Flow top width inside pipe =   90.05(In.)
Critical Depth =   85.30(In.)
Pipe flow velocity =     15.63(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    30.54 min.


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Process from Point/Station       91.100 to Point/Station       91.200
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    713.880(Ac.)
Runoff from this stream =    827.836(CFS)
Time of concentration =   30.54 min.
Rainfall intensity =     1.799(In/Hr)
Area averaged loss rate (Fm) =    0.3839(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3926
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       91.200
**** USER DEFINED FLOW INFORMATION AT A POINT ****
--------------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.07
Pervious ratio(Ap) = 0.5310     Max loss rate(Fm)=     0.519(In/Hr)
Rainfall intensity =      2.305(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  20.22 min.  Rain intensity =       2.30(In/Hr)
Total area this stream =        30.72(Ac.)
Total Study Area (Main Stream No. 2) =      744.60(Ac.)
Total runoff =     53.93(CFS)


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Process from Point/Station        9.000 to Point/Station       91.200
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     30.721(Ac.)
Runoff from this stream =     53.927(CFS)
Time of concentration =   20.22 min.
Rainfall intensity =     2.305(In/Hr)
Area averaged loss rate (Fm) =    0.5190(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5310
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    827.84   713.880     30.54    0.384      1.799
2     53.93    30.721     20.22    0.519      2.305
Qmax(1) =
         1.000 *    1.000 *   827.836) +
         0.717 *    1.000 *    53.927) + =     866.509
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```
Qmax(2) =
         1.357 *    0.662 *   827.836) +
         1.000 *    1.000 *    53.927) + =     797.626

Total of 2 main streams to confluence:
Flow rates before confluence point:
     828.836      54.927
Maximum flow rates at confluence using above data:
      866.509      797.626
Area of streams before confluence:
      713.880       30.721
Effective area values after confluence:
      744.601      503.394


Results of confluence:
Total flow rate =    866.509(CFS)
Time of concentration =    30.541 min.
Effective stream area after confluence  =    744.601(Ac.)
Study area average Pervious fraction(Ap) =  0.398
Study area average soil loss rate(Fm) =    0.390(In/Hr)
Study area total =     744.60(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       91.200 to Point/Station       91.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   663.100(Ft.)
Downstream point/station elevation =   661.800(Ft.)
Pipe length  =   263.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   866.509(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =   866.509(CFS)
Normal flow depth in pipe =   87.19(In.)
Flow top width inside pipe =   85.20(In.)
Critical Depth =   87.08(In.)
Pipe flow velocity =     15.73(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    30.82 min.


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Process from Point/Station       91.200 to Point/Station       91.300
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    744.601(Ac.)
Runoff from this stream =    866.509(CFS)
Time of concentration =   30.82 min.
Rainfall intensity =     1.790(In/Hr)
Area averaged loss rate (Fm) =    0.3895(In/Hr)
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Area averaged Pervious ratio (Ap) = 0.3984
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Initial subarea data:
Initial area flow distance =   930.000(Ft.)
Top (of initial area) elevation =   691.000(Ft.)
Bottom (of initial area) elevation =   683.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.00860  s(%)=       0.86
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.249 min.
Rainfall intensity =      2.374(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.585
Subarea runoff =     11.509(CFS)
Total initial stream area =        8.290(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.831(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      402.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    19.25 min.
Rainfall intensity =      2.374(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.634
Subarea runoff =      3.605(CFS) for    1.760(Ac.)
Total runoff =     15.114(CFS)
Effective area this stream =       10.05(Ac.)
Total Study Area (Main Stream No. 2) =      754.65(Ac.)
Area averaged Fm value =    0.703(In/Hr)
```

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Process from Point/Station      402.000 to Point/Station       91.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   679.000(Ft.)
Downstream point/station elevation =   661.800(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.114(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    15.114(CFS)
Normal flow depth in pipe =    8.53(In.)
Flow top width inside pipe =   14.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.97(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    19.34 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station       91.300
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     10.050(Ac.)
Runoff from this stream =     15.114(CFS)
Time of concentration =   19.34 min.
Rainfall intensity =     2.367(In/Hr)
Area averaged loss rate (Fm) =    0.7027(In/Hr)
Area averaged Pervious ratio (Ap) = 0.7187
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    866.51   744.601     30.82    0.390      1.790
2     15.11    10.050     19.34    0.703      2.367
Qmax(1) =
         1.000 *    1.000 *   866.509) +
         0.653 *    1.000 *    15.114) + =     876.382
Qmax(2) =
         1.412 *    0.628 *   866.509) +
         1.000 *    1.000 *    15.114) + =     783.121

Total of 2 main streams to confluence:
Flow rates before confluence point:
     867.509      16.114
Maximum flow rates at confluence using above data:
      876.382      783.121
Area of streams before confluence:
      744.601       10.050
Effective area values after confluence:
```

754.651 477.414

Results of confluence:
Total flow rate = 876.382(CFS)
Time of concentration = 30.820 min.
Effective stream area after confluence = 754.651(Ac.)
Study area average Pervious fraction(Ap) = 0.403
Study area average soil loss rate(Fm) = 0.394(In/Hr)
Study area total = 754.65(Ac.)

++
Process from Point/Station 91.300 to Point/Station 91.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 661.800(Ft.)
Downstream point/station elevation = 659.800(Ft.)
Pipe length = 401.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 876.382(CFS)
Nearest computed pipe diameter = 108.00(In.)
Calculated individual pipe flow = 876.382(CFS)
Normal flow depth in pipe = 87.94(In.)
Flow top width inside pipe = 84.01(In.)
Critical Depth = 87.50(In.)
Pipe flow velocity = 15.80(Ft/s)
Travel time through pipe = 0.42 min.
Time of concentration (TC) = 31.24 min.

++
Process from Point/Station 91.400 to Point/Station 91.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 659.800(Ft.)
Downstream point/station elevation = 658.200(Ft.)
Pipe length = 330.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 876.382(CFS)
Nearest computed pipe diameter = 111.00(In.)
Calculated individual pipe flow = 876.382(CFS)
Normal flow depth in pipe = 85.31(In.)
Flow top width inside pipe = 93.63(In.)
Critical Depth = 87.15(In.)
Pipe flow velocity = 15.82(Ft/s)
Travel time through pipe = 0.35 min.
Time of concentration (TC) = 31.59 min.

++
Process from Point/Station 91.400 to Point/Station 91.500
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:

```
In Main Stream number: 1
Stream flow area =    754.651(Ac.)
Runoff from this stream =    876.382(CFS)
Time of concentration =   31.59 min.
Rainfall intensity =     1.763(In/Hr)
Area averaged loss rate (Fm) =    0.3937(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4026
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      413.000 to Point/Station      414.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   250.000(Ft.)
Top (of initial area) elevation =   680.500(Ft.)
Bottom (of initial area) elevation =   678.000(Ft.)
Difference in elevation =     2.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.951 min.
Rainfall intensity =      4.374(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      2.732(CFS)
Total initial stream area =        0.710(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      414.000 to Point/Station      416.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.000(Ft.)
Downstream point/station elevation =   671.000(Ft.)
Pipe length  =   660.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.732(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.732(CFS)
Normal flow depth in pipe =    8.61(In.)
Flow top width inside pipe =   14.83(In.)
Critical Depth =    7.96(In.)
Pipe flow velocity =      3.75(Ft/s)
Travel time through pipe =    2.93 min.
Time of concentration (TC) =     9.89 min.
```

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Process from Point/Station      414.000 to Point/Station      416.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.710(Ac.)
Runoff from this stream =      2.732(CFS)
Time of concentration =    9.89 min.
Rainfall intensity =     3.540(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      416.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   500.000(Ft.)
Top (of initial area) elevation =   680.000(Ft.)
Bottom (of initial area) elevation =   675.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.172 min.
Rainfall intensity =      3.703(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff =     17.036(CFS)
Total initial stream area =        5.250(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      416.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      5.250(Ac.)
Runoff from this stream =     17.036(CFS)
Time of concentration =    9.17 min.
Rainfall intensity =     3.703(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      2.73     0.710      9.89    0.098      3.540
2     17.04     5.250      9.17    0.098      3.703
Qmax(1) =
         1.000 *    1.000 *     2.732) +
         0.955 *    1.000 *    17.036) + =      18.999
Qmax(2) =
         1.047 *    0.928 *     2.732) +
         1.000 *    1.000 *    17.036) + =      19.691

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.732      17.036
Maximum flow rates at confluence using above data:
       18.999       19.691
Area of streams before confluence:
        0.710        5.250
Effective area values after confluence:
        5.960        5.909
Results of confluence:
Total flow rate =     19.691(CFS)
Time of concentration =     9.172 min.
Effective stream area after confluence =      5.909(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total (this main stream) =       5.96(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      416.000 to Point/Station       91.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   672.500(Ft.)
Downstream point/station elevation =   658.200(Ft.)
Pipe length  =   686.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.691(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    19.691(CFS)
Normal flow depth in pipe =   15.02(In.)
Flow top width inside pipe =   18.95(In.)
Critical Depth =   19.08(In.)
Pipe flow velocity =     10.70(Ft/s)
Travel time through pipe =    1.07 min.
Time of concentration (TC) =    10.24 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      416.000 to Point/Station       91.500
```

```
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.909(Ac.)
Runoff from this stream =     19.691(CFS)
Time of concentration =   10.24 min.
Rainfall intensity =     3.466(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    876.38   754.651     31.59    0.394      1.763
2     19.69     5.909     10.24    0.098      3.466
Qmax(1) =
         1.000 *    1.000 *   876.382) +
         0.494 *    1.000 *    19.691) + =     886.118
Qmax(2) =
         2.243 *    0.324 *   876.382) +
         1.000 *    1.000 *    19.691) + =     657.031

Total of 2 main streams to confluence:
Flow rates before confluence point:
     877.382      20.691
Maximum flow rates at confluence using above data:
      886.118      657.031
Area of streams before confluence:
      754.651        5.909
Effective area values after confluence:
      760.560      250.544


Results of confluence:
Total flow rate =    886.118(CFS)
Time of concentration =    31.591 min.
Effective stream area after confluence  =    760.560(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total =     760.56(Ac.)


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Process from Point/Station       91.500 to Point/Station       97.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
--------------------------------------------------------------------------------
Upstream point/station elevation =   658.200(Ft.)
Downstream point/station elevation =   657.600(Ft.)
Pipe length  =   114.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   886.118(CFS)
```

```
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =   886.118(CFS)
Normal flow depth in pipe =   86.44(In.)
Flow top width inside pipe =   86.34(In.)
Critical Depth =   88.00(In.)
Pipe flow velocity =     16.23(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    31.71 min.


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Process from Point/Station       91.500 to Point/Station       97.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    760.560(Ac.)
Runoff from this stream =    886.118(CFS)
Time of concentration =   31.71 min.
Rainfall intensity =     1.759(In/Hr)
Area averaged loss rate (Fm) =    0.3914(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4003
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       97.000 to Point/Station       97.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Rainfall intensity =      1.750(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  31.98 min.  Rain intensity =       1.75(In/Hr)
Total area this stream =        85.79(Ac.)
Total Study Area (Main Stream No. 2) =      846.40(Ac.)
Total runoff =     47.41(CFS)


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Process from Point/Station       97.000 to Point/Station       97.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     85.790(Ac.)
Runoff from this stream =     47.410(CFS)
Time of concentration =   31.98 min.
Rainfall intensity =     1.750(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    886.12   760.560     31.71    0.391      1.759
2     47.41    85.790     31.98    0.391      1.750
Qmax(1) =
         1.000 *    1.000 *   886.118) +
         1.007 *    0.991 *    47.410) + =     933.436
Qmax(2) =
         0.993 *    1.000 *   886.118) +
         1.000 *    1.000 *    47.410) + =     927.696

Total of 2 main streams to confluence:
Flow rates before confluence point:
     887.118      48.410
Maximum flow rates at confluence using above data:
      933.436      927.696
Area of streams before confluence:
      760.560       85.790
Effective area values after confluence:
      845.619      846.350


Results of confluence:
Total flow rate =    933.436(CFS)
Time of concentration =    31.708 min.
Effective stream area after confluence  =    845.619(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total =     846.35(Ac.)


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Process from Point/Station       97.000 to Point/Station       97.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    845.619(Ac.)
Runoff from this stream =    933.436(CFS)
Time of concentration =   31.71 min.
Rainfall intensity =     1.759(In/Hr)
Area averaged loss rate (Fm) =    0.3914(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4002
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      417.000 to Point/Station      418.000
**** INITIAL AREA EVALUATION ****
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   396.000(Ft.)
Top (of initial area) elevation =   677.000(Ft.)
Bottom (of initial area) elevation =   676.000(Ft.)
Difference in elevation =     1.000(Ft.)
Slope =    0.00253  s(%)=       0.25
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.002 min.
Rainfall intensity =      3.320(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.873
Subarea runoff =      5.656(CFS)
Total initial stream area =        1.950(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      418.000 to Point/Station      419.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   672.000(Ft.)
Downstream point/station elevation =   669.000(Ft.)
Pipe length  =   626.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.656(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.656(CFS)
Normal flow depth in pipe =   11.93(In.)
Flow top width inside pipe =   17.02(In.)
Critical Depth =   11.01(In.)
Pipe flow velocity =      4.55(Ft/s)
Travel time through pipe =    2.29 min.
Time of concentration (TC) =    13.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      419.000 to Point/Station      419.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
```

```
Time of concentration =    13.30 min.
Rainfall intensity =      2.964(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.870
Subarea runoff =      7.035(CFS) for    2.970(Ac.)
Total runoff =     12.690(CFS)
Effective area this stream =        4.92(Ac.)
Total Study Area (Main Stream No. 2) =      851.32(Ac.)
Area averaged Fm value =    0.098(In/Hr)


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Process from Point/Station      419.000 to Point/Station       97.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.920(Ac.)
Runoff from this stream =     12.690(CFS)
Time of concentration =   13.30 min.
Rainfall intensity =     2.964(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    933.44   845.619     31.71    0.391      1.759
2     12.69     4.920     13.30    0.098      2.964
Qmax(1) =
         1.000 *    1.000 *   933.436) +
         0.580 *    1.000 *    12.690) + =     940.794
Qmax(2) =
         1.880 *    0.419 *   933.436) +
         1.000 *    1.000 *    12.690) + =     748.681

Total of 2 main streams to confluence:
Flow rates before confluence point:
     934.436      13.690
Maximum flow rates at confluence using above data:
      940.794      748.681
Area of streams before confluence:
      845.619        4.920
Effective area values after confluence:
      850.539      359.533


Results of confluence:
Total flow rate =    940.794(CFS)
Time of concentration =    31.708 min.
Effective stream area after confluence  =    850.539(Ac.)
```

Study area average Pervious fraction(Ap) = 0.399
Study area average soil loss rate(Fm) = 0.390(In/Hr)
Study area total = 850.54(Ac.)
End of computations, Total Study Area = 851.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.398
Area averaged SCS curve number = 32.0

APPENDIX A.3: RATIONAL METHOD ANALYSIS, WALKER ONSITE MITIGATED, AREA D2

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/05/25

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED RATIONAL METHOD HYDROLOGY
AREA D2, 100 YEAR STORM EVENT
FN: RARD2100P

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 403.000 to Point/Station 404.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 650.000(Ft.)
Top (of initial area) elevation = 689.000(Ft.)
Bottom (of initial area) elevation = 682.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01077 s(%)= 1.08
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.037 min.
Rainfall intensity = 3.508(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff = 9.792(CFS)
Total initial stream area = 3.190(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      407.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   678.000(Ft.)
Downstream point/station elevation =   676.400(Ft.)
Pipe length  =   518.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.792(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =     9.792(CFS)
Normal flow depth in pipe =   15.93(In.)
Flow top width inside pipe =   22.68(In.)
Critical Depth =   13.43(In.)
Pipe flow velocity =      4.42(Ft/s)
Travel time through pipe =    1.95 min.
Time of concentration (TC) =    11.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      407.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.190(Ac.)
Runoff from this stream =      9.792(CFS)
Time of concentration =   11.99 min.
Rainfall intensity =     3.154(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      405.000 to Point/Station      406.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   640.000(Ft.)
Top (of initial area) elevation =   687.500(Ft.)
Bottom (of initial area) elevation =   681.000(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.01016  s(%)=       1.02
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =   10.093 min.
Rainfall intensity =      3.497(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =      9.453(CFS)
Total initial stream area =        3.090(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      406.000 to Point/Station      407.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   677.000(Ft.)
Downstream point/station elevation =   676.400(Ft.)
Pipe length  =    38.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.453(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     9.453(CFS)
Normal flow depth in pipe =   11.27(In.)
Flow top width inside pipe =   17.42(In.)
Critical Depth =   14.25(In.)
Pipe flow velocity =      8.12(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    10.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      406.000 to Point/Station      407.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.090(Ac.)
Runoff from this stream =      9.453(CFS)
Time of concentration =   10.17 min.
Rainfall intensity =     3.481(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      9.79     3.190     11.99    0.098      3.154
2      9.45     3.090     10.17    0.098      3.481
Qmax(1) =
         1.000 *    1.000 *     9.792) +
         0.903 *    1.000 *     9.453) + =      18.331
Qmax(2) =
         1.107 *    0.848 *     9.792) +
         1.000 *    1.000 *     9.453) + =      18.649
```

```
Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.792      10.453
Maximum flow rates at confluence using above data:
       18.331       18.649
Area of streams before confluence:
        3.190        3.090
Effective area values after confluence:
        6.280        5.796


Results of confluence:
Total flow rate =     18.649(CFS)
Time of concentration =    10.170 min.
Effective stream area after confluence  =      5.796(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total =       6.28(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      407.000 to Point/Station      411.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   676.400(Ft.)
Downstream point/station elevation =   674.700(Ft.)
Pipe length  =    78.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.649(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    18.649(CFS)
Normal flow depth in pipe =   14.18(In.)
Flow top width inside pipe =   19.67(In.)
Critical Depth =   18.75(In.)
Pipe flow velocity =     10.80(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    10.29 min.


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Process from Point/Station      407.000 to Point/Station      411.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      5.796(Ac.)
Runoff from this stream =     18.649(CFS)
Time of concentration =   10.29 min.
Rainfall intensity =     3.456(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      408.000 to Point/Station      411.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   690.000(Ft.)
Top (of initial area) elevation =   686.000(Ft.)
Bottom (of initial area) elevation =   679.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01014  s(%)=       1.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.403 min.
Rainfall intensity =      3.434(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =     24.530(CFS)
Total initial stream area =        8.170(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      408.000 to Point/Station      411.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      8.170(Ac.)
Runoff from this stream =     24.530(CFS)
Time of concentration =   10.40 min.
Rainfall intensity =     3.434(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      409.000 to Point/Station      410.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   670.000(Ft.)
Top (of initial area) elevation =   688.000(Ft.)
Bottom (of initial area) elevation =   681.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01045  s(%)=       1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.221 min.
Rainfall intensity =      3.470(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =      9.895(CFS)
Total initial stream area =        3.260(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      410.000 to Point/Station      411.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   677.000(Ft.)
Downstream point/station elevation =   674.700(Ft.)
Pipe length  =    38.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.895(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.895(CFS)
Normal flow depth in pipe =    8.57(In.)
Flow top width inside pipe =   14.85(In.)
Critical Depth =   14.17(In.)
Pipe flow velocity =     13.65(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    10.27 min.


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Process from Point/Station      410.000 to Point/Station      411.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      3.260(Ac.)
Runoff from this stream =      9.895(CFS)
Time of concentration =   10.27 min.
Rainfall intensity =     3.461(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1     18.65     5.796     10.29    0.098      3.456
2     24.53     8.170     10.40    0.098      3.434
3      9.90     3.260     10.27    0.098      3.461
Qmax(1) =
         1.000 *    1.000 *    18.649) +
         1.007 *    0.989 *    24.530) +
         0.999 *    1.000 *     9.895) + =      52.958
Qmax(2) =
         0.993 *    1.000 *    18.649) +
         1.000 *    1.000 *    24.530) +
         0.992 *    1.000 *     9.895) + =      52.869
Qmax(3) =
         1.001 *    0.998 *    18.649) +
         1.008 *    0.987 *    24.530) +
         1.000 *    1.000 *     9.895) + =      52.935

Total of 3 main streams to confluence:
Flow rates before confluence point:
      19.649      25.530      10.895
Maximum flow rates at confluence using above data:
       52.958       52.869       52.935
Area of streams before confluence:
        5.796        8.170        3.260
Effective area values after confluence:
       17.138       17.226       17.107


Results of confluence:
Total flow rate =     52.958(CFS)
Time of concentration =    10.291 min.
Effective stream area after confluence  =     17.138(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total =      17.23(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      411.000 to Point/Station      412.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.700(Ft.)
Downstream point/station elevation =   674.500(Ft.)
Pipe length  =    57.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    52.958(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    52.958(CFS)
Normal flow depth in pipe =   30.84(In.)
Flow top width inside pipe =   37.10(In.)
Critical Depth =   27.33(In.)
Pipe flow velocity =      7.00(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    10.43 min.
End of computations, Total Study Area =          17.71 (Ac.)
```

The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0

APPENDIX A.4: UNIT HYDROGRAPH ANALYSIS, WALKER ONSITE MITIGATED, AREA D2

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 05/05/25

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6279

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED UNIT HYDROGRAPH METHOD HYDROLOGY
AREA D2, 100-YEAR STORM EVENT
FN: UARD2P

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
17.71	1	1.20
Rainfall data for year 100		
17.71	6	3.00
Rainfall data for year 100		
17.71	24	6.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	17.71	1.000	0.978	0.100	0.098

Area-averaged adjusted loss rate Fm (In/Hr) = 0.098

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
1.77	0.100	32.0	32.0	21.25	0.022
15.94	0.900	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.866
Area-averaged low loss fraction, Yb = 0.134
User entry of time of concentration = 0.174 (hours)
++
Watershed area = 17.71(Ac.)
Catchment Lag time = 0.139 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 59.8659
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.134 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.444(In)
Computed peak 30-minute rainfall = 0.909(In)
Specified peak 1-hour rainfall = 1.200(In)
Computed peak 3-hour rainfall = 2.105(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:
Using a total area of 17.71(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.444(In)
30-minute factor = 0.999 Adjusted rainfall = 0.909(In)
1-hour factor = 0.999 Adjusted rainfall = 1.199(In)
3-hour factor = 1.000 Adjusted rainfall = 2.104(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 214.18 (CFS))	
1	6.490	13.901

2	41.475	74.931
3	81.584	85.905
4	95.476	29.755
5	98.649	6.796
6	100.000	2.893

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4438	0.4438
2	0.5855	0.1418
3	0.6886	0.1031
4	0.7726	0.0840
5	0.8448	0.0721
6	0.9087	0.0639
7	0.9665	0.0578
8	1.0195	0.0530
9	1.0687	0.0492
10	1.1147	0.0460
11	1.1580	0.0433
12	1.1990	0.0410
13	1.2492	0.0502
14	1.2975	0.0483
15	1.3441	0.0467
16	1.3893	0.0452
17	1.4331	0.0438
18	1.4757	0.0426
19	1.5171	0.0414
20	1.5575	0.0404
21	1.5969	0.0394
22	1.6354	0.0385
23	1.6730	0.0377
24	1.7099	0.0369
25	1.7460	0.0361
26	1.7814	0.0354
27	1.8162	0.0348
28	1.8503	0.0341
29	1.8839	0.0335
30	1.9168	0.0330
31	1.9493	0.0325
32	1.9812	0.0319
33	2.0127	0.0315
34	2.0437	0.0310
35	2.0743	0.0306
36	2.1044	0.0301
37	2.1341	0.0297
38	2.1634	0.0293
39	2.1924	0.0289
40	2.2209	0.0286
41	2.2492	0.0282
42	2.2770	0.0279
43	2.3046	0.0276
44	2.3319	0.0273
45	2.3588	0.0270

46	2.3855	0.0267
47	2.4119	0.0264
48	2.4380	0.0261
49	2.4638	0.0258
50	2.4894	0.0256
51	2.5148	0.0253
52	2.5399	0.0251
53	2.5647	0.0249
54	2.5894	0.0246
55	2.6138	0.0244
56	2.6380	0.0242
57	2.6620	0.0240
58	2.6858	0.0238
59	2.7094	0.0236
60	2.7327	0.0234
61	2.7559	0.0232
62	2.7790	0.0230
63	2.8018	0.0228
64	2.8245	0.0227
65	2.8469	0.0225
66	2.8693	0.0223
67	2.8914	0.0222
68	2.9134	0.0220
69	2.9352	0.0218
70	2.9569	0.0217
71	2.9785	0.0215
72	2.9998	0.0214
73	3.0206	0.0208
74	3.0412	0.0206
75	3.0617	0.0205
76	3.0820	0.0203
77	3.1023	0.0202
78	3.1223	0.0201
79	3.1423	0.0200
80	3.1621	0.0198
81	3.1818	0.0197
82	3.2014	0.0196
83	3.2209	0.0195
84	3.2402	0.0193
85	3.2594	0.0192
86	3.2786	0.0191
87	3.2976	0.0190
88	3.3165	0.0189
89	3.3352	0.0188
90	3.3539	0.0187
91	3.3725	0.0186
92	3.3910	0.0185
93	3.4094	0.0184
94	3.4277	0.0183
95	3.4458	0.0182
96	3.4639	0.0181
97	3.4819	0.0180
98	3.4998	0.0179

99	3.5176	0.0178
100	3.5354	0.0177
101	3.5530	0.0176
102	3.5705	0.0175
103	3.5880	0.0175
104	3.6054	0.0174
105	3.6227	0.0173
106	3.6399	0.0172
107	3.6570	0.0171
108	3.6741	0.0170
109	3.6910	0.0170
110	3.7079	0.0169
111	3.7247	0.0168
112	3.7415	0.0167
113	3.7582	0.0167
114	3.7747	0.0166
115	3.7913	0.0165
116	3.8077	0.0164
117	3.8241	0.0164
118	3.8404	0.0163
119	3.8566	0.0162
120	3.8728	0.0162
121	3.8889	0.0161
122	3.9050	0.0160
123	3.9209	0.0160
124	3.9368	0.0159
125	3.9527	0.0158
126	3.9685	0.0158
127	3.9842	0.0157
128	3.9998	0.0157
129	4.0154	0.0156
130	4.0310	0.0155
131	4.0464	0.0155
132	4.0619	0.0154
133	4.0772	0.0154
134	4.0925	0.0153
135	4.1078	0.0152
136	4.1229	0.0152
137	4.1381	0.0151
138	4.1531	0.0151
139	4.1682	0.0150
140	4.1831	0.0150
141	4.1980	0.0149
142	4.2129	0.0149
143	4.2277	0.0148
144	4.2425	0.0148
145	4.2572	0.0147
146	4.2718	0.0147
147	4.2864	0.0146
148	4.3010	0.0146
149	4.3155	0.0145
150	4.3300	0.0145
151	4.3444	0.0144

152	4.3587	0.0144
153	4.3731	0.0143
154	4.3873	0.0143
155	4.4015	0.0142
156	4.4157	0.0142
157	4.4298	0.0141
158	4.4439	0.0141
159	4.4580	0.0140
160	4.4720	0.0140
161	4.4859	0.0140
162	4.4998	0.0139
163	4.5137	0.0139
164	4.5275	0.0138
165	4.5413	0.0138
166	4.5551	0.0137
167	4.5688	0.0137
168	4.5824	0.0137
169	4.5960	0.0136
170	4.6096	0.0136
171	4.6232	0.0135
172	4.6366	0.0135
173	4.6501	0.0135
174	4.6635	0.0134
175	4.6769	0.0134
176	4.6903	0.0133
177	4.7036	0.0133
178	4.7168	0.0133
179	4.7301	0.0132
180	4.7433	0.0132
181	4.7564	0.0132
182	4.7695	0.0131
183	4.7826	0.0131
184	4.7957	0.0131
185	4.8087	0.0130
186	4.8217	0.0130
187	4.8346	0.0129
188	4.8475	0.0129
189	4.8604	0.0129
190	4.8732	0.0128
191	4.8860	0.0128
192	4.8988	0.0128
193	4.9116	0.0127
194	4.9243	0.0127
195	4.9369	0.0127
196	4.9496	0.0126
197	4.9622	0.0126
198	4.9748	0.0126
199	4.9873	0.0125
200	4.9998	0.0125
201	5.0123	0.0125
202	5.0248	0.0125
203	5.0372	0.0124
204	5.0496	0.0124

205	5.0620	0.0124
206	5.0743	0.0123
207	5.0866	0.0123
208	5.0989	0.0123
209	5.1111	0.0122
210	5.1233	0.0122
211	5.1355	0.0122
212	5.1477	0.0122
213	5.1598	0.0121
214	5.1719	0.0121
215	5.1840	0.0121
216	5.1960	0.0120
217	5.2080	0.0120
218	5.2200	0.0120
219	5.2320	0.0120
220	5.2439	0.0119
221	5.2558	0.0119
222	5.2677	0.0119
223	5.2795	0.0119
224	5.2914	0.0118
225	5.3032	0.0118
226	5.3149	0.0118
227	5.3267	0.0117
228	5.3384	0.0117
229	5.3501	0.0117
230	5.3618	0.0117
231	5.3734	0.0116
232	5.3850	0.0116
233	5.3966	0.0116
234	5.4082	0.0116
235	5.4197	0.0115
236	5.4312	0.0115
237	5.4427	0.0115
238	5.4542	0.0115
239	5.4657	0.0114
240	5.4771	0.0114
241	5.4885	0.0114
242	5.4999	0.0114
243	5.5112	0.0114
244	5.5225	0.0113
245	5.5338	0.0113
246	5.5451	0.0113
247	5.5564	0.0113
248	5.5676	0.0112
249	5.5788	0.0112
250	5.5900	0.0112
251	5.6012	0.0112
252	5.6123	0.0111
253	5.6235	0.0111
254	5.6346	0.0111
255	5.6457	0.0111
256	5.6567	0.0111
257	5.6678	0.0110

258	5.6788	0.0110
259	5.6898	0.0110
260	5.7007	0.0110
261	5.7117	0.0110
262	5.7226	0.0109
263	5.7335	0.0109
264	5.7444	0.0109
265	5.7553	0.0109
266	5.7661	0.0108
267	5.7770	0.0108
268	5.7878	0.0108
269	5.7986	0.0108
270	5.8093	0.0108
271	5.8201	0.0107
272	5.8308	0.0107
273	5.8415	0.0107
274	5.8522	0.0107
275	5.8629	0.0107
276	5.8735	0.0107
277	5.8842	0.0106
278	5.8948	0.0106
279	5.9054	0.0106
280	5.9159	0.0106
281	5.9265	0.0106
282	5.9370	0.0105
283	5.9476	0.0105
284	5.9581	0.0105
285	5.9685	0.0105
286	5.9790	0.0105
287	5.9894	0.0104
288	5.9999	0.0104

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0104	0.0014	0.0090
2	0.0104	0.0014	0.0090
3	0.0105	0.0014	0.0091
4	0.0105	0.0014	0.0091
5	0.0105	0.0014	0.0091
6	0.0106	0.0014	0.0091
7	0.0106	0.0014	0.0092
8	0.0106	0.0014	0.0092
9	0.0107	0.0014	0.0092
10	0.0107	0.0014	0.0092
11	0.0107	0.0014	0.0093
12	0.0107	0.0014	0.0093
13	0.0108	0.0014	0.0093
14	0.0108	0.0014	0.0093
15	0.0108	0.0014	0.0094
16	0.0108	0.0014	0.0094
17	0.0109	0.0015	0.0094

18	0.0109	0.0015	0.0095
19	0.0110	0.0015	0.0095
20	0.0110	0.0015	0.0095
21	0.0110	0.0015	0.0095
22	0.0110	0.0015	0.0096
23	0.0111	0.0015	0.0096
24	0.0111	0.0015	0.0096
25	0.0111	0.0015	0.0097
26	0.0112	0.0015	0.0097
27	0.0112	0.0015	0.0097
28	0.0112	0.0015	0.0097
29	0.0113	0.0015	0.0098
30	0.0113	0.0015	0.0098
31	0.0114	0.0015	0.0098
32	0.0114	0.0015	0.0099
33	0.0114	0.0015	0.0099
34	0.0114	0.0015	0.0099
35	0.0115	0.0015	0.0100
36	0.0115	0.0015	0.0100
37	0.0116	0.0015	0.0100
38	0.0116	0.0015	0.0100
39	0.0116	0.0016	0.0101
40	0.0117	0.0016	0.0101
41	0.0117	0.0016	0.0102
42	0.0117	0.0016	0.0102
43	0.0118	0.0016	0.0102
44	0.0118	0.0016	0.0102
45	0.0119	0.0016	0.0103
46	0.0119	0.0016	0.0103
47	0.0120	0.0016	0.0104
48	0.0120	0.0016	0.0104
49	0.0120	0.0016	0.0104
50	0.0121	0.0016	0.0105
51	0.0121	0.0016	0.0105
52	0.0122	0.0016	0.0105
53	0.0122	0.0016	0.0106
54	0.0122	0.0016	0.0106
55	0.0123	0.0016	0.0107
56	0.0123	0.0016	0.0107
57	0.0124	0.0017	0.0107
58	0.0124	0.0017	0.0108
59	0.0125	0.0017	0.0108
60	0.0125	0.0017	0.0108
61	0.0126	0.0017	0.0109
62	0.0126	0.0017	0.0109
63	0.0127	0.0017	0.0110
64	0.0127	0.0017	0.0110
65	0.0128	0.0017	0.0111
66	0.0128	0.0017	0.0111
67	0.0129	0.0017	0.0112
68	0.0129	0.0017	0.0112
69	0.0130	0.0017	0.0112
70	0.0130	0.0017	0.0113

71	0.0131	0.0017	0.0113
72	0.0131	0.0018	0.0114
73	0.0132	0.0018	0.0114
74	0.0132	0.0018	0.0115
75	0.0133	0.0018	0.0115
76	0.0133	0.0018	0.0116
77	0.0134	0.0018	0.0116
78	0.0135	0.0018	0.0117
79	0.0135	0.0018	0.0117
80	0.0136	0.0018	0.0118
81	0.0137	0.0018	0.0118
82	0.0137	0.0018	0.0119
83	0.0138	0.0018	0.0119
84	0.0138	0.0018	0.0120
85	0.0139	0.0019	0.0121
86	0.0140	0.0019	0.0121
87	0.0140	0.0019	0.0122
88	0.0141	0.0019	0.0122
89	0.0142	0.0019	0.0123
90	0.0142	0.0019	0.0123
91	0.0143	0.0019	0.0124
92	0.0144	0.0019	0.0124
93	0.0145	0.0019	0.0125
94	0.0145	0.0019	0.0126
95	0.0146	0.0019	0.0127
96	0.0147	0.0020	0.0127
97	0.0148	0.0020	0.0128
98	0.0148	0.0020	0.0128
99	0.0149	0.0020	0.0129
100	0.0150	0.0020	0.0130
101	0.0151	0.0020	0.0131
102	0.0151	0.0020	0.0131
103	0.0152	0.0020	0.0132
104	0.0153	0.0020	0.0133
105	0.0154	0.0021	0.0134
106	0.0155	0.0021	0.0134
107	0.0156	0.0021	0.0135
108	0.0157	0.0021	0.0136
109	0.0158	0.0021	0.0137
110	0.0158	0.0021	0.0137
111	0.0160	0.0021	0.0138
112	0.0160	0.0021	0.0139
113	0.0162	0.0022	0.0140
114	0.0162	0.0022	0.0141
115	0.0164	0.0022	0.0142
116	0.0164	0.0022	0.0143
117	0.0166	0.0022	0.0144
118	0.0167	0.0022	0.0144
119	0.0168	0.0022	0.0146
120	0.0169	0.0023	0.0146
121	0.0170	0.0023	0.0148
122	0.0171	0.0023	0.0148
123	0.0173	0.0023	0.0150

124	0.0174	0.0023	0.0151
125	0.0175	0.0023	0.0152
126	0.0176	0.0024	0.0153
127	0.0178	0.0024	0.0154
128	0.0179	0.0024	0.0155
129	0.0181	0.0024	0.0157
130	0.0182	0.0024	0.0158
131	0.0184	0.0025	0.0159
132	0.0185	0.0025	0.0160
133	0.0187	0.0025	0.0162
134	0.0188	0.0025	0.0163
135	0.0190	0.0025	0.0165
136	0.0191	0.0026	0.0166
137	0.0193	0.0026	0.0168
138	0.0195	0.0026	0.0169
139	0.0197	0.0026	0.0171
140	0.0198	0.0026	0.0172
141	0.0201	0.0027	0.0174
142	0.0202	0.0027	0.0175
143	0.0205	0.0027	0.0177
144	0.0206	0.0028	0.0179
145	0.0214	0.0029	0.0185
146	0.0215	0.0029	0.0187
147	0.0218	0.0029	0.0189
148	0.0220	0.0029	0.0191
149	0.0223	0.0030	0.0193
150	0.0225	0.0030	0.0195
151	0.0228	0.0030	0.0198
152	0.0230	0.0031	0.0199
153	0.0234	0.0031	0.0203
154	0.0236	0.0031	0.0204
155	0.0240	0.0032	0.0208
156	0.0242	0.0032	0.0210
157	0.0246	0.0033	0.0213
158	0.0249	0.0033	0.0215
159	0.0253	0.0034	0.0220
160	0.0256	0.0034	0.0222
161	0.0261	0.0035	0.0226
162	0.0264	0.0035	0.0229
163	0.0270	0.0036	0.0234
164	0.0273	0.0036	0.0236
165	0.0279	0.0037	0.0242
166	0.0282	0.0038	0.0245
167	0.0289	0.0039	0.0251
168	0.0293	0.0039	0.0254
169	0.0301	0.0040	0.0261
170	0.0306	0.0041	0.0265
171	0.0315	0.0042	0.0273
172	0.0319	0.0043	0.0277
173	0.0330	0.0044	0.0286
174	0.0335	0.0045	0.0291
175	0.0348	0.0046	0.0301
176	0.0354	0.0047	0.0307

177	0.0369	0.0049	0.0319
178	0.0377	0.0050	0.0326
179	0.0394	0.0053	0.0341
180	0.0404	0.0054	0.0350
181	0.0426	0.0057	0.0369
182	0.0438	0.0058	0.0380
183	0.0467	0.0062	0.0404
184	0.0483	0.0064	0.0419
185	0.0410	0.0055	0.0355
186	0.0433	0.0058	0.0375
187	0.0492	0.0066	0.0426
188	0.0530	0.0071	0.0459
189	0.0639	0.0081	0.0558
190	0.0721	0.0081	0.0640
191	0.1031	0.0081	0.0950
192	0.1418	0.0081	0.1336
193	0.4438	0.0081	0.4356
194	0.0840	0.0081	0.0758
195	0.0578	0.0077	0.0501
196	0.0460	0.0061	0.0399
197	0.0502	0.0067	0.0435
198	0.0452	0.0060	0.0391
199	0.0414	0.0055	0.0359
200	0.0385	0.0051	0.0334
201	0.0361	0.0048	0.0313
202	0.0341	0.0046	0.0296
203	0.0325	0.0043	0.0281
204	0.0310	0.0041	0.0269
205	0.0297	0.0040	0.0257
206	0.0286	0.0038	0.0248
207	0.0276	0.0037	0.0239
208	0.0267	0.0036	0.0231
209	0.0258	0.0035	0.0224
210	0.0251	0.0034	0.0217
211	0.0244	0.0033	0.0212
212	0.0238	0.0032	0.0206
213	0.0232	0.0031	0.0201
214	0.0227	0.0030	0.0196
215	0.0222	0.0030	0.0192
216	0.0217	0.0029	0.0188
217	0.0208	0.0028	0.0180
218	0.0203	0.0027	0.0176
219	0.0200	0.0027	0.0173
220	0.0196	0.0026	0.0170
221	0.0192	0.0026	0.0167
222	0.0189	0.0025	0.0164
223	0.0186	0.0025	0.0161
224	0.0183	0.0024	0.0158
225	0.0180	0.0024	0.0156
226	0.0177	0.0024	0.0154
227	0.0175	0.0023	0.0151
228	0.0172	0.0023	0.0149
229	0.0170	0.0023	0.0147

230	0.0167	0.0022	0.0145
231	0.0165	0.0022	0.0143
232	0.0163	0.0022	0.0141
233	0.0161	0.0021	0.0140
234	0.0159	0.0021	0.0138
235	0.0157	0.0021	0.0136
236	0.0155	0.0021	0.0135
237	0.0154	0.0021	0.0133
238	0.0152	0.0020	0.0132
239	0.0150	0.0020	0.0130
240	0.0149	0.0020	0.0129
241	0.0147	0.0020	0.0127
242	0.0146	0.0019	0.0126
243	0.0144	0.0019	0.0125
244	0.0143	0.0019	0.0124
245	0.0141	0.0019	0.0122
246	0.0140	0.0019	0.0121
247	0.0139	0.0019	0.0120
248	0.0137	0.0018	0.0119
249	0.0136	0.0018	0.0118
250	0.0135	0.0018	0.0117
251	0.0134	0.0018	0.0116
252	0.0133	0.0018	0.0115
253	0.0132	0.0018	0.0114
254	0.0131	0.0017	0.0113
255	0.0129	0.0017	0.0112
256	0.0128	0.0017	0.0111
257	0.0127	0.0017	0.0110
258	0.0126	0.0017	0.0110
259	0.0125	0.0017	0.0109
260	0.0125	0.0017	0.0108
261	0.0124	0.0017	0.0107
262	0.0123	0.0016	0.0106
263	0.0122	0.0016	0.0106
264	0.0121	0.0016	0.0105
265	0.0120	0.0016	0.0104
266	0.0119	0.0016	0.0103
267	0.0119	0.0016	0.0103
268	0.0118	0.0016	0.0102
269	0.0117	0.0016	0.0101
270	0.0116	0.0016	0.0101
271	0.0115	0.0015	0.0100
272	0.0115	0.0015	0.0099
273	0.0114	0.0015	0.0099
274	0.0113	0.0015	0.0098
275	0.0113	0.0015	0.0098
276	0.0112	0.0015	0.0097
277	0.0111	0.0015	0.0096
278	0.0111	0.0015	0.0096
279	0.0110	0.0015	0.0095
280	0.0109	0.0015	0.0095
281	0.0109	0.0015	0.0094
282	0.0108	0.0014	0.0094

283	0.0107	0.0014	0.0093
284	0.0107	0.0014	0.0093
285	0.0106	0.0014	0.0092
286	0.0106	0.0014	0.0092
287	0.0105	0.0014	0.0091
288	0.0105	0.0014	0.0091

Total soil rain loss = 0.73(In)
Total effective rainfall = 5.27(In)
Peak flow rate in flood hydrograph = 48.61(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	12.5	25.0	37.5	50.0
0+ 5	0.0009	0.13	Q				
0+10	0.0064	0.80	Q				
0+15	0.0173	1.58	VQ				
0+20	0.0300	1.85	VQ				
0+25	0.0433	1.92	VQ				
0+30	0.0567	1.95	VQ				
0+35	0.0702	1.96	VQ				
0+40	0.0837	1.96	VQ				
0+45	0.0972	1.97	VQ				
0+50	0.1108	1.97	VQ				
0+55	0.1244	1.98	VQ				
1+ 0	0.1381	1.98	VQ				
1+ 5	0.1518	1.99	VQ				
1+10	0.1655	1.99	VQ				
1+15	0.1792	2.00	VQ				
1+20	0.1931	2.00	VQ				
1+25	0.2069	2.01	|Q				
1+30	0.2208	2.02	|Q				
1+35	0.2347	2.02	|Q				
1+40	0.2487	2.03	|Q				
1+45	0.2627	2.03	|Q				
1+50	0.2767	2.04	|Q				
1+55	0.2908	2.04	|Q				
2+ 0	0.3049	2.05	|Q				
2+ 5	0.3191	2.06	|Q				
2+10	0.3333	2.06	|Q				
2+15	0.3475	2.07	|Q				
2+20	0.3618	2.08	|Q				
2+25	0.3762	2.08	|Q				
2+30	0.3906	2.09	|QV				
2+35	0.4050	2.09	|QV				
2+40	0.4194	2.10	|QV				

2+45	0.4340	2.11	|QV	|	|	|
2+50	0.4485	2.11	|QV	|	|	|
2+55	0.4631	2.12	|QV	|	|	|
3+ 0	0.4778	2.13	|QV	|	|	|
3+ 5	0.4925	2.13	|QV	|	|	|
3+10	0.5072	2.14	|QV	|	|	|
3+15	0.5220	2.15	|QV	|	|	|
3+20	0.5368	2.15	|QV	|	|	|
3+25	0.5517	2.16	|QV	|	|	|
3+30	0.5667	2.17	|QV	|	|	|
3+35	0.5816	2.18	|QV	|	|	|
3+40	0.5967	2.18	|Q V	|	|	|
3+45	0.6118	2.19	|Q V	|	|	|
3+50	0.6269	2.20	|Q V	|	|	|
3+55	0.6421	2.20	|Q V	|	|	|
4+ 0	0.6573	2.21	|Q V	|	|	|
4+ 5	0.6726	2.22	|Q V	|	|	|
4+10	0.6880	2.23	|Q V	|	|	|
4+15	0.7033	2.24	|Q V	|	|	|
4+20	0.7188	2.24	|Q V	|	|	|
4+25	0.7343	2.25	|Q V	|	|	|
4+30	0.7499	2.26	|Q V	|	|	|
4+35	0.7655	2.27	|Q V	|	|	|
4+40	0.7811	2.28	|Q V	|	|	|
4+45	0.7969	2.28	|Q V	|	|	|
4+50	0.8127	2.29	|Q V	|	|	|
4+55	0.8285	2.30	|Q V	|	|	|
5+ 0	0.8444	2.31	|Q V	|	|	|
5+ 5	0.8604	2.32	|Q V	|	|	|
5+10	0.8764	2.33	|Q V	|	|	|
5+15	0.8925	2.34	|Q V	|	|	|
5+20	0.9086	2.34	|Q V	|	|	|
5+25	0.9248	2.35	|Q V	|	|	|
5+30	0.9411	2.36	|Q V	|	|	|
5+35	0.9574	2.37	|Q V	|	|	|
5+40	0.9738	2.38	|Q V	|	|	|
5+45	0.9903	2.39	|Q V	|	|	|
5+50	1.0068	2.40	|Q V	|	|	|
5+55	1.0234	2.41	|Q V	|	|	|
6+ 0	1.0401	2.42	|Q V	|	|	|
6+ 5	1.0568	2.43	|Q V	|	|	|
6+10	1.0736	2.44	|Q V	|	|	|
6+15	1.0905	2.45	|Q V	|	|	|
6+20	1.1074	2.46	|Q V	|	|	|
6+25	1.1244	2.47	|Q V	|	|	|
6+30	1.1415	2.48	|Q V	|	|	|
6+35	1.1587	2.49	|Q V	|	|	|
6+40	1.1759	2.50	| Q V	|	|	|
6+45	1.1932	2.51	| Q V	|	|	|
6+50	1.2106	2.52	| Q V	|	|	|
6+55	1.2281	2.54	| Q V	|	|	|
7+ 0	1.2456	2.55	| Q V	|	|	|
7+ 5	1.2632	2.56	| Q V	|	|	|

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 7+10       1.2809      2.57  | Q   V   |         |         |         |
 7+15       1.2987      2.58  | Q   V   |         |         |         |
 7+20       1.3166      2.59  | Q   V   |         |         |         |
 7+25       1.3345      2.61  | Q   V   |         |         |         |
 7+30       1.3526      2.62  | Q   V   |         |         |         |
 7+35       1.3707      2.63  | Q    V  |         |         |         |
 7+40       1.3889      2.64  | Q    V  |         |         |         |
 7+45       1.4072      2.66  | Q    V  |         |         |         |
 7+50       1.4256      2.67  | Q    V  |         |         |         |
 7+55       1.4441      2.68  | Q    V  |         |         |         |
 8+ 0       1.4627      2.70  | Q    V  |         |         |         |
 8+ 5       1.4814      2.71  | Q    V  |         |         |         |
 8+10       1.5001      2.73  | Q    V  |         |         |         |
 8+15       1.5190      2.74  | Q    V  |         |         |         |
 8+20       1.5380      2.75  | Q    V  |         |         |         |
 8+25       1.5570      2.77  | Q     V |         |         |         |
 8+30       1.5762      2.78  | Q     V |         |         |         |
 8+35       1.5955      2.80  | Q     V |         |         |         |
 8+40       1.6149      2.81  | Q     V |         |         |         |
 8+45       1.6344      2.83  | Q     V |         |         |         |
 8+50       1.6540      2.85  | Q     V |         |         |         |
 8+55       1.6737      2.86  | Q     V |         |         |         |
 9+ 0       1.6935      2.88  | Q     V |         |         |         |
 9+ 5       1.7134      2.90  | Q     V |         |         |         |
 9+10       1.7335      2.91  | Q     V |         |         |         |
 9+15       1.7537      2.93  | Q      V|         |         |         |
 9+20       1.7740      2.95  | Q      V|         |         |         |
 9+25       1.7944      2.97  | Q      V|         |         |         |
 9+30       1.8150      2.98  | Q      V|         |         |         |
 9+35       1.8356      3.00  | Q      V|         |         |         |
 9+40       1.8565      3.02  | Q      V|         |         |         |
 9+45       1.8774      3.04  | Q      V|         |         |         |
 9+50       1.8985      3.06  | Q      V|         |         |         |
 9+55       1.9197      3.08  | Q      V|         |         |         |
10+ 0       1.9411      3.10  | Q      V|         |         |         |
10+ 5       1.9626      3.12  | Q       V         |         |         |
10+10       1.9842      3.14  | Q       V         |         |         |
10+15       2.0060      3.17  | Q       V         |         |         |
10+20       2.0280      3.19  | Q       V         |         |         |
10+25       2.0501      3.21  | Q       V         |         |         |
10+30       2.0724      3.23  | Q       V         |         |         |
10+35       2.0948      3.26  | Q       V         |         |         |
10+40       2.1174      3.28  | Q       V         |         |         |
10+45       2.1402      3.31  | Q       |V        |         |         |
10+50       2.1632      3.33  | Q       |V        |         |         |
10+55       2.1863      3.36  | Q       |V        |         |         |
11+ 0       2.2096      3.39  | Q       |V        |         |         |
11+ 5       2.2331      3.41  | Q       |V        |         |         |
11+10       2.2568      3.44  | Q       |V        |         |         |
11+15       2.2807      3.47  | Q       |V        |         |         |
11+20       2.3048      3.50  | Q       |V        |         |         |
11+25       2.3291      3.53  | Q       |V        |         |         |
11+30       2.3537      3.56  | Q       | V       |         |         |
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11+35	2.3784	3.59	Q	V			
11+40	2.4034	3.63	Q	V			
11+45	2.4286	3.66	Q	V			
11+50	2.4540	3.69	Q	V			
11+55	2.4797	3.73	Q	V			
12+ 0	2.5056	3.77	Q	V			
12+ 5	2.5319	3.81	Q	V			
12+10	2.5586	3.88	Q	V			
12+15	2.5859	3.96	Q	V			
12+20	2.6135	4.01	Q	V			
12+25	2.6414	4.05	Q	V			
12+30	2.6696	4.10	Q	V			
12+35	2.6982	4.15	Q	V			
12+40	2.7271	4.19	Q	V			
12+45	2.7563	4.24	Q	V			
12+50	2.7858	4.29	Q	V			
12+55	2.8158	4.35	Q	V			
13+ 0	2.8461	4.40	Q	V			
13+ 5	2.8768	4.46	Q	V			
13+10	2.9079	4.52	Q	V			
13+15	2.9394	4.58	Q	V			
13+20	2.9714	4.64	Q	V			
13+25	3.0038	4.71	Q	V			
13+30	3.0367	4.78	Q	V			
13+35	3.0702	4.85	Q	V			
13+40	3.1041	4.93	Q	V			
13+45	3.1386	5.01	Q	V			
13+50	3.1737	5.10	Q	V			
13+55	3.2094	5.19	Q	V			
14+ 0	3.2458	5.28	Q	V			
14+ 5	3.2828	5.38	Q	V			
14+10	3.3206	5.49	Q	V			
14+15	3.3592	5.60	Q	V			
14+20	3.3987	5.72	Q	V			
14+25	3.4390	5.85	Q	V			
14+30	3.4802	5.99	Q	V			
14+35	3.5225	6.14	Q	V			
14+40	3.5659	6.30	Q	V			
14+45	3.6104	6.47	Q	V			
14+50	3.6563	6.66	Q	V			
14+55	3.7036	6.86	Q	V			
15+ 0	3.7524	7.09	Q	V			
15+ 5	3.8030	7.34	Q	V			
15+10	3.8555	7.63	Q	V			
15+15	3.9102	7.94	Q	V			
15+20	3.9674	8.31	Q	V			
15+25	4.0265	8.59	Q	V			
15+30	4.0840	8.35	Q	V			
15+35	4.1397	8.09	Q	V			
15+40	4.1984	8.52	Q	V			
15+45	4.2628	9.36	Q	V			
15+50	4.3361	10.64	Q	V			
15+55	4.4234	12.67	Q	V			

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  20+25       7.0850      2.67  | Q       |         |         |     V   |
  20+30       7.1032      2.64  | Q       |         |         |     V   |
  20+35       7.1212      2.62  | Q       |         |         |     V   |
  20+40       7.1391      2.59  | Q       |         |         |     V   |
  20+45       7.1568      2.57  | Q       |         |         |     V   |
  20+50       7.1743      2.55  | Q       |         |         |     V   |
  20+55       7.1917      2.52  | Q       |         |         |     V   |
  21+ 0       7.2089      2.50  | Q       |         |         |      V  |
  21+ 5       7.2260      2.48  |Q        |         |         |      V  |
  21+10       7.2429      2.46  |Q        |         |         |      V  |
  21+15       7.2597      2.44  |Q        |         |         |      V  |
  21+20       7.2763      2.42  |Q        |         |         |      V  |
  21+25       7.2929      2.40  |Q        |         |         |      V  |
  21+30       7.3092      2.38  |Q        |         |         |      V  |
  21+35       7.3255      2.36  |Q        |         |         |      V  |
  21+40       7.3416      2.34  |Q        |         |         |      V  |
  21+45       7.3576      2.32  |Q        |         |         |      V  |
  21+50       7.3735      2.31  |Q        |         |         |      V  |
  21+55       7.3893      2.29  |Q        |         |         |       V |
  22+ 0       7.4050      2.27  |Q        |         |         |       V |
  22+ 5       7.4205      2.26  |Q        |         |         |       V |
  22+10       7.4360      2.24  |Q        |         |         |       V |
  22+15       7.4513      2.23  |Q        |         |         |       V |
  22+20       7.4665      2.21  |Q        |         |         |       V |
  22+25       7.4816      2.20  |Q        |         |         |       V |
  22+30       7.4967      2.18  |Q        |         |         |       V |
  22+35       7.5116      2.17  |Q        |         |         |       V |
  22+40       7.5264      2.15  |Q        |         |         |       V |
  22+45       7.5411      2.14  |Q        |         |         |       V |
  22+50       7.5558      2.13  |Q        |         |         |       V |
  22+55       7.5703      2.11  |Q        |         |         |       V |
  23+ 0       7.5848      2.10  |Q        |         |         |        V|
  23+ 5       7.5992      2.09  |Q        |         |         |        V|
  23+10       7.6135      2.07  |Q        |         |         |        V|
  23+15       7.6277      2.06  |Q        |         |         |        V|
  23+20       7.6418      2.05  |Q        |         |         |        V|
  23+25       7.6558      2.04  |Q        |         |         |        V|
  23+30       7.6698      2.03  |Q        |         |         |        V|
  23+35       7.6836      2.01  |Q        |         |         |        V|
  23+40       7.6974      2.00  |Q        |         |         |        V|
  23+45       7.7112      1.99  |Q        |         |         |        V|
  23+50       7.7248      1.98  |Q        |         |         |        V|
  23+55       7.7384      1.97  |Q        |         |         |        V|
  24+ 0       7.7519      1.96  |Q        |         |         |        V|
  24+ 5       7.7644      1.82  |Q        |         |         |        V|
  24+10       7.7723      1.14  Q         |         |         |        V|
  24+15       7.7747      0.36  Q         |         |         |        V|
  24+20       7.7754      0.09  Q         |         |         |        V|
  24+25       7.7755      0.03  Q         |         |         |         V
-------------------------------------------------------------------------
```

APPENDIX B: GROVE AVENUE STORM DRAIN HYDROLOGY CALCULATIONS

APPENDIX B.1: RATIONAL METHOD ANALYSIS, RERUN FUSCOE MODELS TO GROVE

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/06/25

PORTION OF MDP DA XIII NODE 1 TO 2
PROPOSED DEV DA B
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

MOBILE HOME PARK subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2500 Max loss rate(Fm)= 0.244(In/Hr)
Initial subarea data:
Initial area flow distance = 934.000(Ft.)
Top (of initial area) elevation = 703.000(Ft.)
Bottom (of initial area) elevation = 695.000(Ft.)
Difference in elevation = 8.000(Ft.)
Slope = 0.00857 s(%)= 0.86
TC = k(0.336)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 13.425 min.
Rainfall intensity = 2.947(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.825
Subarea runoff = 24.319(CFS)
Total initial stream area = 10.000(Ac.)
Pervious area fraction = 0.250
Initial area Fm value = 0.244(In/Hr)

End of computations, Total Study Area = 10.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.250
Area averaged SCS curve number = 32.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/06/25

PORTION OF MDP DA XIII NODE 3 TO 5
PROPOSED DEV DA B
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 3.000 to Point/Station 5.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 920.000(Ft.)
Top (of initial area) elevation = 696.000(Ft.)
Bottom (of initial area) elevation = 688.000(Ft.)
Difference in elevation = 8.000(Ft.)
Slope = 0.00870 s(%)= 0.87
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.829 min.
Rainfall intensity = 3.028(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.842
Subarea runoff = 25.492(CFS)
Total initial stream area = 10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        5.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     10.000(Ac.)
Runoff from this stream =     25.492(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     3.028(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   920.000(Ft.)
Top (of initial area) elevation =   696.000(Ft.)
Bottom (of initial area) elevation =   688.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.00870  s(%)=       0.87
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.829 min.
Rainfall intensity =      3.028(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.842
Subarea runoff =     25.492(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     10.000(Ac.)
Runoff from this stream =     25.492(CFS)
Time of concentration =   12.83 min.
```

```
Rainfall intensity =     3.028(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     25.49    10.000     12.83    0.196      3.028
2     25.49    10.000     12.83    0.196      3.028
Qmax(1) =
         1.000 *    1.000 *    25.492) +
         1.000 *    1.000 *    25.492) + =      50.983
Qmax(2) =
         1.000 *    1.000 *    25.492) +
         1.000 *    1.000 *    25.492) + =      50.983

Total of 2 main streams to confluence:
Flow rates before confluence point:
      26.492      26.492
Maximum flow rates at confluence using above data:
       50.983       50.983
Area of streams before confluence:
       10.000       10.000
Effective area values after confluence:
       20.000       20.000


Results of confluence:
Total flow rate =     50.983(CFS)
Time of concentration =    12.829 min.
Effective stream area after confluence  =     20.000(Ac.)
Study area average Pervious fraction(Ap) =  0.200
Study area average soil loss rate(Fm) =    0.196(In/Hr)
Study area total =      20.00(Ac.)
End of computations, Total Study Area =           20.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/06/25

PORTION OF MDP DA XIII NODE 6 TO 11
PROPOSED DEV DA B
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 6.000 to Point/Station 7.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 0.950
Decimal fraction soil group B = 0.050
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 33.20
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.194(In/Hr)
Initial subarea data:
Initial area flow distance = 762.000(Ft.)
Top (of initial area) elevation = 693.000(Ft.)
Bottom (of initial area) elevation = 687.000(Ft.)
Difference in elevation = 6.000(Ft.)
Slope = 0.00787 s(%)= 0.79
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.136 min.
Rainfall intensity = 3.131(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.844
Subarea runoff = 16.729(CFS)
Total initial stream area = 6.330(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.194(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   687.000(Ft.)
End of street segment elevation =   685.000(Ft.)
Length of street segment  =   365.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     24.194(CFS)
Depth of flow =   0.575(Ft.), Average velocity =   2.614(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  21.157(Ft.)
Flow velocity =   2.61(Ft/s)
Travel time =    2.33 min.     TC =   14.46  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.790
Decimal fraction soil group B = 0.210
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 37.04
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.188(In/Hr)
Rainfall intensity =      2.818(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.839
Subarea runoff =     14.806(CFS) for    7.010(Ac.)
Total runoff =     31.535(CFS)
Effective area this stream =       13.34(Ac.)
Total Study Area (Main Stream No. 1) =       13.34(Ac.)
Area averaged Fm value =    0.191(In/Hr)
Street flow at end of street =     31.535(CFS)
Half street flow at end of street =     15.768(CFS)
Depth of flow =   0.621(Ft.), Average velocity =   2.790(Ft/s)
Flow width (from curb towards crown)=  23.452(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
```

```
Upstream point/station elevation =   673.000(Ft.)
Downstream point/station elevation =   656.000(Ft.)
Pipe length  =   695.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    31.535(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    31.535(CFS)
Normal flow depth in pipe =   13.57(In.)
Flow top width inside pipe =   34.89(In.)
Critical Depth =   21.85(In.)
Pipe flow velocity =     12.92(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =    15.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     13.340(Ac.)
Runoff from this stream =     31.535(CFS)
Time of concentration =   15.36 min.
Rainfall intensity =     2.718(In/Hr)
Area averaged loss rate (Fm) =    0.1912(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   805.000(Ft.)
Top (of initial area) elevation =   688.000(Ft.)
Bottom (of initial area) elevation =   684.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00497  s(%)=       0.50
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.602 min.
Rainfall intensity =      2.924(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.840
Subarea runoff =     14.927(CFS)
Total initial stream area =        6.080(Ac.)
```

```
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.080(Ac.)
Runoff from this stream =     14.927(CFS)
Time of concentration =   13.60 min.
Rainfall intensity =     2.924(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   805.000(Ft.)
Top (of initial area) elevation =   690.000(Ft.)
Bottom (of initial area) elevation =   684.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.00745  s(%)=       0.75
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.543 min.
Rainfall intensity =      3.069(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.843
Subarea runoff =     18.156(CFS)
Total initial stream area =        7.020(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      7.020(Ac.)
```

```
Runoff from this stream =     18.156(CFS)
Time of concentration =   12.54 min.
Rainfall intensity =     3.069(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     31.54    13.340     15.36    0.191      2.718
2     14.93     6.080     13.60    0.196      2.924
3     18.16     7.020     12.54    0.196      3.069
Qmax(1) =
         1.000 *    1.000 *    31.535) +
         0.925 *    1.000 *    14.927) +
         0.878 *    1.000 *    18.156) + =      61.274
Qmax(2) =
         1.081 *    0.886 *    31.535) +
         1.000 *    1.000 *    14.927) +
         0.949 *    1.000 *    18.156) + =      62.361
Qmax(3) =
         1.139 *    0.817 *    31.535) +
         1.053 *    0.922 *    14.927) +
         1.000 *    1.000 *    18.156) + =      61.988

Total of 3 main streams to confluence:
Flow rates before confluence point:
      32.535      15.927      19.156
Maximum flow rates at confluence using above data:
       61.274       62.361       61.988
Area of streams before confluence:
       13.340        6.080        7.020
Effective area values after confluence:
       26.440       24.914       23.520


Results of confluence:
Total flow rate =     62.361(CFS)
Time of concentration =    13.602 min.
Effective stream area after confluence  =     24.914(Ac.)
Study area average Pervious fraction(Ap) =  0.200
Study area average soil loss rate(Fm) =    0.193(In/Hr)
Study area total =      26.44(Ac.)
End of computations, Total Study Area =           26.44 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  33.6
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/06/25

PORTION OF MDP DA XIII NODE 12 TO 15
PROPOSED DEV DA B
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 12.000 to Point/Station 13.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.280
Decimal fraction soil group B = 0.720
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 49.28
Pervious ratio(Ap) = 0.8500 Max loss rate(Fm)= 0.695(In/Hr)
Initial subarea data:
Initial area flow distance = 786.000(Ft.)
Top (of initial area) elevation = 684.000(Ft.)
Bottom (of initial area) elevation = 677.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.00891 s(%)= 0.89
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 17.872 min.
Rainfall intensity = 2.482(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.648
Subarea runoff = 10.724(CFS)
Total initial stream area = 6.670(Ac.)
Pervious area fraction = 0.850
Initial area Fm value = 0.695(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       15.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   677.000(Ft.)
End of street segment elevation =   673.000(Ft.)
Length of street segment  =   652.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  16.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     12.161(CFS)
Depth of flow =   0.467(Ft.), Average velocity =   2.308(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  15.756(Ft.)
Flow velocity =   2.31(Ft/s)
Travel time =    4.71 min.     TC =   22.58  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Rainfall intensity =      2.157(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.589
Subarea runoff =      2.751(CFS) for    3.940(Ac.)
Total runoff =     13.475(CFS)
Effective area this stream =       10.61(Ac.)
Total Study Area (Main Stream No. 1) =       10.61(Ac.)
Area averaged Fm value =    0.746(In/Hr)
Street flow at end of street =     13.475(CFS)
Half street flow at end of street =      6.738(CFS)
Depth of flow =   0.480(Ft.), Average velocity =   2.366(Ft/s)
Flow width (from curb towards crown)=  16.419(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
```

```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     10.610(Ac.)
Runoff from this stream =     13.475(CFS)
Time of concentration =   22.58 min.
Rainfall intensity =     2.157(In/Hr)
Area averaged loss rate (Fm) =    0.7458(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Initial subarea data:
Initial area flow distance =   691.000(Ft.)
Top (of initial area) elevation =   689.000(Ft.)
Bottom (of initial area) elevation =   673.000(Ft.)
Difference in elevation =    16.000(Ft.)
Slope =    0.02315  s(%)=       2.32
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.022 min.
Rainfall intensity =      2.871(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.639
Subarea runoff =      5.507(CFS)
Total initial stream area =        3.000(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.831(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.000(Ac.)
Runoff from this stream =      5.507(CFS)
Time of concentration =   14.02 min.
Rainfall intensity =     2.871(In/Hr)
Area averaged loss rate (Fm) =    0.8311(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     13.48    10.610     22.58    0.746      2.157
2      5.51     3.000     14.02    0.831      2.871
Qmax(1) =
         1.000 *    1.000 *    13.475) +
         0.650 *    1.000 *     5.507) + =      17.055
Qmax(2) =
         1.506 *    0.621 *    13.475) +
         1.000 *    1.000 *     5.507) + =      18.107

Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.475       6.507
Maximum flow rates at confluence using above data:
       17.055       18.107
Area of streams before confluence:
       10.610        3.000
Effective area values after confluence:
       13.610        9.589


Results of confluence:
Total flow rate =     18.107(CFS)
Time of concentration =    14.022 min.
Effective stream area after confluence  =      9.589(Ac.)
Study area average Pervious fraction(Ap) =  0.850
Study area average soil loss rate(Fm) =    0.765(In/Hr)
Study area total =      13.61(Ac.)
End of computations, Total Study Area =           13.61 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850
Area averaged SCS curve number =  40.5
```

APPENDIX B.2: RATIONAL METHOD ANALYSIS, GROVE MAINLINE, AREA E (EXCLUDES E3 & E4)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/08/25

GROVE SD TRIBUTARY AREA
OVERALL: JLC-MCC-MDP REV + ONTARIO RANCH

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 66.000 to Point/Station 66.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.391(In/Hr)
Rainfall intensity = 1.776(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 31.21 min. Rain intensity = 1.78(In/Hr)
Total area this stream = 683.10(Ac.)
Total Study Area (Main Stream No. 1) = 683.10(Ac.)
Total runoff = 874.33(CFS)

++

Process from Point/Station 66.000 to Point/Station 66.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 665.200(Ft.)
Downstream point/station elevation = 660.400(Ft.)
Pipe length = 677.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 874.330(CFS)
Nearest computed pipe diameter = 102.00(In.)

```
Calculated individual pipe flow  =   874.330(CFS)
Normal flow depth in pipe =   80.81(In.)
Flow top width inside pipe =   82.76(In.)
Critical Depth =   87.74(In.)
Pipe flow velocity =     18.12(Ft/s)
Travel time through pipe =    0.62 min.
Time of concentration (TC) =    31.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.000 to Point/Station       66.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    683.100(Ac.)
Runoff from this stream =    874.330(CFS)
Time of concentration =   31.83 min.
Rainfall intensity =     1.755(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       66.100
**** USER DEFINED FLOW INFORMATION AT A POINT ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      3.028(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  12.83 min.  Rain intensity =       3.03(In/Hr)
Total area this stream =        20.00(Ac.)
Total Study Area (Main Stream No. 2) =      703.10(Ac.)
Total runoff =     50.98(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       66.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     20.000(Ac.)
Runoff from this stream =     50.983(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     3.028(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    874.33   683.100     31.83    0.391      1.755
2     50.98    20.000     12.83    0.196      3.028
Qmax(1) =
         1.000 *    1.000 *   874.330) +
         0.551 *    1.000 *    50.983) + =     902.405
Qmax(2) =
         1.933 *    0.403 *   874.330) +
         1.000 *    1.000 *    50.983) + =     732.096

Total of 2 main streams to confluence:
Flow rates before confluence point:
     875.330      51.983
Maximum flow rates at confluence using above data:
      902.405      732.096
Area of streams before confluence:
      683.100       20.000
Effective area values after confluence:
      703.100      295.300


Results of confluence:
Total flow rate =    902.405(CFS)
Time of concentration =    31.833 min.
Effective stream area after confluence  =    703.100(Ac.)
Study area average Pervious fraction(Ap) =  0.394
Study area average soil loss rate(Fm) =    0.386(In/Hr)
Study area total =     703.10(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.100 to Point/Station       66.200
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   660.400(Ft.)
Downstream point/station elevation =   657.200(Ft.)
Pipe length  =   458.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   902.405(CFS)
Nearest computed pipe diameter  =    105.00(In.)
Calculated individual pipe flow  =   902.405(CFS)
Normal flow depth in pipe =   80.25(In.)
Flow top width inside pipe =   89.13(In.)
Critical Depth =   88.84(In.)
Pipe flow velocity =     18.29(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =    32.25 min.


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Process from Point/Station       66.100 to Point/Station       66.200
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    703.100(Ac.)
Runoff from this stream =    902.405(CFS)
Time of concentration =   32.25 min.
Rainfall intensity =     1.742(In/Hr)
Area averaged loss rate (Fm) =    0.3856(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3943
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       66.200
**** USER DEFINED FLOW INFORMATION AT A POINT ****
--------------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 33.60
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.194(In/Hr)
Rainfall intensity =      2.924(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  13.60 min.  Rain intensity =       2.92(In/Hr)
Total area this stream =        26.44(Ac.)
Total Study Area (Main Stream No. 2) =      729.54(Ac.)
Total runoff =     62.36(CFS)


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Process from Point/Station       11.000 to Point/Station       66.200
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     26.440(Ac.)
Runoff from this stream =     62.361(CFS)
Time of concentration =   13.60 min.
Rainfall intensity =     2.924(In/Hr)
Area averaged loss rate (Fm) =    0.1936(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    902.40   703.100     32.25    0.386      1.742
2     62.36    26.440     13.60    0.194      2.924
Qmax(1) =
         1.000 *    1.000 *   902.405) +
         0.567 *    1.000 *    62.361) + =     937.767
```

```
Qmax(2) =
         1.872 *    0.422 *   902.405) +
         1.000 *    1.000 *    62.361) + =     774.697

Total of 2 main streams to confluence:
Flow rates before confluence point:
     903.405      63.361
Maximum flow rates at confluence using above data:
      937.767      774.697
Area of streams before confluence:
      703.100       26.440
Effective area values after confluence:
      729.540      322.986


Results of confluence:
Total flow rate =    937.767(CFS)
Time of concentration =    32.250 min.
Effective stream area after confluence  =    729.540(Ac.)
Study area average Pervious fraction(Ap) =  0.387
Study area average soil loss rate(Fm) =    0.379(In/Hr)
Study area total =     729.54(Ac.)


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Process from Point/Station       66.200 to Point/Station       66.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   657.200(Ft.)
Downstream point/station elevation =   655.700(Ft.)
Pipe length  =   214.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   937.767(CFS)
Nearest computed pipe diameter  =    105.00(In.)
Calculated individual pipe flow  =   937.767(CFS)
Normal flow depth in pipe =   83.06(In.)
Flow top width inside pipe =   85.37(In.)
Critical Depth =   90.23(In.)
Pipe flow velocity =     18.37(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    32.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.200 to Point/Station       66.300
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    729.540(Ac.)
Runoff from this stream =    937.767(CFS)
Time of concentration =   32.44 min.
Rainfall intensity =     1.735(In/Hr)
Area averaged loss rate (Fm) =    0.3786(In/Hr)
```

```
Area averaged Pervious ratio (Ap) = 0.3873
Program is now starting with Main Stream No. 2


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Process from Point/Station       15.000 to Point/Station       66.300
**** USER DEFINED FLOW INFORMATION AT A POINT ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 40.50
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.775(In/Hr)
Rainfall intensity =      2.871(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  14.02 min.  Rain intensity =       2.87(In/Hr)
Total area this stream =         9.59(Ac.)
Total Study Area (Main Stream No. 2) =      739.13(Ac.)
Total runoff =     18.11(CFS)


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Process from Point/Station       15.000 to Point/Station       66.300
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      9.589(Ac.)
Runoff from this stream =     18.107(CFS)
Time of concentration =   14.02 min.
Rainfall intensity =     2.871(In/Hr)
Area averaged loss rate (Fm) =    0.7752(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    937.77   729.540     32.44    0.379      1.735
2     18.11     9.589     14.02    0.775      2.871
Qmax(1) =
         1.000 *    1.000 *   937.767) +
         0.458 *    1.000 *    18.107) + =     946.064
Qmax(2) =
         1.837 *    0.432 *   937.767) +
         1.000 *    1.000 *    18.107) + =     762.546

Total of 2 main streams to confluence:
Flow rates before confluence point:
     938.767      19.107
Maximum flow rates at confluence using above data:
      946.064      762.546
Area of streams before confluence:
```

```
      729.540        9.589
Effective area values after confluence:
      739.129      324.890


Results of confluence:
Total flow rate =    946.064(CFS)
Time of concentration =    32.444 min.
Effective stream area after confluence  =    739.129(Ac.)
Study area average Pervious fraction(Ap) =  0.393
Study area average soil loss rate(Fm) =    0.384(In/Hr)
Study area total =     739.13(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.300 to Point/Station       66.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   655.700(Ft.)
Downstream point/station elevation =   655.000(Ft.)
Pipe length  =   143.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   946.064(CFS)
Nearest computed pipe diameter  =    114.00(In.)
Calculated individual pipe flow  =   946.064(CFS)
Normal flow depth in pipe =   87.56(In.)
Flow top width inside pipe =   96.23(In.)
Critical Depth =   89.86(In.)
Pipe flow velocity =     16.18(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    32.59 min.


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Process from Point/Station       66.300 to Point/Station       66.400
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    739.129(Ac.)
Runoff from this stream =    946.064(CFS)
Time of concentration =   32.59 min.
Rainfall intensity =     1.731(In/Hr)
Area averaged loss rate (Fm) =    0.3837(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3933
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.380
```

```
Decimal fraction soil group B = 0.620
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 46.88
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.719(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =   691.000(Ft.)
Bottom (of initial area) elevation =   681.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.229 min.
Rainfall intensity =      2.375(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.628
Subarea runoff =      8.631(CFS)
Total initial stream area =        5.790(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.719(In/Hr)


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Process from Point/Station      602.000 to Point/Station      602.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.570
Decimal fraction soil group B = 0.430
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 42.32
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.089(In/Hr)
Time of concentration =    19.23 min.
Rainfall intensity =      2.375(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.690
Subarea runoff =      4.197(CFS) for    2.040(Ac.)
Total runoff =     12.828(CFS)
Effective area this stream =        7.83(Ac.)
Total Study Area (Main Stream No. 2) =      746.96(Ac.)
Area averaged Fm value =    0.555(In/Hr)


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Process from Point/Station      602.000 to Point/Station       66.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   677.000(Ft.)
Downstream point/station elevation =   655.000(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.828(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    12.828(CFS)
```

```
Normal flow depth in pipe =    8.43(In.)
Flow top width inside pipe =   10.98(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.76(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    19.32 min.


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Process from Point/Station      602.000 to Point/Station       66.400
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      7.830(Ac.)
Runoff from this stream =     12.828(CFS)
Time of concentration =   19.32 min.
Rainfall intensity =     2.368(In/Hr)
Area averaged loss rate (Fm) =    0.5549(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6546
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =   693.000(Ft.)
Bottom (of initial area) elevation =   683.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.229 min.
Rainfall intensity =      2.375(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.585
Subarea runoff =      8.060(CFS)
Total initial stream area =        5.800(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.831(In/Hr)


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Process from Point/Station      502.000 to Point/Station      502.000
**** SUBAREA FLOW ADDITION ****
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    19.23 min.
Rainfall intensity =      2.375(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.656
Subarea runoff =      4.099(CFS) for    2.000(Ac.)
Total runoff =     12.160(CFS)
Effective area this stream =        7.80(Ac.)
Total Study Area (Main Stream No. 3) =      754.76(Ac.)
Area averaged Fm value =    0.643(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station       66.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   679.000(Ft.)
Downstream point/station elevation =   655.000(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.160(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    12.160(CFS)
Normal flow depth in pipe =    7.85(In.)
Flow top width inside pipe =   11.41(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.34(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    19.32 min.


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Process from Point/Station      502.000 to Point/Station       66.400
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      7.800(Ac.)
Runoff from this stream =     12.160(CFS)
Time of concentration =   19.32 min.
Rainfall intensity =     2.369(In/Hr)
Area averaged loss rate (Fm) =    0.6431(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6577
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1    946.06   739.129     32.59    0.384      1.731
2     12.83     7.830     19.32    0.555      2.368
3     12.16     7.800     19.32    0.643      2.369
Qmax(1) =
         1.000 *    1.000 *   946.064) +
         0.648 *    1.000 *    12.828) +
         0.630 *    1.000 *    12.160) + =     962.044
Qmax(2) =
         1.474 *    0.593 *   946.064) +
         1.000 *    1.000 *    12.828) +
         1.000 *    1.000 *    12.160) + =     851.386
Qmax(3) =
         1.474 *    0.593 *   946.064) +
         1.000 *    1.000 *    12.828) +
         1.000 *    1.000 *    12.160) + =     851.358

Total of 3 main streams to confluence:
Flow rates before confluence point:
     947.064      13.828      13.160
Maximum flow rates at confluence using above data:
      962.044      851.386      851.358
Area of streams before confluence:
      739.129        7.830        7.800
Effective area values after confluence:
      754.759      453.794      453.739


Results of confluence:
Total flow rate =    962.044(CFS)
Time of concentration =    32.591 min.
Effective stream area after confluence  =    754.759(Ac.)
Study area average Pervious fraction(Ap) =  0.399
Study area average soil loss rate(Fm) =    0.388(In/Hr)
Study area total =     754.76(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.400 to Point/Station       66.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   655.000(Ft.)
Downstream point/station elevation =   652.400(Ft.)
Pipe length  =   602.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   962.044(CFS)
Nearest computed pipe diameter  =    117.00(In.)
Calculated individual pipe flow  =   962.044(CFS)
Normal flow depth in pipe =   90.75(In.)
Flow top width inside pipe =   97.62(In.)
Critical Depth =   90.22(In.)
Pipe flow velocity =     15.48(Ft/s)
Travel time through pipe =    0.65 min.
```

```
Time of concentration (TC) =    33.24 min.


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Process from Point/Station       66.500 to Point/Station       66.600
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   652.400(Ft.)
Downstream point/station elevation =   651.200(Ft.)
Pipe length  =   275.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   962.044(CFS)
Nearest computed pipe diameter  =    117.00(In.)
Calculated individual pipe flow  =   962.044(CFS)
Normal flow depth in pipe =   90.38(In.)
Flow top width inside pipe =   98.11(In.)
Critical Depth =   90.22(In.)
Pipe flow velocity =     15.55(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =    33.53 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.500 to Point/Station       66.600
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    754.759(Ac.)
Runoff from this stream =    962.044(CFS)
Time of concentration =   33.53 min.
Rainfall intensity =     1.701(In/Hr)
Area averaged loss rate (Fm) =    0.3882(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3987
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      618.000 to Point/Station      619.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Initial subarea data:
Initial area flow distance =   250.000(Ft.)
Top (of initial area) elevation =   675.500(Ft.)
Bottom (of initial area) elevation =   673.000(Ft.)
Difference in elevation =     2.500(Ft.)
Slope =    0.01000  s(%)=       1.00
```

```
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.951 min.
Rainfall intensity =      4.374(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =      2.709(CFS)
Total initial stream area =        0.700(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      619.000 to Point/Station      621.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   669.000(Ft.)
Downstream point/station elevation =   665.600(Ft.)
Pipe length  =  1125.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.709(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.709(CFS)
Normal flow depth in pipe =    9.81(In.)
Flow top width inside pipe =   14.27(In.)
Critical Depth =    7.92(In.)
Pipe flow velocity =      3.19(Ft/s)
Travel time through pipe =    5.88 min.
Time of concentration (TC) =    12.84 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      619.000 to Point/Station      621.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.700(Ac.)
Runoff from this stream =      2.709(CFS)
Time of concentration =   12.84 min.
Rainfall intensity =     3.027(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      620.000 to Point/Station      621.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.770
Decimal fraction soil group B = 0.230
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 37.52
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.094(In/Hr)
Initial subarea data:
```

```
Initial area flow distance =   955.000(Ft.)
Top (of initial area) elevation =   683.000(Ft.)
Bottom (of initial area) elevation =   673.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01047  s(%)=       1.05
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.773 min.
Rainfall intensity =      3.188(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =     23.672(CFS)
Total initial stream area =        8.500(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.094(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      620.000 to Point/Station      621.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      8.500(Ac.)
Runoff from this stream =     23.672(CFS)
Time of concentration =   11.77 min.
Rainfall intensity =     3.188(In/Hr)
Area averaged loss rate (Fm) =    0.0939(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      2.71     0.700     12.84    0.073      3.027
2     23.67     8.500     11.77    0.094      3.188
Qmax(1) =
         1.000 *    1.000 *     2.709) +
         0.948 *    1.000 *    23.672) + =      25.149
Qmax(2) =
         1.055 *    0.917 *     2.709) +
         1.000 *    1.000 *    23.672) + =      26.292

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.709      23.672
Maximum flow rates at confluence using above data:
       25.149       26.292
Area of streams before confluence:
        0.700        8.500
Effective area values after confluence:
        9.200        9.142
Results of confluence:
Total flow rate =     26.292(CFS)
Time of concentration =    11.773 min.
```

```
Effective stream area after confluence =      9.142(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.092(In/Hr)
Study area total (this main stream) =       9.20(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      621.000 to Point/Station       66.600
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   665.600(Ft.)
Downstream point/station elevation =   651.200(Ft.)
Pipe length  =   830.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    26.292(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    26.292(CFS)
Normal flow depth in pipe =   17.51(In.)
Flow top width inside pipe =   21.32(In.)
Critical Depth =   21.51(In.)
Pipe flow velocity =     10.71(Ft/s)
Travel time through pipe =    1.29 min.
Time of concentration (TC) =    13.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      621.000 to Point/Station       66.600
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      9.142(Ac.)
Runoff from this stream =     26.292(CFS)
Time of concentration =   13.06 min.
Rainfall intensity =     2.995(In/Hr)
Area averaged loss rate (Fm) =    0.0923(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      515.000 to Point/Station      516.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   250.000(Ft.)
Top (of initial area) elevation =   683.000(Ft.)
```

```
Bottom (of initial area) elevation =   680.500(Ft.)
Difference in elevation =     2.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.951 min.
Rainfall intensity =      4.374(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      2.694(CFS)
Total initial stream area =        0.700(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      516.000 to Point/Station      518.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   676.500(Ft.)
Downstream point/station elevation =   670.000(Ft.)
Pipe length  =  1072.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.694(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.694(CFS)
Normal flow depth in pipe =    9.54(In.)
Flow top width inside pipe =    9.69(In.)
Critical Depth =    8.45(In.)
Pipe flow velocity =      4.02(Ft/s)
Travel time through pipe =    4.44 min.
Time of concentration (TC) =    11.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      516.000 to Point/Station      518.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 3 in normal stream number 1
Stream flow area =      0.700(Ac.)
Runoff from this stream =      2.694(CFS)
Time of concentration =   11.39 min.
Rainfall intensity =     3.252(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      517.000 to Point/Station      518.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   936.000(Ft.)
Top (of initial area) elevation =   683.500(Ft.)
Bottom (of initial area) elevation =   674.000(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.01015  s(%)=       1.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.752 min.
Rainfall intensity =      3.192(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.872
Subarea runoff =     23.250(CFS)
Total initial stream area =        8.350(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      517.000 to Point/Station      518.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 3 in normal stream number 2
Stream flow area =      8.350(Ac.)
Runoff from this stream =     23.250(CFS)
Time of concentration =   11.75 min.
Rainfall intensity =     3.192(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      2.69     0.700     11.39    0.098      3.252
2     23.25     8.350     11.75    0.098      3.192
Qmax(1) =
         1.000 *    1.000 *     2.694) +
         1.020 *    0.969 *    23.250) + =      25.669
Qmax(2) =
         0.981 *    1.000 *     2.694) +
         1.000 *    1.000 *    23.250) + =      25.893

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.694      23.250
Maximum flow rates at confluence using above data:
       25.669       25.893
Area of streams before confluence:
        0.700        8.350
Effective area values after confluence:
        8.793        9.050
```

```
Results of confluence:
Total flow rate =     25.893(CFS)
Time of concentration =    11.752 min.
Effective stream area after confluence =      9.050(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total (this main stream) =       9.05(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      518.000 to Point/Station       66.600
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   670.000(Ft.)
Downstream point/station elevation =   651.200(Ft.)
Pipe length  =   883.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.893(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    25.893(CFS)
Normal flow depth in pipe =   16.01(In.)
Flow top width inside pipe =   22.62(In.)
Critical Depth =   21.39(In.)
Pipe flow velocity =     11.63(Ft/s)
Travel time through pipe =    1.27 min.
Time of concentration (TC) =    13.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      518.000 to Point/Station       66.600
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      9.050(Ac.)
Runoff from this stream =     25.893(CFS)
Time of concentration =   13.02 min.
Rainfall intensity =     3.002(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 4


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      521.000 to Point/Station      522.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
```

```
Initial subarea data:
Initial area flow distance =   685.000(Ft.)
Top (of initial area) elevation =   682.000(Ft.)
Bottom (of initial area) elevation =   675.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01022  s(%)=       1.02
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.358 min.
Rainfall intensity =      3.443(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =      4.546(CFS)
Total initial stream area =        1.510(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      522.000 to Point/Station      523.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    10.36 min.
Rainfall intensity =      3.443(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      9.754(CFS) for    3.240(Ac.)
Total runoff =     14.300(CFS)
Effective area this stream =        4.75(Ac.)
Total Study Area (Main Stream No. 4) =      777.76(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      523.000 to Point/Station      523.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    10.36 min.
Rainfall intensity =      3.443(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
```

```
Subarea runoff =      8.550(CFS) for    2.840(Ac.)
Total runoff =     22.850(CFS)
Effective area this stream =        7.59(Ac.)
Total Study Area (Main Stream No. 4) =      780.60(Ac.)
Area averaged Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      523.000 to Point/Station       66.600
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 4
Stream flow area =      7.590(Ac.)
Runoff from this stream =     22.850(CFS)
Time of concentration =   10.36 min.
Rainfall intensity =     3.443(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    962.04   754.759     33.53    0.388      1.701
2     26.29     9.142     13.06    0.092      2.995
3     25.89     9.050     13.02    0.098      3.002
4     22.85     7.590     10.36    0.098      3.443
Qmax(1) =
         1.000 *    1.000 *   962.044) +
         0.554 *    1.000 *    26.292) +
         0.552 *    1.000 *    25.893) +
         0.479 *    1.000 *    22.850) + =    1001.869
Qmax(2) =
         1.985 *    0.390 *   962.044) +
         1.000 *    1.000 *    26.292) +
         0.998 *    1.000 *    25.893) +
         0.866 *    1.000 *    22.850) + =     816.030
Qmax(3) =
         1.990 *    0.388 *   962.044) +
         1.002 *    0.996 *    26.292) +
         1.000 *    1.000 *    25.893) +
         0.868 *    1.000 *    22.850) + =     815.246
Qmax(4) =
         2.326 *    0.309 *   962.044) +
         1.154 *    0.793 *    26.292) +
         1.152 *    0.796 *    25.893) +
         1.000 *    1.000 *    22.850) + =     761.890

Total of 4 main streams to confluence:
Flow rates before confluence point:
     963.044      27.292      26.893      23.850
```

```
Maximum flow rates at confluence using above data:
     1001.869      816.030      815.246      761.890
Area of streams before confluence:
      754.759        9.142        9.050        7.590
Effective area values after confluence:
      780.541      319.835      318.720      255.164


Results of confluence:
Total flow rate =   1001.869(CFS)
Time of concentration =    33.534 min.
Effective stream area after confluence  =    780.541(Ac.)
Study area average Pervious fraction(Ap) =  0.389
Study area average soil loss rate(Fm) =    0.379(In/Hr)
Study area total =     780.54(Ac.)
End of computations, Total Study Area =          780.60 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.389
Area averaged SCS curve number =  32.4
```

APPENDIX B.3: RATIONAL METHOD ANALYSIS, GROVE ONSITE MITIGATED, AREA E3

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/06/25

ONTARIO RANCH 108.43.25
ONSITE RATIONAL METHOD HYDROLOGY
AREA E3, 100 YEAR STORM EVENT
FN: RARE3100PEAST

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 503.000 to Point/Station 504.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 700.000(Ft.)
Top (of initial area) elevation = 687.000(Ft.)
Bottom (of initial area) elevation = 680.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01000 s(%)= 1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.493 min.
Rainfall intensity = 3.416(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff = 13.887(CFS)
Total initial stream area = 4.650(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      507.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   676.000(Ft.)
Downstream point/station elevation =   675.800(Ft.)
Pipe length  =    46.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.887(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    13.887(CFS)
Normal flow depth in pipe =   18.33(In.)
Flow top width inside pipe =   20.39(In.)
Critical Depth =   16.11(In.)
Pipe flow velocity =      5.39(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    10.64 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      507.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.650(Ac.)
Runoff from this stream =     13.887(CFS)
Time of concentration =   10.64 min.
Rainfall intensity =     3.389(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      506.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   745.000(Ft.)
Top (of initial area) elevation =   689.500(Ft.)
Bottom (of initial area) elevation =   682.000(Ft.)
Difference in elevation =     7.500(Ft.)
Slope =    0.01007  s(%)=       1.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =   10.744 min.
Rainfall intensity =      3.368(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =     11.361(CFS)
Total initial stream area =        3.860(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      507.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   678.000(Ft.)
Downstream point/station elevation =   675.800(Ft.)
Pipe length  =    65.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.361(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    11.361(CFS)
Normal flow depth in pipe =   11.74(In.)
Flow top width inside pipe =   12.37(In.)
Critical depth could not be calculated.
Pipe flow velocity =     11.03(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    10.84 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      507.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.860(Ac.)
Runoff from this stream =     11.361(CFS)
Time of concentration =   10.84 min.
Rainfall intensity =     3.350(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     13.89     4.650     10.64    0.098      3.389
2     11.36     3.860     10.84    0.098      3.350
Qmax(1) =
         1.000 *    1.000 *    13.887) +
         1.012 *    0.981 *    11.361) + =      25.165
Qmax(2) =
         0.988 *    1.000 *    13.887) +
         1.000 *    1.000 *    11.361) + =      25.084
```

```
Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.887      12.361
Maximum flow rates at confluence using above data:
       25.165       25.084
Area of streams before confluence:
        4.650        3.860
Effective area values after confluence:
        8.436        8.510


Results of confluence:
Total flow rate =     25.165(CFS)
Time of concentration =    10.635 min.
Effective stream area after confluence  =      8.436(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total =       8.51(Ac.)


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Process from Point/Station      507.000 to Point/Station      511.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   675.800(Ft.)
Downstream point/station elevation =   674.000(Ft.)
Pipe length  =   502.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.165(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    25.165(CFS)
Normal flow depth in pipe =   22.22(In.)
Flow top width inside pipe =   30.95(In.)
Critical Depth =   19.93(In.)
Pipe flow velocity =      5.92(Ft/s)
Travel time through pipe =    1.41 min.
Time of concentration (TC) =    12.05 min.


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Process from Point/Station      507.000 to Point/Station      511.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      8.436(Ac.)
Runoff from this stream =     25.165(CFS)
Time of concentration =   12.05 min.
Rainfall intensity =     3.144(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      508.000 to Point/Station      511.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   670.000(Ft.)
Top (of initial area) elevation =   685.000(Ft.)
Bottom (of initial area) elevation =   678.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01045  s(%)=       1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.221 min.
Rainfall intensity =      3.470(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =     28.350(CFS)
Total initial stream area =        9.340(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      508.000 to Point/Station      511.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      9.340(Ac.)
Runoff from this stream =     28.350(CFS)
Time of concentration =   10.22 min.
Rainfall intensity =     3.470(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      509.000 to Point/Station      510.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   440.000(Ft.)
Top (of initial area) elevation =   684.500(Ft.)
Bottom (of initial area) elevation =   680.000(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.01023  s(%)=       1.02
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.676 min.
Rainfall intensity =      3.829(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      7.757(CFS)
Total initial stream area =        2.310(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      510.000 to Point/Station      511.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   676.000(Ft.)
Downstream point/station elevation =   674.000(Ft.)
Pipe length  =   216.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.757(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.757(CFS)
Normal flow depth in pipe =   11.81(In.)
Flow top width inside pipe =   17.10(In.)
Critical Depth =   12.95(In.)
Pipe flow velocity =      6.30(Ft/s)
Travel time through pipe =    0.57 min.
Time of concentration (TC) =     9.25 min.


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Process from Point/Station      510.000 to Point/Station      511.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.310(Ac.)
Runoff from this stream =      7.757(CFS)
Time of concentration =    9.25 min.
Rainfall intensity =     3.685(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1     25.16     8.436     12.05    0.098      3.144
2     28.35     9.340     10.22    0.098      3.470
3      7.76     2.310      9.25    0.098      3.685
Qmax(1) =
         1.000 *    1.000 *    25.165) +
         0.903 *    1.000 *    28.350) +
         0.849 *    1.000 *     7.757) + =      57.358
Qmax(2) =
         1.107 *    0.848 *    25.165) +
         1.000 *    1.000 *    28.350) +
         0.940 *    1.000 *     7.757) + =      59.275
Qmax(3) =
         1.178 *    0.767 *    25.165) +
         1.064 *    0.905 *    28.350) +
         1.000 *    1.000 *     7.757) + =      57.782

Total of 3 main streams to confluence:
Flow rates before confluence point:
      26.165      29.350       8.757
Maximum flow rates at confluence using above data:
       57.358       59.275       57.782
Area of streams before confluence:
        8.436        9.340        2.310
Effective area values after confluence:
       20.086       18.806       17.234


Results of confluence:
Total flow rate =     59.275(CFS)
Time of concentration =    10.221 min.
Effective stream area after confluence  =     18.806(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total =      20.09(Ac.)


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Process from Point/Station      511.000 to Point/Station      514.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.000(Ft.)
Downstream point/station elevation =   673.000(Ft.)
Pipe length  =    49.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    59.275(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    59.275(CFS)
Normal flow depth in pipe =   22.01(In.)
Flow top width inside pipe =   31.11(In.)
Critical Depth =   29.73(In.)
Pipe flow velocity =     14.08(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    10.28 min.
```

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Process from Point/Station      511.000 to Point/Station      514.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     18.806(Ac.)
Runoff from this stream =     59.275(CFS)
Time of concentration =   10.28 min.
Rainfall intensity =     3.459(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


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Process from Point/Station      512.000 to Point/Station      513.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   440.000(Ft.)
Top (of initial area) elevation =   684.500(Ft.)
Bottom (of initial area) elevation =   680.000(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.01023  s(%)=       1.02
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.676 min.
Rainfall intensity =      3.829(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      8.966(CFS)
Total initial stream area =        2.670(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      513.000 to Point/Station      514.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   676.000(Ft.)
Downstream point/station elevation =   673.000(Ft.)
Pipe length  =   147.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.966(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     8.966(CFS)
```

```
Normal flow depth in pipe =   11.93(In.)
Flow top width inside pipe =   12.10(In.)
Critical Depth =   13.85(In.)
Pipe flow velocity =      8.57(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =     8.96 min.


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Process from Point/Station      513.000 to Point/Station      514.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.670(Ac.)
Runoff from this stream =      8.966(CFS)
Time of concentration =    8.96 min.
Rainfall intensity =     3.755(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     59.27    18.806     10.28    0.098      3.459
2      8.97     2.670      8.96    0.098      3.755
Qmax(1) =
         1.000 *    1.000 *    59.275) +
         0.919 *    1.000 *     8.966) + =      67.514
Qmax(2) =
         1.088 *    0.872 *    59.275) +
         1.000 *    1.000 *     8.966) + =      65.205

Total of 2 main streams to confluence:
Flow rates before confluence point:
      60.275       9.966
Maximum flow rates at confluence using above data:
       67.514       65.205
Area of streams before confluence:
       18.806        2.670
Effective area values after confluence:
       21.476       19.066


Results of confluence:
Total flow rate =     67.514(CFS)
Time of concentration =    10.279 min.
Effective stream area after confluence  =     21.476(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total =      21.48(Ac.)
```

End of computations, Total Study Area = 22.83 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0

APPENDIX B.4: RATIONAL METHOD ANALYSIS, GROVE ONSITE MITIGATED, AREA E4

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/07/25

ONTARIO RANCH 108.43.25
ONSITE RATIONAL METHOD HYDROLOGY
AREA E4, 100 YEAR STORM EVENT
FN: RARE4100PwEST

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 603.000 to Point/Station 606.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 670.000(Ft.)
Top (of initial area) elevation = 686.000(Ft.)
Bottom (of initial area) elevation = 679.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01045 s(%)= 1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.221 min.
Rainfall intensity = 3.470(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff = 14.583(CFS)
Total initial stream area = 4.770(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.073(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      606.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.770(Ac.)
Runoff from this stream =     14.583(CFS)
Time of concentration =   10.22 min.
Rainfall intensity =     3.470(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      604.000 to Point/Station      605.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Initial subarea data:
Initial area flow distance =   525.000(Ft.)
Top (of initial area) elevation =   684.500(Ft.)
Bottom (of initial area) elevation =   679.000(Ft.)
Difference in elevation =     5.500(Ft.)
Slope =    0.01048  s(%)=       1.05
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.266 min.
Rainfall intensity =      3.681(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =      8.376(CFS)
Total initial stream area =        2.580(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)


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Process from Point/Station      605.000 to Point/Station      606.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   675.000(Ft.)
Downstream point/station elevation =   674.800(Ft.)
Pipe length  =    54.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.376(CFS)
Nearest computed pipe diameter  =     21.00(In.)
```

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Calculated individual pipe flow  =     8.376(CFS)
Normal flow depth in pipe =   15.14(In.)
Flow top width inside pipe =   18.84(In.)
Critical Depth =   12.90(In.)
Pipe flow velocity =      4.52(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     9.47 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      605.000 to Point/Station      606.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.580(Ac.)
Runoff from this stream =      8.376(CFS)
Time of concentration =    9.47 min.
Rainfall intensity =     3.634(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     14.58     4.770     10.22    0.073      3.470
2      8.38     2.580      9.47    0.073      3.634
Qmax(1) =
         1.000 *    1.000 *    14.583) +
         0.954 *    1.000 *     8.376) + =      22.574
Qmax(2) =
         1.048 *    0.926 *    14.583) +
         1.000 *    1.000 *     8.376) + =      22.532

Total of 2 main streams to confluence:
Flow rates before confluence point:
      15.583       9.376
Maximum flow rates at confluence using above data:
       22.574       22.532
Area of streams before confluence:
        4.770        2.580
Effective area values after confluence:
        7.350        6.997


Results of confluence:
Total flow rate =     22.574(CFS)
Time of concentration =    10.221 min.
Effective stream area after confluence  =      7.350(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.073(In/Hr)
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Study area total =       7.35(Ac.)


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Process from Point/Station      606.000 to Point/Station      610.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.800(Ft.)
Downstream point/station elevation =   674.000(Ft.)
Pipe length  =   209.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.574(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    22.574(CFS)
Normal flow depth in pipe =   22.03(In.)
Flow top width inside pipe =   26.50(In.)
Critical Depth =   19.38(In.)
Pipe flow velocity =      5.84(Ft/s)
Travel time through pipe =    0.60 min.
Time of concentration (TC) =    10.82 min.


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Process from Point/Station      606.000 to Point/Station      610.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      7.350(Ac.)
Runoff from this stream =     22.574(CFS)
Time of concentration =   10.82 min.
Rainfall intensity =     3.354(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      607.000 to Point/Station      610.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.570
Decimal fraction soil group B = 0.430
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 42.32
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.089(In/Hr)
Initial subarea data:
Initial area flow distance =   505.000(Ft.)
Top (of initial area) elevation =   685.000(Ft.)
Bottom (of initial area) elevation =   680.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.00990  s(%)=       0.99
```

```
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.227 min.
Rainfall intensity =      3.690(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.878
Subarea runoff =     12.898(CFS)
Total initial stream area =        3.980(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.089(In/Hr)


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Process from Point/Station      607.000 to Point/Station      610.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.980(Ac.)
Runoff from this stream =     12.898(CFS)
Time of concentration =    9.23 min.
Rainfall intensity =     3.690(In/Hr)
Area averaged loss rate (Fm) =    0.0894(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      609.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.180
Decimal fraction soil group B = 0.820
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 51.68
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   565.000(Ft.)
Top (of initial area) elevation =   687.000(Ft.)
Bottom (of initial area) elevation =   681.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01062  s(%)=       1.06
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.516 min.
Rainfall intensity =      3.622(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      9.695(CFS)
Total initial stream area =        3.040(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


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Process from Point/Station      609.000 to Point/Station      610.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   677.000(Ft.)
Downstream point/station elevation =   674.000(Ft.)
Pipe length  =    54.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.695(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.695(CFS)
Normal flow depth in pipe =    8.70(In.)
Flow top width inside pipe =   14.81(In.)
Critical Depth =   14.12(In.)
Pipe flow velocity =     13.15(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     9.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      610.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      3.040(Ac.)
Runoff from this stream =      9.695(CFS)
Time of concentration =    9.58 min.
Rainfall intensity =     3.607(In/Hr)
Area averaged loss rate (Fm) =    0.0789(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     22.57     7.350     10.82    0.073      3.354
2     12.90     3.980      9.23    0.089      3.690
3      9.69     3.040      9.58    0.079      3.607
Qmax(1) =
         1.000 *    1.000 *    22.574) +
         0.907 *    1.000 *    12.898) +
         0.928 *    1.000 *     9.695) + =      43.270
Qmax(2) =
         1.102 *    0.853 *    22.574) +
         1.000 *    1.000 *    12.898) +
         1.024 *    0.963 *     9.695) + =      43.677
Qmax(3) =
         1.077 *    0.886 *    22.574) +
         0.977 *    1.000 *    12.898) +
         1.000 *    1.000 *     9.695) + =      43.836

Total of 3 main streams to confluence:
Flow rates before confluence point:
```

```
      23.574      13.898      10.695
Maximum flow rates at confluence using above data:
       43.270       43.677       43.836
Area of streams before confluence:
        7.350        3.980        3.040
Effective area values after confluence:
       14.370       13.176       13.533


Results of confluence:
Total flow rate =     43.836(CFS)
Time of concentration =     9.585 min.
Effective stream area after confluence  =     13.533(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.079(In/Hr)
Study area total =      14.37(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      614.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.000(Ft.)
Downstream point/station elevation =   672.300(Ft.)
Pipe length  =   320.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    43.836(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    43.836(CFS)
Normal flow depth in pipe =   26.74(In.)
Flow top width inside pipe =   31.47(In.)
Critical Depth =   25.87(In.)
Pipe flow velocity =      7.79(Ft/s)
Travel time through pipe =    0.69 min.
Time of concentration (TC) =    10.27 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      614.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     13.533(Ac.)
Runoff from this stream =     43.836(CFS)
Time of concentration =   10.27 min.
Rainfall intensity =     3.460(In/Hr)
Area averaged loss rate (Fm) =    0.0790(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      611.000 to Point/Station      614.000
```

**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 675.000(Ft.)
Top (of initial area) elevation = 686.000(Ft.)
Bottom (of initial area) elevation = 679.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01037 s(%)= 1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.267 min.
Rainfall intensity = 3.461(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff = 15.770(CFS)
Total initial stream area = 5.210(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

++
Process from Point/Station 611.000 to Point/Station 614.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 5.210(Ac.)
Runoff from this stream = 15.770(CFS)
Time of concentration = 10.27 min.
Rainfall intensity = 3.461(In/Hr)
Area averaged loss rate (Fm) = 0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3

++
Process from Point/Station 612.000 to Point/Station 613.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 440.000(Ft.)

```
Top (of initial area) elevation =   681.500(Ft.)
Bottom (of initial area) elevation =   677.000(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.01023  s(%)=       1.02
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.676 min.
Rainfall intensity =      3.829(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =      7.421(CFS)
Total initial stream area =        2.210(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      613.000 to Point/Station      614.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   673.000(Ft.)
Downstream point/station elevation =   672.300(Ft.)
Pipe length  =   224.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.421(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.421(CFS)
Normal flow depth in pipe =   14.72(In.)
Flow top width inside pipe =   19.23(In.)
Critical Depth =   12.09(In.)
Pipe flow velocity =      4.12(Ft/s)
Travel time through pipe =    0.91 min.
Time of concentration (TC) =     9.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      613.000 to Point/Station      614.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.210(Ac.)
Runoff from this stream =      7.421(CFS)
Time of concentration =    9.58 min.
Rainfall intensity =     3.608(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     43.84    13.533     10.27    0.079      3.460
2     15.77     5.210     10.27    0.098      3.461
3      7.42     2.210      9.58    0.098      3.608
```

```
Qmax(1) =
         1.000 *    1.000 *    43.836) +
         1.000 *    1.000 *    15.770) +
         0.958 *    1.000 *     7.421) + =      66.713
Qmax(2) =
         1.000 *    1.000 *    43.836) +
         1.000 *    1.000 *    15.770) +
         0.958 *    1.000 *     7.421) + =      66.712
Qmax(3) =
         1.044 *    0.933 *    43.836) +
         1.044 *    0.933 *    15.770) +
         1.000 *    1.000 *     7.421) + =      65.455

Total of 3 main streams to confluence:
Flow rates before confluence point:
      44.836      16.770       8.421
Maximum flow rates at confluence using above data:
       66.713       66.712       65.455
Area of streams before confluence:
       13.533        5.210        2.210
Effective area values after confluence:
       20.953       20.948       19.696


Results of confluence:
Total flow rate =     66.713(CFS)
Time of concentration =    10.270 min.
Effective stream area after confluence  =     20.953(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.086(In/Hr)
Study area total =      20.95(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      614.000 to Point/Station      617.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   672.300(Ft.)
Downstream point/station elevation =   671.900(Ft.)
Pipe length  =   122.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    66.713(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =    66.713(CFS)
Normal flow depth in pipe =   35.48(In.)
Flow top width inside pipe =   36.75(In.)
Critical Depth =   30.16(In.)
Pipe flow velocity =      7.14(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    10.55 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      614.000 to Point/Station      617.000
```

**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 20.953(Ac.)
Runoff from this stream = 66.713(CFS)
Time of concentration = 10.55 min.
Rainfall intensity = 3.404(In/Hr)
Area averaged loss rate (Fm) = 0.0857(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2

++

Process from Point/Station 615.000 to Point/Station 616.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 540.000(Ft.)
Top (of initial area) elevation = 687.000(Ft.)
Bottom (of initial area) elevation = 681.500(Ft.)
Difference in elevation = 5.500(Ft.)
Slope = 0.01019 s(%)= 1.02
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.424 min.
Rainfall intensity = 3.644(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff = 10.850(CFS)
Total initial stream area = 3.400(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

++

Process from Point/Station 616.000 to Point/Station 617.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 677.500(Ft.)
Downstream point/station elevation = 671.900(Ft.)
Pipe length = 155.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 10.850(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 10.850(CFS)
Normal flow depth in pipe = 10.96(In.)
Flow top width inside pipe = 13.31(In.)
Critical depth could not be calculated.

```
Pipe flow velocity =     11.30(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =     9.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      616.000 to Point/Station      617.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.400(Ac.)
Runoff from this stream =     10.850(CFS)
Time of concentration =    9.65 min.
Rainfall intensity =     3.592(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     66.71    20.953     10.55    0.086      3.404
2     10.85     3.400      9.65    0.098      3.592
Qmax(1) =
         1.000 *    1.000 *    66.713) +
         0.946 *    1.000 *    10.850) + =      76.981
Qmax(2) =
         1.056 *    0.915 *    66.713) +
         1.000 *    1.000 *    10.850) + =      75.309

Total of 2 main streams to confluence:
Flow rates before confluence point:
      67.713      11.850
Maximum flow rates at confluence using above data:
       76.981       75.309
Area of streams before confluence:
       20.953        3.400
Effective area values after confluence:
       24.353       22.562


Results of confluence:
Total flow rate =     76.981(CFS)
Time of concentration =    10.555 min.
Effective stream area after confluence  =     24.353(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.087(In/Hr)
Study area total =      24.35(Ac.)
End of computations, Total Study Area =           25.19 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 43.0

APPENDIX B.5: UNIT HYDROGRAPH ANALYSIS, GROVE ONSITE MITIGATED, AREA E3

U n i t H y d r o g r a p h A n a l y s i s

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Study date 05/09/25

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6279

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED UNIT HYDROGRAPH METHOD HYDROLOGY
AREA E3, 100-YEAR STORM EVENT
FN: UARE3P

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
22.83	1	1.20
Rainfall data for year 100		
22.83	6	3.00
Rainfall data for year 100		
22.83	24	6.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	22.83	1.000	0.978	0.100	0.098

Area-averaged adjusted loss rate Fm (In/Hr) = 0.098

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.28	0.100	32.0	32.0	21.25	0.022
20.55	0.900	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.866
Area-averaged low loss fraction, Yb = 0.134
User entry of time of concentration = 0.171 (hours)
++
Watershed area = 22.83(Ac.)
Catchment Lag time = 0.137 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 60.9162
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.134 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.444(In)
Computed peak 30-minute rainfall = 0.909(In)
Specified peak 1-hour rainfall = 1.200(In)
Computed peak 3-hour rainfall = 2.105(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:
Using a total area of 22.83(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.444(In)
30-minute factor = 0.999 Adjusted rainfall = 0.908(In)
1-hour factor = 0.999 Adjusted rainfall = 1.199(In)
3-hour factor = 1.000 Adjusted rainfall = 2.104(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 276.10 (CFS))	
1	6.713	18.534

2	42.770	99.553
3	82.568	109.884
4	95.865	36.711
5	98.734	7.923
6	100.000	3.495

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4437	0.4437
2	0.5854	0.1418
3	0.6885	0.1031
4	0.7724	0.0840
5	0.8446	0.0721
6	0.9085	0.0639
7	0.9662	0.0578
8	1.0192	0.0530
9	1.0684	0.0492
10	1.1144	0.0460
11	1.1577	0.0433
12	1.1987	0.0410
13	1.2489	0.0502
14	1.2972	0.0483
15	1.3439	0.0467
16	1.3890	0.0452
17	1.4329	0.0438
18	1.4754	0.0426
19	1.5169	0.0414
20	1.5572	0.0404
21	1.5967	0.0394
22	1.6352	0.0385
23	1.6728	0.0377
24	1.7097	0.0369
25	1.7458	0.0361
26	1.7812	0.0354
27	1.8160	0.0348
28	1.8502	0.0341
29	1.8837	0.0336
30	1.9167	0.0330
31	1.9492	0.0325
32	1.9811	0.0320
33	2.0126	0.0315
34	2.0436	0.0310
35	2.0742	0.0306
36	2.1044	0.0301
37	2.1340	0.0297
38	2.1634	0.0293
39	2.1923	0.0289
40	2.2209	0.0286
41	2.2491	0.0282
42	2.2770	0.0279
43	2.3046	0.0276
44	2.3318	0.0273
45	2.3588	0.0270

46	2.3854	0.0267
47	2.4118	0.0264
48	2.4379	0.0261
49	2.4638	0.0258
50	2.4894	0.0256
51	2.5147	0.0253
52	2.5398	0.0251
53	2.5647	0.0249
54	2.5893	0.0246
55	2.6137	0.0244
56	2.6379	0.0242
57	2.6619	0.0240
58	2.6857	0.0238
59	2.7093	0.0236
60	2.7327	0.0234
61	2.7559	0.0232
62	2.7789	0.0230
63	2.8017	0.0228
64	2.8244	0.0227
65	2.8469	0.0225
66	2.8692	0.0223
67	2.8914	0.0222
68	2.9134	0.0220
69	2.9352	0.0218
70	2.9569	0.0217
71	2.9784	0.0215
72	2.9998	0.0214
73	3.0205	0.0208
74	3.0412	0.0206
75	3.0616	0.0205
76	3.0820	0.0203
77	3.1022	0.0202
78	3.1223	0.0201
79	3.1422	0.0200
80	3.1621	0.0198
81	3.1818	0.0197
82	3.2013	0.0196
83	3.2208	0.0195
84	3.2402	0.0193
85	3.2594	0.0192
86	3.2785	0.0191
87	3.2975	0.0190
88	3.3164	0.0189
89	3.3352	0.0188
90	3.3539	0.0187
91	3.3725	0.0186
92	3.3909	0.0185
93	3.4093	0.0184
94	3.4276	0.0183
95	3.4458	0.0182
96	3.4639	0.0181
97	3.4819	0.0180
98	3.4998	0.0179

99	3.5176	0.0178
100	3.5353	0.0177
101	3.5530	0.0176
102	3.5705	0.0175
103	3.5880	0.0175
104	3.6053	0.0174
105	3.6226	0.0173
106	3.6398	0.0172
107	3.6570	0.0171
108	3.6740	0.0170
109	3.6910	0.0170
110	3.7079	0.0169
111	3.7247	0.0168
112	3.7414	0.0167
113	3.7581	0.0167
114	3.7747	0.0166
115	3.7912	0.0165
116	3.8077	0.0164
117	3.8240	0.0164
118	3.8404	0.0163
119	3.8566	0.0162
120	3.8728	0.0162
121	3.8889	0.0161
122	3.9049	0.0160
123	3.9209	0.0160
124	3.9368	0.0159
125	3.9526	0.0158
126	3.9684	0.0158
127	3.9841	0.0157
128	3.9998	0.0157
129	4.0154	0.0156
130	4.0309	0.0155
131	4.0464	0.0155
132	4.0618	0.0154
133	4.0772	0.0154
134	4.0925	0.0153
135	4.1077	0.0152
136	4.1229	0.0152
137	4.1380	0.0151
138	4.1531	0.0151
139	4.1681	0.0150
140	4.1831	0.0150
141	4.1980	0.0149
142	4.2129	0.0149
143	4.2277	0.0148
144	4.2424	0.0148
145	4.2571	0.0147
146	4.2718	0.0147
147	4.2864	0.0146
148	4.3010	0.0146
149	4.3155	0.0145
150	4.3299	0.0145
151	4.3443	0.0144

152	4.3587	0.0144
153	4.3730	0.0143
154	4.3873	0.0143
155	4.4015	0.0142
156	4.4157	0.0142
157	4.4298	0.0141
158	4.4439	0.0141
159	4.4579	0.0140
160	4.4719	0.0140
161	4.4859	0.0140
162	4.4998	0.0139
163	4.5137	0.0139
164	4.5275	0.0138
165	4.5413	0.0138
166	4.5550	0.0137
167	4.5687	0.0137
168	4.5824	0.0137
169	4.5960	0.0136
170	4.6096	0.0136
171	4.6231	0.0135
172	4.6366	0.0135
173	4.6501	0.0135
174	4.6635	0.0134
175	4.6769	0.0134
176	4.6902	0.0133
177	4.7035	0.0133
178	4.7168	0.0133
179	4.7300	0.0132
180	4.7432	0.0132
181	4.7564	0.0132
182	4.7695	0.0131
183	4.7826	0.0131
184	4.7956	0.0131
185	4.8086	0.0130
186	4.8216	0.0130
187	4.8346	0.0129
188	4.8475	0.0129
189	4.8604	0.0129
190	4.8732	0.0128
191	4.8860	0.0128
192	4.8988	0.0128
193	4.9115	0.0127
194	4.9242	0.0127
195	4.9369	0.0127
196	4.9495	0.0126
197	4.9622	0.0126
198	4.9747	0.0126
199	4.9873	0.0125
200	4.9998	0.0125
201	5.0123	0.0125
202	5.0247	0.0125
203	5.0372	0.0124
204	5.0496	0.0124

205	5.0619	0.0124
206	5.0742	0.0123
207	5.0866	0.0123
208	5.0988	0.0123
209	5.1111	0.0122
210	5.1233	0.0122
211	5.1355	0.0122
212	5.1476	0.0122
213	5.1597	0.0121
214	5.1718	0.0121
215	5.1839	0.0121
216	5.1960	0.0120
217	5.2080	0.0120
218	5.2200	0.0120
219	5.2319	0.0120
220	5.2439	0.0119
221	5.2558	0.0119
222	5.2676	0.0119
223	5.2795	0.0119
224	5.2913	0.0118
225	5.3031	0.0118
226	5.3149	0.0118
227	5.3266	0.0117
228	5.3383	0.0117
229	5.3500	0.0117
230	5.3617	0.0117
231	5.3734	0.0116
232	5.3850	0.0116
233	5.3966	0.0116
234	5.4081	0.0116
235	5.4197	0.0115
236	5.4312	0.0115
237	5.4427	0.0115
238	5.4542	0.0115
239	5.4656	0.0114
240	5.4770	0.0114
241	5.4884	0.0114
242	5.4998	0.0114
243	5.5112	0.0114
244	5.5225	0.0113
245	5.5338	0.0113
246	5.5451	0.0113
247	5.5563	0.0113
248	5.5676	0.0112
249	5.5788	0.0112
250	5.5900	0.0112
251	5.6012	0.0112
252	5.6123	0.0111
253	5.6234	0.0111
254	5.6345	0.0111
255	5.6456	0.0111
256	5.6567	0.0111
257	5.6677	0.0110

258	5.6787	0.0110
259	5.6897	0.0110
260	5.7007	0.0110
261	5.7116	0.0110
262	5.7226	0.0109
263	5.7335	0.0109
264	5.7444	0.0109
265	5.7553	0.0109
266	5.7661	0.0108
267	5.7769	0.0108
268	5.7877	0.0108
269	5.7985	0.0108
270	5.8093	0.0108
271	5.8200	0.0107
272	5.8308	0.0107
273	5.8415	0.0107
274	5.8522	0.0107
275	5.8628	0.0107
276	5.8735	0.0107
277	5.8841	0.0106
278	5.8947	0.0106
279	5.9053	0.0106
280	5.9159	0.0106
281	5.9265	0.0106
282	5.9370	0.0105
283	5.9475	0.0105
284	5.9580	0.0105
285	5.9685	0.0105
286	5.9790	0.0105
287	5.9894	0.0104
288	5.9998	0.0104

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0104	0.0014	0.0090
2	0.0104	0.0014	0.0090
3	0.0105	0.0014	0.0091
4	0.0105	0.0014	0.0091
5	0.0105	0.0014	0.0091
6	0.0106	0.0014	0.0091
7	0.0106	0.0014	0.0092
8	0.0106	0.0014	0.0092
9	0.0107	0.0014	0.0092
10	0.0107	0.0014	0.0092
11	0.0107	0.0014	0.0093
12	0.0107	0.0014	0.0093
13	0.0108	0.0014	0.0093
14	0.0108	0.0014	0.0093
15	0.0108	0.0014	0.0094
16	0.0108	0.0014	0.0094
17	0.0109	0.0015	0.0094

18	0.0109	0.0015	0.0095
19	0.0110	0.0015	0.0095
20	0.0110	0.0015	0.0095
21	0.0110	0.0015	0.0095
22	0.0110	0.0015	0.0096
23	0.0111	0.0015	0.0096
24	0.0111	0.0015	0.0096
25	0.0111	0.0015	0.0097
26	0.0112	0.0015	0.0097
27	0.0112	0.0015	0.0097
28	0.0112	0.0015	0.0097
29	0.0113	0.0015	0.0098
30	0.0113	0.0015	0.0098
31	0.0114	0.0015	0.0098
32	0.0114	0.0015	0.0099
33	0.0114	0.0015	0.0099
34	0.0114	0.0015	0.0099
35	0.0115	0.0015	0.0100
36	0.0115	0.0015	0.0100
37	0.0116	0.0015	0.0100
38	0.0116	0.0015	0.0100
39	0.0116	0.0016	0.0101
40	0.0117	0.0016	0.0101
41	0.0117	0.0016	0.0102
42	0.0117	0.0016	0.0102
43	0.0118	0.0016	0.0102
44	0.0118	0.0016	0.0102
45	0.0119	0.0016	0.0103
46	0.0119	0.0016	0.0103
47	0.0120	0.0016	0.0104
48	0.0120	0.0016	0.0104
49	0.0120	0.0016	0.0104
50	0.0121	0.0016	0.0105
51	0.0121	0.0016	0.0105
52	0.0122	0.0016	0.0105
53	0.0122	0.0016	0.0106
54	0.0122	0.0016	0.0106
55	0.0123	0.0016	0.0107
56	0.0123	0.0016	0.0107
57	0.0124	0.0017	0.0107
58	0.0124	0.0017	0.0108
59	0.0125	0.0017	0.0108
60	0.0125	0.0017	0.0108
61	0.0126	0.0017	0.0109
62	0.0126	0.0017	0.0109
63	0.0127	0.0017	0.0110
64	0.0127	0.0017	0.0110
65	0.0128	0.0017	0.0111
66	0.0128	0.0017	0.0111
67	0.0129	0.0017	0.0112
68	0.0129	0.0017	0.0112
69	0.0130	0.0017	0.0112
70	0.0130	0.0017	0.0113

71	0.0131	0.0017	0.0113
72	0.0131	0.0018	0.0114
73	0.0132	0.0018	0.0114
74	0.0132	0.0018	0.0115
75	0.0133	0.0018	0.0115
76	0.0133	0.0018	0.0116
77	0.0134	0.0018	0.0116
78	0.0135	0.0018	0.0117
79	0.0135	0.0018	0.0117
80	0.0136	0.0018	0.0118
81	0.0137	0.0018	0.0118
82	0.0137	0.0018	0.0119
83	0.0138	0.0018	0.0119
84	0.0138	0.0018	0.0120
85	0.0139	0.0019	0.0121
86	0.0140	0.0019	0.0121
87	0.0140	0.0019	0.0122
88	0.0141	0.0019	0.0122
89	0.0142	0.0019	0.0123
90	0.0142	0.0019	0.0123
91	0.0143	0.0019	0.0124
92	0.0144	0.0019	0.0124
93	0.0145	0.0019	0.0125
94	0.0145	0.0019	0.0126
95	0.0146	0.0019	0.0127
96	0.0147	0.0020	0.0127
97	0.0148	0.0020	0.0128
98	0.0148	0.0020	0.0128
99	0.0149	0.0020	0.0129
100	0.0150	0.0020	0.0130
101	0.0151	0.0020	0.0131
102	0.0151	0.0020	0.0131
103	0.0152	0.0020	0.0132
104	0.0153	0.0020	0.0133
105	0.0154	0.0021	0.0134
106	0.0155	0.0021	0.0134
107	0.0156	0.0021	0.0135
108	0.0157	0.0021	0.0136
109	0.0158	0.0021	0.0137
110	0.0158	0.0021	0.0137
111	0.0160	0.0021	0.0138
112	0.0160	0.0021	0.0139
113	0.0162	0.0022	0.0140
114	0.0162	0.0022	0.0141
115	0.0164	0.0022	0.0142
116	0.0164	0.0022	0.0143
117	0.0166	0.0022	0.0144
118	0.0167	0.0022	0.0144
119	0.0168	0.0022	0.0146
120	0.0169	0.0023	0.0146
121	0.0170	0.0023	0.0148
122	0.0171	0.0023	0.0148
123	0.0173	0.0023	0.0150

124	0.0174	0.0023	0.0151
125	0.0175	0.0023	0.0152
126	0.0176	0.0024	0.0153
127	0.0178	0.0024	0.0154
128	0.0179	0.0024	0.0155
129	0.0181	0.0024	0.0157
130	0.0182	0.0024	0.0158
131	0.0184	0.0025	0.0159
132	0.0185	0.0025	0.0160
133	0.0187	0.0025	0.0162
134	0.0188	0.0025	0.0163
135	0.0190	0.0025	0.0165
136	0.0191	0.0026	0.0166
137	0.0193	0.0026	0.0168
138	0.0195	0.0026	0.0169
139	0.0197	0.0026	0.0171
140	0.0198	0.0026	0.0172
141	0.0201	0.0027	0.0174
142	0.0202	0.0027	0.0175
143	0.0205	0.0027	0.0177
144	0.0206	0.0028	0.0179
145	0.0214	0.0029	0.0185
146	0.0215	0.0029	0.0187
147	0.0218	0.0029	0.0189
148	0.0220	0.0029	0.0191
149	0.0223	0.0030	0.0193
150	0.0225	0.0030	0.0195
151	0.0228	0.0030	0.0198
152	0.0230	0.0031	0.0199
153	0.0234	0.0031	0.0203
154	0.0236	0.0031	0.0204
155	0.0240	0.0032	0.0208
156	0.0242	0.0032	0.0210
157	0.0246	0.0033	0.0213
158	0.0249	0.0033	0.0215
159	0.0253	0.0034	0.0220
160	0.0256	0.0034	0.0222
161	0.0261	0.0035	0.0226
162	0.0264	0.0035	0.0229
163	0.0270	0.0036	0.0234
164	0.0273	0.0036	0.0236
165	0.0279	0.0037	0.0242
166	0.0282	0.0038	0.0245
167	0.0289	0.0039	0.0251
168	0.0293	0.0039	0.0254
169	0.0301	0.0040	0.0261
170	0.0306	0.0041	0.0265
171	0.0315	0.0042	0.0273
172	0.0320	0.0043	0.0277
173	0.0330	0.0044	0.0286
174	0.0336	0.0045	0.0291
175	0.0348	0.0046	0.0301
176	0.0354	0.0047	0.0307

177	0.0369	0.0049	0.0319
178	0.0377	0.0050	0.0326
179	0.0394	0.0053	0.0341
180	0.0404	0.0054	0.0350
181	0.0426	0.0057	0.0369
182	0.0438	0.0058	0.0380
183	0.0467	0.0062	0.0404
184	0.0483	0.0065	0.0419
185	0.0410	0.0055	0.0355
186	0.0433	0.0058	0.0375
187	0.0492	0.0066	0.0426
188	0.0530	0.0071	0.0459
189	0.0639	0.0081	0.0557
190	0.0721	0.0081	0.0640
191	0.1031	0.0081	0.0949
192	0.1418	0.0081	0.1336
193	0.4437	0.0081	0.4355
194	0.0840	0.0081	0.0758
195	0.0578	0.0077	0.0501
196	0.0460	0.0061	0.0399
197	0.0502	0.0067	0.0435
198	0.0452	0.0060	0.0391
199	0.0414	0.0055	0.0359
200	0.0385	0.0051	0.0334
201	0.0361	0.0048	0.0313
202	0.0341	0.0046	0.0296
203	0.0325	0.0043	0.0281
204	0.0310	0.0041	0.0269
205	0.0297	0.0040	0.0257
206	0.0286	0.0038	0.0248
207	0.0276	0.0037	0.0239
208	0.0267	0.0036	0.0231
209	0.0258	0.0035	0.0224
210	0.0251	0.0034	0.0217
211	0.0244	0.0033	0.0212
212	0.0238	0.0032	0.0206
213	0.0232	0.0031	0.0201
214	0.0227	0.0030	0.0196
215	0.0222	0.0030	0.0192
216	0.0217	0.0029	0.0188
217	0.0208	0.0028	0.0180
218	0.0203	0.0027	0.0176
219	0.0200	0.0027	0.0173
220	0.0196	0.0026	0.0170
221	0.0192	0.0026	0.0167
222	0.0189	0.0025	0.0164
223	0.0186	0.0025	0.0161
224	0.0183	0.0024	0.0158
225	0.0180	0.0024	0.0156
226	0.0177	0.0024	0.0154
227	0.0175	0.0023	0.0151
228	0.0172	0.0023	0.0149
229	0.0170	0.0023	0.0147

230	0.0167	0.0022	0.0145
231	0.0165	0.0022	0.0143
232	0.0163	0.0022	0.0141
233	0.0161	0.0021	0.0140
234	0.0159	0.0021	0.0138
235	0.0157	0.0021	0.0136
236	0.0155	0.0021	0.0135
237	0.0154	0.0021	0.0133
238	0.0152	0.0020	0.0132
239	0.0150	0.0020	0.0130
240	0.0149	0.0020	0.0129
241	0.0147	0.0020	0.0127
242	0.0146	0.0019	0.0126
243	0.0144	0.0019	0.0125
244	0.0143	0.0019	0.0124
245	0.0141	0.0019	0.0122
246	0.0140	0.0019	0.0121
247	0.0139	0.0019	0.0120
248	0.0137	0.0018	0.0119
249	0.0136	0.0018	0.0118
250	0.0135	0.0018	0.0117
251	0.0134	0.0018	0.0116
252	0.0133	0.0018	0.0115
253	0.0132	0.0018	0.0114
254	0.0131	0.0017	0.0113
255	0.0129	0.0017	0.0112
256	0.0128	0.0017	0.0111
257	0.0127	0.0017	0.0110
258	0.0126	0.0017	0.0110
259	0.0125	0.0017	0.0109
260	0.0125	0.0017	0.0108
261	0.0124	0.0017	0.0107
262	0.0123	0.0016	0.0106
263	0.0122	0.0016	0.0106
264	0.0121	0.0016	0.0105
265	0.0120	0.0016	0.0104
266	0.0119	0.0016	0.0103
267	0.0119	0.0016	0.0103
268	0.0118	0.0016	0.0102
269	0.0117	0.0016	0.0101
270	0.0116	0.0016	0.0101
271	0.0115	0.0015	0.0100
272	0.0115	0.0015	0.0099
273	0.0114	0.0015	0.0099
274	0.0113	0.0015	0.0098
275	0.0113	0.0015	0.0098
276	0.0112	0.0015	0.0097
277	0.0111	0.0015	0.0096
278	0.0111	0.0015	0.0096
279	0.0110	0.0015	0.0095
280	0.0109	0.0015	0.0095
281	0.0109	0.0015	0.0094
282	0.0108	0.0014	0.0094

283	0.0107	0.0014	0.0093
284	0.0107	0.0014	0.0093
285	0.0106	0.0014	0.0092
286	0.0106	0.0014	0.0092
287	0.0105	0.0014	0.0091
288	0.0105	0.0014	0.0091

Total soil rain loss = 0.73(In)
Total effective rainfall = 5.27(In)
Peak flow rate in flood hydrograph = 63.63(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

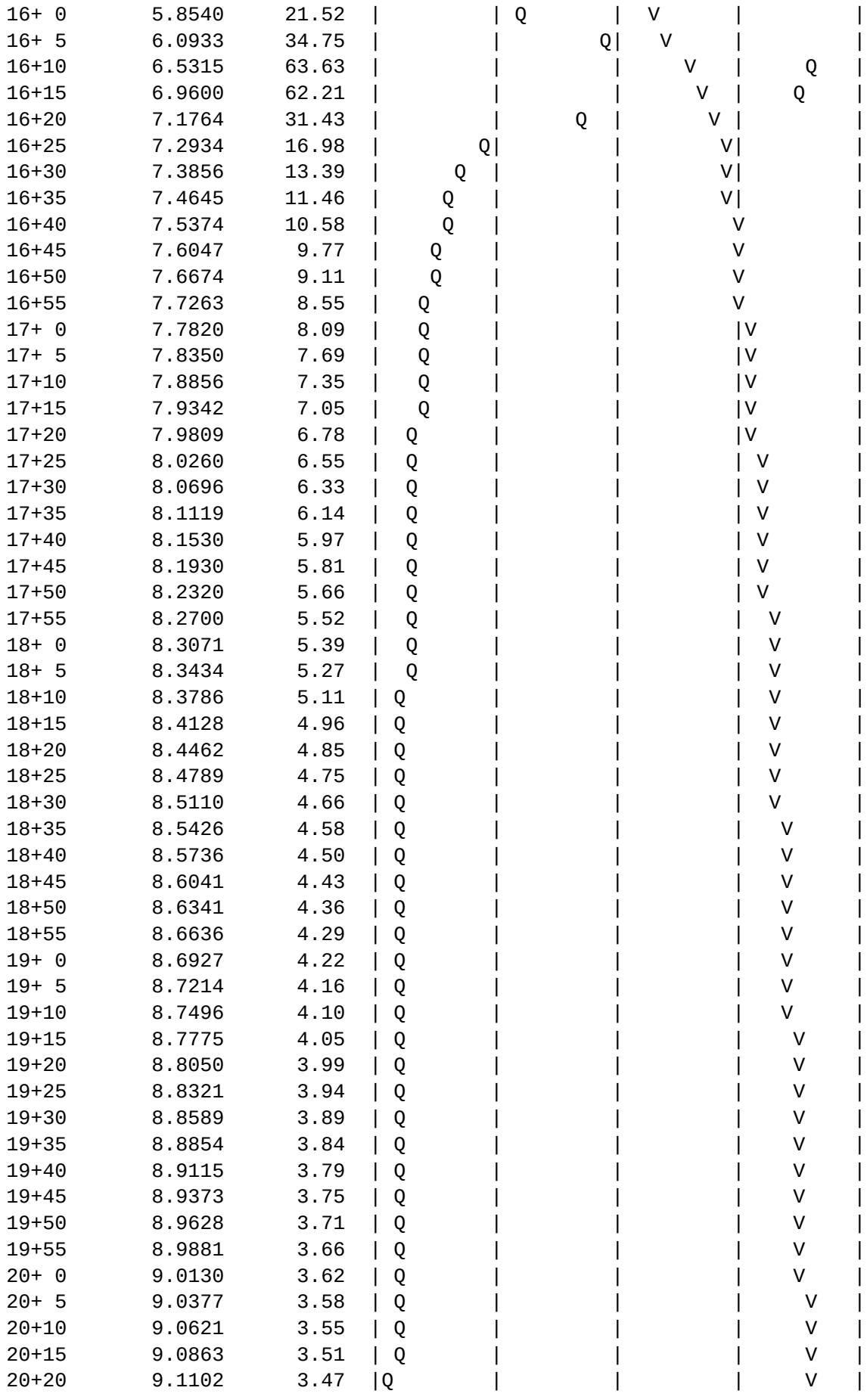
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0
0+ 5	0.0012	0.17	Q				
0+10	0.0085	1.07	Q				
0+15	0.0227	2.06	VQ				
0+20	0.0392	2.40	VQ				
0+25	0.0563	2.48	VQ				
0+30	0.0736	2.51	VQ				
0+35	0.0910	2.52	VQ				
0+40	0.1084	2.53	VQ				
0+45	0.1258	2.54	VQ				
0+50	0.1433	2.54	VQ				
0+55	0.1609	2.55	VQ				
1+ 0	0.1785	2.56	VQ				
1+ 5	0.1961	2.56	VQ				
1+10	0.2138	2.57	VQ				
1+15	0.2316	2.58	VQ				
1+20	0.2494	2.58	VQ				
1+25	0.2672	2.59	|Q				
1+30	0.2851	2.60	|Q				
1+35	0.3031	2.61	|Q				
1+40	0.3211	2.61	|Q				
1+45	0.3391	2.62	|Q				
1+50	0.3572	2.63	|Q				
1+55	0.3754	2.64	|Q				
2+ 0	0.3936	2.64	|Q				
2+ 5	0.4119	2.65	|Q				
2+10	0.4302	2.66	|Q				
2+15	0.4486	2.67	|Q				
2+20	0.4670	2.68	|Q				
2+25	0.4855	2.68	|Q				
2+30	0.5040	2.69	|QV				
2+35	0.5226	2.70	|QV				
2+40	0.5413	2.71	|QV				

2+45	0.5600	2.72	|QV	|	|	|	|
2+50	0.5787	2.73	|QV	|	|	|	|
2+55	0.5976	2.73	|QV	|	|	|	|
3+ 0	0.6165	2.74	|QV	|	|	|	|
3+ 5	0.6354	2.75	|QV	|	|	|	|
3+10	0.6544	2.76	|QV	|	|	|	|
3+15	0.6735	2.77	|QV	|	|	|	|
3+20	0.6926	2.78	|QV	|	|	|	|
3+25	0.7118	2.79	|QV	|	|	|	|
3+30	0.7311	2.80	|QV	|	|	|	|
3+35	0.7504	2.80	|QV	|	|	|	|
3+40	0.7698	2.81	|Q V	|	|	|	|
3+45	0.7892	2.82	|Q V	|	|	|	|
3+50	0.8087	2.83	|Q V	|	|	|	|
3+55	0.8283	2.84	|Q V	|	|	|	|
4+ 0	0.8479	2.85	|Q V	|	|	|	|
4+ 5	0.8677	2.86	|Q V	|	|	|	|
4+10	0.8874	2.87	|Q V	|	|	|	|
4+15	0.9073	2.88	|Q V	|	|	|	|
4+20	0.9272	2.89	|Q V	|	|	|	|
4+25	0.9472	2.90	|Q V	|	|	|	|
4+30	0.9672	2.91	|Q V	|	|	|	|
4+35	0.9874	2.92	|Q V	|	|	|	|
4+40	1.0076	2.93	|Q V	|	|	|	|
4+45	1.0279	2.94	|Q V	|	|	|	|
4+50	1.0482	2.96	|Q V	|	|	|	|
4+55	1.0686	2.97	|Q V	|	|	|	|
5+ 0	1.0891	2.98	|Q V	|	|	|	|
5+ 5	1.1097	2.99	|Q V	|	|	|	|
5+10	1.1304	3.00	|Q V	|	|	|	|
5+15	1.1511	3.01	|Q V	|	|	|	|
5+20	1.1719	3.02	|Q V	|	|	|	|
5+25	1.1928	3.03	|Q V	|	|	|	|
5+30	1.2138	3.05	|Q V	|	|	|	|
5+35	1.2349	3.06	|Q V	|	|	|	|
5+40	1.2560	3.07	|Q V	|	|	|	|
5+45	1.2772	3.08	|Q V	|	|	|	|
5+50	1.2985	3.09	|Q V	|	|	|	|
5+55	1.3199	3.11	|Q V	|	|	|	|
6+ 0	1.3414	3.12	|Q V	|	|	|	|
6+ 5	1.3630	3.13	|Q V	|	|	|	|
6+10	1.3846	3.15	|Q V	|	|	|	|
6+15	1.4064	3.16	|Q V	|	|	|	|
6+20	1.4282	3.17	|Q V	|	|	|	|
6+25	1.4502	3.18	|Q V	|	|	|	|
6+30	1.4722	3.20	|Q V	|	|	|	|
6+35	1.4943	3.21	|Q V	|	|	|	|
6+40	1.5165	3.23	|Q V	|	|	|	|
6+45	1.5388	3.24	|Q V	|	|	|	|
6+50	1.5613	3.25	|Q V	|	|	|	|
6+55	1.5838	3.27	|Q V	|	|	|	|
7+ 0	1.6064	3.28	|Q V	|	|	|	|
7+ 5	1.6291	3.30	|Q V	|	|	|	|

```
 7+10       1.6519      3.31  |Q    V   |          |          |          |
 7+15       1.6749      3.33  |Q    V   |          |          |          |
 7+20       1.6979      3.35  |Q    V   |          |          |          |
 7+25       1.7211      3.36  |Q    V   |          |          |          |
 7+30       1.7443      3.38  |Q    V   |          |          |          |
 7+35       1.7677      3.39  |Q     V  |          |          |          |
 7+40       1.7912      3.41  |Q     V  |          |          |          |
 7+45       1.8148      3.43  |Q     V  |          |          |          |
 7+50       1.8385      3.44  |Q     V  |          |          |          |
 7+55       1.8623      3.46  |Q     V  |          |          |          |
 8+ 0       1.8863      3.48  |Q     V  |          |          |          |
 8+ 5       1.9104      3.50  |Q     V  |          |          |          |
 8+10       1.9346      3.51  | Q    V  |          |          |          |
 8+15       1.9589      3.53  | Q    V  |          |          |          |
 8+20       1.9833      3.55  | Q    V  |          |          |          |
 8+25       2.0079      3.57  | Q     V |          |          |          |
 8+30       2.0326      3.59  | Q     V |          |          |          |
 8+35       2.0575      3.61  | Q     V |          |          |          |
 8+40       2.0825      3.63  | Q     V |          |          |          |
 8+45       2.1076      3.65  | Q     V |          |          |          |
 8+50       2.1329      3.67  | Q     V |          |          |          |
 8+55       2.1583      3.69  | Q     V |          |          |          |
 9+ 0       2.1839      3.71  | Q     V |          |          |          |
 9+ 5       2.2096      3.73  | Q     V |          |          |          |
 9+10       2.2354      3.76  | Q     V |          |          |          |
 9+15       2.2615      3.78  | Q      V|          |          |          |
 9+20       2.2876      3.80  | Q      V|          |          |          |
 9+25       2.3140      3.82  | Q      V|          |          |          |
 9+30       2.3405      3.85  | Q      V|          |          |          |
 9+35       2.3671      3.87  | Q      V|          |          |          |
 9+40       2.3940      3.90  | Q      V|          |          |          |
 9+45       2.4210      3.92  | Q      V|          |          |          |
 9+50       2.4482      3.95  | Q      V|          |          |          |
 9+55       2.4755      3.97  | Q      V|          |          |          |
10+ 0       2.5031      4.00  | Q      V|          |          |          |
10+ 5       2.5308      4.03  | Q       V          |          |          |
10+10       2.5587      4.05  | Q       V          |          |          |
10+15       2.5868      4.08  | Q       V          |          |          |
10+20       2.6151      4.11  | Q       V          |          |          |
10+25       2.6436      4.14  | Q       V          |          |          |
10+30       2.6724      4.17  | Q       V          |          |          |
10+35       2.7013      4.20  | Q       V          |          |          |
10+40       2.7305      4.23  | Q       V          |          |          |
10+45       2.7598      4.26  | Q        |V          |          |          |
10+50       2.7894      4.30  | Q        |V          |          |          |
10+55       2.8193      4.33  | Q        |V          |          |          |
11+ 0       2.8493      4.37  | Q        |V          |          |          |
11+ 5       2.8796      4.40  | Q        |V          |          |          |
11+10       2.9102      4.44  | Q        |V          |          |          |
11+15       2.9410      4.47  | Q        |V          |          |          |
11+20       2.9721      4.51  | Q        |V          |          |          |
11+25       3.0034      4.55  | Q        |V          |          |          |
11+30       3.0351      4.59  | Q        | V         |          |          |
```

11+35	3.0670	4.63	Q	V			
11+40	3.0992	4.68	Q	V			
11+45	3.1317	4.72	Q	V			
11+50	3.1645	4.76	Q	V			
11+55	3.1976	4.81	Q	V			
12+ 0	3.2310	4.86	Q	V			
12+ 5	3.2649	4.91	Q	V			
12+10	3.2993	5.00	Q	V			
12+15	3.3345	5.10	Q	V			
12+20	3.3701	5.17	Q	V			
12+25	3.4061	5.23	Q	V			
12+30	3.4425	5.29	Q	V			
12+35	3.4793	5.35	Q	V			
12+40	3.5166	5.41	Q	V			
12+45	3.5543	5.47	Q	V			
12+50	3.5924	5.54	Q	V			
12+55	3.6310	5.60	Q	V			
13+ 0	3.6701	5.67	Q	V			
13+ 5	3.7097	5.75	Q	V			
13+10	3.7498	5.82	Q	V			
13+15	3.7904	5.90	Q	V			
13+20	3.8317	5.99	Q	V			
13+25	3.8735	6.07	Q	V			
13+30	3.9159	6.16	Q	V			
13+35	3.9590	6.26	Q	V			
13+40	4.0028	6.36	Q	V			
13+45	4.0473	6.46	Q	V			
13+50	4.0926	6.57	Q	V			
13+55	4.1387	6.69	Q	V			
14+ 0	4.1856	6.81	Q	V			
14+ 5	4.2334	6.94	Q	V			
14+10	4.2821	7.08	Q	V			
14+15	4.3319	7.23	Q	V			
14+20	4.3828	7.39	Q	V			
14+25	4.4348	7.55	Q	V			
14+30	4.4880	7.73	Q	V			
14+35	4.5426	7.92	Q	V			
14+40	4.5986	8.13	Q	V			
14+45	4.6561	8.35	Q	V			
14+50	4.7153	8.59	Q	V			
14+55	4.7763	8.86	Q	V			
15+ 0	4.8393	9.16	Q	V			
15+ 5	4.9046	9.48	Q	V			
15+10	4.9724	9.84	Q	V			
15+15	5.0430	10.25	Q	V			
15+20	5.1169	10.72	Q	V			
15+25	5.1932	11.08	Q	V			
15+30	5.2672	10.75	Q	V			
15+35	5.3390	10.42	Q	V			
15+40	5.4147	10.99	Q	V			
15+45	5.4980	12.09	Q	V			
15+50	5.5928	13.77	Q	V			
15+55	5.7058	16.41	Q	V			



```
  20+25       9.1339      3.44  |Q        |         |         |     V   |
  20+30       9.1574      3.41  |Q        |         |         |     V   |
  20+35       9.1806      3.37  |Q        |         |         |     V   |
  20+40       9.2036      3.34  |Q        |         |         |     V   |
  20+45       9.2264      3.31  |Q        |         |         |     V   |
  20+50       9.2490      3.28  |Q        |         |         |     V   |
  20+55       9.2714      3.25  |Q        |         |         |     V   |
  21+ 0       9.2936      3.22  |Q        |         |         |      V  |
  21+ 5       9.3156      3.19  |Q        |         |         |      V  |
  21+10       9.3374      3.17  |Q        |         |         |      V  |
  21+15       9.3590      3.14  |Q        |         |         |      V  |
  21+20       9.3805      3.12  |Q        |         |         |      V  |
  21+25       9.4017      3.09  |Q        |         |         |      V  |
  21+30       9.4229      3.07  |Q        |         |         |      V  |
  21+35       9.4438      3.04  |Q        |         |         |      V  |
  21+40       9.4646      3.02  |Q        |         |         |      V  |
  21+45       9.4852      3.00  |Q        |         |         |      V  |
  21+50       9.5057      2.97  |Q        |         |         |      V  |
  21+55       9.5261      2.95  |Q        |         |         |       V |
  22+ 0       9.5462      2.93  |Q        |         |         |       V |
  22+ 5       9.5663      2.91  |Q        |         |         |       V |
  22+10       9.5862      2.89  |Q        |         |         |       V |
  22+15       9.6059      2.87  |Q        |         |         |       V |
  22+20       9.6256      2.85  |Q        |         |         |       V |
  22+25       9.6451      2.83  |Q        |         |         |       V |
  22+30       9.6644      2.81  |Q        |         |         |       V |
  22+35       9.6837      2.79  |Q        |         |         |       V |
  22+40       9.7028      2.78  |Q        |         |         |       V |
  22+45       9.7218      2.76  |Q        |         |         |       V |
  22+50       9.7406      2.74  |Q        |         |         |       V |
  22+55       9.7594      2.72  |Q        |         |         |       V |
  23+ 0       9.7780      2.71  |Q        |         |         |        V|
  23+ 5       9.7965      2.69  |Q        |         |         |        V|
  23+10       9.8149      2.67  |Q        |         |         |        V|
  23+15       9.8333      2.66  |Q        |         |         |        V|
  23+20       9.8514      2.64  |Q        |         |         |        V|
  23+25       9.8695      2.63  |Q        |         |         |        V|
  23+30       9.8875      2.61  |Q        |         |         |        V|
  23+35       9.9054      2.60  |Q        |         |         |        V|
  23+40       9.9232      2.58  |Q        |         |         |        V|
  23+45       9.9409      2.57  |Q        |         |         |        V|
  23+50       9.9585      2.55  |Q        |         |         |        V|
  23+55       9.9760      2.54  |Q        |         |         |        V|
  24+ 0       9.9934      2.53  |Q        |         |         |        V|
  24+ 5      10.0095      2.35  |Q        |         |         |        V|
  24+10      10.0194      1.44  Q         |         |         |        V|
  24+15      10.0224      0.44  Q         |         |         |        V|
  24+20      10.0231      0.10  Q         |         |         |        V|
  24+25      10.0233      0.03  Q         |         |         |        V|
-------------------------------------------------------------------------
```

APPENDIX B.6: UNIT HYDROGRAPH ANALYSIS, GROVE ONSITE MITIGATED, AREA E4

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 05/09/25

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6279

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED UNIT HYDROGRAPH METHOD HYDROLOGY
AREA E4, 100-YEAR STORM EVENT
FN: UARE4P

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
25.19	1	1.20
Rainfall data for year 100		
25.19	6	3.00
Rainfall data for year 100		
25.19	24	6.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
43.0	43.0	25.19	1.000	0.887	0.100	0.089

Area-averaged adjusted loss rate Fm (In/Hr) = 0.089

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.52	0.100	43.0	43.0	13.26	0.113
22.67	0.900	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.876
Area-averaged low loss fraction, Yb = 0.124
User entry of time of concentration = 0.176 (hours)
++
Watershed area = 25.19(Ac.)
Catchment Lag time = 0.141 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 59.2193
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.087(In/Hr)
Average low loss rate fraction (Yb) = 0.124 (decimal)
Note: user entry of the Fm value
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.444(In)
Computed peak 30-minute rainfall = 0.909(In)
Specified peak 1-hour rainfall = 1.200(In)
Computed peak 3-hour rainfall = 2.105(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:
Using a total area of 25.19(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.444(In)
30-minute factor = 0.999 Adjusted rainfall = 0.908(In)
1-hour factor = 0.999 Adjusted rainfall = 1.199(In)
3-hour factor = 1.000 Adjusted rainfall = 2.104(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 304.64 (CFS))

1	6.355	19.360
2	40.677	104.558
3	80.952	122.694
4	95.217	43.457
5	98.595	10.292
6	100.000	4.279

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4436	0.4436
2	0.5853	0.1417
3	0.6884	0.1031
4	0.7724	0.0840
5	0.8445	0.0721
6	0.9084	0.0639
7	0.9661	0.0578
8	1.0191	0.0530
9	1.0683	0.0492
10	1.1143	0.0460
11	1.1576	0.0433
12	1.1986	0.0410
13	1.2488	0.0502
14	1.2971	0.0483
15	1.3437	0.0467
16	1.3889	0.0452
17	1.4327	0.0438
18	1.4753	0.0426
19	1.5168	0.0414
20	1.5571	0.0404
21	1.5966	0.0394
22	1.6351	0.0385
23	1.6727	0.0377
24	1.7096	0.0369
25	1.7457	0.0361
26	1.7812	0.0354
27	1.8159	0.0348
28	1.8501	0.0342
29	1.8837	0.0336
30	1.9167	0.0330
31	1.9491	0.0325
32	1.9811	0.0320
33	2.0126	0.0315
34	2.0436	0.0310
35	2.0742	0.0306
36	2.1043	0.0302
37	2.1340	0.0297
38	2.1633	0.0293
39	2.1923	0.0289
40	2.2208	0.0286
41	2.2491	0.0282
42	2.2770	0.0279
43	2.3045	0.0276
44	2.3318	0.0273

45	2.3587	0.0270
46	2.3854	0.0267
47	2.4118	0.0264
48	2.4379	0.0261
49	2.4638	0.0258
50	2.4893	0.0256
51	2.5147	0.0253
52	2.5398	0.0251
53	2.5647	0.0249
54	2.5893	0.0246
55	2.6137	0.0244
56	2.6379	0.0242
57	2.6619	0.0240
58	2.6857	0.0238
59	2.7093	0.0236
60	2.7327	0.0234
61	2.7559	0.0232
62	2.7789	0.0230
63	2.8017	0.0228
64	2.8244	0.0227
65	2.8469	0.0225
66	2.8692	0.0223
67	2.8913	0.0222
68	2.9133	0.0220
69	2.9352	0.0218
70	2.9568	0.0217
71	2.9784	0.0215
72	2.9998	0.0214
73	3.0205	0.0208
74	3.0411	0.0206
75	3.0616	0.0205
76	3.0820	0.0203
77	3.1022	0.0202
78	3.1223	0.0201
79	3.1422	0.0200
80	3.1620	0.0198
81	3.1817	0.0197
82	3.2013	0.0196
83	3.2208	0.0195
84	3.2401	0.0193
85	3.2594	0.0192
86	3.2785	0.0191
87	3.2975	0.0190
88	3.3164	0.0189
89	3.3352	0.0188
90	3.3539	0.0187
91	3.3724	0.0186
92	3.3909	0.0185
93	3.4093	0.0184
94	3.4276	0.0183
95	3.4458	0.0182
96	3.4639	0.0181
97	3.4819	0.0180

98	3.4998	0.0179
99	3.5176	0.0178
100	3.5353	0.0177
101	3.5529	0.0176
102	3.5705	0.0175
103	3.5879	0.0175
104	3.6053	0.0174
105	3.6226	0.0173
106	3.6398	0.0172
107	3.6569	0.0171
108	3.6740	0.0170
109	3.6910	0.0170
110	3.7079	0.0169
111	3.7247	0.0168
112	3.7414	0.0167
113	3.7581	0.0167
114	3.7747	0.0166
115	3.7912	0.0165
116	3.8076	0.0164
117	3.8240	0.0164
118	3.8403	0.0163
119	3.8566	0.0162
120	3.8727	0.0162
121	3.8888	0.0161
122	3.9049	0.0160
123	3.9209	0.0160
124	3.9368	0.0159
125	3.9526	0.0158
126	3.9684	0.0158
127	3.9841	0.0157
128	3.9998	0.0157
129	4.0154	0.0156
130	4.0309	0.0155
131	4.0464	0.0155
132	4.0618	0.0154
133	4.0771	0.0154
134	4.0924	0.0153
135	4.1077	0.0152
136	4.1229	0.0152
137	4.1380	0.0151
138	4.1531	0.0151
139	4.1681	0.0150
140	4.1831	0.0150
141	4.1980	0.0149
142	4.2128	0.0149
143	4.2276	0.0148
144	4.2424	0.0148
145	4.2571	0.0147
146	4.2718	0.0147
147	4.2864	0.0146
148	4.3009	0.0146
149	4.3154	0.0145
150	4.3299	0.0145

151	4.3443	0.0144
152	4.3587	0.0144
153	4.3730	0.0143
154	4.3873	0.0143
155	4.4015	0.0142
156	4.4156	0.0142
157	4.4298	0.0141
158	4.4439	0.0141
159	4.4579	0.0140
160	4.4719	0.0140
161	4.4859	0.0140
162	4.4998	0.0139
163	4.5136	0.0139
164	4.5275	0.0138
165	4.5412	0.0138
166	4.5550	0.0137
167	4.5687	0.0137
168	4.5823	0.0137
169	4.5960	0.0136
170	4.6095	0.0136
171	4.6231	0.0135
172	4.6366	0.0135
173	4.6500	0.0135
174	4.6635	0.0134
175	4.6768	0.0134
176	4.6902	0.0133
177	4.7035	0.0133
178	4.7168	0.0133
179	4.7300	0.0132
180	4.7432	0.0132
181	4.7563	0.0132
182	4.7695	0.0131
183	4.7826	0.0131
184	4.7956	0.0131
185	4.8086	0.0130
186	4.8216	0.0130
187	4.8345	0.0129
188	4.8475	0.0129
189	4.8603	0.0129
190	4.8732	0.0128
191	4.8860	0.0128
192	4.8988	0.0128
193	4.9115	0.0127
194	4.9242	0.0127
195	4.9369	0.0127
196	4.9495	0.0126
197	4.9621	0.0126
198	4.9747	0.0126
199	4.9873	0.0125
200	4.9998	0.0125
201	5.0123	0.0125
202	5.0247	0.0125
203	5.0371	0.0124

204	5.0495	0.0124
205	5.0619	0.0124
206	5.0742	0.0123
207	5.0865	0.0123
208	5.0988	0.0123
209	5.1110	0.0122
210	5.1233	0.0122
211	5.1354	0.0122
212	5.1476	0.0122
213	5.1597	0.0121
214	5.1718	0.0121
215	5.1839	0.0121
216	5.1959	0.0120
217	5.2080	0.0120
218	5.2199	0.0120
219	5.2319	0.0120
220	5.2438	0.0119
221	5.2557	0.0119
222	5.2676	0.0119
223	5.2795	0.0119
224	5.2913	0.0118
225	5.3031	0.0118
226	5.3149	0.0118
227	5.3266	0.0117
228	5.3383	0.0117
229	5.3500	0.0117
230	5.3617	0.0117
231	5.3733	0.0116
232	5.3850	0.0116
233	5.3965	0.0116
234	5.4081	0.0116
235	5.4197	0.0115
236	5.4312	0.0115
237	5.4427	0.0115
238	5.4541	0.0115
239	5.4656	0.0114
240	5.4770	0.0114
241	5.4884	0.0114
242	5.4998	0.0114
243	5.5111	0.0114
244	5.5225	0.0113
245	5.5338	0.0113
246	5.5451	0.0113
247	5.5563	0.0113
248	5.5676	0.0112
249	5.5788	0.0112
250	5.5900	0.0112
251	5.6011	0.0112
252	5.6123	0.0111
253	5.6234	0.0111
254	5.6345	0.0111
255	5.6456	0.0111
256	5.6567	0.0111

257	5.6677	0.0110
258	5.6787	0.0110
259	5.6897	0.0110
260	5.7007	0.0110
261	5.7116	0.0110
262	5.7226	0.0109
263	5.7335	0.0109
264	5.7444	0.0109
265	5.7552	0.0109
266	5.7661	0.0108
267	5.7769	0.0108
268	5.7877	0.0108
269	5.7985	0.0108
270	5.8093	0.0108
271	5.8200	0.0107
272	5.8308	0.0107
273	5.8415	0.0107
274	5.8522	0.0107
275	5.8628	0.0107
276	5.8735	0.0107
277	5.8841	0.0106
278	5.8947	0.0106
279	5.9053	0.0106
280	5.9159	0.0106
281	5.9264	0.0106
282	5.9370	0.0105
283	5.9475	0.0105
284	5.9580	0.0105
285	5.9685	0.0105
286	5.9789	0.0105
287	5.9894	0.0104
288	5.9998	0.0104

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0104	0.0013	0.0091
2	0.0104	0.0013	0.0091
3	0.0105	0.0013	0.0092
4	0.0105	0.0013	0.0092
5	0.0105	0.0013	0.0092
6	0.0106	0.0013	0.0092
7	0.0106	0.0013	0.0093
8	0.0106	0.0013	0.0093
9	0.0107	0.0013	0.0093
10	0.0107	0.0013	0.0093
11	0.0107	0.0013	0.0094
12	0.0107	0.0013	0.0094
13	0.0108	0.0013	0.0094
14	0.0108	0.0013	0.0094
15	0.0108	0.0013	0.0095
16	0.0108	0.0014	0.0095

17	0.0109	0.0014	0.0095
18	0.0109	0.0014	0.0096
19	0.0110	0.0014	0.0096
20	0.0110	0.0014	0.0096
21	0.0110	0.0014	0.0096
22	0.0110	0.0014	0.0097
23	0.0111	0.0014	0.0097
24	0.0111	0.0014	0.0097
25	0.0111	0.0014	0.0098
26	0.0112	0.0014	0.0098
27	0.0112	0.0014	0.0098
28	0.0112	0.0014	0.0098
29	0.0113	0.0014	0.0099
30	0.0113	0.0014	0.0099
31	0.0114	0.0014	0.0099
32	0.0114	0.0014	0.0100
33	0.0114	0.0014	0.0100
34	0.0114	0.0014	0.0100
35	0.0115	0.0014	0.0101
36	0.0115	0.0014	0.0101
37	0.0116	0.0014	0.0101
38	0.0116	0.0014	0.0102
39	0.0116	0.0014	0.0102
40	0.0117	0.0015	0.0102
41	0.0117	0.0015	0.0103
42	0.0117	0.0015	0.0103
43	0.0118	0.0015	0.0103
44	0.0118	0.0015	0.0104
45	0.0119	0.0015	0.0104
46	0.0119	0.0015	0.0104
47	0.0120	0.0015	0.0105
48	0.0120	0.0015	0.0105
49	0.0120	0.0015	0.0105
50	0.0121	0.0015	0.0106
51	0.0121	0.0015	0.0106
52	0.0122	0.0015	0.0106
53	0.0122	0.0015	0.0107
54	0.0122	0.0015	0.0107
55	0.0123	0.0015	0.0108
56	0.0123	0.0015	0.0108
57	0.0124	0.0015	0.0108
58	0.0124	0.0015	0.0109
59	0.0125	0.0016	0.0109
60	0.0125	0.0016	0.0110
61	0.0126	0.0016	0.0110
62	0.0126	0.0016	0.0110
63	0.0127	0.0016	0.0111
64	0.0127	0.0016	0.0111
65	0.0128	0.0016	0.0112
66	0.0128	0.0016	0.0112
67	0.0129	0.0016	0.0113
68	0.0129	0.0016	0.0113
69	0.0130	0.0016	0.0114

70	0.0130	0.0016	0.0114
71	0.0131	0.0016	0.0115
72	0.0131	0.0016	0.0115
73	0.0132	0.0016	0.0116
74	0.0132	0.0016	0.0116
75	0.0133	0.0017	0.0117
76	0.0133	0.0017	0.0117
77	0.0134	0.0017	0.0118
78	0.0135	0.0017	0.0118
79	0.0135	0.0017	0.0119
80	0.0136	0.0017	0.0119
81	0.0137	0.0017	0.0120
82	0.0137	0.0017	0.0120
83	0.0138	0.0017	0.0121
84	0.0138	0.0017	0.0121
85	0.0139	0.0017	0.0122
86	0.0140	0.0017	0.0122
87	0.0140	0.0017	0.0123
88	0.0141	0.0018	0.0123
89	0.0142	0.0018	0.0124
90	0.0142	0.0018	0.0125
91	0.0143	0.0018	0.0125
92	0.0144	0.0018	0.0126
93	0.0145	0.0018	0.0127
94	0.0145	0.0018	0.0127
95	0.0146	0.0018	0.0128
96	0.0147	0.0018	0.0128
97	0.0148	0.0018	0.0129
98	0.0148	0.0018	0.0130
99	0.0149	0.0019	0.0131
100	0.0150	0.0019	0.0131
101	0.0151	0.0019	0.0132
102	0.0151	0.0019	0.0132
103	0.0152	0.0019	0.0133
104	0.0153	0.0019	0.0134
105	0.0154	0.0019	0.0135
106	0.0155	0.0019	0.0135
107	0.0156	0.0019	0.0137
108	0.0157	0.0019	0.0137
109	0.0158	0.0020	0.0138
110	0.0158	0.0020	0.0139
111	0.0160	0.0020	0.0140
112	0.0160	0.0020	0.0140
113	0.0162	0.0020	0.0142
114	0.0162	0.0020	0.0142
115	0.0164	0.0020	0.0143
116	0.0164	0.0020	0.0144
117	0.0166	0.0021	0.0145
118	0.0167	0.0021	0.0146
119	0.0168	0.0021	0.0147
120	0.0169	0.0021	0.0148
121	0.0170	0.0021	0.0149
122	0.0171	0.0021	0.0150

123	0.0173	0.0022	0.0151
124	0.0174	0.0022	0.0152
125	0.0175	0.0022	0.0154
126	0.0176	0.0022	0.0154
127	0.0178	0.0022	0.0156
128	0.0179	0.0022	0.0157
129	0.0181	0.0023	0.0158
130	0.0182	0.0023	0.0159
131	0.0184	0.0023	0.0161
132	0.0185	0.0023	0.0162
133	0.0187	0.0023	0.0164
134	0.0188	0.0023	0.0165
135	0.0190	0.0024	0.0166
136	0.0191	0.0024	0.0167
137	0.0193	0.0024	0.0169
138	0.0195	0.0024	0.0170
139	0.0197	0.0025	0.0173
140	0.0198	0.0025	0.0174
141	0.0201	0.0025	0.0176
142	0.0202	0.0025	0.0177
143	0.0205	0.0025	0.0179
144	0.0206	0.0026	0.0181
145	0.0214	0.0027	0.0187
146	0.0215	0.0027	0.0189
147	0.0218	0.0027	0.0191
148	0.0220	0.0027	0.0193
149	0.0223	0.0028	0.0195
150	0.0225	0.0028	0.0197
151	0.0228	0.0028	0.0200
152	0.0230	0.0029	0.0202
153	0.0234	0.0029	0.0205
154	0.0236	0.0029	0.0207
155	0.0240	0.0030	0.0210
156	0.0242	0.0030	0.0212
157	0.0246	0.0031	0.0216
158	0.0249	0.0031	0.0218
159	0.0253	0.0032	0.0222
160	0.0256	0.0032	0.0224
161	0.0261	0.0033	0.0229
162	0.0264	0.0033	0.0231
163	0.0270	0.0034	0.0236
164	0.0273	0.0034	0.0239
165	0.0279	0.0035	0.0244
166	0.0282	0.0035	0.0247
167	0.0289	0.0036	0.0253
168	0.0293	0.0036	0.0257
169	0.0302	0.0038	0.0264
170	0.0306	0.0038	0.0268
171	0.0315	0.0039	0.0276
172	0.0320	0.0040	0.0280
173	0.0330	0.0041	0.0289
174	0.0336	0.0042	0.0294
175	0.0348	0.0043	0.0304

176	0.0354	0.0044	0.0310
177	0.0369	0.0046	0.0323
178	0.0377	0.0047	0.0330
179	0.0394	0.0049	0.0345
180	0.0404	0.0050	0.0354
181	0.0426	0.0053	0.0373
182	0.0438	0.0055	0.0384
183	0.0467	0.0058	0.0409
184	0.0483	0.0060	0.0423
185	0.0410	0.0051	0.0359
186	0.0433	0.0054	0.0379
187	0.0492	0.0061	0.0430
188	0.0530	0.0066	0.0464
189	0.0639	0.0072	0.0566
190	0.0721	0.0072	0.0649
191	0.1031	0.0072	0.0958
192	0.1417	0.0072	0.1345
193	0.4436	0.0072	0.4364
194	0.0840	0.0072	0.0767
195	0.0578	0.0072	0.0506
196	0.0460	0.0057	0.0403
197	0.0502	0.0062	0.0439
198	0.0452	0.0056	0.0396
199	0.0414	0.0052	0.0363
200	0.0385	0.0048	0.0337
201	0.0361	0.0045	0.0316
202	0.0342	0.0043	0.0299
203	0.0325	0.0040	0.0284
204	0.0310	0.0039	0.0272
205	0.0297	0.0037	0.0260
206	0.0286	0.0036	0.0250
207	0.0276	0.0034	0.0241
208	0.0267	0.0033	0.0233
209	0.0258	0.0032	0.0226
210	0.0251	0.0031	0.0220
211	0.0244	0.0030	0.0214
212	0.0238	0.0030	0.0208
213	0.0232	0.0029	0.0203
214	0.0227	0.0028	0.0198
215	0.0222	0.0028	0.0194
216	0.0217	0.0027	0.0190
217	0.0208	0.0026	0.0182
218	0.0203	0.0025	0.0178
219	0.0200	0.0025	0.0175
220	0.0196	0.0024	0.0171
221	0.0192	0.0024	0.0168
222	0.0189	0.0024	0.0165
223	0.0186	0.0023	0.0163
224	0.0183	0.0023	0.0160
225	0.0180	0.0022	0.0158
226	0.0177	0.0022	0.0155
227	0.0175	0.0022	0.0153
228	0.0172	0.0021	0.0151

229	0.0170	0.0021	0.0149
230	0.0167	0.0021	0.0147
231	0.0165	0.0021	0.0145
232	0.0163	0.0020	0.0143
233	0.0161	0.0020	0.0141
234	0.0159	0.0020	0.0139
235	0.0157	0.0020	0.0138
236	0.0155	0.0019	0.0136
237	0.0154	0.0019	0.0134
238	0.0152	0.0019	0.0133
239	0.0150	0.0019	0.0132
240	0.0149	0.0018	0.0130
241	0.0147	0.0018	0.0129
242	0.0146	0.0018	0.0127
243	0.0144	0.0018	0.0126
244	0.0143	0.0018	0.0125
245	0.0141	0.0018	0.0124
246	0.0140	0.0017	0.0123
247	0.0139	0.0017	0.0121
248	0.0137	0.0017	0.0120
249	0.0136	0.0017	0.0119
250	0.0135	0.0017	0.0118
251	0.0134	0.0017	0.0117
252	0.0133	0.0017	0.0116
253	0.0132	0.0016	0.0115
254	0.0131	0.0016	0.0114
255	0.0129	0.0016	0.0113
256	0.0128	0.0016	0.0112
257	0.0127	0.0016	0.0112
258	0.0126	0.0016	0.0111
259	0.0125	0.0016	0.0110
260	0.0125	0.0016	0.0109
261	0.0124	0.0015	0.0108
262	0.0123	0.0015	0.0107
263	0.0122	0.0015	0.0107
264	0.0121	0.0015	0.0106
265	0.0120	0.0015	0.0105
266	0.0119	0.0015	0.0104
267	0.0119	0.0015	0.0104
268	0.0118	0.0015	0.0103
269	0.0117	0.0015	0.0102
270	0.0116	0.0014	0.0102
271	0.0115	0.0014	0.0101
272	0.0115	0.0014	0.0100
273	0.0114	0.0014	0.0100
274	0.0113	0.0014	0.0099
275	0.0113	0.0014	0.0099
276	0.0112	0.0014	0.0098
277	0.0111	0.0014	0.0097
278	0.0111	0.0014	0.0097
279	0.0110	0.0014	0.0096
280	0.0109	0.0014	0.0096
281	0.0109	0.0014	0.0095

282	0.0108	0.0013	0.0095
283	0.0107	0.0013	0.0094
284	0.0107	0.0013	0.0094
285	0.0106	0.0013	0.0093
286	0.0106	0.0013	0.0093
287	0.0105	0.0013	0.0092
288	0.0105	0.0013	0.0092

Total soil rain loss = 0.68(In)
Total effective rainfall = 5.32(In)
Peak flow rate in flood hydrograph = 69.65(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0
0+ 5	0.0012	0.18	Q				
0+10	0.0090	1.13	Q				
0+15	0.0245	2.25	VQ				
0+20	0.0428	2.66	VQ				
0+25	0.0618	2.76	VQ				
0+30	0.0811	2.80	VQ				
0+35	0.1005	2.81	VQ				
0+40	0.1199	2.82	VQ				
0+45	0.1393	2.83	VQ				
0+50	0.1589	2.83	VQ				
0+55	0.1784	2.84	VQ				
1+ 0	0.1981	2.85	VQ				
1+ 5	0.2177	2.86	VQ				
1+10	0.2375	2.86	VQ				
1+15	0.2572	2.87	VQ				
1+20	0.2771	2.88	VQ				
1+25	0.2970	2.89	|Q				
1+30	0.3169	2.90	|Q				
1+35	0.3369	2.91	|Q				
1+40	0.3570	2.91	|Q				
1+45	0.3771	2.92	|Q				
1+50	0.3973	2.93	|Q				
1+55	0.4175	2.94	|Q				
2+ 0	0.4378	2.95	|Q				
2+ 5	0.4582	2.96	|Q				
2+10	0.4786	2.96	|Q				
2+15	0.4991	2.97	|Q				
2+20	0.5196	2.98	|Q				
2+25	0.5403	2.99	|Q				
2+30	0.5609	3.00	|QV				
2+35	0.5816	3.01	|QV				

2+40	0.6024	3.02	|QV	|	|	|	|
2+45	0.6233	3.03	|QV	|	|	|	|
2+50	0.6442	3.04	|QV	|	|	|	|
2+55	0.6652	3.05	|QV	|	|	|	|
3+ 0	0.6863	3.06	|QV	|	|	|	|
3+ 5	0.7074	3.07	|QV	|	|	|	|
3+10	0.7286	3.08	|QV	|	|	|	|
3+15	0.7498	3.09	|QV	|	|	|	|
3+20	0.7711	3.10	|QV	|	|	|	|
3+25	0.7925	3.11	|QV	|	|	|	|
3+30	0.8140	3.12	|QV	|	|	|	|
3+35	0.8355	3.13	|QV	|	|	|	|
3+40	0.8571	3.14	|Q V	|	|	|	|
3+45	0.8788	3.15	|Q V	|	|	|	|
3+50	0.9006	3.16	|Q V	|	|	|	|
3+55	0.9224	3.17	|Q V	|	|	|	|
4+ 0	0.9443	3.18	|Q V	|	|	|	|
4+ 5	0.9663	3.19	|Q V	|	|	|	|
4+10	0.9883	3.20	|Q V	|	|	|	|
4+15	1.0104	3.21	|Q V	|	|	|	|
4+20	1.0326	3.22	|Q V	|	|	|	|
4+25	1.0549	3.24	|Q V	|	|	|	|
4+30	1.0773	3.25	|Q V	|	|	|	|
4+35	1.0997	3.26	|Q V	|	|	|	|
4+40	1.1222	3.27	|Q V	|	|	|	|
4+45	1.1448	3.28	|Q V	|	|	|	|
4+50	1.1675	3.29	|Q V	|	|	|	|
4+55	1.1903	3.31	|Q V	|	|	|	|
5+ 0	1.2132	3.32	|Q V	|	|	|	|
5+ 5	1.2361	3.33	|Q V	|	|	|	|
5+10	1.2591	3.34	|Q V	|	|	|	|
5+15	1.2822	3.36	|Q V	|	|	|	|
5+20	1.3054	3.37	|Q V	|	|	|	|
5+25	1.3287	3.38	|Q V	|	|	|	|
5+30	1.3521	3.39	|Q V	|	|	|	|
5+35	1.3756	3.41	|Q V	|	|	|	|
5+40	1.3991	3.42	|Q V	|	|	|	|
5+45	1.4228	3.44	|Q V	|	|	|	|
5+50	1.4465	3.45	|Q V	|	|	|	|
5+55	1.4704	3.46	|Q V	|	|	|	|
6+ 0	1.4943	3.48	|Q V	|	|	|	|
6+ 5	1.5184	3.49	|Q V	|	|	|	|
6+10	1.5425	3.51	| Q V	|	|	|	|
6+15	1.5668	3.52	| Q V	|	|	|	|
6+20	1.5911	3.54	| Q V	|	|	|	|
6+25	1.6156	3.55	| Q V	|	|	|	|
6+30	1.6401	3.57	| Q V	|	|	|	|
6+35	1.6648	3.58	| Q V	|	|	|	|
6+40	1.6896	3.60	| Q V	|	|	|	|
6+45	1.7144	3.61	| Q V	|	|	|	|
6+50	1.7394	3.63	| Q V	|	|	|	|
6+55	1.7645	3.64	| Q V	|	|	|	|
7+ 0	1.7897	3.66	| Q V	|	|	|	|

7+ 5	1.8150	3.68	Q	V			
7+10	1.8405	3.69	Q	V			
7+15	1.8660	3.71	Q	V			
7+20	1.8917	3.73	Q	V			
7+25	1.9175	3.75	Q	V			
7+30	1.9435	3.76	Q	V			
7+35	1.9695	3.78	Q	V			
7+40	1.9957	3.80	Q	V			
7+45	2.0220	3.82	Q	V			
7+50	2.0484	3.84	Q	V			
7+55	2.0750	3.86	Q	V			
8+ 0	2.1017	3.88	Q	V			
8+ 5	2.1285	3.90	Q	V			
8+10	2.1555	3.92	Q	V			
8+15	2.1826	3.94	Q	V			
8+20	2.2099	3.96	Q	V			
8+25	2.2373	3.98	Q	V			
8+30	2.2648	4.00	Q	V			
8+35	2.2925	4.02	Q	V			
8+40	2.3204	4.04	Q	V			
8+45	2.3484	4.07	Q	V			
8+50	2.3766	4.09	Q	V			
8+55	2.4049	4.11	Q	V			
9+ 0	2.4334	4.14	Q	V			
9+ 5	2.4620	4.16	Q	V			
9+10	2.4909	4.19	Q	V			
9+15	2.5199	4.21	Q	V			
9+20	2.5490	4.24	Q	V			
9+25	2.5784	4.26	Q	V			
9+30	2.6079	4.29	Q	V			
9+35	2.6376	4.31	Q	V			
9+40	2.6675	4.34	Q	V			
9+45	2.6976	4.37	Q	V			
9+50	2.7279	4.40	Q	V			
9+55	2.7584	4.43	Q	V			
10+ 0	2.7891	4.46	Q	V			
10+ 5	2.8200	4.49	Q	V			
10+10	2.8511	4.52	Q	V			
10+15	2.8825	4.55	Q	V			
10+20	2.9140	4.58	Q	V			
10+25	2.9458	4.61	Q	V			
10+30	2.9778	4.65	Q	V			
10+35	3.0101	4.68	Q	V			
10+40	3.0426	4.72	Q	V			
10+45	3.0753	4.75	Q	V			
10+50	3.1083	4.79	Q	V			
10+55	3.1415	4.83	Q	V			
11+ 0	3.1750	4.87	Q	V			
11+ 5	3.2088	4.90	Q	V			
11+10	3.2429	4.95	Q	V			
11+15	3.2772	4.99	Q	V			
11+20	3.3119	5.03	Q	V			
11+25	3.3468	5.07	Q	V			

11+30	3.3820	5.12	Q	V			
11+35	3.4176	5.16	Q	V			
11+40	3.4535	5.21	Q	V			
11+45	3.4897	5.26	Q	V			
11+50	3.5262	5.31	Q	V			
11+55	3.5631	5.36	Q	V			
12+ 0	3.6004	5.41	Q	V			
12+ 5	3.6381	5.47	Q	V			
12+10	3.6765	5.57	Q	V			
12+15	3.7157	5.68	Q	V			
12+20	3.7553	5.76	Q	V			
12+25	3.7955	5.83	Q	V			
12+30	3.8360	5.89	Q	V			
12+35	3.8771	5.96	Q	V			
12+40	3.9186	6.03	Q	V			
12+45	3.9605	6.10	Q	V			
12+50	4.0030	6.17	Q	V			
12+55	4.0460	6.24	Q	V			
13+ 0	4.0896	6.32	Q	V			
13+ 5	4.1337	6.40	Q	V			
13+10	4.1784	6.49	Q	V			
13+15	4.2237	6.58	Q	V			
13+20	4.2696	6.67	Q	V			
13+25	4.3162	6.77	Q	V			
13+30	4.3635	6.87	Q	V			
13+35	4.4115	6.97	Q	V			
13+40	4.4603	7.08	Q	V			
13+45	4.5099	7.20	Q	V			
13+50	4.5603	7.32	Q	V			
13+55	4.6116	7.45	Q	V			
14+ 0	4.6639	7.59	Q	V			
14+ 5	4.7171	7.73	Q	V			
14+10	4.7714	7.89	Q	V			
14+15	4.8269	8.05	Q	V			
14+20	4.8836	8.23	Q	V			
14+25	4.9415	8.41	Q	V			
14+30	5.0008	8.61	Q	V			
14+35	5.0616	8.82	Q	V			
14+40	5.1239	9.05	Q	V			
14+45	5.1879	9.30	Q	V			
14+50	5.2538	9.57	Q	V			
14+55	5.3218	9.86	Q	V			
15+ 0	5.3920	10.19	Q	V			
15+ 5	5.4646	10.55	Q	V			
15+10	5.5401	10.96	Q	V			
15+15	5.6187	11.41	Q	V			
15+20	5.7008	11.93	Q	V			
15+25	5.7858	12.33	Q	V			
15+30	5.8685	12.01	Q	V			
15+35	5.9485	11.62	Q	V			
15+40	6.0327	12.22	Q	V			
15+45	6.1252	13.43	Q	V			
15+50	6.2304	15.29	Q	V			

| | | |

```
  20+20      10.1480      3.87  | Q       |         |         |     V   |
  20+25      10.1744      3.84  | Q       |         |         |     V   |
  20+30      10.2005      3.80  | Q       |         |         |     V   |
  20+35      10.2264      3.76  | Q       |         |         |     V   |
  20+40      10.2521      3.73  | Q       |         |         |     V   |
  20+45      10.2775      3.69  | Q       |         |         |     V   |
  20+50      10.3027      3.66  | Q       |         |         |     V   |
  20+55      10.3277      3.63  | Q       |         |         |     V   |
  21+ 0      10.3524      3.59  | Q       |         |         |      V  |
  21+ 5      10.3770      3.56  | Q       |         |         |      V  |
  21+10      10.4013      3.53  | Q       |         |         |      V  |
  21+15      10.4254      3.50  | Q       |         |         |      V  |
  21+20      10.4494      3.47  |Q        |         |         |      V  |
  21+25      10.4731      3.45  |Q        |         |         |      V  |
  21+30      10.4967      3.42  |Q        |         |         |      V  |
  21+35      10.5200      3.39  |Q        |         |         |      V  |
  21+40      10.5432      3.37  |Q        |         |         |      V  |
  21+45      10.5662      3.34  |Q        |         |         |      V  |
  21+50      10.5891      3.32  |Q        |         |         |      V  |
  21+55      10.6118      3.29  |Q        |         |         |       V |
  22+ 0      10.6343      3.27  |Q        |         |         |       V |
  22+ 5      10.6566      3.25  |Q        |         |         |       V |
  22+10      10.6788      3.22  |Q        |         |         |       V |
  22+15      10.7008      3.20  |Q        |         |         |       V |
  22+20      10.7227      3.18  |Q        |         |         |       V |
  22+25      10.7445      3.16  |Q        |         |         |       V |
  22+30      10.7661      3.14  |Q        |         |         |       V |
  22+35      10.7875      3.12  |Q        |         |         |       V |
  22+40      10.8088      3.09  |Q        |         |         |       V |
  22+45      10.8300      3.08  |Q        |         |         |       V |
  22+50      10.8511      3.06  |Q        |         |         |       V |
  22+55      10.8720      3.04  |Q        |         |         |       V |
  23+ 0      10.8928      3.02  |Q        |         |         |        V|
  23+ 5      10.9134      3.00  |Q        |         |         |        V|
  23+10      10.9339      2.98  |Q        |         |         |        V|
  23+15      10.9544      2.96  |Q        |         |         |        V|
  23+20      10.9746      2.95  |Q        |         |         |        V|
  23+25      10.9948      2.93  |Q        |         |         |        V|
  23+30      11.0149      2.91  |Q        |         |         |        V|
  23+35      11.0348      2.90  |Q        |         |         |        V|
  23+40      11.0547      2.88  |Q        |         |         |        V|
  23+45      11.0744      2.86  |Q        |         |         |        V|
  23+50      11.0940      2.85  |Q        |         |         |        V|
  23+55      11.1135      2.83  |Q        |         |         |        V|
  24+ 0      11.1329      2.82  |Q        |         |         |        V|
  24+ 5      11.1510      2.63  |Q        |         |         |        V|
  24+10      11.1624      1.66  Q         |         |         |        V|
  24+15      11.1661      0.53  Q         |         |         |        V|
  24+20      11.1670      0.13  Q         |         |         |        V|
  24+25      11.1673      0.04  Q         |         |         |         V
-------------------------------------------------------------------------
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APPENDIX C: BON VIEW AVENUE STORM DRAIN HYDROLOGY CALCULATIONS

APPENDIX C.1: RATIONAL METHOD ANALYSIS, RERUN FUSCOE MODELS TO BON VIEW

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/07/25

PORTION OF MPD DA XIV UPSTREAM
PROPOSED DEV DA A2
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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Process from Point/Station 1.000 to Point/Station 6.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 768.000(Ft.)
Top (of initial area) elevation = 694.000(Ft.)
Bottom (of initial area) elevation = 687.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.00911 s(%)= 0.91
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.823 min.
Rainfall intensity = 3.180(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.845
Subarea runoff = 17.566(CFS)
Total initial stream area = 6.540(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

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Process from Point/Station        6.000 to Point/Station        9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   687.000(Ft.)
End of street segment elevation =   684.000(Ft.)
Length of street segment  =   331.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     25.197(CFS)
Depth of flow =   0.541(Ft.), Average velocity =   3.193(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  19.479(Ft.)
Flow velocity =   3.19(Ft/s)
Travel time =    1.73 min.     TC =   13.55  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      2.930(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.840
Subarea runoff =     15.068(CFS) for    6.720(Ac.)
Total runoff =     32.634(CFS)
Effective area this stream =       13.26(Ac.)
Total Study Area (Main Stream No. 1) =       13.26(Ac.)
Area averaged Fm value =    0.196(In/Hr)
Street flow at end of street =     32.634(CFS)
Half street flow at end of street =     16.317(CFS)
Depth of flow =   0.583(Ft.), Average velocity =   3.401(Ft/s)
Flow width (from curb towards crown)=  21.553(Ft.)


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Process from Point/Station        6.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
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```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     13.260(Ac.)
Runoff from this stream =     32.634(CFS)
Time of concentration =   13.55 min.
Rainfall intensity =     2.930(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.147(In/Hr)
Initial subarea data:
Initial area flow distance =   970.000(Ft.)
Top (of initial area) elevation =   693.000(Ft.)
Bottom (of initial area) elevation =   690.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00309  s(%)=       0.31
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.113 min.
Rainfall intensity =      2.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =     22.335(CFS)
Total initial stream area =        9.950(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.147(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   690.000(Ft.)
End of street segment elevation =   684.000(Ft.)
Length of street segment  =   608.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
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```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     37.905(CFS)
Depth of flow =   0.601(Ft.), Average velocity =   3.644(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  22.471(Ft.)
Flow velocity =   3.64(Ft/s)
Travel time =    2.78 min.     TC =   18.89  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.230
Decimal fraction soil group B = 0.770
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.48
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.161(In/Hr)
Rainfall intensity =      2.400(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.842
Subarea runoff =     30.942(CFS) for   16.420(Ac.)
Total runoff =     53.277(CFS)
Effective area this stream =       26.37(Ac.)
Total Study Area (Main Stream No. 2) =       39.63(Ac.)
Area averaged Fm value =    0.155(In/Hr)
Street flow at end of street =     53.277(CFS)
Half street flow at end of street =     26.639(CFS)
Depth of flow =   0.664(Ft.), Average velocity =   3.963(Ft/s)
Flow width (from curb towards crown)=  25.634(Ft.)


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Process from Point/Station        8.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     26.370(Ac.)
Runoff from this stream =     53.277(CFS)
Time of concentration =   18.89 min.
Rainfall intensity =     2.400(In/Hr)
Area averaged loss rate (Fm) =    0.1555(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     32.63    13.260     13.55    0.196      2.930
```

```
2     53.28    26.370     18.89    0.155      2.400
Qmax(1) =
         1.000 *    1.000 *    32.634) +
         1.236 *    0.717 *    53.277) + =      79.863
Qmax(2) =
         0.806 *    1.000 *    32.634) +
         1.000 *    1.000 *    53.277) + =      79.589

Total of 2 main streams to confluence:
Flow rates before confluence point:
      33.634      54.277
Maximum flow rates at confluence using above data:
       79.863       79.589
Area of streams before confluence:
       13.260       26.370
Effective area values after confluence:
       32.173       39.630


Results of confluence:
Total flow rate =     79.863(CFS)
Time of concentration =    13.551 min.
Effective stream area after confluence  =     32.173(Ac.)
Study area average Pervious fraction(Ap) =  0.200
Study area average soil loss rate(Fm) =    0.169(In/Hr)
Study area total =      39.63(Ac.)
End of computations, Total Study Area =           39.63 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  45.7
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/07/25

PORTION OF MPD DA XIV DOWNSTREAM
PROPOSED DEV DA A2
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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Process from Point/Station 4.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.370
Decimal fraction soil group B = 0.630
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 47.12
Pervious ratio(Ap) = 0.8500 Max loss rate(Fm)= 0.717(In/Hr)
Initial subarea data:
Initial area flow distance = 805.000(Ft.)
Top (of initial area) elevation = 684.000(Ft.)
Bottom (of initial area) elevation = 678.000(Ft.)
Difference in elevation = 6.000(Ft.)
Slope = 0.00745 s(%)= 0.75
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 18.698 min.
Rainfall intensity = 2.415(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.633
Subarea runoff = 10.534(CFS)
Total initial stream area = 6.890(Ac.)
Pervious area fraction = 0.850
Initial area Fm value = 0.717(In/Hr)

```
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Process from Point/Station        4.000 to Point/Station       12.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      6.890(Ac.)
Runoff from this stream =     10.534(CFS)
Time of concentration =   18.70 min.
Rainfall intensity =     2.415(In/Hr)
Area averaged loss rate (Fm) =    0.7166(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.624(In/Hr)
Initial subarea data:
Initial area flow distance =   919.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   682.000(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.00218  s(%)=       0.22
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   25.219 min.
Rainfall intensity =      2.019(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.622
Subarea runoff =      7.431(CFS)
Total initial stream area =        5.920(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.624(In/Hr)


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Process from Point/Station       11.000 to Point/Station       12.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   682.000(Ft.)
End of street segment elevation =   678.000(Ft.)
Length of street segment  =   475.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
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Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     11.187(CFS)
Depth of flow =   0.437(Ft.), Average velocity =   2.552(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.282(Ft.)
Flow velocity =   2.55(Ft/s)
Travel time =    3.10 min.     TC =   28.32  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 0.390
Decimal fraction soil group B = 0.610
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 46.64
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.721(In/Hr)
Rainfall intensity =      1.883(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.575
Subarea runoff =      7.358(CFS) for    7.730(Ac.)
Total runoff =     14.789(CFS)
Effective area this stream =       13.65(Ac.)
Total Study Area (Main Stream No. 2) =       20.54(Ac.)
Area averaged Fm value =    0.679(In/Hr)
Street flow at end of street =     14.789(CFS)
Half street flow at end of street =      7.395(CFS)
Depth of flow =   0.472(Ft.), Average velocity =   2.729(Ft/s)
Flow width (from curb towards crown)=  15.994(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     13.650(Ac.)
Runoff from this stream =     14.789(CFS)
Time of concentration =   28.32 min.
Rainfall intensity =     1.883(In/Hr)
Area averaged loss rate (Fm) =    0.6790(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     10.53     6.890     18.70    0.717      2.415
2     14.79    13.650     28.32    0.679      1.883
Qmax(1) =
         1.000 *    1.000 *    10.534) +
         1.442 *    0.660 *    14.789) + =      24.619
Qmax(2) =
         0.686 *    1.000 *    10.534) +
         1.000 *    1.000 *    14.789) + =      22.021

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.534      15.789
Maximum flow rates at confluence using above data:
       24.619       22.021
Area of streams before confluence:
        6.890       13.650
Effective area values after confluence:
       15.902       20.540


Results of confluence:
Total flow rate =     24.619(CFS)
Time of concentration =    18.698 min.
Effective stream area after confluence  =     15.902(Ac.)
Study area average Pervious fraction(Ap) =  0.850
Study area average soil loss rate(Fm) =    0.692(In/Hr)
Study area total =      20.54(Ac.)
End of computations, Total Study Area =           20.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850
Area averaged SCS curve number =  49.5
```

APPENDIX C.2: RATIONAL METHOD ANALYSIS, BON VIEW MAINLINE, AREA F (EXCLUDES F2 & F3)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/08/25

BON VIEW SD TRIBUTARY AREA
OVERALL: JLC-MCC-MDP REV + ONTARIO RANCH

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 6.000 to Point/Station 6.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 54.00
Pervious ratio(Ap) = 0.5000 Max loss rate(Fm)= 0.380(In/Hr)
Rainfall intensity = 1.976(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 26.13 min. Rain intensity = 1.98(In/Hr)
Total area this stream = 430.90(Ac.)
Total Study Area (Main Stream No. 1) = 430.90(Ac.)
Total runoff = 617.51(CFS)

++

Process from Point/Station 6.000 to Point/Station 6.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 659.200(Ft.)
Downstream point/station elevation = 654.800(Ft.)
Pipe length = 868.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 617.510(CFS)
Nearest computed pipe diameter = 96.00(In.)

```
Calculated individual pipe flow  =   617.510(CFS)
Normal flow depth in pipe =   74.81(In.)
Flow top width inside pipe =   79.63(In.)
Critical Depth =   75.83(In.)
Pipe flow velocity =     14.70(Ft/s)
Travel time through pipe =    0.98 min.
Time of concentration (TC) =    27.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    430.900(Ac.)
Runoff from this stream =    617.510(CFS)
Time of concentration =   27.11 min.
Rainfall intensity =     1.933(In/Hr)
Area averaged loss rate (Fm) =    0.3800(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station        6.100
**** USER DEFINED FLOW INFORMATION AT A POINT ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 46.95
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.169(In/Hr)
Rainfall intensity =      2.930(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  13.55 min.  Rain intensity =       2.93(In/Hr)
Total area this stream =        39.63(Ac.)
Total Study Area (Main Stream No. 2) =      470.53(Ac.)
Total runoff =     79.86(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station        6.100
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     39.630(Ac.)
Runoff from this stream =     79.863(CFS)
Time of concentration =   13.55 min.
Rainfall intensity =     2.930(In/Hr)
Area averaged loss rate (Fm) =    0.1690(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    617.51   430.900     27.11    0.380      1.933
2     79.86    39.630     13.55    0.169      2.930
Qmax(1) =
         1.000 *    1.000 *   617.510) +
         0.639 *    1.000 *    79.863) + =     668.522
Qmax(2) =
         1.642 *    0.500 *   617.510) +
         1.000 *    1.000 *    79.863) + =     586.749

Total of 2 main streams to confluence:
Flow rates before confluence point:
     618.510      80.863
Maximum flow rates at confluence using above data:
      668.522      586.749
Area of streams before confluence:
      430.900       39.630
Effective area values after confluence:
      470.530      254.985


Results of confluence:
Total flow rate =    668.522(CFS)
Time of concentration =    27.114 min.
Effective stream area after confluence  =    470.530(Ac.)
Study area average Pervious fraction(Ap) =  0.475
Study area average soil loss rate(Fm) =    0.362(In/Hr)
Study area total =     470.53(Ac.)


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Process from Point/Station        6.100 to Point/Station        6.200
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   654.800(Ft.)
Downstream point/station elevation =   652.500(Ft.)
Pipe length  =   468.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   668.522(CFS)
Nearest computed pipe diameter  =     99.00(In.)
Calculated individual pipe flow  =   668.522(CFS)
Normal flow depth in pipe =   78.00(In.)
Flow top width inside pipe =   80.94(In.)
Critical Depth =   78.27(In.)
Pipe flow velocity =     14.79(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    27.64 min.


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Process from Point/Station        6.100 to Point/Station        6.200
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    470.530(Ac.)
Runoff from this stream =    668.522(CFS)
Time of concentration =   27.64 min.
Rainfall intensity =     1.910(In/Hr)
Area averaged loss rate (Fm) =    0.3622(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4747
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station        6.200
**** USER DEFINED FLOW INFORMATION AT A POINT ****
--------------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 49.50
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.693(In/Hr)
Rainfall intensity =      2.415(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  18.70 min.  Rain intensity =       2.42(In/Hr)
Total area this stream =        20.54(Ac.)
Total Study Area (Main Stream No. 2) =      491.07(Ac.)
Total runoff =     24.62(CFS)


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Process from Point/Station       12.000 to Point/Station        6.200
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     20.540(Ac.)
Runoff from this stream =     24.619(CFS)
Time of concentration =   18.70 min.
Rainfall intensity =     2.415(In/Hr)
Area averaged loss rate (Fm) =    0.6932(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    668.52   470.530     27.64    0.362      1.910
2     24.62    20.540     18.70    0.693      2.415
Qmax(1) =
         1.000 *    1.000 *   668.522) +
         0.707 *    1.000 *    24.619) + =     685.923
```

```
Qmax(2) =
         1.326 *    0.676 *   668.522) +
         1.000 *    1.000 *    24.619) + =     624.341

Total of 2 main streams to confluence:
Flow rates before confluence point:
     669.522      25.619
Maximum flow rates at confluence using above data:
      685.923      624.341
Area of streams before confluence:
      470.530       20.540
Effective area values after confluence:
      491.070      338.830


Results of confluence:
Total flow rate =    685.923(CFS)
Time of concentration =    27.641 min.
Effective stream area after confluence  =    491.070(Ac.)
Study area average Pervious fraction(Ap) =  0.490
Study area average soil loss rate(Fm) =    0.376(In/Hr)
Study area total =     491.07(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.200 to Point/Station        6.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   652.500(Ft.)
Downstream point/station elevation =   650.900(Ft.)
Pipe length  =   312.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   685.923(CFS)
Nearest computed pipe diameter  =     99.00(In.)
Calculated individual pipe flow  =   685.923(CFS)
Normal flow depth in pipe =   78.38(In.)
Flow top width inside pipe =   80.41(In.)
Critical Depth =   79.20(In.)
Pipe flow velocity =     15.11(Ft/s)
Travel time through pipe =    0.34 min.
Time of concentration (TC) =    27.99 min.


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Process from Point/Station        6.200 to Point/Station        6.300
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    491.070(Ac.)
Runoff from this stream =    685.923(CFS)
Time of concentration =   27.99 min.
Rainfall intensity =     1.896(In/Hr)
Area averaged loss rate (Fm) =    0.3761(In/Hr)
```

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Area averaged Pervious ratio (Ap) = 0.4904
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      701.000 to Point/Station      702.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.624(In/Hr)
Initial subarea data:
Initial area flow distance =   590.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   678.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01017  s(%)=       1.02
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   15.518 min.
Rainfall intensity =      2.701(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.692
Subarea runoff =      7.628(CFS)
Total initial stream area =        4.080(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.624(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      702.000 to Point/Station      702.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Time of concentration =    15.52 min.
Rainfall intensity =      2.701(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.772
Subarea runoff =      7.497(CFS) for    3.170(Ac.)
Total runoff =     15.126(CFS)
Effective area this stream =        7.25(Ac.)
Total Study Area (Main Stream No. 2) =      498.32(Ac.)
Area averaged Fm value =    0.383(In/Hr)
```

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Process from Point/Station      702.000 to Point/Station        6.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   674.000(Ft.)
Downstream point/station elevation =   650.900(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.126(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    15.126(CFS)
Normal flow depth in pipe =    9.50(In.)
Flow top width inside pipe =    9.74(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.67(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    15.61 min.


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Process from Point/Station      702.000 to Point/Station        6.300
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      7.250(Ac.)
Runoff from this stream =     15.126(CFS)
Time of concentration =   15.61 min.
Rainfall intensity =     2.692(In/Hr)
Area averaged loss rate (Fm) =    0.3832(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5221
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      703.000 to Point/Station      704.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.624(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =   687.000(Ft.)
Bottom (of initial area) elevation =   677.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.229 min.
Rainfall intensity =      2.375(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.664
Subarea runoff =     13.303(CFS)
Total initial stream area =        8.440(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.624(In/Hr)


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Process from Point/Station      704.000 to Point/Station        6.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   673.000(Ft.)
Downstream point/station elevation =   650.900(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.303(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    13.303(CFS)
Normal flow depth in pipe =    7.65(In.)
Flow top width inside pipe =   11.54(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.14(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    19.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      704.000 to Point/Station        6.300
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      8.440(Ac.)
Runoff from this stream =     13.303(CFS)
Time of concentration =   19.29 min.
Rainfall intensity =     2.371(In/Hr)
Area averaged loss rate (Fm) =    0.6239(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    685.92   491.070     27.99    0.376      1.896
2     15.13     7.250     15.61    0.383      2.692
3     13.30     8.440     19.29    0.624      2.371
Qmax(1) =
         1.000 *    1.000 *   685.923) +
         0.655 *    1.000 *    15.126) +
         0.728 *    1.000 *    13.303) + =     705.524
Qmax(2) =
         1.523 *    0.558 *   685.923) +
         1.000 *    1.000 *    15.126) +
```

```
         1.184 *    0.809 *    13.303) + =     610.601
Qmax(3) =
         1.312 *    0.689 *   685.923) +
         0.861 *    1.000 *    15.126) +
         1.000 *    1.000 *    13.303) + =     646.606

Total of 3 main streams to confluence:
Flow rates before confluence point:
     686.923      16.126      14.303
Maximum flow rates at confluence using above data:
      705.524      610.601      646.606
Area of streams before confluence:
      491.070        7.250        8.440
Effective area values after confluence:
      506.760      287.922      354.100


Results of confluence:
Total flow rate =    705.524(CFS)
Time of concentration =    27.985 min.
Effective stream area after confluence  =    506.760(Ac.)
Study area average Pervious fraction(Ap) =  0.497
Study area average soil loss rate(Fm) =    0.380(In/Hr)
Study area total =     506.76(Ac.)


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Process from Point/Station        6.300 to Point/Station        6.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   650.900(Ft.)
Downstream point/station elevation =   649.000(Ft.)
Pipe length  =   381.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   705.524(CFS)
Nearest computed pipe diameter  =    102.00(In.)
Calculated individual pipe flow  =   705.524(CFS)
Normal flow depth in pipe =   78.00(In.)
Flow top width inside pipe =   86.53(In.)
Critical Depth =   79.93(In.)
Pipe flow velocity =     15.16(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =    28.40 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.400 to Point/Station        6.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   649.000(Ft.)
Downstream point/station elevation =   647.300(Ft.)
Pipe length  =   342.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   705.524(CFS)
Nearest computed pipe diameter  =    102.00(In.)
```

```
Calculated individual pipe flow  =   705.524(CFS)
Normal flow depth in pipe =   78.09(In.)
Flow top width inside pipe =   86.42(In.)
Critical Depth =   79.93(In.)
Pipe flow velocity =     15.14(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =    28.78 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.400 to Point/Station        6.500
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    506.760(Ac.)
Runoff from this stream =    705.524(CFS)
Time of concentration =   28.78 min.
Rainfall intensity =     1.865(In/Hr)
Area averaged loss rate (Fm) =    0.3803(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4969
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      731.000 to Point/Station      732.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.570
Decimal fraction soil group B = 0.010
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 47.78
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.084(In/Hr)
Initial subarea data:
Initial area flow distance =   651.000(Ft.)
Top (of initial area) elevation =   675.500(Ft.)
Bottom (of initial area) elevation =   669.000(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.00998  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.196 min.
Rainfall intensity =      3.475(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.878
Subarea runoff =     11.264(CFS)
Total initial stream area =        3.690(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.084(In/Hr)


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Process from Point/Station      732.000 to Point/Station        6.500
```

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 665.000(Ft.)
Downstream point/station elevation = 647.300(Ft.)
Pipe length = 305.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 11.264(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 11.264(CFS)
Normal flow depth in pipe = 9.46(In.)
Flow top width inside pipe = 14.48(In.)
Critical depth could not be calculated.
Pipe flow velocity = 13.82(Ft/s)
Travel time through pipe = 0.37 min.
Time of concentration (TC) = 10.56 min.

++
Process from Point/Station 732.000 to Point/Station 6.500
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 3.690(Ac.)
Runoff from this stream = 11.264(CFS)
Time of concentration = 10.56 min.
Rainfall intensity = 3.402(In/Hr)
Area averaged loss rate (Fm) = 0.0836(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream No.	Flow rate (CFS)	Area (Ac.)	TC (min)	Fm (In/Hr)	Rainfall Intensity (In/Hr)
1	705.52	506.760	28.78	0.380	1.865
2	11.26	3.690	10.56	0.084	3.402

Qmax(1) =
1.000 * 1.000 * 705.524) +
0.537 * 1.000 * 11.264) + = 711.570
Qmax(2) =
2.036 * 0.367 * 705.524) +
1.000 * 1.000 * 11.264) + = 538.474

Total of 2 main streams to confluence:
Flow rates before confluence point:
706.524 12.264
Maximum flow rates at confluence using above data:
711.570 538.474
Area of streams before confluence:
506.760 3.690
Effective area values after confluence:
510.450 189.698

```
Results of confluence:
Total flow rate =    711.570(CFS)
Time of concentration =    28.781 min.
Effective stream area after confluence  =    510.450(Ac.)
Study area average Pervious fraction(Ap) =  0.494
Study area average soil loss rate(Fm) =    0.378(In/Hr)
Study area total =     510.45(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.500 to Point/Station        7.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   647.300(Ft.)
Downstream point/station elevation =   645.700(Ft.)
Pipe length  =   224.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   711.570(CFS)
Nearest computed pipe diameter  =     96.00(In.)
Calculated individual pipe flow  =   711.570(CFS)
Normal flow depth in pipe =   72.75(In.)
Flow top width inside pipe =   82.25(In.)
Critical Depth =   80.78(In.)
Pipe flow velocity =     17.41(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =    29.00 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.500 to Point/Station        7.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    510.450(Ac.)
Runoff from this stream =    711.570(CFS)
Time of concentration =   29.00 min.
Rainfall intensity =     1.856(In/Hr)
Area averaged loss rate (Fm) =    0.3782(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4940
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      734.000 to Point/Station      735.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.450
Decimal fraction soil group B = 0.550
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 45.20
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.086(In/Hr)
Initial subarea data:
Initial area flow distance =   446.000(Ft.)
Top (of initial area) elevation =   677.500(Ft.)
Bottom (of initial area) elevation =   673.000(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.01009  s(%)=       1.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.746 min.
Rainfall intensity =      3.810(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      3.419(CFS)
Total initial stream area =        1.020(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.086(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      735.000 to Point/Station        7.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.760
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.240
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 40.88
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.091(In/Hr)
Time of concentration =     8.75 min.
Rainfall intensity =      3.810(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =     13.524(CFS) for    4.040(Ac.)
Total runoff =     16.943(CFS)
Effective area this stream =        5.06(Ac.)
Total Study Area (Main Stream No. 2) =      515.51(Ac.)
Area averaged Fm value =    0.090(In/Hr)


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Process from Point/Station      735.000 to Point/Station        7.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.060(Ac.)
Runoff from this stream =     16.943(CFS)
Time of concentration =    8.75 min.
Rainfall intensity =     3.810(In/Hr)
Area averaged loss rate (Fm) =    0.0900(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    711.57   510.450     29.00    0.378      1.856
2     16.94     5.060      8.75    0.090      3.810
Qmax(1) =
         1.000 *    1.000 *   711.570) +
         0.475 *    1.000 *    16.943) + =     719.614
Qmax(2) =
         2.322 *    0.302 *   711.570) +
         1.000 *    1.000 *    16.943) + =     515.311

Total of 2 main streams to confluence:
Flow rates before confluence point:
     712.570      17.943
Maximum flow rates at confluence using above data:
      719.614      515.311
Area of streams before confluence:
      510.450        5.060
Effective area values after confluence:
      515.510      159.037


Results of confluence:
Total flow rate =    719.614(CFS)
Time of concentration =    28.995 min.
Effective stream area after confluence  =    515.510(Ac.)
Study area average Pervious fraction(Ap) =  0.490
Study area average soil loss rate(Fm) =    0.375(In/Hr)
Study area total =     515.51(Ac.)
End of computations, Total Study Area =          515.51 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.490
Area averaged SCS curve number =  53.2
```

APPENDIX C.3: RATIONAL METHOD ANALYSIS, BON VIEW ONSITE MITIGATED, AREA F2

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/07/25

ONTARIO RANCH 108.43.25
ONSITE RATIONAL METHOD HYDROLOGY
AREA F2, 100 YEAR STORM EVENT
FN: RARF2100PEAST

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 711.000 to Point/Station 712.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.250
Decimal fraction soil group B = 0.750
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 50.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.081(In/Hr)
Initial subarea data:
Initial area flow distance = 238.000(Ft.)
Top (of initial area) elevation = 676.500(Ft.)
Bottom (of initial area) elevation = 674.000(Ft.)
Difference in elevation = 2.500(Ft.)
Slope = 0.01050 s(%)= 1.05
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.749 min.
Rainfall intensity = 4.452(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff = 2.478(CFS)
Total initial stream area = 0.630(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.081(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      712.000 to Point/Station      714.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   670.000(Ft.)
Downstream point/station elevation =   668.200(Ft.)
Pipe length  =   603.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.478(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.478(CFS)
Normal flow depth in pipe =    9.27(In.)
Flow top width inside pipe =   14.58(In.)
Critical Depth =    7.56(In.)
Pipe flow velocity =      3.11(Ft/s)
Travel time through pipe =    3.23 min.
Time of concentration (TC) =     9.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      712.000 to Point/Station      714.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.630(Ac.)
Runoff from this stream =      2.478(CFS)
Time of concentration =    9.98 min.
Rainfall intensity =     3.521(In/Hr)
Area averaged loss rate (Fm) =    0.0810(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      713.000 to Point/Station      714.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   461.000(Ft.)
Top (of initial area) elevation =   678.000(Ft.)
Bottom (of initial area) elevation =   673.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01085  s(%)=       1.08
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.736 min.
Rainfall intensity =      3.813(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =     14.345(CFS)
Total initial stream area =        4.290(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      713.000 to Point/Station      714.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.290(Ac.)
Runoff from this stream =     14.345(CFS)
Time of concentration =    8.74 min.
Rainfall intensity =     3.813(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      2.48     0.630      9.98    0.081      3.521
2     14.35     4.290      8.74    0.098      3.813
Qmax(1) =
         1.000 *    1.000 *     2.478) +
         0.921 *    1.000 *    14.345) + =      15.696
Qmax(2) =
         1.085 *    0.876 *     2.478) +
         1.000 *    1.000 *    14.345) + =      16.700

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.478      14.345
Maximum flow rates at confluence using above data:
       15.696       16.700
Area of streams before confluence:
        0.630        4.290
Effective area values after confluence:
        4.920        4.842
Results of confluence:
Total flow rate =     16.700(CFS)
Time of concentration =     8.736 min.
Effective stream area after confluence =      4.842(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.096(In/Hr)
Study area total (this main stream) =       4.92(Ac.)


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Process from Point/Station      714.000 to Point/Station      721.000
```

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 668.200(Ft.)
Downstream point/station elevation = 665.000(Ft.)
Pipe length = 1024.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 16.700(CFS)
Nearest computed pipe diameter = 27.00(In.)
Calculated individual pipe flow = 16.700(CFS)
Normal flow depth in pipe = 21.33(In.)
Flow top width inside pipe = 22.00(In.)
Critical Depth = 17.11(In.)
Pipe flow velocity = 4.96(Ft/s)
Travel time through pipe = 3.44 min.
Time of concentration (TC) = 12.18 min.

++

Process from Point/Station 714.000 to Point/Station 721.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 4.842(Ac.)
Runoff from this stream = 16.700(CFS)
Time of concentration = 12.18 min.
Rainfall intensity = 3.124(In/Hr)
Area averaged loss rate (Fm) = 0.0956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2

++

Process from Point/Station 715.000 to Point/Station 716.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 513.000(Ft.)
Top (of initial area) elevation = 681.000(Ft.)
Bottom (of initial area) elevation = 676.000(Ft.)
Difference in elevation = 5.000(Ft.)
Slope = 0.00975 s(%)= 0.97
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.314 min.
Rainfall intensity = 3.669(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 9.450(CFS)

```
Total initial stream area =        2.920(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      716.000 to Point/Station      721.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   672.000(Ft.)
Downstream point/station elevation =   665.000(Ft.)
Pipe length  =   189.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.450(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.450(CFS)
Normal flow depth in pipe =    9.79(In.)
Flow top width inside pipe =   14.29(In.)
Critical Depth =   14.03(In.)
Pipe flow velocity =     11.15(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =     9.60 min.


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Process from Point/Station      716.000 to Point/Station      721.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.920(Ac.)
Runoff from this stream =      9.450(CFS)
Time of concentration =    9.60 min.
Rainfall intensity =     3.604(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      717.000 to Point/Station      718.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Initial subarea data:
Initial area flow distance =   477.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   679.000(Ft.)
```

```
Difference in elevation =     5.000(Ft.)
Slope =    0.01048  s(%)=       1.05
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.916 min.
Rainfall intensity =      3.767(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =      9.074(CFS)
Total initial stream area =        2.730(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)


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Process from Point/Station      718.000 to Point/Station      721.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   675.000(Ft.)
Downstream point/station elevation =   665.000(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.074(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     9.074(CFS)
Normal flow depth in pipe =    5.84(In.)
Flow top width inside pipe =   12.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     23.96(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     8.94 min.


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Process from Point/Station      718.000 to Point/Station      721.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.730(Ac.)
Runoff from this stream =      9.074(CFS)
Time of concentration =    8.94 min.
Rainfall intensity =     3.761(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 4


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      719.000 to Point/Station      720.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.610
Decimal fraction soil group B = 0.390
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 41.36
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.090(In/Hr)
Initial subarea data:
Initial area flow distance =   582.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   678.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01031  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.687 min.
Rainfall intensity =      3.584(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =     23.393(CFS)
Total initial stream area =        7.440(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.090(In/Hr)


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Process from Point/Station      720.000 to Point/Station      721.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.000(Ft.)
Downstream point/station elevation =   665.000(Ft.)
Pipe length  =    19.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.393(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    23.393(CFS)
Normal flow depth in pipe =    9.38(In.)
Flow top width inside pipe =    9.92(In.)
Critical depth could not be calculated.
Pipe flow velocity =     35.54(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     9.70 min.


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Process from Point/Station      720.000 to Point/Station      721.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 4
Stream flow area =      7.440(Ac.)
Runoff from this stream =     23.393(CFS)
Time of concentration =    9.70 min.
Rainfall intensity =     3.582(In/Hr)
Area averaged loss rate (Fm) =    0.0904(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1     16.70     4.842     12.18    0.096      3.124
2      9.45     2.920      9.60    0.073      3.604
3      9.07     2.730      8.94    0.073      3.761
4     23.39     7.440      9.70    0.090      3.582
Qmax(1) =
         1.000 *    1.000 *    16.700) +
         0.864 *    1.000 *     9.450) +
         0.827 *    1.000 *     9.074) +
         0.869 *    1.000 *    23.393) + =      52.701
Qmax(2) =
         1.158 *    0.788 *    16.700) +
         1.000 *    1.000 *     9.450) +
         0.958 *    1.000 *     9.074) +
         1.006 *    0.990 *    23.393) + =      56.686
Qmax(3) =
         1.210 *    0.734 *    16.700) +
         1.044 *    0.932 *     9.450) +
         1.000 *    1.000 *     9.074) +
         1.051 *    0.922 *    23.393) + =      55.780
Qmax(4) =
         1.151 *    0.796 *    16.700) +
         0.994 *    1.000 *     9.450) +
         0.952 *    1.000 *     9.074) +
         1.000 *    1.000 *    23.393) + =      56.725

Total of 4 main streams to confluence:
Flow rates before confluence point:
      17.700      10.450      10.074      24.393
Maximum flow rates at confluence using above data:
       52.701       56.686       55.780       56.725
Area of streams before confluence:
        4.842        2.920        2.730        7.440
Effective area values after confluence:
       17.932       16.830       15.866       16.945


Results of confluence:
Total flow rate =     56.725(CFS)
Time of concentration =     9.696 min.
Effective stream area after confluence  =     16.945(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.086(In/Hr)
Study area total =      17.93(Ac.)


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Process from Point/Station      721.000 to Point/Station      725.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   665.000(Ft.)
Downstream point/station elevation =   664.200(Ft.)
```

```
Pipe length  =   246.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    56.725(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    56.725(CFS)
Normal flow depth in pipe =   34.03(In.)
Flow top width inside pipe =   32.94(In.)
Critical Depth =   28.32(In.)
Pipe flow velocity =      6.80(Ft/s)
Travel time through pipe =    0.60 min.
Time of concentration (TC) =    10.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      721.000 to Point/Station      725.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     16.945(Ac.)
Runoff from this stream =     56.725(CFS)
Time of concentration =   10.30 min.
Rainfall intensity =     3.455(In/Hr)
Area averaged loss rate (Fm) =    0.0864(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      722.000 to Point/Station      723.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Initial subarea data:
Initial area flow distance =   181.000(Ft.)
Top (of initial area) elevation =   681.000(Ft.)
Bottom (of initial area) elevation =   679.000(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.01105  s(%)=       1.10
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.988 min.
Rainfall intensity =      4.783(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =      6.612(CFS)
Total initial stream area =        1.560(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      723.000 to Point/Station      724.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   675.000(Ft.)
Downstream point/station elevation =   674.500(Ft.)
Pipe length  =    41.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.612(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     6.612(CFS)
Normal flow depth in pipe =   11.41(In.)
Flow top width inside pipe =   12.80(In.)
Critical Depth =   12.41(In.)
Pipe flow velocity =      6.60(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     6.09 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      724.000 to Point/Station      725.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   674.500(Ft.)
Downstream point/station elevation =   664.200(Ft.)
Pipe length  =    96.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.612(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     6.612(CFS)
Normal flow depth in pipe =    6.47(In.)
Flow top width inside pipe =   11.96(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.32(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     6.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      724.000 to Point/Station      725.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.560(Ac.)
Runoff from this stream =      6.612(CFS)
Time of concentration =    6.20 min.
Rainfall intensity =     4.686(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area     TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1     56.72    16.945     10.30    0.086      3.455
2      6.61     1.560      6.20    0.073      4.686
Qmax(1) =
         1.000 *    1.000 *    56.725) +
         0.733 *    1.000 *     6.612) + =      61.572
Qmax(2) =
         1.366 *    0.602 *    56.725) +
         1.000 *    1.000 *     6.612) + =      53.215

Total of 2 main streams to confluence:
Flow rates before confluence point:
      57.725       7.612
Maximum flow rates at confluence using above data:
       61.572       53.215
Area of streams before confluence:
       16.945        1.560
Effective area values after confluence:
       18.505       11.754


Results of confluence:
Total flow rate =     61.572(CFS)
Time of concentration =    10.299 min.
Effective stream area after confluence  =     18.505(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.085(In/Hr)
Study area total =      18.51(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      725.000 to Point/Station      729.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   664.200(Ft.)
Downstream point/station elevation =   663.800(Ft.)
Pipe length  =   113.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    61.572(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =    61.572(CFS)
Normal flow depth in pipe =   32.06(In.)
Flow top width inside pipe =   40.73(In.)
Critical Depth =   28.93(In.)
Pipe flow velocity =      7.32(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =    10.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      725.000 to Point/Station      729.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
```

```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     18.505(Ac.)
Runoff from this stream =     61.572(CFS)
Time of concentration =   10.56 min.
Rainfall intensity =     3.404(In/Hr)
Area averaged loss rate (Fm) =    0.0853(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      726.000 to Point/Station      727.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   355.000(Ft.)
Top (of initial area) elevation =   675.000(Ft.)
Bottom (of initial area) elevation =   671.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.01127  s(%)=       1.13
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.809 min.
Rainfall intensity =      4.079(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.878
Subarea runoff =      7.918(CFS)
Total initial stream area =        2.210(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      727.000 to Point/Station      728.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   667.000(Ft.)
Downstream point/station elevation =   665.800(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.918(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.918(CFS)
Normal flow depth in pipe =    9.32(In.)
Flow top width inside pipe =   14.55(In.)
Critical Depth =   13.32(In.)
Pipe flow velocity =      9.89(Ft/s)
Travel time through pipe =    0.07 min.
```

```
Time of concentration (TC) =     7.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      728.000 to Point/Station      729.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   665.800(Ft.)
Downstream point/station elevation =   663.800(Ft.)
Pipe length  =   113.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.918(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.918(CFS)
Normal flow depth in pipe =   11.34(In.)
Flow top width inside pipe =   12.88(In.)
Critical Depth =   13.32(In.)
Pipe flow velocity =      7.95(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     8.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      728.000 to Point/Station      729.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.210(Ac.)
Runoff from this stream =      7.918(CFS)
Time of concentration =    8.11 min.
Rainfall intensity =     3.986(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     61.57    18.505     10.56    0.085      3.404
2      7.92     2.210      8.11    0.098      3.986
Qmax(1) =
         1.000 *    1.000 *    61.572) +
         0.850 *    1.000 *     7.918) + =      68.304
Qmax(2) =
         1.175 *    0.769 *    61.572) +
         1.000 *    1.000 *     7.918) + =      63.545

Total of 2 main streams to confluence:
Flow rates before confluence point:
      62.572       8.918
Maximum flow rates at confluence using above data:
       68.304       63.545
```

```
Area of streams before confluence:
       18.505        2.210
Effective area values after confluence:
       20.715       16.433


Results of confluence:
Total flow rate =     68.304(CFS)
Time of concentration =    10.556 min.
Effective stream area after confluence  =     20.715(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.087(In/Hr)
Study area total =      20.72(Ac.)
End of computations, Total Study Area =           21.78 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  43.7
```

APPENDIX C.4: RATIONAL METHOD ANALYSIS, BON VIEW ONSITE MITIGATED, AREA F3

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/07/25

ONTARIO RANCH 108.43.25
ONSITE RATIONAL METHOD HYDROLOGY
AREA F3, 100 YEAR STORM EVENT
FN: RARF3100PWEST

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 706.000 to Point/Station 707.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 565.000(Ft.)
Top (of initial area) elevation = 680.600(Ft.)
Bottom (of initial area) elevation = 675.000(Ft.)
Difference in elevation = 5.600(Ft.)
Slope = 0.00991 s(%)= 0.99
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.649 min.
Rainfall intensity = 3.592(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 12.320(CFS)
Total initial stream area = 3.890(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.073(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      707.000 to Point/Station      710.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   671.000(Ft.)
Downstream point/station elevation =   669.500(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.320(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    12.320(CFS)
Normal flow depth in pipe =   10.37(In.)
Flow top width inside pipe =   13.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.61(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      707.000 to Point/Station      710.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.890(Ac.)
Runoff from this stream =     12.320(CFS)
Time of concentration =    9.68 min.
Rainfall intensity =     3.585(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      708.000 to Point/Station      709.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.300
Decimal fraction soil group B = 0.550
Decimal fraction soil group C = 0.150
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.75
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.080(In/Hr)
Initial subarea data:
Initial area flow distance =   465.000(Ft.)
Top (of initial area) elevation =   678.600(Ft.)
Bottom (of initial area) elevation =   674.000(Ft.)
Difference in elevation =     4.600(Ft.)
Slope =    0.00989  s(%)=       0.99
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    8.929 min.
Rainfall intensity =      3.764(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff =     18.034(CFS)
Total initial stream area =        5.440(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.080(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      709.000 to Point/Station      710.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   670.000(Ft.)
Downstream point/station elevation =   669.500(Ft.)
Pipe length  =    20.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.034(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    18.034(CFS)
Normal flow depth in pipe =   13.20(In.)
Flow top width inside pipe =   20.30(In.)
Critical Depth =   18.56(In.)
Pipe flow velocity =     11.34(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     8.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      709.000 to Point/Station      710.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.440(Ac.)
Runoff from this stream =     18.034(CFS)
Time of concentration =    8.96 min.
Rainfall intensity =     3.756(In/Hr)
Area averaged loss rate (Fm) =    0.0800(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     12.32     3.890      9.68    0.073      3.585
2     18.03     5.440      8.96    0.080      3.756
Qmax(1) =
         1.000 *    1.000 *    12.320) +
         0.953 *    1.000 *    18.034) + =      29.514
Qmax(2) =
         1.049 *    0.925 *    12.320) +
         1.000 *    1.000 *    18.034) + =      29.989
```

```
Total of 2 main streams to confluence:
Flow rates before confluence point:
      13.320      19.034
Maximum flow rates at confluence using above data:
       29.514       29.989
Area of streams before confluence:
        3.890        5.440
Effective area values after confluence:
        9.330        9.039


Results of confluence:
Total flow rate =     29.989(CFS)
Time of concentration =     8.958 min.
Effective stream area after confluence  =      9.039(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.077(In/Hr)
Study area total =       9.33(Ac.)
End of computations, Total Study Area =            9.33 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  52.9
```

APPENDIX C.5: UNIT HYDROGRAPH ANALYSIS, BON VIEW ONSITE MITIGATED, AREA F2

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 05/09/25

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6279

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED UNIT HYDROGRAPH METHOD HYDROLOGY
AREA F2, 100-YEAR STORM EVENT
FN: UARF2P

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
21.78	1	1.20
Rainfall data for year 100		
21.78	6	3.00
Rainfall data for year 100		
21.78	24	6.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
43.7	43.7	21.78	1.000	0.880	0.100	0.088

Area-averaged adjusted loss rate Fm (In/Hr) = 0.088

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.18	0.100	43.7	43.7	12.88	0.120
19.60	0.900	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.876
Area-averaged low loss fraction, Yb = 0.124
User entry of time of concentration = 0.176 (hours)
++
Watershed area = 21.78(Ac.)
Catchment Lag time = 0.141 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 59.2193
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.087(In/Hr)
Average low loss rate fraction (Yb) = 0.124 (decimal)
Note: user entry of the Fm value
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.444(In)
Computed peak 30-minute rainfall = 0.909(In)
Specified peak 1-hour rainfall = 1.200(In)
Computed peak 3-hour rainfall = 2.105(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:
Using a total area of 21.78(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.444(In)
30-minute factor = 0.999 Adjusted rainfall = 0.909(In)
1-hour factor = 0.999 Adjusted rainfall = 1.199(In)
3-hour factor = 1.000 Adjusted rainfall = 2.104(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.000(In)

U n i t H y d r o g r a p h

++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 263.40 (CFS))

1	6.355	16.740
2	40.677	90.404
3	80.952	106.085
4	95.217	37.574
5	98.595	8.899
6	100.000	3.700

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4437	0.4437
2	0.5854	0.1418
3	0.6885	0.1031
4	0.7725	0.0840
5	0.8446	0.0721
6	0.9085	0.0639
7	0.9663	0.0578
8	1.0193	0.0530
9	1.0685	0.0492
10	1.1145	0.0460
11	1.1578	0.0433
12	1.1988	0.0410
13	1.2489	0.0502
14	1.2973	0.0483
15	1.3439	0.0467
16	1.3891	0.0452
17	1.4329	0.0438
18	1.4755	0.0426
19	1.5169	0.0414
20	1.5573	0.0404
21	1.5967	0.0394
22	1.6352	0.0385
23	1.6729	0.0377
24	1.7097	0.0369
25	1.7459	0.0361
26	1.7813	0.0354
27	1.8160	0.0348
28	1.8502	0.0341
29	1.8837	0.0336
30	1.9167	0.0330
31	1.9492	0.0325
32	1.9812	0.0320
33	2.0126	0.0315
34	2.0436	0.0310
35	2.0742	0.0306
36	2.1044	0.0301
37	2.1341	0.0297
38	2.1634	0.0293
39	2.1923	0.0289
40	2.2209	0.0286
41	2.2491	0.0282
42	2.2770	0.0279
43	2.3046	0.0276
44	2.3318	0.0273

45	2.3588	0.0270
46	2.3855	0.0267
47	2.4118	0.0264
48	2.4379	0.0261
49	2.4638	0.0258
50	2.4894	0.0256
51	2.5147	0.0253
52	2.5398	0.0251
53	2.5647	0.0249
54	2.5893	0.0246
55	2.6137	0.0244
56	2.6379	0.0242
57	2.6619	0.0240
58	2.6857	0.0238
59	2.7093	0.0236
60	2.7327	0.0234
61	2.7559	0.0232
62	2.7789	0.0230
63	2.8018	0.0228
64	2.8244	0.0227
65	2.8469	0.0225
66	2.8692	0.0223
67	2.8914	0.0222
68	2.9134	0.0220
69	2.9352	0.0218
70	2.9569	0.0217
71	2.9784	0.0215
72	2.9998	0.0214
73	3.0206	0.0208
74	3.0412	0.0206
75	3.0617	0.0205
76	3.0820	0.0203
77	3.1022	0.0202
78	3.1223	0.0201
79	3.1422	0.0200
80	3.1621	0.0198
81	3.1818	0.0197
82	3.2014	0.0196
83	3.2208	0.0195
84	3.2402	0.0193
85	3.2594	0.0192
86	3.2785	0.0191
87	3.2975	0.0190
88	3.3164	0.0189
89	3.3352	0.0188
90	3.3539	0.0187
91	3.3725	0.0186
92	3.3910	0.0185
93	3.4093	0.0184
94	3.4276	0.0183
95	3.4458	0.0182
96	3.4639	0.0181
97	3.4819	0.0180

98	3.4998	0.0179
99	3.5176	0.0178
100	3.5353	0.0177
101	3.5530	0.0176
102	3.5705	0.0175
103	3.5880	0.0175
104	3.6053	0.0174
105	3.6226	0.0173
106	3.6398	0.0172
107	3.6570	0.0171
108	3.6740	0.0170
109	3.6910	0.0170
110	3.7079	0.0169
111	3.7247	0.0168
112	3.7415	0.0167
113	3.7581	0.0167
114	3.7747	0.0166
115	3.7912	0.0165
116	3.8077	0.0164
117	3.8241	0.0164
118	3.8404	0.0163
119	3.8566	0.0162
120	3.8728	0.0162
121	3.8889	0.0161
122	3.9049	0.0160
123	3.9209	0.0160
124	3.9368	0.0159
125	3.9526	0.0158
126	3.9684	0.0158
127	3.9841	0.0157
128	3.9998	0.0157
129	4.0154	0.0156
130	4.0309	0.0155
131	4.0464	0.0155
132	4.0618	0.0154
133	4.0772	0.0154
134	4.0925	0.0153
135	4.1077	0.0152
136	4.1229	0.0152
137	4.1380	0.0151
138	4.1531	0.0151
139	4.1681	0.0150
140	4.1831	0.0150
141	4.1980	0.0149
142	4.2129	0.0149
143	4.2277	0.0148
144	4.2424	0.0148
145	4.2571	0.0147
146	4.2718	0.0147
147	4.2864	0.0146
148	4.3010	0.0146
149	4.3155	0.0145
150	4.3299	0.0145

151	4.3443	0.0144
152	4.3587	0.0144
153	4.3730	0.0143
154	4.3873	0.0143
155	4.4015	0.0142
156	4.4157	0.0142
157	4.4298	0.0141
158	4.4439	0.0141
159	4.4579	0.0140
160	4.4719	0.0140
161	4.4859	0.0140
162	4.4998	0.0139
163	4.5137	0.0139
164	4.5275	0.0138
165	4.5413	0.0138
166	4.5550	0.0137
167	4.5687	0.0137
168	4.5824	0.0137
169	4.5960	0.0136
170	4.6096	0.0136
171	4.6231	0.0135
172	4.6366	0.0135
173	4.6501	0.0135
174	4.6635	0.0134
175	4.6769	0.0134
176	4.6902	0.0133
177	4.7035	0.0133
178	4.7168	0.0133
179	4.7300	0.0132
180	4.7432	0.0132
181	4.7564	0.0132
182	4.7695	0.0131
183	4.7826	0.0131
184	4.7956	0.0131
185	4.8087	0.0130
186	4.8216	0.0130
187	4.8346	0.0129
188	4.8475	0.0129
189	4.8604	0.0129
190	4.8732	0.0128
191	4.8860	0.0128
192	4.8988	0.0128
193	4.9115	0.0127
194	4.9242	0.0127
195	4.9369	0.0127
196	4.9496	0.0126
197	4.9622	0.0126
198	4.9747	0.0126
199	4.9873	0.0125
200	4.9998	0.0125
201	5.0123	0.0125
202	5.0247	0.0125
203	5.0372	0.0124

204	5.0496	0.0124
205	5.0619	0.0124
206	5.0743	0.0123
207	5.0866	0.0123
208	5.0988	0.0123
209	5.1111	0.0122
210	5.1233	0.0122
211	5.1355	0.0122
212	5.1476	0.0122
213	5.1598	0.0121
214	5.1719	0.0121
215	5.1839	0.0121
216	5.1960	0.0120
217	5.2080	0.0120
218	5.2200	0.0120
219	5.2319	0.0120
220	5.2439	0.0119
221	5.2558	0.0119
222	5.2676	0.0119
223	5.2795	0.0119
224	5.2913	0.0118
225	5.3031	0.0118
226	5.3149	0.0118
227	5.3266	0.0117
228	5.3384	0.0117
229	5.3501	0.0117
230	5.3617	0.0117
231	5.3734	0.0116
232	5.3850	0.0116
233	5.3966	0.0116
234	5.4081	0.0116
235	5.4197	0.0115
236	5.4312	0.0115
237	5.4427	0.0115
238	5.4542	0.0115
239	5.4656	0.0114
240	5.4770	0.0114
241	5.4884	0.0114
242	5.4998	0.0114
243	5.5112	0.0114
244	5.5225	0.0113
245	5.5338	0.0113
246	5.5451	0.0113
247	5.5564	0.0113
248	5.5676	0.0112
249	5.5788	0.0112
250	5.5900	0.0112
251	5.6012	0.0112
252	5.6123	0.0111
253	5.6234	0.0111
254	5.6345	0.0111
255	5.6456	0.0111
256	5.6567	0.0111

257	5.6677	0.0110
258	5.6787	0.0110
259	5.6897	0.0110
260	5.7007	0.0110
261	5.7117	0.0110
262	5.7226	0.0109
263	5.7335	0.0109
264	5.7444	0.0109
265	5.7553	0.0109
266	5.7661	0.0108
267	5.7769	0.0108
268	5.7877	0.0108
269	5.7985	0.0108
270	5.8093	0.0108
271	5.8201	0.0107
272	5.8308	0.0107
273	5.8415	0.0107
274	5.8522	0.0107
275	5.8629	0.0107
276	5.8735	0.0107
277	5.8841	0.0106
278	5.8947	0.0106
279	5.9053	0.0106
280	5.9159	0.0106
281	5.9265	0.0106
282	5.9370	0.0105
283	5.9475	0.0105
284	5.9580	0.0105
285	5.9685	0.0105
286	5.9790	0.0105
287	5.9894	0.0104
288	5.9998	0.0104

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0104	0.0013	0.0091
2	0.0104	0.0013	0.0092
3	0.0105	0.0013	0.0092
4	0.0105	0.0013	0.0092
5	0.0105	0.0013	0.0092
6	0.0106	0.0013	0.0092
7	0.0106	0.0013	0.0093
8	0.0106	0.0013	0.0093
9	0.0107	0.0013	0.0093
10	0.0107	0.0013	0.0093
11	0.0107	0.0013	0.0094
12	0.0107	0.0013	0.0094
13	0.0108	0.0013	0.0094
14	0.0108	0.0013	0.0095
15	0.0108	0.0013	0.0095
16	0.0108	0.0013	0.0095

17	0.0109	0.0013	0.0095
18	0.0109	0.0014	0.0096
19	0.0110	0.0014	0.0096
20	0.0110	0.0014	0.0096
21	0.0110	0.0014	0.0097
22	0.0110	0.0014	0.0097
23	0.0111	0.0014	0.0097
24	0.0111	0.0014	0.0097
25	0.0111	0.0014	0.0098
26	0.0112	0.0014	0.0098
27	0.0112	0.0014	0.0098
28	0.0112	0.0014	0.0098
29	0.0113	0.0014	0.0099
30	0.0113	0.0014	0.0099
31	0.0114	0.0014	0.0099
32	0.0114	0.0014	0.0100
33	0.0114	0.0014	0.0100
34	0.0114	0.0014	0.0100
35	0.0115	0.0014	0.0101
36	0.0115	0.0014	0.0101
37	0.0116	0.0014	0.0101
38	0.0116	0.0014	0.0102
39	0.0116	0.0014	0.0102
40	0.0117	0.0014	0.0102
41	0.0117	0.0015	0.0103
42	0.0117	0.0015	0.0103
43	0.0118	0.0015	0.0103
44	0.0118	0.0015	0.0104
45	0.0119	0.0015	0.0104
46	0.0119	0.0015	0.0104
47	0.0120	0.0015	0.0105
48	0.0120	0.0015	0.0105
49	0.0120	0.0015	0.0106
50	0.0121	0.0015	0.0106
51	0.0121	0.0015	0.0106
52	0.0122	0.0015	0.0107
53	0.0122	0.0015	0.0107
54	0.0122	0.0015	0.0107
55	0.0123	0.0015	0.0108
56	0.0123	0.0015	0.0108
57	0.0124	0.0015	0.0109
58	0.0124	0.0015	0.0109
59	0.0125	0.0015	0.0109
60	0.0125	0.0015	0.0110
61	0.0126	0.0016	0.0110
62	0.0126	0.0016	0.0111
63	0.0127	0.0016	0.0111
64	0.0127	0.0016	0.0111
65	0.0128	0.0016	0.0112
66	0.0128	0.0016	0.0112
67	0.0129	0.0016	0.0113
68	0.0129	0.0016	0.0113
69	0.0130	0.0016	0.0114

70	0.0130	0.0016	0.0114
71	0.0131	0.0016	0.0115
72	0.0131	0.0016	0.0115
73	0.0132	0.0016	0.0116
74	0.0132	0.0016	0.0116
75	0.0133	0.0016	0.0117
76	0.0133	0.0017	0.0117
77	0.0134	0.0017	0.0118
78	0.0135	0.0017	0.0118
79	0.0135	0.0017	0.0119
80	0.0136	0.0017	0.0119
81	0.0137	0.0017	0.0120
82	0.0137	0.0017	0.0120
83	0.0138	0.0017	0.0121
84	0.0138	0.0017	0.0121
85	0.0139	0.0017	0.0122
86	0.0140	0.0017	0.0122
87	0.0140	0.0017	0.0123
88	0.0141	0.0017	0.0123
89	0.0142	0.0018	0.0124
90	0.0142	0.0018	0.0125
91	0.0143	0.0018	0.0125
92	0.0144	0.0018	0.0126
93	0.0145	0.0018	0.0127
94	0.0145	0.0018	0.0127
95	0.0146	0.0018	0.0128
96	0.0147	0.0018	0.0128
97	0.0148	0.0018	0.0129
98	0.0148	0.0018	0.0130
99	0.0149	0.0018	0.0131
100	0.0150	0.0019	0.0131
101	0.0151	0.0019	0.0132
102	0.0151	0.0019	0.0133
103	0.0152	0.0019	0.0134
104	0.0153	0.0019	0.0134
105	0.0154	0.0019	0.0135
106	0.0155	0.0019	0.0136
107	0.0156	0.0019	0.0137
108	0.0157	0.0019	0.0137
109	0.0158	0.0020	0.0138
110	0.0158	0.0020	0.0139
111	0.0160	0.0020	0.0140
112	0.0160	0.0020	0.0141
113	0.0162	0.0020	0.0142
114	0.0162	0.0020	0.0142
115	0.0164	0.0020	0.0144
116	0.0164	0.0020	0.0144
117	0.0166	0.0021	0.0145
118	0.0167	0.0021	0.0146
119	0.0168	0.0021	0.0147
120	0.0169	0.0021	0.0148
121	0.0170	0.0021	0.0149
122	0.0171	0.0021	0.0150

123	0.0173	0.0021	0.0152
124	0.0174	0.0022	0.0152
125	0.0175	0.0022	0.0154
126	0.0176	0.0022	0.0155
127	0.0178	0.0022	0.0156
128	0.0179	0.0022	0.0157
129	0.0181	0.0022	0.0159
130	0.0182	0.0023	0.0159
131	0.0184	0.0023	0.0161
132	0.0185	0.0023	0.0162
133	0.0187	0.0023	0.0164
134	0.0188	0.0023	0.0165
135	0.0190	0.0024	0.0167
136	0.0191	0.0024	0.0168
137	0.0193	0.0024	0.0170
138	0.0195	0.0024	0.0171
139	0.0197	0.0024	0.0173
140	0.0198	0.0025	0.0174
141	0.0201	0.0025	0.0176
142	0.0202	0.0025	0.0177
143	0.0205	0.0025	0.0179
144	0.0206	0.0026	0.0181
145	0.0214	0.0026	0.0187
146	0.0215	0.0027	0.0189
147	0.0218	0.0027	0.0191
148	0.0220	0.0027	0.0193
149	0.0223	0.0028	0.0196
150	0.0225	0.0028	0.0197
151	0.0228	0.0028	0.0200
152	0.0230	0.0028	0.0202
153	0.0234	0.0029	0.0205
154	0.0236	0.0029	0.0207
155	0.0240	0.0030	0.0210
156	0.0242	0.0030	0.0212
157	0.0246	0.0030	0.0216
158	0.0249	0.0031	0.0218
159	0.0253	0.0031	0.0222
160	0.0256	0.0032	0.0224
161	0.0261	0.0032	0.0229
162	0.0264	0.0033	0.0231
163	0.0270	0.0033	0.0236
164	0.0273	0.0034	0.0239
165	0.0279	0.0035	0.0244
166	0.0282	0.0035	0.0247
167	0.0289	0.0036	0.0254
168	0.0293	0.0036	0.0257
169	0.0301	0.0037	0.0264
170	0.0306	0.0038	0.0268
171	0.0315	0.0039	0.0276
172	0.0320	0.0040	0.0280
173	0.0330	0.0041	0.0289
174	0.0336	0.0042	0.0294
175	0.0348	0.0043	0.0305

176	0.0354	0.0044	0.0310
177	0.0369	0.0046	0.0323
178	0.0377	0.0047	0.0330
179	0.0394	0.0049	0.0345
180	0.0404	0.0050	0.0354
181	0.0426	0.0053	0.0373
182	0.0438	0.0054	0.0384
183	0.0467	0.0058	0.0409
184	0.0483	0.0060	0.0423
185	0.0410	0.0051	0.0359
186	0.0433	0.0054	0.0379
187	0.0492	0.0061	0.0431
188	0.0530	0.0066	0.0465
189	0.0639	0.0072	0.0566
190	0.0721	0.0072	0.0649
191	0.1031	0.0072	0.0958
192	0.1418	0.0072	0.1345
193	0.4437	0.0072	0.4364
194	0.0840	0.0072	0.0767
195	0.0578	0.0072	0.0506
196	0.0460	0.0057	0.0403
197	0.0502	0.0062	0.0440
198	0.0452	0.0056	0.0396
199	0.0414	0.0051	0.0363
200	0.0385	0.0048	0.0337
201	0.0361	0.0045	0.0317
202	0.0341	0.0042	0.0299
203	0.0325	0.0040	0.0284
204	0.0310	0.0038	0.0272
205	0.0297	0.0037	0.0260
206	0.0286	0.0035	0.0250
207	0.0276	0.0034	0.0242
208	0.0267	0.0033	0.0234
209	0.0258	0.0032	0.0226
210	0.0251	0.0031	0.0220
211	0.0244	0.0030	0.0214
212	0.0238	0.0029	0.0208
213	0.0232	0.0029	0.0203
214	0.0227	0.0028	0.0199
215	0.0222	0.0027	0.0194
216	0.0217	0.0027	0.0190
217	0.0208	0.0026	0.0182
218	0.0203	0.0025	0.0178
219	0.0200	0.0025	0.0175
220	0.0196	0.0024	0.0172
221	0.0192	0.0024	0.0169
222	0.0189	0.0023	0.0166
223	0.0186	0.0023	0.0163
224	0.0183	0.0023	0.0160
225	0.0180	0.0022	0.0158
226	0.0177	0.0022	0.0155
227	0.0175	0.0022	0.0153
228	0.0172	0.0021	0.0151

229	0.0170	0.0021	0.0149
230	0.0167	0.0021	0.0147
231	0.0165	0.0020	0.0145
232	0.0163	0.0020	0.0143
233	0.0161	0.0020	0.0141
234	0.0159	0.0020	0.0139
235	0.0157	0.0019	0.0138
236	0.0155	0.0019	0.0136
237	0.0154	0.0019	0.0135
238	0.0152	0.0019	0.0133
239	0.0150	0.0019	0.0132
240	0.0149	0.0018	0.0130
241	0.0147	0.0018	0.0129
242	0.0146	0.0018	0.0128
243	0.0144	0.0018	0.0126
244	0.0143	0.0018	0.0125
245	0.0141	0.0017	0.0124
246	0.0140	0.0017	0.0123
247	0.0139	0.0017	0.0122
248	0.0137	0.0017	0.0120
249	0.0136	0.0017	0.0119
250	0.0135	0.0017	0.0118
251	0.0134	0.0017	0.0117
252	0.0133	0.0016	0.0116
253	0.0132	0.0016	0.0115
254	0.0131	0.0016	0.0114
255	0.0129	0.0016	0.0113
256	0.0128	0.0016	0.0113
257	0.0127	0.0016	0.0112
258	0.0126	0.0016	0.0111
259	0.0125	0.0016	0.0110
260	0.0125	0.0015	0.0109
261	0.0124	0.0015	0.0108
262	0.0123	0.0015	0.0108
263	0.0122	0.0015	0.0107
264	0.0121	0.0015	0.0106
265	0.0120	0.0015	0.0105
266	0.0119	0.0015	0.0105
267	0.0119	0.0015	0.0104
268	0.0118	0.0015	0.0103
269	0.0117	0.0014	0.0102
270	0.0116	0.0014	0.0102
271	0.0115	0.0014	0.0101
272	0.0115	0.0014	0.0101
273	0.0114	0.0014	0.0100
274	0.0113	0.0014	0.0099
275	0.0113	0.0014	0.0099
276	0.0112	0.0014	0.0098
277	0.0111	0.0014	0.0097
278	0.0111	0.0014	0.0097
279	0.0110	0.0014	0.0096
280	0.0109	0.0014	0.0096
281	0.0109	0.0013	0.0095

282	0.0108	0.0013	0.0095
283	0.0107	0.0013	0.0094
284	0.0107	0.0013	0.0094
285	0.0106	0.0013	0.0093
286	0.0106	0.0013	0.0093
287	0.0105	0.0013	0.0092
288	0.0105	0.0013	0.0092

Total soil rain loss = 0.67(In)
Total effective rainfall = 5.33(In)
Peak flow rate in flood hydrograph = 60.23(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0
0+ 5	0.0011	0.15	Q				
0+10	0.0078	0.98	Q				
0+15	0.0212	1.95	VQ				
0+20	0.0371	2.30	VQ				
0+25	0.0535	2.39	VQ				
0+30	0.0702	2.43	VQ				
0+35	0.0869	2.43	VQ				
0+40	0.1037	2.44	VQ				
0+45	0.1206	2.45	VQ				
0+50	0.1375	2.45	VQ				
0+55	0.1544	2.46	VQ				
1+ 0	0.1714	2.47	VQ				
1+ 5	0.1884	2.47	VQ				
1+10	0.2055	2.48	VQ				
1+15	0.2226	2.49	VQ				
1+20	0.2398	2.49	VQ				
1+25	0.2570	2.50	|Q				
1+30	0.2743	2.51	|Q				
1+35	0.2916	2.51	|Q				
1+40	0.3089	2.52	|Q				
1+45	0.3263	2.53	|Q				
1+50	0.3438	2.54	|Q				
1+55	0.3613	2.54	|Q				
2+ 0	0.3789	2.55	|Q				
2+ 5	0.3965	2.56	|Q				
2+10	0.4142	2.57	|Q				
2+15	0.4319	2.57	|Q				
2+20	0.4497	2.58	|Q				
2+25	0.4675	2.59	|Q				
2+30	0.4854	2.60	|QV				
2+35	0.5033	2.60	|QV				

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2+40       0.5213      2.61  |QV       |         |         |         |
2+45       0.5394      2.62  |QV       |         |         |         |
2+50       0.5575      2.63  |QV       |         |         |         |
2+55       0.5756      2.64  |QV       |         |         |         |
3+ 0       0.5938      2.65  |QV       |         |         |         |
3+ 5       0.6121      2.65  |QV       |         |         |         |
3+10       0.6305      2.66  |QV       |         |         |         |
3+15       0.6489      2.67  |QV       |         |         |         |
3+20       0.6673      2.68  |QV       |         |         |         |
3+25       0.6858      2.69  |QV       |         |         |         |
3+30       0.7044      2.70  |QV       |         |         |         |
3+35       0.7230      2.71  |QV       |         |         |         |
3+40       0.7417      2.71  |Q V      |         |         |         |
3+45       0.7605      2.72  |Q V      |         |         |         |
3+50       0.7793      2.73  |Q V      |         |         |         |
3+55       0.7982      2.74  |Q V      |         |         |         |
4+ 0       0.8171      2.75  |Q V      |         |         |         |
4+ 5       0.8361      2.76  |Q V      |         |         |         |
4+10       0.8552      2.77  |Q V      |         |         |         |
4+15       0.8744      2.78  |Q V      |         |         |         |
4+20       0.8936      2.79  |Q V      |         |         |         |
4+25       0.9129      2.80  |Q V      |         |         |         |
4+30       0.9322      2.81  |Q V      |         |         |         |
4+35       0.9516      2.82  |Q V      |         |         |         |
4+40       0.9711      2.83  |Q  V     |         |         |         |
4+45       0.9907      2.84  |Q  V     |         |         |         |
4+50       1.0103      2.85  |Q  V     |         |         |         |
4+55       1.0300      2.86  |Q  V     |         |         |         |
5+ 0       1.0498      2.87  |Q  V     |         |         |         |
5+ 5       1.0696      2.88  |Q  V     |         |         |         |
5+10       1.0896      2.89  |Q  V     |         |         |         |
5+15       1.1096      2.90  |Q  V     |         |         |         |
5+20       1.1296      2.92  |Q  V     |         |         |         |
5+25       1.1498      2.93  |Q  V     |         |         |         |
5+30       1.1700      2.94  |Q  V     |         |         |         |
5+35       1.1903      2.95  |Q  V     |         |         |         |
5+40       1.2107      2.96  |Q   V    |         |         |         |
5+45       1.2312      2.97  |Q   V    |         |         |         |
5+50       1.2518      2.98  |Q   V    |         |         |         |
5+55       1.2724      3.00  |Q   V    |         |         |         |
6+ 0       1.2931      3.01  |Q   V    |         |         |         |
6+ 5       1.3139      3.02  |Q   V    |         |         |         |
6+10       1.3348      3.03  |Q   V    |         |         |         |
6+15       1.3558      3.05  |Q   V    |         |         |         |
6+20       1.3769      3.06  |Q   V    |         |         |         |
6+25       1.3980      3.07  |Q   V    |         |         |         |
6+30       1.4193      3.09  |Q   V    |         |         |         |
6+35       1.4406      3.10  |Q   V    |         |         |         |
6+40       1.4620      3.11  |Q    V   |         |         |         |
6+45       1.4836      3.13  |Q    V   |         |         |         |
6+50       1.5052      3.14  |Q    V   |         |         |         |
6+55       1.5269      3.15  |Q    V   |         |         |         |
7+ 0       1.5487      3.17  |Q    V   |         |         |         |
```

7+ 5	1.5706	3.18	|Q V |	|	|	|
7+10	1.5926	3.20	|Q V |	|	|	|
7+15	1.6148	3.21	|Q V |	|	|	|
7+20	1.6370	3.23	|Q V |	|	|	|
7+25	1.6593	3.24	|Q V |	|	|	|
7+30	1.6817	3.26	|Q V |	|	|	|
7+35	1.7043	3.27	|Q V |	|	|	|
7+40	1.7269	3.29	|Q V |	|	|	|
7+45	1.7497	3.30	|Q V |	|	|	|
7+50	1.7726	3.32	|Q V |	|	|	|
7+55	1.7956	3.34	|Q V |	|	|	|
8+ 0	1.8187	3.35	|Q V |	|	|	|
8+ 5	1.8419	3.37	|Q V |	|	|	|
8+10	1.8652	3.39	|Q V |	|	|	|
8+15	1.8887	3.41	|Q V |	|	|	|
8+20	1.9123	3.43	|Q V |	|	|	|
8+25	1.9360	3.44	|Q V |	|	|	|
8+30	1.9598	3.46	|Q V |	|	|	|
8+35	1.9838	3.48	|Q V |	|	|	|
8+40	2.0079	3.50	|Q V |	|	|	|
8+45	2.0322	3.52	| Q V |	|	|	|
8+50	2.0565	3.54	| Q V |	|	|	|
8+55	2.0810	3.56	| Q V |	|	|	|
9+ 0	2.1057	3.58	| Q V |	|	|	|
9+ 5	2.1305	3.60	| Q V |	|	|	|
9+10	2.1554	3.62	| Q V |	|	|	|
9+15	2.1805	3.64	| Q V|	|	|	|
9+20	2.2058	3.67	| Q V|	|	|	|
9+25	2.2312	3.69	| Q V|	|	|	|
9+30	2.2567	3.71	| Q V|	|	|	|
9+35	2.2824	3.73	| Q V|	|	|	|
9+40	2.3083	3.76	| Q V|	|	|	|
9+45	2.3344	3.78	| Q V|	|	|	|
9+50	2.3606	3.81	| Q V|	|	|	|
9+55	2.3870	3.83	| Q V|	|	|	|
10+ 0	2.4135	3.86	| Q V|	|	|	|
10+ 5	2.4403	3.88	| Q V	|	|	|
10+10	2.4672	3.91	| Q V	|	|	|
10+15	2.4943	3.94	| Q V	|	|	|
10+20	2.5216	3.96	| Q V	|	|	|
10+25	2.5491	3.99	| Q V	|	|	|
10+30	2.5768	4.02	| Q V	|	|	|
10+35	2.6047	4.05	| Q V	|	|	|
10+40	2.6328	4.08	| Q V	|	|	|
10+45	2.6612	4.11	| Q |V	|	|	|
10+50	2.6897	4.14	| Q |V	|	|	|
10+55	2.7185	4.18	| Q |V	|	|	|
11+ 0	2.7475	4.21	| Q |V	|	|	|
11+ 5	2.7767	4.24	| Q |V	|	|	|
11+10	2.8062	4.28	| Q |V	|	|	|
11+15	2.8359	4.32	| Q |V	|	|	|
11+20	2.8659	4.35	| Q |V	|	|	|
11+25	2.8961	4.39	| Q |V	|	|	|

11+30	2.9266	4.43	Q	V			
11+35	2.9574	4.47	Q	V			
11+40	2.9884	4.51	Q	V			
11+45	3.0198	4.55	Q	V			
11+50	3.0514	4.59	Q	V			
11+55	3.0833	4.64	Q	V			
12+ 0	3.1156	4.68	Q	V			
12+ 5	3.1482	4.74	Q	V			
12+10	3.1814	4.82	Q	V			
12+15	3.2153	4.92	Q	V			
12+20	3.2496	4.99	Q	V			
12+25	3.2844	5.04	Q	V			
12+30	3.3195	5.10	Q	V			
12+35	3.3550	5.16	Q	V			
12+40	3.3909	5.21	Q	V			
12+45	3.4272	5.27	Q	V			
12+50	3.4640	5.34	Q	V			
12+55	3.5012	5.40	Q	V			
13+ 0	3.5389	5.47	Q	V			
13+ 5	3.5770	5.54	Q	V			
13+10	3.6157	5.62	Q	V			
13+15	3.6549	5.69	Q	V			
13+20	3.6947	5.77	Q	V			
13+25	3.7350	5.86	Q	V			
13+30	3.7759	5.94	Q	V			
13+35	3.8175	6.03	Q	V			
13+40	3.8597	6.13	Q	V			
13+45	3.9026	6.23	Q	V			
13+50	3.9462	6.34	Q	V			
13+55	3.9906	6.45	Q	V			
14+ 0	4.0358	6.56	Q	V			
14+ 5	4.0819	6.69	Q	V			
14+10	4.1289	6.82	Q	V			
14+15	4.1769	6.97	Q	V			
14+20	4.2259	7.12	Q	V			
14+25	4.2760	7.28	Q	V			
14+30	4.3273	7.45	Q	V			
14+35	4.3799	7.63	Q	V			
14+40	4.4338	7.83	Q	V			
14+45	4.4892	8.04	Q	V			
14+50	4.5463	8.28	Q	V			
14+55	4.6050	8.53	Q	V			
15+ 0	4.6658	8.82	Q	V			
15+ 5	4.7286	9.13	Q	V			
15+10	4.7939	9.48	Q	V			
15+15	4.8619	9.87	Q	V			
15+20	4.9330	10.32	Q	V			
15+25	5.0065	10.67	Q	V			
15+30	5.0781	10.39	Q	V			
15+35	5.1473	10.06	Q	V			
15+40	5.2202	10.58	Q	V			
15+45	5.3002	11.62	Q	V			
15+50	5.3913	13.22	Q	V			

15+55	5.4998	15.75	| Q |	| V |	|
16+ 0	5.6409	20.50	| Q |	| V |	|
16+ 5	5.8664	32.75	| Q |	| V |	|
16+10	6.2755	59.40	| |	| V |	| Q |
16+15	6.6903	60.23	| |	| V |	| Q |
16+20	6.9061	31.34	| | Q |	| V |	|
16+25	7.0233	17.01	| Q |	| V |	|
16+30	7.1136	13.11	| Q |	| V |	|
16+35	7.1901	11.10	| Q |	| V |	|
16+40	7.2606	10.24	| Q |	| V |	|
16+45	7.3258	9.46	| Q |	| V |	|
16+50	7.3865	8.82	| Q |	| V |	|
16+55	7.4435	8.28	| Q |	| V |	|
17+ 0	7.4974	7.82	| Q |	| | V |	|
17+ 5	7.5486	7.44	| Q |	| | V |	|
17+10	7.5976	7.11	| Q |	| | V |	|
17+15	7.6445	6.81	| Q |	| | V |	|
17+20	7.6897	6.56	| Q |	| | V |	|
17+25	7.7332	6.33	| Q |	| | | V |	|
17+30	7.7754	6.12	| Q |	| | | V |	|
17+35	7.8163	5.93	| Q |	| | | V |	|
17+40	7.8560	5.76	| Q |	| | | V |	|
17+45	7.8946	5.61	| Q |	| | | V |	|
17+50	7.9322	5.46	| Q |	| | | V |	|
17+55	7.9690	5.33	| Q |	| | | V |	|
18+ 0	8.0048	5.21	| Q |	| | | V |	|
18+ 5	8.0398	5.09	| Q |	| | | V |	|
18+10	8.0739	4.94	| Q |	| | | V |	|
18+15	8.1069	4.79	| Q |	| | | V |	|
18+20	8.1391	4.68	| Q |	| | | V |	|
18+25	8.1707	4.59	| Q |	| | | V |	|
18+30	8.2018	4.50	| Q |	| | | V |	|
18+35	8.2322	4.42	| Q |	| | | | V |	|
18+40	8.2622	4.35	| Q |	| | | | V |	|
18+45	8.2916	4.28	| Q |	| | | | V |	|
18+50	8.3206	4.21	| Q |	| | | | V |	|
18+55	8.3491	4.14	| Q |	| | | | V |	|
19+ 0	8.3772	4.08	| Q |	| | | | V |	|
19+ 5	8.4049	4.02	| Q |	| | | | V |	|
19+10	8.4322	3.96	| Q |	| | | | V |	|
19+15	8.4591	3.91	| Q |	| | | | | V |	|
19+20	8.4856	3.85	| Q |	| | | | | V |	|
19+25	8.5118	3.80	| Q |	| | | | | V |	|
19+30	8.5376	3.75	| Q |	| | | | | V |	|
19+35	8.5632	3.71	| Q |	| | | | | V |	|
19+40	8.5884	3.66	| Q |	| | | | | V |	|
19+45	8.6133	3.62	| Q |	| | | | | V |	|
19+50	8.6380	3.58	| Q |	| | | | | V |	|
19+55	8.6623	3.54	| Q |	| | | | | V |	|
20+ 0	8.6864	3.50	| Q |	| | | | | V |	|
20+ 5	8.7102	3.46	| Q |	| | | | | | V |	|
20+10	8.7338	3.42	| Q |	| | | | | | V |	|
20+15	8.7571	3.39	| Q |	| | | | | | V |	|

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  20+20       8.7802      3.35  |Q        |         |         |     V   |
  20+25       8.8031      3.32  |Q        |         |         |     V   |
  20+30       8.8257      3.29  |Q        |         |         |     V   |
  20+35       8.8481      3.26  |Q        |         |         |     V   |
  20+40       8.8703      3.22  |Q        |         |         |     V   |
  20+45       8.8923      3.19  |Q        |         |         |     V   |
  20+50       8.9142      3.17  |Q        |         |         |     V   |
  20+55       8.9358      3.14  |Q        |         |         |     V   |
  21+ 0       8.9572      3.11  |Q        |         |         |      V  |
  21+ 5       8.9784      3.08  |Q        |         |         |      V  |
  21+10       8.9995      3.06  |Q        |         |         |      V  |
  21+15       9.0204      3.03  |Q        |         |         |      V  |
  21+20       9.0411      3.01  |Q        |         |         |      V  |
  21+25       9.0616      2.98  |Q        |         |         |      V  |
  21+30       9.0820      2.96  |Q        |         |         |      V  |
  21+35       9.1022      2.94  |Q        |         |         |      V  |
  21+40       9.1223      2.91  |Q        |         |         |      V  |
  21+45       9.1422      2.89  |Q        |         |         |      V  |
  21+50       9.1619      2.87  |Q        |         |         |      V  |
  21+55       9.1816      2.85  |Q        |         |         |       V |
  22+ 0       9.2010      2.83  |Q        |         |         |       V |
  22+ 5       9.2204      2.81  |Q        |         |         |       V |
  22+10       9.2396      2.79  |Q        |         |         |       V |
  22+15       9.2587      2.77  |Q        |         |         |       V |
  22+20       9.2776      2.75  |Q        |         |         |       V |
  22+25       9.2964      2.73  |Q        |         |         |       V |
  22+30       9.3151      2.71  |Q        |         |         |       V |
  22+35       9.3337      2.70  |Q        |         |         |       V |
  22+40       9.3521      2.68  |Q        |         |         |       V |
  22+45       9.3704      2.66  |Q        |         |         |       V |
  22+50       9.3886      2.64  |Q        |         |         |       V |
  22+55       9.4067      2.63  |Q        |         |         |       V |
  23+ 0       9.4247      2.61  |Q        |         |         |        V|
  23+ 5       9.4426      2.60  |Q        |         |         |        V|
  23+10       9.4604      2.58  |Q        |         |         |        V|
  23+15       9.4780      2.56  |Q        |         |         |        V|
  23+20       9.4956      2.55  |Q        |         |         |        V|
  23+25       9.5131      2.53  |Q        |         |         |        V|
  23+30       9.5304      2.52  |Q        |         |         |        V|
  23+35       9.5477      2.51  |Q        |         |         |        V|
  23+40       9.5648      2.49  |Q        |         |         |        V|
  23+45       9.5819      2.48  |Q        |         |         |        V|
  23+50       9.5989      2.46  |Q        |         |         |        V|
  23+55       9.6157      2.45  |Q        |         |         |        V|
  24+ 0       9.6325      2.44  |Q        |         |         |        V|
  24+ 5       9.6482      2.27  |Q        |         |         |        V|
  24+10       9.6581      1.44  Q         |         |         |        V|
  24+15       9.6612      0.46  Q         |         |         |        V|
  24+20       9.6620      0.12  Q         |         |         |        V|
  24+25       9.6623      0.03  Q         |         |         |         V
-------------------------------------------------------------------------
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APPENDIX C.6: UNIT HYDROGRAPH ANALYSIS, BON VIEW ONSITE MITIGATED, AREA F3

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 05/09/25

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6279

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED UNIT HYDROGRAPH METHOD HYDROLOGY
AREA F3, 100-YEAR STORM EVENT
FN: UARF3P

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
9.33	1	1.20
Rainfall data for year 100		
9.33	6	3.00
Rainfall data for year 100		
9.33	24	6.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
52.9	52.9	9.33	1.000	0.774	0.100	0.077

Area-averaged adjusted loss rate Fm (In/Hr) = 0.077

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.93	0.100	52.9	52.9	8.90	0.226
8.40	0.900	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.887
Area-averaged low loss fraction, Yb = 0.113
User entry of time of concentration = 0.149 (hours)
++
Watershed area = 9.33(Ac.)
Catchment Lag time = 0.119 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 69.7700
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.077(In/Hr)
Average low loss rate fraction (Yb) = 0.113 (decimal)
Note: user entry of the Fm value
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.444(In)
Computed peak 30-minute rainfall = 0.909(In)
Specified peak 1-hour rainfall = 1.200(In)
Computed peak 3-hour rainfall = 2.105(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:
Using a total area of 9.33(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.444(In)
30-minute factor = 1.000 Adjusted rainfall = 0.909(In)
1-hour factor = 1.000 Adjusted rainfall = 1.199(In)
3-hour factor = 1.000 Adjusted rainfall = 2.105(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 112.83 (CFS))

1	8.722	9.841
2	53.219	50.208
3	89.172	40.568
4	97.881	9.826
5	99.445	1.765
6	100.000	0.626

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4439	0.4439
2	0.5858	0.1418
3	0.6889	0.1031
4	0.7729	0.0840
5	0.8451	0.0722
6	0.9090	0.0639
7	0.9668	0.0578
8	1.0199	0.0530
9	1.0691	0.0492
10	1.1151	0.0460
11	1.1584	0.0433
12	1.1995	0.0410
13	1.2496	0.0502
14	1.2979	0.0483
15	1.3446	0.0466
16	1.3897	0.0451
17	1.4335	0.0438
18	1.4761	0.0425
19	1.5175	0.0414
20	1.5578	0.0404
21	1.5972	0.0394
22	1.6357	0.0385
23	1.6733	0.0376
24	1.7102	0.0368
25	1.7463	0.0361
26	1.7817	0.0354
27	1.8164	0.0347
28	1.8505	0.0341
29	1.8841	0.0335
30	1.9170	0.0330
31	1.9495	0.0324
32	1.9814	0.0319
33	2.0129	0.0314
34	2.0439	0.0310
35	2.0744	0.0305
36	2.1045	0.0301
37	2.1342	0.0297
38	2.1635	0.0293
39	2.1925	0.0289
40	2.2210	0.0286
41	2.2493	0.0282
42	2.2771	0.0279
43	2.3047	0.0276
44	2.3320	0.0273

45	2.3589	0.0270
46	2.3856	0.0267
47	2.4120	0.0264
48	2.4381	0.0261
49	2.4639	0.0258
50	2.4895	0.0256
51	2.5149	0.0253
52	2.5400	0.0251
53	2.5648	0.0249
54	2.5895	0.0246
55	2.6139	0.0244
56	2.6381	0.0242
57	2.6621	0.0240
58	2.6859	0.0238
59	2.7094	0.0236
60	2.7328	0.0234
61	2.7560	0.0232
62	2.7790	0.0230
63	2.8019	0.0228
64	2.8245	0.0227
65	2.8470	0.0225
66	2.8693	0.0223
67	2.8915	0.0222
68	2.9135	0.0220
69	2.9353	0.0218
70	2.9570	0.0217
71	2.9785	0.0215
72	2.9999	0.0214
73	3.0207	0.0208
74	3.0413	0.0206
75	3.0618	0.0205
76	3.0821	0.0203
77	3.1023	0.0202
78	3.1224	0.0201
79	3.1424	0.0200
80	3.1622	0.0198
81	3.1819	0.0197
82	3.2015	0.0196
83	3.2209	0.0195
84	3.2403	0.0193
85	3.2595	0.0192
86	3.2786	0.0191
87	3.2976	0.0190
88	3.3165	0.0189
89	3.3353	0.0188
90	3.3540	0.0187
91	3.3726	0.0186
92	3.3911	0.0185
93	3.4095	0.0184
94	3.4277	0.0183
95	3.4459	0.0182
96	3.4640	0.0181
97	3.4820	0.0180

98	3.4999	0.0179
99	3.5177	0.0178
100	3.5354	0.0177
101	3.5531	0.0176
102	3.5706	0.0175
103	3.5881	0.0175
104	3.6055	0.0174
105	3.6228	0.0173
106	3.6400	0.0172
107	3.6571	0.0171
108	3.6741	0.0170
109	3.6911	0.0170
110	3.7080	0.0169
111	3.7248	0.0168
112	3.7416	0.0167
113	3.7582	0.0167
114	3.7748	0.0166
115	3.7913	0.0165
116	3.8078	0.0164
117	3.8242	0.0164
118	3.8405	0.0163
119	3.8567	0.0162
120	3.8729	0.0162
121	3.8890	0.0161
122	3.9050	0.0160
123	3.9210	0.0160
124	3.9369	0.0159
125	3.9528	0.0158
126	3.9685	0.0158
127	3.9843	0.0157
128	3.9999	0.0157
129	4.0155	0.0156
130	4.0310	0.0155
131	4.0465	0.0155
132	4.0619	0.0154
133	4.0773	0.0154
134	4.0926	0.0153
135	4.1078	0.0152
136	4.1230	0.0152
137	4.1381	0.0151
138	4.1532	0.0151
139	4.1682	0.0150
140	4.1832	0.0150
141	4.1981	0.0149
142	4.2130	0.0149
143	4.2278	0.0148
144	4.2426	0.0148
145	4.2573	0.0147
146	4.2719	0.0147
147	4.2865	0.0146
148	4.3011	0.0146
149	4.3156	0.0145
150	4.3300	0.0145

151	4.3445	0.0144
152	4.3588	0.0144
153	4.3731	0.0143
154	4.3874	0.0143
155	4.4016	0.0142
156	4.4158	0.0142
157	4.4299	0.0141
158	4.4440	0.0141
159	4.4581	0.0140
160	4.4721	0.0140
161	4.4860	0.0140
162	4.4999	0.0139
163	4.5138	0.0139
164	4.5276	0.0138
165	4.5414	0.0138
166	4.5551	0.0137
167	4.5688	0.0137
168	4.5825	0.0137
169	4.5961	0.0136
170	4.6097	0.0136
171	4.6232	0.0135
172	4.6367	0.0135
173	4.6502	0.0135
174	4.6636	0.0134
175	4.6770	0.0134
176	4.6903	0.0133
177	4.7036	0.0133
178	4.7169	0.0133
179	4.7301	0.0132
180	4.7433	0.0132
181	4.7565	0.0132
182	4.7696	0.0131
183	4.7827	0.0131
184	4.7957	0.0131
185	4.8088	0.0130
186	4.8217	0.0130
187	4.8347	0.0129
188	4.8476	0.0129
189	4.8605	0.0129
190	4.8733	0.0128
191	4.8861	0.0128
192	4.8989	0.0128
193	4.9116	0.0127
194	4.9243	0.0127
195	4.9370	0.0127
196	4.9497	0.0126
197	4.9623	0.0126
198	4.9749	0.0126
199	4.9874	0.0125
200	4.9999	0.0125
201	5.0124	0.0125
202	5.0249	0.0125
203	5.0373	0.0124

204	5.0497	0.0124
205	5.0620	0.0124
206	5.0744	0.0123
207	5.0867	0.0123
208	5.0989	0.0123
209	5.1112	0.0122
210	5.1234	0.0122
211	5.1356	0.0122
212	5.1477	0.0122
213	5.1599	0.0121
214	5.1720	0.0121
215	5.1840	0.0121
216	5.1961	0.0120
217	5.2081	0.0120
218	5.2201	0.0120
219	5.2320	0.0120
220	5.2440	0.0119
221	5.2559	0.0119
222	5.2677	0.0119
223	5.2796	0.0119
224	5.2914	0.0118
225	5.3032	0.0118
226	5.3150	0.0118
227	5.3267	0.0117
228	5.3385	0.0117
229	5.3502	0.0117
230	5.3618	0.0117
231	5.3735	0.0116
232	5.3851	0.0116
233	5.3967	0.0116
234	5.4082	0.0116
235	5.4198	0.0115
236	5.4313	0.0115
237	5.4428	0.0115
238	5.4543	0.0115
239	5.4657	0.0114
240	5.4771	0.0114
241	5.4885	0.0114
242	5.4999	0.0114
243	5.5113	0.0114
244	5.5226	0.0113
245	5.5339	0.0113
246	5.5452	0.0113
247	5.5565	0.0113
248	5.5677	0.0112
249	5.5789	0.0112
250	5.5901	0.0112
251	5.6013	0.0112
252	5.6124	0.0111
253	5.6235	0.0111
254	5.6346	0.0111
255	5.6457	0.0111
256	5.6568	0.0111

257	5.6678	0.0110
258	5.6788	0.0110
259	5.6898	0.0110
260	5.7008	0.0110
261	5.7118	0.0110
262	5.7227	0.0109
263	5.7336	0.0109
264	5.7445	0.0109
265	5.7554	0.0109
266	5.7662	0.0108
267	5.7770	0.0108
268	5.7878	0.0108
269	5.7986	0.0108
270	5.8094	0.0108
271	5.8202	0.0107
272	5.8309	0.0107
273	5.8416	0.0107
274	5.8523	0.0107
275	5.8629	0.0107
276	5.8736	0.0107
277	5.8842	0.0106
278	5.8948	0.0106
279	5.9054	0.0106
280	5.9160	0.0106
281	5.9266	0.0106
282	5.9371	0.0105
283	5.9476	0.0105
284	5.9581	0.0105
285	5.9686	0.0105
286	5.9791	0.0105
287	5.9895	0.0104
288	5.9999	0.0104

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0104	0.0012	0.0092
2	0.0104	0.0012	0.0093
3	0.0105	0.0012	0.0093
4	0.0105	0.0012	0.0093
5	0.0105	0.0012	0.0093
6	0.0106	0.0012	0.0094
7	0.0106	0.0012	0.0094
8	0.0106	0.0012	0.0094
9	0.0107	0.0012	0.0094
10	0.0107	0.0012	0.0095
11	0.0107	0.0012	0.0095
12	0.0107	0.0012	0.0095
13	0.0108	0.0012	0.0096
14	0.0108	0.0012	0.0096
15	0.0108	0.0012	0.0096
16	0.0108	0.0012	0.0096

17	0.0109	0.0012	0.0097
18	0.0109	0.0012	0.0097
19	0.0110	0.0012	0.0097
20	0.0110	0.0012	0.0097
21	0.0110	0.0012	0.0098
22	0.0110	0.0012	0.0098
23	0.0111	0.0013	0.0098
24	0.0111	0.0013	0.0098
25	0.0111	0.0013	0.0099
26	0.0112	0.0013	0.0099
27	0.0112	0.0013	0.0099
28	0.0112	0.0013	0.0100
29	0.0113	0.0013	0.0100
30	0.0113	0.0013	0.0100
31	0.0114	0.0013	0.0101
32	0.0114	0.0013	0.0101
33	0.0114	0.0013	0.0101
34	0.0114	0.0013	0.0102
35	0.0115	0.0013	0.0102
36	0.0115	0.0013	0.0102
37	0.0116	0.0013	0.0103
38	0.0116	0.0013	0.0103
39	0.0116	0.0013	0.0103
40	0.0117	0.0013	0.0103
41	0.0117	0.0013	0.0104
42	0.0117	0.0013	0.0104
43	0.0118	0.0013	0.0105
44	0.0118	0.0013	0.0105
45	0.0119	0.0013	0.0105
46	0.0119	0.0013	0.0106
47	0.0120	0.0014	0.0106
48	0.0120	0.0014	0.0106
49	0.0120	0.0014	0.0107
50	0.0121	0.0014	0.0107
51	0.0121	0.0014	0.0108
52	0.0122	0.0014	0.0108
53	0.0122	0.0014	0.0108
54	0.0122	0.0014	0.0109
55	0.0123	0.0014	0.0109
56	0.0123	0.0014	0.0109
57	0.0124	0.0014	0.0110
58	0.0124	0.0014	0.0110
59	0.0125	0.0014	0.0111
60	0.0125	0.0014	0.0111
61	0.0126	0.0014	0.0112
62	0.0126	0.0014	0.0112
63	0.0127	0.0014	0.0112
64	0.0127	0.0014	0.0113
65	0.0128	0.0014	0.0113
66	0.0128	0.0014	0.0114
67	0.0129	0.0015	0.0114
68	0.0129	0.0015	0.0114
69	0.0130	0.0015	0.0115

70	0.0130	0.0015	0.0115
71	0.0131	0.0015	0.0116
72	0.0131	0.0015	0.0116
73	0.0132	0.0015	0.0117
74	0.0132	0.0015	0.0117
75	0.0133	0.0015	0.0118
76	0.0133	0.0015	0.0118
77	0.0134	0.0015	0.0119
78	0.0135	0.0015	0.0119
79	0.0135	0.0015	0.0120
80	0.0136	0.0015	0.0120
81	0.0137	0.0015	0.0121
82	0.0137	0.0015	0.0122
83	0.0138	0.0016	0.0122
84	0.0138	0.0016	0.0123
85	0.0139	0.0016	0.0123
86	0.0140	0.0016	0.0124
87	0.0140	0.0016	0.0125
88	0.0141	0.0016	0.0125
89	0.0142	0.0016	0.0126
90	0.0142	0.0016	0.0126
91	0.0143	0.0016	0.0127
92	0.0144	0.0016	0.0127
93	0.0145	0.0016	0.0128
94	0.0145	0.0016	0.0129
95	0.0146	0.0017	0.0130
96	0.0147	0.0017	0.0130
97	0.0148	0.0017	0.0131
98	0.0148	0.0017	0.0131
99	0.0149	0.0017	0.0132
100	0.0150	0.0017	0.0133
101	0.0151	0.0017	0.0134
102	0.0151	0.0017	0.0134
103	0.0152	0.0017	0.0135
104	0.0153	0.0017	0.0136
105	0.0154	0.0017	0.0137
106	0.0155	0.0018	0.0137
107	0.0156	0.0018	0.0138
108	0.0157	0.0018	0.0139
109	0.0158	0.0018	0.0140
110	0.0158	0.0018	0.0141
111	0.0160	0.0018	0.0142
112	0.0160	0.0018	0.0142
113	0.0162	0.0018	0.0143
114	0.0162	0.0018	0.0144
115	0.0164	0.0019	0.0145
116	0.0164	0.0019	0.0146
117	0.0166	0.0019	0.0147
118	0.0167	0.0019	0.0148
119	0.0168	0.0019	0.0149
120	0.0169	0.0019	0.0150
121	0.0170	0.0019	0.0151
122	0.0171	0.0019	0.0152

123	0.0173	0.0020	0.0153
124	0.0174	0.0020	0.0154
125	0.0175	0.0020	0.0156
126	0.0176	0.0020	0.0156
127	0.0178	0.0020	0.0158
128	0.0179	0.0020	0.0159
129	0.0181	0.0020	0.0160
130	0.0182	0.0021	0.0161
131	0.0184	0.0021	0.0163
132	0.0185	0.0021	0.0164
133	0.0187	0.0021	0.0166
134	0.0188	0.0021	0.0167
135	0.0190	0.0021	0.0169
136	0.0191	0.0022	0.0170
137	0.0193	0.0022	0.0172
138	0.0195	0.0022	0.0173
139	0.0197	0.0022	0.0175
140	0.0198	0.0022	0.0176
141	0.0201	0.0023	0.0178
142	0.0202	0.0023	0.0179
143	0.0205	0.0023	0.0182
144	0.0206	0.0023	0.0183
145	0.0214	0.0024	0.0190
146	0.0215	0.0024	0.0191
147	0.0218	0.0025	0.0194
148	0.0220	0.0025	0.0195
149	0.0223	0.0025	0.0198
150	0.0225	0.0025	0.0199
151	0.0228	0.0026	0.0203
152	0.0230	0.0026	0.0204
153	0.0234	0.0026	0.0207
154	0.0236	0.0027	0.0209
155	0.0240	0.0027	0.0213
156	0.0242	0.0027	0.0215
157	0.0246	0.0028	0.0218
158	0.0249	0.0028	0.0221
159	0.0253	0.0029	0.0225
160	0.0256	0.0029	0.0227
161	0.0261	0.0030	0.0232
162	0.0264	0.0030	0.0234
163	0.0270	0.0030	0.0239
164	0.0273	0.0031	0.0242
165	0.0279	0.0032	0.0247
166	0.0282	0.0032	0.0250
167	0.0289	0.0033	0.0257
168	0.0293	0.0033	0.0260
169	0.0301	0.0034	0.0267
170	0.0305	0.0035	0.0271
171	0.0314	0.0036	0.0279
172	0.0319	0.0036	0.0283
173	0.0330	0.0037	0.0292
174	0.0335	0.0038	0.0297
175	0.0347	0.0039	0.0308

176	0.0354	0.0040	0.0314
177	0.0368	0.0042	0.0327
178	0.0376	0.0043	0.0334
179	0.0394	0.0045	0.0349
180	0.0404	0.0046	0.0358
181	0.0425	0.0048	0.0377
182	0.0438	0.0050	0.0388
183	0.0466	0.0053	0.0414
184	0.0483	0.0055	0.0428
185	0.0410	0.0046	0.0364
186	0.0433	0.0049	0.0384
187	0.0492	0.0056	0.0436
188	0.0530	0.0060	0.0470
189	0.0639	0.0064	0.0575
190	0.0722	0.0064	0.0657
191	0.1031	0.0064	0.0967
192	0.1418	0.0064	0.1354
193	0.4439	0.0064	0.4375
194	0.0840	0.0064	0.0776
195	0.0578	0.0064	0.0514
196	0.0460	0.0052	0.0408
197	0.0502	0.0057	0.0445
198	0.0451	0.0051	0.0400
199	0.0414	0.0047	0.0367
200	0.0385	0.0044	0.0341
201	0.0361	0.0041	0.0320
202	0.0341	0.0039	0.0303
203	0.0324	0.0037	0.0288
204	0.0310	0.0035	0.0275
205	0.0297	0.0034	0.0263
206	0.0286	0.0032	0.0253
207	0.0276	0.0031	0.0245
208	0.0267	0.0030	0.0236
209	0.0258	0.0029	0.0229
210	0.0251	0.0028	0.0223
211	0.0244	0.0028	0.0217
212	0.0238	0.0027	0.0211
213	0.0232	0.0026	0.0206
214	0.0227	0.0026	0.0201
215	0.0222	0.0025	0.0196
216	0.0217	0.0025	0.0192
217	0.0208	0.0023	0.0184
218	0.0203	0.0023	0.0180
219	0.0200	0.0023	0.0177
220	0.0196	0.0022	0.0174
221	0.0192	0.0022	0.0171
222	0.0189	0.0021	0.0168
223	0.0186	0.0021	0.0165
224	0.0183	0.0021	0.0162
225	0.0180	0.0020	0.0160
226	0.0177	0.0020	0.0157
227	0.0175	0.0020	0.0155
228	0.0172	0.0019	0.0153

229	0.0170	0.0019	0.0151
230	0.0167	0.0019	0.0148
231	0.0165	0.0019	0.0147
232	0.0163	0.0018	0.0145
233	0.0161	0.0018	0.0143
234	0.0159	0.0018	0.0141
235	0.0157	0.0018	0.0139
236	0.0155	0.0018	0.0138
237	0.0154	0.0017	0.0136
238	0.0152	0.0017	0.0135
239	0.0150	0.0017	0.0133
240	0.0149	0.0017	0.0132
241	0.0147	0.0017	0.0130
242	0.0146	0.0016	0.0129
243	0.0144	0.0016	0.0128
244	0.0143	0.0016	0.0127
245	0.0141	0.0016	0.0125
246	0.0140	0.0016	0.0124
247	0.0139	0.0016	0.0123
248	0.0137	0.0016	0.0122
249	0.0136	0.0015	0.0121
250	0.0135	0.0015	0.0120
251	0.0134	0.0015	0.0119
252	0.0133	0.0015	0.0118
253	0.0132	0.0015	0.0117
254	0.0131	0.0015	0.0116
255	0.0129	0.0015	0.0115
256	0.0128	0.0015	0.0114
257	0.0127	0.0014	0.0113
258	0.0126	0.0014	0.0112
259	0.0125	0.0014	0.0111
260	0.0125	0.0014	0.0110
261	0.0124	0.0014	0.0110
262	0.0123	0.0014	0.0109
263	0.0122	0.0014	0.0108
264	0.0121	0.0014	0.0107
265	0.0120	0.0014	0.0107
266	0.0119	0.0013	0.0106
267	0.0119	0.0013	0.0105
268	0.0118	0.0013	0.0104
269	0.0117	0.0013	0.0104
270	0.0116	0.0013	0.0103
271	0.0115	0.0013	0.0102
272	0.0115	0.0013	0.0102
273	0.0114	0.0013	0.0101
274	0.0113	0.0013	0.0100
275	0.0113	0.0013	0.0100
276	0.0112	0.0013	0.0099
277	0.0111	0.0013	0.0099
278	0.0111	0.0013	0.0098
279	0.0110	0.0012	0.0098
280	0.0109	0.0012	0.0097
281	0.0109	0.0012	0.0096

282	0.0108	0.0012	0.0096
283	0.0107	0.0012	0.0095
284	0.0107	0.0012	0.0095
285	0.0106	0.0012	0.0094
286	0.0106	0.0012	0.0094
287	0.0105	0.0012	0.0093
288	0.0105	0.0012	0.0093

Total soil rain loss = 0.61(In)
Total effective rainfall = 5.39(In)
Peak flow rate in flood hydrograph = 29.33(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+ 5	0.0006	0.09	Q				
0+10	0.0045	0.56	Q				
0+15	0.0109	0.93	VQ				
0+20	0.0179	1.02	VQ				
0+25	0.0251	1.04	VQ				
0+30	0.0324	1.05	VQ				
0+35	0.0396	1.06	VQ				
0+40	0.0469	1.06	VQ				
0+45	0.0542	1.06	VQ				
0+50	0.0616	1.06	VQ				
0+55	0.0689	1.07	VQ				
1+ 0	0.0763	1.07	VQ				
1+ 5	0.0837	1.07	VQ				
1+10	0.0911	1.08	VQ				
1+15	0.0985	1.08	VQ				
1+20	0.1059	1.08	|Q				
1+25	0.1134	1.08	|Q				
1+30	0.1209	1.09	|Q				
1+35	0.1284	1.09	|Q				
1+40	0.1359	1.09	|Q				
1+45	0.1435	1.10	|Q				
1+50	0.1511	1.10	|Q				
1+55	0.1587	1.10	|Q				
2+ 0	0.1663	1.11	|Q				
2+ 5	0.1739	1.11	|Q				
2+10	0.1816	1.11	|Q				
2+15	0.1893	1.12	|Q				
2+20	0.1970	1.12	|Q				
2+25	0.2048	1.12	|Q				
2+30	0.2125	1.13	|QV				
2+35	0.2203	1.13	|QV				

2+40	0.2281	1.13	|QV	|	|	|	|
2+45	0.2359	1.14	|QV	|	|	|	|
2+50	0.2438	1.14	|QV	|	|	|	|
2+55	0.2517	1.14	|QV	|	|	|	|
3+ 0	0.2596	1.15	|QV	|	|	|	|
3+ 5	0.2675	1.15	|QV	|	|	|	|
3+10	0.2755	1.16	|QV	|	|	|	|
3+15	0.2834	1.16	|QV	|	|	|	|
3+20	0.2915	1.16	|QV	|	|	|	|
3+25	0.2995	1.17	|QV	|	|	|	|
3+30	0.3075	1.17	|QV	|	|	|	|
3+35	0.3156	1.17	|Q V	|	|	|	|
3+40	0.3237	1.18	|Q V	|	|	|	|
3+45	0.3319	1.18	|Q V	|	|	|	|
3+50	0.3401	1.19	|Q V	|	|	|	|
3+55	0.3482	1.19	|Q V	|	|	|	|
4+ 0	0.3565	1.19	|Q V	|	|	|	|
4+ 5	0.3647	1.20	|Q V	|	|	|	|
4+10	0.3730	1.20	|Q V	|	|	|	|
4+15	0.3813	1.21	|Q V	|	|	|	|
4+20	0.3896	1.21	|Q V	|	|	|	|
4+25	0.3980	1.21	|Q V	|	|	|	|
4+30	0.4064	1.22	|Q V	|	|	|	|
4+35	0.4148	1.22	|Q V	|	|	|	|
4+40	0.4233	1.23	|Q V	|	|	|	|
4+45	0.4318	1.23	|Q V	|	|	|	|
4+50	0.4403	1.24	|Q V	|	|	|	|
4+55	0.4489	1.24	|Q V	|	|	|	|
5+ 0	0.4574	1.25	|Q V	|	|	|	|
5+ 5	0.4661	1.25	|Q V	|	|	|	|
5+10	0.4747	1.26	|Q V	|	|	|	|
5+15	0.4834	1.26	|Q V	|	|	|	|
5+20	0.4921	1.27	|Q V	|	|	|	|
5+25	0.5008	1.27	|Q V	|	|	|	|
5+30	0.5096	1.28	|Q V	|	|	|	|
5+35	0.5184	1.28	|Q V	|	|	|	|
5+40	0.5273	1.29	|Q V	|	|	|	|
5+45	0.5362	1.29	|Q V	|	|	|	|
5+50	0.5451	1.30	|Q V	|	|	|	|
5+55	0.5541	1.30	|Q V	|	|	|	|
6+ 0	0.5630	1.31	|Q V	|	|	|	|
6+ 5	0.5721	1.31	|Q V	|	|	|	|
6+10	0.5811	1.32	|Q V	|	|	|	|
6+15	0.5902	1.32	|Q V	|	|	|	|
6+20	0.5994	1.33	|Q V	|	|	|	|
6+25	0.6086	1.33	|Q V	|	|	|	|
6+30	0.6178	1.34	|Q V	|	|	|	|
6+35	0.6271	1.34	|Q V	|	|	|	|
6+40	0.6364	1.35	|Q V	|	|	|	|
6+45	0.6457	1.36	|Q V	|	|	|	|
6+50	0.6551	1.36	|Q V	|	|	|	|
6+55	0.6645	1.37	|Q V	|	|	|	|
7+ 0	0.6740	1.38	|Q V	|	|	|	|

7+ 5	0.6835	1.38	|Q V |	|	|	|
7+10	0.6931	1.39	|Q V |	|	|	|
7+15	0.7027	1.39	|Q V |	|	|	|
7+20	0.7123	1.40	|Q V |	|	|	|
7+25	0.7220	1.41	|Q V |	|	|	|
7+30	0.7317	1.41	|Q V |	|	|	|
7+35	0.7415	1.42	|Q V |	|	|	|
7+40	0.7514	1.43	|Q V |	|	|	|
7+45	0.7612	1.43	|Q V |	|	|	|
7+50	0.7712	1.44	|Q V |	|	|	|
7+55	0.7812	1.45	|Q V |	|	|	|
8+ 0	0.7912	1.46	|Q V |	|	|	|
8+ 5	0.8013	1.46	|Q V |	|	|	|
8+10	0.8114	1.47	|Q V |	|	|	|
8+15	0.8216	1.48	|Q V |	|	|	|
8+20	0.8318	1.49	|Q V |	|	|	|
8+25	0.8421	1.49	|Q V |	|	|	|
8+30	0.8525	1.50	| Q V |	|	|	|
8+35	0.8629	1.51	| Q V |	|	|	|
8+40	0.8734	1.52	| Q V |	|	|	|
8+45	0.8839	1.53	| Q V |	|	|	|
8+50	0.8945	1.54	| Q V |	|	|	|
8+55	0.9051	1.55	| Q V |	|	|	|
9+ 0	0.9158	1.55	| Q V |	|	|	|
9+ 5	0.9266	1.56	| Q V |	|	|	|
9+10	0.9374	1.57	| Q V |	|	|	|
9+15	0.9483	1.58	| Q V|	|	|	|
9+20	0.9593	1.59	| Q V|	|	|	|
9+25	0.9703	1.60	| Q V|	|	|	|
9+30	0.9814	1.61	| Q V|	|	|	|
9+35	0.9926	1.62	| Q V|	|	|	|
9+40	1.0038	1.63	| Q V|	|	|	|
9+45	1.0151	1.64	| Q V|	|	|	|
9+50	1.0265	1.65	| Q V|	|	|	|
9+55	1.0380	1.66	| Q V|	|	|	|
10+ 0	1.0495	1.68	| Q V	|	|	|
10+ 5	1.0611	1.69	| Q V	|	|	|
10+10	1.0728	1.70	| Q V	|	|	|
10+15	1.0846	1.71	| Q V	|	|	|
10+20	1.0965	1.72	| Q V	|	|	|
10+25	1.1084	1.73	| Q V	|	|	|
10+30	1.1204	1.75	| Q V	|	|	|
10+35	1.1326	1.76	| Q V	|	|	|
10+40	1.1448	1.77	| Q V	|	|	|
10+45	1.1571	1.79	| Q |V	|	|	|
10+50	1.1695	1.80	| Q |V	|	|	|
10+55	1.1820	1.81	| Q |V	|	|	|
11+ 0	1.1946	1.83	| Q |V	|	|	|
11+ 5	1.2073	1.84	| Q |V	|	|	|
11+10	1.2201	1.86	| Q |V	|	|	|
11+15	1.2330	1.87	| Q |V	|	|	|
11+20	1.2460	1.89	| Q |V	|	|	|
11+25	1.2592	1.91	| Q | V	|	|	|

11+30	1.2724	1.92	Q	V			
11+35	1.2858	1.94	Q	V			
11+40	1.2993	1.96	Q	V			
11+45	1.3129	1.98	Q	V			
11+50	1.3267	2.00	Q	V			
11+55	1.3405	2.02	Q	V			
12+ 0	1.3546	2.04	Q	V			
12+ 5	1.3687	2.06	Q	V			
12+10	1.3832	2.10	Q	V			
12+15	1.3980	2.14	Q	V			
12+20	1.4129	2.17	Q	V			
12+25	1.4280	2.19	Q	V			
12+30	1.4433	2.22	Q	V			
12+35	1.4587	2.24	Q	V			
12+40	1.4743	2.27	Q	V			
12+45	1.4901	2.29	Q	V			
12+50	1.5061	2.32	Q	V			
12+55	1.5223	2.35	Q	V			
13+ 0	1.5387	2.38	Q	V			
13+ 5	1.5553	2.41	Q	V			
13+10	1.5721	2.44	Q	V			
13+15	1.5892	2.48	Q	V			
13+20	1.6065	2.51	Q	V			
13+25	1.6240	2.55	Q	V			
13+30	1.6419	2.59	Q	V			
13+35	1.6599	2.63	Q	V			
13+40	1.6783	2.67	Q	V			
13+45	1.6970	2.71	Q	V			
13+50	1.7160	2.76	Q	V			
13+55	1.7353	2.81	Q	V			
14+ 0	1.7550	2.86	Q	V			
14+ 5	1.7751	2.91	Q	V			
14+10	1.7956	2.97	Q	V			
14+15	1.8165	3.03	Q	V			
14+20	1.8379	3.10	Q	V			
14+25	1.8597	3.17	Q	V			
14+30	1.8821	3.25	Q	V			
14+35	1.9050	3.33	Q	V			
14+40	1.9285	3.42	Q	V			
14+45	1.9527	3.51	Q	V			
14+50	1.9776	3.62	Q	V			
14+55	2.0033	3.73	Q	V			
15+ 0	2.0298	3.86	Q	V			
15+ 5	2.0573	3.99	Q	V			
15+10	2.0859	4.15	Q	V			
15+15	2.1157	4.32	Q	V			
15+20	2.1469	4.53	Q	V			
15+25	2.1789	4.66	Q	V			
15+30	2.2095	4.44	Q	V			
15+35	2.2395	4.35	Q	V			
15+40	2.2717	4.67	Q	V			
15+45	2.3073	5.17	Q	V			
15+50	2.3483	5.96	Q	V			

| | | |

```
  20+20       3.8055      1.45  |Q        |         |         |     V   |
  20+25       3.8153      1.44  |Q        |         |         |     V   |
  20+30       3.8251      1.42  |Q        |         |         |     V   |
  20+35       3.8348      1.41  |Q        |         |         |     V   |
  20+40       3.8444      1.39  |Q        |         |         |     V   |
  20+45       3.8540      1.38  |Q        |         |         |     V   |
  20+50       3.8634      1.37  |Q        |         |         |     V   |
  20+55       3.8727      1.36  |Q        |         |         |      V  |
  21+ 0       3.8820      1.35  |Q        |         |         |      V  |
  21+ 5       3.8912      1.33  |Q        |         |         |      V  |
  21+10       3.9003      1.32  |Q        |         |         |      V  |
  21+15       3.9093      1.31  |Q        |         |         |      V  |
  21+20       3.9183      1.30  |Q        |         |         |      V  |
  21+25       3.9272      1.29  |Q        |         |         |      V  |
  21+30       3.9360      1.28  |Q        |         |         |      V  |
  21+35       3.9447      1.27  |Q        |         |         |      V  |
  21+40       3.9534      1.26  |Q        |         |         |      V  |
  21+45       3.9620      1.25  |Q        |         |         |      V  |
  21+50       3.9706      1.24  |Q        |         |         |      V  |
  21+55       3.9791      1.23  |Q        |         |         |       V |
  22+ 0       3.9875      1.22  |Q        |         |         |       V |
  22+ 5       3.9959      1.22  |Q        |         |         |       V |
  22+10       4.0042      1.21  |Q        |         |         |       V |
  22+15       4.0124      1.20  |Q        |         |         |       V |
  22+20       4.0206      1.19  |Q        |         |         |       V |
  22+25       4.0288      1.18  |Q        |         |         |       V |
  22+30       4.0369      1.17  |Q        |         |         |       V |
  22+35       4.0449      1.17  |Q        |         |         |       V |
  22+40       4.0529      1.16  |Q        |         |         |       V |
  22+45       4.0608      1.15  |Q        |         |         |       V |
  22+50       4.0687      1.14  |Q        |         |         |       V |
  22+55       4.0765      1.14  |Q        |         |         |       V |
  23+ 0       4.0843      1.13  |Q        |         |         |        V|
  23+ 5       4.0921      1.12  |Q        |         |         |        V|
  23+10       4.0997      1.12  |Q        |         |         |        V|
  23+15       4.1074      1.11  |Q        |         |         |        V|
  23+20       4.1150      1.10  |Q        |         |         |        V|
  23+25       4.1225      1.10  |Q        |         |         |        V|
  23+30       4.1301      1.09  |Q        |         |         |        V|
  23+35       4.1375      1.08  |Q        |         |         |        V|
  23+40       4.1450      1.08  |Q        |         |         |        V|
  23+45       4.1523      1.07  |Q        |         |         |        V|
  23+50       4.1597      1.07  |Q        |         |         |        V|
  23+55       4.1670      1.06  |Q        |         |         |        V|
  24+ 0       4.1743      1.06  |Q        |         |         |        V|
  24+ 5       4.1809      0.96  |Q        |         |         |        V|
  24+10       4.1843      0.49  Q         |         |         |        V|
  24+15       4.1850      0.11  Q         |         |         |        V|
  24+20       4.1852      0.02  Q         |         |         |        V|
  24+25       4.1852      0.01  Q         |         |         |        V|
-------------------------------------------------------------------------
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APPENDIX D: CAMPUS AVENUE STORM DRAIN HYDROLOGY CALCULATIONS

APPENDIX D.1: RATIONAL METHOD ANALYSIS, RERUN FUSCOE MODELS TO CAMPUS

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/08/25

PORTION OF MPD DA XIV UPSTREAM
PROPOSED DEC DA A1
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 771.000(Ft.)
Top (of initial area) elevation = 694.000(Ft.)
Bottom (of initial area) elevation = 685.000(Ft.)
Difference in elevation = 9.000(Ft.)
Slope = 0.01167 s(%)= 1.17
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.270 min.
Rainfall intensity = 3.273(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.846
Subarea runoff = 18.140(CFS)
Total initial stream area = 6.550(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   685.000(Ft.)
End of street segment elevation =   683.000(Ft.)
Length of street segment  =   293.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     25.474(CFS)
Depth of flow =   0.565(Ft.), Average velocity =   2.876(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.680(Ft.)
Flow velocity =   2.88(Ft/s)
Travel time =    1.70 min.     TC =   12.97  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.720
Decimal fraction soil group B = 0.280
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 38.72
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.186(In/Hr)
Rainfall intensity =      3.008(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.843
Subarea runoff =     14.473(CFS) for    6.310(Ac.)
Total runoff =     32.613(CFS)
Effective area this stream =       12.86(Ac.)
Total Study Area (Main Stream No. 1) =       12.86(Ac.)
Area averaged Fm value =    0.191(In/Hr)
Street flow at end of street =     32.613(CFS)
Half street flow at end of street =     16.307(CFS)
Depth of flow =   0.607(Ft.), Average velocity =   3.056(Ft/s)
Flow width (from curb towards crown)=  22.769(Ft.)
End of computations, Total Study Area =           12.86 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.
```

```
Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number =  35.3
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/08/25

PORTION OF MPD DA XIV DOWNSTREAM
PROPOSED DEC DA A1
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 4.000 to Point/Station 5.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.130
Decimal fraction soil group B = 0.870
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 52.88
Pervious ratio(Ap) = 0.8500 Max loss rate(Fm)= 0.658(In/Hr)
Initial subarea data:
Initial area flow distance = 791.000(Ft.)
Top (of initial area) elevation = 684.000(Ft.)
Bottom (of initial area) elevation = 678.000(Ft.)
Difference in elevation = 6.000(Ft.)
Slope = 0.00759 s(%)= 0.76
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 18.502 min.
Rainfall intensity = 2.431(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.656
Subarea runoff = 11.184(CFS)
Total initial stream area = 7.010(Ac.)
Pervious area fraction = 0.850
Initial area Fm value = 0.658(In/Hr)

End of computations, Total Study Area = 7.01 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850
Area averaged SCS curve number = 52.9

APPENDIX D.2: RATIONAL METHOD ANALYSIS, CAMPUS MAINLINE, AREA G (EXCLUDES G2)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/08/25

CAMPUS SD TRIBUTARY AREA
OVERALL: JLC-MCC-MDP REV + ONTARIO RANCH

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 814.000 to Point/Station 815.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.110
Decimal fraction soil group B = 0.890
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 53.36
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.077(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 694.000(Ft.)
Bottom (of initial area) elevation = 689.000(Ft.)
Difference in elevation = 5.000(Ft.)
Slope = 0.01042 s(%)= 1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.950 min.
Rainfall intensity = 3.758(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 12.690(CFS)
Total initial stream area = 3.830(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.077(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      815.000 to Point/Station       12.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   685.000(Ft.)
Downstream point/station elevation =   664.700(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.690(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    12.690(CFS)
Normal flow depth in pipe =    8.05(In.)
Flow top width inside pipe =   11.28(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.66(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     9.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       12.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   664.700(Ft.)
Downstream point/station elevation =   661.500(Ft.)
Pipe length  =   429.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.690(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    12.690(CFS)
Normal flow depth in pipe =   15.98(In.)
Flow top width inside pipe =   17.91(In.)
Critical Depth =   15.93(In.)
Pipe flow velocity =      6.46(Ft/s)
Travel time through pipe =    1.11 min.
Time of concentration (TC) =    10.13 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       12.100
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.830(Ac.)
Runoff from this stream =     12.690(CFS)
Time of concentration =   10.13 min.
Rainfall intensity =     3.489(In/Hr)
Area averaged loss rate (Fm) =    0.0768(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station       12.100
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 35.30
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.191(In/Hr)
Rainfall intensity =      3.008(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  12.97 min.  Rain intensity =       3.01(In/Hr)
Total area this stream =        12.86(Ac.)
Total Study Area (Main Stream No. 2) =       16.69(Ac.)
Total runoff =     32.61(CFS)


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Process from Point/Station        3.000 to Point/Station       12.100
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     12.860(Ac.)
Runoff from this stream =     32.613(CFS)
Time of concentration =   12.97 min.
Rainfall intensity =     3.008(In/Hr)
Area averaged loss rate (Fm) =    0.1912(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     12.69     3.830     10.13    0.077      3.489
2     32.61    12.860     12.97    0.191      3.008
Qmax(1) =
         1.000 *    1.000 *    12.690) +
         1.171 *    0.781 *    32.613) + =      42.510
Qmax(2) =
         0.859 *    1.000 *    12.690) +
         1.000 *    1.000 *    32.613) + =      43.515

Total of 2 main streams to confluence:
Flow rates before confluence point:
      13.690      33.613
Maximum flow rates at confluence using above data:
       42.510       43.515
Area of streams before confluence:
        3.830       12.860
Effective area values after confluence:
       13.874       16.690
```

```
Results of confluence:
Total flow rate =     43.515(CFS)
Time of concentration =    12.970 min.
Effective stream area after confluence  =     16.690(Ac.)
Study area average Pervious fraction(Ap) =  0.177
Study area average soil loss rate(Fm) =    0.165(In/Hr)
Study area total =      16.69(Ac.)


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Process from Point/Station       12.100 to Point/Station       12.200
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   661.500(Ft.)
Downstream point/station elevation =   658.000(Ft.)
Pipe length  =   472.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    43.515(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    43.515(CFS)
Normal flow depth in pipe =   25.83(In.)
Flow top width inside pipe =   27.22(In.)
Critical Depth =   26.27(In.)
Pipe flow velocity =      8.73(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =    13.87 min.


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Process from Point/Station       12.100 to Point/Station       12.200
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     16.690(Ac.)
Runoff from this stream =     43.515(CFS)
Time of concentration =   13.87 min.
Rainfall intensity =     2.889(In/Hr)
Area averaged loss rate (Fm) =    0.1650(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1771
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      815.000 to Point/Station      816.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Initial subarea data:
Initial area flow distance =   900.000(Ft.)
Top (of initial area) elevation =   689.000(Ft.)
Bottom (of initial area) elevation =   680.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.603 min.
Rainfall intensity =      3.216(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.879
Subarea runoff =     22.373(CFS)
Total initial stream area =        7.910(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)


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Process from Point/Station      816.000 to Point/Station      816.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Time of concentration =    11.60 min.
Rainfall intensity =      3.216(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =     11.285(CFS) for    3.990(Ac.)
Total runoff =     33.658(CFS)
Effective area this stream =       11.90(Ac.)
Total Study Area (Main Stream No. 2) =       28.59(Ac.)
Area averaged Fm value =    0.073(In/Hr)


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Process from Point/Station      816.000 to Point/Station       12.200
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   676.000(Ft.)
Downstream point/station elevation =   658.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    33.658(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    33.658(CFS)
Normal flow depth in pipe =   11.70(In.)
Flow top width inside pipe =   17.17(In.)
Critical depth could not be calculated.
Pipe flow velocity =     27.72(Ft/s)
```

```
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    11.66 min.


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Process from Point/Station      816.000 to Point/Station       12.200
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     11.900(Ac.)
Runoff from this stream =     33.658(CFS)
Time of concentration =   11.66 min.
Rainfall intensity =     3.206(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       12.200
**** USER DEFINED FLOW INFORMATION AT A POINT ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 52.90
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.658(In/Hr)
Rainfall intensity =      2.431(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  18.50 min.  Rain intensity =       2.43(In/Hr)
Total area this stream =         7.01(Ac.)
Total Study Area (Main Stream No. 3) =       35.60(Ac.)
Total runoff =     11.18(CFS)


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Process from Point/Station        5.000 to Point/Station       12.200
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      7.010(Ac.)
Runoff from this stream =     11.184(CFS)
Time of concentration =   18.50 min.
Rainfall intensity =     2.431(In/Hr)
Area averaged loss rate (Fm) =    0.6578(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1     43.51    16.690     13.87    0.165      2.889
2     33.66    11.900     11.66    0.073      3.206
3     11.18     7.010     18.50    0.658      2.431
Qmax(1) =
         1.000 *    1.000 *    43.515) +
         0.899 *    1.000 *    33.658) +
         1.259 *    0.750 *    11.184) + =      84.324
Qmax(2) =
         1.116 *    0.841 *    43.515) +
         1.000 *    1.000 *    33.658) +
         1.437 *    0.630 *    11.184) + =      84.634
Qmax(3) =
         0.832 *    1.000 *    43.515) +
         0.753 *    1.000 *    33.658) +
         1.000 *    1.000 *    11.184) + =      72.705

Total of 3 main streams to confluence:
Flow rates before confluence point:
      44.515      34.658      12.184
Maximum flow rates at confluence using above data:
       84.324       84.634       72.705
Area of streams before confluence:
       16.690       11.900        7.010
Effective area values after confluence:
       33.846       30.353       35.600


Results of confluence:
Total flow rate =     84.634(CFS)
Time of concentration =    11.663 min.
Effective stream area after confluence  =     30.353(Ac.)
Study area average Pervious fraction(Ap) =  0.284
Study area average soil loss rate(Fm) =    0.231(In/Hr)
Study area total =      35.60(Ac.)


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Process from Point/Station       12.200 to Point/Station       12.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   658.000(Ft.)
Downstream point/station elevation =   655.600(Ft.)
Pipe length  =   750.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    84.634(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =    84.634(CFS)
Normal flow depth in pipe =   37.31(In.)
Flow top width inside pipe =   45.20(In.)
Critical Depth =   32.87(In.)
Pipe flow velocity =      7.60(Ft/s)
Travel time through pipe =    1.64 min.
Time of concentration (TC) =    13.31 min.
```

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Process from Point/Station       12.200 to Point/Station       12.300
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     30.353(Ac.)
Runoff from this stream =     84.634(CFS)
Time of concentration =   13.31 min.
Rainfall intensity =     2.962(In/Hr)
Area averaged loss rate (Fm) =    0.2314(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2838
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      801.000 to Point/Station      802.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.624(In/Hr)
Initial subarea data:
Initial area flow distance =   550.000(Ft.)
Top (of initial area) elevation =   684.500(Ft.)
Bottom (of initial area) elevation =   679.000(Ft.)
Difference in elevation =     5.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   15.139 min.
Rainfall intensity =      2.742(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.695
Subarea runoff =      7.739(CFS)
Total initial stream area =        4.060(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.624(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      802.000 to Point/Station      802.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Time of concentration =    15.14 min.
Rainfall intensity =      2.742(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.727
Subarea runoff =      2.089(CFS) for    0.870(Ac.)
Total runoff =      9.828(CFS)
Effective area this stream =        4.93(Ac.)
Total Study Area (Main Stream No. 2) =       40.53(Ac.)
Area averaged Fm value =    0.527(In/Hr)


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Process from Point/Station      802.000 to Point/Station       12.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   675.000(Ft.)
Downstream point/station elevation =   655.600(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.828(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     9.828(CFS)
Normal flow depth in pipe =    6.88(In.)
Flow top width inside pipe =   11.87(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.09(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    15.22 min.


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Process from Point/Station      802.000 to Point/Station       12.300
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.930(Ac.)
Runoff from this stream =      9.828(CFS)
Time of concentration =   15.22 min.
Rainfall intensity =     2.733(In/Hr)
Area averaged loss rate (Fm) =    0.5267(In/Hr)
Area averaged Pervious ratio (Ap) = 0.7176
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     84.63    30.353     13.31    0.231      2.962
2      9.83     4.930     15.22    0.527      2.733
Qmax(1) =
         1.000 *    1.000 *    84.634) +
         1.104 *    0.874 *     9.828) + =      94.120
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```
Qmax(2) =
         0.916 *    1.000 *    84.634) +
         1.000 *    1.000 *     9.828) + =      87.361

Total of 2 main streams to confluence:
Flow rates before confluence point:
      85.634      10.828
Maximum flow rates at confluence using above data:
       94.120       87.361
Area of streams before confluence:
       30.353        4.930
Effective area values after confluence:
       34.664       35.283


Results of confluence:
Total flow rate =     94.120(CFS)
Time of concentration =    13.307 min.
Effective stream area after confluence  =     34.664(Ac.)
Study area average Pervious fraction(Ap) =  0.344
Study area average soil loss rate(Fm) =    0.273(In/Hr)
Study area total =      35.28(Ac.)


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Process from Point/Station       12.300 to Point/Station       12.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   655.600(Ft.)
Downstream point/station elevation =   653.600(Ft.)
Pipe length  =   780.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    94.120(CFS)
Nearest computed pipe diameter  =     54.00(In.)
Calculated individual pipe flow  =    94.120(CFS)
Normal flow depth in pipe =   41.81(In.)
Flow top width inside pipe =   45.15(In.)
Critical Depth =   34.17(In.)
Pipe flow velocity =      7.12(Ft/s)
Travel time through pipe =    1.83 min.
Time of concentration (TC) =    15.13 min.


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Process from Point/Station       12.400 to Point/Station       12.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   653.600(Ft.)
Downstream point/station elevation =   652.000(Ft.)
Pipe length  =   311.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    94.120(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =    94.120(CFS)
Normal flow depth in pipe =   36.05(In.)
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Flow top width inside pipe =   41.51(In.)
Critical Depth =   35.29(In.)
Pipe flow velocity =      9.29(Ft/s)
Travel time through pipe =    0.56 min.
Time of concentration (TC) =    15.69 min.


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Process from Point/Station       12.400 to Point/Station       12.500
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     34.664(Ac.)
Runoff from this stream =     94.120(CFS)
Time of concentration =   15.69 min.
Rainfall intensity =     2.683(In/Hr)
Area averaged loss rate (Fm) =    0.2727(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3444
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      811.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   700.000(Ft.)
Top (of initial area) elevation =   675.000(Ft.)
Bottom (of initial area) elevation =   668.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.493 min.
Rainfall intensity =      3.416(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =     10.951(CFS)
Total initial stream area =        3.620(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


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Process from Point/Station      811.000 to Point/Station       12.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
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```
Upstream point/station elevation =   668.000(Ft.)
Downstream point/station elevation =   652.000(Ft.)
Pipe length  =   275.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.951(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    10.951(CFS)
Normal flow depth in pipe =    9.27(In.)
Flow top width inside pipe =   14.58(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.75(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =    10.83 min.


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Process from Point/Station      811.000 to Point/Station       12.500
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.620(Ac.)
Runoff from this stream =     10.951(CFS)
Time of concentration =   10.83 min.
Rainfall intensity =     3.353(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     94.12    34.664     15.69    0.273      2.683
2     10.95     3.620     10.83    0.055      3.353
Qmax(1) =
         1.000 *    1.000 *    94.120) +
         0.797 *    1.000 *    10.951) + =     102.849
Qmax(2) =
         1.278 *    0.690 *    94.120) +
         1.000 *    1.000 *    10.951) + =      93.922

Total of 2 main streams to confluence:
Flow rates before confluence point:
      95.120      11.951
Maximum flow rates at confluence using above data:
      102.849       93.922
Area of streams before confluence:
       34.664        3.620
Effective area values after confluence:
       38.284       27.539


Results of confluence:
```

```
Total flow rate =    102.849(CFS)
Time of concentration =    15.690 min.
Effective stream area after confluence  =     38.284(Ac.)
Study area average Pervious fraction(Ap) =  0.321
Study area average soil loss rate(Fm) =    0.252(In/Hr)
Study area total =      38.28(Ac.)


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Process from Point/Station       12.500 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   652.000(Ft.)
Downstream point/station elevation =   651.200(Ft.)
Pipe length  =   161.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   102.849(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =   102.849(CFS)
Normal flow depth in pipe =   36.56(In.)
Flow top width inside pipe =   45.95(In.)
Critical Depth =   36.34(In.)
Pipe flow velocity =      9.44(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    15.97 min.


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Process from Point/Station       12.500 to Point/Station       14.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     38.284(Ac.)
Runoff from this stream =    102.849(CFS)
Time of concentration =   15.97 min.
Rainfall intensity =     2.655(In/Hr)
Area averaged loss rate (Fm) =    0.2521(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3213
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      817.000 to Point/Station      818.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.100
Decimal fraction soil group C = 0.900
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.70
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.057(In/Hr)
Initial subarea data:
```

```
Initial area flow distance =   750.000(Ft.)
Top (of initial area) elevation =   676.500(Ft.)
Bottom (of initial area) elevation =   669.000(Ft.)
Difference in elevation =     7.500(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.787 min.
Rainfall intensity =      3.360(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =     23.605(CFS)
Total initial stream area =        7.940(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.057(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      818.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   665.000(Ft.)
Downstream point/station elevation =   651.200(Ft.)
Pipe length  =    77.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.605(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    23.605(CFS)
Normal flow depth in pipe =   10.76(In.)
Flow top width inside pipe =   13.51(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.08(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    10.84 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      818.000 to Point/Station       14.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      7.940(Ac.)
Runoff from this stream =     23.605(CFS)
Time of concentration =   10.84 min.
Rainfall intensity =     3.350(In/Hr)
Area averaged loss rate (Fm) =    0.0568(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      812.000 to Point/Station      813.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   570.000(Ft.)
Top (of initial area) elevation =   673.700(Ft.)
Bottom (of initial area) elevation =   668.000(Ft.)
Difference in elevation =     5.700(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.665 min.
Rainfall intensity =      3.589(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =      4.262(CFS)
Total initial stream area =        1.340(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      813.000 to Point/Station      813.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.480
Decimal fraction soil group C = 0.520
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 62.76
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.064(In/Hr)
Time of concentration =     9.67 min.
Rainfall intensity =      3.589(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =      4.600(CFS) for    1.450(Ac.)
Total runoff =      8.862(CFS)
Effective area this stream =        2.79(Ac.)
Total Study Area (Main Stream No. 3) =       54.88(Ac.)
Area averaged Fm value =    0.060(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      813.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   664.000(Ft.)
Downstream point/station elevation =   651.200(Ft.)
Pipe length  =    39.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.862(CFS)
Nearest computed pipe diameter  =      9.00(In.)
```

```
Calculated individual pipe flow  =     8.862(CFS)
Normal flow depth in pipe =    6.90(In.)
Flow top width inside pipe =    7.61(In.)
Critical depth could not be calculated.
Pipe flow velocity =     24.38(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      813.000 to Point/Station       14.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      2.790(Ac.)
Runoff from this stream =      8.862(CFS)
Time of concentration =    9.69 min.
Rainfall intensity =     3.583(In/Hr)
Area averaged loss rate (Fm) =    0.0596(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    102.85    38.284     15.97    0.252      2.655
2     23.60     7.940     10.84    0.057      3.350
3      8.86     2.790      9.69    0.060      3.583
Qmax(1) =
         1.000 *    1.000 *   102.849) +
         0.789 *    1.000 *    23.605) +
         0.737 *    1.000 *     8.862) + =     127.995
Qmax(2) =
         1.290 *    0.678 *   102.849) +
         1.000 *    1.000 *    23.605) +
         0.934 *    1.000 *     8.862) + =     121.867
Qmax(3) =
         1.386 *    0.607 *   102.849) +
         1.071 *    0.894 *    23.605) +
         1.000 *    1.000 *     8.862) + =     117.965

Total of 3 main streams to confluence:
Flow rates before confluence point:
     103.849      24.605       9.862
Maximum flow rates at confluence using above data:
      127.995      121.867      117.965
Area of streams before confluence:
       38.284        7.940        2.790
Effective area values after confluence:
       49.014       36.704       33.118
```

Results of confluence:
Total flow rate = 127.995(CFS)
Time of concentration = 15.974 min.
Effective stream area after confluence = 49.014(Ac.)
Study area average Pervious fraction(Ap) = 0.273
Study area average soil loss rate(Fm) = 0.209(In/Hr)
Study area total = 49.01(Ac.)
End of computations, Total Study Area = 54.88 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.275
Area averaged SCS curve number = 53.6

APPENDIX D.3: RATIONAL METHOD ANALYSIS, CAMPUS ONSITE MITIGATED, AREA G2

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/07/25

ONTARIO RANCH 108.43.25
ONSITE RATIONAL METHOD HYDROLOGY
AREA G2, 100 YEAR STORM EVENT
FN: RARG2100P

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 803.000 to Point/Station 804.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.940
Decimal fraction soil group C = 0.060
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.78
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.072(In/Hr)
Initial subarea data:
Initial area flow distance = 550.000(Ft.)
Top (of initial area) elevation = 679.500(Ft.)
Bottom (of initial area) elevation = 674.000(Ft.)
Difference in elevation = 5.500(Ft.)
Slope = 0.01000 s(%)= 1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.528 min.
Rainfall intensity = 3.620(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 8.396(CFS)
Total initial stream area = 2.630(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.072(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      804.000 to Point/Station      809.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   670.000(Ft.)
Downstream point/station elevation =   667.500(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.396(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     8.396(CFS)
Normal flow depth in pipe =    8.24(In.)
Flow top width inside pipe =   11.13(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.60(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      804.000 to Point/Station      809.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.630(Ac.)
Runoff from this stream =      8.396(CFS)
Time of concentration =    9.56 min.
Rainfall intensity =     3.612(In/Hr)
Area averaged loss rate (Fm) =    0.0724(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      805.000 to Point/Station      806.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.073(In/Hr)
Initial subarea data:
Initial area flow distance =   300.000(Ft.)
Top (of initial area) elevation =   677.000(Ft.)
Bottom (of initial area) elevation =   674.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    7.477 min.
Rainfall intensity =      4.186(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff =      4.553(CFS)
Total initial stream area =        1.230(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.073(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      806.000 to Point/Station      809.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   670.000(Ft.)
Downstream point/station elevation =   667.500(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.553(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     4.553(CFS)
Normal flow depth in pipe =    7.03(In.)
Flow top width inside pipe =    7.44(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.31(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     7.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      806.000 to Point/Station      809.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.230(Ac.)
Runoff from this stream =      4.553(CFS)
Time of concentration =    7.52 min.
Rainfall intensity =     4.173(In/Hr)
Area averaged loss rate (Fm) =    0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      807.000 to Point/Station      808.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.180
Decimal fraction soil group C = 0.820
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 66.66
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.058(In/Hr)
```

```
Initial subarea data:
Initial area flow distance =   390.000(Ft.)
Top (of initial area) elevation =   676.000(Ft.)
Bottom (of initial area) elevation =   672.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.01026  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.262 min.
Rainfall intensity =      3.943(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff =     18.949(CFS)
Total initial stream area =        5.420(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.058(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      808.000 to Point/Station      809.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   668.000(Ft.)
Downstream point/station elevation =   667.500(Ft.)
Pipe length  =    38.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.949(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    18.949(CFS)
Normal flow depth in pipe =   15.23(In.)
Flow top width inside pipe =   23.11(In.)
Critical Depth =   18.81(In.)
Pipe flow velocity =      9.02(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     8.33 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      808.000 to Point/Station      809.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      5.420(Ac.)
Runoff from this stream =     18.949(CFS)
Time of concentration =    8.33 min.
Rainfall intensity =     3.923(In/Hr)
Area averaged loss rate (Fm) =    0.0583(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      8.40     2.630      9.56    0.072      3.612
```

```
2      4.55     1.230      7.52    0.073      4.173
3     18.95     5.420      8.33    0.058      3.923
Qmax(1) =
         1.000 *    1.000 *     8.396) +
         0.863 *    1.000 *     4.553) +
         0.920 *    1.000 *    18.949) + =      29.750
Qmax(2) =
         1.158 *    0.786 *     8.396) +
         1.000 *    1.000 *     4.553) +
         1.065 *    0.902 *    18.949) + =      30.401
Qmax(3) =
         1.088 *    0.871 *     8.396) +
         0.939 *    1.000 *     4.553) +
         1.000 *    1.000 *    18.949) + =      31.183

Total of 3 main streams to confluence:
Flow rates before confluence point:
       9.396       5.553      19.949
Maximum flow rates at confluence using above data:
       29.750       30.401       31.183
Area of streams before confluence:
        2.630        1.230        5.420
Effective area values after confluence:
        9.280        8.187        8.942


Results of confluence:
Total flow rate =     31.183(CFS)
Time of concentration =     8.333 min.
Effective stream area after confluence  =      8.942(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.064(In/Hr)
Study area total =       9.28(Ac.)
End of computations, Total Study Area =            9.28 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  62.4
```

APPENDIX D.4: UNIT HYDROGRAPH ANALYSIS, CAMPUS ONSITE MITIGATED, AREA G2

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 05/09/25

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6279

ONTARIO RANCH 108.43.25
COMMERCIAL MITIGATED UNIT HYDROGRAPH METHOD HYDROLOGY
AREA G2, 100-YEAR STORM EVENT
FN: UARG2P

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
9.28	1	1.20
Rainfall data for year 100		
9.28	6	3.00
Rainfall data for year 100		
9.28	24	6.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
62.4	62.4	9.28	1.000	0.646	0.100	0.065

Area-averaged adjusted loss rate Fm (In/Hr) = 0.065

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.93	0.100	62.4	62.4	6.03	0.354
8.35	0.900	98.0	98.0	0.20	0.960

Area-averaged catchment yield fraction, Y = 0.900
Area-averaged low loss fraction, Yb = 0.100
User entry of time of concentration = 0.139 (hours)
++
Watershed area = 9.28(Ac.)
Catchment Lag time = 0.111 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 74.9940
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.064(In/Hr)
Average low loss rate fraction (Yb) = 0.100 (decimal)
Note: user entry of the Fm value
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.444(In)
Computed peak 30-minute rainfall = 0.909(In)
Specified peak 1-hour rainfall = 1.200(In)
Computed peak 3-hour rainfall = 2.105(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.000(In)

Rainfall depth area reduction factors:
Using a total area of 9.28(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.444(In)
30-minute factor = 1.000 Adjusted rainfall = 0.909(In)
1-hour factor = 1.000 Adjusted rainfall = 1.199(In)
3-hour factor = 1.000 Adjusted rainfall = 2.105(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 112.23 (CFS))

1	10.006	11.230
2	58.771	54.730
3	91.994	37.285
4	98.466	7.264
5	100.000	1.721

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4439	0.4439
2	0.5858	0.1418
3	0.6889	0.1031
4	0.7729	0.0840
5	0.8451	0.0722
6	0.9090	0.0639
7	0.9668	0.0578
8	1.0199	0.0530
9	1.0691	0.0492
10	1.1151	0.0460
11	1.1584	0.0433
12	1.1995	0.0410
13	1.2496	0.0502
14	1.2979	0.0483
15	1.3446	0.0466
16	1.3897	0.0451
17	1.4335	0.0438
18	1.4761	0.0425
19	1.5175	0.0414
20	1.5578	0.0404
21	1.5972	0.0394
22	1.6357	0.0385
23	1.6733	0.0376
24	1.7102	0.0368
25	1.7463	0.0361
26	1.7817	0.0354
27	1.8164	0.0347
28	1.8505	0.0341
29	1.8841	0.0335
30	1.9170	0.0330
31	1.9495	0.0324
32	1.9814	0.0319
33	2.0129	0.0314
34	2.0439	0.0310
35	2.0744	0.0305
36	2.1045	0.0301
37	2.1342	0.0297
38	2.1635	0.0293
39	2.1925	0.0289
40	2.2210	0.0286
41	2.2493	0.0282
42	2.2772	0.0279
43	2.3047	0.0276
44	2.3320	0.0273
45	2.3589	0.0270

46	2.3856	0.0267
47	2.4120	0.0264
48	2.4381	0.0261
49	2.4639	0.0258
50	2.4895	0.0256
51	2.5149	0.0253
52	2.5400	0.0251
53	2.5648	0.0249
54	2.5895	0.0246
55	2.6139	0.0244
56	2.6381	0.0242
57	2.6621	0.0240
58	2.6859	0.0238
59	2.7094	0.0236
60	2.7328	0.0234
61	2.7560	0.0232
62	2.7790	0.0230
63	2.8019	0.0228
64	2.8245	0.0227
65	2.8470	0.0225
66	2.8693	0.0223
67	2.8915	0.0222
68	2.9135	0.0220
69	2.9353	0.0218
70	2.9570	0.0217
71	2.9785	0.0215
72	2.9999	0.0214
73	3.0207	0.0208
74	3.0413	0.0206
75	3.0618	0.0205
76	3.0821	0.0203
77	3.1023	0.0202
78	3.1224	0.0201
79	3.1424	0.0200
80	3.1622	0.0198
81	3.1819	0.0197
82	3.2015	0.0196
83	3.2209	0.0195
84	3.2403	0.0193
85	3.2595	0.0192
86	3.2786	0.0191
87	3.2976	0.0190
88	3.3165	0.0189
89	3.3353	0.0188
90	3.3540	0.0187
91	3.3726	0.0186
92	3.3911	0.0185
93	3.4095	0.0184
94	3.4277	0.0183
95	3.4459	0.0182
96	3.4640	0.0181
97	3.4820	0.0180
98	3.4999	0.0179

99	3.5177	0.0178
100	3.5354	0.0177
101	3.5531	0.0176
102	3.5706	0.0175
103	3.5881	0.0175
104	3.6055	0.0174
105	3.6228	0.0173
106	3.6400	0.0172
107	3.6571	0.0171
108	3.6741	0.0170
109	3.6911	0.0170
110	3.7080	0.0169
111	3.7248	0.0168
112	3.7416	0.0167
113	3.7582	0.0167
114	3.7748	0.0166
115	3.7914	0.0165
116	3.8078	0.0164
117	3.8242	0.0164
118	3.8405	0.0163
119	3.8567	0.0162
120	3.8729	0.0162
121	3.8890	0.0161
122	3.9050	0.0160
123	3.9210	0.0160
124	3.9369	0.0159
125	3.9528	0.0158
126	3.9685	0.0158
127	3.9843	0.0157
128	3.9999	0.0157
129	4.0155	0.0156
130	4.0310	0.0155
131	4.0465	0.0155
132	4.0619	0.0154
133	4.0773	0.0154
134	4.0926	0.0153
135	4.1078	0.0152
136	4.1230	0.0152
137	4.1381	0.0151
138	4.1532	0.0151
139	4.1682	0.0150
140	4.1832	0.0150
141	4.1981	0.0149
142	4.2130	0.0149
143	4.2278	0.0148
144	4.2426	0.0148
145	4.2573	0.0147
146	4.2719	0.0147
147	4.2865	0.0146
148	4.3011	0.0146
149	4.3156	0.0145
150	4.3300	0.0145
151	4.3445	0.0144

152	4.3588	0.0144
153	4.3731	0.0143
154	4.3874	0.0143
155	4.4016	0.0142
156	4.4158	0.0142
157	4.4299	0.0141
158	4.4440	0.0141
159	4.4581	0.0140
160	4.4721	0.0140
161	4.4860	0.0140
162	4.4999	0.0139
163	4.5138	0.0139
164	4.5276	0.0138
165	4.5414	0.0138
166	4.5551	0.0137
167	4.5688	0.0137
168	4.5825	0.0137
169	4.5961	0.0136
170	4.6097	0.0136
171	4.6232	0.0135
172	4.6367	0.0135
173	4.6502	0.0135
174	4.6636	0.0134
175	4.6770	0.0134
176	4.6903	0.0133
177	4.7036	0.0133
178	4.7169	0.0133
179	4.7301	0.0132
180	4.7433	0.0132
181	4.7565	0.0132
182	4.7696	0.0131
183	4.7827	0.0131
184	4.7957	0.0131
185	4.8088	0.0130
186	4.8217	0.0130
187	4.8347	0.0129
188	4.8476	0.0129
189	4.8605	0.0129
190	4.8733	0.0128
191	4.8861	0.0128
192	4.8989	0.0128
193	4.9116	0.0127
194	4.9243	0.0127
195	4.9370	0.0127
196	4.9497	0.0126
197	4.9623	0.0126
198	4.9749	0.0126
199	4.9874	0.0125
200	4.9999	0.0125
201	5.0124	0.0125
202	5.0249	0.0125
203	5.0373	0.0124
204	5.0497	0.0124

205	5.0620	0.0124
206	5.0744	0.0123
207	5.0867	0.0123
208	5.0989	0.0123
209	5.1112	0.0122
210	5.1234	0.0122
211	5.1356	0.0122
212	5.1477	0.0122
213	5.1599	0.0121
214	5.1720	0.0121
215	5.1840	0.0121
216	5.1961	0.0120
217	5.2081	0.0120
218	5.2201	0.0120
219	5.2320	0.0120
220	5.2440	0.0119
221	5.2559	0.0119
222	5.2677	0.0119
223	5.2796	0.0119
224	5.2914	0.0118
225	5.3032	0.0118
226	5.3150	0.0118
227	5.3267	0.0117
228	5.3385	0.0117
229	5.3502	0.0117
230	5.3618	0.0117
231	5.3735	0.0116
232	5.3851	0.0116
233	5.3967	0.0116
234	5.4083	0.0116
235	5.4198	0.0115
236	5.4313	0.0115
237	5.4428	0.0115
238	5.4543	0.0115
239	5.4657	0.0114
240	5.4771	0.0114
241	5.4885	0.0114
242	5.4999	0.0114
243	5.5113	0.0114
244	5.5226	0.0113
245	5.5339	0.0113
246	5.5452	0.0113
247	5.5565	0.0113
248	5.5677	0.0112
249	5.5789	0.0112
250	5.5901	0.0112
251	5.6013	0.0112
252	5.6124	0.0111
253	5.6235	0.0111
254	5.6346	0.0111
255	5.6457	0.0111
256	5.6568	0.0111
257	5.6678	0.0110

258	5.6788	0.0110
259	5.6898	0.0110
260	5.7008	0.0110
261	5.7118	0.0110
262	5.7227	0.0109
263	5.7336	0.0109
264	5.7445	0.0109
265	5.7554	0.0109
266	5.7662	0.0108
267	5.7770	0.0108
268	5.7878	0.0108
269	5.7986	0.0108
270	5.8094	0.0108
271	5.8202	0.0107
272	5.8309	0.0107
273	5.8416	0.0107
274	5.8523	0.0107
275	5.8629	0.0107
276	5.8736	0.0107
277	5.8842	0.0106
278	5.8948	0.0106
279	5.9054	0.0106
280	5.9160	0.0106
281	5.9266	0.0106
282	5.9371	0.0105
283	5.9476	0.0105
284	5.9581	0.0105
285	5.9686	0.0105
286	5.9791	0.0105
287	5.9895	0.0104
288	5.9999	0.0104

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0104	0.0010	0.0094
2	0.0104	0.0010	0.0094
3	0.0105	0.0011	0.0094
4	0.0105	0.0011	0.0094
5	0.0105	0.0011	0.0095
6	0.0106	0.0011	0.0095
7	0.0106	0.0011	0.0095
8	0.0106	0.0011	0.0095
9	0.0107	0.0011	0.0096
10	0.0107	0.0011	0.0096
11	0.0107	0.0011	0.0096
12	0.0107	0.0011	0.0097
13	0.0108	0.0011	0.0097
14	0.0108	0.0011	0.0097
15	0.0108	0.0011	0.0097
16	0.0108	0.0011	0.0098
17	0.0109	0.0011	0.0098

18	0.0109	0.0011	0.0098
19	0.0110	0.0011	0.0099
20	0.0110	0.0011	0.0099
21	0.0110	0.0011	0.0099
22	0.0110	0.0011	0.0099
23	0.0111	0.0011	0.0100
24	0.0111	0.0011	0.0100
25	0.0111	0.0011	0.0100
26	0.0112	0.0011	0.0100
27	0.0112	0.0011	0.0101
28	0.0112	0.0011	0.0101
29	0.0113	0.0011	0.0102
30	0.0113	0.0011	0.0102
31	0.0114	0.0011	0.0102
32	0.0114	0.0011	0.0102
33	0.0114	0.0011	0.0103
34	0.0114	0.0011	0.0103
35	0.0115	0.0012	0.0103
36	0.0115	0.0012	0.0104
37	0.0116	0.0012	0.0104
38	0.0116	0.0012	0.0104
39	0.0116	0.0012	0.0105
40	0.0117	0.0012	0.0105
41	0.0117	0.0012	0.0105
42	0.0117	0.0012	0.0106
43	0.0118	0.0012	0.0106
44	0.0118	0.0012	0.0106
45	0.0119	0.0012	0.0107
46	0.0119	0.0012	0.0107
47	0.0120	0.0012	0.0108
48	0.0120	0.0012	0.0108
49	0.0120	0.0012	0.0108
50	0.0121	0.0012	0.0109
51	0.0121	0.0012	0.0109
52	0.0122	0.0012	0.0109
53	0.0122	0.0012	0.0110
54	0.0122	0.0012	0.0110
55	0.0123	0.0012	0.0111
56	0.0123	0.0012	0.0111
57	0.0124	0.0012	0.0111
58	0.0124	0.0012	0.0112
59	0.0125	0.0013	0.0112
60	0.0125	0.0013	0.0113
61	0.0126	0.0013	0.0113
62	0.0126	0.0013	0.0113
63	0.0127	0.0013	0.0114
64	0.0127	0.0013	0.0114
65	0.0128	0.0013	0.0115
66	0.0128	0.0013	0.0115
67	0.0129	0.0013	0.0116
68	0.0129	0.0013	0.0116
69	0.0130	0.0013	0.0117
70	0.0130	0.0013	0.0117

71	0.0131	0.0013	0.0118
72	0.0131	0.0013	0.0118
73	0.0132	0.0013	0.0119
74	0.0132	0.0013	0.0119
75	0.0133	0.0013	0.0120
76	0.0133	0.0013	0.0120
77	0.0134	0.0013	0.0121
78	0.0135	0.0014	0.0121
79	0.0135	0.0014	0.0122
80	0.0136	0.0014	0.0122
81	0.0137	0.0014	0.0123
82	0.0137	0.0014	0.0123
83	0.0138	0.0014	0.0124
84	0.0138	0.0014	0.0124
85	0.0139	0.0014	0.0125
86	0.0140	0.0014	0.0126
87	0.0140	0.0014	0.0126
88	0.0141	0.0014	0.0127
89	0.0142	0.0014	0.0128
90	0.0142	0.0014	0.0128
91	0.0143	0.0014	0.0129
92	0.0144	0.0014	0.0129
93	0.0145	0.0015	0.0130
94	0.0145	0.0015	0.0131
95	0.0146	0.0015	0.0131
96	0.0147	0.0015	0.0132
97	0.0148	0.0015	0.0133
98	0.0148	0.0015	0.0133
99	0.0149	0.0015	0.0134
100	0.0150	0.0015	0.0135
101	0.0151	0.0015	0.0136
102	0.0151	0.0015	0.0136
103	0.0152	0.0015	0.0137
104	0.0153	0.0015	0.0138
105	0.0154	0.0015	0.0139
106	0.0155	0.0016	0.0139
107	0.0156	0.0016	0.0140
108	0.0157	0.0016	0.0141
109	0.0158	0.0016	0.0142
110	0.0158	0.0016	0.0143
111	0.0160	0.0016	0.0144
112	0.0160	0.0016	0.0144
113	0.0162	0.0016	0.0145
114	0.0162	0.0016	0.0146
115	0.0164	0.0016	0.0147
116	0.0164	0.0016	0.0148
117	0.0166	0.0017	0.0149
118	0.0167	0.0017	0.0150
119	0.0168	0.0017	0.0151
120	0.0169	0.0017	0.0152
121	0.0170	0.0017	0.0153
122	0.0171	0.0017	0.0154
123	0.0173	0.0017	0.0156

124	0.0174	0.0017	0.0156
125	0.0175	0.0018	0.0158
126	0.0176	0.0018	0.0159
127	0.0178	0.0018	0.0160
128	0.0179	0.0018	0.0161
129	0.0181	0.0018	0.0163
130	0.0182	0.0018	0.0164
131	0.0184	0.0018	0.0165
132	0.0185	0.0019	0.0166
133	0.0187	0.0019	0.0168
134	0.0188	0.0019	0.0169
135	0.0190	0.0019	0.0171
136	0.0191	0.0019	0.0172
137	0.0193	0.0019	0.0174
138	0.0195	0.0020	0.0175
139	0.0197	0.0020	0.0177
140	0.0198	0.0020	0.0178
141	0.0201	0.0020	0.0181
142	0.0202	0.0020	0.0182
143	0.0205	0.0021	0.0184
144	0.0206	0.0021	0.0186
145	0.0214	0.0021	0.0192
146	0.0215	0.0022	0.0194
147	0.0218	0.0022	0.0196
148	0.0220	0.0022	0.0198
149	0.0223	0.0022	0.0201
150	0.0225	0.0023	0.0202
151	0.0228	0.0023	0.0205
152	0.0230	0.0023	0.0207
153	0.0234	0.0023	0.0210
154	0.0236	0.0024	0.0212
155	0.0240	0.0024	0.0216
156	0.0242	0.0024	0.0218
157	0.0246	0.0025	0.0222
158	0.0249	0.0025	0.0224
159	0.0253	0.0025	0.0228
160	0.0256	0.0026	0.0230
161	0.0261	0.0026	0.0235
162	0.0264	0.0026	0.0237
163	0.0270	0.0027	0.0243
164	0.0273	0.0027	0.0245
165	0.0279	0.0028	0.0251
166	0.0282	0.0028	0.0254
167	0.0289	0.0029	0.0260
168	0.0293	0.0029	0.0264
169	0.0301	0.0030	0.0271
170	0.0305	0.0031	0.0275
171	0.0314	0.0032	0.0283
172	0.0319	0.0032	0.0287
173	0.0330	0.0033	0.0297
174	0.0335	0.0034	0.0302
175	0.0347	0.0035	0.0313
176	0.0354	0.0036	0.0319

177	0.0368	0.0037	0.0331
178	0.0376	0.0038	0.0339
179	0.0394	0.0040	0.0354
180	0.0404	0.0040	0.0363
181	0.0425	0.0043	0.0383
182	0.0438	0.0044	0.0394
183	0.0466	0.0047	0.0420
184	0.0483	0.0048	0.0435
185	0.0410	0.0041	0.0369
186	0.0433	0.0043	0.0390
187	0.0492	0.0049	0.0443
188	0.0530	0.0053	0.0477
189	0.0639	0.0053	0.0586
190	0.0722	0.0053	0.0668
191	0.1031	0.0053	0.0978
192	0.1418	0.0053	0.1365
193	0.4439	0.0053	0.4386
194	0.0840	0.0053	0.0787
195	0.0578	0.0053	0.0525
196	0.0460	0.0046	0.0414
197	0.0502	0.0050	0.0451
198	0.0451	0.0045	0.0406
199	0.0414	0.0042	0.0373
200	0.0385	0.0039	0.0346
201	0.0361	0.0036	0.0325
202	0.0341	0.0034	0.0307
203	0.0324	0.0033	0.0292
204	0.0310	0.0031	0.0279
205	0.0297	0.0030	0.0267
206	0.0286	0.0029	0.0257
207	0.0276	0.0028	0.0248
208	0.0267	0.0027	0.0240
209	0.0258	0.0026	0.0233
210	0.0251	0.0025	0.0226
211	0.0244	0.0024	0.0220
212	0.0238	0.0024	0.0214
213	0.0232	0.0023	0.0209
214	0.0227	0.0023	0.0204
215	0.0222	0.0022	0.0199
216	0.0217	0.0022	0.0195
217	0.0208	0.0021	0.0187
218	0.0203	0.0020	0.0183
219	0.0200	0.0020	0.0180
220	0.0196	0.0020	0.0176
221	0.0192	0.0019	0.0173
222	0.0189	0.0019	0.0170
223	0.0186	0.0019	0.0167
224	0.0183	0.0018	0.0164
225	0.0180	0.0018	0.0162
226	0.0177	0.0018	0.0159
227	0.0175	0.0018	0.0157
228	0.0172	0.0017	0.0155
229	0.0170	0.0017	0.0153

230	0.0167	0.0017	0.0151
231	0.0165	0.0017	0.0149
232	0.0163	0.0016	0.0147
233	0.0161	0.0016	0.0145
234	0.0159	0.0016	0.0143
235	0.0157	0.0016	0.0141
236	0.0155	0.0016	0.0140
237	0.0154	0.0015	0.0138
238	0.0152	0.0015	0.0137
239	0.0150	0.0015	0.0135
240	0.0149	0.0015	0.0134
241	0.0147	0.0015	0.0132
242	0.0146	0.0015	0.0131
243	0.0144	0.0014	0.0130
244	0.0143	0.0014	0.0128
245	0.0141	0.0014	0.0127
246	0.0140	0.0014	0.0126
247	0.0139	0.0014	0.0125
248	0.0137	0.0014	0.0124
249	0.0136	0.0014	0.0123
250	0.0135	0.0014	0.0121
251	0.0134	0.0013	0.0120
252	0.0133	0.0013	0.0119
253	0.0132	0.0013	0.0118
254	0.0131	0.0013	0.0117
255	0.0129	0.0013	0.0116
256	0.0128	0.0013	0.0116
257	0.0127	0.0013	0.0115
258	0.0126	0.0013	0.0114
259	0.0125	0.0013	0.0113
260	0.0125	0.0012	0.0112
261	0.0124	0.0012	0.0111
262	0.0123	0.0012	0.0110
263	0.0122	0.0012	0.0110
264	0.0121	0.0012	0.0109
265	0.0120	0.0012	0.0108
266	0.0119	0.0012	0.0107
267	0.0119	0.0012	0.0107
268	0.0118	0.0012	0.0106
269	0.0117	0.0012	0.0105
270	0.0116	0.0012	0.0105
271	0.0115	0.0012	0.0104
272	0.0115	0.0012	0.0103
273	0.0114	0.0011	0.0103
274	0.0113	0.0011	0.0102
275	0.0113	0.0011	0.0101
276	0.0112	0.0011	0.0101
277	0.0111	0.0011	0.0100
278	0.0111	0.0011	0.0100
279	0.0110	0.0011	0.0099
280	0.0109	0.0011	0.0098
281	0.0109	0.0011	0.0098
282	0.0108	0.0011	0.0097

283	0.0107	0.0011	0.0097
284	0.0107	0.0011	0.0096
285	0.0106	0.0011	0.0096
286	0.0106	0.0011	0.0095
287	0.0105	0.0011	0.0095
288	0.0105	0.0010	0.0094

Total soil rain loss = 0.54(In)
Total effective rainfall = 5.46(In)
Peak flow rate in flood hydrograph = 30.80(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	10.0	20.0	30.0	40.0
0+ 5	0.0007	0.11	Q				
0+10	0.0050	0.62	Q				
0+15	0.0117	0.97	Q				
0+20	0.0188	1.04	VQ				
0+25	0.0261	1.06	VQ				
0+30	0.0334	1.06	VQ				
0+35	0.0408	1.07	VQ				
0+40	0.0481	1.07	VQ				
0+45	0.0555	1.07	VQ				
0+50	0.0629	1.07	VQ				
0+55	0.0703	1.08	VQ				
1+ 0	0.0778	1.08	VQ				
1+ 5	0.0852	1.08	VQ				
1+10	0.0927	1.09	VQ				
1+15	0.1002	1.09	VQ				
1+20	0.1077	1.09	|Q				
1+25	0.1152	1.09	|Q				
1+30	0.1228	1.10	|Q				
1+35	0.1304	1.10	|Q				
1+40	0.1380	1.10	|Q				
1+45	0.1456	1.11	|Q				
1+50	0.1533	1.11	|Q				
1+55	0.1609	1.11	|Q				
2+ 0	0.1686	1.12	|Q				
2+ 5	0.1763	1.12	|Q				
2+10	0.1841	1.12	|Q				
2+15	0.1918	1.13	|Q				
2+20	0.1996	1.13	|Q				
2+25	0.2074	1.13	|Q				
2+30	0.2153	1.14	|QV				
2+35	0.2231	1.14	|QV				
2+40	0.2310	1.14	|QV				

```
2+45       0.2389      1.15  |QV       |         |         |         |
2+50       0.2468      1.15  |QV       |         |         |         |
2+55       0.2548      1.15  |QV       |         |         |         |
3+ 0       0.2628      1.16  |QV       |         |         |         |
3+ 5       0.2708      1.16  |QV       |         |         |         |
3+10       0.2788      1.17  |QV       |         |         |         |
3+15       0.2869      1.17  |QV       |         |         |         |
3+20       0.2949      1.17  |QV       |         |         |         |
3+25       0.3031      1.18  |QV       |         |         |         |
3+30       0.3112      1.18  |QV       |         |         |         |
3+35       0.3194      1.19  |Q V      |         |         |         |
3+40       0.3275      1.19  |Q V      |         |         |         |
3+45       0.3358      1.19  |Q V      |         |         |         |
3+50       0.3440      1.20  |Q V      |         |         |         |
3+55       0.3523      1.20  |Q V      |         |         |         |
4+ 0       0.3606      1.21  |Q V      |         |         |         |
4+ 5       0.3689      1.21  |Q V      |         |         |         |
4+10       0.3773      1.21  |Q V      |         |         |         |
4+15       0.3856      1.22  |Q V      |         |         |         |
4+20       0.3941      1.22  |Q V      |         |         |         |
4+25       0.4025      1.23  |Q V      |         |         |         |
4+30       0.4110      1.23  |Q V      |         |         |         |
4+35       0.4195      1.24  |Q V      |         |         |         |
4+40       0.4280      1.24  |Q  V     |         |         |         |
4+45       0.4366      1.24  |Q  V     |         |         |         |
4+50       0.4452      1.25  |Q  V     |         |         |         |
4+55       0.4538      1.25  |Q  V     |         |         |         |
5+ 0       0.4625      1.26  |Q  V     |         |         |         |
5+ 5       0.4712      1.26  |Q  V     |         |         |         |
5+10       0.4799      1.27  |Q  V     |         |         |         |
5+15       0.4887      1.27  |Q  V     |         |         |         |
5+20       0.4975      1.28  |Q  V     |         |         |         |
5+25       0.5063      1.28  |Q  V     |         |         |         |
5+30       0.5152      1.29  |Q  V     |         |         |         |
5+35       0.5241      1.29  |Q  V     |         |         |         |
5+40       0.5330      1.30  |Q   V    |         |         |         |
5+45       0.5420      1.30  |Q   V    |         |         |         |
5+50       0.5510      1.31  |Q   V    |         |         |         |
5+55       0.5600      1.31  |Q   V    |         |         |         |
6+ 0       0.5691      1.32  |Q   V    |         |         |         |
6+ 5       0.5782      1.32  |Q   V    |         |         |         |
6+10       0.5874      1.33  |Q   V    |         |         |         |
6+15       0.5966      1.33  |Q   V    |         |         |         |
6+20       0.6058      1.34  |Q   V    |         |         |         |
6+25       0.6151      1.35  |Q   V    |         |         |         |
6+30       0.6244      1.35  |Q   V    |         |         |         |
6+35       0.6337      1.36  |Q    V   |         |         |         |
6+40       0.6431      1.36  |Q    V   |         |         |         |
6+45       0.6525      1.37  |Q    V   |         |         |         |
6+50       0.6620      1.38  |Q    V   |         |         |         |
6+55       0.6715      1.38  |Q    V   |         |         |         |
7+ 0       0.6811      1.39  |Q    V   |         |         |         |
7+ 5       0.6907      1.39  |Q    V   |         |         |         |
```

7+10	0.7003	1.40	|Q	V |	|	|	|
7+15	0.7100	1.41	|Q	V |	|	|	|
7+20	0.7198	1.41	|Q	V |	|	|	|
7+25	0.7296	1.42	|Q	V |	|	|	|
7+30	0.7394	1.43	|Q	V |	|	|	|
7+35	0.7493	1.43	|Q	V |	|	|	|
7+40	0.7592	1.44	|Q	V |	|	|	|
7+45	0.7692	1.45	|Q	V |	|	|	|
7+50	0.7792	1.46	|Q	V |	|	|	|
7+55	0.7893	1.46	|Q	V |	|	|	|
8+ 0	0.7994	1.47	|Q	V |	|	|	|
8+ 5	0.8096	1.48	|Q	V |	|	|	|
8+10	0.8198	1.49	|Q	V |	|	|	|
8+15	0.8301	1.49	|Q	V |	|	|	|
8+20	0.8404	1.50	|Q	V |	|	|	|
8+25	0.8508	1.51	|Q	V |	|	|	|
8+30	0.8613	1.52	|Q	V |	|	|	|
8+35	0.8718	1.53	|Q	V |	|	|	|
8+40	0.8824	1.53	|Q	V |	|	|	|
8+45	0.8930	1.54	|Q	V |	|	|	|
8+50	0.9037	1.55	|Q	V |	|	|	|
8+55	0.9144	1.56	|Q	V |	|	|	|
9+ 0	0.9252	1.57	|Q	V |	|	|	|
9+ 5	0.9361	1.58	|Q	V |	|	|	|
9+10	0.9470	1.59	|Q	V |	|	|	|
9+15	0.9580	1.60	|Q	V|	|	|	|
9+20	0.9691	1.61	|Q	V|	|	|	|
9+25	0.9802	1.62	|Q	V|	|	|	|
9+30	0.9914	1.63	|Q	V|	|	|	|
9+35	1.0027	1.64	|Q	V|	|	|	|
9+40	1.0141	1.65	|Q	V|	|	|	|
9+45	1.0255	1.66	|Q	V|	|	|	|
9+50	1.0370	1.67	|Q	V|	|	|	|
9+55	1.0486	1.68	|Q	V|	|	|	|
10+ 0	1.0602	1.69	|Q	V	|	|	|
10+ 5	1.0719	1.70	|Q	V	|	|	|
10+10	1.0837	1.72	|Q	V	|	|	|
10+15	1.0956	1.73	|Q	V	|	|	|
10+20	1.1076	1.74	|Q	V	|	|	|
10+25	1.1197	1.75	|Q	V	|	|	|
10+30	1.1318	1.76	|Q	V	|	|	|
10+35	1.1441	1.78	|Q	V	|	|	|
10+40	1.1564	1.79	|Q	V	|	|	|
10+45	1.1688	1.80	|Q	|V	|	|	|
10+50	1.1814	1.82	|Q	|V	|	|	|
10+55	1.1940	1.83	|Q	|V	|	|	|
11+ 0	1.2067	1.85	|Q	|V	|	|	|
11+ 5	1.2195	1.86	|Q	|V	|	|	|
11+10	1.2325	1.88	|Q	|V	|	|	|
11+15	1.2455	1.89	|Q	|V	|	|	|
11+20	1.2587	1.91	|Q	|V	|	|	|
11+25	1.2719	1.93	|Q	| V	|	|	|
11+30	1.2853	1.94	|Q	| V	|	|	|

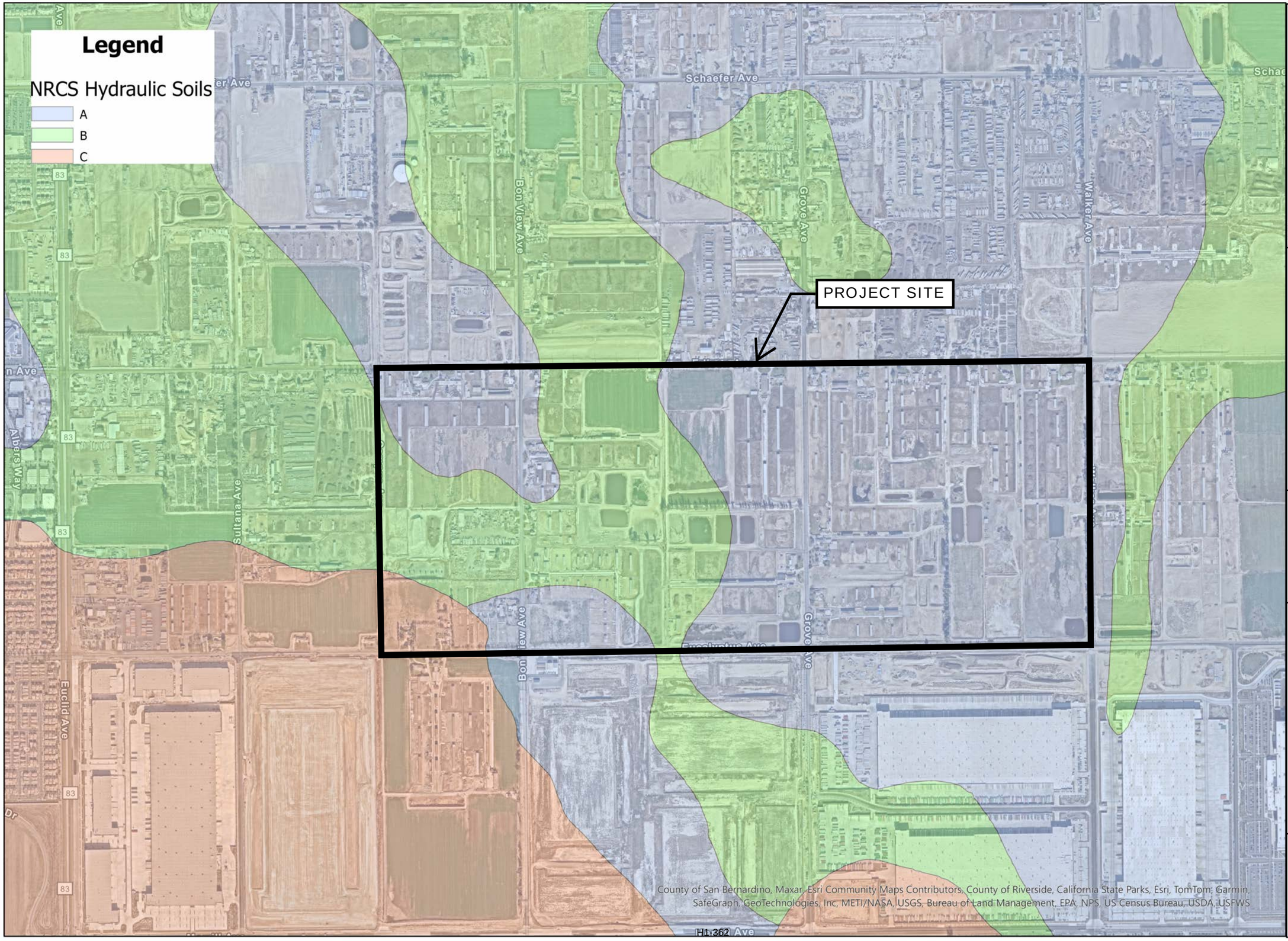
11+35	1.2988	1.96	Q	V			
11+40	1.3124	1.98	Q	V			
11+45	1.3262	2.00	Q	V			
11+50	1.3401	2.02	Q	V			
11+55	1.3541	2.04	Q	V			
12+ 0	1.3683	2.06	Q	V			
12+ 5	1.3826	2.08	Q	V			
12+10	1.3973	2.13	Q	V			
12+15	1.4122	2.16	Q	V			
12+20	1.4273	2.19	Q	V			
12+25	1.4425	2.21	Q	V			
12+30	1.4579	2.24	Q	V			
12+35	1.4735	2.26	Q	V			
12+40	1.4893	2.29	Q	V			
12+45	1.5053	2.32	Q	V			
12+50	1.5214	2.35	Q	V			
12+55	1.5378	2.37	Q	V			
13+ 0	1.5543	2.41	Q	V			
13+ 5	1.5711	2.44	Q	V			
13+10	1.5881	2.47	Q	V			
13+15	1.6054	2.50	Q	V			
13+20	1.6228	2.54	Q	V			
13+25	1.6406	2.57	Q	V			
13+30	1.6586	2.61	Q	V			
13+35	1.6769	2.65	Q	V			
13+40	1.6954	2.70	Q	V			
13+45	1.7143	2.74	Q	V			
13+50	1.7335	2.79	Q	V			
13+55	1.7531	2.84	Q	V			
14+ 0	1.7730	2.89	Q	V			
14+ 5	1.7933	2.95	Q	V			
14+10	1.8140	3.01	Q	V			
14+15	1.8351	3.07	Q	V			
14+20	1.8567	3.14	Q	V			
14+25	1.8788	3.21	Q	V			
14+30	1.9015	3.29	Q	V			
14+35	1.9246	3.37	Q	V			
14+40	1.9485	3.46	Q	V			
14+45	1.9729	3.55	Q	V			
14+50	1.9981	3.66	Q	V			
14+55	2.0241	3.77	Q	V			
15+ 0	2.0510	3.91	Q	V			
15+ 5	2.0788	4.04	Q	V			
15+10	2.1078	4.21	Q	V			
15+15	2.1380	4.38	Q	V			
15+20	2.1696	4.59	Q	V			
15+25	2.2020	4.71	Q	V			
15+30	2.2327	4.45	Q	V			
15+35	2.2630	4.40	Q	V			
15+40	2.2957	4.76	Q	V			
15+45	2.3320	5.27	Q	V			
15+50	2.3742	6.13	Q	V			
15+55	2.4249	7.36	Q	V			

| | | |

```
  20+25       3.8463      1.45  |Q        |         |         |     V   |
  20+30       3.8562      1.43  |Q        |         |         |     V   |
  20+35       3.8660      1.42  |Q        |         |         |     V   |
  20+40       3.8757      1.41  |Q        |         |         |     V   |
  20+45       3.8852      1.39  |Q        |         |         |     V   |
  20+50       3.8947      1.38  |Q        |         |         |     V   |
  20+55       3.9042      1.37  |Q        |         |         |      V  |
  21+ 0       3.9135      1.36  |Q        |         |         |      V  |
  21+ 5       3.9228      1.34  |Q        |         |         |      V  |
  21+10       3.9320      1.33  |Q        |         |         |      V  |
  21+15       3.9411      1.32  |Q        |         |         |      V  |
  21+20       3.9501      1.31  |Q        |         |         |      V  |
  21+25       3.9591      1.30  |Q        |         |         |      V  |
  21+30       3.9679      1.29  |Q        |         |         |      V  |
  21+35       3.9768      1.28  |Q        |         |         |      V  |
  21+40       3.9855      1.27  |Q        |         |         |      V  |
  21+45       3.9942      1.26  |Q        |         |         |      V  |
  21+50       4.0028      1.25  |Q        |         |         |      V  |
  21+55       4.0114      1.24  |Q        |         |         |       V |
  22+ 0       4.0199      1.23  |Q        |         |         |       V |
  22+ 5       4.0283      1.23  |Q        |         |         |       V |
  22+10       4.0367      1.22  |Q        |         |         |       V |
  22+15       4.0450      1.21  |Q        |         |         |       V |
  22+20       4.0533      1.20  |Q        |         |         |       V |
  22+25       4.0615      1.19  |Q        |         |         |       V |
  22+30       4.0696      1.18  |Q        |         |         |       V |
  22+35       4.0777      1.18  |Q        |         |         |       V |
  22+40       4.0858      1.17  |Q        |         |         |       V |
  22+45       4.0938      1.16  |Q        |         |         |       V |
  22+50       4.1017      1.15  |Q        |         |         |       V |
  22+55       4.1096      1.15  |Q        |         |         |       V |
  23+ 0       4.1175      1.14  |Q        |         |         |        V|
  23+ 5       4.1253      1.13  |Q        |         |         |        V|
  23+10       4.1330      1.13  |Q        |         |         |        V|
  23+15       4.1408      1.12  |Q        |         |         |        V|
  23+20       4.1484      1.11  |Q        |         |         |        V|
  23+25       4.1560      1.11  |Q        |         |         |        V|
  23+30       4.1636      1.10  |Q        |         |         |        V|
  23+35       4.1712      1.09  |Q        |         |         |        V|
  23+40       4.1786      1.09  |Q        |         |         |        V|
  23+45       4.1861      1.08  |Q        |         |         |        V|
  23+50       4.1935      1.08  |Q        |         |         |        V|
  23+55       4.2009      1.07  |Q        |         |         |        V|
  24+ 0       4.2082      1.06  |Q        |         |         |        V|
  24+ 5       4.2148      0.95  Q         |         |         |        V|
  24+10       4.2178      0.44  Q         |         |         |        V|
  24+15       4.2184      0.08  Q         |         |         |        V|
  24+20       4.2185      0.02  Q         |         |         |        V|
-------------------------------------------------------------------------
```

EXCERPTS

EXCERPT A: NRCS HYDRAULIC SOILS MAP



TITLE
NRCS HYDRAULIC SOILS MAP

PROJECT
ONTARIO RANCH
Ontario, CA

N

SCALE 1:10,000

DATE 5/12/25

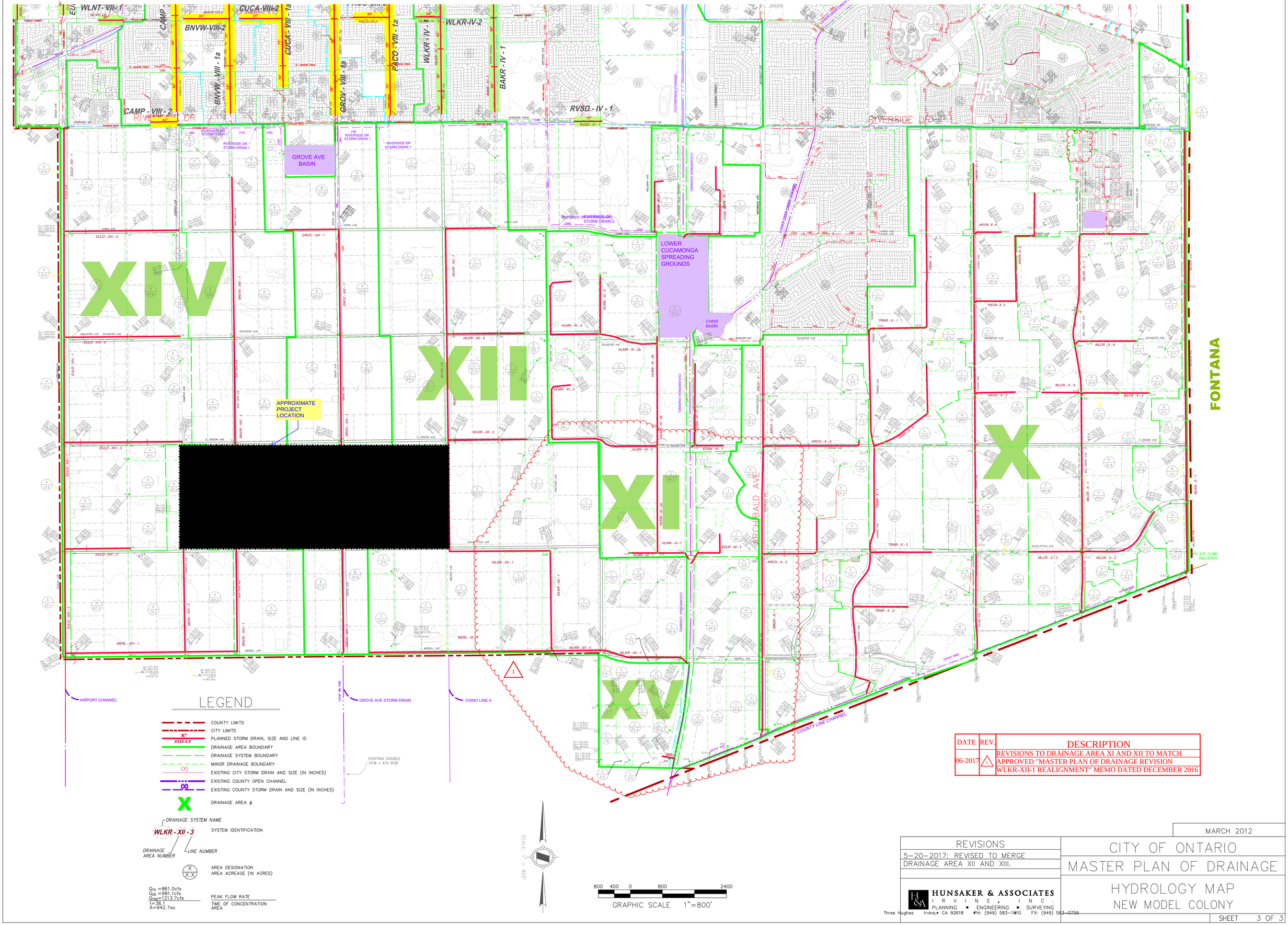
JLC Engineering & Consulting, Inc.
MURRIETA, CA 92562
Office 951.304.9552 Fax 951.304.3568

FILE NAME:

EXCERPT

A

EXCERPT B: CITY OF ONTARIO MASTER DRAINAGE PLAN HYDROLOGY MAP



LEGEND

- COUNTY LIMITS
- CITY LIMITS
- X" / XXXX-X-X — PLANNED STORM DRAIN, SIZE AND LINE ID
- DRAINAGE AREA BOUNDARY
- DRAINAGE SYSTEM BOUNDARY
- MINOR DRAINAGE BOUNDARY
- (X) — EXISTING CITY STORM DRAIN AND SIZE (IN INCHES)
- EXISTING COUNTY OPEN CHANNEL
- EXISTING COUNTY STORM DRAIN AND SIZE (IN INCHES)
- X — DRAINAGE AREA #

DRAINAGE SYSTEM NAME — WLKR - XII - 3 — SYSTEM IDENTIFICATION

DRAINAGE AREA NUMBER — LINE NUMBER

X / XX — AREA DESIGNATION, AREA ACREAGE (IN ACRES)

Q_{10} =861.0cfs
Q_{25} =981.1cfs
Q_{100}=1213.7cfs — PEAK FLOW RATE
t=36.1 — TIME OF CONCENTRATION
A=942.7ac — AREA

SCALE: 1" = 800'

800 400 0 800 2400
GRAPHIC SCALE 1"=800'

DATE	REV.	DESCRIPTION
06-2017	1	REVISIONS TO DRAINAGE AREA XI AND XII TO MATCH APPROVED "MASTER PLAN OF DRAINAGE REVISION WLKR-XII-1 REALIGNMENT" MEMO DATED DECEMBER 2016

MARCH 2012

REVISIONS
5-20-2017: REVISED TO MERGE DRAINAGE AREA XII AND XIII.

CITY OF ONTARIO
MASTER PLAN OF DRAINAGE
HYDROLOGY MAP
NEW MODEL COLONY

HUNSAKER & ASSOCIATES
IRVINE, INC
PLANNING ■ ENGINEERING ■ SURVEYING
Three Hughes Irvine, CA 92618 Ph: (949) 583-1010 FX: (949) 583-0759

SHEET 3 OF 3

PLOTTED 12/12/2017 1:53 PM \\TUSFS1\HFIProject\140152\Eng\140152-0000\Hm\Hydrology Report\MPD Update\Civil 3D Files\New Model Hydrology Map Update.dwg

EXCERPT C: CITY OF ONTARIO MASTER DRAINAGE PLAN PLANNED FACILITIES MAP

CITY OF ONTARIO

PLANNED FACILITIES MAP

LEGEND

- PLANNED STORM DRAIN, SIZE AND LINE ID (XXXX-X-X)
- COUNTY LIMIT
- CITY LIMIT
- DRAINAGE AREA BOUNDARY
- DRAINAGE SYSTEM BOUNDARY
- EXISTING COUNTY OPEN CHANNEL
- EXISTING COUNTY STORM DRAIN AND SIZE (IN INCHES)
- EXISTING CALTRANS STORM DRAIN
- EXISTING GRASS LINED CHANNEL (MAINTAINED BY PROPERTY OWNER)
- EXISTING CITY OPEN CHANNEL
- EXISTING CITY STORM DRAIN AND SIZE (IN INCHES)
- FUTURE NEIGHBORING CITIES STORM DRAIN AND SIZE (IN INCHES)
- EXISTING NEIGHBORING CITIES STORM DRAIN AND SIZE (IN INCHES)
- EXISTING DETENTION BASIN (MAINTAINED BY OTHER AGENCIES)
- (P) PARALLEL TO EXISTING STORM DRAIN
- X DRAINAGE AREA #
- DRAINAGE SYSTEM NAME — WLKR - XII - 3 — SYSTEM IDENTIFICATION (DRAINAGE AREA NUMBER, LINE NUMBER)

APPROXIMATE PROJECT LOCATION

GRAPHIC SCALE 1"=1,600'

DATE	REV.	DESCRIPTION
06-2017	1	REVISIONS TO DRAINAGE AREA XI AND XII TO MATCH APPROVED "MASTER PLAN OF DRAINAGE REVISION WLKR-XII-1 REALIGNMENT" MEMO DATED DECEMBER 2016

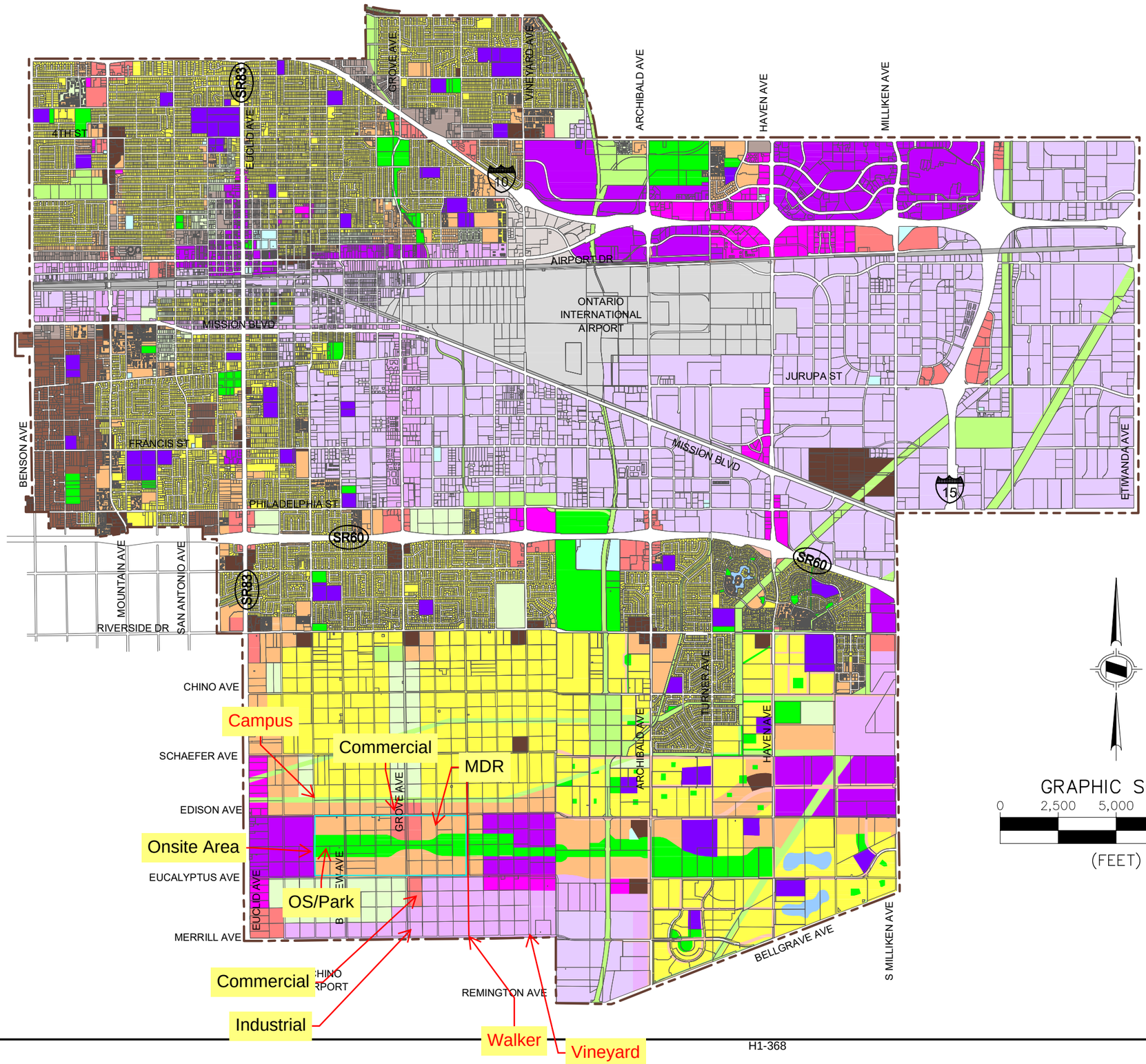
EXHIBIT 8
MARCH 2012
CITY OF ONTARIO
MASTER PLAN OF DRAINAGE

H1-366

F: \0641\Engineering\SY_SD Master Plan\Rpt_SD Master Plan\Exh 8 - PLANNED FACILITIES.dwg

03/09/2018

EXCERPT D: CITY OF ONTARIO MASTER DRAINAGE PLAN LAND USE MAP



H1-368

Residential

- Rural
- Low Density
- Low - Medium Density
- Medium Density
- High Density

Retail/Service

- Neighborhood Commercial
- General Commercial
- Office Commercial
- Hospitality

Employment

- Business Park
- Industrial

Other

- Open Space - Non Recreation
- Open Space - Parkland
- Open Space - Water
- Public Facility
- Public School
- Airport
- Rail
- Landfill

Mixed Use

- Mixed Use

GRAPHIC SCALE

0 2,500 5,000 10,000

(FEET)

*ADOPTED BY CITY COUNCIL ON JANUARY 27, 2010

03/10/2012

EXHIBIT 4

MARCH 2012

CITY OF ONTARIO MASTER PLAN OF DRAINAGE

LAND USE PLAN

F:\0641\Engineering\SY_SD Master Plan\Rpt_SD Master Plan\Exh 4 – LUSE PLAN.dwg 3/15/2012 11:44 AM Joanna Swiatkowska

EXCERPT E: CITY OF ONTARIO MASTER DRAINAGE PLAN CALCULATIONS

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)
CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 05/18/17

City of Ontario Master Plan of Drainage
100-Yr Study
Area C

Program License Serial Number 6385

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 81.000 to Point/Station 82.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.590
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.410
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 47.17
Pervious ratio(Ap) = 0.5000 Max loss rate(Fm)= 0.421(In/Hr)
Initial subarea data:
Initial area flow distance = 998.000(Ft.)
Top (of initial area) elevation = 775.000(Ft.)
Bottom (of initial area) elevation = 767.000(Ft.)
Difference in elevation = 8.000(Ft.)
Slope = 0.00802 s(%)= 0.80
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 16.174 min.
Rainfall intensity = 2.635(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.756
Subarea runoff = 19.326(CFS)
Total initial stream area = 9.700(Ac.)
Pervious area fraction = 0.500
Initial area Fm value = 0.421(In/Hr)

++
Process from Point/Station 82.000 to Point/Station 83.000

**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 767.000(Ft.)
End of street segment elevation = 750.000(Ft.)
Length of street segment = 1686.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 65.000(Ft.)
Distance from crown to crossfall grade break = 60.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 10.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0150
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150
Estimated mean flow rate at midpoint of street = 29.610(CFS)
Depth of flow = 0.535(Ft.), Average velocity = 3.455(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 20.393(Ft.)
Flow velocity = 3.45(Ft/s)
Travel time = 8.13 min. TC = 24.31 min.
Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.790
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.210
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 39.77
Pervious ratio(Ap) = 0.5000 Max loss rate(Fm)= 0.459(In/Hr)
Rainfall intensity = 2.064(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.706
Subarea runoff = 20.423(CFS) for 17.600(Ac.)
Total runoff = 39.749(CFS)
Effective area this stream = 27.30(Ac.)
Total Study Area (Main Stream No. 1) = 27.30(Ac.)
Area averaged Fm value = 0.446(In/Hr)
Street flow at end of street = 39.749(CFS)
Half street flow at end of street = 19.874(CFS)
Depth of flow = 0.584(Ft.), Average velocity = 3.714(Ft/s)
Flow width (from curb towards crown)= 22.856(Ft.)

++
Process from Point/Station 83.000 to Point/Station 84.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 750.000(Ft.)
Downstream point/station elevation = 747.700(Ft.)
Pipe length = 1333.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 39.749(CFS)
Nearest computed pipe diameter = 42.00(In.)
Calculated individual pipe flow = 39.749(CFS)

```
Normal flow depth in pipe =   32.72(In.)
Flow top width inside pipe =   34.85(In.)
Critical Depth =   23.53(In.)
Pipe flow velocity =      4.94(Ft/s)
Travel time through pipe =    4.49 min.
Time of concentration (TC) =    28.80 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       84.000 to Point/Station       84.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Time of concentration =    28.80 min.
Rainfall intensity =      1.864(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.670
Subarea runoff =     84.317(CFS) for   72.100(Ac.)
Total runoff =    124.066(CFS)
Effective area this stream =       99.40(Ac.)
Total Study Area (Main Stream No. 1) =       99.40(Ac.)
Area averaged Fm value =    0.477(In/Hr)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Process from Point/Station       84.000 to Point/Station       84.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4700     Max loss rate(Fm)=     0.460(In/Hr)
Time of concentration =    28.80 min.
Rainfall intensity =      1.864(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.674
Subarea runoff =    127.148(CFS) for  100.600(Ac.)
Total runoff =    251.214(CFS)
Effective area this stream =      200.00(Ac.)
Total Study Area (Main Stream No. 1) =      200.00(Ac.)
Area averaged Fm value =    0.468(In/Hr)


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Process from Point/Station       84.000 to Point/Station       85.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   747.700(Ft.)
Downstream point/station elevation =   722.700(Ft.)
Pipe length  =  2630.00(Ft.)   Manning's N = 0.013
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```
No. of pipes = 1  Required pipe flow  =   251.214(CFS)
Nearest computed pipe diameter  =     60.00(In.)
Calculated individual pipe flow  =   251.214(CFS)
Normal flow depth in pipe =   48.56(In.)
Flow top width inside pipe =   47.14(In.)
Critical Depth =   53.16(In.)
Pipe flow velocity =     14.74(Ft/s)
Travel time through pipe =    2.97 min.
Time of concentration (TC) =    31.77 min.


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Process from Point/Station       85.000 to Point/Station       85.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5900     Max loss rate(Fm)=     0.577(In/Hr)
Time of concentration =    31.77 min.
Rainfall intensity =      1.757(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.642
Subarea runoff =     87.022(CFS) for  100.000(Ac.)
Total runoff =    338.236(CFS)
Effective area this stream =      300.00(Ac.)
Total Study Area (Main Stream No. 1) =      300.00(Ac.)
Area averaged Fm value =    0.504(In/Hr)


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Process from Point/Station       85.000 to Point/Station       85.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5200     Max loss rate(Fm)=     0.508(In/Hr)
Time of concentration =    31.77 min.
Rainfall intensity =      1.757(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.642
Subarea runoff =     10.002(CFS) for    8.900(Ac.)
Total runoff =    348.239(CFS)
Effective area this stream =      308.90(Ac.)
Total Study Area (Main Stream No. 1) =      308.90(Ac.)
Area averaged Fm value =    0.505(In/Hr)


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Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    308.900(Ac.)
Runoff from this stream =    348.239(CFS)
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```
Time of concentration =   31.77 min.
Rainfall intensity =     1.757(In/Hr)
Area averaged loss rate (Fm) =    0.5046(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5199


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Process from Point/Station       86.000 to Point/Station       87.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.240
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.760
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 60.12
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.339(In/Hr)
Initial subarea data:
Initial area flow distance =   764.000(Ft.)
Top (of initial area) elevation =   750.000(Ft.)
Bottom (of initial area) elevation =   740.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01309  s(%)=       1.31
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.177 min.
Rainfall intensity =      2.980(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.798
Subarea runoff =     22.579(CFS)
Total initial stream area =        9.500(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.339(In/Hr)


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Process from Point/Station       87.000 to Point/Station       88.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   740.000(Ft.)
End of street segment elevation =   724.700(Ft.)
Length of street segment  =  1880.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  13.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     42.202(CFS)
Depth of flow =   0.599(Ft.), Average velocity =   3.913(Ft/s)
Note:  depth of flow exceeds top of street crown.
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```
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   3.91(Ft/s)
Travel time =    8.01 min.     TC =   21.18  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.3900     Max loss rate(Fm)=     0.214(In/Hr)
Rainfall intensity =      2.241(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.800
Subarea runoff =     39.120(CFS) for   24.900(Ac.)
Total runoff =     61.699(CFS)
Effective area this stream =       34.40(Ac.)
Total Study Area (Main Stream No. 1) =      343.30(Ac.)
Area averaged Fm value =    0.248(In/Hr)
Street flow at end of street =     61.699(CFS)
Half street flow at end of street =     30.849(CFS)
Depth of flow =   0.682(Ft.), Average velocity =   4.475(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    0.78(Ft.)
Flow width (from curb towards crown)=  18.000(Ft.)


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Process from Point/Station       88.000 to Point/Station       89.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   724.700(Ft.)
Downstream point/station elevation =   724.000(Ft.)
Pipe length  =   695.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    61.699(CFS)
Nearest computed pipe diameter  =     54.00(In.)
Calculated individual pipe flow  =    61.699(CFS)
Normal flow depth in pipe =   43.69(In.)
Flow top width inside pipe =   42.45(In.)
Critical Depth =   27.38(In.)
Pipe flow velocity =      4.47(Ft/s)
Travel time through pipe =    2.59 min.
Time of concentration (TC) =    23.77 min.


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Process from Point/Station       89.000 to Point/Station       89.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 64.14
Pervious ratio(Ap) = 0.5200     Max loss rate(Fm)=     0.323(In/Hr)
Time of concentration =    23.77 min.
Rainfall intensity =      2.091(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.776
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Subarea runoff =     58.392(CFS) for   39.600(Ac.)
Total runoff =    120.091(CFS)
Effective area this stream =       74.00(Ac.)
Total Study Area (Main Stream No. 1) =      382.90(Ac.)
Area averaged Fm value =    0.288(In/Hr)


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Process from Point/Station       89.000 to Point/Station       90.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   724.000(Ft.)
Downstream point/station elevation =   722.900(Ft.)
Pipe length  =  1105.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   120.091(CFS)
Nearest computed pipe diameter  =     72.00(In.)
Calculated individual pipe flow  =   120.091(CFS)
Normal flow depth in pipe =   53.34(In.)
Flow top width inside pipe =   63.09(In.)
Critical Depth =   35.49(In.)
Pipe flow velocity =      5.35(Ft/s)
Travel time through pipe =    3.44 min.
Time of concentration (TC) =    27.22 min.


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Process from Point/Station       90.000 to Point/Station       90.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 34.05
Pervious ratio(Ap) = 0.6800     Max loss rate(Fm)=     0.656(In/Hr)
Time of concentration =    27.22 min.
Rainfall intensity =      1.928(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.681
Subarea runoff =     70.543(CFS) for   71.100(Ac.)
Total runoff =    190.634(CFS)
Effective area this stream =      145.10(Ac.)
Total Study Area (Main Stream No. 1) =      454.00(Ac.)
Area averaged Fm value =    0.468(In/Hr)


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Process from Point/Station       90.000 to Point/Station       85.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   722.900(Ft.)
Downstream point/station elevation =   722.700(Ft.)
Pipe length  =   200.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   190.634(CFS)
Nearest computed pipe diameter  =     84.00(In.)
Calculated individual pipe flow  =   190.634(CFS)
Normal flow depth in pipe =   64.97(In.)
Flow top width inside pipe =   70.33(In.)
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Critical Depth =   43.12(In.)
Pipe flow velocity =      5.97(Ft/s)
Travel time through pipe =    0.56 min.
Time of concentration (TC) =    27.78 min.


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Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    145.100(Ac.)
Runoff from this stream =    190.634(CFS)
Time of concentration =   27.78 min.
Rainfall intensity =     1.905(In/Hr)
Area averaged loss rate (Fm) =    0.4685(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5748
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    348.24   308.900     31.77    0.505      1.757
2    190.63   145.100     27.78    0.468      1.905
Qmax(1) =
         1.000 *    1.000 *   348.239) +
         0.897 *    1.000 *   190.634) + =     519.270
Qmax(2) =
         1.118 *    0.874 *   348.239) +
         1.000 *    1.000 *   190.634) + =     530.938

Total of 2 streams to confluence:
Flow rates before confluence point:
     348.239     190.634
Maximum flow rates at confluence using above data:
      519.270      530.938
Area of streams before confluence:
      308.900      145.100
Effective area values after confluence:
      454.000      415.120
Results of confluence:
Total flow rate =    530.938(CFS)
Time of concentration =    27.775 min.
Effective stream area after confluence =    415.120(Ac.)
Study area average Pervious fraction(Ap) =  0.537
Study area average soil loss rate(Fm) =    0.493(In/Hr)
Study area total (this main stream) =     454.00(Ac.)


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Process from Point/Station       85.000 to Point/Station       91.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   722.700(Ft.)
Downstream point/station elevation =   697.000(Ft.)
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Pipe length  =  2645.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   530.938(CFS)
Nearest computed pipe diameter  =     81.00(In.)
Calculated individual pipe flow  =   530.938(CFS)
Normal flow depth in pipe =   61.78(In.)
Flow top width inside pipe =   68.92(In.)
Critical Depth =   71.70(In.)
Pipe flow velocity =     18.14(Ft/s)
Travel time through pipe =    2.43 min.
Time of concentration (TC) =    30.21 min.


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Process from Point/Station       91.000 to Point/Station       91.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4600     Max loss rate(Fm)=     0.450(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    503.705(CFS)
therefore the upstream flow rate of Q =    530.938(CFS) is being used
Time of concentration =    30.21 min.
Rainfall intensity =      1.811(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.655
Subarea runoff =      0.000(CFS) for    9.100(Ac.)
Total runoff =    530.938(CFS)
Effective area this stream =      424.22(Ac.)
Total Study Area (Main Stream No. 1) =      463.10(Ac.)
Area averaged Fm value =    0.492(In/Hr)


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Process from Point/Station       91.000 to Point/Station       91.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4500     Max loss rate(Fm)=     0.440(In/Hr)
Time of concentration =    30.21 min.
Rainfall intensity =      1.811(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.660
Subarea runoff =     77.558(CFS) for   84.900(Ac.)
Total runoff =    608.495(CFS)
Effective area this stream =      509.12(Ac.)
Total Study Area (Main Stream No. 1) =      548.00(Ac.)
Area averaged Fm value =    0.483(In/Hr)


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Process from Point/Station       91.000 to Point/Station       91.000
**** CONFLUENCE OF MINOR STREAMS ****
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```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    509.120(Ac.)
Runoff from this stream =    608.495(CFS)
Time of concentration =   30.21 min.
Rainfall intensity =     1.811(In/Hr)
Area averaged loss rate (Fm) =    0.4834(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5215


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Process from Point/Station       92.000 to Point/Station       93.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.050
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.950
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.15
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.288(In/Hr)
Initial subarea data:
Initial area flow distance =   780.000(Ft.)
Top (of initial area) elevation =   730.000(Ft.)
Bottom (of initial area) elevation =   720.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01282  s(%)=       1.28
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.342 min.
Rainfall intensity =      2.958(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.812
Subarea runoff =     22.345(CFS)
Total initial stream area =        9.300(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.288(In/Hr)


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Process from Point/Station       93.000 to Point/Station       94.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   720.000(Ft.)
End of street segment elevation =   701.000(Ft.)
Length of street segment  =  1920.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  13.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
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 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     42.026(CFS)
Depth of flow =   0.581(Ft.), Average velocity =   4.144(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   4.14(Ft/s)
Travel time =    7.72 min.     TC =   21.06  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 49.51
Pervious ratio(Ap) = 0.4100     Max loss rate(Fm)=     0.334(In/Hr)
Rainfall intensity =      2.249(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.771
Subarea runoff =     39.213(CFS) for   26.200(Ac.)
Total runoff =     61.557(CFS)
Effective area this stream =       35.50(Ac.)
Total Study Area (Main Stream No. 1) =      583.50(Ac.)
Area averaged Fm value =    0.322(In/Hr)
Street flow at end of street =     61.557(CFS)
Half street flow at end of street =     30.779(CFS)
Depth of flow =   0.654(Ft.), Average velocity =   4.820(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  18.000(Ft.)


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Process from Point/Station       94.000 to Point/Station       95.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   701.000(Ft.)
Downstream point/station elevation =   699.000(Ft.)
Pipe length  =   700.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    61.557(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =    61.557(CFS)
Normal flow depth in pipe =   35.06(In.)
Flow top width inside pipe =   37.33(In.)
Critical Depth =   28.93(In.)
Pipe flow velocity =      6.66(Ft/s)
Travel time through pipe =    1.75 min.
Time of concentration (TC) =    22.81 min.


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Process from Point/Station       95.000 to Point/Station       95.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4600     Max loss rate(Fm)=     0.252(In/Hr)
Time of concentration =    22.81 min.
Rainfall intensity =      2.144(In/Hr) for a   100.0 year storm
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Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.781
Subarea runoff =     68.139(CFS) for   42.000(Ac.)
Total runoff =    129.697(CFS)
Effective area this stream =       77.50(Ac.)
Total Study Area (Main Stream No. 1) =      625.50(Ac.)
Area averaged Fm value =    0.284(In/Hr)


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Process from Point/Station       95.000 to Point/Station       96.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   699.000(Ft.)
Downstream point/station elevation =   697.200(Ft.)
Pipe length  =  1100.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =   129.697(CFS)
Nearest computed pipe diameter  =     69.00(In.)
Calculated individual pipe flow  =   129.697(CFS)
Normal flow depth in pipe =   55.31(In.)
Flow top width inside pipe =   55.03(In.)
Critical Depth =   37.46(In.)
Pipe flow velocity =      5.82(Ft/s)
Travel time through pipe =    3.15 min.
Time of concentration (TC) =    25.97 min.


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Process from Point/Station       96.000 to Point/Station       96.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 41.47
Pervious ratio(Ap) = 0.3600     Max loss rate(Fm)=     0.325(In/Hr)
Time of concentration =    25.97 min.
Rainfall intensity =      1.984(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.762
Subarea runoff =     95.559(CFS) for   71.500(Ac.)
Total runoff =    225.256(CFS)
Effective area this stream =      149.00(Ac.)
Total Study Area (Main Stream No. 1) =      697.00(Ac.)
Area averaged Fm value =    0.304(In/Hr)


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Process from Point/Station       96.000 to Point/Station       91.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   697.200(Ft.)
Downstream point/station elevation =   697.000(Ft.)
Pipe length  =   200.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   225.256(CFS)
Nearest computed pipe diameter  =     90.00(In.)
Calculated individual pipe flow  =   225.256(CFS)
```

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Normal flow depth in pipe =   68.53(In.)
Flow top width inside pipe =   76.71(In.)
Critical Depth =   46.05(In.)
Pipe flow velocity =      6.24(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    26.50 min.


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Process from Point/Station       91.000 to Point/Station       91.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    149.000(Ac.)
Runoff from this stream =    225.256(CFS)
Time of concentration =   26.50 min.
Rainfall intensity =     1.959(In/Hr)
Area averaged loss rate (Fm) =    0.3037(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4057
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    608.50   509.120     30.21    0.483      1.811
2    225.26   149.000     26.50    0.304      1.959
Qmax(1) =
         1.000 *    1.000 *   608.495) +
         0.911 *    1.000 *   225.256) + =     813.615
Qmax(2) =
         1.111 *    0.877 *   608.495) +
         1.000 *    1.000 *   225.256) + =     818.589

Total of 2 streams to confluence:
Flow rates before confluence point:
     608.495     225.256
Maximum flow rates at confluence using above data:
      813.615      818.589
Area of streams before confluence:
      509.120      149.000
Effective area values after confluence:
      658.120      595.656
Results of confluence:
Total flow rate =    818.589(CFS)
Time of concentration =    26.500 min.
Effective stream area after confluence =    595.656(Ac.)
Study area average Pervious fraction(Ap) =  0.495
Study area average soil loss rate(Fm) =    0.443(In/Hr)
Study area total (this main stream) =     658.12(Ac.)


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Process from Point/Station       91.000 to Point/Station       97.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
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Upstream point/station elevation =   697.000(Ft.)
Downstream point/station elevation =   685.000(Ft.)
Pipe length  =  2637.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   818.589(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =   818.589(CFS)
Normal flow depth in pipe =   85.88(In.)
Flow top width inside pipe =   87.18(In.)
Critical Depth =   84.80(In.)
Pipe flow velocity =     15.09(Ft/s)
Travel time through pipe =    2.91 min.
Time of concentration (TC) =    29.41 min.


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Process from Point/Station       97.000 to Point/Station       97.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 45.69
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.344(In/Hr)
Time of concentration =    29.41 min.
Rainfall intensity =      1.841(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.689
Subarea runoff =     43.263(CFS) for   83.500(Ac.)
Total runoff =    861.852(CFS)
Effective area this stream =      679.16(Ac.)
Total Study Area (Main Stream No. 1) =      780.50(Ac.)
Area averaged Fm value =    0.431(In/Hr)


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Process from Point/Station       97.000 to Point/Station       97.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5300     Max loss rate(Fm)=     0.518(In/Hr)
Time of concentration =    29.41 min.
Rainfall intensity =      1.841(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.685
Subarea runoff =     93.423(CFS) for   78.500(Ac.)
Total runoff =    955.274(CFS)
Effective area this stream =      757.66(Ac.)
Total Study Area (Main Stream No. 1) =      859.00(Ac.)
Area averaged Fm value =    0.440(In/Hr)


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Process from Point/Station       97.000 to Point/Station     1708.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
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Upstream point/station elevation =   685.000(Ft.)
Downstream point/station elevation =   650.000(Ft.)
Pipe length  =  2549.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   955.274(CFS)
Nearest computed pipe diameter  =     93.00(In.)
Calculated individual pipe flow  =   955.274(CFS)
Normal flow depth in pipe =   74.06(In.)
Flow top width inside pipe =   74.90(In.)
Critical Depth =   87.99(In.)
Pipe flow velocity =     23.72(Ft/s)
Travel time through pipe =    1.79 min.
Time of concentration (TC) =    31.20 min.


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Process from Point/Station     1708.000 to Point/Station     1708.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    757.656(Ac.)
Runoff from this stream =    955.274(CFS)
Time of concentration =   31.20 min.
Rainfall intensity =     1.776(In/Hr)
Area averaged loss rate (Fm) =    0.4396(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4884


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Process from Point/Station     1700.000 to Point/Station     1701.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.890
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.110
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 36.07
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =   907.000(Ft.)
Top (of initial area) elevation =   697.500(Ft.)
Bottom (of initial area) elevation =   693.100(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.00485  s(%)=       0.49
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.451 min.
Rainfall intensity =      2.943(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.871
Subarea runoff =     20.071(CFS)
Total initial stream area =        7.830(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


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Process from Point/Station     1701.000 to Point/Station     1702.000
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**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Top of street segment elevation =   693.100(Ft.)
End of street segment elevation =   689.120(Ft.)
Length of street segment  =   382.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     30.694(CFS)
Depth of flow =   0.538(Ft.), Average velocity =   3.529(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.549(Ft.)
Flow velocity =   3.53(Ft/s)
Travel time =    1.80 min.     TC =   15.25  min.
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.630
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.370
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 45.69
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.086(In/Hr)
Rainfall intensity =      2.729(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.870
Subarea runoff =     21.139(CFS) for    9.520(Ac.)
Total runoff =     41.210(CFS)
Effective area this stream =       17.35(Ac.)
Total Study Area (Main Stream No. 1) =      876.35(Ac.)
Area averaged Fm value =    0.090(In/Hr)
Street flow at end of street =     41.210(CFS)
Half street flow at end of street =     20.605(CFS)
Depth of flow =   0.587(Ft.), Average velocity =   3.794(Ft/s)
Flow width (from curb towards crown)=  23.030(Ft.)


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Process from Point/Station     1702.000 to Point/Station     1704.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Top of street segment elevation =   689.120(Ft.)
End of street segment elevation =   685.500(Ft.)
Length of street segment  =   817.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
```

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Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     56.262(CFS)
Depth of flow =   0.746(Ft.), Average velocity =   2.853(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    3.96(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  30.000(Ft.)
Flow velocity =   2.85(Ft/s)
Travel time =    4.77 min.     TC =   20.03  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4200     Max loss rate(Fm)=     0.411(In/Hr)
Rainfall intensity =      2.318(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.797
Subarea runoff =     29.918(CFS) for   21.170(Ac.)
Total runoff =     71.128(CFS)
Effective area this stream =       38.52(Ac.)
Total Study Area (Main Stream No. 1) =      897.52(Ac.)
Area averaged Fm value =    0.266(In/Hr)
Street flow at end of street =     71.128(CFS)
Half street flow at end of street =     35.564(CFS)
Depth of flow =   0.797(Ft.), Average velocity =   3.045(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    6.54(Ft.)
Flow width (from curb towards crown)=  30.000(Ft.)


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Process from Point/Station     1704.000 to Point/Station     1706.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   679.500(Ft.)
Downstream point/station elevation =   671.500(Ft.)
Pipe length  =   611.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    71.128(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    71.128(CFS)
Normal flow depth in pipe =   27.52(In.)
Flow top width inside pipe =   30.56(In.)
Critical Depth =   32.06(In.)
Pipe flow velocity =     12.27(Ft/s)
Travel time through pipe =    0.83 min.
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Time of concentration (TC) =    20.86 min.


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Process from Point/Station     1706.000 to Point/Station     1706.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4800     Max loss rate(Fm)=     0.469(In/Hr)
Time of concentration =    20.86 min.
Rainfall intensity =      2.262(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.770
Subarea runoff =     24.075(CFS) for   16.120(Ac.)
Total runoff =     95.202(CFS)
Effective area this stream =       54.64(Ac.)
Total Study Area (Main Stream No. 1) =      913.64(Ac.)
Area averaged Fm value =    0.326(In/Hr)


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Process from Point/Station     1706.000 to Point/Station     1708.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   671.500(Ft.)
Downstream point/station elevation =   666.500(Ft.)
Pipe length  =   970.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    95.202(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =    95.202(CFS)
Normal flow depth in pipe =   36.38(In.)
Flow top width inside pipe =   41.13(In.)
Critical Depth =   35.51(In.)
Pipe flow velocity =      9.31(Ft/s)
Travel time through pipe =    1.74 min.
Time of concentration (TC) =    22.59 min.


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Process from Point/Station     1708.000 to Point/Station     1708.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    22.59 min.
Rainfall intensity =      2.156(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.787
Subarea runoff =     27.785(CFS) for   17.810(Ac.)
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Total runoff =    122.987(CFS)
Effective area this stream =       72.45(Ac.)
Total Study Area (Main Stream No. 1) =      931.45(Ac.)
Area averaged Fm value =    0.270(In/Hr)


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Process from Point/Station     1708.000 to Point/Station     1708.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     72.450(Ac.)
Runoff from this stream =    122.987(CFS)
Time of concentration =   22.59 min.
Rainfall intensity =     2.156(In/Hr)
Area averaged loss rate (Fm) =    0.2700(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2781


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Process from Point/Station     1710.000 to Point/Station     1711.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   787.000(Ft.)
Top (of initial area) elevation =   702.500(Ft.)
Bottom (of initial area) elevation =   698.500(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00508  s(%)=       0.51
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.591 min.
Rainfall intensity =      3.062(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.871
Subarea runoff =     13.474(CFS)
Total initial stream area =        5.050(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station     1711.000 to Point/Station     1712.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   698.500(Ft.)
End of street segment elevation =   694.900(Ft.)
Length of street segment  =   239.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
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Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     25.950(CFS)
Depth of flow =   0.485(Ft.), Average velocity =   3.892(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.907(Ft.)
Flow velocity =   3.89(Ft/s)
Travel time =    1.02 min.     TC =   13.61  min.
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      2.922(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.870
Subarea runoff =     24.831(CFS) for   10.020(Ac.)
Total runoff =     38.305(CFS)
Effective area this stream =       15.07(Ac.)
Total Study Area (Main Stream No. 1) =      946.52(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Street flow at end of street =     38.305(CFS)
Half street flow at end of street =     19.153(CFS)
Depth of flow =   0.544(Ft.), Average velocity =   4.282(Ft/s)
Flow width (from curb towards crown)=  20.848(Ft.)


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Process from Point/Station     1712.000 to Point/Station     1714.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   688.900(Ft.)
Downstream point/station elevation =   684.300(Ft.)
Pipe length  =   723.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    38.305(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    38.305(CFS)
Normal flow depth in pipe =   24.66(In.)
Flow top width inside pipe =   28.69(In.)
Critical Depth =   24.72(In.)
Pipe flow velocity =      8.05(Ft/s)
Travel time through pipe =    1.50 min.
Time of concentration (TC) =    15.11 min.
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Process from Point/Station     1714.000 to Point/Station     1714.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    15.11 min.
Rainfall intensity =      2.745(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.868
Subarea runoff =     50.169(CFS) for   22.070(Ac.)
Total runoff =     88.474(CFS)
Effective area this stream =       37.14(Ac.)
Total Study Area (Main Stream No. 1) =      968.59(Ac.)
Area averaged Fm value =    0.098(In/Hr)


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Process from Point/Station     1714.000 to Point/Station     1716.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   684.300(Ft.)
Downstream point/station elevation =   681.800(Ft.)
Pipe length  =   689.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    88.474(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =    88.474(CFS)
Normal flow depth in pipe =   36.80(In.)
Flow top width inside pipe =   45.72(In.)
Critical Depth =   33.67(In.)
Pipe flow velocity =      8.08(Ft/s)
Travel time through pipe =    1.42 min.
Time of concentration (TC) =    16.53 min.


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Process from Point/Station     1716.000 to Point/Station     1716.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4700     Max loss rate(Fm)=     0.460(In/Hr)
Time of concentration =    16.53 min.
Rainfall intensity =      2.600(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.821
Subarea runoff =     35.433(CFS) for   20.890(Ac.)
Total runoff =    123.907(CFS)
Effective area this stream =       58.03(Ac.)
Total Study Area (Main Stream No. 1) =      989.48(Ac.)
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Area averaged Fm value =    0.228(In/Hr)


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Process from Point/Station     1716.000 to Point/Station     1708.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   681.800(Ft.)
Downstream point/station elevation =   666.500(Ft.)
Pipe length  =  1015.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   123.907(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =   123.907(CFS)
Normal flow depth in pipe =   31.41(In.)
Flow top width inside pipe =   41.32(In.)
Critical Depth =   40.04(In.)
Pipe flow velocity =     15.04(Ft/s)
Travel time through pipe =    1.12 min.
Time of concentration (TC) =    17.66 min.


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Process from Point/Station     1708.000 to Point/Station     1708.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    17.66 min.
Rainfall intensity =      2.500(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.831
Subarea runoff =     43.038(CFS) for   22.340(Ac.)
Total runoff =    166.945(CFS)
Effective area this stream =       80.37(Ac.)
Total Study Area (Main Stream No. 1) =     1011.82(Ac.)
Area averaged Fm value =    0.192(In/Hr)


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Process from Point/Station     1708.000 to Point/Station     1708.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =     80.370(Ac.)
Runoff from this stream =    166.945(CFS)
Time of concentration =   17.66 min.
Rainfall intensity =     2.500(In/Hr)
Area averaged loss rate (Fm) =    0.1918(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1962
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    955.27   757.656     31.20    0.440      1.776
2    122.99    72.450     22.59    0.270      2.156
3    166.94    80.370     17.66    0.192      2.500
Qmax(1) =
         1.000 *    1.000 *   955.274) +
         0.799 *    1.000 *   122.987) +
         0.687 *    1.000 *   166.945) + =    1168.120
Qmax(2) =
         1.284 *    0.724 *   955.274) +
         1.000 *    1.000 *   122.987) +
         0.851 *    1.000 *   166.945) + =    1153.236
Qmax(3) =
         1.541 *    0.566 *   955.274) +
         1.182 *    0.782 *   122.987) +
         1.000 *    1.000 *   166.945) + =    1113.691

Total of 3 streams to confluence:
Flow rates before confluence point:
     955.274     122.987     166.945
Maximum flow rates at confluence using above data:
     1168.120     1153.236     1113.691
Area of streams before confluence:
      757.656       72.450       80.370
Effective area values after confluence:
      910.476      701.405      565.747
Results of confluence:
Total flow rate =   1168.120(CFS)
Time of concentration =    31.203 min.
Effective stream area after confluence =    910.476(Ac.)
Study area average Pervious fraction(Ap) =  0.446
Study area average soil loss rate(Fm) =    0.404(In/Hr)
Study area total (this main stream) =     910.48(Ac.)


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Process from Point/Station     1708.000 to Point/Station     1722.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   666.500(Ft.)
Downstream point/station elevation =   643.400(Ft.)
Pipe length  =  2500.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1168.120(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =  1168.120(CFS)
Normal flow depth in pipe =   86.06(In.)
Flow top width inside pipe =   86.90(In.)
Critical Depth =   97.79(In.)
Pipe flow velocity =     21.50(Ft/s)
Travel time through pipe =    1.94 min.
Time of concentration (TC) =    33.14 min.
```

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Process from Point/Station     1708.000 to Point/Station     1722.100
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    910.476(Ac.)
Runoff from this stream =   1168.120(CFS)
Time of concentration =   33.14 min.
Rainfall intensity =     1.713(In/Hr)
Area averaged loss rate (Fm) =    0.4043(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4459
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1   1168.12   910.476     33.14    0.404      1.713
Qmax(1) =
         1.000 *    1.000 *  1168.120) + =    1168.120

Total of 1 main streams to confluence:
Flow rates before confluence point:
    1169.120
Maximum flow rates at confluence using above data:
     1168.120
Area of streams before confluence:
      910.476
Effective area values after confluence:
      910.476


Results of confluence:
Total flow rate =   1168.120(CFS)
Time of concentration =    33.141 min.
Effective stream area after confluence  =    910.476(Ac.)
Study area average Pervious fraction(Ap) =  0.446
Study area average soil loss rate(Fm) =    0.404(In/Hr)
Study area total =     910.48(Ac.)


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Process from Point/Station      102.100 to Point/Station      102.200
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   550.000(Ft.)
Top (of initial area) elevation =   677.000(Ft.)
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Bottom (of initial area) elevation =   667.000(Ft.)
Difference in elevation =    10.000(Ft.)
Slope =    0.01818  s(%)=       1.82
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.455 min.
Rainfall intensity =      3.889(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.877
Subarea runoff =     33.778(CFS)
Total initial stream area =        9.900(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


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Process from Point/Station      102.200 to Point/Station      102.300
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   667.000(Ft.)
End of street segment elevation =   655.000(Ft.)
Length of street segment  =  1850.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     61.991(CFS)
Depth of flow =   0.710(Ft.), Average velocity =   3.799(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    2.15(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  22.000(Ft.)
Flow velocity =   3.80(Ft/s)
Travel time =    8.12 min.     TC =   16.57  min.
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.338
Decimal fraction soil group B = 0.251
Decimal fraction soil group C = 0.411
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 53.23
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.077(In/Hr)
Rainfall intensity =      2.597(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =     56.306(CFS) for   29.900(Ac.)
Total runoff =     90.084(CFS)
Effective area this stream =       39.80(Ac.)
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Total Study Area (Main Stream No. 1) =     1051.62(Ac.)
Area averaged Fm value =    0.082(In/Hr)
Street flow at end of street =     90.084(CFS)
Half street flow at end of street =     45.042(CFS)
Depth of flow =   0.817(Ft.), Average velocity =   4.080(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    7.52(Ft.)
Flow width (from curb towards crown)=  22.000(Ft.)


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Process from Point/Station      102.300 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   647.450(Ft.)
Downstream point/station elevation =   646.100(Ft.)
Pipe length  =  1340.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    90.084(CFS)
Nearest computed pipe diameter  =     63.00(In.)
Calculated individual pipe flow  =    90.084(CFS)
Normal flow depth in pipe =   49.31(In.)
Flow top width inside pipe =   51.96(In.)
Critical Depth =   31.84(In.)
Pipe flow velocity =      4.95(Ft/s)
Travel time through pipe =    4.51 min.
Time of concentration (TC) =    21.08 min.


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Process from Point/Station      102.300 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.824
Decimal fraction soil group B = 0.020
Decimal fraction soil group C = 0.156
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 38.25
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.093(In/Hr)
Time of concentration =    21.08 min.
Rainfall intensity =      2.248(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.864
Subarea runoff =    136.990(CFS) for   77.100(Ac.)
Total runoff =    227.074(CFS)
Effective area this stream =      116.90(Ac.)
Total Study Area (Main Stream No. 1) =     1128.72(Ac.)
Area averaged Fm value =    0.089(In/Hr)


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Process from Point/Station      102.000 to Point/Station      101.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   646.100(Ft.)
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Downstream point/station elevation =   644.900(Ft.)
Pipe length  =  1190.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   227.074(CFS)
Nearest computed pipe diameter  =     90.00(In.)
Calculated individual pipe flow  =   227.074(CFS)
Normal flow depth in pipe =   68.81(In.)
Flow top width inside pipe =   76.37(In.)
Critical Depth =   46.34(In.)
Pipe flow velocity =      6.27(Ft/s)
Travel time through pipe =    3.16 min.
Time of concentration (TC) =    24.24 min.


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Process from Point/Station      102.000 to Point/Station      101.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.898
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.102
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 35.77
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Time of concentration =    24.24 min.
Rainfall intensity =      2.067(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.860
Subarea runoff =    130.562(CFS) for   84.300(Ac.)
Total runoff =    357.636(CFS)
Effective area this stream =      201.20(Ac.)
Total Study Area (Main Stream No. 1) =     1213.02(Ac.)
Area averaged Fm value =    0.092(In/Hr)


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Process from Point/Station      101.000 to Point/Station      100.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   644.900(Ft.)
Downstream point/station elevation =   643.630(Ft.)
Pipe length  =  1350.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   357.636(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =   357.636(CFS)
Normal flow depth in pipe =   82.69(In.)
Flow top width inside pipe =   91.50(In.)
Critical Depth =   55.52(In.)
Pipe flow velocity =      6.84(Ft/s)
Travel time through pipe =    3.29 min.
Time of concentration (TC) =    27.53 min.


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Process from Point/Station      101.000 to Point/Station      100.000
**** SUBAREA FLOW ADDITION ****
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COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    27.53 min.
Rainfall intensity =      1.915(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =     86.812(CFS) for   69.900(Ac.)
Total runoff =    444.448(CFS)
Effective area this stream =      271.10(Ac.)
Total Study Area (Main Stream No. 1) =     1282.92(Ac.)
Area averaged Fm value =    0.093(In/Hr)


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Process from Point/Station      101.000 to Point/Station      100.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    271.100(Ac.)
Runoff from this stream =    444.448(CFS)
Time of concentration =   27.53 min.
Rainfall intensity =     1.915(In/Hr)
Area averaged loss rate (Fm) =    0.0934(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1   1168.12   910.476     33.14    0.404      1.713
2    444.45   271.100     27.53    0.093      1.915
Qmax(1) =
         1.000 *    1.000 *  1168.120) +
         0.889 *    1.000 *   444.448) + =    1563.374
Qmax(2) =
         1.154 *    0.831 *  1168.120) +
         1.000 *    1.000 *   444.448) + =    1564.331

Total of 2 main streams to confluence:
Flow rates before confluence point:
    1169.120     445.448
Maximum flow rates at confluence using above data:
     1563.374     1564.331
Area of streams before confluence:
      910.476      271.100
Effective area values after confluence:
     1181.576     1027.480
```

```
Results of confluence:
Total flow rate =   1564.331(CFS)
Time of concentration =    27.532 min.
Effective stream area after confluence  =   1027.480(Ac.)
Study area average Pervious fraction(Ap) =  0.366
Study area average soil loss rate(Fm) =    0.333(In/Hr)
Study area total =    1181.58(Ac.)


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Process from Point/Station     1722.100 to Point/Station     1722.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   643.400(Ft.)
Downstream point/station elevation =   642.200(Ft.)
Pipe length  =  1190.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1564.331(CFS)
Nearest computed pipe diameter  =    183.00(In.)
Calculated individual pipe flow  =  1564.331(CFS)
Normal flow depth in pipe =  144.75(In.)
Flow top width inside pipe =  148.82(In.)
Critical Depth =  102.22(In.)
Pipe flow velocity =     10.09(Ft/s)
Travel time through pipe =    1.97 min.
Time of concentration (TC) =    29.50 min.


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Process from Point/Station     1722.000 to Point/Station     1722.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1510.533(CFS)
therefore the upstream flow rate of Q =   1564.331(CFS) is being used
Time of concentration =    29.50 min.
Rainfall intensity =      1.837(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.745
Subarea runoff =      0.000(CFS) for   76.220(Ac.)
Total runoff =   1564.331(CFS)
Effective area this stream =     1103.70(Ac.)
Total Study Area (Main Stream No. 1) =     1359.14(Ac.)
Area averaged Fm value =    0.317(In/Hr)


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Process from Point/Station     1722.000 to Point/Station     1724.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
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Upstream point/station elevation =   649.400(Ft.)
Downstream point/station elevation =   643.000(Ft.)
Pipe length  =  1335.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1564.331(CFS)
Nearest computed pipe diameter  =    135.00(In.)
Calculated individual pipe flow  =  1564.331(CFS)
Normal flow depth in pipe =  110.44(In.)
Flow top width inside pipe =  104.17(In.)
Critical Depth =  110.43(In.)
Pipe flow velocity =     17.98(Ft/s)
Travel time through pipe =    1.24 min.
Time of concentration (TC) =    30.74 min.


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 46.02
Pervious ratio(Ap) = 0.4300     Max loss rate(Fm)=     0.368(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1472.382(CFS)
therefore the upstream flow rate of Q =   1564.331(CFS) is being used
Time of concentration =    30.74 min.
Rainfall intensity =      1.793(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.741
Subarea runoff =      0.000(CFS) for    4.920(Ac.)
Total runoff =   1564.331(CFS)
Effective area this stream =     1108.62(Ac.)
Total Study Area (Main Stream No. 1) =     1364.06(Ac.)
Area averaged Fm value =    0.317(In/Hr)


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =   1108.620(Ac.)
Runoff from this stream =   1564.331(CFS)
Time of concentration =   30.74 min.
Rainfall intensity =     1.793(In/Hr)
Area averaged loss rate (Fm) =    0.3169(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3485


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Process from Point/Station     1726.000 to Point/Station     1728.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.390
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Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.610
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 54.57
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.075(In/Hr)
Initial subarea data:
Initial area flow distance =   810.000(Ft.)
Top (of initial area) elevation =   685.000(Ft.)
Bottom (of initial area) elevation =   670.400(Ft.)
Difference in elevation =    14.600(Ft.)
Slope =    0.01802  s(%)=       1.80
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.888 min.
Rainfall intensity =      3.540(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff =     23.450(CFS)
Total initial stream area =        7.520(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.075(In/Hr)


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Process from Point/Station     1728.000 to Point/Station     1730.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   670.400(Ft.)
End of street segment elevation =   665.200(Ft.)
Length of street segment  =   541.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     30.983(CFS)
Depth of flow =   0.546(Ft.), Average velocity =   3.431(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.949(Ft.)
Flow velocity =   3.43(Ft/s)
Travel time =    2.63 min.     TC =   12.52  min.
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.330
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.670
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.79
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.072(In/Hr)
Rainfall intensity =      3.073(In/Hr) for a   100.0 year storm
```

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Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.878
Subarea runoff =     14.963(CFS) for    6.710(Ac.)
Total runoff =     38.413(CFS)
Effective area this stream =       14.23(Ac.)
Total Study Area (Main Stream No. 1) =     1378.29(Ac.)
Area averaged Fm value =    0.074(In/Hr)
Street flow at end of street =     38.413(CFS)
Half street flow at end of street =     19.206(CFS)
Depth of flow =   0.582(Ft.), Average velocity =   3.617(Ft/s)
Flow width (from curb towards crown)=  22.766(Ft.)


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Process from Point/Station     1730.000 to Point/Station     1730.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 70.23
Pervious ratio(Ap) = 0.4700     Max loss rate(Fm)=     0.249(In/Hr)
Time of concentration =    12.52 min.
Rainfall intensity =      3.073(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =      5.644(CFS) for    2.220(Ac.)
Total runoff =     44.057(CFS)
Effective area this stream =       16.45(Ac.)
Total Study Area (Main Stream No. 1) =     1380.51(Ac.)
Area averaged Fm value =    0.097(In/Hr)


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Process from Point/Station     1730.000 to Point/Station     1730.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    12.52 min.
Rainfall intensity =      3.073(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =     28.633(CFS) for   10.540(Ac.)
Total runoff =     72.690(CFS)
Effective area this stream =       26.99(Ac.)
Total Study Area (Main Stream No. 1) =     1391.05(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1730.000 to Point/Station     1732.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   661.450(Ft.)
Downstream point/station elevation =   656.790(Ft.)
Pipe length  =   491.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    72.690(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    72.690(CFS)
Normal flow depth in pipe =   29.02(In.)
Flow top width inside pipe =   34.04(In.)
Critical Depth =   32.39(In.)
Pipe flow velocity =     10.98(Ft/s)
Travel time through pipe =    0.75 min.
Time of concentration (TC) =    13.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1732.000 to Point/Station     1732.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.320
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.680
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 57.16
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.072(In/Hr)
Time of concentration =    13.26 min.
Rainfall intensity =      2.968(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =     34.315(CFS) for   14.140(Ac.)
Total runoff =    107.005(CFS)
Effective area this stream =       41.13(Ac.)
Total Study Area (Main Stream No. 1) =     1405.19(Ac.)
Area averaged Fm value =    0.078(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1732.000 to Point/Station     1732.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    13.26 min.
Rainfall intensity =      2.968(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.877
Subarea runoff =     19.169(CFS) for    7.310(Ac.)
Total runoff =    126.173(CFS)
Effective area this stream =       48.44(Ac.)
```

```
Total Study Area (Main Stream No. 1) =     1412.50(Ac.)
Area averaged Fm value =    0.074(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1732.000 to Point/Station     1734.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   656.790(Ft.)
Downstream point/station elevation =   652.050(Ft.)
Pipe length  =   511.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   126.173(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   126.173(CFS)
Normal flow depth in pipe =   36.00(In.)
Flow top width inside pipe =   41.57(In.)
Critical Depth =   40.43(In.)
Pipe flow velocity =     12.48(Ft/s)
Travel time through pipe =    0.68 min.
Time of concentration (TC) =    13.94 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1734.000 to Point/Station     1734.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 47.54
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.084(In/Hr)
Time of concentration =    13.94 min.
Rainfall intensity =      2.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =     32.530(CFS) for   14.450(Ac.)
Total runoff =    158.703(CFS)
Effective area this stream =       62.89(Ac.)
Total Study Area (Main Stream No. 1) =     1426.95(Ac.)
Area averaged Fm value =    0.076(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1734.000 to Point/Station     1734.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 70.22
Pervious ratio(Ap) = 0.4700     Max loss rate(Fm)=     0.249(In/Hr)
Time of concentration =    13.94 min.
Rainfall intensity =      2.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
```

```
Subarea runoff =      8.053(CFS) for    3.400(Ac.)
Total runoff =    166.757(CFS)
Effective area this stream =       66.29(Ac.)
Total Study Area (Main Stream No. 1) =     1430.35(Ac.)
Area averaged Fm value =    0.085(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1734.000 to Point/Station     1734.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    13.94 min.
Rainfall intensity =      2.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =     19.123(CFS) for    7.520(Ac.)
Total runoff =    185.880(CFS)
Effective area this stream =       73.81(Ac.)
Total Study Area (Main Stream No. 1) =     1437.87(Ac.)
Area averaged Fm value =    0.082(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1734.000 to Point/Station     1736.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   652.050(Ft.)
Downstream point/station elevation =   648.150(Ft.)
Pipe length  =   412.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   185.880(CFS)
Nearest computed pipe diameter  =     54.00(In.)
Calculated individual pipe flow  =   185.880(CFS)
Normal flow depth in pipe =   42.94(In.)
Flow top width inside pipe =   43.59(In.)
Critical Depth =   47.21(In.)
Pipe flow velocity =     13.71(Ft/s)
Travel time through pipe =    0.50 min.
Time of concentration (TC) =    14.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1736.000 to Point/Station     1736.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.630
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.370
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 45.69
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.086(In/Hr)
Time of concentration =    14.44 min.
Rainfall intensity =      2.820(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =     24.682(CFS) for   11.660(Ac.)
Total runoff =    210.562(CFS)
Effective area this stream =       85.47(Ac.)
Total Study Area (Main Stream No. 1) =     1449.53(Ac.)
Area averaged Fm value =    0.083(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1736.000 to Point/Station     1736.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    14.44 min.
Rainfall intensity =      2.820(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =     12.842(CFS) for    5.160(Ac.)
Total runoff =    223.404(CFS)
Effective area this stream =       90.63(Ac.)
Total Study Area (Main Stream No. 1) =     1454.69(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1736.000 to Point/Station     1724.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   648.150(Ft.)
Downstream point/station elevation =   643.000(Ft.)
Pipe length  =   481.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   223.404(CFS)
Nearest computed pipe diameter  =     57.00(In.)
Calculated individual pipe flow  =   223.404(CFS)
Normal flow depth in pipe =   44.34(In.)
Flow top width inside pipe =   47.38(In.)
Critical Depth =   50.72(In.)
Pipe flow velocity =     15.09(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    14.98 min.


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 0.600
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.400
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 46.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.085(In/Hr)
Time of concentration =    14.98 min.
Rainfall intensity =      2.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
Subarea runoff =     19.409(CFS) for   10.110(Ac.)
Total runoff =    242.813(CFS)
Effective area this stream =      100.74(Ac.)
Total Study Area (Main Stream No. 1) =     1464.80(Ac.)
Area averaged Fm value =    0.081(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 70.21
Pervious ratio(Ap) = 0.4600     Max loss rate(Fm)=     0.243(In/Hr)
Time of concentration =    14.98 min.
Rainfall intensity =      2.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =      6.250(CFS) for    2.760(Ac.)
Total runoff =    249.063(CFS)
Effective area this stream =      103.50(Ac.)
Total Study Area (Main Stream No. 1) =     1467.56(Ac.)
Area averaged Fm value =    0.086(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    14.98 min.
Rainfall intensity =      2.760(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
Subarea runoff =     14.289(CFS) for    5.870(Ac.)
Total runoff =    263.352(CFS)
Effective area this stream =      109.37(Ac.)
```

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Total Study Area (Main Stream No. 1) =     1473.43(Ac.)
Area averaged Fm value =    0.084(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1724.000 to Point/Station     1724.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    109.370(Ac.)
Runoff from this stream =    263.352(CFS)
Time of concentration =   14.98 min.
Rainfall intensity =     2.760(In/Hr)
Area averaged loss rate (Fm) =    0.0841(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1281
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1   1564.33  1108.620     30.74    0.317      1.793
2    263.35   109.370     14.98    0.084      2.760
Qmax(1) =
         1.000 *    1.000 *  1564.331) +
         0.639 *    1.000 *   263.352) + =    1732.505
Qmax(2) =
         1.655 *    0.487 *  1564.331) +
         1.000 *    1.000 *   263.352) + =    1525.003

Total of 2 streams to confluence:
Flow rates before confluence point:
    1564.331     263.352
Maximum flow rates at confluence using above data:
     1732.505     1525.003
Area of streams before confluence:
     1108.620      109.370
Effective area values after confluence:
     1217.990      649.541
Results of confluence:
Total flow rate =   1732.505(CFS)
Time of concentration =    30.735 min.
Effective stream area after confluence =   1217.990(Ac.)
Study area average Pervious fraction(Ap) =  0.329
Study area average soil loss rate(Fm) =    0.296(In/Hr)
Study area total (this main stream) =    1217.99(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1724.000 to Point/Station     1738.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   643.000(Ft.)
Downstream point/station elevation =   641.900(Ft.)
Pipe length  =   784.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1732.505(CFS)
```

```
Nearest computed pipe diameter  =    177.00(In.)
Calculated individual pipe flow  =  1732.505(CFS)
Normal flow depth in pipe =  143.81(In.)
Flow top width inside pipe =  138.17(In.)
Critical Depth =  108.83(In.)
Pipe flow velocity =     11.65(Ft/s)
Travel time through pipe =    1.12 min.
Time of concentration (TC) =    31.86 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1738.000 to Point/Station     1738.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 70.02
Pervious ratio(Ap) = 0.4100     Max loss rate(Fm)=     0.218(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1602.926(CFS)
therefore the upstream flow rate of Q =   1732.505(CFS) is being used
Time of concentration =    31.86 min.
Rainfall intensity =      1.754(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.748
Subarea runoff =      0.000(CFS) for    3.020(Ac.)
Total runoff =   1732.505(CFS)
Effective area this stream =     1221.01(Ac.)
Total Study Area (Main Stream No. 1) =     1476.45(Ac.)
Area averaged Fm value =    0.296(In/Hr)
End of computations, Total Study Area =         1476.45 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.345
Area averaged SCS curve number =  39.9
```

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
        (c) Copyright 1983-2011 Advanced Engineering Software (aes)
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                        Analysis prepared by:

                        HUNSAKER & ASSOCIATES
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 ************************* DESCRIPTION OF STUDY *************************
* W.O. #915-1, ONTARIO MPD                                              *
* 100-YR STUDY                                                          *
* GROVE AVE. AREA 'B'                                                   *
 ************************************************************************

  FILE NAME: GROVE_M.DAT
  TIME/DATE OF STUDY: 13:01 08/09/2011
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-   / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  ===== ====== ===== =======
  1   65.0     60.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  2   54.0     49.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  3   47.0     42.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  4   42.0     37.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  5   38.0     33.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  6   32.0     27.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  7   24.0     19.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  8   20.0     15.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  9   18.0     13.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                      AREA-AVERAGED
         DURATION    RAINFALL(INCH)
         5-MINUTES         0.44
        30-MINUTES         0.91
         1-HOUR            1.20
         3-HOUR            2.10
         6-HOUR            3.00
        24-HOUR            6.00
 *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   912.00
  ELEVATION DATA: UPSTREAM(FEET) =    780.00  DOWNSTREAM(FEET) =    770.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.654
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.796
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       10.00      0.57     0.500    69   14.65
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =     22.62
  TOTAL AREA(ACRES) =     10.00   PEAK FLOW RATE(CFS) =     22.62

**************************************************************************
  FLOW PROCESS FROM NODE     61.00 TO NODE     62.00 IS CODE =  62
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  9 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  770.00  DOWNSTREAM ELEVATION(FEET) =  750.00
  STREET LENGTH(FEET) =  1838.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      40.94
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.60
   HALFSTREET FLOOD WIDTH(FEET) =   18.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.22
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.52
 STREET FLOW TRAVEL TIME(MIN.) =   7.25   Tc(MIN.) =   21.91
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.196
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A       19.20      0.98     0.500    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       C        3.80      0.57     0.500    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.91
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
 SUBAREA AREA(ACRES) =   23.00      SUBAREA RUNOFF(CFS) =   36.07
 EFFECTIVE AREA(ACRES) =     33.00    AREA-AVERAGED Fm(INCH/HR) =  0.40
 AREA-AVERAGED Fp(INCH/HR) =  0.80  AREA-AVERAGED Ap =  0.50
 TOTAL AREA(ACRES) =       33.0        PEAK FLOW RATE(CFS) =      53.30

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.64   HALFSTREET FLOOD WIDTH(FEET) =  18.00
 FLOW VELOCITY(FEET/SEC.) =  4.67   DEPTH*VELOCITY(FT*FT/SEC.) =   3.01
 LONGEST FLOWPATH FROM NODE     60.00 TO NODE     62.00 =    2750.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     62.00 TO NODE     63.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   750.00  DOWNSTREAM(FEET) =   748.00
 FLOW LENGTH(FEET) =  1318.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  51.0 INCH PIPE IS  36.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.94
 ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      53.30
 PIPE TRAVEL TIME(MIN.) =   4.45    Tc(MIN.) =   26.35
 LONGEST FLOWPATH FROM NODE     60.00 TO NODE     63.00 =    4068.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     63.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   26.35
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.966
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A       18.90      0.98     0.200    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A       13.40      0.98     0.500    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       C        5.50      0.57     0.500    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.89
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.350
 SUBAREA AREA(ACRES) =   37.80      SUBAREA RUNOFF(CFS) =   56.29
 EFFECTIVE AREA(ACRES) =     70.80   AREA-AVERAGED Fm(INCH/HR) =  0.35
 AREA-AVERAGED Fp(INCH/HR) =  0.84  AREA-AVERAGED Ap =  0.42
 TOTAL AREA(ACRES) =       70.8       PEAK FLOW RATE(CFS) =     102.74

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     63.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   26.35
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.966
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 A        9.00      0.98     0.100    32
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A       42.10      0.98     0.200    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A       26.30      0.98     0.500    32
 COMMERCIAL                 C        0.90      0.57     0.100    69
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       C        3.80      0.57     0.500    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.298
 SUBAREA AREA(ACRES) =   82.10      SUBAREA RUNOFF(CFS) =  124.54
 EFFECTIVE AREA(ACRES) =    152.90   AREA-AVERAGED Fm(INCH/HR) =  0.31
 AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.35
 TOTAL AREA(ACRES) =      152.9       PEAK FLOW RATE(CFS) =     227.27

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     63.00 IS CODE =  16
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED CONSTANT SOURCE FLOW AT NODE<<<<<
============================================================================
 USER-SPECIFIED CONSTANT SOURCE FLOW =   300.00(CFS)
 USER-SPECIFIED AREA ASSOCIATED TO SOURCE FLOW =   248.90(ACRES)
 * CUMULATIVE SOURCE FLOW DATA: FLOW(CFS) =   300.00  AREA(AC.) =   248.90
 * SUMMED DATA: FLOW(CFS) =   527.27    TOTAL AREA(ACRES) =   401.80

****************************************************************************
 FLOW PROCESS FROM NODE     63.00 TO NODE     65.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   748.00  DOWNSTREAM(FEET) =   720.00
  FLOW LENGTH(FEET) =  2635.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  81.0 INCH PIPE IS  61.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.00
  ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     527.27
  PIPE TRAVEL TIME(MIN.) =   2.44    Tc(MIN.) =   28.79
  * TOTAL SOURCE FLOW(CFS) =     300.00
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     65.00 =    6703.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     65.00 TO NODE     65.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   28.79
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.864
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        9.80      0.98     0.100    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A       26.50      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       15.30      0.98     0.500    32
  PUBLIC PARK                A        4.80      0.98     0.850    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C        0.50      0.57     0.200    69
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C        8.40      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.90
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.342
  SUBAREA AREA(ACRES) =   65.30      SUBAREA RUNOFF(CFS) =   91.57
  EFFECTIVE AREA(ACRES) =    218.20   AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =      218.2       PEAK FLOW RATE(CFS) =     304.84

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =     604.84    TOTAL AREA(ACRES) =      467.1

****************************************************************************
  FLOW PROCESS FROM NODE     65.00 TO NODE     65.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   28.79
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.864
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A       36.90      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       17.00      0.98     0.500    32
  PUBLIC PARK                A        5.10      0.98     0.850    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.343
  SUBAREA AREA(ACRES) =   59.00      SUBAREA RUNOFF(CFS) =   81.25
  EFFECTIVE AREA(ACRES) =    277.20   AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.91  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =      277.2       PEAK FLOW RATE(CFS) =     386.09

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =     686.09    TOTAL AREA(ACRES) =      526.1

****************************************************************************
  FLOW PROCESS FROM NODE     65.00 TO NODE     66.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   720.00  DOWNSTREAM(FEET) =   695.00
  FLOW LENGTH(FEET) =  2650.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  90.0 INCH PIPE IS  71.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.25
  ESTIMATED PIPE DIAMETER(INCH) =  90.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     686.09
  PIPE TRAVEL TIME(MIN.) =   2.42    Tc(MIN.) =   31.21
  * TOTAL SOURCE FLOW(CFS) =     300.00
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     66.00 =    9353.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     66.00 TO NODE     66.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   31.21
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.776
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        8.50      0.98     0.100    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A       14.90      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       19.50      0.98     0.500    32
  PUBLIC PARK                A        4.60      0.98     0.850    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C       22.20      0.57     0.200    69
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C        9.30      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.84
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.336
  SUBAREA AREA(ACRES) =   79.00      SUBAREA RUNOFF(CFS) =  106.30
  EFFECTIVE AREA(ACRES) =    356.20   AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =      356.2       PEAK FLOW RATE(CFS) =     470.41

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =     770.41    TOTAL AREA(ACRES) =      605.1
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     66.00 TO NODE     66.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   31.21
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.776
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                A        8.40      0.98     0.100    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      A       19.30      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"      A       26.00      0.98     0.500    32
  PUBLIC PARK               A        3.20      0.98     0.850    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      C       19.00      0.57     0.200    69
  PUBLIC PARK               C        2.10      0.57     0.850    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.89
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.333
  SUBAREA AREA(ACRES) =   78.00      SUBAREA RUNOFF(CFS) =  103.92
  EFFECTIVE AREA(ACRES) =    434.20   AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =      434.2       PEAK FLOW RATE(CFS) =     574.33

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =     874.33    TOTAL AREA(ACRES) =      683.1

****************************************************************************
  FLOW PROCESS FROM NODE     66.00 TO NODE     67.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   695.00  DOWNSTREAM(FEET) =   673.50
  FLOW LENGTH(FEET) =  2642.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 102.0 INCH PIPE IS  79.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.40
  ESTIMATED PIPE DIAMETER(INCH) = 102.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     874.33
  PIPE TRAVEL TIME(MIN.) =   2.39    Tc(MIN.) =   33.61
  * TOTAL SOURCE FLOW(CFS) =     300.00
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     67.00 =   11995.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     67.00 TO NODE     67.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   33.61
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.699
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                A       15.70      0.98     0.100    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      A       32.60      0.98     0.200    32
  PUBLIC PARK               A       10.70      0.98     0.850    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      C       10.40      0.57     0.200    69
  PUBLIC PARK               C       11.40      0.57     0.850    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.81
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.358
  SUBAREA AREA(ACRES) =   80.80      SUBAREA RUNOFF(CFS) =  102.48
  EFFECTIVE AREA(ACRES) =    515.00   AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.88  AREA-AVERAGED Ap =  0.35
  TOTAL AREA(ACRES) =      515.0       PEAK FLOW RATE(CFS) =     646.72

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =     946.72    TOTAL AREA(ACRES) =      763.9

****************************************************************************
  FLOW PROCESS FROM NODE     67.00 TO NODE     67.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   33.61
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.699
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                A       16.90      0.98     0.100    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      A       50.60      0.98     0.200    32
  PUBLIC PARK               A       12.90      0.98     0.850    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.283
  SUBAREA AREA(ACRES) =   80.40      SUBAREA RUNOFF(CFS) =  102.96
  EFFECTIVE AREA(ACRES) =    595.40   AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =      595.4       PEAK FLOW RATE(CFS) =     749.69

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =    1049.69    TOTAL AREA(ACRES) =      844.3

****************************************************************************
  FLOW PROCESS FROM NODE     67.00 TO NODE     68.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   673.50  DOWNSTREAM(FEET) =   655.90
  FLOW LENGTH(FEET) =  2641.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 114.0 INCH PIPE IS  87.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.92
  ESTIMATED PIPE DIAMETER(INCH) = 114.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    1049.69
  PIPE TRAVEL TIME(MIN.) =   2.46    Tc(MIN.) =   36.06
  * TOTAL SOURCE FLOW(CFS) =     300.00
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     68.00 =   14636.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     68.00 TO NODE     68.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   36.06
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.629
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A       16.00      0.98     0.200    32
  COMMERCIAL                 B        5.00      0.75     0.100    56
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C       16.90      0.57     0.200    69
  COMMERCIAL                 C       19.60      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.72
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.157
  SUBAREA AREA(ACRES) =   57.50      SUBAREA RUNOFF(CFS) =   78.42
  EFFECTIVE AREA(ACRES) =    652.90   AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.88  AREA-AVERAGED Ap =  0.32
  TOTAL AREA(ACRES) =      652.9       PEAK FLOW RATE(CFS) =     790.37

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =    1090.37    TOTAL AREA(ACRES) =      901.8

****************************************************************************
  FLOW PROCESS FROM NODE     68.00 TO NODE     68.00 IS CODE =  71
----------------------------------------------------------------------------
  >>>>>PEAK FLOW RATE ESTIMATOR CHANGED TO UNIT-HYDROGRAPH METHOD<<<<<
  >>>>>USING TIME-OF-CONCENTRATION OF LONGEST FLOWPATH<<<<<
============================================================================
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.60; LAG(HR) = 0.48; Fm(INCH/HR) = 0.28; Ybar = 0.31
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.97; 30M = 0.97; 1HR = 0.97;
  3HR = 1.00; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      652.9
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     68.00 =   14636.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0300; Lca/L=0.4,n=.0269; Lca/L=0.5,n=.0247;Lca/L=0.6,n=.0231
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     232.33
  UNIT-HYDROGRAPH METHOD PEAK FLOW RATE(CFS) =    854.97
  TOTAL PEAK FLOW RATE(CFS) =   1154.97 (SOURCE FLOW INCLUDED)
  RATIONAL METHOD PEAK FLOW RATE(CFS) =   1090.37
   (UPSTREAM NODE PEAK FLOW RATE(CFS) =   1090.37)
  PEAK FLOW RATE(CFS) USED =   1154.97
  TOTAL SOURCE FLOW(CFS) =     300.00
  TOTAL AREA ASSOCIATED TO SOURCE FLOW(ACRES) =      248.9

****************************************************************************
  FLOW PROCESS FROM NODE     68.00 TO NODE     68.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   36.06
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.629
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A       17.60      0.98     0.100    32
  COMMERCIAL                 B        8.50      0.75     0.100    56
  COMMERCIAL                 C       14.80      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.78
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   40.90
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.60; LAG(HR) = 0.48; Fm(INCH/HR) = 0.27; Ybar = 0.30
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.97; 30M = 0.97; 1HR = 0.97;
  3HR = 1.00; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      693.8
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     68.00 =   14636.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0300; Lca/L=0.4,n=.0269; Lca/L=0.5,n=.0247;Lca/L=0.6,n=.0231
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     250.59
  UNIT-HYDROGRAPH PEAK FLOW RATE(CFS) =     913.69
  TOTAL AREA(ACRES) =      693.8       PEAK FLOW RATE(CFS) =     913.69

  * SOURCE FLOW DATA: FLOW(CFS) =     300.00     AREA(ACRES) =      248.9
  * SUMMED DATA: FLOW(CFS) =    1213.69    TOTAL AREA(ACRES) =      942.7
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      693.8  TC(MIN.) =     36.06
  AREA-AVERAGED Fm(INCH/HR)=  0.27   Ybar =  0.30
  PEAK FLOW RATE(CFS)   =    913.69
  * CUMULATIVE SOURCE FLOW DATA: FLOW(CFS) =     300.00  AREA(AC.) =
248.9
  * SUMMED DATA: FLOW(CFS) =    1213.69    TOTAL AREA(ACRES) =      942.7
============================================================================
============================================================================
  END OF INTEGRATED RATIONAL/UNIT-HYDROGRAPH METHOD ANALYSIS
```

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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                        Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* W.O. #915-1, ONTARIO MPD                                              *
* 100-YR STUDY                                                          *
* EUCLID, CAMPUS & BONVIEW AVENUE                                       *
 ************************************************************************

  FILE NAME: EUCLID_M.DAT
  TIME/DATE OF STUDY: 13:40 08/11/2011
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-   / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   65.0     60.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  2   54.0     49.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  3   47.0     42.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  4   42.0     37.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  5   38.0     33.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  6   32.0     27.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  7   24.0     19.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  8   20.0     15.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150
  9   18.0     13.0    0.020/0.020/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
    *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
     OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
    *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

    UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
      WATERSHED LAG = 0.80 * Tc
      USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
      2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
      FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
      SIERRA MADRE DEPTH-AREA FACTORS USED.
                        AREA-AVERAGED
           DURATION    RAINFALL(INCH)
           5-MINUTES         0.44
          30-MINUTES         0.91
           1-HOUR            1.20
           3-HOUR            2.10
           6-HOUR            3.00
          24-HOUR            6.00
   *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR UNIT HYDROGRAPH METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   775.00
  ELEVATION DATA: UPSTREAM(FEET) =    783.00  DOWNSTREAM(FEET) =    776.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.273
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.840
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A        0.80      0.98     0.500    32   14.27
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C        5.50      0.57     0.500    69   14.27
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.62
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =     14.35
  TOTAL AREA(ACRES) =      6.30   PEAK FLOW RATE(CFS) =     14.35

**************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  9 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  776.00  DOWNSTREAM ELEVATION(FEET) =  765.00
  STREET LENGTH(FEET) =  1029.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      41.61
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.60
    HALFSTREET FLOOD WIDTH(FEET) =   18.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.22
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.54
  STREET FLOW TRAVEL TIME(MIN.) =   4.07   Tc(MIN.) =   18.34
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.444
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       20.20      0.98     0.500    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C        9.50      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.84
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =   29.70      SUBAREA RUNOFF(CFS) =   54.04
  EFFECTIVE AREA(ACRES) =     36.00    AREA-AVERAGED Fm(INCH/HR) =  0.40
  AREA-AVERAGED Fp(INCH/HR) =  0.80  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =       36.0        PEAK FLOW RATE(CFS) =      66.14

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.69   HALFSTREET FLOOD WIDTH(FEET) =  19.15
  FLOW VELOCITY(FEET/SEC.) =  5.06   DEPTH*VELOCITY(FT*FT/SEC.) =   3.49
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1029.0 FT WITH ELEVATION-DROP =  11.0 FT, IS   61.1 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE      3.00
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1804.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   765.00  DOWNSTREAM(FEET) =   750.00
  FLOW LENGTH(FEET) =  1367.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.69
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      66.14
  PIPE TRAVEL TIME(MIN.) =   2.13    Tc(MIN.) =   20.47
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    3171.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.47
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.288
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       48.90      0.98     0.500    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C        1.00      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =   49.90      SUBAREA RUNOFF(CFS) =   81.03
  EFFECTIVE AREA(ACRES) =     85.90   AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.90  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =       85.9        PEAK FLOW RATE(CFS) =     142.11

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.47
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.288
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       39.00      0.98     0.500    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =   39.00      SUBAREA RUNOFF(CFS) =   63.18
  EFFECTIVE AREA(ACRES) =    124.90   AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.92  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =      124.9        PEAK FLOW RATE(CFS) =     205.29

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   750.00  DOWNSTREAM(FEET) =   717.00
  FLOW LENGTH(FEET) =  2637.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  43.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.96
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     205.29
  PIPE TRAVEL TIME(MIN.) =   2.94    Tc(MIN.) =   23.41
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    5808.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN.) =   23.41
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.111
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       31.80      0.98     0.500    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       35.20      0.57     0.500    69
  PUBLIC PARK                C        1.20      0.57     0.850    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.506
  SUBAREA AREA(ACRES) =   68.20      SUBAREA RUNOFF(CFS) =  106.12
  EFFECTIVE AREA(ACRES) =    193.10   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.86  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =      193.1       PEAK FLOW RATE(CFS) =     291.53

********************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN.) =   23.41
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.111
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                A        3.50      0.98     0.850    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       40.50      0.98     0.500    32
  PUBLIC PARK                C        3.50      0.57     0.850    69
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       46.10      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.76
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.526
  SUBAREA AREA(ACRES) =   93.60      SUBAREA RUNOFF(CFS) =  144.17
  EFFECTIVE AREA(ACRES) =    286.70   AREA-AVERAGED Fm(INCH/HR) =  0.42
  AREA-AVERAGED Fp(INCH/HR) =  0.83  AREA-AVERAGED Ap =  0.51
  TOTAL AREA(ACRES) =      286.7       PEAK FLOW RATE(CFS) =     435.70

********************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   717.00  DOWNSTREAM(FEET) =   692.00
  FLOW LENGTH(FEET) =  2642.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  75.0 INCH PIPE IS  61.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.19
  ESTIMATED PIPE DIAMETER(INCH) =  75.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     435.70
  PIPE TRAVEL TIME(MIN.) =   2.72    Tc(MIN.) =   26.13
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =    8450.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN.) =   26.13
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.976
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A       14.10      0.98     0.200    32
  PUBLIC PARK                A        3.70      0.98     0.850    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A        7.00      0.98     0.500    32
  PUBLIC PARK                C        3.80      0.57     0.850    69
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       35.00      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.69
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.475
  SUBAREA AREA(ACRES) =   63.60      SUBAREA RUNOFF(CFS) =   94.24
  EFFECTIVE AREA(ACRES) =    350.30   AREA-AVERAGED Fm(INCH/HR) =  0.41
  AREA-AVERAGED Fp(INCH/HR) =  0.80  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =      350.3       PEAK FLOW RATE(CFS) =     495.19

********************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN.) =   26.13
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.976
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A        1.40      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       11.20      0.98     0.500    32
  PUBLIC PARK                C        5.60      0.57     0.850    69
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C       16.10      0.57     0.200    69
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       46.30      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.63
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.459
  SUBAREA AREA(ACRES) =   80.60      SUBAREA RUNOFF(CFS) =  122.32
  EFFECTIVE AREA(ACRES) =    430.90   AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.77  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =      430.9       PEAK FLOW RATE(CFS) =     617.51

********************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   692.00  DOWNSTREAM(FEET) =   670.00
  FLOW LENGTH(FEET) =  2643.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  90.0 INCH PIPE IS  68.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.09
  ESTIMATED PIPE DIAMETER(INCH) =  90.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     617.51
  PIPE TRAVEL TIME(MIN.) =   2.58    Tc(MIN.) =   28.71
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =   11093.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      7.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   28.71
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.868
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK               A        3.80      0.98     0.850    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      A       13.00      0.98     0.200    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      B        5.80      0.75     0.200    56
  PUBLIC PARK               C       10.20      0.57     0.850    69
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      C        7.30      0.57     0.200    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.72
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.427
  SUBAREA AREA(ACRES) =   40.10      SUBAREA RUNOFF(CFS) =   56.34
  EFFECTIVE AREA(ACRES) =    471.00   AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.77  AREA-AVERAGED Ap =  0.49
  TOTAL AREA(ACRES) =      471.0       PEAK FLOW RATE(CFS) =     631.79

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      7.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   28.71
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.868
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK               A        3.70      0.98     0.850    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      A        3.50      0.98     0.200    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      B       11.60      0.75     0.200    56
  PUBLIC PARK               C       22.10      0.57     0.850    69
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      C       38.00      0.57     0.200    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.63
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.413
  SUBAREA AREA(ACRES) =   78.90      SUBAREA RUNOFF(CFS) =  114.24
  EFFECTIVE AREA(ACRES) =    549.90   AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.48
  TOTAL AREA(ACRES) =      549.9       PEAK FLOW RATE(CFS) =     746.02

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   670.00  DOWNSTREAM(FEET) =   650.00
  FLOW LENGTH(FEET) =  2592.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  96.0 INCH PIPE IS  77.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.24
  ESTIMATED PIPE DIAMETER(INCH) =  96.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     746.02
  PIPE TRAVEL TIME(MIN.) =   2.51    Tc(MIN.) =   31.21
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      8.00 =   13685.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      8.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   31.21
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.776
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      A        2.20      0.98     0.200    32
  COMMERCIAL                B       27.50      0.75     0.100    56
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      B       63.70      0.75     0.200    56
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"      C       12.60      0.57     0.200    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.73
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.174
  SUBAREA AREA(ACRES) =  106.00      SUBAREA RUNOFF(CFS) =  157.34
  EFFECTIVE AREA(ACRES) =    655.90   AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.43
  TOTAL AREA(ACRES) =      655.9       PEAK FLOW RATE(CFS) =     858.09

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      8.00 IS CODE =  71
----------------------------------------------------------------------------
  >>>>>PEAK FLOW RATE ESTIMATOR CHANGED TO UNIT-HYDROGRAPH METHOD<<<<<
  >>>>>USING TIME-OF-CONCENTRATION OF LONGEST FLOWPATH<<<<<
============================================================================
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.52; LAG(HR) = 0.42; Fm(INCH/HR) = 0.32; Ybar = 0.34
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
```

```
  DEPTH-AREA FACTORS: 5M = 0.97; 30M = 0.97; 1HR = 0.97;
  3HR = 1.00; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      655.9
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      8.00 =   13685.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0281; Lca/L=0.4,n=.0252; Lca/L=0.5,n=.0231;Lca/L=0.6,n=.0216
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     223.69
  UNIT-HYDROGRAPH METHOD PEAK FLOW RATE(CFS) =    922.15
  TOTAL PEAK FLOW RATE(CFS) =    922.15 (SOURCE FLOW INCLUDED)
  RATIONAL METHOD PEAK FLOW RATE(CFS) =    858.09
   (UPSTREAM NODE PEAK FLOW RATE(CFS) =    858.09)
  PEAK FLOW RATE(CFS) USED =    922.15

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE     15.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   650.00  DOWNSTREAM(FEET) =   645.00
  FLOW LENGTH(FEET) =  1277.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 120.0 INCH PIPE IS  92.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.21
  ESTIMATED PIPE DIAMETER(INCH) = 120.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     922.15
  PIPE TRAVEL TIME(MIN.) =   1.50    Tc(MIN.) =   32.71
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     15.00 =   14962.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     15.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  PEAK FLOW RATE(CFS) =     922.15    Tc(MIN.) =   32.71
  AREA-AVERAGED Fm(INCH/HR) =  0.32   Ybar = 0.34
  TOTAL AREA(ACRES) =      655.9

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   735.00
  ELEVATION DATA: UPSTREAM(FEET) =    694.00  DOWNSTREAM(FEET) =    690.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.085
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.139
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        0.40      0.98     0.100    32   12.08
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A        5.90      0.98     0.200    32   12.88
  COMMERCIAL                 C        3.10      0.57     0.100    69   12.08
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.89
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.163
  SUBAREA RUNOFF(CFS) =     25.32
  TOTAL AREA(ACRES) =      9.40   PEAK FLOW RATE(CFS) =     25.32

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  690.00  DOWNSTREAM ELEVATION(FEET) =  678.00
  STREET LENGTH(FEET) =  1343.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 42.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  37.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      57.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.70
    HALFSTREET FLOOD WIDTH(FEET) =   28.30
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.69
  STREET FLOW TRAVEL TIME(MIN.) =   5.78   Tc(MIN.) =   17.86
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.483
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A        5.20      0.98     0.200    32
  PUBLIC PARK                A        1.50      0.98     0.850    32
  COMMERCIAL                 C       11.60      0.57     0.100    69
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C        1.30      0.57     0.200    69
  PUBLIC PARK                C       12.70      0.57     0.850    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.63
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.450
  SUBAREA AREA(ACRES) =   32.30      SUBAREA RUNOFF(CFS) =   63.92
  EFFECTIVE AREA(ACRES) =     41.70    AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.66  AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =       41.7        PEAK FLOW RATE(CFS) =      83.69

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.78   HALFSTREET FLOOD WIDTH(FEET) =  36.39
  FLOW VELOCITY(FEET/SEC.) =  4.17   DEPTH*VELOCITY(FT*FT/SEC.) =   3.24
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1343.0 FT WITH ELEVATION-DROP =  12.0 FT, IS   75.5 CFS,
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        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE     13.00
  LONGEST FLOWPATH FROM NODE     11.00 TO NODE     13.00 =    2078.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   678.00  DOWNSTREAM(FEET) =   670.00
  FLOW LENGTH(FEET) =   910.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.57
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      83.69
  PIPE TRAVEL TIME(MIN.) =   1.43    Tc(MIN.) =   19.30
  LONGEST FLOWPATH FROM NODE     11.00 TO NODE     14.00 =    2988.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.30
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.370
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        6.10      0.75     0.100    56
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B        9.30      0.75     0.200    56
  COMMERCIAL                 C        1.70      0.57     0.100    69
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C        4.90      0.57     0.200    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.69
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.165
  SUBAREA AREA(ACRES) =   22.00      SUBAREA RUNOFF(CFS) =   44.68
  EFFECTIVE AREA(ACRES) =     63.70   AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.66  AREA-AVERAGED Ap =  0.31
  TOTAL AREA(ACRES) =       63.7       PEAK FLOW RATE(CFS) =     124.15

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   670.00  DOWNSTREAM(FEET) =   645.00
  FLOW LENGTH(FEET) =  2595.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  36.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.09
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     124.15
  PIPE TRAVEL TIME(MIN.) =   3.58    Tc(MIN.) =   22.87
  LONGEST FLOWPATH FROM NODE     11.00 TO NODE     15.00 =    5583.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     15.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   22.87
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.140
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B       61.10      0.75     0.200    56
  COMMERCIAL                 B       21.30      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.174
  SUBAREA AREA(ACRES) =   82.40      SUBAREA RUNOFF(CFS) =  149.06
  EFFECTIVE AREA(ACRES) =    146.10   AREA-AVERAGED Fm(INCH/HR) =  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.70  AREA-AVERAGED Ap =  0.23
  TOTAL AREA(ACRES) =      146.1       PEAK FLOW RATE(CFS) =     260.03

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     15.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.87
  RAINFALL INTENSITY(INCH/HR) =   2.14
  AREA-AVERAGED Fm(INCH/HR) =  0.16
  AREA-AVERAGED Fp(INCH/HR) =  0.70
  AREA-AVERAGED Ap =  0.23
  EFFECTIVE STREAM AREA(ACRES) =     146.10
  TOTAL STREAM AREA(ACRES) =     146.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     260.03
  ** CONFLUENCE DATA **
  STREAM      Q        Tc      AREA      HEADWATER
  NUMBER    (CFS)    (MIN.)   (ACRES)      NODE
     1       922.15   32.71      655.90        1.00
     2       260.03   22.87      146.10       11.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.55; LAG(HR) = 0.44; Fm(INCH/HR) = 0.29; Ybar = 0.31
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.96; 30M = 0.96; 1HR = 0.96;
  3HR = 0.99; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      802.0
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     15.00 =   14962.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0272; Lca/L=0.4,n=.0244; Lca/L=0.5,n=.0224;Lca/L=0.6,n=.0209
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     283.63
```

```
  PEAK FLOW RATE(CFS) =    1117.23

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   645.00  DOWNSTREAM(FEET) =   639.40
  FLOW LENGTH(FEET) =  1392.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 126.0 INCH PIPE IS 101.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.92
  ESTIMATED PIPE DIAMETER(INCH) = 126.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    1117.23
  PIPE TRAVEL TIME(MIN.) =   1.55    Tc(MIN.) =   34.27
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     16.00 =   16354.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   34.27
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.679
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B       20.10      0.75     0.100    56
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B       56.00      0.75     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.174
  SUBAREA AREA(ACRES) =   76.10
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.57; LAG(HR) = 0.46; Fm(INCH/HR) = 0.28; Ybar = 0.30
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.96; 30M = 0.96; 1HR = 0.96;
  3HR = 0.99; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      878.1
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     16.00 =   16354.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0264; Lca/L=0.4,n=.0237; Lca/L=0.5,n=.0217;Lca/L=0.6,n=.0203
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     315.88
  UNIT-HYDROGRAPH PEAK FLOW RATE(CFS) =    1195.68
  TOTAL AREA(ACRES) =      878.1       PEAK FLOW RATE(CFS) =    1195.68

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     17.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   639.40  DOWNSTREAM(FEET) =   633.60
  FLOW LENGTH(FEET) =  1455.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 132.0 INCH PIPE IS 101.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.27
  ESTIMATED PIPE DIAMETER(INCH) = 132.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    1195.68
  PIPE TRAVEL TIME(MIN.) =   1.59    Tc(MIN.) =   35.85
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     17.00 =   17809.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     17.00 TO NODE     17.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   35.85
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.634
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B       69.60      0.75     0.100    56
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       B       17.70      0.75     0.200    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.120
  SUBAREA AREA(ACRES) =   87.30
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.60; LAG(HR) = 0.48; Fm(INCH/HR) = 0.26; Ybar = 0.28
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.96; 30M = 0.96; 1HR = 0.96;
  3HR = 0.99; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      965.4
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     17.00 =   17809.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0257; Lca/L=0.4,n=.0230; Lca/L=0.5,n=.0211;Lca/L=0.6,n=.0197
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     354.37
  UNIT-HYDROGRAPH PEAK FLOW RATE(CFS) =    1270.95
  TOTAL AREA(ACRES) =      965.4       PEAK FLOW RATE(CFS) =    1270.95

****************************************************************************
  FLOW PROCESS FROM NODE     17.00 TO NODE     48.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   633.60  DOWNSTREAM(FEET) =   633.00
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 132.0 INCH PIPE IS 103.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.87
  ESTIMATED PIPE DIAMETER(INCH) = 132.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    1270.95
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   36.00
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     48.00 =   17949.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE     48.00 TO NODE     48.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   688.00
 ELEVATION DATA: UPSTREAM(FEET) =    787.00  DOWNSTREAM(FEET) =    779.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.111
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.493
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                A        5.60      0.98     0.100    32   10.11
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =     17.11
 TOTAL AREA(ACRES) =      5.60   PEAK FLOW RATE(CFS) =     17.11

****************************************************************************
 FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  779.00  DOWNSTREAM ELEVATION(FEET) =  760.00
 STREET LENGTH(FEET) =  1980.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 42.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  37.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      32.50
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.58
   HALFSTREET FLOOD WIDTH(FEET) =   21.15
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.49
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.03
 STREET FLOW TRAVEL TIME(MIN.) =   9.47   Tc(MIN.) =   19.58
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.350
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A       17.90      0.98     0.500    32
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
 SUBAREA AREA(ACRES) =   17.90      SUBAREA RUNOFF(CFS) =   30.00
 EFFECTIVE AREA(ACRES) =     23.50    AREA-AVERAGED Fm(INCH/HR) =  0.39
 AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.40
 TOTAL AREA(ACRES) =       23.5        PEAK FLOW RATE(CFS) =      41.35

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.62   HALFSTREET FLOOD WIDTH(FEET) =  23.25
 FLOW VELOCITY(FEET/SEC.) =  3.70   DEPTH*VELOCITY(FT*FT/SEC.) =   2.30
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE     23.00 =    2668.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     23.00 TO NODE     24.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   760.00  DOWNSTREAM(FEET) =   753.00
 FLOW LENGTH(FEET) =  1230.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.60
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      41.35
 PIPE TRAVEL TIME(MIN.) =   2.70    Tc(MIN.) =   22.28
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE     24.00 =    3898.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     24.00 TO NODE     24.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   22.28
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.174
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                A        5.90      0.98     0.100    32
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A        9.20      0.98     0.200    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A       47.00      0.98     0.500    32
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.418
 SUBAREA AREA(ACRES) =   62.10      SUBAREA RUNOFF(CFS) =   98.78
 EFFECTIVE AREA(ACRES) =     85.60   AREA-AVERAGED Fm(INCH/HR) =  0.40
 AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.41
 TOTAL AREA(ACRES) =       85.6       PEAK FLOW RATE(CFS) =     136.42

****************************************************************************
 FLOW PROCESS FROM NODE     24.00 TO NODE     25.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   753.00  DOWNSTREAM(FEET) =   751.20
  FLOW LENGTH(FEET) =  1525.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  72.0 INCH PIPE IS  58.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.57
  ESTIMATED PIPE DIAMETER(INCH) =  72.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     136.42
  PIPE TRAVEL TIME(MIN.) =   4.57    Tc(MIN.) =   26.84
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     25.00 =    5423.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     25.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   26.84
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.944
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A       55.50      0.98     0.200    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C       15.30      0.57     0.200    69
  COMMERCIAL                 A       14.88      0.98     0.100    32
  COMMERCIAL                 C        0.92      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.89
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.182
  SUBAREA AREA(ACRES) =   86.60      SUBAREA RUNOFF(CFS) =  138.89
  EFFECTIVE AREA(ACRES) =    172.20   AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.95  AREA-AVERAGED Ap =  0.30
  TOTAL AREA(ACRES) =      172.2       PEAK FLOW RATE(CFS) =     257.58

****************************************************************************
  FLOW PROCESS FROM NODE     25.00 TO NODE     29.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   751.20  DOWNSTREAM(FEET) =   751.00
  FLOW LENGTH(FEET) =   105.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  84.0 INCH PIPE IS  66.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.83
  ESTIMATED PIPE DIAMETER(INCH) =  84.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     257.58
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   27.07
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     29.00 =    5528.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     29.00 TO NODE     29.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   27.07
  RAINFALL INTENSITY(INCH/HR) =   1.93
  AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.95
  AREA-AVERAGED Ap =  0.30
  EFFECTIVE STREAM AREA(ACRES) =     172.20
  TOTAL STREAM AREA(ACRES) =     172.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     257.58

****************************************************************************
  FLOW PROCESS FROM NODE     26.00 TO NODE     27.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    805.00  DOWNSTREAM(FEET) =    800.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.789
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.489
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A        5.06      0.98     0.500    32   17.79
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =      9.11
  TOTAL AREA(ACRES) =      5.06   PEAK FLOW RATE(CFS) =      9.11

****************************************************************************
  FLOW PROCESS FROM NODE     27.00 TO NODE     27.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN.) =   17.79
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.489
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A        5.42      0.98     0.500    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =    5.42      SUBAREA RUNOFF(CFS) =    9.76
  EFFECTIVE AREA(ACRES) =     10.48   AREA-AVERAGED Fm(INCH/HR) =  0.49
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      18.88

****************************************************************************
  FLOW PROCESS FROM NODE     27.00 TO NODE     28.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  6 USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) =  800.00  DOWNSTREAM ELEVATION(FEET) =  785.00
```

```
  STREET LENGTH(FEET) =  1760.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      48.17
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.66
    HALFSTREET FLOOD WIDTH(FEET) =   25.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.43
  STREET FLOW TRAVEL TIME(MIN.) =   8.01   Tc(MIN.) =   25.80
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.991
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A       15.47      0.98     0.100    32
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A        7.16      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       15.04      0.98     0.500    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.279
  SUBAREA AREA(ACRES) =   37.67      SUBAREA RUNOFF(CFS) =   58.29
  EFFECTIVE AREA(ACRES) =     48.15    AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.33
  TOTAL AREA(ACRES) =       48.2        PEAK FLOW RATE(CFS) =      72.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.75   HALFSTREET FLOOD WIDTH(FEET) =  33.67
  FLOW VELOCITY(FEET/SEC.) =  3.99   DEPTH*VELOCITY(FT*FT/SEC.) =   2.99
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1760.0 FT WITH ELEVATION-DROP =  15.0 FT, IS   81.8 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE     28.00
  LONGEST FLOWPATH FROM NODE     26.00 TO NODE     28.00 =    2760.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     28.00 TO NODE     29.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   785.00  DOWNSTREAM(FEET) =   751.00
  FLOW LENGTH(FEET) =  2580.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.72
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      72.47
  PIPE TRAVEL TIME(MIN.) =   3.67    Tc(MIN.) =   29.47
  LONGEST FLOWPATH FROM NODE     26.00 TO NODE     29.00 =    5340.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     29.00 TO NODE     29.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   29.47
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.838
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        9.22      0.98     0.100    32
  COMMERCIAL                 C        1.68      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.91
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   10.90      SUBAREA RUNOFF(CFS) =   17.14
  EFFECTIVE AREA(ACRES) =     59.05   AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.28
  TOTAL AREA(ACRES) =       59.1       PEAK FLOW RATE(CFS) =      82.99

****************************************************************************
  FLOW PROCESS FROM NODE     29.00 TO NODE     29.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   29.47
  RAINFALL INTENSITY(INCH/HR) =   1.84
  AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.97
  AREA-AVERAGED Ap =  0.28
  EFFECTIVE STREAM AREA(ACRES) =      59.05
  TOTAL STREAM AREA(ACRES) =      59.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      82.99

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      257.58   27.07    1.935  0.95( 0.28) 0.30     172.2      21.00
      2       82.99   29.47    1.838  0.97( 0.28) 0.28      59.1      26.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      338.50   27.07    1.935  0.95( 0.28) 0.29     226.4      21.00
      2      325.55   29.47    1.838  0.96( 0.28) 0.29     231.2      26.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     338.50    Tc(MIN.) =    27.07
  EFFECTIVE AREA(ACRES) =     226.43   AREA-AVERAGED Fm(INCH/HR) =  0.28
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 AREA-AVERAGED Fp(INCH/HR) =  0.95  AREA-AVERAGED Ap =  0.29
 TOTAL AREA(ACRES) =      231.2
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE     29.00 =    5528.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     29.00 TO NODE     35.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   751.00  DOWNSTREAM(FEET) =   718.50
 FLOW LENGTH(FEET) =  2645.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  66.0 INCH PIPE IS  51.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  16.92
 ESTIMATED PIPE DIAMETER(INCH) =  66.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     338.50
 PIPE TRAVEL TIME(MIN.) =   2.60    Tc(MIN.) =   29.67
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE     35.00 =    8173.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     35.00 TO NODE     35.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   29.67
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.831
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 C       11.10      0.57     0.100    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =   11.10      SUBAREA RUNOFF(CFS) =   17.73
 EFFECTIVE AREA(ACRES) =    237.53   AREA-AVERAGED Fm(INCH/HR) =  0.27
 AREA-AVERAGED Fp(INCH/HR) =  0.95  AREA-AVERAGED Ap =  0.29
 TOTAL AREA(ACRES) =      242.4       PEAK FLOW RATE(CFS) =     338.50
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE     35.00 TO NODE     35.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   29.67
 RAINFALL INTENSITY(INCH/HR) =   1.83
 AREA-AVERAGED Fm(INCH/HR) =  0.27
 AREA-AVERAGED Fp(INCH/HR) =  0.95
 AREA-AVERAGED Ap =  0.29
 EFFECTIVE STREAM AREA(ACRES) =     237.53
 TOTAL STREAM AREA(ACRES) =     242.35
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     338.50

****************************************************************************
 FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   937.00
 ELEVATION DATA: UPSTREAM(FEET) =    760.00  DOWNSTREAM(FEET) =    750.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.893
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.769
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A        7.50      0.98     0.500    32   14.89
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
 SUBAREA RUNOFF(CFS) =     15.40
 TOTAL AREA(ACRES) =      7.50   PEAK FLOW RATE(CFS) =     15.40

****************************************************************************
 FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  750.00  DOWNSTREAM ELEVATION(FEET) =  722.00
 STREET LENGTH(FEET) =  1670.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 42.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  37.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      26.92
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.51
   HALFSTREET FLOOD WIDTH(FEET) =   17.61
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.09
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.09
 STREET FLOW TRAVEL TIME(MIN.) =   6.80   Tc(MIN.) =   21.70
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.209
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A        6.50      0.98     0.500    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       C        7.40      0.57     0.500    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.76
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
```

```
  SUBAREA AREA(ACRES) =   13.90      SUBAREA RUNOFF(CFS) =   22.90
  EFFECTIVE AREA(ACRES) =     21.40    AREA-AVERAGED Fm(INCH/HR) =  0.42
  AREA-AVERAGED Fp(INCH/HR) =  0.83  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =       21.4        PEAK FLOW RATE(CFS) =      34.52

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  19.42
  FLOW VELOCITY(FEET/SEC.) =  4.36   DEPTH*VELOCITY(FT*FT/SEC.) =   2.38
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =    2607.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     32.00 TO NODE     33.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   722.00  DOWNSTREAM(FEET) =   720.50
  FLOW LENGTH(FEET) =  1270.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.02
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      34.52
  PIPE TRAVEL TIME(MIN.) =   5.26    Tc(MIN.) =   26.96
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     33.00 =    3877.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     33.00 TO NODE     33.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   26.96
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.939
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       58.00      0.98     0.500    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       10.80      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.91
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA AREA(ACRES) =   68.80      SUBAREA RUNOFF(CFS) =   91.89
  EFFECTIVE AREA(ACRES) =     90.20   AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.50
  TOTAL AREA(ACRES) =       90.2       PEAK FLOW RATE(CFS) =     121.22

****************************************************************************
  FLOW PROCESS FROM NODE     33.00 TO NODE     34.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   720.50  DOWNSTREAM(FEET) =   718.70
  FLOW LENGTH(FEET) =  1525.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  69.0 INCH PIPE IS  55.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.41
  ESTIMATED PIPE DIAMETER(INCH) =  69.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     121.22
  PIPE TRAVEL TIME(MIN.) =   4.70    Tc(MIN.) =   31.66
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     34.00 =    5402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     34.00 TO NODE     34.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   31.66
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.761
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       C       58.70      0.57     0.200    69
  RESIDENTIAL
  "11+ DWELLINGS/ACRE"       A        4.50      0.98     0.200    32
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       25.80      0.57     0.500    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.58
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.287
  SUBAREA AREA(ACRES) =   89.00      SUBAREA RUNOFF(CFS) =  127.73
  EFFECTIVE AREA(ACRES) =    179.20   AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.78  AREA-AVERAGED Ap =  0.39
  TOTAL AREA(ACRES) =      179.2       PEAK FLOW RATE(CFS) =     234.48

****************************************************************************
  FLOW PROCESS FROM NODE     34.00 TO NODE     35.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   718.70  DOWNSTREAM(FEET) =   718.50
  FLOW LENGTH(FEET) =   105.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  81.0 INCH PIPE IS  64.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.65
  ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     234.48
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   31.88
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     35.00 =    5507.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     35.00 TO NODE     35.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   31.88
  RAINFALL INTENSITY(INCH/HR) =   1.75
  AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.78
  AREA-AVERAGED Ap =  0.39
```

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 EFFECTIVE STREAM AREA(ACRES) =     179.20
 TOTAL STREAM AREA(ACRES) =     179.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     234.48

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1      338.50   29.67    1.831  0.95( 0.27) 0.29     237.5      21.00
     1      325.55   32.09    1.747  0.95( 0.27) 0.29     242.4      26.00
     2      234.48   31.88    1.754  0.78( 0.31) 0.39     179.2      30.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1      568.37   29.67    1.831  0.87( 0.29) 0.33     404.3      21.00
     2      561.11   31.88    1.754  0.86( 0.29) 0.33     421.1      30.00
     3      558.96   32.09    1.747  0.86( 0.29) 0.33     421.6      26.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     568.37    Tc(MIN.) =    29.67
 EFFECTIVE AREA(ACRES) =     404.30   AREA-AVERAGED Fm(INCH/HR) =  0.29
 AREA-AVERAGED Fp(INCH/HR) =  0.87  AREA-AVERAGED Ap =  0.33
 TOTAL AREA(ACRES) =      421.6
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE     35.00 =    8173.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     35.00 TO NODE     41.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   718.50  DOWNSTREAM(FEET) =   688.00
 FLOW LENGTH(FEET) =  2640.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  81.0 INCH PIPE IS  63.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  18.81
 ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     568.37
 PIPE TRAVEL TIME(MIN.) =   2.34    Tc(MIN.) =   32.01
 LONGEST FLOWPATH FROM NODE     21.00 TO NODE     41.00 =   10813.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     41.00 TO NODE     41.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   32.01
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.749
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 C       11.60      0.57     0.100    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =   11.60      SUBAREA RUNOFF(CFS) =   17.67
 EFFECTIVE AREA(ACRES) =    415.90   AREA-AVERAGED Fm(INCH/HR) =  0.28
 AREA-AVERAGED Fp(INCH/HR) =  0.86  AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =      433.2       PEAK FLOW RATE(CFS) =     568.37
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
 FLOW PROCESS FROM NODE     41.00 TO NODE     41.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   32.01
 RAINFALL INTENSITY(INCH/HR) =   1.75
 AREA-AVERAGED Fm(INCH/HR) =  0.28
 AREA-AVERAGED Fp(INCH/HR) =  0.86
 AREA-AVERAGED Ap =  0.32
 EFFECTIVE STREAM AREA(ACRES) =     415.90
 TOTAL STREAM AREA(ACRES) =     433.15
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     568.37

****************************************************************************
 FLOW PROCESS FROM NODE     36.00 TO NODE     37.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   719.00
 ELEVATION DATA: UPSTREAM(FEET) =    722.00  DOWNSTREAM(FEET) =    715.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.365
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.256
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A        3.60      0.98     0.200    32   11.36
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A        2.60      0.98     0.500    32   13.64
 PUBLIC PARK                A        2.90      0.98     0.850    32   16.94
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.493
 SUBAREA RUNOFF(CFS) =     22.73
 TOTAL AREA(ACRES) =      9.10   PEAK FLOW RATE(CFS) =     22.73

****************************************************************************
 FLOW PROCESS FROM NODE     37.00 TO NODE     38.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  715.00  DOWNSTREAM ELEVATION(FEET) =  695.00
 STREET LENGTH(FEET) =  1996.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 42.00
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 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  37.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      49.76
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.65
   HALFSTREET FLOOD WIDTH(FEET) =   24.84
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.91
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.56
 STREET FLOW TRAVEL TIME(MIN.) =   8.50   Tc(MIN.) =   19.87
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.329
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A       18.10      0.98     0.200    32
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE"       A        7.90      0.98     0.500    32
 PUBLIC PARK                A        2.60      0.98     0.850    32
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       C        1.00      0.57     0.200    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.337
 SUBAREA AREA(ACRES) =   29.60      SUBAREA RUNOFF(CFS) =   53.37
 EFFECTIVE AREA(ACRES) =     38.70    AREA-AVERAGED Fm(INCH/HR) =  0.36
 AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.37
 TOTAL AREA(ACRES) =       38.7        PEAK FLOW RATE(CFS) =      68.51

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.72   HALFSTREET FLOOD WIDTH(FEET) =  30.61
 FLOW VELOCITY(FEET/SEC.) =  4.23   DEPTH*VELOCITY(FT*FT/SEC.) =   3.04
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1996.0 FT WITH ELEVATION-DROP =  20.0 FT, IS   59.4 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE     38.00
 LONGEST FLOWPATH FROM NODE     36.00 TO NODE     38.00 =    2715.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     38.00 TO NODE     39.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   695.00  DOWNSTREAM(FEET) =   692.00
 FLOW LENGTH(FEET) =  1310.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  51.0 INCH PIPE IS  37.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.11
 ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      68.51
 PIPE TRAVEL TIME(MIN.) =   3.57    Tc(MIN.) =   23.44
 LONGEST FLOWPATH FROM NODE     36.00 TO NODE     39.00 =    4025.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     39.00 TO NODE     39.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   23.44
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.109
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                A        5.00      0.98     0.850    32
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A       30.70      0.98     0.200    32
 PUBLIC PARK                C        3.10      0.57     0.850    69
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       C       19.60      0.57     0.200    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.82
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.290
 SUBAREA AREA(ACRES) =   58.40      SUBAREA RUNOFF(CFS) =   98.40
 EFFECTIVE AREA(ACRES) =     97.10   AREA-AVERAGED Fm(INCH/HR) =  0.29
 AREA-AVERAGED Fp(INCH/HR) =  0.89  AREA-AVERAGED Ap =  0.32
 TOTAL AREA(ACRES) =       97.1       PEAK FLOW RATE(CFS) =     159.24

****************************************************************************
 FLOW PROCESS FROM NODE     39.00 TO NODE     40.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   692.00  DOWNSTREAM(FEET) =   688.30
 FLOW LENGTH(FEET) =  1490.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  69.0 INCH PIPE IS  50.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.78
 ESTIMATED PIPE DIAMETER(INCH) =  69.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     159.24
 PIPE TRAVEL TIME(MIN.) =   3.19    Tc(MIN.) =   26.63
 LONGEST FLOWPATH FROM NODE     36.00 TO NODE     40.00 =    5515.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     40.00 TO NODE     40.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   26.63
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.954
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 PUBLIC PARK                A        0.90      0.98     0.850    32
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       A        4.70      0.98     0.200    32
 PUBLIC PARK                C       11.50      0.57     0.850    69
 RESIDENTIAL
 "11+ DWELLINGS/ACRE"       C       29.50      0.57     0.200    69
```

```
  COMMERCIAL                 C       41.50      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.244
  SUBAREA AREA(ACRES) =   88.10      SUBAREA RUNOFF(CFS) =  143.30
  EFFECTIVE AREA(ACRES) =    185.20   AREA-AVERAGED Fm(INCH/HR) =  0.22
  AREA-AVERAGED Fp(INCH/HR) =  0.77  AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =      185.2       PEAK FLOW RATE(CFS) =     288.95

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   688.30  DOWNSTREAM(FEET) =   688.00
  FLOW LENGTH(FEET) =   137.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  87.0 INCH PIPE IS  66.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.57
  ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     288.95
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   26.90
  LONGEST FLOWPATH FROM NODE     36.00 TO NODE     41.00 =    5652.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     41.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   26.90
  RAINFALL INTENSITY(INCH/HR) =   1.94
  AREA-AVERAGED Fm(INCH/HR) =  0.22
  AREA-AVERAGED Fp(INCH/HR) =  0.77
  AREA-AVERAGED Ap =  0.29
  EFFECTIVE STREAM AREA(ACRES) =     185.20
  TOTAL STREAM AREA(ACRES) =     185.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     288.95

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      568.37   32.01    1.749  0.86( 0.28) 0.32     415.9      21.00
      1      561.11   34.23    1.681  0.86( 0.28) 0.33     432.7      30.00
      1      558.96   34.43    1.675  0.86( 0.28) 0.33     433.2      26.00
      2      288.95   26.90    1.942  0.77( 0.22) 0.29     185.2      36.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      829.09   26.90    1.942  0.83( 0.26) 0.31     534.7      36.00
      2      825.02   32.01    1.749  0.84( 0.26) 0.31     601.1      21.00
      3      806.21   34.23    1.681  0.84( 0.26) 0.31     617.9      30.00
      4      803.06   34.43    1.675  0.84( 0.26) 0.31     618.4      26.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     829.09    Tc(MIN.) =    26.90
  EFFECTIVE AREA(ACRES) =     534.68   AREA-AVERAGED Fm(INCH/HR) =  0.26
  AREA-AVERAGED Fp(INCH/HR) =  0.83  AREA-AVERAGED Ap =  0.31
  TOTAL AREA(ACRES) =      618.4
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     41.00 =   10813.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     47.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   688.00  DOWNSTREAM(FEET) =   665.00
  FLOW LENGTH(FEET) =  2655.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 102.0 INCH PIPE IS  74.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.81
  ESTIMATED PIPE DIAMETER(INCH) = 102.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     829.09
  PIPE TRAVEL TIME(MIN.) =   2.35    Tc(MIN.) =   29.25
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     47.00 =   13468.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     47.00 TO NODE     47.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   29.25
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.847
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                B        4.00      0.75     0.100    56
  COMMERCIAL                C        8.00      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.63
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   12.00      SUBAREA RUNOFF(CFS) =   19.27
  EFFECTIVE AREA(ACRES) =    546.68   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.83  AREA-AVERAGED Ap =  0.31
  TOTAL AREA(ACRES) =      630.4       PEAK FLOW RATE(CFS) =     829.09
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     47.00 TO NODE     47.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   29.25
  RAINFALL INTENSITY(INCH/HR) =   1.85
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.83
```

```
 AREA-AVERAGED Ap =  0.31
 EFFECTIVE STREAM AREA(ACRES) =     546.68
 TOTAL STREAM AREA(ACRES) =     630.35
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     829.09

****************************************************************************
 FLOW PROCESS FROM NODE     42.00 TO NODE     43.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
 ELEVATION DATA: UPSTREAM(FEET) =    694.00  DOWNSTREAM(FEET) =    690.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.537
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.809
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 C        8.70      0.57     0.100    69   14.54
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =     21.55
 TOTAL AREA(ACRES) =      8.70   PEAK FLOW RATE(CFS) =     21.55

****************************************************************************
 FLOW PROCESS FROM NODE     43.00 TO NODE     44.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  7 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  690.00  DOWNSTREAM ELEVATION(FEET) =  680.00
 STREET LENGTH(FEET) =   890.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 24.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.01
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.62
   HALFSTREET FLOOD WIDTH(FEET) =   22.92
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.95
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.44
 STREET FLOW TRAVEL TIME(MIN.) =   3.76   Tc(MIN.) =   18.29
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.447
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 C       19.90      0.57     0.100    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =   19.90      SUBAREA RUNOFF(CFS) =   42.82
 EFFECTIVE AREA(ACRES) =     28.60    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       28.6        PEAK FLOW RATE(CFS) =      61.54

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.68   HALFSTREET FLOOD WIDTH(FEET) =  24.50
 FLOW VELOCITY(FEET/SEC.) =  4.48   DEPTH*VELOCITY(FT*FT/SEC.) =   3.03
 LONGEST FLOWPATH FROM NODE     42.00 TO NODE     44.00 =    1890.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     44.00 TO NODE     45.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  7 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  680.00  DOWNSTREAM ELEVATION(FEET) =  667.60
 STREET LENGTH(FEET) =  1365.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 24.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  19.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      89.99
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.77
   HALFSTREET FLOOD WIDTH(FEET) =   29.26
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.77
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    3.68
 STREET FLOW TRAVEL TIME(MIN.) =   4.77   Tc(MIN.) =   23.06
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.130
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 B       18.60      0.75     0.100    56
 COMMERCIAL                 C       12.00      0.57     0.100    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.68
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =   30.60      SUBAREA RUNOFF(CFS) =   56.79
 EFFECTIVE AREA(ACRES) =     59.20    AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.62  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       59.2        PEAK FLOW RATE(CFS) =     110.15

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.82   HALFSTREET FLOOD WIDTH(FEET) =  31.64
 FLOW VELOCITY(FEET/SEC.) =  5.06   DEPTH*VELOCITY(FT*FT/SEC.) =   4.15
```

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  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1365.0 FT WITH ELEVATION-DROP =  12.4 FT, IS   77.4 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE     45.00
  LONGEST FLOWPATH FROM NODE     42.00 TO NODE     45.00 =    3255.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     45.00 TO NODE     46.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   667.60  DOWNSTREAM(FEET) =   665.20
  FLOW LENGTH(FEET) =  1435.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  63.0 INCH PIPE IS  49.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.05
  ESTIMATED PIPE DIAMETER(INCH) =  63.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     110.15
  PIPE TRAVEL TIME(MIN.) =   3.95    Tc(MIN.) =   27.01
  LONGEST FLOWPATH FROM NODE     42.00 TO NODE     46.00 =    4690.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     46.00 TO NODE     46.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   27.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.937
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B       29.30      0.75     0.100    56
  COMMERCIAL                 C       57.40      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.63
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   86.70      SUBAREA RUNOFF(CFS) =  146.24
  EFFECTIVE AREA(ACRES) =    145.90   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.63  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =      145.9       PEAK FLOW RATE(CFS) =     246.12

****************************************************************************
  FLOW PROCESS FROM NODE     46.00 TO NODE     47.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   665.20  DOWNSTREAM(FEET) =   665.00
  FLOW LENGTH(FEET) =   147.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  90.0 INCH PIPE IS  67.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.90
  ESTIMATED PIPE DIAMETER(INCH) =  90.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     246.12
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   27.37
  LONGEST FLOWPATH FROM NODE     42.00 TO NODE     47.00 =    4837.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     47.00 TO NODE     47.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   27.37
  RAINFALL INTENSITY(INCH/HR) =   1.92
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.63
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =     145.90
  TOTAL STREAM AREA(ACRES) =     145.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     246.12

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1      829.09   29.25    1.847  0.83( 0.25) 0.31     546.7      36.00
      1      825.02   34.36    1.677  0.84( 0.26) 0.31     613.1      21.00
      1      806.21   36.59    1.615  0.83( 0.26) 0.31     629.9      30.00
      1      803.06   36.85    1.608  0.83( 0.26) 0.31     630.4      26.00
      2      246.12   27.37    1.922  0.63( 0.06) 0.10     145.9      42.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1     1058.50   27.37    1.922  0.81( 0.21) 0.26     657.4      42.00
      2     1065.27   29.25    1.847  0.82( 0.21) 0.26     692.6      36.00
      3     1038.67   34.36    1.677  0.82( 0.22) 0.27     759.0      21.00
      4     1011.67   36.59    1.615  0.82( 0.22) 0.27     775.8      30.00
      5     1007.61   36.85    1.608  0.82( 0.22) 0.27     776.2      26.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    1065.27    Tc(MIN.) =    29.25
  EFFECTIVE AREA(ACRES) =     692.58   AREA-AVERAGED Fm(INCH/HR) =  0.21
  AREA-AVERAGED Fp(INCH/HR) =  0.82  AREA-AVERAGED Ap =  0.26
  TOTAL AREA(ACRES) =      776.2
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     47.00 =   13468.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     47.00 TO NODE     47.00 IS CODE =  71
----------------------------------------------------------------------------
  >>>>>PEAK FLOW RATE ESTIMATOR CHANGED TO UNIT-HYDROGRAPH METHOD<<<<<
  >>>>>USING TIME-OF-CONCENTRATION OF LONGEST FLOWPATH<<<<<
============================================================================
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.57; LAG(HR) = 0.46; Fm(INCH/HR) = 0.22; Ybar = 0.25
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.97; 30M = 0.97; 1HR = 0.97;
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  3HR = 0.99; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      776.2
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     47.00 =   13468.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0309; Lca/L=0.4,n=.0277; Lca/L=0.5,n=.0254;Lca/L=0.6,n=.0237
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     298.04
  UNIT-HYDROGRAPH METHOD PEAK FLOW RATE(CFS) =   1097.00
  TOTAL PEAK FLOW RATE(CFS) =   1097.00 (SOURCE FLOW INCLUDED)
  RATIONAL METHOD PEAK FLOW RATE(CFS) =   1065.27
   (UPSTREAM NODE PEAK FLOW RATE(CFS) =   1065.27)
  PEAK FLOW RATE(CFS) USED =   1097.00

****************************************************************************
  FLOW PROCESS FROM NODE     47.00 TO NODE     48.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   665.00  DOWNSTREAM(FEET) =   633.00
  FLOW LENGTH(FEET) =  2630.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN 102.0 INCH PIPE IS  81.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.53
  ESTIMATED PIPE DIAMETER(INCH) = 102.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    1097.00
  PIPE TRAVEL TIME(MIN.) =   1.95    Tc(MIN.) =   36.31
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     48.00 =   16098.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     48.00 TO NODE     48.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   36.31
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.622
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B       12.10      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   12.10
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.61; LAG(HR) = 0.48; Fm(INCH/HR) = 0.22; Ybar = 0.25
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.96; 30M = 0.96; 1HR = 0.96;
  3HR = 0.99; 6HR = 1.00; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =      788.3
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     48.00 =   16098.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0288; Lca/L=0.4,n=.0258; Lca/L=0.5,n=.0237;Lca/L=0.6,n=.0221
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     303.46
  UNIT-HYDROGRAPH PEAK FLOW RATE(CFS) =    1060.48
  TOTAL AREA(ACRES) =      788.3       PEAK FLOW RATE(CFS) =    1097.00

  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE     48.00 TO NODE     48.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  PEAK FLOW RATE(CFS) =     1097.00    Tc(MIN.) =   36.31
  AREA-AVERAGED Fm(INCH/HR) =  0.22    Ybar = 0.25
  TOTAL AREA(ACRES) =      788.3
  LONGEST FLOWPATH FROM NODE     21.00 TO NODE     48.00 =   16098.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  PEAK FLOW RATE(CFS) =     1270.95    Tc(MIN.) =   36.00
  AREA-AVERAGED Fm(INCH/HR) =  0.26    Ybar = 0.28
  TOTAL AREA(ACRES) =      965.4
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     48.00 =   17949.00 FEET.

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  UNIT-HYDROGRAPH DATA:
  RAINFALL(INCH): 5M= 0.44;30M= 0.91;1H= 1.20;3H= 2.10;6H= 3.00;24H= 6.00
  S-GRAPH: VALLEY(DEV.)=100.0%;VALLEY(UNDEV.)/DESERT=  0.0%
           MOUNTAIN=  0.0%;FOOTHILL=  0.0%;DESERT(UNDEV.)=  0.0%
  Tc(HR) = 0.60; LAG(HR) = 0.48; Fm(INCH/HR) = 0.24; Ybar = 0.27
  USED SIERRA MADRE DEPTH-AREA CURVES WITH AMC  II CONDITION.
  DEPTH-AREA FACTORS: 5M = 0.92; 30M = 0.92; 1HR = 0.92;
  3HR = 0.99; 6HR = 0.99; 24HR= 1.00
  UNIT-INTERVAL(MIN) =  5.00   TOTAL AREA(ACRES) =     1753.7
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     48.00 =   17949.00 FEET.
   EQUIVALENT BASIN FACTOR APPROXIMATIONS:
   Lca/L=0.3,n=.0256; Lca/L=0.4,n=.0230; Lca/L=0.5,n=.0211;Lca/L=0.6,n=.0197
  TIME OF PEAK FLOW(HR) = 16.50  RUNOFF VOLUME(AF) =     655.41
  PEAK FLOW RATE(CFS) =    2234.49
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     1753.7  TC(MIN.) =     36.00
  AREA-AVERAGED Fm(INCH/HR)=  0.24   Ybar =  0.27
  PEAK FLOW RATE(CFS)   =   2234.49
============================================================================
============================================================================
  END OF INTEGRATED RATIONAL/UNIT-HYDROGRAPH METHOD ANALYSIS
```

EXCERPT F: EXCERPTS FROM MERRILL COMMERCE CENTER REPORT

MERRILL COMMERCE CENTER HYDROLOGY AND HYDRAULICS STUDY FOR MERRILL AVENUE STORM DRAIN SYSTEM (WLKR-XII-1 AND MERL-XI-1) PM-20273

REPORT 1 OF 2
HYDROLOGY AND MAINLINE HYDRAULICS

CITY OF ONTARIO
CALIFORNIA

PREPARED FOR:

WESTLAND GROUP, INC.
4150 CONCOURS, ONTARIO CA

PREPARED BY:

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552
FAX 951.304.3568

FEBRUARY 25, 2021
REVISED: MAY 5, 2021, JUNE 2, 2021, OCTOBER 11, 2021, DECEMBER 02, 2021, JUNE 20, 2022, SEPTEMBER 20, 2022, NOVEMBER 29, 2022

This report has been prepared by or under the direction of the following registered civil engineer who attests to the technical information contained herein. The registered civil engineer has also judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.



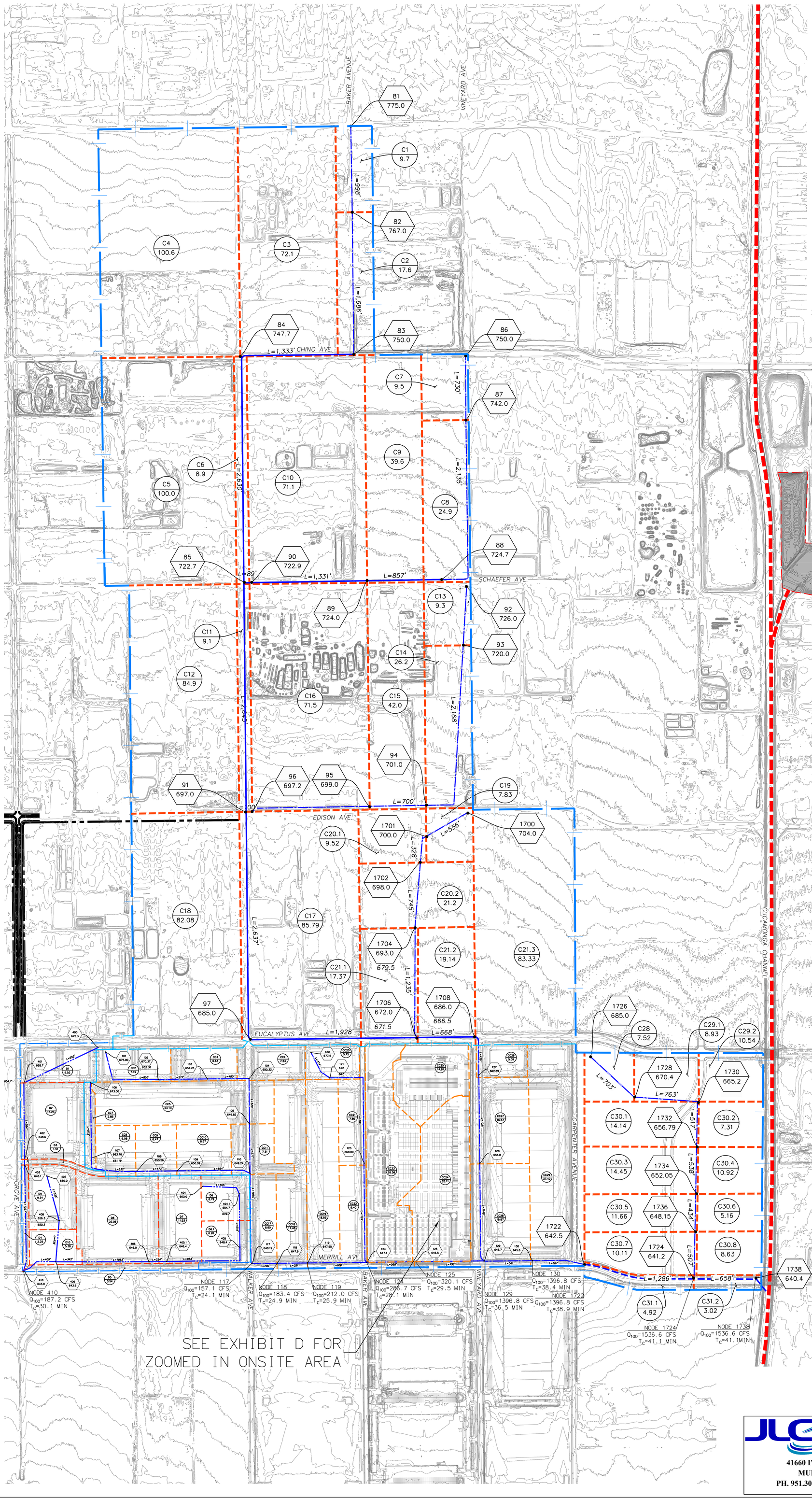
11/29/2022

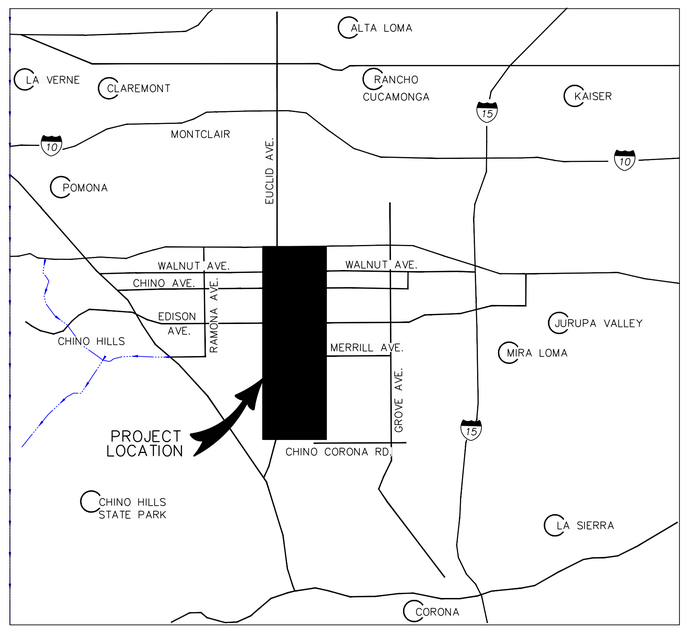
Joseph L. Castaneda RCE 59835 Registered Civil Engineer	Date	Seal

CITY OF ONTARIO MASTER DRAINAGE PLAN

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

ULTIMATE CONDITION HYDROLOGY MAP





VICINITY MAP
N.T.S.
TXN – RXW SECTION X

RATIONAL METHOD AND UNIT HYDROGRAPH RESULTS FOR NODES ALONG MERRILL AVENUE – MERRILL AVE SD			
	AREA C AND AREA CC		
	RATIONAL METHOD RESULTS		UNIT HYDROGRAPH RESULTS (100-YEAR, 24-HOUR STORM EVENT)
NODE	Q_{100} (CFS)	T_C (MIN)	PEAK Q_{100} (CFS)
117	157.1	24.1	
118	183.4	24.9	
119	212.0	25.9	
124	286.7	28.1	
125	320.1	29.5	N/A
129	1396.8	36.5	
130	1396.8	38.4	
1722	1396.8	38.9	
1724	1536.6	41.1	
1738	1536.6	42.1	1651.1

RATIONAL METHOD AND UNIT HYDROGRAPH RESULTS FOR NODE ALONG MERRILL AVENUE – GROVE AVE SD			
NODE	RATIONAL METHOD RESULTS		UNIT HYDROGRAPH RESULTS (100-YEAR, 24-HOUR STORM)
	Q_{100} (CFS)	T_C (MIN)	PEAK Q_{100} (CFS)
410	187.2	30.1	161.3

LEGEND:

- XXX.X / XXXX — *NODE/CONCENTRATION POINT / FLOWLINE ELEVATION*
- XXXX.X — *APPROXIMATE INVERT ELEVATION*
- XXX / X.X — *SUB AREA / ACRES*
- L=XXX' — *FLOW DISTANCE*
- *FLOW PATH*
- *WATERSHED SUB-BOUNDARY*
- *WATERSHED BOUNDARY*
- *CUCAMONGA CHANNEL*

GRAPHIC SCALE
400' 0 200' 400' 800'
1" = 400'

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EXHIBIT "C"

CITY OF ONTARIO MASTER DRAINAGE PLAN

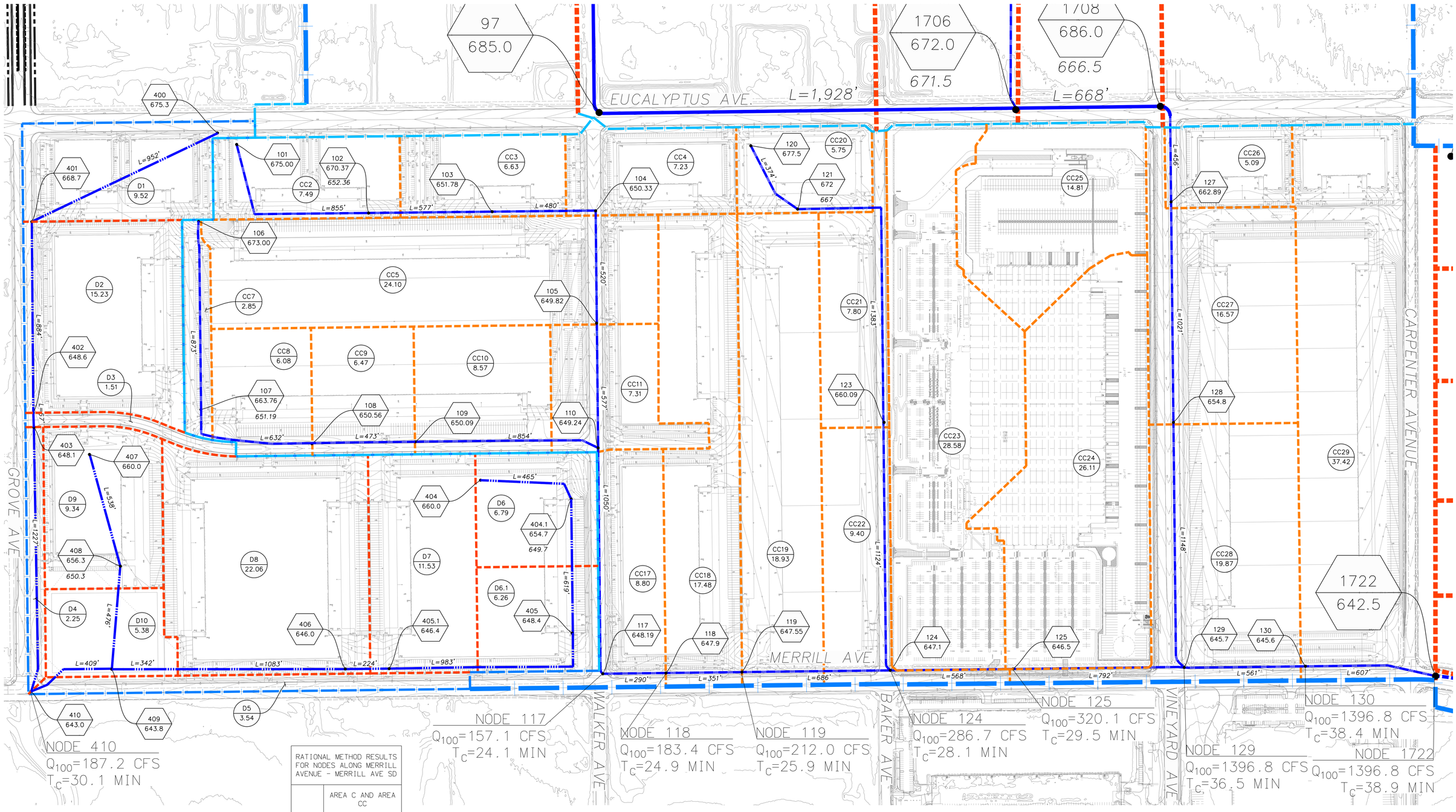
ULTIMATE CONDITION HYDROLOGY MAP

Drawing Name: O:\265.13.20\Engineering\Hydrology_Prjon\Exhibits\EXHIBIT-C-D-MERRILL-GROVE-ALT-2.dwg
Last Opened: Nov 17, 2021 - 8:04pm by stonner

CITY OF ONTARIO MASTER DRAINAGE PLAN

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

ULTIMATE CONDITION HYDROLOGY MAP



RATIONAL METHOD AND UNIT HYDROGRAPH RESULTS FOR NODE ALONG MERRILL AVENUE - GROVE AVE SD			
NODE	RATIONAL METHOD RESULTS		UNIT HYDROGRAPH RESULTS (100-YEAR, 24-HOUR STORM)
	Q_{100} (CFS)	T_C (MIN)	PEAK Q_{100} (CFS)
410	187.2	30.1	161.3

RATIONAL METHOD RESULTS FOR NODES ALONG MERRILL AVENUE - MERRILL AVE SD		
	AREA C AND AREA CC	
NODE	Q_{100} (CFS)	T_C (MIN)
117	157.1	24.1
118	183.4	24.9
119	212.0	25.9
124	286.7	28.1
125	320.1	29.5
129	1396.8	36.5
130	1396.8	38.4
1722	1396.8	38.9

LEGEND:

- XXX.X / XXXX — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION
- XXXX.X — APPROXIMATE INVERT ELEVATION
- XXX / X.X — SUB AREA / ACRES
- L=XXX' — FLOW DISTANCE
- FLOW PATH
- MERRILL AREA CC WATERSHED SUB-BOUNDARY
- MERRILL AREA CC WATERSHED BOUNDARY
- GROVE WATERSHED SUB-BOUNDARY
- GROVE WATERSHED BOUNDARY

GRAPHIC SCALE 150' 0 75' 150' 300' 1" = 150'

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EXHIBIT "D"

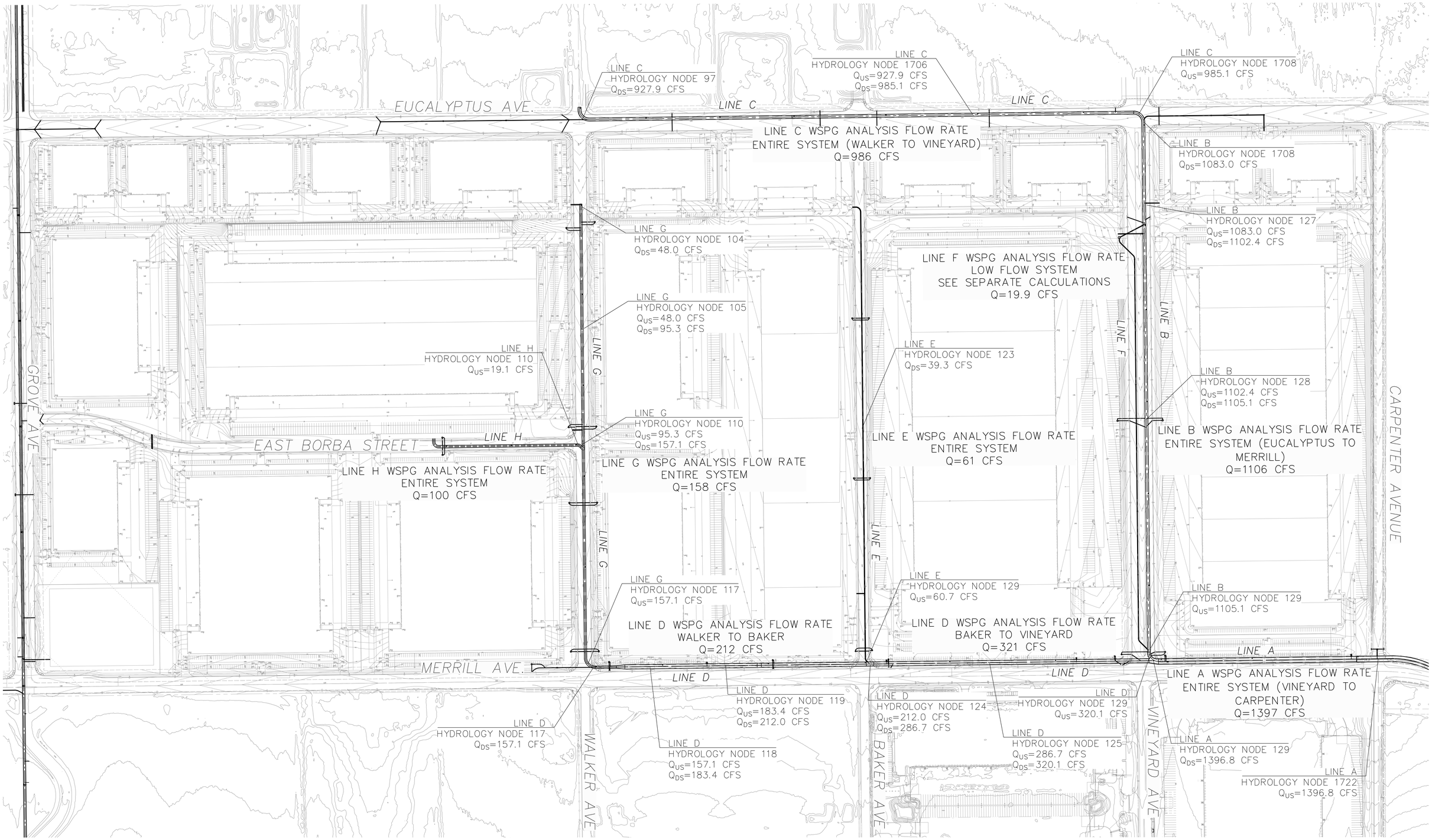
CITY OF ONTARIO MASTER DRAINAGE PLAN

ULTIMATE CONDITION HYDROLOGY MAP

CITY OF ONTARIO MASTER DRAINAGE PLAN

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

MAINLINE STORM DRAIN FACILITIES MAP



LEGEND:

LINE A HYDROLOGY NODE XX Q_{US}=XX CFS Q_{DS}=XX CFS	FACILITY NAME HYDROLOGY NODE UPSTREAM FLOW RATE PER HYDROLOGY ANALYSIS FOR 100-YEAR DOWNSTREAM FLOW RATE PER HYDROLOGY ANALYSIS FOR 100-YEAR

N

GRAPHIC SCALE
150' 0 75' 150' 300'
1" = 150'

JLC Engineering & Consulting, Inc.
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EXHIBIT "H"

CITY OF ONTARIO
MASTER DRAINAGE PLAN

MAINLINE STORM DRAIN
FACILITIES MAP

Drawing Name: Q:\265.13.20\Engineering\Hydrology_Plan\Exhibits\EXHIBIT-H-MAINLINE-FLOW-RATES.dwg
Last Opened: Nov 20, 2022 - 9:01pm by stonner

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 10/01/21

CITY OF ONTARIO MASTER PLAN OF DRAINAGE
100 YEAR STUDY
AREA C & AREA CC TRIBUTARY TO MERRILL AVENUE STORM DRAIN
ALTERNATIVE 2

Program License Serial Number 6279

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.200 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 81.000 to Point/Station 82.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.590
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.410
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 47.17
Pervious ratio(Ap) = 0.5000 Max loss rate(Fm)= 0.421(In/Hr)
Initial subarea data:
Initial area flow distance = 998.000(Ft.)
Top (of initial area) elevation = 775.000(Ft.)
Bottom (of initial area) elevation = 767.000(Ft.)
Difference in elevation = 8.000(Ft.)
Slope = 0.00802 s(%)= 0.80
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 16.174 min.
Rainfall intensity = 2.635(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.756
Subarea runoff = 19.326(CFS)
Total initial stream area = 9.700(Ac.)
Pervious area fraction = 0.500
Initial area Fm value = 0.421(In/Hr)

++

Process from Point/Station 82.000 to Point/Station 83.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

```
Top of street segment elevation =   767.000(Ft.)
End of street segment elevation =   750.000(Ft.)
Length of street segment  =  1686.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  65.000(Ft.)
Distance from crown to crossfall grade break  =  60.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     29.610(CFS)
Depth of flow =   0.535(Ft.), Average velocity =   3.455(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.393(Ft.)
Flow velocity =   3.45(Ft/s)
Travel time =    8.13 min.     TC =   24.31  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.790
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.210
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 39.77
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.459(In/Hr)
Rainfall intensity =      2.064(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.706
Subarea runoff =     20.423(CFS) for   17.600(Ac.)
Total runoff =     39.749(CFS)
Effective area this stream =       27.30(Ac.)
Total Study Area (Main Stream No. 1) =       27.30(Ac.)
Area averaged Fm value =    0.446(In/Hr)
Street flow at end of street =     39.749(CFS)
Half street flow at end of street =     19.874(CFS)
Depth of flow =   0.584(Ft.), Average velocity =   3.714(Ft/s)
Flow width (from curb towards crown)=  22.856(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       83.000 to Point/Station       84.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   750.000(Ft.)
Downstream point/station elevation =   747.700(Ft.)
Pipe length  =  1333.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    39.749(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    39.749(CFS)
Normal flow depth in pipe =   32.72(In.)
Flow top width inside pipe =   34.85(In.)
Critical Depth =   23.53(In.)
Pipe flow velocity =      4.94(Ft/s)
Travel time through pipe =    4.49 min.
```

```
Time of concentration (TC) =    28.80 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       84.000 to Point/Station       84.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Time of concentration =    28.80 min.
Rainfall intensity =      1.864(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.670
Subarea runoff =     84.317(CFS) for   72.100(Ac.)
Total runoff =    124.066(CFS)
Effective area this stream =       99.40(Ac.)
Total Study Area (Main Stream No. 1) =       99.40(Ac.)
Area averaged Fm value =    0.477(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       84.000 to Point/Station       84.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4700     Max loss rate(Fm)=     0.460(In/Hr)
Time of concentration =    28.80 min.
Rainfall intensity =      1.864(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.674
Subarea runoff =    127.148(CFS) for  100.600(Ac.)
Total runoff =    251.214(CFS)
Effective area this stream =      200.00(Ac.)
Total Study Area (Main Stream No. 1) =      200.00(Ac.)
Area averaged Fm value =    0.468(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       84.000 to Point/Station       85.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   747.700(Ft.)
Downstream point/station elevation =   722.700(Ft.)
Pipe length  =  2630.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   251.214(CFS)
Nearest computed pipe diameter  =     60.00(In.)
Calculated individual pipe flow  =   251.214(CFS)
Normal flow depth in pipe =   48.56(In.)
Flow top width inside pipe =   47.14(In.)
Critical Depth =   53.16(In.)
Pipe flow velocity =     14.74(Ft/s)
Travel time through pipe =    2.97 min.
```

```
Time of concentration (TC) =    31.77 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       85.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5900     Max loss rate(Fm)=     0.577(In/Hr)
Time of concentration =    31.77 min.
Rainfall intensity =      1.757(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.642
Subarea runoff =     87.022(CFS) for  100.000(Ac.)
Total runoff =    338.236(CFS)
Effective area this stream =      300.00(Ac.)
Total Study Area (Main Stream No. 1) =      300.00(Ac.)
Area averaged Fm value =    0.504(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       85.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5200     Max loss rate(Fm)=     0.508(In/Hr)
Time of concentration =    31.77 min.
Rainfall intensity =      1.757(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.642
Subarea runoff =     10.002(CFS) for    8.900(Ac.)
Total runoff =    348.239(CFS)
Effective area this stream =      308.90(Ac.)
Total Study Area (Main Stream No. 1) =      308.90(Ac.)
Area averaged Fm value =    0.505(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       85.000 to Point/Station       85.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    308.900(Ac.)
Runoff from this stream =    348.239(CFS)
Time of concentration =   31.77 min.
Rainfall intensity =     1.757(In/Hr)
Area averaged loss rate (Fm) =    0.5046(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5199


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       86.000 to Point/Station       87.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
RESIDENTIAL(5 - 7 dwl/acre)
```

```
Decimal fraction soil group A = 0.240
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.760
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 60.12
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.339(In/Hr)
Initial subarea data:
Initial area flow distance =   730.000(Ft.)
Top (of initial area) elevation =   750.000(Ft.)
Bottom (of initial area) elevation =   742.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.01096  s(%)=       1.10
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.407 min.
Rainfall intensity =      2.949(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.797
Subarea runoff =     22.315(CFS)
Total initial stream area =        9.500(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.339(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       87.000 to Point/Station       88.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   742.000(Ft.)
End of street segment elevation =   724.700(Ft.)
Length of street segment  =  2135.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  13.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     40.720(CFS)
Depth of flow =   0.593(Ft.), Average velocity =   3.853(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   3.85(Ft/s)
Travel time =    9.23 min.     TC =   22.64  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.3900     Max loss rate(Fm)=     0.214(In/Hr)
Rainfall intensity =      2.153(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.796
Subarea runoff =     36.667(CFS) for   24.900(Ac.)
Total runoff =     58.982(CFS)
```

```
Effective area this stream =       34.40(Ac.)
Total Study Area (Main Stream No. 1) =      343.30(Ac.)
Area averaged Fm value =    0.248(In/Hr)
Street flow at end of street =     58.982(CFS)
Half street flow at end of street =     29.491(CFS)
Depth of flow =   0.667(Ft.), Average velocity =   4.460(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    0.01(Ft.)
Flow width (from curb towards crown)=  18.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       88.000 to Point/Station       89.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   724.700(Ft.)
Downstream point/station elevation =   724.000(Ft.)
Pipe length  =   857.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    58.982(CFS)
Nearest computed pipe diameter  =     57.00(In.)
Calculated individual pipe flow  =    58.982(CFS)
Normal flow depth in pipe =   42.61(In.)
Flow top width inside pipe =   49.52(In.)
Critical Depth =   26.32(In.)
Pipe flow velocity =      4.15(Ft/s)
Travel time through pipe =    3.44 min.
Time of concentration (TC) =    26.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       89.000 to Point/Station       89.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 64.14
Pervious ratio(Ap) = 0.5200     Max loss rate(Fm)=     0.323(In/Hr)
Time of concentration =    26.08 min.
Rainfall intensity =      1.978(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.769
Subarea runoff =     53.571(CFS) for   39.600(Ac.)
Total runoff =    112.554(CFS)
Effective area this stream =       74.00(Ac.)
Total Study Area (Main Stream No. 1) =      382.90(Ac.)
Area averaged Fm value =    0.288(In/Hr)


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Process from Point/Station       89.000 to Point/Station       90.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   724.000(Ft.)
Downstream point/station elevation =   722.900(Ft.)
Pipe length  =  1331.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   112.554(CFS)
Nearest computed pipe diameter  =     72.00(In.)
Calculated individual pipe flow  =   112.554(CFS)
```

Normal flow depth in pipe = 54.66(In.)
Flow top width inside pipe = 61.58(In.)
Critical Depth = 34.37(In.)
Pipe flow velocity = 4.89(Ft/s)
Travel time through pipe = 4.54 min.
Time of concentration (TC) = 30.62 min.

++
Process from Point/Station 90.000 to Point/Station 90.000
**** SUBAREA FLOW ADDITION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 34.05
Pervious ratio(Ap) = 0.6800 Max loss rate(Fm)= 0.656(In/Hr)
Time of concentration = 30.62 min.
Rainfall intensity = 1.797(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.665
Subarea runoff = 60.890(CFS) for 71.100(Ac.)
Total runoff = 173.444(CFS)
Effective area this stream = 145.10(Ac.)
Total Study Area (Main Stream No. 1) = 454.00(Ac.)
Area averaged Fm value = 0.468(In/Hr)

++
Process from Point/Station 90.000 to Point/Station 85.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 722.900(Ft.)
Downstream point/station elevation = 722.700(Ft.)
Pipe length = 89.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 173.444(CFS)
Nearest computed pipe diameter = 69.00(In.)
Calculated individual pipe flow = 173.444(CFS)
Normal flow depth in pipe = 54.66(In.)
Flow top width inside pipe = 56.00(In.)
Critical Depth = 43.61(In.)
Pipe flow velocity = 7.86(Ft/s)
Travel time through pipe = 0.19 min.
Time of concentration (TC) = 30.81 min.

++
Process from Point/Station 85.000 to Point/Station 85.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 145.100(Ac.)
Runoff from this stream = 173.444(CFS)
Time of concentration = 30.81 min.
Rainfall intensity = 1.790(In/Hr)
Area averaged loss rate (Fm) = 0.4685(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5748
Summary of stream data:

Stream	Flow rate	Area	TC	Fm	Rainfall Intensity

```
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    348.24   308.900     31.77    0.505      1.757
2    173.44   145.100     30.81    0.468      1.790
Qmax(1) =
         1.000 *    1.000 *   348.239) +
         0.975 *    1.000 *   173.444) + =     517.375
Qmax(2) =
         1.026 *    0.970 *   348.239) +
         1.000 *    1.000 *   173.444) + =     519.954

Total of 2 streams to confluence:
Flow rates before confluence point:
     348.239     173.444
Maximum flow rates at confluence using above data:
      517.375      519.954
Area of streams before confluence:
      308.900      145.100
Effective area values after confluence:
      454.000      444.618
Results of confluence:
Total flow rate =    519.954(CFS)
Time of concentration =    30.810 min.
Effective stream area after confluence =    444.618(Ac.)
Study area average Pervious fraction(Ap) =  0.537
Study area average soil loss rate(Fm) =    0.493(In/Hr)
Study area total (this main stream) =     454.00(Ac.)


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Process from Point/Station       85.000 to Point/Station       91.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   722.700(Ft.)
Downstream point/station elevation =   697.000(Ft.)
Pipe length  =  2645.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   519.954(CFS)
Nearest computed pipe diameter  =     81.00(In.)
Calculated individual pipe flow  =   519.954(CFS)
Normal flow depth in pipe =   60.66(In.)
Flow top width inside pipe =   70.26(In.)
Critical Depth =   71.19(In.)
Pipe flow velocity =     18.10(Ft/s)
Travel time through pipe =    2.44 min.
Time of concentration (TC) =    33.25 min.


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Process from Point/Station       91.000 to Point/Station       91.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4600     Max loss rate(Fm)=     0.450(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    497.350(CFS)
therefore the upstream flow rate of Q =    519.954(CFS) is being used
```

```
Time of concentration =    33.25 min.
Rainfall intensity =      1.710(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.641
Subarea runoff =      0.000(CFS) for    9.100(Ac.)
Total runoff =    519.954(CFS)
Effective area this stream =      453.72(Ac.)
Total Study Area (Main Stream No. 1) =      463.10(Ac.)
Area averaged Fm value =    0.492(In/Hr)


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Process from Point/Station       91.000 to Point/Station       91.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4500     Max loss rate(Fm)=     0.440(In/Hr)
Time of concentration =    33.25 min.
Rainfall intensity =      1.710(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.645
Subarea runoff =     74.447(CFS) for   84.900(Ac.)
Total runoff =    594.401(CFS)
Effective area this stream =      538.62(Ac.)
Total Study Area (Main Stream No. 1) =      548.00(Ac.)
Area averaged Fm value =    0.484(In/Hr)


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Process from Point/Station       91.000 to Point/Station       91.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    538.618(Ac.)
Runoff from this stream =    594.401(CFS)
Time of concentration =   33.25 min.
Rainfall intensity =     1.710(In/Hr)
Area averaged loss rate (Fm) =    0.4840(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5224


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Process from Point/Station       92.000 to Point/Station       93.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.050
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.950
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.15
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.288(In/Hr)
Initial subarea data:
Initial area flow distance =   687.000(Ft.)
Top (of initial area) elevation =   726.000(Ft.)
Bottom (of initial area) elevation =   720.000(Ft.)
Difference in elevation =     6.000(Ft.)
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Slope =    0.00873  s(%)=       0.87
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.693 min.
Rainfall intensity =      2.912(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.811
Subarea runoff =     21.962(CFS)
Total initial stream area =        9.300(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.288(In/Hr)


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Process from Point/Station       93.000 to Point/Station       94.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   720.000(Ft.)
End of street segment elevation =   701.000(Ft.)
Length of street segment  =  2168.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  13.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     40.078(CFS)
Depth of flow =   0.584(Ft.), Average velocity =   3.921(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   3.92(Ft/s)
Travel time =    9.22 min.     TC =   22.91  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 49.51
Pervious ratio(Ap) = 0.4100     Max loss rate(Fm)=     0.334(In/Hr)
Rainfall intensity =      2.138(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.764
Subarea runoff =     36.064(CFS) for   26.200(Ac.)
Total runoff =     58.025(CFS)
Effective area this stream =       35.50(Ac.)
Total Study Area (Main Stream No. 1) =      583.50(Ac.)
Area averaged Fm value =    0.322(In/Hr)
Street flow at end of street =     58.025(CFS)
Half street flow at end of street =     29.013(CFS)
Depth of flow =   0.655(Ft.), Average velocity =   4.539(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  18.000(Ft.)


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Process from Point/Station       94.000 to Point/Station       95.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   701.000(Ft.)
Downstream point/station elevation =   699.000(Ft.)
Pipe length  =   700.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    58.025(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =    58.025(CFS)
Normal flow depth in pipe =   33.28(In.)
Flow top width inside pipe =   39.50(In.)
Critical Depth =   28.09(In.)
Pipe flow velocity =      6.62(Ft/s)
Travel time through pipe =    1.76 min.
Time of concentration (TC) =    24.67 min.


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Process from Point/Station       95.000 to Point/Station       95.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4600     Max loss rate(Fm)=     0.252(In/Hr)
Time of concentration =    24.67 min.
Rainfall intensity =      2.045(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.775
Subarea runoff =     64.815(CFS) for   42.000(Ac.)
Total runoff =    122.840(CFS)
Effective area this stream =       77.50(Ac.)
Total Study Area (Main Stream No. 1) =      625.50(Ac.)
Area averaged Fm value =    0.284(In/Hr)


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Process from Point/Station       95.000 to Point/Station       96.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   699.000(Ft.)
Downstream point/station elevation =   697.200(Ft.)
Pipe length  =  1349.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =   122.840(CFS)
Nearest computed pipe diameter  =     72.00(In.)
Calculated individual pipe flow  =   122.840(CFS)
Normal flow depth in pipe =   54.19(In.)
Flow top width inside pipe =   62.14(In.)
Critical Depth =   35.94(In.)
Pipe flow velocity =      5.38(Ft/s)
Travel time through pipe =    4.18 min.
Time of concentration (TC) =    28.85 min.


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Process from Point/Station       96.000 to Point/Station       96.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
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USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 41.47
Pervious ratio(Ap) = 0.3600     Max loss rate(Fm)=     0.325(In/Hr)
Time of concentration =    28.85 min.
Rainfall intensity =      1.862(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.753
Subarea runoff =     86.113(CFS) for   71.500(Ac.)
Total runoff =    208.953(CFS)
Effective area this stream =      149.00(Ac.)
Total Study Area (Main Stream No. 1) =      697.00(Ac.)
Area averaged Fm value =    0.304(In/Hr)


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Process from Point/Station       96.000 to Point/Station       91.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   697.200(Ft.)
Downstream point/station elevation =   697.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   208.953(CFS)
Nearest computed pipe diameter  =     75.00(In.)
Calculated individual pipe flow  =   208.953(CFS)
Normal flow depth in pipe =   60.75(In.)
Flow top width inside pipe =   58.85(In.)
Critical Depth =   46.88(In.)
Pipe flow velocity =      7.85(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =    29.06 min.


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Process from Point/Station       91.000 to Point/Station       91.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    149.000(Ac.)
Runoff from this stream =    208.953(CFS)
Time of concentration =   29.06 min.
Rainfall intensity =     1.854(In/Hr)
Area averaged loss rate (Fm) =    0.3037(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4057
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    594.40   538.618     33.25    0.484      1.710
2    208.95   149.000     29.06    0.304      1.854
Qmax(1) =
         1.000 *    1.000 *   594.401) +
         0.907 *    1.000 *   208.953) + =     783.994
Qmax(2) =
         1.117 *    0.874 *   594.401) +
         1.000 *    1.000 *   208.953) + =     789.468

Total of 2 streams to confluence:
```

```
Flow rates before confluence point:
     594.401     208.953
Maximum flow rates at confluence using above data:
      783.994      789.468
Area of streams before confluence:
      538.618      149.000
Effective area values after confluence:
      687.618      619.883
Results of confluence:
Total flow rate =    789.468(CFS)
Time of concentration =    29.065 min.
Effective stream area after confluence =    619.883(Ac.)
Study area average Pervious fraction(Ap) =  0.497
Study area average soil loss rate(Fm) =    0.445(In/Hr)
Study area total (this main stream) =     687.62(Ac.)


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Process from Point/Station       91.000 to Point/Station       97.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   697.000(Ft.)
Downstream point/station elevation =   685.000(Ft.)
Pipe length  =  2637.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   789.468(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =   789.468(CFS)
Normal flow depth in pipe =   83.06(In.)
Flow top width inside pipe =   91.02(In.)
Critical Depth =   83.36(In.)
Pipe flow velocity =     15.05(Ft/s)
Travel time through pipe =    2.92 min.
Time of concentration (TC) =    31.98 min.


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Process from Point/Station       97.000 to Point/Station       97.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 45.69
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.344(In/Hr)
Time of concentration =    31.98 min.
Rainfall intensity =      1.750(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.678
Subarea runoff =     47.405(CFS) for   85.790(Ac.)
Total runoff =    836.873(CFS)
Effective area this stream =      705.67(Ac.)
Total Study Area (Main Stream No. 1) =      782.79(Ac.)
Area averaged Fm value =    0.433(In/Hr)


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Process from Point/Station       97.000 to Point/Station       97.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
```

```
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5300     Max loss rate(Fm)=     0.518(In/Hr)
Time of concentration =    31.98 min.
Rainfall intensity =      1.750(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.673
Subarea runoff =     91.014(CFS) for   82.080(Ac.)
Total runoff =    927.886(CFS)
Effective area this stream =      787.75(Ac.)
Total Study Area (Main Stream No. 1) =      864.87(Ac.)
Area averaged Fm value =    0.442(In/Hr)


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Process from Point/Station       97.000 to Point/Station     1706.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   685.000(Ft.)
Downstream point/station elevation =   671.500(Ft.)
Pipe length  =  1928.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   927.886(CFS)
Nearest computed pipe diameter  =    105.00(In.)
Calculated individual pipe flow  =   927.886(CFS)
Normal flow depth in pipe =   82.31(In.)
Flow top width inside pipe =   86.43(In.)
Critical Depth =   89.82(In.)
Pipe flow velocity =     18.35(Ft/s)
Travel time through pipe =    1.75 min.
Time of concentration (TC) =    33.74 min.


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Process from Point/Station     1706.000 to Point/Station     1706.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    787.753(Ac.)
Runoff from this stream =    927.886(CFS)
Time of concentration =   33.74 min.
Rainfall intensity =     1.695(In/Hr)
Area averaged loss rate (Fm) =    0.4415(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4899


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Process from Point/Station     1700.000 to Point/Station     1701.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.890
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.110
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 36.07
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.095(In/Hr)
Initial subarea data:
Initial area flow distance =   556.000(Ft.)
Top (of initial area) elevation =   704.000(Ft.)
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```
Bottom (of initial area) elevation =   700.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00719  s(%)=       0.72
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.221 min.
Rainfall intensity =      3.470(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff =     23.786(CFS)
Total initial stream area =        7.830(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.095(In/Hr)


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Process from Point/Station     1701.000 to Point/Station     1702.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   700.000(Ft.)
End of street segment elevation =   698.000(Ft.)
Length of street segment  =   328.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     35.824(CFS)
Depth of flow =   0.611(Ft.), Average velocity =   2.996(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  24.193(Ft.)
Flow velocity =   3.00(Ft/s)
Travel time =    1.82 min.     TC =   12.05  min.
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.630
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.370
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 45.69
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.086(In/Hr)
Rainfall intensity =      3.145(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =     23.911(CFS) for    9.520(Ac.)
Total runoff =     47.697(CFS)
Effective area this stream =       17.35(Ac.)
Total Study Area (Main Stream No. 1) =      882.22(Ac.)
Area averaged Fm value =    0.090(In/Hr)
Street flow at end of street =     47.697(CFS)
Half street flow at end of street =     23.848(CFS)
Depth of flow =   0.667(Ft.), Average velocity =   3.215(Ft/s)
Warning: depth of flow exceeds top of curb
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Distance that curb overflow reaches into property =    0.00(Ft.)
Flow width (from curb towards crown)=  27.001(Ft.)


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Process from Point/Station     1702.000 to Point/Station     1704.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   698.000(Ft.)
End of street segment elevation =   693.000(Ft.)
Length of street segment  =   745.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     65.955(CFS)
Depth of flow =   0.736(Ft.), Average velocity =   3.464(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    3.46(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  30.000(Ft.)
Flow velocity =   3.46(Ft/s)
Travel time =    3.58 min.     TC =   15.63  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4200     Max loss rate(Fm)=     0.411(In/Hr)
Rainfall intensity =      2.690(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.811
Subarea runoff =     36.316(CFS) for   21.170(Ac.)
Total runoff =     84.013(CFS)
Effective area this stream =       38.52(Ac.)
Total Study Area (Main Stream No. 1) =      903.39(Ac.)
Area averaged Fm value =    0.266(In/Hr)
Street flow at end of street =     84.013(CFS)
Half street flow at end of street =     42.006(CFS)
Depth of flow =   0.788(Ft.), Average velocity =   3.705(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    6.07(Ft.)
Flow width (from curb towards crown)=  30.000(Ft.)


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Process from Point/Station     1704.000 to Point/Station     1706.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
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Upstream point/station elevation =   679.500(Ft.)
Downstream point/station elevation =   671.500(Ft.)
Pipe length  =  1235.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    84.013(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =    84.013(CFS)
Normal flow depth in pipe =   32.25(In.)
Flow top width inside pipe =   40.56(In.)
Critical Depth =   33.86(In.)
Pipe flow velocity =      9.92(Ft/s)
Travel time through pipe =    2.08 min.
Time of concentration (TC) =    17.71 min.


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Process from Point/Station     1706.000 to Point/Station     1706.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     38.520(Ac.)
Runoff from this stream =     84.013(CFS)
Time of concentration =   17.71 min.
Rainfall intensity =     2.496(In/Hr)
Area averaged loss rate (Fm) =    0.2662(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2759
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    927.89   787.753     33.74    0.442      1.695
2     84.01    38.520     17.71    0.266      2.496
Qmax(1) =
         1.000 *    1.000 *   927.886) +
         0.641 *    1.000 *    84.013) + =     981.734
Qmax(2) =
         1.639 *    0.525 *   927.886) +
         1.000 *    1.000 *    84.013) + =     881.996

Total of 2 streams to confluence:
Flow rates before confluence point:
     927.886      84.013
Maximum flow rates at confluence using above data:
      981.734      881.996
Area of streams before confluence:
      787.753       38.520
Effective area values after confluence:
      826.273      451.982
Results of confluence:
Total flow rate =    981.734(CFS)
Time of concentration =    33.735 min.
Effective stream area after confluence =    826.273(Ac.)
Study area average Pervious fraction(Ap) =  0.480
Study area average soil loss rate(Fm) =    0.433(In/Hr)
Study area total (this main stream) =     826.27(Ac.)


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Process from Point/Station     1706.000 to Point/Station     1706.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4800     Max loss rate(Fm)=     0.469(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    957.535(CFS)
therefore the upstream flow rate of Q =    981.734(CFS) is being used
Time of concentration =    33.74 min.
Rainfall intensity =      1.695(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.670
Subarea runoff =      0.000(CFS) for   17.370(Ac.)
Total runoff =    981.734(CFS)
Effective area this stream =      843.64(Ac.)
Total Study Area (Main Stream No. 1) =      920.76(Ac.)
Area averaged Fm value =    0.434(In/Hr)


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Process from Point/Station     1706.000 to Point/Station     1706.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Time of concentration =    33.74 min.
Rainfall intensity =      1.695(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.673
Subarea runoff =      3.318(CFS) for   19.140(Ac.)
Total runoff =    985.052(CFS)
Effective area this stream =      862.78(Ac.)
Total Study Area (Main Stream No. 1) =      939.90(Ac.)
Area averaged Fm value =    0.427(In/Hr)


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Process from Point/Station     1706.000 to Point/Station     1708.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   671.500(Ft.)
Downstream point/station elevation =   666.500(Ft.)
Pipe length  =   668.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   985.052(CFS)
Nearest computed pipe diameter  =    105.00(In.)
Calculated individual pipe flow  =   985.052(CFS)
Normal flow depth in pipe =   84.56(In.)
Flow top width inside pipe =   83.14(In.)
Critical Depth =   91.96(In.)
Pipe flow velocity =     19.00(Ft/s)
Travel time through pipe =    0.59 min.
Time of concentration (TC) =    34.32 min.


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Process from Point/Station     1708.000 to Point/Station     1708.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1960     Max loss rate(Fm)=     0.192(In/Hr)
Time of concentration =    34.32 min.
Rainfall intensity =      1.678(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.682
Subarea runoff =     97.922(CFS) for   83.330(Ac.)
Total runoff =   1082.974(CFS)
Effective area this stream =      946.11(Ac.)
Total Study Area (Main Stream No. 1) =     1023.23(Ac.)
Area averaged Fm value =    0.406(In/Hr)


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Process from Point/Station     1708.000 to Point/Station      127.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   666.500(Ft.)
Downstream point/station elevation =   662.890(Ft.)
Pipe length  =   456.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1082.974(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =  1082.974(CFS)
Normal flow depth in pipe =   86.16(In.)
Flow top width inside pipe =   86.76(In.)
Critical Depth =   95.43(In.)
Pipe flow velocity =     19.90(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =    34.70 min.


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Process from Point/Station      127.000 to Point/Station      127.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    34.70 min.
Rainfall intensity =      1.667(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.684
Subarea runoff =     12.032(CFS) for   14.810(Ac.)
Total runoff =   1095.005(CFS)
Effective area this stream =      960.92(Ac.)
Total Study Area (Main Stream No. 1) =     1038.04(Ac.)
Area averaged Fm value =    0.401(In/Hr)


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Process from Point/Station      127.000 to Point/Station      127.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    34.70 min.
Rainfall intensity =      1.667(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.685
Subarea runoff =      7.384(CFS) for    5.090(Ac.)
Total runoff =   1102.389(CFS)
Effective area this stream =      966.01(Ac.)
Total Study Area (Main Stream No. 1) =     1043.13(Ac.)
Area averaged Fm value =    0.399(In/Hr)


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Process from Point/Station      127.000 to Point/Station      128.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   662.890(Ft.)
Downstream point/station elevation =   654.800(Ft.)
Pipe length  =  1021.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1102.389(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =  1102.389(CFS)
Normal flow depth in pipe =   87.75(In.)
Flow top width inside pipe =   84.31(In.)
Critical Depth =   96.02(In.)
Pipe flow velocity =     19.92(Ft/s)
Travel time through pipe =    0.85 min.
Time of concentration (TC) =    35.56 min.


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Process from Point/Station      128.000 to Point/Station      128.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    35.56 min.
Rainfall intensity =      1.643(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.685
Subarea runoff =      2.687(CFS) for   16.570(Ac.)
Total runoff =   1105.076(CFS)
Effective area this stream =      982.58(Ac.)
Total Study Area (Main Stream No. 1) =     1059.70(Ac.)
Area averaged Fm value =    0.393(In/Hr)
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Process from Point/Station      128.000 to Point/Station      129.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   654.800(Ft.)
Downstream point/station elevation =   645.700(Ft.)
Pipe length  =  1148.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1105.076(CFS)
Nearest computed pipe diameter  =    108.00(In.)
Calculated individual pipe flow  =  1105.076(CFS)
Normal flow depth in pipe =   87.94(In.)
Flow top width inside pipe =   84.01(In.)
Critical Depth =   96.10(In.)
Pipe flow velocity =     19.92(Ft/s)
Travel time through pipe =    0.96 min.
Time of concentration (TC) =    36.52 min.


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Process from Point/Station      128.000 to Point/Station      129.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    982.583(Ac.)
Runoff from this stream =   1105.076(CFS)
Time of concentration =   36.52 min.
Rainfall intensity =     1.616(In/Hr)
Area averaged loss rate (Fm) =    0.3929(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4344
Program is now starting with Main Stream No. 2


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Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   855.000(Ft.)
Top (of initial area) elevation =   675.000(Ft.)
Bottom (of initial area) elevation =   670.370(Ft.)
Difference in elevation =     4.630(Ft.)
Slope =    0.00542  s(%)=       0.54
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.851 min.
Rainfall intensity =      3.025(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff =     20.021(CFS)
Total initial stream area =        7.490(Ac.)
Pervious area fraction = 0.100
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Initial area Fm value =    0.055(In/Hr)


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Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   652.360(Ft.)
Downstream point/station elevation =   651.780(Ft.)
Pipe length  =   577.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    20.021(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    20.021(CFS)
Normal flow depth in pipe =   27.94(In.)
Flow top width inside pipe =   30.02(In.)
Critical Depth =   17.24(In.)
Pipe flow velocity =      3.40(Ft/s)
Travel time through pipe =    2.83 min.
Time of concentration (TC) =    15.68 min.


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Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    15.68 min.
Rainfall intensity =      2.685(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.882
Subarea runoff =     13.402(CFS) for    6.630(Ac.)
Total runoff =     33.423(CFS)
Effective area this stream =       14.12(Ac.)
Total Study Area (Main Stream No. 2) =     1073.82(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   651.780(Ft.)
Downstream point/station elevation =   650.330(Ft.)
Pipe length  =   480.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    33.423(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    33.423(CFS)
Normal flow depth in pipe =   27.00(In.)
Flow top width inside pipe =   31.18(In.)
Critical Depth =   22.53(In.)
Pipe flow velocity =      5.88(Ft/s)
Travel time through pipe =    1.36 min.
Time of concentration (TC) =    17.04 min.
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Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    17.04 min.
Rainfall intensity =      2.554(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =     14.600(CFS) for    7.230(Ac.)
Total runoff =     48.023(CFS)
Effective area this stream =       21.35(Ac.)
Total Study Area (Main Stream No. 2) =     1081.05(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   650.330(Ft.)
Downstream point/station elevation =   649.820(Ft.)
Pipe length  =   520.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    48.023(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =    48.023(CFS)
Normal flow depth in pipe =   38.11(In.)
Flow top width inside pipe =   44.33(In.)
Critical Depth =   24.46(In.)
Pipe flow velocity =      4.22(Ft/s)
Travel time through pipe =    2.05 min.
Time of concentration (TC) =    19.09 min.


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Process from Point/Station      105.000 to Point/Station      105.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    19.09 min.
Rainfall intensity =      2.386(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =     47.317(CFS) for   24.100(Ac.)
Total runoff =     95.341(CFS)
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Effective area this stream =       45.45(Ac.)
Total Study Area (Main Stream No. 2) =     1105.15(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      105.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   649.820(Ft.)
Downstream point/station elevation =   649.240(Ft.)
Pipe length  =   577.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    95.341(CFS)
Nearest computed pipe diameter  =     66.00(In.)
Calculated individual pipe flow  =    95.341(CFS)
Normal flow depth in pipe =   48.75(In.)
Flow top width inside pipe =   58.00(In.)
Critical Depth =   32.33(In.)
Pipe flow velocity =      5.07(Ft/s)
Travel time through pipe =    1.90 min.
Time of concentration (TC) =    20.99 min.


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Process from Point/Station      110.000 to Point/Station      110.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    20.99 min.
Rainfall intensity =      2.254(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.878
Subarea runoff =      9.073(CFS) for    7.310(Ac.)
Total runoff =    104.414(CFS)
Effective area this stream =       52.76(Ac.)
Total Study Area (Main Stream No. 2) =     1112.46(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      105.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     52.760(Ac.)
Runoff from this stream =    104.414(CFS)
Time of concentration =   20.99 min.
Rainfall intensity =     2.254(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


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Process from Point/Station      106.000 to Point/Station      107.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   873.000(Ft.)
Top (of initial area) elevation =   673.000(Ft.)
Bottom (of initial area) elevation =   663.760(Ft.)
Difference in elevation =     9.240(Ft.)
Slope =    0.01058  s(%)=       1.06
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.333 min.
Rainfall intensity =      3.262(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =      8.226(CFS)
Total initial stream area =        2.850(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


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Process from Point/Station      107.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   651.190(Ft.)
Downstream point/station elevation =   650.560(Ft.)
Pipe length  =   623.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.226(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     8.226(CFS)
Normal flow depth in pipe =   18.87(In.)
Flow top width inside pipe =   24.77(In.)
Critical Depth =   11.81(In.)
Pipe flow velocity =      2.77(Ft/s)
Travel time through pipe =    3.75 min.
Time of concentration (TC) =    15.08 min.


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Process from Point/Station      108.000 to Point/Station      108.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    15.08 min.
Rainfall intensity =      2.748(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.882
```

```
Subarea runoff =     13.422(CFS) for    6.080(Ac.)
Total runoff =     21.648(CFS)
Effective area this stream =        8.93(Ac.)
Total Study Area (Main Stream No. 2) =     1121.39(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      108.000 to Point/Station      109.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   650.560(Ft.)
Downstream point/station elevation =   650.090(Ft.)
Pipe length  =   473.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.648(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    21.648(CFS)
Normal flow depth in pipe =   27.16(In.)
Flow top width inside pipe =   35.86(In.)
Critical Depth =   17.55(In.)
Pipe flow velocity =      3.51(Ft/s)
Travel time through pipe =    2.25 min.
Time of concentration (TC) =    17.32 min.


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Process from Point/Station      109.000 to Point/Station      109.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    17.32 min.
Rainfall intensity =      2.529(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.880
Subarea runoff =     12.639(CFS) for    6.470(Ac.)
Total runoff =     34.287(CFS)
Effective area this stream =       15.40(Ac.)
Total Study Area (Main Stream No. 2) =     1127.86(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      109.000 to Point/Station      109.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    17.32 min.
```

```
Rainfall intensity =      2.529(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.880
Subarea runoff =     19.080(CFS) for    8.570(Ac.)
Total runoff =     53.367(CFS)
Effective area this stream =       23.97(Ac.)
Total Study Area (Main Stream No. 2) =     1136.43(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      109.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   650.090(Ft.)
Downstream point/station elevation =   649.240(Ft.)
Pipe length  =   854.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    53.367(CFS)
Nearest computed pipe diameter  =     54.00(In.)
Calculated individual pipe flow  =    53.367(CFS)
Normal flow depth in pipe =   38.63(In.)
Flow top width inside pipe =   48.74(In.)
Critical Depth =   25.40(In.)
Pipe flow velocity =      4.39(Ft/s)
Travel time through pipe =    3.24 min.
Time of concentration (TC) =    20.57 min.


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Process from Point/Station      109.000 to Point/Station      110.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     23.970(Ac.)
Runoff from this stream =     53.367(CFS)
Time of concentration =   20.57 min.
Rainfall intensity =     2.281(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1    104.41    52.760     20.99    0.055      2.254
2     53.37    23.970     20.57    0.055      2.281
Qmax(1) =
         1.000 *    1.000 *   104.414) +
         0.988 *    1.000 *    53.367) + =     157.124
Qmax(2) =
         1.012 *    0.980 *   104.414) +
         1.000 *    1.000 *    53.367) + =     156.974

Total of 2 streams to confluence:
Flow rates before confluence point:
     104.414      53.367
Maximum flow rates at confluence using above data:
      157.124      156.974
```

```
Area of streams before confluence:
       52.760       23.970
Effective area values after confluence:
       76.730       75.678
Results of confluence:
Total flow rate =    157.124(CFS)
Time of concentration =    20.987 min.
Effective stream area after confluence =     76.730(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.055(In/Hr)
Study area total (this main stream) =      76.73(Ac.)


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Process from Point/Station      110.000 to Point/Station      117.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   649.240(Ft.)
Downstream point/station elevation =   648.190(Ft.)
Pipe length  =  1050.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   157.124(CFS)
Nearest computed pipe diameter  =     78.00(In.)
Calculated individual pipe flow  =   157.124(CFS)
Normal flow depth in pipe =   60.56(In.)
Flow top width inside pipe =   64.99(In.)
Critical Depth =   39.91(In.)
Pipe flow velocity =      5.68(Ft/s)
Travel time through pipe =    3.08 min.
Time of concentration (TC) =    24.07 min.


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Process from Point/Station      117.000 to Point/Station      117.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    155.589(CFS)
therefore the upstream flow rate of Q =    157.124(CFS) is being used
Time of concentration =    24.07 min.
Rainfall intensity =      2.076(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =      0.000(CFS) for    8.800(Ac.)
Total runoff =    157.124(CFS)
Effective area this stream =       85.53(Ac.)
Total Study Area (Main Stream No. 2) =     1145.23(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      117.000 to Point/Station      118.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
```

```
Upstream point/station elevation =   648.190(Ft.)
Downstream point/station elevation =   647.900(Ft.)
Pipe length  =   290.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   157.124(CFS)
Nearest computed pipe diameter  =     78.00(In.)
Calculated individual pipe flow  =   157.124(CFS)
Normal flow depth in pipe =   60.56(In.)
Flow top width inside pipe =   64.99(In.)
Critical Depth =   39.91(In.)
Pipe flow velocity =      5.68(Ft/s)
Travel time through pipe =    0.85 min.
Time of concentration (TC) =    24.92 min.


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Process from Point/Station      118.000 to Point/Station      118.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    24.92 min.
Rainfall intensity =      2.033(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =     26.295(CFS) for   17.480(Ac.)
Total runoff =    183.419(CFS)
Effective area this stream =      103.01(Ac.)
Total Study Area (Main Stream No. 2) =     1162.71(Ac.)
Area averaged Fm value =    0.055(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      118.000 to Point/Station      119.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   647.900(Ft.)
Downstream point/station elevation =   647.550(Ft.)
Pipe length  =   351.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   183.419(CFS)
Nearest computed pipe diameter  =     84.00(In.)
Calculated individual pipe flow  =   183.419(CFS)
Normal flow depth in pipe =   62.81(In.)
Flow top width inside pipe =   72.96(In.)
Critical Depth =   42.33(In.)
Pipe flow velocity =      5.94(Ft/s)
Travel time through pipe =    0.99 min.
Time of concentration (TC) =    25.90 min.


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Process from Point/Station      119.000 to Point/Station      119.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
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COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    25.90 min.
Rainfall intensity =      1.986(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.875
Subarea runoff =     28.576(CFS) for   18.930(Ac.)
Total runoff =    211.995(CFS)
Effective area this stream =      121.94(Ac.)
Total Study Area (Main Stream No. 2) =     1181.64(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      119.000 to Point/Station      124.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   647.550(Ft.)
Downstream point/station elevation =   647.100(Ft.)
Pipe length  =   686.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   211.995(CFS)
Nearest computed pipe diameter  =     93.00(In.)
Calculated individual pipe flow  =   211.995(CFS)
Normal flow depth in pipe =   75.19(In.)
Flow top width inside pipe =   73.19(In.)
Critical Depth =   44.25(In.)
Pipe flow velocity =      5.19(Ft/s)
Travel time through pipe =    2.20 min.
Time of concentration (TC) =    28.11 min.


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Process from Point/Station      119.000 to Point/Station      124.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =    121.940(Ac.)
Runoff from this stream =    211.995(CFS)
Time of concentration =   28.11 min.
Rainfall intensity =     1.891(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   374.000(Ft.)
Top (of initial area) elevation =   677.500(Ft.)
Bottom (of initial area) elevation =   672.000(Ft.)
Difference in elevation =     5.500(Ft.)
Slope =    0.01471  s(%)=       1.47
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.560 min.
Rainfall intensity =      4.159(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff =     21.238(CFS)
Total initial stream area =        5.750(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


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Process from Point/Station      121.000 to Point/Station      123.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   667.000(Ft.)
Downstream point/station elevation =   660.090(Ft.)
Pipe length  =  1383.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.238(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    21.238(CFS)
Normal flow depth in pipe =   21.42(In.)
Flow top width inside pipe =   21.86(In.)
Critical Depth =   19.34(In.)
Pipe flow velocity =      6.27(Ft/s)
Travel time through pipe =    3.67 min.
Time of concentration (TC) =    11.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      123.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    11.23 min.
Rainfall intensity =      3.279(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =     18.081(CFS) for    7.800(Ac.)
Total runoff =     39.319(CFS)
Effective area this stream =       13.55(Ac.)
Total Study Area (Main Stream No. 2) =     1195.19(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      123.000 to Point/Station      124.000
```

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 660.090(Ft.)
Downstream point/station elevation = 647.100(Ft.)
Pipe length = 1124.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 39.319(CFS)
Nearest computed pipe diameter = 30.00(In.)
Calculated individual pipe flow = 39.319(CFS)
Normal flow depth in pipe = 22.08(In.)
Flow top width inside pipe = 26.45(In.)
Critical Depth = 25.38(In.)
Pipe flow velocity = 10.15(Ft/s)
Travel time through pipe = 1.84 min.
Time of concentration (TC) = 13.08 min.

++
Process from Point/Station 124.000 to Point/Station 124.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.055(In/Hr)
Time of concentration = 13.08 min.
Rainfall intensity = 2.993(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.884
Subarea runoff = 21.371(CFS) for 9.400(Ac.)
Total runoff = 60.690(CFS)
Effective area this stream = 22.95(Ac.)
Total Study Area (Main Stream No. 2) = 1204.59(Ac.)
Area averaged Fm value = 0.055(In/Hr)

++
Process from Point/Station 123.000 to Point/Station 124.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 2
Stream flow area = 22.950(Ac.)
Runoff from this stream = 60.690(CFS)
Time of concentration = 13.08 min.
Rainfall intensity = 2.993(In/Hr)
Area averaged loss rate (Fm) = 0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream No.	Flow rate (CFS)	Area (Ac.)	TC (min)	Fm (In/Hr)	Rainfall Intensity (In/Hr)
1	211.99	121.940	28.11	0.055	1.891
2	60.69	22.950	13.08	0.055	2.993

Qmax(1) =
1.000 * 1.000 * 211.995) +

```
         0.625 *    1.000 *    60.690) + =     249.932
Qmax(2) =
         1.600 *    0.465 *   211.995) +
         1.000 *    1.000 *    60.690) + =     218.520

Total of 2 streams to confluence:
Flow rates before confluence point:
     211.995      60.690
Maximum flow rates at confluence using above data:
      249.932      218.520
Area of streams before confluence:
      121.940       22.950
Effective area values after confluence:
      144.890       79.698
Results of confluence:
Total flow rate =    249.932(CFS)
Time of concentration =    28.105 min.
Effective stream area after confluence =    144.890(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.055(In/Hr)
Study area total (this main stream) =     144.89(Ac.)


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Process from Point/Station      124.000 to Point/Station      124.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    28.11 min.
Rainfall intensity =      1.891(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =     36.817(CFS) for   28.580(Ac.)
Total runoff =    286.749(CFS)
Effective area this stream =      173.47(Ac.)
Total Study Area (Main Stream No. 2) =     1233.17(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      124.000 to Point/Station      125.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   647.100(Ft.)
Downstream point/station elevation =   646.500(Ft.)
Pipe length  =   568.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   286.749(CFS)
Nearest computed pipe diameter  =     96.00(In.)
Calculated individual pipe flow  =   286.749(CFS)
Normal flow depth in pipe =   75.94(In.)
Flow top width inside pipe =   78.06(In.)
Critical Depth =   51.23(In.)
Pipe flow velocity =      6.72(Ft/s)
```

```
Travel time through pipe =    1.41 min.
Time of concentration (TC) =    29.51 min.


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Process from Point/Station      125.000 to Point/Station      125.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    29.51 min.
Rainfall intensity =      1.837(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
Subarea runoff =     33.333(CFS) for   26.110(Ac.)
Total runoff =    320.082(CFS)
Effective area this stream =      199.58(Ac.)
Total Study Area (Main Stream No. 2) =     1259.28(Ac.)
Area averaged Fm value =    0.055(In/Hr)


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Process from Point/Station      125.000 to Point/Station      129.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   646.500(Ft.)
Downstream point/station elevation =   645.700(Ft.)
Pipe length  =   792.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   320.082(CFS)
Nearest computed pipe diameter  =    102.00(In.)
Calculated individual pipe flow  =   320.082(CFS)
Normal flow depth in pipe =   78.56(In.)
Flow top width inside pipe =   85.82(In.)
Critical Depth =   53.31(In.)
Pipe flow velocity =      6.83(Ft/s)
Travel time through pipe =    1.93 min.
Time of concentration (TC) =    31.45 min.


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Process from Point/Station      125.000 to Point/Station      129.000
**** CONFLUENCE OF MAIN STREAMS ****
----------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    199.580(Ac.)
Runoff from this stream =    320.082(CFS)
Time of concentration =   31.45 min.
Rainfall intensity =     1.768(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
```

```
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1   1105.08   982.583     36.52    0.393      1.616
2    320.08   199.580     31.45    0.055      1.768
Qmax(1) =
         1.000 *    1.000 *  1105.076) +
         0.911 *    1.000 *   320.082) + =    1396.821
Qmax(2) =
         1.124 *    0.861 *  1105.076) +
         1.000 *    1.000 *   320.082) + =    1389.692

Total of 2 main streams to confluence:
Flow rates before confluence point:
    1106.076     321.082
Maximum flow rates at confluence using above data:
     1396.821     1389.692
Area of streams before confluence:
      982.583      199.580
Effective area values after confluence:
     1182.163     1045.732


Results of confluence:
Total flow rate =   1396.821(CFS)
Time of concentration =    36.518 min.
Effective stream area after confluence  =   1182.163(Ac.)
Study area average Pervious fraction(Ap) =  0.378
Study area average soil loss rate(Fm) =    0.336(In/Hr)
Study area total =    1182.16(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      129.000 to Point/Station      129.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1390.472(CFS)
therefore the upstream flow rate of Q =   1396.821(CFS) is being used
Time of concentration =    36.52 min.
Rainfall intensity =      1.616(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.716
Subarea runoff =      0.000(CFS) for   19.870(Ac.)
Total runoff =   1396.821(CFS)
Effective area this stream =     1202.03(Ac.)
Total Study Area (Main Stream No. 1) =     1279.15(Ac.)
Area averaged Fm value =    0.331(In/Hr)


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Process from Point/Station      129.000 to Point/Station      130.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   645.700(Ft.)
Downstream point/station elevation =   645.600(Ft.)
Pipe length  =   561.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1396.821(CFS)
Nearest computed pipe diameter  =    240.00(In.)
Calculated individual pipe flow  =  1396.821(CFS)
Normal flow depth in pipe =  195.75(In.)
Flow top width inside pipe =  186.14(In.)
Critical Depth =   88.50(In.)
Pipe flow velocity =      5.09(Ft/s)
Travel time through pipe =    1.84 min.
Time of concentration (TC) =    38.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      130.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1390.716(CFS)
therefore the upstream flow rate of Q =   1396.821(CFS) is being used
Time of concentration =    38.36 min.
Rainfall intensity =      1.570(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.715
Subarea runoff =      0.000(CFS) for   37.420(Ac.)
Total runoff =   1396.821(CFS)
Effective area this stream =     1239.45(Ac.)
Total Study Area (Main Stream No. 1) =     1316.57(Ac.)
Area averaged Fm value =    0.323(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station     1722.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   645.600(Ft.)
Downstream point/station elevation =   642.500(Ft.)
Pipe length  =   607.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1396.821(CFS)
Nearest computed pipe diameter  =    129.00(In.)
Calculated individual pipe flow  =  1396.821(CFS)
Normal flow depth in pipe =  102.94(In.)
Flow top width inside pipe =  103.59(In.)
Critical Depth =  105.52(In.)
Pipe flow velocity =     18.00(Ft/s)
Travel time through pipe =    0.56 min.
Time of concentration (TC) =    38.92 min.
```

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Process from Point/Station     1722.000 to Point/Station     1724.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   642.500(Ft.)
Downstream point/station elevation =   641.200(Ft.)
Pipe length  =  1286.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1396.821(CFS)
Nearest computed pipe diameter  =    174.00(In.)
Calculated individual pipe flow  =  1396.821(CFS)
Normal flow depth in pipe =  140.63(In.)
Flow top width inside pipe =  137.02(In.)
Critical Depth =   97.74(In.)
Pipe flow velocity =      9.78(Ft/s)
Travel time through pipe =    2.19 min.
Time of concentration (TC) =    41.11 min.


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 46.02
Pervious ratio(Ap) = 0.4300     Max loss rate(Fm)=     0.368(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1324.396(CFS)
therefore the upstream flow rate of Q =   1396.821(CFS) is being used
Time of concentration =    41.11 min.
Rainfall intensity =      1.506(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.707
Subarea runoff =      0.000(CFS) for    4.920(Ac.)
Total runoff =   1396.821(CFS)
Effective area this stream =     1244.37(Ac.)
Total Study Area (Main Stream No. 1) =     1321.49(Ac.)
Area averaged Fm value =    0.323(In/Hr)


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =   1244.373(Ac.)
Runoff from this stream =   1396.821(CFS)
Time of concentration =   41.11 min.
Rainfall intensity =     1.506(In/Hr)
Area averaged loss rate (Fm) =    0.3230(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3653


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Process from Point/Station     1726.000 to Point/Station     1728.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.390
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Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.610
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 54.57
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.075(In/Hr)
Initial subarea data:
Initial area flow distance =   703.000(Ft.)
Top (of initial area) elevation =   685.000(Ft.)
Bottom (of initial area) elevation =   670.400(Ft.)
Difference in elevation =    14.600(Ft.)
Slope =    0.02077  s(%)=       2.08
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.082 min.
Rainfall intensity =      3.725(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =     24.704(CFS)
Total initial stream area =        7.520(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.075(In/Hr)


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Process from Point/Station     1728.000 to Point/Station     1730.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   670.400(Ft.)
End of street segment elevation =   665.200(Ft.)
Length of street segment  =   763.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  20.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     33.652(CFS)
Depth of flow =   0.589(Ft.), Average velocity =   3.076(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  23.116(Ft.)
Flow velocity =   3.08(Ft/s)
Travel time =    4.13 min.     TC =   13.22  min.
 Adding area flow to street
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 60.13
Pervious ratio(Ap) = 0.1900     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      2.974(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.868
Subarea runoff =     17.789(CFS) for    8.930(Ac.)
Total runoff =     42.492(CFS)
Effective area this stream =       16.45(Ac.)
Total Study Area (Main Stream No. 1) =     1337.94(Ac.)
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```
Area averaged Fm value =    0.104(In/Hr)
Street flow at end of street =     42.492(CFS)
Half street flow at end of street =     21.246(CFS)
Depth of flow =   0.632(Ft.), Average velocity =   3.258(Ft/s)
Flow width (from curb towards crown)=  25.286(Ft.)


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Process from Point/Station     1730.000 to Point/Station     1730.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    13.22 min.
Rainfall intensity =      2.974(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =     27.696(CFS) for   10.540(Ac.)
Total runoff =     70.188(CFS)
Effective area this stream =       26.99(Ac.)
Total Study Area (Main Stream No. 1) =     1348.48(Ac.)
Area averaged Fm value =    0.085(In/Hr)


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Process from Point/Station     1730.000 to Point/Station     1732.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   661.450(Ft.)
Downstream point/station elevation =   656.790(Ft.)
Pipe length  =   517.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    70.188(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    70.188(CFS)
Normal flow depth in pipe =   28.78(In.)
Flow top width inside pipe =   34.30(In.)
Critical Depth =   31.90(In.)
Pipe flow velocity =     10.69(Ft/s)
Travel time through pipe =    0.81 min.
Time of concentration (TC) =    14.02 min.


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Process from Point/Station     1732.000 to Point/Station     1732.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.320
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.680
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 57.16
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.072(In/Hr)
Time of concentration =    14.02 min.
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```
Rainfall intensity =      2.871(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.875
Subarea runoff =     33.095(CFS) for   14.140(Ac.)
Total runoff =    103.283(CFS)
Effective area this stream =       41.13(Ac.)
Total Study Area (Main Stream No. 1) =     1362.62(Ac.)
Area averaged Fm value =    0.080(In/Hr)


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Process from Point/Station     1732.000 to Point/Station     1732.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    14.02 min.
Rainfall intensity =      2.871(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =     18.525(CFS) for    7.310(Ac.)
Total runoff =    121.808(CFS)
Effective area this stream =       48.44(Ac.)
Total Study Area (Main Stream No. 1) =     1369.93(Ac.)
Area averaged Fm value =    0.077(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1732.000 to Point/Station     1734.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   656.790(Ft.)
Downstream point/station elevation =   652.050(Ft.)
Pipe length  =   538.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   121.808(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   121.808(CFS)
Normal flow depth in pipe =   35.72(In.)
Flow top width inside pipe =   41.89(In.)
Critical Depth =   39.83(In.)
Pipe flow velocity =     12.15(Ft/s)
Travel time through pipe =    0.74 min.
Time of concentration (TC) =    14.76 min.


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Process from Point/Station     1734.000 to Point/Station     1734.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 47.54
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.084(In/Hr)
Time of concentration =    14.76 min.
Rainfall intensity =      2.784(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.875
Subarea runoff =     31.317(CFS) for   14.450(Ac.)
Total runoff =    153.126(CFS)
Effective area this stream =       62.89(Ac.)
Total Study Area (Main Stream No. 1) =     1384.38(Ac.)
Area averaged Fm value =    0.078(In/Hr)


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Process from Point/Station     1734.000 to Point/Station     1734.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.38
Pervious ratio(Ap) = 0.2150     Max loss rate(Fm)=     0.117(In/Hr)
Time of concentration =    14.76 min.
Rainfall intensity =      2.784(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
Subarea runoff =     26.212(CFS) for   10.920(Ac.)
Total runoff =    179.338(CFS)
Effective area this stream =       73.81(Ac.)
Total Study Area (Main Stream No. 1) =     1395.30(Ac.)
Area averaged Fm value =    0.084(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1734.000 to Point/Station     1736.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   652.050(Ft.)
Downstream point/station elevation =   648.150(Ft.)
Pipe length  =   434.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   179.338(CFS)
Nearest computed pipe diameter  =     54.00(In.)
Calculated individual pipe flow  =   179.338(CFS)
Normal flow depth in pipe =   42.56(In.)
Flow top width inside pipe =   44.13(In.)
Critical Depth =   46.53(In.)
Pipe flow velocity =     13.35(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    15.30 min.


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Process from Point/Station     1736.000 to Point/Station     1736.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.630
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.370
Decimal fraction soil group D = 0.000
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```
SCS curve number for soil(AMC 2)  = 45.69
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.086(In/Hr)
Time of concentration =    15.30 min.
Rainfall intensity =      2.724(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =     23.728(CFS) for   11.660(Ac.)
Total runoff =    203.066(CFS)
Effective area this stream =       85.47(Ac.)
Total Study Area (Main Stream No. 1) =     1406.96(Ac.)
Area averaged Fm value =    0.084(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1736.000 to Point/Station     1736.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    15.30 min.
Rainfall intensity =      2.724(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
Subarea runoff =     12.396(CFS) for    5.160(Ac.)
Total runoff =    215.462(CFS)
Effective area this stream =       90.63(Ac.)
Total Study Area (Main Stream No. 1) =     1412.12(Ac.)
Area averaged Fm value =    0.083(In/Hr)


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Process from Point/Station     1736.000 to Point/Station     1724.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   648.150(Ft.)
Downstream point/station elevation =   641.200(Ft.)
Pipe length  =   507.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   215.462(CFS)
Nearest computed pipe diameter  =     54.00(In.)
Calculated individual pipe flow  =   215.462(CFS)
Normal flow depth in pipe =   41.44(In.)
Flow top width inside pipe =   45.63(In.)
Critical Depth =   49.57(In.)
Pipe flow velocity =     16.45(Ft/s)
Travel time through pipe =    0.51 min.
Time of concentration (TC) =    15.82 min.


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.600
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Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.400
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 46.80
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.085(In/Hr)
Time of concentration =    15.82 min.
Rainfall intensity =      2.671(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.872
Subarea runoff =     19.172(CFS) for   10.110(Ac.)
Total runoff =    234.634(CFS)
Effective area this stream =      100.74(Ac.)
Total Study Area (Main Stream No. 1) =     1422.23(Ac.)
Area averaged Fm value =    0.083(In/Hr)


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 69.39
Pervious ratio(Ap) = 0.2150     Max loss rate(Fm)=     0.117(In/Hr)
Time of concentration =    15.82 min.
Rainfall intensity =      2.671(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =     19.838(CFS) for    8.630(Ac.)
Total runoff =    254.471(CFS)
Effective area this stream =      109.37(Ac.)
Total Study Area (Main Stream No. 1) =     1430.86(Ac.)
Area averaged Fm value =    0.085(In/Hr)


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Process from Point/Station     1724.000 to Point/Station     1724.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    109.370(Ac.)
Runoff from this stream =    254.471(CFS)
Time of concentration =   15.82 min.
Rainfall intensity =     2.671(In/Hr)
Area averaged loss rate (Fm) =    0.0854(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1279
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1   1396.82  1244.373     41.11    0.323      1.506
2    254.47   109.370     15.82    0.085      2.671
Qmax(1) =
         1.000 *    1.000 *  1396.821) +
         0.549 *    1.000 *   254.471) + =    1536.613
Qmax(2) =
         1.985 *    0.385 *  1396.821) +
```

```
         1.000 *    1.000 *   254.471) + =    1321.290

Total of 2 streams to confluence:
Flow rates before confluence point:
    1396.821     254.471
Maximum flow rates at confluence using above data:
     1536.613     1321.290
Area of streams before confluence:
     1244.373      109.370
Effective area values after confluence:
     1353.743      588.108
Results of confluence:
Total flow rate =   1536.613(CFS)
Time of concentration =    41.110 min.
Effective stream area after confluence =   1353.743(Ac.)
Study area average Pervious fraction(Ap) =  0.346
Study area average soil loss rate(Fm) =    0.304(In/Hr)
Study area total (this main stream) =    1353.74(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1724.000 to Point/Station     1738.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   641.200(Ft.)
Downstream point/station elevation =   640.400(Ft.)
Pipe length  =   658.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =  1536.613(CFS)
Nearest computed pipe diameter  =    174.00(In.)
Calculated individual pipe flow  =  1536.613(CFS)
Normal flow depth in pipe =  141.00(In.)
Flow top width inside pipe =  136.43(In.)
Critical Depth =  102.77(In.)
Pipe flow velocity =     10.72(Ft/s)
Travel time through pipe =    1.02 min.
Time of concentration (TC) =    42.13 min.


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Process from Point/Station     1738.000 to Point/Station     1738.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 70.02
Pervious ratio(Ap) = 0.4100     Max loss rate(Fm)=     0.218(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =   1440.779(CFS)
therefore the upstream flow rate of Q =   1536.613(CFS) is being used
Time of concentration =    42.13 min.
Rainfall intensity =      1.484(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.716
Subarea runoff =      0.000(CFS) for    3.020(Ac.)
Total runoff =   1536.613(CFS)
Effective area this stream =     1356.76(Ac.)
Total Study Area (Main Stream No. 1) =     1433.88(Ac.)
Area averaged Fm value =    0.304(In/Hr)
End of computations, Total Study Area =         1433.88 (Ac.)
```
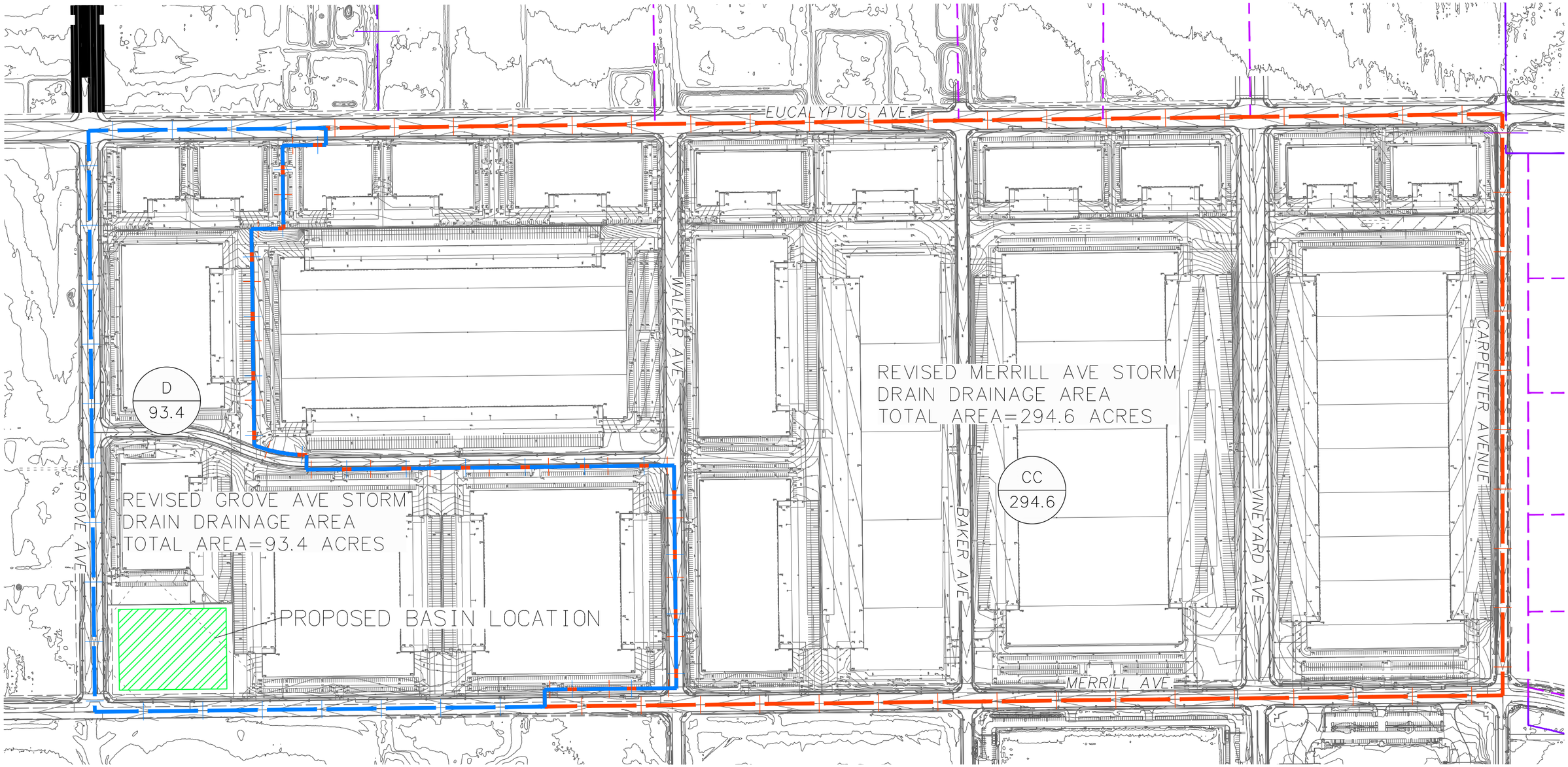

The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.355
Area averaged SCS curve number = 46.8



LEGEND:

XXX / X.X — SUB AREA / ACRES

MERRILL AVENUE STORM DRAIN WATERSHED BOUNDARY

GROVE AVENUE STORM DRAIN WATERSHED BOUNDARY

GRAPHIC SCALE

450' 0 225' 450' 900'

1" = 450'

H1-483

N

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

FIGURE 5

CITY OF ONTARIO MASTER DRAINAGE PLAN

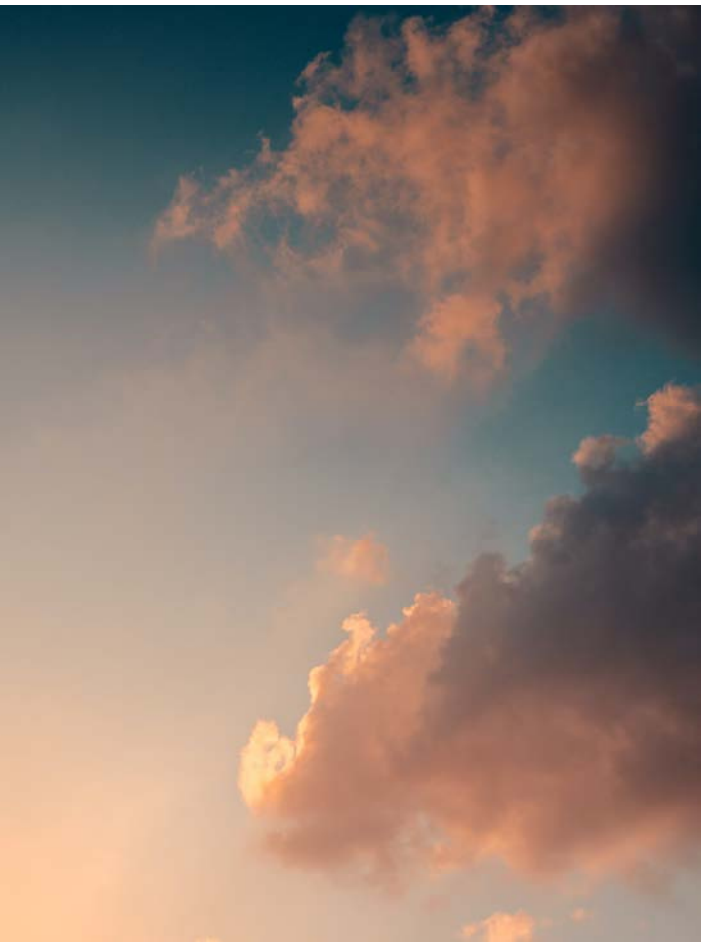
GROVE SD AND MERRILL SD DRAINAGE AREAS

Drawing Name: O:\265.13.20\Engineering\Hydrology_Plan\Exhibits\FIGURE-5-ALTERNATIVE 2.dwg
Last Opened: Nov 17, 2021 - 9:44pm by stanner

EXCERPT G: EXCERPTS FROM FUSCOE ENGINEERING REPORT







FUSCOE ENGINEERING

PRELIMINARY HYDROLOGY REPORT

CENTER PARK SPECIFIC PLAN

Edison Avenue to the North, Walker Avenue to the East
Ontario, CA

Prepared for:
ONTARIO RANCH VENTURES I, LP &
ONTARIO RANCH VENTURES II, LP

C/O: RCCD
8101 E. Kaiser Blvd, Suite 140
Anaheim, CA 92808

Project Manager: Carolina Gonzalez



Prepared By
Moyenuddin Sirajee, PE
909.581.0676

Date Prepared: 09.09.24

Project Number: 3036-015

FUSCOE ENGINEERING, INC.
3257 E Guasti Rd. Suite 300
Ontario, CA 91761

www.fuscoe.com

H1-485

PRELIMINARY HYDROLOGY REPORT

CENTER PARK SPECIFIC PLAN

Located by Edison Avenue to the north, Walker Avenue to the east in the City of Ontario, County of San Bernardino, California

Prepared for:

ONTARIO RANCH VENTURES I, LP &
ONTARIO RANCH VENTURES II, LP
C/O: RCCD
8101 E. Kaiser Blvd, Suite 140
Anaheim, CA 92808
510.316.6121

Prepared by:

FUSCOE ENGINEERING, INC.
3257 E Guasti Rd. Suite 300
Ontario, CA 91761
909.581.0676

Date Prepared: August 2024

APPENDIX 1

RATIONAL METHOD (Q100): POST SPECIFIC PLAN

PROPOSED CONDITIONS
Q100

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/23/24

PORTION OF MPD DA XIV
PROPOSED DEV DA A1
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6049

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.410 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 771.000(Ft.)
Top (of initial area) elevation = 694.000(Ft.)
Bottom (of initial area) elevation = 685.000(Ft.)
Difference in elevation = 9.000(Ft.)
Slope = 0.01167 s(%)= 1.17
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.270 min.
Rainfall intensity = 3.845(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.854
Subarea runoff = 21.516(CFS)
Total initial stream area = 6.550(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

++

Process from Point/Station 2.000 to Point/Station 3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 685.000(Ft.)
End of street segment elevation = 683.000(Ft.)
Length of street segment = 293.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 32.000(Ft.)
Distance from crown to crossfall grade break = 30.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 12.000(Ft.)

```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     30.234(CFS)
Depth of flow =   0.594(Ft.), Average velocity =   3.000(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  22.109(Ft.)
Flow velocity =   3.00(Ft/s)
Travel time =    1.63 min.     TC =   12.90  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.720
Decimal fraction soil group B = 0.280
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 38.72
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.186(In/Hr)
Rainfall intensity =      3.546(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.852
Subarea runoff =     17.323(CFS) for    6.310(Ac.)
Total runoff =     38.839(CFS)
Effective area this stream =       12.86(Ac.)
Total Study Area (Main Stream No. 1) =       12.86(Ac.)
Area averaged Fm value =    0.191(In/Hr)
Street flow at end of street =     38.839(CFS)
Half street flow at end of street =     19.420(CFS)
Depth of flow =   0.639(Ft.), Average velocity =   3.190(Ft/s)
Flow width (from curb towards crown)=  24.363(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.130
Decimal fraction soil group B = 0.870
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 52.88
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.658(In/Hr)
Initial subarea data:
Initial area flow distance =   791.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   678.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.00759  s(%)=       0.76
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.502 min.
Rainfall intensity =      2.856(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.693
Subarea runoff =     13.868(CFS)
Total initial stream area =        7.010(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.658(In/Hr)
End of computations, Total Study Area =           19.87 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.429
Area averaged SCS curve number =  41.5
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/23/24

PORTION OF MPD DA XIV
PROPOSED DEV DA A2
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6049

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.410 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 6.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 768.000(Ft.)
Top (of initial area) elevation = 694.000(Ft.)
Bottom (of initial area) elevation = 687.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.00911 s(%)= 0.91
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.823 min.
Rainfall intensity = 3.736(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.853
Subarea runoff = 20.842(CFS)
Total initial stream area = 6.540(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

++

Process from Point/Station 6.000 to Point/Station 9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 687.000(Ft.)
End of street segment elevation = 684.000(Ft.)
Length of street segment = 331.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 32.000(Ft.)
Distance from crown to crossfall grade break = 30.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 12.000(Ft.)

```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     29.918(CFS)
Depth of flow =   0.568(Ft.), Average velocity =   3.330(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.835(Ft.)
Flow velocity =   3.33(Ft/s)
Travel time =    1.66 min.     TC =   13.48  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      3.454(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.849
Subarea runoff =     18.041(CFS) for    6.720(Ac.)
Total runoff =     38.883(CFS)
Effective area this stream =       13.26(Ac.)
Total Study Area (Main Stream No. 1) =       13.26(Ac.)
Area averaged Fm value =    0.196(In/Hr)
Street flow at end of street =     38.883(CFS)
Half street flow at end of street =     19.442(CFS)
Depth of flow =   0.613(Ft.), Average velocity =   3.551(Ft/s)
Flow width (from curb towards crown)=  23.072(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     13.260(Ac.)
Runoff from this stream =     38.883(CFS)
Time of concentration =   13.48 min.
Rainfall intensity =     3.454(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.147(In/Hr)
Initial subarea data:
Initial area flow distance =   970.000(Ft.)
Top (of initial area) elevation =   693.000(Ft.)
Bottom (of initial area) elevation =   690.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00309  s(%)=       0.31
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.113 min.
Rainfall intensity =      3.103(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff =     26.474(CFS)
Total initial stream area =        9.950(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.147(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   690.000(Ft.)
End of street segment elevation =   684.000(Ft.)
Length of street segment  =   608.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     45.040(CFS)
Depth of flow =   0.632(Ft.), Average velocity =   3.802(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  24.025(Ft.)
Flow velocity =   3.80(Ft/s)
Travel time =    2.67 min.     TC =   18.78  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.230
Decimal fraction soil group B = 0.770
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.48
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.161(In/Hr)
Rainfall intensity =      2.831(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.851
Subarea runoff =     37.020(CFS) for   16.420(Ac.)
Total runoff =     63.494(CFS)
Effective area this stream =       26.37(Ac.)
Total Study Area (Main Stream No. 2) =       39.63(Ac.)
Area averaged Fm value =    0.155(In/Hr)
Street flow at end of street =     63.494(CFS)
Half street flow at end of street =     31.747(CFS)
Depth of flow =   0.708(Ft.), Average velocity =   4.004(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    2.06(Ft.)
Flow width (from curb towards crown)=  27.812(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     26.370(Ac.)
Runoff from this stream =     63.494(CFS)
Time of concentration =   18.78 min.
Rainfall intensity =     2.831(In/Hr)
Area averaged loss rate (Fm) =    0.1555(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     38.88    13.260     13.48    0.196      3.454
2     63.49    26.370     18.78    0.155      2.831
Qmax(1) =
           1.000 *    1.000 *    38.883) +
           1.233 *    0.718 *    63.494) + =      95.075
Qmax(2) =
           0.809 *    1.000 *    38.883) +
           1.000 *    1.000 *    63.494) + =      94.943

Total of 2 main streams to confluence:
Flow rates before confluence point:
      39.883      64.494
Maximum flow rates at confluence using above data:
       95.075       94.943
Area of streams before confluence:
       13.260       26.370
Effective area values after confluence:
       32.190       39.630


Results of confluence:
Total flow rate =     95.075(CFS)
Time of concentration =    13.480 min.
Effective stream area after confluence  =     32.190(Ac.)
Study area average Pervious fraction(Ap) =  0.200
Study area average soil loss rate(Fm) =    0.169(In/Hr)
Study area total =      39.63(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.370
Decimal fraction soil group B = 0.630
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 47.12
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.717(In/Hr)
Initial subarea data:
Initial area flow distance =   805.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   678.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.00745  s(%)=       0.75
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.698 min.
Rainfall intensity =      2.838(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.673
Subarea runoff =     13.156(CFS)
Total initial stream area =        6.890(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.717(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station       12.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      6.890(Ac.)
```

```
Runoff from this stream =     13.156(CFS)
Time of concentration =   18.70 min.
Rainfall intensity =     2.838(In/Hr)
Area averaged loss rate (Fm) =    0.7166(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.624(In/Hr)
Initial subarea data:
Initial area flow distance =   919.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   682.000(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.00218  s(%)=       0.22
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   25.219 min.
Rainfall intensity =      2.372(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.663
Subarea runoff =      9.313(CFS)
Total initial stream area =        5.920(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.624(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   682.000(Ft.)
End of street segment elevation =   678.000(Ft.)
Length of street segment  =   475.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     14.208(CFS)
Depth of flow =   0.466(Ft.), Average velocity =   2.703(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  15.738(Ft.)
Flow velocity =   2.70(Ft/s)
Travel time =    2.93 min.     TC =   28.15  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 0.390
Decimal fraction soil group B = 0.610
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 46.64
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.721(In/Hr)
```

```
Rainfall intensity =      2.220(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.625
Subarea runoff =      9.624(CFS) for    7.730(Ac.)
Total runoff =     18.937(CFS)
Effective area this stream =       13.65(Ac.)
Total Study Area (Main Stream No. 2) =       60.17(Ac.)
Area averaged Fm value =    0.679(In/Hr)
Street flow at end of street =     18.937(CFS)
Half street flow at end of street =      9.468(CFS)
Depth of flow =   0.505(Ft.), Average velocity =   2.897(Ft/s)
Flow width (from curb towards crown)=  17.655(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     13.650(Ac.)
Runoff from this stream =     18.937(CFS)
Time of concentration =   28.15 min.
Rainfall intensity =     2.220(In/Hr)
Area averaged loss rate (Fm) =    0.6790(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     13.16     6.890     18.70    0.717      2.838
2     18.94    13.650     28.15    0.679      2.220
Qmax(1) =
           1.000 *    1.000 *    13.156) +
           1.401 *    0.664 *    18.937) + =      30.775
Qmax(2) =
           0.709 *    1.000 *    13.156) +
           1.000 *    1.000 *    18.937) + =      28.262

Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.156      19.937
Maximum flow rates at confluence using above data:
       30.775       28.262
Area of streams before confluence:
        6.890       13.650
Effective area values after confluence:
       15.957       20.540


Results of confluence:
Total flow rate =     30.775(CFS)
Time of concentration =    18.698 min.
Effective stream area after confluence  =     15.957(Ac.)
Study area average Pervious fraction(Ap) =  0.850
Study area average soil loss rate(Fm) =    0.692(In/Hr)
Study area total =      20.54(Ac.)
End of computations, Total Study Area =           60.17 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.422
Area averaged SCS curve number =  47.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/24/24

PORTION OF MPD DA XIII
PROPOSED DEV DA B
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6049

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.410 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

MOBILE HOME PARK subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2500 Max loss rate(Fm)= 0.244(In/Hr)
Initial subarea data:
Initial area flow distance = 934.000(Ft.)
Top (of initial area) elevation = 703.000(Ft.)
Bottom (of initial area) elevation = 695.000(Ft.)
Difference in elevation = 8.000(Ft.)
Slope = 0.00857 s(%)= 0.86
TC = k(0.336)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 13.425 min.
Rainfall intensity = 3.462(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.836
Subarea runoff = 28.960(CFS)
Total initial stream area = 10.000(Ac.)
Pervious area fraction = 0.250
Initial area Fm value = 0.244(In/Hr)

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Process from Point/Station 3.000 to Point/Station 5.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 920.000(Ft.)
Top (of initial area) elevation = 696.000(Ft.)

```
Bottom (of initial area) elevation =   688.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.00870  s(%)=       0.87
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.829 min.
Rainfall intensity =      3.558(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.851
Subarea runoff =     30.261(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


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Process from Point/Station        3.000 to Point/Station        5.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     10.000(Ac.)
Runoff from this stream =     30.261(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     3.558(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   920.000(Ft.)
Top (of initial area) elevation =   696.000(Ft.)
Bottom (of initial area) elevation =   688.000(Ft.)
Difference in elevation =     8.000(Ft.)
Slope =    0.00870  s(%)=       0.87
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.829 min.
Rainfall intensity =      3.558(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.851
Subarea runoff =     30.261(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


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Process from Point/Station        4.000 to Point/Station        5.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     10.000(Ac.)
Runoff from this stream =     30.261(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     3.558(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:
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```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     30.26    10.000     12.83    0.196      3.558
2     30.26    10.000     12.83    0.196      3.558
Qmax(1) =
           1.000 *    1.000 *    30.261) +
           1.000 *    1.000 *    30.261) + =      60.522
Qmax(2) =
           1.000 *    1.000 *    30.261) +
           1.000 *    1.000 *    30.261) + =      60.522

Total of 2 main streams to confluence:
Flow rates before confluence point:
      31.261      31.261
Maximum flow rates at confluence using above data:
       60.522       60.522
Area of streams before confluence:
       10.000       10.000
Effective area values after confluence:
       20.000       20.000


Results of confluence:
Total flow rate =     60.522(CFS)
Time of concentration =    12.829 min.
Effective stream area after confluence  =     20.000(Ac.)
Study area average Pervious fraction(Ap) =  0.200
Study area average soil loss rate(Fm) =    0.196(In/Hr)
Study area total =      20.00(Ac.)


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Process from Point/Station        6.000 to Point/Station        7.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 0.950
Decimal fraction soil group B = 0.050
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 33.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.194(In/Hr)
Initial subarea data:
Initial area flow distance =   762.000(Ft.)
Top (of initial area) elevation =   693.000(Ft.)
Bottom (of initial area) elevation =   687.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.00787  s(%)=       0.79
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.136 min.
Rainfall intensity =      3.678(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.853
Subarea runoff =     19.850(CFS)
Total initial stream area =        6.330(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.194(In/Hr)


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Process from Point/Station        7.000 to Point/Station        8.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   687.000(Ft.)
End of street segment elevation =   685.000(Ft.)
Length of street segment  =   365.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
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Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     28.804(CFS)
Depth of flow =   0.605(Ft.), Average velocity =   2.728(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  22.643(Ft.)
Flow velocity =   2.73(Ft/s)
Travel time =    2.23 min.     TC =   14.37  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.790
Decimal fraction soil group B = 0.210
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 37.04
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.188(In/Hr)
Rainfall intensity =      3.324(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =     17.767(CFS) for    7.010(Ac.)
Total runoff =     37.617(CFS)
Effective area this stream =       13.34(Ac.)
Total Study Area (Main Stream No. 1) =       43.34(Ac.)
Area averaged Fm value =    0.191(In/Hr)
Street flow at end of street =     37.617(CFS)
Half street flow at end of street =     18.809(CFS)
Depth of flow =   0.654(Ft.), Average velocity =   2.914(Ft/s)
Flow width (from curb towards crown)=  25.107(Ft.)


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Process from Point/Station        8.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   673.000(Ft.)
Downstream point/station elevation =   656.000(Ft.)
Pipe length  =   695.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    37.617(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    37.617(CFS)
Normal flow depth in pipe =   14.95(In.)
Flow top width inside pipe =   35.48(In.)
Critical Depth =   23.93(In.)
Pipe flow velocity =     13.56(Ft/s)
Travel time through pipe =    0.85 min.
Time of concentration (TC) =    15.22 min.


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Process from Point/Station        8.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     13.340(Ac.)
Runoff from this stream =     37.617(CFS)
Time of concentration =   15.22 min.
Rainfall intensity =     3.211(In/Hr)
Area averaged loss rate (Fm) =    0.1912(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
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Program is now starting with Main Stream No. 2


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Process from Point/Station        9.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   805.000(Ft.)
Top (of initial area) elevation =   688.000(Ft.)
Bottom (of initial area) elevation =   684.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00497  s(%)=       0.50
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.602 min.
Rainfall intensity =      3.435(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.849
Subarea runoff =     17.727(CFS)
Total initial stream area =        6.080(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.080(Ac.)
Runoff from this stream =     17.727(CFS)
Time of concentration =   13.60 min.
Rainfall intensity =     3.435(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   805.000(Ft.)
Top (of initial area) elevation =   690.000(Ft.)
Bottom (of initial area) elevation =   684.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.00745  s(%)=       0.75
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.543 min.
Rainfall intensity =      3.606(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.851
Subarea runoff =     21.550(CFS)
Total initial stream area =        7.020(Ac.)
Pervious area fraction = 0.200
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Initial area Fm value =    0.196(In/Hr)


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Process from Point/Station       10.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      7.020(Ac.)
Runoff from this stream =     21.550(CFS)
Time of concentration =   12.54 min.
Rainfall intensity =     3.606(In/Hr)
Area averaged loss rate (Fm) =    0.1956(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     37.62    13.340     15.22    0.191      3.211
2     17.73     6.080     13.60    0.196      3.435
3     21.55     7.020     12.54    0.196      3.606
Qmax(1) =
           1.000 *    1.000 *    37.617) +
           0.931 *    1.000 *    17.727) +
           0.884 *    1.000 *    21.550) + =      73.171
Qmax(2) =
           1.074 *    0.894 *    37.617) +
           1.000 *    1.000 *    17.727) +
           0.950 *    1.000 *    21.550) + =      74.306
Qmax(3) =
           1.131 *    0.824 *    37.617) +
           1.053 *    0.922 *    17.727) +
           1.000 *    1.000 *    21.550) + =      73.817

Total of 3 main streams to confluence:
Flow rates before confluence point:
      38.617      18.727      22.550
Maximum flow rates at confluence using above data:
       73.171       74.306       73.817
Area of streams before confluence:
       13.340        6.080        7.020
Effective area values after confluence:
       26.440       25.022       23.620


Results of confluence:
Total flow rate =     74.306(CFS)
Time of concentration =    13.602 min.
Effective stream area after confluence  =     25.022(Ac.)
Study area average Pervious fraction(Ap) =  0.200
Study area average soil loss rate(Fm) =    0.193(In/Hr)
Study area total =      26.44(Ac.)


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Process from Point/Station       12.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.280
Decimal fraction soil group B = 0.720
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 49.28
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.695(In/Hr)
Initial subarea data:
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Initial area flow distance =   786.000(Ft.)
Top (of initial area) elevation =   684.000(Ft.)
Bottom (of initial area) elevation =   677.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.00891  s(%)=       0.89
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.872 min.
Rainfall intensity =      2.916(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.685
Subarea runoff =     13.331(CFS)
Total initial stream area =        6.670(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.695(In/Hr)


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Process from Point/Station       13.000 to Point/Station       15.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   677.000(Ft.)
End of street segment elevation =   673.000(Ft.)
Length of street segment  =   652.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  16.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     15.357(CFS)
Depth of flow =   0.498(Ft.), Average velocity =   2.442(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.299(Ft.)
Flow velocity =   2.44(Ft/s)
Travel time =    4.45 min.     TC =   22.32  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Rainfall intensity =      2.552(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.637
Subarea runoff =      3.916(CFS) for    3.940(Ac.)
Total runoff =     17.247(CFS)
Effective area this stream =       10.61(Ac.)
Total Study Area (Main Stream No. 1) =       67.05(Ac.)
Area averaged Fm value =    0.746(In/Hr)
Street flow at end of street =     17.247(CFS)
Half street flow at end of street =      8.623(CFS)
Depth of flow =   0.513(Ft.), Average velocity =   2.518(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  18.000(Ft.)


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Process from Point/Station       13.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
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In Main Stream number: 1
Stream flow area =     10.610(Ac.)
Runoff from this stream =     17.247(CFS)
Time of concentration =   22.32 min.
Rainfall intensity =     2.552(In/Hr)
Area averaged loss rate (Fm) =    0.7458(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Initial subarea data:
Initial area flow distance =   691.000(Ft.)
Top (of initial area) elevation =   689.000(Ft.)
Bottom (of initial area) elevation =   673.000(Ft.)
Difference in elevation =    16.000(Ft.)
Slope =    0.02315  s(%)=       2.32
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.022 min.
Rainfall intensity =      3.373(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.678
Subarea runoff =      6.863(CFS)
Total initial stream area =        3.000(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.831(In/Hr)


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Process from Point/Station       14.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.000(Ac.)
Runoff from this stream =      6.863(CFS)
Time of concentration =   14.02 min.
Rainfall intensity =     3.373(In/Hr)
Area averaged loss rate (Fm) =    0.8311(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     17.25    10.610     22.32    0.746      2.552
2      6.86     3.000     14.02    0.831      3.373
Qmax(1) =
          1.000 *    1.000 *    17.247) +
          0.677 *    1.000 *     6.863) + =      21.893
Qmax(2) =
          1.455 *    0.628 *    17.247) +
          1.000 *    1.000 *     6.863) + =      22.622

Total of 2 main streams to confluence:
Flow rates before confluence point:
      18.247       7.863
Maximum flow rates at confluence using above data:
       21.893       22.622
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```
Area of streams before confluence:
       10.610        3.000
Effective area values after confluence:
       13.610        9.665


Results of confluence:
Total flow rate =     22.622(CFS)
Time of concentration =    14.022 min.
Effective stream area after confluence  =      9.665(Ac.)
Study area average Pervious fraction(Ap) =  0.850
Study area average soil loss rate(Fm) =    0.765(In/Hr)
Study area total =      13.61(Ac.)
End of computations, Total Study Area =           70.05 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.333
Area averaged SCS curve number =  34.3
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/24/24

PORTION OF MPD DA XII
PROPOSED DEV DA C
RATIONAL, 100 YEAR EVENT
FUSCOE ENGINEERING

Program License Serial Number 6049

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.410 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.196(In/Hr)
Initial subarea data:
Initial area flow distance = 974.000(Ft.)
Top (of initial area) elevation = 700.000(Ft.)
Bottom (of initial area) elevation = 693.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.00719 s(%)= 0.72
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 13.635 min.
Rainfall intensity = 3.430(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.849
Subarea runoff = 29.111(CFS)
Total initial stream area = 10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.196(In/Hr)

++

Process from Point/Station 2.000 to Point/Station 3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 693.000(Ft.)
End of street segment elevation = 689.000(Ft.)
Length of street segment = 607.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 32.000(Ft.)
Distance from crown to crossfall grade break = 30.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 12.000(Ft.)

```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     48.156(CFS)
Depth of flow =   0.689(Ft.), Average velocity =   3.256(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    1.14(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  26.891(Ft.)
Flow velocity =   3.26(Ft/s)
Travel time =    3.11 min.     TC =   16.74  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      3.033(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.842
Subarea runoff =     37.939(CFS) for   16.260(Ac.)
Total runoff =     67.051(CFS)
Effective area this stream =       26.26(Ac.)
Total Study Area (Main Stream No. 1) =       26.26(Ac.)
Area averaged Fm value =    0.196(In/Hr)
Street flow at end of street =     67.051(CFS)
Half street flow at end of street =     33.525(CFS)
Depth of flow =   0.769(Ft.), Average velocity =   3.369(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    5.13(Ft.)
Flow width (from curb towards crown)=  30.880(Ft.)


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Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Initial subarea data:
Initial area flow distance =   933.000(Ft.)
Top (of initial area) elevation =   696.000(Ft.)
Bottom (of initial area) elevation =   691.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.00536  s(%)=       0.54
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.213 min.
Rainfall intensity =      3.346(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.847
Subarea runoff =     28.352(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.196(In/Hr)


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Process from Point/Station        5.000 to Point/Station        6.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
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Top of street segment elevation =   691.000(Ft.)
End of street segment elevation =   689.000(Ft.)
Length of street segment  =   288.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  30.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     36.312(CFS)
Depth of flow =   0.625(Ft.), Average velocity =   3.158(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  23.658(Ft.)
Flow velocity =   3.16(Ft/s)
Travel time =    1.52 min.     TC =   15.73  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.196(In/Hr)
Rainfall intensity =      3.148(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.844
Subarea runoff =     15.730(CFS) for    6.590(Ac.)
Total runoff =     44.082(CFS)
Effective area this stream =       16.59(Ac.)
Total Study Area (Main Stream No. 1) =       42.85(Ac.)
Area averaged Fm value =    0.196(In/Hr)
Street flow at end of street =     44.082(CFS)
Half street flow at end of street =     22.041(CFS)
Depth of flow =   0.662(Ft.), Average velocity =   3.313(Ft/s)
Flow width (from curb towards crown)=  25.498(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        7.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   689.000(Ft.)
End of street segment elevation =   687.000(Ft.)
Length of street segment  =   353.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  14.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     46.099(CFS)
Depth of flow =   0.681(Ft.), Average velocity =   3.577(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    0.71(Ft.)
```

```
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   3.58(Ft/s)
Travel time =    1.64 min.     TC =   17.38  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Rainfall intensity =      2.966(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.808
Subarea runoff =      3.867(CFS) for    3.430(Ac.)
Total runoff =     47.949(CFS)
Effective area this stream =       20.02(Ac.)
Total Study Area (Main Stream No. 1) =       46.28(Ac.)
Area averaged Fm value =    0.304(In/Hr)
Street flow at end of street =     47.949(CFS)
Half street flow at end of street =     23.975(CFS)
Depth of flow =   0.693(Ft.), Average velocity =   3.588(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    1.34(Ft.)
Flow width (from curb towards crown)=  18.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
____________________________________________________________________________
Upstream point/station elevation =   675.000(Ft.)
Downstream point/station elevation =   666.750(Ft.)
Pipe length  =  1327.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    47.949(CFS)
Given pipe size =     42.00(In.)
Calculated individual pipe flow  =    47.949(CFS)
Normal flow depth in pipe =   23.55(In.)
Flow top width inside pipe =   41.69(In.)
Critical Depth =   25.95(In.)
Pipe flow velocity =      8.63(Ft/s)
Travel time through pipe =    2.56 min.
Time of concentration (TC) =    19.94 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     20.020(Ac.)
Runoff from this stream =     47.949(CFS)
Time of concentration =   19.94 min.
Rainfall intensity =     2.731(In/Hr)
Area averaged loss rate (Fm) =    0.3045(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3114
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        8.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
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```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Initial subarea data:
Initial area flow distance =   997.000(Ft.)
Top (of initial area) elevation =   689.000(Ft.)
Bottom (of initial area) elevation =   685.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00401  s(%)=       0.40
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   23.054 min.
Rainfall intensity =      2.503(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.601
Subarea runoff =     14.670(CFS)
Total initial stream area =        9.750(Ac.)
Pervious area fraction = 0.850
Initial area Fm value =    0.831(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =   685.000(Ft.)
End of street segment elevation =   683.000(Ft.)
Length of street segment  =   393.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  18.000(Ft.)
Distance from crown to crossfall grade break  =  16.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.300(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     16.752(CFS)
Depth of flow =   0.521(Ft.), Average velocity =   2.353(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.000(Ft.)
Flow velocity =   2.35(Ft/s)
Travel time =    2.78 min.     TC =   25.84  min.
 Adding area flow to street
PARK subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.831(In/Hr)
Rainfall intensity =      2.337(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.580
Subarea runoff =      4.025(CFS) for    4.040(Ac.)
Total runoff =     18.695(CFS)
Effective area this stream =       13.79(Ac.)
Total Study Area (Main Stream No. 2) =       60.07(Ac.)
Area averaged Fm value =    0.831(In/Hr)
Street flow at end of street =     18.695(CFS)
Half street flow at end of street =      9.348(CFS)
Depth of flow =   0.535(Ft.), Average velocity =   2.458(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  18.000(Ft.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     13.790(Ac.)
Runoff from this stream =     18.695(CFS)
Time of concentration =   25.84 min.
Rainfall intensity =     2.337(In/Hr)
Area averaged loss rate (Fm) =    0.8311(In/Hr)
Area averaged Pervious ratio (Ap) = 0.8500
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     47.95    20.020     19.94    0.304      2.731
2     18.70    13.790     25.84    0.831      2.337
Qmax(1) =
           1.000 *    1.000 *    47.949) +
           1.261 *    0.772 *    18.695) + =      66.143
Qmax(2) =
           0.838 *    1.000 *    47.949) +
           1.000 *    1.000 *    18.695) + =      58.873

Total of 2 main streams to confluence:
Flow rates before confluence point:
      48.949      19.695
Maximum flow rates at confluence using above data:
       66.143       58.873
Area of streams before confluence:
       20.020       13.790
Effective area values after confluence:
       30.662       33.810


Results of confluence:
Total flow rate =     66.143(CFS)
Time of concentration =    19.939 min.
Effective stream area after confluence  =     30.662(Ac.)
Study area average Pervious fraction(Ap) =  0.531
Study area average soil loss rate(Fm) =    0.519(In/Hr)
Study area total =      33.81(Ac.)
End of computations, Total Study Area =           60.07 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.386
Area averaged SCS curve number =  32.0
```
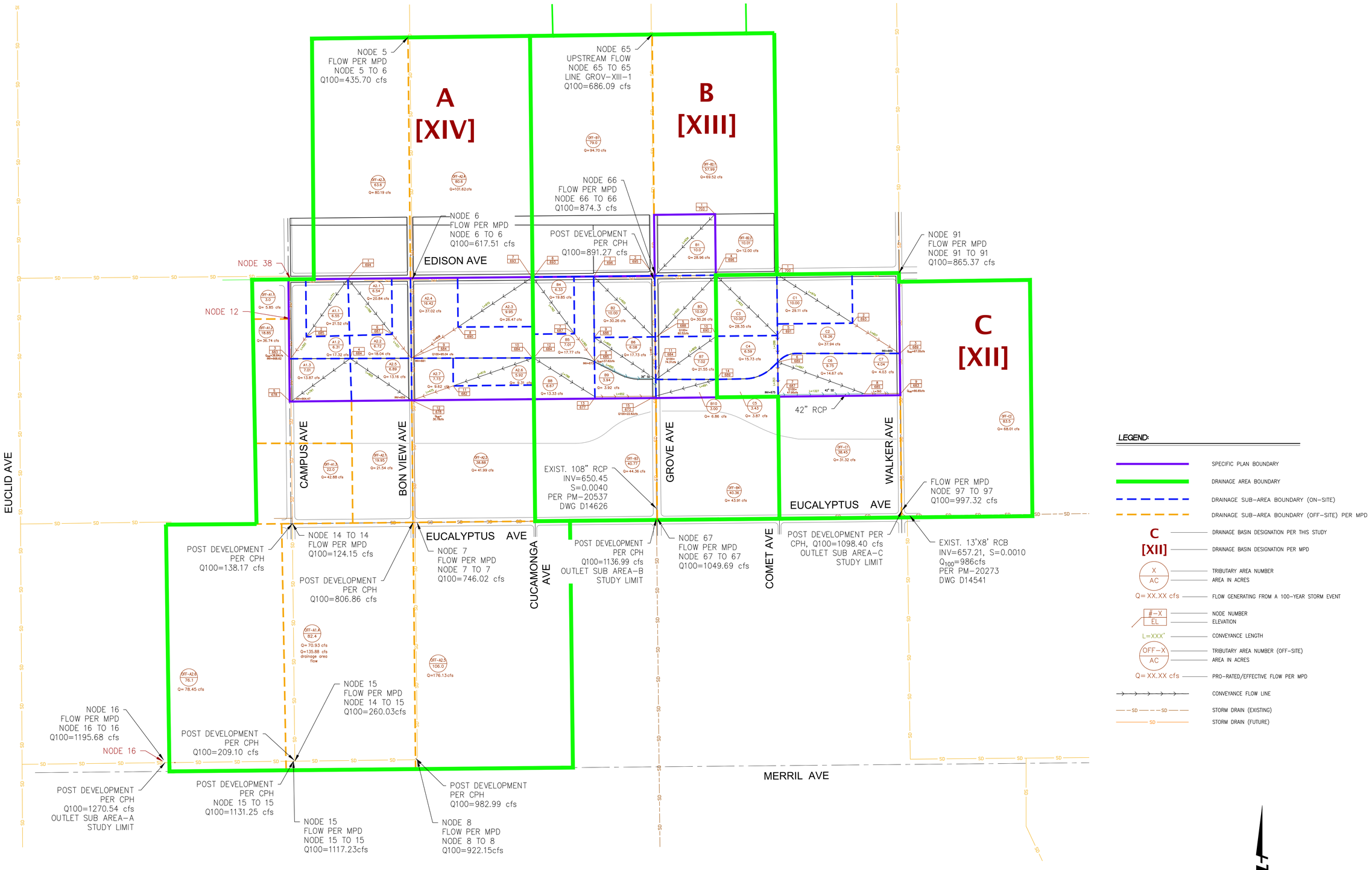

APPENDIX 2

HYDROLOGY MAPS

HYDROLOGY MAP POST- SPECIFIC PLAN



FUSCOE ENGINEERING
15535 Sand Canyon Ave, Suite 100
Irvine, California 92618
949.474.1960 fuscoe.com

EXCERPT H: STORM DRAIN IMPROVEMENT PLANS FOR LINE C, PM-20273

STORM DRAIN IMPROVEMENT PLAN
FOR PM 20273
EUCALYPTUS AVENUE, VINEYARD AVENUE AND BAKER AVENUE
IN THE CITY OF ONTARIO

Recommended by HARRIS for APPROVAL by City By: _____ 02/06/2025

For Delta Rev#5 only

1/23/2025 Eng Dept Harris PC#1 Revision#5

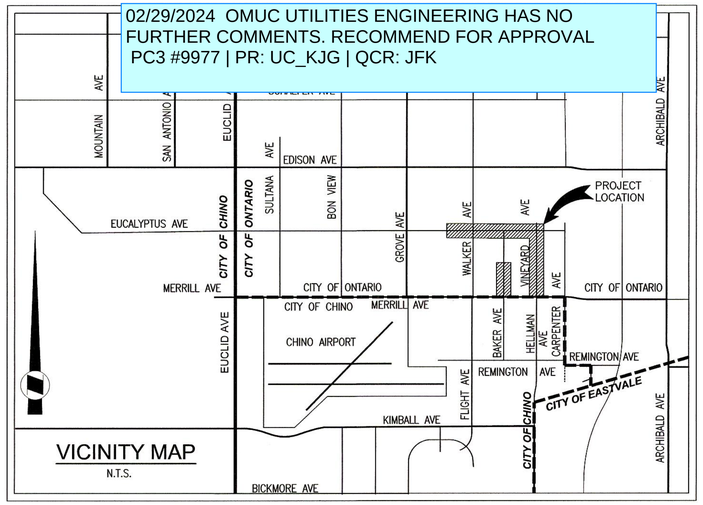
No further comments

02/29/2024 OMUC UTILITIES ENGINEERING HAS NO FURTHER COMMENTS. RECOMMEND FOR APPROVAL PC3 #9977 | PR: UC_KJG | QCR: JFK

02/05/25 **OMUC UTILITIES ENGINEERING HAS NO FURTHER COMMENTS. - REVISION 5** PC1 | PR: UC_KJG | QCR:EW

2/27/2024 Eng Dept Harris PC#3 Delta #4

No further comments



VICINITY MAP
N.T.S.

INDEX OF DRAWINGS

INDEX NO.	DESCRIPTION
SHEET 1	TITLE SHEET
SHEET 2	INDEX SYSTEM MAP
SHEET 3	VINEYARD AVE – FROM MERRILL AVE TO 1000' N/O MERRILL AVE
SHEET 4	VINEYARD AVE – FROM 1000' N/O MERRILL AVE TO 635' S/O EUCALYPTUS AVE
SHEET 5	VINEYARD AVE – FROM 6353' S/O EUCALYPTUS AVE TO EUCALYPTUS AVE
SHEET 6	EUCALYPTUS AVE – FROM EUCALYPTUS AVE TO 600' E/O VINEYARD AVE
SHEET 7–8	VINEYARD AVE – LATERAL PROFILES & DETAILS
SHEET 9	EUCALYPTUS AVE – FROM EUCALYPTUS AVE TO 920' W/O VINEYARD AVE
SHEET 10	EUCALYPTUS AVE – FROM 920' W/O VINEYARD AVE TO 500' W/O BAKER AVE
SHEET 11	EUCALYPTUS AVE – FROM 500' W/O BAKER AVE TO WALKER AVE
SHEET 12	EUCALYPTUS AVE – FROM WALKER AVE TO 750' W/O WALKER AVE
SHEET 13	EUCALYPTUS AVE – FROM 750' W/O WALKER AVE TO 950' W/O WALKER AVE
SHEET 14	BAKER AVE – LATERAL PROFILES & DETAILS
SHEET 15	BAKER AVE – MERRILL AVE TO 1056' N/O MERRILL AVE
SHEET 16	BAKER AVE – 1056' N/O MERRILL AVE TO 1700' N/O MERRILL AVE
SHEET 17	BAKER AVE – LATERAL PROFILES & DETAILS
SHEET 18	VINEYARD AVE – LINE F PROFILE
SHEET 19–26	DETAILS

CITY OF ONTARIO GENERAL NOTES:

1. ALL WORK SHALL BE DONE IN STRICT CONFORMANCE WITH THE CURRENT CITY OF ONTARIO STANDARD SPECIFICATIONS AND STANDARD DRAWINGS AND CURRENT STANDARD SPECIFICATIONS AND STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION AND CALTRANS PERMIT UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. ANY CONTRACTOR PERFORMING WORK ON THIS PROJECT SHALL FAMILIARIZE HIMSELF/HERSELF WITH THE SITE AND SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES RESULTING DIRECTLY OR INDIRECTLY FROM HIS/HER OPERATIONS, WHETHER OR NOT THE FACILITY IS SHOWN ON THESE PLANS.
3. ALL OBSTRUCTIONS WITHIN THE AREA TO BE IMPROVED SHALL BE REMOVED AND/OR RELOCATED AT THE DIRECTION OF THE CITY ENGINEER. UTILITIES ARE TO BE RELOCATED BY THEIR RESPECTIVE OWNERS UNLESS NOTED OTHERWISE. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
4. UTILITY LINE LOCATIONS WERE TAKEN FROM AVAILABLE RECORD DATA AND WERE NOT LOCATED IN THE FIELD, UNLESS OTHERWISE NOTED ON THE PLAN. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
5. IN CASE OF ANY ACCIDENTS INVOLVING SAFETY MATTERS COVERED BY SECTION 6409(B) OF THE CALIFORNIA LABOR CODE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE STATE DIVISION OF INDUSTRIAL SAFETY.
6. STATE LAW (SB 3019) REQUIRES THE CONTRACTOR TO CONTACT UNDERGROUND SERVICE ALERT AND OBTAIN AN IDENTIFICATION NUMBER PRIOR TO THE ISSUANCE OF CITY'S ENCROACHMENT PERMITS. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT AT 1–800–422–4133 A MINIMUM OF 48–HOURS IN ADVANCE OF ANY CONSTRUCTION ACTIVITY.
7. PRIOR TO THE START OF ANY WORK THE CONTRACTOR SHALL OBTAIN A BUSINESS LICENSE FROM THE CITY OF ONTARIO. THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM THE ENGINEERING DEPARTMENT NO LESS THAN 48 HOURS PRIOR TO START OF ANY CONSTRUCTION WITHIN THE PUBLIC RIGHT–OF–WAY.
8. THE CONTRACTOR SHALL OBTAIN A TRAFFIC CONTROL PERMIT 48 HOURS PRIOR TO TIME OF CONSTRUCTION WITHIN THE PUBLIC RIGHT–OF–WAY. THE CONTRACTOR IS REFERRED TO SECTION 7–10.3 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
9. THE CONTRACTOR SHALL RENEW OR REPLACE ANY EXISTING TRAFFIC STRIPING AND/OR PAVEMENT MARKINGS, WHICH DURING HIS OPERATIONS HAVE BEEN EITHER REMOVED OR THE EFFECTIVENESS OF WHICH HAS BEEN REDUCED. RENEWAL OF TRAFFIC STRIPING AND MARKINGS SHALL BE DONE USING REFLECTIVE THERMO–PLASTIC MARKINGS IN CONFORMANCE WITH SECTION 84 & 85 OF THE CALTRANS STANDARD SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER. ALL REGULATORY, WARNING, AND GUIDE SIGNS SHALL HAVE 3M DIAMOND, VIP GRADE SHEETING WITH SERIES 1160 PROTECTIVE OVERLAY FILM.
10. THE LAND SURVEYORS ACT, SECTION 8771 OF THE BUSINESS & PROFESSIONAL CODE, AND SECTIONS 732.5, 1492–5, 1810–5 OF THE STREETS AND HIGHWAY CODE REQUIRE THAT SURVEY MONUMENTS SHALL BE PROTECTED AND PERPETUATED.

    "IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR OTHERS PERFORMING THE CONSTRUCTION WORK TO RETAIN A QUALIFIED REGISTERED CIVIL ENGINEER AND/OR LICENSED LAND SURVEYOR PRIOR TO THE START OF CONSTRUCTION TO LOCATE, REFERENCE AND FILE THE NECESSARY CORNER RECORDS WITH THE COUNTY SURVEYOR'S OFFICE FOR SURVEY CONTROL POINTS/MONUMENTS THAT EXIST AS SHOWN ON RECORDED TRACT MAPS, PARCEL MAPS, RECORDS OF SURVEYS AND HIGHWAY MAPS, AND MAY BE DISTRIBUTED OR DAMAGED BY THE PROPOSED CONSTRUCTION"

    AFTER THE COMPLETION OF THE PROPOSED CONSTRUCTION, SAID MONUMENTS AND/OR CONTROL SURVEY POINTS SHALL BE RESET TO THE NEW SURFACE IN ACCORDANCE WITH THE CURRENT PROFESSIONAL LAND SURVEYING PRACTICES. CORNER RECORDS SHALL BE FILED WITH THE COUNTY SURVEYOR FOR ALL THE NEW MONUMENTS SET.
11. THE DEVELOPER SHALL PROVIDE THE CITY WITH A COMPLETED SET OF "AS BUILT", MYLAR DRAWINGS PRIOR TO THE FINAL INSPECTION.
12. A CITY ACCEPTED/APPROVED SET OF PLANS SHALL BE KEPT ON THE JOB SITE AT ALL TIMES.
13. A PRE–CONSTRUCTION MEETING SHALL OCCUR PRIOR TO CONSTRUCTION. ATTENDEES SHALL INCLUDE A CITY REPRESENTATIVE AND THE CONTRACTOR WHO WILL PERFORM THE WORK. "CUT–SHEETS" SHALL BE PROVIDED TO THE CITY AT THIS MEETING FOR ITS REVIEW.
14. CITY ACCEPTANCE OF PLANS DOES NOT RELIEVE THE DEVELOPER FROM RESPONSIBILITY FOR THE CORRECTION OF ERROR AND OMISSION DISCOVERED DURING CONSTRUCTION. UPON REQUEST OF THE CITY INSPECTOR, THE REQUIRED PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR REVIEW.
15. ANY REQUIRED RIGHT–OF–WAY OR EASEMENT SHALL BE DEDICATED TO AND ACCEPTED BY THE CITY PRIOR TO COMMENCEMENT OF CONSTRUCTION OF THE IMPROVEMENTS WITHIN THE REQUIRED RIGHT–OF–WAY OR EASEMENT.
16. WHERE UTILITIES NEED TO BE SUPPORTED, SAID SUPPORTS SHALL BE IN ACCORDANCE WITH A.P.W.A. STANDARD 224–1 UNLESS OTHERWISE INDICATED.
17. PRIOR TO STARTING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF EXISTING SEWER MAIN(S) AND NOTIFY THE DESIGN ENGINEER OF ANY VARIATION FROM DESIGN.
18. THE PIPE SHOWN HEREON SHALL BE INSTALLED IN ACCORDANCE WITH CASE III BEDDING AS SHOWN ON L.A.C.D.P.W. STANDARD 3080–2, UNLESS OTHERWISE SHOWN. "W" VALUE SHALL BE AS SPECIFIED ON L.A.C.D.P.W. STANDARD 3080–2 FOR CASE III BEDDING, NOTES 3 (A), 3 (B), AND 3 (C). IF THE "W" VALUE AT THE TOP OF THE PIPE IS EXCEEDED, THE BEDDING SHALL BE MODIFIED AND/OR PIPE OF ADDITIONAL STRENGTH SHALL BE PROVIDED. ALL PROPOSED MODIFICATIONS TO THIS REQUIREMENT SHALL BE APPROVED BY THE CITY ENGINEER.
19. MINIMUM COVER OF STORM DRAIN MAIN SHALL BE 7 FEET FROM THE FINISHED SURFACE PER STANDARD DRAWING 1302–1304.
20. STORM DRAIN MAIN STATIONING IS PER PIPE CENTERLINE.
21. STREET CENTERLINE STATIONING IS PER THE STREET IMPROVEMENT PLANS AND PROVIDED FOR REFERENCE.
22. CONTRACTOR SHALL NOT BACKFILL TRENCH UNTIL THE CITY INSPECTOR HAS OBTAINED AS–BUILT STATIONING ON ALL STRUCTURES.
23. UPON COMPLETION OF CONSTRUCTION OF ALL STORM DRAIN LINES AND PRIOR TO PAVING, THE DEVELOPER SHALL HIRE A CITY APPROVED VIDEO COMPANY TO VIDEO TAPE THE PIPELINES. CITY SHALL REVIEW SAID VIDEOTAPES FOR POTENTIAL CONSTRUCTION DEFECTS PRIOR TO ACCEPTANCE OF THE PROJECT.

CIVIL ENGINEERS NOTICE TO CONTRACTOR

1. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF MY KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTION AND ANY MEASURES TO PROTECT THE UTILITIES AND STRUCTURES SHOWN AND OTHER LINES OR STRUCTURES NOT OF RECORD OR NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR THE PROTECTION OF, AND ANY DAMAGE TO, THESE UTILITY LINES OR STRUCTURES.
2. THE CONTRACTOR AGREES THAT HE WILL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY AND NOT BE LIMITED TO A NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER, OR ANY PUBLIC AGENCY.
3. THE ESTIMATES OF IMPROVEMENT QUANTITIES AS SHOWN HEREON ARE PROVIDED ONLY FOR THE PURPOSE OF SATISFYING DISTRICT PLAN INFORMATION REQUIREMENTS. THE CONTRACTOR SHALL PERFORM AN INDEPENDENT ESTIMATE OF ALL IMPROVEMENT QUANTITIES AND SHALL USE SAME AS A BASIS FOR HIS BID(S) AND CONTRACT(S).
4. CONTRACTOR TO VERIFY CLEARANCE AT ALL UTILITY CROSSINGS. IF INTERFERENCE OCCURS, OTHER THAN NOTED ON PLAN, CONTRACTOR SHALL CONTACT THE DESIGN ENGINEER FOR POSSIBLE REDESIGN. IF REDESIGN IS NOT FEASIBLE, CONTRACTOR TO RELOCATE UTILITY AT NO EXPENSE TO ENGINEER.
5. CONTRACTOR SHALL TAKE EXTREME CARE DURING STORM DRAIN CONSTRUCTION AND IS RESPONSIBLE FOR TRENCHING AND SHORING. CONTRACTOR SHALL SUBMIT A DETAILED SHORING PLAN PER SECTION 7–10.4.2.2 OF SPPWC AND A PERMIT FROM STATE DIVISION OF INDUSTRIAL SAFETY PRIOR TO COMMENCING WORK. CONTRACTOR SHALL VERIFY PAVEMENT ELEVATION AT RIM PRIOR TO SETTING CONE.

811 Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE

TECK, C. LOH, P.E.
HARRIS AND ASSOCIATES — DATE 1/23/2023

REFERENCE DRAWINGS

DESCRIPTION	REFERENCE	
PR 12" DOMESTIC WATER BAKER AVE	PM–20273	DOMESTIC WATER IMPROVEMENT PLAN
PR 16" DOMESTIC WATER VINEYARD AVE	PM–20273	DOMESTIC WATER IMPROVEMENT PLAN
PR 16" DOMESTIC WATER MERRILL AVE	PM–20273	DOMESTIC WATER IMPROVEMENT PLAN
PR 16" RECYCLED WATER MERRILL AVE	PM–20273	RECYCLED WATER IMPROVEMENT PLAN
PR 8" RECYCLED WATER VINEYARD AVE	PM–20273	RECYCLED WATER IMPROVEMENT PLAN
PR DBLE 12'X12' RCB SD MERRILL AVE	PM–20273	STORM DRAIN LINE A IMPROVEMENT PLAN
PR DBLE 9'X9' RCB SD MERRILL AVE	PM–20273	STORM DRAIN LINE D IMPROVEMENT PLAN

LEGAL DESCRIPTION

PARCEL MAP NO. 20273
IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA BEING A SUBDIVISION OF LOTS 1 THROUGH 32, INCLUSIVE, OF SECTION 21, TOGETHER WITH LOTS 7 THROUGH 10, INCLUSIVE, AND LOTS 23 THROUGH 26, INCLUSIVE, OF SECTION 22, BOTH IN TOWNSHIP 2 SOUTH, RANGE 7 WEST, SAN BERNARDINO MERIDIAN, ACCORDING TO THE MAP OF SUBDIVISION OF PART OF RANCHO SANTA ANA DEL CHINO, RECORDED IN BOOK 6 OF MAPS, PAGE 15, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

OWNER/DEVELOPER:

PROLOGIS, L.P.
3546 CONCOURS STREET, SUITE 100
ONTARIO, CA 91764

CONTACT: SAM CHO, DEVELOPMENT MANAGER
PHONE: (909) 673–8700

CIVIL ENGINEER

WESTLAND GROUP INC.
4150 CONCOURS STREET, SUITE 100
ONTARIO, CA 91764

CONTACT: SIARA MACKINNEY, PE, MS, QSD
PHONE: (909)–989–9789

GEOTECHNICAL ENGINEER:

SOUTHERN CALIFORNIA GEOTECHNICAL
22885 EAST SAVI RANCH PARKWAY, SUITE E
YORBA LINDA, CA 92887

CONTACT: GREGORY K. MITCHELL
PHONE: (714) 685–1115

STRUCTURAL ENGINEER:

RENDE CONSULTING GROUP INC.
22431 ANTONIO PARKWAY, SUITE B160–470
RANCHO SANTA MARGARITA, CA 92688

CONTACT: GREGORY L. RENDE
PHONE: (949)–713–6780

UTILITY PURVEYORS:

CITY OF ONTARIO, MUNICIPAL UTILITIES AGENCY
DAYTIME PH: (909) 395–2678
24–HOUR EMERGENCY: (909) 986–6711

CITY OF ONTARIO, COMMUNITY & PUBLIC SERVICES AGENCY
DAYTIME PH: (909) 395–2633
24–HOUR EMERGENCY: (909) 986–6711

INLAND EMPIRE UTILITY AGENCY
DAYTIME PH: (909) 944–6000
24–HOUR EMERGENCY: (909) 987–2591

SOUTHERN CALIFORNIA GAS COMPANY
DAYTIME PH: (800) 423–1391
24–HOUR EMERGENCY: (800) 423–1391

TIME WARNER CABLE / WEST COAST COMMUNICATIONS
24–HOUR EMERGENCY: (888) 892–2253

VERIZON
24–HOUR EMERGENCY: (800) 483–2000

BASIS OF BEARING

BEARINGS ARE BASED UPON THE CENTERLINE OF MERRILL AVENUE BETWEEN BAKER AVENUE AND VINEYARD AVENUE BEING N89°26'19"E AS SHOWN ON RECORD OF SURVEY 92/97 RECORDED AS INSTRUMENT NO. 1991–447293 OF OFFICIAL RECORDS OF THE COUNTY OF SAN BERNARDINO.

LEGEND OF ABBREVIATIONS & SYMBOLS

BC	BEGIN CURVE	CMP	CORRUGATED METAL PIPE
CB	CATCH BASIN	℄ OR P/L OR PL	PROPERTY LINE
C&G	CURB AND GUTTER	PROP	PROPOSED
℄ OR C/L OR CL	CENTERLINE	RCB	REINFORCED CONCRETE BOX
CP	CONNECTOR PIPE	RCP	REINFORCED CONCRETE PIPE
EC	END CURVE	RW	RECYCLED WATER
EX, EXIST.	EXISTING	R/W, ROW	RIGHT OF WAY
FL	FLOWLINE	ST	STREET
FS	FINISH SURFACE	STA	STATION
FUT	FUTURE	TC	TOP OF CURB
GAS	GAS	TYP	TYPICAL
GB	GRADE BREAK	TSP	TEMPORARY STANDPIPE
INT	INTERSECTION	SD	STORM DRAIN
INV	INVERT	SPPWC	STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
LP	LOW POINT	SS	SEWER
MH	MANHOLE	DW	DOMESTIC WATER
MWS	MODULAR WETLAND SYSTEM	WQ	WATER QUALITY

(100) EXISTING CONTOURS
100 PROP. CONTOUR
EXIST. EASEMENT
2% SLOPE
CENTERLINE
FLOWLINE
FIRE HYDRANT
SIGN
STREET LIGHT
BOUNDARY LINE
FENCE LINE

CONSTRUCTION NOTES

ITEM	DESCRIPTION	PUBLIC QUANTITY		PRIVATE QUANTITY	
1	CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST–IN–PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST–IN–PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")	~~5300~~ 5325	LF		
2	CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D–LOAD PER PLAN	5000	LF		
3	CONSTRUCT 10' DIA. CDS UNIT PER DETAIL, SHEET 19	1	EA		
4	CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D–LOAD PER PLAN	~~1950~~ 2020	LF		
5	CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT PER CITY STANDARD #3018	25	EA		
6	CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.	25	EA		
7	CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326–2, PER DETAIL ON SHEET 20	13	EA		
8	CONSTRUCT CONNECTOR PIPE SCREEN ON 18" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED) PER CITY OF ONTARIO STANDARD #3017	10	EA		
9	INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19	10	EA		
10	CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333–2, PER DETAIL ON SHEET 21	26 ~~24~~	EA		
11	CONSTRUCT JUNCTION STRUCTURE NO. 1 CASE 1, PER CITY OF ONTARIO STD. DWG. NO. 3010	6	EA		
12	CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL 12 ON SHEET 24	4 ~~2~~	EA		
13	CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19	26	EA		
14	CONSTRUCT CONCRETE PIPE COLLAR PER SPPWC STD. PLAN NO. 380–4, PER DETAIL ON SHEET 20	1	EA	2	EA
15	CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009	18	EA		
16	CONSTRUCT CONCRETE PROTECTION PER CITY OF ONTARIO STD. DWG. NO. 2102, L=150, L=1	~~150~~	LF		
17	CONSTRUCT 12" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2 (PRIVATELY MAINTAINED)			676	LF
18	CONSTRUCT 12" RCP 45° BEND (PRIVATELY MAINTAINED)			1	EA
19	REMOVE EXISTING CONCRETE BULKHEAD	2	EA		
20	CONSTRUCT MANHOLE PIPE–TO–PIPE (LARGE SIDE INLET) PER SPPWC STD. PLAN NO. 322–3, PER DETAIL ON SHEET 22 & 23	4	EA		
21	CONSTRUCT PRECAST 13'X12' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST–IN–PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST–IN–PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")	8	LF		
22	CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330–2, DETAIL ON SHEET 20	18	EA		
23	CONSTRUCT MANHOLE PIPE–TO–PIPE (LARGE SIDE INLET) PER SPPWC STD. PLAN NO. 322–3, PER DETAIL ON SHEET 22 & 23	1	EA		
24	CONSTRUCT EDGE BEAM PER DETAIL ON SHEET 26	1	EA		
25	CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D–LOAD PER PLAN	960	LF		

INSTALL CATCH BASIN CONNECTOR PIPE SCREEN PER CITY OF ONTARIO STANDARD #3017

3 AT THE REQUEST OF THE CONTRACTOR, ADJUST INVERT OF LATERAL E-8 TO MATCH UP WITH ONSITE CONNECTION . THIS DELTA AFFECTS 3 SHEETS, 1, 14, AND 15

4 -AT THE REQUEST OF THE ENGINEER, ADJUST LATERALS C-12 AND C-13 TO NEW CATCH BASIN LOCATION.
-AT THE REQUEST OF THE ENGINEER, ADD TWO TEMPORARY 36" RISERS ON WALKER AVENUE, NORTH OF EUCALYPTUS AVENUE TO CATCH THE WATER FROM THE ADDED SWALES.
THIS DELTA AFFECTS 5 SHEETS, 1, 2, and 11-13

AT THE REQUEST OF THE ENGINEER, REMOVE CONCRETE PROTECTION CONSTRUCTION NOTE, ADD 1 SPECIAL COVER TO LATERAL B-4. THIS DELTA AFFECTS 2 SHEETS, 1, AND 6

1 AT THE REQUEST OF THE CONTRACTOR, THE 10' DIAMETER CDS UNIT ON VINEYARD AVENUE WAS SHIFTED INTO THE PARKWAY TO ACCOMODATE ONSITE WALL. THIS DELTA AFFECTS 4 SHEETS, 1, 4, 5, AND 18

2 AT THE REQUEST OF THE CONTRACTOR, ADJUST CONNECTION OF LATERAL B-8 & B-9 TO RCB, AND AT THE REQUEST OF THE ENGINEER, SHIFT CDS "C" FIVE FEET EAST TO AVOID CONFLICT WITH SCREEN WALL. THIS DELTA AFFECTS 4 SHEETS, 1, 4, 5, AND 18

APPROVED Sep 01, 2023 BY _____ 2

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.
1	6-16-23	WLG	
2	7-25-23	WLG	
3	10-17-23	WLG	
4	11-8-23	WLG	

DESIGNED BY: BK DATE: 2/2/2022
DRAWN BY: BK DATE: 2/2/2022
CHECKED BY: DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN CIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG–18–1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG–18–1." SET ON TOP OF CURB. APPROX 5' +/– SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA REE MACKINNEY No.85559 Exp. 9/30/2024 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN
EUCALYPTUS AVE, VINEYARD AVE AND BAKER AVE
TITLE SHEET

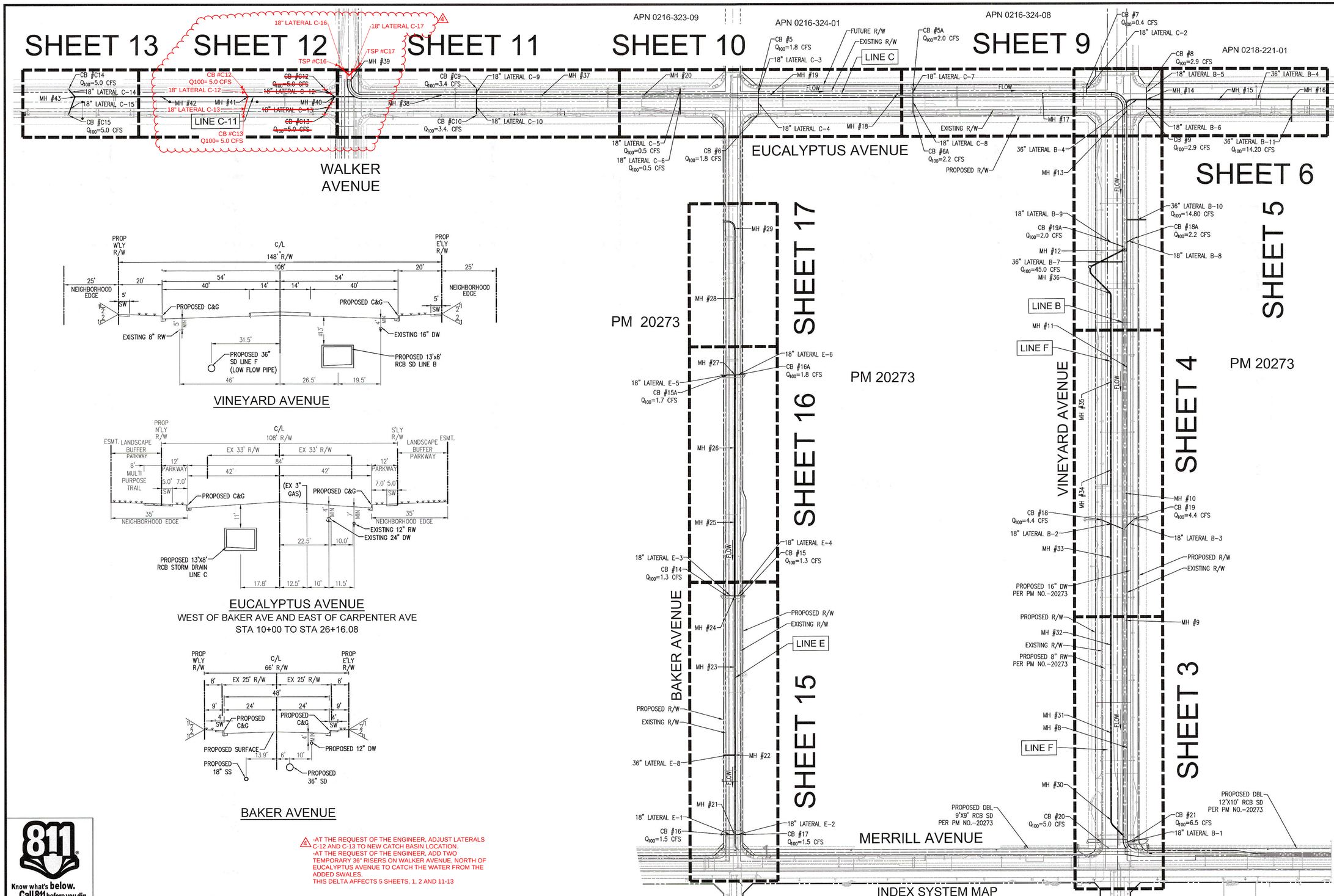
PM-20273

SHEET 1 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14531

01/11/2023

H1-515

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I – Prologis – Tom Donohue\06 Engineering\Sheets\OFF–SITE\Storm Drain\01_2020-263_SD.dwg
Last Opened: Jan 11, 2023 – 4:10pm by: Brent.King



Know what's **below.** **Call 811** before you dig.

⚠ -AT THE REQUEST OF THE ENGINEER, ADJUST LATERALS C-12 AND C-13 TO NEW CATCH BASIN LOCATION.
-AT THE REQUEST OF THE ENGINEER, ADD TWO TEMPORARY 36" RISERS ON WALKER AVENUE, NORTH OF EUCALYPTUS AVENUE TO CATCH THE WATER FROM THE ADDED SWALES.
THIS DELTA AFFECTS 5 SHEETS, 1, 2 AND 11-13

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.
⚠1	11-8-23	WLG	

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
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REGISTERED PROFESSIONAL ENGINEER — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

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4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 1/11/23

STORM DRAIN IMPROVEMENT PLAN

INDEX SYSTEM MAP

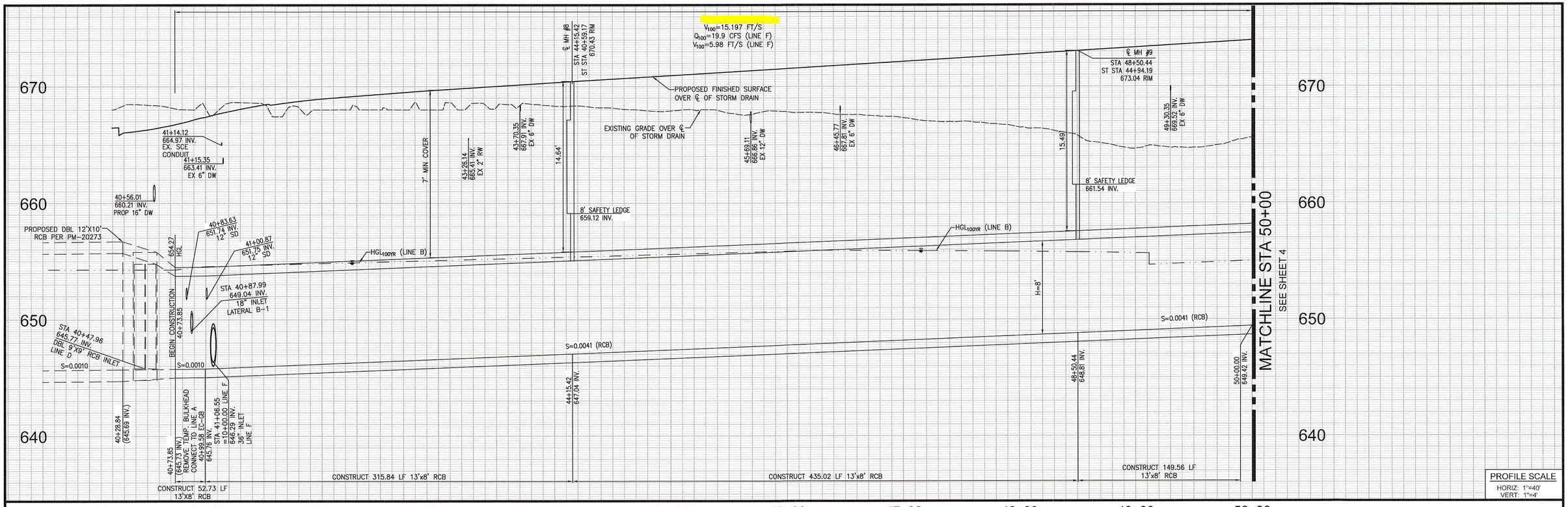
PM-20273

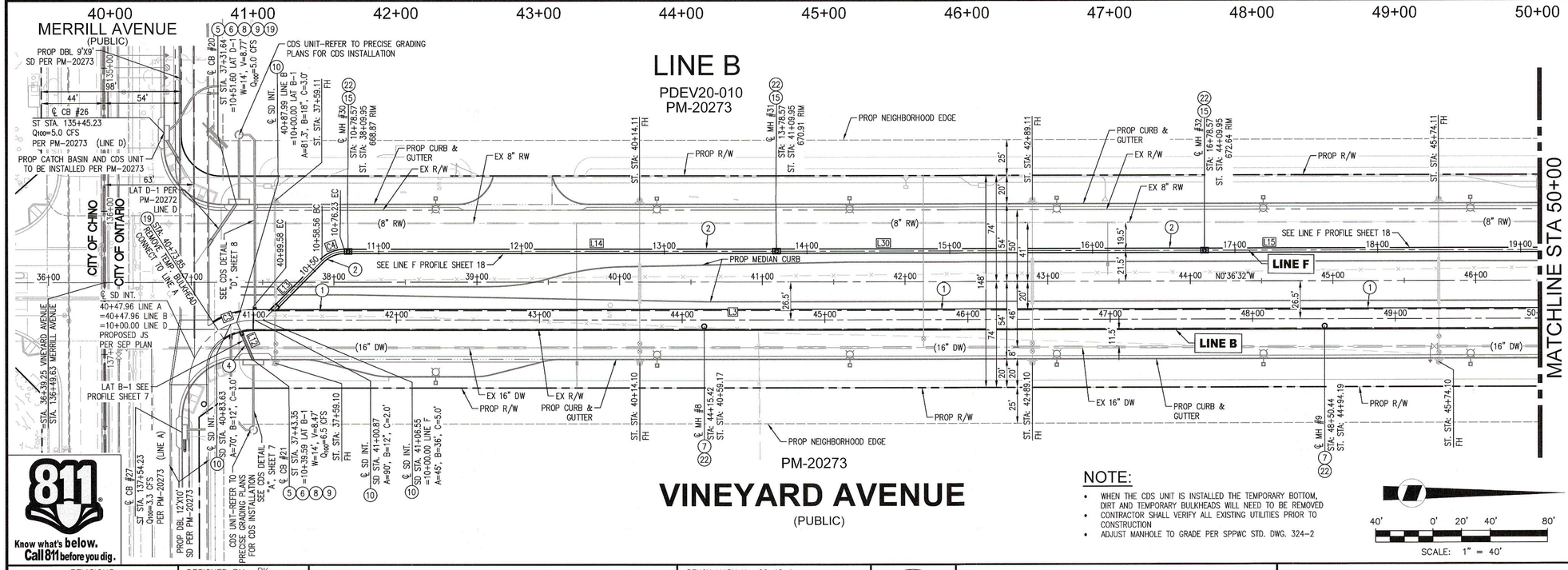
SHEET 2 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14582

01/09/2023

H1-516

Drawing Name: P:\Year 2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\02_2020-263_SD-USM.dwg
Last Opened: Jan 09, 2023 - 3:21pm by: BrentKing





LINE B

PDEV20-010
PM-20273

PM-20273

VINEYARD AVENUE

(PUBLIC)

CONSTRUCTION NOTES

1. CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST-IN-PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST-IN-PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")
2. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326-2, PER DETAIL ON SHEET 20
8. CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)
9. INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
15. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
19. REMOVE EXISTING CONCRETE BULKHEAD
22. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330-2, DETAIL ON SHEET 20

STORM DRAIN CENTERLINE DATA TABLE

LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C3	032°45'39"	25.73'	45.00
C4	045°00'00"	17.67'	22.50
L3	N0°36'32"W	2016.84'	
L12	N65°57'51"E	19.31'	
L13	N45°36'32"W	44.37'	
L14	N0°36'32"W	295.33'	
L15	N0°36'32"W	295.33'	
L30	N0°36'32"W	295.33'	

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

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REGISTERED PROFESSIONAL ENGINEER — SIARA RENE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
VINEYARD AVENUE
FROM MERRILL AVE TO 1000 NORTH OF MERRILL AVE

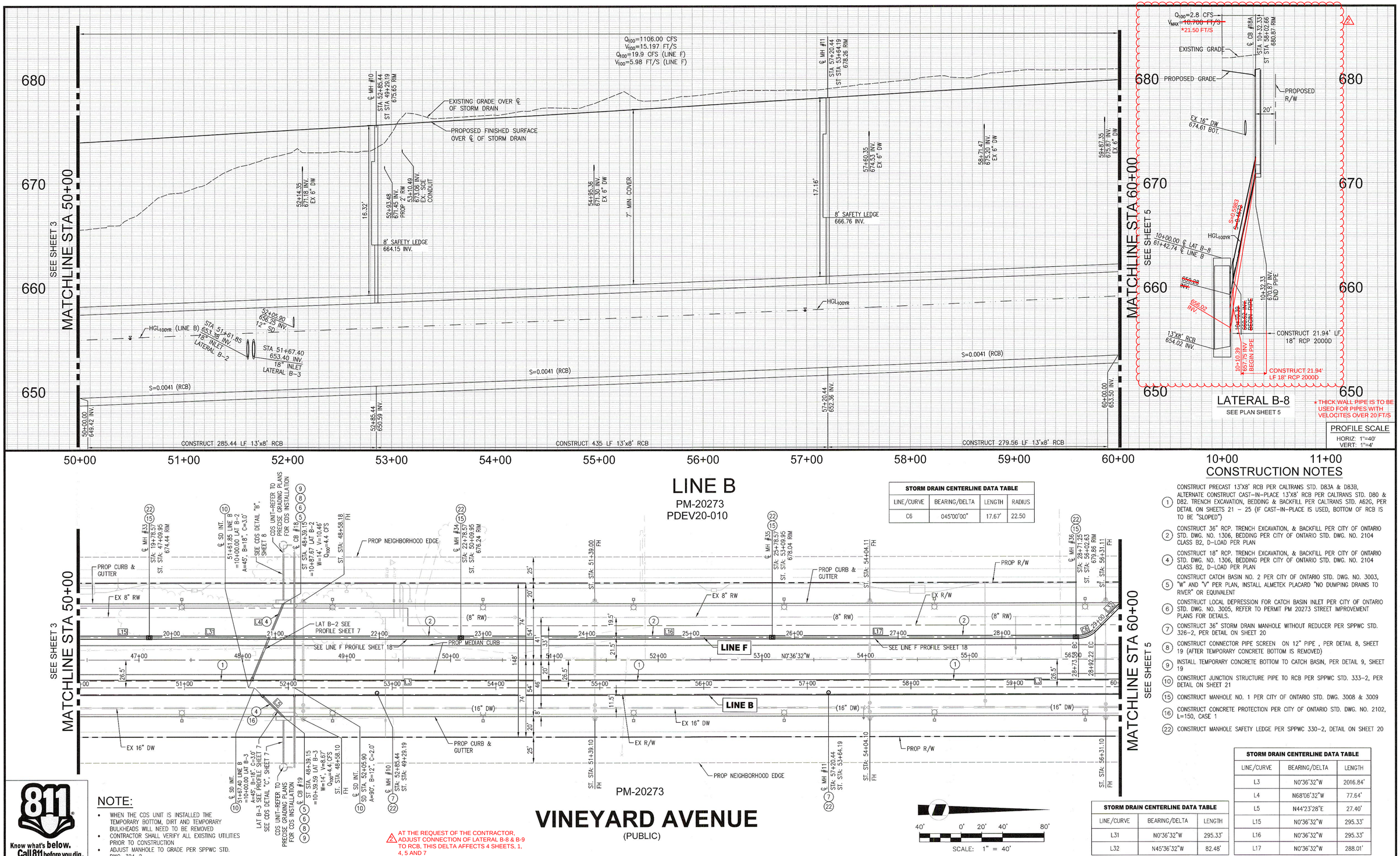
PM-20273

SHEET 3 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14533

01/09/2023

H1-517

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donohue\06 Engineering\Sheets\OFF-SITE\Storm Drain\03-6_2020-263_SD_VINEYARD.dwg
Last Opened: Jan 09, 2023 - 10:50am by: Brent.King



STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C6	045°00'00"	17.67'	22.50

STORM DRAIN CENTERLINE DATA TABLE		
LINE/CURVE	BEARING/DELTA	LENGTH
L3	N0°36'32"W	2016.84'
L4	N68°06'32"W	77.64'
L5	N44°23'28"E	27.40'
L15	N0°36'32"W	295.33'
L16	N0°36'32"W	295.33'
L17	N0°36'32"W	288.01'

STORM DRAIN CENTERLINE DATA TABLE		
LINE/CURVE	BEARING/DELTA	LENGTH
L31	N0°36'32"W	295.33'
L32	N45°36'32"W	82.48'

CONSTRUCTION NOTES

1. CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST-IN-PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST-IN-PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")
2. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326-2, PER DETAIL ON SHEET 20
8. CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)
9. INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
15. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
16. CONSTRUCT CONCRETE PROTECTION PER CITY OF ONTARIO STD. DWG. NO. 2102, L=150, CASE 1
22. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330-2, DETAIL ON SHEET 20

★THICK WALL PIPE IS TO BE USED FOR PIPES WITH VELOCITIES OVER 20 FT/S

Know what's below. Call 811 before you dig.

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

⚠2 AT THE REQUEST OF THE CONTRACTOR, ADJUST CONNECTION OF LATERAL B-8 & B-9 TO RCB, THIS DELTA AFFECTS 4 SHEETS, 1, 4, 5 AND 7

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.
⚠2	7-25-23	WLG	

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
VINEYARD AVENUE
FROM 1000' NORTH OF MERRILL AVE TO
635' SOUTH OF EUCALYPTUS AVE

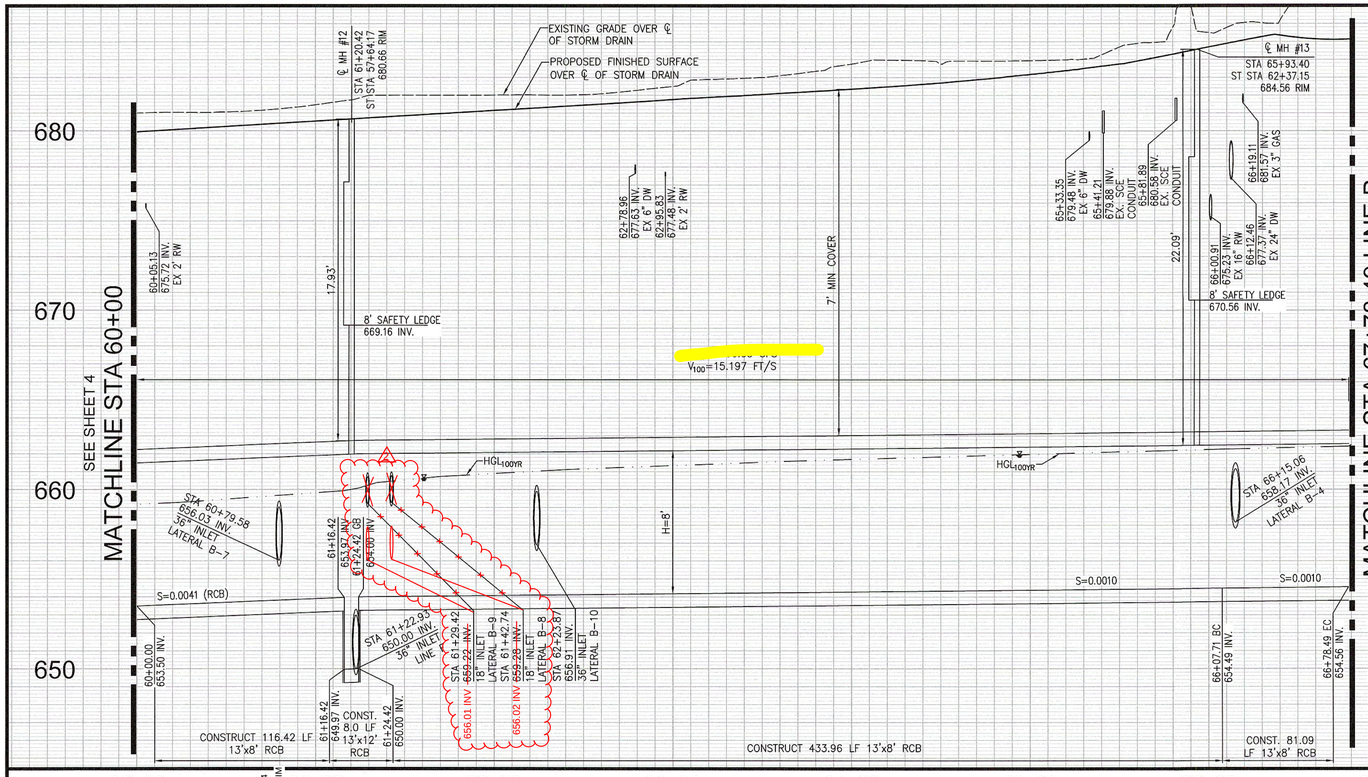
PM-20273

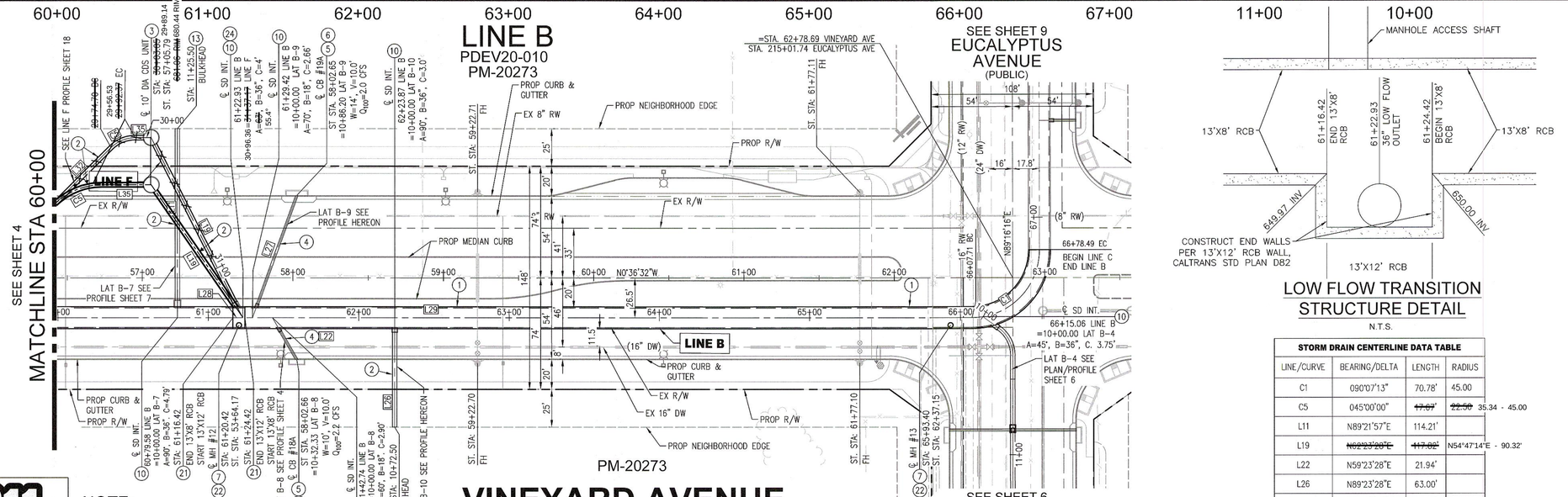
SHEET 4 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14631

01/09/2023

H1-518

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\03-6_2020-263_SD_VINEYARD.dwg
Last Opened: Jan 09, 2023 - 10:51am by: Brent.King





CONSTRUCTION NOTES

1. CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST–IN–PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST–IN–PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")
2. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D–LOAD PER PLAN
3. CONSTRUCT 10' DIA. CDS UNIT PER DETAIL, SHEET 19
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D–LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326–2, PER DETAIL ON SHEET 20
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333–2, PER DETAIL ON SHEET 21
13. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19
21. CONSTRUCT PRECAST 13'X12' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST–IN–PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25
22. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330–2, DETAIL ON SHEET 20
24. CONSTRUCT EDGE BEAM PER DETAIL ON SHEET 26

40' 0' 20' 40' 80'
SCALE: 1" = 40'

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324–2
- CDS IS IS LOCATED IN THE STREET/CITY RIGHT OF WAY AND WILL BE MAINTAINED BY THE CITY OF ONTARIO

Know what's below. Call 811 before you dig.

1 AT THE REQUEST OF THE CONTRACTOR, THE 10' DIAMETER CDS UNIT ON VINEYARD AVENUE WAS SHIFTED INTO THE PARKWAY TO ACCOMODATE ONSITE WALL. THIS DELTA AFFECTS 4 SHEETS, 1, 4, 5, AND 18

2 AT THE REQUEST OF THE CONTRACTOR, ADJUST CONNECTION OF LATERAL B-8 & B-9 TO RCB, THIS DELTA AFFECTS 4 SHEETS, 1, 4, 5 AND 7

STORM DRAIN CENTERLINE DATA TABLE

LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C1	090°07'13"	70.78'	45.00
C5	045°00'00"	~~17.67'~~ ~~22.50~~	35.34 - 45.00
L11	N89°21'57"E	114.21'	
L19	~~N62°23'28"E~~	~~117.82'~~	N54°47'14"E - 90.32'
L22	N59°23'28"E	21.94'	
L26	N89°23'28"E	63.00'	
L27	N70°36'32"W	76.62'	
L28	N0°36'32"W	8.00'	
L29	N0°36'32"W	483.29'	
L32	N45°36'32"W	~~82.46'~~	28.96
L35	N0°36'32"W	~~5.68'~~	27.61

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO
1 2	6-16-23	WLG	
	7-25-23	WLG	

DESIGNED BY: BK DATE: 2/2/2022
DRAWN BY: BK DATE: 2/2/2022
CHECKED BY: DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG–18–1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG–18–1," SET ON TOP OF CURB, APPROX 5' +/– SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA ROSE MACKINNEY No. 85559 Exp. 9/30/2022 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

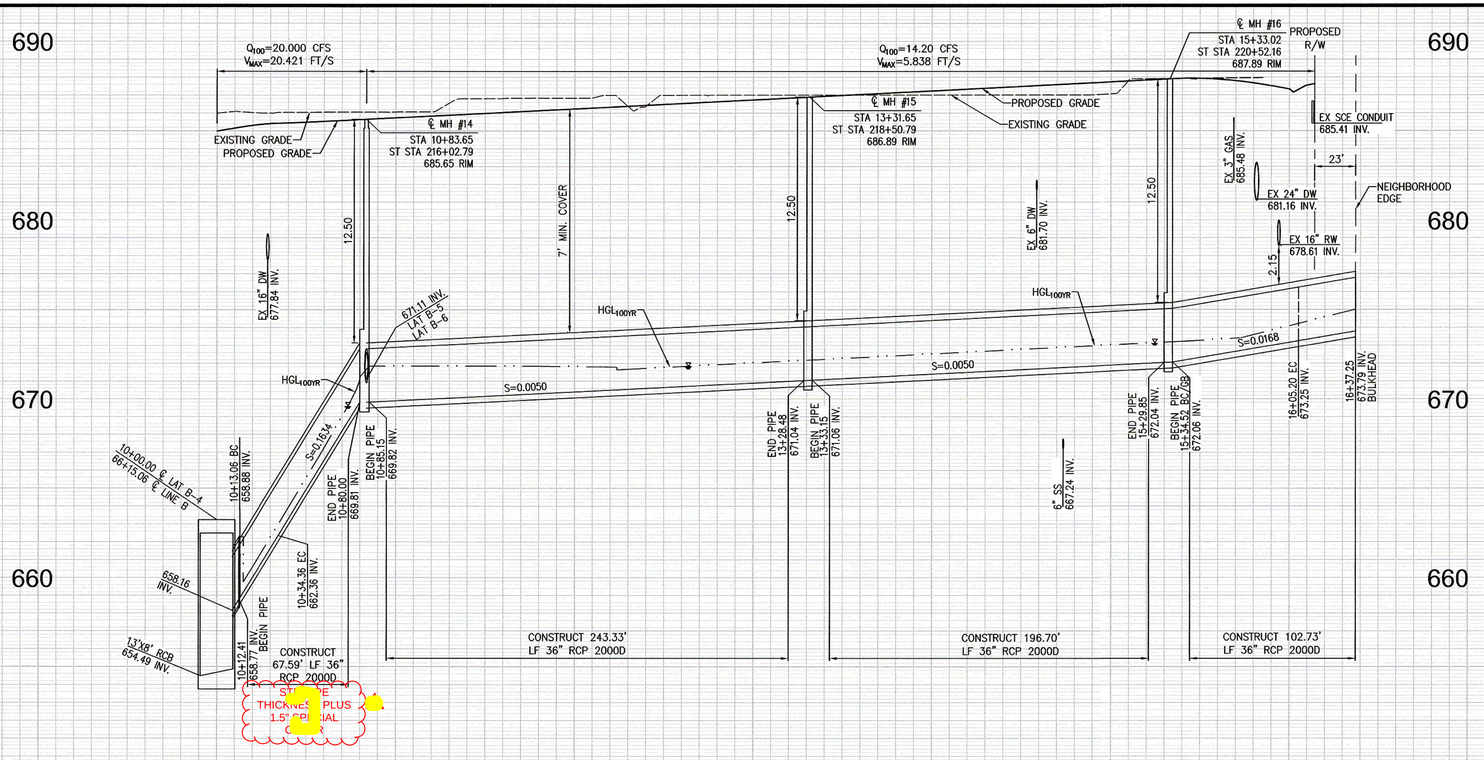
STORM DRAIN IMPROVEMENT PLAN & PROFILE
VINEYARD AVENUE
FROM 635' SOUTH OF EUCALYPTUS TO EUCALYPTUS AVE

PM-20273

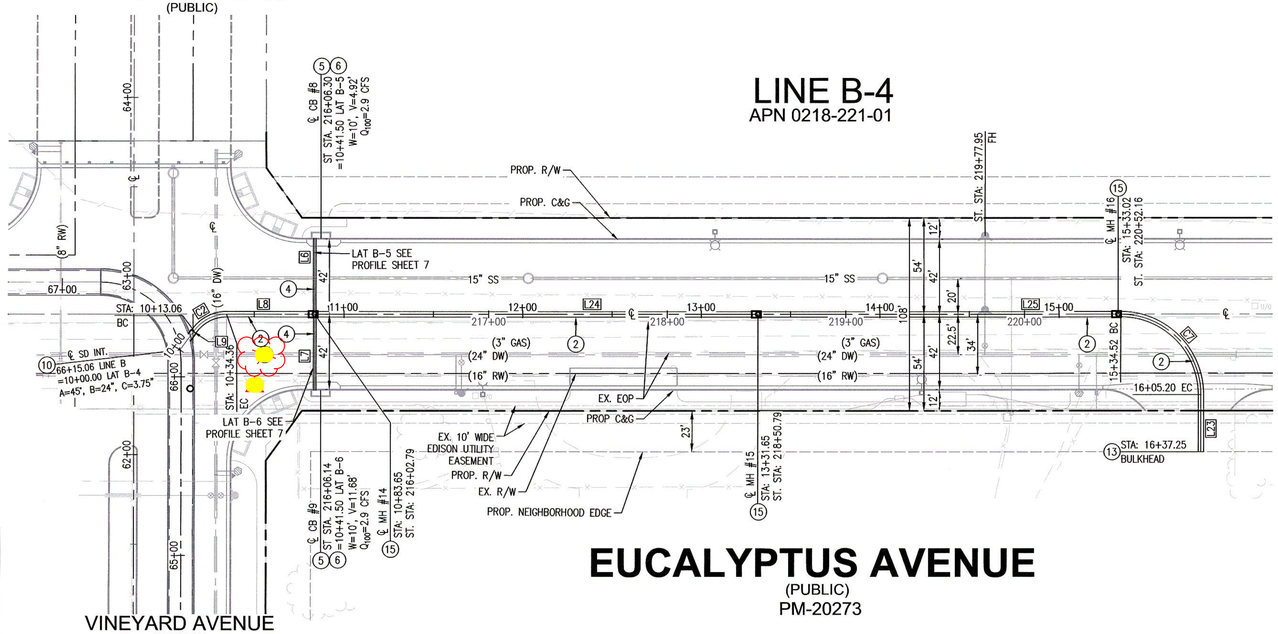
SHEET 5 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14535

01/09/2023

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I – Prologis – Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\03-6_2020-263_SD_VINEYARD.dwg
Last Opened: Jan 09, 2023 – 1:09pm by: Brent.King



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



EUCALYPTUS AVENUE
(PUBLIC)
PM-20273

STORM DRAIN CENTERLINE DATA TABLE		
LINE/CURVE	BEARING/DELTA	LENGTH
L6	N0°39'46"W	41.49'
L7	N0°40'03"W	41.50'
L8	N89°20'14"E	47.09'
L9	N35°06'55"E	0.65'
L23	S0°40'03"E	32.04'
L24	S89°19'58"W	243.33'
L25	N89°19'58"E	196.70'

STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C2	054°13'19"	21.29'	22.50
C7	090°00'00"	70.69'	45.00

CONSTRUCTION NOTES

(2) CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(4) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.

(10) CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21

(11) CONSTRUCT JUNCTION STRUCTURE NO. 1 CASE 1, PER CITY OF ONTARIO STD. DWG. NO. 3010

(13) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19

(15) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009

~~CONSTRUCT CONCRETE PROTECTION PER CITY OF ONTARIO STD. DWG. NO. 2102, CASE 1~~

AT THE REQUEST OF THE ENGINEER, REMOVE CONCRETE PROTECTION CONSTRUCTION NOTE, ADD 1.5" SPECIAL COVER TO LATERAL B-4. THIS DELTA AFFECTS 2 SHEETS, 1, AND 6

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 2/6/23 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 2-7-23 DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF EOR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RAE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
VINEYARD AVENUE
FROM EUCALYPTUS AVE TO 600' E/O
VINEYARD AVE

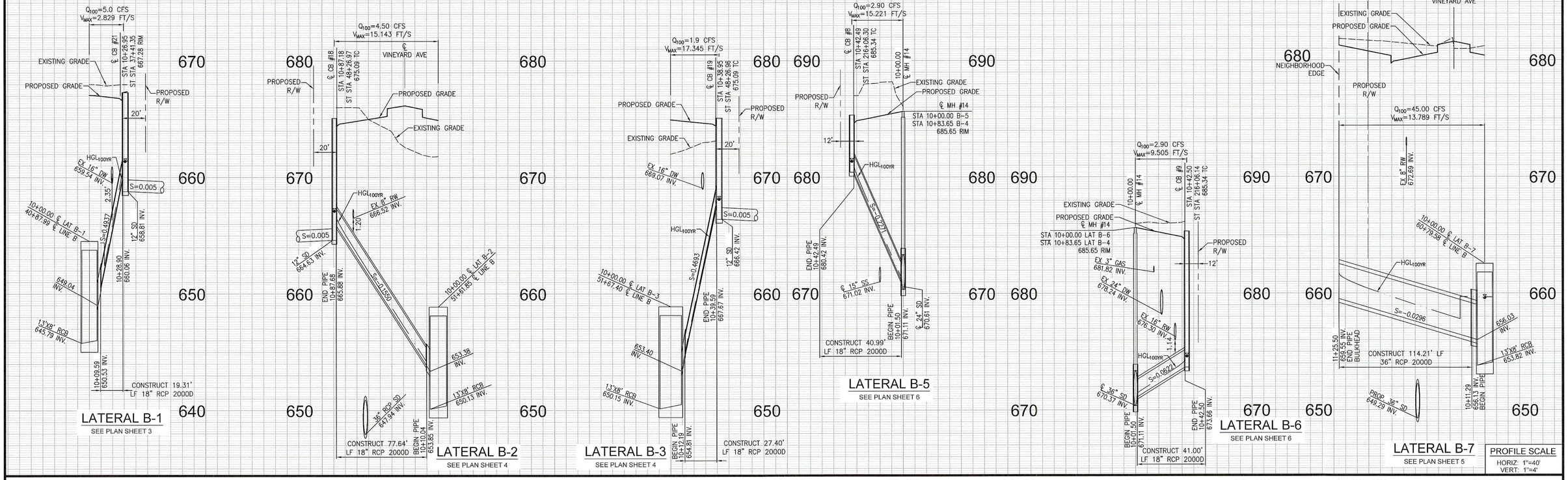
PM-20273

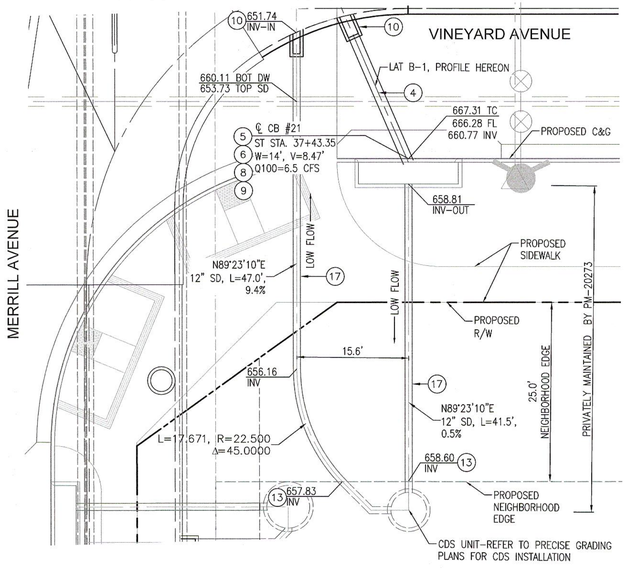
SHEET 6 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14536

01/11/2023

H1-520

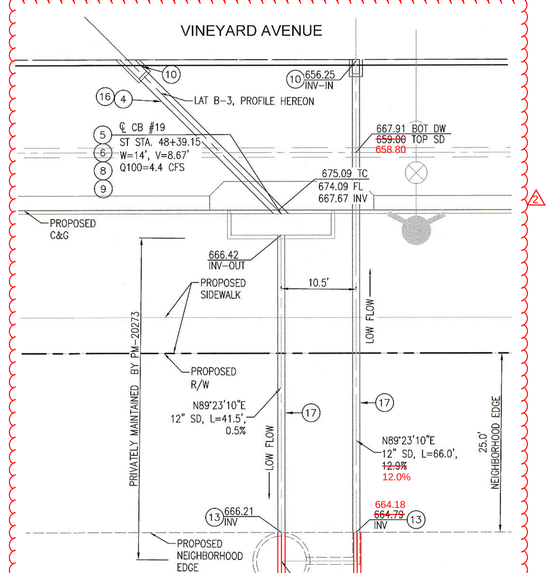
Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donohue\06 Engineering\Sheets\OFF-SITE\Storm Drain\03-6_2020-263_SD_VINEYARD.dwg
Last Opened: Jan 11, 2023 - 4:07pm by: BrentKing





CDS DETAIL "A" (PRIVATELY MAINTAINED)

SCALE: 1"=10'
SEE SHEET 3



CDS UNIT-REFER TO PRECISE GRADING PLANS FOR CDS INSTALLATION

CDS DETAIL "C" (PRIVATELY MAINTAINED)

SCALE: 1"=10'
SEE SHEET 4

CONSTRUCTION NOTES

4. CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
8. CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)
9. INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
13. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19
16. CONSTRUCT CONCRETE PROTECTION PER CITY OF ONTARIO STD. DWG. NO. 2102, L=150, CASE 1
17. CONSTRUCT 12" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2 (PRIVATELY MAINTAINED)

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

2 AT THE REQUEST OF THE ENGINEER, SHIFT CDS "C" FIVE FEET EAST TO AVOID CONFLICT WITH SCREEN WALL, THIS DELTA AFFECTS 4 SHEETS, 1, 4, 5 AND 7

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.
2	7-25-23	WLG	

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 2/6/23 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 2-7-23 DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RENE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
VINEYARD AVENUE

LATERAL PROFILES AND DETAILS

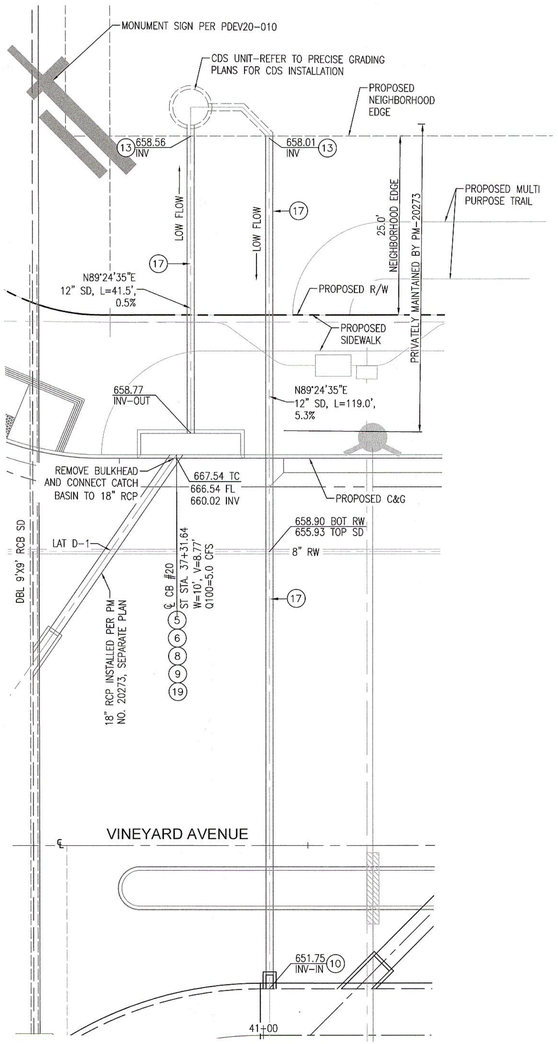
PM-20273

SHEET 7 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14537

01/09/2023

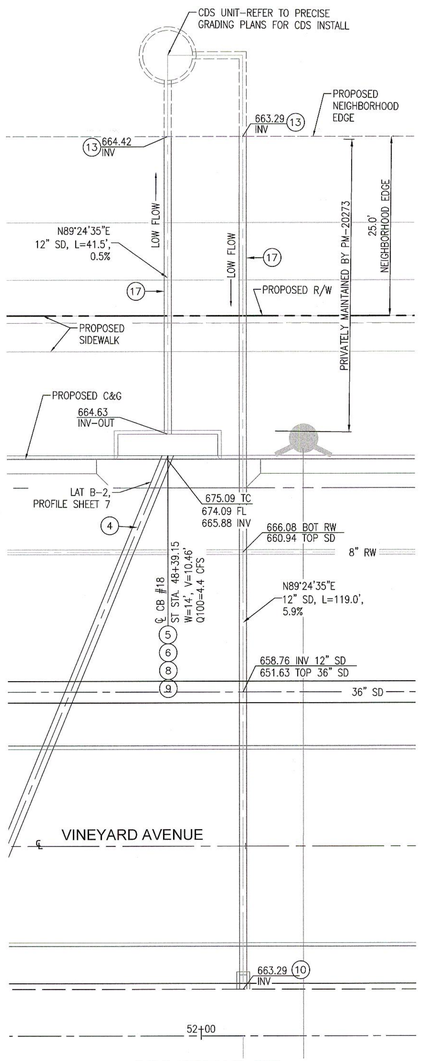
H1-521

Drawing Name: P:\Year_2020\2020-263_Merrill Commerce Center Phase I — Prologis — Tom Donohue\06 Engineering\Sheets\OFF-SITE\Storm Drain\03-6_2020-263_SD_VINEYARD.dwg
Last Opened: Jan 09, 2023 - 10:56am by: Brent.King



CDS DETAIL "D" (PRIVATELY MAINTAINED)

SCALE: 1"=10'
SEE SHEET 3



CDS DETAIL "B" (PRIVATELY MAINTAINED)

SCALE: 1"=10'
SEE SHEET 4

CONSTRUCTION NOTES

(4) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.

(8) CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)

(9) INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19

(10) CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21

(13) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19

(17) CONSTRUCT 12" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2 (PRIVATELY MAINTAINED)

(19) REMOVE EXISTING CONCRETE BULKHEAD

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED.
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION

10' 0' 5' 10' 20'
SCALE: 1" = 10'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN KIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN
VINEYARD AVENUE

LATERAL PROFILES AND DETAILS

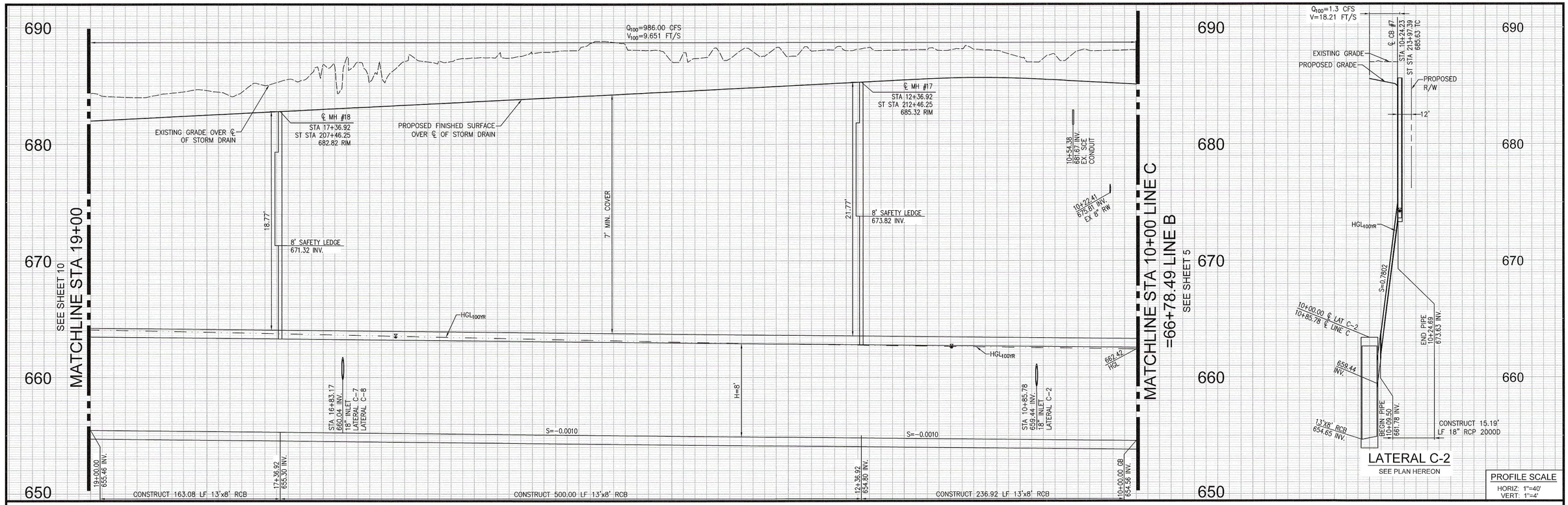
PM-20273

SHEET 8 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14538

01/09/2023

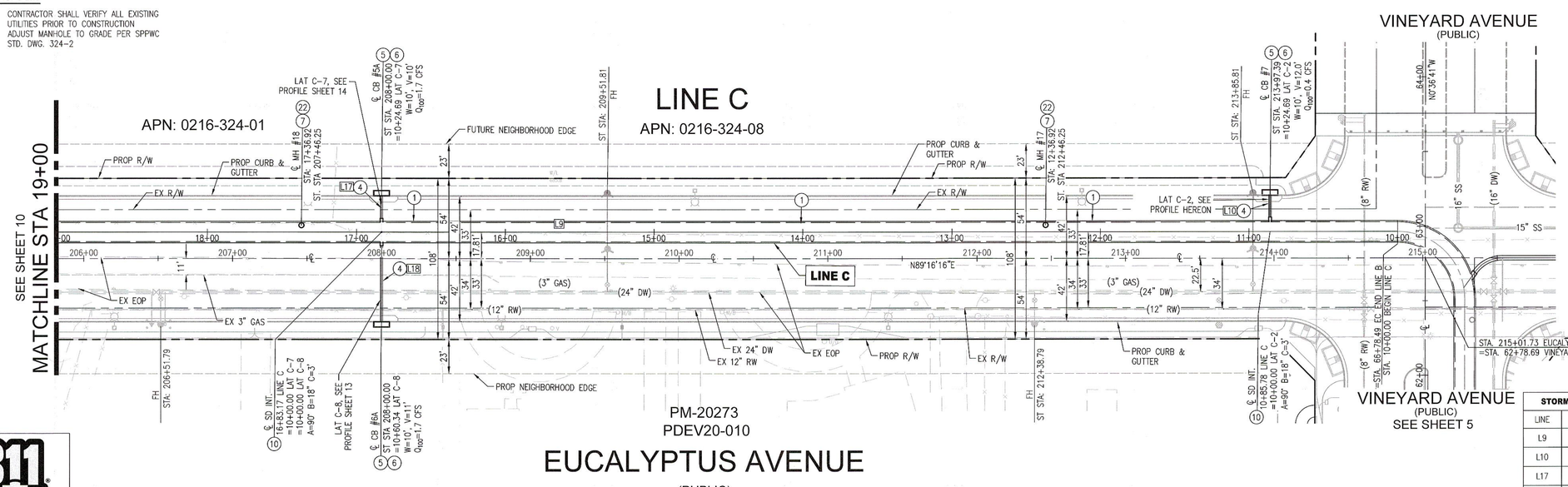
H1-522

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07_2020-263_SD_VINEYARD.dwg
Last Opened: Jan 09, 2023 - 4:35pm by: Brent.King



NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2



CONSTRUCTION NOTES

1. CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST-IN-PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST-IN-PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326-2, PER DETAIL ON SHEET 20
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
13. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19
14. CONSTRUCT CONCRETE PIPE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 20
22. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330-2, DETAIL ON SHEET 20

STORM DRAIN CENTERLINE DATA TABLE

LINE	BEARING	LENGTH
L9	N89°16'16"E	2575.23'
L10	N0°43'44"W	15.19'
L17	N0°43'44"W	15.69'
L18	N0°43'44"W	51.31'

40' 0' 20' 40' 80'
SCALE: 1" = 40'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. 85559 R.C.E. NO. 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
EUCALYPTUS AVENUE
FROM EUCALYPTUS AVE TO 920' WEST OF VINEYARD AVE

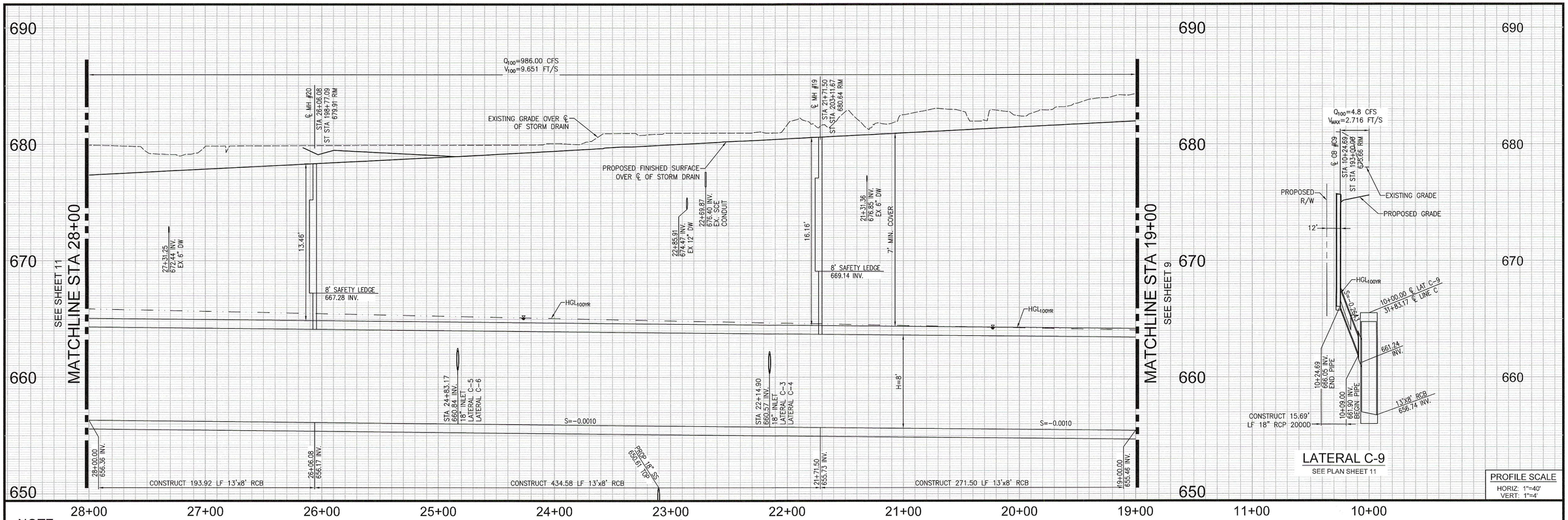
PM-20273

SHEET 9 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14529

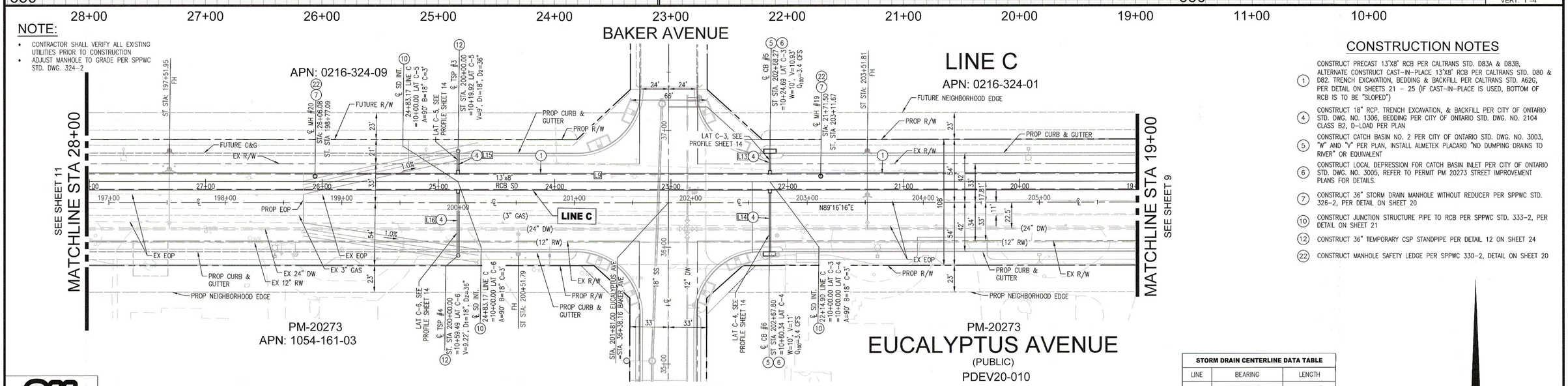
01/09/2023

H1-523

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I – Prologis – Tom Donohue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07-09-2020-263_SD_EUCALYPTUS.dwg
Last Opened: Jan 09, 2023 – 4:09pm by: Brent.King



PROFILE SCALE
HORIZ. 1"=40'
VERT. 1"=4'



NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

CONSTRUCTION NOTES

1. CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST-IN-PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62C, PER DETAIL ON SHEETS 21 – 25 (IF CAST-IN-PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326-2, PER DETAIL ON SHEET 20
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
12. CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL 12 ON SHEET 24
22. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330-2, DETAIL ON SHEET 20

STORM DRAIN CENTERLINE DATA TABLE		
LINE	BEARING	LENGTH
L9	S89°16'16"W	2575.23'
L13	N0°43'44"W	15.34'
L14	S0°43'44"E	51.02'
L15	N0°43'44"W	15.35'
L16	S0°43'44"E	52.22'

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RAE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE

EUCALYPTUS AVENUE
FROM 920' WEST OF VINEYARD AVE
TO 500' WEST OF BAKER AVE

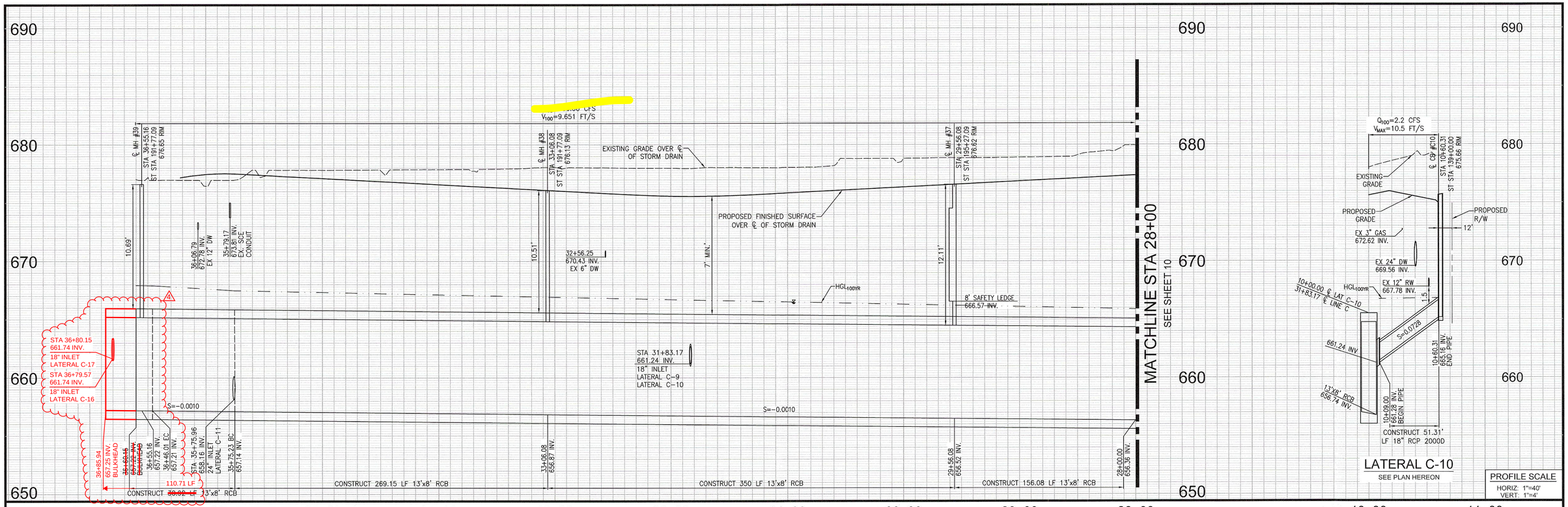
PM-20273

SHEET 10 OF 26
CONTRACT _____
ACCOUNT
DWG. NO. D14540

01/09/2023

H1-524

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07-09_2020-263_SD_EUCALYPTUS.dwg
Last Opened: Jan 09, 2023 - 4:10pm by: BrentKing



CONSTRUCTION NOTES

1. CONSTRUCT PRECAST 13'X8' RCB PER CALTRANS STD. D83A & D83B, ALTERNATE CONSTRUCT CAST-IN-PLACE 13'X8' RCB PER CALTRANS STD. D80 & D82. TRENCH EXCAVATION, BEDDING & BACKFILL PER CALTRANS STD. A62G, PER DETAIL ON SHEETS 21 – 25 (IF CAST-IN-PLACE IS USED, BOTTOM OF RCB IS TO BE "SLOPED")
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT PER CITY STANDARD #3018, INSTALL CATCH BASIN CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STANDARD #3017
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT 36" STORM DRAIN MANHOLE WITHOUT REDUCER PER SPPWC STD. 326-2, PER DETAIL ON SHEET 20
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
13. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19
22. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330-2, DETAIL ON SHEET 20
12. CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL 12 ON SHEET 24

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

Know what's below. Call 811 before you dig.

4 -AT THE REQUEST OF THE ENGINEER, ADD TWO TEMPORARY 36" RISERS ON WALKER AVENUE, NORTH OF EUCALYPTUS AVENUE TO CATCH THE WATER FROM THE ADDED SWALES.
THIS DELTA AFFECTS 5 SHEETS, 1, 2 AND 11-13

STORM DRAIN CENTERLINE DATA TABLE

CURVE	DELTA	LENGTH	RADIUS	TANGENT
C1	090°07'16.5"	70.78'	45.00'	45.10'

4

L36	N44°23'32"E	33.37'
L37	N48°15'14"W	35.70'

STORM DRAIN CENTERLINE DATA TABLE

LINE	BEARING	LENGTH
L9	S89°16'16"W	2575.23'
L19	N0°43'44"W	15.69'
L20	S0°43'44"E	51.31'
L31	N0°36'28"W	~~44.44'~~ 39.93'

4

40' 0' 20' 40' 80'
SCALE: 1" = 40'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO
4	11-8-23	WLG	

DESIGNED BY: BK DATE: 2/2/2022
DRAWN BY: BK DATE: 2/2/2022
CHECKED BY: DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LOBLEY, P.E., ASSISTANT CITY ENGINEER — 2/6/23 DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 2-7-23 DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RENE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
EUCALYPTUS AVENUE
FROM 500' WEST OF BAKER AVE TO WALKER AVE

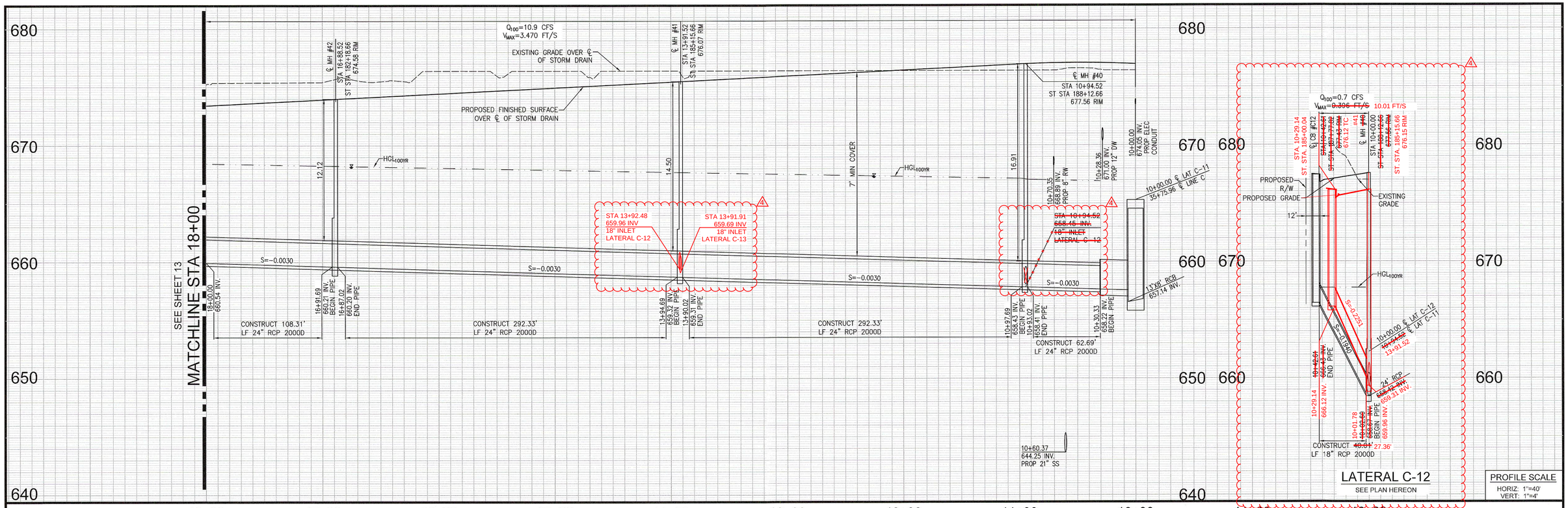
PM-20273

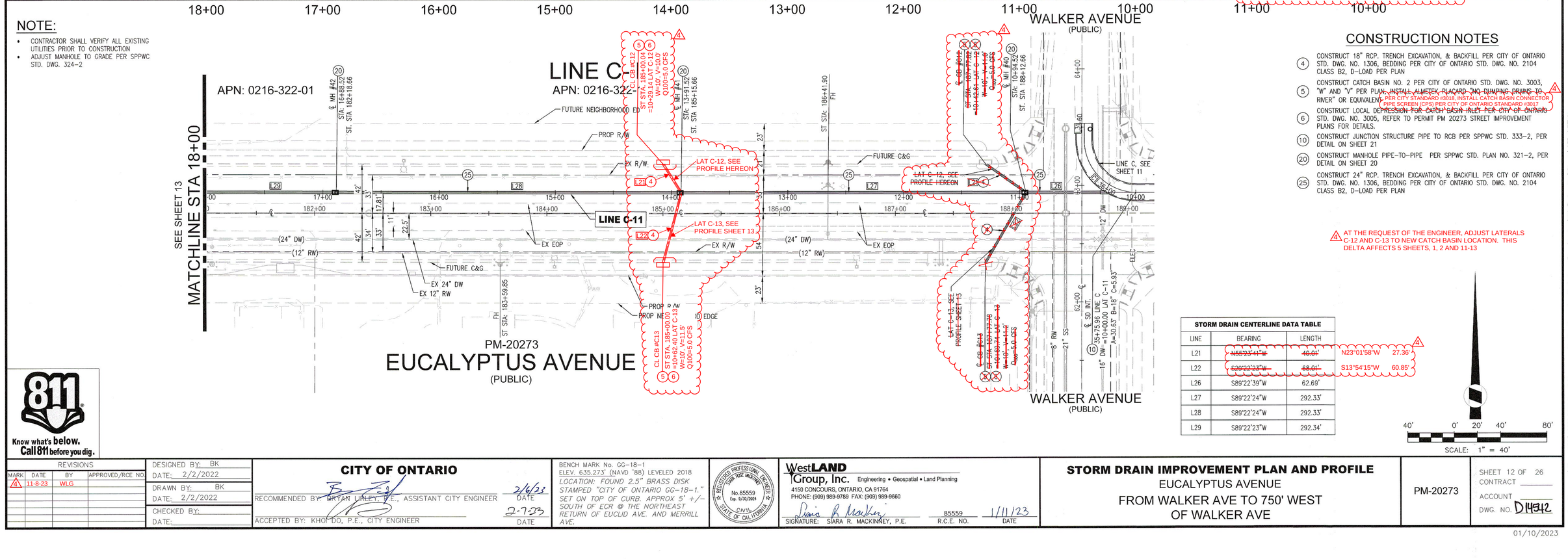
SHEET 11 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14541

01/09/2023

H1-525

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07-09_2020-263_SD_EUCALYPTUS.dwg
Last Opened: Jan 09, 2023 - 5:00pm by: Brent.King





NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

CONSTRUCTION NOTES

(4) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT, ~~PER CITY STANDARD #3018. INSTALL CATCH BASIN CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STANDARD #3017~~ (4)

(6) CONSTRUCT LOCAL ~~DEPRESSION FOR CATCH BASIN INLET~~ PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.

(10) CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21

(20) CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 20

(25) CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(4) AT THE REQUEST OF THE ENGINEER, ADJUST LATERALS C-12 AND C-13 TO NEW CATCH BASIN LOCATION. THIS DELTA AFFECTS 5 SHEETS, 1, 2 AND 11-13

STORM DRAIN CENTERLINE DATA TABLE

LINE	BEARING	LENGTH	
L21	~~N65°23'44"W~~	~~40.01'~~	N23°01'58"W 27.36'
L22	~~S20°39'23"W~~	~~68.01'~~	S13°54'15"W 60.85'
L26	S89°22'39"W	62.69'	
L27	S89°22'24"W	292.33'	
L28	S89°22'24"W	292.33'	
L29	S89°22'23"W	292.34'	

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.
(4)	11-8-23	WLG	

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LINLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF EOR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA REE MACKINNEY No. 85559 Exp. 9/30/2024 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
EUCALYPTUS AVENUE
FROM WALKER AVE TO 750' WEST OF WALKER AVE

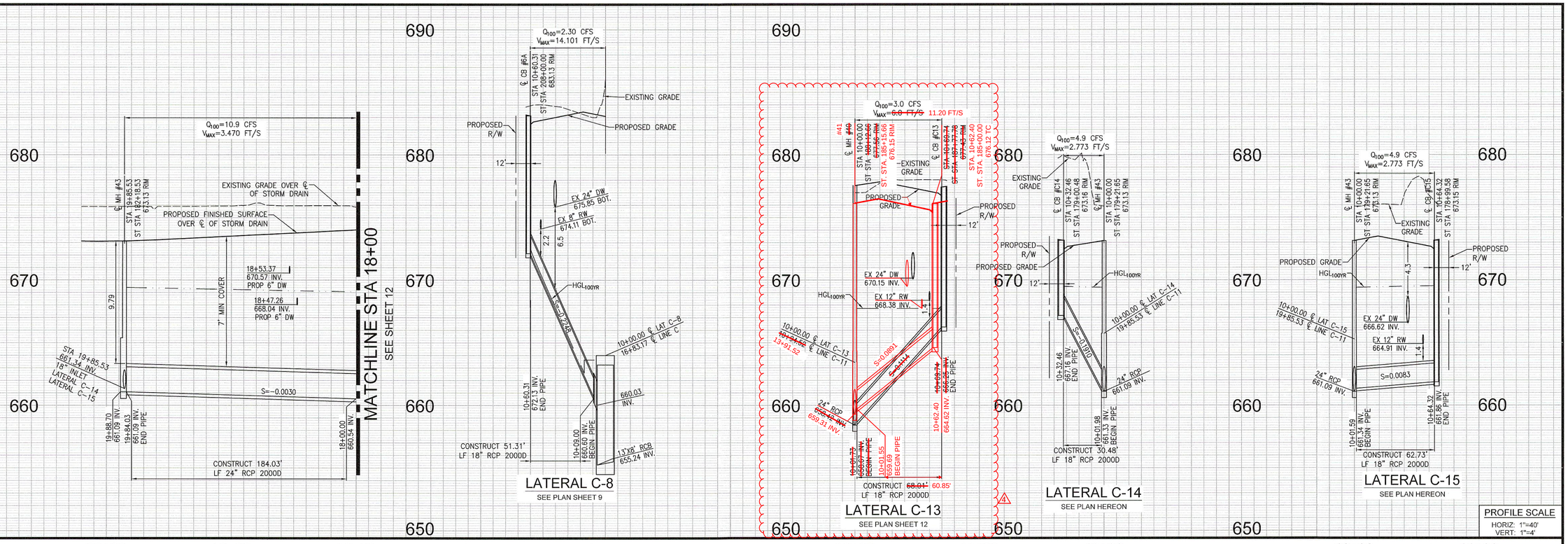
PM-20273

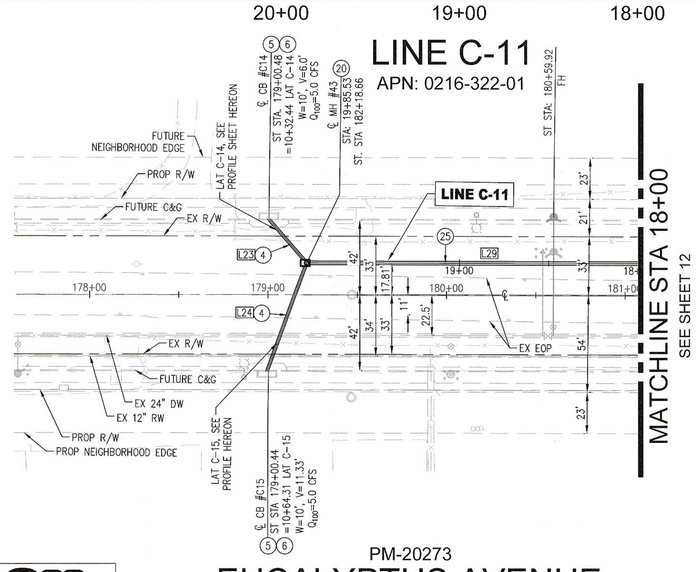
SHEET 12 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14312

01/10/2023

H1-526

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07-09_2020-263_SD_EUCALYPTUS.dwg
Last Opened: Jan 10, 2023 - 1:37pm by: Brent.King





PM-20273

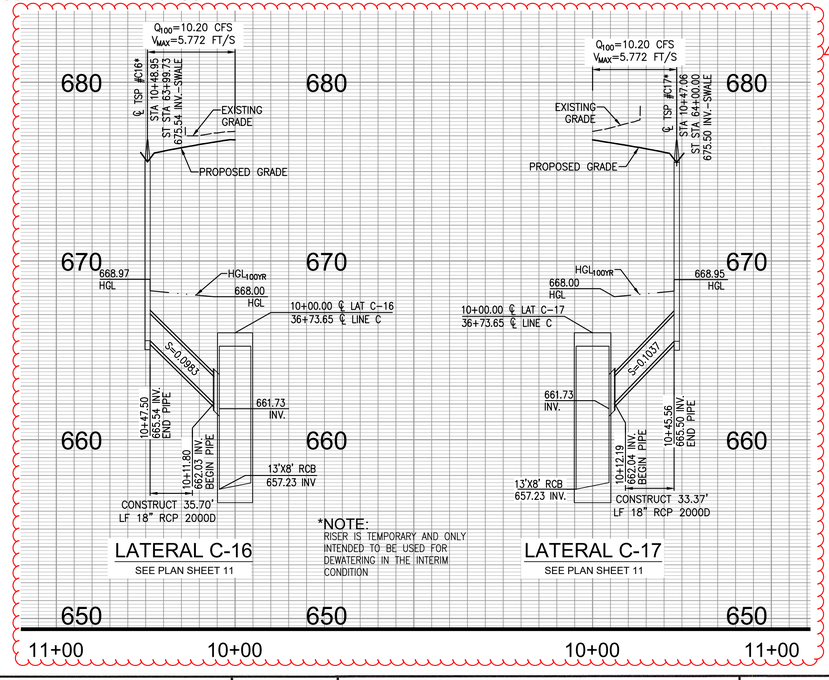
EUCALYPTUS AVENUE

(PUBLIC)

811 Know what's below. Call 811 before you dig.

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2



CONSTRUCTION NOTES

(4) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, ~~INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT~~ (PER CITY STANDARD #3018, INSTALL CATCH BASIN CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STANDARD #3017.)

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.

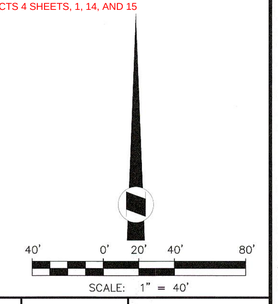
(20) CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 20

(25) CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(4) -AT THE REQUEST OF THE ENGINEER, ADJUST LATERALS C-12 AND C-13 TO NEW CATCH BASIN LOCATION.
-AT THE REQUEST OF THE ENGINEER, ADD TWO TEMPORARY 36" RISERS ON WALKER AVENUE, NORTH OF EUCALYPTUS AVENUE TO CATCH THE WATER FROM THE ADDED SWALES.
THIS DELTA AFFECTS 4 SHEETS, 1, 14, AND 15

STORM DRAIN CENTERLINE DATA TABLE

LINE	BEARING	LENGTH
L23	N41°21'33"W	30.48'
L24	S19°26'12"W	62.73'
L29	S89°22'23"W	292.34'



REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO
4	11-8-23	WLG	

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN SHIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
EUCALYPTUS AVENUE
FROM 750' WEST OF WALKER AVE
TO 950' WEST OF WALKER AVE

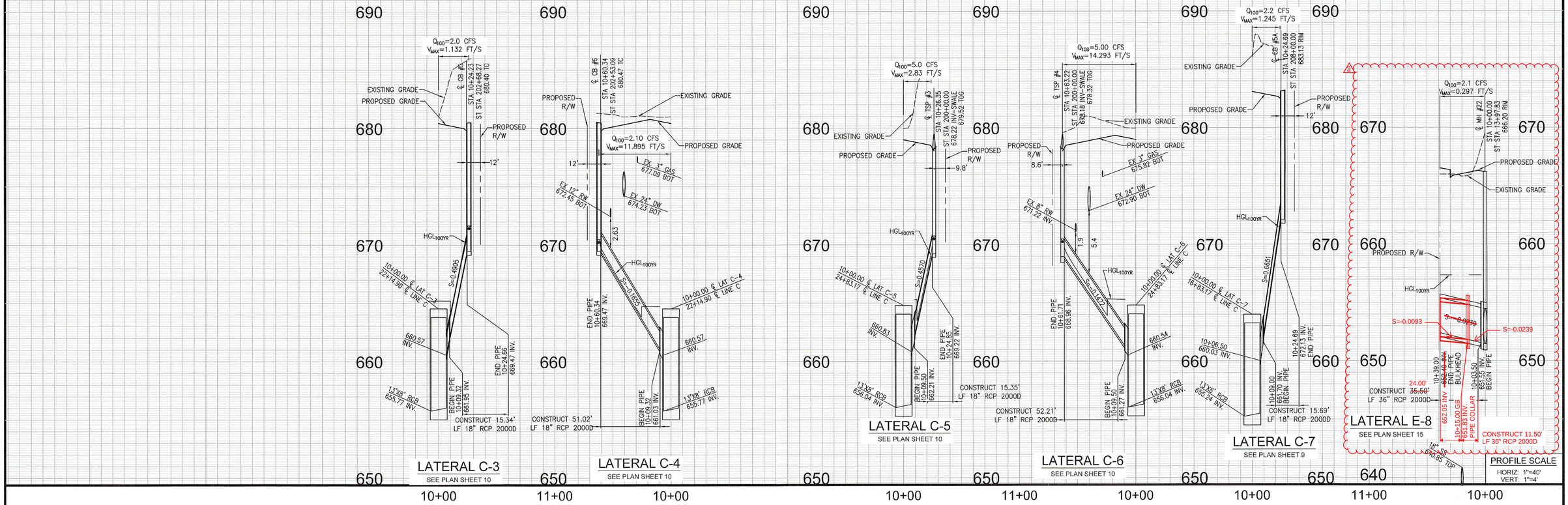
PM-20273

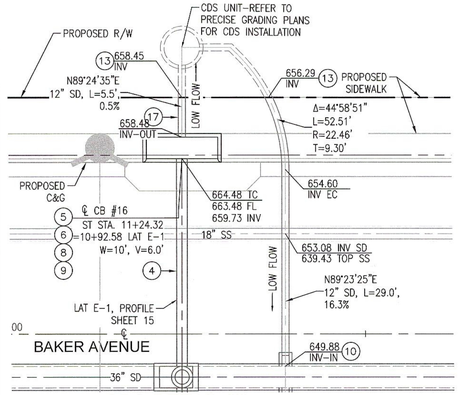
SHEET 13 OF 26
CONTRACT _____
ACCOUNT _____
DWG. NO. D14343

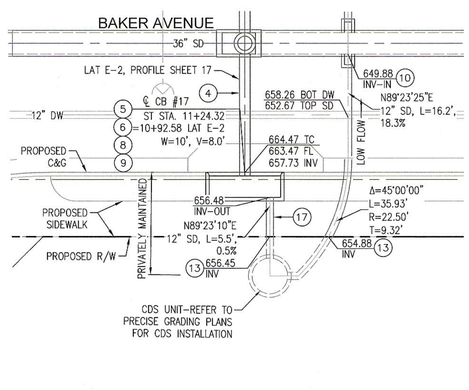
01/09/2023

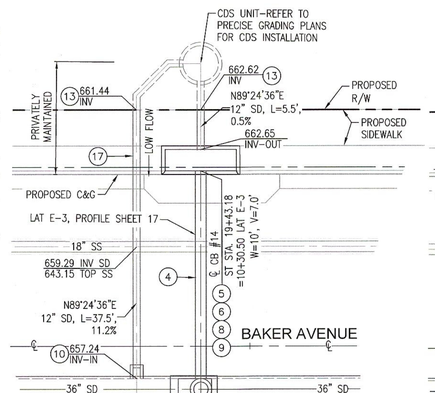
H1-527

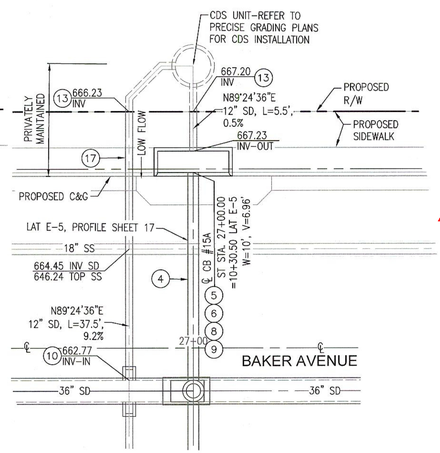
Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07-09_2020-263_SD_EUCALYPTUS.dwg
Last Opened: Jan 09, 2023 - 5:06pm by: Brent.King











CONSTRUCTION NOTES

4. CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
8. CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)
9. INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19
10. CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21
13. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19
17. CONSTRUCT 12" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2 (PRIVATELY MAINTAINED)

⚠3 14. CONSTRUCT CONCRETE PIPE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 20

⚠3 AT THE REQUEST OF THE CONTRACTOR, ADJUST INVERT OF LATERAL E-8 TO MATCH UP WITH ONSITE CONNECTION . THIS DELTA AFFECTS 3 SHEETS, 1, 14, AND 15

10' 0' 5' 10'
SCALE: 1" = 10'

811 Know what's below. Call 811 before you dig.

NOTE:
CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.
⚠3	10-17-23	WLG	

DESIGNED BY: BK DATE: 2/2/2022
DRAWN BY: BK DATE: 2/2/2022
CHECKED BY: DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN IRKLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 1/11/23

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
BAKER AVENUE
LATERAL PROFILES

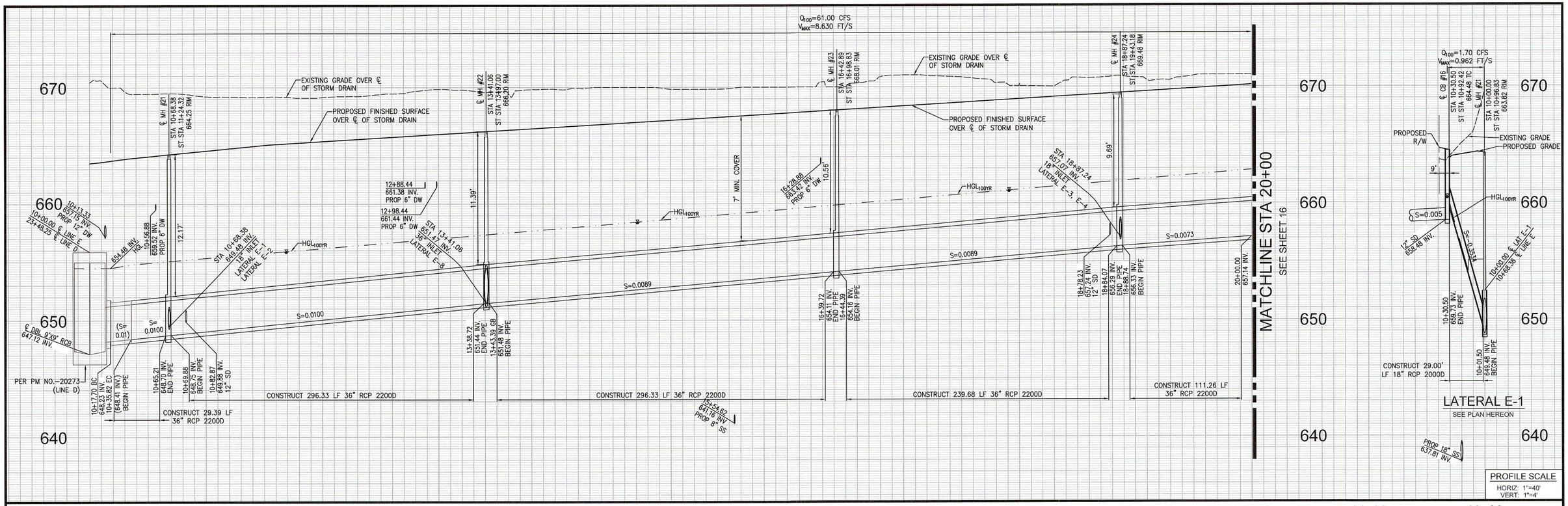
PM-20273

SHEET 14 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14541

01/09/2023

H1-528

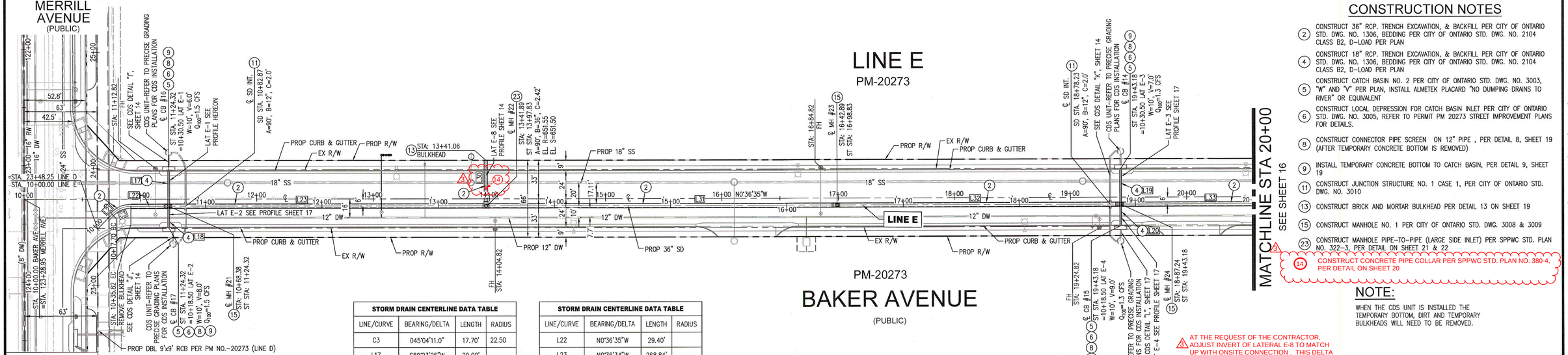
Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\07-09_2020-263_SD_EUCALYPTUS.dwg
Last Opened: Jan 09, 2023 - 4:16pm by: BrentKing



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00

11+00 10+00



STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C3	045°04'11.0"	17.70'	22.50
L17	S89°23'26"W	29.00'	
L18	N89°23'25"E	17.00'	
L19	S89°23'25"W	29.00'	
L20	N89°23'25"E	17.00'	
L21	N45°40'24"W	0.42'	

STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
L22	N0°36'35"W	29.40'	
L23	N0°36'34"W	268.84'	
L30	S89°23'49"W	37.50'	
L31	N0°36'33"W	296.33'	
L32	N0°36'34"W	239.68'	
L33	N0°36'35"W	247.60'	

CONSTRUCTION NOTES

2. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.
8. CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)
9. INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19
11. CONSTRUCT JUNCTION STRUCTURE NO. 1 CASE 1, PER CITY OF ONTARIO STD. DWG. NO. 3010
13. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19
15. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
23. CONSTRUCT MANHOLE PIPE-TO-PIPE (LARGE SIDE INLET) PER SPPWC STD. PLAN NO. 322-3, PER DETAIL ON SHEET 21 & 22
14. CONSTRUCT CONCRETE PIPE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 20

NOTE:

WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED.

3. AT THE REQUEST OF THE CONTRACTOR, ADJUST INVERT OF LATERAL E-8 TO MATCH UP WITH ONSITE CONNECTION . THIS DELTA AFFECTS 3 SHEETS, 1, 14, AND 15

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

Know what's below. Call 811 before you dig.

40' 0' 20' 40' 80'
SCALE: 1" = 40'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN TIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 1/11/23

STORM DRAIN IMPROVEMENT PLAN & PROFILE
BAKER AVENUE
FROM MERRILL AVE TO 1,056' NORTH OF MERRILL AVE

PM-20273

SHEET 15 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14515

01/09/2023

H1-529

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\10-12_2020-263_SD_BAKER.dwg
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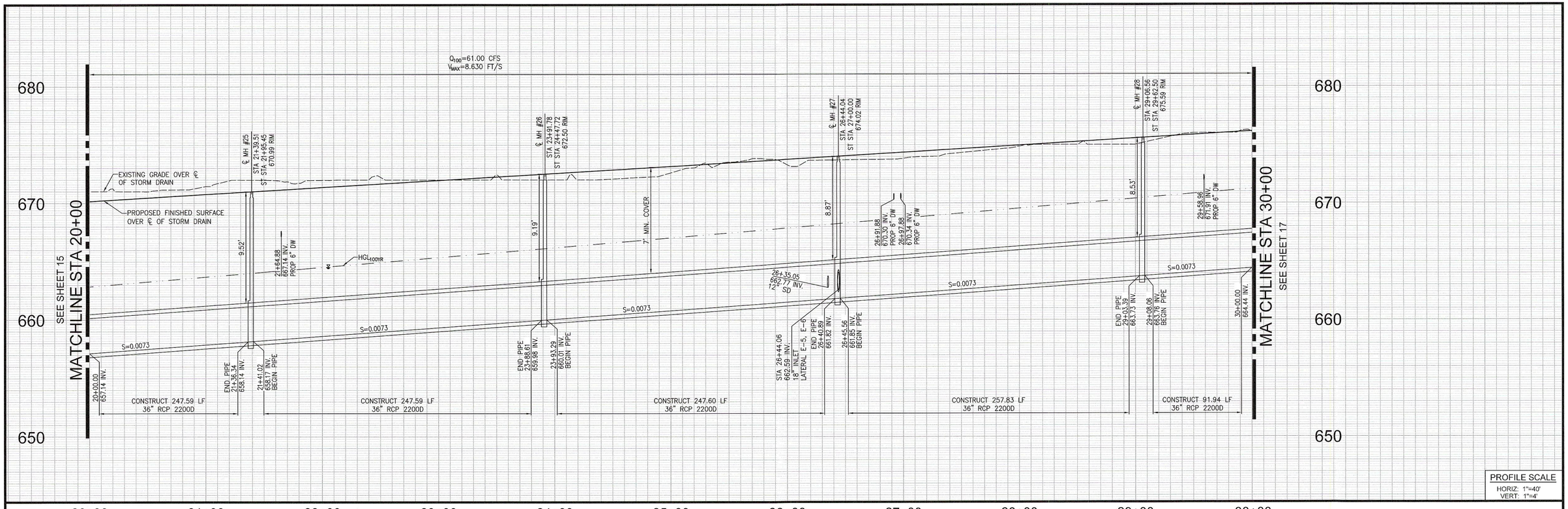
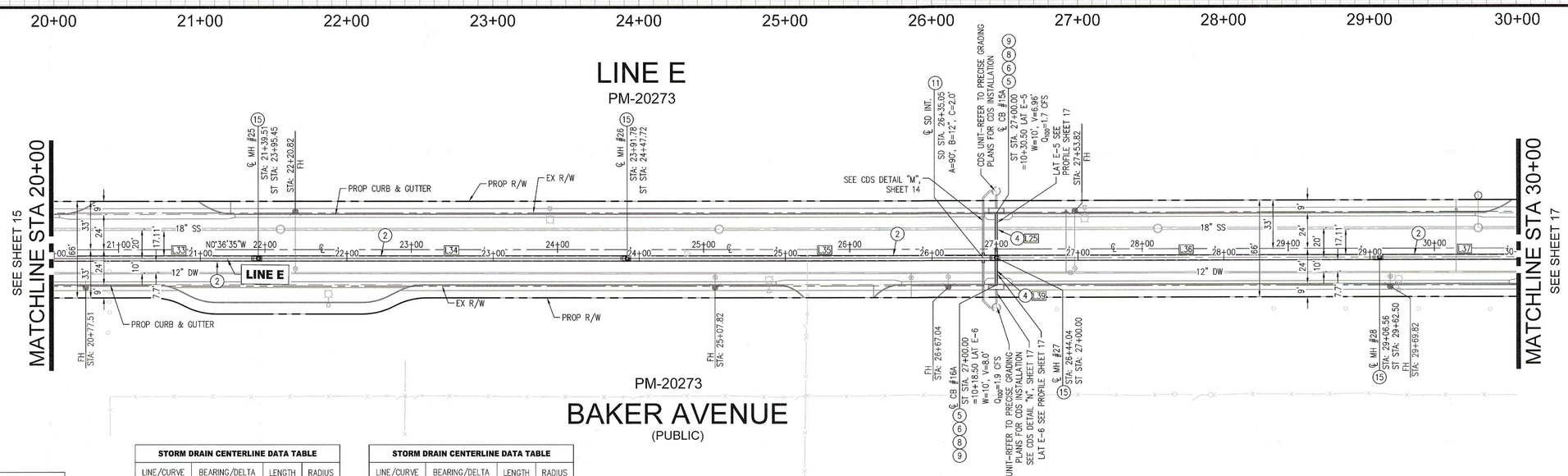


PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
L25	N89°23'25"E	28.83'	
L33	N0°36'35"W	247.60'	
L34	N0°36'35"W	247.60'	
L35	N0°36'35"W	247.61'	
L36	N0°36'35"W	257.83'	

STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
L37	N0°36'33"W	234.25'	
L39	N89°23'25"E	17.00'	

CONSTRUCTION NOTES

(2) CONSTRUCT 36" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(4) CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.

(8) CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)

(9) INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19

(11) CONSTRUCT JUNCTION STRUCTURE NO. 1 CASE 1, PER CITY OF ONTARIO STD. DWG. NO. 3010

(15) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED.
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

40' 0' 20' 40' 80'
SCALE: 1" = 40'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LINLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
BAKER AVENUE
FROM 1056' NORTH OF MERRILL AVE
TO 2,056' NORTH OF MERRILL AVE

PM-20273

SHEET 16 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14416

01/09/2023

H1-530

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donohue\06 Engineering\Sheets\OFF-SITE\Storm Drain\10-12_2020-263_SD_BAKER.dwg
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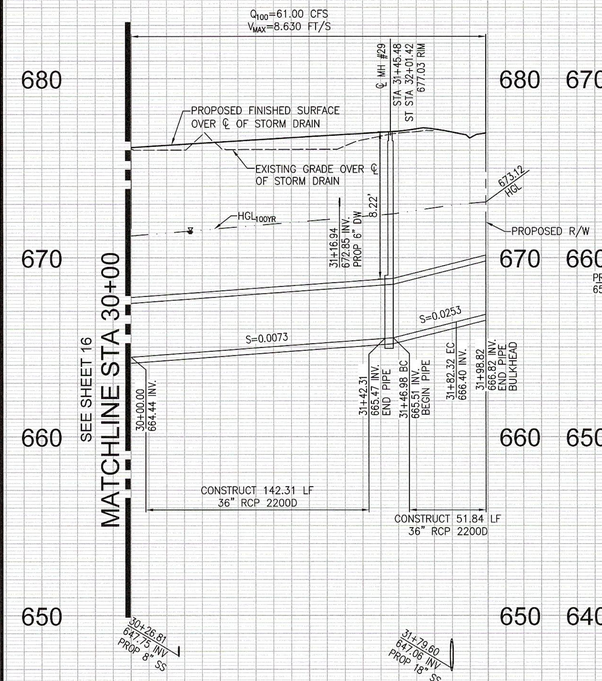
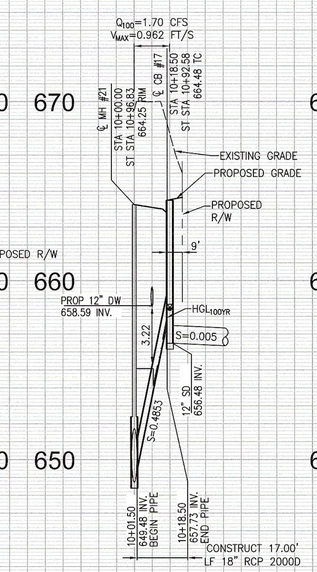
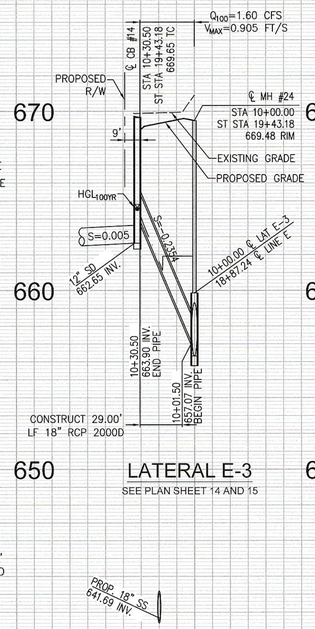
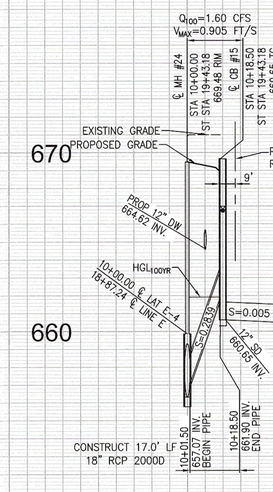




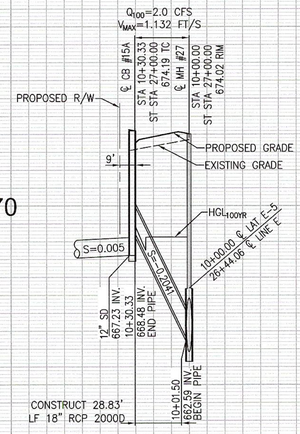
LATERAL E-2
SEE PLAN SHEET 14 AND15



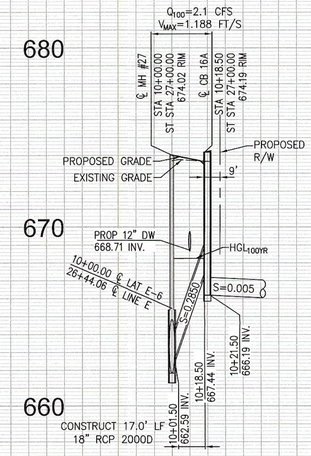
LATERAL E-3
SEE PLAN SHEET 14 AND 15



LATERAL E-4
SEE PLAN HEREON AND SHEET 15



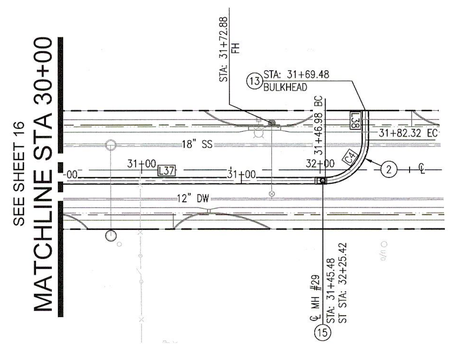
LATERAL E-5
SEE PLAN SHEET 14 AND16



LATERAL E-6
SEE PLAN HEREON AND SHEET 16

PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

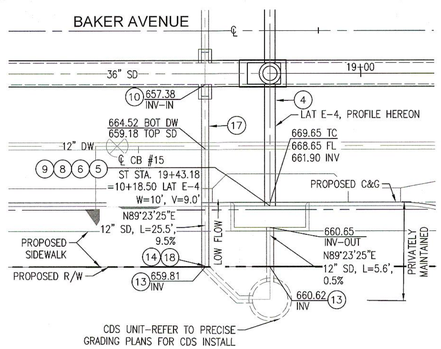
LINE E
PM-20273



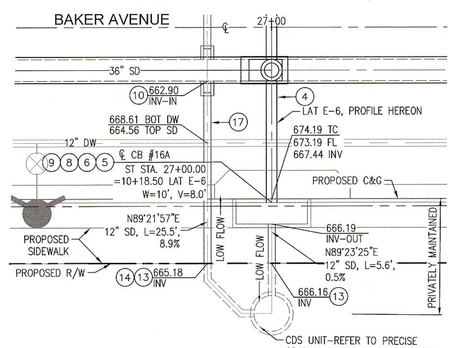
PM-20273

BAKER AVENUE
(PUBLIC)

STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C4	090°00'00.0"	35.34'	22.50
L37	N0°36'33"W	234.25'	
L38	N89°23'25"E	16.50'	



CDS DETAIL "L"
(PRIVATELY MAINTAINED)
SCALE: 1"=10'
SEE SHEET 15



CDS DETAIL "N"
(PRIVATELY MAINTAINED)
SCALE: 1"=10'
SEE SHEET 16

CONSTRUCTION NOTES

(2) CONSTRUCT 36" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(4) CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "Y" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20273 STREET IMPROVEMENT PLANS FOR DETAILS.

(8) CONSTRUCT CONNECTOR PIPE SCREEN ON 12" PIPE , PER DETAIL 8, SHEET 19 (AFTER TEMPORARY CONCRETE BOTTOM IS REMOVED)

(9) INSTALL TEMPORARY CONCRETE BOTTOM TO CATCH BASIN, PER DETAIL 9, SHEET 19

(10) CONSTRUCT JUNCTION STRUCTURE PIPE TO RCB PER SPPWC STD. 333-2, PER DETAIL ON SHEET 21

(13) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 13 ON SHEET 19

(14) CONSTRUCT CONCRETE PIPE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 20

(15) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009

(17) CONSTRUCT 12" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2 (PRIVATELY MAINTAINED)

(18) CONSTRUCT 12" RCP 45° BEND (PRIVATELY MAINTAINED)

(23) CONSTRUCT MANHOLE PIPE-TO-PIPE (LARGE SIDE INLET) PER SPPWC STD. PLAN NO. 322-3, PER DETAIL ON SHEET 22 & 23

NOTE:

- WHEN THE CDS UNIT IS INSTALLED THE TEMPORARY BOTTOM, DIRT AND TEMPORARY BULKHEADS WILL NEED TO BE REMOVED.
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

40' 0' 20' 40' 80'
SCALE: 1" = 40'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF EOR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA RENE MACKINNEY No. 85559 Exp. 9/30/2022 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 1/11/23

STORM DRAIN IMPROVEMENT PLAN & PROFILE
BAKER AVENUE
FROM 2,056' NORTH OF MERRILL AVE
TO 2,226' NORTH OF MERRILL AVE

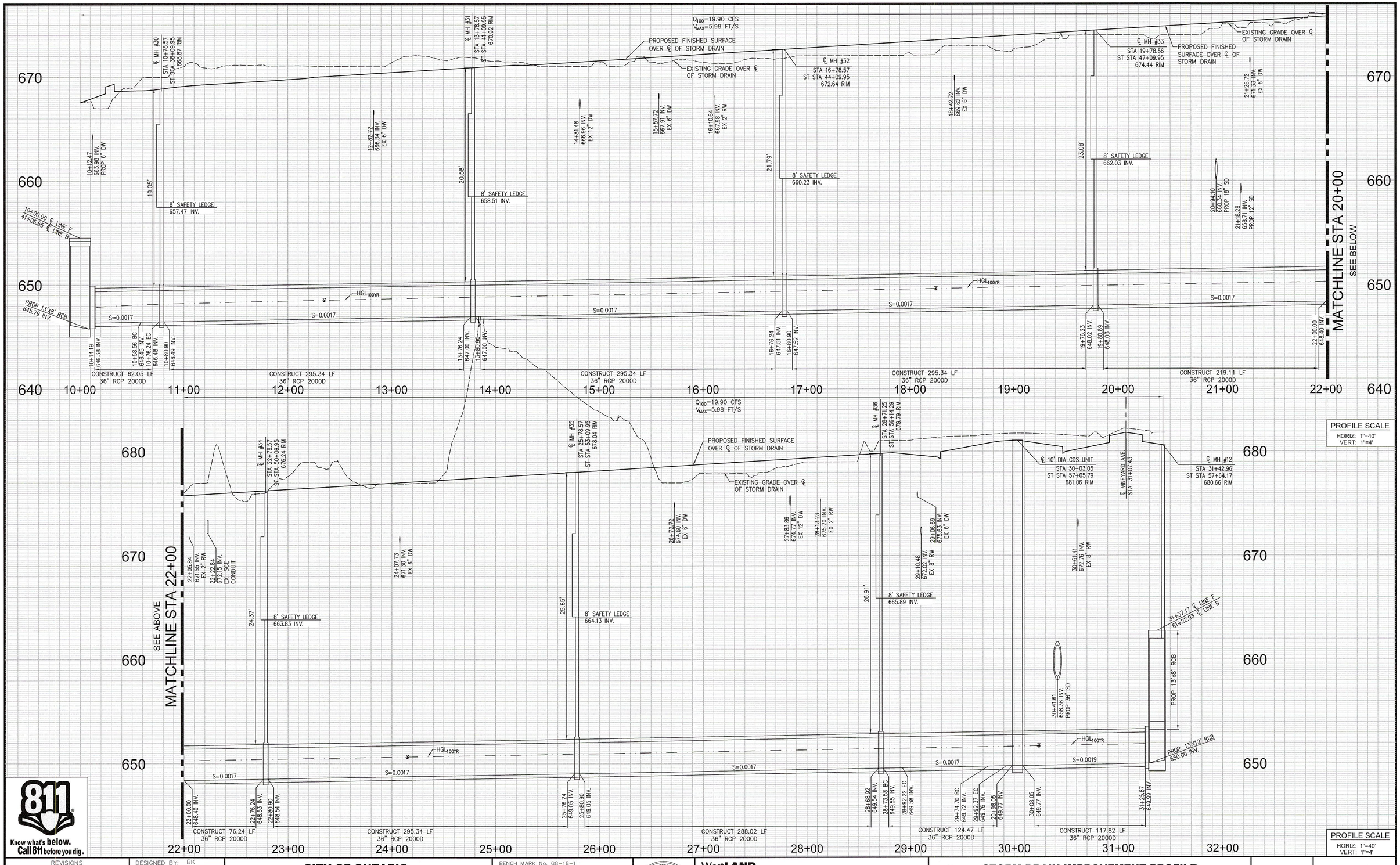
PM-20273

SHEET 17 OF 26
CONTRACT
ACCOUNT
DWG. NO. D1497

01/09/2023

H1-531

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\10-12_2020-263_SD_BAKER.dwg
Last Opened: Jan 09, 2023 - 2:00pm by: Brent.King



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
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CITY OF ONTARIO

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BENCH MARK No. GG-18-1
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REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No. 85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PROFILE
VINEYARD AVENUE
LINE 'F' PROFILE

PM-20273

SHEET 18 OF 26
CONTRACT _____
ACCOUNT
DWG. NO. D14818

01/09/2023

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\19_2020-263_SD_LINE_F.dwg
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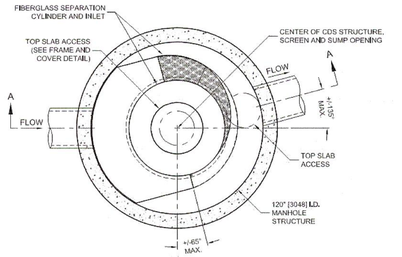
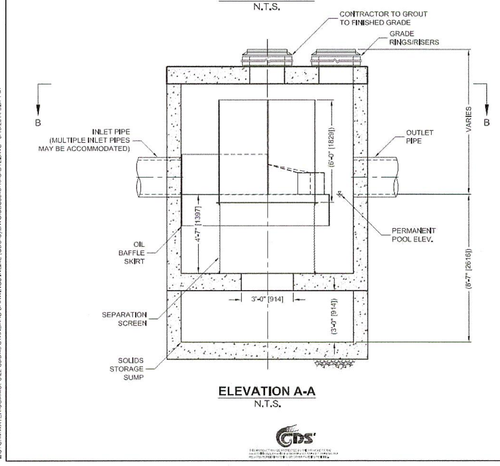
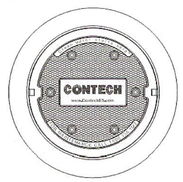


PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.

CDS5640-10-C DESIGN NOTES
CDS5640-10-C RATED TREATMENT CAPACITY IS 9.0 CFS [254.9 L/s], OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 50.0 CFS [1416 L/s], IF THE SITE CONDITIONS EXCEED 50.0 CFS [1416 L/s], AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.
THE STANDARD CDS5640-10-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.
CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

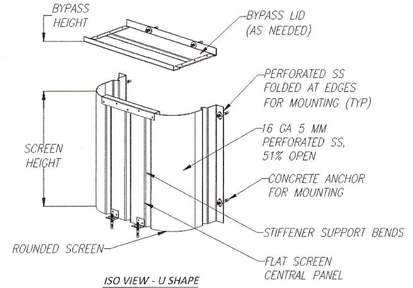
GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS, ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO H520 AND CASTINGS SHALL MEET H520 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS5640-10-C
INLINE CDS
STANDARD DETAIL

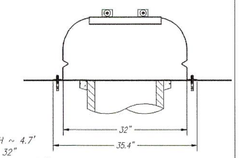
CONNECTOR PIPE SCREEN (CPS)
U 4.7



ISO VIEW - U SHAPE

CPS U WITH 4.7 FT SCREEN LENGTH	
CPS HEIGHT (IN)	SCREEN FLOW (CFS)
12	6.67
18	12.26
24	18.88
30	26.40
36	34.71

NOTE: BYPASS FLOW RATES VARY WITH VAULT DEPTH AND BYPASS HEIGHT. CONTACT BIO CLEAN FOR ADDITIONAL INFORMATION.



TOTAL SCREEN LENGTH = 4.7'
SPAN LENGTH = 32"
COMPATIBLE WITH PIPES UP TO Ø24"

TOP SECTION VIEW - U SHAPE

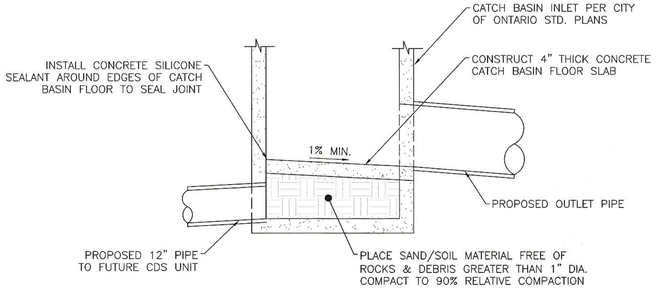
GENERAL NOTES
1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE.
3. THIS CPS UNIT IS DESIGNED FOR TREATMENT FLOWS THROUGH THE SCREEN. FLOWS GREATER THAN THE TREATMENT FLOW RATE WILL BYPASS OVER THE SCREEN.
4. A BYPASS LID IS REQUIRED WHEN THE OUTLET PIPE IS DIRECTLY BELOW THE CURB OPENING.
5. CPS IS COMPRISED OF 304 STAINLESS STEEL. THICKNESS IS 16 GAUGE. SCREEN PERFORATIONS ARE 5 MILLIMETERS IN DIAMETER. THE SCREEN AREA IS 51% OPEN SPACE.

INSTALLATION NOTES
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO INSTALL THE CPS UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. POSITION THE CPS SO IT IS EVENLY SPACED AROUND THE CONNECTOR PIPE, ENSURING A MIN. OF 4" SPACING AWAY FROM ANY CORNERS. SCREEN BOTTOM SHALL BE FLUSH WITH THE CATCH BASIN FLOOR, OR WITH GAPS NO GREATER THAN 5 MM.
3. IF A BYPASS LID IS REQUIRED, VERIFY THE BYPASS HEIGHT NEEDED AND MARK THAT LOCATION ON THE WALL DIRECTLY ABOVE THE BASE UPRIGHTS. LIFT THE LID IN PLACE AND MARK THE HOLE LOCATIONS FOR THE LID MOUNTING BRACKETS. SECURE THE LID WITH STAINLESS STEEL NUTS.

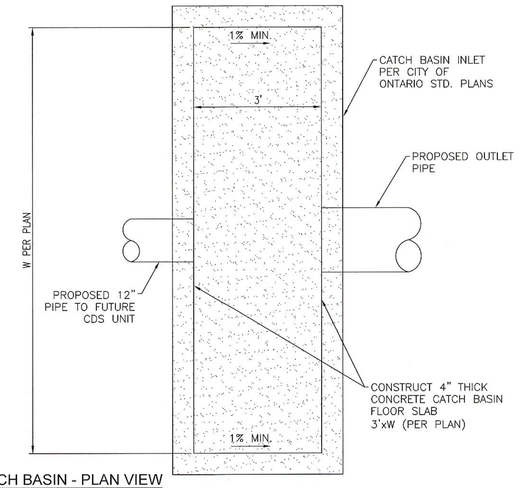
WARRANTY: 3 YEAR MANUFACTURER'S		MEETS FULL CAPTURE REQUIREMENTS	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 1/17/2020	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: G.M.S.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

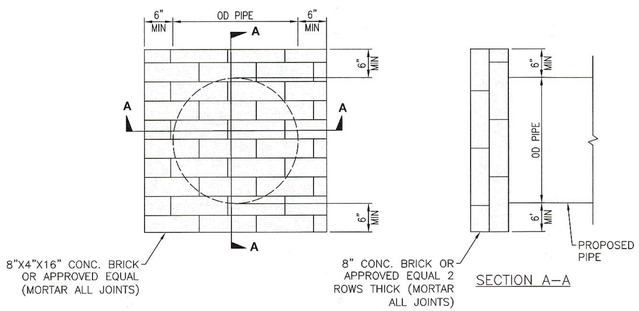
8 PIPE CONNECTOR SCREEN DETAIL



9 CATCH BASIN - TEMPORARY FLOOR CONSTRUCTION DETAIL



CATCH BASIN - PLAN VIEW



13 BRICK AND MORTAR BULKHEAD DETAIL

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No. 85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

PM-20273

SHEET 19 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14919

01/09/2023

H1-533

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_SD_DET Line B-E.dwg
Last Opened: Jan 09, 2023 - 2:27pm by: Brent.King

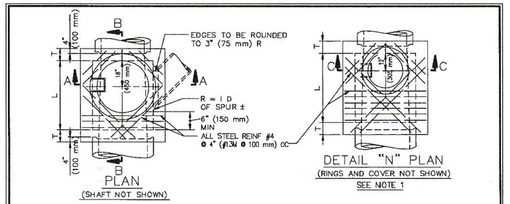


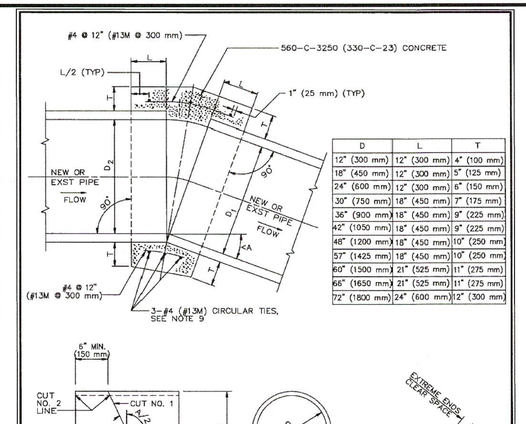
TABLE OF VALUES FOR M (SEE NOTE 1)				
SECTION	PAVED STREET		UNPAVED STREET	
	MAX	MIN	MAX	MIN
A-A		2'-10 1/2" (867 mm)		3'-6" (1060 mm)
C-C	11" (282 mm)	8 1/2" (217 mm)	16" (410 mm)	15" (380 mm)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 2009	MANHOLE PIPE-TO-PIPE (ONE OR BOTH MAIN LINE IDS 33" (825 mm) OR SMALLER)	STANDARD PLAN 321-2
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 3

NOTES

1. WHEN DEPTH M FROM STREET GRADE TO THE TOP OF THE BOX IS LESS THAN 2'-10 1/2" (867 mm) FOR PAVED STREETS OR 3'-6" (1060 mm) FOR UNPAVED STREETS, CONSTRUCT SHAFT PER SECTION C-C AND DETAIL "N". DEPTH M MAY BE REDUCED TO AN ABSOLUTE LIMIT OF 8" (150 mm) WHEN LARGER VALUES OF M WOULD REDUCE H IN SECTION C-C TO 3'-6" (1060 mm) OR LESS.
2. H (IN SECTION A-A AND B-B) SHALL NOT BE LESS THAN 4'-0" (1.2 m), BUT MAY BE INCREASED PROVIDED THAT THE VALUE OF M SHALL NOT BE LESS THAN THE MINIMUM SPECIFIED AND THAT THE REDUCER SHALL BE USED. FOR H (IN SECTION C-C) SEE NOTE 1.
3. L SHALL BE 4'-0" (1.2 m) UNLESS OTHERWISE SHOWN. L MAY BE INCREASED OR LOCATION OF MANHOLE SHIFTED TO MEET PIPE ENDS, BUT ANY CHANGE IN LOCATION OF THE SPUR MUST BE APPROVED BY THE ENGINEER.
4. T SHALL BE 8" (200 mm) FOR VALUES OF H UP TO AND INCLUDING 8'-0" (2.4 m) AND 10" (250 mm) FOR VALUES OF H OVER 8'-0" (2.4 m).
5. STATIONS OF MANHOLES SHOWN ON PLANS APPLY AT CENTERLINE OF SHAFT. ELEVATIONS ARE SHOWN AT CENTERLINE OF SHAFT AND REFER TO THE PROLONGED INVERT GRADE LINES. SEE NOTE 3.
6. REINFORCEMENT SHALL CONFORM TO ASTM A 615, GRADE 40 (ASTM A 615M, GRADE 300), AND SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN.
7. FLOOR OF MANHOLE SHALL BE STEEL TROWELED TO SPRING LINE.
8. BODY OF MANHOLE SHALL BE POURED IN ONE CONTINUOUS OPERATION EXCEPT THAT A CONSTRUCTION JOINT WITH A LONGITUDINAL KEYWAY MAY BE PLACED AT SPRING LINE.
9. THICKNESS OF THE DECK SHALL VARY WHEN NECESSARY TO PROVIDE A LEVEL SEAT BUT SHALL NOT BE LESS THAN 8" (200 mm).
10. STEPS SHALL CONFORM TO SPPWC 635 OR 636. UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" (350 mm) TO 15" (375 mm) OC. THE LOWEST STEP SHALL NOT BE MORE THAN 24" (600 mm) ABOVE THE LEDGE AT THE SIDE OF THE MANHOLE.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	
MANHOLE PIPE-TO-PIPE (ONE OR BOTH MAIN LINE IDS = 33" (825 mm) OR SMALLER)	STANDARD PLAN 321-2 SHEET 2 OF 3



D	L	T
12" (300 mm)	12" (300 mm)	4" (100 mm)
18" (450 mm)	12" (300 mm)	5" (125 mm)
24" (600 mm)	12" (300 mm)	6" (150 mm)
30" (750 mm)	18" (450 mm)	7" (175 mm)
36" (900 mm)	18" (450 mm)	9" (225 mm)
42" (1050 mm)	18" (450 mm)	9" (225 mm)
48" (1200 mm)	18" (450 mm)	10" (250 mm)
57" (1425 mm)	18" (450 mm)	10" (250 mm)
60" (1500 mm)	21" (525 mm)	11" (275 mm)
66" (1650 mm)	21" (525 mm)	11" (275 mm)
72" (1800 mm)	24" (600 mm)	12" (300 mm)

CUT NO. 1: SAW THE TUBE AT AN ANGLE OF A/2 WITH THE TRANSVERSE PLANE. REVERSE ONE SECTION AND TAPE BOTH SECTIONS TOGETHER FORMING THE DEFLECTION ANGLE A.
CUT NO. 2: SAW THE TUBE LONGITUDINALLY REMOVING A STRIP 3.14 (D-d) D WIDE ON THE SIDE OPPOSITE THE OPEN JOINT. BEND THE ENDS OF THE CUT TOGETHER AND INSERT THE TUBE IN THE PIPE.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 1997, 1998, 2009	CONCRETE COLLAR FOR RCB 12" (300 mm) THROUGH 72" (1800 mm)	STANDARD PLAN 380-4
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 2

NOTES

1. A CONCRETE COLLAR IS REQUIRED WHERE THE CHANGE IN GRADE EXCEEDS 10%.
2. FOR CURVE JOINTS (SEE DETAIL B, SHEET 1)
   IF THE EXTREME ENDS OF THE PIPE LEAVE A CLEAR SPACE THAT IS GREATER THAN 1" (25 mm), BUT IS LESS THAN 3" (75 mm) A CONCRETE COVER IS REQUIRED IN ACCORDANCE WITH SSPWC 306-1.2.4.
   IF THE EXTREME ENDS OF THE PIPE LEAVE A CLEAR SPACE THAT IS EQUAL TO OR GREATER THAN 3" (75 mm), BUT LESS THAN 6" (150 mm), A CONCRETE COLLAR IS REQUIRED. IF THE CLEAR SPACE IS 6" (150 mm) OR GREATER, A TRANSITION STRUCTURE IS REQUIRED.
3. CONCRETE COLLAR SHALL NOT BE USED FOR A SIZE CHANGE ON THE MAIN LINE.
4. CONNECTOR PIPES
   A. WHERE PIPES OF DIFFERENT DIAMETERS ARE JOINED WITH A CONCRETE COLLAR, L AND T SHALL BE THOSE OF THE LARGER PIPE. D=D_1 OR D_2, WHICHEVER IS GREATER.
   B. WHEN D_1 IS EQUAL TO OR LESS THAN D_2, JOIN INVERTS AND WHEN D_1 IS GREATER THAN D_2, JOIN SOFFITS.
5. FOR PIPE LARGER THAN 72" (1800 mm) SPECIAL COLLAR DETAILS ARE REQUIRED.
6. FOR PIPE SIZE NOT LISTED USE NEXT SIZE LARGER.
7. REINFORCEMENT SHALL CONFORM TO ASTM A 615 (A 615 M) GRADE 40 (300).
8. WHERE REINFORCING IS REQUIRED THE DIAMETER OF THE CIRCULAR TIES SHALL BE D+(2X WALL THICKNESS) + T.
9. REINFORCING SHALL BE USED WHERE THE PIPE DIAMETER IS GREATER THAN 21" (525 mm) AND ON ALL PIPES WHERE THE SPACES BETWEEN THE EXTREME OUTER ENDS IS 3" (75 mm) OR LARGER.

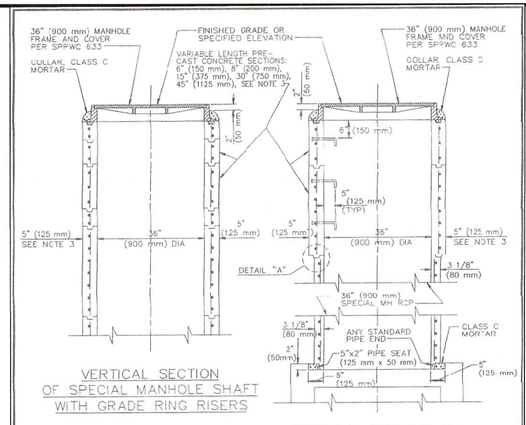
CIRCULAR TIES:

PIPE DIAMETER	NO. OF CIRCULAR TIES
21" (525 mm) OR LESS	3
24" (600 mm) TO 30" (750 mm)	3
33" (825 mm) TO 57" (1425 mm)	4
60" (1500 mm) TO 72" (1800 mm)	5

WHERE THE SPACE BETWEEN PIPE ENDS EXCEEDS 3" (75 mm), THE NUMBER OF CIRCULAR TIES SHALL BE INCREASED TO MAINTAIN AN APPROXIMATE SPACING OF 6" (150 mm) O.C.

10. WHERE THE PIPE IS 21" (525 mm) OR LESS IN DIAMETER AN INTERIOR FORM OF UNSEALED SONO-TUBE OR EQUAL SHALL BE USED TO PROVIDE A SMOOTH INTERIOR JOINT. THE PAPER FORM MAY BE LEFT IN PLACE (SEE DETAIL A). WHEN THE PIPE IS 24" (600 mm) OR LARGER A REMOVABLE INTERIOR FORM SHALL BE USED OR THE INTERIOR JOINT SHALL BE COMPLETELY FILLED WITH MORTAR AND NEATLY POINTED.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	
CONCRETE COLLAR FOR RCB 12" (300 mm) THROUGH 72" (1800 mm)	STANDARD PLAN 380-4 SHEET 2 OF 2



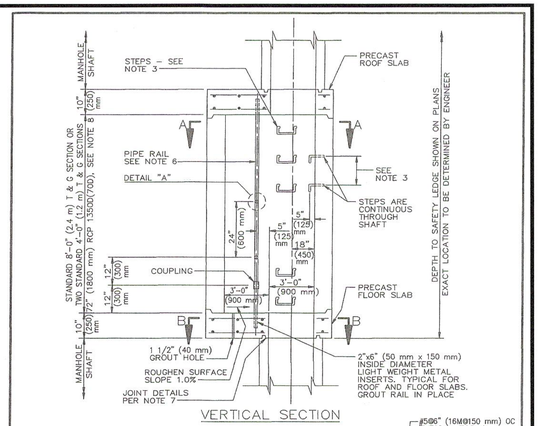
NOTES

1. UNLESS OTHERWISE INDICATED THIS STRUCTURE SHALL CONFORM TO ASTM C 478 (ASTM C 478M). ALL STEEL SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACES AND ALL CONCRETE SHALL BE PER SSPWC.
2. WHERE A 36" (900 mm) MANHOLE IS CONSTRUCTED WITH 36" (900 mm) MANHOLE RCP, THE RCP SECTION SHALL CONTAIN A CIRCULAR CAGE AND HAVE A LOAD CARRYING CAPACITY OF AT LEAST 1000D (50D). SPECIAL MANHOLE SHAFT SHALL BE PER THIS STANDARD AND 36" (900 mm) MANHOLE FRAME AND COVER SHALL BE PER SPPWC 633.
3. THE MANHOLE SHAFT AND RINGS MAY BE PLAIN CONCRETE. FOR PLAIN CONCRETE SECTIONS THE MINIMUM THICKNESS SHALL BE 6" (150 mm).
4. ALL JOINTS SHALL BE SEALED BY FILLING THE ANNULAR SPACES WITH CLASS C MORTAR. THE INSIDE OF THE SHAFT AT EACH JOINT SHALL BE WIPED CLEAN OF EXCESS MORTAR.
5. PROTECTIVE PLASTIC LINER (T LOCK) OR ENGINEER-APPROVED COATINGS WHERE REQUIRED BY THE PLANS SHALL BE IN ACCORDANCE WITH SSPWC AND THE MANUFACTURER'S DIRECTIONS.
6. STEPS SHALL CONFORM TO SPPWC 635 OR 636. THE TOP STEP SHALL BE PLACED 6" (150 mm) BENEATH THE MANHOLE COVER FRAME. UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" (350 mm) TO 15" (375 mm) OC.
7. THE PRECAST CONCRETE MANHOLE STRUCTURES WILL BE INSPECTED BY THE ENGINEER WHO WILL INDICATE ACCEPTANCE FOR SHIPMENT TO THE JOB BY MARKING THE STRUCTURES WITH THE AGENCY'S STAMP.
8. THE VERTICAL SIDES OF THE MANHOLE SHAFT SHALL BE LOCATED ABOVE AND IN LINE WITH THE SIDE OF THE STORM DRAIN CONDUIT.
9. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC 330 IF DEPTH OF MANHOLE TO INVERT IS GREATER THAN 20' (6 m) AND MANHOLE SHAFT IS GREATER THAN 10' (3 m).
10. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:

    633 36" (900 mm) MANHOLE FRAME AND COVER
    635 STEEL STEP
    636 POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 2009	MANHOLE SHAFT 36"(900 mm) WITHOUT REDUCER	STANDARD PLAN 326-2
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 2

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	
MANHOLE SHAFT 36"(900 mm) WITHOUT REDUCER	STANDARD PLAN 326-2 SHEET 2 OF 2



NOTES

1. MANHOLE SHAFT SAFETY LEDGE WILL BE NOTED ON THE PLANS WHEN REQUIRED. IT IS TO BE CONSTRUCTED WHEN DEPTH OF MANHOLE TO INVERT IS GREATER THAN 20' (6 m) AND MANHOLE SHAFT IS GREATER THAN 10' (3 m).
2. A SAFETY LEDGE SHALL NOT BE USED IF A PRESSURE MANHOLE IS REQUIRED.
3. STEPS SHALL CONFORM TO SPPWC 635 OR 636 AND SHALL BE ANCHORED 4" (100 mm) IN THE WALL OF THE STRUCTURE. STEPS SHALL BE PLACED TO MATCH THE SPACING OF THE MANHOLE SHAFT.
4. REINFORCEMENT SHALL BE PER ASTM A 615, GRADE 40 (ASTM A 615M, GRADE 300) AND SHALL TERMINATE 2" (50 mm) CLEAR OF CONCRETE SURFACE UNLESS OTHERWISE SHOWN.
5. GROUT HOLES, PIPE AND FITTINGS SHALL BE PROVIDED IN THE FLOOR SLAB. PRESSURE GROUTING SHALL BE USED TO FILL VOIDS AND TO SECURE UNIFORM BEARING. THE GROUT SHALL BE NEAT CEMENT GROUT AND GROUTING PRESSURES SHALL BE AS DETERMINED IN THE FIELD BY THE ENGINEER.
6. PIPE RAIL SHALL BE FABRICATED OF 1 1/4" (32 mm) STANDARD GALVANIZED PIPE COMPOSED OF TWO SECTIONS 7'-6" (2.25 m) & 18" (450 mm) IN LENGTH JOINED BY A GALVANIZED COUPLING. THE COUPLING SHALL BE THREADED A MINIMUM OF 2" (50 mm) ON EACH PIPE LENGTH.
7. ROOF AND FLOOR SLABS SHALL BE PRECAST AND KEYED FOR REINFORCED CONCRETE PIPE SECTIONS AS SHOWN. ALL JOINTS SHALL BE FILLED WITH CLASS C MORTAR AND NEATLY POINTED OR WIPED ON THE INSIDE.
8. 72" (1800 mm) RCP SHALL BE PROVIDED WITH TWO CIRCULAR CAGES OF REINFORCEMENT.
9. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:

   324 MANHOLE SHAFT - WITH ECCENTRIC REDUCER
   326 MANHOLE SHAFT - 36" (900 mm) WITHOUT REDUCER
   635 STEEL STEP
   636 POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 2009	MANHOLE SHAFT SAFETY LEDGE	STANDARD PLAN 330-2
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 2

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	
MANHOLE SHAFT SAFETY LEDGE	STANDARD PLAN 330-2 SHEET 2 OF 2

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RENE MACKINNEY — No. 85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 1/11/23

STORM DRAIN IMPROVEMENT PLAN

DETAILS

SHEET 20 OF 26
CONTRACT _____
ACCOUNT
DWG. NO. D14550

PM-20273

01/09/2023

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_SD_DET Line B-E.dwg
Last Opened: Jan 09, 2023 - 2:29pm by: Brent.King

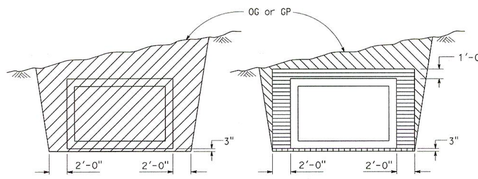
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

May 31, 2018
PLANS APPROVAL DATE

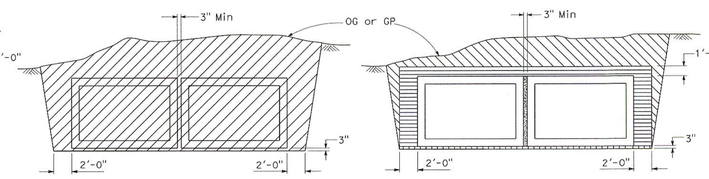
Carl W. Duan
No. C59976
Exp. 6-30-18
CIVIL
STATE OF CALIFORNIA

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.



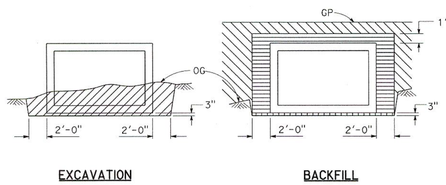
EXCAVATION BACKFILL

IN TRENCH



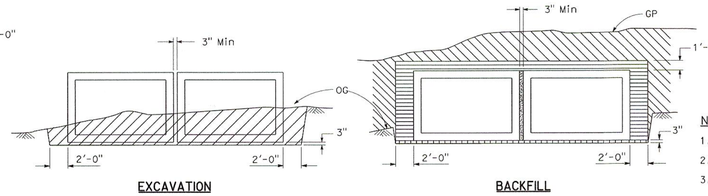
EXCAVATION BACKFILL

IN TRENCH



EXCAVATION BACKFILL

IN EMBANKMENT



EXCAVATION BACKFILL

IN EMBANKMENT

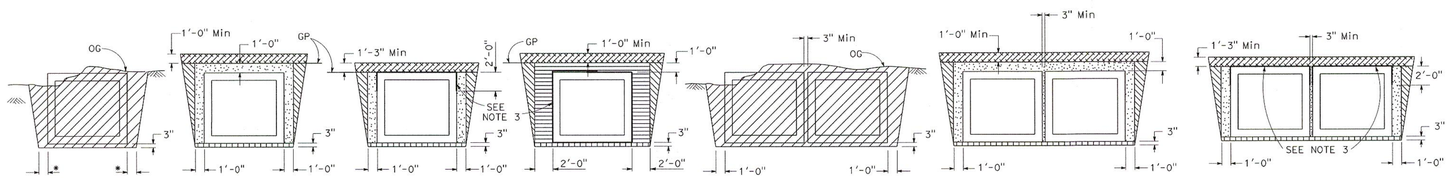
FILL HEIGHT GREATER THAN 2'-0"

LEGEND:

- STRUCTURE EXCAVATION (CULVERT)
- STRUCTURE BACKFILL (CULVERT) 95% RELATIVE COMPACTION
- ROADWAY EMBANKMENT
- SLURRY CEMENT BACKFILL
- SAND BEDDING (CULVERT)
- ROADWAY PAVEMENT STRUCTURE

NOTES:

1. Slope or shore excavation sides as necessary.
2. Dimensions shown are minimum.
3. Method 2 and 3 for single or multiple boxes requires an approved external sealing band. See Standard Plan D83A.
4. Construction of Roadway Pavement Structure in Method 2 or Method 3 shall not disturb the external sealing band installation.



EXCAVATION METHOD 1 METHOD 2 METHOD 3 EXCAVATION METHOD 1 METHOD 2

BACKFILL

FILL HEIGHT 2'-0" OR LESS

* 1'-0" Where Method 1 or 2 Backfill is used.
2'-0" Where Method 3 Backfill is used.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

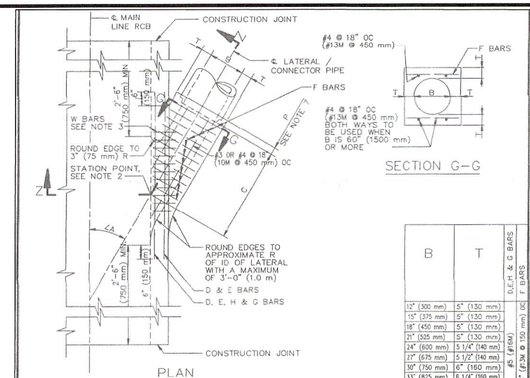
EXCAVATION AND BACKFILL PRECAST REINFORCED CONCRETE BOX CULVERT

NO SCALE

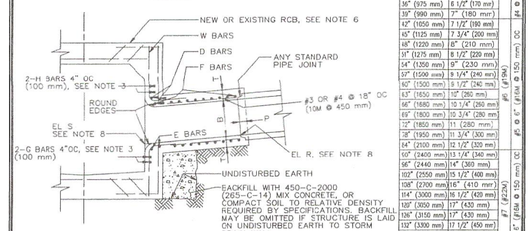
A62G

1-29-18

2018 STANDARD PLAN A62G



B	T	E, F, H, & G BARS	F BARS
12" (300 mm)	5" (130 mm)		
15" (375 mm)	5" (130 mm)		
18" (450 mm)	5" (130 mm)		
21" (525 mm)	5" (130 mm)		
24" (600 mm)	5 1/4" (140 mm)		
27" (675 mm)	5 1/2" (140 mm)		
30" (750 mm)	6" (160 mm)	#5 @ 18" (#16M @ 450 mm) OC	#4 @ 9" (#13M @ 150 mm) OC
33" (825 mm)	6 1/4" (160 mm)		
36" (975 mm)	6 1/2" (170 mm)		
39" (990 mm)	7" (180 mm)		
42" (1050 mm)	7 1/2" (190 mm)		
45" (1125 mm)	7 3/4" (200 mm)		
48" (1220 mm)	8" (210 mm)		
51" (1275 mm)	8 1/2" (220 mm)		
54" (1350 mm)	9" (230 mm)	#6 @ 18" (#19M @ 450 mm) OC	#5 @ 9" (#16M @ 150 mm) OC
57" (1500 mm)	9 3/4" (240 mm)		
60" (1500 mm)	9 1/2" (240 mm)		
63" (1650 mm)	10" (280 mm)		
66" (1680 mm)	10 1/4" (250 mm)		
69" (1800 mm)	10 3/4" (280 mm)		
72" (1850 mm)	11 (280 mm)		
78" (1950 mm)	11 3/4" (300 mm)		
84" (2100 mm)	12 1/2" (320 mm)		
90" (2400 mm)	13 1/4" (340 mm)	#7 (#22M) @ 150 mm) OC	#5 @ 9" (#16M @ 150 mm) OC
96" (2440 mm)	14" (360 mm)		
102" (2550 mm)	15 1/2" (400 mm)		
108" (2700 mm)	16" (410 mm)		
114" (3000 mm)	16 1/2" (420 mm)		
120" (3050 mm)	17" (430 mm)		
126" (3150 mm)	17" (430 mm)		
132" (3300 mm)	17 1/2" (450 mm)		
138" (3450 mm)	17 1/2" (450 mm)		
144" (3600 mm)	18" (460 mm)		



STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1968 REV. 1998, 2009

JUNCTION STRUCTURE – PIPE TO RCB

STANDARD PLAN 333-2

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

SHEET 1 OF 2

NOTES

1. VALUES FOR A, B AND C SHALL BE SHOWN ON THE PLANS. *ELEVATION R AND ELEVATION S SHALL BE SHOWN WHEN REQUIRED PER* NOTE 8.
2. STATIONS SPECIFIED ON THE PLANS APPLY AT THE INTERSECTION OF CENTERLINES OF MAIN LINE AND LATERALS, EXCEPT THAT STATIONS FOR CATCH BASIN CONNECTOR PIPES APPLY AT NSIDE WALL OF STRUCTURE.
3. REINFORCING STEEL SHALL CONFORM TO ASTM A 615, GRADE 40, (ASTM A 615M, GRADE 300), AND SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACE UNLESS OTHERWISE SHOWN.
   a. W BARS ARE OF SIZE AND SPACING SPECIFIED FOR WALL STEEL ON PLANS, AND SHALL BE CUT IN CENTER OF OPENING AND BENT INTO TOP AND BOTTOM OF JUNCTION STRUCTURE.
   b. OMIT H BARS WHEN SOFFIT OF SPUR IS 12" (300 mm) OR LESS BELOW *SOFFIT OF MAIN LINE, AND OMIT G BARS WHEN INVERT OF SPUR IS* 12" (300 mm) OR LESS ABOVE FLOOR OF MAIN LINE.
4. JUNCTION STRUCTURE SHALL BE POURED MONOLITHICALLY WITH MAIN LINE, MANHOLE OR TRANSITION STRUCTURE.
5. FLOOR OF STRUCTURE SHALL BE STEEL-TROWELED TO THE SPRING LINE.
6. WHEN CONNECTING TO EXISTING RCD, BREAKOUT LIMITS AND DETAILS SHALL BE SHOWN ON THE PLANS.
7. EMBEDMENT, P, SHALL BE 5" (130 mm) FOR B = 96" (2400 mm) OR LESS 8" (200 mm) FOR B OVER 95" (2400 mm).
8. IF ELEVATION R AND ELEVATION S ARE NOT SHOWN ON THE PLANS *THEN THE INLET OPENING SHALL FALL 6" (150 mm) BELOW* THE SOFFIT OF THE MAIN LINE WITH THE INLET PIPE LAID ON A STRAIGHT GRADE FROM MAIN LINE TO CATCH BASIN OR TO GRADE BREAK IN INLET LINE. ELEVATION S SHALL BE SHOWN ON THE PLANS IF THE INLET OPENING FALLS MORE THAN 6" (150 mm) BELOW THE SOFFIT OF THE MAIN LINE WITH THE INLET PIPE LAID ON A STRAIGHT GRADE AS STATED ABOVE.
   ELEVATION R SHALL BE SHOWN ON THE PLANS ONLY WHEN A STUB IS TO BE PROVIDED FOR A FUTURE CONNECTION.
9. LATERALS OR CONNECTOR PIPES 24" (600 mm) OR LESS IN DIAMETER SHALL BE NO MORE THAN 5' (1.5 m) ABOVE THE INVERT. LATERALS OR CONNECTOR PIPES 27" (675 mm) OR LARGER IN DIAMETER SHALL BE NO MORE THAN 18" (450 mm) ABOVE THE INVERT, WITH THE EXCEPTION THAT CATCH BASIN CONNECTOR PIPES LESS THAN 50' (15 m) IN LENGTH SHALL NOT BE MORE THAN 5' (1.5 m) ABOVE THE INVERT.
10. THE NEED FOR AN EDGE BEAM AND/OR ADDITIONAL REINFORCEMENT SHALL BE NVESTIGATED BY THE ENGINEER FOR ANY ONE OF THE FOLLOWING CONDITIONS:
    a. ANGLE A IS LESS THAN 30°
    b. TOP OF INLET PIPE IS LESS THAN 6" (150 mm) BELOW THE SOFFIT
    c. FLOW LINE OF INLET PIPE IS LESS THAN 7" (180 mm) ABOVE THE THE FLOOR OF THE RCB AT THE INSIDE FACE

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

JUNCTION STRUCTURE – PIPE TO RCB

STANDARD PLAN 333-2

SHEET 2 OF 2

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 2/6/23 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 2-7-23 DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No. 85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

PM-20273

SHEET 21 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14551

01/09/2023

H1-535

Drawing Name: P:\Year 2020\2020-263 Merrill Commerce Center Phase I – Prologis – Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_SD_DET Line B-E.dwg
Last Opened: Jan 09, 2023 – 2:27pm by: Brent.King

SPAN, S			4′			5′				6′				7′					8′				
HEIGHT, H			2′	3′	4′	2′	3′	4′	5′	3′	4′	5′	6′	3′	4′	5′	6′	7′	4′	5′	6′	7′	8′
MAXIMUM EARTH COVER			10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′
Conc	ROOF	T_1	7″	7″	7″	7″	7″	7″	7″	8″	8″	8″	8″	8″	8″	8″	8″	8″	8″	8″	8″	8″	8″
	WALLS	T_2	6″	6″	6½″	6½″	7″	7½″	6″	6″	6½″	6½″	7″	7″	7″	7½″	8″	8″	9½″	6½″	7″	7½″	8″	9″
	INVERT	T_3	7″	7″	7″	7″	7″	7½″	7″	8″	8″	8″	8″	8″	9″	9″	9″	9½″	8″	8″	8″	8″	8″	8″
Reinf	SPACING		7″	6″	7″	6″	7″	6″	8½″	6″	8½″	5½″	8″	5½″	8″	5″	7½″	5″	7½″	5″	7″	5″	7″	4½″
	"a"	SIZE BAR	#6	#6	#6	#6	#6	#6	#7	#7	#7	#7	#7	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7
	"e"	SIZE BAR	#4	#4	#5	#6	#5	#5	#5	#6	#6	#6	#6	#4	#5	#6	#6	#6	#7	#6	#4	#5	#5	#6
QUANTITIES	CONCRETE	CF/LF	7.8	8.3	9.2	9.6	10.7	11.6	9.5	10.0	10.9	11.4	12.4	12.9	14.1	15.1	13.1	14.3	14.2	15.4	15.9	18.0	17.8	21.2
	REINFORCEMENT	LB/LF	47.7	51.1	57.8	71.4	63.5	80.8	57.8	73.7	66.6	92.5	83.0	111	101	114	77.6	94.7	96.6	114	110	126	132	152
*** SOIL PRESSURE (ksf)			2.4	4.5	2.4	4.5	2.5	4.6	2.4	4.5	2.4	4.5	2.5	4.6	2.5	4.6	2.4	4.6	2.5	4.6	2.5	4.6	2.5	4.7

SPAN, S			10′						12′						14′								
HEIGHT, H			5′	6′	7′	8′	9′	10′	6′	7′	8′	9′	10′	11′	12′	7′	8′	9′	10′	11′	12′	13′	14′
MAXIMUM EARTH COVER			10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′
Conc	ROOF	T_1	9½″	12″	9½″	12″	9½″	12″	9½″	12″	9½″	12″	9½″	12″	10½″	14½″	10½″	14½″	10½″	14½″	10½″	14½″	14½″
	WALLS	T_2	8½″	8½″	8½″	9½″	9″	10½″	9″	12″	10″	13½″	11″	15″	9″	10½″	9″	10½″	9″	12″	10″	13½″	11″	15″
	INVERT	T_3	10″	12½″	10″	12½″	10″	12½″	10″	13″	10″	13″	10″	13″	11″	14½″	11″	15″	11″	15″	11½″	15″	11½″	15″
Reinf	SPACING		11″	12″	12″	11″	11″	10″	11″	10″	11″	10″	11″	10″	9″	10″	9″	10″	9″	10″	8″	10″	8″	9″
	"a"	SIZE BAR	#7	#8	#7	#8	#7	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#8	#7	#7	#7
	"b"	SIZE BAR	#7	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#8	#7	#8	#7	#7	#7
		DIMENSION "B" ft-inch	2-11	2-11	2-11	3-0	2-11	3-0	2-9	2-11	3-9	2-11	3-9	2-11	3-9	3-1	3-2	3-9	3-9	3-9	3-7	3-9	3-7	4-0
		DIMENSION "Bw" ft-inch	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-7	4-7	6-0	5-10	6-2	6-7	6-2	6-7	4-11	6-4	11-4	11-4
	"c"	SIZE BAR #	#6	#7	#6	#7	#6	#7	#7	#7	#7	#7	#7	#7	#6	#7	#6	#7	#6	#7	#6	#7	#7	#7
		DIMENSION "C" ft-inch	3-4	3-6	7-4	4-8	7-7	4-8	8-2	4-8	7-7	5-2	7-7	5-11	4-4	3-10	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7
	"e"	SIZE BAR	#4	#4	#4	#5	#6	#6	#6	#7	#7	#7	#8	#8	#4	#4	#4	#4	#4	#5	#4	#5	#5	#5
QUANTITIES	CONCRETE	CF/LF	25.1	30.4	27.1	33.1	29.2	36.2	30.7	41	34	45.8	37.6	51	33.2	43.7	34.7	46.1	37	50.4	39.5	55.3	43.7	60.6
	REINFORCEMENT	LB/LF	271	296	278	333	341	366	359	406	428	469	487	530	322	371	379	417	390	449	430	477	499	500
*** SOIL PRESSURE (ksf)			3.7	4.7	3.8	4.7	3.8	4.8	3.8	4.8	3.9	4.9	3.9	5.0	3.6	4.8	3.6	4.8	3.6	4.9	3.6	4.9	3.7	5.0

SPAN, S			4′			5′				6′				7′					8′				
HEIGHT, H			2′	3′	4′	2′	3′	4′	5′	3′	4′	5′	6′	3′	4′	5′	6′	7′	4′	5′	6′	7′	8′
MAXIMUM EARTH COVER			10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′
Conc	ROOF	T_1	7″ 7½″	7″ 7½″	7″ 7½″	7½″ 8″	7½″ 8″	7½″ 8″	7½″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″	8″ 8″
	WALLS	T_2	6″ 6″	6½″ 6½″	7″ 7½″	6″ 6″	6½″ 6½″	7″ 7″	7″ 6½″	7″ 7″	7″ 7″	7½″ 8″	8″ 9½″	6½″ 7″	6½″ 7½″	7″ 7″	8″ 7½″	9½″ 8½″	11″ 6½″	7½″ 7″	8½″ 7½″	9½″ 8½″	11″ 9″
	INVERT	T_3	7″ 7½″	7″ 7½″	7″ 7½″	7½″ 8″	7½″ 8″	7½″ 8″	7½″ 8″	8″ 9″	8″ 9″	8″ 9″	8″ 9½″	8″ 10½″	8″ 10½″	8″ 10½″	8″ 10½″	8″ 10½″	8½″ 11½″	8½″ 11½″	8½″ 11½″	8½″ 11½″	8½″ 11½″
Reinf	SPACING		7″ 6″	7″ 6″	7″ 6″	8½″ 6″	8½″ 5½″	8″ 5½″	8″ 5″	7½″ 5″	7½″ 5″	7″ 5″	7″ 4½″	6″ 4½″	6″ 4½″	6″ 5½″	6″ 5½″	6″ 5½″	5″ 5½″	5″ 5½″	6″ 4½″	5½″ 4½″	5½″ 4½″
	"a"	SIZE BAR	#6	#6	#6	#6	#6	#6	#6	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7
	"e"	SIZE BAR	#4	#4	#5	#6	#5	#5	#5	#6	#6	#6	#6	#6	#7	#7	#7	#7	#7	#6	#6	#6	#7	#7
QUANTITIES	CONCRETE	CF/LF	7.8	8.3	9.2	9.6	10.7	11.6	9.5	10.0	10.9	11.4	12.4	12.9	14.1	15.1	13.1	14.3	14.2	15.4	15.9	18.0	17.8	21.2
	REINFORCEMENT	LB/LF	47.7	51.1	57.8	71.4	63.5	80.8	57.8	73.7	66.6	92.5	83.0	111	101	114	77.6	94.7	96.6	114	110	126	132	152
*** SOIL PRESSURE (ksf)			2.4	4.5	2.4	4.5	2.5	4.6	2.4	4.5	2.4	4.5	2.5	4.6	2.5	4.6	2.4	4.6	2.5	4.6	2.5	4.6	2.5	4.7

SPAN, S			10′						12′						14′								
HEIGHT, H			5′	6′	7′	8′	9′	10′	6′	7′	8′	9′	10′	11′	12′	7′	8′	9′	10′	11′	12′	13′	14′
MAXIMUM EARTH COVER			10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′	10′ 20′
Conc	ROOF	T_1	9½″ 12″	9½″ 12″	9½″ 12″	9½″ 12″	9½″ 12″	9½″ 12″	9½″ 12″	10½″ 14½″	10½″ 14½″	10½″ 14½″	10½″ 14½″	10½″ 14½″	10½″ 14½″	12″ 16½″	12″ 16½″	12″ 16½″	12″ 16½″	12″ 16½″	12″ 16½″	12″ 16½″	12″ 16½″
	WALLS	T_2	8½″ 8½″	8½″ 8½″	8½″ 9½″	9″ 10½″	9″ 12″	10″ 13½″	9″ 10½″	9″ 10½″	9″ 12″	10″ 13½″	11″ 15″	15″ 12½″	16½″ 13½″	18″ 9½″	11″ 9½″	12″ 10″	13½″ 11½″	15″ 12½″	16½″ 13½″	18″ 15″	19½″ 16½″
	INVERT	T_3	10″ 12½″	10″ 12½″	10″ 12½″	10″ 13″	10″ 13″	10″ 13″	10″ 13″	11″ 14½″	11″ 15″	11″ 15″	11″ 15″	11½″ 15″	12″ 15½″	12″ 17″	12″ 17″	12″ 17″	12″ 17″	12½″ 17″	13″ 17½″	13″ 17½″	13″ 18″
Reinf	SPACING		11″ 12″	12″ 12″	11″ 11″	10″ 11″	10″ 10″	11″ 10″	10″ 9″	10″ 9″	10″ 9″	10″ 8″	10″ 8″	10″ 10″	9″ 9″	8″ 10″	9″ 10″	9″ 10″	8″ 10″	8″ 9″	8″ 8″	8″ 10″	10″ 10″	10″ 9″
	"a"	SIZE BAR	#7 #8	#7 #8	#7 #8	#7 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#7 #7	#7 #7	#7 #8	#7 #8	#7 #8	#7 #8	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7
	"b"	SIZE BAR	#7 #7	#6 #7	#6 #7	#7 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #8	#7 #7	#7 #8	#7 #8	#8 #8
		DIMENSION "B" ft-inch	2-11	2-11	3-0	2-11	3-9	2-11	3-9	2-11	3-9	3-9	3-7	3-9	3-7	4-3	4-2	6-9	6-9	5-10	5-10	6-0	6-4	8-11
		DIMENSION "Bw" ft-inch	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-7	4-7	6-0	5-10	6-2	6-7	6-2	6-7	4-11	6-4	11-4	11-4	6-0	6-0
	"c"	SIZE BAR #	#6 #7	#6 #7	#6 #7	#7 #7	#7 #7	#7 #7	#6 #7	#6 #7	#6 #7	#6 #7	#6 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#7 #7	#8 #8	#8 #8
		DIMENSION "C" ft-inch	3-4	3-6	7-4	4-8	7-7	5-2	7-7	5-11	4-4	3-10	8-1	5-7	8-1	5-7	8-1	5-7	8-1	6-4	8-11	7-0	8-11	7-7
	"e"	SIZE BAR	#4 #4	#4 #5	#5 #6	#6 #6	#6 #7	#7 #7	#7 #8	#8 #8	#4 #4	#4 #4	#4 #4	#4 #5	#4 #5	#5 #5	#5 #6	#6 #6	#6 #6	#4 #4	#4 #4	#4 #4	#4 #5	#5 #5
QUANTITIES	CONCRETE	CF/LF	25.1	30.4	27.1	33.1	29.2	36.2	30.7	41	34	45.8	37.6	51	33.2	43.7	34.7	46.1	37	50.4	39.5	55.3	43.7	60.6
	REINFORCEMENT	LB/LF	271	296	278	333	341	366	359	406	428	469	487	530	322	371	379	417	390	449	430	477	499	500
*** SOIL PRESSURE (ksf)			3.7	4.7	3.8	4.7	3.8	4.8	3.8	4.8	3.9	4.9	3.9	5.0	3.6	4.8	3.6	4.8	3.6	4.9	3.6	4.9	3.7	5.0

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

REGISTERED CIVIL ENGINEER

May 31, 2018

PLANS APPROVAL DATE

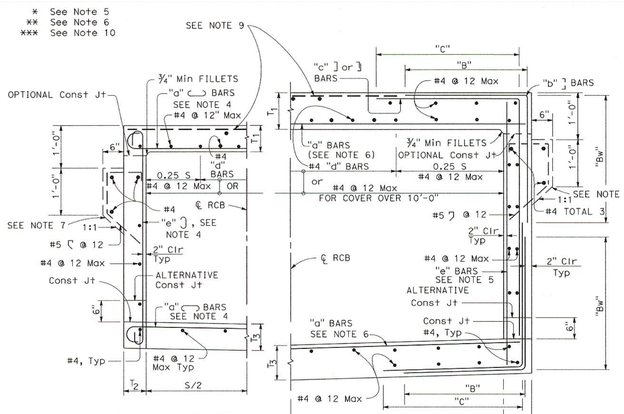
Carl W. Dunn
No. C59976
Exp. 6-30-18
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER

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.

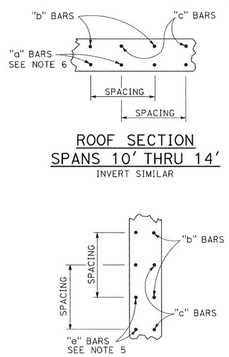
"d" BARS, FOR EARTH COVERS UP TO AND INCLUDING 10′-0″								
SPAN	4′	5′	6′	7′	8′	10′	12′	14′
NUMBER	7	8	9	10	11	12	15	20

* See Note 5
** See Note 6
*** See Note 10



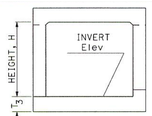
TYPICAL SECTION
SPANS 4′ THRU 8′

TYPICAL SECTION
SPANS 10′ THRU 14′

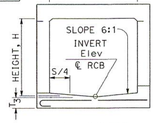


ROOF SECTION
SPANS 10′ THRU 14′
INVERT SIMILAR

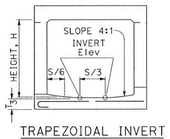
WALL SECTION
SPANS 10′ THRU 14′



FLAT INVERT

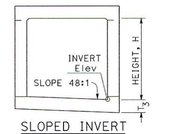


V INVERT



TRAPEZOIDAL INVERT

ALTERNATIVE INVERTS



SLOPED INVERT

NOTES:

1. For boxes with span or height less than any of those shown in table, use next greater size box concrete dimensions and reinforcement. Make necessary changes in bar lengths and quantities.
2. Quantities are approximate and for design purposes only.
3. For boxes with span or height or cover greater than those shown in tables, a special design is required.
4. It is permissible to eliminate the 180° hooks on every other bar.
5. "e" bars are at half spacing (spans 10′ - 14′ only).
6. "a" bars are at half spacing (spans 10′ - 14′ only).
7. Provide paving notch when top is exposed and when pavement is concrete, and adjust quantities.
8. For design and details not shown, see Standard Plan D82.
9. For exposed top, provide #4 @ 12 each way, lap "c" bars 2′-0" or use full span length.
10. Soil pressures shown are factored per AASHTO LRFD and include soil weight of fill over box, self weight of box and live load where applicable.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT

NO SCALE

D80

1-29-18

2018 STANDARD PLAN D80

221

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF EOR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RAE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

PM-20273

SHEET 22 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14552

01/09/2023

H1-536

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_50_DET Line B-E.dwg
Last Opened: Jan 09, 2023 - 2:27pm by: BrentKing

DESIGN NOTES:

Design Specifications:
AASHTO LRFD Bridge Design Specifications, 6th Edition with California Amendments.

Loading:
Live load: (AASHTO LRFD 3.6.1.2)
HL-93 consists of design truck or design tandem and design lane load.

Impact Factor: (Apply to roof slab only)
$IM = 33(1.0-0.125D_E) \geq 0\%$ (AASHTO LRFD 3.6.2.2)
D_E = minimum depth of earth cover

Earth load:
Earth pressure for two conditions:
140 pcf vertical, 42 pcf horizontal
140 pcf vertical, 140 pcf horizontal

Load Factors:
AASHTO LRFD Table 3.4.1.1 & Table 3.4.1.2

Unit stresses:
f'_c = 3600 psi
f_y = 60,000 psi

Distribution "d" bars:
Up to and including 10'-0" cover
Express as a percentage of main positive reinforcement required: $\frac{100}{\sqrt{S}}$, Max 50%,
Over 10'-0" cover,
4 @ 12 maximum

Shear:
$V_c = (2.14\sqrt{f'_c}+4600\frac{A_s}{bd_e}\frac{Vud_e}{Mu})\,b.d_e \leq 4.0\sqrt{f'_c}\,b.d_e$ (Pounds)
V_c shall not be less than $3.00\sqrt{f'_c}\,b.d_e$ for frame members and $2.5\sqrt{f'_c}\,b.d_e$ for simply supported members.

Exclusion:
Compressive reinforcement and negative moment reduction (for continuity) do not apply.
Axial loading on members has not been considered.

CONSTRUCTION NOTES:

Construction loads:
Strutting required as shown on Standard Plan D88. Strutting may be required on culvert extensions when existing parapet is removed.

Expansion joints:
Invert:
No expansion joints shall be permitted.

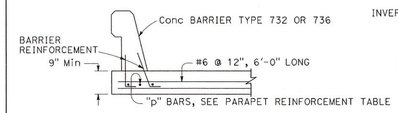
Roof and Walls:
When cover is less than span length-
Place ½" premolded expansion joint filler at 30'-0" ± centers outside the paved roadway lanes and place Bridge Detail 3-2, Standard Plan B0-3, at 30'-0" centers under paved roadway lanes.
When cover is more than span length-
Place ½" premolded expansion joint filler at 30'-0" ± centers and additional ½" premolded expansion joints at locations of change in foundation character, as directed by the Engineer.

Construction joints:
Temporary joints may be permitted if normal (or radial) to ℄ of RCB. Otherwise, the contractor is to submit a proposal for consideration.

Cutoff walls:
4'-0" cutoff walls are to be provided at inlet and/or outlet unless adjacent channel is lined and unless otherwise shown. These walls are to be extended if scour conditions warrant.

Earthwork:
See Standard Plan A62E.

Backfill:
See Standard Specifications, except that the difference in level of backfill (against outside walls) shall not exceed 2'-0".



BARRIER SECTION (30'-0" MINIMUM)

GENERAL NOTES:

Designation:
Standard single or multiple box culverts are shown on plans as span times height with maximum cover over roof thus: 8' x 5' RCB with 10' or double 10' x 5' RCB with 20', followed by alternatives.

Alternatives:
Single cell: Invert will be sloped unless "trapezoidal invert", "flat invert" or "V invert" is included in designation.
Multiple cell: Invert will be vee unless "flat invert" is specified. Ends of culvert will be rounded unless "square ends" are designated. Parapets will be as shown unless designated in plans. Such designations may be different for inlet and outlet ends.

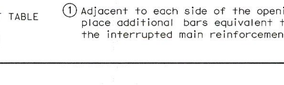
Quantities:
Quantities do not include the following:
- Concrete for parapet, paving notches and cut-off wall.
- Reinforcement for 2% splices, parapets, paving notches, cut-off wall and additional required bars for exposed top slab (D-80, Note 9).

Reinforcement placement:
Main reinforcement is to be placed transversely or, for curved culverts, radially. When radial, reinforcing spacing of the "a", "f" and "g" bars is measured along the centerline. Stagger splices not shown. Hooks may be rotated or tilted, as necessary, for clearance.

Special reinforcement coverage:
Box standard plans are not to be used for culverts in a corrosive environment or where there is a severe abrasive flow condition or in freeze-thaw locations.

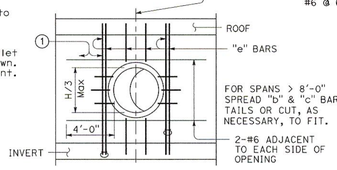
Special design:
Required for culverts with conditions, loads, design bearing pressures or sizes greater than those given on this plan or Standard Plans D80 & D81. Also required for multiple cell culverts with unequal spans. For culverts with railroad loading, see the current AREMA design specification.

3 or more cells:
For culverts with more than two cells, use dimensions and reinforcement for the standard "double box culvert" and adjust quantities accordingly.



PART PLAN-SECTION

BRIDGE DETAIL 3-2 Std PLAN B0-3, NO EXPANSION JOINT WITHIN 4'-0" OF ℄ OPENING

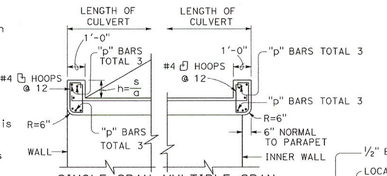


LONGITUDINAL SECTION

UTILITY OPENING-WALL

H=Height of box

① Adjacent to each side of the opening, place additional bars equivalent to half the interrupted main reinforcement.



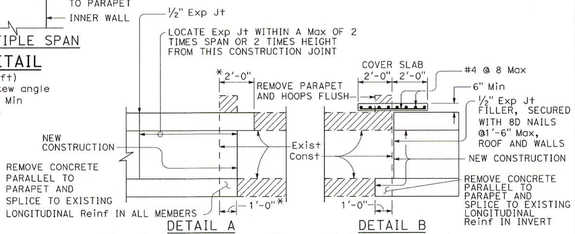
SINGLE SPAN MULTIPLE SPAN

PARAPET DETAIL

s = Clear span (ft)
a = 12 cosine skew angle
h = Height, 1'-0" Min

PARAPET "p" BARS			
SKEW ANGLE / SPAN	0° TO 15°	16° TO 30°	31° TO 45°
4'	#4	#4	#4
6'	#4	#4	#5
8'	#4	#5	#6
10'	#5	#6	#7
12'	#6	#7	#8
14'	#7	#8	#9

PARAPET REINFORCEMENT



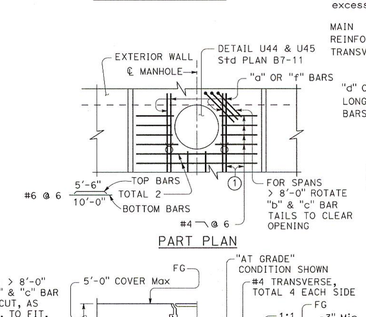
DETAIL A

20° maximum skew as shown. If existing longitudinal and transverse reinforcing bars in top slab are lap spliced with new longitudinal and transverse reinforcing bars, the 20° skew may be exceeded. Lap splicing may require removal of top slab in excess of 2'-0" shown.

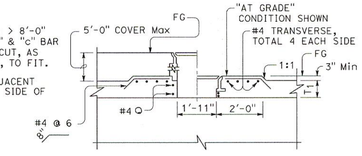
DETAIL B

Single cell only, no skew allowed, 1'-0" minimum cover.

* Measured perpendicular to parapet



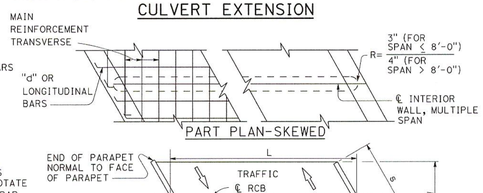
PART PLAN



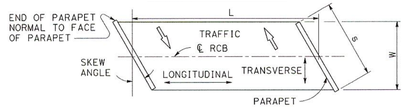
PART LONGITUDINAL SECTION

MANHOLE

CULVERT EXTENSION



PART PLAN-SKEWED



RCB TERMINOLOGY

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE REINFORCED CONCRETE BOX CULVERT MISCELLANEOUS DETAILS

NO SCALE

D82

1-29-18

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

May 31, 2018
PLANS APPROVAL DATE

Cari W. Dunn
No. C59976
Exp. 6-30-18
CIVIL
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.

2018 STANDARD PLAN D82

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN SIRLES, P.E., ASSISTANT CITY ENGINEER — 2/6/23 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 2-7-23 DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIAR REE MACKINNEY — No. 85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

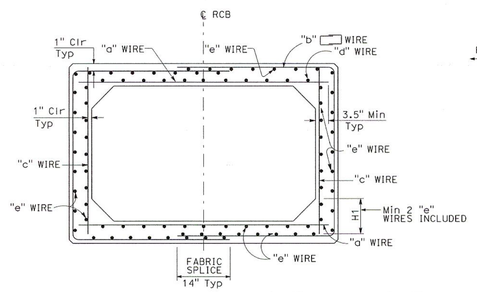
PM-20273

SHEET 23 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14552

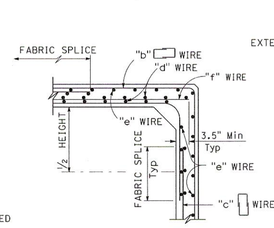
01/09/2023

H1-537

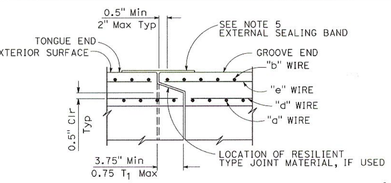
Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_SD_DET Line B-E.dwg
Last Opened: Jan 09, 2023 - 2:27pm by: Brent.King



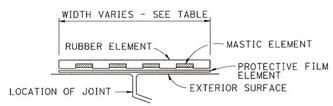
TYPICAL SECTION - SPANS 4'-0" THRU 12'-0"



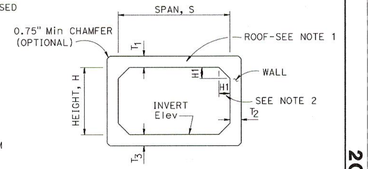
ALTERNATIVE DETAILING OPTION



END JOINT DETAIL



EXTERNAL SEALING BAND SCHEMATIC



SCHEMATIC

TABLE	
SPAN	EXTERNAL SEALING BAND WIDTH
4'-6'	9"
7'-8'	11"
10'-12'	13"

SPAN, S			4'				5'				6'				7'					
HEIGHT, H			2'	3'	4'		2'	3'	4'	5'	3'	4'	5'	6'	3'	4'	5'	6'	7'	
MAXIMUM EARTH COVER			10' 20'	10' 20'	10' 20'		10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'
CONCRETE (INCH)	ROOF	T_1	5.5" 5.5"	5.5" 5.5"	5.5" 5.5"		6" 6"	6" 6"	6" 6"	6" 6"	7" 7"	7" 7"	7" 7"	7" 7"	8" 8"	8" 8"	8" 8"	8" 8"	8" 8"	
	SIDE WALL	T_2	5.5" 5.5"	5.5" 5.5"	5.5" 5.5"		6" 6"	6" 6"	6" 6"	6" 6"	7" 7"	7" 7"	7" 7"	7" 7"	8" 8"	8" 8"	8" 8"	8" 8"	8" 8"	
	INVERT	T_3	5.5" 5.5"	5.5" 5.5"	5.5" 5.5"		6" 6"	6" 6"	6" 6"	6" 6"	7" 7"	7" 7"	7" 7"	7" 7"	8" 8"	8" 8"	8" 8"	8" 8"	8" 8"	
MINIMUM WELDED WIRE FABRIC ($inch^2/ft$)		"a"	.33 .47	.34 .49	.34 .50		.40 .62	.41 .62	.42 .64	.43 .64	.44 .67	.45 .70	.46 .71	.47 .72	.47 .72	.48 .75	.50 .78	.50 .79	.51 .80	
		"b"	.23 .28	.23 .25	.21 .23		.26 .36	.24 .36	.24 .33	.24 .30	.28 .44	.27 .40	.27 .37	.27 .38	.33 .52	.31 .48	.30 .45	.30 .43	.30 .48	
		"c"	.11 .11	.11 .12	.18 .24		.11 .11	.11 .11	.13 .23	.24 .34	.11 .11	.11 .12	.19 .27	.27 .42	.11 .11	.11 .11	.13 .20	.26 .31	.30 .50	
		"d"	.16 .11	.16 .11	.16 .11		.17 .11	.18 .11	.18 .11	.18 .11	.17 .11	.18 .11	.18 .11	.18 .11	.17 .11	.17 .11	.18 .11	.18 .11	.18 .11	
		"e"	.11 .11	.11 .11	.11 .11		.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	
		"f"	.22 .36	.23 .37	.22 .26		.29 .51	.30 .51	.29 .41	.26 .30	.33 .56	.34 .58	.27 .44	.21 .30	.36 .61	.37 .64	.37 .57	.25 .48	.21 .30	
* QUANTITY	Conc	CY/LF	.31	.34	.38		.37	.41	.44	.48	.51	.56	.60	.64	.63	.68	.73	.78	.83	
	Reinf	LB/LF	35 41	39 45	45 51		49 58	49 62	54 69	62 78	60 79	64 83	72 93	80 107	72 98	76 102	81 110	92 120	101 143	
** SOIL PRESSURE (ksf)			2.3 4.4	2.4 4.5	2.4 4.5		3.1 4.4	3.1 4.5	3.1 4.5	3.2 4.5	2.7 4.5	2.8 4.5	2.8 4.6	2.8 4.6	2.5 4.5	2.5 4.6	2.5 4.6	2.5 4.6	2.6 4.6	

SPAN, S			8'						10'								12'									
HEIGHT, H			4'	5'	6'	7'	8'		5'	6'	7'	8'	9'	10'			6'	7'	8'	9'	10'	11'	12'			
MAXIMUM EARTH COVER			10' 20'	10' 20'	10' 20'	10' 20'	10' 20'		10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'			10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'	10' 20'			
CONCRETE (INCH)	ROOF	T_1	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"		10" 10"	10" 10"	10" 10"	10" 10"	10" 10"	10" 10"			12" 12"	12" 12"	12" 12"	12" 12"	12" 12"	12" 12"	12" 12"			
	SIDE WALL	T_2	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"		10" 10"	10" 10"	10" 10"	10" 10"	10" 10"	10" 10"			12" 12"	12" 12"	12" 12"	12" 12"	12" 12"	12" 12"	12" 12"			
	INVERT	T_3	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"	8.5" 8.5"		10" 10"	10" 10"	10" 10"	10" 10"	10" 10"	10" 10"			12" 12"	12" 12"	12" 12"	12" 12"	12" 12"	12" 12"	12" 12"			
MINIMUM WELDED WIRE FABRIC ($inch^2/ft$)		"a"	.55 .87	.56 .90	.57 .92	.58 .93	.58 .94		.66 1.07	.67 1.10	.69 1.13	.70 1.14	.70 1.16	.71 1.16			.73 1.21	.21 1.24	.77 1.27	.24 1.29	1.27 1.31	.78 1.32	1.29 1.32			
		"b"	.37 .59	.35 .55	.33 .52	.33 .52	.36 .57		.45 .74	.43 .70	.41 .67	.40 .64	.43 .67	.48 .67			.51 .85	.85 .81	.49 .77	.81 .74	.77 .77	.53 .79	.74 .79			
		"c"	.11 .11	.11 .11	.20 .31	.31 .42	.38 .62		.11 .11	.11 .11	.22 .31	.36 .42	.40 .62	.54 .86			.11 .11	.11 .11	.23 .30	.37 .42	.42 .60	.54 .82	.42 1.06			
		"d"	.19 .11	.19 .11	.20 .11	.20 .11	.20 .11		.20 .11	.20 .11	.21 .11	.21 .11	.21 .11	.21 .11			.20 .11	.20 .11	.21 .11	.22 .11	.22 .11	.22 .11	.22 .11			
		"e"	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11		.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11			.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11	.11 .11			
		"f"	.44 .76	.45 .79	.37 .61	.27 .52	.20 .31		.55 .96	.56 .99	.47 .81	.34 .73	.31 .53	.16 .30			.62 1.10	1.10 1.13	.64 .97	1.13 .87	.97 .71	.40 .50	.87 .26			
* QUANTITY	Conc	CY/LF	.78	.83	.88	.94	.99		1.10	1.17	1.23	1.29	1.35	1.41			1.56	1.63	1.70	1.78	1.85	1.93	2.00			
	Reinf	LB/LF	93 129	97 133	105 148	117 161	131 189		133 191	138 196	148 212	191 225	176 253	201 282			174 255	179 261	191 279	207 293	223 323	249 357	281 393			
** SOIL PRESSURE (ksf)			2.5 4.6	2.5 4.6	2.5 4.6	2.5 4.6	2.5 4.6		3.8 4.6	3.8 4.7	3.8 4.7	4.6 4.7	3.9 4.7	3.9 4.8			3.6 4.7	3.7 4.7	3.7 4.8	3.7 4.8	3.7 4.8	3.8 4.9	3.8 4.9			

* See Note 3 ** See Note 6

NOTES:

1. The inside and outside surfaces of the RCB roof shall be marked "TOP".
2. H1 minimum shall equal the wall thickness. H1 maximum shall be 8" for spans through 8' and 14" for spans over 8'.
3. Quantities are approximate and for design purposes only.
4. For design and details not shown see Standard Plan D83B.
5. For external sealing band applications see Standard Plan A62G.
6. Soil pressures shown are factored per AASHTO LRFD and include soil weight of fill over box, self weight of box and live load where applicable.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PRECAST REINFORCED CONCRETE BOX CULVERT

NO SCALE

D83A

1-29-18

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

REGISTERED CIVIL ENGINEER

May 31, 2018
PLANS APPROVAL DATE

Carl W. Dunn, No. C59976, Exp. 6-30-18, CIVIL, STATE OF CALIFORNIA

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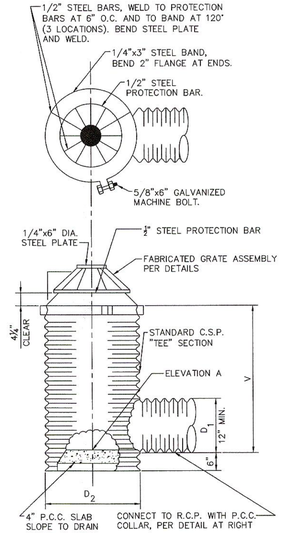
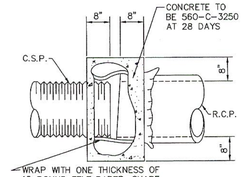


NOTES:

1. V, D_1, D_2 AND ELEVATION "A" SHALL BE SHOWN ON THE CONSTRUCTION PLANS.
2. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT C.S.P. OF SIZE "D_2".
3. GRATE ASSEMBLY SHALL BE GALVANIZED AFTER FABRICATION.
4. R.C.P. SHALL BE SIZED TO FIT FUTURE CATCH BASIN DESIGN.
5. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT THE OUTSIDE DIAMETER OF STANDARD JUNCTION STRUCTURE SHAFT IF INDICATED ON CONSTRUCTION PLANS.



COLLAR DETAIL

12 TYPICAL TEMPORARY STANDPIPE DETAIL

2018 STANDARD PLAN D83A

224

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

PM-20273

SHEET 24 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14534

01/09/2023

H1-538

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_SD_DET Line B-E.dwg
Last Opened: Jan 09, 2023 - 2:27pm by: Brent.King

DESIGN NOTES:

Specifications:

AASHTO LRFD Bridge Design Specifications, 4th Edition with California Amendments.

Earth load:

Earth pressures for two conditions:
140 pcf Vert, 42 pcf Horiz
140 pcf Vert, 140 pcf Horiz

Unit stresses:

f'c = 5.0 ksi
fy = 65.0 ksi for weld wire fabric
n = 7

Shear:

Based on

$V_c = \{2.14\sqrt{f'_c} + 4600\ \frac{A_s}{bd_e}\ \frac{V_u d_e}{M_u}\} b.d_e \leq 4.0\sqrt{f'_c} b.d_e$ (Pounds)

V_c shall not be less than $3.00\sqrt{f'_c} b.d_e$ for frame members and $2.5\sqrt{f'_c} b.d_e$ for simply supported members.

Exclusion:

Axial loading on the members has not been considered.

GENERAL NOTES:

Designation:

Standard single or multiple precast box culverts are shown on the plans as span times height with maximum cover over roof thus: 8' x 5' RCB with 10'-0" or double 10' x 5' RCB with 20'-0", followed by alternatives.

Alternatives:

Single cell:

Standard dimensions of AASHTO Material Specification 'M259' or 'M273'.

Multiple cell:

Constructed by placing single cells adjacent to each other. Inlet and outlet ends of culvert will be rounded unless square ends are designated. Parapet will be shown unless designated in plans. Such designation may be different for inlet and outlet ends.

Limitations:

Where the overfill is less than 12", Precast RCB culverts are not to be used. Precast RCB culverts are not to be used in siphon or pressurized installations unless appropriate "watertight" jointing is provided.

Special reinforcement coverage:

Precast RCB culvert standard plans are not to be used in a corrosive environment or where there is a severe abrasive flow condition or freeze-thaw locations.

Special design:

Required for culvert with different conditions, loads or design bearing pressures greater than those given on these plans. Required for culverts where end details need higher skew angles, higher parapets or barrier sections.

CONSTRUCTION NOTES:

Cutoff walls:

4'-0" Cutoff walls are to be provided at inlet and/or outlet unless channel is lined and unless otherwise shown. These walls are to be extended if scour conditions warrant. See Standard Plans D84, D85 and D86A.

Wingwalls:

Wingwalls shall be cast-in-place and shall conform to standard plan details for box culvert wingwalls. See Standard Plans D84, D85 and D86A.

Earthwork:

See Standard Plan A62G.

Construction loads:

Strutting may be required near temporary ends. For construction loads on culverts, See Standard Plan D88.

Dist	COUNTY	ROUTE	POST-MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

May 31, 2018
PLANS APPROVAL DATE

Cori M. Duon
No. C59976
Exp. 6-30-18
CIVIL
STATE OF CALIFORNIA

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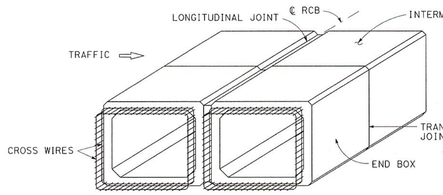
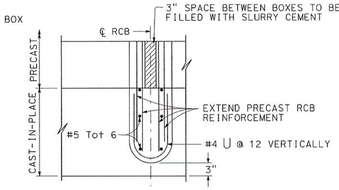


PRECAST RCB TERMINOLOGY

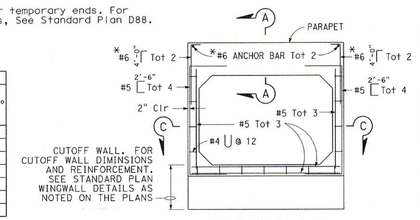
NOTE: Inner and outer reinforcement to be exposed as required to tie to cast-in-place construction. A minimum of two cross wires shall be exposed on all sides.



PARTIAL PLAN INTERIOR WALL MULTICELL CULVERT

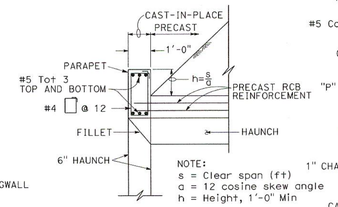
PARAPET "P" BARS			
SKEW ANGLE / SPAN	0° TO 15°	16° TO 30°	31° TO 45°
4'-0"	#5	#5	#5
5'-0"	#5	#5	#6
6'-0"	#6	#6	#6
7'-0"	#7	#7	#7
8'-0"	#7	#7	#8
10'-0"	#8	#8	#9
12'-0"	#9	#9	#10

BARRIER PARAPET REINFORCEMENT

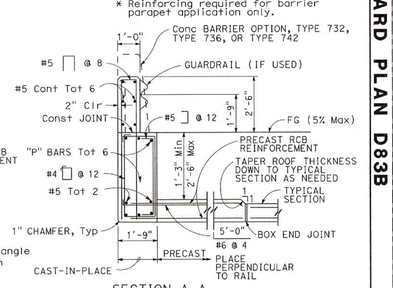


CAST-IN-PLACE END ELEVATION

* Reinforcing required for barrier parapet application only.



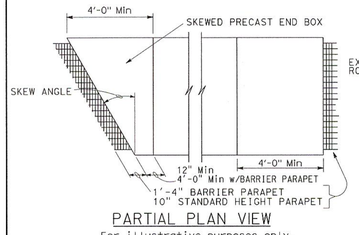
SECTION A-A
(Standard Height Parapet)



SECTION A-A
(Barrier Parapet)

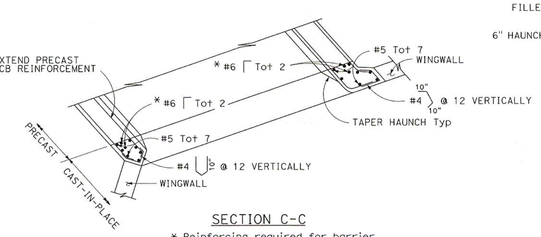
TYPICAL CULVERT END DETAILS

For wall and invert reinforcement not shown, See "End Elevation" detail.



PARTIAL PLAN VIEW

For illustrative purposes only.
For correct skew direction see plans.



SECTION C-C

* Reinforcing required for barrier parapet application only.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PRECAST REINFORCED CONCRETE BOX CULVERT MISCELLANEOUS DETAILS

NO SCALE

D83B

1-29-18

2018 STANDARD PLAN D83B

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 2/2/2022
DRAWN BY: BK
DATE: 2/2/2022
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 2/6/23
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 2-7-23

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 Exp. 9/30/2022 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 1/11/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

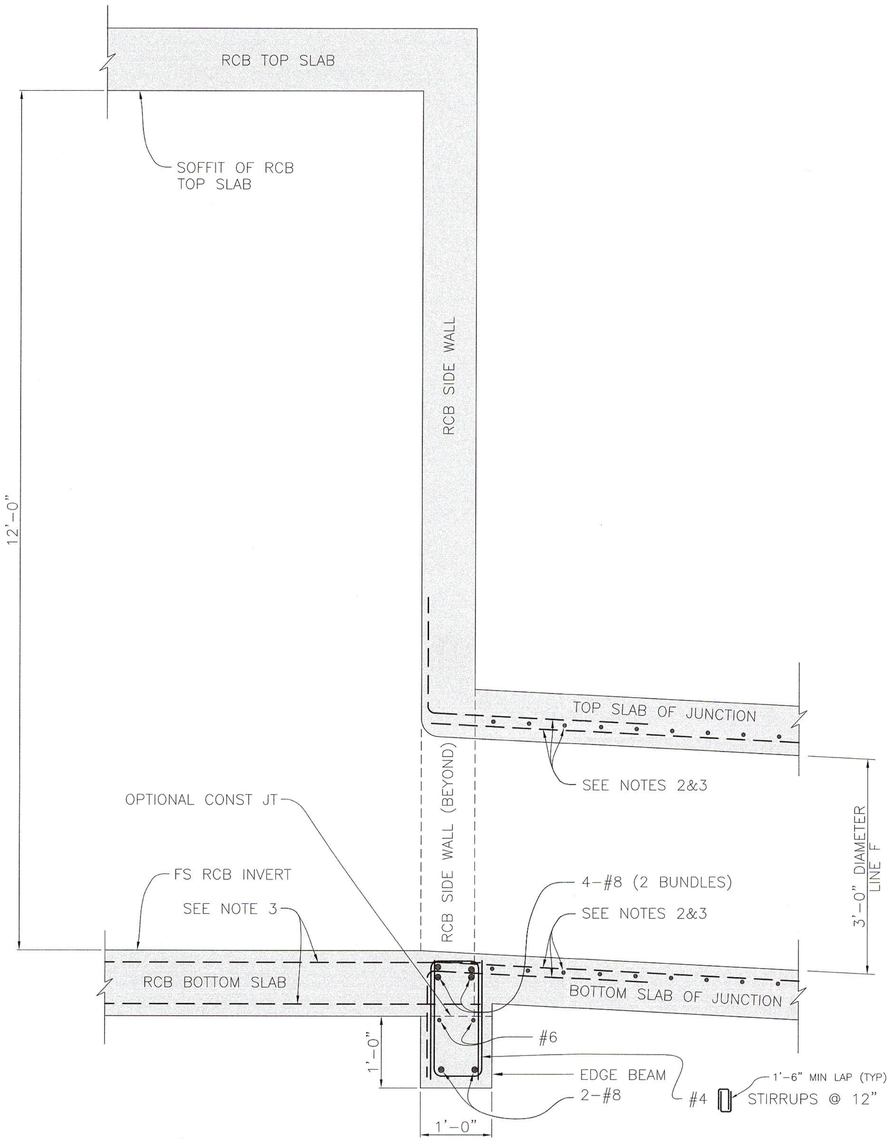
PM-20273

SHEET 25 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14565

01/09/2023

H1-539

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donahue\06 Engineering\Sheets\OFF-SITE\Storm Drain\13_2020-263_SD_DET Line B-E.dwg
Last Opened: Jan 09, 2023 - 2:28pm by: Brent.King



SUPPLEMENTAL
SECTION Z-Z
TO SPPWC STD PLAN 333-2
NO SCALE

NOTES:

1. CLEAR COVER TO ALL BAR REINFORCEMENT IS 2", UNLESS OTHERWISE SHOWN HEREON OR ON THE REFERENCED STANDARD PLANS.
2. CONSTRUCT JUNCTION STRUCTURE (WITH ALL BAR REINFORCEMENT PROPERLY EXTENDED) PER SPPWC STANDARD PLAN 333-2, AS MODIFIED HEREON.
3. FOR BAR REINFORCEMENT AND ADDITIONAL INFORMATION NOT SHOWN, SEE SPPWC STANDARD PLAN 333-2 AND CALTRANS STANDARD PLAN D80 (NOT ALL BARS SHOWN).
4. EDGE BEAM EXTENDS FOR THE FULL LENGTH OF THE 13'X12' RCB (BETWEEN END WALLS), AND ITS LONGITUDINAL REINFORCEMENT EXTENDS INTO THE END WALLS AND TO WITHIN 2" CLEAR OF THE REAR FACE OF EACH END WALL.

REGISTERED PROFESSIONAL ENGINEER
GREGORY L. RENDA
No. 54529
CIVIL
STATE OF CALIFORNIA

City of Ontario
PM-20273 Storm Drain Line B
Edge Beam Details for
Junction Structure at STA 61+22.93
September 30, 2022

811 Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE
4LEAF, INC. Davison Chanda C-83946 — 01/31/2023 DATE

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK DATE: 2/2/2022
DRAWN BY: BK DATE: 2/2/2022
CHECKED BY: DATE:

CITY OF ONTARIO
RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 2/6/23 DATE
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REGISTERED PROFESSIONAL ENGINEER SIARA REE MACKINNEY No.85559 Exp. 9/30/2022 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 2/2/23 DATE

STORM DRAIN IMPROVEMENT PLAN

DETAILS

PM-20273

SHEET 26 OF 26
CONTRACT
ACCOUNT
DWG. NO. D14556

01/09/2023

H1-540

Drawing Name: P:\Year_2020\2020-263 Merrill Commerce Center Phase I - Prologis - Tom Donohue\06 Engineering\Sheets\OFF-SITE\Storm Drain Line B Edge Beam Details.dwg
Last Opened: Jan 09, 2023 - 5:34pm by: Brent King

EXCERPT I: STORM DRAIN IMPROVEMENT PLANS FOR LINE C, PM-20537

STORM DRAIN IMPROVEMENT PLAN

FOR PM 20537
GROVE AVENUE
IN THE CITY OF ONTARIO

CITY OF ONTARIO GENERAL NOTES:

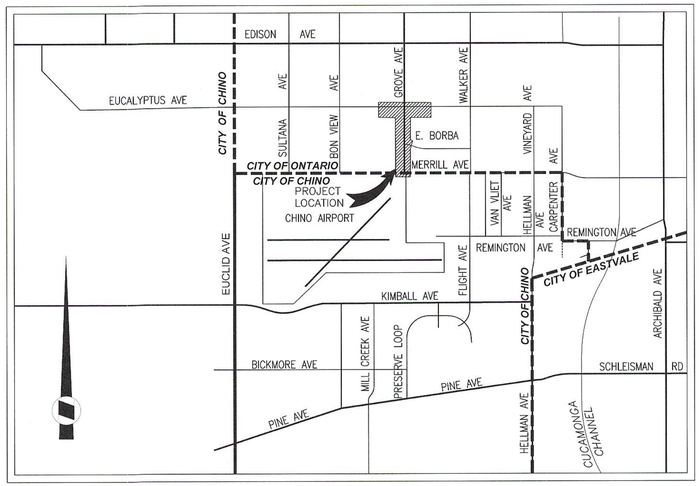
1. ALL WORK SHALL BE DONE IN STRICT CONFORMANCE WITH THE CURRENT CITY OF ONTARIO STANDARD SPECIFICATIONS AND STANDARD DRAWINGS AND CURRENT STANDARD SPECIFICATIONS AND STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION AND CALTRANS PERMIT UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. ANY CONTRACTOR PERFORMING WORK ON THIS PROJECT SHALL FAMILIARIZE HIMSELF/HERSELF WITH THE SITE AND SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES RESULTING DIRECTLY OR INDIRECTLY FROM HIS/HER OPERATIONS, WHETHER OR NOT THE FACILITY IS SHOWN ON THESE PLANS.
3. ALL OBSTRUCTIONS WITHIN THE AREA TO BE IMPROVED SHALL BE REMOVED AND/OR RELOCATED AT THE DIRECTION OF THE CITY ENGINEER. UTILITIES ARE TO BE RELOCATED BY THEIR RESPECTIVE OWNERS UNLESS NOTED OTHERWISE. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
4. UTILITY LINE LOCATIONS WERE TAKEN FROM AVAILABLE RECORD DATA AND WERE NOT LOCATED IN THE FIELD, UNLESS OTHERWISE NOTED ON THE PLAN. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
5. IN CASE OF ANY ACCIDENTS INVOLVING SAFETY MATTERS COVERED BY SECTION 6409(B) OF THE CALIFORNIA LABOR CODE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE STATE DIVISION OF INDUSTRIAL SAFETY.
6. STATE LAW (SB 3019) REQUIRES THE CONTRACTOR TO CONTACT UNDERGROUND SERVICE ALERT AND OBTAIN AN IDENTIFICATION NUMBER PRIOR TO THE ISSUANCE OF CITY'S ENCROACHMENT PERMITS. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT AT 1-800-422-4133 A MINIMUM OF 48-HOURS IN ADVANCE OF ANY CONSTRUCTION ACTIVITY.
7. PRIOR TO THE START OF ANY WORK THE CONTRACTOR SHALL OBTAIN A BUSINESS LICENSE FROM THE CITY OF ONTARIO. THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM THE ENGINEERING DEPARTMENT NO LESS THAN 48 HOURS PRIOR TO START OF ANY CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY.
8. THE CONTRACTOR SHALL OBTAIN A TRAFFIC CONTROL PERMIT 48 HOURS PRIOR TO TIME OF CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR IS REFERRED TO SECTION 7-10.3 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
9. THE CONTRACTOR SHALL RENEW OR REPLACE ANY EXISTING TRAFFIC STRIPING AND/OR PAVEMENT MARKINGS, WHICH DURING HIS OPERATIONS HAVE BEEN EITHER REMOVED OR THE EFFECTIVENESS OF WHICH HAS BEEN REDUCED. RENEWAL OF TRAFFIC STRIPING AND MARKINGS SHALL BE DONE USING REFLECTIVE THERMO-PLASTIC MARKINGS IN CONFORMANCE WITH SECTION 84 & 85 OF THE CALTRANS STANDARD SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER. ALL REGULATORY, WARNING, AND GUIDE SIGNS SHALL HAVE 3M DIAMOND, VIP GRADE SHEETING WITH SERIES 1160 PROTECTIVE OVERLAY FILM.
10. THE LAND SURVEYORS ACT, SECTION 8771 OF THE BUSINESS & PROFESSIONAL CODE, AND SECTIONS 732.5, 1492-5, 1810-5 OF THE STREETS AND HIGHWAY CODE REQUIRE THAT SURVEY MONUMENTS SHALL BE PROTECTED AND PERPETUATED.

    "IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR OTHERS PERFORMING THE CONSTRUCTION WORK TO RETAIN A QUALIFIED REGISTERED CIVIL ENGINEER AND/OR LICENSED LAND SURVEYOR PRIOR TO THE START OF CONSTRUCTION TO LOCATE, REFERENCE AND FILE THE NECESSARY CORNER RECORDS WITH THE COUNTY SURVEYOR'S OFFICE FOR SURVEY CONTROL POINTS/MONUMENTS THAT EXIST AS SHOWN ON RECORDED TRACT MAPS, PARCEL MAPS, RECORDS OF SURVEYS AND HIGHWAY MAPS, AND MAY BE DISTRIBUTED OR DAMAGED BY THE PROPOSED CONSTRUCTION"

    AFTER THE COMPLETION OF THE PROPOSED CONSTRUCTION, SAID MONUMENTS AND/OR CONTROL SURVEY POINTS SHALL BE RESET TO THE NEW SURFACE IN ACCORDANCE WITH THE CURRENT PROFESSIONAL LAND SURVEYING PRACTICES. CORNER RECORDS SHALL BE FILED WITH THE COUNTY SURVEYOR FOR ALL THE NEW MONUMENTS SET.
11. THE DEVELOPER SHALL PROVIDE THE CITY WITH A COMPLETED SET OF "AS BUILT", MYLAR DRAWINGS PRIOR TO THE FINAL INSPECTION.
12. A CITY ACCEPTED/APPROVED SET OF PLANS SHALL BE KEPT ON THE JOB SITE AT ALL TIMES.
13. A PRE-CONSTRUCTION MEETING SHALL OCCUR PRIOR TO CONSTRUCTION. ATTENDEES SHALL INCLUDE A CITY REPRESENTATIVE AND THE CONTRACTOR WHO WILL PERFORM THE WORK. "CUT-SHEETS" SHALL BE PROVIDED TO THE CITY AT THIS MEETING FOR ITS REVIEW.
14. CITY ACCEPTANCE OF PLANS DOES NOT RELIEVE THE DEVELOPER FROM RESPONSIBILITY FOR THE CORRECTION OF ERROR AND OMISSION DISCOVERED DURING CONSTRUCTION. UPON REQUEST OF THE CITY INSPECTOR, THE REQUIRED PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR REVIEW.
15. ANY REQUIRED RIGHT-OF-WAY OR EASEMENT SHALL BE DEDICATED TO AND ACCEPTED BY THE CITY PRIOR TO COMMENCEMENT OF CONSTRUCTION OF THE IMPROVEMENTS WITHIN THE REQUIRED RIGHT-OF-WAY OR EASEMENT.
16. WHERE UTILITIES NEED TO BE SUPPORTED, SAID SUPPORTS SHALL BE IN ACCORDANCE WITH A.P.W.A. STANDARD 224-1 UNLESS OTHERWISE INDICATED.
17. PRIOR TO STARTING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF EXISTING SEWER MAIN(S) AND NOTIFY THE DESIGN ENGINEER OF ANY VARIATION FROM DESIGN.
18. THE PIPE SHOWN HEREON SHALL BE INSTALLED IN ACCORDANCE WITH CASE III BEDDING AS SHOWN ON L.A.C.D.P.W. STANDARD 3080-2, UNLESS OTHERWISE SHOWN. "W" VALUE SHALL BE AS SPECIFIED ON L.A.C.D.P.W. STANDARD 3080-2 FOR CASE III BEDDING, NOTES 3 (A), 3 (B), AND 3 (C). IF THE "W" VALUE AT THE TOP OF THE PIPE IS EXCEEDED, THE BEDDING SHALL BE MODIFIED AND/OR PIPE OF ADDITIONAL STRENGTH SHALL BE PROVIDED. ALL PROPOSED MODIFICATIONS TO THIS REQUIREMENT SHALL BE APPROVED BY THE CITY ENGINEER.
19. MINIMUM COVER OF STORM DRAIN MAIN SHALL BE 7 FEET FROM THE FINISHED SURFACE PER STANDARD DRAWING 1302-1304.
20. STORM DRAIN MAIN STATIONING IS PER PIPE CENTERLINE.
21. STREET CENTERLINE STATIONING IS PER THE STREET IMPROVEMENT PLANS AND PROVIDED FOR REFERENCE.
22. CONTRACTOR SHALL NOT BACKFILL TRENCH UNTIL THE CITY INSPECTOR HAS OBTAINED AS-BUILT STATIONING ON ALL STRUCTURES.
23. UPON COMPLETION OF CONSTRUCTION OF ALL STORM DRAIN LINES AND PRIOR TO PAVING, THE DEVELOPER SHALL HIRE A CITY APPROVED VIDEO COMPANY TO VIDEO TAPE THE PIPELINES. CITY SHALL REVIEW SAID VIDEOTAPES FOR POTENTIAL CONSTRUCTION DEFECTS PRIOR TO ACCEPTANCE OF THE PROJECT.

CIVIL ENGINEERS NOTICE TO CONTRACTOR

1. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF MY KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTION AND ANY MEASURES TO PROTECT THE UTILITIES AND STRUCTURES SHOWN AND OTHER LINES OR STRUCTURES NOT OF RECORD OR NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR THE PROTECTION OF, AND ANY DAMAGE TO, THESE UTILITY LINES OR STRUCTURES.
2. THE CONTRACTOR AGREES THAT HE WILL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY AND NOT BE LIMITED TO A NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER, OR ANY PUBLIC AGENCY.
3. THE ESTIMATES OF IMPROVEMENT QUANTITIES AS SHOWN HEREON ARE PROVIDED ONLY FOR THE PURPOSE OF SATISFYING CITY PLAN INFORMATION REQUIREMENTS. THE CONTRACTOR SHALL PERFORM AN INDEPENDENT ESTIMATE OF ALL IMPROVEMENT QUANTITIES AND SHALL USE SAME AS A BASIS FOR HIS BID(S) AND CONTRACT(S).
4. CONTRACTOR TO VERIFY CLEARANCE AT ALL UTILITY CROSSINGS. IF INTERFERENCE OCCURS, OTHER THAN NOTED ON PLAN, CONTRACTOR SHALL CONTACT THE DESIGN ENGINEER FOR POSSIBLE REDESIGN. IF REDESIGN IS NOT FEASIBLE, CONTRACTOR TO RELOCATE UTILITY AT NO EXPENSE TO ENGINEER.
5. CONTRACTOR SHALL TAKE EXTREME CARE DURING UNDERGROUND CONSTRUCTION AND IS RESPONSIBLE FOR TRENCHING AND SHORING. CONTRACTOR SHALL SUBMIT A DETAILED SHORING PLAN PER SECTION 7-10.4.2.2 OF SPPWC AND A PERMIT FROM STATE DIVISION OF INDUSTRIAL SAFETY PRIOR TO COMMENCING WORK.
6. CONTRACTOR SHALL VERIFY PAVEMENT ELEVATION AT RIM PRIOR TO SETTING CONE.



VICINITY MAP

N.T.S.

INDEX OF DRAWINGS

INDEX NO.	DESCRIPTION
SHEET 1	TITLE SHEET
SHEET 2	INDEX/SYSTEM MAP
SHEET 3	GROVE AVE - FROM MERRILL AVE. TO 1000' NORTH OF MERRILL AVE.
SHEET 4	GROVE AVE - FROM 1000' NORTH OF MERRILL AVE. TO 1900' NORTH OF MERRILL AVE.
SHEET 5	GROVE AVE - FROM 750' SOUTH OF EUCALYPTUS AVE. TO 130' NORTH OF EUCALYPTUS AVE.
SHEET 6	EUCALYPTUS AVE - FROM GROVE AVE. TO 700' WEST OF GROVE AVE.
SHEET 7	EUCALYPTUS AVE - FROM GROVE AVE. TO 400' EAST OF GROVE AVE.
SHEET 8	GROVE AVE - LATERALS C-1 & C-1A
SHEET 9-10	LATERAL PROFILES
SHEET 12-14	DETAILS
SHEET 15-16	STRUCTURE DETAIL
SHEET 17	MODIFIED CONCRETE COLLAR DETAIL

OWNER/DEVELOPER:

PROLOGIS
3546 CONCOURS ST., SUITE 100
ONTARIO CALIFORNIA 91764

CONTACT: SAM CHO
PHONE: (909) 673.8721
EMAIL: SCHO@PROLOGIS.COM

CIVIL ENGINEER

WESTLAND GROUP INC.
4150 CONCOURS STREET, SUITE 100
ONTARIO, CA 91764

CONTACT: SIARA R. MACKINNEY P.E.
PHONE: (909)-403-5647

GEOTECHNICAL ENGINEER:

SOUTHERN CALIFORNIA GEOTECHNICAL
22885 EAST SAVI RANCH PARKWAY, SUITE E
YORBA LINDA, CA 92887

CONTACT: GREGORY K. MITCHELL
PHONE: (714) 685-1115

UTILITY PURVEYORS:

CITY OF CHINO, PUBLIC WORKS
DAYTIME PH: (909) 364-2800
24-HOUR EMERGENCY: (909) 364-2860

CITY OF ONTARIO, MUNICIPAL UTILITIES AGENCY
DAYTIME PH: (909) 395-2678
24-HOUR EMERGENCY: (909) 986-6711

CITY OF ONTARIO, COMMUNITY & PUBLIC SERVICES AGENCY
DAYTIME PH: (909) 395-2633
24-HOUR EMERGENCY: (909) 986-6711

INLAND EMPIRE UTILITY AGENCY
DAYTIME PH: (909) 944-6000
24-HOUR EMERGENCY: (909) 987-2591

SOUTHERN CALIFORNIA EDISON
24-HOUR EMERGENCY: (800) 611-1911

SOUTHERN CALIFORNIA GAS COMPANY
DAYTIME PH: (800) 423-1391
24-HOUR EMERGENCY: (800) 423-1391

TIME WARNER CABLE / WEST COAST COMMUNICATIONS
24-HOUR EMERGENCY: (888) 892-2253

VERIZON
24-HOUR EMERGENCY: (800) 483-2000

CONSTRUCTION NOTES

ITEM	DESCRIPTION	PUBLIC QUANTITY	
1	CONSTRUCT 108" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	120	LF
2	CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	910	LF
3	CONSTRUCT JUNCTION STRUCTURE PER CITY OF ONTARIO STD. DWG. NO. 3010, CASE 1	7	EA
4	CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009	14	EA
5	CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003 & 3015, "W" AND "V" PER PLAN	18	EA
6	CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005	18	EA
7	CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017	18	EA
8	INSTALL ALMETEK PLACARD "NO DUMPING, DRAINS TO RIVER" OR EQUIVALENT	18	EA
9	CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 9 ON SHEET 14	2	EA
10	CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	1,100	LF
11	REMOVE BRICK AND MORTAR PLUG	1	EA
12	CONSTRUCT 120" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	2,500	LF
13	CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12	3	EA
14	CONSTRUCT 36" TEMPORARY CSP STANDPIPE (14 GAUGE) PER DETAIL 1 ON SHEET 12	4	EA
15	REMOVE EXISTING 24" RCP PIPE	93	LF
16	REMOVE EXISTING 42" RCP PIPE	85	LF
17	REMOVE EXISTING STORM DRAIN MANHOLE	1	EA
18	REMOVE EXISTING CATCH BASIN PER SEPARATE GROVE AVENUE IMPROVEMENT PLAN	4	EA
19	CONSTRUCT 66" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	75	LF
20	CONNECT TO EXISTING 120" RCP PIPE PER SPPWC STD. 335-2, PER DETAIL ON SHEET 13	1	EA
21	CONSTRUCT TRANSITION STRUCTURE PIPE TO RCB PER SPPWC STD. 342-2, PER DETAIL ON SHEET 14	2	EA
22	CONSTRUCT MODIFIED CONCRETE COLLAR PER SPPWC STD. 380-2 AS MODIFIED PER DETAIL ON SHEET 17	1	EA
23	CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. 330-2, PER DETAIL ON SHEET 14	3	EA
24	REMOVE EXISTING 120" RCP PIPE	12	LF
25	CONSTRUCT 10' DIA. CDS UNIT PER DETAIL, SHEET 14	1	EA
26	CONSTRUCT DIVERGENT STRUCTURE PER DETAIL ON SHEET 15	1	EA
27	CONSTRUCT 42" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	100	LF
28	CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	55	LF
29	CONSTRUCT 30" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	125	LF
30	CONSTRUCT 48" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN	25	LF

REFERENCE DRAWINGS

DESCRIPTION	REFERENCE	
PROPOSED RECYCLED WATER	PM-20537	RECYCLED WATER IMPROVEMENT PLAN
PROPOSED SANITARY SEWER	PM-20537	SANITARY SEWER IMPROVEMENT PLAN
STREET IMPROVEMENT PLAN	PM-20537	STREET IMPROVEMENT PLAN
PROPOSED DOMESTIC WATER	PM-20537	DOMESTIC WATER IMPROVEMENT PLAN
EXISTING STORM DRAIN	AA-5861SD	STORM DRAIN IMPROVEMENT PLAN

LEGEND OF ABBREVIATIONS & SYMBOLS

BC	BEGIN CURVE	FS	FINISHED SURFACE	RCB	REINFORCED CONCRETE BOX
BCR	BEGIN CURB RETURN	FT/S	FEET PER SECOND	RCP	REINFORCED CONCRETE PIPE
BNDY	BOUNDARY	GB	GRADE BREAK	RT	RIGHT
C+G	CURB AND GUTTER	HDPE	HIGH DENSITY POLYETHYLENE	RW	RECYCLED WATER
CB	CATCH BASIN	HGL	HYDRAULIC GRADE LINE	R/W	RIGHT OF WAY
CFS	CUBIC FEET PER SECOND	HP	HIGH POINT	SL	STREET LIGHT
CSP	CORRUGATED STEEL PIPE	INT	INTERIM	SP	STAND PIPE (RCP)
℄ OR C/L OR CL	CENTERLINE	INV	INVERT	STA	STATION
DBL	DOUBLE	LT	LEFT	TC	TOP OF CURB
EA	EACH	LAT	LATERAL	TSP	TEMPORARY STAND PIPE
EC	END CURVE	LF	LINEAR FEET	TYP	TYPICAL
ECR	END CURB RETURN	LP	LOW POINT	ULT	ULTIMATE
ELEV	ELEVATION	MIN	MINIMUM	SD	STORM DRAIN
EP	EDGE OF PAVEMENT	PCC	POINT OF COMPOUND CURVE	SPPWC	STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
ESMT	EASEMENT	ℙ OR P/L OR PL	PROPERTY LINE	SS	SANITARY SEWER
EX, EXIST.	EXISTING	PRC	POINT OF REVERSE CURVE	DW	DOMESTIC WATER
FH	FIRE HYDRANT	PVC	POLYVINYL CHLORIDE		
FL	FLOW LINE				

(100) EXISTING CONTOURS
100 PROP. CONTOUR
EXIST. EASEMENT
2% FLOW RATE
CENTERLINE
FIRE HYDRANT
SIGN
STREET LIGHT
BOUNDARY LINE
FENCE LINE
PROPOSED STORM DRAIN MH
PROPOSED CATCH BASIN
PROPOSED STORM DRAIN

BASIS OF BEARING

BEARINGS ARE BASED UPON THE CENTERLINE OF MERRILL AVENUE BETWEEN BAKER AVENUE AND VINEYARD AVENUE BEING N89°26'19"E AS SHOWN ON RECORD OF SURVEY 92/97 RECORDED AS INSTRUMENT NO. 1991-447293 OF OFFICIAL RECORDS OF THE COUNTY OF SAN BERNARDINO.

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

LOTS 1, 2, 3, 16, 17, 18, 19, 20, 21, 34, 35 AND 36 IN SECTION 19, TOWNSHIP 2 SOUTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO MAP OF SUBDIVISION OF PART OF THE RANCHO SANTA ANA DEL CHINO, RECORDED IN BOOK 6, PAGE 15 OF MAPS, RECORDS OF SAID COUNTY.

Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE

TECK, C. LOH, P.E.
HARRIS AND ASSOCIATES — 3/20/2024 DATE

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 3/21/24 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 3.21.24 DATE

BENCH MARK No. GG-18-1
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REGISTERED PROFESSIONAL ENGINEER — DIANA ROSE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

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PHONE: (909) 989-9789 FAX: (909) 989-9660

Diana R Mackinney — 85559 R.C.E. NO. — 3/14/24 DATE
SIGNATURE: SIARA R. MACKINNEY, P.E.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK DATE: 8/30/2023
DRAWN BY: BK DATE: 8/30/2023
CHECKED BY: DATE:

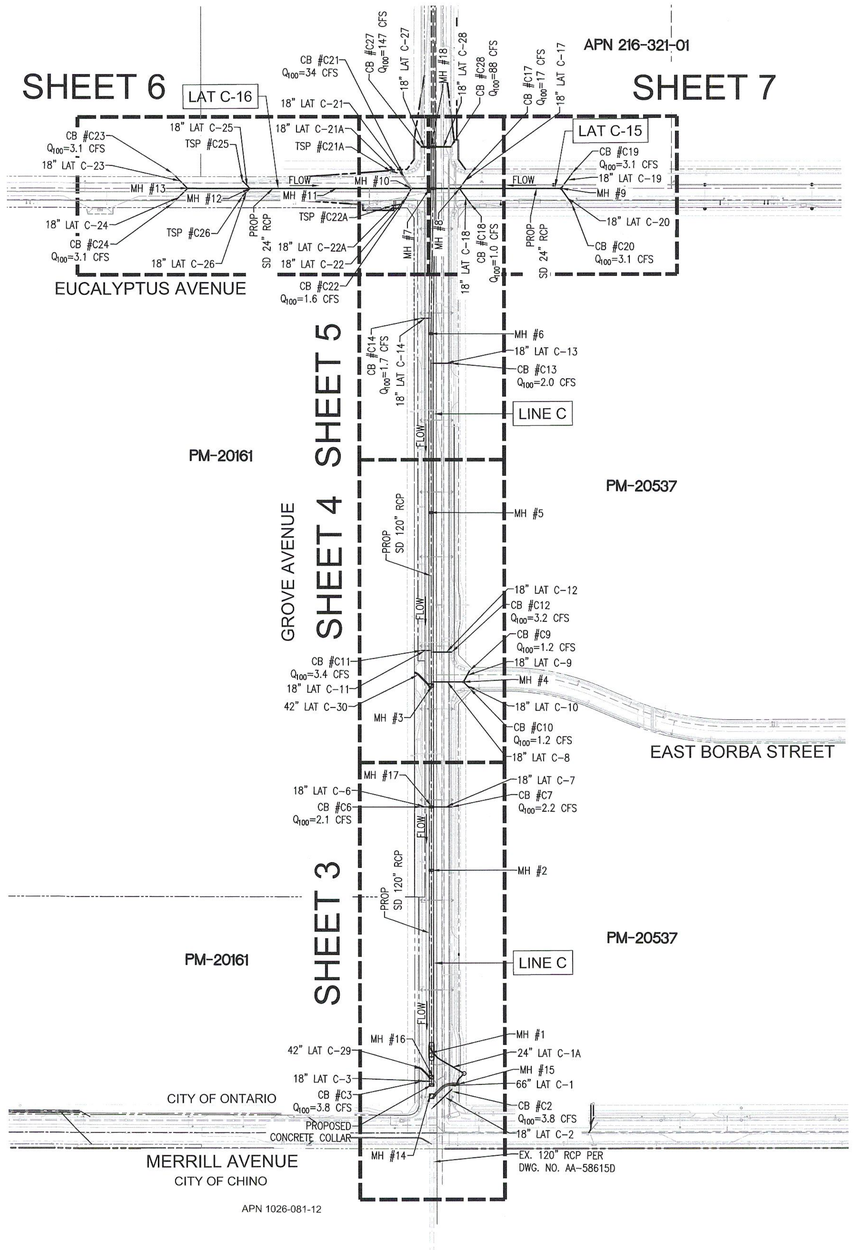
STORM DRAIN IMPROVEMENT PLAN
GROVE AVENUE
TITLE SHEET

PM-20537

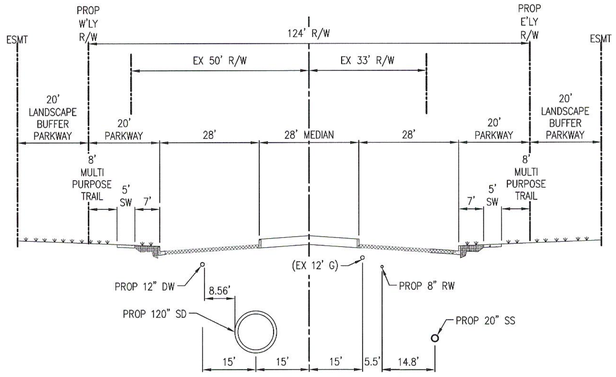
SHEET 1 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14022

02/28/2024

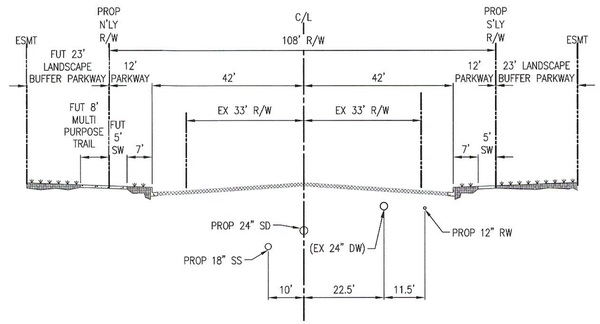
Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\01_2021-315_S01.dwg
Last Opened: Feb 28, 2024 - 12:55pm by: BrentLKing



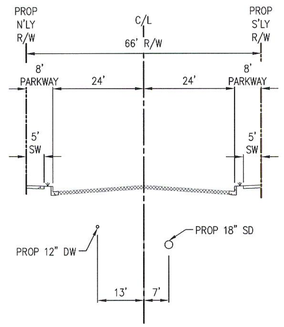
INDEX / SYSTEM MAP



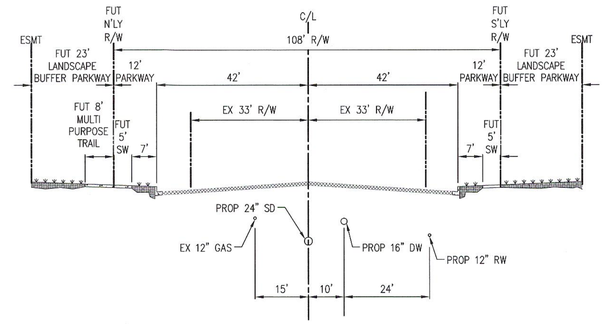
GROVE AVE
MERRILL AVE TO EUCALYPTUS AVE
1"=20'



EUCALYPTUS AVE
EAST OF GROVE AVE
1"=20'



EAST BORBA STREET
1"=20'



EUCALYPTUS AVE
WEST OF GROVE AVE
1"=20'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/21/24

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 3/14/24

STORM DRAIN IMPROVEMENT PLAN

INDEX / SYSTEM MAP

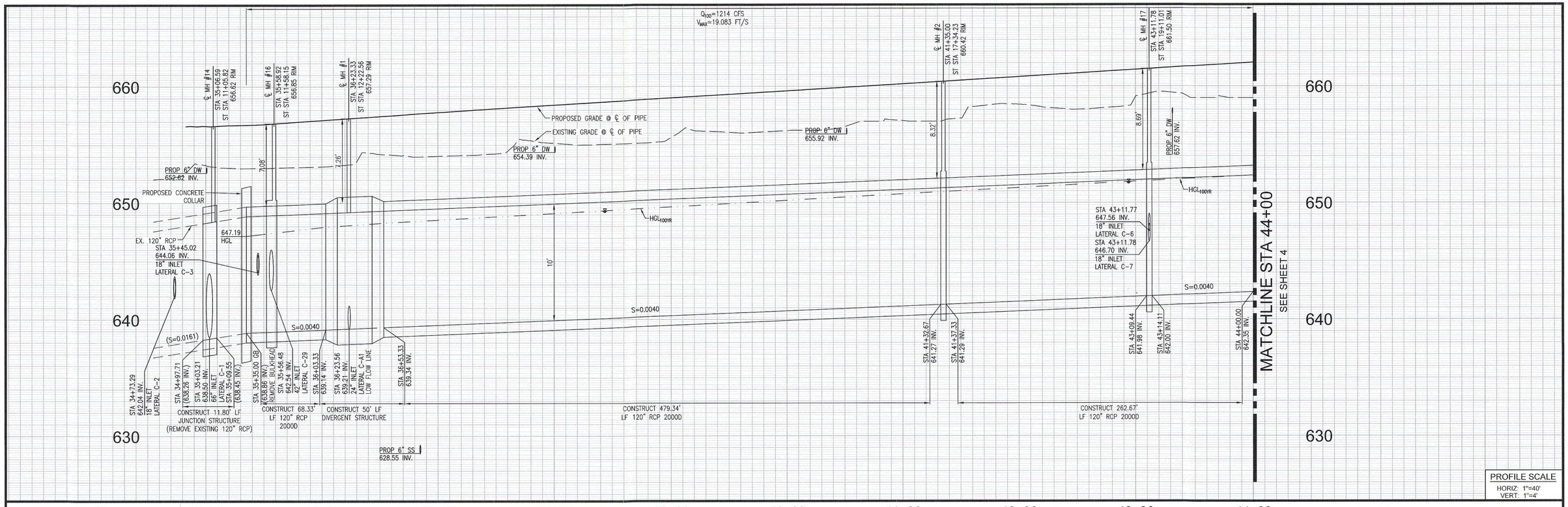
PM-20537

SHEET 2 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14023

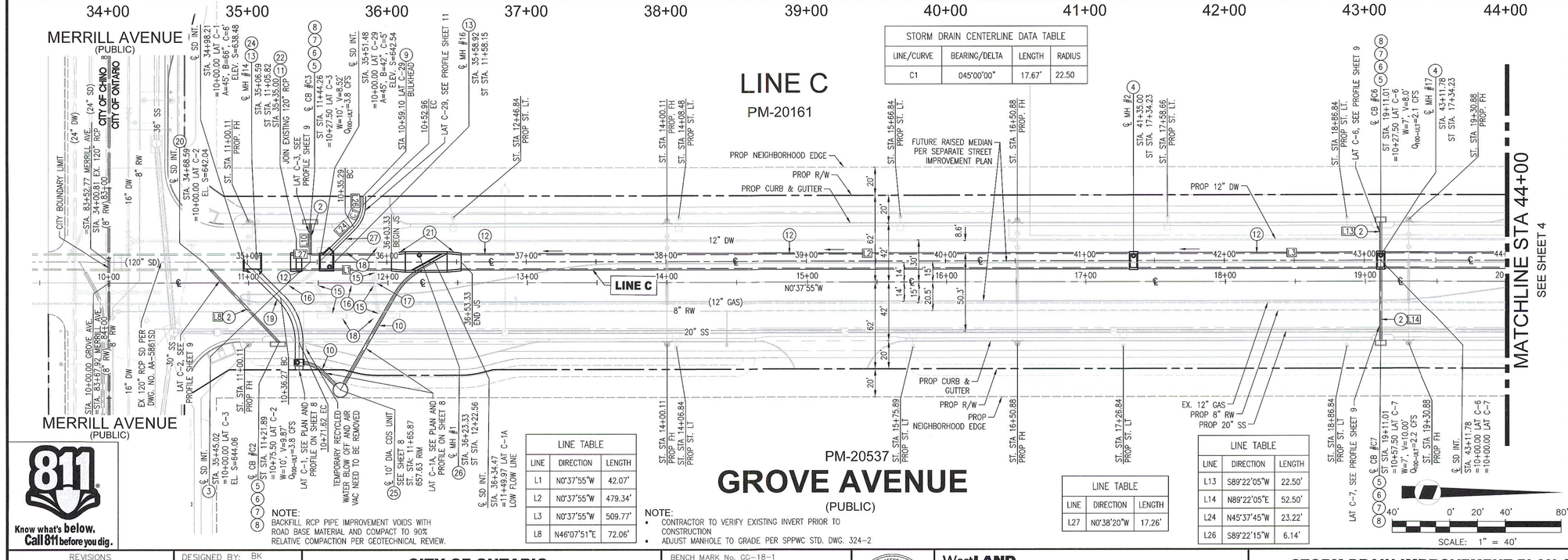
02/28/2024

H1-543

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pang\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\02_2021-315_SD-USM.dwg
Last Opened: Feb 28, 2024 - 1:14pm by: Brent.King



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C1	045°00'00"	17.67'	22.50

LINE TABLE		
LINE	DIRECTION	LENGTH
L1	N0°37'55"W	42.07'
L2	N0°37'55"W	479.34'
L3	N0°37'55"W	509.77'
L8	N46°07'51"E	72.06'

LINE TABLE		
LINE	DIRECTION	LENGTH
L27	N0°38'20"W	17.26'

LINE TABLE		
LINE	DIRECTION	LENGTH
L13	S89°22'05"W	22.50'
L14	N89°22'05"E	52.50'
L24	N45°37'45"W	23.22'
L26	S89°22'15"W	6.14'

NOTE:
BACKFILL RCP PIPE IMPROVEMENT VOIDS WITH ROAD BASE MATERIAL AND COMPACT TO 90% RELATIVE COMPACTION PER GEOTECHNICAL REVIEW.

NOTE:
- CONTRACTOR TO VERIFY EXISTING INVERT PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

CONSTRUCTION NOTES

2. CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
3. CONSTRUCT JUNCTION STRUCTURE PER CITY OF ONTARIO STD. DWG. NO. 3010, CASE 1
4. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003 & 3015, "W" AND "V" PER PLAN
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005
7. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
8. INSTALL ALMETEK PLACARD "NO DUMPING, DRAINS TO RIVER" OR EQUIVALENT
9. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 9 ON SHEET 14
10. CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
11. REMOVE BRICK AND MORTAR PLUG
12. CONSTRUCT 120" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
13. CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12
15. REMOVE EXISTING 24" RCP PIPE
16. REMOVE EXISTING 42" RCP PIPE
17. REMOVE EXISTING STORM DRAIN MANHOLE
18. REMOVE EXISTING CATCH BASIN PER SEPARATE GROVE AVENUE IMPROVEMENT PLAN
19. CONSTRUCT 66" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
20. CONNECT TO EXISTING 120" RCP PIPE PER SPPWC STD. 335-2, PER DETAIL ON SHEET 13
21. CONSTRUCT TRANSITION STRUCTURE PIPE TO RCB PER SPPWC STD. 342-2, PER DETAIL ON SHEET 14
22. CONSTRUCT MODIFIED CONCRETE COLLAR PER SPPWC STD. 380-2 AS MODIFIED PER DETAIL ON SHEET 17
24. REMOVE EXISTING 120" RCP PIPE
25. CONSTRUCT 10' DIA. CDS UNIT PER DETAIL, SHEET 14
26. CONSTRUCT DIVERGENT STRUCTURE PER DETAIL ON SHEET 15
27. CONSTRUCT 42" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/14/24

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA RISE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
GROVE AVENUE
FROM MERRILL AVE. TO 1000' NORTH OF MERRILL AVE.

PM-20537

SHEET 3 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14024

01/09/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pang\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\03-06_2021-315_SD_GROVE.dwg
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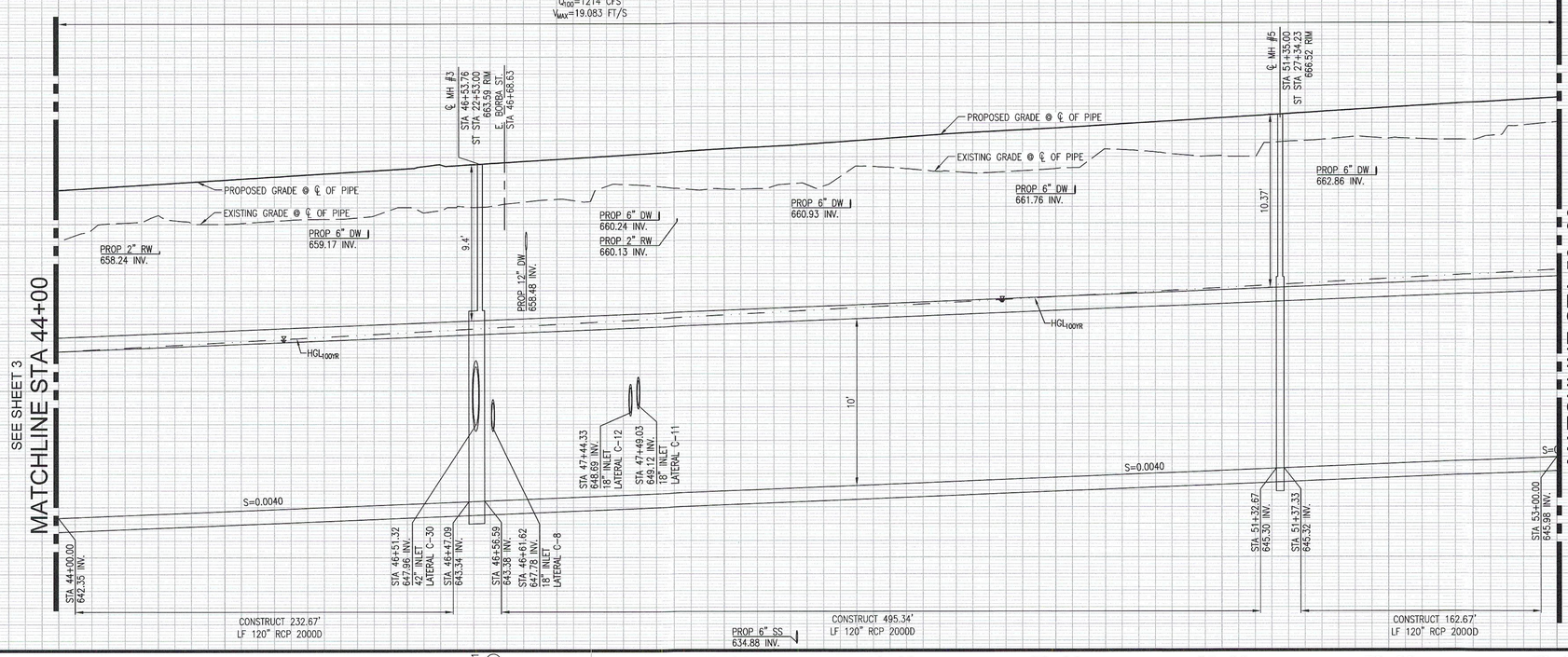
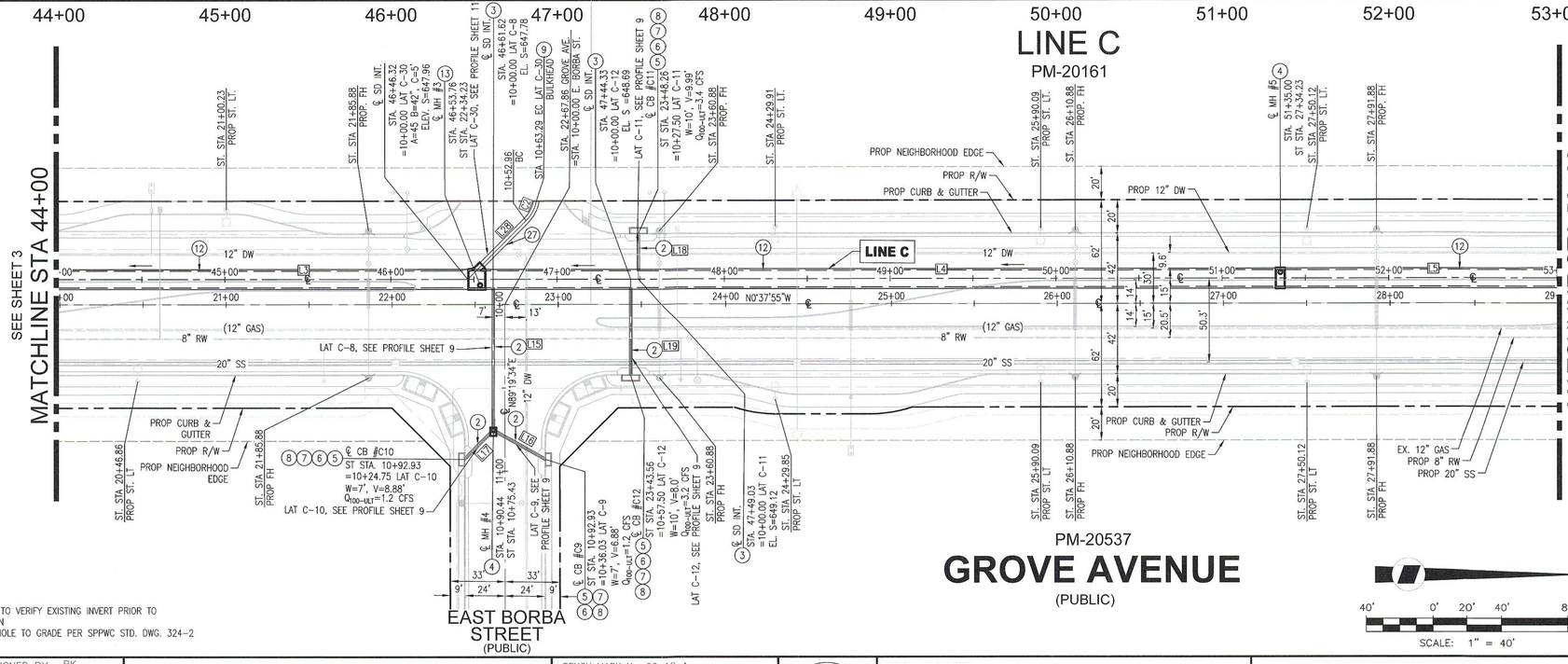


PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



CONSTRUCTION NOTES

(2) CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(3) CONSTRUCT JUNCTION STRUCTURE PER CITY OF ONTARIO STD. DWG. NO. 3010, CASE 1

(4) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003 & 3015, "W" AND "V" PER PLAN

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005

(7) CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017

(8) INSTALL ALMETEK PLACARD "NO DUMPING, DRAINS TO RIVER" OR EQUIVALENT

(9) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 9 ON SHEET 14

(12) CONSTRUCT 120" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(13) CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12

(27) CONSTRUCT 42" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

LINE TABLE		
LINE	DIRECTION	LENGTH
L3	N0°37'55"W	509.77'
L4	N0°37'55"W	476.07'
L5	N0°37'55"W	495.34'
L15	N89°19'34"E	83.94'
L16	N28°22'52"E	34.32'
L17	S45°40'26"E	22.62'
L18	S89°22'05"W	22.50'
L19	N89°22'05"E	52.50'
L28	N45°37'45"W	37.58'

Know what's below. Call 811 before you dig.

NOTE:
- CONTRACTOR TO VERIFY EXISTING INVERT PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/21/24

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
GROVE AVENUE
FROM 1000' NORTH OF MERRILL AVE. TO 1900' NORTH OF MERRILL AVE.

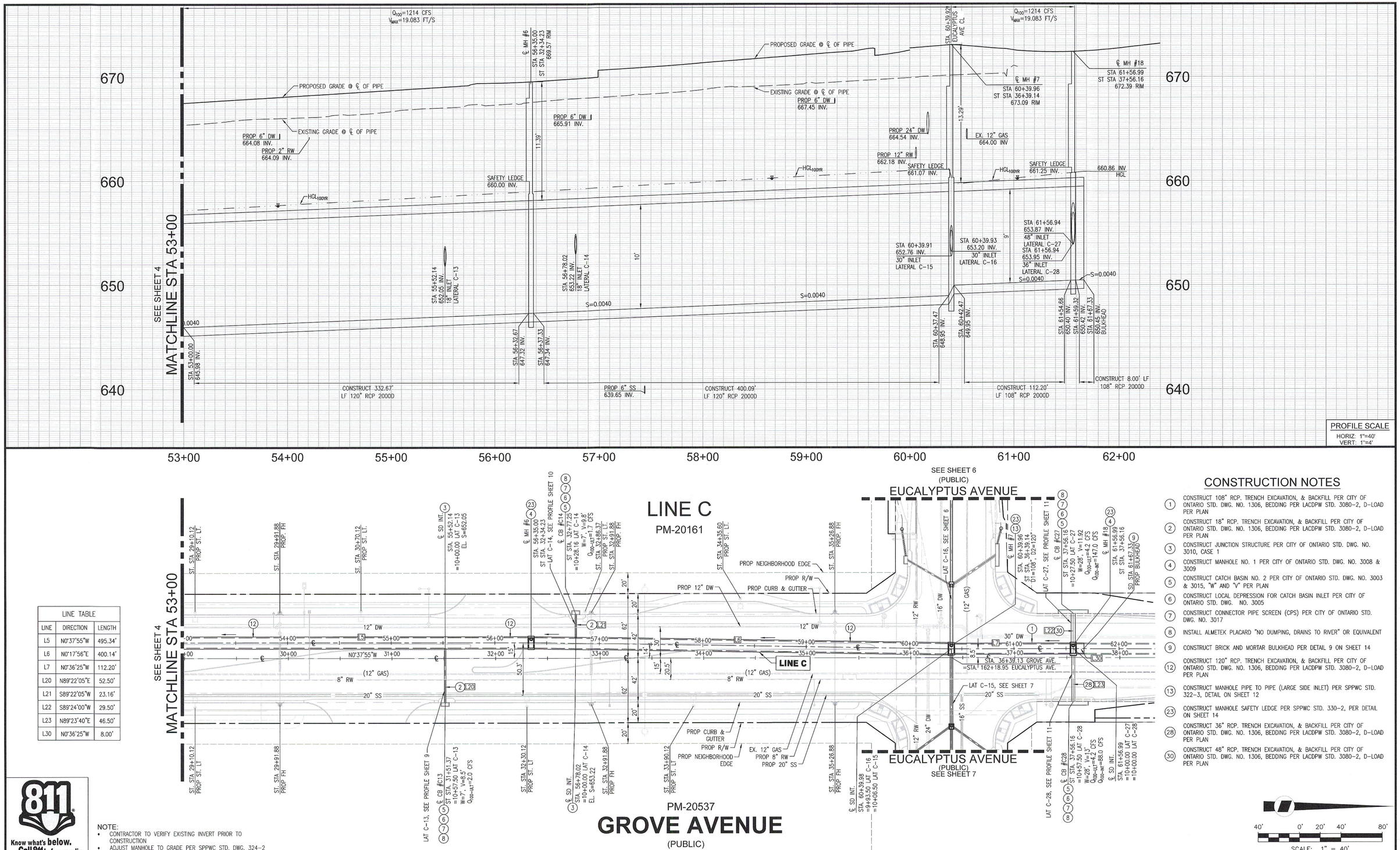
PM-20537

SHEET 4 OF 17
CONTRACT _____
ACCOUNT _____
DWG. NO. D.H025

01/08/2024

H1-545

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\03-06-2024_3725_2021-315.dwg
Last Updated: Jan 08, 2024 - 4:32pm by: Brent.King



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

LINE TABLE		
LINE	DIRECTION	LENGTH
L5	N0°37'55"W	495.34'
L6	N0°17'56"E	400.14'
L7	N0°36'25"W	112.20'
L20	N89°22'05"E	52.50'
L21	S89°24'00"W	23.16'
L22	S89°24'00"W	29.50'
L23	N89°23'40"E	46.50'
L30	N0°36'25"W	8.00'

CONSTRUCTION NOTES

1. CONSTRUCT 108" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
2. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
3. CONSTRUCT JUNCTION STRUCTURE PER CITY OF ONTARIO STD. DWG. NO. 3010, CASE 1
4. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009
5. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003 & 3015, "W" AND "V" PER PLAN
6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005
7. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
8. INSTALL ALMETEK PLACARD "NO DUMPING, DRAINS TO RIVER" OR EQUIVALENT
9. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 9 ON SHEET 14
12. CONSTRUCT 120" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
13. CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12
23. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. 330-2, PER DETAIL ON SHEET 14
28. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN
30. CONSTRUCT 48" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

811 Know what's below. Call 811 before you dig.

NOTE:
- CONTRACTOR TO VERIFY EXISTING INVERT PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

40' 0' 20' 40' 80'
SCALE: 1" = 40'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN LEE, P.E., ASSISTANT CITY ENGINEER — DATE 3/01/24

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
GROVE AVENUE
FROM 750' SOUTH OF EUCALYPTUS AVE. TO 130' NORTH OF EUCALYPTUS AVE.

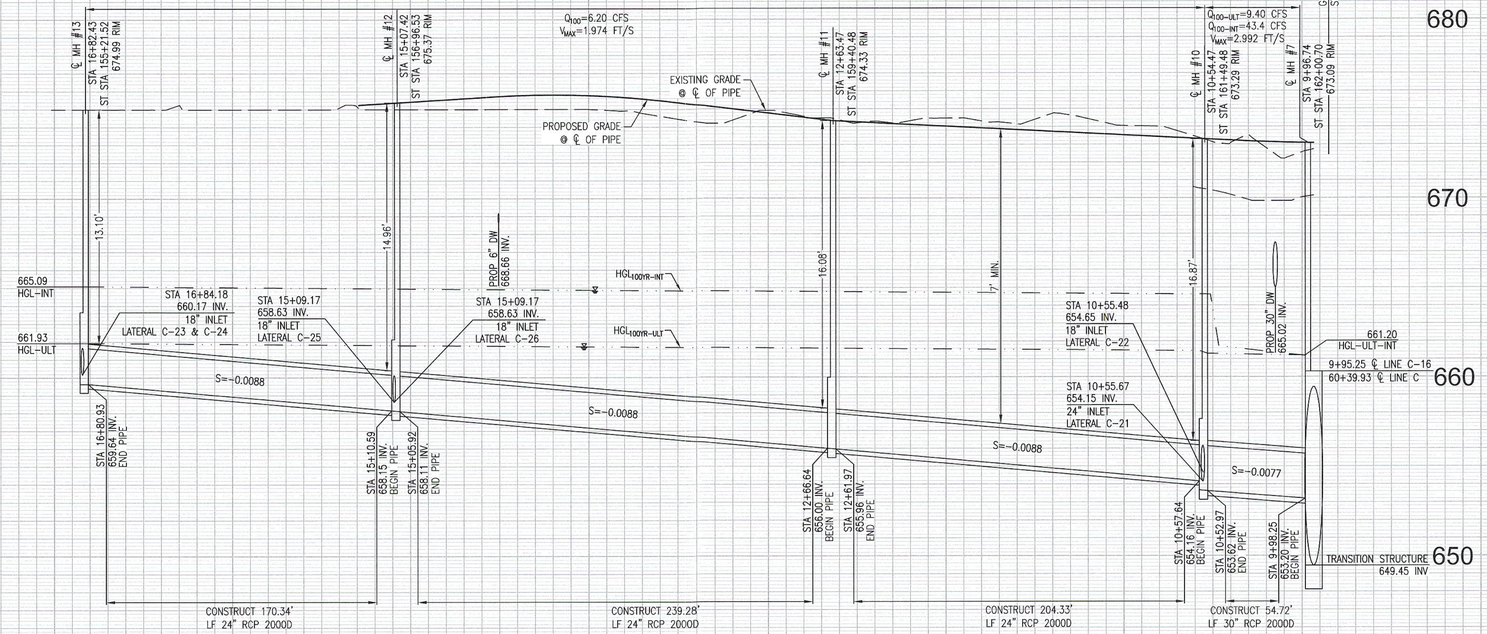
PM-20537

SHEET 5 OF 17
CONTRACT _____
ACCOUNT _____
DWG. NO. D14026

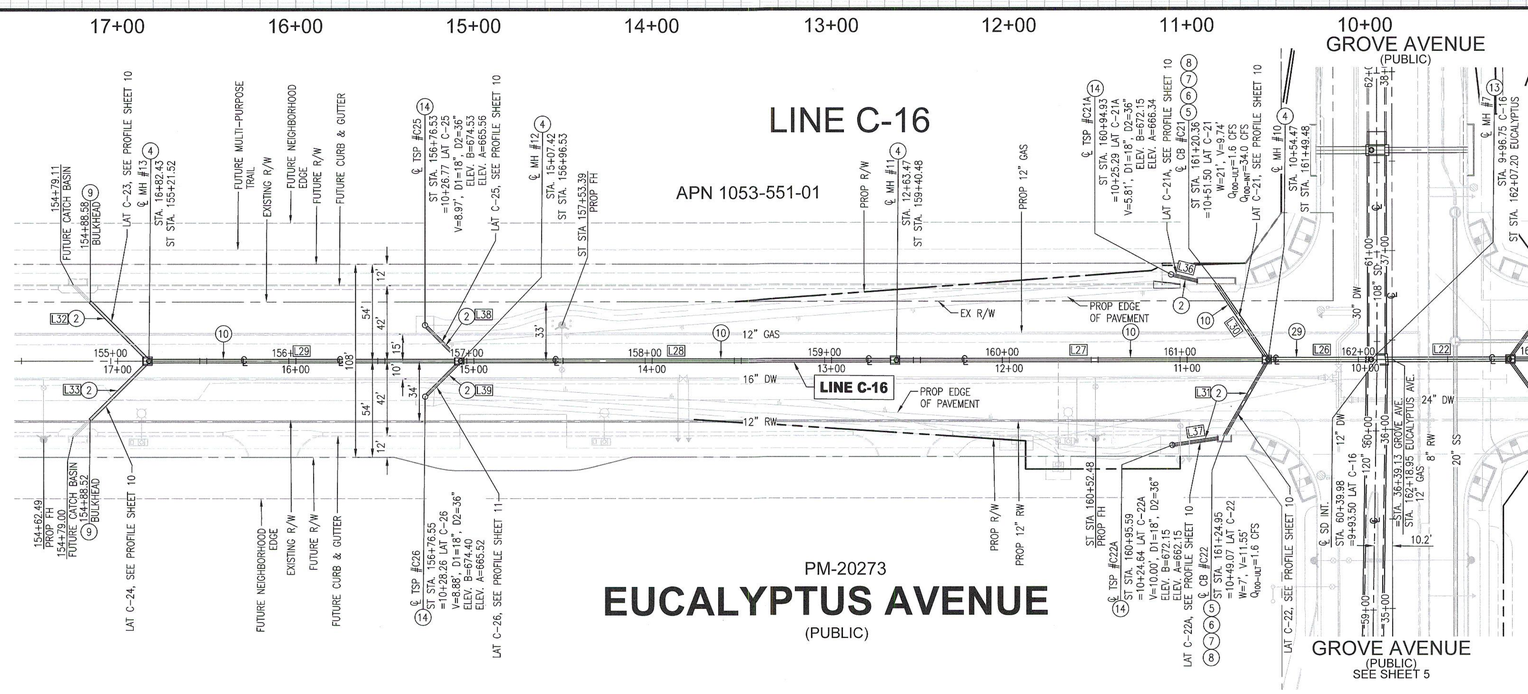
02/28/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 – Prologis – Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\08-28-2021-315_SD_GROVE.dwg
Last Opened: Feb 28, 2024 - 1:45pm by: Brent.King

H1-546



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



CONSTRUCTION NOTES

(2) CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(4) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003 & 3015, "W" AND "V" PER PLAN

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005

(7) CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017

(8) INSTALL ALMETEK PLACARD "NO DUMPING, DRAINS TO RIVER" OR EQUIVALENT

(9) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 9 ON SHEET 14

(10) CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(13) CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12

(14) CONSTRUCT 36" TEMPORARY CSP STANDPIPE (14 GAUGE) PER DETAIL 1 ON SHEET 12

(29) CONSTRUCT 30" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

LINE TABLE		
LINE	DIRECTION	LENGTH
L22	N89°22'23"E	67.56'
L26	S89°27'10"W	54.72'
L27	S89°27'10"W	204.33'
L28	S89°27'12"W	239.28'
L29	S89°27'12"W	170.34'
L30	N34°58'11"W	49.38'
L31	S29°26'27"W	47.05'
L32	N45°29'42"W	44.16'
L33	S44°27'10"W	44.19'
L36	S76°51'20"E	13.87'
L37	N81°15'17"E	24.64'
L38	S45°34'25"E	24.30'
L39	S44°25'41"W	24.28'

40' 0' 20' 40' 80'
SCALE: 1" = 40'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/4/24
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 3/14/24

STORM DRAIN IMPROVEMENT PLAN & PROFILE
EUCALYPTUS AVENUE
FROM GROVE AVE. TO 700' WEST OF GROVE AVE.

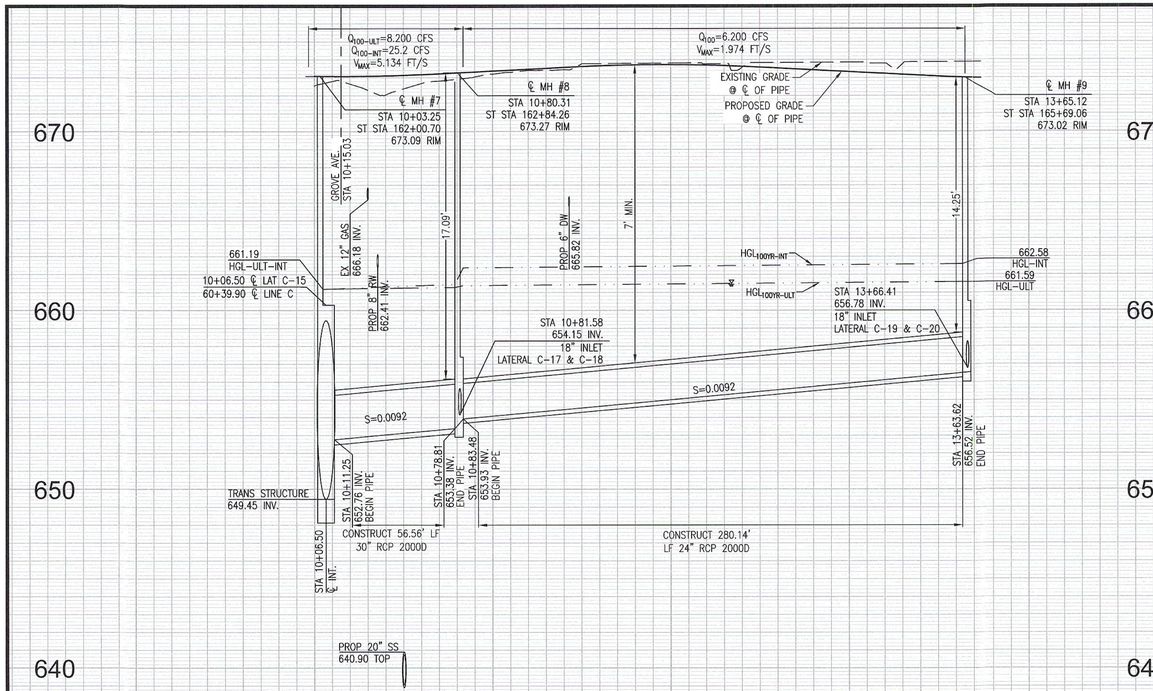
PM-20537

SHEET 6 OF 17
CONTRACT _____
ACCOUNT _____
DWG. NO. D14027

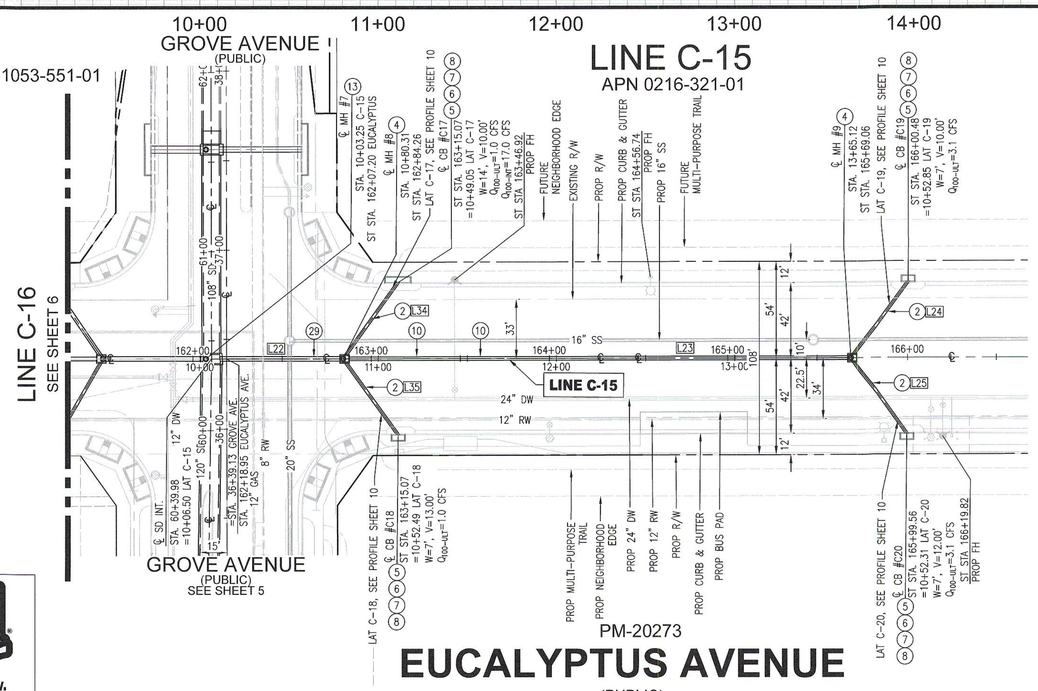
02/28/2024

H1-547

Drawing Name: P:\Yes_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pang\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN PLAN & PROFILE.dgn
Last Opened: Feb 28, 2024 - 1:52pm by: Brent.King



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



CONSTRUCTION NOTES

(2) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(4) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003 & 3015, "W" AND "V" PER PLAN

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005

(7) CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017

(8) INSTALL ALMETEK PLACARD "NO DUMPING, DRAINS TO RIVER" OR EQUIVALENT

(10) CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(13) CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12

(29) CONSTRUCT 30" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

LINE TABLE		
LINE	DIRECTION	LENGTH
L22	N89°22'23"E	67.56'
L23	N89°22'23"E	280.14'
L24	N35°50'45"E	50.67'
L25	S36°17'25"E	50.16'
L34	N35°18'47"E	50.33'
L35	S36°34'04"E	50.33'

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 3/21/24 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 3.21.24 DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF EOR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: Siara R. Mackinney — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
EUCALYPTUS AVENUE
FROM GROVE AVE. TO 400' EAST OF GROVE AVE.

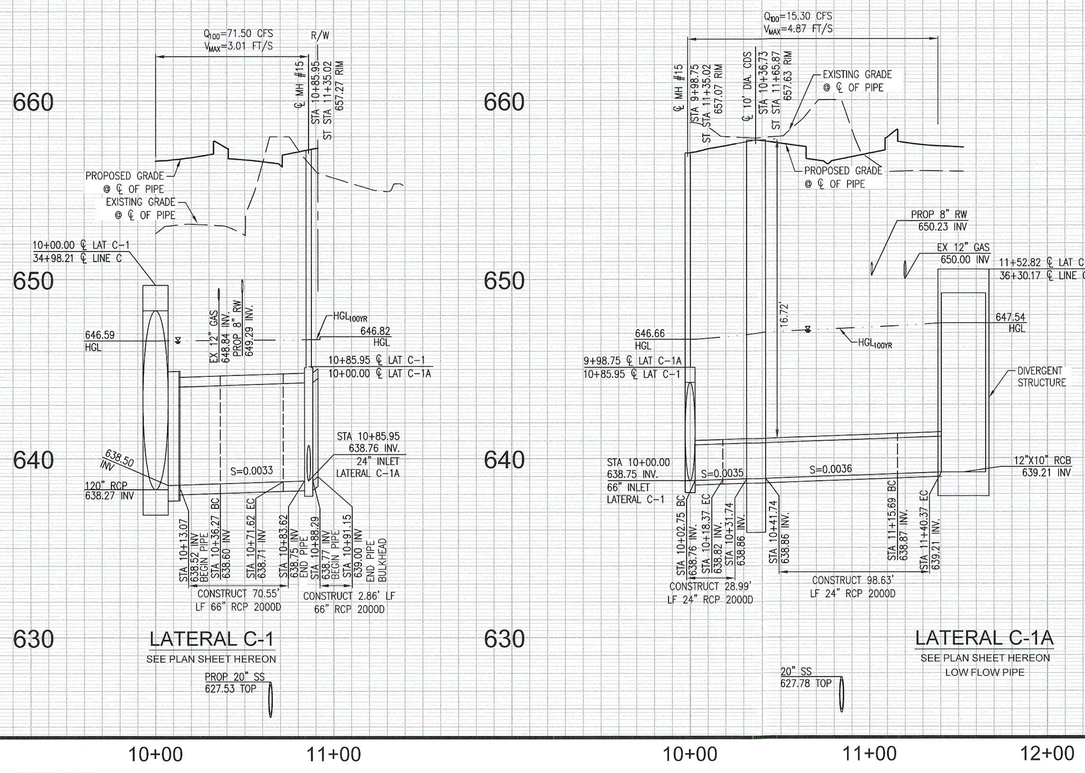
PM-20537

SHEET 7 OF 17
CONTRACT _____
ACCOUNT _____
DWG. NO. D14028

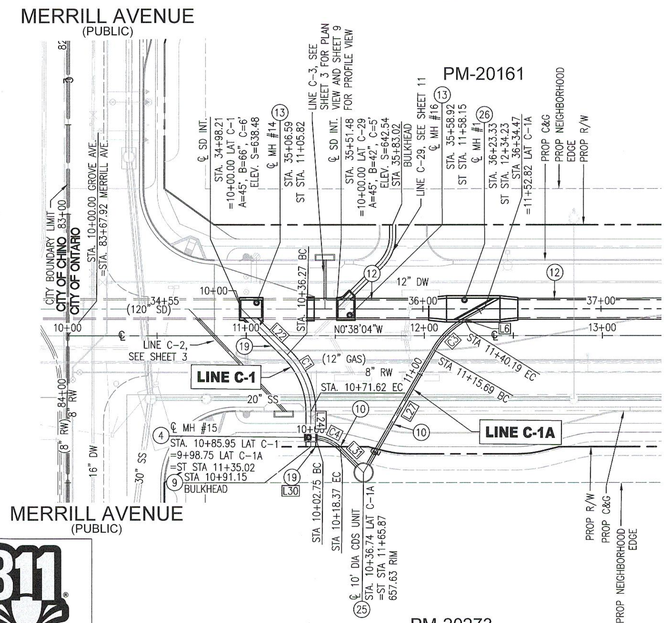
02/28/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\06_2021-315_SD_EUCA.dwg
Last Opened: Feb 26, 2024 - 10:59am by: Brent.King

H1-548



PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'



STORM DRAIN CENTERLINE DATA TABLE			
LINE/CURVE	BEARING/DELTA	LENGTH	RADIUS
C1	044°59'59"	35.34'	45.00
C3	031°11'24"	24.50'	45.00
C4	039°46'11"	15.62'	22.50
L6	S29°26'31"E	0.18'	
L22	N44°22'07"E	23.20'	
L24	N89°22'05"E	12.00'	
L27	S60°37'55"E	73.94'	
L30	N89°22'05"E	2.86'	
L31	S44°22'05"W	13.37'	

NOTE:
- CONTRACTOR TO VERIFY EXISTING INVERT PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

CONSTRUCTION NOTES

(4) CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. NO. 3008 & 3009

(9) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 9 ON SHEET 14

(10) CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(12) CONSTRUCT 120" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(13) CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER SPPWC STD. 322-3, DETAIL ON SHEET 12

(19) CONSTRUCT 66" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2, D-LOAD PER PLAN

(25) CONSTRUCT 10' DIA. CDS UNIT PER DETAIL, SHEET 14

(26) CONSTRUCT DIVERGENT STRUCTURE PER DETAIL ON SHEET 15

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRIAN TIRLEY, P.E., ASSISTANT CITY ENGINEER — 3/4/24 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 3-21-24 DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN & PROFILE
GROVE AVENUE
LATERALS C-1 & C-1A

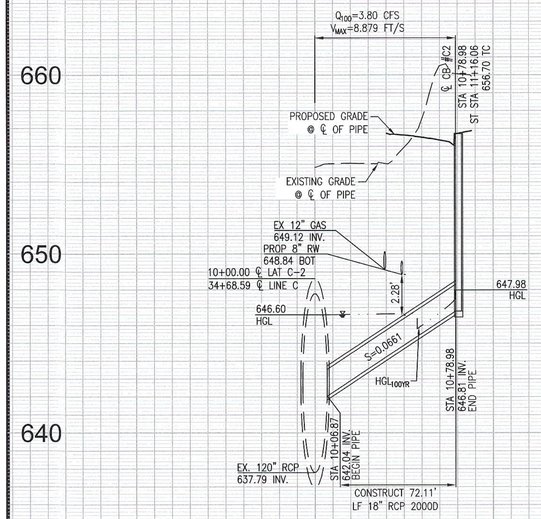
PM-20537

SHEET 8 OF 17
CONTRACT _____
ACCOUNT _____
DWG. NO. D14029

02/21/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\06-26-2023_GROVE.dwg
Last Updated: Feb 21, 2024 - 2:24pm by: Brent King

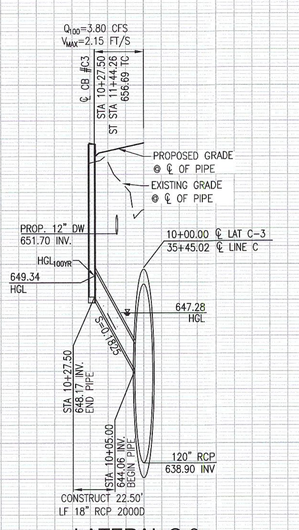
H1-549



LATERAL C-2

SEE PLAN SHEET 3

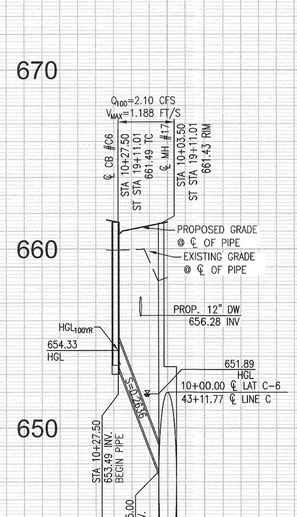
10+00



LATERAL C-3

SEE PLAN SHEET 3

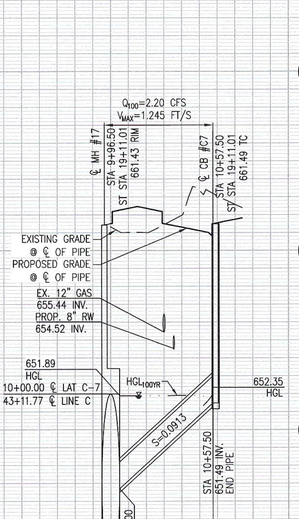
10+00



LATERAL C-6

SEE PLAN SHEET 3

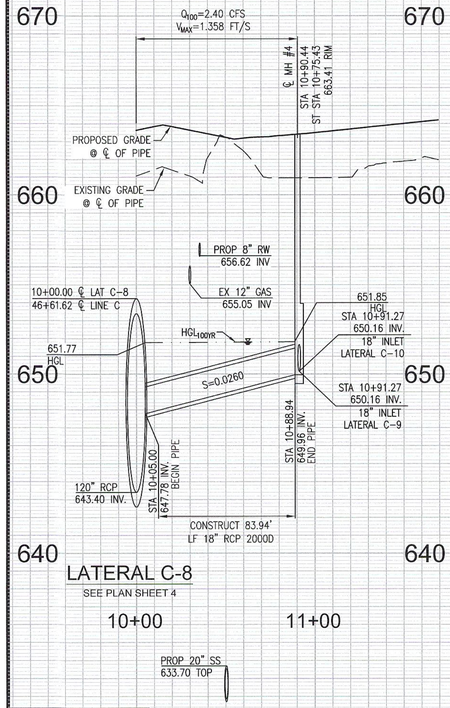
10+00



LATERAL C-7

SEE PLAN SHEET 3

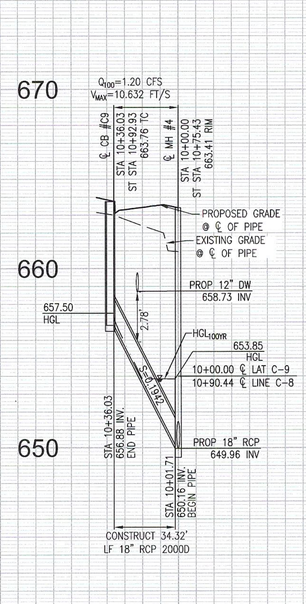
10+00



LATERAL C-8

SEE PLAN SHEET 4

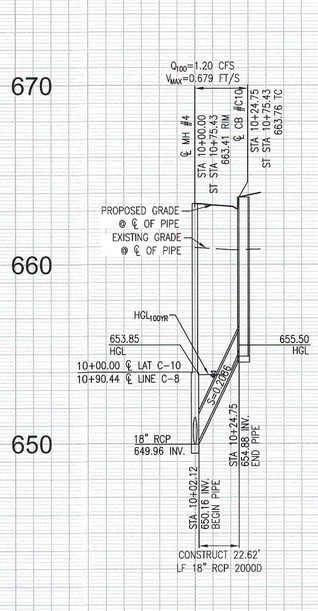
10+00 11+00



LATERAL C-9

SEE PLAN SHEET 4

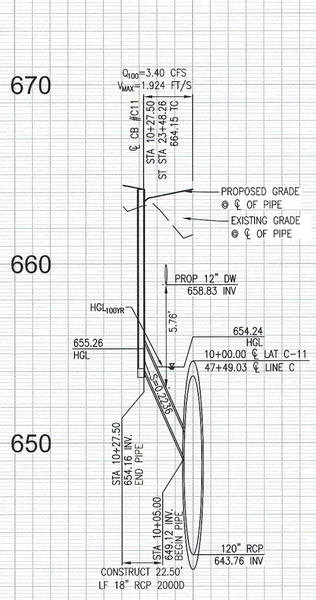
10+00



LATERAL C-10

SEE PLAN SHEET 4

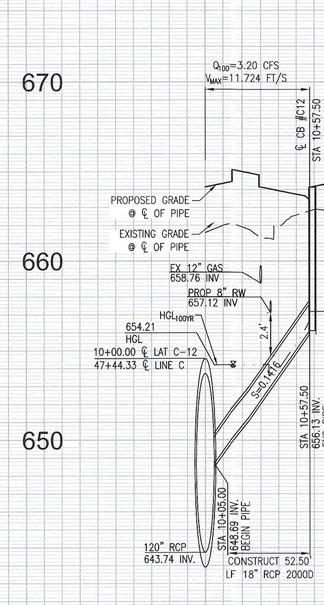
10+00



LATERAL C-11

SEE PLAN SHEET 4

10+00

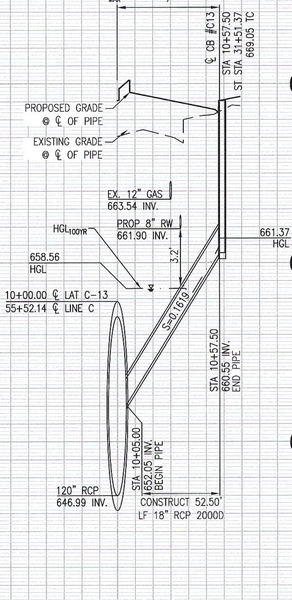


LATERAL C-12

SEE PLAN SHEET 4

10+00

PROP 20" SS
634.09 TOP



LATERAL C-13

SEE PLAN SHEET 5

10+00

PROP 20" SS
638.43 TOP

Know what's below. Call 811 before you dig.

PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY: SRM
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 8/31/24
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-8789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PROFILE

LATERAL PROFILES

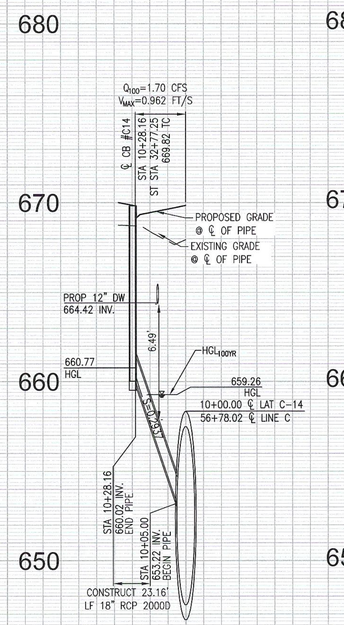
PM-20537

SHEET 9 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14030

02/21/2024

H1-550

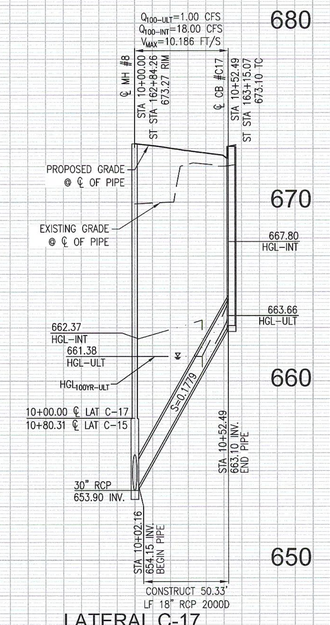
Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\09_2021-315_SD_LATPROF.dwg
Last Opened: Feb 21, 2024 - 3:14pm by: Brent.King



LATERAL C-14

SEE PLAN SHEET 5

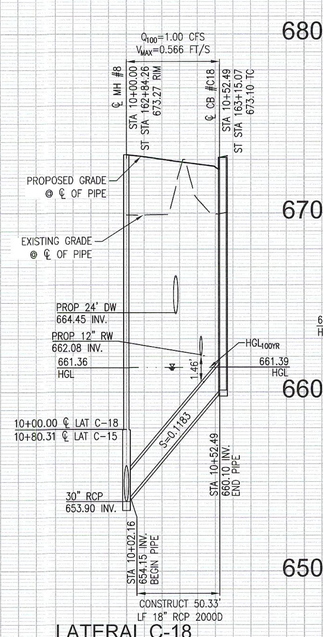
10+00



LATERAL C-17

SEE PLAN SHEET 7

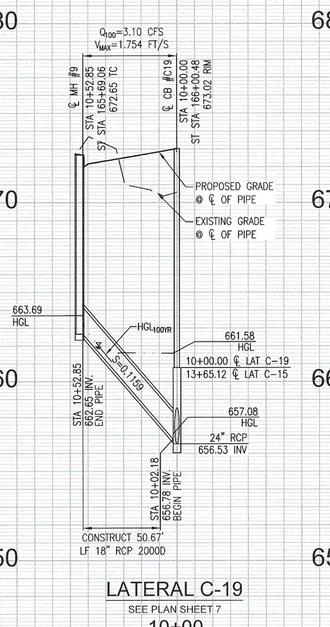
10+00



LATERAL C-18

SEE PLAN SHEET 7

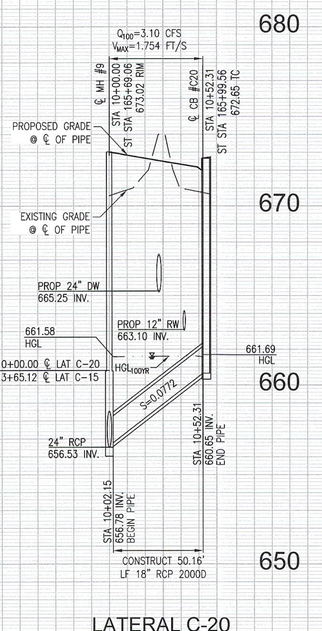
10+00



LATERAL C-19

SEE PLAN SHEET 7

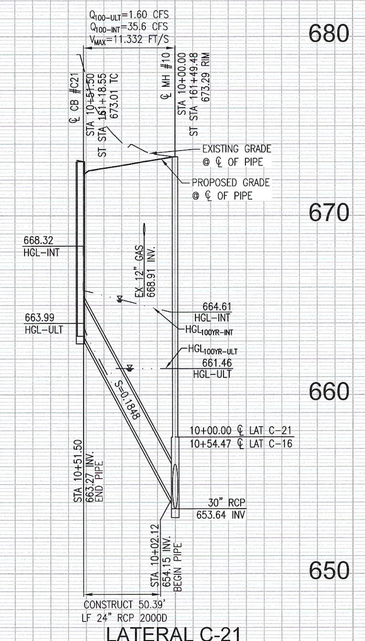
10+00



LATERAL C-20

SEE PLAN SHEET 7

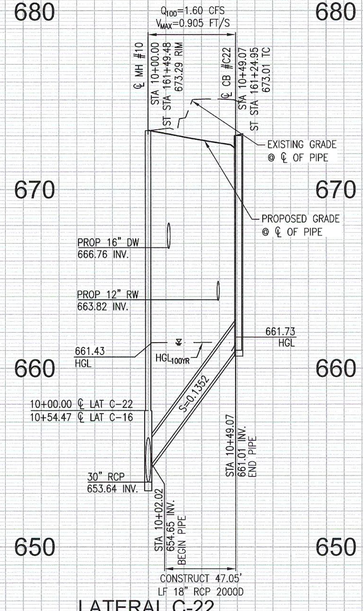
10+00



LATERAL C-21

SEE PLAN SHEET 6

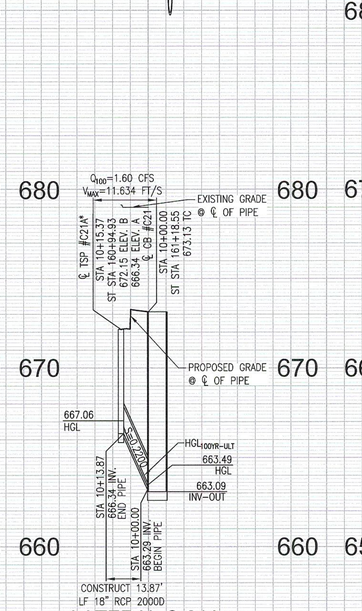
10+00



LATERAL C-22

SEE PLAN SHEET 6

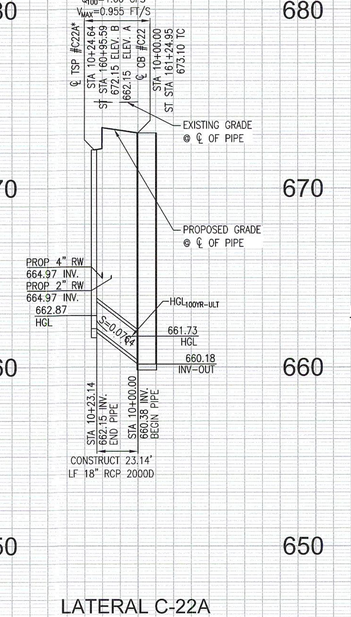
10+00



LATERAL C-21A

SEE PLAN SHEET 6

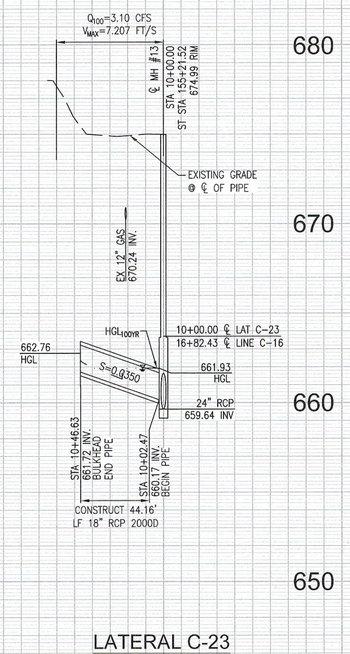
10+00



LATERAL C-22A

SEE PLAN SHEET 6

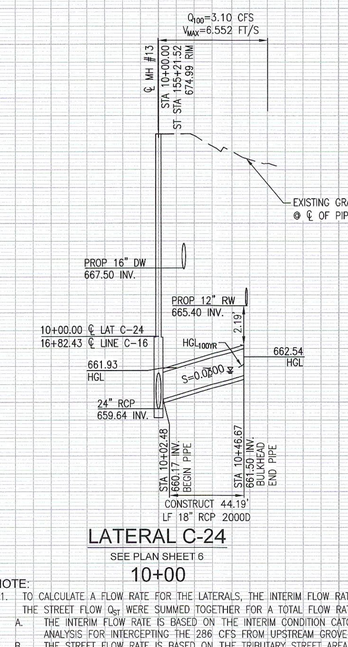
10+00



LATERAL C-23

SEE PLAN SHEET 6

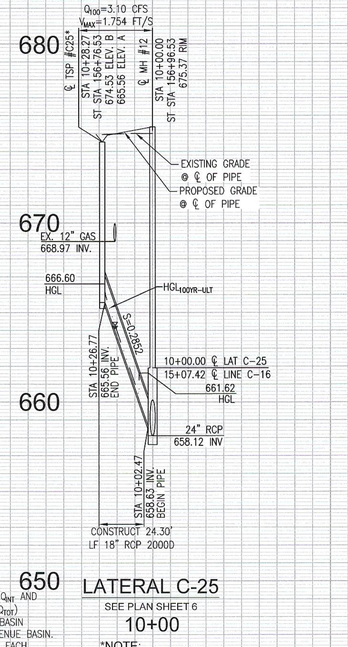
10+00



LATERAL C-24

SEE PLAN SHEET 6

10+00



LATERAL C-25

SEE PLAN SHEET 6

10+00

NOTE:

1. TO CALCULATE A FLOW RATE FOR THE LATERALS, THE INTERIM FLOW RATE (Q_{INT} AND THE STREET FLOW Q_{ST} WERE SUMMED TOGETHER FOR A TOTAL FLOW RATE (Q_{TOT})
   A. THE INTERIM FLOW RATE IS BASED ON THE INTERIM CONDITION CATCH BASIN ANALYSIS FOR INTERCEPTING THE 286 CFS FROM UPSTREAM GROVE AVENUE BASIN.
   B. THE STREET FLOW RATE IS BASED ON THE TRIBUTARY STREET AREA TO EACH CATCH BASIN, AS CALCULATED IN THE MCC GROVE AVENUE REPORT. USING A SUM OF THE INTERIM FLOW RATE AND STREET FLOW RATE PROVIDES A CONSERVATIVE ANALYSIS FOR THE STORM DRAIN SYSTEM.

*NOTE:
RISER IS TEMPORARY AND ONLY INTENDED TO BE USED FOR DEWATERING IN THE INTERIM CONDITION.

PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY: SRM
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/21/24

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
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REGISTERED PROFESSIONAL ENGINEER — No. 85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: Siara R. MacKinney — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PROFILE

LATERAL PROFILES

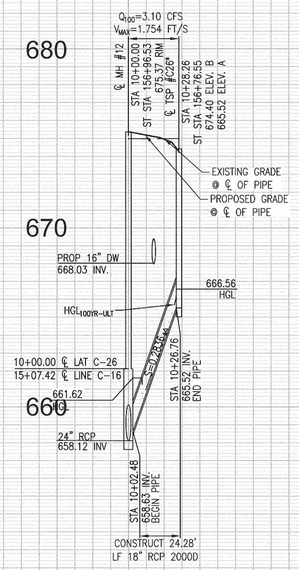
PM-20537

SHEET 10 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14031

02/28/2024

H1-551

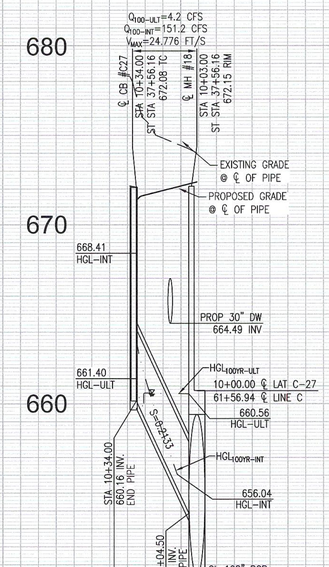
Drawing Name: P:\Yes-2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pang\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN LATERALS.dwg
Last Opened: Feb 28, 2024 - 10:47am by: Brent.King



LATERAL C-26

SEE PLAN SHEET 6

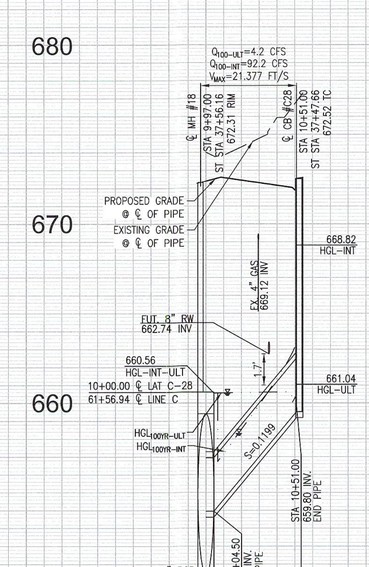
10+00



LATERAL C-27

SEE PLAN SHEET 5

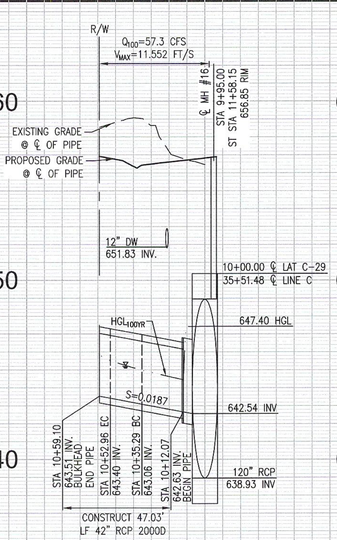
10+00



LATERAL C-28

SEE PLAN SHEET 5

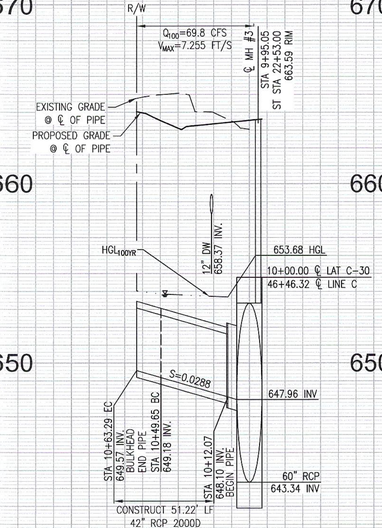
10+00



LATERAL C-29

SEE PLAN SHEET 3

10+00



LATERAL C-30

SEE PLAN SHEET 4

10+00

*NOTE:
RISER IS TEMPORARY AND ONLY INTENDED TO BE USED FOR DEWATERING IN THE INTERIM CONDITION.

NOTE:
1. TO CALCULATE A FLOW RATE FOR THE LATERALS, THE INTERIM FLOW RATE (Q_{INT} AND THE STREET FLOW Q_{ST} WERE SUMMED TOGETHER FOR A TOTAL FLOW RATE Q_{TOT})
   A. THE INTERIM FLOW RATE IS BASED ON THE INTERIM CONDITION CATCH BASIN ANALYSIS FOR INTERCEPTING THE 286 CFS FROM UPSTREAM GROVE AVENUE BASIN.
   B. THE STREET FLOW RATE IS BASED ON THE TRIBUTARY STREET AREA TO EACH CATCH BASIN, AS CALCULATED IN THE MCC GROVE AVENUE REPORT. USING A SUM OF THE INTERIM FLOW RATE AND STREET FLOW RATE PROVIDES A CONSERVATIVE ANALYSIS FOR THE STORM DRAIN SYSTEM.

PROFILE SCALE
HORIZ: 1"=40'
VERT: 1"=4'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY: SRM
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN JARLES, P.E., ASSISTANT CITY ENGINEER — DATE 3/14/24
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — R.C.E. NO. 85559 — DATE 3/14/24

STORM DRAIN IMPROVEMENT PROFILE

LATERAL PROFILES

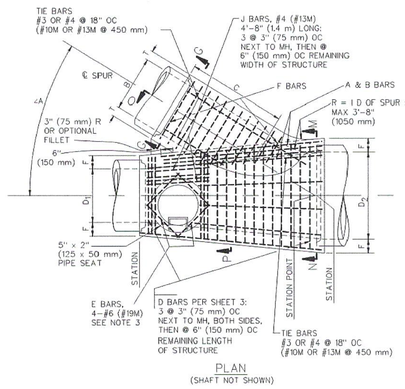
PM-20537

SHEET 11 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14082

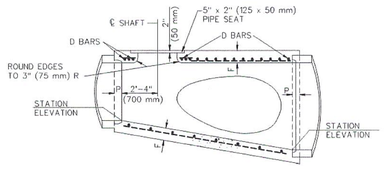
02/28/2024

H1-552

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN_09_2021-315_LATPROF.dwg
Last Opened: Feb 28, 2024 - 10:06am by: BrentKing



PLAN
(SHAFT NOT SHOWN)



LONGITUDINAL SECTION

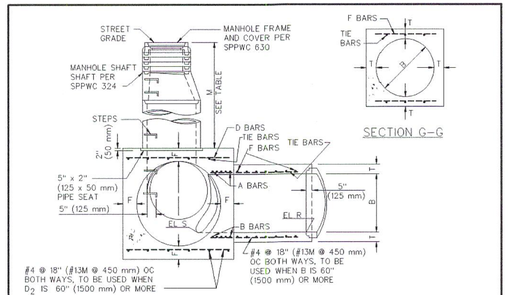
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY: THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE
REV.: 1998, 2006, 2021

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

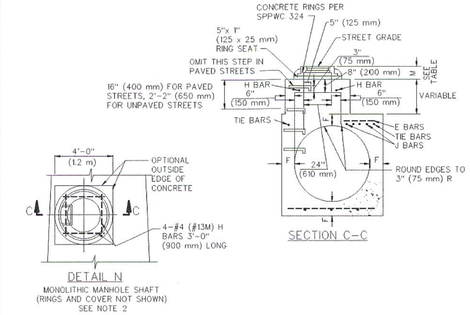
USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 322-3
SHEET 1 OF 4



SECTION N-M-P-O

SECTION G-G



SECTION C-C

DETAIL N
MONOLITHIC MANHOLE SHAFT (RINGS AND COVER NOT SHOWN) SEE NOTE 2

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

STANDARD PLAN 322-3
SHEET 2 OF 4

TABLE OF BAR SIZES		
D2 OR B	A & B	D OR F
12"–39" (300 – 975 mm)	#5 @ 3" (#16M @ 75 mm)	#4 @ 6" (#13M @ 150 mm)
42"–84" (1050 – 2100 mm)	#6 @ 3" (#19M @ 75 mm)	#5 @ 6" (#16M @ 150 mm)
90"–144" (2250 – 3600 mm)	#7 @ 3" (#22M @ 75 mm)	#6 @ 6" (#19M @ 150 mm)

TABLE OF VALUES FOR M (SEE NOTE 2)				
SECTION	PAVED STREET		UNPAVED STREET	
	MAX	MIN	MAX	MIN
N-M-P-O		2' 10-1/2" (867 mm)		1060 mm (3'-6")
C-C	11" (282 mm)	8-1/2" (217 mm)	16" (410 mm)	15" (380 mm)

TABLE OF VALUES FOR F	
D2	F
36" (900 mm)	6-1/2" (165 mm)
39" (975 mm)	7" (180 mm)
42" (1050 mm)	7-1/2" (190 mm)
45" (1125 mm)	7-3/4" (195 mm)
48" (1200 mm)	8" (205 mm)
51" (1275 mm)	8-1/2" (215 mm)
54" (1350 mm)	9" (230 mm)
57" (1425 mm)	9-1/4" (235 mm)
60" (1500 mm)	9-1/2" (240 mm)
63" (1575 mm)	10" (255 mm)
66" (1650 mm)	10-1/4" (260 mm)
69" (1725 mm)	10-3/4" (275 mm)
72" (1800 mm)	11" (280 mm)
78" (1950 mm)	11-3/4" (300 mm)
84" (2100 mm)	12-1/2" (320 mm)
90" (2250 mm)	13-1/4" (335 mm)
96" (2400 mm)	14" (355 mm)
102" (2550 mm)	15-1/2" (395 mm)
108" (2700 mm)	16" (405 mm)
114" (2850 mm)	16-1/2" (420 mm)
120" (3000 mm)	17" (430 mm)
126" (3150 mm)	17" (430 mm)
132" (3300 mm)	17-1/2" (445 mm)
138" (3450 mm)	17-1/2" (445 mm)
144" (3600 mm)	18" (455 mm)

TABLE OF VALUES FOR T	
B	T
12" (300 mm)	4" (100 mm)
15" (375 mm)	4-1/4" (110 mm)
18" (450 mm)	4-1/2" (115 mm)
21" (525 mm)	5" (125 mm)
24" (600 mm)	5-1/4" (135 mm)
27" (675 mm)	5-1/2" (140 mm)
30" (750 mm)	6" (150 mm)
33" (825 mm)	6-1/4" (160 mm)
36" (900 mm)	6-1/2" (165 mm)
39" (975 mm)	7" (180 mm)
42" (1050 mm)	7-1/2" (190 mm)
45" (1125 mm)	7-3/4" (195 mm)
48" (1200 mm)	8" (205 mm)
51" (1275 mm)	8-1/2" (215 mm)
54" (1350 mm)	9" (230 mm)
57" (1425 mm)	9-1/4" (235 mm)
60" (1500 mm)	9-1/2" (240 mm)
63" (1575 mm)	10" (255 mm)
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72" (1800 mm)	11" (280 mm)
78" (1950 mm)	11-3/4" (300 mm)
84" (2100 mm)	12-1/2" (320 mm)
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96" (2400 mm)	14" (355 mm)
102" (2550 mm)	15-1/2" (395 mm)
108" (2700 mm)	16" (405 mm)
114" (2850 mm)	16-1/2" (420 mm)
120" (3000 mm)	17" (430 mm)
126" (3150 mm)	17" (430 mm)
132" (3300 mm)	17-1/2" (445 mm)
138" (3450 mm)	17-1/2" (445 mm)
144" (3600 mm)	18" (455 mm)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

STANDARD PLAN 322-3
SHEET 3 OF 4

NOTES

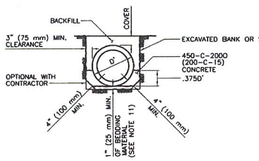
1. VALUES FOR A, B, C, D1, D2, ELEVATION R AND ELEVATION S ARE SHOWN ON THE PLANS. ELEVATION S APPLIES AT INSIDE WALL OF STRUCTURE.
2. WHEN DEPTH M FROM STREET GRADE TO THE TOP OF THE BOX IS LESS THAN 2'-10 1/2" (867 mm) FOR PAVED STREETS OR 3'-6" (1060 mm) FOR UNPAVED STREETS, CONSTRUCT MONOLITHIC SHAFT PER SECTION C–C AND DETAIL "N". SHAFT FOR ANY DEPTH OF MANHOLE MAY BE CONSTRUCTED PER SECTION C–C. WHEN DIAMETER D1 IS 48" (1200 mm) OR LESS, CENTER OF SHAFT MAY BE LOCATED PER NOTE 3.
3. CENTER OF MANHOLE SHAFT SHALL BE LOCATED OVER CENTERLINE OF STORM DRAIN WHEN DIAMETER D1 IS 48" (1200 mm) OR LESS, IN WHICH CASE PLACE E BARS SYMMETRICALLY AROUND SHAFT AT 45° WITH CENTERLINE.
4. LENGTH OF MANHOLE MAY BE INCREASED AT OPTION TO MEET PIPE ENDS, BUT ANY CHANGE IN LOCATION F SPUR MUST BE APPROVED BY THE ENGINEER.
5. P SHALL BE 5" (125 mm) FOR D2=96" (2400 mm) OR LESS AND 8" (200 mm) FOR D2 OVER 96" (2400 mm).
6. REINFORCEMENT SHALL CONFORM TO ASTM A 615M, GRADE 300 (ASTM A 615, GRADE 40), AND SHALL TERMINATE 1–1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN.
7. FLOOR OF MANHOLE SHALL BE STEEL–TROWLED TO SPRING LINE.
8. BODY OF MANHOLE SHALL BE POURED IN ONE CONTINUOUS OPERATION EXCEPT THAT A CONSTRUCTION JOINT WITH A LONGITUDINAL KEYWAY MAY BE PLACED AT SPRING LINE.
9. THICKNESS OF THE DECK SHALL VARY WHEN NECESSARY TO PROVIDE A LEVEL SEAT BUT SHALL NOT BE LESS THAN THE TABULAR VALUES OF F SHOWN ON TABLE, SHEET 1.
10. IF LATERALS ENTER ON BOTH SIDES OF MANHOLE, SHAFT SHALL BE LOCATED ON SIDE RECEIVING THE SMALLER LATERAL.
11. STEPS SHALL CONFORM TO SPPWC 635 OR 636, UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" TO 15" (350 TO 375 mm) OC. THE LOWEST STEP SHALL NOT BE MORE THAN 24" (600 mm) ABOVE THE INVERT.
12. THE FOLLOWING CRITERIA SHALL BE USED FOR THIS MANHOLE:
    - o THIS STANDARD PLAN IS USED WHEN SPPWC 320 IS INADEQUATE.
    - o MAIN LINE = 900 mm (36") INSIDE DIAMETER OR LARGER.
    - o LATERAL = 300 mm (12") TO 3600 mm (144") INSIDE DIAMETER; HOWEVER, THE INSIDE DIAMETER SHALL NOT EXCEED THE INSIDE DIAMETER OF THE MAIN LINE.
13. MANHOLE FRAME AND COVER SHALL CONFORM TO SPPWC 630 UNLESS OTHERWISE SHOWN.
14. MANHOLE SHAFT SHALL CONFORM TO SPPWC 324 UNLESS OTHERWISE SHOWN.
15. WHERE A MANHOLE SHAFT – 900 mm (36") WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 326.
16. WHERE A PRESSURE MANHOLE SHAFT – WITH ECCENTRIC REDUCER IS SPECIFIED REFER TO SPPWC 328.
17. WHERE A PRESSURE MANHOLE SHAFT – 914 mm (36") WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 329.
18. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:

324	MANHOLE SHAFT – WITH ECCENTRIC REDUCER
326	MANHOLE SHAFT – 900 mm (36") WITHOUT REDUCER
328	PRESSURE MANHOLE SHAFT – WITH ECCENTRIC REDUCER
329	PRESSURE MANHOLE SHAFT – 914 mm (36") WITHOUT REDUCER
630	610 mm (24") MANHOLE FRAME AND COVER
633	914 mm (36") MANHOLE FRAME AND COVER
635	STEEL STEP
636	POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

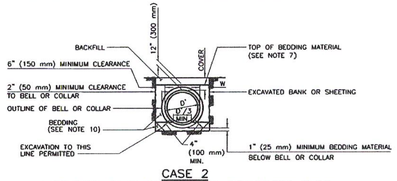
MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

STANDARD PLAN 322-3
SHEET 4 OF 4



CASE 1

NOTE:
CASE 1 BEDDING (LOAD FACTOR 2.1) SHALL BE USED WHERE SPECIFIED ON THE PLANS OR WHERE REQUIRED AS AN ALTERNATIVE TO CASE 2 OR CASE 3 BEDDING AS PROVIDED HEREON AND ON SH. 2. CASE 4 BEDDING SHALL BE USED INSTEAD OF CASE 1 AGAINST SHEETING OR UNSTABLE TRENCH SIDES IF SO REQUIRED BY THE ENGINEER.



CASE 2
VITRIFIED CLAY AND PLAIN CONCRETE PIPE

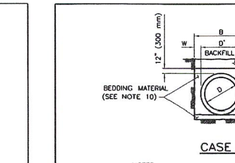
NOTES:
CASE 2 BEDDING & BACKFILL AROUND PIPE (LOAD FACTOR 1.8)
(a) W AT SPRING LINE SHALL NOT BE LESS THAN 6" (150 mm) FOR ANY DEPTH OF TRENCH. THIS DIMENSION MAY INCLUDE THE THICKNESS OF ANY SHEETING.
(b) WHERE COVER IS GREATER THAN 8'-0" (2.5 m), W MEASURED AT TOP OF PIPE SHALL NOT BE GREATER THAN 8" (200 mm) UNLESS THE CONTRACTOR AT ITS OWN EXPENSE PROVIDES CASE 1 BEDDING OR STRONGER PIPE. THE STATED 8" (200 mm) INCLUDES THE THICKNESS OF ANY SHEETING.
(c) SCREED BEDDING MATERIAL TO FIT CURVATURE AND GRADE OF PIPE. TYPE OF SCREED AND THE METHOD OF USE TO BE APPROVED BY THE ENGINEER.

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

PIPE BEDDING IN TRENCHES

APPROVED Thomas P. Rubinsky 5/31/1992
DIRECTOR OF PUBLIC WORKS — DATE
1995, 1999, 2007 — REVISIONS

STANDARD PLAN 3080-3
SHEET 1 OF 3



CASE 6

NOTES:
CASE 6 BEDDING (LOAD FACTOR 1.5)
(a) NOTES (a), (b), AND (c) FROM CASE 3 SHALL APPLY.
(b) WHERE SUBGRADE IS COMPOSED OF OTHER THAN GRANULAR OR SANDY MATERIAL, THE TRENCH SHALL BE EXCAVATED TO DEPTH OF AT LEAST 3" (75 mm) BELOW THE PIPE AND BACKFILLED WITH BEDDING MATERIAL OR OTHER MATERIALS AS MAY BE SPECIFIED OR OTHERWISE APPROVED BY THE AGENCY.

NOTES

1. USE CASE 3 FOR RCP, CASE 2 FOR VITRIFIED CLAY, AND PLAIN CONCRETE PIPE UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE PLANS. SEE PLANS FOR BEDDING DETAILS FOR PIPE OF OTHER MATERIALS.
2. BEDDING MATERIAL SHALL CONFORM TO TABLE 3080-3.1

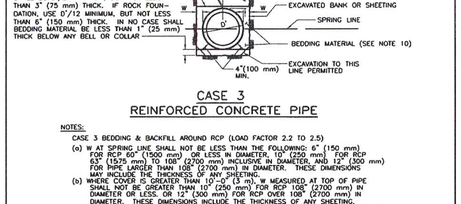
TABLE 3080-3.1	
PARTICLE SIZE (MAX.)	3/4"
% PASSING NO. 4 SIEVE (MIN.)	50
% PASSING NO. 16 SIEVE (MIN.)	15
SAND EQUIVALENT (MIN.)	20

3. CONCRETE BACKFILL SHALL BE POURED FROM WALL TO WALL OF THE TRENCH AND FROM THE BOTTOM OF THE TRENCH TO A MINIMUM DEPTH OF 4" (100 mm) OVER THE TOP OF THE PIPE.
4. CONCRETE BACKFILL SHALL BE PROVIDED FOR RCP 21" (525 mm) IN DIAMETER OR LESS WHERE THE COVER IS EQUAL TO OR LESS THAN 24" (600 mm), FOR RCP GREATER THAN 21" (525 mm) IN DIAMETER BUT LESS THAN 39" (975 mm) WHERE THE COVER IS LESS THAN 15" (375 mm) AND FOR RCP 39" (975 mm) OR GREATER WHERE THE COVER IS LESS THAN 12" (300 mm). CONCRETE BACKFILL SHALL CONFORM TO NOTE 3.
5. 3-EDGE BEARING TEST LOAD FACTOR (D-LOAD) = 1.0.
6. DIMENSIONS SHOWN ON THIS STANDARD PLAN FOR ENGLISH AND METRIC UNITS ARE NOT EQUIVALENT. IF METRIC UNITS ARE USED, ALL UNITS SHALL BE METRIC, IF ENGLISH UNITS ARE USED, ALL UNITS SHALL BE ENGLISH.
7. TOP OF BEDDING MATERIAL AS SHOWN, UNLESS OTHERWISE SHOWN ON THE PLANS OR SPECIFIED IN THE SPECIAL PROVISIONS.
8. D–LOADS FOR RCP TO BE PLACED IN ACCORDANCE WITH THIS STANDARD PLAN MUST BE DESIGNED FOR AN EMBANKMENT CONDITION, EVEN WHEN PLACED IN A TRENCH.
9. FOR WORK WITHIN THE JURISDICTION OF THE U.S. ARMY CORPS OF ENGINEERS, REFER TO PERMIT REQUIREMENTS.
10. BEDDING MATERIAL BELOW THE PIPE SHALL BE LOOSELY PLACED TO AVOID STRESS CONCENTRATIONS AT THE BOTTOM OF THE PIPE. BEDDING MATERIAL BELOW THE SPRING LINE, UNLESS CONCRETE, SHALL BE COMPACTED AFTER PLACEMENT OF THE PIPE.

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

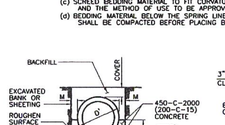
PIPE BEDDING IN TRENCHES

STANDARD PLAN 3080-3
SHEET 3 OF 3



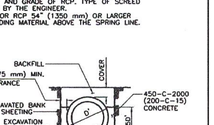
CASE 3
REINFORCED CONCRETE PIPE

NOTES:
CASE 3 BEDDING & BACKFILL AROUND RCP (LOAD FACTOR 2.2 TO 2.5)
(a) W AT SPRING LINE SHALL NOT BE LESS THAN THE FOLLOWING: 6" (150 mm) FOR RCP 60" (1500 mm) OR LESS IN DIAMETER, 10" (250 mm) FOR RCP 63" (1575 mm) TO 108" (2700 mm) INCLUSIVE IN DIAMETER, AND 12" (300 mm) FOR PIPE LARGER THAN 108" (2700 mm) IN DIAMETER. THESE DIMENSIONS MAY INCLUDE THE THICKNESS OF ANY SHEETING.
(b) WHERE COVER IS GREATER THAN 10'-0" (3 m), W MEASURED AT TOP OF PIPE SHALL NOT BE GREATER THAN 12" (250 mm) FOR RCP 60" (1500 mm) OR LESS IN DIAMETER, 16" (400 mm) FOR RCP 63" (1575 mm) TO 108" (2700 mm) IN DIAMETER. THESE DIMENSIONS INCLUDE THE THICKNESS OF ANY SHEETING.
(c) SCREED BEDDING MATERIAL TO FIT CURVATURE AND GRADE OF RCP. TYPE OF SCREED AND THE METHOD OF USE TO BE APPROVED BY THE ENGINEER.
(d) BEDDING MATERIAL BELOW THE SPRING LINE FOR RCP 54" (1350 mm) OR LARGER SHALL BE COMPACTED BEFORE PLACING BEDDING MATERIAL ABOVE THE SPRING LINE.



CASE 4

NOTE:
CASE 4 BEDDING (LOAD FACTOR 3.0) WHERE REQUIRED BY THE ENGINEER AS AN ALTERNATIVE TO CASE 1 OR CASE 5 TO MEET CONDITIONS ARISING DURING CONSTRUCTION.



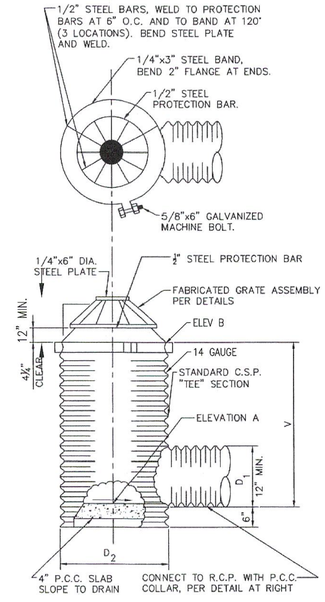
CASE 5

NOTE:
CASE 5 BEDDING (LOAD FACTOR 2.7) SHALL BE USED WHERE SPECIFIED ON THE PLANS. CASE 4 BEDDING SHALL BE USED INSTEAD OF CASE 5 AGAINST SHEETING OR UNSTABLE TRENCH WALLS IF SO REQUIRED BY THE ENGINEER.

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

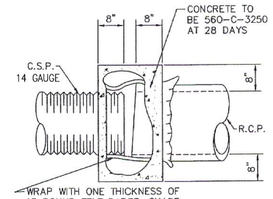
PIPE BEDDING IN TRENCHES

STANDARD PLAN 3080-3
SHEET 2 OF 3



NOTES:

1. V, D_1, D_2 AND ELEVATION "A" SHALL BE SHOWN ON THE CONSTRUCTION PLANS.
2. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT C.S.P. OF SIZE "D_2".
3. GRATE ASSEMBLY SHALL BE GALVANIZED AFTER FABRICATION.
4. R.C.P. SHALL BE SIZED TO FIT FUTURE CATCH BASIN DESIGN.
5. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT THE OUTSIDE DIAMETER OF STANDARD JUNCTION STRUCTURE SHAFT IF INDICATED ON CONSTRUCTION PLANS.



COLLAR DETAIL

14 TEMPORARY CSP STANDPIPE DETAIL
DETAIL 1

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN KINLEY, P.E., ASSISTANT CITY ENGINEER — 3/21/24 DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 3.21.24 DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: Siara R. MacKinney — SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

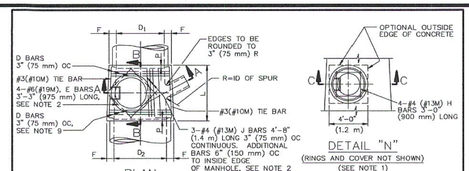
STORM DRAIN IMPROVEMENT PLAN
GROVE AVENUE
DETAILS

PM-20537

SHEET 12 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14083

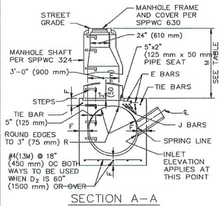
02/27/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 – Prologis – Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\12_2021-315_SD-DETAILS.dwg
Last Opened: Feb 27, 2024 - 12:40pm by: Brent.King

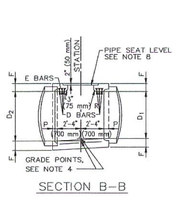


PLAN
(SHAFT NOT SHOWN)

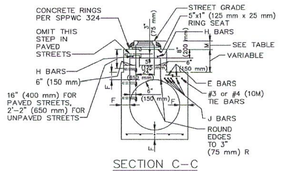
DETAIL "N"
(RINGS AND COVER NOT SHOWN)
(SEE NOTE 1)



SECTION A–A



SECTION B–B



SECTION C–C

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS, INC. GREENBOOK COMMITTEE 1992 REV: 1996, 1997, 1999, 2009

MANHOLE PIPE-TO-PIPE
MAIN LINE ID=36" (900 mm) OR LARGER

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 320-2
SHEET 1 OF 4

TABLE OF VALUES FOR F	
D_2	F
36" (900 mm)	6 1/2" (165 mm)
39" (975 mm)	7" (180 mm)
42" (1050 mm)	7 1/2" (190 mm)
45" (1125 mm)	7 3/4" (195 mm)
48" (1200 mm)	8" (205 mm)
51" (1275 mm)	8 1/2" (215 mm)
54" (1350 mm)	9" (230 mm)
57" (1425 mm)	9 1/4" (235 mm)
60" (1500 mm)	9 1/2" (240 mm)
63" (1575 mm)	10" (255 mm)
66" (1650 mm)	10 1/4" (260 mm)
69" (1725 mm)	10 3/4" (275 mm)
72" (1800 mm)	11" (280 mm)
78" (1950 mm)	11 3/4" (300 mm)
84" (2100 mm)	12 1/2" (320 mm)
90" (2250 mm)	13 1/4" (335 mm)
96" (2400 mm)	14" (355 mm)
102" (2550 mm)	15 1/2" (395 mm)
108" (2700 mm)	16" (405 mm)
114" (2850 mm)	16 1/2" (420 mm)
120" (3000 mm)	17" (430 mm)
126" (3150 mm)	17" (430 mm)
132" (3300 mm)	17 1/2" (445 mm)
138" (3450 mm)	17 1/2" (445 mm)
144" (3600 mm)	18" (455 mm)

TABLE OF VALUES FOR M (SEE NOTE 1)				
SECTION	PAVED STREET		UNPAVED STREET	
	MAX	MIN	MAX	MIN
A–A		2'-10 1/2" (867 mm)		3'-6" (1060 mm)
C–C	11" (282 mm)	8 1/2" (217 mm)	16" (410 mm)	15" (380 mm)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE PIPE-TO-PIPE
MAIN LINE ID = 36" (900 mm) OR LARGER

STANDARD PLAN 320-2
SHEET 2 OF 4

NOTES

1. WHEN DEPTH M FROM STREET GRADE TO THE TOP OF THE BOX IS LESS THAN 2'-10 1/2" (867 mm) FOR PAVED STREETS OR 3'-6" (1060 mm) FOR UNPAVED STREETS, CONSTRUCT MONOLITHIC SHAFT PER SECTION C–C AND DETAIL "N". SHAFT FOR ANY DEPTH OF MANHOLE MAY BE CONSTRUCTED PER SECTION C–C. WHEN DIAMETER D_1 IS 48" (1200 mm) OR LESS, CENTER OF SHAFT MAY BE LOCATED PER NOTE 2.
2. CENTER OF MANHOLE SHAFT SHALL BE LOCATED OVER CENTER LINE OF STORM DRAIN WHEN DIAMETER D_1 IS 48" (1200 mm) OR LESS, IN WHICH CASE PLACE E BARS SYMMETRICALLY AROUND SHAFT AT 45° WITH CENTERLINE AND OMIT J BARS.
3. L AND P SHALL HAVE THE FOLLOWING VALUES UNLESS OTHERWISE SHOWN ON THE PROJECT DRAWINGS:
   A. D_2 =96" (2400 mm) OR LESS, L=5'–6" (1.7 m), P=5" (130 mm)
   B. D_2 OVER 96" (2400 mm), L=6'–0" (1.8 m), P=8" (210 mm)
   L MAY BE INCREASED OR LOCATION OF MANHOLE SHIFTED TO MEET PIPE ENDS. WHEN L GREATER THAN THAT SHOWN ABOVE IS SPECIFIED, D BARS SHALL BE CONTINUED 6" (150 mm) OC.
4. STATIONS OF MANHOLES SHOWN ON PLANS APPLY AT CENTERLINE OF SHAFT. ELEVATIONS ARE SHOWN AT CENTERLINE OF SHAFT AND REFER TO THE PROLONGED INVERT GRADE LINES.
5. REINFORCEMENT SHALL CONFORM TO ASTM A 615M, GRADE 300 (ASTM A 615, GRADE 40), AND SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN.
6. FLOOR OF MANHOLE SHALL BE STEEL TROWELED TO SPRING LINE.
7. BODY OF MANHOLE SHALL BE POURED IN ONE CONTINUOUS OPERATION EXCEPT THAT A CONSTRUCTION JOINT WITH A LONGITUDINAL KEYWAY MAY BE PLACED AT SPRING LINE.
8. THICKNESS OF THE DECK SHALL VARY WHEN NECESSARY TO PROVIDE A LEVEL SEAT BUT SHALL NOT BE LESS THAN THE TABULAR VALUES FOR F SHOWN ON SHEET 2.
9. D BARS SHALL BE #4 (#13M) FOR D_2=39" (975 mm) OR LESS, #5 (#16M) FOR D_2 = 42" (1050 mm) TO 84" (2100 mm) INCLUSIVE AND #6 (#19M) FOR D_2 = 90" (2250 mm) OR OVER.
10. CENTERLINE OF INLET PIPE SHALL INTERSECT INSIDE FACE OF CONE AT SPRING LINE UNLESS OTHERWISE SHOWN.
11. STEPS SHALL CONFORM TO SPPWC 635 OR 636. UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" (350 mm) TO 15" (375 mm) OC. THE LOWEST STEP SHALL NOT BE MORE THAN 24" (600 mm) ABOVE THE INVERT.
12. THE FOLLOWING CRITERIA SHALL BE USED FOR THIS MANHOLE:
   A. MAIN LINE = 36" (900 mm) INSIDE DIAMETER OR LARGER, EXCEPT IF THE MAIN LINE RCP DOWNSTREAM OF MANHOLE IS 36" (900 mm) TO 42" (1050 mm) INSIDE DIAMETER AND THE MAIN LINE RCP UPSTREAM IS 33" (825 mm) OR LESS SPPWC 321 SHALL BE USED.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE PIPE-TO-PIPE
MAIN LINE ID = 36" (900 mm) OR LARGER

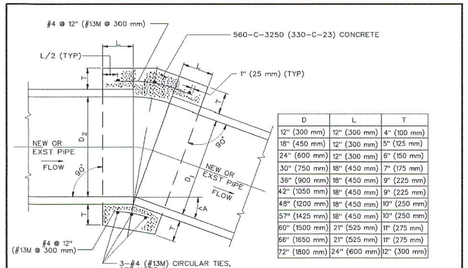
STANDARD PLAN 320-2
SHEET 3 OF 4

   B. THE OUTSIDE DIAMETER OF THE LATERAL MUST BE LESS THAN OR EQUAL TO 1/2 THE INSIDE DIAMETER OF THE MAIN LINE. IF THE UPSTREAM AND DOWNSTREAM DIAMETERS OF THE MANHOLE ARE NOT THE SAME, THE GOVERNING INSIDE DIAMETER OF THE MAIN LINE SHALL BE CONSIDERED TO BE THAT WHERE THE EXTENDED CENTERLINE OF THE LATERAL ENTERS THE MANHOLE.
   C. IN NO INSTANCE SHALL THE INSIDE DIAMETER OF THE LATERAL TO THE MANHOLE BE GREATER THAN 30" (750 mm).
13. MANHOLE FRAME AND COVER SHALL CONFORM TO SPPWC 630 UNLESS OTHERWISE SHOWN.
14. MANHOLE SHAFT SHALL CONFORM TO SPPWC 324 UNLESS OTHERWISE SHOWN.
15. WHERE A MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 326.
16. WHERE A PRESSURE MANHOLE SHAFT – WITH ECCENTRIC REDUCER IS SPECIFIED REFER TO SPPWC 328.
17. WHERE A PRESSURE MANHOLE SHAFT – 914 mm (36") WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 329.
18. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:
    324 MANHOLE SHAFT – WITH ECCENTRIC REDUCER
    326 MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER
    328 PRESSURE MANHOLE SHAFT – WITH ECCENTRIC
    329 PRESSURE MANHOLE SHAFT 36" (914 mm) WITHOUT REDUCER
    630 24" (610 mm) MANHOLE FRAME AND COVER
    633 36" (914 mm) MANHOLE FRAME AND COVER
    635 STEEL STEP
    636 POLYPROPYLENE PLASTIC STEP

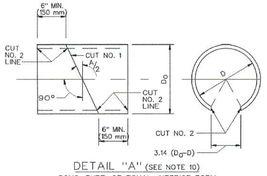
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE PIPE-TO-PIPE
MAIN LINE ID = 36" (900 mm) OR LARGER

STANDARD PLAN 320-2
SHEET 4 OF 4



D	L	T
12" (300 mm)	12" (300 mm)	4" (100 mm)
18" (450 mm)	12" (300 mm)	5" (125 mm)
24" (600 mm)	12" (300 mm)	6" (150 mm)
30" (750 mm)	18" (450 mm)	7" (175 mm)
36" (900 mm)	18" (450 mm)	9" (225 mm)
42" (1050 mm)	18" (450 mm)	9" (225 mm)
48" (1200 mm)	18" (450 mm)	10" (250 mm)
57" (1425 mm)	18" (450 mm)	10" (250 mm)
60" (1500 mm)	21" (525 mm)	11" (275 mm)
66" (1650 mm)	21" (525 mm)	11" (275 mm)
72" (1800 mm)	24" (600 mm)	12" (300 mm)



DETAIL "A" (SEE NOTE 10)
SONO-TUBE, OR EQUAL, INTERIOR FORM

CUT NO. 1: SAW THE TUBE AT AN ANGLE OF A/2 WITH THE TRANSVERSE PLANE, REVERSE ONE SECTION AND TAPE BOTH SECTIONS TOGETHER FORMING THE DEFLECTION ANGLE A.
CUT NO. 2: SAW THE TUBE LONGITUDINALLY REMOVING A STRIP 3.14 (D_2-D) WIDE ON THE SIDE OPPOSITE THE OPEN JOINT. BEND THE ENDS OF THE CUT TOGETHER AND INSERT THE TUBE IN THE PIPE.



DETAIL "B"
TYPICAL JOINT FOR
REINFORCED CONCRETE PIPE

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS, INC. GREENBOOK COMMITTEE 1992 REV: 1996, 1997, 1999, 2009

CONCRETE COLLAR FOR RCP
12" (300 mm) THROUGH 72" (1800 mm)

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 380-4
SHEET 1 OF 2

NOTES

1. A CONCRETE COLLAR IS REQUIRED WHERE THE CHANGE IN GRADE EXCEEDS 10%.
2. FOR CURVE JOINTS (SEE DETAIL B, SHEET 1)
   IF THE EXTREME ENDS OF THE PIPE LEAVE A CLEAR SPACE THAT IS GREATER THAN 1" (25 mm), BUT IS LESS THAN 3" (75 mm) A CONCRETE COVER IS REQUIRED IN ACCORDANCE WITH SSPWC 306-7.3.2.1.
   IF THE EXTREME ENDS OF THE PIPE LEAVE A CLEAR SPACE THAT IS EQUAL TO OR GREATER THAN 3" (75 mm), BUT LESS THAN 6" (150 mm), A CONCRETE COLLAR IS REQUIRED. IF THE CLEAR SPACE IS 6" (150 mm) OR GREATER, A TRANSITION STRUCTURE IS REQUIRED.
3. CONCRETE COLLAR SHALL NOT BE USED FOR A SIZE CHANGE ON THE MAIN LINE.
4. CONNECTOR PIPES
   A. WHERE PIPES OF DIFFERENT DIAMETERS ARE JOINED WITH A CONCRETE COLLAR, L AND T SHALL BE THOSE OF THE LARGER PIPE. D=D_1 OR D_2 WHICHEVER IS GREATER.
   B. WHEN D_1 IS EQUAL TO OR LESS THAN D_2 JOIN INVERTS AND WHEN D_1 IS GREATER THAN D_2 JOIN SOFFITS.
5. FOR PIPE LARGER THAN 72" (1800 mm) SPECIAL COLLAR DETAILS ARE REQUIRED.
6. FOR PIPE SIZE NOT LISTED USE NEXT SIZE LARGER.
7. REINFORCEMENT SHALL CONFORM TO ASTM A 615 (A 615 M) GRADE 40 (300).
8. WHERE REINFORCING IS REQUIRED THE DIAMETER OF THE CIRCULAR TIES SHALL BE D+(2X WALL THICKNESS) + T.
9. REINFORCING SHALL BE USED WHERE THE PIPE DIAMETER IS GREATER THAN 21" (525 mm) AND ON ALL PIPES WHERE THE SPACES BETWEEN THE EXTREME OUTER ENDS IS 3" (75 mm) OR LARGER.

CIRCULAR TIES:

PIPE DIAMETER	NO. OF CIRCULAR TIES
21" (525 mm) OR LESS	3
24" (600 mm) TO 30" (750 mm)	3
33" (825 mm) TO 57" (1425 mm)	4
60" (1500 mm) TO 72" (1800 mm)	5

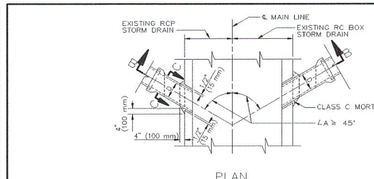
WHERE THE SPACE BETWEEN PIPE ENDS EXCEEDS 3" (75 mm), THE NUMBER OF CIRCULAR TIES SHALL BE INCREASED TO MAINTAIN AN APPROXIMATE SPACING OF 6" (150 mm) O.C.

10. WHERE THE PIPE IS 21" (525 mm) OR LESS IN DIAMETER AN INTERIOR FORM OF UNSEALED SONO-TUBE OR EQUAL SHALL BE USED TO PROVIDE A SMOOTH INTERIOR JOINT. THE PAPER FORM MAY BE LEFT IN PLACE (SEE DETAIL A). WHEN THE PIPE IS 24" (600 mm) OR LARGER A REMOVABLE INTERIOR FORM SHALL BE USED OR THE INTERIOR JOINT SHALL BE COMPLETELY FILLED WITH MORTAR AND NEATLY POINTED.

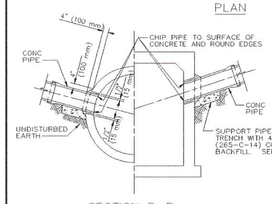
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

CONCRETE COLLAR FOR RCP
12" (300 mm) THROUGH 72" (1800 mm)

STANDARD PLAN 380-4
SHEET 2 OF 2



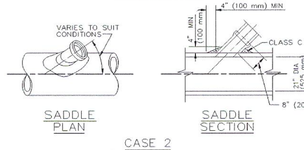
PLAN



SECTION B–B

SECTION C–C

CASE 1
PLAIN CONCRETE PIPE
D = 24" (600 mm) MAX



SADDLE PLAN

SADDLE SECTION

CASE 2
SADDLE CONNECTION

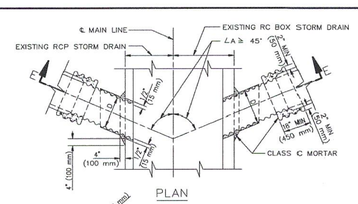
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS, INC. GREENBOOK COMMITTEE 1984 REV: 1996, 2009

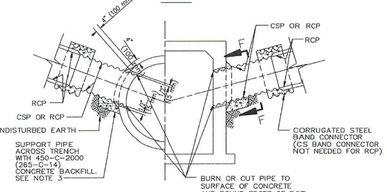
PIPE CONNECTIONS TO EXISTING STORM DRAINS

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

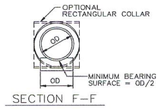
STANDARD PLAN 335-2
SHEET 1 OF 3



PLAN



SECTION E–E



SECTION F–F

DIAMETER OF CSP	MIN GAGE
15" (375 mm) – 21" (525 mm)	16
24" (600 mm)	14

CASE 3
RCP OR CSP
D = 24" (600 mm) MAX

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PIPE CONNECTIONS TO EXISTING STORM DRAINS

STANDARD PLAN 335-2
SHEET 2 OF 3

NOTES

CASE 1 AND CASE 3

1. OUTSIDE DIAMETER OF THE CONNECTOR PIPE SHALL NOT BE GREATER THAN 1/2 THE INSIDE DIAMETER OF THE RCP MAIN LINE.
2. INSIDE DIAMETER D OF THE CONNECTOR PIPE SHALL NOT BE GREATER THAN 24" (600 mm).
3. THE MINIMUM OPENING INTO THE EXISTING STORM DRAIN SHALL BE THE OUTSIDE DIAMETER OF THE CONNECTING PIPE PLUS 1" (30 mm). THE CONCRETE BACKFILL SUPPORTING THE CONNECTING PIPE MAY BE OMITTED IF THE PIPE IS LAID ON UNDISTURBED EARTH TO STORM DRAIN WALL.
4. ALL CSP AND FITTINGS SHALL BE GALVANIZED. BAND CONNECTORS MAY BE 2 GAGES LIGHTER THAN THE PIPE, BUT WITH A MINIMUM GAGE OF 16. THEY SHALL BE CONNECTED AT THE ENDS BY ANGLES HAVING MINIMUM DIMENSIONS OF 2"x2"x3/16" (50 mm x 50 mm x 5 mm) AND 5 1/2" (140 mm) BOLTS.
5. WHEN JOINING A RCP CONNECTOR PIPE TO A CSP CONNECTOR PIPE, THE INSIDE DIAMETER D OF THE CSP SHALL BE AT LEAST EQUAL TO BUT NOT MORE THAN 3" (75 mm) GREATER THAN THAT OF THE RCP.
6. CONNECTOR PIPES SHALL BE NOT MORE THAN 5' (1.5 m) ABOVE THE INVERT.
7. CONNECTOR PIPES SHALL ENTER MAIN LINE RCP RADIALLY.
8. WHEN CONNECTING TO A RCB, SPPWC 333 SHALL BE USED IF THE TOP OF THE CONNECTOR PIPE IS LESS THAN 12" (300 mm) BELOW THE SOFFIT OF THE RCB OR THE FLOW LINE OF THE PIPE IS LESS THAN 13" (330 mm) ABOVE THE FLOOR OF THE RCB AT THE INSIDE FACE.

CASE 2

9. SADDLE CONNECTIONS SHALL BE USED WHEN CONNECTING TO PIPES 21" (525 mm) OR LESS IN DIAMETER WITHOUT THE USE OF JUNCTION STRUCTURES OR PRECAST Y BRANCHES.
10. TRIM OR CUT SADDLE TO FIT SNUGLY OVER THE OUTSIDE OF THE MAIN PIPE SO ITS AXIS WILL BE ON THE LINE AND GRADE OF THE CONNECTING PIPE.
11. THE OPENING INTO THE PIPE SHALL BE CUT AND TRIMMED TO FIT THE SADDLE SO THAT NO PART WILL PROJECT WITHIN THE BORE OF THE SADDLE PIPE.
12. THE CONNECTOR PIPE SHALL BE SUPPORTED AS SHOWN IN CASE 1 AND CASE 3.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PIPE CONNECTIONS TO EXISTING STORM DRAINS

STANDARD PLAN 335-2
SHEET 3 OF 3

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/21/24
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — No.85559 Exp. 9/30/2024 — CIVIL — STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN
GROVE AVENUE
DETAILS

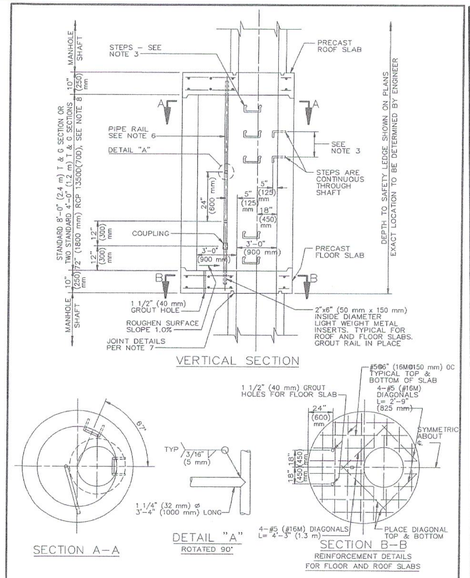
PM-20537

SHEET 13 OF 17
CONTRACT
ACCOUNT
DWG. NO. DH4084

02/27/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 – Prologis – Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN_2021-315_DETAILS.dwg
Last Updated: Feb 27, 2024 - 12:47pm by: BrentKing

H1-554



STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1995, 2009

MANHOLE SHAFT SAFETY LEDGE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 330–2

SHEET 1 OF 2

NOTES

1. MANHOLE SHAFT SAFETY LEDGE WILL BE NOTED ON THE PLANS WHEN REQUIRED. IT IS TO BE CONSTRUCTED WHEN DEPTH OF MANHOLE TO INVERT IS GREATER THAN 20' (6 m) AND MANHOLE SHAFT IS GREATER THAN 10' (3 m).
2. A SAFETY LEDGE SHALL NOT BE USED IF A PRESSURE MANHOLE IS REQUIRED.
3. STEPS SHALL CONFORM TO SPPWC 635 OR 636 AND SHALL BE ANCHORED 4" (100 mm) IN THE WALL OF THE STRUCTURE. STEPS SHALL BE PLACED TO MATCH THE SPACING OF THE MANHOLE SHAFT.
4. REINFORCEMENT SHALL BE PER ASTM A 615, GRADE 40 (ASTM A 615M, GRADE 300) AND SHALL TERMINATE 2" (50 mm) CLEAR OF CONCRETE SURFACE UNLESS OTHERWISE SHOWN.
5. GROUT HOLES, PIPE AND FITTINGS SHALL BE PROVIDED IN THE FLOOR SLAB. PRESSURE GROUTING SHALL BE USED TO FILL VOIDS AND TO SECURE UNIFORM BEARING. THE GROUT SHALL BE NEAT CEMENT GROUT AND GROUTING PRESSURES SHALL BE AS DETERMINED IN THE FIELD BY THE ENGINEER.
6. PIPE RAIL SHALL BE FABRICATED OF 1 1/4" (32 mm) STANDARD GALVANIZED PIPE COMPOSED OF TWO SECTIONS 7'–6" (2.25 m) & 18" (450 mm) IN LENGTH JOINED BY A GALVANIZED COUPLING. THE COUPLING SHALL BE THREADED A MINIMUM OF 2" (50 mm) ON EACH PIPE LENGTH.
7. ROOF AND FLOOR SLABS SHALL BE PRECAST AND KEYED FOR REINFORCED CONCRETE PIPE SECTIONS AS SHOWN. ALL JOINTS SHALL BE FILLED WITH CLASS C MORTAR AND NEATLY POINTED OR WIPED ON THE INSIDE.
8. 72" (1800 mm) RCP SHALL BE PROVIDED WITH TWO CIRCULAR CAGES OF REINFORCEMENT.
9. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:

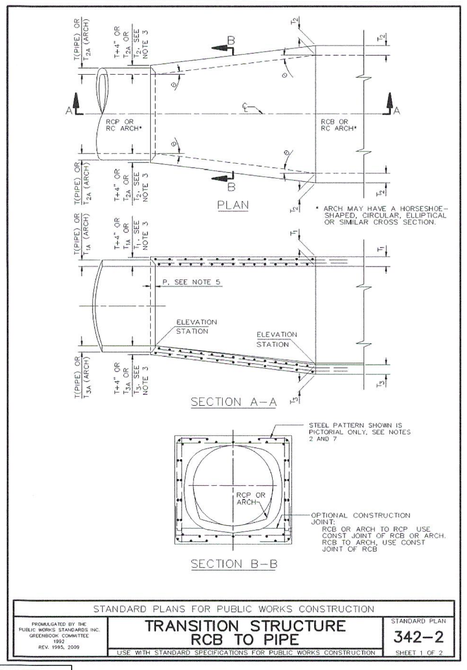
   324 MANHOLE SHAFT – WITH ECCENTRIC REDUCER
   326 MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER
   635 STEEL STEP
   636 POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE SHAFT SAFETY LEDGE

STANDARD PLAN 330–2

SHEET 2 OF 2



STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1995, 2009

TRANSITION STRUCTURE RCB TO PIPE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 342–2

SHEET 1 OF 2

NOTES

1. THE HORIZONTAL ANGLE OF DIVERGENCE OR CONVERGENCE, θ, SHALL NOT EXCEED 5° 45'.
2. REINFORCING STEEL BAR SIZES, SPACING, PATTERN AND COVER OVER THE STEEL SHALL BE AS FOLLOWS:
   RCB TO RCP AND RCB TO ARCH – THAT OF RCB SECTION.
   ARCH TO RCP – THAT OF ARCH SECTION.
   ARCH TO ARCH – THAT OF ARCH SECTION HAVING THE THICKER WALLS. THE BAR LENGTHS SHALL VARY UNIFORMLY THROUGHOUT THE TRANSITION.
3. THE CONCRETE THICKNESS SHALL BE AS FOLLOWS:
   RCB TO RCP AND ARCH TO RCP – THAT OF ARCH OR RCB SECTION UNLESS THE WALL THICKNESS OF THE RCP PLUS 100 mm (4") GREATER, IN WHICH CASE THE CONCRETE THICKNESS SHALL VARY UNIFORMLY FROM THAT OF THE ARCH OR RCB SECTION TO THAT OF THE RCP WALL PLUS 100 mm (4").

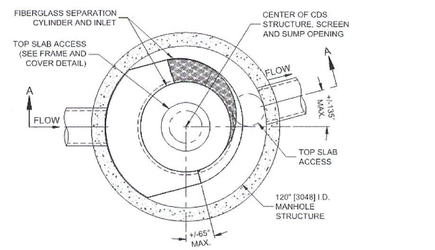
   RCB TO ARCH AND ARCH TO ARCH – THAT OF THE ADJOINING RCB OR ARCH SECTION AT EACH END OF THE TRANSITION AND SHALL VARY UNIFORMLY BETWEEN THE TWO ENDS.
4. THE INTERIOR SURFACE SHALL BE SMOOTH AND VARY UNIFORMLY BETWEEN THE TWO ADJOINING SECTIONS.
5. AT RCP JUNCTURE, EMBEDMENT P SHALL BE 130 mm (5") FOR PIPE SIZE OF 2400 mm (96") OR LESS, AND 200 mm (8") FOR PIPE SIZES OVER 2400 mm (96").
6. f'_c = 28 MPa (4000 PSI) AT 28 DAYS AND THE CONCRETE SHALL BE THE SAME MIX AS THE ADJACENT RCB.
7. ALL STEEL, EXCEPT LONGITUDINAL STEEL SHALL BE GRADE 400 (60) BILLET STEEL CONFORMING TO ASTM A 615 M (A 615) AND SHALL TERMINATE 40 mm (1 1/2") CLEAR OF CONCRETE SURFACE UNLESS OTHERWISE SHOWN.
8. KEYED CONSTRUCTION JOINTS OF THE SAME DIMENSIONS AS THOSE OF THE RCB OR ARCH SECTION MAY BE CARRIED THROUGH THE TRANSITION STRUCTURE AT THE CONTRACTOR'S OPTION. SEE SECTION B–B.
9. THE TRANSITION STRUCTURE SHALL BE CONSTRUCTED IN ACCORDANCE THE STRUCTURAL NOTES APPLYING TO RCB OR ARCH STRUCTURES SHOWN ON THE PLANS.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

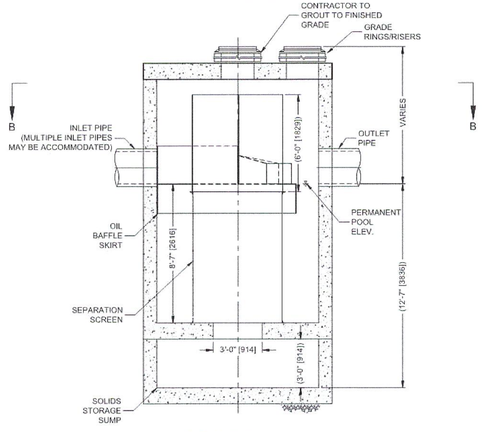
TRANSITION STRUCTURE RCB TO PIPE

STANDARD PLAN 342–2

SHEET 2 OF 2



PLAN VIEW B-B
NOT TO SCALE

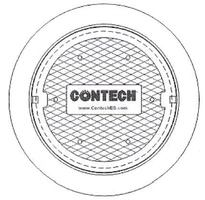


ELEVATION A-A
NOT TO SCALE

CDS5678-10-C DESIGN NOTES

CDS5678-10-C RATED TREATMENT CAPACITY IS 25.0 CFS [708.0 L/s], OR PER LOCAL REGULATIONS. IF THE SITE CONDITIONS EXCEED MAXIMUM HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CDS5678-10-C STANDARD CONFIGURATION IS SHOWN.



FRAME AND COVER
(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

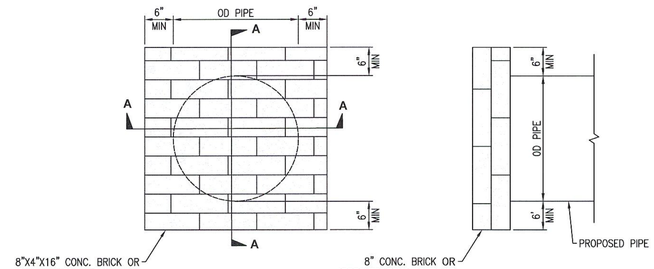
* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS5678-10-C
ONLINE CDS
STANDARD DETAIL



9 BRICK AND MORTAR BULKHEAD DETAIL
N.T.S.

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE 3/14/24

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE 3-21-24

BENCH MARK No. GG–18–1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG–18–1." SET ON TOP OF CURB. APPROX 5' +/– SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA REE MACKINNEY No.85559 Exp. 9/30/2024 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN
GROVE AVENUE

DETAILS

PM-20537

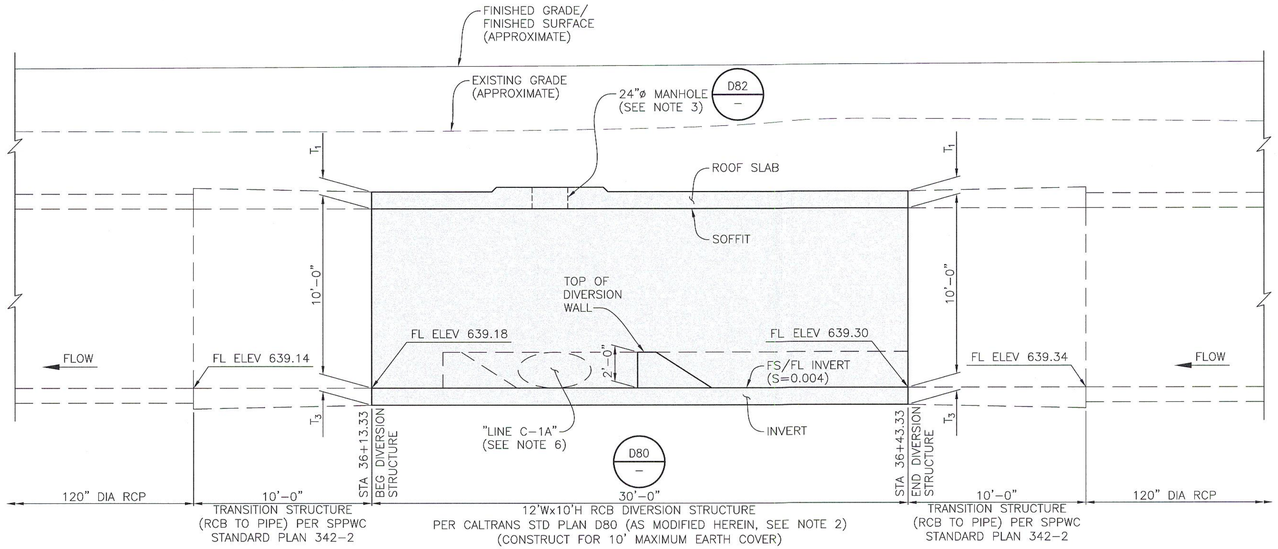
SHEET 14 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14435

02/27/2024

H1-555

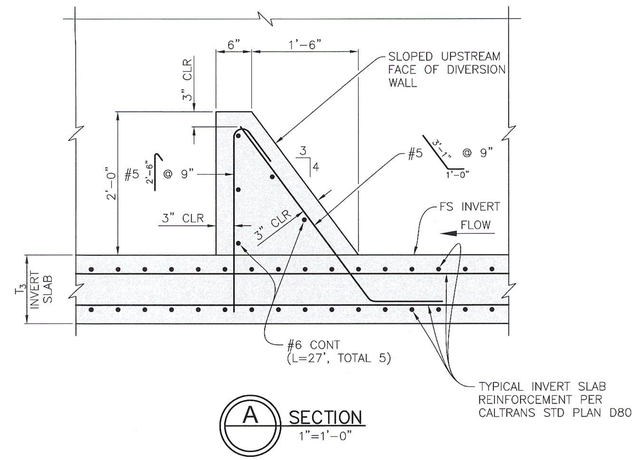
I:\COMMON\CAD\TREATMENT\22 CDS\40 STANDARD DRAWINGS\ONLINE (CDS+CURB WITH TREATMENT F, FLOWSOV)\CDS5678-10-C-DTL.DWG, 6/9/2021 12:51 PM

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 – Prologis – Eddie Pang\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN PLAN AND PROFILE.dwg
Last Opened: Feb 27, 2024 - 12:47pm by: Brent.King



LONGITUDINAL SECTION ALONG ℄ "LINE C"

¼"=1'-0"



A SECTION

1"=1'-0"

CONCRETE TYPE LEGEND:

INDICATES BAR-REINFORCED STRUCTURAL CONCRETE CONFORMING TO THE REQUIREMENTS FOR "MODERATE EXPOSURE" IN TABLE 201-1.1.3 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (2021 EDITION).

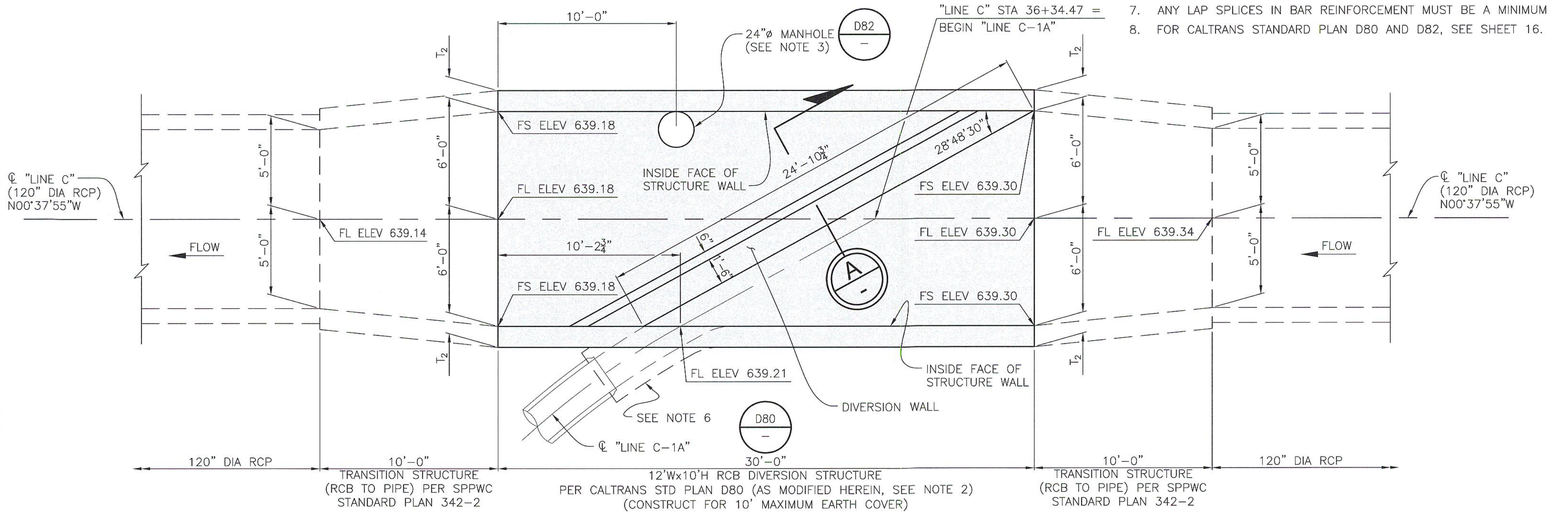
NOTES:

1. FOR HORIZONTAL AND VERTICAL ALIGNMENT INFORMATION NOT SHOWN, SEE THE PLAN AND PROFILE SHEETS AND IMPROVEMENT PLANS FOR THE ADJOINING RCB's.
2. MODIFICATIONS TO CALTRANS STANDARD PLAN No. D80 ARE LIMITED TO THE ADDITION OF THE REINFORCED CONCRETE DIVERSION WALL ANCHORED TO THE REINFORCED CONCRETE INVERT SLAB.
3. MANHOLE RISERS, RINGS, FRAME AND COVER PER CITY OF ONTARIO STANDARD DRAWINGS.
4. CONSTRUCT RCB WITH IN ACCORDANCE WITH THE "FLAT INVERT" ALTERNATIVE PER CALTRANS STD PLAN D80.
5. FOR T1, T2, T3, BAR REINFORCEMENT AND INFORMATION NOT SHOWN, SEE CALTRANS STD PLAN D80.
6. CONNECTION OF LATERAL "LINE C-1A" TO RCB DIVERSION STRUCTURE SHALL BE CONSTRUCTED PER SPPWC STANDARD PLAN No. 333-2 AND THE FOLLOWING VALUES:
   B = 24" / C = 5'-0" / ELEVATION "S" = 639.21 / ELEVATION "R" = 639.19
7. ANY LAP SPLICES IN BAR REINFORCEMENT MUST BE A MINIMUM OF 60 BAR DIAMETERS IN LENGTH.
8. FOR CALTRANS STANDARD PLAN D80 AND D82, SEE SHEET 16.

LEGEND:

SECTION OR DETAIL DESIGNATION

SHEET NUMBER WHERE SHOWN
("-" DENOTES SAME SHEET)



PLAN

¼"=1'-0"

2023 CALTRANS STANDARD PLAN REFERENCE KEY:

SHEET NO.

CALTRANS STANDARD PLAN REFERENCE

DETAIL NO.

2023 CALTRANS STANDARD PLANS LIST:

D80	CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT
D82	CAST-IN-PLACE REINFORCED CONCRETE BOX CULVERT - MISCELLANEOUS DETAILS

GENERAL NOTES:

DESIGN:

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH EDITION, WITH INTERIMS AND THE (APRIL 2019) CALIFORNIA AMENDMENTS.
LIVE LOAD: HL-93 DESIGN TRUCK OR DESIGN TANDEM
P15 PERMIT DESIGN VEHICLE
IMPACT FACTOR: (APPLIES TO ROOF SLAB ONLY)
IM = $33(1.0-0.125D_E)\geq 0\%$ (AASHTO LRFD 3.6.2.2)
D_E = MINIMUM DEPTH OF EARTH COVER
EARTH LOAD: EARTH PRESSURE FOR TWO CONDITIONS:
140 pcf VERTICAL, 36 pcf HORIZONTAL
140 pcf VERTICAL, 120 pcf HORIZONTAL
REINFORCED CONCRETE:
f'c = 3,600 psi, fy = 60,000 psi

CONSTRUCTION:

CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE 2021 EDITION OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.

811 Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE

KHUONG LE C-95173 — 12/12/2023
4LEAF, INC. — DATE

WARNING 1" IF THIS LINE IS NOT 1" LONG, THEN DWG IS NOT TO SCALE.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: GLR
DATE: June, 2023
DRAWN BY: GLR
DATE: June, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — 3/14/24 DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 3-21-24 DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER — GREGORY L. RENDE — No. 54529 — CIVIL — STATE OF CALIFORNIA

RENDE CONSULTING GROUP
22431 ANTONIO PARKWAY - SUITE B160-470
RANCHO SANTA MARGARITA, CA 92688
- 949-713-6780 -

SIGNATURE: GREGORY L. RENDE, P.E. — 54529 R.C.E. NO. — 10-27-2023 DATE

STORM DRAIN IMPROVEMENT PLAN

GROVE AVENUE
SD "LINE C" DIVERSION STRUCTURE AT "LATERAL C-1A"
STRUCTURE LAYOUT

PM-20537

SHEET 15 OF 17
CONTRACT
ACCOUNT
DWG. NO. D1140336

11/03/2023

H1-556

Drawing Name: C:\RCG Projects\WestLAND\Grove SD CDS Diversion Structure\CADD\dlv\RCG Structural Sheets - Grove SD Diversion.dwg
Last Opened: Nov 03, 2023 - 9:37am by: greg

SPAN, S	2'			3'			4'			5'			6'			7'			8'		
HEIGHT, H	2'	3'	4'	2'	3'	4'	2'	3'	4'	2'	3'	4'	2'	3'	4'	2'	3'	4'	2'	3'	4'
MAXIMUM EARTH COVER	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc ROOF t_1	7½"	7"	8"	7"	8"	7"	8"	8"	8"	7¼"	8"	8"	8"	8"	8"	8"	8"	8"	8"	8"	8"	8"	8"	8"
Conc WALLS t_2	6"	6"	6"	6"	7"	7"	6"	6 8½"	6 8½"	7"	7¼"	7"	7"	7"	7"	7"	7 7½"	7½"	7"	8"	8"	8"	8"	8"
INVERT t_3	6"	7"	7"	7½"	7"	7½"	8"	7½"	9"	7½"	9½"	8"	10"	8"	10½"	8"	10"	8"	11½"	8"	11"	9"	11½"	9"
Reinf "a" SIZE BAR	#5	#5	#5	#4	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#6	#6	#6	#6	#6	#6
Reinf "a" SPACING	6"	5"	6"	5"	5"	5"	5½"	4½"	5"	4½"	5"	5"	5"	5"	5"	4½"	4½"	4½"	5"	4½"	5"	4½"	5"	4½"
Reinf "b" SIZE BAR	#4	#5	#4	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#6	#6	#6	#6	#6
Reinf "b" SPACING	5½"	6"	6"	6"	6"	6"	4½"	5"	6"	5½"	6"	6"	5½"	6"	6"	5"	6"	6"	5"	6"	6"	5"	6"	6"
Reinf "e" SIZE BAR	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4
Reinf "e" SPACING	3½"	3½"	3½"	3½"	3½"	3½"	3½"	3½"	3½"	3½"	3½"	3½"	12"	11"	8½"	6½"	6"	5½"	11"	11"	9"	8"	7"	6"
DIMENSION "B" ft-inch	2-4	2-3	2-4	2-5	2-6	2-5	2-7	2-7	2-6	2-9	2-8	2-9	2-10	2-9	2-8	3-0	2-9	2-8	3-1	3-0	2-11	3-1	2-9	3-4
BOUNDARY CONDITION 2 CONCRETE CF/LF	8.0	7.8	9.3	9.0	11.1	10.9	9.8	10.0	11.1	11.4	12.4	13.9	13.8	17.0	13.1	14.8	14.5	17.1	15.0	19.7	18.4	22.8	16.7	18.8
BOUNDARY CONDITION 2 REINFORCEMENT LB/LF	79	84	84	96	104	127	107	110	112	114	123	128	154	140	126	147	132	139	159	153	206	186	145	162
## SOIL PRESSURE (ksf), Ser	2.4	3.5	2.4	3.5	2.4	3.5	2.1	3.5	2.1	3.5	2.1	3.6	2.1	3.6	1.9	3.5	1.9	3.6	1.9	3.6	2.0	3.7	1.9	3.6
## SOIL PRESSURE (ksf), Str	3.9	4.5	3.0	4.5	3.9	4.6	3.3	4.5	3.3	4.5	3.3	4.6	3.4	4.7	2.9	4.6	2.9	4.6	3.0	4.7	3.0	4.7	2.6	4.6

SPAN, S	10'						12'						14'					
HEIGHT, H	5'	6'	7'	8'	9'	10'	6'	7'	8'	9'	10'	11'	12'	7'	8'	9'	10'	11'	12'	13'	14'
MAXIMUM EARTH COVER	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc ROOF t_1	10"	15"	8½"	14"	8½"	13½"	9½"	14"	10"	15"	10"	15"	11½"	17"	11½"	16½"	11"	16"	11½"	17"	11½"	16½"	11½"	16"
Conc WALLS t_2	8½"	10"	8½"	11½"	10"	12½"	11"	14"	12"	15½"	13½"	16½"	13"	16"	14"	16½"	15"	18"	16½"	20"	16"	19"	16"	19"
INVERT t_3	10"	15"	10"	15"	10"	15"	10"	15½"	10"	16"	10½"	15"	11"	17½"	11"	17"	11"	17"	11½"	16"	12"	18"	12½"	20"
Reinf "a" SIZE BAR	#6	#7	#6	#7	#6	#7	#6	#6	#6	#5	#6	#7	#7	#7	#7	#7	#6	#6	#6	#6	#6	#6	#6	#6
Reinf "a" SPACING	4½"	5"	5"	6"	4½"	5"	5"	4½"	4½"	5"	4½"	5"	5"	4½"	4½"	5"	4½"	5"	5"	4½"	4½"	5"	4½"	5"
Reinf "b" SIZE BAR	#5	#5	#6	#6	#6	#6	#7	#5	#7	#6	#7	#6	#6	#6	#6	#7	#6	#7	#6	#7	#7	#6	#8	#8
Reinf "b" SPACING	4½"	5½"	5"	5"	4½"	5"	5"	4½"	4½"	5½"	4½"	5"	5"	4½"	5"	5½"	4½"	5"	5"	4½"	4½"	5"	4½"	5"
Reinf "e" SIZE BAR	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#5	#5	#6
Reinf "e" SPACING	9½"	11½"	9½"	6"	11½"	15½"	6"	5"	5"	6½"	5"	5"	8½"	6"	7½"	5½"	6½"	5"	5"	6½"	5"	5"	8½"	6"
DIMENSION "B" ft-inch	3-10	3-10	3-9	3-3	4-0	3-6	4-9	4-5	4-9	4-11	4-10	4-7	4-3	4-1	4-3	4-1	5-0	4-7	4-3	5-1	5-3	5-1	5-2	5-4
BOUNDARY CONDITION 2 CONCRETE CF/LF	26.1	37.5	27.1	40.3	30.6	43.3	34.7	49.0	38.0	55.5	43.4	59.0	44.8	64.3	50.8	68.1	55.9	78.6	63.1	88.6	64.2	88.6	69.2	92.9
BOUNDARY CONDITION 2 REINFORCEMENT LB/LF	251	284	285	318	307	338	375	313	418	375	425	404	381	381	382	397	469	418	497	455	488	534	526	479
## SOIL PRESSURE (ksf), Ser	2.0	3.7	2.0	3.7	2.0	3.8	2.0	3.8	2.1	3.9	2.2	3.8	2.3	3.8	2.3	3.8	2.3	3.9	2.3	3.9	2.3	3.9	2.4	4.0
## SOIL PRESSURE (ksf), Str	2.5	4.8	2.5	4.8	2.6	4.9	2.6	4.9	2.7	5.0	2.7	5.1	3.0	4.9	3.0	4.9	3.1	5.0	3.1	5.0	3.2	5.1	3.2	5.2

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER — Cori W. Bunn — 03/31/24 — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

May 1, 2023
PLANS APPROVAL DATE

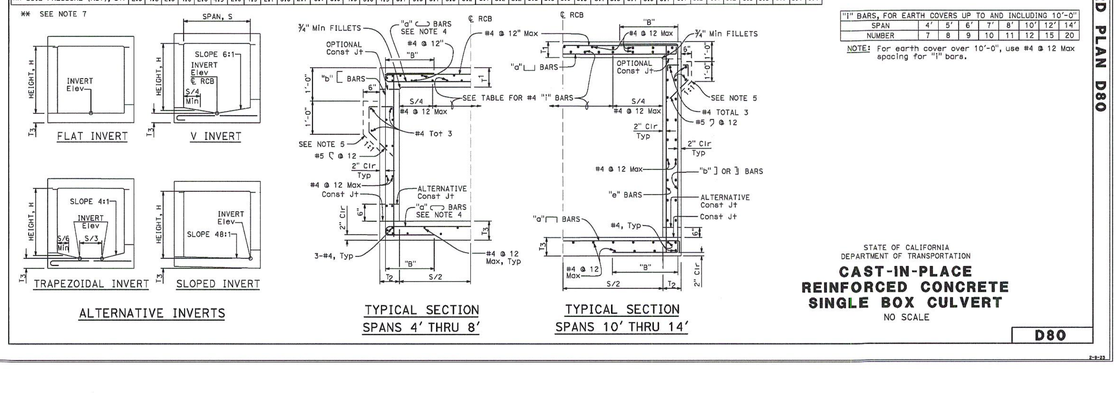
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR ANY ALTERATIONS OR CHANGES TO SIGNED COPIES OF THIS PLAN SHEET.

NOTES:

1. For boxes with span or height less than any of those shown in table, use next greater size box concrete dimensions and reinforcement. Make necessary changes in bar lengths and quantities.
2. Quantities are approximate and for design purposes only.
3. For boxes with span or height or cover greater than those shown in tables, a special design is required.
4. It is permissible to eliminate the 180° hooks on every other bar.
5. Provide paving notch when top is exposed and when pavement is concrete, and adjust quantities.
6. For design and details not shown, see Standard Plan D86.
7. Soil pressures shown are factored per AASHTO LRFD BDS and include soil weight of fill over box, self weight of box, and live load where applicable.
8. Stagger rebars for wall thickness less than 7".

"I" BARS, FOR EARTH COVERS UP TO AND INCLUDING 10'-0"							
SPAN	4'	5'	6'	7'	8'	10'	12'	14'
NUMBER	7	8	9	10	11	12	15	20

NOTE: For earth cover over 10'-0", use #4 @ 12 Max spacing for "I" bars.



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT

NO SCALE

D80

2-1-23

2023 STANDARD PLAN D80

DESIGN NOTES:

Design Specifications:
AASHTO LRFD Bridge Design Specifications, 8th Edition and Cal Amendments.

Loading:
Live loads (AASHTO LRFD 3.6.1.2) and CA Amendments 3.6.1.2:
HL-93 design truck or design tandem
P15 Permit Design Vehicle

Impact Factor (Apply to roof slab only)
$IM = 33(1.0-0.125D_E) \geq 0\%$ (AASHTO LRFD 3.6.2.2)
D_E = minimum depth of earth cover

Earth Loads:
Earth pressure for two conditions:
140 pcf active, 30 pcf fluid + 280 psf horizontal
140 pcf vertical, 120 pcf horizontal

Load Factors:
AASHTO-CA BDS-8 Table 3.4.1.1 & Table 3.4.1.2

Unit stresses:
f_y = 160,000 psi
f'_c = 60,000 psi

Distribution "I" bars:
Up to and including 10'-0" cover
Express as a percentage of main positive reinforcement required $\frac{100}{\sqrt{S}}$, Max 50%,
where S = span
Over 10'-0" cover, # 4 @ 12" maximum

Shear:
For Slabs less than 16" thick and fill > 2'-0"
$V_c = (0.0676\sqrt{f'_c}+4.6\frac{f_{st}\rho_w}{d_{st}})b_w d \leq 0.126\lambda\sqrt{f'_c}b_w d$(kips)
V_c shall not be less than $0.0948\lambda\sqrt{f'_c}b_w d$, for frame
For all other members
$Vc = 0.0316\beta\lambda\sqrt{f'_c}b_w d$(kips)
β = 2.0 for members less than 16" thick
= based on iterative θ and β method for all other cases

Control of cracking by distribution of reinforcement:
Class 2 exposure environment Service Limit State

CONSTRUCTION NOTES:

Construction loads:
Strutting required as shown on Standard Plan D88.
Strutting may be required on culvert extensions when existing parapet is removed.

Expansion joints:
Invert:
No expansion joints shall be permitted.

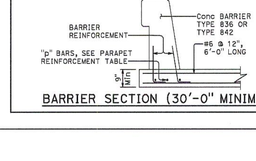
Roof and Walls:
When cover is less than span length-
Place ½" premolded expansion joint filler at 30'-0" ± centers outside the paved roadway lanes and place Bridge Detail 3-2, Standard Plan BD-3, at 30'-0" centers under paved roadway lanes.
When cover is more than span length-
Place ½" premolded expansion joint filler at 30'-0"± centers and additional ½" premolded expansion joints at locations of change in foundation character, as directed by the Engineer.

Construction joints:
Temporary joints may be permitted if normal (or radial) to ℄ of RCB. Otherwise, the contractor is to submit a proposal for consideration.

Cutoff walls:
4'-0" cutoff walls are to be provided at inlet and/or outlet unless adjacent channel is lined and unless otherwise shown. These walls are to be extended if scour conditions warrant.

Earthwork:
See Standard Plan A62E.

Backfill:
See Standard Specifications, except that the difference in level of backfill (against outside walls) shall not exceed 2'-0".



BARRIER SECTION (30'-0" MINIMUM)

GENERAL NOTES:

Designation:
Standard single or multiple box culverts are shown on plans as span times height with maximum cover over roof thus: 8' x 5' RCB with 10' or double 10' x 5' RCB with 20', followed by alternatives.

Alternatives:
Single cell: Invert will be sloped unless "trapezoidal Invert", "flat Invert", or "V Invert" is included in designation.
Multiple cells: Invert will be vee unless "flat Invert" is specified. Ends of culvert will be rounded unless "square ends" are designated. Parapets will be as shown unless designated in plans. Such designations may be different for inlet and outlet ends.

Quantities:
Quantities do not include the following:
- Concrete for parapet, paving notches, and cut-off wall.
- Reinforcement for 2% splices, parapets, paving notches, cut-off wall, and additional required bars for exposed top slab.

Reinforcement placement:
Main reinforcement is to be placed transversely or, for curved culverts, radially. When radial, reinforcing spacing of the "a" and "e" bars is measured along the centerline. Stagger splices not shown. Hooks may be rotated or tilted, as necessary, for clearance.

Special reinforcement coverage:
Box standard plans are not to be used for culverts in a corrosive environment or where there is a severe corrosive flow condition or in freeze-thaw locations.

Special design:
Required for culverts with conditions, loads, design bearing pressures, or sizes greater than shown on this plan or Standard Plans D80 AND D81. Also required for multiple cell culverts with unequal spans. For culverts with railroad loading, see the current AREMA design specifications.

Three or more cells:
For culverts with more than two cells, use dimensions and reinforcement for the standard "double box culvert". Reduce spacing of "f" bars and "b" bars by ½" and adjust quantities accordingly.

Special design:
Required for culverts with conditions, loads, design bearing pressures, or sizes greater than shown on this plan or Standard Plans D80 AND D81. Also required for multiple cell culverts with unequal spans. For culverts with railroad loading, see the current AREMA design specifications.

CONSTRUCTION NOTES:

Construction loads:
Strutting required as shown on Standard Plan D88.
Strutting may be required on culvert extensions when existing parapet is removed.

Expansion joints:
Invert:
No expansion joints shall be permitted.

Roof and Walls:
When cover is less than span length-
Place ½" premolded expansion joint filler at 30'-0" ± centers outside the paved roadway lanes and place Bridge Detail 3-2, Standard Plan BD-3, at 30'-0" centers under paved roadway lanes.
When cover is more than span length-
Place ½" premolded expansion joint filler at 30'-0"± centers and additional ½" premolded expansion joints at locations of change in foundation character, as directed by the Engineer.

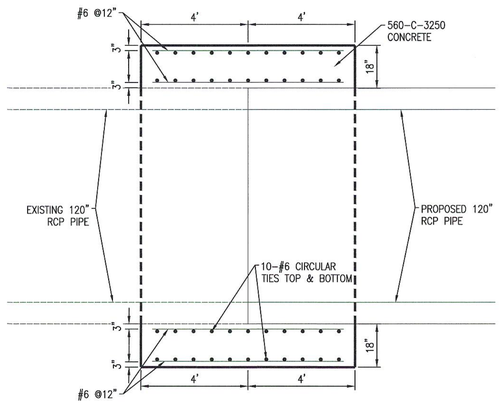
Construction joints:
Temporary joints may be permitted if normal (or radial) to ℄ of RCB. Otherwise, the contractor is to submit a proposal for consideration.

Cutoff walls:
4'-0" cutoff walls are to be provided at inlet and/or outlet unless adjacent channel is lined and unless otherwise shown. These walls are to be extended if scour conditions warrant.

Earthwork:
See Standard Plan A62E.

Backfill:
See Standard Specifications, except that the difference in level of backfill (against outside walls) shall not exceed 2'-0".

BARRIER SECTION (30'-0" MINIMUM)



22 MODIFIED CONCRETE COLLAR DETAIL
N.T.S.
(BASED ON SPPWC 380-4, DETAIL ON SHEET 13)
NOTE: USE ASTM A615 GRADE 60 BAR REINFORCEMENT

811 Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE

KHUONG LE C-95173 — 12/12/2023
4LEAF, INC. — DATE

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO

DESIGNED BY: BK
DATE: 8/30/2023
DRAWN BY: BK
DATE: 8/30/2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRKEY, P.E., ASSISTANT CITY ENGINEER — 3/21/24 DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — 3-21-24 DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD '88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA ROSE MACKINNEY No.85559 Exp. 9/30/2024 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 3/14/24 DATE

STORM DRAIN IMPROVEMENT PLAN
GROVE AVENUE

MODIFIED CONCRETE COLLAR DETAIL

PM-20537

SHEET 17 OF 17
CONTRACT
ACCOUNT
DWG. NO. D14038

02/27/2024

Drawing Name: P:\Year_2021\2021-315 Merrill Commerce Center Phase 2 - Prologis - Eddie Pong\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\GROVE STORM DRAIN\12_2021-315_SD-DETAILS.dwg
Last Opened: Feb 27, 2024 - 12:48pm by: Brent.King

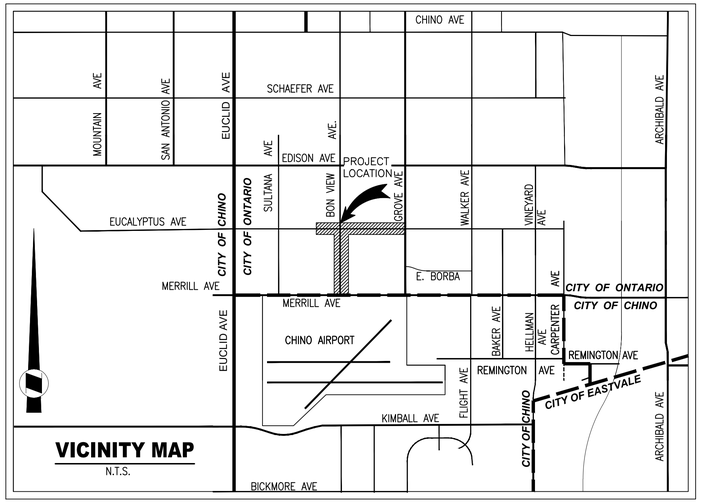
EXCERPT J: STORM DRAIN IMPROVEMENT PLANS FOR LINE D, PM-20161

STORM DRAIN IMPROVEMENT PLAN

FOR PM 20161

BON VIEW AVENUE AND EUCALYPTUS AVENUE

IN THE CITY OF ONTARIO



VICINITY MAP

N.T.S.

INDEX OF DRAWINGS

INDEX NO.	DESCRIPTION
SHEET 1	TITLE SHEET
SHEET 2	SHEET INDEX
SHEET 3	BON VIEW AVENUE – FROM MERRILL AVE TO 950' NORTH OF MERRILL AVE
SHEET 4	BON VIEW AVENUE – FROM 950' NORTH OF MERRILL AVE TO 800' SOUTH OF EUCALYPTUS AVE
SHEET 5	BON VIEW AVENUE – FROM 800' SOUTH OF EUCALYPTUS AVE TO 100' NORTH OF EUCALYPTUS AVE
SHEET 6	EUCALYPTUS AVENUE – BON VIEW AVE TO 300' EAST OF BON VIEW AVE
SHEET 7	EUCALYPTUS AVENUE – FROM BON VIEW AVE TO 950' EAST OF BON VIEW AVE
SHEET 8	EUCALYPTUS AVENUE – FROM 950' EAST OF BON VIEW AVE TO 1400' EAST OF BON VIEW AVE
SHEET 9	LATERAL PROFILES
SHEET 10	LATERAL PROFILES
SHEET 11	DETAILS
SHEET 12	DETAILS

OWNER/DEVELOPER:

PROLOGIS, L.P.
3546 CONCOURS STREET, SUITE 100
ONTARIO, CA 91764

CONTACT: SAM CHO, DEVELOPMENT MANAGER
PHONE: (909) 673-8700

CIVIL ENGINEER

WESTLAND GROUP INC.
4150 CONCOURS STREET, SUITE 100
ONTARIO, CA 91764

CONTACT: SIARA MACKINNEY, PE, MS, QSD
PHONE: (909)-989-9789

GEOTECHNICAL ENGINEER:

SOUTHERN CALIFORNIA GEOTECHNICAL
22885 EAST SAVI RANCH PARKWAY, SUITE E
YORBA LINDA, CA 92887

CONTACT: GREGORY K. MITCHELL
PHONE: (714) 685-1115

UTILITY PURVEYORS:

CITY OF ONTARIO, MUNICIPAL UTILITIES AGENCY
DAYTIME PH: (909) 395-2678
24-HOUR EMERGENCY: (909) 986-6711

CITY OF ONTARIO, COMMUNITY & PUBLIC SERVICES AGENCY
DAYTIME PH: (909) 395-2633
24-HOUR EMERGENCY: (909) 986-6711

INLAND EMPIRE UTILITY AGENCY
DAYTIME PH: (909) 944-6000
24-HOUR EMERGENCY: (909) 987-2591

SOUTHERN CALIFORNIA EDISON
24-HOUR EMERGENCY: (800) 611-1911

SOUTHERN CALIFORNIA GAS COMPANY
DAYTIME PH: (800) 423-1391
24-HOUR EMERGENCY: (800) 423-1391

TIME WARNER CABLE / WEST COAST COMMUNICATIONS
24-HOUR EMERGENCY: (888) 892-2253

VERIZON
24-HOUR EMERGENCY: (800) 483-2000

CONSTRUCTION NOTES

ITEM	DESCRIPTION	PUBLIC QUANTITY	
1	CONSTRUCT 102" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN	2620	LF
2	CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009	4	EA
3	CONSTRUCT JUNCTION STRUCTURE NO. 1 PER CITY OF ONTARIO STD. DWG. 3010, CASE 1	4	EA
4	CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN	550	LF
5	CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL ON SHEET 11	10	EA
6	CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" PER CITY OF ONTARIO STD. DWG. NO. 3018	8	EA
7	CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20161 STREET IMPROVEMENT PLANS FOR DETAILS	9	EA
8	CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017	9	EA
9	CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL ON SHEET 11	4	EA
10	REMOVE EXISTING CONCRETE BULKHEAD	3	EA
11	CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 11	10	EA
12	CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN	1560	LF
13	CONSTRUCT CONCRETE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 11	2	EA
14	NOT USED	–	–
15	REMOVE EXISTING 18" RCP	30	LF
16	CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. PLAN NO. 330-2, PER DETAIL ON SHEET 11	8	EA
17	EXISTING 36" TEMPORARY CSP STANDPIPE TO BE REMOVED	4	EA
18	CONSTRUCT MANHOLE PIPE-TO-PIPE (LARGE SIDE INLET) PER SPPWC STD. DWG. NO. 322-3, PER DETAIL ON SHEET 12	4	EA
19	CONSTRUCT 36" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN	50	LF
20	CONSTRUCT JUNCTION STRUCTURE NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3012	2	EA
21	CONSTRUCT 42" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN	545	LF
22	CONSTRUCT MODIFIED CONCRETE COLLAR PER SPPWC STD. 380-2 AS MODIFIED PER DETAIL ON SHEET 12	1	EA
23	CONSTRUCT CATCH BASIN WITH MANHOLE IN STREET PER SPPWC STD. PLAN NO. 307-4, PER DETAIL ON SHEET 12	1	EA

CITY OF ONTARIO GENERAL NOTES:

1. ALL WORK SHALL BE DONE IN STRICT CONFORMANCE WITH THE CURRENT CITY OF ONTARIO STANDARD SPECIFICATIONS AND STANDARD DRAWINGS AND CURRENT STANDARD SPECIFICATIONS AND STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION AND CALTRANS PERMIT UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. ANY CONTRACTOR PERFORMING WORK ON THIS PROJECT SHALL FAMILIARIZE HIMSELF/HERSELF WITH THE SITE AND SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES RESULTING DIRECTLY OR INDIRECTLY FROM HIS/HER OPERATIONS, WHETHER OR NOT THE FACILITY IS SHOWN ON THESE PLANS.
3. ALL OBSTRUCTIONS WITHIN THE AREA TO BE IMPROVED SHALL BE REMOVED AND/OR RELOCATED AT THE DIRECTION OF THE CITY ENGINEER. UTILITIES ARE TO BE RELOCATED BY THEIR RESPECTIVE OWNERS UNLESS NOTED OTHERWISE. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
4. UTILITY LINE LOCATIONS WERE TAKEN FROM AVAILABLE RECORD DATA AND WERE NOT LOCATED IN THE FIELD, UNLESS OTHERWISE NOTED ON THE PLAN. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
5. IN CASE OF ANY ACCIDENTS INVOLVING SAFETY MATTERS COVERED BY SECTION 6409(B) OF THE CALIFORNIA LABOR CODE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE STATE DIVISION OF INDUSTRIAL SAFETY.
6. STATE LAW (SB 3019) REQUIRES THE CONTRACTOR TO CONTACT UNDERGROUND SERVICE ALERT AND OBTAIN AN IDENTIFICATION NUMBER PRIOR TO THE ISSUANCE OF CITY'S ENCROACHMENT PERMITS. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT AT 1-800-422-4133 A MINIMUM OF 48-HOURS IN ADVANCE OF ANY CONSTRUCTION ACTIVITY.
7. PRIOR TO THE START OF ANY WORK THE CONTRACTOR SHALL OBTAIN A BUSINESS LICENSE FROM THE CITY OF ONTARIO. THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM THE ENGINEERING DEPARTMENT NO LESS THAN 48 HOURS PRIOR TO START OF ANY CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY.
8. THE CONTRACTOR SHALL OBTAIN A TRAFFIC CONTROL PERMIT 48 HOURS PRIOR TO TIME OF CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR IS REFERRED TO SECTION 7-10.3 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
9. THE CONTRACTOR SHALL RENEW OR REPLACE ANY EXISTING TRAFFIC STRIPING AND/OR PAVEMENT MARKINGS, WHICH DURING HIS OPERATIONS HAVE BEEN EITHER REMOVED OR THE EFFECTIVENESS OF WHICH HAS BEEN REDUCED. RENEWAL OF TRAFFIC STRIPING AND MARKINGS SHALL BE DONE USING REFLECTIVE THERMO-PLASTIC MARKINGS IN CONFORMANCE WITH SECTION 84 & 85 OF THE CALTRANS STANDARD SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER. ALL REGULATORY, WARNING, AND GUIDE SIGNS SHALL HAVE 3M DIAMOND, VIP GRADE SHEETING WITH SERIES 1160 PROTECTIVE OVERLAY FILM.
10. THE LAND SURVEYORS ACT, SECTION 8771 OF THE BUSINESS & PROFESSIONAL CODE, AND SECTIONS 732.5, 1492-5, 1810-5 OF THE STREETS AND HIGHWAY CODE REQUIRE THAT SURVEY MONUMENTS SHALL BE PROTECTED AND PERPETUATED.

    "IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR OTHERS PERFORMING THE CONSTRUCTION WORK TO RETAIN A QUALIFIED REGISTERED CIVIL ENGINEER AND/OR LICENSED LAND SURVEYOR PRIOR TO THE START OF CONSTRUCTION TO LOCATE, REFERENCE AND FILE THE NECESSARY CORNER RECORDS WITH THE COUNTY SURVEYOR'S OFFICE FOR SURVEY CONTROL POINTS/MONUMENTS THAT EXIST AS SHOWN ON RECORDED TRACT MAPS, PARCEL MAPS, RECORDS OF SURVEYS AND HIGHWAY MAPS, AND MAY BE DISTRIBUTED OR DAMAGED BY THE PROPOSED CONSTRUCTION"

    AFTER THE COMPLETION OF THE PROPOSED CONSTRUCTION, SAID MONUMENTS AND/OR CONTROL SURVEY POINTS SHALL BE RESET TO THE NEW SURFACE IN ACCORDANCE WITH THE CURRENT PROFESSIONAL LAND SURVEYING PRACTICES. CORNER RECORDS SHALL BE FILED WITH THE COUNTY SURVEYOR FOR ALL THE NEW MONUMENTS SET.
11. THE DEVELOPER SHALL PROVIDE THE CITY WITH A COMPLETED SET OF "AS BUILT", MYLAR DRAWINGS PRIOR TO THE FINAL INSPECTION.
12. A CITY ACCEPTED/APPROVED SET OF PLANS SHALL BE KEPT ON THE JOB SITE AT ALL TIMES.
13. A PRE-CONSTRUCTION MEETING SHALL OCCUR PRIOR TO CONSTRUCTION. ATTENDEES SHALL INCLUDE A CITY REPRESENTATIVE AND THE CONTRACTOR WHO WILL PERFORM THE WORK. "CUT-SHEETS" SHALL BE PROVIDED TO THE CITY AT THIS MEETING FOR ITS REVIEW.
14. CITY ACCEPTANCE OF PLANS DOES NOT RELIEVE THE DEVELOPER FROM RESPONSIBILITY FOR THE CORRECTION OF ERROR AND OMISSION DISCOVERED DURING CONSTRUCTION. UPON REQUEST OF THE CITY INSPECTOR, THE REQUIRED PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR REVIEW.
15. ANY REQUIRED RIGHT-OF-WAY OR EASEMENT SHALL BE DEDICATED TO AND ACCEPTED BY THE CITY PRIOR TO COMMENCEMENT OF CONSTRUCTION OF THE IMPROVEMENTS WITHIN THE REQUIRED RIGHT-OF-WAY OR EASEMENT.
16. WHERE UTILITIES NEED TO BE SUPPORTED, SAID SUPPORTS SHALL BE IN ACCORDANCE WITH A.P.W.A. STANDARD 224-1 UNLESS OTHERWISE INDICATED.
17. PRIOR TO STARTING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF EXISTING SEWER MAIN(S) AND NOTIFY THE DESIGN ENGINEER OF ANY VARIATION FROM DESIGN.
18. THE PIPE SHOWN HEREON SHALL BE INSTALLED IN ACCORDANCE WITH CASE III BEDDING AS SHOWN ON L.A.C.D.P.W. STANDARD 3080-2, UNLESS OTHERWISE SHOWN. "W" VALUE SHALL BE AS SPECIFIED ON L.A.C.D.P.W. STANDARD 3080-2 FOR CASE III BEDDING, NOTES 3 (A), 3 (B), AND 3 (C). IF THE "W" VALUE AT THE TOP OF THE PIPE IS EXCEEDED, THE BEDDING SHALL BE MODIFIED AND/OR PIPE OF ADDITIONAL STRENGTH SHALL BE PROVIDED. ALL PROPOSED MODIFICATIONS TO THIS REQUIREMENT SHALL BE APPROVED BY THE CITY ENGINEER.
19. MINIMUM COVER OF STORM DRAIN MAIN SHALL BE 7 FEET FROM THE FINISHED SURFACE PER STANDARD DRAWING 1302-1304.
20. STORM DRAIN MAIN STATIONING IS PER PIPE CENTERLINE.
21. STREET CENTERLINE STATIONING IS PER THE STREET IMPROVEMENT PLANS AND PROVIDED FOR REFERENCE.
22. CONTRACTOR SHALL NOT BACKFILL TRENCH UNTIL THE CITY INSPECTOR HAS OBTAINED AS-BUILT STATIONING ON ALL STRUCTURES.
23. UPON COMPLETION OF CONSTRUCTION OF ALL STORM DRAIN LINES AND PRIOR TO PAVING, THE DEVELOPER SHALL HIRE A CITY APPROVED VIDEO COMPANY TO VIDEO TAPE THE PIPELINES. CITY SHALL REVIEW SAID VIDEOTAPES FOR POTENTIAL CONSTRUCTION DEFECTS PRIOR TO ACCEPTANCE OF THE PROJECT.

CIVIL ENGINEERS NOTICE TO CONTRACTOR

1. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF MY KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTION AND ANY MEASURES TO PROTECT THE UTILITIES AND STRUCTURES SHOWN AND OTHER LINES OR STRUCTURES NOT OF RECORD OR NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR THE PROTECTION OF, AND ANY DAMAGE TO, THESE UTILITY LINES OR STRUCTURES.
2. THE CONTRACTOR AGREES THAT HE WILL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY AND NOT BE LIMITED TO A NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER, OR ANY PUBLIC AGENCY.
3. THE ESTIMATES OF IMPROVEMENT QUANTITIES AS SHOWN HEREON ARE PROVIDED ONLY FOR THE PURPOSE OF SATISFYING CITY PLAN INFORMATION REQUIREMENTS. THE CONTRACTOR SHALL PERFORM AN INDEPENDENT ESTIMATE OF ALL IMPROVEMENT QUANTITIES AND SHALL USE SAME AS A BASIS FOR HIS BID(S) AND CONTRACT(S).
4. CONTRACTOR TO VERIFY CLEARANCE AT ALL UTILITY CROSSINGS. IF INTERFERENCE OCCURS, OTHER THAN NOTED ON PLAN, CONTRACTOR SHALL CONTACT THE DESIGN ENGINEER FOR POSSIBLE REDESIGN. IF REDESIGN IS NOT FEASIBLE, CONTRACTOR TO RELOCATE UTILITY AT NO EXPENSE TO ENGINEER.
5. CONTRACTOR SHALL TAKE EXTREME CARE DURING UNDERGROUND CONSTRUCTION AND IS RESPONSIBLE FOR TRENCHING AND SHORING. CONTRACTOR SHALL SUBMIT A DETAILED SHORING PLAN PER SECTION 7-10.4.2.2 OF SPPWC AND A PERMIT FROM STATE DIVISION OF INDUSTRIAL SAFETY PRIOR TO COMMENCING WORK.
6. CONTRACTOR SHALL VERIFY PAVEMENT ELEVATION AT RIM PRIOR TO SETTING CONE.

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

LOTS 1, 2, 3, 16, 17, 18, 19, 20, 21, 31, 32, 34, 35 AND 36 IN SECTION 19, TOWNSHIP 2 SOUTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO MAP OF SUBDIVISION OF PART OF THE RANCHO SANTA ANA DEL CHINO, RECORDED IN BOOK 6, PAGE 15 OF MAPS, RECORDS OF SAID COUNTY.

BASIS OF BEARING

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA STATE PLANE COORDINATE SYSTEM (CCS83), ZONE 5, NORTH AMERICAN DATUM 1983 (NAD83) BASED LOCALLY ON CONTINUOUSLY OPERATING REFERENCE STATIONS (CORS) "LORS" AND "EWPP" AS SHOWN HEREON (BASIS OF BEARINGS: S 81°29'26" E). ALL BEARINGS SHOWN HEREON ARE GRID BEARINGS.

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

REFERENCE DRAWINGS

SANITARY SEWER	PM-20016, PM-20161, PM-20517 & PM-20537 SANITARY SEWER IMPROVEMENT PLAN
DOMESTIC WATER	PM-20016, PM-20161, PM-20517 & PM-20537 DOMESTIC WATER IMPROVEMENT PLAN
STORM DRAIN	PM-20016, PM-20161, PM-20517 & PM-20537 STORM DRAIN IMPROVEMENT PLAN
STREET IMPROVEMENT	PM-20016, PM-20161, PM-20517 & PM-20537 STREET IMPROVEMENT PLAN
RECYCLED WATER	PM-20016, PM-20161, PM-20517 & PM-20537 RECYCLED WATER IMPROVEMENT PLAN

LEGEND OF ABBREVIATIONS & SYMBOLS

BC	BEGIN CURVE	F'S	FINISHED SURFACE	RCB	REINFORCED CONCRETE BOX
BCR	BEGIN CURB RETURN	FT/S	FEET PER SECOND	RCP	REINFORCED CONCRETE PIPE
BNDY	BOUNDARY	GB	GRADE BREAK	RT	RIGHT
C+G	CURB AND GUTTER	HDPE	HIGH DENSITY POLYETHYLENE	RW	RECYCLED WATER
CB	CATCH BASIN	HGL	HYDRAULIC GRADE LINE	R/W	RIGHT OF WAY
CFS	CUBIC FEET PER SECOND	HP	HIGH POINT	SL	STREET LIGHT
CSP	CORRUGATED STEEL PIPE	INT	INTERIM	SP	STAND PIPE (RCP)
℄ OR C/L OR CL	CENTERLINE	INV	INVERT	STA	STATION
DBL	DOUBLE	LT	LEFT	TC	TOP OF CURB
EA	EACH	LAT	LATERAL	TSP	TEMPORARY STAND PIPE
EC	END CURVE	LF	LINEAR FEET	TYP	TYPICAL
ECR	END CURB RETURN	LP	LOW POINT	ULT	ULTIMATE
ELEV	ELEVATION	MIN	MINIMUM	SD	STORM DRAIN
EP	EDGE OF PAVEMENT	PCC	POINT OF COMPOUND CURVE	SPPWC	STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
ESMT	EASEMENT	℗ OR P/L OR PL	PROPERTY LINE	SS	SANITARY SEWER
EX, EXIST.	EXISTING	PRC	POINT OF REVERSE CURVE	DW	DOMESTIC WATER
FH	FIRE HYDRANT	PVC	POLYVINYL CHLORIDE		
FL	FLOW LINE				

(100) EXISTING CONTOURS — STREET LIGHT
100 PROP. CONTOUR — BOUNDARY LINE
EXIST. EASEMENT — FENCE LINE
2% FLOW RATE — PROPOSED STORM DRAIN MH
CENTERLINE — PROPOSED CATCH BASIN
FIRE HYDRANT — PROPOSED STORM DRAIN
SIGN

Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE

TECK, C. LOH, P.E.
HARRIS AND ASSOCIATES DATE

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/6/2024
DRAWN BY: BK
DATE: 8/6/2024
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN
BON VIEW AVENUE AND EUCALYPTUS AVENUE
TITLE SHEET

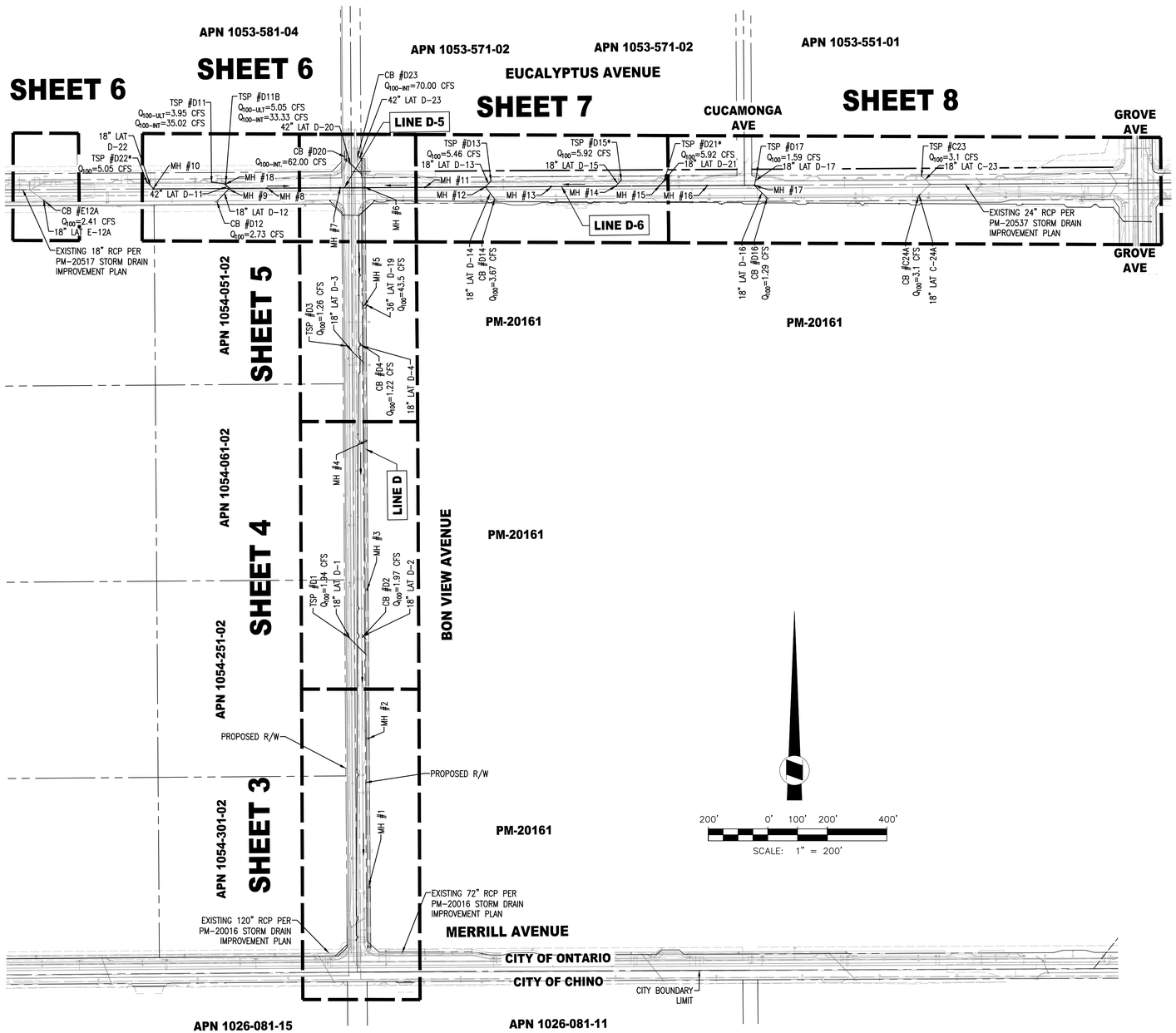
PM-20161

SHEET 1 OF 12
CONTRACT
ACCOUNT
DWG. NO.

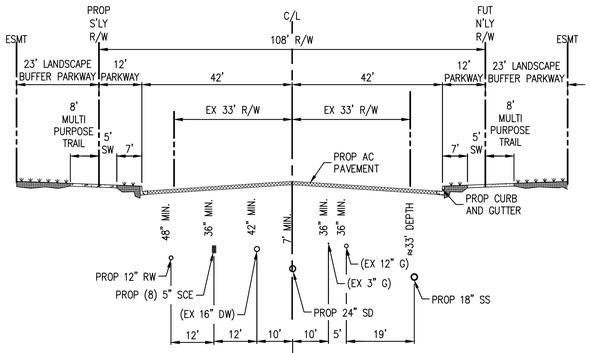
11/11/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\01_2023-038_SD_TS.dwg

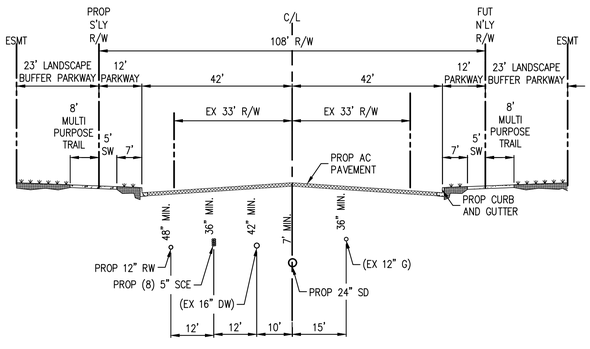
H1-560



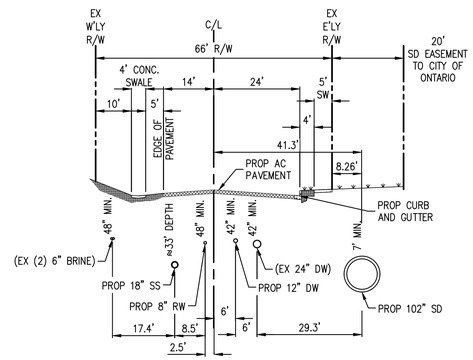
INDEX/ SYSTEM MAP



EUCALYPTUS AVE
EAST OF BON VIEW AVE
1"=20'



EUCALYPTUS AVE
WEST OF GROVE AVE
1"=20'



BON VIEW AVE
BETWEEN MERRILL AVE AND EUCALYPTUS AVE
1"=20'

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER SIARA ROSE MACKINNEY No.85559 Exp. 9/30/2026 CIVIL STATE OF CALIFORNIA

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/6/2024
DRAWN BY: BK
DATE: 8/6/2024
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

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WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN

INDEX/ SYSTEM MAP AND SECTIONS

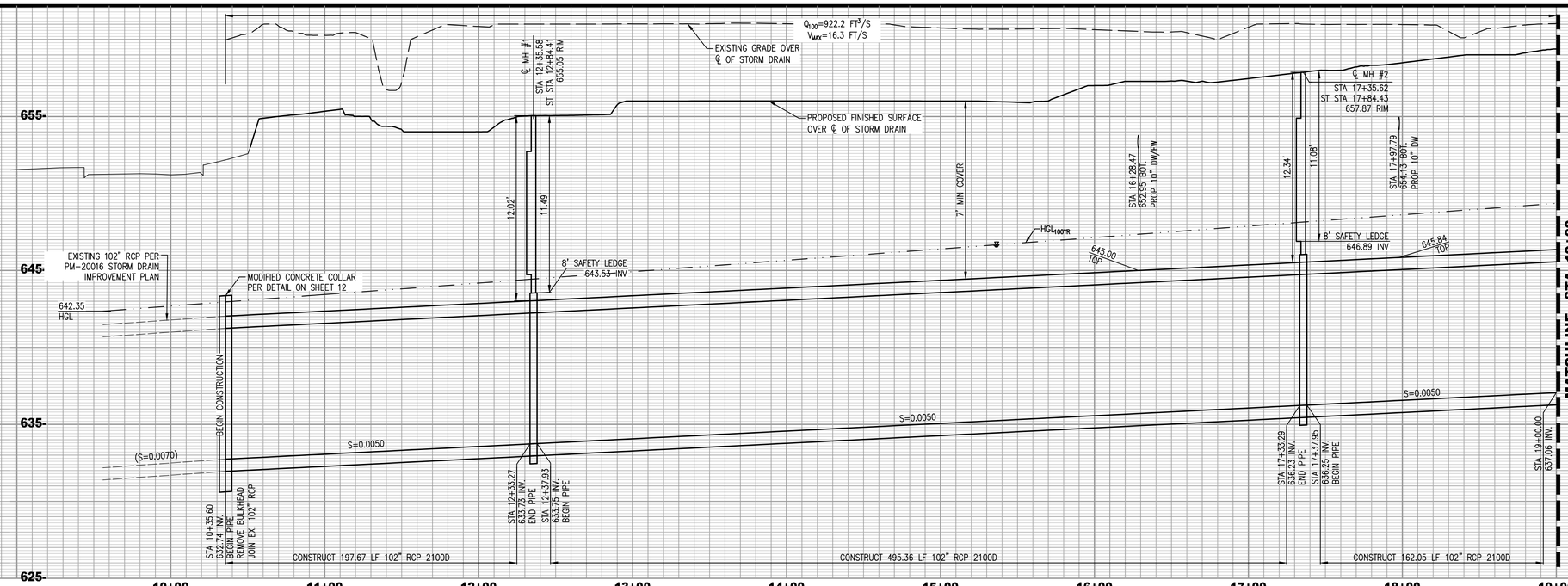
PM-20161

SHEET 2 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/11/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\02_2023-038_SD_SHEET INDEX.dwg

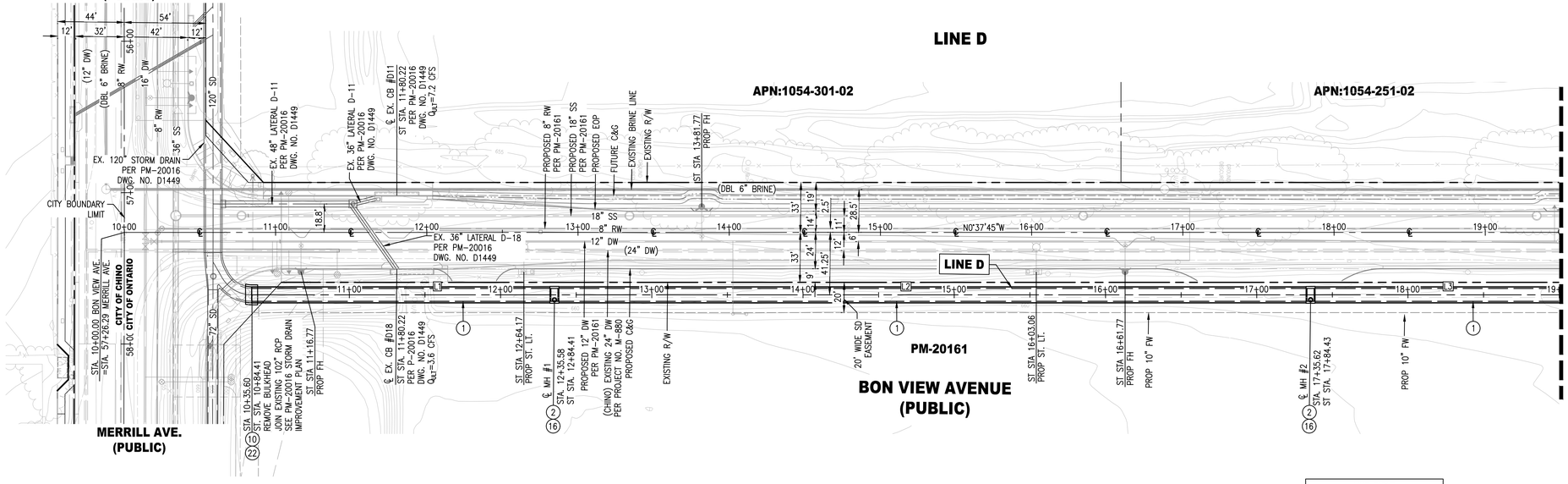
H1-561



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'

CONSTRUCTION NOTES

1. CONSTRUCT 102" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
2. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
10. REMOVE EXISTING CONCRETE BULKHEAD
16. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. PLAN NO. 330-2, PER DETAIL ON SHEET 11
22. CONSTRUCT MODIFIED CONCRETE COLLAR PER SPPWC STD. 380-2 AS MODIFIED PER DETAIL ON SHEET 11



LINE TABLE		
LINE NO.	BEARING	LENGTH
L1	N00°37'45"W	197.67'
L2	N00°37'45"W	495.36'
L3	N00°37'45"W	495.34'

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

811 Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 Exp. 9/30/2026 — CIVIL — STATE OF CALIFORNIA

40' 0' 20' 40' 80'
SCALE: 1" = 40'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/6/2024
DRAWN BY: BK
DATE: 8/6/2024
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

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BENCH MARK No. GG-18-1
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4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN

BON VIEW AVENUE

FROM MERRILL AVE TO 950' NORTH OF MERRILL AVE

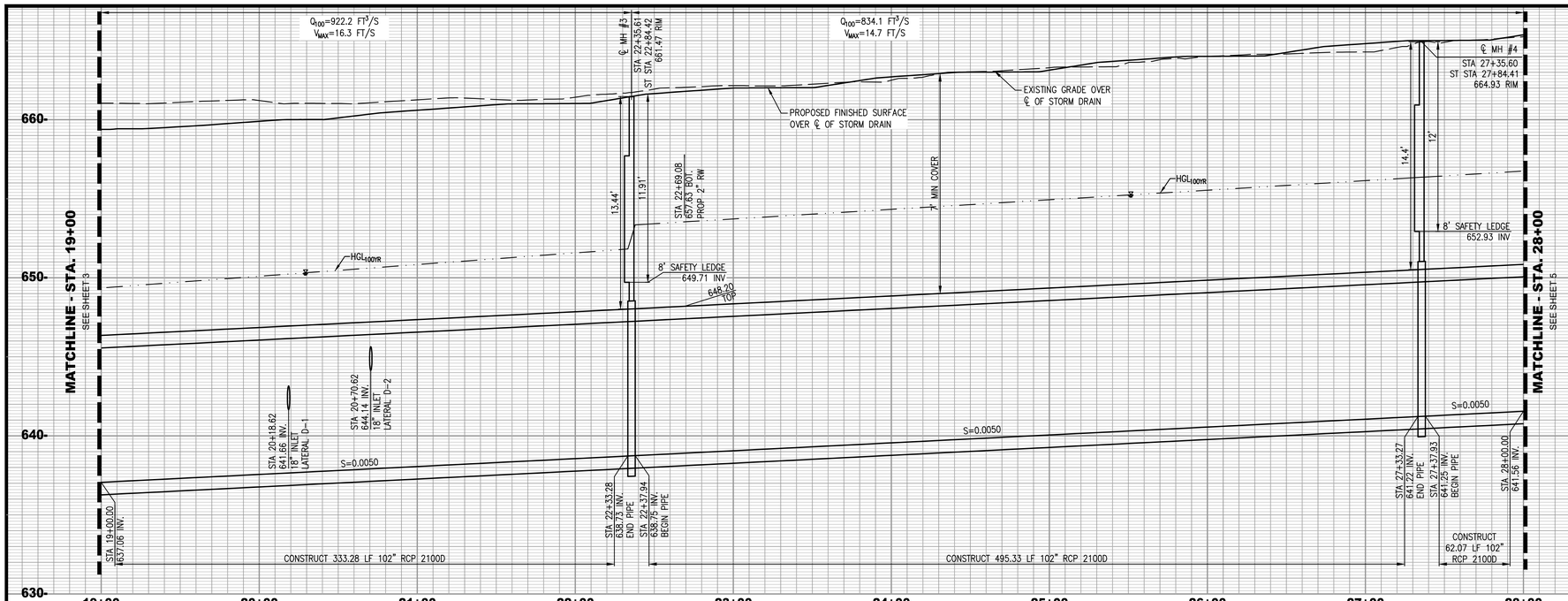
PM-20161

SHEET 3 OF 12
CONTRACT _____
ACCOUNT _____
DWG. NO. _____

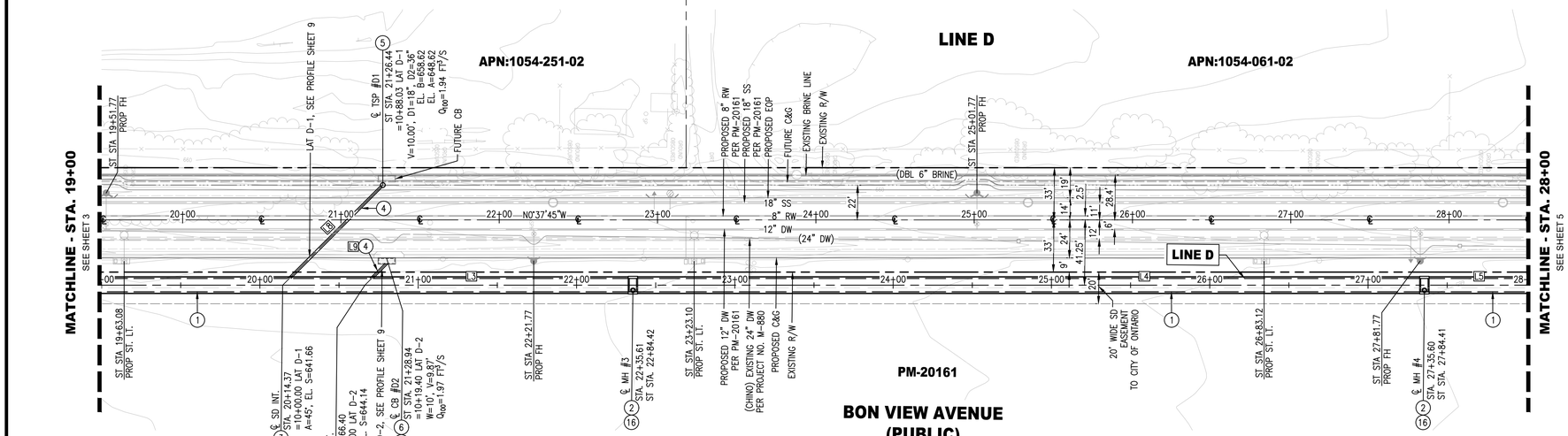
11/07/2024

H1-562

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\03-05_2023-038_SD_BON VIEW.dwg



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'



CONSTRUCTION NOTES

1. CONSTRUCT 102" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
2. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
3. CONSTRUCT JUNCTION STRUCTURE NO. 1 PER CITY OF ONTARIO STD. DWG. 3010, CASE 1
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
5. CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL ON SHEET 11
6. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" PER CITY OF ONTARIO STD. DWG. NO. 3018
7. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20161 STREET IMPROVEMENT PLANS FOR DETAILS
8. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
16. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. PLAN NO. 330-2, PER DETAIL ON SHEET 11

LINE TABLE		
LINE NO.	BEARING	LENGTH
L3	N00°37'45"W	495.34'
L4	N00°37'45"W	495.33'
L5	N00°37'45"W	495.34'
L8	N45°37'44"W	81.94'
L9	N45°37'44"W	13.44'

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

40' 0' 20' 40' 80'
SCALE: 1" = 40'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/6/2024
DRAWN BY: BK
DATE: 8/6/2024
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
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LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

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4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN

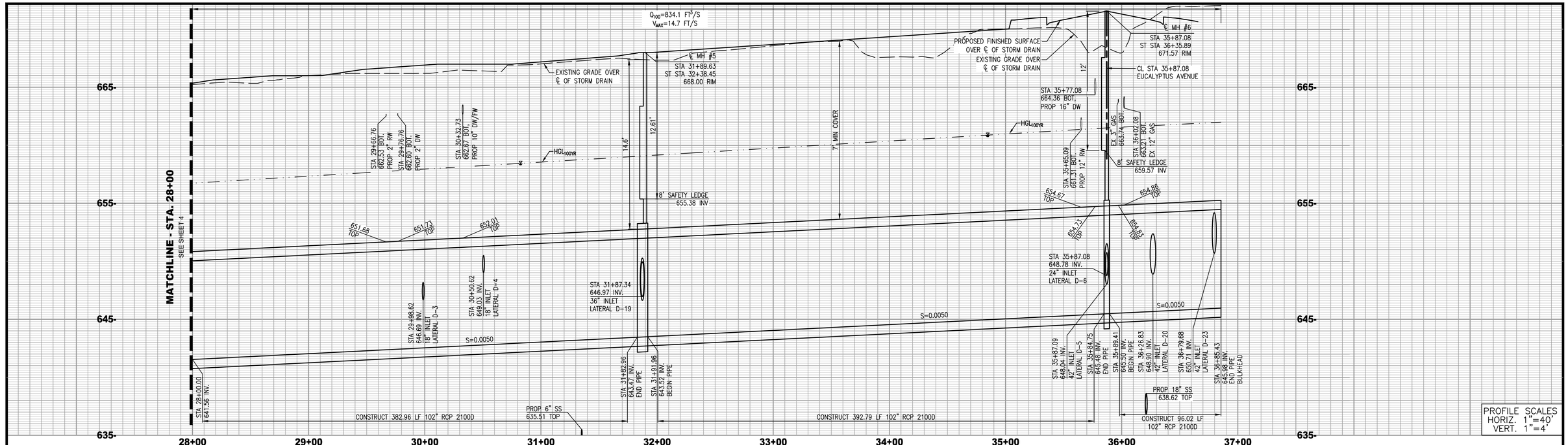
BON VIEW AVENUE
FROM 950' NORTH OF MERRILL AVE TO 800' SOUTH OF EUCALYPTUS AVE

PM-20161

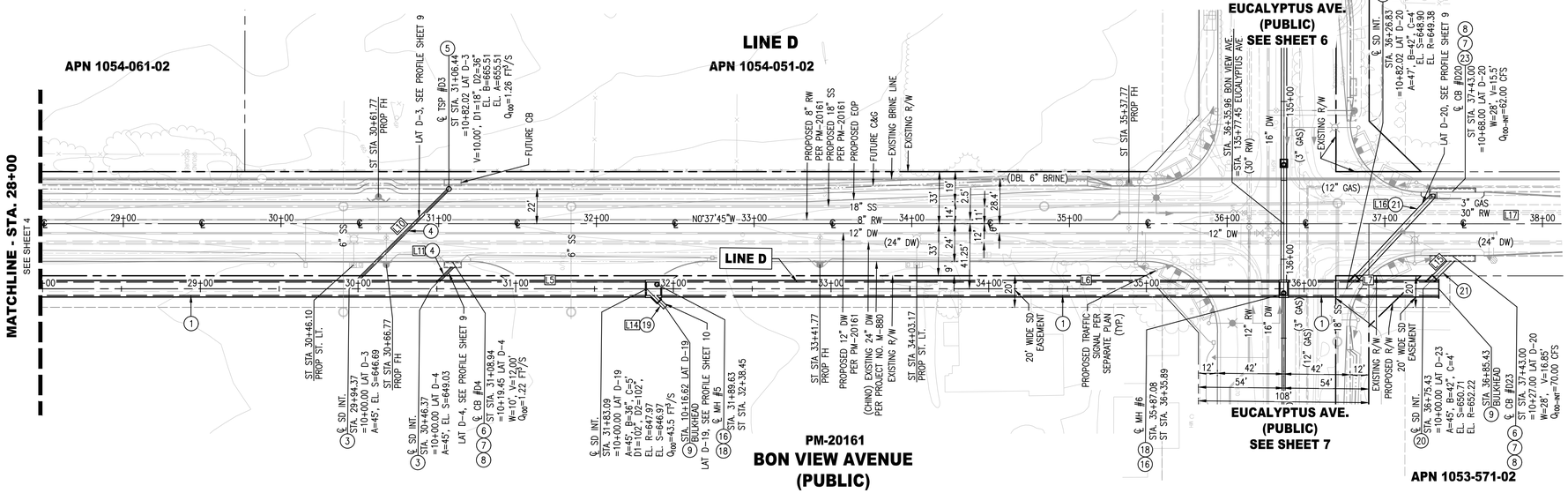
SHEET 4 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/07/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLO\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\03-05_2023-038_SD_BON VIEW.dwg



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'



LINE TABLE		
LINE NO.	BEARING	LENGTH
L15	N45°37'45"W	15.01'
L16	S47°37'55"E	73.52'
L14	N44°22'15"E	5.61'
L5	N00°37'45"W	495.34'
L6	N00°37'45"W	346.83'
L7	N00°37'45"W	96.01'
L10	N45°37'44"W	81.94'
L11	N45°37'44"W	13.43'
L17	N00°35'51"W	32.46'

CONSTRUCTION NOTES

1. CONSTRUCT 102" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
2. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
3. CONSTRUCT JUNCTION STRUCTURE NO. 1 PER CITY OF ONTARIO STD. DWG. 3010, CASE 1
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
5. CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL ON SHEET 11
6. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" PER CITY OF ONTARIO STD. DWG. NO. 3018
7. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20161 STREET IMPROVEMENT PLANS FOR DETAILS
8. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
9. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL ON SHEET 11
16. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. PLAN NO. 330-2, PER DETAIL ON SHEET 11
18. CONSTRUCT MANHOLE PIPE-TO-PIPE (LARGE SIDE INLET) PER SPPWC STD. DWG. NO. 322-3, PER DETAIL ON SHEET 12
19. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
20. CONSTRUCT JUNCTION STRUCTURE NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3012
21. CONSTRUCT 42" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
23. CONSTRUCT CATCH BASIN WITH MANHOLE IN STREET PER SPPWC STD. PLAN. NO. 307-4, PER DETAIL ON SHEET 12

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

40' 0' 20' 40' 80'
SCALE: 1" = 40'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/6/2024
DRAWN BY: BK
DATE: 8/6/2024
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DATE:

CITY OF ONTARIO

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SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN

BON VIEW AVENUE
FROM 800' SOUTH OF EUCALYPTUS AVE TO 100' NORTH OF EUCALYPTUS AVE

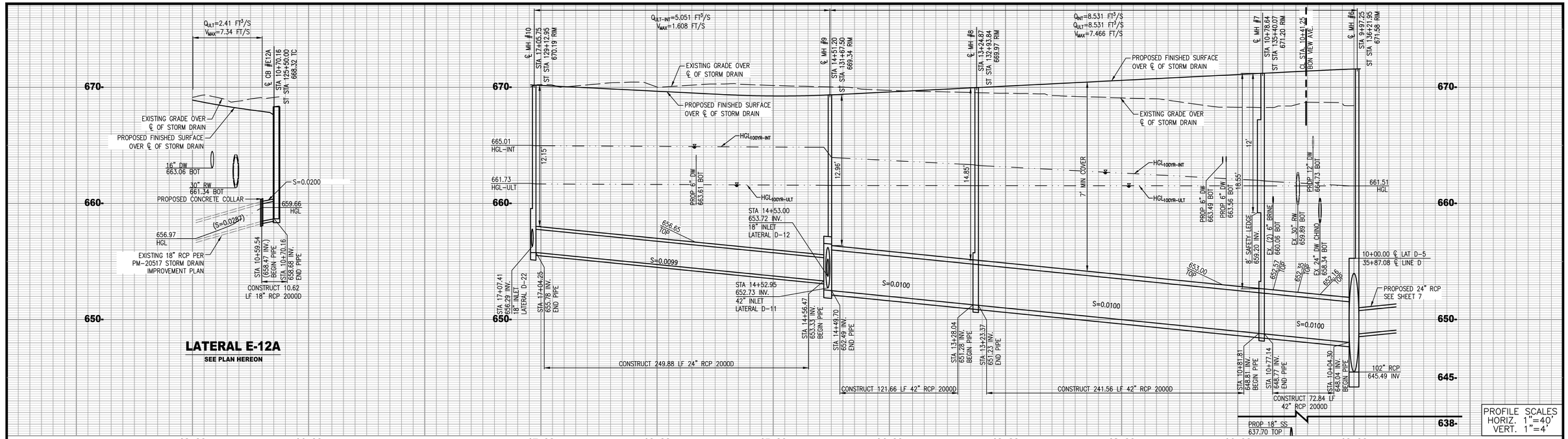
PM-20161

SHEET 5 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/11/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\03-05_2023-038_SD_BON VIEW.dwg

H1-564



APN 1054-051-03

APN 1054-051-01
PM-20161

LINE D-5

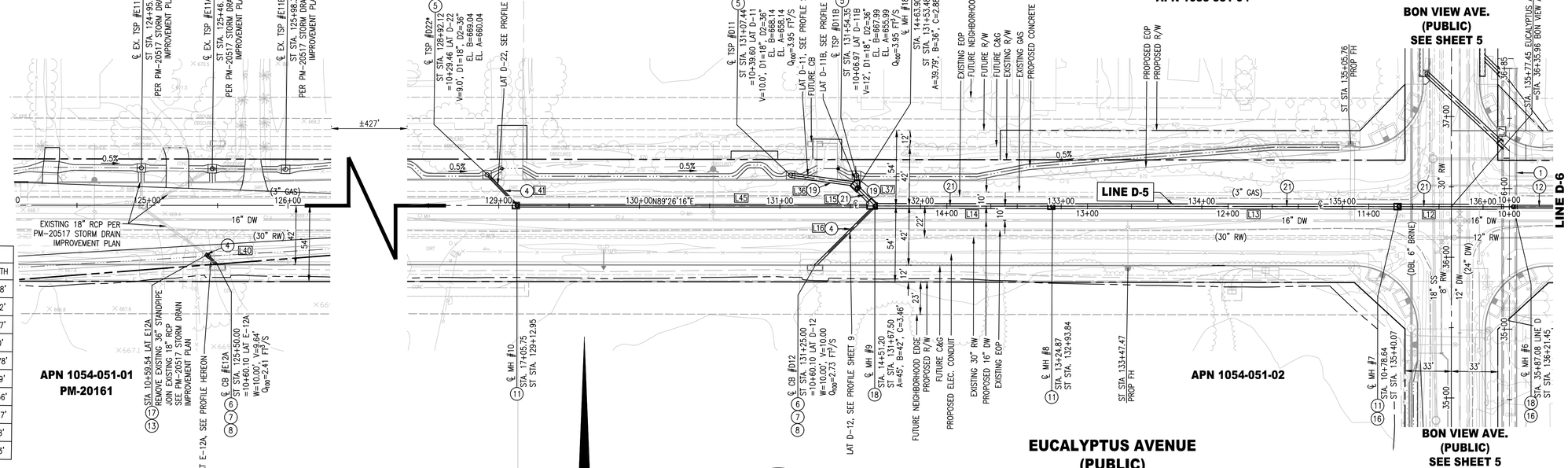
APN 1053-581-04

APN 1054-051-02

EUCALYPTUS AVENUE
(PUBLIC)

BON VIEW AVE.
(PUBLIC)
SEE SHEET 5

LINE D-6
SEE SHEET 7



LINE TABLE		
LINE NO.	BEARING	LENGTH
L41	S44°11'05"E	26.28'
L40	S46°47'48"E	10.62'
L36	N82°51'55"W	43.07'
L37	N05°46'30"W	2.40'
L45	N89°26'16"E	247.78'
L12	S89°26'16"W	35.89'
L13	S89°26'16"W	241.56'
L14	S89°26'16"W	121.67'
L15	N45°33'44"W	10.98'
L16	S44°26'16"W	57.63'

CONSTRUCTION NOTES

1. CONSTRUCT 102" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
5. CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL ON SHEET 11
6. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" PER CITY OF ONTARIO STD. DWG. NO. 3018
7. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20161 STREET IMPROVEMENT PLANS FOR DETAILS
8. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
11. CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 11
12. CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
13. CONSTRUCT CONCRETE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 11
16. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. PLAN NO. 330-2, PER DETAIL ON SHEET 11
17. EXISTING 36" TEMPORARY CSP STANDPIPE TO BE REMOVED
18. CONSTRUCT MANHOLE PIPE-TO-PIPE (LARGE SIDE INLET) PER SPPWC STD. DWG. NO. 322-3, PER DETAIL ON SHEET 12
19. CONSTRUCT 36" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
21. CONSTRUCT 42" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN

811 Know what's below. Call 811 before you dig.

NOTE:
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

SCALE: 1" = 40'

REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 Exp. 9/30/2026 — CIVIL — STATE OF CALIFORNIA

***NOTE:**
RISER IS TEMPORARY AND ONLY INTENDED TO BE USED FOR DEWATERING IN THE INTERIM CONDITION

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK DATE: 8/6/2024
DRAWN BY: BK DATE: 8/6/2024
CHECKED BY: DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN

EUCALYPTUS AVENUE

BON VIEW AVE TO 300' EAST OF BON VIEW AVE

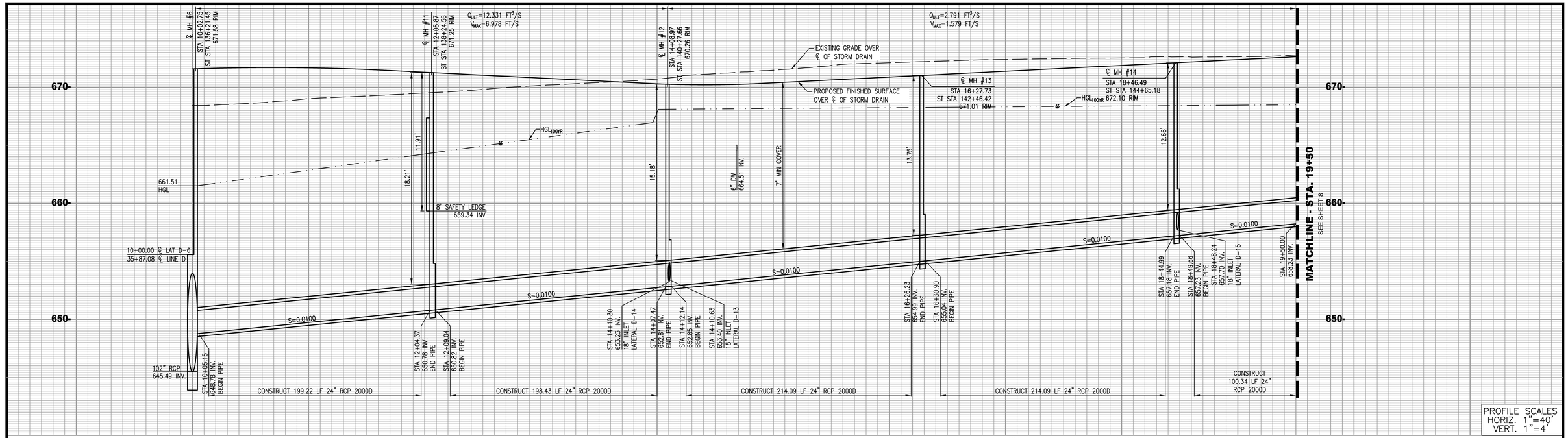
PM-20161

SHEET 6 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/11/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\06-08_2023-038_SD_EUCALYPTUS.dwg

H1-565



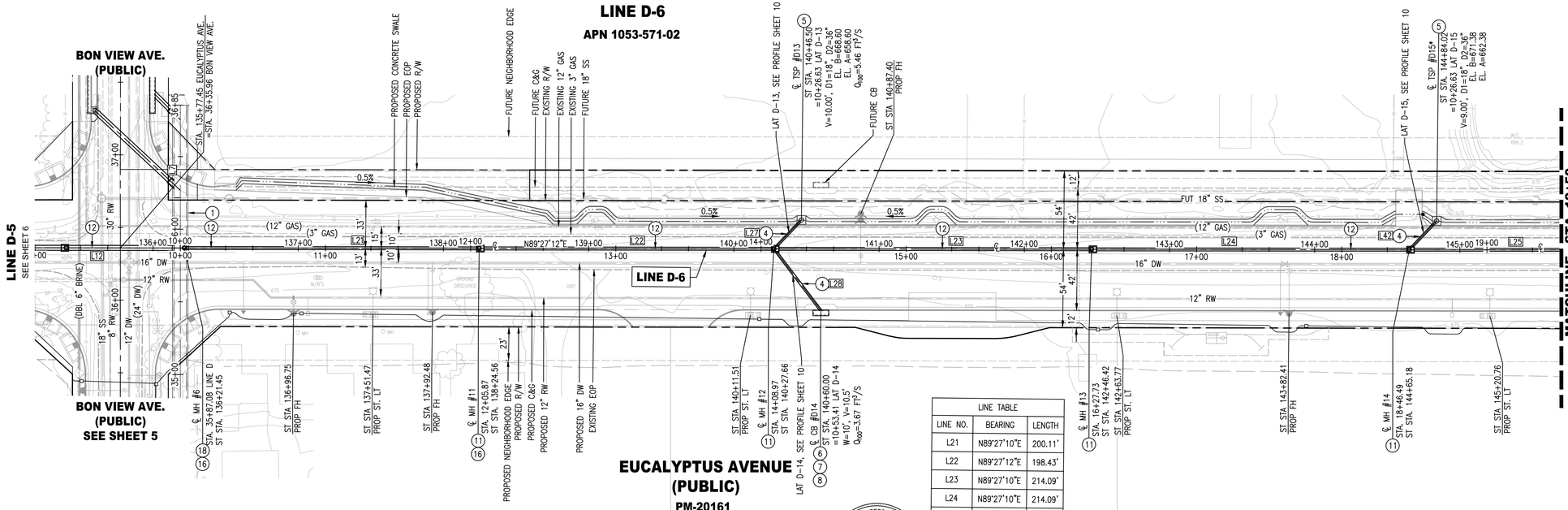
PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'

CONSTRUCTION NOTES

1. CONSTRUCT 102" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
2. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009
4. CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN
5. CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL ON SHEET 11
6. CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" PER CITY OF ONTARIO STD. DWG. NO. 3018
7. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20161 STREET IMPROVEMENT PLANS FOR DETAILS
8. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
11. CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 11
12. CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN
16. CONSTRUCT MANHOLE SAFETY LEDGE PER SPPWC STD. PLAN NO. 330-2, PER DETAIL ON SHEET 11
18. CONSTRUCT MANHOLE PIPE-TO-PIPE (LARGE SIDE INLET) PER SPPWC STD. DWG. NO. 322-3, PER DETAIL ON SHEET 12

LINE D-6

APN 1053-571-02



LINE TABLE		
LINE NO.	BEARING	LENGTH
L21	N89°27'10"E	200.11'
L22	N89°27'12"E	198.43'
L23	N89°27'10"E	214.09'
L24	N89°27'10"E	214.09'
L25	N89°27'10"E	141.63'
L27	N42°56'51"E	23.46'
L28	S37°48'59"E	51.21'
L12	S89°26'16"W	35.89'
L7	N00°37'45"W	96.01'

LINE TABLE		
LINE NO.	BEARING	LENGTH
L42	S42°56'02"W	23.45'

NOTE:
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

***NOTE:**
RISER IS TEMPORARY AND ONLY INTENDED TO BE USED FOR DEWATERING IN THE INTERIM CONDITION

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

40' 0' 20' 40' 80'
SCALE: 1" = 40'

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK DATE: 8/6/2024
DRAWN BY: BK DATE: 8/6/2024
CHECKED BY: DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN
EUCALYPTUS AVENUE
FROM BON VIEW AVE TO 950' EAST OF BON VIEW AVE

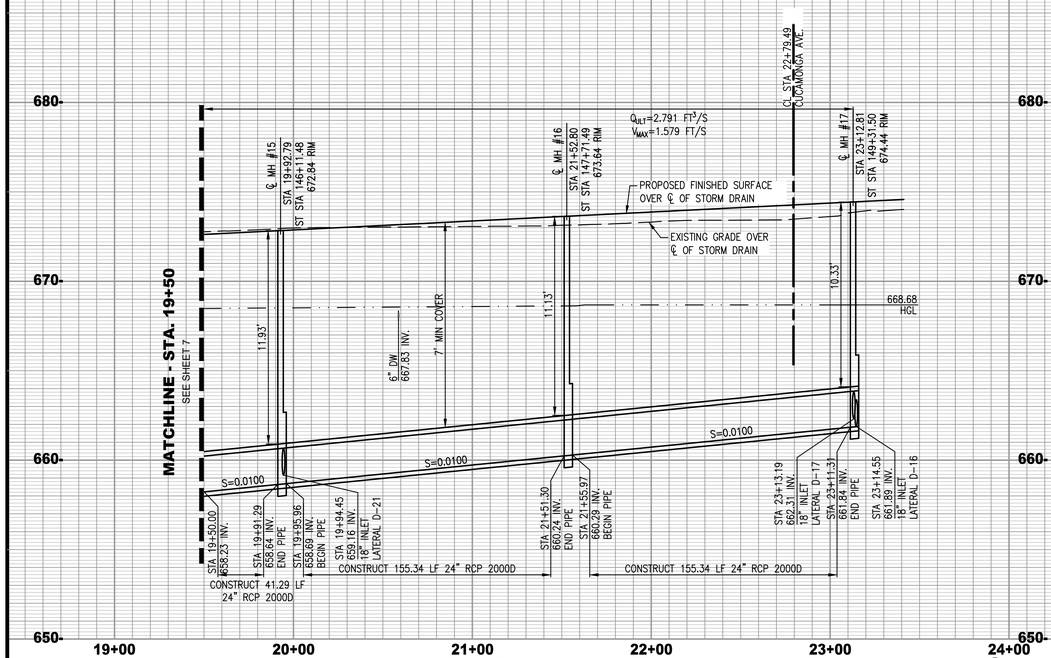
PM-20161

SHEET 7 OF 12
CONTRACT
ACCOUNT
DWG. NO.

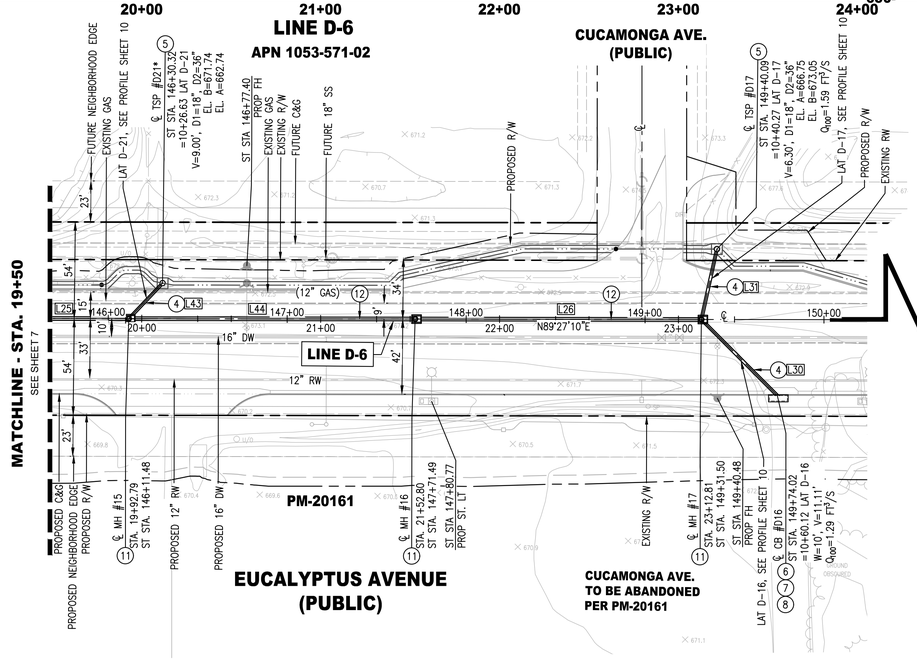
11/07/2024

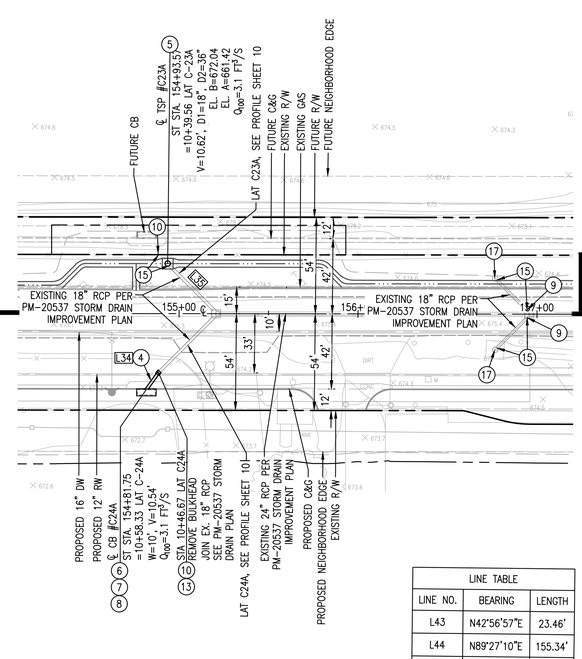
H1-566

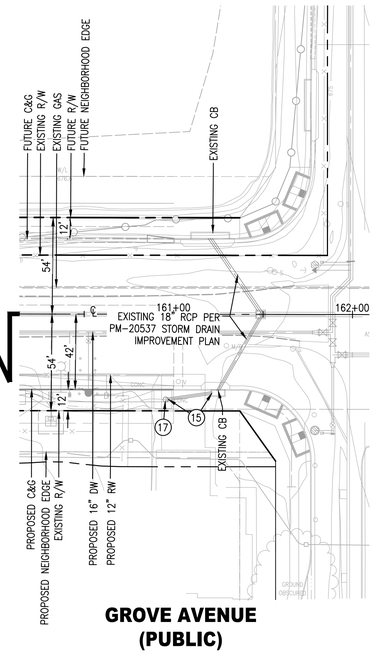
Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\06-08_2023-038_SD_EUCALYPTUS.dwg



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'







CONSTRUCTION NOTES

(4) CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER LACDPW STD. 3080-2 CASE 3, D-LOAD PER PLAN

(5) CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL ON SHEET 11

(6) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" PER CITY OF ONTARIO STD. DWG. NO. 3018

(7) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20161 STREET IMPROVEMENT PLANS FOR DETAILS

(8) CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017

(9) CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL ON SHEET 11

(10) REMOVE EXISTING CONCRETE BULKHEAD

(11) CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 11

(12) CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(13) CONSTRUCT CONCRETE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 11

(15) REMOVE EXISTING 18" RCP

(17) EXISTING 36" TEMPORARY CSP STANDPIPE TO BE REMOVED

LINE TABLE		
LINE NO.	BEARING	LENGTH
L43	N42°56'57"E	23.46'
L44	N89°27'10"E	155.34'
L34	S34°51'06"W	11.54'
L35	N45°29'42"W	35.59'
L25	N89°27'10"E	141.63'
L26	N89°27'10"E	155.34'
L30	S45°33'44"E	57.65'
L31	N11°46'14"E	36.98'

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call 811 before you dig.

NOTE:
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

***NOTE:**
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REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: 8/6/2024
DRAWN BY: BK
DATE: 8/6/2024
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN
EUCALYPTUS AVENUE
FROM 950' EAST OF BON VIEW AVE TO 1400' EAST OF BON VIEW AVE

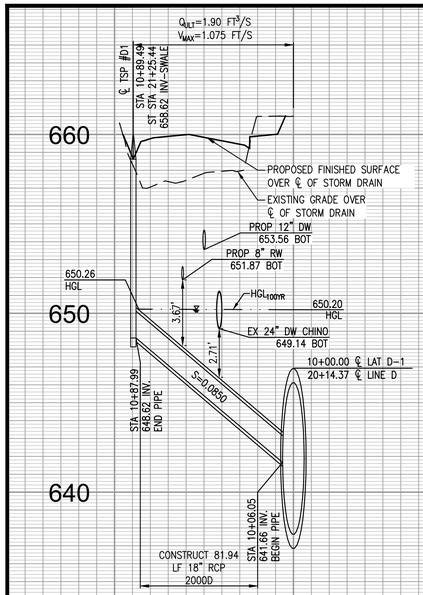
PM-20161

SHEET 8 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/11/2024

H1-567

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\06-08_2023-038_SD_EUCALYPTUS.dwg



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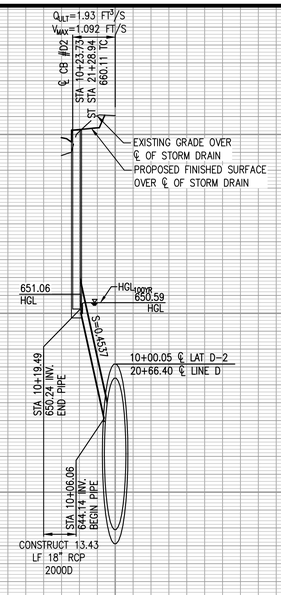
SEE PLAN SHEET 4



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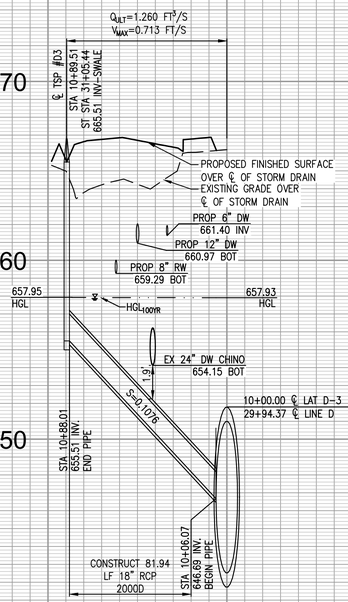
SEE PLAN SHEET 4



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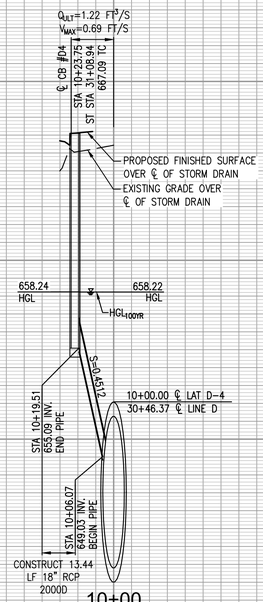

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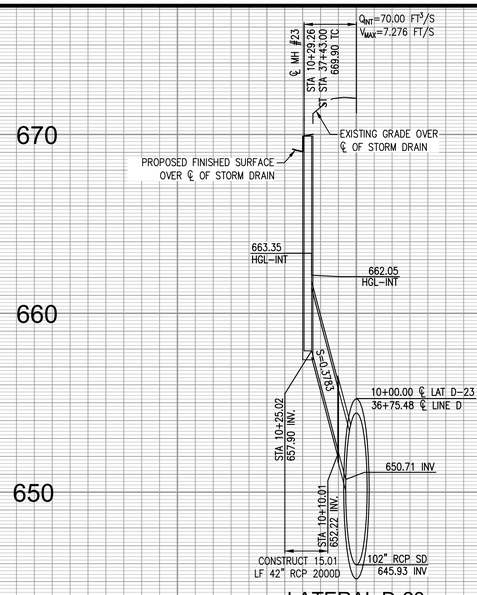
SEE PLAN SHEET 5



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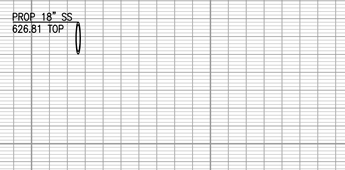
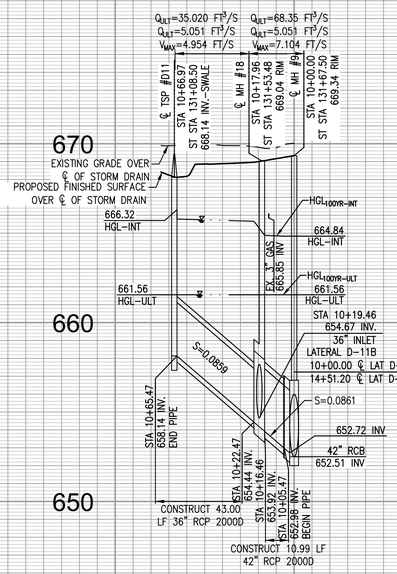
SEE PLAN SHEET 5





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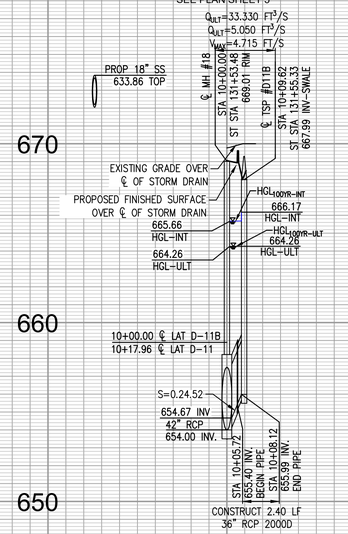
SEE PLAN SHEET 6



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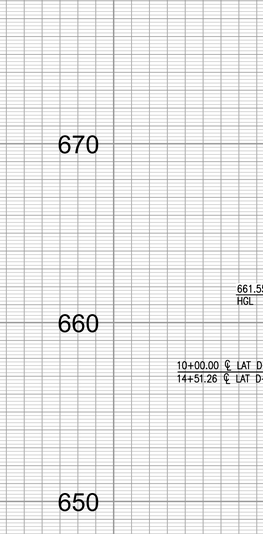

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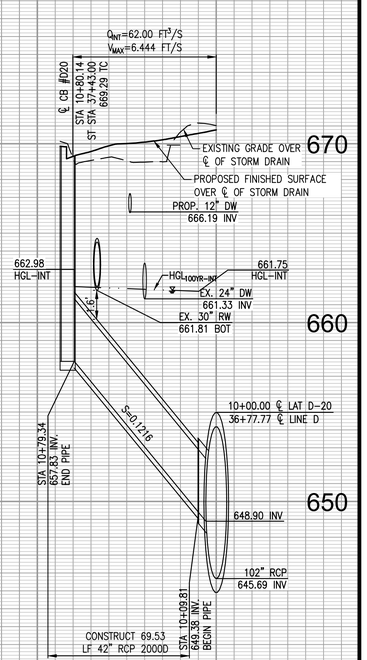
SEE PLAN SHEET 6



10+00
LATERAL D-20
SEE PLAN SHEET 5

PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER
SIARA REZE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

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BENCH MARK No. GG-18-1
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WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
BON VIEW AVENUE AND EUCALYPTUS AVENUE
LATERAL PROFILES

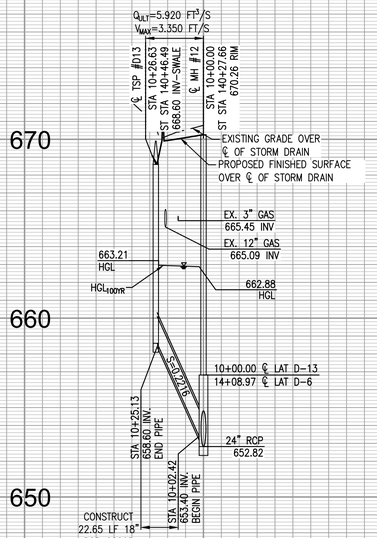
PM-20161

SHEET 9 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/11/2024

H1-568

Drawing Name: P:\Year_2023\2023-038-REDA-SOL\C\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\09_2023-038_SD_LATPROF.dwg



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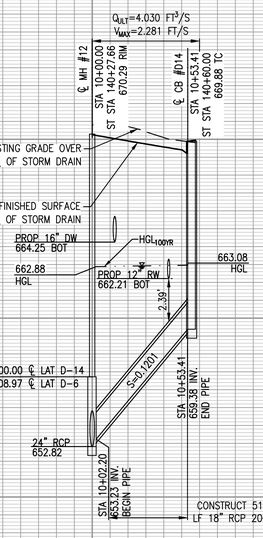
LATERAL D-13
SEE PLAN SHEET 7



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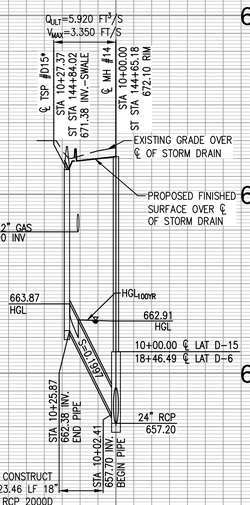
LATERAL D-14
SEE PLAN SHEET 7



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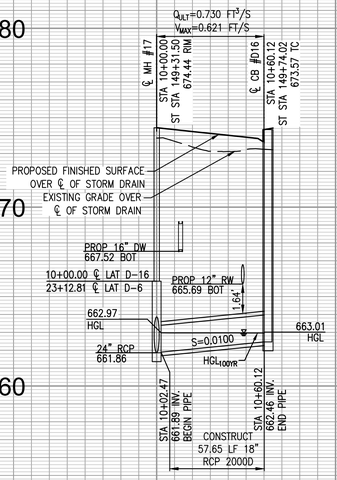
LATERAL D-15
SEE PLAN SHEET 7



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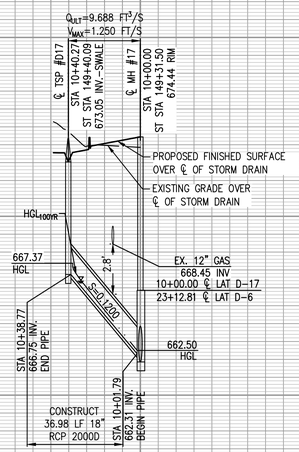
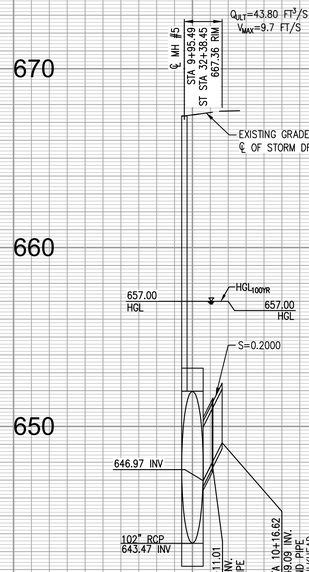
LATERAL D-16
SEE PLAN SHEET 8



10+00
LATERAL D-17
SEE PLAN SHEET 8



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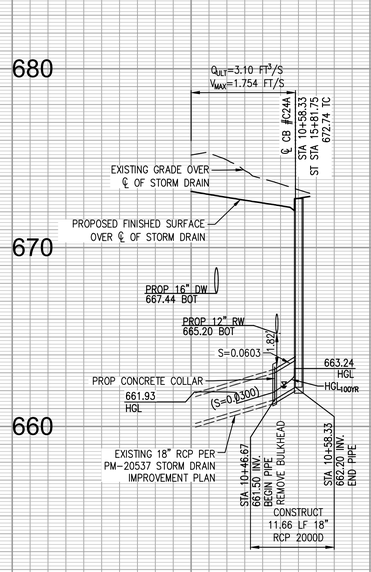
LATERAL D-19
SEE PLAN SHEET 5



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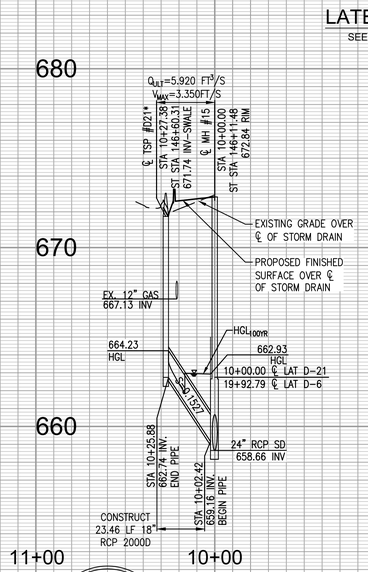
LATERAL C-24A
SEE PLAN SHEET 8



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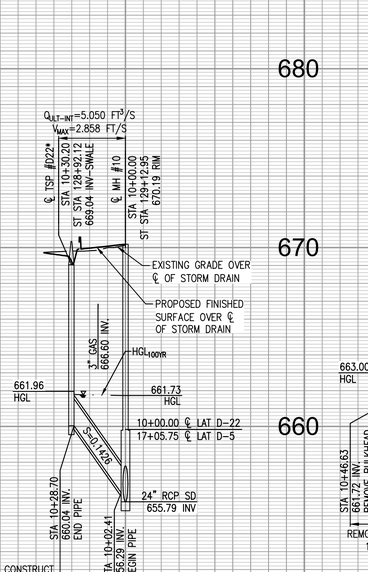
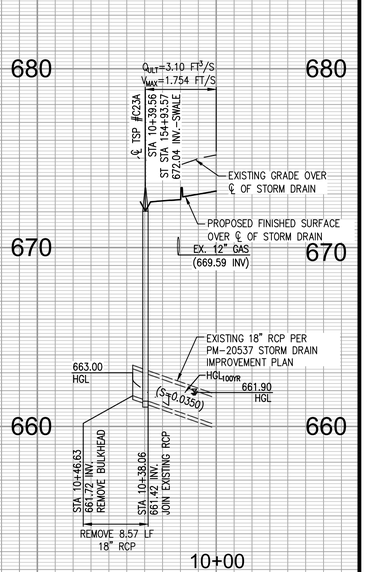
LATERAL D-21
SEE PLAN SHEET 8



10+00
LATERAL D-22
SEE PLAN SHEET 6



10+00
LATERAL C-23A
SEE PLAN SHEET 8

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

*NOTE:
RISER IS TEMPORARY AND ONLY INTENDED TO BE USED FOR DEWATERING IN THE INTERIM CONDITION

PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
BON VIEW AVENUE AND EUCALYPTUS AVENUE
LATERAL PROFILES

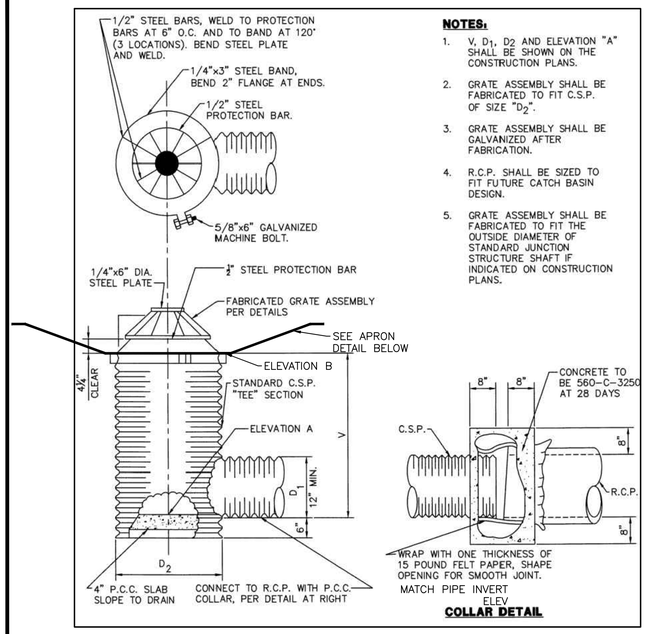
PM-20161

SHEET 10 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/07/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\09_2023-038_SD_LATPROF.dwg

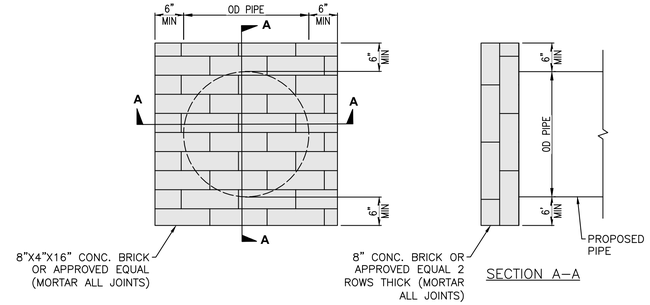
H1-569



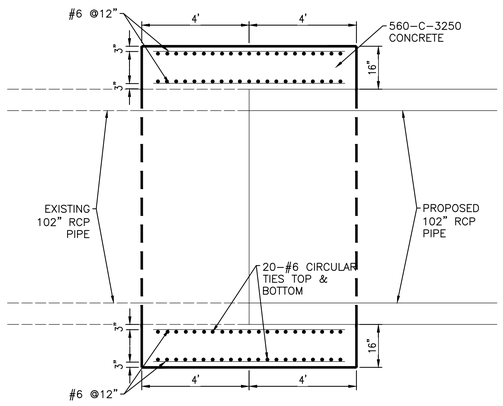
NOTES:

1. V, D_1, D_2 AND ELEVATION "A" SHALL BE SHOWN ON THE CONSTRUCTION PLANS.
2. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT C.S.P. OF SIZE "D_2".
3. GRATE ASSEMBLY SHALL BE GALVANIZED AFTER FABRICATION.
4. R.C.P. SHALL BE SIZED TO FIT FUTURE CATCH BASIN DESIGN.
5. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT THE OUTSIDE DIAMETER OF STANDARD JUNCTION STRUCTURE SHAFT IF INDICATED ON CONSTRUCTION PLANS.

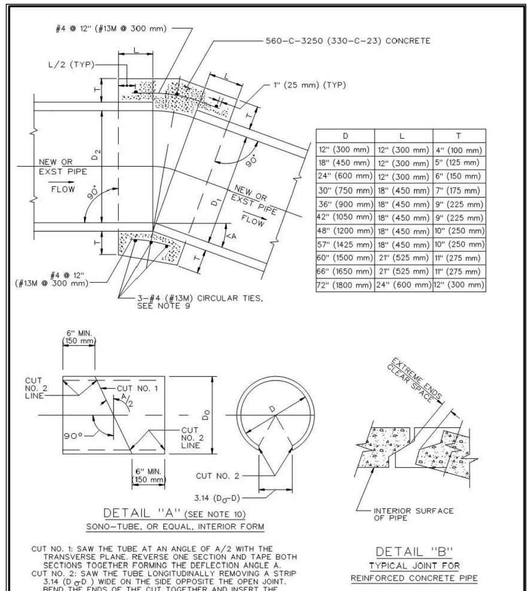
(5) TEMPORARY CSP STANDPIPE DETAIL
DETAIL 1



(9) BRICK AND MORTAR BULKHEAD DETAIL
DETAIL 2



(22) MODIFIED CONCRETE COLLAR DETAIL
N.T.S.
(BASED ON SPPWC 380-4, DETAIL ON SHEET 13)
NOTE: USE ASTM A615 GRADE 60 BAR REINFORCEMENT



D	L	T
12" (300 mm)	12" (300 mm)	4" (100 mm)
18" (450 mm)	12" (300 mm)	5" (125 mm)
24" (600 mm)	12" (300 mm)	6" (150 mm)
30" (750 mm)	18" (450 mm)	7" (175 mm)
36" (900 mm)	18" (450 mm)	9" (225 mm)
42" (1050 mm)	18" (450 mm)	9" (225 mm)
48" (1200 mm)	18" (450 mm)	10" (250 mm)
57" (1425 mm)	18" (450 mm)	10" (250 mm)
60" (1500 mm)	21" (525 mm)	11" (275 mm)
66" (1650 mm)	21" (525 mm)	11" (275 mm)
72" (1800 mm)	24" (600 mm)	12" (300 mm)

DETAIL "A" (SEE NOTE 10)
SONO-TUBE, OR EQUAL, INTERIOR FORM

CUT NO. 1: SAW THE TUBE AT AN ANGLE OF A/2 WITH THE TRANSVERSE PLANE. REVERSE ONE SECTION AND TAPE BOTH SECTIONS TOGETHER FORMING THE DEFLECTION ANGLE A.
CUT NO. 2: SAW THE TUBE LONGITUDINALLY REMOVING A STRIP 3.14 (D_0-D) WIDE ON THE SIDE OPPOSITE THE OPEN JOINT. BEND THE ENDS OF THE CUT TOGETHER AND INSERT THE TUBE IN THE PIPE.

DETAIL "B"
TYPICAL JOINT FOR
REINFORCED CONCRETE PIPE

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 1997, 1999, 2009

CONCRETE COLLAR FOR RCP
12" (300 mm) THROUGH 72" (1800 mm)

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 380-4
SHEET 1 OF 2

NOTES

1. A CONCRETE COLLAR IS REQUIRED WHERE THE CHANGE IN GRADE EXCEEDS 10%.
2. FOR CURVE JOINTS (SEE DETAIL B, SHEET 1)
   IF THE EXTREME ENDS OF THE PIPE LEAVE A CLEAR SPACE THAT IS GREATER THAN 1" (25 mm), BUT IS LESS THAN 3" (75 mm) A CONCRETE COVER IS REQUIRED IN ACCORDANCE WITH SSPWC 306-7.3.2.1.
   IF THE EXTREME ENDS OF THE PIPE LEAVE A CLEAR SPACE THAT IS EQUAL TO OR GREATER THAN 3" (75 mm), BUT LESS THAN 6" (150 mm), A CONCRETE COLLAR IS REQUIRED. IF THE CLEAR SPACE IS 6" (150 mm) OR GREATER, A TRANSITION STRUCTURE IS REQUIRED.
3. CONCRETE COLLAR SHALL NOT BE USED FOR A SIZE CHANGE ON THE MAIN LINE.
4. CONNECTOR PIPES
   A. WHERE PIPES OF DIFFERENT DIAMETERS ARE JOINED WITH A CONCRETE COLLAR, L AND T SHALL BE THOSE OF THE LARGER PIPE. $D=D_1$ OR D_2 WHICHEVER IS GREATER.
   B. WHEN D_1 IS EQUAL TO OR LESS THAN D_2 JOIN INVERTS AND WHEN D_1 IS GREATER THAN D_2 JOIN SOFFITS.
5. FOR PIPE LARGER THAN 72" (1800 mm) SPECIAL COLLAR DETAILS ARE REQUIRED.
6. FOR PIPE SIZE NOT LISTED USE NEXT SIZE LARGER.
7. REINFORCEMENT SHALL CONFORM TO ASTM A 615 (A 615 M) GRADE 40 (300).
8. WHERE REINFORCING IS REQUIRED THE DIAMETER OF THE CIRCULAR TIES SHALL BE D+(2X WALL THICKNESS) + T.
9. REINFORCING SHALL BE USED WHERE THE PIPE DIAMETER IS GREATER THAN 21" (525 mm) AND ON ALL PIPES WHERE THE SPACES BETWEEN THE EXTREME OUTER ENDS IS 3" (75 mm) OR LARGER.

CIRCULAR TIES:

PIPE DIAMETER	NO. OF CIRCULAR TIES
21" (525 mm) OR LESS	3
24" (600 mm) TO 30" (750 mm)	3
33" (825 mm) TO 57" (1425 mm)	4
60" (1500 mm) TO 72" (1800 mm)	5

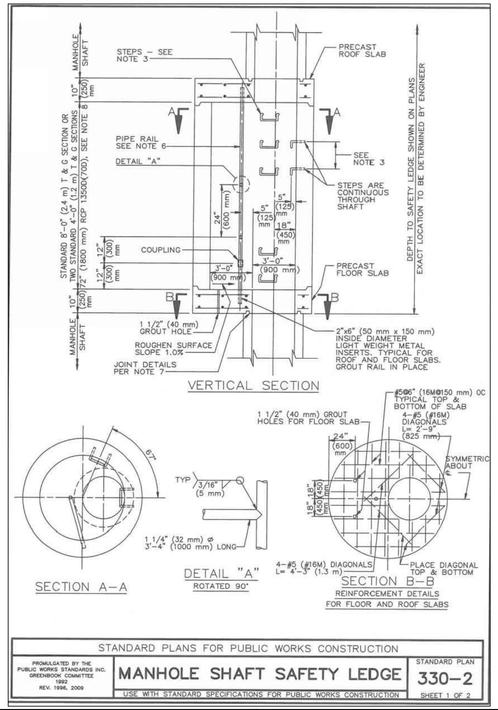
WHERE THE SPACE BETWEEN PIPE ENDS EXCEEDS 3" (75 mm), THE NUMBER OF CIRCULAR TIES SHALL BE INCREASED TO MAINTAIN AN APPROXIMATE SPACING OF 6" (150 mm) O.C.

10. WHERE THE PIPE IS 21" (525 mm) OR LESS IN DIAMETER AN INTERIOR FORM OF UNSEALED SONO-TUBE OR EQUAL SHALL BE USED TO PROVIDE A SMOOTH INTERIOR JOINT. THE PAPER FORM MAY BE LEFT IN PLACE (SEE DETAIL A). WHEN THE PIPE IS 24" (600 mm) OR LARGER A REMOVABLE INTERIOR FORM SHALL BE USED OR THE INTERIOR JOINT SHALL BE COMPLETELY FILLED WITH MORTAR AND NEATLY POINTED.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

CONCRETE COLLAR FOR RCP
12" (300 mm) THROUGH 72" (1800 mm)

STANDARD PLAN 380-4
SHEET 2 OF 2



STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 2009

MANHOLE SHAFT SAFETY LEDGE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 330-2
SHEET 1 OF 2

NOTES

1. MANHOLE SHAFT SAFETY LEDGE WILL BE NOTED ON THE PLANS WHEN REQUIRED. IT IS TO BE CONSTRUCTED WHEN DEPTH OF MANHOLE TO INVERT IS GREATER THAN 20' (6 m) AND MANHOLE SHAFT IS GREATER THAN 10' (3 m).
2. A SAFETY LEDGE SHALL NOT BE USED IF A PRESSURE MANHOLE IS REQUIRED.
3. STEPS SHALL CONFORM TO SPPWC 635 OR 636 AND SHALL BE ANCHORED 4" (100 mm) IN THE WALL OF THE STRUCTURE. STEPS SHALL BE PLACED TO MATCH THE SPACING OF THE MANHOLE SHAFT.
4. REINFORCEMENT SHALL BE PER ASTM A 615, GRADE 40 (ASTM A 615M, GRADE 300) AND SHALL TERMINATE 2" (50 mm) CLEAR OF CONCRETE SURFACE UNLESS OTHERWISE SHOWN.
5. GROUT HOLES, PIPE AND FITTINGS SHALL BE PROVIDED IN THE FLOOR SLAB. PRESSURE GROUTING SHALL BE USED TO FILL VOIDS AND TO SECURE UNIFORM BEARING. THE GROUT SHALL BE NEAT CEMENT GROUT AND GROUTING PRESSURES SHALL BE AS DETERMINED IN THE FIELD BY THE ENGINEER.
6. PIPE RAIL SHALL BE FABRICATED OF 1 1/4" (32 mm) STANDARD GALVANIZED PIPE COMPOSED OF TWO SECTIONS 7'-6" (2.25 m) & 18" (450 mm) IN LENGTH JOINED BY A GALVANIZED COUPLING. THE COUPLING SHALL BE THREADED A MINIMUM OF 2" (50 mm) ON EACH PIPE LENGTH.
7. ROOF AND FLOOR SLABS SHALL BE PRECAST AND KEYED FOR REINFORCED CONCRETE PIPE SECTIONS AS SHOWN. ALL JOINTS SHALL BE FILLED WITH CLASS C MORTAR AND NEATLY POINTED OR WIPED ON THE INSIDE.
8. 72" (1800 mm) RCP SHALL BE PROVIDED WITH TWO CIRCULAR CAGES OF REINFORCEMENT.
9. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:

   324 MANHOLE SHAFT - WITH ECCENTRIC REDUCER
   326 MANHOLE SHAFT - 36" (900 mm) WITHOUT REDUCER
   635 STEEL STEP
   636 POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE SHAFT SAFETY LEDGE

STANDARD PLAN 330-2
SHEET 2 OF 2

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1," SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

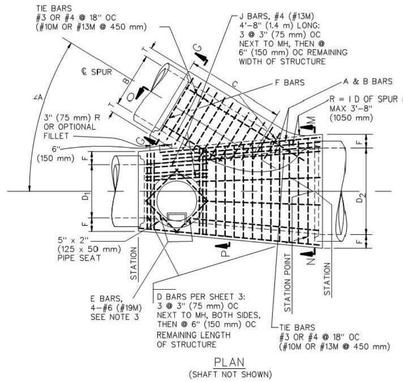
STORM DRAIN IMPROVEMENT PLAN
BON VIEW AVENUE AND EUCALYPTUS AVENUE
DETAILS

PM-20161

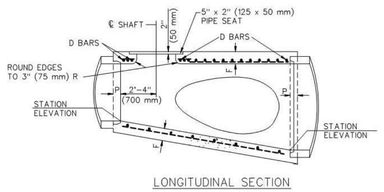
SHEET 11 OF 12
CONTRACT
ACCOUNT
DWG. NO.

11/11/2024

Drawing Name: P:\Year_2023\2023-038-REDA-SOLC\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\11_2023-038_SD_DETAIL.dwg



PLAN
(SHAFT NOT SHOWN)



LONGITUDINAL SECTION

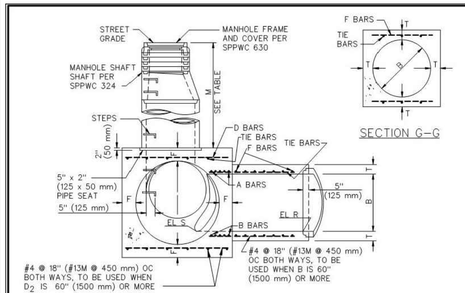
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1998, 2006, 2021

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

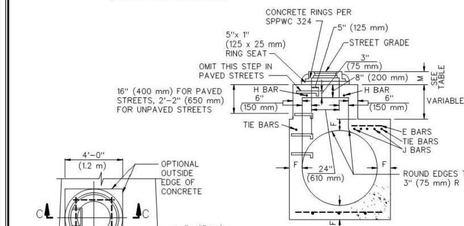
USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 322-3 SHEET 1 OF 4

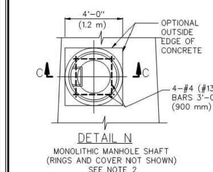


SECTION N-M-P-O

SECTION G-G



SECTION C-C



DETAIL N

MONOLITHIC MANHOLE SHAFT
(RINGS AND COVER NOT SHOWN)
SEE NOTE 2

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

STANDARD PLAN 322-3 SHEET 2 OF 4

TABLE OF BAR SIZES		
D2 OR B	A & B	D OR F
12"–39" (300 – 975 mm)	#5 @ 3" (#16M @ 75 mm)	#4 @ 6" (#13M @ 150 mm)
42"–84" (1050 – 2100 mm)	#6 @ 3" (#19M @ 75 mm)	#5 @ 6" (#16M @ 150 mm)
90"–144" (2250 – 3600 mm)	#7 @ 3" (#22M @ 75 mm)	#6 @ 6" (#19M @ 150 mm)

TABLE OF VALUES FOR M (SEE NOTE 2)				
SECTION	PAVED STREET		UNPAVED STREET	
	MAX	MIN	MAX	MIN
N–M–P–O		2' 10–1/2" (867 mm)		1060 mm (3'–6")
C–C	11" (282 mm)	8–1/2" (217 mm)	16" (410 mm)	15" (380 mm)

TABLE OF VALUES FOR F	
D2	F
36" (900 mm)	6–1/2" (165 mm)
39" (975 mm)	7" (180 mm)
42" (1050 mm)	7–1/2" (190 mm)
45" (1125 mm)	7–3/4" (195 mm)
48" (1200 mm)	8" (205 mm)
51" (1275 mm)	8–1/2" (215 mm)
54" (1350 mm)	9" (230 mm)
57" (1425 mm)	9–1/4" (235 mm)
60" (1500 mm)	9–1/2" (240 mm)
63" (1575 mm)	10" (255 mm)
66" (1650 mm)	10–1/4" (260 mm)
69" (1725 mm)	10–3/4" (275 mm)
72" (1800 mm)	11" (280 mm)
78" (1950 mm)	11–3/4" (300 mm)
84" (2100 mm)	12–1/2" (320 mm)
90" (2250 mm)	13–1/4" (335 mm)
96" (2400 mm)	14" (355 mm)
102" (2550 mm)	15–1/2" (395 mm)
108" (2700 mm)	16" (405 mm)
114" (2850 mm)	16–1/2" (420 mm)
120" (3000 mm)	17" (430 mm)
126" (3150 mm)	17" (430 mm)
132" (3300 mm)	17–1/2" (445 mm)
138" (3450 mm)	17–1/2" (445 mm)
144" (3600 mm)	18" (455 mm)

TABLE OF VALUES FOR T	
B	T
12" (300 mm)	4" (100 mm)
15" (375 mm)	4–1/4" (110 mm)
18" (450 mm)	4–1/2" (115 mm)
21" (525 mm)	5" (125 mm)
24" (600 mm)	5–1/4" (135 mm)
27" (675 mm)	5–1/2" (140 mm)
30" (750 mm)	6" (150 mm)
33" (825 mm)	6–1/4" (160 mm)
36" (900 mm)	6–1/2" (165 mm)
39" (975 mm)	7" (180 mm)
42" (1050 mm)	7–1/2" (190 mm)
45" (1125 mm)	7–3/4" (195 mm)
48" (1200 mm)	8" (205 mm)
51" (1275 mm)	8–1/2" (215 mm)
54" (1350 mm)	9" (230 mm)
57" (1425 mm)	9–1/4" (235 mm)
60" (1500 mm)	9–1/2" (240 mm)
63" (1575 mm)	10" (255 mm)
66" (1650 mm)	10–1/4" (260 mm)
69" (1725 mm)	10–3/4" (275 mm)
72" (1800 mm)	11" (280 mm)
78" (1950 mm)	11–3/4" (300 mm)
84" (2100 mm)	12–1/2" (320 mm)
90" (2250 mm)	13–1/4" (335 mm)
96" (2400 mm)	14" (355 mm)
102" (2550 mm)	15–1/2" (395 mm)
108" (2700 mm)	16" (405 mm)
114" (2850 mm)	16–1/2" (420 mm)
120" (3000 mm)	17" (430 mm)
126" (3150 mm)	17" (430 mm)
132" (3300 mm)	17–1/2" (445 mm)
138" (3450 mm)	17–1/2" (445 mm)
144" (3600 mm)	18" (455 mm)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

STANDARD PLAN 322-3 SHEET 3 OF 4

NOTES

1. VALUES FOR A, B, C, D1, D2, ELEVATION R AND ELEVATION S ARE SHOWN ON THE PLANS. ELEVATION S APPLIES AT INSIDE WALL OF STRUCTURE.
2. WHEN DEPTH M FROM STREET GRADE TO THE TOP OF THE BOX IS LESS THAN 2'–10 1/2" (867 mm) FOR PAVED STREETS OR 3'–6" (1060 mm) FOR UNPAVED STREETS, CONSTRUCT MONOLITHIC SHAFT PER SECTION C–C AND DETAIL "N". SHAFT FOR ANY DEPTH OF MANHOLE MAY BE CONSTRUCTED PER SECTION C–C. WHEN DIAMETER D1 IS 48" (1200 mm) OR LESS, CENTER OF SHAFT MAY BE LOCATED PER NOTE 3.
3. CENTER OF MANHOLE SHAFT SHALL BE LOCATED OVER CENTERLINE OF STORM DRAIN WHEN DIAMETER D1 IS 48" (1200 mm) OR LESS, IN WHICH CASE PLACE E BARS SYMMETRICALLY AROUND SHAFT AT 45° WITH CENTERLINE.
4. LENGTH OF MANHOLE MAY BE INCREASED AT OPTION TO MEET PIPE ENDS, BUT ANY CHANGE IN LOCATION F SPUR MUST BE APPROVED BY THE ENGINEER.
5. P SHALL BE 5" (125 mm) FOR D2=96" (2400 mm) OR LESS AND 8" (200 mm) FOR D2 OVER 96" (2400 mm).
6. REINFORCEMENT SHALL CONFORM TO ASTM A 615M, GRADE 300 (ASTM A 615, GRADE 40), AND SHALL TERMINATE 1–1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN.
7. FLOOR OF MANHOLE SHALL BE STEEL–TROWLED TO SPRING LINE.
8. BODY OF MANHOLE SHALL BE POURED IN ONE CONTINUOUS OPERATION EXCEPT THAT A CONSTRUCTION JOINT WITH A LONGITUDINAL KEYWAY MAY BE PLACED AT SPRING LINE.
9. THICKNESS OF THE DECK SHALL VARY WHEN NECESSARY TO PROVIDE A LEVEL SEAT BUT SHALL NOT BE LESS THAN THE TABULAR VALUES OF F SHOWN ON TABLE, SHEET 1.
10. IF LATERALS ENTER ON BOTH SIDES OF MANHOLE, SHAFT SHALL BE LOCATED ON SIDE RECEIVING THE SMALLER LATERAL.
11. STEPS SHALL CONFORM TO SPPWC 635 OR 636. UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" TO 15" (350 TO 375 mm) OC. THE LOWEST STEP SHALL NOT BE MORE THAN 24" (600 mm) ABOVE THE INVERT.
12. THE FOLLOWING CRITERIA SHALL BE USED FOR THIS MANHOLE:
    - o THIS STANDARD PLAN IS USED WHEN SPPWC 320 IS INADEQUATE.
    - o MAIN LINE = 900 mm (36") INSIDE DIAMETER OR LARGER.
    - o LATERAL = 300 mm (12") TO 3600 mm (144") INSIDE DIAMETER; HOWEVER, THE INSIDE DIAMETER SHALL NOT EXCEED THE INSIDE DIAMETER OF THE MAIN LINE.
13. MANHOLE FRAME AND COVER SHALL CONFORM TO SPPWC 630 UNLESS OTHERWISE SHOWN.
14. MANHOLE SHAFT SHALL CONFORM TO SPPWC 324 UNLESS OTHERWISE SHOWN.
15. WHERE A MANHOLE SHAFT – 900 mm (36") WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 326.
16. WHERE A PRESSURE MANHOLE SHAFT – WITH ECCENTRIC REDUCER IS SPECIFIED REFER TO SPPWC 328.
17. WHERE A PRESSURE MANHOLE SHAFT – 914 mm (36") WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 329.
18. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:
    - 324 MANHOLE SHAFT – WITH ECCENTRIC REDUCER
    - 326 MANHOLE SHAFT – 900 mm (36") WITHOUT REDUCER
    - 328 PRESSURE MANHOLE SHAFT – WITH ECCENTRIC REDUCER
    - 329 PRESSURE MANHOLE SHAFT – 914 mm (36") WITHOUT REDUCER
    - 630 610 mm (24") MANHOLE FRAME AND COVER
    - 633 914 mm (36") MANHOLE FRAME AND COVER
    - 635 STEEL STEP
    - 636 POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE – PIPE TO PIPE (LARGE SIDE INLET)

STANDARD PLAN 322-3 SHEET 4 OF 4

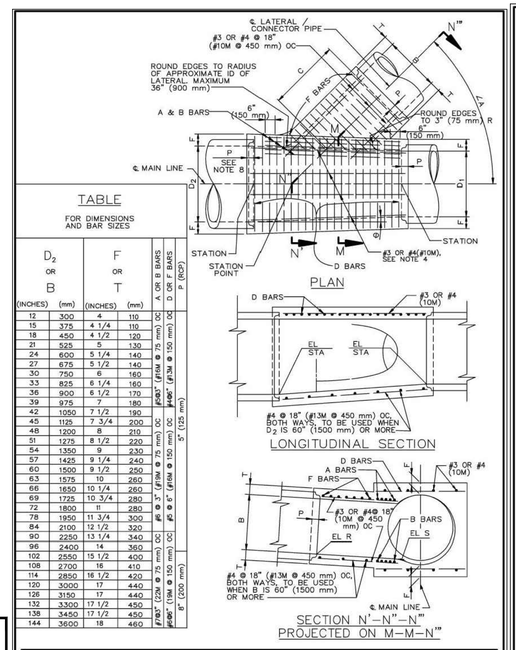
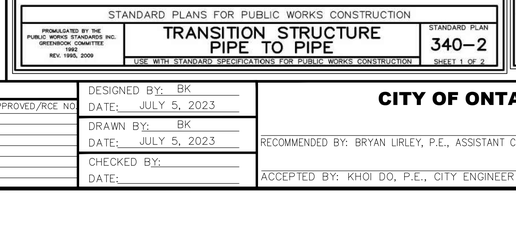


TABLE
FOR DIMENSIONS
AND BAR SIZES

D_2 OR B (INCHES)	(mm)	F OR T (INCHES)	(mm)	A OR B BARS	D OR F BARS	P (MIN)
12	300	4 1/4	110	OC	OC	5" (125 mm)
15	375	4 1/4	110	OC	OC	5" (125 mm)
18	450	4 1/2	120	OC	OC	5" (125 mm)
21	525	4 3/4	120	OC	OC	5" (125 mm)
24	600	5 1/4	140	OC	OC	5" (125 mm)
27	675	5 1/2	140	OC	OC	5" (125 mm)
30	750	6	160	OC	OC	5" (125 mm)
33	825	6 1/4	160	OC	OC	5" (125 mm)
36	900	6 1/2	170	OC	OC	5" (125 mm)
39	975	7	180	OC	OC	5" (125 mm)
42	1050	7 1/2	190	OC	OC	5" (125 mm)
45	1125	7 3/4	200	OC	OC	5" (125 mm)
48	1200	8	210	OC	OC	5" (125 mm)
51	1275	8 1/2	220	OC	OC	5" (125 mm)
54	1350	9	230	OC	OC	5" (125 mm)
57	1425	9 1/4	240	OC	OC	5" (125 mm)
60	1500	9 1/2	250	OC	OC	5" (125 mm)
63	1575	10	260	OC	OC	5" (125 mm)
66	1650	10 1/4	260	OC	OC	5" (125 mm)
69	1725	10 3/4	280	OC	OC	5" (125 mm)
72	1800	11	280	OC	OC	5" (125 mm)
78	1950	11 3/4	300	OC	OC	5" (125 mm)
84	2100	12 1/2	320	OC	OC	5" (125 mm)
90	2250	13 1/4	340	OC	OC	5" (125 mm)
96	2400	14	360	OC	OC	5" (125 mm)
102	2550	15 1/2	400	OC	OC	5" (125 mm)
108	2700	16	410	OC	OC	5" (125 mm)
114	2850	16 1/2	420	OC	OC	5" (125 mm)
120	3000	17	440	OC	OC	5" (125 mm)
126	3150	17	440	OC	OC	5" (125 mm)
132	3300	17 1/2	450	OC	OC	5" (125 mm)
138	3450	17 1/2	450	OC	OC	5" (125 mm)
144	3600	18	460	OC	OC	5" (125 mm)

#3 OR #4 @ 18" (#10M @ 450 mm) OC
#5 @ 3" (#16M @ 75 mm)
#6 @ 3" (#19M @ 75 mm)
#7 @ 3" (#22M @ 75 mm)
#4 @ 6" (#13M @ 150 mm)
#5 @ 6" (#16M @ 150 mm)
#6 @ 6" (#19M @ 150 mm)



LONGITUDINAL SECTION

SECTION N'–N"–N'"
PROJECTED ON M–M–N'"

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1995, 2009

TRANSITION STRUCTURE PIPE TO PIPE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 340–2 SHEET 1 OF 2

NOTES

1. THE HORIZONTAL ANGLE OF CONVERGENCE OR DIVERGENCE, θ, SHALL NOT EXCEED 5° 45'.
2. VALUES FOR A, B, C, D_1 AND D_2 ARE SHOWN ON THE PLANS. ELEVATION R AND ELEVATION S ARE SHOWN WHEN REQUIRED BY NOTE 10.
3. FLOOR OF STRUCTURE SHALL BE STEEL TROWELED TO SPRING LINE.
4. REINFORCEMENT STEEL SHALL CONFORM TO ASTM A 615 (A 615 M), GRADE 300 (40), AND SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN. LONGITUDINAL BARS SHALL BE #3 OR #4 @ 18" (#10M @ 450 mm) OC OR LESS.
5. ELEVATION S APPLIES AT INSIDE WALL OF STRUCTURE.
6. TRANSITION STRUCTURE SHALL BE POURED IN ONE CONTINUOUS OPERATION, EXCEPT THAT THE CONTRACTOR SHALL HAVE THE OPTION OF PLACING AT THE SPRING LINE A CONSTRUCTION JOINT LONGITUDINAL KEYWAY.
7. THE LENGTH OF THE STRUCTURE MAY BE INCREASED AT THE OPTION OF THE CONTRACTOR TO MEET RCP ENDS, USING D BARS, LONGITUDINAL AND BOTTOM REINFORCEMENT IN EXTENDED PORTION OF SAME DIAMETER AND SPACING AS SPECIFIED IN THE TABLE, BUT ANY CHANGE IN THE LOCATION OF SPUR MUST BE APPROVED BY THE ENGINEER.
8. EMBEDMENT P SHALL BE AS SPECIFIED IN THE TABLE, UNLESS OTHERWISE SHOWN ON THE PLANS.
9. WHEN THERE IS NO SPUR REQUIRED, A & B BARS SHALL BE OMITTED.
10. WHEN ELEVATION R AND ELEVATION S ARE NOT SHOWN ON PLANS, INLET PIPE SHALL ENTER MAIN LINE RADIALLY. WHEN INLET PIPE ENTERS MAIN LINE OTHER THAN RADIALLY, ELEVATION S SHALL BE SHOWN ON PLANS, AND INLET PIPE SHALL BE LAID ON A STRAIGHT GRADE FROM ELEVATION S TO CATCH BASIN OR GRADE BREAK IN INLET LINE. ELEVATION R SHALL BE SHOWN ON THE PLANS ONLY WHEN STUB IS TO BE PROVIDED IN MAIN LINE FOR FUTURE CONSTRUCTION OF INLET PIPE.
11. THE MAXIMUM COVER ABOVE THIS STRUCTURE SHALL BE 25' (7.5 m). IF THE COVER EXCEEDS 25' (7.5 m') A SPECIAL STRUCTURE SHALL BE DESIGNED FOR THE COVER AND DETAILED ON THE PLANS.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

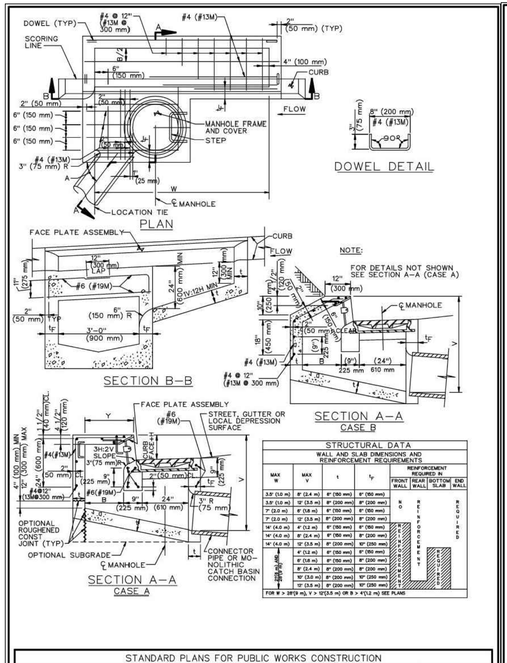
TRANSITION STRUCTURE PIPE TO PIPE

STANDARD PLAN 340–2 SHEET 2 OF 2

4LEAF, INC.

APPROVED BY _____ DATE _____

REGISTERED PROFESSIONAL ENGINEER
SHAWN REESE MAHONEY
No.85559
Exp. 9/30/2026
CIVIL
STATE OF CALIFORNIA



STRUCTURAL DATA
WALL AND SLAB DIMENSIONS AND
REINFORCEMENT REQUIREMENTS

MAX W	MAX Y	t	I_y	REINFORCEMENT REQUIRED IN: FRONT WALL	SIDE WALL	BOTTOM SLAB	END WALL
3'-0" (1.0 m)	9' (2.8 m)	8" (205 mm)	9" (230 mm)				
3'-5" (1.0 m)	10' (3.0 m)	8" (205 mm)	9" (230 mm)				
7'-0" (2.0 m)	8' (2.5 m)	8" (205 mm)	8" (205 mm)				
7'-0" (2.0 m)	10' (3.0 m)	8" (205 mm)	9" (230 mm)				
14'-0" (4.0 m)	6' (1.8 m)	8" (205 mm)	8" (205 mm)				
14'-0" (4.0 m)	8' (2.4 m)	8" (205 mm)	9" (230 mm)				
14'-0" (4.0 m)	10' (3.0 m)	8" (205 mm)	10" (255 mm)				
3'-0" (1.0 m)	6' (1.8 m)	8" (205 mm)	8" (205 mm)				
3'-0" (1.0 m)	8' (2.4 m)	8" (205 mm)	9" (230 mm)				
3'-0" (1.0 m)	10' (3.0 m)	8" (205 mm)	10" (255 mm)				
7'-0" (2.0 m)	6' (1.8 m)	8" (205 mm)	8" (205 mm)				
7'-0" (2.0 m)	8' (2.4 m)	8" (205 mm)	9" (230 mm)				
7'-0" (2.0 m)	10' (3.0 m)	8" (205 mm)	10" (255 mm)				

FOR W > 3'(0.9 m), Y > 10'(3.0 m) OR B > 4'(1.2 m) SEE PLANS

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1994 REV. 1992, 1998, 2006, 2021

CURB OPENING CATCH BASIN WITH MANHOLE IN STREET

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 307–4 SHEET 1 OF 2

NOTES:

1. WHERE THE BASIN IS TO BE CONSTRUCTED WITHIN THE LIMITS OF EXISTING OR PROPOSED SIDEWALK OR IS CONTIGUOUS TO SUCH SIDEWALK, THE TOP SLAB OF THE BASIN MAY BE POURED EITHER MONOLITHIC WITH THE SIDEWALK OR SEPARATELY, USING THE SAME CLASS OF CONCRETE AS IN THE BASIN. WHEN POURED MONOLITHICALLY, THE SIDEWALK SHALL BE PROVIDED WITH A WEAKENED PLANE OR A 1" (25 mm) DEEP SAWCUT CONTINUOUSLY AROUND THE EXTERNAL PERIMETER OF THE CATCH BASIN WALLS, INCLUDING ACROSS THE FULL WIDTH OF THE SIDEWALK. SURFACE OF ALL EXPOSED CONCRETE SHALL CONFORM IN SLOPE, GRADE, COLOR, FINISH, AND SCORING TO EXISTING OR PROPOSED CURB AND WALK ADJACENT TO THE BASIN.
2. ALL CURVED CONCRETE SURFACES SHALL BE FORMED BY CURVED FORMS, AND SHALL NOT BE SHAPED BY PLASTERING.
3. FLOOR OF BASIN SHALL BE GIVEN A STEEL TROWEL FINISH. FLOOR OF MANHOLE CHAMBER SHALL HAVE A LONGITUDINAL AND LATERAL SLOPE OF 1V:12H MINIMUM AND 1V:3H MAXIMUM SLOPE FLOOR FROM ALL DIRECTIONS TO THE OUTLET.
4. CATCH BASIN SHALL BE CASE A UNLESS OTHERWISE SPECIFIED.
5. DIMENSIONS:
   - W = 7' (2 m)
   - B = 20" (500 mm)
   - Y = 24" (600 mm)
   - V = THE DIFFERENCE IN ELEVATION BETWEEN THE TOP OF THE CURB AND THE INVERT OF THE CATCH BASIN AT THE OUTLET = 4.5' (1.35 m).
   - V_1 = THE DIFFERENCE IN ELEVATION BETWEEN THE TOP OF THE CURB AND THE INVERT OF THE INLET, NOTED ON THE PLANS.
   - H = NOTED ON THE PLANS.
   - A = THE ANGLE, IN DEGREES, INTERCEPTED BY THE CENTERLINE OF THE CONNECTOR PIPE AND THE CATCH BASIN WALL TO WHICH THE CONNECTOR PIPE IS ATTACHED.
6. PLACE CONNECTOR PIPES AS INDICATED ON THE PLANS. UNLESS OTHERWISE SPECIFIED, THE CONNECTOR PIPE SHALL BE LOCATED AT THE DOWNSTREAM END OF THE BASIN, WHERE THE CONNECTOR PIPE IS SHOWN AT A CORNER, THE CENTERLINE OF THE PIPE SHALL INTERSECT THE INSIDE CORNER OF THE BASIN. THE PIPE MAY BE CUT AND TRIMMED AT A SKEW NECESSARY TO ENSURE MINIMUM 3" (75 mm) PIPE EMBEDMENT ALL AROUND, WHEN THE CATCH BASIN WALL AND 3" (75 mm) RADIUS OF ROUNDING OF STRUCTURE CONCRETE, ALL AROUND ADJACENT TO PIPE ENDS. A MONOLITHIC CATCH BASIN CONNECTION SHALL BE USED TO JOIN THE CONNECTOR PIPE TO THE CATCH BASIN WHENEVER ANGLE "A" IS LESS THAN 70° OR GREATER THAN 110°, OR WHENEVER THE CONNECTOR PIPE IS LOCATED IN A CORNER. THE OPTIONAL USE OF A MONOLITHIC CATCH BASIN CONNECTION IN ANY CASE IS PERMITTED. MONOLITHIC CATCH BASIN CONNECTIONS MAY BE CONSTRUCTED TO AVOID CUTTING STANDARD LENGTHS OF PIPE.
7. STEPS SHALL BE LOCATED AS SHOWN. IF THE CONNECTOR PIPE INTERFERES WITH THE STEPS, THEY SHALL BE LOCATED ON THE FRONT WALL OF THE MANHOLE CHAMBER OR THE DOWNSTREAM WALL OF THE MANHOLE CHAMBER AND THE MANHOLE MOVED DOWNSTREAM 12" (300 mm). STEPS SHALL BE SPACED 12" (300 mm) APART. THE TOP STEP SHALL BE 7" (175 mm) BELOW THE TOP OF THE MANHOLE AND PROJECT 2–1/2" (65 mm). ALL OTHER STEPS SHALL PROJECT 5" (130 mm).
8. DOWELS ARE REQUIRED AT EACH CORNER AND AT 7' (2.0 m) ON CENTER (MAXIMUM) ALONG THE BACKWALL.
9. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:
   - 308 MONOLITHIC CATCH BASIN CONNECTION
   - 309 CATCH BASIN REINFORCEMENT
   - 310 CATCH BASIN FACE PLATE ASSEMBLY AND PROTECTION BAR
   - 630 24" (610 mm) MANHOLE FRAME AND COVER
   - 635 STEEL STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

CURB OPENING CATCH BASIN WITH MANHOLE IN STREET

STANDARD PLAN 307–4 SHEET 2 OF 2

811 Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER _____ DATE _____

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER _____ DATE _____

BENCH MARK No. GG–18–1
ELEV. 635.314' (NAVD88) LEVELED 2018
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG–18–1." SET ON TOP OF CURB, APPROX 5' +/– SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. 85559 R.C.E. NO. _____ DATE

STORM DRAIN IMPROVEMENT PLAN
BON VIEW AVENUE AND EUCALYPTUS AVENUE
DETAILS

PM-20161

SHEET 12 OF 12
CONTRACT _____
ACCOUNT _____
DWG. NO. _____

11/11/2024

H1-571

Drawing Name: P:\Year_2023\2023-038-RDA-SOL\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\11_2023-038_SD_DETAIL.dwg

EXCERPT K: STORM DRAIN IMPROVEMENT PLANS FOR LINE E, PM-20517

STORM DRAIN IMPROVEMENT PLANS

FOR

PARCEL MAP 20517

CAMPUS AVENUE & EUCALYPTUS AVENUE

IN THE CITY OF ONTARIO

GENERAL NOTES:

1. ALL WORK SHALL BE DONE IN STRICT CONFORMANCE WITH THE CURRENT CITY OF ONTARIO STANDARD SPECIFICATIONS AND STANDARD DRAWINGS AND CURRENT STANDARD SPECIFICATIONS AND STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. ANY CONTRACTOR PERFORMING WORK ON THIS PROJECT SHALL FAMILIARIZE HIMSELF/HERSELF WITH THE SITE AND SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES RESULTING DIRECTLY OR INDIRECTLY FROM HIS/HER OPERATIONS, WHETHER OR NOT THE FACILITY IS SHOWN ON THESE PLANS.
3. ALL OBSTRUCTIONS WITHIN THE AREA TO BE IMPROVED SHALL BE REMOVED AND/OR RELOCATED AT THE DIRECTION OF THE CITY ENGINEER. UTILITIES ARE TO BE RELOCATED BY THEIR RESPECTIVE OWNERS UNLESS NOTED OTHERWISE. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
4. UTILITY LINE LOCATIONS WERE TAKEN FROM AVAILABLE RECORD DATA AND WERE NOT LOCATED IN THE FIELD, UNLESS OTHERWISE NOTED ON THE PLAN. THE CONTRACTOR IS REFERRED TO SECTION 5 OF THE STANDARD SPECIFICATIONS, FOR PUBLIC WORKS CONSTRUCTION.
5. IN CASE OF ANY ACCIDENTS INVOLVING SAFETY MATTERS COVERED BY SECTION 6409(B) OF THE CALIFORNIA LABOR CODE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE STATE DIVISION OF INDUSTRIAL SAFETY.
6. STATE LAW (SB 3019) REQUIRES THE CONTRACTOR TO CONTACT UNDERGROUND SERVICE ALERT AND OBTAIN AN IDENTIFICATION NUMBER PRIOR TO THE ISSUANCE OF CITY'S ENCROACHMENT PERMITS. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT AT 1-800-422-4133 A MINIMUM OF 48-HOURS IN ADVANCE OF ANY CONSTRUCTION ACTIVITY.
7. PRIOR TO THE START OF ANY WORK THE CONTRACTOR SHALL OBTAIN A BUSINESS LICENSE FROM THE CITY OF ONTARIO. THE CONTRACTOR SHALL ALSO OBTAIN AN ENCROACHMENT PERMIT FROM THE ENGINEERING DEPARTMENT NO LESS THAN 48 HOURS PRIOR TO START OF ANY CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY.
8. THE CONTRACTOR SHALL OBTAIN A TRAFFIC CONTROL PERMIT 48 HOURS PRIOR TO TIME OF CONSTRUCTION WITHIN THE PUBLIC RIGHT-OF-WAY.
9. THE CONTRACTOR SHALL RENEW OR REPLACE ANY EXISTING TRAFFIC STRIPING AND/OR PAVEMENT MARKINGS, WHICH DURING HIS OPERATIONS HAVE BEEN EITHER REMOVED OR THE EFFECTIVENESS OF WHICH HAS BEEN REDUCED. RENEWAL OF TRAFFIC STRIPING AND MARKINGS SHALL BE DONE USING REFLECTIVE THERMO-PLASTIC MARKINGS IN CONFORMANCE WITH SECTION 84 & 85 OF THE CALTRANS STANDARD SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER. ALL REGULATORY, WARNING, AND GUIDE SIGNS SHALL HAVE 3M DIAMOND, VIP GRADE SHEETING WITH SERIES 1160 PROTECTIVE OVERLAY FILM.
10. THE LAND SURVEYORS ACT, SECTION 8771 OF THE BUSINESS & PROFESSIONAL CODE, AND SECTIONS 732.5, 1492-5, 1810-5 OF THE STREETS AND HIGHWAY CODE REQUIRE THAT SURVEY MONUMENTS SHALL BE PROTECTED AND PERPETUATED.

    "IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR OTHERS PERFORMING THE CONSTRUCTION WORK TO RETAIN A QUALIFIED REGISTERED CIVIL ENGINEER AND/OR LICENSED LAND SURVEYOR PRIOR TO THE START OF CONSTRUCTION TO LOCATE, REFERENCE AND FILE THE NECESSARY CORNER RECORDS WITH THE COUNTY SURVEYOR'S OFFICE FOR SURVEY CONTROL POINTS/MONUMENTS THAT EXIST AS SHOWN ON RECORDED TRACT MAPS, PARCEL MAPS, RECORDS OF SURVEYS AND HIGHWAY MAPS, AND MAY BE DISTRIBUTED OR DAMAGED BY THE PROPOSED CONSTRUCTION"

    AFTER THE COMPLETION OF THE PROPOSED CONSTRUCTION, SAID MONUMENTS AND/OR CONTROL SURVEY POINTS SHALL BE RESET TO THE NEW SURFACE IN ACCORDANCE WITH THE CURRENT PROFESSIONAL LAND SURVEYING PRACTICES. CORNER RECORDS SHALL BE FILED WITH THE COUNTY SURVEYOR FOR ALL THE NEW MONUMENTS SET.
11. THE DEVELOPER SHALL PROVIDE THE CITY WITH A COMPLETED SET OF "AS BUILT", MYLAR DRAWINGS PRIOR TO THE FINAL INSPECTION.
12. A CITY ACCEPTED/APPROVED SET OF PLANS SHALL BE KEPT ON THE JOB SITE AT ALL TIMES.
13. A PRE-CONSTRUCTION MEETING SHALL OCCUR PRIOR TO CONSTRUCTION. ATTENDEES SHALL INCLUDE A CITY REPRESENTATIVE AND THE CONTRACTOR WHO WILL PERFORM THE WORK. "CUT-SHEETS" SHALL BE PROVIDED TO THE CITY AT THIS MEETING FOR ITS REVIEW.
14. CITY ACCEPTANCE OF PLANS DOES NOT RELIEVE THE DEVELOPER FROM RESPONSIBILITY FOR THE CORRECTION OF ERROR AND OMISSION DISCOVERED DURING CONSTRUCTION. UPON REQUEST OF THE CITY INSPECTOR, THE REQUIRED PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR REVIEW.
15. ANY REQUIRED RIGHT-OF-WAY OR EASEMENT SHALL BE DEDICATED TO AND ACCEPTED BY THE CITY PRIOR TO COMMENCEMENT OF CONSTRUCTION OF THE IMPROVEMENTS WITHIN THE REQUIRED RIGHT-OF-WAY OR EASEMENT.
16. WHERE UTILITIES NEED TO BE SUPPORTED, SAID SUPPORTS SHALL BE IN ACCORDANCE WITH A.P.W.A. STANDARD 224-1 UNLESS OTHERWISE INDICATED.
17. PRIOR TO STARTING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY LOCATION AND ELEVATION OF EXISTING SEWER MAIN(S) AND NOTIFY THE DESIGN ENGINEER OF ANY VARIATION FROM DESIGN.
18. THE PIPE SHOWN HEREON SHALL BE INSTALLED IN ACCORDANCE WITH CASE III BEDDING AS SHOWN ON L.A.C.D.P.W. STANDARD 3080-2, UNLESS OTHERWISE SHOWN. "W" VALUE SHALL BE AS SPECIFIED ON L.A.C.D.P.W. STANDARD 3080-2 FOR CASE III BEDDING, NOTES 3 (A), 3 (B), AND 3 (C). IF THE "W" VALUE AT THE TOP OF THE PIPE IS EXCEEDED, THE BEDDING SHALL BE MODIFIED AND/OR PIPE OF ADDITIONAL STRENGTH SHALL BE PROVIDED. ALL PROPOSED MODIFICATIONS TO THIS REQUIREMENT SHALL BE APPROVED BY THE CITY ENGINEER.
19. MINIMUM COVER OF STORM DRAIN MAIN SHALL BE 7 FEET FROM THE FINISHED SURFACE PER STANDARD DRAWING 1302-1304.
20. STORM DRAIN MAIN STATIONING IS PER PIPE CENTERLINE.
21. STREET CENTERLINE STATIONING IS PER THE STREET IMPROVEMENT PLANS AND PROVIDED FOR REFERENCE.
22. CONTRACTOR SHALL NOT BACKFILL TRENCH UNTIL THE CITY INSPECTOR HAS OBTAINED AS-BUILT STATIONING ON ALL STRUCTURES.
23. UPON COMPLETION OF CONSTRUCTION OF ALL STORM DRAIN LINES AND PRIOR TO PAVING, THE DEVELOPER SHALL HIRE A CITY APPROVED VIDEO COMPANY TO VIDEO TAPE THE PIPELINES. CITY SHALL REVIEW SAID VIDEOTAPES FOR POTENTIAL CONSTRUCTION DEFECTS PRIOR TO ACCEPTANCE OF THE PROJECT.

CIVIL ENGINEERS NOTICE TO CONTRACTOR

1. THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF MY KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTION AND ANY MEASURES TO PROTECT THE UTILITIES AND STRUCTURES SHOWN AND OTHER LINES OR STRUCTURES NOT OF RECORD OR NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR THE PROTECTION OF, AND ANY DAMAGE TO, THESE UTILITY LINES OR STRUCTURES.

811 Know what's below. Call 811 before you dig.

RECOMMENDED FOR ACCEPTANCE

TECK, C. LOH, P.E.
HARRIS AND ASSOCIATES DATE

OWNER/DEVELOPER:

REDA
4100 MACARTHUR, SUITE 120
NEWPORT BEACH, CA 92660

CONTACT: JEFF JOHNSTON
PHONE: (949) 945-6809
EMAIL: JJOHNSTON@REDALLC.COM

CIVIL ENGINEER

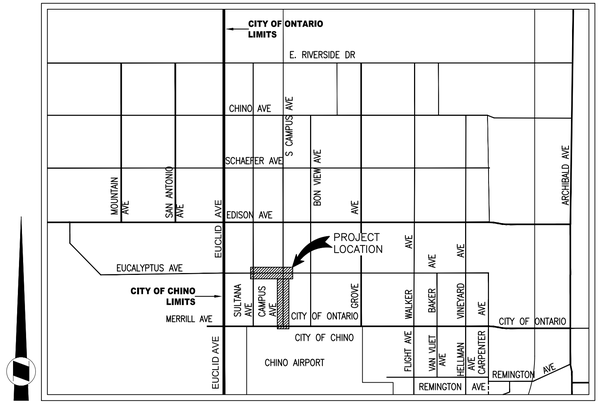
WESTLAND GROUP INC.
4150 CONCOURS, SUITE 100
ONTARIO, CA 91764
TEL (909)-989-9789

CONTACT: SIARA R. MACKINNEY, PE, QSD
PHONE: (909) 989-9789

GEOTECHNICAL ENGINEER:

SOUTHERN CALIFORNIA GEOTECHNICAL
22885 EAST SAVI RANCH PARKWAY, SUITE E
YORBA LINDA, CA 92887

CONTACT: GREGORY K. MITCHELL
PHONE: (714) 685-1115



VICINITY MAP
N.T.S.

UTILITY PURVEYORS:

CITY OF ONTARIO, MUNICIPAL UTILITIES AGENCY
DAYTIME PH: (909) 395-2678
24-HOUR EMERGENCY: (909) 986-6711

CITY OF ONTARIO, COMMUNITY & PUBLIC SERVICES AGENCY
DAYTIME PH: (909) 395-2633
24-HOUR EMERGENCY: (909) 986-6711

INLAND EMPIRE UTILITY AGENCY
DAYTIME PH: (909) 944-6000
24-HOUR EMERGENCY: (909) 987-2591

SOUTHERN CALIFORNIA EDISON
24-HOUR EMERGENCY: (800) 611-1911

SOUTHERN CALIFORNIA GAS COMPANY
DAYTIME PH: (800) 423-1391
24-HOUR EMERGENCY: (800) 423-1391

TIME WARNER CABLE / WEST COAST COMMUNICATIONS
24-HOUR EMERGENCY: (888) 892-2253

VERIZON
24-HOUR EMERGENCY: (800) 483-2000

CONSTRUCTION NOTES

ITEM	DESCRIPTION	PUBLIC QUANTITIES	
1	CONSTRUCT 60" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN	2619	LF
2	CONSTRUCT 18" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN	516	LF
3	CONSTRUCT JUNCTION STRUCTURE NO. 1, CASE 1, PER CITY OF ONTARIO STD. DWG. 3010.	2	EA
4	CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL 4 ON SHEET 9	6	EA
5	CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT	4	EA
6	CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20517 STREET IMPROVEMENT PLANS FOR DETAILS.	4	EA
7	CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017	4	EA
8	CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 8, ON SHEET 9	3	EA
9	REMOVE EXISTING CONCRETE BULKHEAD	1	EA
10	CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009	7	EA
11	CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 9	3	EA
12	CONSTRUCT 24" RCP, TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN	416	LF
13	CONSTRUCT CONCRETE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 9	1	EA

INDEX OF DRAWINGS

INDEX NO.	DESCRIPTION
SHEET 1	TITLE SHEET
SHEET 2	STORM DRAIN SYSTEM MAP INDEX MAP AND SECTIONS
SHEET 3	CAMPUS AVENUE-FROM MERRILL AVENUE TO 950' NORTH OF MERRILL AVENUE
SHEET 4	CAMPUS AVENUE-FROM 950' NORTH OF MERRILL AVENUE TO 800' SOUTH OF EUCALYPTUS AVENUE
SHEET 5	CAMPUS AVENUE-FROM 800' SOUTH OF EUCALYPTUS AVENUE TO 100' NORTH OF EUCALYPTUS AVENUE
SHEET 6	EUCALYPTUS AVENUE-FROM 250' WEST OF CAMPUS AVENUE TO 300' EAST OF CAMPUS AVENUE
SHEET 7	EUCALYPTUS AVENUE-FROM SULTANA AVENUE TO 300' EAST OF SULTANA AVENUE
SHEET 8	LATERAL PROFILES
SHEET 9	DETAILS

REFERENCE DRAWINGS

SANITARY SEWER	PM-20016 & PM-20517 SANITARY SEWER IMPROVEMENT PLAN
DOMESTIC WATER	PM-20016 & PM-20517 DOMESTIC WATER IMPROVEMENT PLAN
STORM DRAIN	PM-20016 & PM-20517 STORM DRAIN IMPROVEMENT PLAN
STREET IMPROVEMENT	PM-20016 & PM-20517 STREET IMPROVEMENT PLAN
RECYCLED WATER	PM-20016 & PM-20517 RECYCLED WATER IMPROVEMENT PLAN

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

LOTS 7, 8, 9, 10, 23, 24, 25, AND 26, IN SECTION 20, TOWNSHIP 2 SOUTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN, ACCORDING TO THE MAP OF SUBDIVISION OF RANCHO SANTA ANA DEL CHINO, AS PER PLAT RECORDED IN BOOK 6, PAGE 15 OF MAPS, IN THE OFFICE OF THE COUNTY OF SAN BERNARDINO COUNTY.

BASIS OF BEARING

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA STATE PLANE COORDINATE SYSTEM (CCS83), ZONE 5, NORTH AMERICAN DATUM 1983 (NAD83) BASED LOCALLY ON CONTINUOUSLY OPERATING REFERENCE STATIONS (CORS) "LORS" AND "EWPP" (BASIS OF BEARINGS: S 81°29'26" E). ALL BEARINGS SHOWN HEREON ARE REPRESENTED HEREON BY THE CENTERLINE OF EUCLID AVENUE BEING NORTH 0°25'42" WEST

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
CIVIL
STATE OF CALIFORNIA

LEGEND OF ABBREVIATIONS & SYMBOLS

BC	BEGIN CURVE	CMP	CORRUGATED METAL PIPE
CB	CATCH BASIN	℄ OR P/L OR PL	PROPERTY LINE
C&G	CURB AND GUTTER	PROP	PROPOSED
℄ OR C/L OR CL	CENTERLINE	RCB	REINFORCED CONCRETE BOX
CP	CONNECTOR PIPE	RCP	REINFORCED CONCRETE PIPE
EC	END CURVE	RW	RECYCLED WATER
EX, EXIST.	EXISTING	R/W, ROW	RIGHT OF WAY
FL	FLOWLINE	ST	STREET
FS	FINISH SURFACE	STA	STATION
FUT	FUTURE	TC	TOP OF CURB
GAS	GAS	TYP	TYPICAL
GB	GRADE BREAK	TSP	TEMPORARY STANDPIPE
INT	INTERSECTION	SD	STORM DRAIN
INV	INVERT	SPPWC	STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
LP	LOW POINT	SS	SEWER
MH	MANHOLE	DW	DOMESTIC WATER
MWS	MODULAR WETLAND SYSTEM	WQ	WATER QUALITY

(100) EXISTING CONTOURS
100 PROP. CONTOUR
EXIST. EASEMENT
2% SLOPE
CENTERLINE
FLOWLINE
FIRE HYDRANT
SIGN
STREET LIGHT
BOUNDARY LINE
FENCE LINE

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD88) 2017
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
8885 HAVEN AVE., SUITE 100, RANCHO CUCAMONGA, CA 91730
PHONE: (909) 989-9789 FAX: (909) 989-9660

Siara R. MacKinney
SIGNATURE: SIARA R. MACKINNEY, P.E. 85559 R.C.E. NO. 05/30/2024 DATE

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
TITLE SHEET

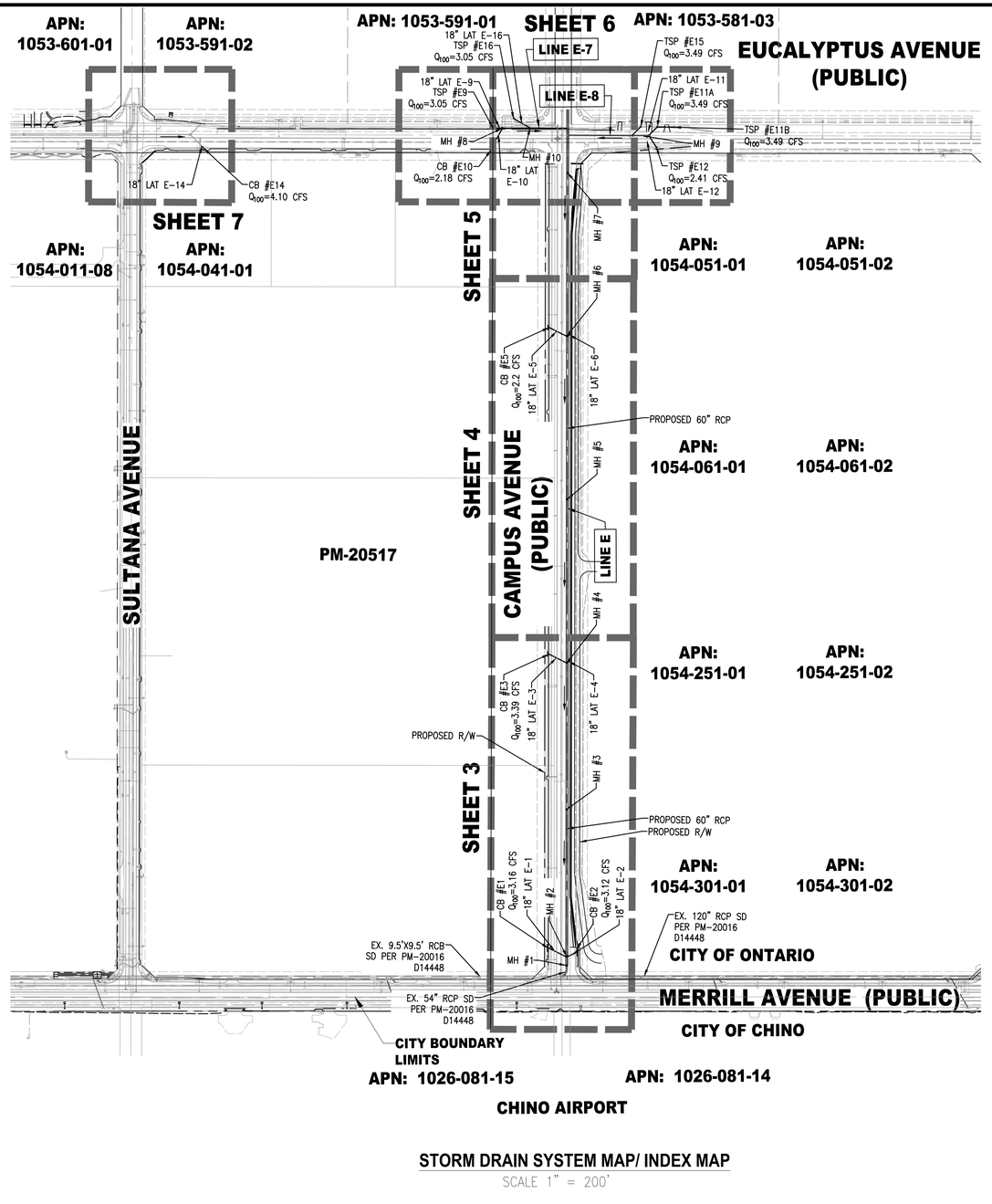
PM-20517

SHEET 1 OF 9
CONTRACT
ACCOUNT
DWG. NO.

02/19/2025

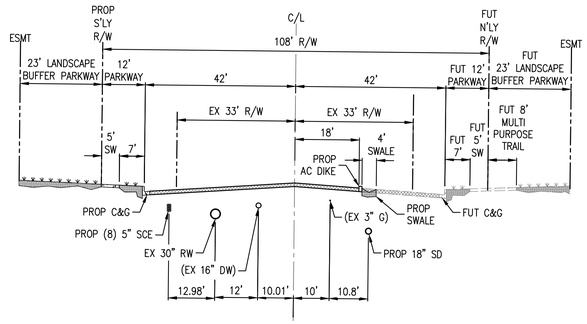
H1-573

Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\01_2023-037_SD_TITLE SHEET.dwg



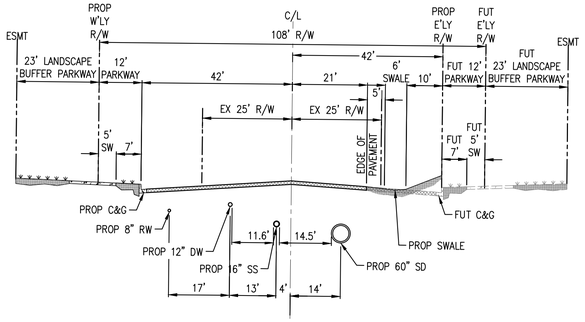
STORM DRAIN SYSTEM MAP/ INDEX MAP

SCALE 1" = 200'



EUCALYPTUS AVE (PUBLIC)

AT CAMPUS AVE
1"=20'



CAMPUS AVE (PUBLIC)

BETWEEN MERRILL AVE AND EUCALYPTUS AVE
1"=20'

Know what's below. Call811 before you dig.

REVISIONS			
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8885 HAVEN AVE., SUITE 100, RANCHO CUCAMONGA, CA 91730
PHONE: (909) 989-9789 FAX: (909) 989-9660
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 05/30/2024 DATE

REGISTERED PROFESSIONAL ENGINEER — SIARA ROSE MACKINNEY — No.85559 — CIVIL — STATE OF CALIFORNIA

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
STORM DRAIN SYSTEM MAP INDEX MAP AND SECTIONS

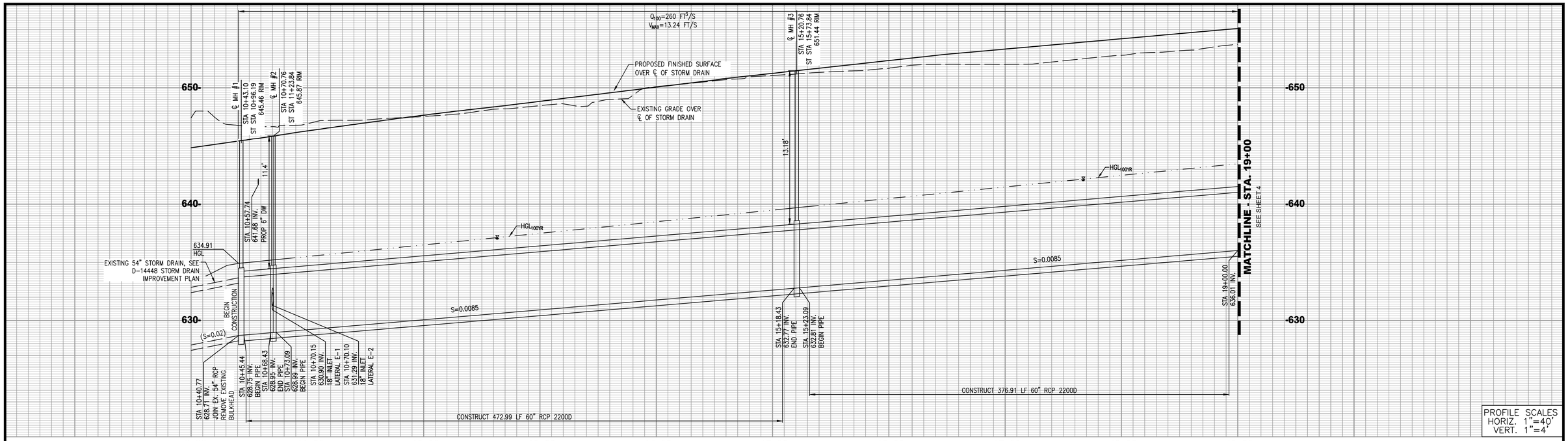
PM-20517

SHEET 2 OF 9
CONTRACT
ACCOUNT
DWG. NO.

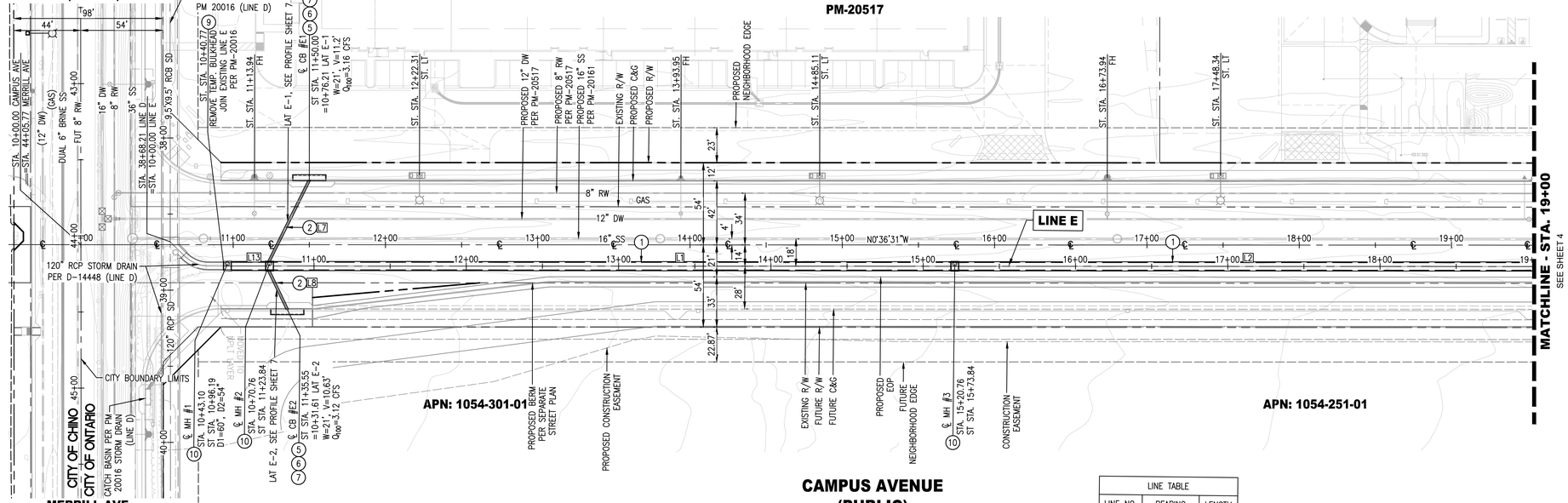
02/19/2025

H1-574

Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\02_2023-037_SD_SHEET INDEX.dwg



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'



LINE E
PM-20517

CAMPUS AVENUE (PUBLIC)

CONSTRUCTION NOTES

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6. CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20517 STREET IMPROVEMENT PLANS FOR DETAILS.
7. CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017
8. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 8, ON SHEET 9
9. REMOVE EXISTING CONCRETE BULKHEAD
10. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009

LINE TABLE		
LINE NO.	BEARING	LENGTH
L13	S00°36'31"E	22.99'
L2	N00°36'31"W	445.50'
L7	N64°14'48"W	60.27'
L8	N64°01'02"E	28.86'
L1	N00°36'31"W	445.34'

Know what's below. Call 811 before you dig.

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2
- CONTRACTOR SHALL VERIFY EXISTING STORM DRAIN ELEVATION AND GRADE PRIOR TO CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
CIVIL
STATE OF CALIFORNIA

40' 0' 20' 40' 80'
SCALE: 1" = 40'

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SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 05/30/2024 DATE

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
CAMPUS AVENUE
FROM MERRILL AVENUE TO 950' NORTH OF MERRILL AVENUE

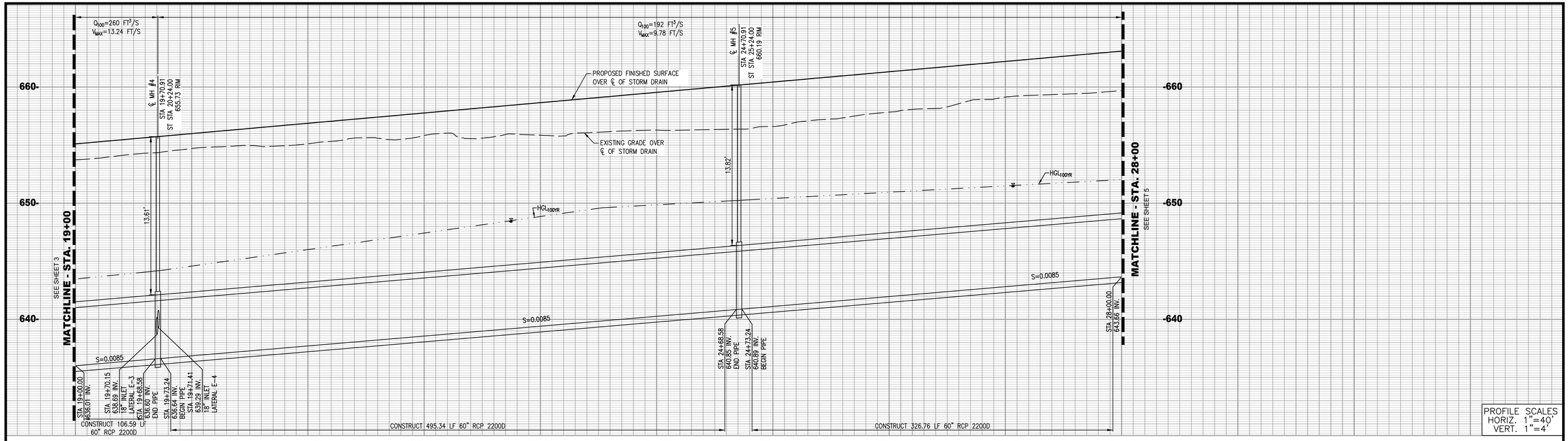
PM-20517

SHEET 3 OF 9
CONTRACT
ACCOUNT
DWG. NO.

02/19/2025

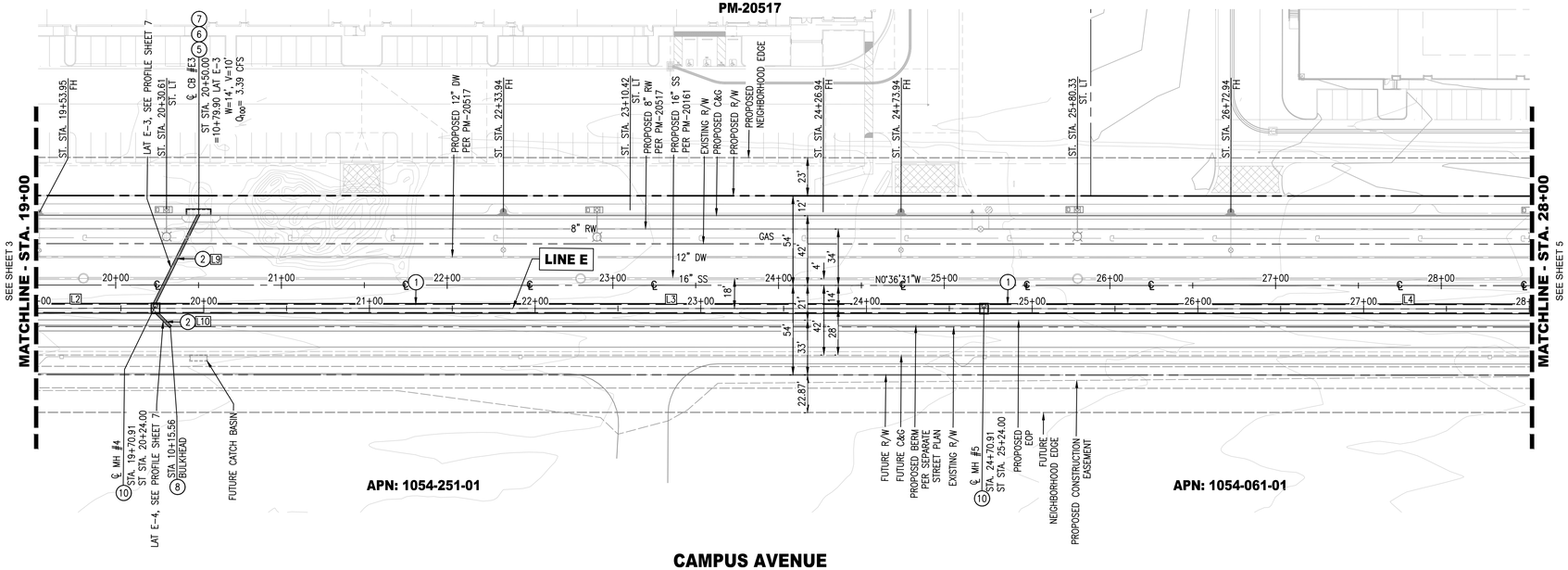
H1-575

Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\03-05_2023-037_SD_CAMPUS.dwg



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'

LINE E
PM-20517



CAMPUS AVENUE
(PUBLIC)

CONSTRUCTION NOTES

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8. CONSTRUCT BRICK AND MORTAR BULKHEAD PER DETAIL 8, ON SHEET 9
10. CONSTRUCT MANHOLE NO. 1 PER CITY OF ONTARIO STD. DWG. 3008 & 3009

LINE TABLE		
LINE NO.	BEARING	LENGTH
L2	N00°36'31"W	445.50'
L3	N00°36'31"W	495.34'
L4	N00°36'31"W	495.34'
L9	N64°14'48"W	60.27'
L10	N44°23'29"E	12.37'

NOTE:
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- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

REGISTERED PROFESSIONAL ENGINEER
SIARA REE MACKINNEY
No.85559
CIVIL
STATE OF CALIFORNIA

40' 0' 20' 40' 80'
SCALE: 1" = 40'

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STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
CAMPUS AVENUE FROM 950' NORTH OF MERRILL AVENUE TO 800' SOUTH OF EUCALYPTUS AVENUE

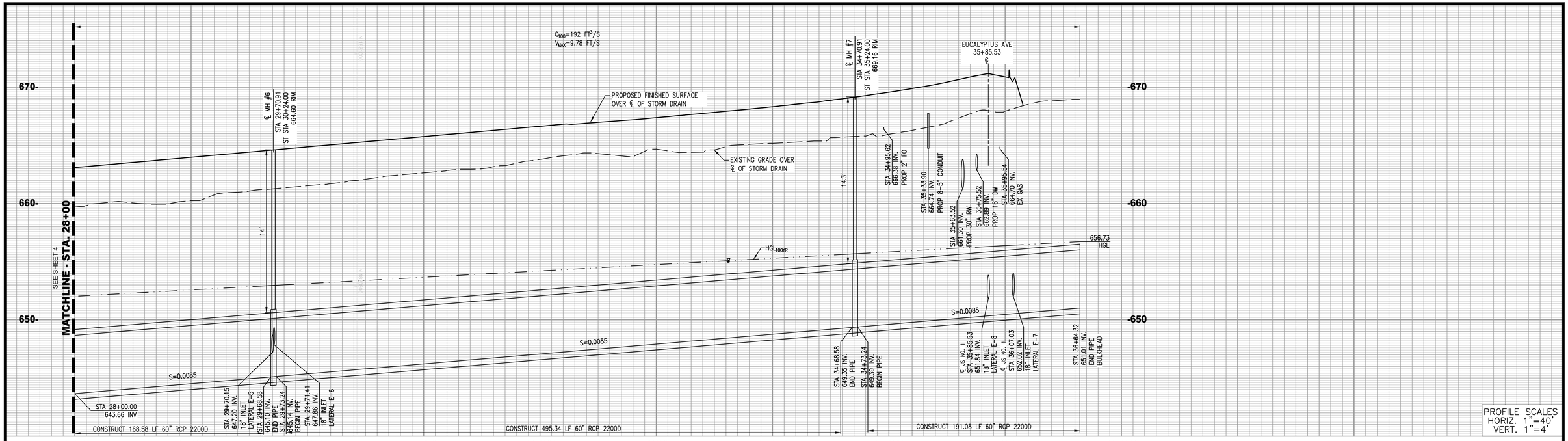
PM-20517

SHEET 4 OF 9
CONTRACT
ACCOUNT
DWG. NO.

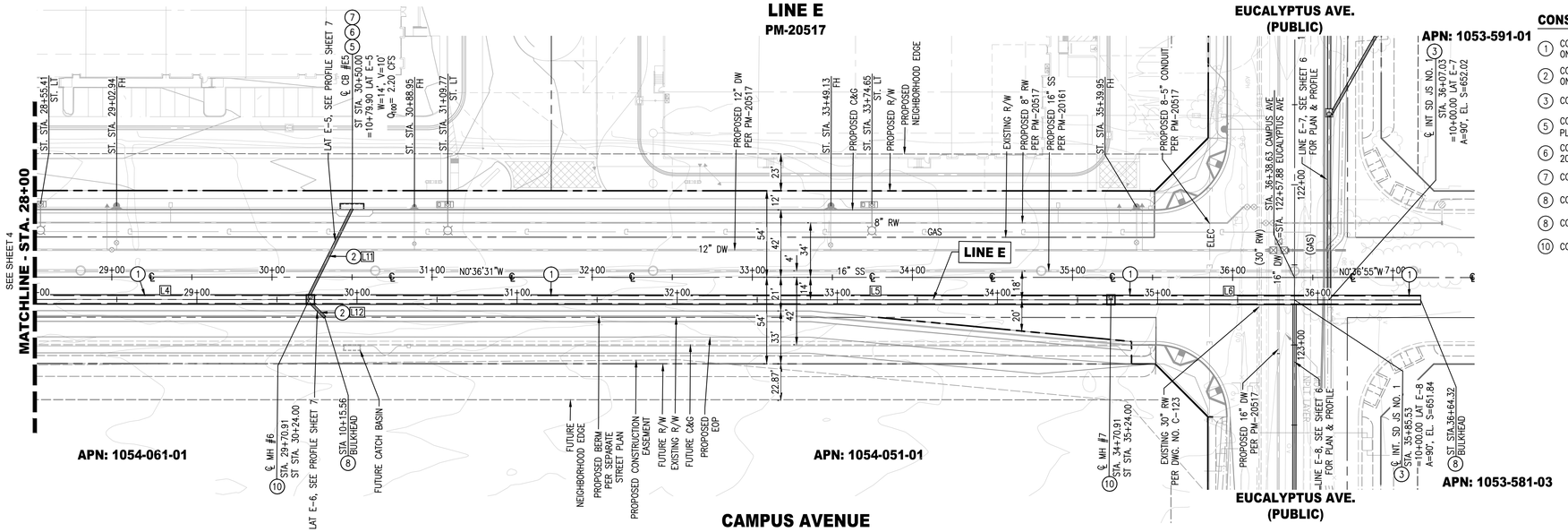
02/19/2025

H1-576

Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\03-05_2023-037_SD_CAMPUS.dwg



PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'



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REGISTERED PROFESSIONAL ENGINEER — SIARA REE MACKINNEY — No.85559 — CIVIL — STATE OF CALIFORNIA

40' 0' 20' 40' 80'
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PHONE: (909) 980-6789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 05/30/2024 DATE

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
CAMPUS AVENUE FROM 800' SOUTH OF EUCALYPTUS AVENUE TO 100' NORTH OF EUCALYPTUS AVENUE

PM-20517

SHEET 5 OF 9
CONTRACT
ACCOUNT
DWG. NO.

02/19/2025

H1-577

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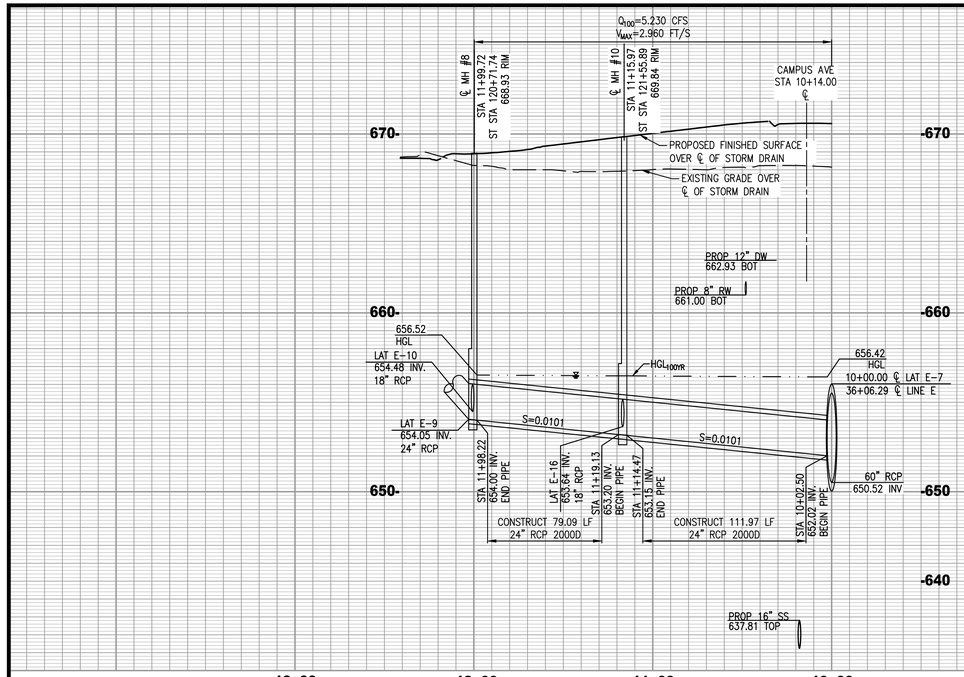
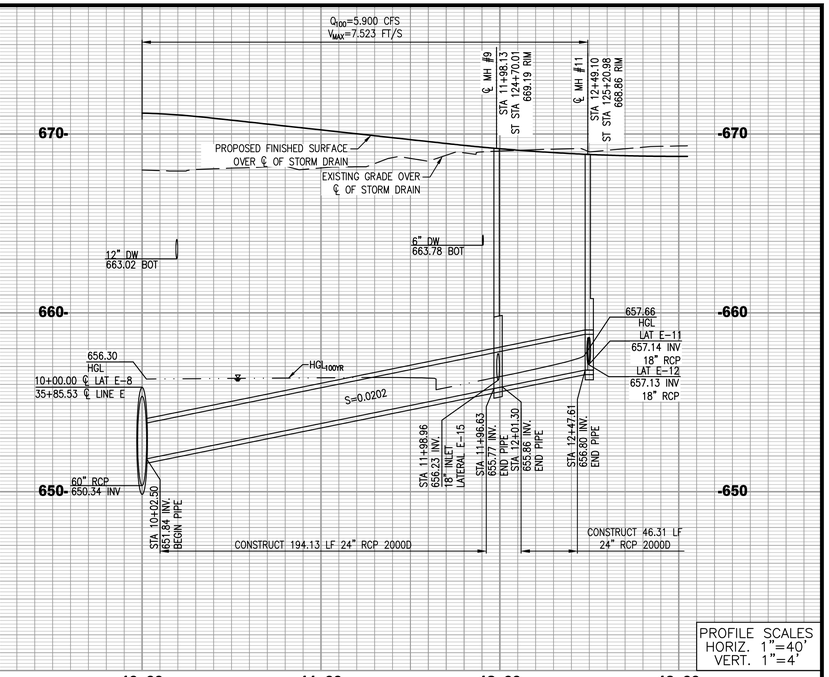
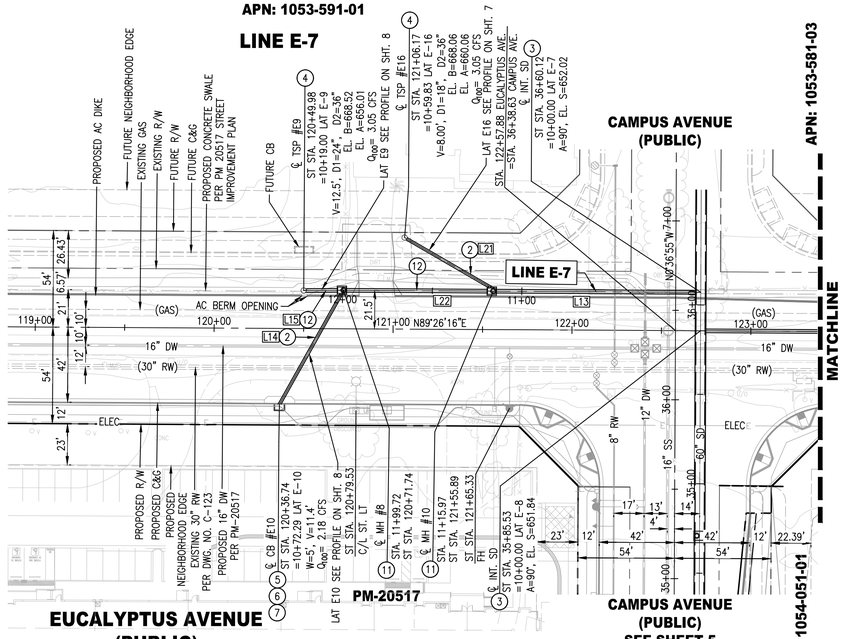
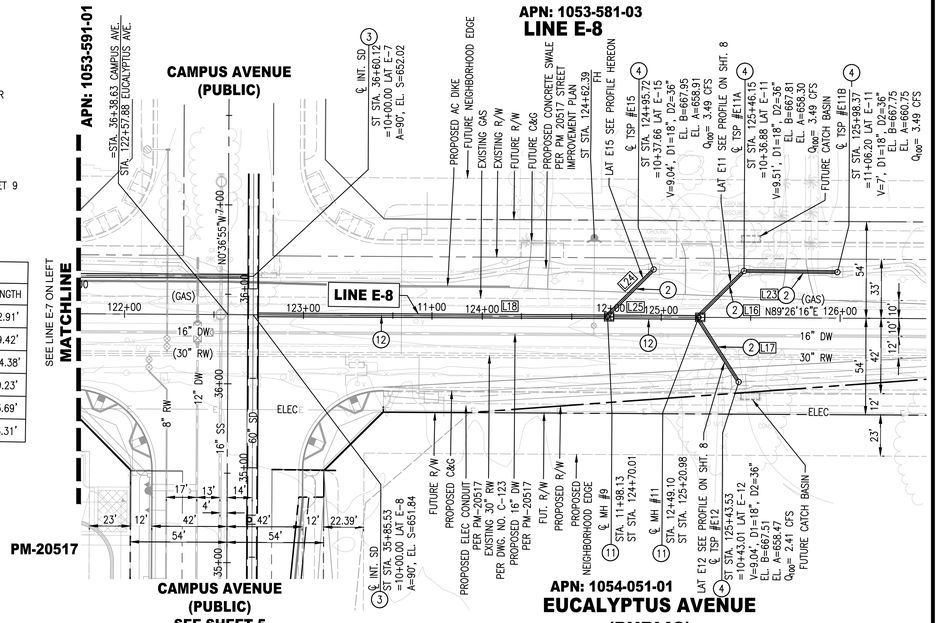




PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'





CONSTRUCTION NOTES

(2) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(3) CONSTRUCT JUNCTION STRUCTURE NO. 1, CASE 1, PER CITY OF ONTARIO STD. DWG. 3010.

(4) CONSTRUCT 36" TEMPORARY CSP STANDPIPE PER DETAIL 4 ON SHEET 9

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20517 STREET IMPROVEMENT PLANS FOR DETAILS.

(7) CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017

(11) CONSTRUCT MANHOLE PIPE-TO-PIPE PER SPPWC STD. PLAN NO. 321-2, PER DETAIL ON SHEET 9

(12) CONSTRUCT 24" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

LINE TABLE		
LINE NO.	BEARING	LENGTH
L13	S89°26'16"W	114.47'
L14	S28°23'31"W	70.29'
L15	S88°40'50"W	17.50'
L21	N60°49'37"W	54.80'
L22	S89°26'16"W	79.08'

LINE TABLE		
LINE NO.	BEARING	LENGTH
L16	N44°26'16"E	32.91'
L17	S33°37'46"E	39.42'
L18	N89°26'16"E	194.38'
L23	N89°50'44"E	49.23'
L24	N44°26'16"E	33.69'
L25	N89°26'16"E	46.31'

NOTE:

- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

40' 0' 20' 40' 80'
SCALE: 1" = 40'

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
CIVIL
STATE OF CALIFORNIA

Know what's below. Call811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD88) 2017
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
8885 HAVEN AVE., SUITE 100, RANCHO CUCAMONGA, CA 91730
PHONE: (909) 989-9789 FAX: (909) 989-9660

Siara R. MacKinney
SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 05/30/2024 DATE

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
EUCALYPTUS AVENUE
FROM 250' WEST OF CAMPUS AVENUE TO 300' EAST OF CAMPUS AVENUE

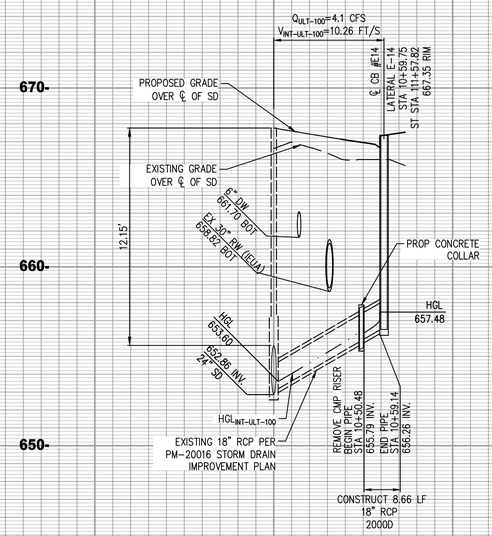
PM-20517

SHEET 6 OF 9
CONTRACT
ACCOUNT
DWG. NO.

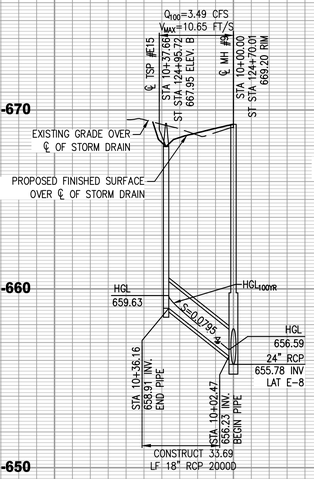
02/19/2025

H1-578

Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\06-07_2023-037_SD_EUCALYPTUS.dwg

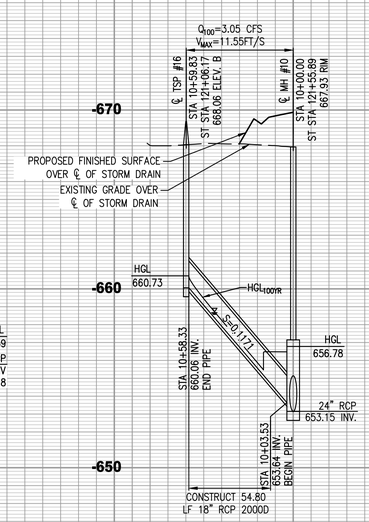


LATERAL E14



LATERAL E15

SEE PLAN VIEW ON SHEET 6



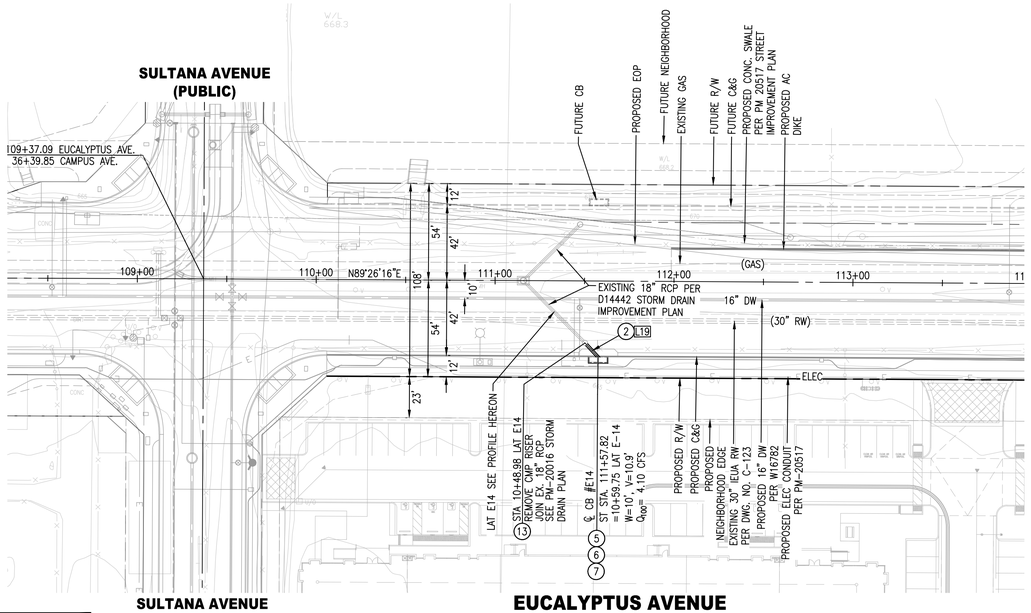
LATERAL E16

SEE PLAN VIEW ON SHEET 6

670 / 660 / 650

10+00 11+00 11+00 10+00 11+00 10+00

PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'



CONSTRUCTION NOTES

(2) CONSTRUCT 18" RCP. TRENCH EXCAVATION, & BACKFILL PER CITY OF ONTARIO STD. DWG. NO. 1306, BEDDING PER CITY OF ONTARIO STD. DWG. NO. 2104 CLASS B2, D-LOAD PER PLAN

(5) CONSTRUCT CATCH BASIN NO. 2 PER CITY OF ONTARIO STD. DWG. NO. 3003, "W" AND "V" PER PLAN, INSTALL ALMETEK PLACARD "NO DUMPING DRAINS TO RIVER" OR EQUIVALENT

(6) CONSTRUCT LOCAL DEPRESSION FOR CATCH BASIN INLET PER CITY OF ONTARIO STD. DWG. NO. 3005, REFER TO PERMIT PM 20517 STREET IMPROVEMENT PLANS FOR DETAILS.

(7) CONSTRUCT CONNECTOR PIPE SCREEN (CPS) PER CITY OF ONTARIO STD. DWG. NO. 3017

(13) CONSTRUCT CONCRETE COLLAR PER SPPWC STD. PLAN NO. 380-4, PER DETAIL ON SHEET 9

LINE TABLE		
LINE NO.	BEARING	LENGTH
L19	S43°40'50"E	10.77'

NOTE:
- CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION
- ADJUST MANHOLE TO GRADE PER SPPWC STD. DWG. 324-2

40' 0' 20' 40' 80'
SCALE: 1" = 40'

Know what's below. Call811 before you dig.

REVISIONS

MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD88) 2017
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB. APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA REGE MACKINNEY No.85559 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
8885 HAVEN AVE., SUITE 100, RANCHO CUCAMONGA, CA 91730
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 05/30/2024 DATE

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
EUCALYPTUS AVENUE
FROM SULTANA AVENUE TO 300' EAST OF SULTANA AVENUE

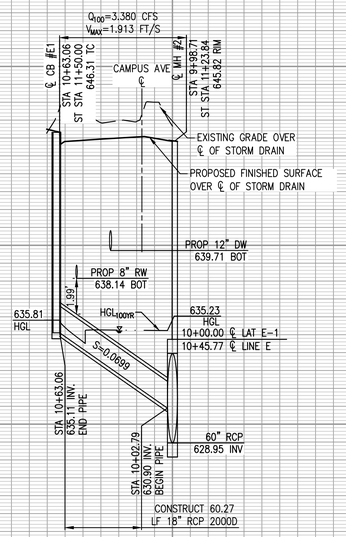
PM-20517

SHEET 7 OF 9
CONTRACT
ACCOUNT
DWG. NO.

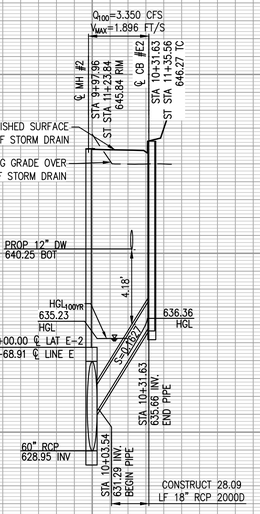
02/19/2025

H1-579

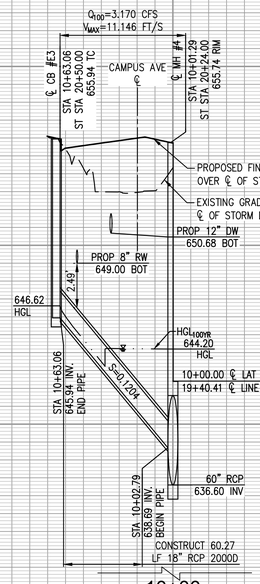
Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\06-07_2023-037_SD_EUCALYPTUS.dwg



10+00
LATERAL E-1
SEE PLAN SHEET 3



10+00
LATERAL E-2
SEE PLAN SHEET 3



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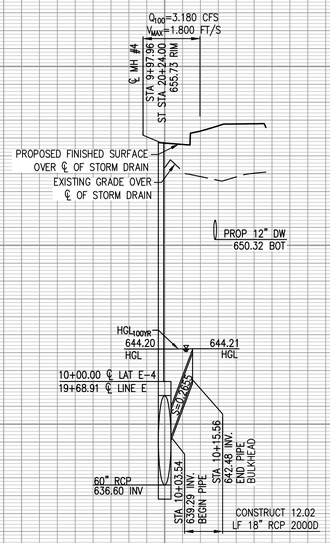
LATERAL E-3
SEE PLAN SHEET 4



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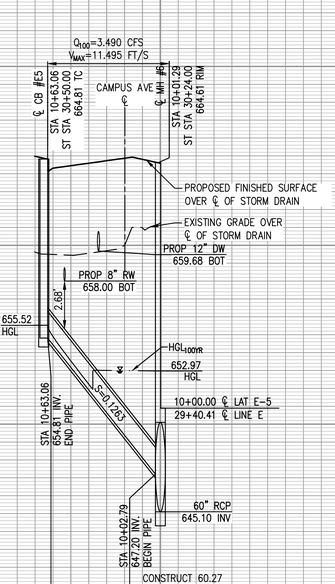
LATERAL E-4
SEE PLAN SHEET 4

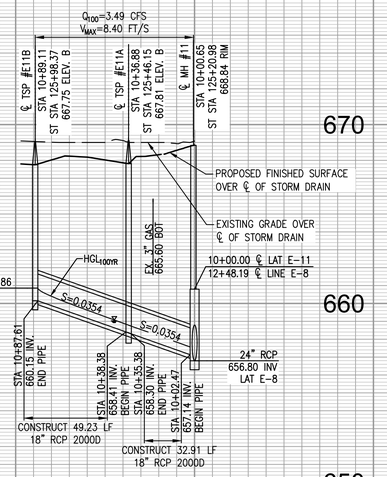


10+00
LATERAL E-5
SEE PLAN SHEET 5

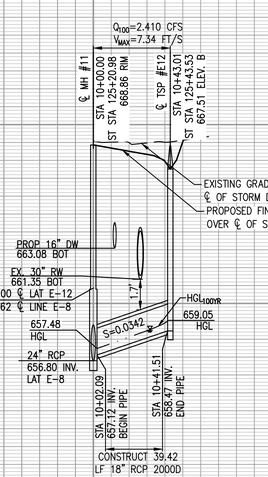
10+00
LATERAL E-6
SEE PLAN SHEET 5

10+00
LATERAL E-9
SEE PLAN SHEET 6

10+00
LATERAL E-10
SEE PLAN SHEET 6



10+00
LATERAL E-11
SEE PLAN SHEET 6



10+00
LATERAL E-12
SEE PLAN SHEET 6

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER
SIARA ROSE MACKINNEY
No.85559
CIVIL
STATE OF CALIFORNIA

PROFILE SCALES
HORIZ. 1"=40'
VERT. 1"=4'

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE
ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. CG-18-1
ELEV. 635.223' (NAVD88) 2017
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO CG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
8885 HAVEN AVE., SUITE 100, RANCHO CUCAMONGA, CA 91730
PHONE: (909) 989-9789 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — DATE

STORM DRAIN IMPROVEMENT PLAN AND PROFILE
CAMPUS AVENUE AND EUCALYPTUS AVENUE
LATERAL PROFILES

PM-20517

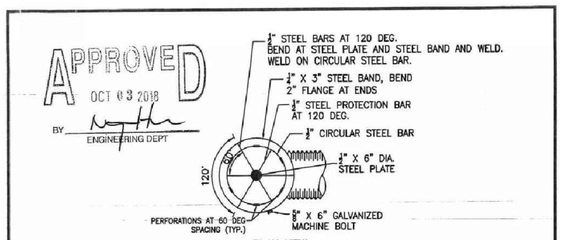
SHEET 8 OF 9
CONTRACT
ACCOUNT
DWG. NO.

02/19/2025

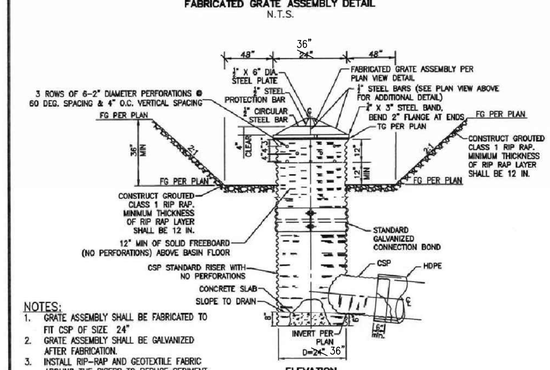
H1-580

Drawing Name: P:\Year_2023\2023-037-REDA-DRBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\08_2023-037_SD_LATPROF.dwg

APPROVED
OCT 03 2018
BY ENGINEERING DEPT



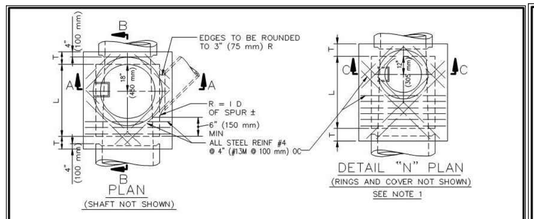
PLAN VIEW
FABRICATED GRATE ASSEMBLY DETAIL
N.T.S.

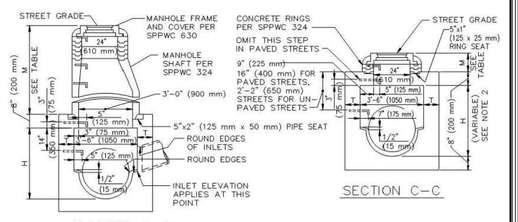


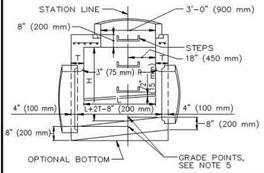
NOTES:
1. GRATE ASSEMBLY SHALL BE FABRICATED TO FIT CSP OF SIZE 24"
2. GRATE ASSEMBLY SHALL BE GALVANIZED AFTER FABRICATION.
3. INSTALL RIP-RAP AND GEOTEXTILE FABRIC AROUND THE RISERS TO REDUCE SEDIMENT TRANSPORT
4. CSP SHALL BE 16 GAGE.

ELEVATION
INLET STRUCTURE
N.T.S.

(4) **TEMPORARY CSP STANDPIPE DETAIL**







SECTION	TABLE OF VALUES FOR M (SEE NOTE 1)			
	PAVED STREET		UNPAVED STREET	
	MAX	MIN	MAX	MIN
A-A		2'-10 1/2" (867 mm)		3'-6" (1060 mm)
C-C	11" (282 mm)	8 1/2" (217 mm)	16" (410 mm)	15" (380 mm)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1992 REV. 1996, 2009

MANHOLE PIPE-TO-PIPE (ONE OR BOTH MAIN LINE IDS 33" (825 mm) OR SMALLER)

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 321-2 SHEET 1 OF 3

NOTES

1. WHEN DEPTH M FROM STREET GRADE TO THE TOP OF THE BOX IS LESS THAN 2'-10 1/2" (867 mm) FOR PAVED STREETS OR 3'-6" (1060 mm) FOR UNPAVED STREETS, CONSTRUCT SHAFT PER SECTION C-C AND DETAIL "N". DEPTH M MAY BE REDUCED TO AN ABSOLUTE LIMIT OF 6" (150 mm) WHEN LARGER VALUES OF M WOULD REDUCE H IN SECTION C-C TO 3'-6" (1060 mm) OR LESS.
2. H (IN SECTION A-A AND B-B) SHALL NOT BE LESS THAN 4'-0" (1.2 m), BUT MAY BE INCREASED PROVIDED THAT THE VALUE OF M SHALL NOT BE LESS THAN THE MINIMUM SPECIFIED AND THAT THE REDUCER SHALL BE USED. FOR H (IN SECTION C-C) SEE NOTE 1.
3. L SHALL BE 4'-0" (1.2 m) UNLESS OTHERWISE SHOWN. L MAY BE INCREASED OR LOCATION OF MANHOLE SHIFTED TO MEET PIPE ENDS, BUT ANY CHANGE IN LOCATION OF THE SPUR MUST BE APPROVED BY THE ENGINEER.
4. T SHALL BE 8" (200 mm) FOR VALUES OF H UP TO AND INCLUDING 8'-0" (2.4 m) AND 10" (250 mm) FOR VALUES OF H OVER 8'-0" (2.4 m).
5. STATIONS OF MANHOLES SHOWN ON PLANS APPLY AT CENTERLINE OF SHAFT. ELEVATIONS ARE SHOWN AT CENTERLINE OF SHAFT AND REFER TO THE PROLONGED INVERT GRADE LINES. SEE NOTE 3.
6. REINFORCEMENT SHALL CONFORM TO ASTM A 615, GRADE 40 (ASTM A 615M, GRADE 300), AND SHALL TERMINATE 1 1/2" (40 mm) CLEAR OF CONCRETE SURFACES UNLESS OTHERWISE SHOWN.
7. FLOOR OF MANHOLE SHALL BE STEEL TROWELED TO SPRING LINE.
8. BODY OF MANHOLE SHALL BE POURED IN ONE CONTINUOUS OPERATION EXCEPT THAT A CONSTRUCTION JOINT WITH A LONGITUDINAL KEYWAY MAY BE PLACED AT SPRING LINE.
9. THICKNESS OF THE DECK SHALL VARY WHEN NECESSARY TO PROVIDE A LEVEL SEAT BUT SHALL NOT BE LESS THAN 8" (200 mm).
10. STEPS SHALL CONFORM TO SPPWC 635 OR 636. UNLESS OTHERWISE SHOWN, STEPS SHALL BE UNIFORMLY SPACED 14" (350 mm) TO 15" (375 mm) OC. THE LOWEST STEP SHALL NOT BE MORE THAN 24" (600 mm) ABOVE THE LEDGE AT THE SIDE OF THE MANHOLE.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE PIPE-TO-PIPE (ONE OR BOTH MAIN LINE IDS = 33" (825 mm) OR SMALLER)

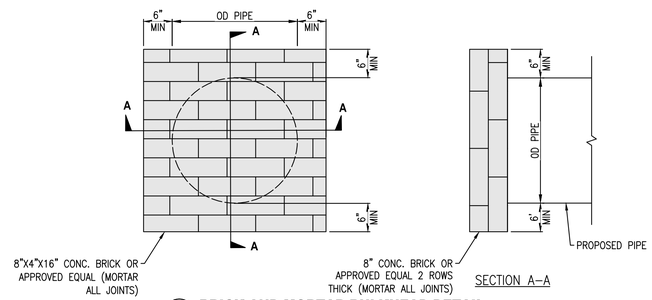
STANDARD PLAN 321-2 SHEET 2 OF 3

11. THE FOLLOWING CRITERIA SHALL BE USED FOR THIS MANHOLE:
    A. MAIN LINE = 33" (825 mm) INSIDE DIAMETER OR LESS. (EXCEPTION – IF THE MAIN LINE RCP DOWNSTREAM OF THE MANHOLE IS 36" (900 mm) TO 42" (1050 mm) INSIDE DIAMETER AND THE MAIN LINE RCP UPSTREAM IS 33" (825 mm) OR LESS.) SPPWC 320 OR 322 IS NOT APPLICABLE WHERE THE MAIN LINE CONDUIT IS LESS THAN 36" (900 mm) IN DIAMETER.
    B. SEE SECTION A – A. THE MAXIMUM SIZE LATERAL THAT MAY BE CONNECTED TO THIS MANHOLE IS SUCH THAT THE DISTANCE FROM THE OUTSIDE (TOP) OF THE LATERAL TO THE BOTTOM OF THE 8" (200 mm) THICK TOP OF THE MANHOLE CHAMBER, MEASURED VERTICALLY FROM THE END OF THE RCP, SHALL BE A MINIMUM OF 6" (150 mm).
    C. IF THE SIZE OF THE LATERAL IS SUCH THAT THE ABOVE-SPECIFIED MINIMUM DISTANCES CANNOT BE MAINTAINED, THEN ONE OF THE FOLLOWING ALTERNATE SOLUTIONS MUST BE USED.
        1. PROVIDE A SPECIAL STRUCTURE.
        2. PROVIDE TWO STANDARD STRUCTURES, CONSISTING OF THIS MANHOLE PLACED UPSTREAM OR DOWNSTREAM FROM THE APPLICABLE JUNCTION STRUCTURE OR TRANSITION STRUCTURE.
12. MANHOLE FRAME AND COVER SHALL CONFORM TO SPPWC 630 UNLESS OTHERWISE SHOWN.
13. MANHOLE SHAFT SHALL CONFORM TO SPPWC 324 UNLESS OTHERWISE SHOWN.
14. WHERE A MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 336.
15. WHERE A PRESSURE MANHOLE SHAFT – WITH ECCENTRIC REDUCER IS SPECIFIED REFER TO SPPWC 328.
16. WHERE A PRESSURE MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER IS SPECIFIED REFER TO SPPWC 329.
17. THE FOLLOWING SPPWC ARE INCORPORATED HEREIN:
    324 MANHOLE SHAFT – WITH ECCENTRIC REDUCER
    326 MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER
    328 PRESSURE MANHOLE SHAFT – WITH ECCENTRIC
    329 PRESSURE MANHOLE SHAFT – 36" (900 mm) WITHOUT REDUCER
    630 24" (610 mm) MANHOLE FRAME AND COVER
    633 36" (900 mm) MANHOLE FRAME AND COVER
    635 STEEL STEP
    636 POLYPROPYLENE PLASTIC STEP

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

MANHOLE PIPE-TO-PIPE (ONE OR BOTH MAIN LINE IDS = 33" (825 mm) OR SMALLER)

STANDARD PLAN 321-2 SHEET 3 OF 3



(8) **BRICK AND MORTAR BULKHEAD DETAIL**

Know what's below. Call 811 before you dig.

REVISIONS			
MARK	DATE	BY	APPROVED/RCE NO.

DESIGNED BY: BK
DATE: JULY 5, 2023
DRAWN BY: BK
DATE: JULY 5, 2023
CHECKED BY:
DATE:

CITY OF ONTARIO

RECOMMENDED BY: BRYAN LIRLEY, P.E., ASSISTANT CITY ENGINEER — DATE

ACCEPTED BY: KHOI DO, P.E., CITY ENGINEER — DATE

BENCH MARK No. GG-18-1
ELEV. 635.273' (NAVD88) 2017
LOCATION: FOUND 2.5" BRASS DISK STAMPED "CITY OF ONTARIO GG-18-1." SET ON TOP OF CURB, APPROX 5' +/- SOUTH OF ECR @ THE NORTHEAST RETURN OF EUCLID AVE. AND MERRILL AVE.

REGISTERED PROFESSIONAL ENGINEER SIARA REE MACKINNEY No.85559 CIVIL STATE OF CALIFORNIA

WestLAND Group, Inc. Engineering • Geospatial • Land Planning
8885 HAVEN AVE., SUITE 100, RANCHO CUCAMONGA, CA 91730
PHONE: (909) 980-9779 FAX: (909) 989-9660

SIGNATURE: SIARA R. MACKINNEY, P.E. — 85559 R.C.E. NO. — 05/30/2024 DATE

STORM DRAIN IMPROVEMENT PLAN
CAMPUS AVENUE AND EUCALYPTUS AVENUE
DETAILS

PM-20517

SHEET 9 OF 9
CONTRACT
ACCOUNT
DWG. NO.

Drawing Name: P:\Year_2023\2023-037-REDA-ORBP Phase II\06 Engineering\Sheets\OFF-SITE\STORM DRAIN\09_2023-037_SD_DET.dwg

02/19/2025

H1-581

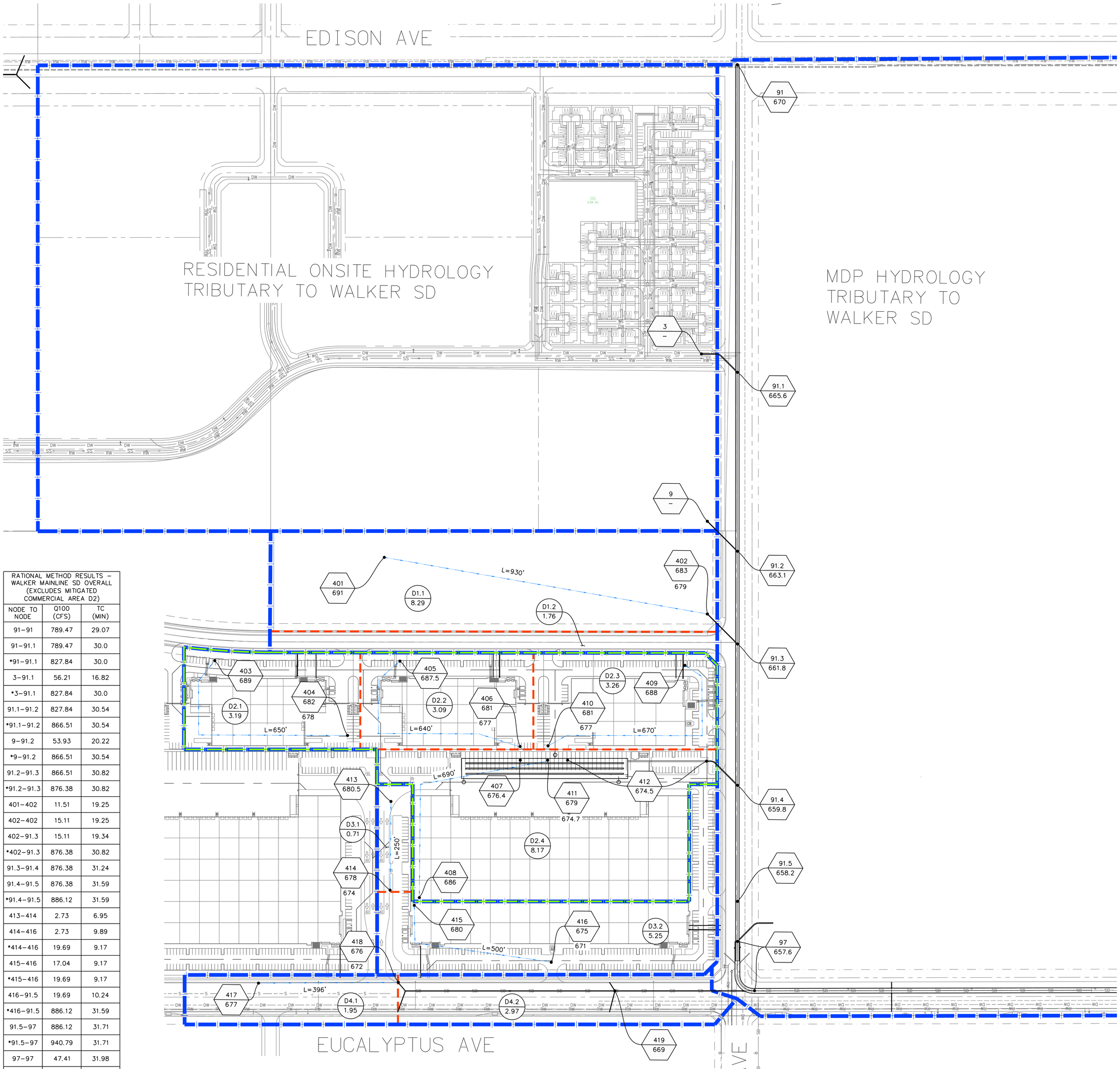
EXHIBITS

EXHIBIT A: WALKER AVENUE HYDROLOGY MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

WALKER AVENUE HYDROLOGY MAP



RATIONAL METHOD RESULTS – WALKER MAINLINE SD OVERALL (EXCLUDES MITIGATED COMMERCIAL AREA D2)		
NODE TO NODE	Q100 (CFS)	TC (MIN)
91–91	789.47	29.07
91–91.1	789.47	30.0
*91–91.1	827.84	30.0
3–91.1	56.21	16.82
*3–91.1	827.84	30.0
91.1–91.2	827.84	30.54
*91.1–91.2	866.51	30.54
9–91.2	53.93	20.22
*9–91.2	866.51	30.54
91.2–91.3	866.51	30.82
*91.2–91.3	876.38	30.82
401–402	11.51	19.25
402–402	15.11	19.25
402–91.3	15.11	19.34
*402–91.3	876.38	30.82
91.3–91.4	876.38	31.24
91.4–91.5	876.38	31.59
*91.4–91.5	886.12	31.59
413–414	2.73	6.95
414–416	2.73	9.89
*414–416	19.69	9.17
415–416	17.04	9.17
*415–416	19.69	9.17
416–91.5	19.69	10.24
*416–91.5	886.12	31.59
91.5–97	886.12	31.71
*91.5–97	940.79	31.71
97–97	47.41	31.98
*97–97	940.79	31.71
*97–97	940.79	31.71
417–418	5.66	11.0
418–419	5.66	13.3
419–419	12.69	13.3
*419–97	940.79	31.71

*DENOTES CONFLUENCE POINT

RATIONAL METHOD RESULTS – MITIGATED COMMERCIAL ONSITE AREA D2		
NODE TO NODE	Q100 (CFS)	TC (MIN)
403–404	9.79	10.04
404–407	9.79	11.99
*404–407	18.65	10.17
405–406	9.45	10.09
406–407	9.45	10.17
*406–407	18.65	10.17
407–411	18.65	10.29
*407–411	52.96	10.29
408–411	24.53	10.4
*408–411	52.96	10.29
409–410	9.9	10.22
410–411	9.9	10.27
*410–411	52.96	10.29
411–412	52.96	10.43

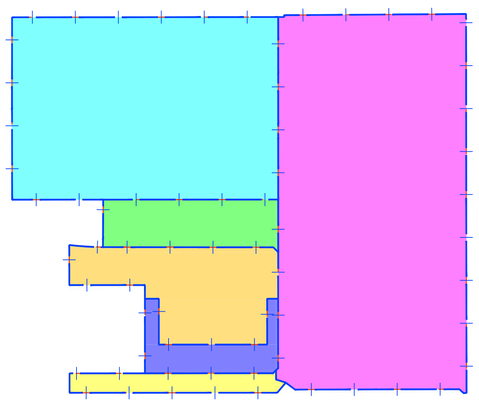
*DENOTES CONFLUENCE POINT

DESIGN NOTES:

1. RATIONAL METHOD MODEL PROVIDES LONGEST FLOW PATH SINCE PROJECT DOES NOT HAVE CONCEPTUAL GRADING.
2. MODELS PROVIDE ELEVATIONS THAT ARE BASED ON A SLOPE OF 1%. THIS IS TO ENSURE SURFACE GRADES DRAIN APPROPRIATELY. NOTE THIS ELEVATION DO NOT REPRESENT CONCEPTUAL GRADING AND ARE MEANT TO PROVIDE DATA TO COMPUTE Tc AND FLOW RATES.
3. HYDROLOGY DOES NOT ACCOUNT FOR ALL INLETS AND STORM DRAIN LATERALS. THIS WILL BE DONE AFTER COMPLETING CONCEPTUAL GRADING PLAN.SD IS CONCEPTUAL AND ONLY INTENDED FOR RM MODELING PURPOSES.
4. OVERALL MAINLINE SD HYDROLOGY EXCLUDES MITIGATED AREA. RESULTING PEAK FLOW IS Q100 IN MAINLINE + ROUTED Q100 FROM BASIN. ROUTED Q100 RESULTS FROM ROUTING THE UNIT HYDROGRAPH MODEL RESULTS.RATIONAL METHOD FOR MITIGATED AREA USED TO DEFINE TC FOR UH MODEL.

LEGEND:

- X.X / X.X — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION
- XXXX.X — APPROXIMATE INVERT ELEVATION
- XXX / X.X — SUB AREA / ACRES
- L=XXX' — FLOW DISTANCE
- FLOW PATH
- WATERSHED SUB-BOUNDARY
- WATERSHED BOUNDARY
- UNIT HYDROGRAPH WATERSHED BOUNDARY



HYDROLOGY INDEX MAP

HYDROLOGY INDEX MAP TABLE FOR MAINLINE RM MODEL					
HATCH	AREA LABEL	LAND USE	MODELED BY	IS MITIGATED ?	MODEL ELEMENT
	RES. AREA	RES	FUSCOE	NO	USER DEFINED
	MDP AREA	COMM/RES/PARK	JLC (MCC MDP)	NO	USER DEFINED
	D1	PARK	JLC	NO	INITIAL AREA
	D2	COMM	JLC	YES	USER DEFINED
	D3	COMM	JLC	NO	INITIAL AREA
	D4	COMM	JLC	NO	INITIAL AREA

*NOTE: INITIAL MODEL ENTRY IS USER DEFINED FOR ALL MDP AREA TO THE NORTH.
*NOTE: MDP AREAS MODELED AS USER DEFINED BASED ON MDP MODEL OUTPUT.
*NOTE: ONSITE COMMERICIAL MITIGATED AREA MODELED AS USER DEFINED; HAS ITS OWN RM OUTPUT

SCALE 1"=1100'

EXHIBIT "A"

ONTARIO RANCH

WALKER AVENUE HYDROLOGY MAP

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

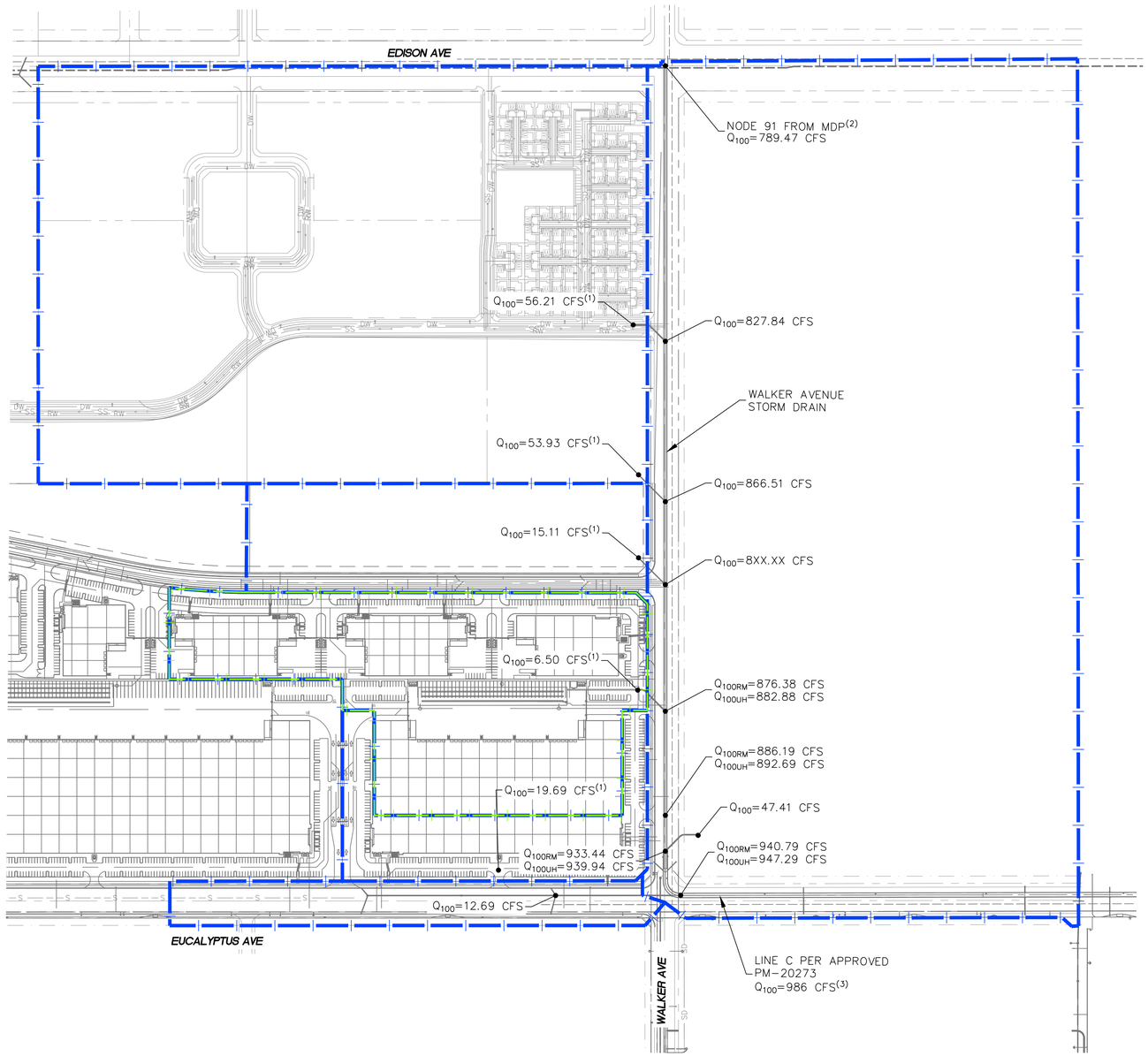
Drawing Name: O:\108.43.25\Engineering\Hydrology_Plan\Exhibits\OnsiteHydrologyMap_Walker.dwg
Last Opened: Feb 09, 2026 – 7:16pm by stonner

EXHIBIT B: WALKER AVENUE FLOW RATE MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

WALKER STORM DRAIN FLOW RATE MAP



DESIGN NOTES:

1) LATERAL LOCATIONS FOR THE WALKER AVENUE STORM DRAIN ARE NOT FINAL.

2) Q_{100} IS BASED ON THE REVISED MASTER DRAINAGE PLAN (MDP) FROM THE APPROVED JLC ENGINEERING REPORT FOR MCC. SEE EXCERPT B.

3) LINE C IS SIZED FOR THE UPSTREAM FLOW OF 986 CFS. HOWEVER, THE REVISED MCC MDP ALLOCATES 928 CFS TO LINE C (NODE 97 IN MCC MDP). SEE EXCERPT B.

LEGEND:

- WATERSHED BOUNDARY
- UNIT HYDROGRAPH WATERSHED BOUNDARY
- Q_{100} – PEAK 100-YEAR RATIONAL METHOD FLOWS
- Q_{100RM} – PEAK 100-YEAR RATIONAL METHOD FLOWS EXCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW
- Q_{100UH} – PEAK 100-YEAR RATIONAL METHOD FLOWS INCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW

SCALE 1"=200'

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EXHIBIT "B"

ONTARIO RANCH

WALKER STORM DRAIN FLOW RATE MAP

Drawing Name: C:\108 43 25\Engineering\Hydrology-Plan\Exhibits\Flow_Rate_Map_Walker.dwg
Last Opened: Feb 09, 2026 - 6:43pm by stanner

EXHIBIT C: GROVE AVENUE HYDROLOGY MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

GROVE AVENUE HYDROLOGY MAP

DESIGN NOTES:
1. RATIONAL METHOD MODEL PROVIDES LONGEST FLOW PATH SINCE PROJECT DOES NOT HAVE CONCEPTUAL GRADING.
2. MODELS PROVIDE ELEVATIONS THAT ARE BASED ON A SLOPE OF 1%. THIS IS TO ENSURE SURFACE GRADES DRAIN APPROPRIATELY. NOTE THIS ELEVATION DO NOT REPRESENT CONCEPTUAL GRADING AND ARE MEANT TO PROVIDE DATA TO COMPUTE Tc AND FLOW RATES.
3. HYDROLOGY DOES NOT ACCOUNT FOR ALL INLETS AND STORM DRAIN LATERALS. THIS WILL BE DONE AFTER COMPLETING CONCEPTUAL GRADING PLAN.SD IS CONCEPTUAL AND ONLY INTENDED FOR RM MODELING PURPOSES.
4. OVERALL MAINLINE SD HYDROLOGY EXCLUDES MITIGATED AREA. RESULTING PEAK FLOW IS Q100 IN MAINLINE + ROUTED Q100 FROM BASIN. ROUTED Q100 RESULTS FROM ROUTING THE UNIT HYDROGRAPH MODEL RESULTS.RATIONAL METHOD FOR MITIGATED AREA USED TO DEFINE TC FOR UH MODEL.

RATIONAL METHOD RESULTS – MITIGATED COMMERCIAL ONSITE AREA E3		
NODE TO NODE	Q100 (CFS)	TC (MIN)
503–504	13.89	10.49
504–507	13.89	10.64
*504–507	25.16	10.64
505–506	11.36	10.74
506–507	11.36	10.84
*506–507	25.16	10.64
507–511	25.16	12.05
*507–511	59.28	10.22
508–511	28.35	10.22
*508–511	59.28	10.22
509–510	7.76	8.68
510–511	7.76	9.25
*510–511	59.28	10.22
511–514	59.28	10.28
*511–514	67.51	10.28
512–513	8.97	8.68
513–514	8.97	8.96
*513–514	67.51	10.28

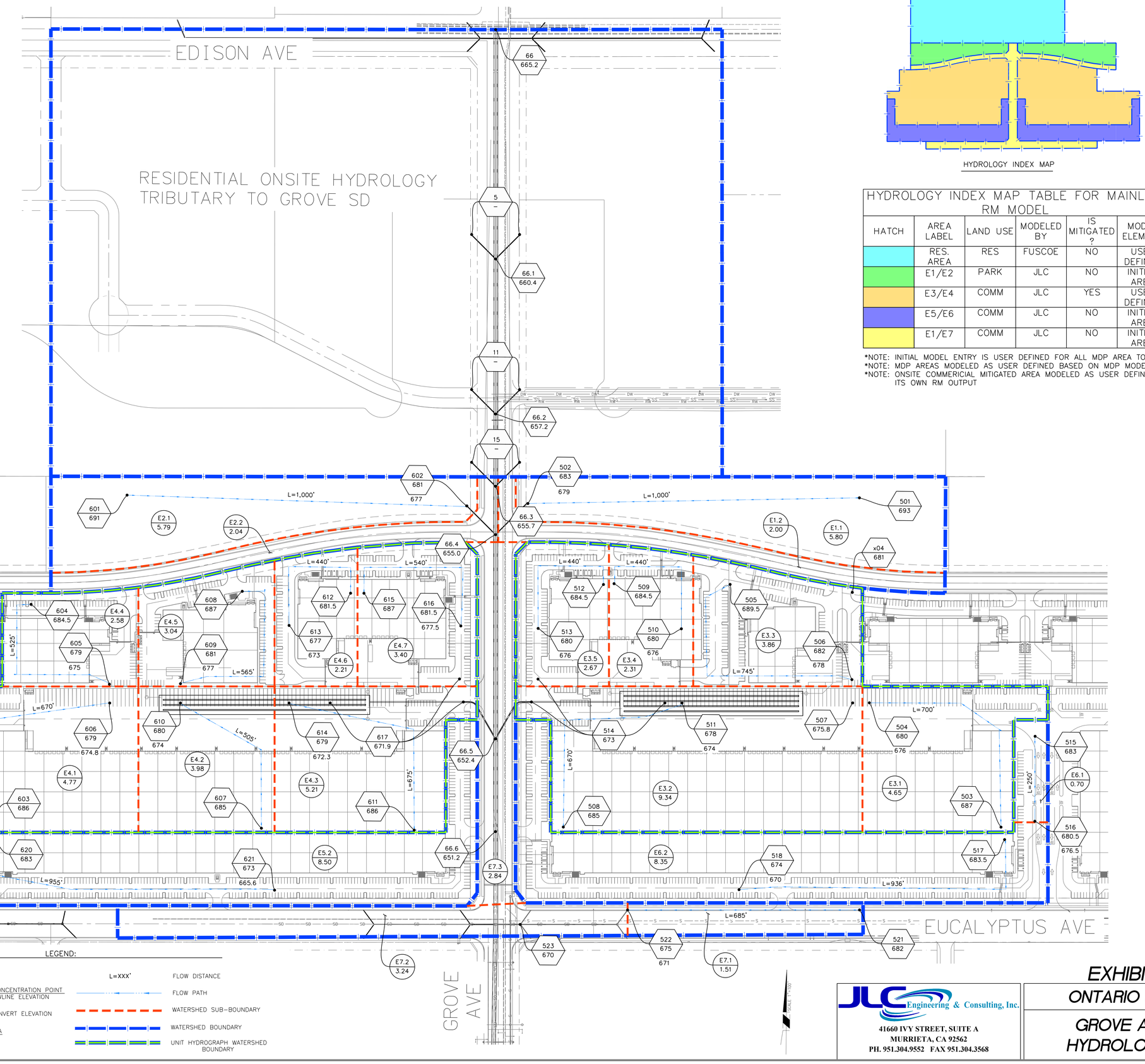
*DENOTES CONFLUENCE POINT

RATIONAL METHOD RESULTS – GROVE MAINLINE SD OVERALL (EXCLUDES MITIGATED COMMERCIAL AREA E3, E4)		
NODE TO NODE	Q100 (CFS)	TC (MIN)
66–66	874.33	31.21
66–66.1	874.33	31.83
*66–66.1	902.4	31.83
5–66.1	50.98	12.83
*5–66.1	902.4	31.83
66.1–66.2	902.4	32.25
*66.1–66.2	937.77	32.25
11–66.2	62.36	13.6
*11–66.2	937.77	32.25
66.2–66.3	937.77	32.44
*66.2–66.3	946.06	32.44
15–66.3	18.11	14.02
*15–66.3	946.06	32.44
66.3–66.4	946.06	32.59
*66.3–66.4	962.04	32.59
601–602	8.63	19.23
602–602	12.83	19.23
602–66.4	12.83	19.32
*602–66.4	962.04	32.59
501–502	8.06	19.23
502–502	12.16	19.23
502–66.4	12.16	19.32
*502–66.4	962.04	32.59
66.4–66.5	962.04	33.24
66.5–66.6	962.04	33.53
*66.5–66.6	1001.87	33.53
618–619	2.71	6.95
619–621	2.71	12.84
*619–621	26.29	11.77
620–621	23.67	11.77
*620–621	26.29	11.77
621–66.6	26.29	13.06
*621–66.6	1001.87	33.53
515–516	2.69	6.95
516–518	2.69	11.39
*516–518	25.89	11.75
517–518	23.25	11.75
*517–518	25.89	11.75
518–66.6	25.89	13.02
*518–66.6	1001.87	33.53
521–522	4.55	10.36
522–523	14.3	10.36
523–523	22.85	10.36
*523–66.6	1001.87	33.53

*DENOTES CONFLUENCE POINT

RATIONAL METHOD RESULTS – MITIGATED COMMERCIAL ONSITE AREA E4		
NODE TO NODE	Q100 (CFS)	TC (MIN)
603–606	14.58	10.22
*603–606	22.57	10.22
604–605	8.38	9.27
605–606	8.38	9.47
*605–606	22.57	10.22
606–610	22.57	10.82
*606–610	43.84	9.59
607–610	12.9	9.23
*607–610	43.84	9.59
608–609	9.7	9.52
609–610	9.7	9.58
*609–610	43.84	9.59
610–614	43.84	10.27
*610–614	66.71	10.27
611–614	15.77	10.27
*611–614	66.71	10.27
612–613	7.42	8.68
613–614	7.42	9.58
*613–614	66.71	10.27
614–617	66.71	10.55
*614–617	76.98	10.56
615–616	10.85	9.42
616–617	10.85	9.65
*616–617	76.98	10.56

*DENOTES CONFLUENCE POINT



LEGEND:

X.X / X.X — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION

XXXX.X — APPROXIMATE INVERT ELEVATION

XXX / X.X — SUB AREA / ACRES

L=XXX' — FLOW DISTANCE

FLOW PATH

WATERSHED SUB-BOUNDARY

WATERSHED BOUNDARY

UNIT HYDROGRAPH WATERSHED BOUNDARY

SCALE 1"=100'

HYDROLOGY INDEX MAP

HYDROLOGY INDEX MAP TABLE FOR MAINLINE RM MODEL					
HATCH	AREA LABEL	LAND USE	MODELED BY	IS MITIGATED ?	MODEL ELEMENT
	RES. AREA	RES	FUSCOE	NO	USER DEFINED
	E1/E2	PARK	JLC	NO	INITIAL AREA
	E3/E4	COMM	JLC	YES	USER DEFINED
	E5/E6	COMM	JLC	NO	INITIAL AREA
	E1/E7	COMM	JLC	NO	INITIAL AREA

*NOTE: INITIAL MODEL ENTRY IS USER DEFINED FOR ALL MDP AREA TO THE NORTH.
*NOTE: MDP AREAS MODELED AS USER DEFINED BASED ON MDP MODEL OUTPUT.
*NOTE: ONSITE COMMERICIAL MITIGATED AREA MODELED AS USER DEFINED; HAS ITS OWN RM OUTPUT

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EXHIBIT "C"

ONTARIO RANCH

GROVE AVENUE HYDROLOGY MAP

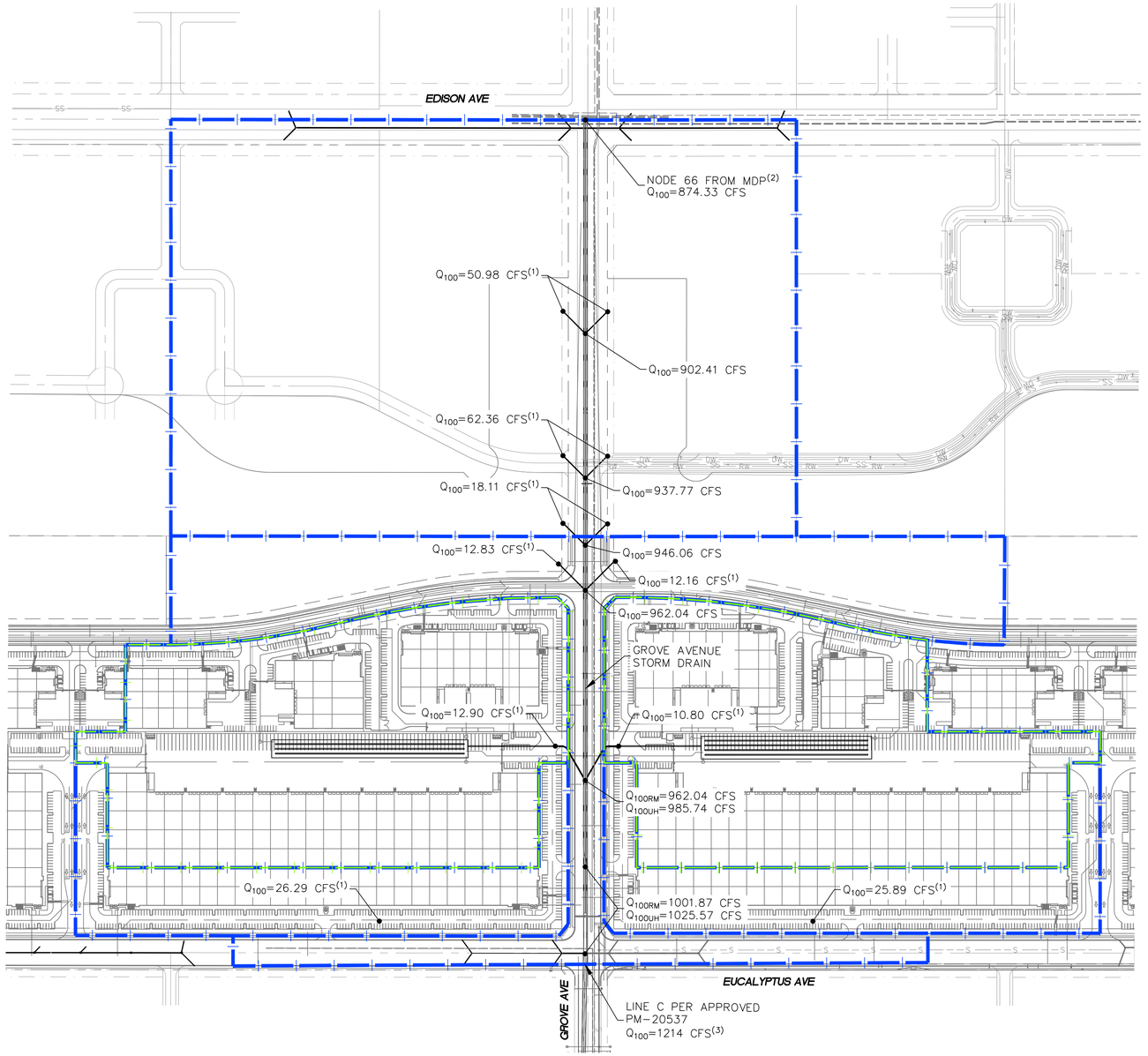
Drawing Name: O:\108.43.25\Engineering\Hydrology_Plan\Exhibits\OnsiteHydrologyMap_Grove.dwg
Last Opened: Feb 09, 2026 - 7:10pm by stonner

EXHIBIT D: GROVE AVENUE FLOW RATE MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

GROVE STORM DRAIN FLOW RATE MAP



DESIGN NOTES:

1) LATERAL LOCATIONS FOR THE GROVE AVENUE STORM DRAIN ARE NOT FINAL.

2) Q_{100} IS BASED ON THE ONTARIO MASTER DRAINAGE PLAN (MDP). SEE EXCERPT A.

3) LINE C IS SIZED FOR THE UPSTREAM FLOW OF 1,214 CFS. HOWEVER, THE ONTARIO MDP ALLOCATES 1,050 CFS TO LINE C (NODE 67 IN MDP). SEE EXCERPT A.

LEGEND:

- WATERSHED BOUNDARY
- UNIT HYDROGRAPH WATERSHED BOUNDARY
- Q_{100} – PEAK 100-YEAR RATIONAL METHOD FLOWS
- Q_{100RM} – PEAK 100-YEAR RATIONAL METHOD FLOWS EXCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW
- Q_{100UH} – PEAK 100-YEAR RATIONAL METHOD FLOWS INCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW

SCALE 1"=200'

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EXHIBIT "D"

ONTARIO RANCH

GROVE STORM DRAIN FLOW RATE MAP

Drawing Name: O:\108.43.25\Engineering\Hydrology_Plan\Exhibits\Flow_Rate_Map_Grove.dwg
Last Opened: Feb 09, 2026 - 6:27pm by stanner

EXHIBIT E: BONE VIEW AVENUE HYDROLOGY MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

BON VIEW AVENUE HYDROLOGY MAP

RATIONAL METHOD RESULTS – BON VIEW MAINLINE SD OVERALL (EXCLUDES MITIGATED COMMERCIAL AREA F2, F3)		
NODE TO NODE	Q100 (CFS)	TC (MIN)
6–6	617.51	26.13
6–6.1	617.51	27.11
*6–6.1	668.52	27.11
9–6.1	79.86	13.55
*9–6.1	668.52	27.11
6.1–6.2	668.52	27.64
*6.1–6.2	685.92	27.64
12–6.2	24.62	18.7
*12–6.2	685.92	27.64
6.2–6.3	685.92	27.99
*6.2–6.3	705.52	27.98
701–702	7.63	15.52
702–702	15.13	15.52
702–6.3	15.13	15.61
*702–6.3	705.52	27.98
703–704	13.3	19.23
704–6.3	13.3	19.29
*704–6.3	705.52	27.98
6.3–6.4	705.52	28.4
6.4–6.5	705.52	28.78
*6.4–6.5	711.57	28.78
731–732	11.26	10.2
732–6.5	11.26	10.56
*732–6.5	711.57	28.78
6.5–7	711.57	29.0
*6.5–7	719.61	29.0
734–735	3.42	8.75
735–7	16.94	8.75
*735–7	719.61	29.0

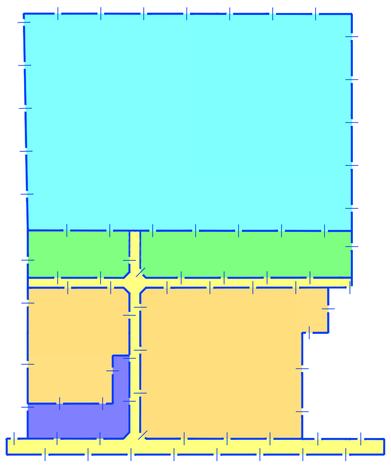
*DENOTES CONFLUENCE POINT

RATIONAL METHOD RESULTS – MITIGATED COMMERCIAL ONSITE AREA F2		
NODE TO NODE	Q100 (CFS)	TC (MIN)
711–712	2.48	6.75
712–714	2.48	9.98
*712–714	16.7	8.74
713–714	14.34	8.74
*713–714	16.7	8.74
714–721	16.7	12.18
*714–721	56.72	9.7
715–716	9.45	9.31
716–721	9.45	9.6
*716–721	56.72	9.7
717–718	9.07	8.92
718–721	9.07	8.94
*718–721	56.72	9.7
719–720	23.39	9.69
720–721	23.39	9.7
*720–721	56.72	9.7
721–725	56.72	10.3
*721–725	61.57	10.3
722–723	6.61	5.99
723–724	6.61	6.09
724–725	6.61	6.2
*724–725	61.57	10.3
725–729	61.57	10.56
*725–729	68.3	10.56
726–727	7.92	7.81
727–728	7.92	7.88
728–729	7.92	8.11
*728–729	68.3	10.56

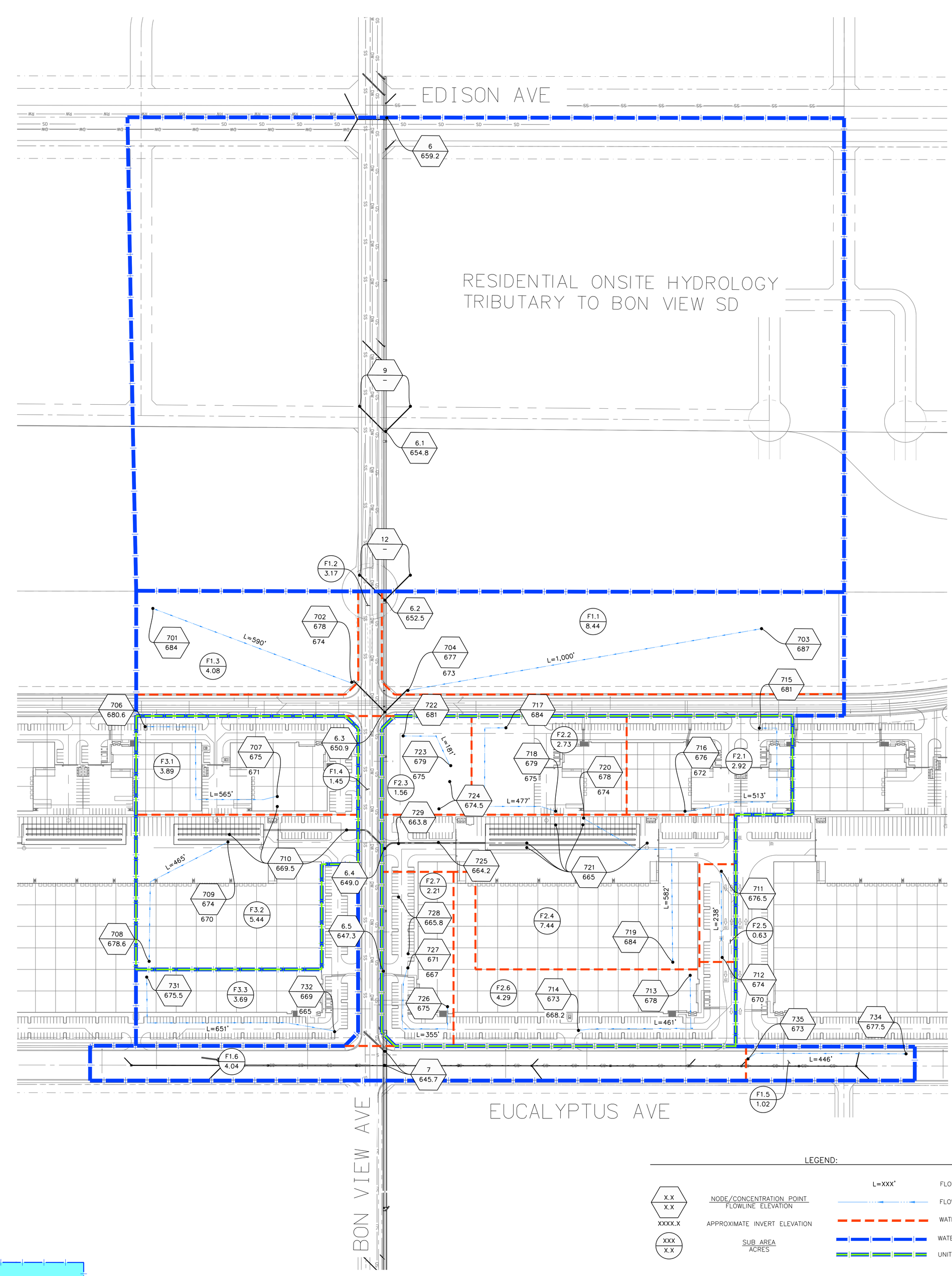
*DENOTES CONFLUENCE POINT

RATIONAL METHOD RESULTS – MITIGATED COMMERCIAL ONSITE AREA F3		
NODE TO NODE	Q100 (CFS)	TC (MIN)
706–707	12.32	9.65
707–710	12.32	9.68
*707–710	29.99	8.96
708–709	18.03	8.93
709–710	18.03	8.96
*709–710	29.99	8.96

*DENOTES CONFLUENCE POINT



HYDROLOGY INDEX MAP



HYDROLOGY INDEX MAP TABLE FOR MAINLINE RM MODEL					
HATCH	AREA LABEL	LAND USE	MODELED BY	IS MITIGATED ?	MODEL ELEMENT
	RES. AREA	RES	FUSCOE	NO	USER DEFINED
	F1	PARK	JLC	NO	INITIAL AREA
	F2/F3	COMM	JLC	YES	USER DEFINED
	F3	COMM	JLC	NO	INITIAL AREA
	F1	COMM	JLC	NO	INITIAL AREA

*NOTE: INITIAL MODEL ENTRY IS USER DEFINED FOR ALL MDP AREA TO THE NORTH.
*NOTE: MDP AREAS MODELED AS USER DEFINED BASED ON MDP MODEL OUTPUT.
*NOTE: ONSITE COMMERICIAL MITIGATED AREA MODELED AS USER DEFINED; HAS ITS OWN RM OUTPUT

LEGEND:

- X.X / X.X — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION
- XXXX.X — APPROXIMATE INVERT ELEVATION
- XXX / X.X — SUB AREA / ACRES
- L=XXX' — FLOW DISTANCE
- FLOW PATH
- WATERSHED SUB–BOUNDARY
- WATERSHED BOUNDARY
- UNIT HYDROGRAPH WATERSHED BOUNDARY

DESIGN NOTES:
1. RATIONAL METHOD MODEL PROVIDES LONGEST FLOW PATH SINCE PROJECT DOES NOT HAVE CONCEPTUAL GRADING.
2. MODELS PROVIDE ELEVATIONS THAT ARE BASED ON A SLOPE OF 1%. THIS IS TO ENSURE SURFACE GRADES DRAIN APPROPRIATELY. NOTE THIS ELEVATION DO NOT REPRESENT CONCEPTUAL GRADING AND ARE MEANT TO PROVIDE DATA TO COMPUTE Tc AND FLOW RATES.
3. HYDROLOGY DOES NOT ACCOUNT FOR ALL INLETS AND STORM DRAIN LATERALS. THIS WILL BE DONE AFTER COMPLETING CONCEPTUAL GRADING PLAN.SD IS CONCEPTUAL AND ONLY INTENDED FOR RM MODELING PURPOSES.
4. OVERALL MAINLINE SD HYDROLOGY EXCLUDES MITIGATED AREA. RESULTING PEAK FLOW IS Q100 IN MAINLINE + ROUTED Q100 FROM BASIN. ROUTED Q100 RESULTS FROM ROUTING THE UNIT HYDROGRAPH MODEL RESULTS.RATIONAL METHOD FOR MITIGATED AREA USED TO DEFINE TC FOR UH MODEL.

SCALE 1"=100'

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EXHIBIT "E"

ONTARIO RANCH

BON VIEW AVENUE HYDROLOGY MAP

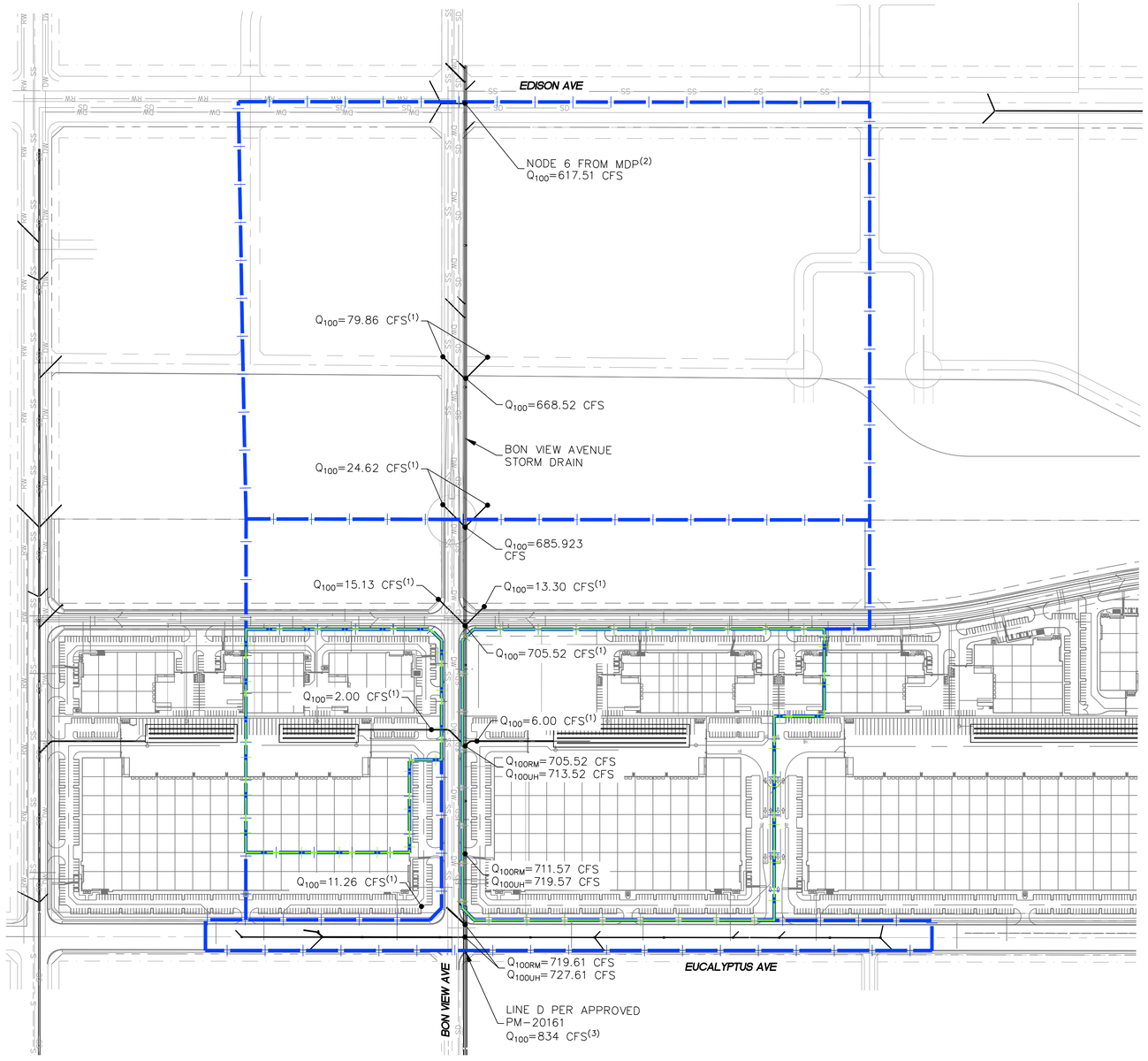
Drawing Name: O:\108.43.25\Engineering\Hydrology_Plan\Exhibits\OnsiteHydrologyMap_BonView.dwg
Last Opened: Feb 09, 2026 – 5:41pm by stanner

EXHIBIT F: BON VIEW AVENUE FLOW RATE MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

BON VIEW STORM DRAIN FLOW RATE MAP



DESIGN NOTES:

1) LATERAL LOCATIONS FOR THE BON VIEW AVENUE STORM DRAIN ARE NOT FINAL.

2) Q_{100} IS BASED ON THE ONTARIO MASTER DRAINAGE PLAN (MDP). SEE EXCERPT A.

3) LINE D IS SIZED FOR THE UPSTREAM FLOW OF 834 CFS. HOWEVER, THE ONTARIO MDP ALLOCATES 746 CFS TO LINE D (NODE 7 IN MDP). SEE EXCERPT A.

LEGEND:

	WATERSHED BOUNDARY
	UNIT HYDROGRAPH WATERSHED BOUNDARY
Q_{100} –	*PEAK 100-YEAR RATIONAL METHOD FLOWS*
Q_{100RM} –	*PEAK 100-YEAR RATIONAL METHOD FLOWS EXCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW*
Q_{100UH} –	*PEAK 100-YEAR RATIONAL METHOD FLOWS INCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW*

SCALE 1"=200'

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EXHIBIT "F"

ONTARIO RANCH

BON VIEW STORM DRAIN FLOW RATE MAP

H1-594

Drawing Name: C:\108 43 25\Engineering\Hydrology_Plan\Exhibits\Flow_Rate_Map_BonView.dwg
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EXHIBIT G: CAMPUS AVENUE HYDROLOGY MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

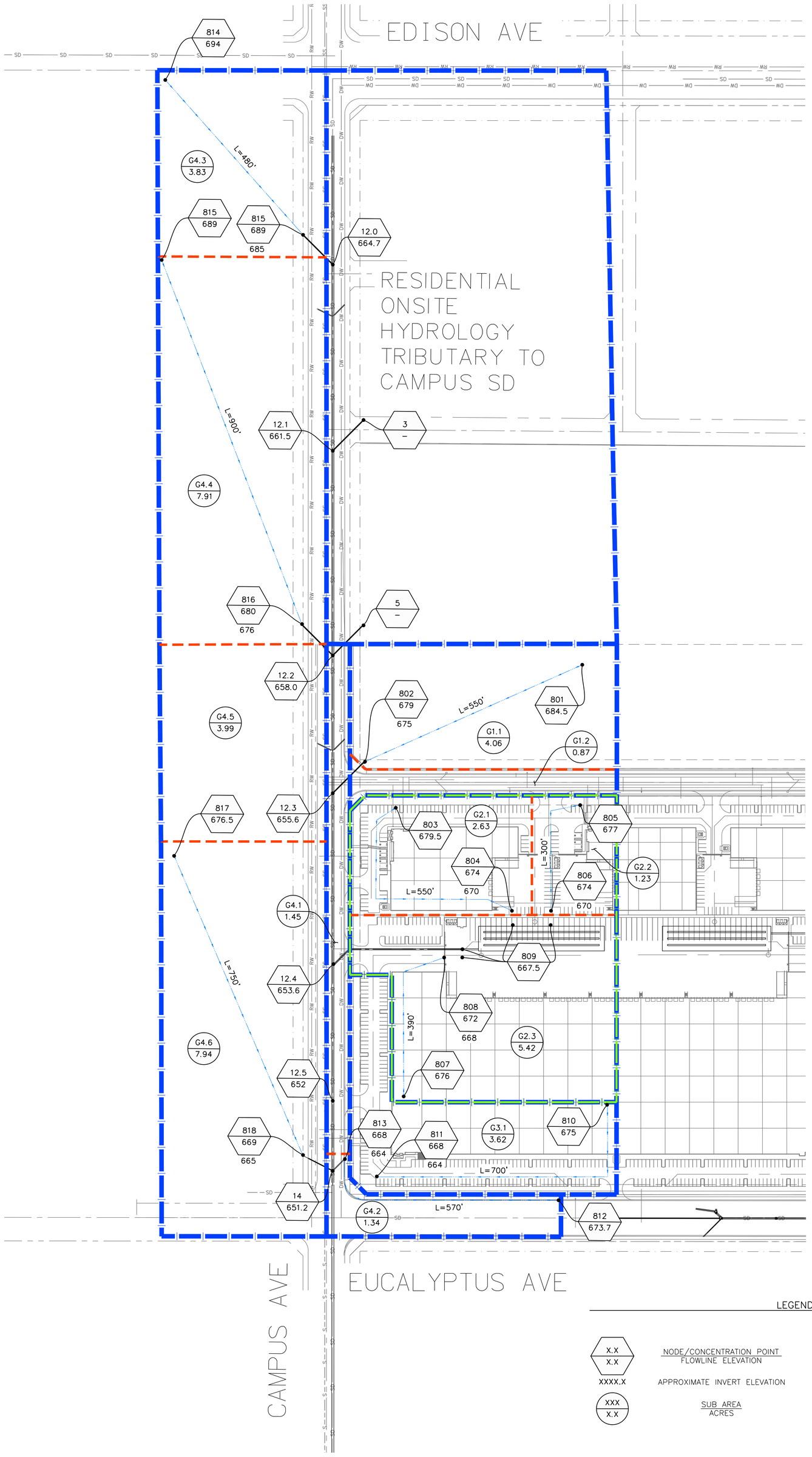
CAMPUS AVENUE HYDROLOGY MAP

RATIONAL METHOD RESULTS – CAMPUS MAINLINE SD OVERALL (EXCLUDES MITIGATED COMMERCIAL AREA G2)		
NODE TO NODE	Q100 (CFS)	TC (MIN)
814–815	12.69	8.95
815–12	12.69	9.02
12–12.1	12.69	10.13
*12–12.1	43.52	12.97
3–12.1	32.61	12.97
*3–12.1	43.52	12.97
12.1–12.2	43.52	13.87
*12.1–12.2	84.63	11.66
815–816	22.37	11.6
816–816	33.66	11.6
816–12.2	33.66	11.66
*816–12.2	84.63	11.66
5–12.2	11.18	18.5
*5–12.2	84.63	11.66
12.2–12.3	84.63	13.31
*12.2–12.3	94.12	13.31
801–802	7.74	15.14
802–802	9.83	15.14
802–12.3	9.83	15.22
*802–12.3	94.12	13.31
12.3–12.4	94.12	15.13
12.4–12.5	94.12	15.69
*12.4–12.5	102.85	15.69
810–811	10.95	10.49
811–12.5	10.95	10.83
*811–12.5	102.85	15.69
12.5–14	102.85	15.97
*12.5–14	128.0	15.97
817–818	23.6	10.79
818–14	23.6	10.84
*818–14	128.0	15.97
812–813	4.26	9.66
813–813	8.86	9.67
813–14	8.86	9.69
*813–14	128.0	15.97

*DENOTES CONFLUENCE POINT

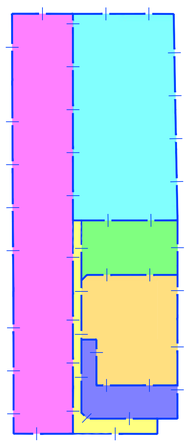
RATIONAL METHOD RESULTS – MITIGATED COMMERCIAL ONSITE AREA G2		
NODE TO NODE	Q100 (CFS)	TC (MIN)
803–804	8.4	9.53
804–809	8.4	9.56
*804–809	31.18	8.33
805–806	4.55	7.48
806–809	4.55	7.52
*806–809	31.18	8.33
807–808	18.95	8.26
808–809	18.95	8.33
*808–809	31.18	8.33

*DENOTES CONFLUENCE POINT



LEGEND:

X.X / X.X — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION	L=XXX' — FLOW DISTANCE
XXXX.X — APPROXIMATE INVERT ELEVATION	FLOW PATH
XXX / X.X — SUB AREA / ACRES	WATERSHED SUB-BOUNDARY
	WATERSHED BOUNDARY
	UNIT HYDROGRAPH WATERSHED BOUNDARY



HYDROLOGY INDEX MAP

HYDROLOGY INDEX MAP TABLE FOR MAINLINE RM MODEL					
HATCH	AREA LABEL	LAND USE	MODELED BY	IS MITIGATED ?	MODEL ELEMENT
	RES. AREA	RES	FUSCOE	NO	USER DEFINED
	MDP AREA	COMM	JLC (MCC MDP)	NO	INITIAL AREA
	G1	PARK	JLC	NO	INITIAL AREA
	G2	COMM	JLC	YES	USER DEFINED
	G3	COMM	JLC	NO	INITIAL AREA
	G4	COMM	JLC	NO	INITIAL AREA

*NOTE: INITIAL MODEL ENTRY IS USER DEFINED FOR ALL MDP AREA TO THE NORTH.
*NOTE: MDP AREAS MODELED AS USER DEFINED BASED ON MDP MODEL OUTPUT.
*NOTE: ONSITE COMMERICIAL MITIGATED AREA MODELED AS USER DEFINED; HAS ITS OWN RM OUTPUT

DESIGN NOTES:
1. RATIONAL METHOD MODEL PROVIDES LONGEST FLOW PATH SINCE PROJECT DOES NOT HAVE CONCEPTUAL GRADING.
2. MODELS PROVIDE ELEVATIONS THAT ARE BASED ON A SLOPE OF 1%. THIS IS TO ENSURE SURFACE GRADES DRAIN APPROPRIATELY. NOTE THIS ELEVATION DO NOT REPRESENT CONCEPTUAL GRADING AND ARE MEANT TO PROVIDE DATA TO COMPUTE Tc AND FLOW RATES.
3. HYDROLOGY DOES NOT ACCOUNT FOR ALL INLETS AND STORM DRAIN LATERALS. THIS WILL BE DONE AFTER COMPLETING CONCEPTUAL GRADING PLAN.SD IS CONCEPTUAL AND ONLY INTENDED FOR RM MODELING PURPOSES.
4. OVERALL MAINLINE SD HYDROLOGY EXCLUDES MITIGATED AREA. RESULTING PEAK FLOW IS Q100 IN MAINLINE + ROUTED Q100 FROM BASIN. ROUTED Q100 RESULTS FROM ROUTING THE UNIT HYDROGRAPH MODEL RESULTS.RATIONAL METHOD FOR MITIGATED AREA USED TO DEFINE TC FOR UH MODEL.

SCALE 1" = 100'

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EXHIBIT "G"

ONTARIO RANCH

CAMPUS AVENUE HYDROLOGY MAP

Drawing Name: O:\108.43.25\Engineering\Hydrology_Plan\Exhibits\OnsiteHydrologyMap_Campus.dwg
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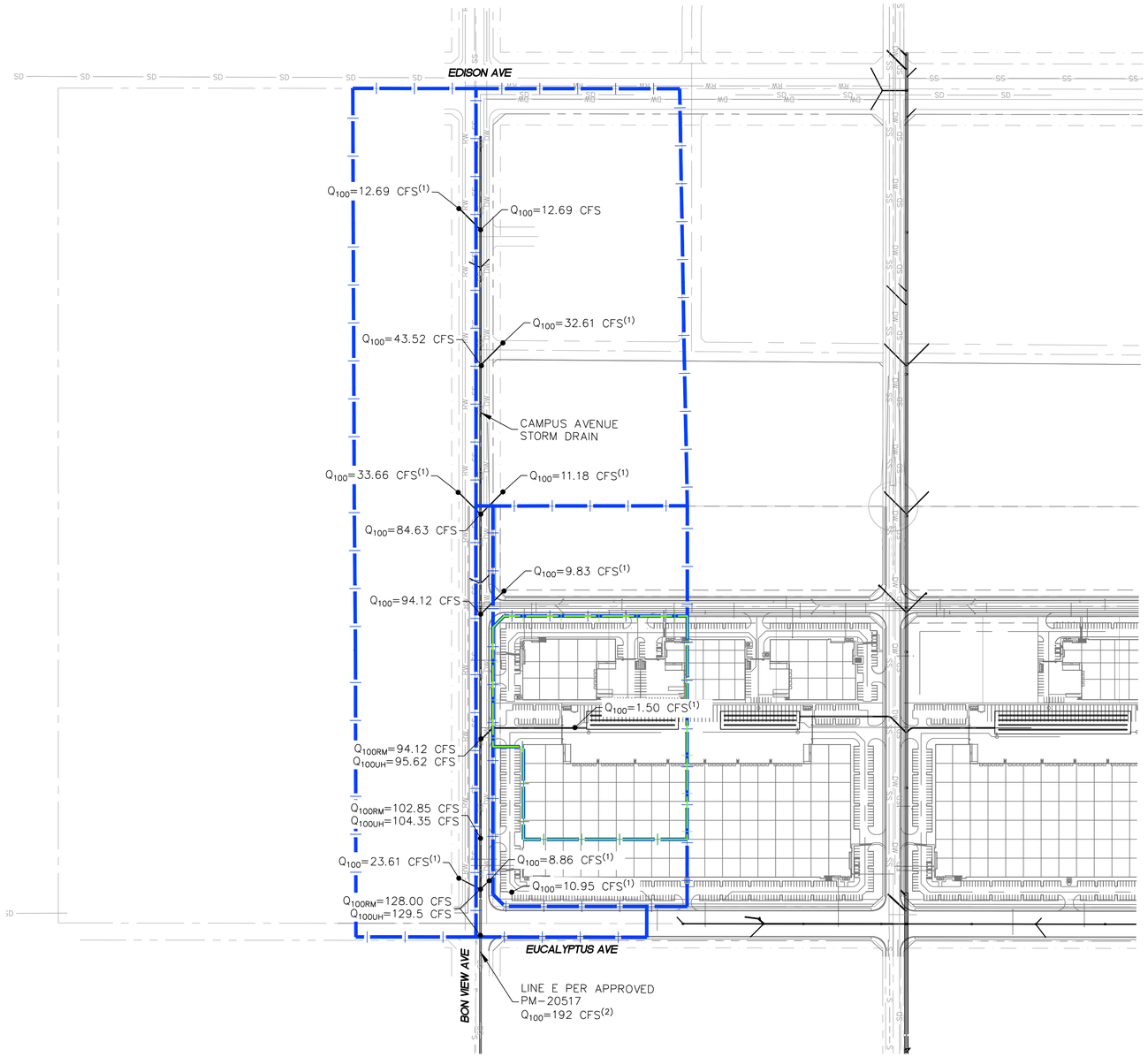
EXHIBIT H: CAMPUS AVENUE FLOW RATE MAP

ONTARIO RANCH

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO STATE OF CALIFORNIA

CAMPUS STORM DRAIN FLOW RATE MAP



DESIGN NOTES:

1) LATERAL LOCATIONS FOR THE BON VIEW AVENUE STORM DRAIN ARE NOT FINAL.

2) LINE D IS SIZED FOR THE UPSTREAM FLOW OF 192 CFS. HOWEVER, THE ONTARIO MDP ALLOCATES 124 CFS TO LINE E (NODE 14 IN MDP). SEE EXCERPT A.

LEGEND:

- WATERSHED BOUNDARY
- UNIT HYDROGRAPH WATERSHED BOUNDARY
- Q_{100} – PEAK 100-YEAR RATIONAL METHOD FLOWS
- Q_{100RM} – PEAK 100-YEAR RATIONAL METHOD FLOWS EXCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW
- Q_{100UH} – PEAK 100-YEAR RATIONAL METHOD FLOWS INCLUDING ONSITE UNIT HYDROGRAPH PEAK FLOW

SCALE 1"=200'

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EXHIBIT "H"

ONTARIO RANCH

CAMPUS STORM DRAIN FLOW RATE MAP

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