

Appendix F: Preliminary Hydrology Study

MEMORANDUM



Development Coordination Staff Committee (DCRC)

Date: February 24, 2023
Project (PRJ) Number: ZON-2022-0097
Project Address: 1500 S. Raymond Avenue
Department Name: Community and Economic Development Dept. - Planning Division
Department Contact: Edgardo Caldera, Senior Planner
Edgardo.Caldera@cityoffullerton.com , Phone 714-773-5773

I have reviewed the above-referenced case and it **does** comply with our requirements.

COMMENTS:

☒ Corrections

Recommended Plan Corrections / Additional Information Required:

The project site is on property currently zoned M-P (Manufacturing Park) and has a General Plan designation of Industrial. The site is within General Plan Focus Area K, Southeast Industrial, which is envisioned as one for the City's primary employment generating areas and will be characterized by preserved industrial uses that will support expanding industries, including high tech and clean technology, research and development, creative industries and medical research. The project would be consistent with the vision for Focus Area K.

CEQA:

Application is complete subject to the completion of required environmental documents.

Preliminary Conditions of Approval (provided as available):

1. Pursuant to Fullerton Municipal Code (FMC) §15.40.040.F, landscape and irrigation shall be provided for landscaped areas pursuant to FMC §15.50. Pursuant to FMC §15.50.030, a Landscape Documentation Package shall be submitted to the City for review and approval. The Landscape Documentation Package includes, but is not limited to, certified landscape and irrigation design plans. The Landscape and Documentation Package requires a separate plan check submittal and fee.

MEMORANDUM

Development Coordination Review Committee (DCRC)



Date: February 21, 2023

Project Number: **ZON-2022-0097**

Project Address: 1500 S Raymond Ave

Department Name: Community and Economic Development – Building Division
Tri Nguyen, Building Official

Department Contact: (714) 773-5799
tri.nguyen@cityoffullerton.com

I have reviewed the above-referenced case. Please see the comments and conditions below for more details.

COMMENTS:

The plans have been submitted for plan check. Our Building Division will review and provide a complete plan check.

As a courtesy notice, please be aware of the following items for future building permits.

1. **REMINDER!** Construction plans shall be submitted to the Community and Economic Development Department for review and issuance of any future building permit(s). Construction plans shall comply with Fullerton Building Codes, as adopted and in effect at time of plan submittal.
2. **REMINDER! In addition to the Fullerton Zoning Code**, the Architect of Record shall verify that the proposed Type of Construction will meet the Allowable Area, Allowable Height and Number of Stories as specified in **Chapter 5 of the California Building Code**.
 - a. If utilizing the unlimited area provisions of CBC Section 507, plans need to verify that the 60'-0" yards are provided around the building. Where yards are less than 60'-0" in width but no less than 40'-0" in width (that do not front public ways), please verify that the building will be made to comply with the reduced open space provisions of CBC Section 507.2.1.
3. **REMINDER!** Architect of record shall be aware of requirements in Chapter 11B of California Building Code as it relates to site accessibility requirements for the building in regards to parking requirements, EVCS, interior routes of travel and facility accessibility and accessible path of travel from public right of way.
4. **REMINDER!** Automatic fire sprinkler system shall be installed in accordance with Chapter 9 of the California Building Code as applicable.
5. **REMINDER!** Soils report and investigation will be required with building permit application submittal.
6. **REMINDER!** Comply with FMC Section 14.01.015 for Flood zone development.

MEMORANDUM



Development Coordination Review Committee (DCRC)

Date: February 9, 2023
Project Number: ZON-2022-0097
Project Address: 1500 S. Raymond Ave
Department Name: Police Department
Department Contact: Sgt. E. Bridges
(714) 738-6838
ebridges@fullertonpd.org

I have reviewed the above-referenced case. Please see the comments and conditions below for more details.

COMMENTS:



No Comments / Corrections

MEMORANDUM



Development Coordination Review Committee (DCRC)

Date: February 9, 2023
Project Number: ZON-2022-0097
Project Address: 1500 S Raymond Avenue
Department Name: Public Works – Water Engineering
Stacy Matsumoto, Water Technical Design Specialist
Department Contact: 714-738-7803
Stacym@ci.fullerton.ca.us

I have reviewed the above-referenced case and it **does**/does not comply with our requirements.

Recommended Conditions of Approval:

The conditions referenced below are preliminary based on the plans and information available. Final conditions of approval will be determined prior to public hearing.

1. The existing 8" fire service will need to be abandoned and a new hot tap from the City main shall be installed for the relocation of the 8" DCDA on the east side of property.
2. Provide calcs for domestic, irrigation, and fire services to determine meter sizes. If it is determined that the existing services are insufficient, the existing services shall be abandoned at the main and install new services, meters, and backflows per City Standards.
3. A water improvement plan prepared by a Civil Engineer is required to be submitted to Public Works and shall be approved prior to building plan approval. Water Improvement plan shall include existing, proposed, and abandonment of services, fire hydrants, etc. A public fire hydrant is required to be within 50' of a DCDA w/FDC or a new public fire hydrant shall be installed by the development.

Attachments:

- City of Fullerton Standard Plans:
<https://www.cityoffullerton.com/government/departments/public-works/engineering/general-engineering/standard-drawings>
- Fee Schedule
- <https://www.cityoffullerton.com/government/departments/public-works/engineering/applications-permits>
- Fire flow testing information can be obtained by contacting MJohansen@cityoffullerton.com or gar.huang@cityoffullerton.com.
- City of Fullerton Title Block:
<https://www.cityoffullerton.com/government/departments/public-works/engineering/general-engineering>

MEMORANDUM

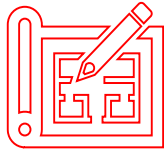


Development Coordination Review Committee (DCRC)

Date: February 9, 2022
Project Number: ZON-2022-0097
Project Address: 1500 S. Raymond Avenue
Department Name: Public Works/Traffic Division
Dave Roseman, City Traffic Engineer
(714) 738-6330
Department Contact: Roseman@llgengineers.com

I have reviewed the above-referenced case and it **does**/does not comply with our requirements.

COMMENTS:



PRELIMINARY REVIEW

Approval pending City Traffic Engineer review

☐ No Comments / Corrections

Recommended Plan Corrections / Additional Information Required:

1. Per TAPP Analysis, no further VMT or LOS analysis is needed.
2. Truck traffic to be restricted to the easterly driveway to avoid blocking the intersection of Raymond/Burton. Developer noted.
3. Please note parking is not allowed on Burton along entire project frontage. Developer noted requirement, no further action needed.

Attachments:

MEMORANDUM



Development Coordination Review Committee (DCRC)

Date: February 9 2023
Project (PRJ) Number: ZON-2022-0097
Project Address: 1500 S Raymond Avenue
Department Name: Public Works – General Engineering
Juan Zavala, Principal Civil Engineer
Department Contact: Juan.zavala@cityoffullerton.com
714-738-6322

I have reviewed the above-referenced case. Please see the comments and conditions below. Please note that corrections and comments provided in this memo based on information provided with the application and are subject to change.

COMMENTS:

☒ Corrections

Recommended Plan Corrections / Additional Information Required:

1. Preliminary Priority Water Quality Management Plan (WQMP) has been reviewed and found incomplete. Additional information/corrections are needed to deem the application complete. Please refer to Priority WQMP Checklist dated November 28, 2022 (attached).
2. Conceptual Grading Plan has been reviewed and found acceptable for the entitlement phase of the project. Comments that are provided on preliminary documents shall be addressed during the final design, prior to issuance of Grading Permit. Please refer to Cannon's review comments dated November 23 2022 (attached). Please note that the site design may be impacted by WQMP' revisions, resulting in additional Conceptual Grading Plan comments.
3. The engineers certification shall be included and filled out (see attached). Sign, date and stamp the certification.
4. The Limited Sewer Study should reference the OCSD code/manual. Otherwise reference material and sections and the fixture units table of the UPC need to be provided in the memo during final plans.

Recommended Conditions of Approval:

Project specific

1. The project shall be submitted to Burlington Northern Santa Fe (BNSF) Railroad Company and Orange County Flood Control District (OCFCD) for review and shall comply with their requirements prior to issuance of Grading Permit.
2. After on-site construction is completed, the project shall rehabilitate AC pavement over the entire street right-of-way on Burton Street along project's frontage. Currently, AC pavement

is in good condition with the Pavement Condition Index (PCI) of 84. Therefore, a minimal level of rehabilitation that includes 2" AC grind and overlay is anticipated to be sufficient.

3. There are no pedestrian improvements on Burton Street. The project shall dedicate a minimum 6-foot-wide additional street right-of-way to the City of Fullerton and shall construct a full width concrete sidewalk within the dedicated easement along project frontage prior to issuance of Certificate of Temporary Occupancy. All improvements that conflict with new sidewalk, shall be relocated on-site. The applicant shall be responsible for preparation of dedication documents (legal description and plot). New street right-of-way shall be shown on plans and shall be accommodated by site design.
4. All unneeded driveways shall be removed, and new full-height curb and gutter and full width concrete sidewalk shall be constructed within removal limits.
5. Existing driveways that will be utilized for the proposed project shall be upgraded as needed to comply with current Fullerton Standards. Driveway design shall address City Traffic Engineer's requirements and shall be reviewed and approved by the City Traffic Engineer.
6. New driveways shall be constructed in accordance with Fullerton Standards. Driveway design shall address City Traffic Engineer's requirements and shall be reviewed and approved by the City Traffic Engineer.
7. Damaged/substandard curb and gutter shall be removed and reconstructed with new curb and gutter in accordance with Fullerton Standards.
8. Existing low voltage streetlights shall be upgraded to current City standards including replacement of WHPS luminaires with City-approved LED luminaires. The LED lighting shall produce lighting photometric similar to the existing or better.
9. According to FMC Section 16.05.060, all proposed utilities that provide direct service to the subject property, including electric and all telecommunication systems, shall be installed underground; all existing facilities, including power poles, providing direct service to the development shall be undergrounded.

General:

- All work in the public right of way shall be constructed in accordance with the Standard Plans and Standard Specifications for Public Works Construction, latest edition. This includes supplements thereto and City of Fullerton Standard Drawings.
- All plans for improvements in the public right of way shall be prepared by a Registered Civil Engineer authorized to practice in the State of California.
- Before undertaking any grading or construction work of any type within the public right of way, the owner must first obtain the applicable permits from the Public Works Department.
- During site improvement, all deliveries to the project site that are overweight, or oversize will require a transportation permit from the Public Works Department.
- The project shall utilize the City's benchmarks. A list of the City's benchmarks is available on the City of Fullerton website.
- The developer shall provide and maintain all necessary flag persons, barricades, delineators, signs, flashers, and any other safety equipment as set forth in the latest publication of the State of California, Manual of Traffic Control, or as required by the Public Works Department permit requirements to ensure safe passage of pedestrian and vehicular traffic.
- Street trenches required for the installation of utility connections shall comply with City of Fullerton Standard No. 312 and 313.
- Any controlling survey monumentation (property lines, tract lines, street centerline, etc.) which are at risk of being destroyed or disturbed during the course of this project must be

preserved in accordance with Section 8771(b) of the California Business and Professions Code (Professional Land Surveyors Act). Pre-construction field ties, along with the preparation and filing of the required Corner Records or Record of Survey with the County of Orange, shall be accomplished by, or under the direction of, a licensed surveyor or civil engineer authorized to practice land surveying. Copies of said records shall be furnished to the City Engineer for review and approval prior to issuance of any onsite or offsite construction permits. Any monuments disturbed or destroyed by this project must be reset and post-construction Corner Records or Record of Survey filed with the County of Orange. A copy of the recorded documents shall be submitted to the City Engineer for review and approval prior to issuance of any permits within the public right of way.

- All the public improvements, studies, designs, plans, calculations, and other requirements shall be installed, provided, and supplied by the developer in accordance with City and State codes, policies, and requirements at no cost to the City. All work shall comply with City standards and specifications and with the City of Fullerton Municipal Codes.
- Proposed sewer laterals shall be minimum 6" V.C.P. per City Std. 209A and 209B. All existing lateral connections to be utilized for the development shall be video inspected to determine their condition. Video shall be submitted to the Public Works/Maintenance for review. If determined that the existing connection(s) are in poor condition, they shall be replaced with new lateral connections per standard plans.
- Existing public and private easements shall not be affected by the proposed development. Any modification to an existing public and/or private easement shall be coordinated and approved by applicable easement owners.
- All facilities crossing lot lines shall be located in private easements.
- Site development shall not result in the increase of storm water run-off and flow intensity to the adjacent properties nor obstruct storm water flow into the site. The size and alignment of on-site drainage facilities shall be based upon detailed hydrology and hydraulic calculations prepared by a California Registered Engineer and shall be approved by the City Engineer.
- Grading plan shall be reviewed and approved prior to issuance of grading permit.
- Site grading shall adhere to the approved grading plan and shall be completed prior to issuance of temporary occupancy.
- As-Built Grading Plan, signed and stamped by the Engineer of Record and the Geotechnical Engineer, shall be submitted to Public Works Department prior to finalizing and closing the grading permit. Any deviations from the approved grading plan will require a submittal of grading plan revision for the City Engineer's review and approval.
- In addition to all retaining walls, any above-ground construction, regardless of its height, that may alter the existing storm water flow pattern shall be shown on the grading plan.
- Prior to issuance of building permits, all public improvements (if any) shall be guaranteed to be installed by the execution of an Agreement for Public Improvements secured by sufficient bonds or sureties for both Faithful Performance and Labor and Materials, in a form approved by the City Attorney.

Attachments:

- Cannon's Memo dated February 6th 2023
- Engineer certification
- City of Fullerton Standard Plans:

<https://www.cityoffullerton.com/government/departments/public-works/engineering/general-engineering/standard-drawings>

- City of Fullerton Benchmarks:
<https://www.cityoffullerton.com/government/departments/public-works/engineering/general-engineering/bench-marks>



To: Juan Zavala, PE (Principal Civil Engineer) & Matt Laninovich, PE, QSD (Civil Engineer)
City of Fullerton, Public Works / Engineering

From: Gary Solsona, PE, QSD
Cannon Corp. JN: 19028.00.343
Contact info: garys@cannoncorp.us or 949-777-1580 (office)

Date: February 6, 2023

Subject: **3rd Entitlement Review of Proposed Conceptual Grading Plan for
1500 South Raymond Avenue, Fullerton, CA**

Cannon has reviewed the city-provided Conceptual Grading Plan, Preliminary Hydrology Report and Soils Report and have deemed it **complete for entitlement process**. Additionally, we recommend the following items below to be incorporated into the conditions of approval.

Hydrology Report:

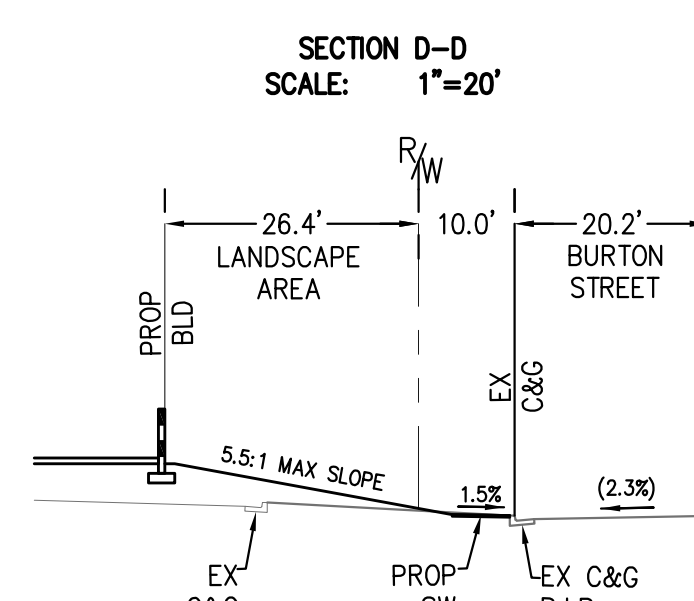
1. A Hydrology and Hydraulic Report shall comply with Orange County Hydrology and Local Drainage Manuals. The report shall be submitted with final engineering plans.
2. A portion of the project is in FEMA Flood Zone AO. For any construction in a FEMA flood zone, the Engineer of Record shall comply with the requirements from Fullerton Municipal Code "chapter 14.01.015 Flood zone development".
3. See comments on the attached Hydrology Study, to incorporate into the final report.

Conceptual Grading Plan:

1. Part of the property is in flood zone AO. It shall be conditioned to comply with City municipal code for construction in flood zone.

Soils Report:

1. See attached comments from LOR Geotechnical Group, Inc to incorporate into the conditions of approval and prior to approval of final grading permit.



ENAME, MA, 02024-32-375 (ref: 150) C. *topazius* (CV 23375-65mg, 1357 SAVED ON: Oct 26 2022 2:00pm; E-OTTERD (P) 04718260, ON: Nov 01 2022 2:50pm, CFC)

NOT FOR CONSTRUCTION

Cannon has reviewed the City provided Hydrology Study and have deemed it complete for entitlement.

Preliminary

HYDROLOGY STUDY

For:

Rexford Industrial Warehouse Building

Project Site Location/Address:

1500 S Raymond Avenue
Fullerton, CA 92831

Prepared For:

Rexford Industrial
11620 Wilshire Boulevard, 10th floor
Los Angeles, CA 90024

Lead Agency:

City of Fullerton
303 W Commonwealth Avenue
Fullerton, CA 92832

Prepared by:

DRC Engineering, Inc.
160 S. Old Springs Road, Suite 210
Anaheim, CA 92808
(714) 685-6860
Christopher McKee, P.E.

Please see inside the report for comments
to incorporate with final report

July 27, 2022

Project No. 22-375

TABLE OF CONTENTS

Section I	Introduction
Section II	Hydrology Methodology
Section III	Project Description Existing Site Conditions Proposed Site Conditions
Section IV	Conclusion
Appendix A	Vicinity Map
Appendix B	Existing Hydrology Map

Part of property is in Flood zone AO. Please see the following requirements from Fullerton Municipal Code for construction in flood zone.

F. Building Requirements.

1. Residential. All new construction or substantial improvements of residential structures shall have the lowest floor (including basement) elevated to or above the base flood elevation in AE zone; elevated above the highest adjacent grade to a height equal to or exceeding the depth number specified in feet on the FIRM, or elevated at least 2 feet above the highest adjacent grade if no depth number is specified in AO zone; elevated to or above the base flood elevation in A zone (base flood elevation shall be determined in accordance with Section C, Item 5). Upon the completion of the structure, the elevation of the lowest floor, including basement, shall be certified by a registered civil engineer or licensed land surveyor, and verified by the community building inspector to be properly elevated. Such certification and verification shall be provided to the Flood Records Manager.

2. Nonresidential. All new construction, or substantial improvements of nonresidential structures within AO, A, and AE zones shall either be elevated to conform with Section F, Item 1 or, together with attendant utility and sanitary facilities, be completely floodproofed to or above that level, so that any space below that level is watertight with walls substantially impermeable to passage of water, and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.

Section I

Introduction

The following hydrology study has been prepared for the development of a 138,500 square foot warehouse building with associated truck & auto parking, drive aisles and landscaping. The site is located to the north of East Burton Street directly east of Raymond Avenue in Fullerton, CA. The existing 7.2 acres property consists of a hotel and parking lot that is planned to be demolished. The general location of the site is illustrated on the Vicinity Map (see Appendix A of this report).

Section II

Methodology

The hydrologic analysis was completed assuming the ultimate project condition based on conceptual site plans. For both the existing and proposed conditions, Advanced Engineering Software (AES) was utilized to model the 100 year hydrology of the site using the Rational Method. The 100 year flow rates were compared for each to ensure the proposed development does not have a significant impact on flows leaving the site. A hydrologic soil group type A was assigned to the project site based on the Orange County Hydrology Manual Plate A (see map in Appendix A). Soil Group A is categorized as having low runoff protentional with soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well-drained sands or gravels. These soils have a high rate of water transmission.

Panel 0132J of the FEMA Flood Insurance Rate Map shows approximately 0.6 acres to the southwest of the site (8% of the overall 7.2 acres) being located in an area designated as Zone AO. Zone AO is described as an area subject to inundation by the 1% annual chance flood with depths of 1 to 3 feet (usually sheet flow on sloping terrain). The FEMA map shows ponding up to the existing building at an approximate elevation of 177'. Elevations on-site are consistently 2-3 feet higher compared to Burton Street which ranges from 173'-174.5'. Therefore, the on-site ponding that is shown on the FEMA flood map would only occur if flooding is seen over the entire length of Barton Street, inundating neighboring properties as well as portions to the south of Carbon Creek. Since this is not reflected on the flood map, it was concluded that the data shown on the map was miscalculated and is not relevant to our proposed design. For conservative purposes the finished floor of the proposed building was increased 2' from the existing elevation to 179.2'. An exhibit has been included in Appendix B showing what the same area zoned AO would look like using existing grades currently on-site.

Section III

Project Description

Existing Site Conditions

The existing conditions of the site and associated parking lot that are planned to be demolished. There are no sources of run-on to the site, however, there is an existing public 27" RCP that bypasses the site under the eastern parking lot that outlets to Carbon Creek to the south. The site is currently divided into 3 watersheds. Landscaping takes up 28,850 square feet making up 9.0% of the site. Watershed A sheet flows to the south to a curb and gutter and outlets via parkway drain to Burton Street. Watershed B sheet flows to a v-gutter located in the drive aisle along the northern portion of the property and outlets at the driveway to the west of the site. Watershed C flows to two drain inlets connected to the catch basin on Burton Street which flows to Carbon Creek. Carbon Creek flows to the west and converges with Coyote Creek which flows to the San Gabriel Estuary before flowing into to the Pacific Ocean.

show proposed FF elevations for the buildings on the Hydrology Map



Proposed Site Conditions

The proposed development will consist of the construction a 138,500 square foot warehouse and associated parking lots. The amount of landscaping will slightly shrink to 24,800 square feet taking up 8.0% of the site. The proposed site will be broken up into 3 different watersheds. Watersheds A & B will include on-site storm drain systems flowing to infiltration basins to retain the design capture volume as calculated per Orange County water quality requirements. Higher flows will bypass the systems and outlet the site. Watershed A will be connected to the existing public 27" RCP currently passing under the east of the site. Further south the 27" RCP outlets into Carbon Creek. High flows from watershed B will spill out of the existing drain inlet located at the proposed western driveway and continue to flow to existing catch basins located on Burton Street. Watershed C will be made up of all landscaping sheet flowing to Burton Street. All roof drains will drain to the north and spill out onto the finished surface before being captured by drain inlets.

Section IV

Conclusion

The following tables summarize the data and results for the 100-year 24 hour design storm in the existing and proposed conditions utilizing the rational method as set forth in the Orange County Hydrology Manual.

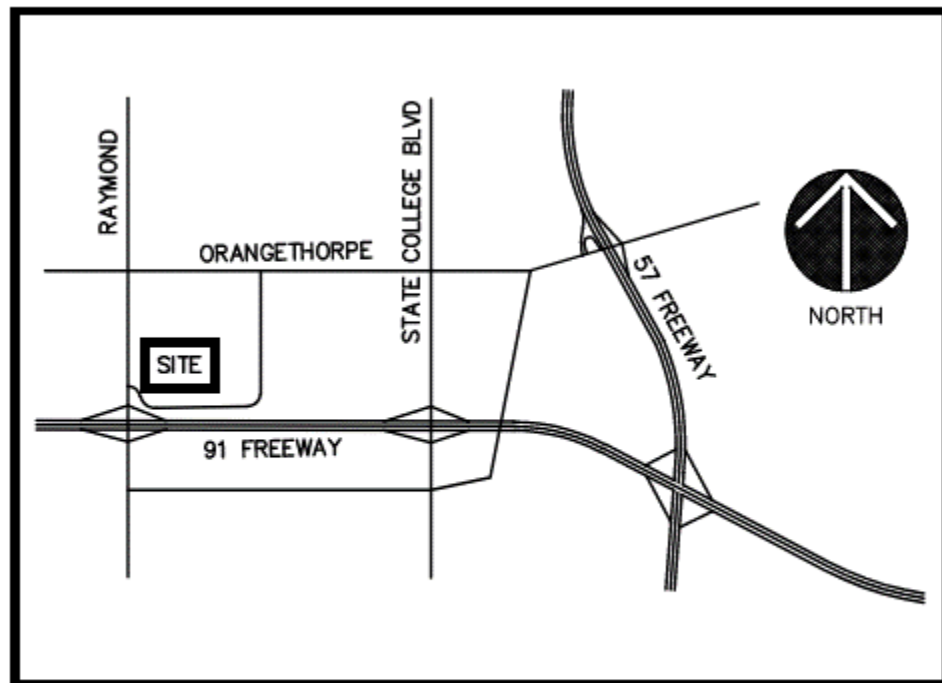
100-YEAR STORM RATIONAL METHOD

Storm Duration (hours)	Existing Flowrate (cfs)	Proposed Flowrate (cfs)
24	33.60	32.59

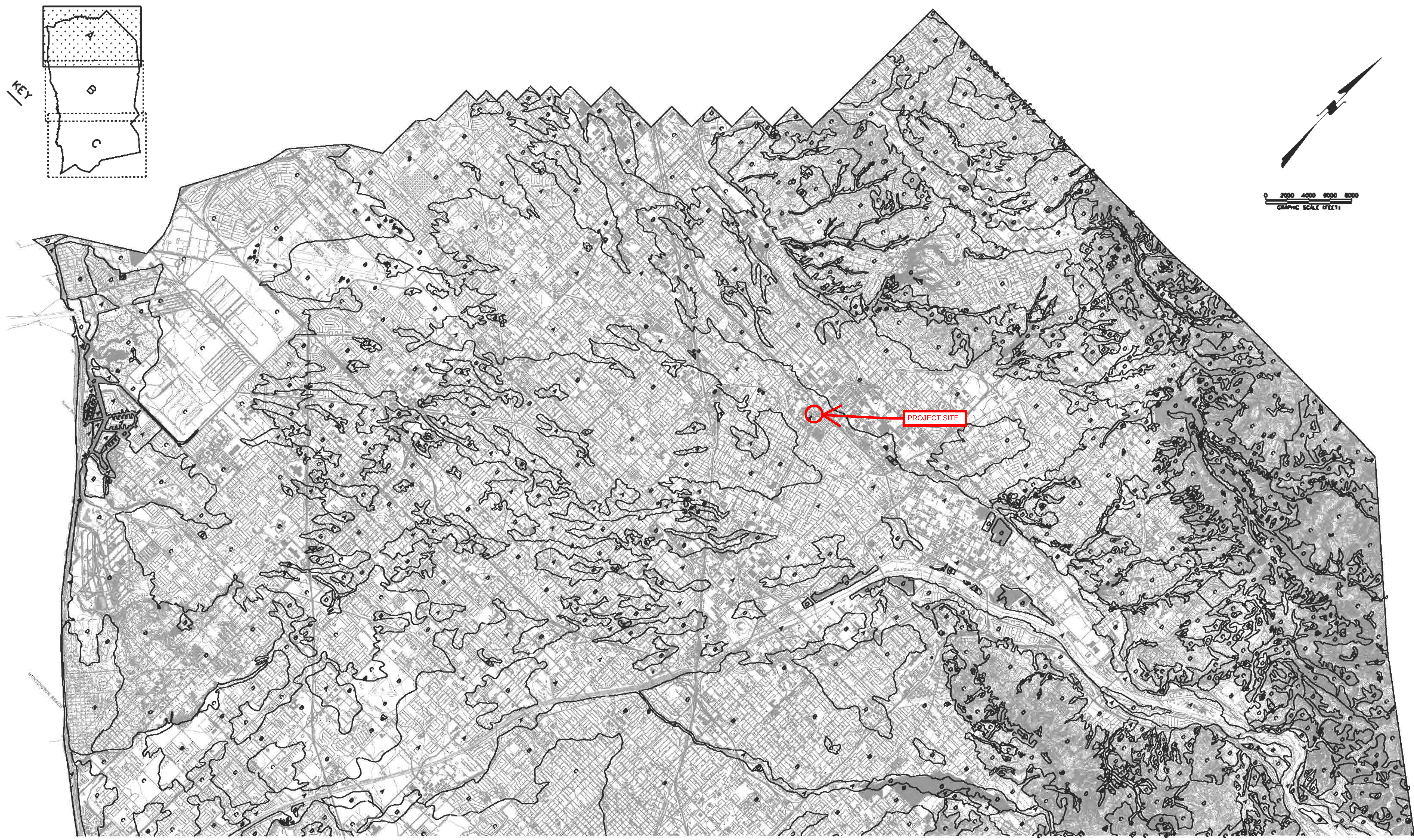
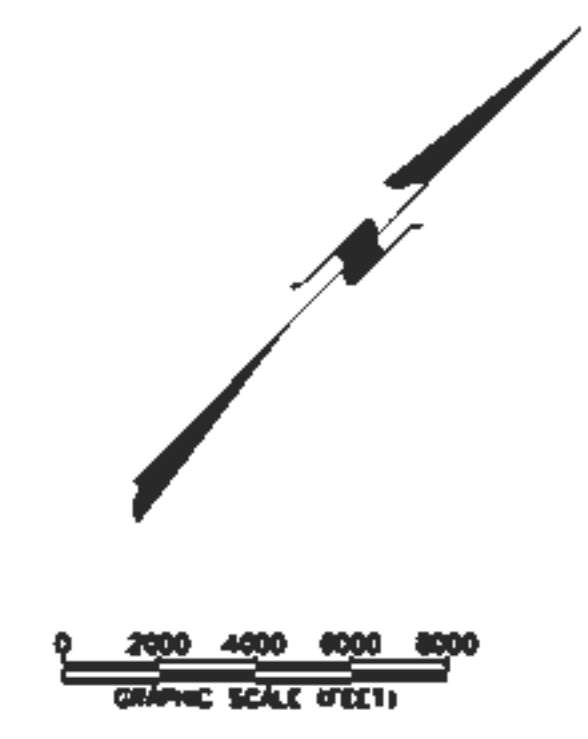
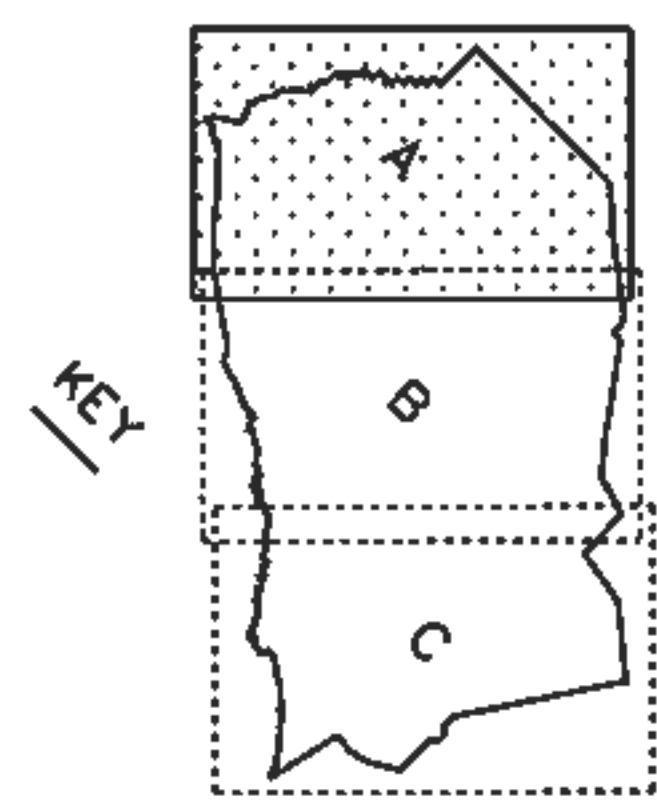
Outflows decreases for the 100-year storm in the proposed condition. The proposed infiltration basins were assumed to be full prior to running these calculations, giving a more conservative result for the proposed flow rate.



APPENDIX A



VICINITY MAP
NTS



LEGEND				
A	B	C	D	HYDROLOGIC SOIL GROUPS
—	—	—	—	HYDROLOGIC SOIL GROUP BOUNDARY

SOURCES:
BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT
GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
SOIL GROUPS - SOIL SURVEY OF ORANGE COUNTY AND
WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA,
USDA, SOIL CONSERVATION SERVICE, 1978.

APPENDIX B

Existing Hydrology Map
Proposed Hydrology Map



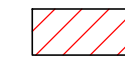
Please see the following requirements from Fullerton Municiple Code for construction in flood zone.

F. Building Requirements.

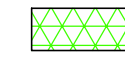
1. Residential. All new construction or substantial improvements of residential structures shall have the lowest floor (including basement) elevated to or above the base flood elevation in AE zone; elevated above the highest adjacent grade to a height equal to or exceeding the depth number specified in feet on the FIRM, or elevated at least 2 feet above the highest adjacent grade if no depth number is specified in AO zone; elevated to or above the base flood elevation in A zone (base flood elevation shall be determined in accordance with Section C, Item 5). Upon the completion of the structure, the elevation of the lowest floor, including basement, shall be certified by a registered civil engineer or licensed land surveyor, and verified by the community building inspector to be properly elevated. Such certification and verification shall be provided to the Flood Records Manager.

2. Nonresidential. All new construction, or substantial improvements of nonresidential structures within AO, A, and AE zones shall either be elevated to conform with Section F, Item 1 or, together with attendant utility and sanitary facilities, be completely floodproofed to or above that level, so that any space below that level is watertight with walls substantially impermeable to passage of water, and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.

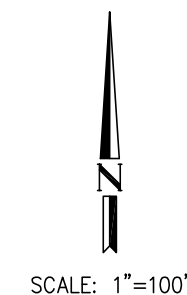
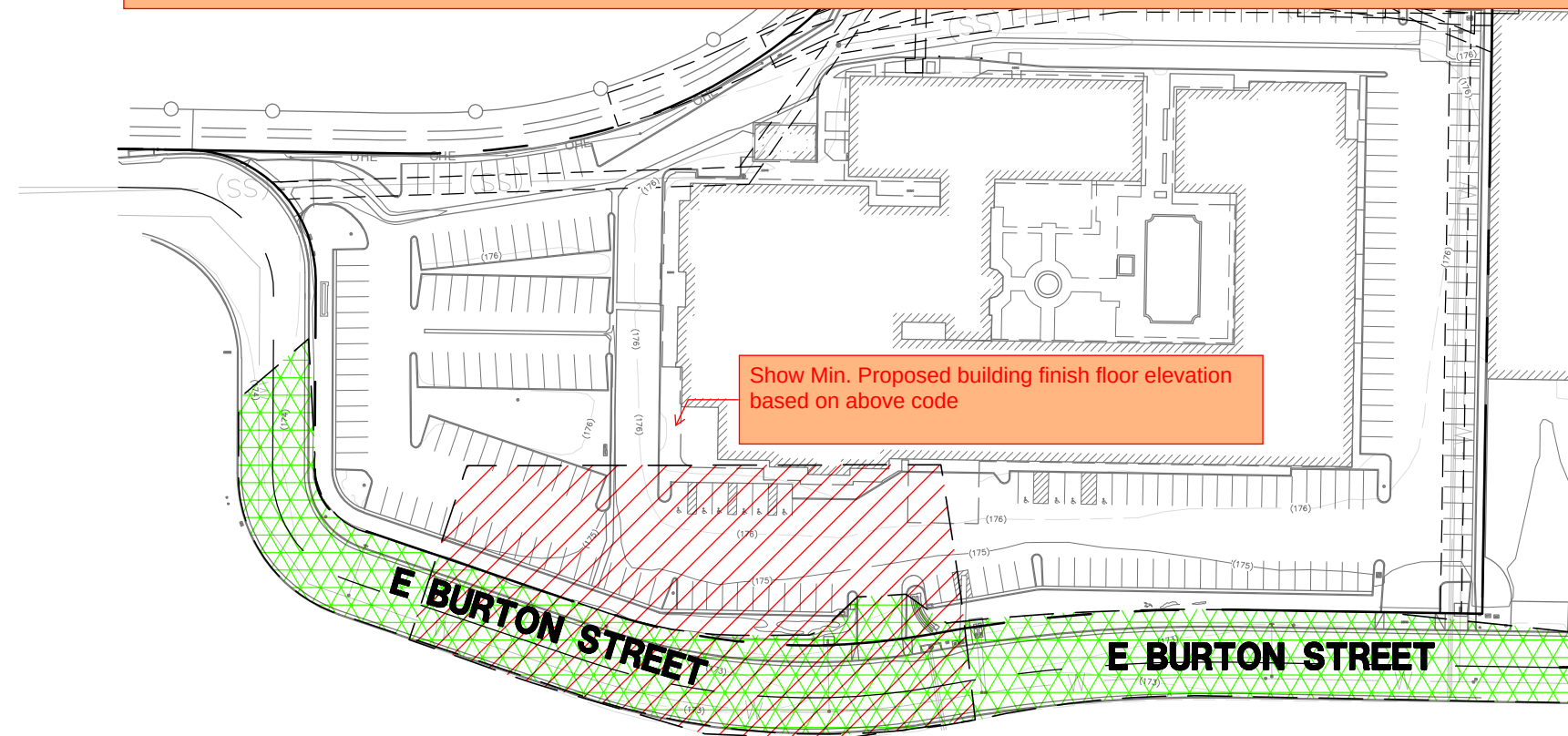
LEGEND:



APPROXIMATE AREA DESIGNATED AO ON
FEMA FLOOD MAP



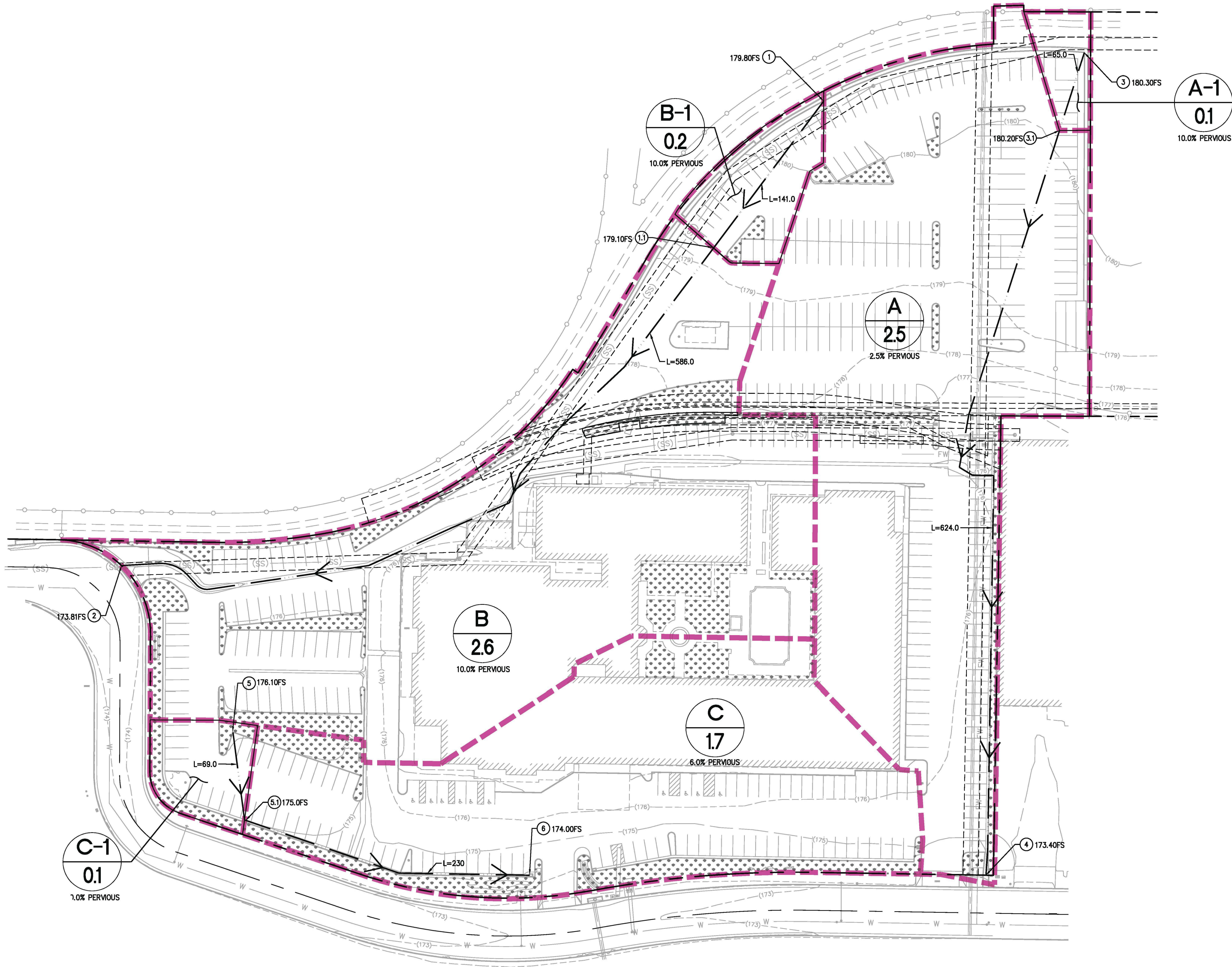
SAME APPROXIMATE AREA DESIGNATED
AO BASED ON EXISTING ELEVATIONS



REXFORD INDUSTRIAL WAREHOUSE
FEMA FLOOD MAP EXHIBIT
FULLERTON, CA

DRC Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning

160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860



NO.	REVISION:	DATE:

PROJECT: REXFORD INDUSTRIAL WAREHOUSE
1500 S RAYMOND AVENUE
FULLERTON, CA

DRAWING NAME: EXISTING HYDROLOGY MAP

ISSUE:	HYDROLOGY
DATE:	07-27-22
CHECKED: KH	DRAWN: KH
DRAWING FILE:	22375HM
PROJECT NO.:	22-375
SHEET NUMBER:	1
OF	1 SHEETS
SCALE:	AS SHOWN

1. For final submittal

2. Hydrology and Hydraulic Report will be based on OC Hydrology Manual and Local Drainage Manual 2nd addition December 2020

3. Provide hydrology map to include:

o Vicinity map

o North arrow & Scale

o Legend

o Flow path

o Elevations

o Watershed boundary

o Sub-area boundary

o Show storm drain and parkway drain if any

o Direction of flow for each subarea

o Soil classifications

o Land use information

o Lot lines

o Nodes, elevations, and length

o Show Q, Area, Tc, pipe sizes and inlets on the Hydrology Map

o Show building elevation and top of inlets and elevation at property line

4. Include the following in the report

o Purpose

o Project description

o Pre-development condition

o Post-developed condition

o Offsite runoff - if there is none then indicate in the report

o Basis of Design Criteria

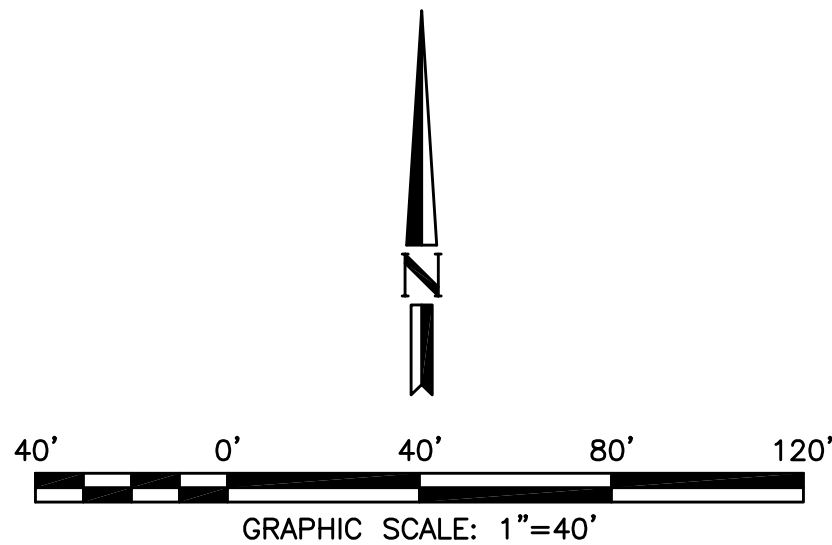
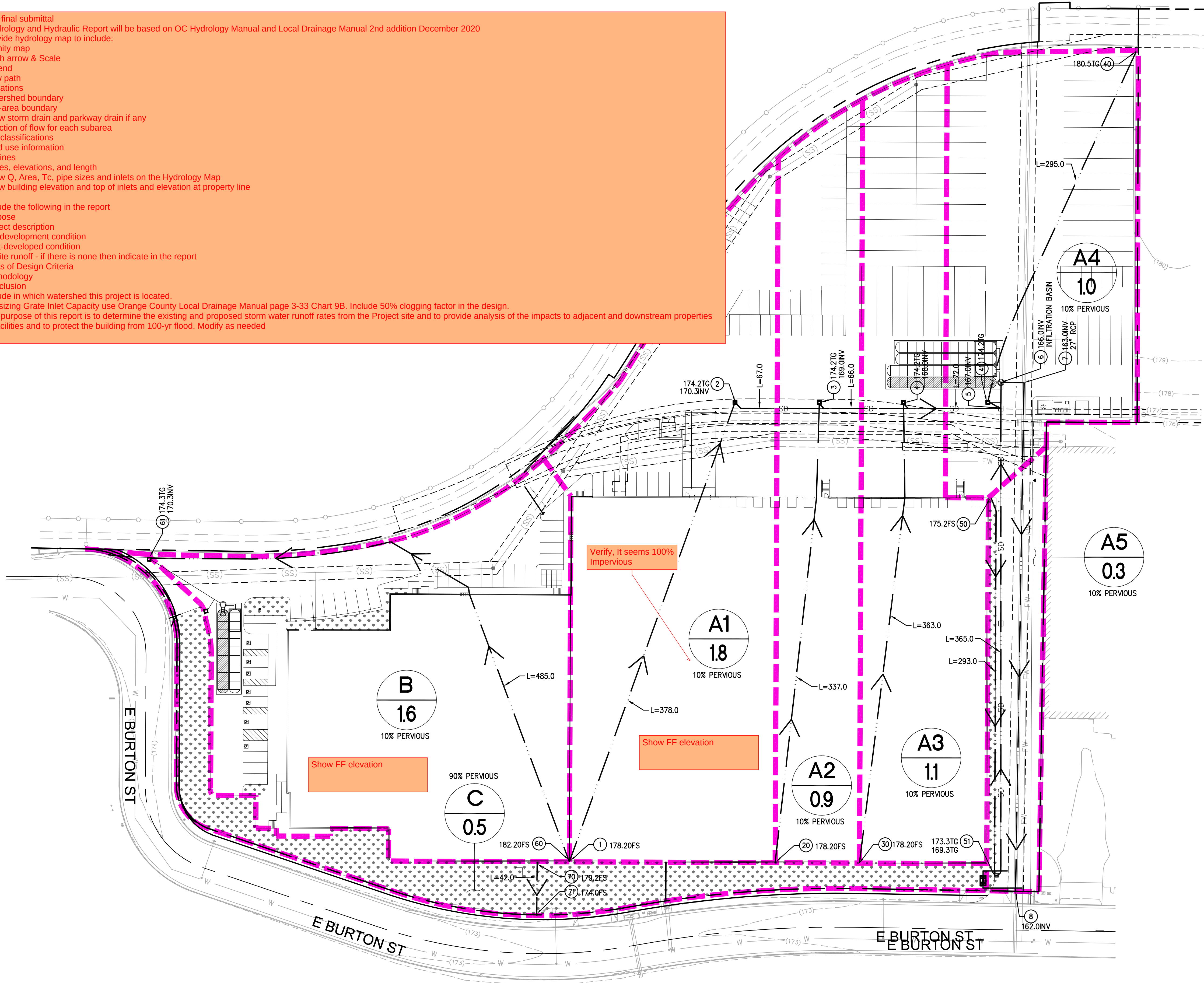
o Methodology

o Conclusion

5. Include in which watershed this project is located.

5. For sizing Grate Inlet Capacity use Orange County Local Drainage Manual page 3-33 Chart 9B. Include 50% clogging factor in the design.

6. The purpose of this report is to determine the existing and proposed storm water runoff rates from the Project site and to provide analysis of the impacts to adjacent and downstream properties and facilities and to protect the building from 100-yr flood. Modify as needed



160 S. Old Springs Road
Suite 210
Anaheim Hills, CA 92808
714-685-6860

Engineering, Inc.
Civil Engineering/Land Surveying/Land Planning

NO.: REVISION:

DATE:

PROJECT:
**REXFORD INDUSTRIAL WAREHOUSE
1500 S RAYMOND AVENUE
FULLERTON, CA**

DRAWING NAME:
PROPOSED HYDROLOGY MAP

ISSUE: **HYDROLOGY**

DATE: **07-27-22**

CHECKED: KH DRAWN: KH

DRAWING FILE: **22375HM**

PROJECT NO.: **22-375**

SHEET NUMBER:
1

OF 1 SHEETS

SCALE: **AS SHOWN**

FILENAME: M:\2022\22-375 Rexford 1500 S. Raymond\YHM\Proposed Hydrology Map.dwg; LAST SAVED ON: Jul 27 2022 7:58am PLOTTED BY: KENNY, ON: Jul 27 2022 9:06am, C76

NOT FOR CONSTRUCTION

APPENDIX C

AES – 100 Year Storm Rational Method



RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
(c) Copyright 1983-2015 Advanced Engineering Software (aes)
Ver. 22.0 Release Date: 07/01/2015 License ID 1510

Analysis prepared by:

DRC Engineering, Inc.
160 South Old Springs Road, Suite 210
Anaheim Hills, CA 92808
714-685-6860

***** DESCRIPTION OF STUDY *****
* 22-375 REXFORD INDUSTRIAL *
* 100-YEAR *
* EXISTING *

FILE NAME: 22375E.DAT
TIME/DATE OF STUDY: 10:52 07/26/2022

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

	HALF- WIDTH	CROWN TO CROSSFALL	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
NO.	(FT)	(FT)						
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	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

+-----+
| WATERSHED A |
| |
| |
+-----+

FLOW PROCESS FROM NODE 1.00 TO NODE 1.10 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 141.00
ELEVATION DATA: UPSTREAM(FEET) = 179.80 DOWNSTREAM(FEET) = 179.10

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION\ CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 6.359

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.391

SUBAREA T_c AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	A	0.20	0.40	0.100	52	6.36

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

SUBAREA RUNOFF(CFS) = 0.96

TOTAL AREA(ACRES) = 0.20 PEAK FLOW RATE(CFS) = 0.96

FLOW PROCESS FROM NODE 1.10 TO NODE 2.00 IS CODE = 91

>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<

=====

UPSTREAM NODE ELEVATION(FEET) = 179.10

DOWNSTREAM NODE ELEVATION(FEET) = 173.81

CHANNEL LENGTH THRU SUBAREA(FEET) = 586.00

"V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.120

PAVEMENT LIP(FEET) = 0.020 MANNING'S N = .0150

PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.04000

MAXIMUM DEPTH(FEET) = 0.50

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.243

SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	A	2.60	0.40	0.100	52

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.62

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.96

AVERAGE FLOW DEPTH(FEET) = 0.34 FLOOD WIDTH(FEET) = 13.23

"V" GUTTER FLOW TRAVEL TIME(MIN.) = 3.30 T_c (MIN.) = 9.66

SUBAREA AREA(ACRES) = 2.60 SUBAREA RUNOFF(CFS) = 9.83

EFFECTIVE AREA(ACRES) = 2.80 AREA-AVERAGED F_m (INCH/HR) = 0.04

AREA-AVERAGED F_p (INCH/HR) = 0.40 AREA-AVERAGED A_p = 0.10

TOTAL AREA(ACRES) = 2.8 PEAK FLOW RATE(CFS) = 10.59

END OF SUBAREA "V" GUTTER HYDRAULICS:

DEPTH(FEET) = 0.43 FLOOD WIDTH(FEET) = 17.38

FLOW VELOCITY(FEET/SEC.) = 3.34 DEPTH*VELOCITY(FT*FT/SEC) = 1.43

LONGEST FLOWPATH FROM NODE 1.00 TO NODE 2.00 = 727.00 FEET.

FLOW PROCESS FROM NODE 2.00 TO NODE 2.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

=====

TOTAL NUMBER OF STREAMS = 3

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION(MIN.) = 9.66

RAINFALL INTENSITY(INCH/HR) = 4.24

AREA-AVERAGED F_m (INCH/HR) = 0.04

AREA-AVERAGED F_p (INCH/HR) = 0.40

AREA-AVERAGED A_p = 0.10

EFFECTIVE STREAM AREA(ACRES) = 2.80
TOTAL STREAM AREA(ACRES) = 2.80
PEAK FLOW RATE(CFS) AT CONFLUENCE = 10.59

FLOW PROCESS FROM NODE 3.00 TO NODE 3.10 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
ELEVATION DATA: UPSTREAM(FEET) = 180.30 DOWNSTREAM(FEET) = 180.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.897

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.629

SUBAREA T_c AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	A	0.10	0.40	0.100	52	5.90

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

SUBAREA RUNOFF(CFS) = 0.50

TOTAL AREA(ACRES) = 0.10 PEAK FLOW RATE(CFS) = 0.50

FLOW PROCESS FROM NODE 3.10 TO NODE 4.00 IS CODE = 91

>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<

=====

UPSTREAM NODE ELEVATION(FEET) = 180.20
DOWNSTREAM NODE ELEVATION(FEET) = 173.40
CHANNEL LENGTH THRU SUBAREA(FEET) = 624.00
"V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.120
PAVEMENT LIP(FEET) = 0.020 MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.04000
MAXIMUM DEPTH(FEET) = 0.50
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.354

SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	A	2.50	0.40	0.100	52

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.98

TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 3.12

AVERAGE FLOW DEPTH(FEET) = 0.32 FLOOD WIDTH(FEET) = 12.04

"V" GUTTER FLOW TRAVEL TIME(MIN.) = 3.34 T_c (MIN.) = 9.23

SUBAREA AREA(ACRES) = 2.50 SUBAREA RUNOFF(CFS) = 9.71

EFFECTIVE AREA(ACRES) = 2.60 AREA-AVERAGED F_m (INCH/HR) = 0.04

AREA-AVERAGED F_p (INCH/HR) = 0.40 AREA-AVERAGED A_p = 0.10

TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 10.09

END OF SUBAREA "V" GUTTER HYDRAULICS:

DEPTH(FEET) = 0.41 FLOOD WIDTH(FEET) = 16.39

FLOW VELOCITY(FEET/SEC.) = 3.56 DEPTH*VELOCITY(FT*FT/SEC) = 1.45

LONGEST FLOWPATH FROM NODE 3.00 TO NODE 4.00 = 689.00 FEET.

FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 1

```

-----
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 9.23
RAINFALL INTENSITY(INCH/HR) = 4.35
AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.40
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 2.60
TOTAL STREAM AREA(ACRES) = 2.60
PEAK FLOW RATE(CFS) AT CONFLUENCE = 10.09

*****
FLOW PROCESS FROM NODE 5.00 TO NODE 5.10 IS CODE = 21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 230.00
ELEVATION DATA: UPSTREAM(FEET) = 176.10 DOWNSTREAM(FEET) = 175.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.792
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.798
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL A 1.70 0.40 0.100 52 7.79
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.40
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 7.28
TOTAL AREA(ACRES) = 1.70 PEAK FLOW RATE(CFS) = 7.28

*****
FLOW PROCESS FROM NODE 5.10 TO NODE 6.00 IS CODE = 91
-----
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
=====
UPSTREAM NODE ELEVATION(FEET) = 175.00
DOWNSTREAM NODE ELEVATION(FEET) = 174.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 230.00
"V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.120
PAVEMENT LIP(FEET) = 0.020 MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.04000
MAXIMUM DEPTH(FEET) = 0.50
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.329
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL A 1.70 0.40 0.100 52
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.40
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 10.57
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.50
AVERAGE FLOW DEPTH(FEET) = 0.48 FLOOD WIDTH(FEET) = 20.19
"V" GUTTER FLOW TRAVEL TIME(MIN.) = 1.53 Tc(MIN.) = 9.33
SUBAREA AREA(ACRES) = 1.70 SUBAREA RUNOFF(CFS) = 6.56
EFFECTIVE AREA(ACRES) = 3.40 AREA-AVERAGED Fm(INCH/HR) = 0.04

```

AREA-AVERAGED Fp (INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 3.4 PEAK FLOW RATE (CFS) = 13.12

==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.

END OF SUBAREA "V" GUTTER HYDRAULICS:

DEPTH (FEET) = 0.50 FLOOD WIDTH (FEET) = 21.00
FLOW VELOCITY (FEET/SEC.) = 2.88 DEPTH*VELOCITY (FT*FT/SEC) = 1.44
LONGEST FLOWPATH FROM NODE 5.00 TO NODE 6.00 = 460.00 FEET.

FLOW PROCESS FROM NODE 6.00 TO NODE 6.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====

TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
TIME OF CONCENTRATION (MIN.) = 9.33
RAINFALL INTENSITY (INCH/HR) = 4.33
AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.40
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA (ACRES) = 3.40
TOTAL STREAM AREA (ACRES) = 3.40
PEAK FLOW RATE (CFS) AT CONFLUENCE = 13.12

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	10.59	9.66	4.243	0.40 (0.04)	0.10	2.8	1.00
2	10.09	9.23	4.354	0.40 (0.04)	0.10	2.6	3.00
3	13.12	9.33	4.329	0.40 (0.04)	0.10	3.4	5.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	33.55	9.23	4.354	0.40 (0.04)	0.10	8.6	3.00
2	33.60	9.33	4.329	0.40 (0.04)	0.10	8.7	5.00
3	33.29	9.66	4.243	0.40 (0.04)	0.10	8.8	1.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 33.60 Tc (MIN.) = 9.33
EFFECTIVE AREA (ACRES) = 8.70 AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 8.8
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 727.00 FEET.
=====

END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 8.8 TC (MIN.) = 9.33
EFFECTIVE AREA (ACRES) = 8.70 AREA-AVERAGED Fm (INCH/HR) = 0.04
AREA-AVERAGED Fp (INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE (CFS) = 33.60

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	33.55	9.23	4.354	0.40 (0.04)	0.10	8.6	3.00
2	33.60	9.33	4.329	0.40 (0.04)	0.10	8.7	5.00
3	33.29	9.66	4.243	0.40 (0.04)	0.10	8.8	1.00

END OF RATIONAL METHOD ANALYSIS

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
(c) Copyright 1983-2015 Advanced Engineering Software (aes)
Ver. 22.0 Release Date: 07/01/2015 License ID 1510

Analysis prepared by:

DRC Engineering, Inc.
160 South Old Springs Road, Suite 210
Anaheim Hills, CA 92808
714-685-6860

***** DESCRIPTION OF STUDY *****

* Rexord Industrial *
* 100-Year *
* Proposed *

FILE NAME: 22375P.DAT
TIME/DATE OF STUDY: 09:36 07/26/2022

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

	HALF- WIDTH	CROWN TO CROSSFALL	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
NO.	(FT)	(FT)						
1	30.0	20.0	0.018/0.018/0.020	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

+-----+
| WATERSHED A |
| |
| |
+-----+

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) = 378.00
ELEVATION DATA: UPSTREAM(FEET) = 178.20 DOWNSTREAM(FEET) = 174.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 8.109

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.690

SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	A	1.80	0.40	0.100	52	8.11

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

SUBAREA RUNOFF (CFS) = 7.53

TOTAL AREA (ACRES) = 1.80 PEAK FLOW RATE (CFS) = 7.53

FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 170.30 DOWNSTREAM(FEET) = 169.00

FLOW LENGTH(FEET) = 67.00 MANNING'S N = 0.011

ASSUME FULL-FLOWING PIPELINE

PIPE-FLOW VELOCITY (FEET/SEC.) = 9.59

PIPE FLOW VELOCITY = (TOTAL FLOW) / (PIPE CROSS SECTION AREA)

GIVEN PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1

PIPE-FLOW (CFS) = 7.53

PIPE TRAVEL TIME (MIN.) = 0.12 T_c (MIN.) = 8.23

LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 445.00 FEET.

FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 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.) = 8.23

RAINFALL INTENSITY (INCH/HR) = 4.65

AREA-AVERAGED F_m (INCH/HR) = 0.04

AREA-AVERAGED F_p (INCH/HR) = 0.40

AREA-AVERAGED A_p = 0.10

EFFECTIVE STREAM AREA (ACRES) = 1.80

TOTAL STREAM AREA (ACRES) = 1.80

PEAK FLOW RATE (CFS) AT CONFLUENCE = 7.53

FLOW PROCESS FROM NODE 20.00 TO NODE 3.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 337.00

ELEVATION DATA: UPSTREAM (FEET) = 178.20 DOWNSTREAM (FEET) = 174.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 7.569

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.879

SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.90	0.40	0.100	52	7.57

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.40
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 3.92
 TOTAL AREA(ACRES) = 0.90 PEAK FLOW RATE(CFS) = 3.92

FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 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.) = 7.57
 RAINFALL INTENSITY(INCH/HR) = 4.88
 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.40
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 0.90
 TOTAL STREAM AREA(ACRES) = 0.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.92

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	7.53	8.23	4.652	0.40(0.04)	0.10	1.8	1.00
2	3.92	7.57	4.879	0.40(0.04)	0.10	0.9	20.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	11.19	7.57	4.879	0.40(0.04)	0.10	2.6	20.00
2	11.27	8.23	4.652	0.40(0.04)	0.10	2.7	1.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 11.27 Tc(MIN.) = 8.23
 EFFECTIVE AREA(ACRES) = 2.70 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 2.7
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 445.00 FEET.

FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 169.00 DOWNSTREAM(FEET) = 168.00
 FLOW LENGTH(FEET) = 66.00 MANNING'S N = 0.011
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 9.46
 GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 11.27
 PIPE TRAVEL TIME(MIN.) = 0.12 Tc(MIN.) = 8.34

LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 511.00 FEET.

FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 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.) = 8.34
RAINFALL INTENSITY(INCH/HR) = 4.61
AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.40
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 2.70
TOTAL STREAM AREA(ACRES) = 2.70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 11.27

FLOW PROCESS FROM NODE 30.00 TO NODE 4.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 363.00
ELEVATION DATA: UPSTREAM(FEET) = 178.20 DOWNSTREAM(FEET) = 174.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.914
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.756
SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	1.10	0.40	0.100	52	7.91

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.40
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 4.67
TOTAL AREA(ACRES) = 1.10 PEAK FLOW RATE(CFS) = 4.67

FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 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.) = 7.91
RAINFALL INTENSITY(INCH/HR) = 4.76
AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.40
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 1.10
TOTAL STREAM AREA(ACRES) = 1.10
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.67

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	11.19	7.69	4.836	0.40(0.04)	0.10	2.6	20.00

1	11.27	8.34	4.615	0.40 (0.04)	0.10	2.7	1.00
2	4.67	7.91	4.756	0.40 (0.04)	0.10	1.1	30.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	15.80	7.69	4.836	0.40 (0.04)	0.10	3.6	20.00
2	15.89	7.91	4.756	0.40 (0.04)	0.10	3.7	30.00
3	15.80	8.34	4.615	0.40 (0.04)	0.10	3.8	1.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 15.89 Tc(MIN.) = 7.91
EFFECTIVE AREA(ACRES) = 3.71 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 3.8
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 511.00 FEET.

FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 168.00 DOWNSTREAM(FEET) = 167.00
FLOW LENGTH(FEET) = 72.00 MANNING'S N = 0.011
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) = 8.99
PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 15.89
PIPE TRAVEL TIME(MIN.) = 0.13 Tc(MIN.) = 8.05
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 583.00 FEET.

FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

=====

TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 8.05
RAINFALL INTENSITY(INCH/HR) = 4.71
AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.40
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 3.71
TOTAL STREAM AREA(ACRES) = 3.80
PEAK FLOW RATE(CFS) AT CONFLUENCE = 15.89

FLOW PROCESS FROM NODE 40.00 TO NODE 41.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 295.00
ELEVATION DATA: UPSTREAM(FEET) = 180.50 DOWNSTREAM(FEET) = 174.20

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 6.381
 * 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.380
 SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	A	1.00	0.40	0.100	52	6.38

 SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
 SUBAREA RUNOFF (CFS) = 4.81
 TOTAL AREA (ACRES) = 1.00 PEAK FLOW RATE (CFS) = 4.81

 FLOW PROCESS FROM NODE 41.00 TO NODE 5.00 IS CODE = 41

>>>> COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA <<<<
 >>>> USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT) <<<<

=====
 ELEVATION DATA: UPSTREAM (FEET) = 170.20 DOWNSTREAM (FEET) = 167.00
 FLOW LENGTH (FEET) = 15.00 MANNING'S N = 0.011
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.1 INCHES
 PIPE-FLOW VELOCITY (FEET/SEC.) = 20.52
 GIVEN PIPE DIAMETER (INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW (CFS) = 4.81
 PIPE TRAVEL TIME (MIN.) = 0.01 T_c (MIN.) = 6.39
 LONGEST FLOWPATH FROM NODE 40.00 TO NODE 5.00 = 310.00 FEET.

 FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<

=====
 TOTAL NUMBER OF STREAMS = 3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION (MIN.) = 6.39
 RAINFALL INTENSITY (INCH/HR) = 5.37
 AREA-AVERAGED F_m (INCH/HR) = 0.04
 AREA-AVERAGED F_p (INCH/HR) = 0.40
 AREA-AVERAGED A_p = 0.10
 EFFECTIVE STREAM AREA (ACRES) = 1.00
 TOTAL STREAM AREA (ACRES) = 1.00
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 4.81

 FLOW PROCESS FROM NODE 50.00 TO NODE 51.00 IS CODE = 21

>>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS <<<<
 >> USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA <<

=====
 INITIAL SUBAREA FLOW-LENGTH (FEET) = 293.00
 ELEVATION DATA: UPSTREAM (FEET) = 175.20 DOWNSTREAM (FEET) = 173.30

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 8.077
 * 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.701
 SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	A	1.10	0.40	0.100	52	8.08

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.40
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100
 SUBAREA RUNOFF(CFS) = 4.61
 TOTAL AREA(ACRES) = 1.10 PEAK FLOW RATE(CFS) = 4.61

 FLOW PROCESS FROM NODE 51.00 TO NODE 5.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) =	169.30	DOWNSTREAM(FEET) =	167.00
FLOW LENGTH(FEET) =	365.00	MANNING'S N =	0.011
ASSUME FULL-FLOWING PIPELINE			
PIPE-FLOW VELOCITY(FEET/SEC.) =	5.87		
PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)			
GIVEN PIPE DIAMETER(INCH) =	12.00	NUMBER OF PIPES =	1
PIPE-FLOW(CFS) =	4.61		
PIPE TRAVEL TIME(MIN.) =	1.04	T_c (MIN.) =	9.11
LONGEST FLOWPATH FROM NODE	50.00	TO NODE	5.00 = 658.00 FEET.

 FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

=====

TOTAL NUMBER OF STREAMS = 3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.11
 RAINFALL INTENSITY(INCH/HR) = 4.39
 AREA-AVERAGED F_m (INCH/HR) = 0.04
 AREA-AVERAGED F_p (INCH/HR) = 0.40
 AREA-AVERAGED A_p = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 1.10
 TOTAL STREAM AREA(ACRES) = 1.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.61

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	T_c (MIN.)	Intensity (INCH/HR)	$F_p(F_m)$ (INCH/HR)	A_p	A_e (ACRES)	HEADWATER NODE
1	15.80	7.82	4.789	0.40(0.04)	0.10	3.6	20.00
1	15.89	8.05	4.710	0.40(0.04)	0.10	3.7	30.00
1	15.80	8.48	4.573	0.40(0.04)	0.10	3.8	1.00
2	4.81	6.39	5.374	0.40(0.04)	0.10	1.0	40.00
3	4.61	9.11	4.387	0.40(0.04)	0.10	1.1	50.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	T_c (MIN.)	Intensity (INCH/HR)	$F_p(F_m)$ (INCH/HR)	A_p	A_e (ACRES)	HEADWATER NODE
1	23.29	6.39	5.374	0.40(0.04)	0.10	4.7	40.00
2	24.41	7.82	4.789	0.40(0.04)	0.10	5.6	20.00
3	24.47	8.05	4.710	0.40(0.04)	0.10	5.7	30.00
4	24.36	8.48	4.573	0.40(0.04)	0.10	5.8	1.00
5	23.68	9.11	4.387	0.40(0.04)	0.10	5.9	50.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

```

PEAK FLOW RATE(CFS) =      24.47      Tc(MIN.) =      8.05
EFFECTIVE AREA(ACRES) =      5.68      AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.40      AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =      5.9
LONGEST FLOWPATH FROM NODE      50.00 TO NODE      5.00 =      658.00 FEET.

*****
FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  41
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =  167.00  DOWNSTREAM(FEET) =  166.00
FLOW LENGTH(FEET) =  15.00  MANNING'S N =  0.011
DEPTH OF FLOW IN  24.0 INCH PIPE IS  9.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  20.10
GIVEN PIPE DIAMETER(INCH) =  24.00  NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =      24.47
PIPE TRAVEL TIME(MIN.) =  0.01  Tc(MIN.) =  8.06
LONGEST FLOWPATH FROM NODE      50.00 TO NODE      6.00 =      673.00 FEET.

*****
FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  41
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =  166.00  DOWNSTREAM(FEET) =  163.00
FLOW LENGTH(FEET) =  15.00  MANNING'S N =  0.011
DEPTH OF FLOW IN  24.0 INCH PIPE IS  7.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  29.91
GIVEN PIPE DIAMETER(INCH) =  24.00  NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =      24.47
PIPE TRAVEL TIME(MIN.) =  0.01  Tc(MIN.) =  8.07
LONGEST FLOWPATH FROM NODE      50.00 TO NODE      7.00 =      688.00 FEET.

*****
FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  41
-----
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =  163.00  DOWNSTREAM(FEET) =  162.00
FLOW LENGTH(FEET) =  393.55  MANNING'S N =  0.011
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) =  6.16
PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
GIVEN PIPE DIAMETER(INCH) =  27.00  NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =      24.47
PIPE TRAVEL TIME(MIN.) =  1.07  Tc(MIN.) =  9.13
LONGEST FLOWPATH FROM NODE      50.00 TO NODE      8.00 =      1081.55 FEET.

*****
FLOW PROCESS FROM NODE      8.00 TO NODE      8.00 IS CODE =  10
-----
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
=====
+-----+
| WATERSHED B |

```

```

|
|
+-----+

*****
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) =   485.00
ELEVATION DATA: UPSTREAM(FEET) =   182.20  DOWNSTREAM(FEET) =   174.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   8.219
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =   4.654
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp      Ap      SCS      Tc
LAND USE              GROUP   (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL            A        1.60    0.40    0.100    52    8.22
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA RUNOFF(CFS) =      6.64
TOTAL AREA(ACRES) =      1.60  PEAK FLOW RATE(CFS) =      6.64

*****
FLOW PROCESS FROM NODE      61.00 TO NODE      61.00 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.) =   8.22
RAINFALL INTENSITY(INCH/HR) =   4.65
AREA-AVERAGED Fm(INCH/HR) =   0.04
AREA-AVERAGED Fp(INCH/HR) =   0.40
AREA-AVERAGED Ap =   0.10
EFFECTIVE STREAM AREA(ACRES) =      1.60
TOTAL STREAM AREA(ACRES) =      1.60
PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.64

+-----+
| Watershed C |
|             |
|             |
+-----+

*****
FLOW PROCESS FROM NODE      70.00 TO NODE      71.00 IS CODE =  21
-----
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) =   42.00
ELEVATION DATA: UPSTREAM(FEET) =   179.20  DOWNSTREAM(FEET) =   174.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   5.000
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =   6.187
SUBAREA Tc AND LOSS RATE DATA(AMC III):

```

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
RESIDENTIAL ".4 DWELLING/ACRE"	A	0.50	0.40	0.900	52	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.40
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA RUNOFF(CFS) = 2.62
TOTAL AREA(ACRES) = 0.50 PEAK FLOW RATE(CFS) = 2.62

FLOW PROCESS FROM NODE 71.00 TO NODE 71.00 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.) = 5.00
RAINFALL INTENSITY(INCH/HR) = 6.19
AREA-AVERAGED Fm(INCH/HR) = 0.36
AREA-AVERAGED Fp(INCH/HR) = 0.40
AREA-AVERAGED Ap = 0.90
EFFECTIVE STREAM AREA(ACRES) = 0.50
TOTAL STREAM AREA(ACRES) = 0.50
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.62

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.64	8.22	4.654	0.40(0.04)	0.10	1.6	60.00
2	2.62	5.00	6.187	0.40(0.36)	0.90	0.5	70.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	8.01	5.00	6.187	0.40(0.15)	0.37	1.5	70.00
2	8.58	8.22	4.654	0.40(0.12)	0.29	2.1	60.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 8.58 Tc(MIN.) = 8.22
EFFECTIVE AREA(ACRES) = 2.10 AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.29
TOTAL AREA(ACRES) = 2.1
LONGEST FLOWPATH FROM NODE 60.00 TO NODE 71.00 = 485.00 FEET.

FLOW PROCESS FROM NODE 71.00 TO NODE 71.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	8.01	5.00	6.187	0.40(0.15)	0.37	1.5	70.00
2	8.58	8.22	4.654	0.40(0.12)	0.29	2.1	60.00

LONGEST FLOWPATH FROM NODE 60.00 TO NODE 71.00 = 485.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	23.29	7.53	4.892	0.40 (0.04)	0.10	4.7	40.00
2	24.41	8.91	4.444	0.40 (0.04)	0.10	5.6	20.00
3	24.47	9.13	4.381	0.40 (0.04)	0.10	5.7	30.00
4	24.36	9.57	4.266	0.40 (0.04)	0.10	5.8	1.00
5	23.68	10.23	4.104	0.40 (0.04)	0.10	5.9	50.00
LONGEST FLOWPATH FROM NODE				50.00 TO NODE	71.00 =	1081.55 FEET.	

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	27.59	5.00	6.187	0.40 (0.07)	0.19	4.6	70.00
2	31.75	7.53	4.892	0.40 (0.06)	0.16	6.7	40.00
3	32.43	8.22	4.654	0.40 (0.06)	0.16	7.3	60.00
4	32.59	8.91	4.444	0.40 (0.06)	0.15	7.7	20.00
5	32.53	9.13	4.381	0.40 (0.06)	0.15	7.8	30.00
6	32.20	9.57	4.266	0.40 (0.06)	0.15	7.9	1.00
7	31.22	10.23	4.104	0.40 (0.06)	0.15	8.0	50.00
TOTAL AREA(ACRES) =			8.0				

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 32.59 Tc(MIN.) = 8.909
 EFFECTIVE AREA(ACRES) = 7.67 AREA-AVERAGED Fm(INCH/HR) = 0.06
 AREA-AVERAGED Fp(INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 8.0
 LONGEST FLOWPATH FROM NODE 50.00 TO NODE 71.00 = 1081.55 FEET.

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 8.0 TC(MIN.) = 8.91
 EFFECTIVE AREA(ACRES) = 7.67 AREA-AVERAGED Fm(INCH/HR) = 0.06
 AREA-AVERAGED Fp(INCH/HR) = 0.40 AREA-AVERAGED Ap = 0.152
 PEAK FLOW RATE(CFS) = 32.59

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	27.59	5.00	6.187	0.40 (0.07)	0.19	4.6	70.00
2	31.75	7.53	4.892	0.40 (0.06)	0.16	6.7	40.00
3	32.43	8.22	4.654	0.40 (0.06)	0.16	7.3	60.00
4	32.59	8.91	4.444	0.40 (0.06)	0.15	7.7	20.00
5	32.53	9.13	4.381	0.40 (0.06)	0.15	7.8	30.00
6	32.20	9.57	4.266	0.40 (0.06)	0.15	7.9	1.00
7	31.22	10.23	4.104	0.40 (0.06)	0.15	8.0	50.00

END OF RATIONAL METHOD ANALYSIS

**City of Fullerton
Entitlement**

**Proposed Industrial Development
1500 S. Raymond Avenue
Fullerton, California**

Submittals: Leighton Consulting, Inc.
Geotechnical Exploration Report
Proposed Industrial Building
1500 S. Raymond
Fullerton, California
Project No. 13477.001
dated May 25, 2022

Reviewed By: John P. Leuer, LOR Geotechnical Group, Inc.

Review Discipline: Geotechnical

Date: September 19, 2022

LOR Project No: 63628BS.1

Comment No.	Submittal Section	Comment
1	General	This review consists of a brief overview of the submittal for general conformance for entitlement. Additional in depth review will be necessary during the additional planning stages. The report will need further clarification including but not limited to: • verification of the use of an exception from the structural engineer for seismic design values provided which assume the use of an exception • quantitative definition of geotechnically suitable soil (ie unit weight, in-place relative compaction, etc.) considered suitable for fill placement and their geologic interpretation (ie: alluvium, bedrock, etc.)

ENGINEER'S CERTIFICATION
WATER QUALITY MANAGEMENT PLAN

Preparer (Engineer) Certification			
Preparer (Engineer):			
Title		PE Registration #	
Company			
Address			
Email			
Telephone #			
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.			
Preparer Signature		Date	
Place Stamp Here			