APPENDIX L :HYDROLOGY TECHNICAL SUPPORT DOCUMENTS

Stormwater Management Plan prepared by Kier + Wright

Guadalupe Quarry Drainage Report prepared by Schaaf & Wheeler

Drainage Technical Memorandum prepared by Wood Rodgers, Inc.

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Guadalupe Quarry - Closure, Annexation and Redevelopment Project
Building Permit

Storm Water Management Plan

Proposed
Storm Water Facilities Design

Date:
January 10, 2024

Prepared For:
Orchard Partners
3697 Mt. Diablo Blvd, Suite 200
Lafayette, CA 94549

Design Engineer:

Adam Mahoney, P.E.
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2850 Collier Canyon Road
Livermore, CA 94551

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Appendix C: Stormwater Treatment Design Details

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1.0 Introduction

The Guadalupe Quarry - Closure, Annexation and Redevelopment project located in Brisbane, CA, reclaims a 144 acre quarry into a 61.4 acre industrial development with an 80 acre minimum habitat conservation area. The proposed development includes a 3 story distribution center, a 3 story parking garage, paved access road to the site, and other associated site improvements. The industrial portion of the site has been designed in a manner to promote sustainability and includes Low Impact Design elements such as maximizing landscaping to reduce impervious area and bioretention areas to treat impervious surfaces.

Figure 1: Vicinity Map



The purpose of this report is to document the Low Impact Design elements and treatment facilities used for the proposed project comply with San Mateo County's C.3 Guidelines.

2.0 Existing Site

The existing site is a quarry and includes existing buildings with asphalt and gravel access roads. Existing pervious and impervious areas are given in Table 1 and shown in Appendix A. The site has variable terrain with steep slopes and terracing in the quarry operations area. Existing stormwater runoff exits the site via a ditch alongside Quarry Road and enters the City's storm drain network before discharging to the bay. Per the geotechnical report prepared by Cornerstone Earth Group dated September 15, 2021, the project site is underlain by deep quarry fills, colluvium, and alluvium overlying Franciscan Formation bedrock.

Table 1: Existing Impervious and Pervious Areas within Project Limit

Existing Surface Area		
Type	**SF**	**Acres**
Effective Impervious	590,050	13.55
Pervious	2,084,534	47.85
Total	**2,674,584**	**61.40**

3.0 Proposed Storm Water Quality

Stormwater is treated onsite with Low Impact Design (LID) elements. LID features are designed according to criteria as set by the San Mateo County C.3 Stormwater Technical Guidance (C.3 Technical Guide). Runoff from impervious roof areas, parking lots, and roads flow into bioretention areas which infiltrate and biologically treat stormwater runoff. Proposed pervious and impervious areas are given in Table 2 and shown in Appendix B.

Table 2: Proposed Impervious and Pervious Areas within Project Limit

Proposed Surface Area		
Type	**SF**	**Acres**
Impervious	1,504,448	34.54
Pervious	1,170,136	26.86
Total	**2,674,584**	**61.40**

3.1 Source Control and Source Control Measures

To help ensure improved water quality and to reduce the potential of contaminants and pollutants entering the storm drain system, source control measures were added to the design of the project. These items, as applicable to the design, are listed in the C.3 and C.6 Development Review Checklist in Appendix G and listed below:

- All on-site inlets shall be marked with the words "No Dumping! Flows to Bay" or an equivalent.
- Interior and Parking Garage floor drains will be plumbed to the sanitary sewer.
- Landscaping:
    - Existing vegetation will be retained as practical for the proposed work
    - Diverse species appropriate to the site will be selected and include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects.
    - The use of pesticides and quick-release fertilizers will be minimized, and efficient irrigation systems designed to minimize runoff will be used.
- Refuse areas shall:
    - Provide a roofed and enclosed area for dumpsters, recycling containers, etc., and be designed to prevent stormwater run-on and runoff
    - Connect any drains beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.
- Loading dock areas shall:
    - Be covered and/or graded to minimize run-on to and runoff from the loading area.
    - Position downspouts to direct stormwater away from the loading area.
    - Drain water from loading dock areas to the sanitary sewer.
    - Install door skirts between the trailers and the building.
- Fire sprinkler systems shall be designed for discharge of fire sprinkler test water to landscape or sanitary sewer.
- Miscellaneous drain or wash water features shall:
    - Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.
    - Have roof drains from equipment drain to landscape areas where practicable.
    - Drain boiler drain lines, roof top equipment, and all wash water to sanitary sewer.

3.2 Design Constraints

The existing quarry and access road poses significant issues for the site. Terracing of the surrounding hills limits the development envelope of the project site, limiting the area that is appropriate for LID elements. Compacted quarry fills that the site lies over create poor infiltration, limiting the capacity for LID elements that rely heavily infiltration such as pervious pavement and other LID elements that rely on direct infiltration. Steep slopes along the quarry access roads require LID elements to be surrounded by retaining walls creating additional complexity to the access road.

3.3 Treatment Facilities

The project will use bioretention areas to treat runoff from pervious landscape and impervious project areas. In areas that allow direct runoff into the treatment area, water will sheet flow into the planter. Where sheet flow directly to the treatment area is infeasible, water from roof and at-grade areas will be collected into catch basins and conveyed to the treatment area by pipe.

Bioretention areas consist of a layer that is at least 18-inches of biotreatment soil mix, a 12-inch layer of permeable rock (with an underdrain). The area is designed to have a maximum ponding depth of 6-12 inches. See Appendix C for a typical bioretention area treatment planter section and Table 3 below for a summary of the typical LID parameters.

Native infiltration is infeasible onsite due to the presence of contaminated soils. This requires all bioretention planters onsite to be lined with an impermeable liner preventing infiltration. The perforated pipes within the bioretention planters will be placed at the bottom of the class II permeable layer.

Table 3: Summary of LID Parameters

LID Element	Medium	Depth (inches)	Void Ratio (%)	Infiltration Rate (in/hr)
Bioretention Areas	Surface Ponding*	6-12	N/A	N/A
	Planting Soil	18	N/A	5
	Rock Layer	12	40	N/A

*See Appendix B for sizing calculation for required ponding.

Bioretention areas are concave landscaped areas that function as soil and plant-based filtration devices that use biological, physical, and chemical processes to remove pollutants that runoff collects. Areas are sized using the combination flow and volume and 4% method from the San Mateo County Water Pollution Prevention Program C.3 Stormwater Technical Guidance document (C.3 Technical Guide). The ponding area is determined as the bottom area of the bioretention facility and does not include the side slope areas. See Table 4 below for drainage management area and bioretention sizing ratios, Appendix B for Stormwater Quality Control Plan, and Appendix D for Combination Flow and Volume Method Calculations.

3.4 Hydromodification Management

The site has been analyzed using a BAHM 2013 model to meet the Municipal regional Permit (MRP) requirements for hydromodification management. The results of this BAHM model and the site specific controls are described in detail in appendix F.

Table 4: Bioretention Calculations

Bioretention Calculations

Area No.	Total Area (SF)	DMA Landscape (SF)	DMA Impervious (SF)	Treatment Area * (SF)	Minimum IMP Size** (SF)	IMP Size Provided (SF)	Sizing Ratio (%)	Facility Name and Number
1	779,215	91,942	665,172	674,366	22,101	22,101	3.3%	BIORETENTION PLANTER 1
2	779,594	91,830	666,046	675,229	21,718	21,718	3.2%	BIORETENTION PLANTER 2
3	71,234	16,143	52,501	54,115	2,165	2,590	4.8%	BIORETENTION PLANTER 3
4	25,665	3,412	21,383	21,724	869	870	4.0%	BIORETENTION PLANTER 4
5	83,647	16,826	63,659	65,342	2,614	3,162	4.8%	BIORETENTION PLANTER 5
6	52,753	11,731	38,687	39,860	1,594	2,335	5.9%	BIORETENTION PLANTER 6
7	135,558	135,558	-	-	-	-	-	SELF TREATING LANDSCAPE
Total:	1,927,666	367,442	1,507,448	1,530,636		52,776		

*: Treatment Area is equal to Impverious Area + 10% of the Landscape Area.
**: Minimum IMP Size is Equal to 4% of the Treatment Area, areas under 4% are sized using the Combination Method.

4.0 Monitoring and Maintenance

A comprehensive monitoring and maintenance program is an essential aspect of a long-term storm water management plan. The proposed storm water system for the hotel project site is designed to operate automatically and reliably with necessary routine maintenance. It is the Owner's responsibility to maintain the LID structures. The Owner must enter a Stormwater Operations and Maintenance Agreement with the city. The agreement runs with the land, in perpetuity. The Operations and Maintenance Manual will be included with construction documents.

5.0 Conclusions

The Guadalupe Quarry - Closure, Annexation and Redevelopment project will include post-construction stormwater treatment facilities that are in conformance with the California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Permit Stormwater NPDES Permit, Order R2-2022-0018. The project design will incorporate the bioretention treatment areas per Section 6.1 of the San Mateo County Water Pollution Prevention Program C.3 Stormwater Technical Guidance document (C.3 Technical Guide).

Bioretention treatment areas are sized using the combination and 4% method with at least an 18-inch soil section where runoff can infiltrate at least 5 inches per hour. The bioretention area will pond 6 inches before runoff discharges through an inlet that flows to the associated overflow catch basin. The area is designed to treat and retain the runoff from a storm that produces 0.2 in/hr of rainfall.

Through the implementation of these LID's the Guadalupe Quarry - Closure, Annexation and Redevelopment project will provide the necessary facilities to treat contaminants and retain

stormwater before being safely discharged into the storm drain system and promote the overall sustainability of the development.

6.0 References

San Mateo Countywide Water Pollution Prevention Program, “C.3 Regulated Projects Guide”, January 2020.

Schaaf & Wheeler, “Guadalupe Quarry Drainage Report”, May 2022.

Cornerstone Earth Group, “Geotechnical Design Summary”, Project No. 585-5-2, September 15, 2021

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Appendices

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Appendix A

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EXISTING IMPERVIOUS AREA EXHIBIT
OF
GUADALUPE QUARRY - CLOSURE, ANNEXATION AND REDEVELOPMENT
FOR
ORCHARD PARTNERS, LLC

BRISBANE, CALIFORNIA

DATE	MAY, 2023
SCALE	AS SHOWN
DESIGNER	KAS
DRAWN BY	KAS
JOB NO.	A18573-3
SHEET	EX
OF	1 SHEETS

KIER+WRIGHT
250 Cherry Lane, Suite 107, 208 Phone: (209) 328-1123
Manteca, CA 95337 www.kierwright.com

REGISTERED PROFESSIONAL ENGINEER JOHN KIER MURDEY No. 62365 CIVIL STATE OF CALIFORNIA

NO.	REVISION	BY

NO.	REVISION	BY

NORTH

0 75 150 300 450
Scale 1" = 150'

LEGEND

APPROXIMATELY 125,553 SF OF ASPHALT PAVING AND BUILDINGS

QUARRY OPERATION ROADS, APPROXIMATELY 663,587 SF OF GRAVEL WITH FENCE CONNECTION TO ASPHALT PAVING, APPROXIMATELY 70% OF THE EQUIVALENT IMPERVIOUS SURFACE IS APPROXIMATELY 464,497 SF

SURFACE DRAINAGE DIRECTION

SOUTH HILL DRIVE

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Appendix B

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Bioretention Calculations

Area No.	Total Area (SF)	DMA Landscape (SF)	DMA Impervious (SF)	Treatment Area * (SF)	Minimum IMP Size** (SF)	IMP Size Provided (SF)	Sizing Ratio (%)	Facility Name and Number
1	779,215	91,942	665,172	674,366	22,101	22,101	3.3%	BIORETENTION PLANTER 1
2	779,594	91,830	666,046	675,229	21,718	21,718	3.2%	BIORETENTION PLANTER 2
3	71,234	16,143	52,501	54,115	2,165	2,590	4.8%	BIORETENTION PLANTER 3
4	25,665	3,412	21,383	21,724	869	870	4.0%	BIORETENTION PLANTER 4
5	83,647	16,826	63,659	65,342	2,614	3,162	4.8%	BIORETENTION PLANTER 5
6	52,753	11,731	38,687	39,860	1,594	2,335	5.9%	BIORETENTION PLANTER 6
7	135,558	135,558	-	-	-	-	-	SELF TREATING LANDSCAPE
DA1	241,498	-	-	-	-	-	-	Offsite Runon
DA2	132,687	-	-	-	-	-	-	Offsite Runon
DA3	1,414,253	-	-	-	-	-	-	Offsite Runon
DA4	1,022,854	-	-	-	-	-	-	Offsite Runon
DA5	459,102	-	-	-	-	-	-	Offsite Runon
DA6	462,554	-	-	-	-	-	-	Offsite Runon
DA7	517,245	-	-	-	-	-	-	Offsite Runon
DA8	301,487	-	-	-	-	-	-	Offsite Runon
DA9	216,437	-	-	-	-	-	-	Offsite Runon
DA10	403,259	-	-	-	-	-	-	Offsite Runon
Total:	7,099,042	367,442	1,507,448	1,530,636		52,776		

*: Treatment Area is equal to Impervious Area + 10% of the Landscape Area.

**: Minimum IMP Size is Equal to 4% of the Treatment Area, areas under 4% are sized using the Combination Method.

AS SHOWN ON THE C.3 DEVELOPMENT REVIEW CHECKLIST, WORKSHEET C, THE FOLLOWING LOW IMPACT DEVELOPMENT – SITE DESIGN MEASURES HAVE BEEN IMPLEMENTED. RUNOFF FROM ROOF, SIDEWALKS, DRIVEWAYS, PARKING LOTS AND ALL OTHER IMPERVIOUS SURFACES DRAIN TO CATCH BASINS OR CURB CUTS WHICH DISCHARGE TO BIO-RETENTION PLANTERS.

NORTH

0 75 150 300 450

Scale 1" = 150'

- TRIBUTARY AREA LIMITS
- LANDSCAPE AREA
- IMPERVIOUS ROOFTOP DRAINING TO BIO-SWALE
- IMPERVIOUS PAVEMENT DRAINING TO BIO-SWALE
- BIO-RETENTION TREATMENT AREA
- SELF TREATING LANDSCAPE AREA
- OFF-SITE DRAINAGE RUNON
- STORM DRAIN CONNECTING DIRECTLY TO CITY STORM DRAIN
- UNTREATED STORM DRAIN CONNECTING TO BIORETENTION PLANTERS
- EXISTING CONCRETE V DITCH CONNECTED TO CITY STORM DRAIN
- EXISTING DRAINAGE SYSTEM

DRAINAGE AREA 1
DRAINAGE AREA 2
DRAINAGE AREA 3
DRAINAGE AREA 4
DRAINAGE AREA 5
DRAINAGE AREA 6
DRAINAGE AREA 7
DRAINAGE AREA 8
DRAINAGE AREA 9
DRAINAGE AREA 10

DMA 1
DMA 2
DMA 3
DMA 4
DMA 5
DMA 6
DMA 7

L.I.D. site design measure g, h, and i: Conserve existing trees, slope, soils, and minimize impervious surfaces

L.I.D. site design measures b, c, and d: All Impervious areas in DMA 1 are directed into vegetated areas.

L.I.D. site design measures b, c, and d: All Impervious areas in DMA 2 are directed into vegetated areas.

L.I.D. site design measures b, c, and d: All Impervious areas in DMA 3 are directed into vegetated areas.

L.I.D. site design measures b, c, and d: All Impervious areas in DMA 4 are directed into vegetated areas.

L.I.D. site design measures b, c, and d: All Impervious areas in DMA 5 are directed into vegetated areas.

L.I.D. site design measures b, c, and d: All Impervious areas in DMA 6 are directed into vegetated areas.

L.I.D. site design measure g: Maintaining existing drainage systems.

DRAINAGE AREAS 2-4 TO BE CONNECTED TO THESE PIPES

DRAINAGE AREAS 5-10 TO BE CONNECTED TO THESE PIPES

POND 1 - COLLECTS AND DETAINS STORMWATER RUN ON. THIS WATER IS FROM UNDEVELOPED PORTION OF WATERSHED AND IS CLEAN

POND 2 - COLLECTS AND DETAINS STORMWATER RUN ON. THIS WATER IS FROM UNDEVELOPED PORTION OF WATERSHED AND IS CLEAN

POND 3 - COLLECTS AND DETAINS STORMWATER RUN OFF FROM DMA 2. THIS WATER REQUIRES TREATMENT. UNTREATED WATER IS CONVEYED BY UNDERGOUND STORM DRAIN TO IMP 2.

POND 4 - COLLECTS AND DETAINS STORMWATER RUN OFF FROM DMA 1. THIS WATER REQUIRES TREATMENT. UNTREATED WATER IS CONVEYED BY UNDERGOUND STORM DRAIN TO IMP 1.

IMP 1 - TREATS STORMWATER RUN OFF FROM DMA 6 VIA UNTREATED STORM DRAIN AND SURFACE FLOWS. TREATED WATER IS CONVERYED TO THE CITY STORM DRAIN VIA ONSITE STORM DRAIN

IMP 2 - TREATS STORMWATER RUN OFF FROM DMA 6 VIA UNTREATED STORM DRAIN AND SURFACE FLOWS. TREATED WATER IS CONVERYED TO THE CITY STORM DRAIN VIA ONSITE STORM DRAIN

IMP 3 - TREATS STORMWATER RUN OFF FROM DMA 6 VIA UNTREATED STORM DRAIN AND SURFACE FLOWS. TREATED WATER IS CONVERYED TO THE CITY STORM DRAIN VIA ONSITE STORM DRAIN

IMP 4 - TREATS STORMWATER RUN OFF FROM DMA 4 VIA SURFACE FLOWS. TREATED WATER IS CONVERYED TO THE CITY STORM DRAIN VIA ONSITE STORM DRAIN.

IMP 5 - TREATS STORMWATER RUN OFF FROM DMA 6 VIA UNTREATED STORM DRAIN AND SURFACE FLOWS. TREATED WATER IS CONVERYED TO THE CITY STORM DRAIN VIA ONSITE STORM DRAIN

IMP 6 - TREATS STORMWATER RUN OFF FROM DMA 6 VIA UNTREATED STORM DRAIN AND SURFACE FLOWS. TREATED WATER IS CONVERYED TO THE CITY STORM DRAIN VIA ONSITE STORM DRAIN

CONCRETE V DITCH - COLLECTS STORMWATER RUN ON AND PORTIONS OF RUNOFF FROM SELF RETAINING AREAS

EXISTING CONCRETE V DITCH CONNECTION TO STORM DRAIN

IMP 1 IMP 2 IMP 3 IMP 4 IMP 5 IMP 6

REVISION

NO.	BY

REVISION

NO.	BY

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Livermore, CA 94551
Phone: (925) 245-8788
www.kierwright.com

STORMWATER QUALITY CONTROL PLAN

GUADALUPE QUARRY - CLOSURE, OF ANNEXATION AND REDEVELOPMENT FOR ORCHARD PARTNERS, LLC

BRISBANE, CALIFORNIA

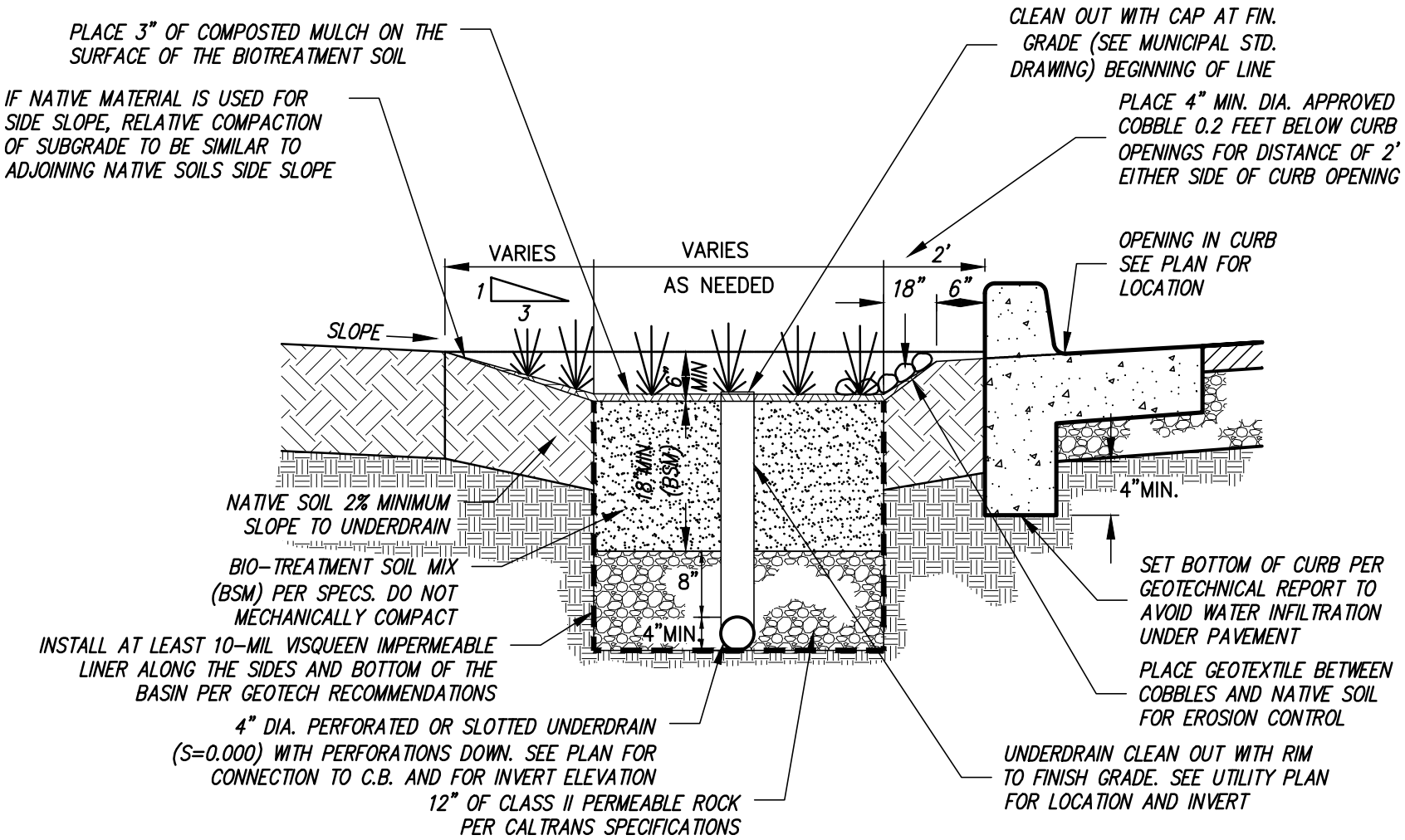
DATE	DEC., 2023
SCALE	AS SHOWN
DESIGNER:	AJC
DRAWN:	AJA
JOB NO.	A18573-3
SHEET	C6.0
OF	SHEETS

\\Kierwright-local\Global\2\2018\A18573-3\DWG\EXHIBITS\OFFSITE DRAINAGE A18573-3-Pre-SWD.dwg 1-11-24 08:47:57 AM ozarvalho

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Appendix C

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BIORETENTION DETAILS

NOT TO SCALE

1

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Appendix D

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Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

1.0 Project Information

1-1	Project Name:	Crocker Logistics Center
1-2	City application ID:	
1-3	Site Address or APN:	1 Quarry Road
1-4	Tract or Parcel Map No:	
1-5	Rainfall Region	5
1-6	Region Mean Annual Precipitation (MAP)	21.00
1-7	Site Mean Annual Precipitation (MAP)	28

The calculations presented here are based on the **combination flow and volume sizing method** provided in the Countywide Program's C.3 Technical Guidance, Version 5.0 (2016). The steps presented below are explained in Section 5.1 of the Guidance, applicable portions of which are included in this file, in the sheet named "Guidance from Chapter 5".

Click here for map

1-8 ***MAP adjustment factor is automatically calculated as:*** **1.33**

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5-3, below.)

Refer to the map in Appendix C of the C.3 Technical Guidance to identify the Rainfall Region for the site.

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: **DMA 1**

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft.)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	665,172	1.0	665,172
2-3	Pervious surface	91,942	0.1	9,194
	Total DMA Area (square feet) =	757,114		

2-4 ***Total Effective Impervious Area (EIA)*** **674,366** **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-3. Unit Basin Storage Volumes in Inches for 80 Percent Capture Using 48-Hour Drawdowns, based on runoff coefficient

Region	Station, and Mean Annual Precipitation (Inches)	Runoff Coefficient of 1.0
1	Boulder Creek, 55.9"	2.04"
2	La Honda, 24.4"	0.86"
3	Half Moon Bay, 25.92"	0.82"
4	Palo Alto, 14.6"	0.64"
5	San Francisco, 21.0"	0.73"
6	San Francisco airport, 20.1"	0.85"
7	San Francisco Oceanside, 19.3"	0.72"

3-1 ***Unit basin storage volume from Table 5-3:*** **0.73**

(The coefficient for this method is always 1.0, due to the conversion of any landscaping to effective impervious area.)

3-2 ***Adjusted unit basin storage volume:*** **0.97** **Inches**

(The unit basin storage volume [Item 3-1] is adjusted by applying the MAP adjustment factor [Item 1-8].)

3-3 ***Required Capture Volume (in cubic feet):*** **54,699** **Cubic feet**

(The adjusted unit basin sizing volume [Item 3-2] is multiplied by the DMA EIA [Item 2-4] and converted to cubic feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	**Inches per hour**
4-2	Divide Item 3-2 by Item 4-1	4.87	**Hours of Rain Event Duration**

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA EIA (Item 2-4)	26974.6452	**Square feet**
5-2	Area 25% smaller than Item 5-1 (i.e., 3% of DMA EIA)	20230.9839	**Square feet**
5-3	Volume of treated runoff for area in Item 5-2	41023.94	**Cubic feet** (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	13674.65	**Cubic feet** (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.68	**Feet** (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from feet to inches	8.11	**Inches** (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth (recommend 6"), skip to Item 8-1. If not, continue to Step 7-1.

(Note: Overflow outlet elevation should be set based on the calculated ponding depth.)

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger than Item 5-2	22101	**Sq.ft.** (enter larger area if you need less ponding depth.)
7-2	Volume of treated runoff for area in Item 7-1	44815.92	**Cubic feet** (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	9882.67	**Cubic feet** (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	0.45	**Feet** (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from ft. to inches	5.37	**Inches** (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.

(Note: Overflow outlet elevation should be set based on the calculated ponding depth.)

8.0 Surface Area of Treatment Measure for DMA

8-1	Final surface area of treatment	22,101	**Square feet** (Either Item 5-2 or final amount in Item 7-1)

Worksheet for Calculating the Combination Flow and Volume Method

Instructions: After completing Section 1, make a copy of this Excel file for each Drainage Management Area within the project. Enter information specific to the project and DMA in the cells shaded in yellow. Cells shaded in light blue contain formulas and values that will be automatically calculated.

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1-2	City application ID:	
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1-5	Rainfall Region	5
1-6	Region Mean Annual Precipitation (MAP)	21.00
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The calculations presented here are based on the **combination flow and volume sizing method** provided in the Countywide Program's C.3 Technical Guidance, Version 5.0 (2016). The steps presented below are explained in Section 5.1 of the Guidance, applicable portions of which are included in this file, in the sheet named "Guidance from Chapter 5".

Click here for map

1-8 ***MAP adjustment factor is automatically calculated as:*** **1.33**

(The "Site Mean Annual Precipitation (MAP)" is divided by the MAP for the applicable rain gauge, showin in Table 5-3, below.)
Refer to the map in Appendix C of the C.3 Technical Guidance to identify the Rainfall Region for the site.

2.0 Calculate Percentage of Impervious Surface for Drainage Management Area (DMA)

2-1 Name of DMA: **DMA 2**

For items 2-2 and 2-3, enter the areas in square feet for each type of surface within the DMA.

	Type of Surface	Area of surface type within DMA (Sq. Ft.)	Adjust Pervious Surface	Effective Impervious Area
2-2	Impervious surface	666,046	1.0	666,046
2-3	Pervious surface	91,830	0.1	9,183
	Total DMA Area (square feet) =	757,876		

2-4 ***Total Effective Impervious Area (EIA)*** **675,229** **Square feet**

3.0 Calculate Unit Basin Storage Volume in Inches

Table 5-3. Unit Basin Storage Volumes in Inches for 80 Percent Capture Using 48-Hour Drawdowns, based on runoff coefficient

Region	Station, and Mean Annual Precipitation (Inches)	Runoff Coefficient of 1.0
1	Boulder Creek, 55.9"	2.04"
2	La Honda, 24.4"	0.86"
3	Half Moon Bay, 25.92"	0.82"
4	Palo Alto, 14.6"	0.64"
5	San Francisco, 21.0"	0.73"
6	San Francisco airport, 20.1"	0.85"
7	San Francisco Oceanside, 19.3"	0.72"

3-1 ***Unit basin storage volume from Table 5-3:*** **0.73**

(The coefficient for this method is always 1.0, due to the conversion of any landscaping to effective impervious area.)

3-2 ***Adjusted unit basin storage volume:*** **0.97** **Inches**

(The unit basin storage volume [Item 3-1] is adjusted by applying the MAP adjustment factor [Item 1-8].)

3-3 ***Required Capture Volume (in cubic feet):*** **54,769** **Cubic feet**

(The adjusted unit basin sizing volume [Item 3-2] is multiplied by the DMA EIA [Item 2-4] and converted to cubic feet)

4.0 Calculate the Duration of the Rain Event

4-1	Rainfall intensity	0.2	**Inches per hour**
4-2	Divide Item 3-2 by Item 4-1	4.87	**Hours of Rain Event Duration**

5.0 Preliminary Estimate of Surface Area of Treatment Measure

5-1	4% of DMA EIA (Item 2-4)	27009.16	**Square feet**
5-2	Area 25% smaller than Item 5-1 (i.e., 3% of DMA EIA)	20256.87	**Square feet**
5-3	Volume of treated runoff for area in Item 5-2	41076.43	**Cubic feet** (Item 5-2 * 5 inches per hour * 1/12 * Item 4-2)

6.0 Initial Adjustment of Depth of Surface Ponding Area

6-1	Subtract Item 5-3 from Item 3-3	13692.14	**Cubic feet** (Amount of runoff to be stored in ponding area)
6-2	Divide Item 6-1 by Item 5-2	0.68	**Feet** (Depth of stored runoff in surface ponding area)
6-3	Convert Item 6-2 from feet to inches	8.11	**Inches** (Depth of stored runoff in surface ponding area)

6-4 If ponding depth in Item 6-3 meets your target depth (recommend 6"), skip to Item 8-1. If not, continue to Step 7-1.
(Note: Overflow outlet elevation should be set based on the calculated ponding depth.)

7.0 Optimize Size of Treatment Measure

7-1	Enter an area larger than Item 5-2	21718	**Sq.ft.** (enter larger area if you need less ponding depth.)
7-2	Volume of treated runoff for area in Item 7-1	44039.28	**Cubic feet** (Item 7-1 * 5 inches per hour * 1/12 * Item 4-2)
7-3	Subtract Item 7-2 from Item 3-3	10729.30	**Cubic feet** (Amount of runoff to be stored in ponding area)
7-4	Divide Item 7-3 by Item 7-1	0.49	**Feet** (Depth of stored runoff in surface ponding area)
7-5	Convert Item 7-4 from ft. to inches	5.93	**Inches** (Depth of stored runoff in surface ponding area)

7-6 If the ponding depth in Item 7-5 meets target, stop here. If not, repeat Steps 7-1 through 7-5 until you obtain target depth.
(Note: Overflow outlet elevation should be set based on the calculated ponding depth.)

8.0 Surface Area of Treatment Measure for DMA

8-1 Final surface area of treatment **21,718** **Square feet** (Either Item 5-2 or final amount in Item 7-1)

KIER+WRIGHT

Appendix E

2850 Collier Canyon Road · Livermore, California 94551 · (925) 245-8788 · FAX (925) 245-8796

SAN MATEO COUNTYWIDE
Water Pollution Prevention Program
Clean Water. Healthy Community.

C.3 and C.6 Development Review Checklist

Municipal Regional Stormwater Permit (MRP 3.0)
Stormwater Controls for Development Projects

City/County _____
Department _____
Address _____
Phone _____
Website _____

Project Information (Enter information only into blue-highlighted cells - other cells are locked.)

I.A Enter Project Data (For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report.)

Project Name:	Crocker Logistics Center	Case Number:	
Project Address:	1 Quarry Road	Cross Street:	South Hill Drive
Project APN:	005-270-007, 005-270-008, 005-270-00	Project Watershed:	GUADALUPE VALLEY
Applicant Name:	Tyler Higgins	Project Phase No.	
Applicant Phone:	925-876-1118	Applicant Email Address:	thiggins@orchardpartners.com

Development Type: (check all that apply)

- ☐ Small Single-Family Home Project (<10,000 sq. ft. of created and/or replaced impervious surface[1])
- ☐ Large Single-Family Home Project (≥10,000 sq. ft. of created and/or replaced impervious surface[1])
- ☐ Subdivision - Residential: Two or more lot development[2] # of units:
- ☐ Multi-Family Residential # of units:
- ☐ Commercial
- ☑ Industrial, Manufacturing
- ☐ Mixed-Use # of units:
- ☐ New, widened or reconstructed roads related to parcel-based projects[3]
- ☐ Stand-alone pavement maintenance or construction work, or similar work related to parcel-based projects[3]
- ☑ Other redevelopment project as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred.
- ☐ Institutional: schools, libraries, jails, etc.
- ☐ Parks and trails, camp grounds, other recreational
- ☐ Kennels, Ranches
- ☐ Other, Please specify

Project Description (Don't include past or future phases)[4]: Reclamation of 144.38 acre quarry to construct 61.4 acres of industrial development. Includes dedication of a minimum 80 acres to habitat conservation area.

I.A.1 Total Project Area: 2,674,584 square feet (on and off-site)
I.A.2 Total Area on-site: 2,671,196 square feet (on the private property)
I.A.3 Total Area off-site: 3,388 square feet (frontage or area in Public Right of Way being improved)
I.A.4 Total Area of land disturbed during construction: 1,927,666 square feet
(Include all project on-site and off-site areas of clearing, grading, excavating and stockpiling)
I.A.5 Site slope: 11 %

I.A.6 Certification:

I certify that the information provided on this form is correct and acknowledge that, should the project exceed the amount of new and/or replaced impervious surface provided in this form, the as-built project may be subject to additional improvements.

☑ Preliminary Calculations Attached ☐ Final Calculations Attached ☑ Stormwater Control Plan Attached

Name of person completing the form:	Adam Mahoney	Title:	Senior Associate
Signature:	John A. Mahoney	Date:	1/11/2024
Phone Number:	925-412-3053	E-mail:	amahoney@kierwright.com

[1] Small and Large Detached Single-Family Homes that are not part of a common plan of development[2].

[2] Common Plans of Development (subdivisions or contiguous, commonly owned lots, for the construction of two or more homes developed within 1 year of each other), and/or constructed with shared utilities, are not considered single family home projects by the MRP.

[3] Stand-alone roadway or pavement projects, or pavement work that is part of a project, creating or replacing 5,000 sq. ft. or more of impervious surface may be subject to C.3 requirements - both in public and private areas. See the Roads Factsheet at: www.flowstobay.org/newdevelopment

[4] Project description examples: 5-story office building, industrial warehouse, residential with five 4-story buildings for 200 condominiums, etc.

I.B Is the project a "C.3 Regulated Project" per MRP Provision C.3.b? (Use table below to make determination.)

I.B.1 Enter the amount of Impervious surface Retained, Replaced or Created[5] by the project (use DMA Table in Worksheet D):

Table I.B.1 Impervious[6] and Pervious[6] Surfaces (Match DMA Summary Table in Worksheet D, if applicable)

	Pre-Project	Post-Project			
Impervious Surfaces (IS) (e.g., sidewalks, driveways, parking areas, patios, roads, rooftops, pools, pathways, etc.)	**I.B.1.a** Existing (Pre-Project) Impervious Surface (sq.ft.)	**I.B.1.b** Existing Impervious Surface to be Retained[5] (sq.ft.)	**I.B.1.c** Existing Impervious Surface to be Replaced[5] (sq.ft.)	**I.B.1.d** New Impervious Surface to be Created[5] (sq.ft.)	**I.B.1.e** Post-Project Impervious Surface (sq.ft.) (=b+c+d)
On-site area (within the parcel/private site boundaries)	588,340	-	588,479	915,720	1,504,199
Off-site area (e.g., frontage/other area in Public Right of Way)	1,710		1,571	1,678	3,249
Subtotal:	590,050	-	590,050	917,398	1,507,448
Total Impervious Surface Replaced and Created: ***(sum of totals for columns I.B.1.c and I.B.1.d):***		**I.B.1.f**	**1,507,448 sq. ft.**		
Pervious Surfaces (PS) (e.g., landscaping, pervious pavement, bioretention areas, parking strips, street trees, etc. - both on-site and off-site)	Existing (Pre-Project) Pervious Surface (sq.ft.)				Post-project Pervious Surface (sq.ft.)
All pervious off-site area (e.g., frontage/Public Right of Way)[6]	1,678				139
Landscaping area on-site	1,335,938				420,079
Pervious Pavement area on-site				**I.B.1.g**	
Green Roof area on-site					
Subtotal:	1,337,616	**50% Rule Calculation**			420,218
Total Project Area (should be equal to **I.A.1**)	1,927,666	**I.B.1.h**	**100** %		1,927,666

I.B.2 Please review and attach additional worksheets as required below using the Total Impervious Surface (IS) Replaced or Created in cell **I.B.1.f** from Table **I.B.1** above and other factors:

	Review Steps	Check One Yes	Check One No	Attach Worksheet
I.B.2.a	Does this project involve any earthwork and/or stockpiling of soil, aggregates etc? If YES, then Check Yes, and Complete Worksheet A. If NO, then Check No, and go to I.B.2.b	☑	☐	A
I.B.2.b	Is **I.B.1.f** greater than or equal to 2,500 sq.ft? If YES, then the Project is subject to Provision C.3.i. - complete Worksheets B, C and go to I.B.2.c. If NO, go to I.B.2.i - or ask municipal staff for Small Project Checklist.	☑	☐	B, C
I.B.2.c	Does the 50% rule apply to the project? Is **I.B.1.h** 50% or more? If YES, site design, source control and treatment requirements apply to the entire on-site area. Continue to I.B.2.d If NO, these requirements apply only to the impervious surface created and/or replaced. Continue to I.B.2.d	☑	☐	
I.B.2.d	Is this project a Roadway Project and is **I.B.1.f** greater than or equal to 5,000 sq.ft? If YES, project may be C.3 Regulated Project. See the Roadways Fact Sheet at: www.flowstobay.org/newdevelopment If NO, go to I.B.2.e	☐	☑	
I.B.2.e	Is **I.B.1.f** greater than or equal to 5,000 sq.ft? (Or 10,000 sq.ft. for a Large Single-Family Home?) If YES, project is a C.3 Regulated Project - complete Worksheet D. Then continue to I.B.2.f. If NO, then skip to I.B.2.g. - or ask municipal staff for Small Project Checklist.	☑	☐	D
I.B.2.f	Is **I.B.1.f** greater than or equal to 43,560 sq.ft, (i.e., one acre)? If YES, project may be subject to Hydromodification Management requirements - complete Worksheet E then go to I.B.2.g. If NO, then go to I.B.2.g.	☑	☐	E
I.B.2.g	Is **I.A.4** greater than or equal to 43,560 sq.ft., (i.e., one acre)? If YES, check box, obtain coverage under CA Construction General Permit & submit Notice of Intent to municipality- go to I.B.2.h. If NO, then go to I.B.2.h. For more information see: www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml	☑	☐	
I.B.2.h	Is this a Special Project or does it have the potential to be a Special Project? If YES, complete Worksheet F - then continue to I.B.2.i. If NO, go to I.B.2.i.	☐	☑	F
I.B.2.i	Is this project a High Priority Site? (Determined by the Municipality. High Priority Sites can include those located within 100 ft. of a sensitive habitat, an Area of Special Biological Significance, a body of water, or on sites disturbing >=5,000 sq.ft. with slopes >=15% **(see I.A.5)** [or per municipal criteria/map.] Subject to monthly inspections from Oct 1 to April 30.) If YES, complete section G-2 on Worksheet G - then continue to I.B.2.j. and complete the Certification in Section **I.A.6** If NO, then go to I.B.2.j and complete the Certification in Section **I.A.6**	☐	☑	G
I.B.2.j	**For Municipal Staff Use Only**: Are you using Alternative Certification for the project review? If YES, then fill out section G-1 on Worksheet G. Fill out other sections of Worksheet G as appropriate. See cell **I.B.1.g** above - Is the project installing 3,000 square feet or more of pervious pavement? If YES, then fill out section G-3 on Worksheet G. Add to Municipal Inspection Lists (C.3 and C.3.h)	☐ ☐	☐ ☐	G

[5] "Retained" means to leave existing impervious surfaces in place; "Replaced" means to install new impervious surface where existing impervious surface is removed anywhere on the same site; and "Created" means the amount of new impervious surface being proposed which exceeds the total amount of existing impervious surface at the site.

[6] Per the MRP, pavement that meets the following definition of pervious pavement is NOT an impervious surface. Pervious pavement is defined as pavement that stores and infiltrates rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or that stores and infiltrates the rainfall runoff volume described in Provision C.3. Gravel pavement is not pervious unless it is constructed using pervious pavement system designs or runoff flows to adjacent landscaping. Pervious off-site areas include landscaped areas such as parking strips and street trees; off-site pervious pavement includes pervious concrete gutters and interlocking permeable concrete paver sidewalks, etc. 7/1/23

Worksheet A

C.6 – Construction Stormwater BMPs

Identify Plan sheet showing the appropriate construction Best Management Practices (BMPs) used on this project:
(Applies to all projects with earthwork)

Yes	Plan Sheet	Best Management Practice (BMP)
☑		Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, wash water or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.
☑		Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
☑		Do not clean, fuel, or maintain vehicles on-site, except in a designated area where wash water is contained and treated.
☑		Train and provide instruction to all employees/subcontractors re: construction BMPs.
☑		Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
☑		Limit construction access routes and stabilize designated access points.
☑		Attach the San Mateo Countywide Water Pollution Prevention Program's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
☑		Use temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
☑		Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
☑		Provide notes, specifications, or attachments describing the following: ■ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency; ■ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material; ■ Specifications for vegetative cover & mulch, include methods and schedules for planting and fertilization; ■ Provisions for temporary and/or permanent irrigation.
☐		Perform clearing and earth moving activities only during dry weather.
☐		Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
☑		Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
☑		Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
☑		Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.

Note: Project is in planning review. Details of items checked shall be provided in Construction Drawings

Worksheet B

C.3 – Source Controls

Select appropriate source controls and identify the detail/plan sheet where these elements are shown.

Yes	Detail/Plan Sheet No.	Features that require source control	Source Control Measures (Refer to Local Source Control List for detailed requirements)
☑	C3.0, C3.1	Storm Drain	Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.
☑	C4.0	Floor Drains	Plumb interior floor drains to sanitary sewer [or prohibit].
☑	C4.0	Parking garage	Plumb interior parking garage floor drains to sanitary sewer.[8]
☑	L1.0-L1.11	Landscaping	■ Retain existing vegetation as practicable. ■ Follow ReScape (www.rescapeca.org) principles. Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects. ■ Minimize use of pesticides and quick-release fertilizers. ■ Use efficient irrigation system; design to minimize runoff.
☐		Pool/Spa/Fountain	Provide connection to the sanitary sewer to facilitate draining.[8]
☐		Food Service Equipment (non-residential)	Provide sink or other area for equipment cleaning, which is: ■ Connected to a grease interceptor prior to sanitary sewer discharge.[8] ■ Large enough for the largest mat or piece of equipment to be cleaned. ■ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.
☑		Refuse Areas	■ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff. ■ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.[8] ■ For more information, see the New Development Projects Litter Reduction Fact Sheet at: https://www.flowstobay.org/wp-content/uploads/2021/06/New-Dev-Litter-Reduction-Fact-Sheet-060421.pdf
☐		Outdoor Process Activities[9]	Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer.[8]
☐		Outdoor Equipment/ Materials Storage	■ Cover the area or design to avoid pollutant contact with stormwater runoff. ■ Locate area only on paved and contained areas. ■ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer[8], and contain by berms or similar.
☐		Vehicle/ Equipment Cleaning	■ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer[8], and sign as a designated wash area. ■ Commercial car wash facilities shall discharge to the sanitary sewer.[8]
☐		Vehicle/ Equipment Repair and Maintenance	■ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas. ■ No floor drains unless pretreated prior to discharge to the sanitary sewer.[8] ■ Connect containers or sinks used for parts cleaning to the sanitary sewer.[8]
☐		Fuel Dispensing Areas	■ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break. ■ Canopy shall extend at least 10 ft. in each direction from each pump and drain away from fueling area.
☑	C3.0, C3.1	Loading Docks	■ Cover and/or grade to minimize run-on to and runoff from the loading area. ■ Position downspouts to direct stormwater away from the loading area. ■ Drain water from loading dock areas to the sanitary sewer.[8] ■ Install door skirts between the trailers and the building.
☑	C4.0	Fire Sprinklers	Design for discharge of fire sprinkler test water to landscape or sanitary sewer.[8]
☑	C4.0	Miscellaneous Drain or Wash Water	■ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.[8] ■ Roof drains from equipment drain to landscaped area where practicable. ■ Drain boiler drain lines, roof top equipment, all wash water to sanitary sewer.[8]
☐		Architectural Copper Rinse Water	■ Drain rinse water to landscaping, discharge to sanitary sewer[8], or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."[10]

8 Any connection to the sanitary sewer system is subject to sanitary district approval.
9 Businesses that may have outdoor process activities/equipment include machine shops, auto repair, industries with pretreatment facilities.

Note: Project is in planning review. Details of items checked shall be provided in Construction Drawings

Worksheet C

Low Impact Development – Site Design Measures

Select Appropriate Site Design Measures *(Required for C.3 Regulated Projects; all other projects are encouraged to implement site design measures, which may be required at municipality discretion.) Projects that create and/or replace between 2,500 and 5,000 sq.ft. of impervious surface, and detached single family homes that create/replace between 2,500 and 10,000 sq.ft. of impervious surface, must include* ***one of Site Design Measures a through f*** *(Provision C.3.i requirements).*[10] *Larger (>=5,000 sq.ft) projects must also include applicable Site Design Measures g through i. Consult with municipal staff about requirements for your project.*

Select appropriate site design measures and Identify the Plan Sheet where these elements are shown.

Yes	Plan Sheet No.	Site Design Measures
☐		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
☑	C6.0	b. Direct roof runoff onto vegetated areas.
☑	C6.0	c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
☑	C6.0	d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
☐		e. Construct sidewalks, walkways, and/or patios with pervious or permeable surfaces. Use the specifications in the C.3 Regulated Projects Guide downloadable at www.flowstobay.org/newdevelopment
☐		f. Construct bike lanes, driveways, and/or uncovered parking lots with pervious surfaces. Use the specifications in the C.3 Regulated Projects Guide downloadable at www.flowstobay.org/newdevelopment
☑	C3.0, C3.1, C6.0	g. Limit disturbance of natural water bodies and drainage systems; minimize compaction of highly permeable soils; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies;
☑	C3.0, C3.1	h. Conserve natural areas, including existing trees, other vegetation and soils.
☑	C3.0, C3.1	i. Minimize impervious surfaces.

Regulated Projects can also consider the following site design measures to reduce treatment system sizing:

Yes	Plan Sheet No.	Site Design Measures
☑	C6.0	j. Self-treating area (see Section 4.2 of the C.3 Regulated Projects Guide)
☐		k. Self-retaining area (see Section 4.3 of the C.3 Regulated Projects Guide)

[10] See MRP Provision C.3.a.i.(6) for non-C.3 Regulated Projects, C.3.c.i.(2)(a) for Regulated Projects, C.3.i for projects that create/replace between 2,500 and 5,000 sq.ft. of impervious surface and detached single family homes that create/replace between 2,500 and 10,000 sq.ft. of impervious surface.

Worksheet D

C.3 Regulated Projects and Non-Regulated GI Projects

Stormwater Treatment Measures and Site Design Measures by Drainage Management Area (DMA)

Check all applicable boxes, answer questions and fill in cells related to the site design and treatment measure(s) included in the project.

Drainage Management Area Summary Table

Complete the information below at the Entitlement, Building Permit and Certificate of Occupancy stages for Regulated C.3 Projects and Non-Regulated Green Infrastructure Projects. (The first four cells are automatically filled in from the Project Info sheet.)

Project Name:	Crocker Logistics Center		
Project Address:	1 Quarry Road		
Cross Streets:	South Hill Drive		
APN:	005-270-007, 005-270-008, 005-270-009, 005-270-011		
Special Project[11]?	No		**of C.3.d amount of runoff treated by Non-LID Systems on the Special Project site.**
C.3 Regulated?	Yes		
Public or Private Project?	Private	Public projects are those on public property or ROW; private projects are on privately-owned property but can include improvements in the public ROW required as part of the project.	

DMA Identification Number	Impervious Area[12] (ft^2)	Pervious Area[13] (ft^2)	Type of Site Design Measure or Treatment Measure[14]	Sizing Criteria Used[15]	Size Required[16]	Size Provided
Example DMA 1	5,000	2,000	Bioretention unlined with underdrain	2c: Flow	208 ft2	220 ft2
Example DMA 2	1,000	1,000	Self-retaining area	Other	< 2:1 ratio	1:1 ratio
Example DMA 3	1,000	-	Infiltration trench	1b: Volume	1,000 ft3	1,100 ft3
1	665,172	91,942	Bioretention lined with underdrain	3: Combination	22,101	22,101
2	666,046	91,830	Bioretention lined with underdrain	3: Combination	21,718	21,718
3	52,501	16,143	Bioretention lined with underdrain	2c: Flow	2,165	2,590
4	21,383	3,412	Bioretention lined with underdrain	2c: Flow	869	870
5	63,659	16,826	Bioretention lined with underdrain	2c: Flow	2,614	3,162
6	38,687	11,731	Bioretention lined with underdrain	2c: Flow	1,594	2,335
7	-	135,558	Self-treating area			
8						
9						
10						
11						
12						
13						
14						
15	Pervious area and Bioretention area sum to total from Project Info Cells					
16						
17						
18						
add rows, if needed						
TOTALS	1,507,448	367,442	N/A	N/A	N/A	52,776
Totals from Project Info Sheet Cells	1,507,448	1,167,136				

Is the project harvesting and using rainwater? Yes ☐

Rainwater Harvesting/Use Measures:

- ☐ Rainwater Harvesting for indoor non-potable water use
- ☐ Rainwater Harvesting for landscape irrigation use

A long term Operations and Maintenance (O&M) Agreement and Plan for this project will be required. Please contact the municipality for an agreement template and/or consult the C.3 Regulated Projects Guide and table of contents at www.flowstobay.org/newdevelopment for maintenance plan templates for specific facility types.

11 Special Projects are smart growth, high density, transit-oriented or affordable housing developments with the criteria defined in Provision C.3.e.ii.(2), (3) or (4) (see Worksheet F).
12 The sq.ft. of impervious area within the Drainage Management Area
13 The sq.ft. of pervious area within the Drainage Management Area
14 "Lined" refers to an impermeable liner placed on the bottom of a bioretention area, such that no infiltration into native soil occurs.
15 Select from the menu which of the following Provision C.3.d.i hydraulic sizing methods was used, if any. Volume based approaches: 1(a) Urban Runoff Quality Management approach, or 1(b) 80% capture approach (recommended volume-based approach). Flow-based approaches: 2(a) 10% of 50-year peak flow approach, 2(b) 2 times the 85th percentile rainfall intensity approach, 2(c) 0.2-Inch-per-hour intensity approach (recommended flow-based approach - also known as the 4% rule for bioretention), or 3 Combination flow and volume-based approach. "Other" is used for Site Design Measures such as Self-Retaining or Self-Treating Areas.
16 Each DMA should drain to one treatment area (unless it is self-treating or self-retaining). If multiple DMAs are draining to one treatment area, they should be combined into one DMA. If one DMA drains to multiple treatment areas, that DMA should be split up so there is one DMA per treatment area (which allows the treatment area to be properly sized). 7/1/23

Worksheet E
Hydromodification Management

E-1 Is the project a Hydromodification[17] Management (HM) Project?

E-1.1 Is the total impervious area increased over the pre-project condition?

- ☑ Yes. Continue to E-1.2
- ☐ No. Go to Item E-1.3 and check “No.”

E-1.2 Is the site located in an HM Control Area per the HM Control Areas map (Appendix H of the C.3 Regulated Projects Guide)?

- ☑ Yes. Go to E-1.3 and Check "Yes".
- ☐ No. Attach map, indicating project location. Go to Item E-1.3 and check “No.”

E-1.3 Is the project a Hydromodification Management Project?

- ☑ Yes. The project is subject to HM requirements in Provision C.3.g of the Municipal Regional Stormwater Permit.
- ☐ No. The project is EXEMPT from HM requirements.

► If the project is subject to the HM requirements, incorporate in the project flow duration control measures designed such that post-project discharge rates and durations match pre-project discharge rates and durations.

► The Bay Area Hydrology Model (BAHM) has been developed to help size flow duration controls. See www.clearcreeksolutions.info/downloads. Guidance is provided in Chapter 7 of the C.3 Regulated Projects Guide.

E-2 Incorporate HM Controls (if required)

Are the applicable items provided with the Plans?

Yes	No	NA	
☑	☐	☐	Site plans with pre- and post-project impervious surface areas, surface flow directions of entire site, locations of flow duration controls and site design measures per HM site design requirement
☑	☐	☐	Soils report or other site-specific document showing soil type(s) on site
☑	☐	☐	If project uses the Bay Area Hydrology Model (BAHM), a list of model inputs and outputs.
☐	☐	☑	If project uses custom modeling, a summary of the modeling calculations with corresponding graph showing curve matching (existing, post-project, and post-project with HM controls curves), goodness of fit, and (allowable) low flow rate.
☐	☐	☑	If project uses the Impracticability Provision, a listing of all applicable costs and a brief description of the alternative HM project (name, location, date of start up, entity responsible for maintenance).
☐	☐	☑	If the project uses alternatives to the default BAHM approach or settings, a written description and rationale.

17 Hydromodification is the change in a site’s runoff hydrograph, including increases in flows and durations that results when land is developed (made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion of receiving streams, loss of habitat, increased sediment transport and/or deposition, and increased flooding. Hydromodification control measures are designed to reduce these effects.

Worksheet F
Special Projects

Complete this worksheet for projects that appear to meet the definition of "Special Project", per Provision C.3.e.ii of the Municipal Regional Stormwater Permit (MRP). The form assists in determining whether a project meets Special Project criteria, and the percentage of low impact development (LID) treatment reduction credit. Special Projects that implement less than 100% LID treatment must provide a narrative discussion of the feasibility or infeasibility of 100% LID treatment. See Appendix J of the C.3 Regulated Projects Guide (download at www.flowstobay.org/newdevelopment) for more information.

F-1

"Special Project" Determination (Check the boxes to determine if the project meets any of the following categories.)

Special Project Category "A"

Does the project have ALL of the following characteristics?

- ☐ Located in a municipality's designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district;
- ☐ Creates and/or replaces 0.5 acres or less of impervious surface - enter answer in F-2 table;
- ☐ Includes no surface parking, except for incidental parking for emergency vehicle access, ADA access, and passenger or freight loading zones;
- ☐ Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment - enter answer in F-2 Table

☐ No (continue)

☐ Yes – Complete Section F-2 below

Special Project Category "B"

Does the project have ALL of the following characteristics?

- ☐ Located in a municipality's designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district[15];
- ☐ Creates and/or replaces more than 0.5 acres of impervious area and less than 2.0 acres - enter answer in F-2 Table;
- ☐ Includes no surface parking, except for incidental parking for emergency access, ADA access, and passenger or freight loading zones;
- ☐ Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment - enter answer in F-2 Table;
- ☐ Minimum gross density of either 50 dwelling units per acre (for residential projects) or a Floor Area Ratio (FAR) of 2:1 (for commercial projects) - mixed use projects may use either criterion[16] - enter answer in F-2 Table;

☐ No (continue)

☐ Yes – Complete Section F-2 below

Special Project Category "C"

Complete the Special Project Category C - Affordable Housing Credit Calculator (AHCC) Worksheet.

Does the project meet ALL of the required characteristics for Category C?

☐ No

☐ Yes – Complete Section F-2 below

[15] And built as part of a municipality's stated objective to preserve/enhance a pedestrian-oriented type of urban design.

[16] The MRP establishes definitions for "Gross Density"(GD) & FAR. GD is defined as, "the total number of residential units divided by the acreage of the entire site area, including land occupied by public right-of-ways, recreational, civic, commercial and other non-residential uses." FAR is defined as," the Ratio of the total floor area on all floors of all buildings at a project site (except structures, floors, or floor areas dedicated to parking) to the total project site area.

F-2 LID Treatment Reduction Credit Calculation

If more than one category applies, choose only one of the applicable categories and fill out the table for that category.
Fill in all cells with blue highlighting that pertain to the chosen Special Project Category.

Category	Impervious Area Created/Replaced (sq. ft.)	Site Coverage (%)	Project Density[16] or FAR[16]	Density/Criteria	Allowable Credit (%)	Applied Credit (%)
A			N.A.	See above in F-1	100%	
B				Res ≥ 50 DU/ac or FAR ≥ 2:1	50%	
				Res ≥ 75 DU/ac or FAR ≥ 3:1	75%	
				Res ≥ 100 DU/ac or FAR ≥ 4:1	100%	
C				Affordable Housing Credit - from AHCC Worksheet):		
					TOTAL CREDIT =	0%

F-3 Narrative Discussion of the Feasibility/Infeasibility of 100% LID Treatment:

If project will implement less than 100% LID, prepare a discussion of the feasibility or infeasibility of 100% LID treatment, as described in Appendix J of the C.3 Regulated Projects Guide.

F-4 Select Certified Non-LID Treatment Measures:

If the project will include non-LID treatment measures, select a treatment measure certified for "Basic" General Use Level Designation (GULD) by the Washington State Department of Ecology's Technical Assessment Protocol – Ecology (TAPE[17]). See guidance in Appendix J of the C.3 Regulated Projects Guide (www.flowstobay.org/newdevelopment).

[17] TAPE certification is used in order to satisfy Special Project's reporting requirements in the MRP.

Worksheet G
(For municipal staff use only)

G-1 **Alternative Certification:** Were the treatment and/or HM control sizing and design reviewed by a qualified third-party professional that is not a member of the project team or agency staff?

☐ Yes ☐ No Name of Reviewer: _____

G-2 **High Priority Site:** High Priority Sites can include those located in or within 100 feet of a sensitive habitat, an Area of Special Biological Significance (ASBS), a body of water, or on "hillside projects" disturbing >=5,000 sq.ft. of land and with steep slopes (of >=15% - see cell **I.A.5** - or as identified by municipal criteria or map). These sites are subject to monthly inspections from Oct 1 to April 30. See MRP Provision C.6.e.ii.(2)(b) and C.6.e.ii.(2)(c).

☐ Yes ☐ No If yes, then add site to Staff's Monthly Rainy Season Construction Site Inspection List

G-3

Inspections of Sites with Pervious Pavement: Regulated projects that are installing 3,000 sq.ft. or more of pervious pavement (see cell **I.B.1.g**) (excluding private-use patios in single family homes, townhomes, or condominiums) must have the pavement system inspected by the jurisdiction upon completion of the installation and the site must be added to the jurisdiction's list of sites needing inspections at least once every five years – see provision C.3.h. Pervious pavement systems include pervious concrete, pervious asphalt, pervious pavers and grid pavers etc. and are described in the C3 Regulated Projects Guide downloadable at: www.flowstobay.org/newdevelopment.

☐ Yes ☐ No If yes, then add site to Staff's Lists for Construction and O&M inspections (C.3 and C.3.h)

Operations and Maintenance (O&M) Submittals

G-4 Stormwater Treatment Measure and/HM Control Owner or Operator's Information:

Name: _____

Address: _____

Phone: _____ Email: _____

► Applicant must call for inspection and receive inspection at completion of installation of treatment measures and/or hydromodification management controls including any pervious pavement areas of 3,000 sq.ft. or more.

The following questions apply to C.3 Regulated Projects and Hydromodification Management Projects.

		Yes	No	N/A
G-4.1	Was maintenance plan submitted?	☐	☐	☐
G-4.2	Was maintenance plan approved?	☐	☐	☐
G-4.3	Was maintenance agreement submitted? (Date executed: _____)	☐	☐	☐

► *Attach the executed maintenance agreement as an appendix to this checklist.*

G-5 **Annual Operations and Maintenance (O&M) Submittals (for municipal staff use only):**

For C.3 Regulated Projects and Hydromodification Management Projects, indicate the dates on which the Applicant submitted annual reports for project O&M:

_____

G-6 **Comments (for municipal staff use only):**

G-7 NOTES (for municipal staff use only):

Project Info Notes: _____

Worksheet A Notes: _____

Worksheet B Notes: _____

Worksheet C Notes: _____

Worksheet D Notes: _____

Worksheet E Notes: _____

Worksheet F Notes: _____

G-8 Project Close-Out (for municipal staff use only):

		Yes	No	N/A
8.1	Were final Conditions of Approval met?	☐	☐	
8.2	Was initial inspection of the completed treatment/HM measure(s) conducted? (Date of inspection: _____)	☐	☐	☐
8.3	Was maintenance plan submitted? (Date executed: _____)	☐	☐	☐
8.4	Was project information provided to staff responsible for O&M verification inspections? (Date provided to inspection staff: _____)	☐	☐	☐

G-9 Project Close-Out (Continued -- for municipal staff use only):

Name of staff confirming project is closed out: _____

Signature: _____ Date: _____

Name of O&M staff receiving information: _____

Signature: _____ Date: _____

KIER+WRIGHT

Appendix F

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Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

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San Francisco, CA 94102
(415) 271-3117
rlee@swsv.com

MEMORANDUM

DATE: January 11, 2024
TO: City of Brisbane
FROM: Robin J. Lee, PE, CFM
SUBJECT: Guadalupe Quarry Redevelopment Project HMP – Preliminary Design

Introduction

Schaaf & Wheeler has been retained by Kier + Wright to analyze the proposed development at the subject site for hydromodification management (HM) requirements to meet the Municipal Regional Permit (MRP). Schaaf & Wheeler studied this site as one watershed to determine the approximate storage volume requirement for the entire site and compared that volume to the proposed storage pipes presented on the preliminary civil drawings. The results were summarized in a memo dated October 9, 2023 and attached to this memo as Attachment 1.

This memo further details the site plan layout, breaks down individual drainages to their respective detention systems, and designs outlet structures from the detention pipe systems to confirm that site meets HMP requirements in the BAHM 2013 model. Attempts were made to model this site in BAHM 2023, but several bugs were found and the technical team decided to go with 2013 for the time being. The proposed site design has four locations of underground storage in oversized pipes referred to as Ponds 1, 2, 3, and 4 shown in **blue** in Figure 1. The site is broken down into offsite (**green**) and onsite (**orange**) runoff in the BAHM model and depicted in Figure 1.

The results of the 2013 BAHM model show that outlet structures with a low flow orifice and a rectangular notched weir can be constructed to meter the flow from the offsite runoff and the runoff from DMAs 1 and 2 to account for the entire development. This analysis is preliminary and will be modified during detailed design. The analysis is considered conservative since the pre-project site is considered entirely grass land cover, while some of the existing quarry has access roads and areas of decomposed granite (DG) that act more like impervious areas under the pre-project condition. Portions of the site are also outside of the HMP applicability area. However, they are still included within this analysis to remain conservative at the planning level of design.

Hydrology

The offsite runoff is the steep hillsides that drain into the site. This area in **green** in Figure 1 is divided into 10 drainage areas. These are all modeled in the pre-project as steep grass on C/D soils subbasins. The subbasins remain the same in both the pre-project and the mitigated project conditions.

The onsite runoff is the area shown in **orange** in Figure 1 and is the area that has proposed development. The onsite runoff is broken down into drainage management areas (DMA) 1 through 7 and water quality treatment measures such as bioretention areas. These subbasins are modeled as moderately sloped grass in the pre-project condition and then impervious areas based on the proposed development in the mitigated project.

DMA 7 is an area of landscaping that is not being altered as part of the development and is included as a separate basin in both the pre project and mitigated scenarios. The total area depicted in Figure 1 is 163 acres. Table 2 summarizes the subbasins in the model.

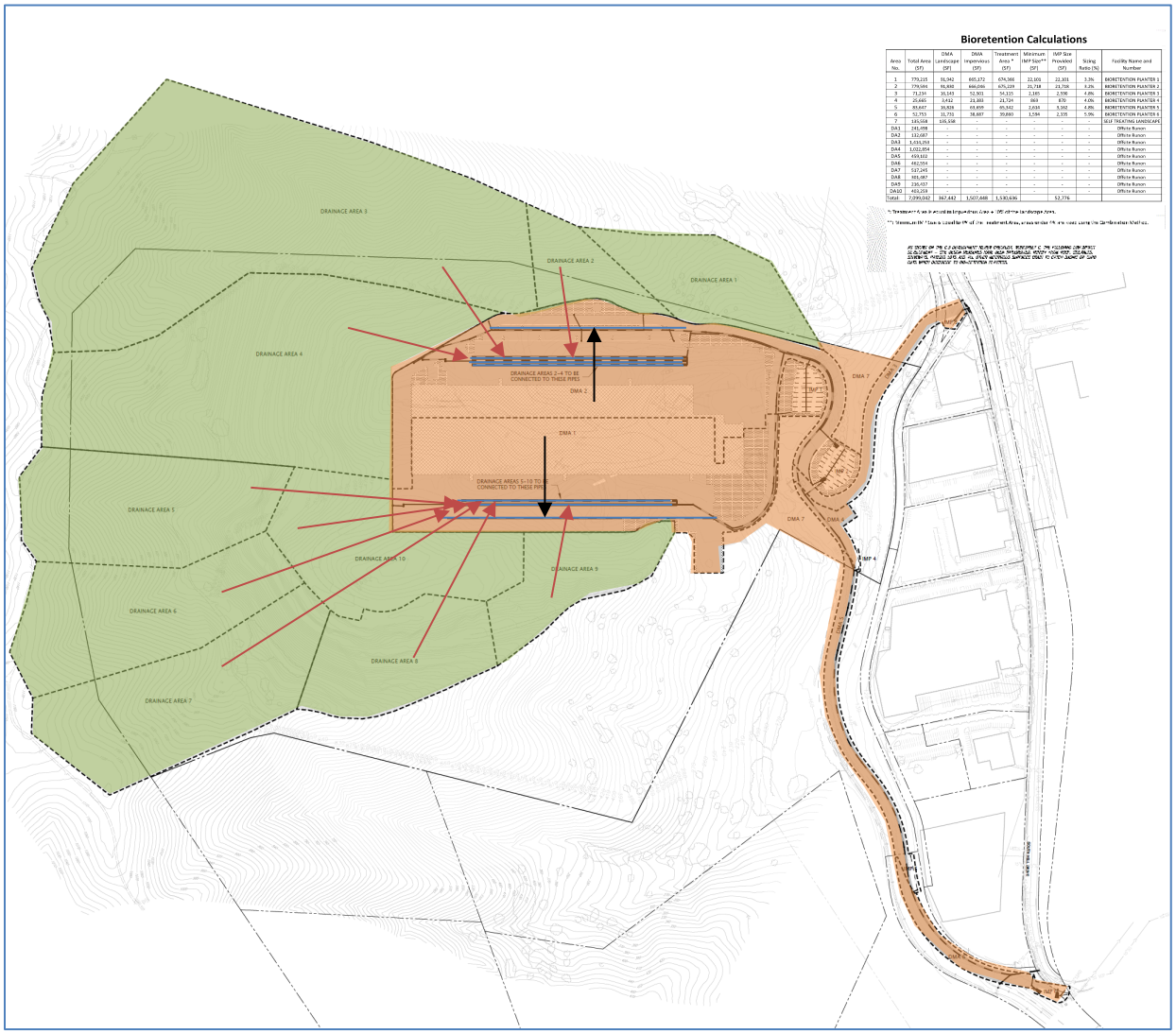


Figure 1. Offsite (green) and Onsite (orange) Watersheds
Offsite Flow Arrows to Detention (red) Onsite Flow Arrows to Detention (black)

Table 1. Land Use Summary for Pre-Project and Mitigated Watersheds

Subbasin Name	Pre-Project		Mitigated	
	Pervious	Impervious	Pervious	Impervious
Drainage Area 1	5.5	0	5.5	0
Drainage Areas 2 – 4	59	0	59	0
Drainage Areas 5 – 10	54.2	0	54.2	0
DMA 1	17.9	0	2.6	15.3
DMA 2	17.9	0	2.6	15.3
DMA 3-6	5.4	0	1.2	4.2
DMA 7	3.1	0	3.1	0
TOTAL	**163**	**0**	**128.2**	**34.8**

HMP Model Development

The entire site drains to one outfall location: the City's concrete-lined drainage ditch. This is discussed in more detail in Attachment 1 memo. This point is used as the point of connection (POC) for both the existing and the mitigated scenarios. While there is a portion of the site that drains to the north, ultimately that flow ends up in the same concrete lined ditch.

The seven subbasins depicted in Table 1 are used in the pre-project model without any mitigation. In the mitigated scenario, the underground pipes that are used as detention are included in the model. These detention pipes are called “ponds.” The bioretention areas are not modeled in this preliminary design memo. Drainage Area 1, DMA 3 – 6, and DMA 7 subbasins are directly connected to the POC since they do not drain to detention systems. During detailed design, DMA 3 – 6 will be connected to the bioretention areas since they provide some mitigation on the lower flows.

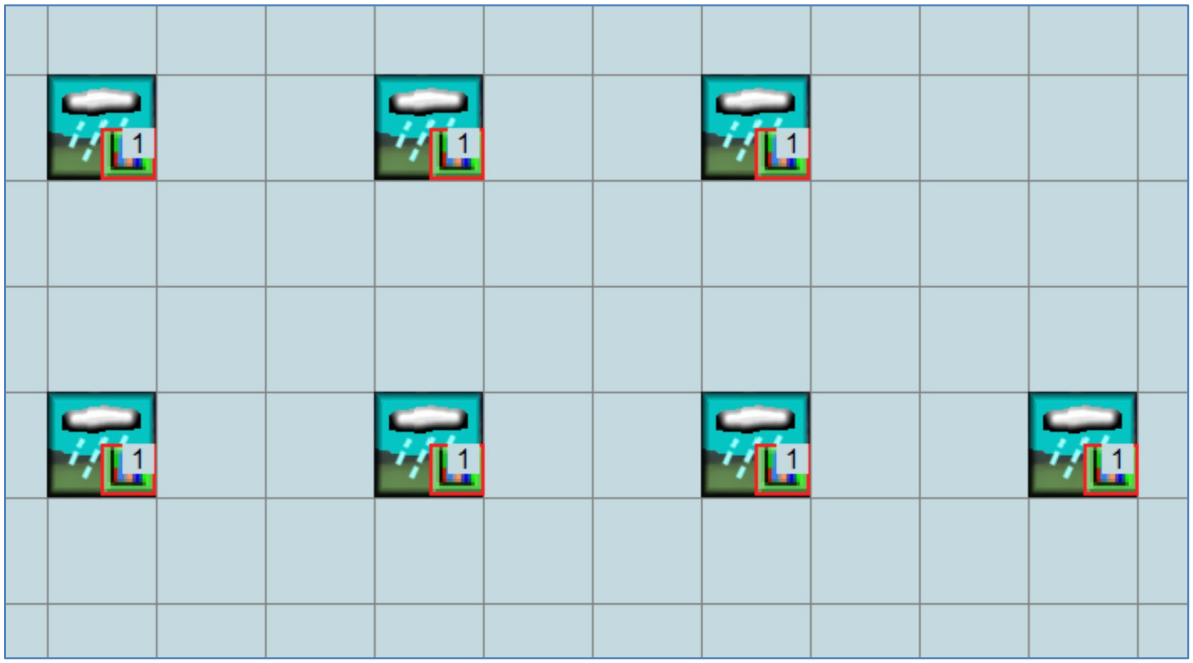


Figure 3. Pre-Project Model Set Up

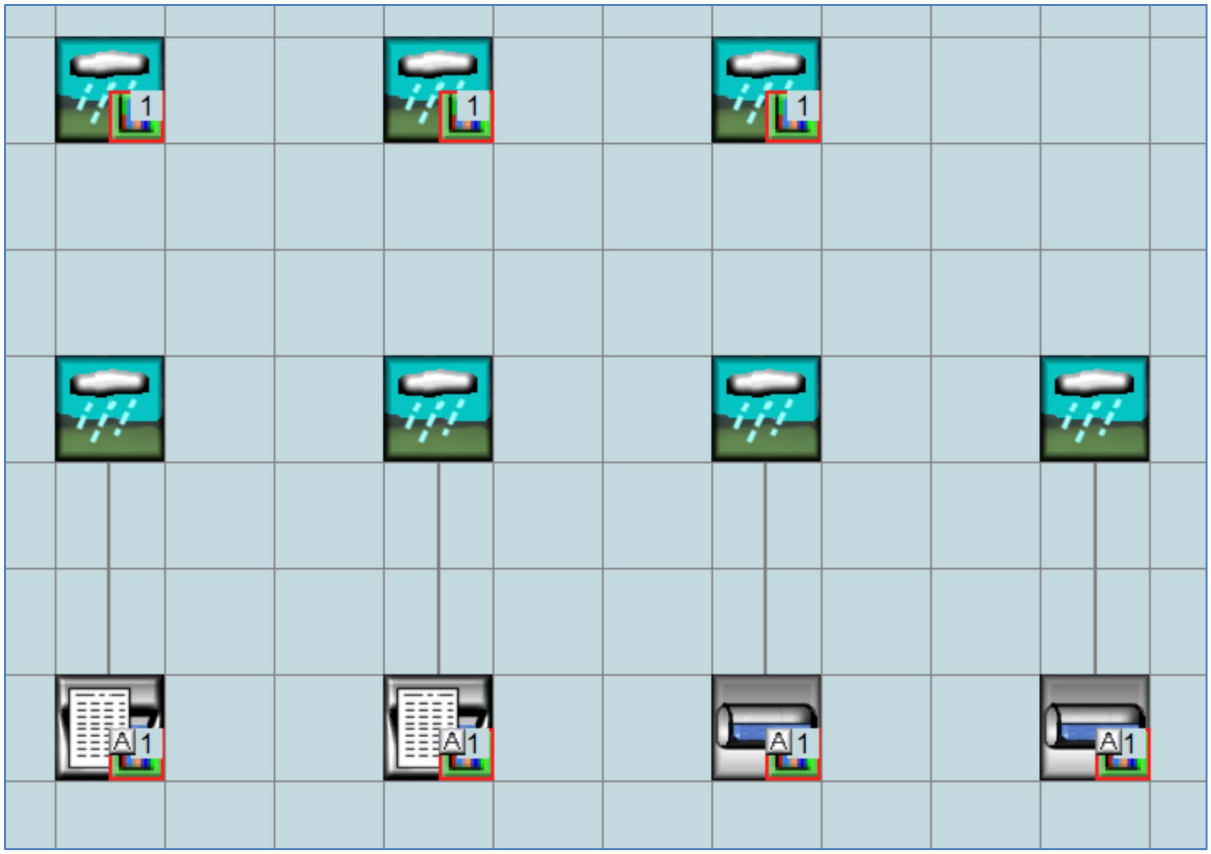


Figure 4. Mitigated Model Set Up

Detention Pipe Outlet Structure Preliminary Design

Outlet structures with a low flow orifice and a rectangular notched weir were selected to simplify construction. Low flow orifices are 3 or 4 inches in diameter. The rectangular notches are 0.5 and 1 foot wide and range from 1 to 3 feet in height. Ponds 1 and 2 will be large pipes entering into a vault overflow structure with a weir plate and are modeled using the stage storage discharge (SSD) table as they will have weirs that are higher than the crown of the incoming storage pipe. BAHM does not allow for this in the model and conversations with Clear Creek indicate that the SSD is the best approach to model this layout. Ponds 3 and 4 are modeled as tanks with risers that are 1-ft below the crown of the pipe. Riser diameters are sized to convey 100-year flows. All detention pipes will come into the vault structure at equal elevations to match the model. Table 2 details the outlet structures for each of the detention pipes that are called "Ponds" in the civil drawings. Attachment 2 contains the SSD calculations.

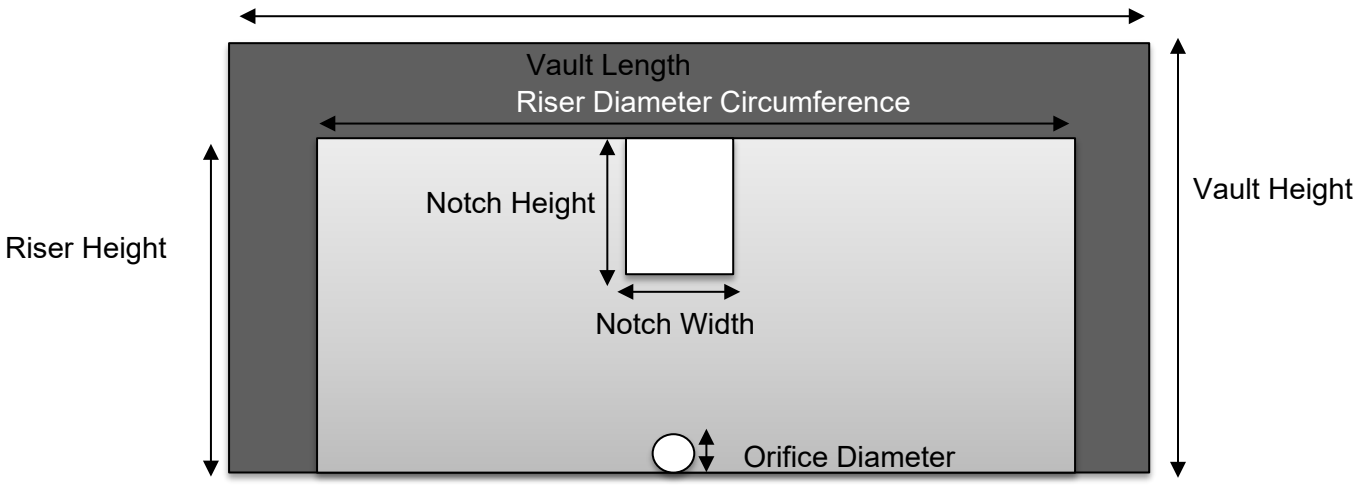


Figure 4: Outlet Structure Dimensions as Weird Wall in Vault

Table 2. Outlet Structure Preliminary Designs

BAHM Tank Element	Diameter (ft)	Length (ft)	Orifice Diameter (in)	Riser Diameter (in)	Riser Height (ft)	Rect Notch Height (ft)	Rect Notch Width (ft)
Pond 1	8	2,580	4	96	12	1	.5
Pond 2	8	1,720	4	96	11	3	1
Pond 3	4	1,000	4	60	3	1	1
Pond 4	4	1,100	4	60	3	1	1

BAHM Results

The outlet structures in Table 2 are modeled in the mitigated scenario and show that the system passes the BAHM model. Table 3 shows the pre-flows and mitigated flows. Figure 5 depicts the flow frequency curves. The BAHM Report is contained in Attachment 3.

Table 3. Flow Frequencies for the Site

Flow Frequency	Pre-Project	Post-Project
2-Year	34.0	19.3
5-Year	72.1	49.7
10-Year	81.3	70.3

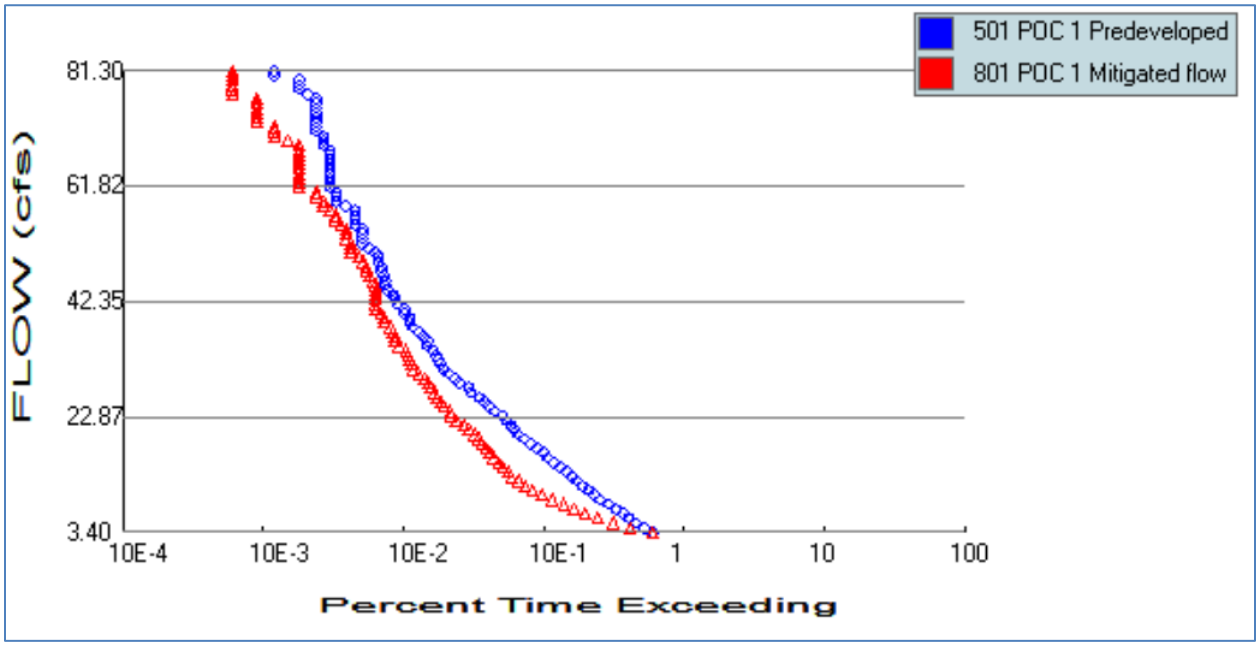


Figure 5: BAHM Model Output Flow Durations at POC

Conclusion

The development site proposes to detain the runoff from the hillsides in Ponds 1 and 2 and meter the flow out slowly. The site also detains DMA 1 and DMA 2 in Ponds 3 and 4. These four detention systems have enough volume to mitigate the runoff from the proposed development.

The outlet structures detailed in Table 2 are preliminary in design and constructable. During detailed design, these structures may change slightly, and volumes will be modified as necessary. In addition, during detailed design, the bioretention areas may be included since they provide some storage of the lower flows. Finally, during detailed design, a more thorough look into the existing site landcover will be conducted to identify any areas of existing impervious surfaces.

ATTACHMENT 1

HMP Feasibility Memo October 2023

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

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(415) 433-4848
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MEMORANDUM

DATE: October 9, 2023
TO: City of Brisbane
FROM: Robin J. Lee, PE, CFM
SUBJECT: Guadalupe Quarry Redevelopment Project Hydromodification Management

Introduction

Schaaf & Wheeler has been retained by Kier + Wright to analyze the proposed development at the subject site for hydromodification management (HM) requirements to meet the Municipal Regional Permit (MRP). This memo summarizes the results of modeling using the Bay Area Hydromodification Model (BAHM), which show that the site needs to detain approximately 4.7 acre-feet to meet MRP requirements. The requirements state that post project flows shall be mitigated based on 10% of the 2-year storm event up to the 10-year storm event. The site plans show development of 34.6 acres of impervious area and a capacity to detain 6.7 acre-feet of water, which exceeds the HM requirement from the BAHM model.

The Guadalupe Quarry - Closure, Annexation and Redevelopment project located in Brisbane, CA, reclaims a 144-acre quarry into a 56-acre industrial development with an 80-acre minimum habitat conservation area. The proposed development includes a three-story distribution center, a three-story parking garage, a paved access road to the site, and other associated site improvements. The industrial portion of the site has been designed to promote sustainability and includes Low Impact Design elements, including maximizing landscaping to reduce impervious area and bioretention areas to treat impervious surfaces.

Hydrology

The proposed development includes managing run-on from the upper hillsides through the site. Figure 1 shows the watershed that is modeled in BAHM and the corresponding point of compliance (POC) or outlet to the municipal storm drain system, which consists of a concrete-lined ditch. The total watershed area draining to the POC is 181.5 acres. Under existing conditions, the majority of the site is underlying bedrock or compacted rocks from quarry operations. In addition, the hillside is steep. Since quarry land cover is not an option, the site is considered to be urban land cover under pervious and 10% impervious surfaces in order to mimic the existing site conditions.



Figure 1. Watershed to POC in Red Arrow



Figure 2. POC to Municipal Storm Drain System

The proposed development includes the construction of 34.6 acres of impervious surfaces. In order to account for the upper hillside, which is generating more runoff due to the underlying bedrock, the mitigated basin is assumed to be 47.3 acres of impervious surfaces. The upper hillside and run on to the site are roughly 126.8 acres of steep hillside. Table 1 lists the pre- and post-pervious and impervious breakdown.

Table 1. Land Use Summary for Pre-Project and Mitigated Watersheds

BAHM Input	Pre-Project Acres	Mitigated Acres
C/D, Urban, Steep (10-20%)	126.8	126.8
C/D, Urban, Mod (5-10%)	36.6	7.4
Parking, Mod (5-10%)	18.1	12.7
Parking, Flat (0-5%)		34.6
TOTAL	**181.5**	**181.5**

HMP Model Development

Since the project is in a hydromodification management (HM) area and will create and/or replace one acre or more of impervious surface, the project must comply with the MRP requirement, which states that post-project runoff is less than or equal to the estimated pre-project rates and durations. Pre-project and post-project (mitigated) conditions were modeled using the BAHM 2013, which is the standard HM model. While there is a 2023 version of BAHM, it is still in beta version and is not recommend until further research is conducted into the results.

The entire site drains to one outfall location to the City's concrete-lined drainage ditch. This point is used as the POC for both the existing and the mitigated scenarios. In the mitigated scenario, a trapezoidal pond is added to determine the total site detention requirement. Figure 3 shows the pre-project and the mitigated project model layouts.

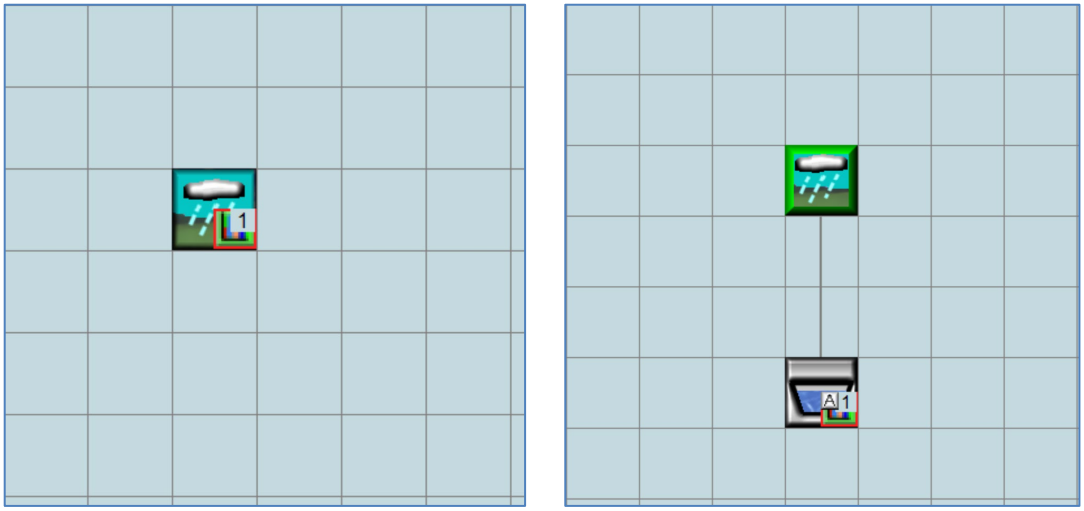


Figure 3. Pre-Project (left) and Mitigated (right) Model Set Up

HMP Sizing Results

Based on the BAHM output, the site must detain at least 3.5 acre-feet, which is the volume stored at the riser in the trapezoidal pond. In order to have 1 foot of freeboard, the total volume detained is 4.7 acre-feet. To be conservative, the larger detention volume of 4.7 acre-feet is recommended. Attachment 1 contains the BAHM model output report.

Site Mitigation Measures

The development site proposes to detain the runoff from the hillsides and meter the flow out slowly. These detention systems are a series of underground 96-inch detention pipes that have a 19-inch outlet structure. These are indicated in the plans in Attachment 1 as Pond 1 and Pond 2. For the development portion of the site, 48-inch pipes are used to detain flows that meter into 24-inch pipes downstream. These oversized detention pipes are shown as Pond 3 and Pond 4 in Attachment 1.

Runoff from the new impervious surfaces is conveyed to six infiltration planters throughout the site prior to ultimately discharging into the City's concrete-lined ditch. These mitigation measures were compared to the required 4.7 acre-feet of required detention for HMP. The bioretention areas use six inches of ponding and the volume stored in the 12 inches of rock with a porosity of 40%. The storage within the biotreatment soil is ignored to be conservative. Table 2 lists the total detention volume provided on the development.

Table 2. Detention Provided in Site Plans

Detention System	Type	Size	Volume
			Acre-feet
Pond 1	Oversized Pipes	2,580 ft, 96 in	2.98
Pond 2	Oversized Pipes	1,720 ft, 96 in	1.98
Pond 3	Oversized Pipes	1,000 ft, 48 in	0.29
Pond 4	Oversized Pipe	1,100 ft, 48 in	0.32
Infiltration Planter 1	6 in pond, rock	22,101 sf	0.46
Infiltration Planter 2	6 in pond, rock	21718 sf	0.45
Infiltration Planter 3	6 in pond, rock	2,590 sf	0.05
Infiltration Planter 4	6 in pond, rock	870 sf	0.02
Infiltration Planter 5	6 in pond, rock	3,162 sf	0.07
Infiltration Planter 6	6 in pond, rock	2,335 sf	0.05
		TOTAL	**6.7**

Results

The oversized detention pipes listed as Ponds 1-4 and the available storage within the bioretention areas exceed the volume requirement from the BAHM model. A comparison of the pre-project and mitigated post-project flows is presented in Table 3.

Table 3. Flow Frequencies for the Site

Flow Frequency	Pre-Project	Post-Project
2-Year	52.6	38.6
5-Year	97.4	69.2
10-Year	110.3	79.1

Flow frequency curves for the pre-project and mitigated post-project flow are presented in Figure 4.

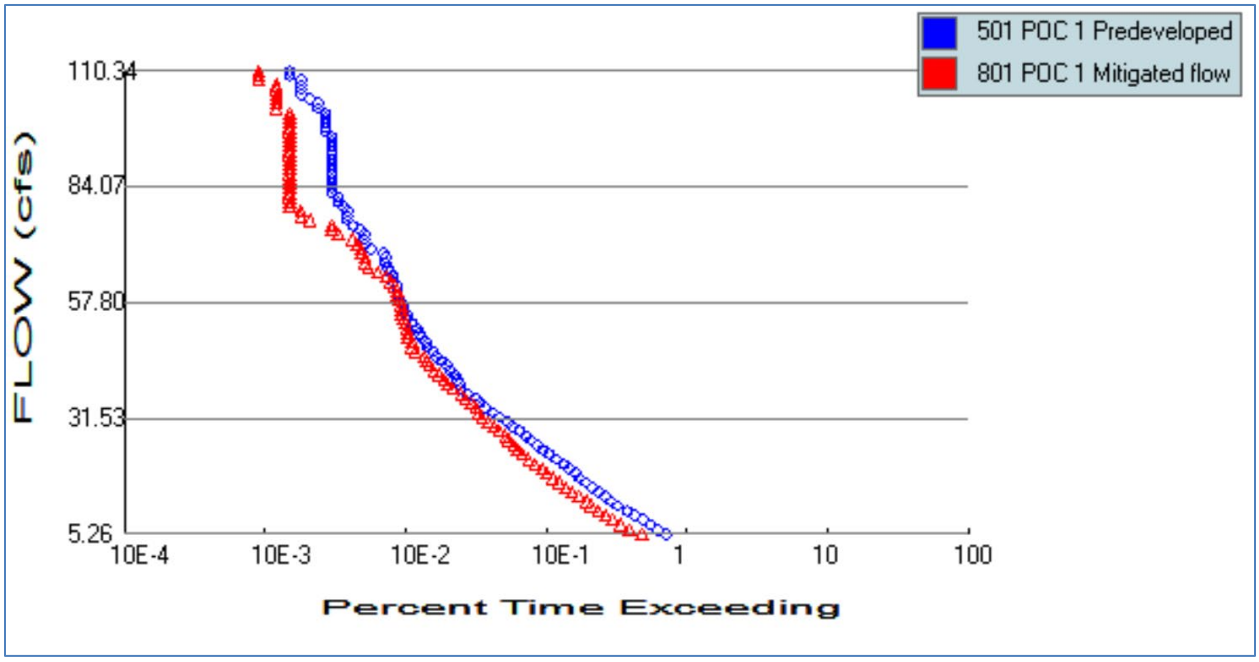


Figure 4: BAHM Model Output Flow Durations at POC

Conclusion

The developed site has increased impervious area and requires detention to reduce the peak discharge to levels equal to or less than the pre-project peak runoff. To reduce the peak discharge to pre-project rates for all storms from 10% of the 2-year event up to the 10-year event included in BAHM 2013, total storage volume required to be detained is 4.7 acre-feet. This includes 1-foot of freeboard. The current site plan meets the MRP requirements for HMP by proposing 6.7 acre-feet.

ATTACHMENT 2

SSD Calculations

Pond 1

Area and Volume Calcs										Radian Calc for Pipe Area			Discharge Calcs - orifice and weir					COPY TO BAHM			
	Dia	dia	radius	depth ratio	flow depth	X area	volume	X area	volume				orifice flow	rect notch	top weir	TOTAL	Orifice Diam	0.33			
Notes	**dia (d)**	**dia (d)**	**r**	**Ratio of h**	**h**	**A**	**V**	**A**	**V**	Theta (Rad	Theta (Deg)	Wetted Perim	Q	Q	Q	Q	Notch H	1			
units / form.	in	ft	ft	h / d	ft	ft^2	ft^3	acres	acre-ft				cfs	cfs	cfs	cfs	Notch W	0.5	STAGE	AREA	STORAGE	DISCHARGE
					STAGE	AREA	VOLUME	AREA	VOLUME								Top Weir L	25.13	ft	acres	acre-ft	cfs
Pipe I.L.	96	8.0	4.0	0.000	0.00	0.00	0.00	0.0000	0.00	0	0	0	0	0		0	Weir Height	12	0.00	0.00000	0.000	0.000
	96	8.0	4.0	0.031	0.25	0.47	1204.76	0.0000	0.03	0.711	40.728	2.843	0.210	0.000	0.000	0.210	Notch Elev	11	0.25	0.00001	0.028	0.210
	96	8.0	4.0	0.063	0.50	1.31	3374.76	0.0000	0.08	1.011	57.910	4.043	0.297	0.000	0.000	0.297			0.50	0.00003	0.077	0.297
	96	8.0	4.0	0.094	0.75	2.38	6138.85	0.0001	0.14	1.245	71.318	4.979	0.364	0.000	0.000	0.364			0.75	0.00005	0.141	0.364
	96	8.0	4.0	0.125	1.00	3.63	9356.35	0.0001	0.21	1.445	82.819	5.782	0.420	0.000	0.000	0.420			1.00	0.00008	0.215	0.420
	96	8.0	4.0	0.156	1.25	5.02	12941.44	0.0001	0.30	1.626	93.135	6.502	0.470	0.000	0.000	0.470			1.25	0.00012	0.297	0.470
	96	8.0	4.0	0.188	1.50	6.52	16832.92	0.0001	0.39	1.791	102.636	7.165	0.515	0.000	0.000	0.515			1.50	0.00015	0.386	0.515
	96	8.0	4.0	0.219	1.75	8.13	20983.30	0.0002	0.48	1.947	111.542	7.787	0.556	0.000	0.000	0.556			1.75	0.00019	0.482	0.556
	96	8.0	4.0	0.250	2.00	9.83	25353.55	0.0002	0.58	2.094	120.000	8.378	0.594	0.000	0.000	0.594			2.00	0.00023	0.582	0.594
	96	8.0	4.0	0.281	2.25	11.59	29910.32	0.0003	0.69	2.236	128.111	8.944	0.630	0.000	0.000	0.630			2.25	0.0003	0.687	0.630
	96	8.0	4.0	0.313	2.50	13.42	34624.23	0.0003	0.79	2.373	135.951	9.491	0.665	0.000	0.000	0.665			2.50	0.0003	0.795	0.665
	96	8.0	4.0	0.344	2.75	15.30	39468.77	0.0004	0.91	2.506	143.580	10.024	0.697	0.000	0.000	0.697			2.75	0.0004	0.906	0.697
	96	8.0	4.0	0.375	3.00	17.22	44419.53	0.0004	1.02	2.636	151.045	10.545	0.728	0.000	0.000	0.728			3.00	0.0004	1.020	0.728
Half Full	96	8.0	4.0	0.406	3.25	19.17	49453.66	0.0004	1.14	2.764	158.386	11.057	0.758	0.000	0.000	0.758			3.25	0.0004	1.135	0.758
	96	8.0	4.0	0.438	3.50	21.14	54549.41	0.0005	1.25	2.891	165.638	13.569	0.786	0.000	0.000	0.786			3.50	0.0005	1.252	0.786
	96	8.0	4.0	0.469	3.75	23.13	59685.83	0.0005	1.37	3.017	172.833	12.066	0.814	0.000	0.000	0.814			3.75	0.0005	1.370	0.814
	96	8.0	4.0	0.500	4.00	25.13	64842.47	0.0006	1.49	3.142	180.000	12.566	0.841	0.000	0.000	0.841			4.00	0.0006	1.489	0.841
	96	8.0	4.0	0.531	4.25	27.13	69999.11	0.0006	1.61	3.267	187.167	13.067	0.866	0.000	0.000	0.866			4.25	0.0006	1.607	0.866
	96	8.0	4.0	0.563	4.50	29.12	75135.53	0.0007	1.72	3.392	194.362	13.569	0.892	0.000	0.000	0.892			4.50	0.0007	1.725	0.892
	96	8.0	4.0	0.594	4.75	31.10	80231.28	0.0007	1.84	3.519	201.614	14.075	0.916	0.000	0.000	0.916			4.75	0.0007	1.842	0.916
	96	8.0	4.0	0.625	5.00	33.05	85265.41	0.0008	1.96	3.647	208.955	14.588	0.940	0.000	0.000	0.940			5.00	0.0008	1.957	0.940
	96	8.0	4.0	0.656	5.25	34.97	90216.17	0.0008	2.07	3.777	216.420	15.109	0.963	0.000	0.000	0.963			5.25	0.0008	2.071	0.963
	96	8.0	4.0	0.688	5.50	36.85	95060.72	0.0008	2.18	3.910	224.049	15.642	0.986	0.000	0.000	0.986			5.50	0.0008	2.182	0.986
	96	8.0	4.0	0.719	5.75	38.67	99774.63	0.0009	2.29	4.047	231.889	16.189	1.008	0.000	0.000	1.008			5.75	0.0009	2.291	1.008
	96	8.0	4.0	0.750	6.00	40.44	104331.39	0.0009	2.40	4.189	240.000	16.755	1.029	0.000	0.000	1.029			6.00	0.0009	2.395	1.029
	96	8.0	4.0	0.781	6.25	42.13	108701.64	0.0010	2.50	4.336	248.458	17.346	1.051	0.000	0.000	1.051			6.25	0.0010	2.495	1.051
	96	8.0	4.0	0.813	6.50	43.74	112852.02	0.0010	2.59	4.492	257.364	17.967	1.072	0.000	0.000	1.072			6.50	0.0010	2.591	1.072
	96	8.0	4.0	0.844	6.75	45.25	116743.51	0.0010	2.68	4.658	266.865	18.631	1.092	0.000	0.000	1.092			6.75	0.0010	2.680	1.092
	96	8.0	4.0	0.875	7.00	46.64	120328.59	0.0011	2.76	4.838	277.181	19.351	1.112	0.000	0.000	1.112			7.00	0.001071	2.762	1.112
	96	8.0	4.0	0.906	7.25	47.89	123546.09	0.0011	2.84	5.038	288.682	20.154	1.132	0.000	0.000	1.132			7.25	0.001099	2.836	1.132
	96	8.0	4.0	0.938	7.50	48.96	126310.18	0.0011	2.90	5.272	302.090	21.090	1.151	0.000	0.000	1.151			7.50	0.001124	2.900	1.151
	96	8.0	4.0	0.969	7.75	49.80	128480.19	0.0011	2.95	5.572	319.272	22.289	1.170	0.000	0.000	1.170			7.75	0.001143	2.949	1.170
	96	8.0	4.0	1.000	8.00	50.27	129684.94	0.0012	2.98	6.283	360.000	25.133	1.189	0.000	0.000	1.189			8.00	0.001154	2.977	1.189
O.L./ full	96	8.0	4.0	1.031	8.25	50.27	129684.94	0.0012	2.98				1.207	0.000	0.000	1.207			8.25	0.001154	2.978	1.207
					8.50	50.27	129684.94	0.0012	2.98				1.225	0.000	0.000	1.225			8.50	0.001154	2.979	1.225
					8.75	50.27	129684.95	0.0012	2.98				1.243	0.000	0.000	1.243			8.75	0.001154	2.980	1.243
					9.00	50.27	129684.95	0.0012	2.98				1.261	0.000	0.000	1.261			9.00	0.001154	2.981	1.261
					9.25	50.27	129684.95	0.0012	2.98				1.278	0.000	0.000	1.278			9.25	0.001154	2.982	1.278
					9.50	50.27	129684.95	0.0012	2.98				1.295	0.000	0.000	1.295			9.50	0.001154	2.983	1.295
					9.75	50.27	129684.95	0.0012	2.98				1.312	0.000	0.000	1.312			9.75	0.001154	2.984	1.312
					10.00	50.27	129684.95	0.0012	2.99				1.329	0.000	0.000	1.329			10.00	0.001154	2.985	1.329
					10.25	50.27	129684.95	0.0012	2.99				1.346	0.000	0.000	1.346			10.25	0.001154	2.986	1.346
					10.50	50.27	129684.95	0.0012	2.99				1.362	0.000	0.000	1.362			10.50	0.001154	2.987	1.362
					10.75	50.27	129684.95	0.0012	2.99				1.378	0.000	0.000	1.378			10.75	0.001154	2.988	1.378
					11.00	50.27	129684.95	0.0012	2.99				1.394	0.000	0.000	1.394			11.00	0.001154	2.989	1.394
					11.25	50.27	129684.95	0.0012	2.99				1.410	0.208	0.000	1.618			11.25	0.001154	2.990	1.618
					11.50	50.27	129684.95	0.0012	2.99				1.425	0.589	0.000	2.014			11.50	0.001154	2.991	2.014
					11.75	50.27	129684.95	0.0012	2.99				1.441	1.081	0.000	2.522			11.75	0.001154	2.992	2.522
					12.00	50.27	129684.95	0.0012	2.99				1.456	1.665	0.000	3.121			12.00	0.001154	2.993	3.121
					12.25	50.27	129684.95	0.0012	2.99				1.471	0.000	10.462	11.932			12.25	0.001154	2.994	11.932
					12.50	50.27	129684.95	0.0012	3.00				1.486	0.000	153.752	155.238			12.50	0.001154	2.995	155.238
					12.75	50.27	129684.95	0.0012	3.00				1.501	0.000	193.750	195.250			12.75	0.001154	2.996	195.250
					13.00	50.27	129684.95	0.0012	3.00				1.515	0.000	236.717	238.232			13.00	0.001154	2.997	238.232

Pond 2

Area and Volume Calcs

Notes	Dia dia (d)	dia dia (d)	radius r	depth ratio Ratio of h	flow depth h	X area A	volume V	X area A	volume V
units / form.	in	ft	ft	h / d	ft	ft²	ft³	acres	acre-ft
					STAGE	AREA	VOLUME	AREA	VOLUME
Pipe I.L.	96	8.0	4.0	0.0000	0.00	0.00	0.00	0.0000	0.00
	96	8.0	4.0	0.0313	0.25	0.47	803.17	0.0000	0.02
	96	8.0	4.0	0.0625	0.50	1.31	2249.84	0.0000	0.05
	96	8.0	4.0	0.0938	0.75	2.38	4092.57	0.0001	0.09
	96	8.0	4.0	0.1250	1.00	3.63	6237.57	0.0001	0.14
	96	8.0	4.0	0.1563	1.25	5.02	8627.62	0.0001	0.20
	96	8.0	4.0	0.1875	1.50	6.52	11221.95	0.0001	0.26
	96	8.0	4.0	0.2188	1.75	8.13	13988.87	0.0002	0.32
	96	8.0	4.0	0.2500	2.00	9.83	16902.37	0.0002	0.39
	96	8.0	4.0	0.2813	2.25	11.59	19940.21	0.0003	0.46
	96	8.0	4.0	0.3125	2.50	13.42	23082.82	0.0003	0.53
	96	8.0	4.0	0.3438	2.75	15.30	26312.51	0.0004	0.60
	96	8.0	4.0	0.3750	3.00	17.22	29613.02	0.0004	0.68
Half Full	96	8.0	4.0	0.4063	3.25	19.17	32969.11	0.0004	0.76
	96	8.0	4.0	0.4375	3.50	21.14	36366.27	0.0005	0.83
	96	8.0	4.0	0.4688	3.75	23.13	39790.56	0.0005	0.91
	96	8.0	4.0	0.5000	4.00	25.13	43228.31	0.0006	0.99
	96	8.0	4.0	0.5313	4.25	27.13	46666.07	0.0006	1.07
	96	8.0	4.0	0.5625	4.50	29.12	50090.36	0.0007	1.15
	96	8.0	4.0	0.5938	4.75	31.10	53487.52	0.0007	1.23
	96	8.0	4.0	0.6250	5.00	33.05	56843.61	0.0008	1.30
	96	8.0	4.0	0.6563	5.25	34.97	60144.12	0.0008	1.38
	96	8.0	4.0	0.6875	5.50	36.85	63373.81	0.0008	1.45
	96	8.0	4.0	0.7188	5.75	38.67	66516.42	0.0009	1.53
	96	8.0	4.0	0.7500	6.00	40.44	69554.26	0.0009	1.60
	96	8.0	4.0	0.7813	6.25	42.13	72467.76	0.0010	1.66
	96	8.0	4.0	0.8125	6.50	43.74	75234.68	0.0010	1.73
	96	8.0	4.0	0.8438	6.75	45.25	77829.01	0.0010	1.79
	96	8.0	4.0	0.8750	7.00	46.64	80219.06	0.0011	1.84
	96	8.0	4.0	0.9063	7.25	47.89	82364.06	0.0011	1.89
	96	8.0	4.0	0.9375	7.50	48.96	84206.79	0.0011	1.93
	96	8.0	4.0	0.9688	7.75	49.80	85653.46	0.0011	1.97
	96	8.0	4.0	1.0000	8.00	50.27	86456.63	0.0012	1.98
O.L./ full	96	8.0	4.0	1.0313	8.25	50.27	86456.63	0.0012	1.99
					8.50	50.27	86456.63	0.0012	1.99
					8.75	50.27	86456.63	0.0012	1.99
					9.00	50.27	86456.63	0.0012	1.99
					9.25	50.27	86456.63	0.0012	1.99
					9.50	50.27	86456.63	0.0012	1.99
					9.75	50.27	86456.63	0.0012	1.99
					10.00	50.27	86456.63	0.0012	1.99
					10.25	50.27	86456.63	0.0012	1.99
					10.50	50.27	86456.63	0.0012	1.99
					10.75	50.27	86456.63	0.0012	2.00
					11.00	50.27	86456.63	0.0012	2.00
					11.25	50.27	86456.63	0.0012	2.00
					11.50	50.27	86456.63	0.0012	2.00
					11.75	50.27	86456.63	0.0012	2.00
					12.00	50.27	86456.63	0.0012	2.00
					12.25	50.27	86456.63	0.0012	2.00
					12.50	50.27	86456.63	0.0012	2.00
					12.75	50.27	86456.63	0.0012	2.00
					13.00	50.27	86456.63	0.0012	2.00

Radian Calc for Pipe Area

Theta (Rad)	Theta (Deg)	Wetted Perim
0.00	0.00	0.00
0.71	40.73	2.84
1.01	57.91	4.04
1.24	71.32	4.98
1.45	82.82	5.78
1.63	93.13	6.50
1.79	102.64	7.17
1.95	111.54	7.79
2.09	120.00	8.38
2.24	128.11	8.94
2.37	135.95	9.49
2.51	143.58	10.02
2.64	151.04	10.54
2.76	158.39	11.06
2.89	165.64	13.57
3.02	172.83	12.07
3.14	180.00	12.57
3.27	187.17	13.07
3.39	194.36	13.57
3.52	201.61	14.08
3.65	208.96	14.59
3.78	216.42	15.11
3.91	224.05	15.64
4.05	231.89	16.19
4.19	240.00	16.76
4.34	248.46	17.35
4.49	257.36	17.97
4.66	266.87	18.63
4.84	277.18	19.35
5.04	288.68	20.15
5.27	302.09	21.09
5.57	319.27	22.29
6.28	360.00	25.13

Discharge Calcs - orifice and weir

orifice flow Q cfs	rect notch Q cfs	top weir Q	TOTAL Q
0	0		0
0.21	0.00	0.00	0.21
0.30	0.00	0.00	0.30
0.36	0.00	0.00	0.36
0.42	0.00	0.00	0.42
0.47	0.00	0.00	0.47
0.51	0.00	0.00	0.51
0.56	0.00	0.00	0.56
0.59	0.00	0.00	0.59
0.63	0.00	0.00	0.63
0.66	0.00	0.00	0.66
0.70	0.00	0.00	0.70
0.73	0.00	0.00	0.73
0.76	0.00	0.00	0.76
0.79	0.00	0.00	0.79
0.81	0.00	0.00	0.81
0.84	0.00	0.00	0.84
0.87	0.00	0.00	0.87
0.89	0.00	0.00	0.89
0.92	0.00	0.00	0.92
0.94	0.00	0.00	0.94
0.96	0.00	0.00	0.96
0.99	0.00	0.00	0.99
1.01	0.00	0.00	1.01
1.03	0.00	0.00	1.03
1.05	0.00	0.00	1.05
1.07	0.00	0.00	1.07
1.09	0.00	0.00	1.09
1.11	0.00	0.00	1.11
1.13	0.00	0.00	1.13
1.15	0.00	0.00	1.15
1.17	0.00	0.00	1.17
1.19	0.00	0.00	1.19
1.21	0.42	0.00	1.62
1.23	1.18	0.00	2.40
1.24	2.16	0.00	3.41
1.26	3.33	0.00	4.59
1.28	4.65	0.00	5.93
1.30	6.12	0.00	7.41
1.31	7.71	0.00	9.02
1.33	9.42	0.00	10.75
1.35	11.24	0.00	12.58
1.36	13.16	0.00	14.52
1.38	15.19	0.00	16.56
1.39	17.30	0.00	18.70
1.41	0.00	490.35	491.76
1.43	0.00	548.01	549.43
1.44	0.00	607.76	609.20
1.46	0.00	669.54	670.99
1.47	0.00	116.96	118.43
1.49	0.00	798.92	800.41
1.50	0.00	866.41	867.91
1.52	0.00	935.71	937.22

Orifice Dia	0.33
Notch H	3
Notch W	1
Weir L	25.13
Weir Heigh	11
Notch Elev	8

COPY TO BAHM

STAGE ft	AREA acres	STORAGE acre-ft	DISCHARGI cfs
0.00	0.00000	0.000	0
0.25	0.00001	0.018	0.210139
0.50	0.00003	0.052	0.297181
0.75	0.00005	0.094	0.363971
1.00	0.00008	0.143	0.420278
1.25	0.00012	0.198	0.469885
1.50	0.00015	0.258	0.514733
1.75	0.00019	0.321	0.555975
2.00	0.00023	0.388	0.594363
2.25	0.0003	0.458	0.630417
2.50	0.0003	0.530	0.664518
2.75	0.0004	0.604	0.696952
3.00	0.0004	0.680	0.727942
3.25	0.0004	0.757	0.757667
3.50	0.0005	0.835	0.786268
3.75	0.0005	0.913	0.813864
4.00	0.0006	0.992	0.840556
4.25	0.0006	1.071	0.866425
4.50	0.0007	1.150	0.891544
4.75	0.0007	1.228	0.915974
5.00	0.0008	1.305	0.93977
5.25	0.0008	1.381	0.962977
5.50	0.0008	1.455	0.985639
5.75	0.0009	1.527	1.007791
6.00	0.0009	1.597	1.029466
6.25	0.0010	1.664	1.050694
6.50	0.0010	1.727	1.071502
6.75	0.0010	1.787	1.091914
7.00	0.001071	1.842	1.11195
7.25	0.001099	1.891	1.131633
7.50	0.001124	1.933	1.150978
7.75	0.001143	1.966	1.170004
8.00	0.001154	1.985	1.188725
8.25	0.001154	1.986	1.623406
8.50	0.001154	1.987	2.402643
8.75	0.001154	1.988	3.406097
9.00	0.001154	1.989	4.590833
9.25	0.001154	1.990	5.932041
9.50	0.001154	1.991	7.412984
9.75	0.001154	1.992	9.021375
10.00	0.001154	1.993	10.7477
10.25	0.001154	1.994	12.5843
10.50	0.001154	1.995	14.52484
10.75	0.001154	1.996	16.56397
11.00	0.001154	1.997	18.69709
11.25	0.001154	1.998	491.763
11.50	0.001154	1.999	549.4323
11.75	0.001154	2.000	609.1991
12.00	0.001154	2.001	670.9921
12.25	0.001154	2.002	118.4341
12.50	0.001154	2.003	800.4051
12.75	0.001154	2.004	867.9128
13.00	0.001154	2.005	937.2207

ATTACHMENT 3

BAHM 2023 Report

BAHM2013

PROJECT REPORT

General Model Information

Project Name:	Project_Bay_01.12.24
Site Name:	
Site Address:	
City:	
Report Date:	1/12/2024
Gage:	San Francisco
Data Start:	1959/10/01
Data End:	1997/09/30
Timestep:	Hourly
Precip Scale:	1.286
Version Date:	2021/05/25

POC Thresholds

Low Flow Threshold for POC1:	10 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

Landuse Basin Data
Predeveloped Land Use

Drainage 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Mod(5-10%)	5.5
Pervious Total	5.5
Impervious Land Use	acre
Impervious Total	0
Basin Total	5.5

Element Flows To:

Surface	Interflow	Groundwater

Drainage 2-4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Very(>20%)	59
Pervious Total	59
Impervious Land Use	acre
Impervious Total	0
Basin Total	59

Element Flows To:

Surface	Interflow	Groundwater

Drainage 5-10

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Very(>20%)	54.2
Pervious Total	54.2
Impervious Land Use	acre
Impervious Total	0
Basin Total	54.2

Element Flows To:

Surface	Interflow	Groundwater

DMA 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A,Grass,Mod(5-10%)	17.9
Pervious Total	17.9
Impervious Land Use	acre
Impervious Total	0
Basin Total	17.9

Element Flows To:

Surface	Interflow	Groundwater

DMA 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Mod(5-10%)	17.9
Pervious Total	17.9
Impervious Land Use	acre
Impervious Total	0
Basin Total	17.9

Element Flows To:

Surface	Interflow	Groundwater

DMA 3-6

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Mod(5-10%)	5.4
Pervious Total	5.4
Impervious Land Use	acre
Impervious Total	0
Basin Total	5.4

Element Flows To:

Surface	Interflow	Groundwater

DMA 7

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Mod(5-10%)	3.1
Pervious Total	3.1
Impervious Land Use	acre
Impervious Total	0
Basin Total	3.1

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Drainage 1

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Ste(10-20)	5.5
Pervious Total	5.5
Impervious Land Use	acre
Impervious Total	0
Basin Total	5.5

Element Flows To:

Surface	Interflow	Groundwater

DMA 3-6

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
C D,Urban,Flat(0-5%)	1.2
Pervious Total	1.2

Impervious Land Use	acre
Roads,Flat(0-5%)	4.2
Impervious Total	4.2
Basin Total	5.4

Element Flows To:

Surface	Interflow	Groundwater

DMA 7

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Mod(5-10%)	3.1
Pervious Total	3.1
Impervious Land Use	acre
Impervious Total	0
Basin Total	3.1

Element Flows To:

Surface	Interflow	Groundwater

Drainage 2-4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Ste(10-20)	59
Pervious Total	59
Impervious Land Use	acre
Impervious Total	0
Basin Total	59

Element Flows To:

Surface	Interflow	Groundwater
SSD Table 1	SSD Table 1	

Drainage 5-10

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C D,Grass,Ste(10-20)	54.2
Pervious Total	54.2
Impervious Land Use	acre
Impervious Total	0
Basin Total	54.2

Element Flows To:

Surface	Interflow	Groundwater
SSD Table 2	SSD Table 2	

DMA 2

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C D,Urban,Flat(0-5%)	2.6
Pervious Total	2.6

Impervious Land Use	acre
Roof Area	15.3
Impervious Total	15.3
Basin Total	17.9

Element Flows To:

Surface	Interflow	Groundwater
Pond 3	Pond 3	

DMA 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C D,Urban,Flat(0-5%)	2.6
Pervious Total	2.6

Impervious Land Use	acre
Roof Area	15.3
Impervious Total	15.3
Basin Total	17.9

Element Flows To:

Surface	Interflow	Groundwater
Pond 4	Pond 4	

Routing Elements
Predeveloped Routing

Mitigated Routing

Pond 3

Dimensions
Depth: 4 ft.
Tank Type: Circular
Diameter: 4 ft.
Length: 1000 ft.
Discharge Structure
Riser Height: 3 ft.
Riser Diameter: 60 in.
Notch Type: Rectangular
Notch Width: 1.000 ft.
Notch Height: 1.000 ft.
Orifice 1 Diameter: 4 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

Tank Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000000	0.000000	0.000	0.000
0.0444	0.019251	0.000572	0.091	0.000
0.0889	0.027072	0.001612	0.129	0.000
0.1333	0.032967	0.002951	0.158	0.000
0.1778	0.037848	0.004527	0.183	0.000
0.2222	0.042068	0.006305	0.204	0.000
0.2667	0.045812	0.008259	0.224	0.000
0.3111	0.049187	0.010372	0.242	0.000
0.3556	0.052265	0.012627	0.258	0.000
0.4000	0.055096	0.015014	0.274	0.000
0.4444	0.057717	0.017522	0.289	0.000
0.4889	0.060155	0.020142	0.303	0.000
0.5333	0.062431	0.022866	0.317	0.000
0.5778	0.064562	0.025689	0.330	0.000
0.6222	0.066563	0.028603	0.342	0.000
0.6667	0.068444	0.031604	0.354	0.000
0.7111	0.070216	0.034685	0.366	0.000
0.7556	0.071886	0.037844	0.377	0.000
0.8000	0.073462	0.041074	0.388	0.000
0.8444	0.074949	0.044372	0.399	0.000
0.8889	0.076353	0.047735	0.409	0.000
0.9333	0.077677	0.051158	0.419	0.000
0.9778	0.078927	0.054638	0.429	0.000
1.0222	0.080105	0.058173	0.439	0.000
1.0667	0.081215	0.061758	0.448	0.000
1.1111	0.082260	0.065391	0.457	0.000
1.1556	0.083241	0.069069	0.466	0.000
1.2000	0.084161	0.072789	0.475	0.000
1.2444	0.085023	0.076549	0.484	0.000
1.2889	0.085827	0.080346	0.492	0.000
1.3333	0.086576	0.084177	0.501	0.000
1.3778	0.087270	0.088041	0.509	0.000
1.4222	0.087912	0.091934	0.517	0.000
1.4667	0.088502	0.095854	0.525	0.000
1.5111	0.089042	0.099800	0.533	0.000

1.5556	0.089531	0.103768	0.541	0.000
1.6000	0.089972	0.107758	0.549	0.000
1.6444	0.090365	0.111765	0.556	0.000
1.6889	0.090710	0.115789	0.564	0.000
1.7333	0.091007	0.119828	0.571	0.000
1.7778	0.091259	0.123878	0.578	0.000
1.8222	0.091464	0.127939	0.586	0.000
1.8667	0.091623	0.132008	0.593	0.000
1.9111	0.091737	0.136082	0.600	0.000
1.9556	0.091805	0.140161	0.607	0.000
2.0000	0.091827	0.144242	0.614	0.000
2.0444	0.091805	0.148323	0.652	0.000
2.0889	0.091737	0.152402	0.715	0.000
2.1333	0.091623	0.156477	0.796	0.000
2.1778	0.091464	0.160545	0.890	0.000
2.2222	0.091259	0.164606	0.996	0.000
2.2667	0.091007	0.168657	1.112	0.000
2.3111	0.090710	0.172695	1.237	0.000
2.3556	0.090365	0.176719	1.372	0.000
2.4000	0.089972	0.180727	1.515	0.000
2.4444	0.089531	0.184716	1.665	0.000
2.4889	0.089042	0.188684	1.823	0.000
2.5333	0.088502	0.192630	1.988	0.000
2.5778	0.087912	0.196550	2.159	0.000
2.6222	0.087270	0.200444	2.337	0.000
2.6667	0.086576	0.204307	2.521	0.000
2.7111	0.085827	0.208138	2.711	0.000
2.7556	0.085023	0.211935	2.907	0.000
2.8000	0.084161	0.215695	3.109	0.000
2.8444	0.083241	0.219415	3.316	0.000
2.8889	0.082260	0.223093	3.528	0.000
2.9333	0.081215	0.226726	3.746	0.000
2.9778	0.080105	0.230311	3.968	0.000
3.0222	0.078927	0.233846	4.260	0.000
3.0667	0.077677	0.237326	5.003	0.000
3.1111	0.076353	0.240749	6.060	0.000
3.1556	0.074949	0.244112	7.354	0.000
3.2000	0.073462	0.247410	8.848	0.000
3.2444	0.071886	0.250641	10.51	0.000
3.2889	0.070216	0.253799	12.34	0.000
3.3333	0.068444	0.256880	14.31	0.000
3.3778	0.066563	0.259881	16.41	0.000
3.4222	0.064562	0.262795	18.63	0.000
3.4667	0.062431	0.265618	20.96	0.000
3.5111	0.060155	0.268343	23.40	0.000
3.5556	0.057717	0.270963	25.94	0.000
3.6000	0.055096	0.273470	28.56	0.000
3.6444	0.052265	0.275857	31.27	0.000
3.6889	0.049187	0.278112	34.05	0.000
3.7333	0.045812	0.280225	36.89	0.000
3.7778	0.042068	0.282179	39.80	0.000
3.8222	0.037848	0.283957	42.75	0.000
3.8667	0.032967	0.285534	45.75	0.000
3.9111	0.027072	0.286873	48.79	0.000
3.9556	0.019251	0.287912	51.85	0.000
4.0000	0.000000	0.288484	54.93	0.000
4.0444	0.000000	0.000000	58.03	0.000

Pond 4

Dimensions

Depth:	4 ft.
Tank Type:	Circular
Diameter:	4 ft.
Length:	1100 ft.

Discharge Structure

Riser Height:	3 ft.
Riser Diameter:	60 in.
Notch Type:	Rectangular
Notch Width:	1.000 ft.
Notch Height:	1.000 ft.
Orifice 1 Diameter:	4 in. Elevation:0 ft.

Element Flows To:

Outlet 1 Outlet 2

Tank Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000000	0.000000	0.000	0.000
0.0444	0.021176	0.000629	0.091	0.000
0.0889	0.029779	0.001773	0.129	0.000
0.1333	0.036264	0.003246	0.158	0.000
0.1778	0.041632	0.004980	0.183	0.000
0.2222	0.046275	0.006936	0.204	0.000
0.2667	0.050393	0.009085	0.224	0.000
0.3111	0.054105	0.011409	0.242	0.000
0.3556	0.057492	0.013890	0.258	0.000
0.4000	0.060606	0.016515	0.274	0.000
0.4444	0.063489	0.019274	0.289	0.000
0.4889	0.066170	0.022156	0.303	0.000
0.5333	0.068674	0.025153	0.317	0.000
0.5778	0.071018	0.028258	0.330	0.000
0.6222	0.073219	0.031463	0.342	0.000
0.6667	0.075288	0.034764	0.354	0.000
0.7111	0.077237	0.038154	0.366	0.000
0.7556	0.079075	0.041628	0.377	0.000
0.8000	0.080808	0.045181	0.388	0.000
0.8444	0.082444	0.048810	0.399	0.000
0.8889	0.083988	0.052508	0.409	0.000
0.9333	0.085445	0.056274	0.419	0.000
0.9778	0.086820	0.060102	0.429	0.000
1.0222	0.088116	0.063990	0.439	0.000
1.0667	0.089337	0.067934	0.448	0.000
1.1111	0.090485	0.071930	0.457	0.000
1.1556	0.091565	0.075976	0.466	0.000
1.2000	0.092577	0.080068	0.475	0.000
1.2444	0.093525	0.084204	0.484	0.000
1.2889	0.094410	0.088380	0.492	0.000
1.3333	0.095233	0.092595	0.501	0.000
1.3778	0.095997	0.096845	0.509	0.000
1.4222	0.096703	0.101127	0.517	0.000
1.4667	0.097352	0.105440	0.525	0.000
1.5111	0.097946	0.109780	0.533	0.000
1.5556	0.098484	0.114145	0.541	0.000
1.6000	0.098969	0.118533	0.549	0.000

1.6444	0.099401	0.122942	0.556	0.000
1.6889	0.099781	0.127368	0.564	0.000
1.7333	0.100108	0.131810	0.571	0.000
1.7778	0.100385	0.136266	0.578	0.000
1.8222	0.100610	0.140733	0.586	0.000
1.8667	0.100785	0.145208	0.593	0.000
1.9111	0.100910	0.149691	0.600	0.000
1.9556	0.100985	0.154177	0.607	0.000
2.0000	0.101010	0.158666	0.614	0.000
2.0444	0.100985	0.163155	0.652	0.000
2.0889	0.100910	0.167642	0.715	0.000
2.1333	0.100785	0.172124	0.796	0.000
2.1778	0.100610	0.176600	0.890	0.000
2.2222	0.100385	0.181067	0.996	0.000
2.2667	0.100108	0.185522	1.112	0.000
2.3111	0.099781	0.189964	1.237	0.000
2.3556	0.099401	0.194391	1.372	0.000
2.4000	0.098969	0.198799	1.515	0.000
2.4444	0.098484	0.203187	1.665	0.000
2.4889	0.097946	0.207553	1.823	0.000
2.5333	0.097352	0.211893	1.988	0.000
2.5778	0.096703	0.216205	2.159	0.000
2.6222	0.095997	0.220488	2.337	0.000
2.6667	0.095233	0.224738	2.521	0.000
2.7111	0.094410	0.228952	2.711	0.000
2.7556	0.093525	0.233129	2.907	0.000
2.8000	0.092577	0.237265	3.109	0.000
2.8444	0.091565	0.241357	3.316	0.000
2.8889	0.090485	0.245403	3.528	0.000
2.9333	0.089337	0.249399	3.746	0.000
2.9778	0.088116	0.253343	3.968	0.000
3.0222	0.086820	0.257230	4.260	0.000
3.0667	0.085445	0.261059	5.003	0.000
3.1111	0.083988	0.264824	6.060	0.000
3.1556	0.082444	0.268523	7.354	0.000
3.2000	0.080808	0.272151	8.848	0.000
3.2444	0.079075	0.275705	10.51	0.000
3.2889	0.077237	0.279179	12.34	0.000
3.3333	0.075288	0.282568	14.31	0.000
3.3778	0.073219	0.285869	16.41	0.000
3.4222	0.071018	0.289075	18.63	0.000
3.4667	0.068674	0.292180	20.96	0.000
3.5111	0.066170	0.295177	23.40	0.000
3.5556	0.063489	0.298059	25.94	0.000
3.6000	0.060606	0.300817	28.56	0.000
3.6444	0.057492	0.303443	31.27	0.000
3.6889	0.054105	0.305924	34.05	0.000
3.7333	0.050393	0.308247	36.89	0.000
3.7778	0.046275	0.310397	39.80	0.000
3.8222	0.041632	0.312353	42.75	0.000
3.8667	0.036264	0.314087	45.75	0.000
3.9111	0.029779	0.315560	48.79	0.000
3.9556	0.021176	0.316704	51.85	0.000
4.0000	0.000000	0.317333	54.93	0.000
4.0444	0.000000	0.000000	58.03	0.000

SSD Table 1

Depth: 13 ft.
Element Flows To:
Outlet 1 Outlet 2

SSD Table Hydraulic Table

Stage (feet)	Area (ac.)	Volume (ac-ft.)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.250	0.000	0.028	0.210	0.000	0.000	0.000	0.000
0.500	0.000	0.077	0.297	0.000	0.000	0.000	0.000
0.750	0.000	0.141	0.364	0.000	0.000	0.000	0.000
1.000	0.000	0.215	0.420	0.000	0.000	0.000	0.000
1.250	0.000	0.297	0.470	0.000	0.000	0.000	0.000
1.500	0.000	0.386	0.515	0.000	0.000	0.000	0.000
1.750	0.000	0.482	0.556	0.000	0.000	0.000	0.000
2.000	0.000	0.582	0.594	0.000	0.000	0.000	0.000
2.250	0.000	0.687	0.630	0.000	0.000	0.000	0.000
2.500	0.000	0.795	0.665	0.000	0.000	0.000	0.000
2.750	0.000	0.906	0.697	0.000	0.000	0.000	0.000
3.000	0.000	1.020	0.728	0.000	0.000	0.000	0.000
3.250	0.000	1.135	0.758	0.000	0.000	0.000	0.000
3.500	0.001	1.252	0.786	0.000	0.000	0.000	0.000
3.750	0.001	1.370	0.814	0.000	0.000	0.000	0.000
4.000	0.001	1.489	0.841	0.000	0.000	0.000	0.000
4.250	0.001	1.607	0.866	0.000	0.000	0.000	0.000
4.500	0.001	1.725	0.892	0.000	0.000	0.000	0.000
4.750	0.001	1.842	0.916	0.000	0.000	0.000	0.000
5.000	0.001	1.957	0.940	0.000	0.000	0.000	0.000
5.250	0.001	2.071	0.963	0.000	0.000	0.000	0.000
5.500	0.001	2.182	0.986	0.000	0.000	0.000	0.000
5.750	0.001	2.291	1.008	0.000	0.000	0.000	0.000
6.000	0.001	2.395	1.029	0.000	0.000	0.000	0.000
6.250	0.001	2.495	1.051	0.000	0.000	0.000	0.000
6.500	0.001	2.591	1.072	0.000	0.000	0.000	0.000
6.750	0.001	2.680	1.092	0.000	0.000	0.000	0.000
7.000	0.001	2.762	1.112	0.000	0.000	0.000	0.000
7.250	0.001	2.836	1.132	0.000	0.000	0.000	0.000
7.500	0.001	2.900	1.151	0.000	0.000	0.000	0.000
7.750	0.001	2.949	1.170	0.000	0.000	0.000	0.000
8.000	0.001	2.977	1.189	0.000	0.000	0.000	0.000
8.250	0.001	2.978	1.207	0.000	0.000	0.000	0.000
8.500	0.001	2.979	1.225	0.000	0.000	0.000	0.000
8.750	0.001	2.980	1.243	0.000	0.000	0.000	0.000
9.000	0.001	2.981	1.261	0.000	0.000	0.000	0.000
9.250	0.001	2.982	1.278	0.000	0.000	0.000	0.000
9.500	0.001	2.983	1.295	0.000	0.000	0.000	0.000
9.750	0.001	2.984	1.312	0.000	0.000	0.000	0.000
10.000	0.001	2.985	1.329	0.000	0.000	0.000	0.000
10.25	0.001	2.986	1.346	0.000	0.000	0.000	0.000
10.50	0.001	2.987	1.362	0.000	0.000	0.000	0.000
10.75	0.001	2.988	1.378	0.000	0.000	0.000	0.000
11.00	0.001	2.989	1.394	0.000	0.000	0.000	0.000
11.25	0.001	2.990	1.618	0.000	0.000	0.000	0.000
11.50	0.001	2.991	2.014	0.000	0.000	0.000	0.000

11.75	0.001	2.992	2.522	0.000	0.000	0.000	0.000
12.00	0.001	2.993	3.121	0.000	0.000	0.000	0.000
12.25	0.001	2.994	11.93	0.000	0.000	0.000	0.000
12.50	0.001	2.995	155.2	0.000	0.000	0.000	0.000
12.75	0.001	2.996	195.3	0.000	0.000	0.000	0.000
13.00	0.001	2.997	238.2	0.000	0.000	0.000	0.000

SSD Table 2

Depth: 13 ft.
Element Flows To:
Outlet 1 Outlet 2

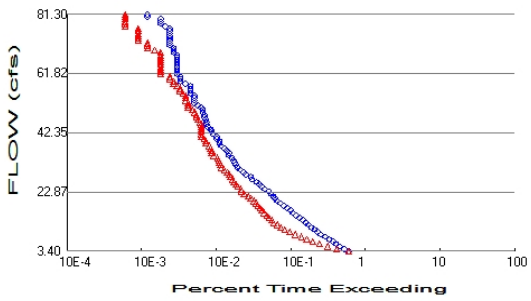
SSD Table Hydraulic Table

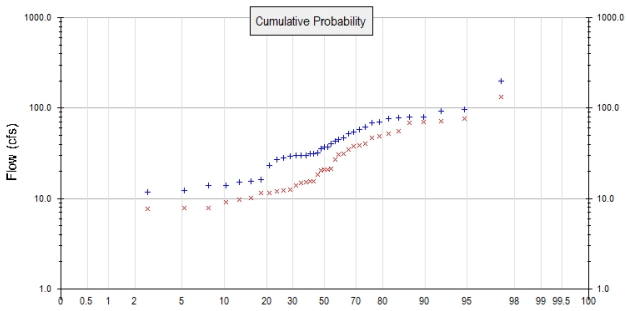
Stage (feet)	Area (ac.)	Volume (ac-ft.)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.250	0.000	0.018	0.210	0.000	0.000	0.000	0.000
0.500	0.000	0.052	0.297	0.000	0.000	0.000	0.000
0.750	0.000	0.094	0.364	0.000	0.000	0.000	0.000
1.000	0.000	0.143	0.420	0.000	0.000	0.000	0.000
1.250	0.000	0.198	0.470	0.000	0.000	0.000	0.000
1.500	0.000	0.258	0.515	0.000	0.000	0.000	0.000
1.750	0.000	0.321	0.556	0.000	0.000	0.000	0.000
2.000	0.000	0.388	0.594	0.000	0.000	0.000	0.000
2.250	0.000	0.458	0.630	0.000	0.000	0.000	0.000
2.500	0.000	0.530	0.665	0.000	0.000	0.000	0.000
2.750	0.000	0.604	0.697	0.000	0.000	0.000	0.000
3.000	0.000	0.680	0.728	0.000	0.000	0.000	0.000
3.250	0.000	0.757	0.758	0.000	0.000	0.000	0.000
3.500	0.001	0.835	0.786	0.000	0.000	0.000	0.000
3.750	0.001	0.913	0.814	0.000	0.000	0.000	0.000
4.000	0.001	0.992	0.841	0.000	0.000	0.000	0.000
4.250	0.001	1.071	0.866	0.000	0.000	0.000	0.000
4.500	0.001	1.150	0.892	0.000	0.000	0.000	0.000
4.750	0.001	1.228	0.916	0.000	0.000	0.000	0.000
5.000	0.001	1.305	0.940	0.000	0.000	0.000	0.000
5.250	0.001	1.381	0.963	0.000	0.000	0.000	0.000
5.500	0.001	1.455	0.986	0.000	0.000	0.000	0.000
5.750	0.001	1.527	1.008	0.000	0.000	0.000	0.000
6.000	0.001	1.597	1.029	0.000	0.000	0.000	0.000
6.250	0.001	1.664	1.051	0.000	0.000	0.000	0.000
6.500	0.001	1.727	1.072	0.000	0.000	0.000	0.000
6.750	0.001	1.787	1.092	0.000	0.000	0.000	0.000
7.000	0.001	1.842	1.112	0.000	0.000	0.000	0.000
7.250	0.001	1.891	1.132	0.000	0.000	0.000	0.000
7.500	0.001	1.933	1.151	0.000	0.000	0.000	0.000
7.750	0.001	1.966	1.170	0.000	0.000	0.000	0.000
8.000	0.001	1.985	1.189	0.000	0.000	0.000	0.000
8.250	0.001	1.986	1.623	0.000	0.000	0.000	0.000
8.500	0.001	1.987	2.403	0.000	0.000	0.000	0.000
8.750	0.001	1.988	3.406	0.000	0.000	0.000	0.000
9.000	0.001	1.989	4.591	0.000	0.000	0.000	0.000
9.250	0.001	1.990	5.932	0.000	0.000	0.000	0.000
9.500	0.001	1.991	7.413	0.000	0.000	0.000	0.000
9.750	0.001	1.992	9.021	0.000	0.000	0.000	0.000
10.000	0.001	1.993	10.75	0.000	0.000	0.000	0.000
10.25	0.001	1.994	12.58	0.000	0.000	0.000	0.000
10.50	0.001	1.995	14.52	0.000	0.000	0.000	0.000
10.75	0.001	1.996	16.56	0.000	0.000	0.000	0.000
11.00	0.001	1.997	18.70	0.000	0.000	0.000	0.000
11.25	0.001	1.998	491.8	0.000	0.000	0.000	0.000
11.50	0.001	1.999	549.4	0.000	0.000	0.000	0.000

11.75	0.001	2.000	609.2	0.000	0.000	0.000	0.000
12.00	0.001	2.001	671.0	0.000	0.000	0.000	0.000
12.25	0.001	2.002	118.4	0.000	0.000	0.000	0.000
12.50	0.001	2.003	800.4	0.000	0.000	0.000	0.000
12.75	0.001	2.004	867.9	0.000	0.000	0.000	0.000
13.00	0.001	2.005	937.2	0.000	0.000	0.000	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 163
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 128.2
Total Impervious Area: 34.8

Flow Frequency Method: Weibull

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	33.960167
5 year	72.0642
10 year	81.296223
25 year	125.80259

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	19.325018
5 year	49.741615
10 year	70.330469
25 year	92.742179

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1960	29.214	11.931
1961	15.665	10.068
1962	54.779	26.843
1963	30.057	15.392
1964	23.464	12.644
1965	31.179	9.049
1966	26.722	11.548
1967	44.717	40.240
1968	47.224	20.782
1969	71.018	46.557
1970	80.270	70.190
1971	36.834	20.304
1972	15.334	7.859
1973	58.045	55.683

1974	31.021	15.152
1975	30.241	13.913
1976	0.027	6.654
1977	13.979	9.649
1978	28.121	21.026
1979	29.769	11.633
1980	35.876	15.397
1981	13.909	37.578
1982	68.452	68.751
1983	197.395	131.921
1984	43.464	38.600
1985	51.963	18.395
1986	97.677	77.351
1987	37.416	30.842
1988	80.410	31.549
1989	40.106	21.183
1990	32.141	14.921
1991	11.791	7.663
1992	91.926	49.131
1993	61.551	52.533
1994	16.192	12.272
1995	76.848	72.020
1996	12.217	7.799
1997	77.997	34.616

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	197.3950	131.9210
2	97.6770	77.3505
3	91.9261	72.0197
4	80.4104	70.1897
5	80.2700	68.7509
6	77.9969	55.6832
7	76.8482	52.5330
8	71.0177	49.1310
9	68.4519	46.5572
10	61.5508	40.2398
11	58.0448	38.6001
12	54.7793	37.5781
13	51.9633	34.6163
14	47.2243	31.5486
15	44.7171	30.8422
16	43.4640	26.8431
17	40.1061	21.1833
18	37.4157	21.0264
19	36.8344	20.7819
20	35.8755	20.3043
21	32.1406	18.3947
22	31.1786	15.3966
23	31.0214	15.3917
24	30.2411	15.1518
25	30.0565	14.9212
26	29.7694	13.9132
27	29.2137	12.6444
28	28.1208	12.2724
29	26.7222	11.9310
30	23.4639	11.6326

31	16.1917	11.5484
32	15.6654	10.0682
33	15.3343	9.6487
34	13.9792	9.0492
35	13.9094	7.8586
36	12.2172	7.7986
37	11.7908	7.6629
38	0.0266	6.6540

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
3.3960	1983	1975	99	Pass
4.1829	1729	1379	79	Pass
4.9698	1530	1038	67	Pass
5.7566	1348	813	60	Pass
6.5435	1222	656	53	Pass
7.3304	1094	546	49	Pass
8.1172	956	465	48	Pass
8.9041	845	381	45	Pass
9.6910	759	320	42	Pass
10.4779	693	277	39	Pass
11.2647	630	243	38	Pass
12.0516	573	219	38	Pass
12.8385	527	196	37	Pass
13.6253	480	185	38	Pass
14.4122	435	171	39	Pass
15.1991	397	159	40	Pass
15.9859	359	147	40	Pass
16.7728	328	137	41	Pass
17.5597	302	129	42	Pass
18.3466	268	121	45	Pass
19.1334	245	114	46	Pass
19.9203	221	107	48	Pass
20.7072	202	97	48	Pass
21.4940	193	90	46	Pass
22.2809	181	79	43	Pass
23.0678	168	73	43	Pass
23.8547	151	72	47	Pass
24.6415	136	65	47	Pass
25.4284	127	61	48	Pass
26.2153	116	57	49	Pass
27.0021	101	55	54	Pass
27.7890	97	52	53	Pass
28.5759	83	50	60	Pass
29.3628	77	47	61	Pass
30.1496	70	43	61	Pass
30.9365	64	39	60	Pass
31.7234	61	38	62	Pass
32.5102	59	37	62	Pass
33.2971	57	36	63	Pass
34.0840	54	35	64	Pass
34.8708	50	31	62	Pass
35.6577	49	29	59	Pass
36.4446	46	29	63	Pass
37.2315	43	28	65	Pass
38.0183	39	27	69	Pass
38.8052	37	24	64	Pass
39.5921	37	24	64	Pass
40.3789	34	23	67	Pass
41.1658	34	21	61	Pass
41.9527	30	21	70	Pass
42.7396	29	21	72	Pass
43.5264	28	21	75	Pass
44.3133	26	21	80	Pass

45.1002	25	21	84	Pass
45.8870	25	20	80	Pass
46.6739	24	19	79	Pass
47.4608	23	18	78	Pass
48.2477	23	18	78	Pass
49.0345	22	17	77	Pass
49.8214	22	16	72	Pass
50.6083	21	14	66	Pass
51.3951	19	14	73	Pass
52.1820	17	14	82	Pass
52.9689	17	13	76	Pass
53.7557	17	13	76	Pass
54.5426	17	13	76	Pass
55.3295	15	12	80	Pass
56.1164	15	11	73	Pass
56.9032	15	11	73	Pass
57.6901	15	10	66	Pass
58.4770	13	9	69	Pass
59.2638	11	9	81	Pass
60.0507	11	8	72	Pass
60.8376	11	8	72	Pass
61.6245	10	6	60	Pass
62.4113	10	6	60	Pass
63.1982	10	6	60	Pass
63.9851	10	6	60	Pass
64.7719	10	6	60	Pass
65.5588	10	6	60	Pass
66.3457	10	6	60	Pass
67.1325	10	6	60	Pass
67.9194	10	6	60	Pass
68.7063	9	6	66	Pass
69.4932	9	5	55	Pass
70.2800	9	4	44	Pass
71.0669	8	4	50	Pass
71.8538	8	4	50	Pass
72.6406	8	3	37	Pass
73.4275	8	3	37	Pass
74.2144	8	3	37	Pass
75.0013	8	3	37	Pass
75.7881	8	3	37	Pass
76.5750	8	3	37	Pass
77.3619	7	2	28	Pass
78.1487	6	2	33	Pass
78.9356	6	2	33	Pass
79.7225	6	2	33	Pass
80.5094	4	2	50	Pass
81.2962	4	2	50	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

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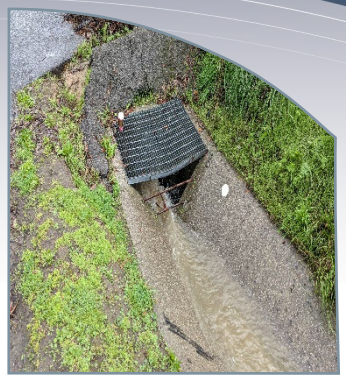
DRAFT GUADALUPE QUARRY DRAINAGE REPORT

May 2023

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1 Introduction

The Guadalupe Quarry Drainage Report reviews the existing drainage conditions and discusses modifications done for the proposed development at the project site. This report focuses on the hydrology and hydraulic conditions at the quarry and adjacent drainage system within the City of Brisbane (City). The quarry site is located in the San Mateo County jurisdiction, outside of the west side of the City limits. The quarry is bordered by commercial areas along South Hill Drive to the north and the San Bruno Mountain State Park to the south, east, and west. The quarry is approximately 80 acres where operations take place while the rest of the area is open space.

The quarry site will be converted to a new commercial building and parking lot. The new development will consist of paving the area that will reduce the pervious area and change runoff conditions. The development will convey runoff along the access road via underground pipes connect to the existing City of Brisbane storm drain network along South Hill Drive. As part of the proposed project, a basin is added to collect runoff and discharge into the Guadalupe Valley Drainage System. The location of the quarry site and the adjacent drainage system are shown in Figure 1-1.

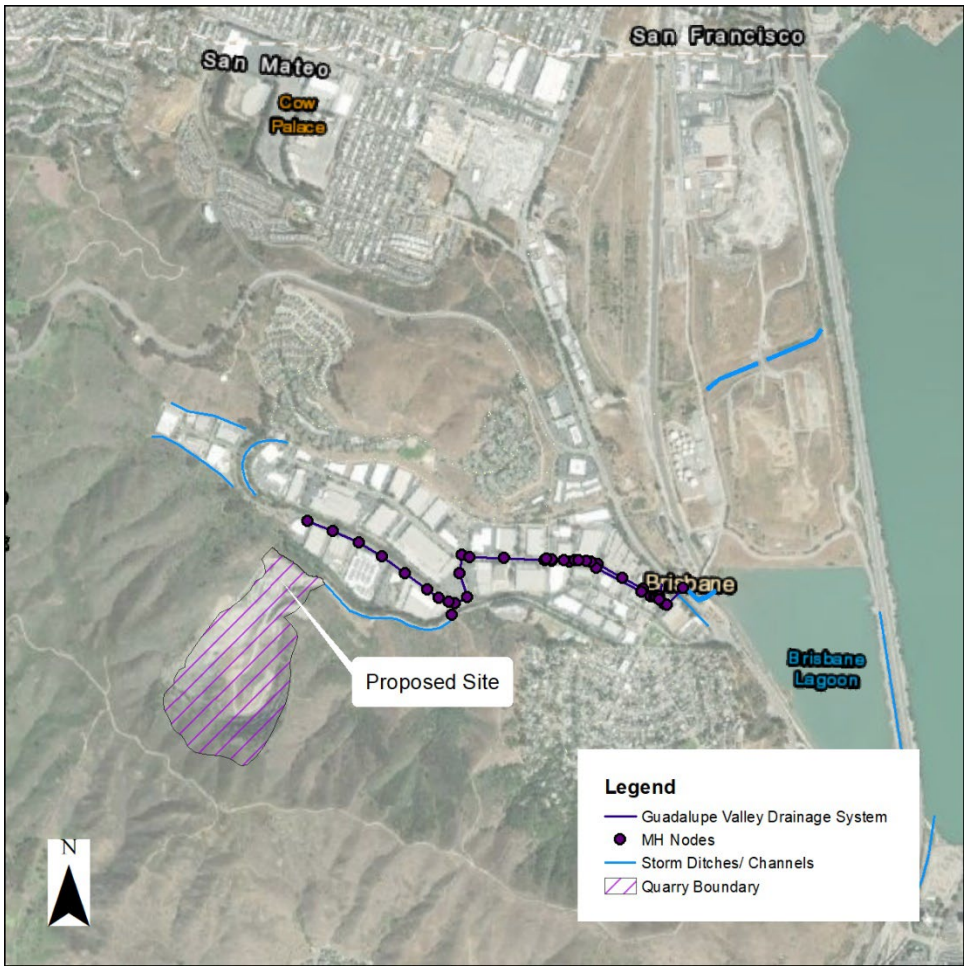


Figure 1-1: Quarry Location

2 Effective Studies

A review of the City of Brisbane's Storm Drain Master Plan (2003, RBF) was conducted in regard to the quarry site and the adjacent drainage systems. The review focuses on the existing hydrologic and hydraulic characteristics of the system and notes system deficiencies. The methodologies and modeling results from the SDMP were compared to regional standards and differences were noted. In general, the storm runoff from the quarry and adjacent lands appears high.

2.1 Rainfall

The City SDMP states that methodologies from the Santa Clara County Drainage Manual (SCCDM) were used to calculate the design rainfall depths. In the SDMP, the mean annual precipitation (MAP) of 21 inches is used throughout most of Brisbane. This value was applied to calculate the 24-hour 10-year rainfall to be 3.98 inches. This value was compared to NOAA Atlas 14 showing a precipitation depth of 3.9 inches for the same event, which is very close. But the upper watersheds along the southerly hills do have a higher MAP (mean annual precipitation) than the 21-inches in Exhibit 3 of the City SDMP.

2.2 Land Use

The quarry area is within the San Bruno Mountain and serves as an active mining area. The site is currently outside city limits and is planned to be annexed; limited access is available at Quarry Road. Land use at the quarry is labeled as Quarry and the surrounding area is called as Open Space in the SDMP. Land uses were compared to the latest county land use data available (county website). The land uses from the SDMP are consistent with City and county data and appear to match aerial imagery. See Figure 2-1 for City land uses.

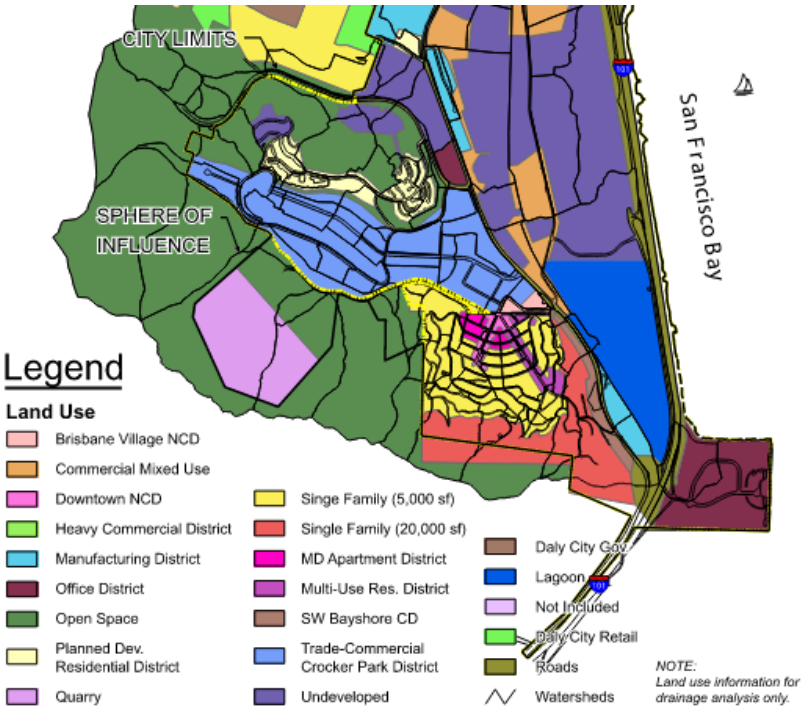


Figure 2-1: Site Land Uses

Land uses are used to identify the impervious surfaces at the site. The quarry watershed is approximately 145.2 acres with 45% slopes and a SDMP time-of-concentration (Tc) of 10.4 minutes. That is very quick and suspect. Schaaf & Wheeler came up with the same drainage area but a lag of 17.4 minutes (Tc 29 minutes). Our site visits validate the longer Tc.

2.3 Losses

Hydrologic losses follow methodologies in the Urban Hydrology for Small Watersheds TR-55, which is described in the SCCDM. The Curve Number (CN) considers potential losses for a given soil and land use. The SDMP has identified the quarry having a Hydrologic Soils Group of D (poorly draining), Curve Number of 91 assuming Antecedent Moisture Condition (AMC) 2, and an impervious area of 5-percent. Yet the SCCDM states that the 10-year storm event uses an AMC 2.5. So, the Curve Number of 91 in AMC 2 needs to be corrected by following steps discussed in Section 4.6.4 in the SCCDM.

2.4 Peak Flows

The southern watershed flows are captured via the Guadalupe Valley Drainage system and drains to the lagoon, refer to Figure 1-1. The watershed tributary to the Brisbane Lagoon is approximately 2,150 acres. The SDMP states potential existing system deficiencies include excessive overland flows, material failure and maintenance issues. A hydraulic model of the City's storm drain network was created to identify existing deficiencies and propose improvements to correct the issues. The SDMP lists a summary of peak flows throughout the drainage system. The quarry has a 10-year peak runoff of 258cfs. While the conduit entering the City system at South Hill Drive has a 10-year peak flow of 301cfs and a 100-year peak flow of 480cfs. This flow would exceed the capacity of the exiting city drainage system.

2.5 Pipe Constrictions

Pipes with capacity constraints were identified in the SDMP including the existing pipelines on South Hill Drive. The storm drain system leaving the quarry and open space area does have 10-year capacity. However, the system has 10-year deficiencies from South Hill Drive to the lagoon. It was noted that the existing 45-inch pipeline along South Hill Drive does not have enough capacity to prevent excessive street flooding. In addition, flow entering the lagoon is restricted due to the undersized boxes at the bridge along Bayshore Blvd. Refer to Figure 2-2 for pipe system layout and areas with inadequacies in the 10-year or 100-year storm events.

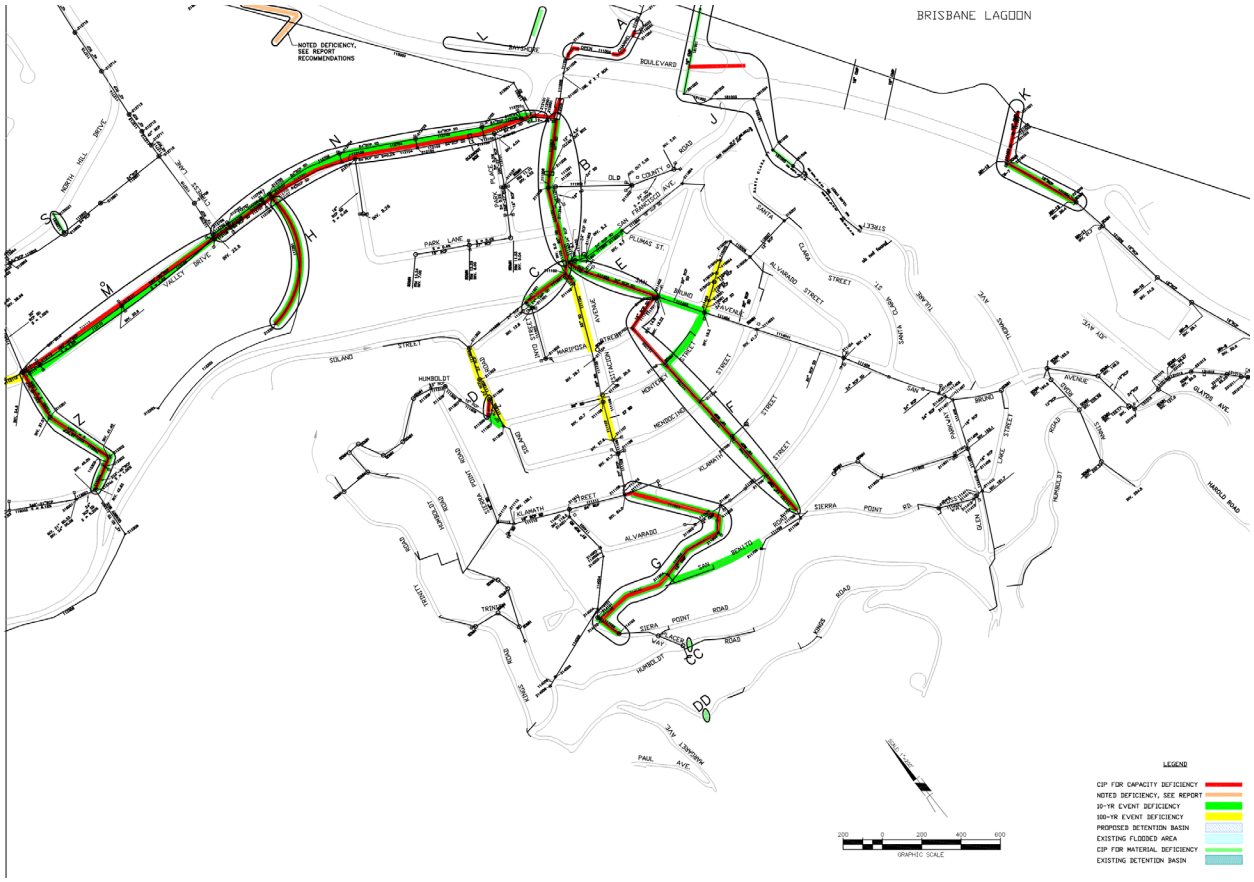


Figure 2-2: City Storm Drain Deficiencies

2.6 Proposed CIPs

The SDMP hydraulic model results were used to identify problematic locations within the City which led to the extensive CIPs listed in the SDMP. The CIPs are necessary to correct for existing deficiencies, prevent excess street flooding and to help contain higher runoff expected from development. The CIPs mainly comprise of upsizing existing systems or adding parallel lines to increase capacity. There are two CIPs that would help improve conditions at the quarry site. The first CIP along South Hill Drive, from Quarry Road to Valley Drive, requires adding a second parallel pipeline of either 45-inch or 48-inch RCP to increase capacities. The second CIP consists of replacing the road bridge with a configuration that significantly reduces restricted flow and potential for flood damage west of Bayshore Boulevard along Valley Drive. Note: this project has since been completed.

3 Revised Existing

The City SDMP shows that the Guadalupe Valley Drainage System has a lacking capacity for the 10-year event. Available hydrologic and hydraulic data within the City's SDMP had some missing or outdated information based on the review discussed in the previous section. Schaaf & Wheeler used SCCDM and Alameda County Hydrology & Hydraulics Manual to obtain reasonable runoff values, analyze system performance in the existing condition and differentiate necessary improvements.

3.1 Hydrology

Schaaf & Wheeler conducted a revised hydrologic model of the City of Brisbane's drainage system by applying the SCCDM. This is due to San Mateo County not having a prescribed unit hydrograph methodology; however, the SCCDM is often used in San Mateo County. Revised hydrologic data were necessary to better estimate runoff at the quarry watershed during large storms. Schaaf & Wheeler also reviewed and validated data from the City SDMP for the existing hydrologic conditions.

3.1.1 Updated Rainfall

The 24-hour 10-year total rainfall in the Santa Clara manual matches the RBF SDMP values for MAP 21-inches for parts of the City of Brisbane. Schaaf & Wheeler utilized Average Annual Precipitation from 1981-2010 map, found in the California Water Resources Control Board, to assign higher rainfall values to the southern hillside watersheds based on higher MAP values of 27 to 29 inches. The design rainfall pattern used for this manual's method is different than the 1998 Valley Water design storm used in the SDMP. It is poor practice to mix rainfall patterns between methodologies without calibration; updated methods are consistent with the drainage manual. A 100-year 24-hour design storms were also developed.

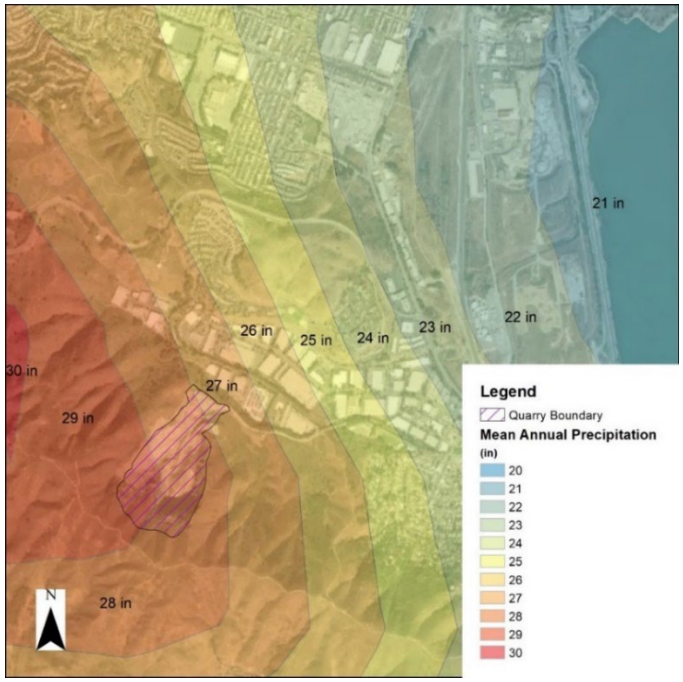


Figure 3-1: Mean Annual Precipitation

3.1.2 Updated Land Use and Losses

The land use designations from the SDMP are valid and were used in this study for existing conditions. The Hydrologic Soils Group from the USDA Soil Resource Report does not provide a soil group at the quarry, but the surrounding area is classified as C. Refer to Figure 3-2 for Hydrologic Soils Groups with Brisbane. This soil group information is consistent with the SDMP. Schaaf & Wheeler calculated new Curve Numbers to identify the potential losses for watersheds around the quarry that are tributary to the Brisbane Lagoon. The adjusted Curve Number of 94 for the quarry watershed was computed by using an AMC of II1/2 and a 5-percent impervious area.

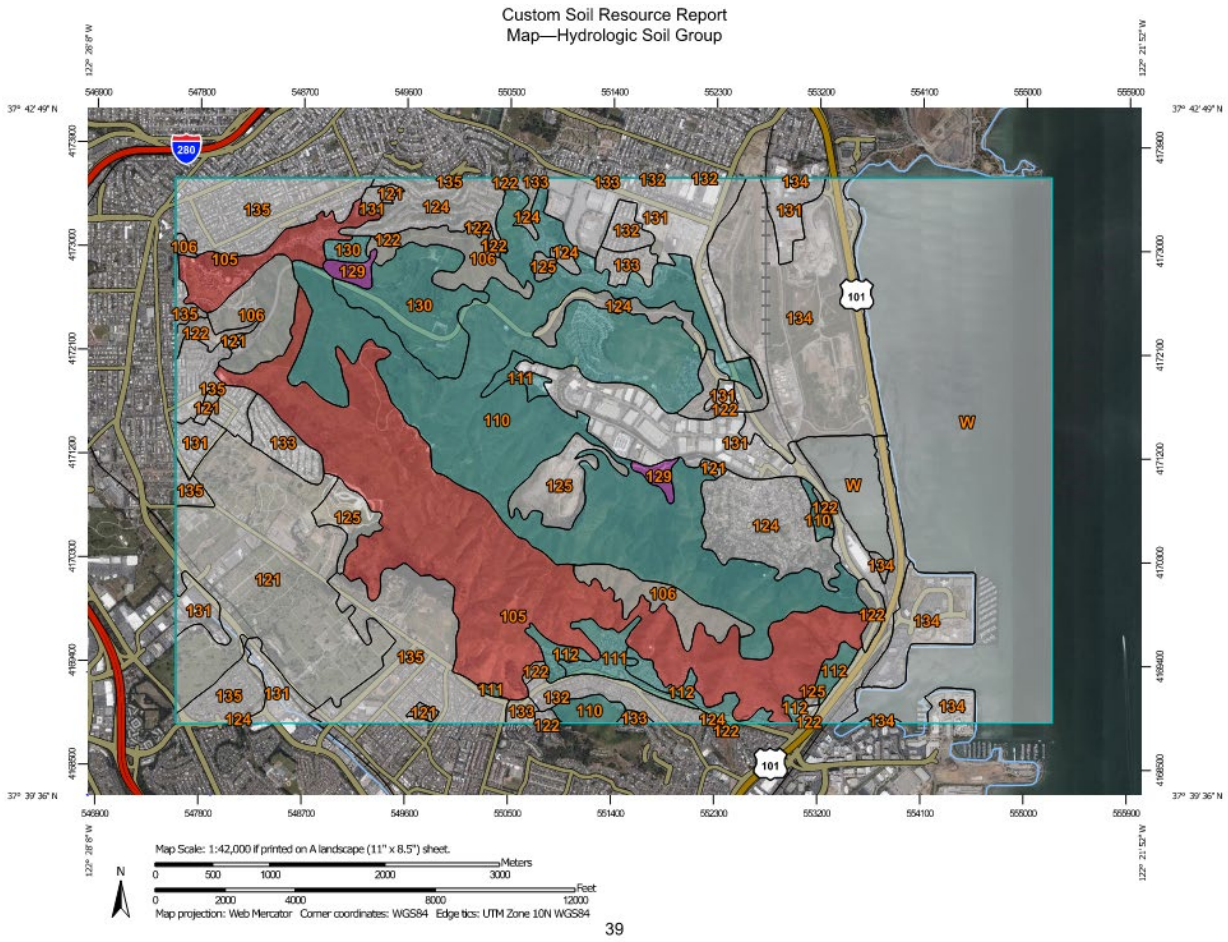


Figure 3-2: City SDMP Land Uses

3.1.3 Updated Peak Flows

The updated hydrology produces lower peak runoff from the quarry watershed. This decrease can be attributed to the longer basin lag and the different design storm. The basin lag of 29 minutes is reasonable considering the various ditches, ponds and grading on the quarry site. The Curve Numbers used in this analysis are calibrated to the design storm. The peak 10-year runoff from the quarry site is 135cfs with the existing ponds and 158cfs when ponds are removed (Figure 3-3). The 100-year peak runoff from the site, with ponds, is 281cfs. These peak flows are

significantly less than the SDMP values (Section 2.4) which did not analyze the impacts of quarry ponds.

For validation of the result, a HEC-HMS model of the quarry watershed was developed using the Alameda County 2017 Hydrology & Hydraulics Manual and it yielded a peak flow of 139cfs with ponds. This makes it clear that the SDMP method overestimated the peak runoff from the quarry.

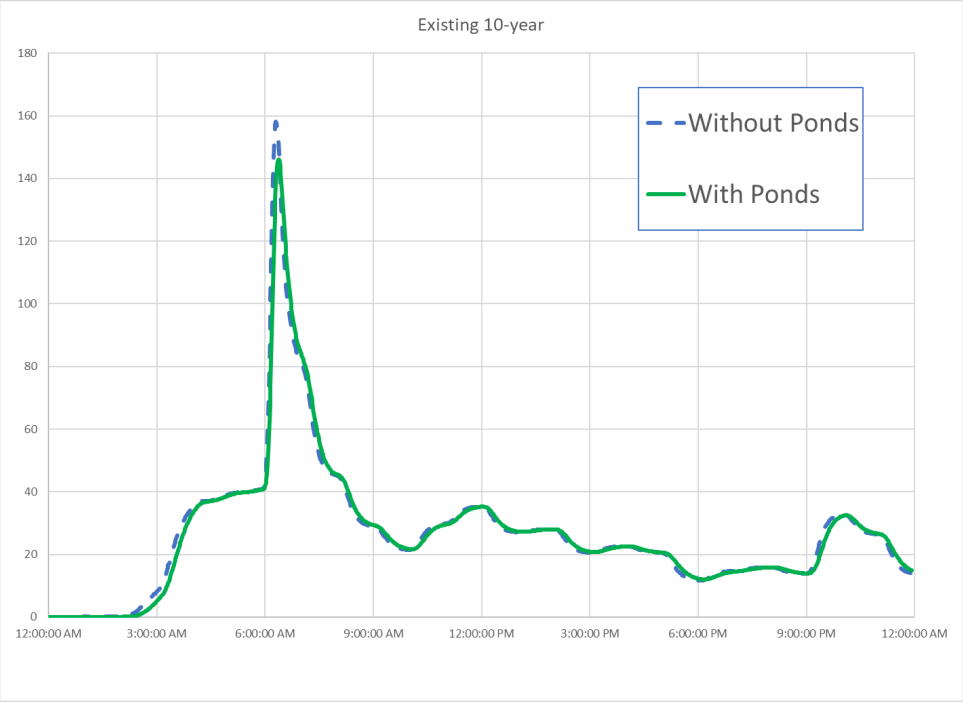


Figure 3-3: 10-year Quarry Runoff Hydrographs

3.2 Hydraulics

The 10-year runoff hydrographs from the HEC-HMS model were used for a hydraulic model of the storm drain network. The storm drain network extends from the quarry to the Brisbane Lagoon. The results from the hydraulic model are used to evaluate system adequacy and compared with the results from the SDMP. The new model confirms that the existing city system does not have 10-year capacity along Valley and South Hill Drives.

Schaaf & Wheeler created a hydraulic model using the MIKE-URBAN (MU) software to model the site and the Guadalupe Valley Drainage System, including existing drainage ponds. MU is an ArcMap based program that includes tools specifically designed to develop urban drainage models. The 10-year and 100-year storm events were modeled as the SDMP states the existing storm drain system is deficient in the 10-year event. The CIPs were used as the basis for setting up the proposed model to appropriately size pipes to increase capacities.

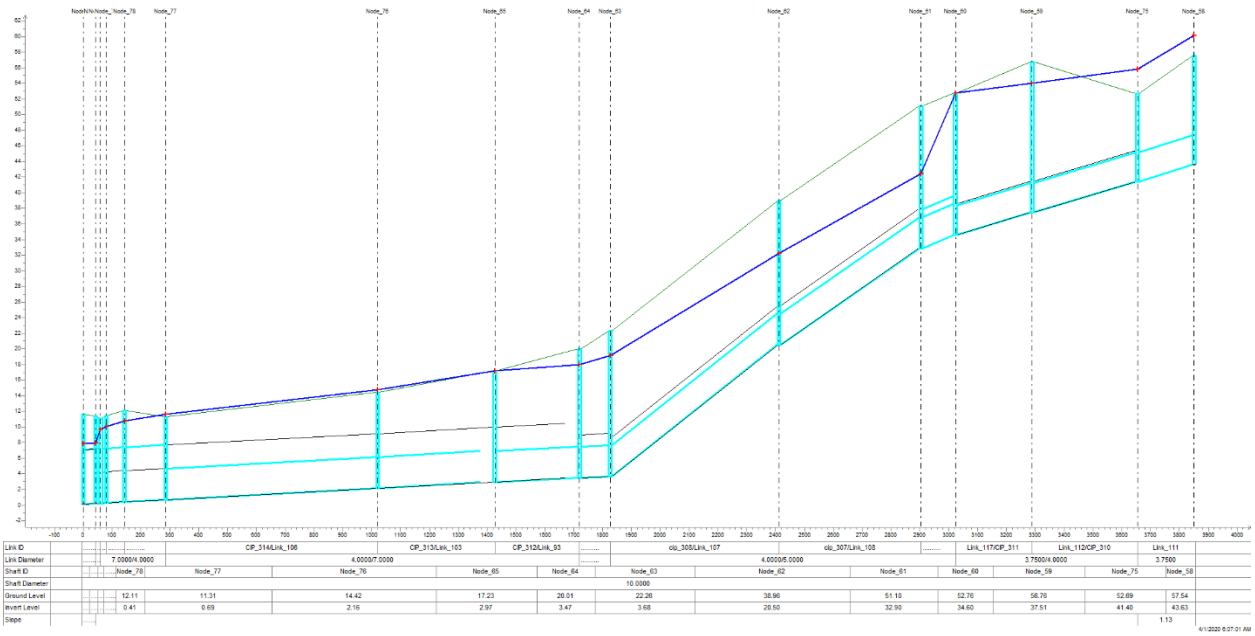


Figure 3-4: Existing 10-year Profile (with Quarry Ponds)

3.2.1 Updated CIPs

The updated hydrology was applied to a storm drain system model for the system from the quarry to the lagoon. Available City GIS data and new field surveys were used to develop models of the pipeline networks. The results show similar system limitations and drainage issues as the SDMP. Refer to Figure 3-5 for the updated 10-year profile with updated CIP implemented. There appears to be capacity constrictions on a 45-inch pipe downstream of the access road.

Adding capacity improvements along South Hill Drive could impact downstream pipes that are at 10-year capacity under existing conditions. Adding a sealed parallel 48-inch system along South Hill Drive to an existing manhole at the downstream end of Valley Drive should convey existing runoff without spilling at the low point on South Hill Drive. Refer to Figure 3-6 for CIP locations.

A possible alternative to reducing flooding on South Hill Drive is to develop upstream detention to reduce peak flows into the City system. There does not appear to be any City owned land to provide the storage necessary to reduce the 10-year peak flows enough to provide 10-year protection to South Hill Drive.

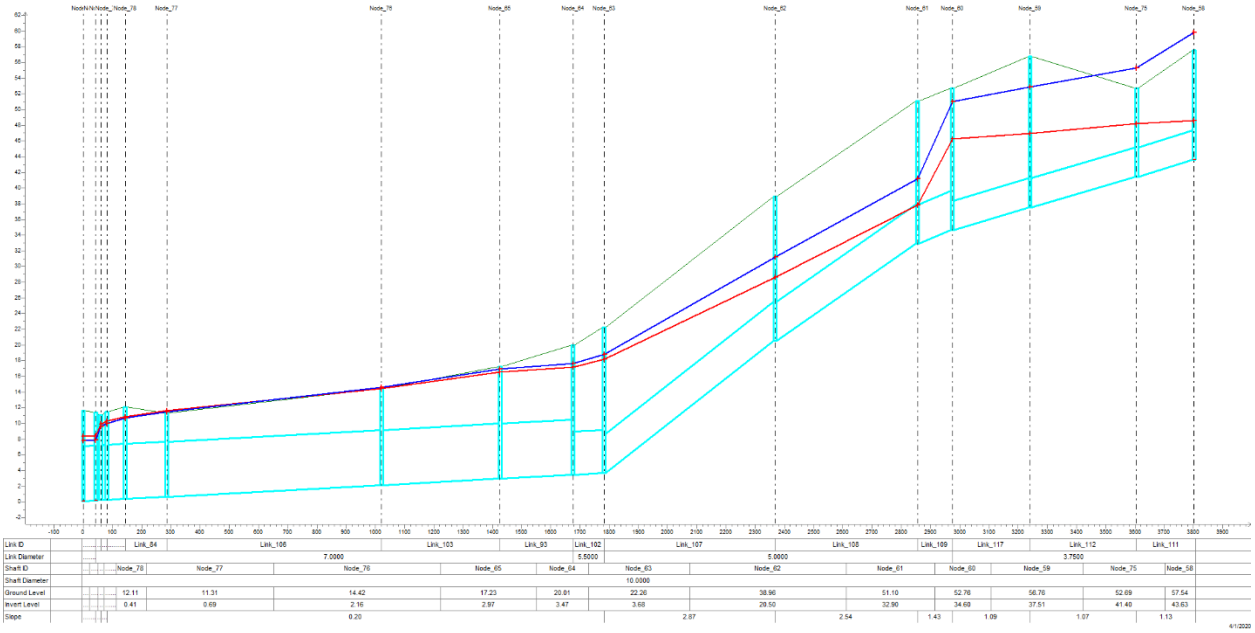


Figure 3-5: Updated 10-year CIP Profile

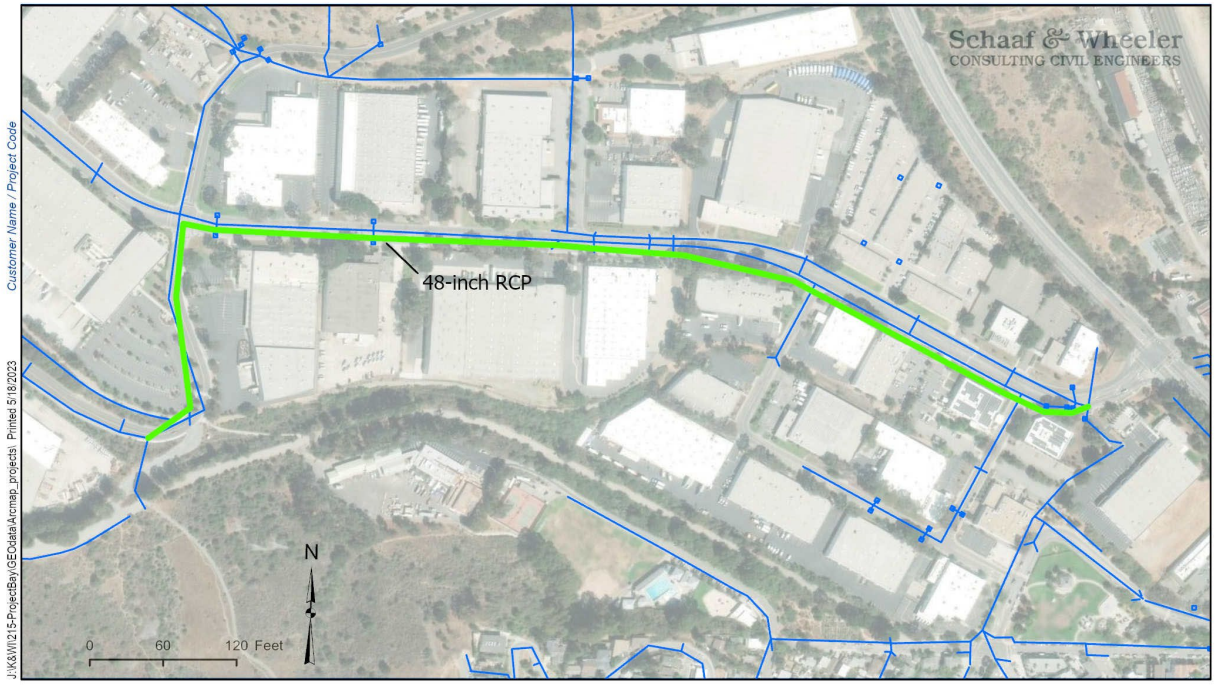


Figure 3-6: Updated CIP Locations

4 Project Conditions

4.1 Hydrologic Changes

Currently, the quarry does have poor drainage due to the soil conditions. However, the surrounding open space areas are part of the quarry watershed, and all discharges enter the City's Guadalupe Valley Storm Drainage System. There are sediment ponds inside the quarry work area that collect runoff from the quarry slopes and attenuate the runoff. The proposed project will change the hydrologic characteristics as the development paves over quarry site and directly connects to the city storm drainage system. This will increase the imperviousness within the quarry's watershed. The impact of this change results in an increase in peak 10-year runoff to 170cfs and assumes all existing ponds will be removed. The development proposes on-stie detention to mitigate the increases in peak runoff and volume.

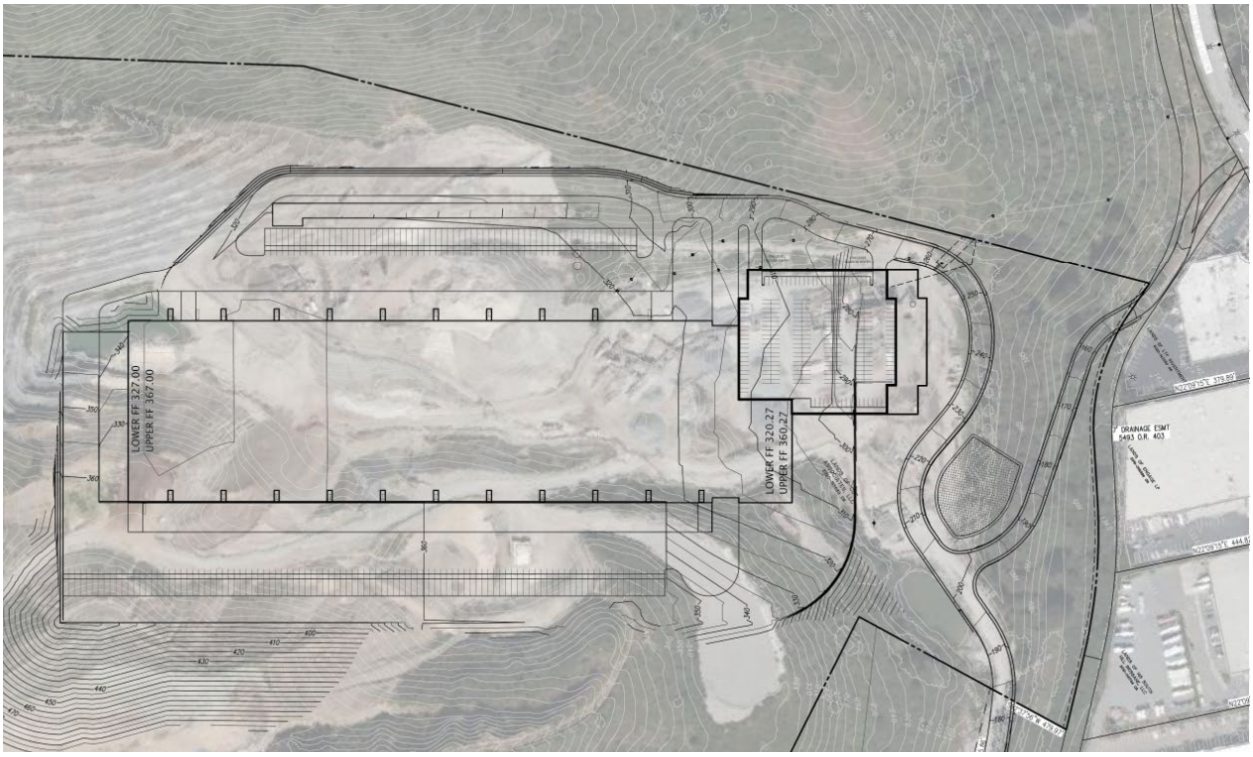


Figure 4-1: Proposed Development at Quarry Site

4.2 Proposed Hydraulic Changes

Schaaf & Wheeler recommends maintaining the existing concrete lined ditch along the quarry road from South Hill Drive. A new 42-inch pipeline will be added along the access road to connect the development site to the City's drainage system at South Hill Drive. Energy dissipation will be needed to reduce velocities along the steep slope of the access road this can be mitigated by utilizing corrugated metal piping and a drop structure near south hill drive. Keeping elements of the exiting ditch system could be beneficial but are not assumed in this analysis.

4.3 Proposed Detention

The increase in runoff will need to be detained to prevent further impacts on the city storm drain system. Adding detention at the development site and metering out the runoff will mitigate the impacts of the increase impervious areas. The proposed design should reduce the peak 10-year site runoff to 51cfs. This sizing eliminates the need for the city's proposed improvements along South Hill Drive. The basin size and outfall configuration should be optimized as the development progresses.

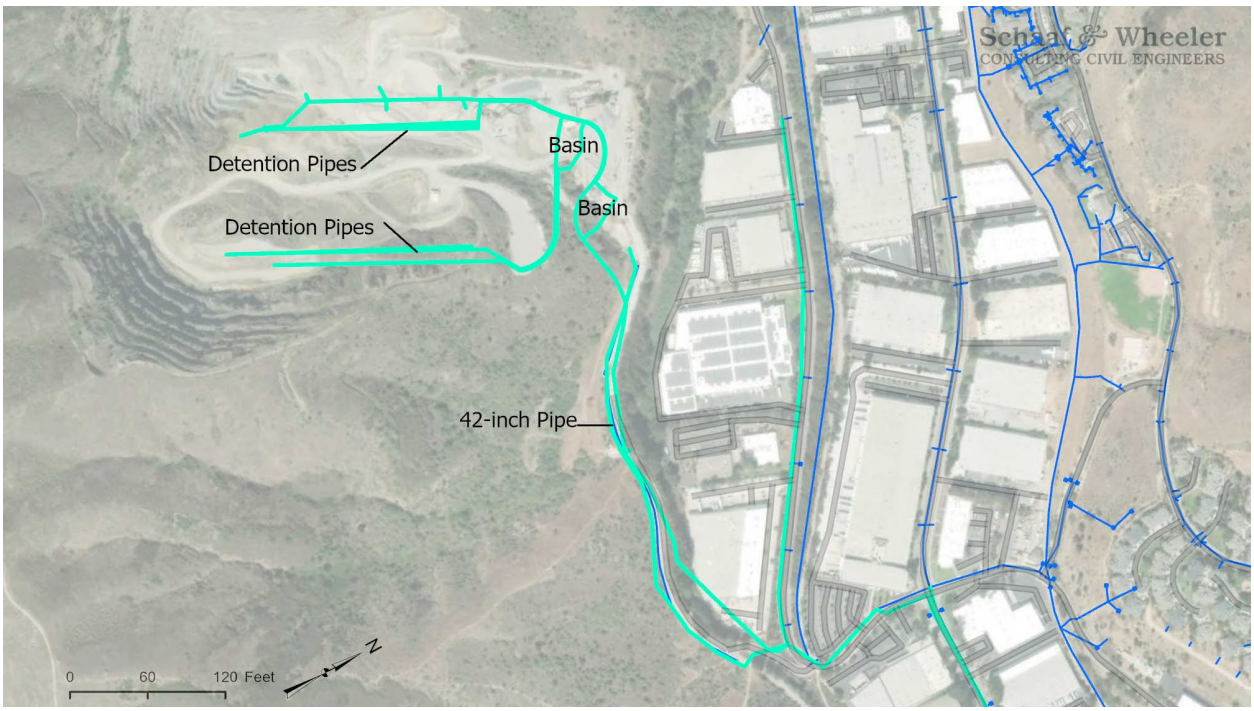


Figure 4-2: Proposed System Improvements

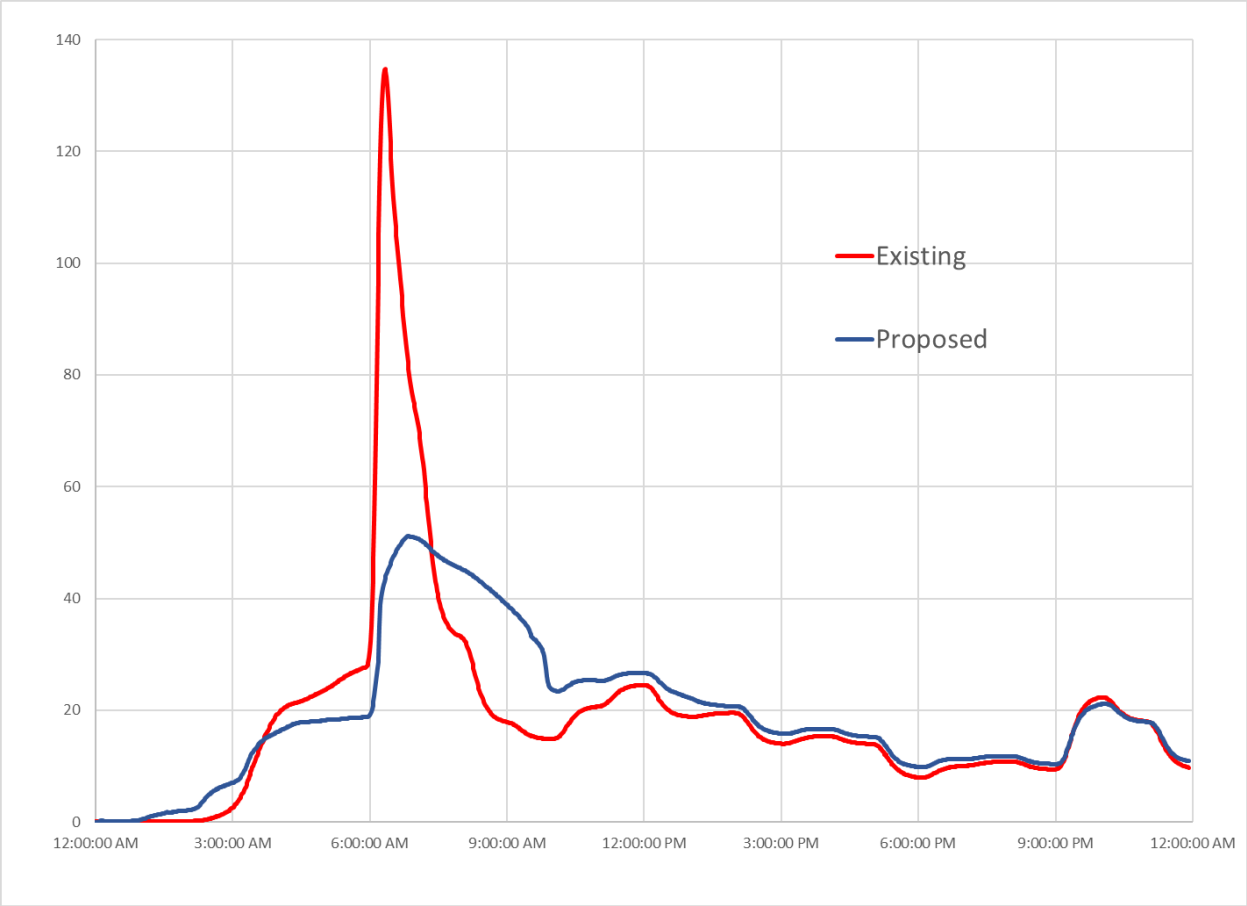


Figure 4-3: Proposed Hydrographs

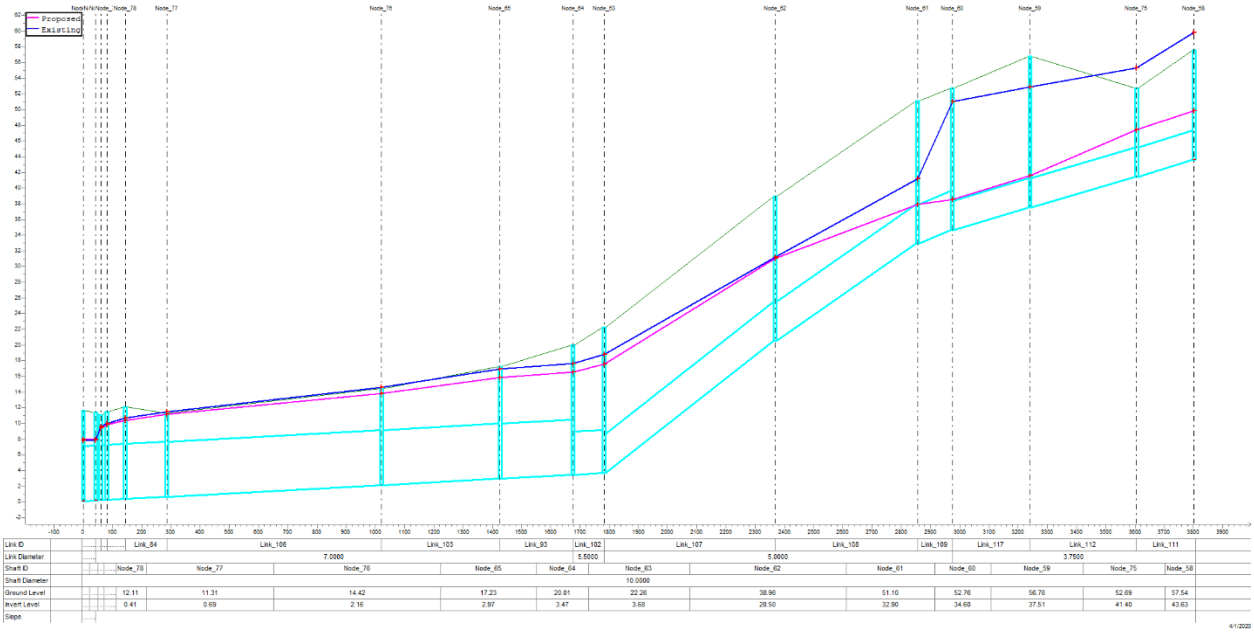


Figure 4-4: 10-year Profile Proposed

4.5 100-year Results

Though proposed system of pipes and detention are sized for a 10-year level-of-service, they do provide benefit during larger events. The proposed project reduces the peak 100-year site runoff at the city connection on South Hill Drive from 281cfs to 76cfs. Figure 4-5 shows a comparison of the existing and proposed 100-year hydrographs off the site.

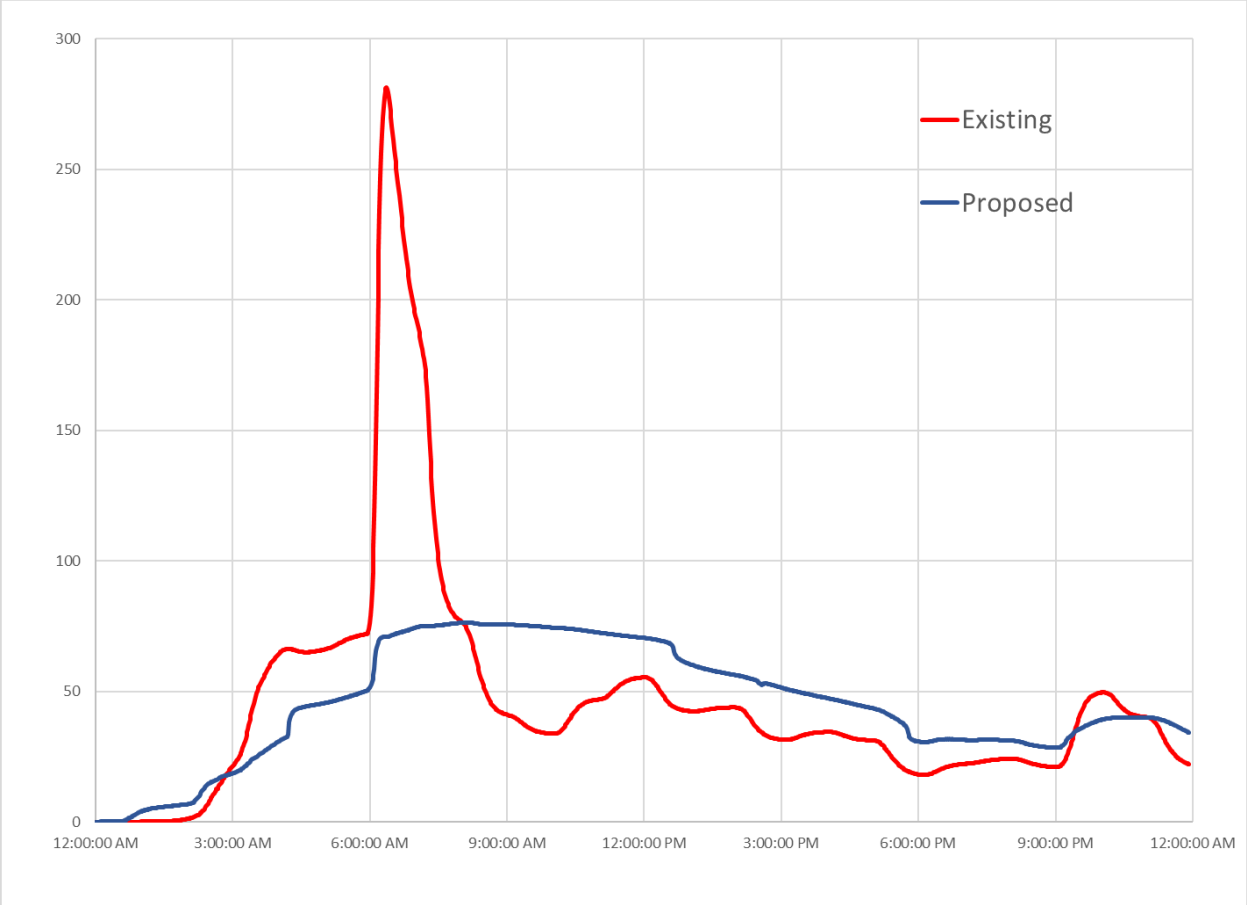


Figure 4-5: 100-year Hydrographs

4.6 Hydromodification

The proposed development drains entirely to hardened channels and underground pipes. The Regional Water Quality Control Board (RWQCB) posts hydromodification (HMP) requirements in the Municipal Regional Permit (MRP 3.0) Order No. R2-2022-0018 NPDES Permit No. CAS612008 May 11, 2022. According to those published guidelines (Figure 4-6) this site is exempt from HMP.

C.3.g. Hydromodification Management

i. **Hydromodification Management (HM) Projects** are Regulated Projects that create and/or replace one acre or more of impervious surface except where one of the following applies.

(1) The post-project impervious surface area is less than, or the same as, the pre-project impervious surface area.

(2) The project is located in a catchment that drains to a hardened (e.g., continuously lined with concrete) engineered channel or channels or enclosed pipes, which extend continuously to the Bay, Delta, or flow-controlled reservoir, or, in a catchment that drains to channels that are tidally influenced.

(3) The project is located in a catchment or subwatershed that is highly developed (i.e., that is 70 percent or more impervious).[23]

All HM Projects shall meet the HM Standard of either Provision C.3.g.ii or Provision C.3.g.iii.

The Hydromodification Applicability Maps developed by the Permittees in the Alameda, Santa Clara, San Mateo, and Fairfield-Suisun Programs, and the

Figure 4-6: MRP 3.0 HMP Requirements

5 Conclusion

This drainage study provides a review of the existing drainage system, deficiencies that may impact the quarry and potential improvements to reduce both nuisance flooding and the likelihood of more serious drainage problems. The study is based on available information including the City of Brisbane's SDMP, GIS data and field observations. It is difficult to estimate the existing runoff from the quarry due to its operations and unique geology and topography. The City's effective SDMP is a good macro-scale analysis of the drainage systems which provides a breakdown of watershed conditions. However, the rainfall runoff values appear to overestimate the peak flows on the drainage network. Both the Santa Clara and Alameda County Drainage Manuals were used to support this finding.

5.1 Potential Impacts of Proposed Project

The development of proposed a building and parking lots could change the hydrologic characteristics at the quarry site, raising imperviousness within the quarry's watershed. This could lead to small increases in runoff peak flows and volumes if the impacts are unmitigated. These increases could exacerbate drainage issues downstream as the system is already undersized to provide a 10-year level of service.

5.2 Proposed Project Improvements

Based on the impacts of the project site, it is recommended to keep the exiting ditch system and add a 42-inch pipeline to convey the runoff from the development directly to the city network. Schaaf & Wheeler has determined that the addition of a detention storage and properly sized outlet structures should mitigate the impacts of the development's increase in impervious areas and reduce the need for system upgrades on South Hill Drive. Other existing city system deficiencies should be improved to provide an adequate level of service to the entire watershed.

The proposed project improvements provide adequate detention to mitigate the 100-year impacts from the development's increase impervious area. 100-year flows will continues to be conveyed along the access road along with any additional capacity in the new 42-inch pipeline.

WOOD RODGERS

TECHNICAL MEMORANDUM



TO: Mr. Randy Breault, PE,
Director of Public Works/City Engineer,
City of Brisbane

FROM: Mr. Harvey Oslick, PE, CFM, CPSWQ, Wood Rodgers, Inc.
Mr. Mitchell Berggren, EIT, Wood Rodgers, Inc.

DATE: October 2, 2023

SUBJECT: Quarry Redevelopment Drainage Review

INTRODUCTION

Wood Rodgers, Inc. (Wood Rodgers) prepared this review to assess the adequacy of the drainage systems for the proposed Guadalupe Quarry Redevelopment Project (Project) situated within the city of Brisbane (City). The Project is at the former Guadalupe Quarry located in the upstream portion of the Brisbane Lagoon Watershed within the City. A drainage study supporting the Project was prepared by Schaaf & Wheeler Consulting Civil Engineers (Schaaf & Wheeler) and dated August 2023. The Project comprises a large industrial building and site improvements that include underground detention, water quality treatment basins, and underground stormwater pipes that connect into the City's existing drainage system. The City's 2003 Storm Drainage Master Plan (SDMP) had identified various pipe, culvert, and channel capacity deficiencies, some of which are downstream of the proposed industrial Project. The primary goal of this review is to evaluate the Project's potential impacts on the existing drainage infrastructure. Additionally, the review revisits the Drainage Master Plan's hydrologic and hydraulic modeling and the identified downstream deficiencies within the City.

EXISTING DRAINAGE CONDITIONS

The assessment of existing drainage conditions for the Project area establishes the baseline hydrological and hydraulic characteristics for the study watersheds. Drainage conditions were comprehensively studied in the SDMP. Since the SDMP was completed in 2003, new data has been published to determine hydrologic characteristics and several improvements to drainage infrastructure have been implemented. In order to provide an up-to-date representation of the expected performance of the drainage system during design storm events, several changes were made to the modeling from the SDMP.

Rainfall Distributions

National Oceanic and Atmospheric Administration (NOAA) Atlas 14 data was used in order to improve the design rainfall values. Specifically, the SDMP rainfall distributions were refined by dividing the City into distinct rainfall zones based on areas of similar 24-hour rainfall depths. This

approach replaced the use of a single 24-hour rainfall depth for the entire City. The previous city-wide rainfall totals were 5.925 inches for the 100-year 24-hour storm event and 3.979 inches for the 10-year 24-hour storm event. The updated 100-year rainfall total varies from 5.0 inches near San Francisco Bay to 6.5 inches in the western end of the City. Similarly, the updated 10-year rainfall total varies from 3.4 inches to 4.2 inches across the City. This zoning approach allows for a more realistic representation of the expected rainfall patterns across the modeled watersheds and increases the design rainfall at the Project site from the SDMP values to 4.0 inches and 6.4 inches for the 10-year and 100-year 24-hour design storm depths, respectively. Design rainfall totals for the 10-year and 100-year storm 24-hour storm events are shown on **Figure 1** and **Figure 2** (attached).

Terrain Data and Watershed Delineations

Terrain data from the United States Geological Survey (USGS) was used to validate and verify the appropriateness of watershed delineations in the SDMP. The watershed delineations within the SDMP were validated; however, there were a couple of errors in the area values used in the XPSWMM hydrologic model. Specifically, in Watershed Group 4 as defined in the SDMP, an additional 110.7 acres had been erroneously included in the modeled watershed. For this study, this error in the SDMP Watershed 4 group was corrected. The revised watershed areas are shown in the table below. The other watersheds throughout the model were checked for accuracy and no other discrepancies were found. The watershed area changes are presented in **Table 1**, below.

Table 1 – Watershed Area Comparison

Watershed	DMP Area (acres)	Revised Area (acres)	Difference (acres)
4A	102.92	102.92	0.00
4B	4.14	4.14	0.00
4C	114.71	84.61	-30.10
4D	11.37	10.51	-0.86
4E	23.86	23.86	0.00
4F	247.63	167.91	-79.72
Total	**504.63**	**393.94**	**-110.69**

Hydrologic Parameters

The hydrologic parameters for the revised watersheds were recalculated following methodology presented in the Soil Conservation Service (SCS) Technical Release 55, *Urban Hydrology of Small Watersheds*, dated June 1986, (TR-55). Antecedent moisture condition adjustments were made to the SCS Curve Number (CN) values for the 10-year storm event in the Schaaf & Wheeler drainage

study. However, these adjustments are not recommended in TR-55. Therefore, curve numbers for the 10-year storm event were unchanged from the 100-year storm event.

Infrastructure Changes

The SDMP modeling was revised in order to reflect projects that have been implemented and studies that have been completed since completion of the SDMP. These changes were incorporated into the assessment of existing drainage conditions and were carried forward to the analysis of proposed conditions. The changes included:

- Replacement of a culvert under Machinery Road with a clear span bridge.
- Analysis associated with 425 Valley Drive which modified land use and changed overland flow -through the development. It should be noted that 425 Valley Drive is not along the main conveyance route from the Project to Brisbane Lagoon and these updates do not significantly impact the results.
- The geometry of Guadalupe Channel between Bayshore Boulevard and the Machinery Road crossing was updated to reflect a survey that was conducted for a 2020 study of channel erosion.

The locations of these changes are shown on **Figure 3.**

Tidal Data

Updated tidal data was reviewed and compared to the downstream boundary condition used in the SDMP. Based on this review, the SDMP tidal conditions were deemed appropriate and were utilized for this study.

Results

The infrastructure improvements had little impact on drainage within the Project area; however, these revisions did provide a baseline for further investigation of other drainage deficiencies within the watershed. The revised rainfall zones resulted in more total rainfall applied in the upper watershed, including the Project area. Similar overall rainfall was applied to the watershed. On average, a rainfall depth of 5.96 inches was applied to the watershed in the 100-year 24-hour storm event as compared to 5.95 inches in the SDMP modeling. The most impactful change was the corrected drainage area of Watershed 4, that caused the modeling discharges at Quarry Road to decrease significantly. The revised modeling will be referred to as the baseline conditions throughout the remainder of this TM and will be used to determine Project impacts. The comparison of flow in the Quarry Road storm drain between the SDMP model and the baseline model is shown below in **Exhibit 1**.

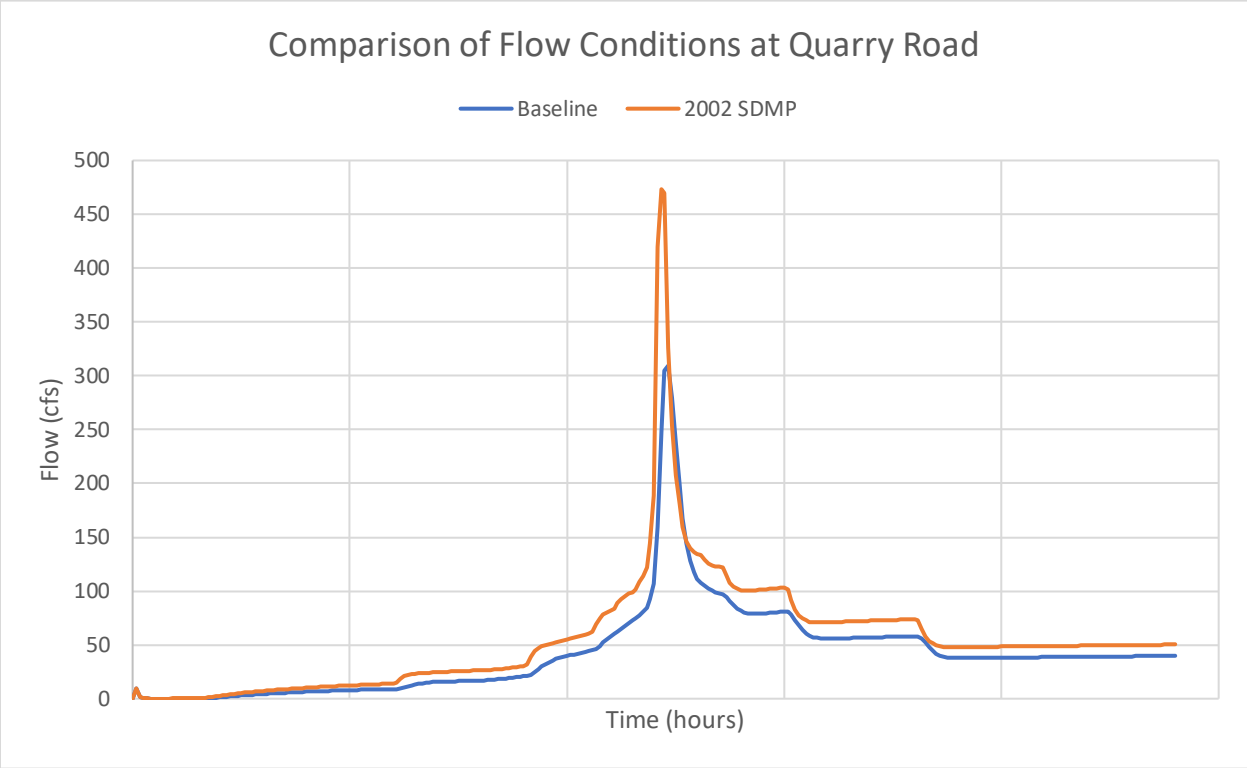


Exhibit 1 – Comparison of 100-Year 24-Hour Flow in 42-Inch Pipe Entering South Hill Drive

PROPOSED DRAINAGE CONDITIONS

An analysis of proposed drainage conditions was carried out in order to calculate changes in flow rates and flood levels under design conditions following the completion of the Project. The results of the proposed drainage conditions analysis are used to assess how conditions are expected to change downstream of the Project and whether or not the Capital Improvement Projects (CIPs) recommended in the SDMP are appropriate based on the updated baseline and Project condition analysis. Additionally, the analysis will broadly assess the adequacy of the City's drainage system as it relates to the Project.

Revisions to Hydrologic Parameters

To account for the change in land use due to the construction of the Project, adjustments were made to the hydrologic parameters for the existing watershed that encompasses the Project site. The curve number, which characterizes the land's runoff potential, was revised upwards to reflect the introduction of the more impervious surfaces associated with the Project. The basin lag time was adjusted to reflect the post-grading conditions that expedite drainage flows into the proposed stormwater detention system on the Project site.

Proposed Drainage System

The proposed drainage system for the Project incorporates features to manage increased stormwater runoff. Five underground storage pipes measuring 902 feet long with 96-inch diameters will serve as the primary detention facility to regulate releases from the developing portions of the Project watershed. The site will redirect runoff into a new 42-inch conduit instead of the existing concrete channel before connecting with the City's storm drain system in South Hill Drive. The existing concrete channel will continue to collect runoff from undeveloped watersheds east of the Project. The proposed drainage system and watersheds are shown on **Figure 4.**

On-Site Drainage

The on-site drainage system was analyzed based on 10-year and 100-year water surface elevations with respect to the ground elevation. While the City does not have specific design guidelines, the SDMP provided guidance stating that 10-year water surface elevations should remain at 1.0 foot below rim elevations within underground pipe systems and the 100-year water surface elevation should remain at 1.0 foot below building pad elevations. The on-site system is sized appropriately. Two locations with low freeboard were noted. However, the low freeboard below the rim invert may not be an issue for the Project drainage system. The modeled 10-year peak water surface elevations are near the rim elevations of the manhole structures with the orifice openings. The western structure has a 10-year peak water surface at 0.2 foot below the rim elevation. The eastern structure has a 10-year peak water surface at 0.7 foot below the rim elevation. The 100-year peak water surface elevation at the eastern structure indicates that 1.1 feet of ponding will occur. The ponding may be reduced by overland flow, but these details were not included in the modeling. The locations where low freeboard conditions were computed are provided for the applicant's consideration and do not indicate a deficiency that needs to be resolved because it will be a private system and no structures would be at risk of flooding. The on-site drainage system results are shown below in **Table 2**. The node locations are shown on Figure 4.

Table 2 – On-Site Drainage System Results

Node	Rim Elevation (ft)	10-Year Water Surface Elevation (ft)	Freeboard (ft)	100-Year Water Surface Elevation (ft)	100-Year Ponding (ft)
10	200.9	193.4	7.5	193.6	0.0
11	213.5	206.6	6.8	207.0	0.0
15	235.0	227.0	8.0	227.0	0.0
16	235.4	227.6	7.8	227.8	0.0
17	280.0	265.5	14.5	265.6	0.0
19	267.3	260.4	6.9	260.6	0.0

Table 2 – On-Site Drainage System Results					
Node	**Rim Elevation (ft)**	**10-Year Water Surface Elevation (ft)**	**Freeboard (ft)**	**100-Year Water Surface Elevation (ft)**	**100-Year Ponding (ft)**
2	62.9	54.0	8.9	58.3	0.0
20	276.7	269.1	7.5	269.3	0.0
22	308.8	301.0	7.8	301.2	0.0
23	309.1	308.9	0.2	309.6	0.4
24	315.9	308.6	7.4	312.5	0.0
25	316.2	308.6	7.6	312.5	0.0
26	316.5	308.6	7.9	312.5	0.0
27	313.2	308.6	4.6	309.6	0.0
28	315.2	308.3	6.9	309.5	0.0
29	316.3	307.2	9.1	309.6	0.0
3	116.8	109.5	7.3	109.6	0.0
30	318.6	308.7	10.0	308.7	0.0
31	320.7	309.7	11.0	309.7	0.0
32	320.7	308.6	12.1	312.5	0.0
33	321.2	315.7	5.5	315.7	0.0
34	321.4	309.8	11.6	312.7	0.0
35	321.9	310.4	11.5	313.4	0.0
39	208.5	207.0	1.5	207.3	0.0
4	125.3	118.0	7.3	118.1	0.0
45	325.3	315.7	9.7	315.7	0.0
5	150.5	142.9	7.6	143.2	0.0
51	314.6	291.5	23.1	291.5	0.0
53	282.7	262.2	20.5	262.2	0.0
54	280.3	270.4	9.9	270.4	0.0
55	280.3	277.5	2.8	277.5	0.0
56	288.4	281.0	7.4	281.0	0.0
57	288.4	282.5	5.9	282.6	0.0
58	294.5	286.7	7.8	286.8	0.0

Table 2 – On-Site Drainage System Results					
Node	**Rim Elevation (ft)**	**10-Year Water Surface Elevation (ft)**	**Freeboard (ft)**	**100-Year Water Surface Elevation (ft)**	**100-Year Ponding (ft)**
59	320.1	313.4	6.8	313.5	0.0
60	342.1	335.2	6.8	335.3	0.0
61	350.7	338.3	12.5	338.4	0.0
62	351.5	344.2	7.3	346.7	0.0
63	351.9	344.2	7.7	346.7	0.0
65	356.0	344.2	11.8	346.6	0.0
66	357.1	347.3	9.8	351.9	0.0
67	358.0	347.7	10.3	353.0	0.0
69	296.6	275.8	20.9	275.8	0.0
7	162.1	154.2	7.8	154.5	0.0
70	316.4	304.0	12.4	304.0	0.0
71	319.4	306.8	12.6	306.9	0.0
72	342.1	340.0	2.0	340.1	0.0
73	347.9	347.1	0.7	349.0	1.1
74	351.4	347.2	4.2	351.4	0.0
75	352.9	347.2	5.8	352.7	0.0
76	354.8	347.2	7.6	354.3	0.0
8	175.6	168.3	7.3	168.5	0.0
9	188.5	181.2	7.3	181.4	0.0
52	273.2	249.8	23.4	249.8	0.0

Model Review

Full details of the proposed Project on-site drainage system were not provided for review. The Schaaf & Wheeler drainage study was intended for evaluation of Project impacts, and the general approach that was taken appears to be adequate for that purpose. A total of nine watersheds were delineated that were tributary to the Project drainage system, including three off-site watersheds where runoff enters the system and six on-site watersheds. Runoff is introduced to the drainage system in the hydraulic model at the upstream portion of the on-site watersheds system.

The plan set shows profile views of the proposed drainage trunkline in Quarry Road, but profiles upstream of Quarry Road were not included. Hydraulic grade lines for the 100-year and 10-year storm events were not provided throughout the system on the plans or in the Schaaf & Wheeler drainage study. Some storm drain pipe lengths in the model do not match the plans. For example, the plans show 902 feet of 96-inch diameter storm drain pipes, while the Schaaf & Wheeler drainage study includes only 861 feet of 96-inch-diameter pipes. The analysis that was based on 861 feet of pipe would indicate conservative estimates of peak flow mitigation if more underground storage pipes were provided than were included in the calculations.

Drainage Mitigation

The proposed drainage system adequately mitigates peak flows during the design storm events. The 100-year peak flow entering the City's system was reduced from 309 cubic feet per second (cfs) to 209 cfs and the 10-year peak flow entering the system was reduced from 136 cfs to 104 cfs. A comparison of the baseline and proposed runoff entering the City's drainage system is shown below on **Exhibit 2** for the 10-year storm and **Exhibit 3** for the 100-year storm. Baseline and proposed conditions peak water surface elevations were compared within the City's storm drainage system trunklines running from South Hill Drive to the Brisbane Lagoon. This comparison is shown below in **Table 3**. The node locations are shown on **Figure 5**. The slight increases in peak water surface elevations shown in Table 3 were determined to be the result of minor model instabilities rather than actual expected impacts. Therefore, it can be concluded that the fully mitigated Project would not increase downstream flooding.

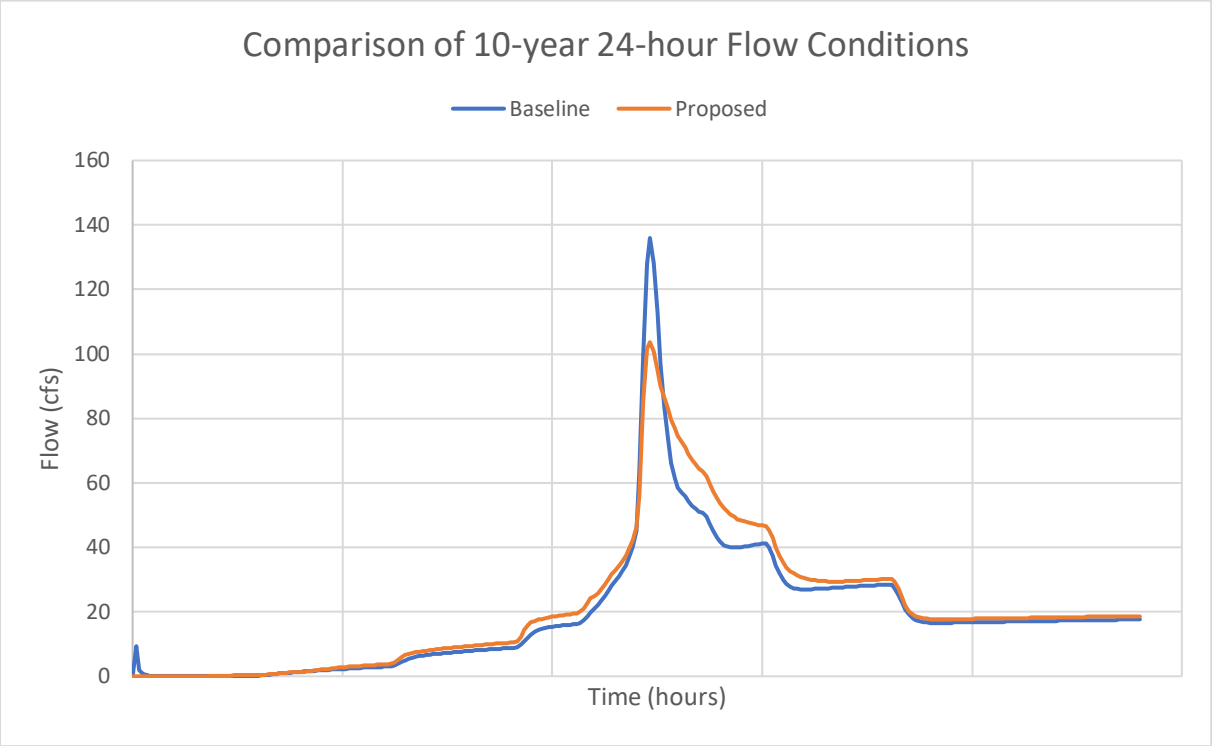


Exhibit 2 – Comparison of 10-Year 24-Hour Flow in Pipe Connecting to the City Drainage System at South Hill Drive

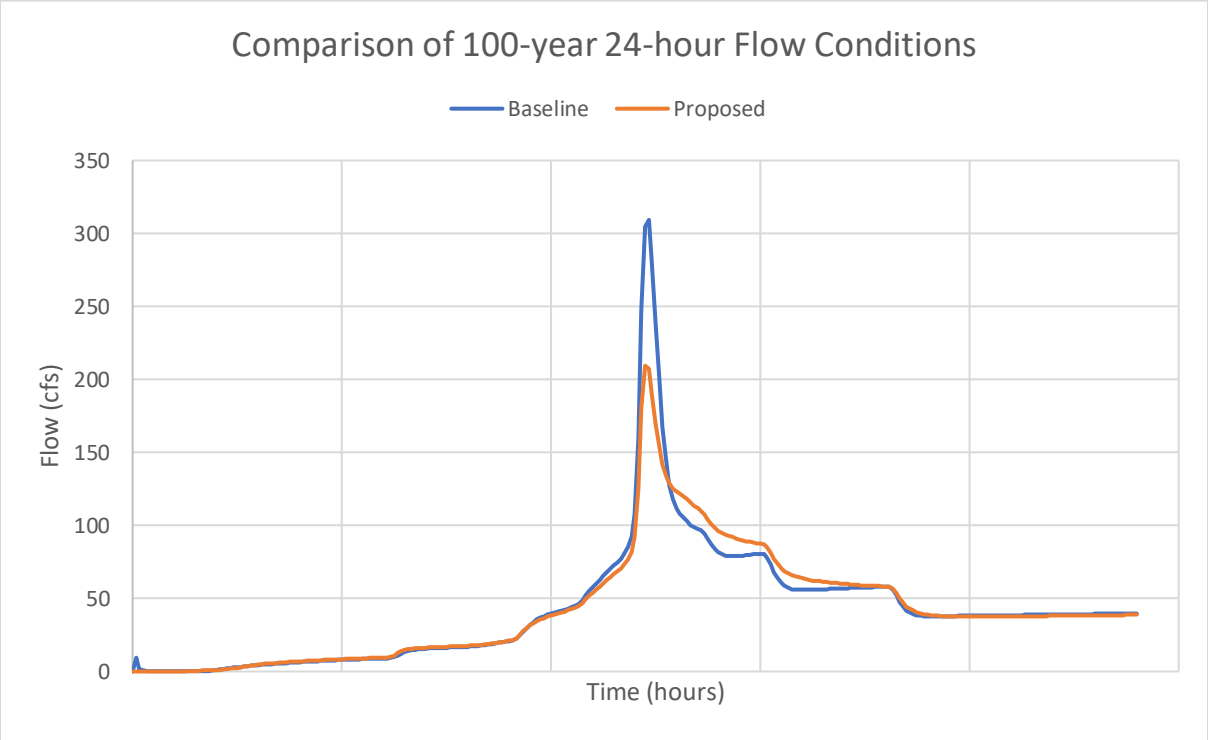


Exhibit 3 – Comparison of 100-Year 24-Hour Flow in Pipe Connecting to the City Drainage System at South Hill Drive

Table 3 – City Drainage System Water Surface Elevation Comparison

Node	Baseline 100-Year Water Surface Elevation (ft)	Proposed 100-Year Water Surface Elevation (ft)	100-year Difference (ft)	Baseline 10-year Water Surface Elevation (ft)	Proposed 10-year Water Surface Elevation (ft)	10-year Difference (ft)
212304	54.95	54.78	-0.17	54.01	53.18	-0.83
212303	51.86	51.83	-0.02	51.65	51.50	-0.14
212302	51.42	51.34	-0.08	51.09	51.01	-0.08
212301	47.35	47.33	-0.02	43.99	43.87	-0.13
212113	44.36	44.39	0.03	38.73	38.67	-0.07
212112	42.34	42.37	0.03	37.12	37.04	-0.08
212111	29.87	29.90	0.04	27.09	26.93	-0.16
212110	15.36	15.27	-0.09	14.63	14.60	-0.03
212109	14.33	14.18	-0.15	13.17	13.12	-0.05
212108	13.97	13.83	-0.14	12.97	12.99	0.01
212107	13.77	13.64	-0.13	12.87	12.86	-0.01
212105	12.78	12.69	-0.10	12.23	12.17	-0.06

Table 3 – City Drainage System Water Surface Elevation Comparison						
Node	**Baseline 100-Year Water Surface Elevation (ft)**	**Proposed 100-Year Water Surface Elevation (ft)**	**100-year Difference (ft)**	**Baseline 10-year Water Surface Elevation (ft)**	**Proposed 10-year Water Surface Elevation (ft)**	**10-year Difference (ft)**
212104	12.12	12.06	-0.07	11.43	11.36	-0.07
212103	11.54	11.48	-0.06	10.65	10.52	-0.13
212102	11.15	11.09	-0.06	10.08	9.92	-0.16
212101	10.63	10.57	-0.06	9.22	9.12	-0.11
212001	9.58	9.52	-0.06	8.03	8.02	-0.01
211007	9.35	9.29	-0.06	7.78	7.76	-0.02
211005	8.77	8.72	-0.05	7.41	7.40	-0.01
211004	8.33	8.28	-0.05	6.94	6.93	-0.01
2110032	7.72	7.67	-0.05	6.35	6.34	-0.01
211003	7.62	7.57	-0.05	6.24	6.23	-0.01
211002	6.08	6.09	0.00	6.01	6.01	0.00

City Storm Drain Deficiencies

The SDMP identified drainage system deficiencies and recommended CIPs to address the deficiencies. As a result of the model updates, drainage area corrections, and flow attenuation that would result from the Project, some of the deficiencies that had been identified in the SDMP no longer exist. **Table 4** compares water surface elevations along the same system included in Table 3 for proposed conditions and conditions from the SDMP with all CIPs recommended in the SDMP. One may conclude that if peak water levels based on proposed conditions are lower than the objective elevations that would have been achieved by implementation of the CIPs in the SDMP, then no CIP would be needed.

There are several proposed CIPs downstream of the Quarry. The locations of these CIPs are shown on Figure 5. SDMP CIPs M, N, and Z were evaluated. The 100-year peak flows along South Hill Drive would be significantly reduced from the existing conditions just downstream of the Project due to model revisions and proposed detention. With the lower flows, the peak water surface would be contained below the South Hill Drive roadway. This would make SDMP CIP Z, a proposed parallel drainage pipe in South Hill Drive, unnecessary. Flows would also be reduced along Valley Drive between South Hill Drive and Cypress Lane resulting in peak water surface elevations being lower than the objective CIP conditions. Therefore, SDMP CIP M is no longer needed. SDMP CIP N proposes a parallel pipe along Valley Road east of Cypress Lane. SDMP CIP N may still be beneficial to the City.

Table 4 – City Drainage System Comparison between Proposed Conditions and CIP Conditions				
Name	**Ground Elevation (Spill Crest) (ft)**	**CIP Max Water Elevation (ft)**	**Proposed Max Water Elevation (ft)**	**Difference (ft)**
212304	55.44	54.76	54.78	0.02
212303	53.00	52.37	51.83	-0.53
212302	52.25	52.18	51.34	-0.84
212301	56.29	50.11	47.33	-2.78
212113	49.90	48.59	44.39	-4.20
212112	48.40	46.95	42.37	-4.58
212111	35.18	34.52	29.90	-4.62
212110	19.80	15.68	15.27	-0.41
212109	16.80	14.90	14.18	-0.72
212108	13.84	13.77	13.83	0.06
212107	13.57	13.48	13.64	0.16
212105	12.00	12.62	12.69	0.07
212104	12.00	12.09	12.06	-0.03
212103	12.00	11.50	11.48	-0.02
212102	12.00	11.11	11.09	-0.02
212101	8.71	10.58	10.57	-0.01
212001	11.00	9.65	9.52	-0.13
211007	9.74	9.34	9.29	-0.05
211005	14.00	8.28	8.72	0.44
211004	12.00	7.72	8.28	0.56
2110032	12.00	6.88	7.67	0.79
211003	11.40	6.64	7.57	0.93
211002	11.40	6.10	6.09	-0.01

CONCLUSION

The SDMP drainage model was updated with revised hydrology and other updates to re-define a baseline condition. Project conditions included detention that would mitigate for increased runoff by reducing peak flows downstream from the Project in order that future peak flows would be significantly less than flows under the baseline condition. Future conditions, with implementation of the Project, would not require CIPs along South Hill Drive and Valley Drive between South Hill Drive and Cypress Lane, which, in turn, eliminates the need for SDMP CIPs M and Z. In conclusion, the proposed drainage system of underground pipe storage adequately mitigates potential adverse impacts downstream of the Project.

CIP N may still be useful because, even though the flood levels affected by CIP N will go down as a result of the detention system for the Quarry Redevelopment Project, the flood levels would be higher than flood levels that would have resulted from the CIP N improvement as evaluated in the SDMP. There would not be a clear nexus for the Quarry Redevelopment Project to contribute towards CIP N because the detention included in the Quarry Redevelopment Project would reduce the peak discharge rates through the CIP N area.

10-yr 24-hr Precipitation Contour

Watershed

Lagoon Watershed

10-yr 24-hr Precipitation Depth Zones (in)

3.4

3.6

3.8

4

4.2

NORTH

0 1,000 2,000 4,000

Feet

GUADALUPE QUARRY REVIEW

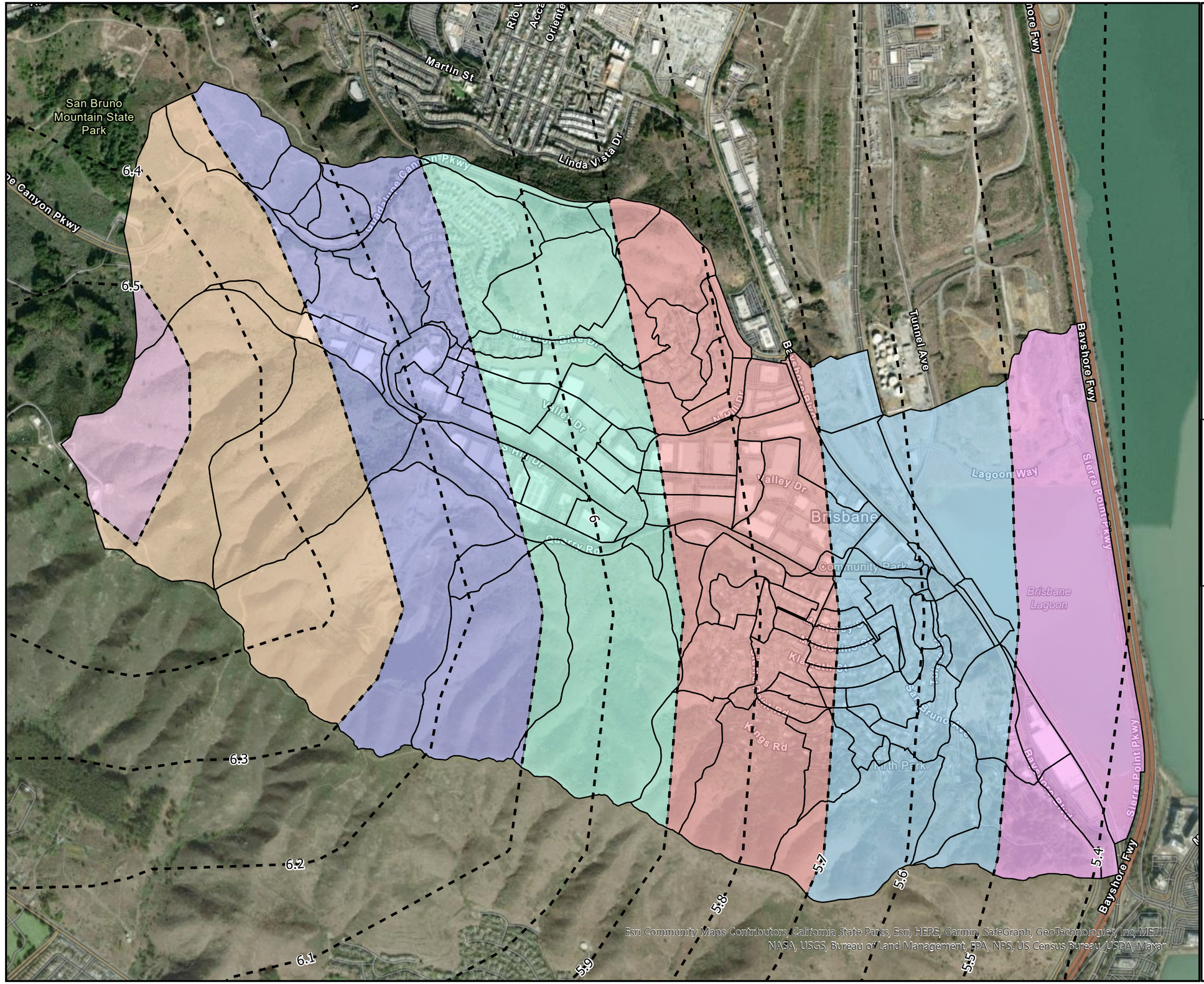
10-YR 24-HR RAINFALL ZONES

CITY OF BRISBANE, CALIFORNIA
September 2023

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FIGURE 1



- - - 100-year 24-hour Precipitation Contour

Watershed

Lagoon Watershed

100-yr 24-hr Precipitation Depth Zones (in)

- 5.2
- 5.4
- 5.6
- 5.8
- 6
- 6.2
- 6.4
- 6.5

NORTH

0 1,000 2,000 4,000

Feet

GUADALUPE QUARRY REVIEW

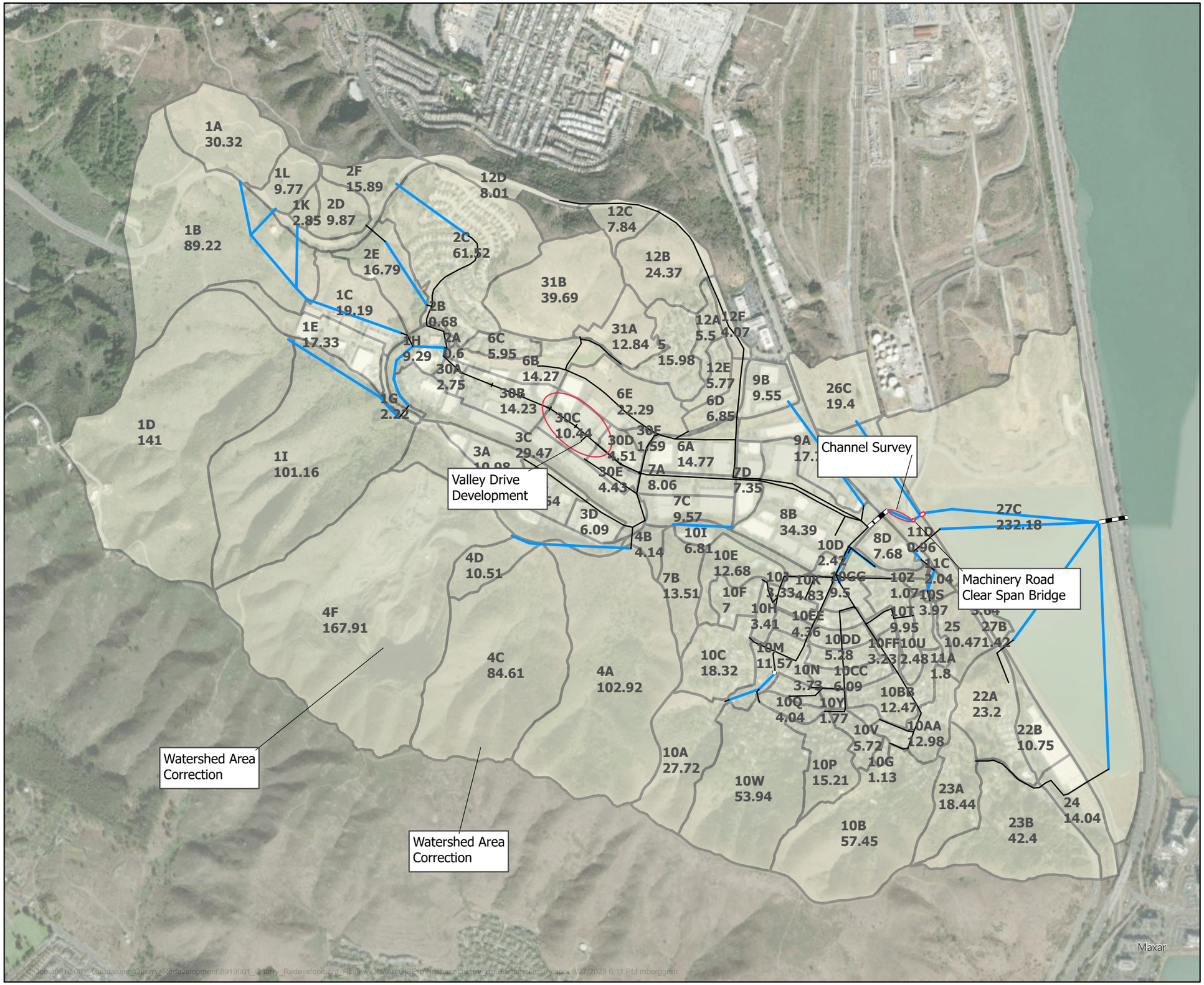
100-YR 24-HR RAINFALL ZONES

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FIGURE 2



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Existing Revisions
Culvert
Pipe
Pipe
Channel
Lagoon

NORTH

0 600 1,200 2,400
Feet

GUADALUPE QUARRY REVIEW

REVISED EXISTING CONDITIONS

CITY OF BRISBANE, CALIFORNIA
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FIGURE 3



Connection
Manhole
Pipe
Watershed

NORTH

0 250 500 1,000
Feet

GUADALUPE QUARRY REVIEW

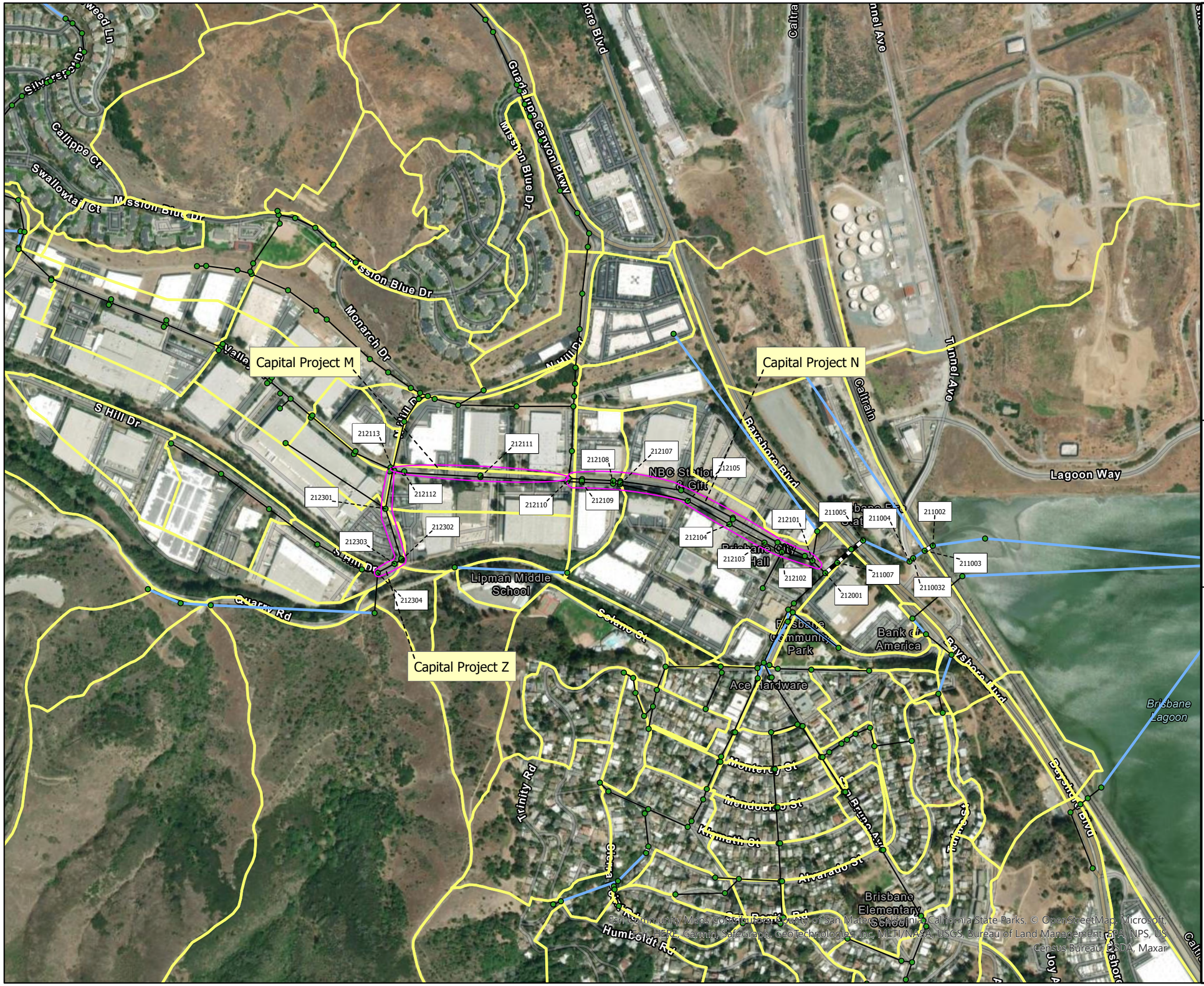
PROPOSED DRAINAGE CONDITIONS

CITY OF BRISBANE, CALIFORNIA
September 2023

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FIGURE 4



GUADALUPE QUARRY REVIEW

CITY DRAINAGE SYSTEM AND AFFECTED CIP PROJECTS

CITY OF BRISBANE, CALIFORNIA
September 2023

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FIGURE 5