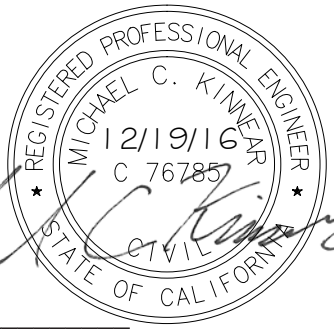
The City of San Diego

PRIORITY DEVELOPMENT PROJECT (PDP) STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) FOR

Project Name: Washington Place Residence
1826 Washington Place, San Diego, CA 92103
PTS No.

ENGINEER OF WORK:



Michael Kinnear, RCE 76785

Insert Civil Engineer's Name and PE Number Here
Provide Wet Signature and Stamp Above Line

PREPARED FOR:

Jim Nicholas
3593 5th Ave.
San Diego, CA 92103
(619) 542-1840

PREPARED BY:

COFFEY ENGINEERING, INC.

Coffey Engineering, Inc.
9666 Businesspark Ave., Suite 210
San Diego, CA 92131
(858) 831-0111

DATE:

12/19/15

Approved by: City of San Diego Date

CERTIFICATION PAGE

Project Name: Washington Place Residence
Permit Application Number:

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the Storm Water Standards, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Storm Water Standards. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

RCE 76785, Expiration Date 12/31/18

Engineer of Work's Signature, PE Number & Expiration Date

Michael Kinnear

Print Name

Coffey Engineering, Inc.

Company

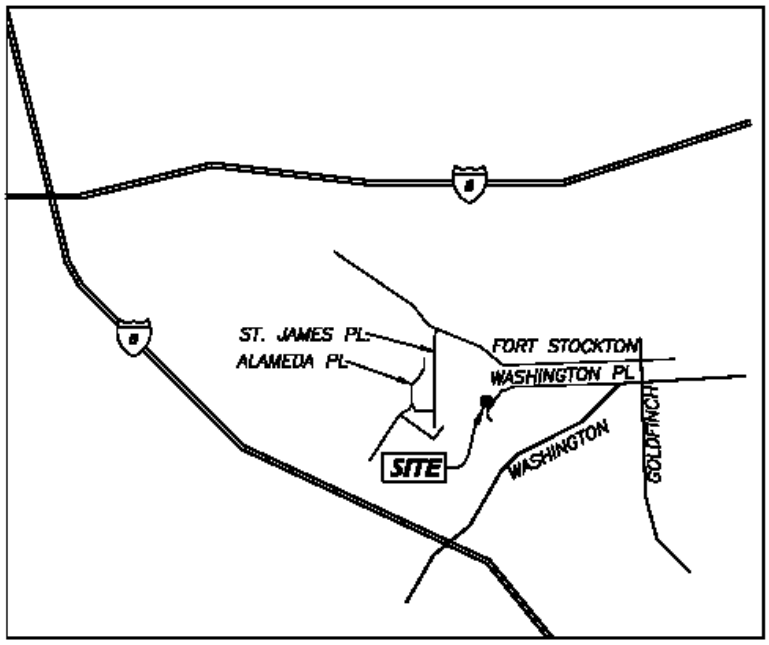
12/19/16

Date

Engineer's Stamp

Table of Contents

1.0 Vicinity Map



VICINITY MAP
THOMAS BROS. MAP 1268–H5
NO SCALE

2.0 Project Description

The site is located in San Diego, on Washington Pl near the intersection of Washington Pl and Portola Pl, Lots 95 and 96. The lot is currently developed and graded. The project proposes to develop the site as a single family residence. The site (13,497 ft^2) will be graded and developed with a new single family residence, and new landscape and hardscape features. The redevelopment will have an impervious footprint of approximately 6,454 ft^2 (47.8% impervious), this is an increase of 22.8% from the existing impervious footprint of 3,325 ft^2 (25% impervious). The proposed development is not part of a larger master development. The site qualifies as a priority development project due to its location in a Water Quality Sensitive Area and its creation of 2,500 SF or more of impervious area. The project developer is Laura Ducharme Conboy, 7742 Herschel Avenue, Suite H, La Jolla 92037 (858) 454-5205.

The site lies approximately 2000 feet northeast from the I-5 and 3,500 feet south from the I-8, with a general drainage pattern that flows from east to west through the site. Offsite run-on is not present at this site.

The existing drainage pattern consists of one drainage basin (Basin 1). Basin 1 consists of the entire developed site with two single-family residences with associated hardscape and landscape. Storm drainage sheet flows across the site to the north and is deposited into Robin's Egg Trail downslope of the site. During the 100-year storm Basin 1 will experience flows of 0.67 CFS. Refer to Drainage Map – Existing Conditions found in Appendix D of this report for the pre-construction basin map.

Drainage for the proposed site will be accomplished by sheet flow over landscape areas and existing vegetation, and overflow of treatment facilities via catch basins and PVC drain lines.

The proposed drainage pattern consists of two drainage basins, with the second being divided into two sub basins. Basin A consists of the existing rear yard vegetated hillside and concrete patio. Basin B.1 is comprised entirely of the western portion of the building footprint. Drainage is directed to a sump pump installed in the patio, where it discharges to a bioretention area north of the driveway. Basin B.2 incorporates the remaining building footprint and surrounding hardscape and landscape areas. Drainage sheet flows to the aforementioned bioretention area, where the combined flows are channeled to a storm water retention system underneath the driveway. Storm water is then pumped through a second sump pump to a D-25 curb outlet north of the bioretention area, where it ultimately enters the public drainage system north of the site.

During the 100-year storm, the rear yard hillside will experience a decrease in flows, from 0.67 cfs to 0.21 cfs. The expected runoff to the street will increase from 0.00 cfs to 0.62 cfs. Refer to Drainage Map – Proposed Conditions found in Appendix D of this report for the post-construction basin map.

2.1 Flow Path Description

Storm water runoff from the site will discharge in two locations. The basins that comprise the building footprint and front yard (B.1, B.2) discharge to Washington Place, where drainage will flow northward until it reaches an inlet to the public drainage system. The storm water that reaches the undisturbed slope (Basin A) will flow down the hillside. From there, the flow continues northward across the I-8, until it reaches the San Diego River. It is then carried by the river and deposited into the Pacific Ocean.

3.0 Pollutants and Conditions of Concern

The proposed construction most closely falls under the general project category of *Detached Residential Housing Development*. The following pollutants are listed as anticipated pollutants generated from this type of development:

- Sediment
- Nutrients
- Trash & Debris
- Oxygen Demanding Substances
- Oil & Grease
- Bacteria & Viruses
- Pesticides

(per Section 4.1.5, table 4-1 of the City of San Diego-Storm Water Standards Manual, January 2012)

The subject site is located in Calwater watershed 908.21 (San Diego region 9, Pueblo San Diego Hydrologic Unit 08, San Diego Mesa HA, Lindbergh HSA 8.21). The following table lists the bodies of water on the CWA section 303(d) list within this watershed:

Name	Pollutant Stressor
San Diego Bay Shoreline, at Marriott Marina	Copper
San Diego Bay Shoreline, at Harbor Island (East Basin)	Copper
San Diego Bay Shoreline, Downtown Anchorage	Benthic Community Effects Sediment Toxicity
San Diego Bay Shoreline, G Street Pier	Indicator Bacteria Total Dissolved Solids
San Diego Bay Shoreline, near Switzer Creek	Chlordane Lindane/HCH PAH
San Diego Bay Shoreline, Vicinity of B St and Broadway Piers	Benthic Community Effects Indicator Bacteria Sediment Toxicity

Required Pollutant Removal Efficiency

Name	High	Medium
Sediment	X	
Nutrients		X
Trash & Debris	X	
Oxygen Demanding Substances	X	
Oil & Grease	X	
Bacteria & Viruses	X	
Pesticides	X	

The nearest impacted area for this watershed would be the San Diego Bay, approximately 1.5 miles to the south (see the CWA 303(d) list for a complete listing of impacted areas for this watershed).

Beneficial Uses of Receiving Water

Inland Surface Waters	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRESH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWM
Pueblo San Diego Watershed																
Powerhouse Canyon	908.21	+							○	●		●		●		

+ Excepted from Municipal ● Existing Beneficial Use ○ Potential Beneficial Use

Structural BMP devices were chosen based on a multifaceted approach. First any device that did not treat for sediment, heavy metals, and bacteria and viruses with a high efficiency was removed. The remaining devices were infiltration basins, bio-retention facilities, cistern plus bio-retention, vault plus bio-retention, self-retaining areas, dry wells, constructed wetlands, and flow through planter boxes. Second any device that would require a large footprint was removed due to site constraints. The remaining devices were infiltration basins, bio-retention facilities, vault plus bio-retention, dry wells, and flow through planter boxes. Due to the fact that the flows entering the treatment device are being conveyed via sheet flow the project had insufficient hydraulic head to utilize flow through planters. Of the remaining treatment devices, a bioretention area with vault was chosen due to the limited above-ground storage area.

Table 4-3. Structural BMP Treatment Control Selection Matrix									
BMP	LID	HMP Control	Sediment	Nutrients	Trash	Metals	Bacteria	Oils and Grease	Organics
Infiltration Basin	Y	Y	H	H	H	H	H	H	H
Bioretention Basin	Y	Y	H	M	H	H	H	H	H
Cistern Plus Bioretention	Y	Y	H	M	H	H	H	H	H
Vault plus Bioretention	Y	Y	H	M	H	H	H	H	H
Self-retaining Area	Y	Y	H	H	H	H	H	H	H
Dry Wells	Y	Y	H	H	H	H	H	H	H
Constructed Wetlands	Y	Y	H	M	H	H	H	H	H
Extended Detention Basin	Y	Y	M	L	H	M	M	M	M
Vegetated Swale	Y	N	M	L	L	M	L	M	M
Vegetated Buffer Strips	Y	N	H	L	M	H	L	H	M
Flow-Through Planter Boxes	Y	Y	H	M	H	H	H	H	H
Vortex Separator or Wet Vault	N	N	M	L	M	L	L	L	L
Media Filter	N	N	H	L	H	H	M	H	H

H High removal efficiency
M Medium removal efficiency
L Low removal efficiency

4.0 Types of BMPs

4.1 Site Design/Low Impact Development BMPs

- Optimize the Site Layout - The proposed project will conserve the site's natural areas and vegetation along the rear yard hillside.
- Minimize Impervious Footprint – Extensive landscaping will be installed throughout the site.
- Disperse Runoff to Adjacent Landscaping – Runoff will be directed to landscaping. Hardscapes will be pitched to landscape wherever possible. Flows will travel through landscaped areas before being released from the site whenever possible.

- Construction Considerations - Soil compaction shall be minimized in landscaped areas. Soil amendments will be used to enhance and support continued vegetative growth.
- All basins are either considered self-treating or will be directed to the bio-retention facility.
- Install energy dissipaters – There are no concentrated flows to the hillside. An energy dissipater will be installed in the bioretention area to reduce the velocity of the pumped flows from the lower level pump. An energy dissipater will not be necessary for the second pump, as the positioning of the D-25 curb outlet will decrease the velocity by disrupting the flow.
- Vegetate slopes with either native or drought tolerant vegetation – Landscaping of disturbed slopes is an important part to the aesthetic of the project and will be implemented.
- Convey runoff safely away from tops of slopes – Downspouts will collect storm water and direct it to the treatment device via sump pumps and sheet flow through landscape areas.
- Design and Implementation of Pervious Surfaces – Landscape surfaces are implemented into the site design to reduce impervious areas.

LID BMP's Not Used:

- Stabilize permanent channel crossings – no channels or crossings within project.

4.2 Source Control BMPs

- (4.2.6) Efficient Irrigation - The irrigation system will be designed with sensitivity to each landscape area's water requirements (per CASQA BMP SD-12).
- (4.2.7) Trash Storage - Trash containers will have attached lids to prevent trash contact with storm water (per CASQA BMP SD-32).
- (4.2.8) Materials Storage – In the event that any landscaping or construction or any other material that could contaminate rainwater is stored onsite they will be stored in such a way as to eliminate contact with storm water. This includes but is not limited to: storing material above ground on palettes, using plastic covers, and employing secondary containment as needed (per CASQA BMP SD-34).
- (4.2.10) Employ integrated pest management principles – Plants in landscaped areas will be chosen to prevent pests (either native or pest-resistant plants) to reduce the need for pesticide use.
- (4.2.12) Design fire sprinkler system to discharge to sanitary sewer – If fire sprinkler system will be incorporated into the units all interior drains will be connected to the sanitary sewer per the California Building Code.
- (4.2.13) Manage Air Conditioning Condensate – Air conditioning condensate shall be directed to adjacent landscaping.
- (4.2.14) Use Non-Toxic Roofing Materials Where Feasible – The roof will be constructed with a non-toxic material. Metallic roofing will not be used.

- (4.2.15) Other Source Control Requirements – Site shall be stabilized with landscaping wherever possible. Pet wastes (if any) shall be collected and disposed of in proper waste containers (trash cans).

  *Numbers in parenthesis represent section within the City of San Diego Storm Water Standards Manual, Jan. 2012.

Source Control BMP's Not Used:

- (4.2.1) Maintenance Bays - Project is a single family residence, no maintenance bays are proposed.
- (4.2.2) Vehicle and Equipment Wash Areas - Project is a single family residence, no wash areas are proposed.
- (4.2.3) Outdoor Processing Areas - Project is a single family residence, no outdoor processing areas are proposed.
- (4.2.4) Retail and Non-Retail Fueling Areas - Project is a single family residence, no fueling areas are proposed.
- (4.2.5) Steep Hillside Landscaping – No steep hillsides will be disturbed on the project.
- (4.2.9) Design Loading Docks to Reduce Pollutant Contribution – Project is a single family residence; no loading docks are proposed.
- (4.2.11) Provide concrete stamping on storm water inlets and catch basins – Generally site drainage is managed through the use of small area drains - however in the event a catch basin or storm drain inlet is utilized, stamping or signage notifying of a direct connection to the storm drain will be employed.

  *Numbers in parenthesis represent sections within the City of San Diego Storm Water Standards Manual, Jan. 2012.

4.4 Treatment Control BMPs

Treatment for the site will occur in basins B.1 and B.2. Calculations show that this site requires a treatment facility with a surface area of 166 ft^2. 179 ft^2 is provided.
Sizing calculations are included in Appendix B.

Maintenance Conditions

Maintenance of the bioretention area will largely consists of periodic trimming of shrubbery and collection of trimmings and debris. Cutting the any grass to no less than 4" in height. Other maintenance activities are performed as needed and include:

- Re-seeding bare areas
- Weed control

- Repairing ruts or holes (utilizing soil that is properly tamped and seeded)
- Clearing of sediment and debris (clear sediment when 3" deep)

Should the infiltration rate drop below the minimum required by the City of San Diego Storm Water Standards Manual at any time, replacement of the engineered soil mix may be required.
Inspections should occur, at the very least, at the end of the wet season and after heavy rains.

Maintenance Responsibility

The financial and physical responsibility for BMP maintenance will be the property's owners, successors and/or assigns, in perpetuity. The large majority of these costs should fall within the typical responsibilities for landscape maintenance on the site. The property owners will execute and record a *Storm Water Management and Discharge Control Maintenance Agreement (SWMDCMA)* which shall run with the land as the mechanism to ensure maintenance extends into perpetuity as well.

5.0 Hydromodification Compliance

This project does not qualify for exemption from hydromodification. The implementation of an underground storage tank will be used in order to comply with hydromodification mitigation measures. A system of holding tanks (cistern) totaling 1731 ft^3 will be implemented underground (1680 ft^3 required).

6.0 Buffer Measures

The proposed project does not have any natural water bodies present therefore we do not propose utilizing buffer zones in order to protect any natural water bodies.

Bibliography

- City of San Diego 2016. *Storm Water Standards.* http://www.sandiego.gov/stormwater/regulations/index.shtml

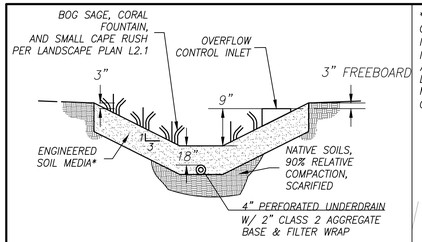
- City of San Diego. 2011. *Low Impact Development Design Manual.* http://www.sandiego.gov/stormwater/pdf/lidmanual.pdf

- RWQCB. 2013. California Regional Water Quality Control Board for the San Diego Region. *Order R9-2013-0001 (Stormwater NPDES Permit)* www.waterboards.ca.gov/sandiego/

- CASQA. 2003. California Stormwater Quality Association. *California Stormwater BMP Handbooks.* Four Handbooks: *New Development and Redevelopment, Construction, Municipal, and Industrial/Commercial.* www.cabmphandbooks.org

- San Diego Regional Water Quality Control Board. 2010. *CWA Section 303(d) List of Water Quality Limited Segments Requiring TMDLs.* http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml

Appendix A-Site Map



*ENGINEERED SOIL MEDIA CONSISTS OF 85% WASHED COURSE SAND, 10% FINES (RANGE: 8–12%; 8% = 2 IN/HR INFILTRATION RATE, 12% = 1 IN/HR INFILTRATION RATE), AND 5% ORGANIC MATTER. FOR ADDITIONAL STANDARDS SEE SAN DIEGO LOW IMPACT DEVELOPMENT DESIGN MANUAL SECTION 1.2.4.2 SOIL MEDIA MUST MAINTAIN A MINIMUM INFILTRATION RATE OF 5 IN/HR

DETAIL 'A'
BIO-RETENTION FACILITY
NOT TO SCALE

LEGEND

DESCRIPTION	STD DWG	SYMBOL
STREET CENTERLINE		℄
PROPERTY LINE		N45°45'45"W
EXISTING CONTOUR		90
EXISTING SPOT ELEVATION		100.00
PROPOSED CONTOUR		90
PROPOSED SPOT ELEVATION		100.00
DRAINAGE SWALE OR DIRECTION OF FLOW		
PVC DRAIN LINE		
6" LANDSCAPE DRAIN		Ø
5" HARDSCAPE DRAIN		
BUILDING FOOTPRINT		
CMU RETAINING WALL		
CMU RETAINING WALL		
EXISTING GAS LINE		G
EXISTING SEWER–MAIN		S
EXISTING TELEPHONE LINE		T
EXISTING WATER MAIN		W
P.C.C. DRIVEWAY	SDG–160	
4" TIGHT LINE PIPE (PVT)		

PERMANENT BMP LEGEND

SOURCE CONTROL BMPs *

3.1.6	EFFICIENT IRRIGATION
3.1.7	TRASH STORAGE
3.1.8	MATERIALS STORAGE
3.1.10	EMPLOY INTEGRATED PEST MANAGEMENT PRINCIPLES
3.1.13	MANAGE AIR CONDITIONING CONDENSATE
3.1.14	USE NON–TOXIC ROOFING MATERIALS WHERE FEASIBLE
3.1.15	OTHER SOURCE CONTROL REQUIREMENTS

LID & SITE DESIGN BMPs

LID–1	OPTIMIZE SITE LAYOUT
LID–2	MINIMIZE IMPERVIOUS FOOTPRINT
LID–3	DISPERSE RUNOFF TO ADJACENT LANDSCAPING
LID–4	CONSTRUCTION CONSIDERATIONS

* REFER TO WATER QUALITY STUDY AND STORM WATER STANDARDS 2012 FOR DETAILS

BENCHMARK

N'LY BP IN TOP OF CURB AT WASHINGTON PLACE AND PRINGLE STREET
EL: 272.027 FEET. DATUM: NGVD 29 (CITY OF SAN DIEGO MSL)

LEGAL DESCRIPTION

LOTS 95 & 96 OF MISSION HILLS, IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP NO. 1115, ON FILE IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY.

APN: 443–631–01 & 443–631–02

EASEMENTS

THIS PLAN WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT. EASEMENTS MAY BE PRESENT ON AND AFFECT THE SUBJECT PROPERTY.

CIVIL ENGINEER:

JOHN S. COFFEY
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(858) 831–0111
FAX: (858) 831–0179

REGISTERED PROFESSIONAL ENGINEER JOHN S. COFFEY No. 062716 CIVIL STATE OF CALIFORNIA

PRELIMINARY

JOHN S. COFFEY DATE
RCE 062716

ABBREVIATIONS

AC	ASPHALTIC CONCRETE
APN	ASSESSOR'S PARCEL NUMBER
BRW	BOTTOM OF RETAINING WALL GRADE
℄	CENTER LINE
CB	CATCH BASIN
CO	CLEANOUT
CONC	CONCRETE
(E); EX	EXISTING
EL	ELEVATION
FF	FINISH FLOOR
℄; FL	FLOW LINE
H	HEIGHT
IE	INVERT ELEVATION
MAT'L	MATERIAL
MAX	MAXIMUM
MIN	MINIMUM
(P); PR	PROPOSED
PCC	PORTLAND CEMENT CONCRETE
PLTR	PLANTER/PLANTING AREA
PP	POWER POLE
S	SEWER
SD	STORM DRAIN
SF	SQUARE FEET
TC	TOP OF CURB
TG	TOP OF GRATE (DRAIN)
TRW	TOP OF RETAINING WALL GRADE
TYP	TYPICAL
W	WATER
WM	WATER METER

TOPOGRAPHY NOTE

WE PREPARED THIS GRADING PLAN WITH THE BENEFIT OF A TOPOGRAPHY AND/OR A RECORD DRAWINGS PROVIDED BY THE OWNER, ANOTHER SURVEYOR, AND/OR A GOVERNMENT AGENCY. THEREFORE, WE WILL NOT BE HELD RESPONSIBLE FOR CONSTRUCTION CONFLICTS, DELAYS, OR ADDITIONAL COSTS INCURRED AS A RESULT OF INACCURATE TOPOGRAPHIC INFORMATION. FURTHERMORE, THE PLOTTING OF EXISTING UTILITIES ON THIS PLAN DOES NOT CONSTITUTE A GUARANTEE OF THEIR LOCATION, SLOPE, DEPTH, SIZE, OR TYPE. EXACT LOCATION, DEPTH, SIZE, OR TYPE OF LINES AND FACILITIES CAN ONLY BE DETERMINED BY FIELD EXPLORATION (I.E. POTHOLING, EXCAVATION) PRIOR TO CONSTRUCTION. WE WILL NOT BE HELD RESPONSIBLE FOR COSTS INCURRED IN THE EVENT THAT EXISTING UTILITIES WERE NOT OF THE LOCATION, SLOPE, DEPTH, SIZE, OR TYPE INDICATED.

GRADING PLAN NOTES

A. PRIOR TO THE ISSUANCE OF ANY CONSTRUCTION PERMIT, THE APPLICANT SHALL INCORPORATE ANY CONSTRUCTION BEST MANAGEMENT PRACTICES NECESSARY TO COMPLY WITH CHAPTER 14, ARTICLE 2, DIVISION 1 (GRADING REGULATIONS) OF THE SAN DIEGO MUNICIPAL CODE, INTO THE CONSTRUCTION PLANS OR SPECIFICATIONS.

B. PRIOR TO THE ISSUANCE OF ANY CONSTRUCTION PERMIT THE APPLICANT SHALT SUBMIT A WATER POLLUTION CONTROL PLAN (WPCP). THE WPCPW SHALL BE PREPARED IN ACCORDANCE WITH THE GUIDELINES IN APPENDIX E OF THE CITY'S STORM WATER STANDARDS.

SOURCE OF TOPOGRAPHY

WOODS LAND SURVEYING, INC
2180 GARNET AVE., SUITE 3K SAN DIEGO, CA 92109
PH: (858) 273–4700 FAX: (858) 273–4922 E–MAIL: survey@woodslandsurveying.com
STEVEN L. WOODS, RLS NO. 6427 DATE OF SURVEY: SEPTEMBER, 2014

GRADING TABULATIONS

TOTAL AMOUNT OF SITE TO BE GRADED:	0.19	ACRES	% OF TOTAL SITE:	61%	
AMOUNT OF CUT:	580	CUBIC YARDS	MAXIMUM DEPTH OF CUT:	11.62 *	FEET
AMOUNT OF FILL:	10	CUBIC YARDS	MAXIMUM DEPTH OF FILL:	3	FEET
MAXIMUM HEIGHT OF FILL SLOPE(S):	2	FEET	SLOPE RATIO:	N/A	
MAXIMUM HEIGHT OF CUT SLOPE(S):	N/A	FEET	SLOPE RATIO:	N/A	
AMOUNT OF ~~IMPORT~~/ EXPORT SOIL:	570	CUBIC YARDS			
RETAINING/ ~~CRIB WALLS~~:	LENGTH 75	FEET	MAXIMUM HEIGHT:	6	FEET

* INSIDE THE BUILDING

DRAINAGE NOTES

1. ALL MAIN DRAIN LINES SHOWN TO BE 6" PVC @ 1% MINIMUM SLOPE UNLESS OTHERWISE NOTED.
2. ALL CATCH BASIN LEADS TO BE 4" PVC @ 2% MINIMUM SLOPE UNLESS OTHERWISE NOTED.
3. HARDSCAPE GRADES TO BE 1% MINIMUM TO DRAINS AND AWAY FROM STRUCTURE.
4. SOFTSCAPE GRADES TO BE 2% MINIMUM TO DRAINS (1% WHERE FLOW IS CONCENTRATED) AND 2% MINIMUM AWAY FROM STRUCTURE.
5. SOIL COVER ABOVE DRAIN LINES SHALL BE 12" MINIMUM UNLESS OTHERWISE NOTED.
6. NOTIFY CIVIL ENGINEER IF ANY NON–DRAINING SUMP CONDITIONS BECOME APPARENT DURING CONSTRUCTION.
7. THIS PROJECT WILL NOT DISCHARGE ANY INCREASE IN STORM WATER RUN–OFF ONTO THE EXISTING HILLSIDE AREAS.
8. AT THE STORM WATER DISCHARGE LOCATIONS, SUITABLE ENERGY DISSIPATERS ARE TO BE INSTALLED TO REDUCE THE DISCHARGE TO NON–ERODIBLE VELOCITIES.
9. NO ADDITIONAL RUN–OFF IS PROPOSED FOR THE DISCHARGE LOCATIONS.

INTERIM BINDER NOTE

GRADED, DISTURBED, OR ERODED AREAS TO BE TREATED WITH A NON–IRRIGATED HYDROSEED MIX SHALL RECEIVE AN INTERIM BINDER/TACKIFIER AS NEEDED BETWEEN APRIL 2 AND AUGUST 31 FOR DUST EROSION CONTROL WITH SUBSEQUENT APPLICATION OF HYDROSEED MIX DURING THE RAINY SEASON BETWEEN OCTOBER 1 AND APRIL 1.

COFFEY ENGINEERING, INC.
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CITY OF SAN DIEGO, CALIFORNIA

SITE DEVELOPMENT PERMIT

WASHINGTON PLACE RESIDENCE
1826 - 1836 Washington Place
San Diego, CA 92103

ORIGINAL 12/19/16

REVISIONS

GRADING & DRAINAGE PLAN — C.1

DRAWN BY: DTK
CHECKED BY: JSC

SHEET 1 OF 2

Appendix B-Calculations

Categorization of Infiltration Feasibility Condition	**Form I-8**

Part 1 - Full Infiltration Feasibility Screening Criteria
Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	✔	☐

Provide basis:

Based on NRCS soils classification and region specific analysis we expect Class C or D soils to be present on site. Detailed Infiltration tests and Geotechnical evaluation to be presented during Ministerial phase. If detailed geotechnical analysis returns factors different than what has been estimated engineering design will be revised to account for verified factors.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

2	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	☐	✔

Provide basis:

Due to facility proximity to building foundation full infiltration is not feasable. Detailed Infiltration tests and Geotechnical evaluation to be presented during Ministerial phase. If detailed geotechnical analysis returns factors different than what has been estimated engineering design will be revised to account for verified factors.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Form I-8 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✔	
Provide basis: Based on NRCS soils classification and region specific analysis we expect Class C or D soils to be present on site. Detailed Infiltration tests and Geotechnical evaluation to be presented during Ministerial phase. If detailed geotechnical analysis returns factors different than what has been estimated engineering design will be revised to account for verified factors. Groundwater contamination potential will be assessed as part of the detailed geotechnical analysis. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✔	
Provide basis: Based on NRCS soils classification and region specific analysis we expect Class C or D soils to be present on site. Detailed Infiltration tests and Geotechnical evaluation to be presented during Ministerial phase. If detailed geotechnical analysis returns factors different than what has been estimated engineering design will be revised to account for verified factors. Water balance issues will be assessed as part of the detailed geotechnical analysis. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City Engineer to substantiate findings

Form I-8 Page 3 of 4			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
5	Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	✔	☐
Provide basis: Hydrologic soil group C or D. Low infiltration. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
6	Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	✔	☐
Provide basis: Hydrologic soil group C or D. Low infiltration. Possible mitigation to reduce geologic hazard is possible in a partial infiltration condition. Detailed Infiltration tests and Geotechnical evaluation to be presented during Ministerial phase. If detailed geotechnical analysis returns factors different than what has been estimated engineering design will be revised to account for verified factors. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			

Form I-8 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✔	
Provide basis: Hydrologic soil group C or D. Low infiltration. Possible mitigation to reduce groundwater risk is possible in a partial infiltration condition. Detailed Infiltration tests and Geotechnical evaluation to be presented during Ministerial phase. If detailed geotechnical analysis returns factors different than what has been estimated engineering design will be revised to account for verified factors. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✔	
Provide basis: Hydrologic soil group C or D. Low infiltration. no groundwater rights issues currently expected. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration. If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City Engineer to substantiate findings

Factor of Saftey and Design Infiltration Rate Worksheet			Worksheet D.5-1		
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p=w x v
A	Suitability Assessment	Soil assessment methods	0.25	3	0.75
		Predominant soil texture	0.25	3	0.75
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	2	0.5
		Suitability Assessment Safety Factor, $S_A = \sum p$			2.5
B	Design	Level of Pretreatment / expected sediment loads	0.5	1	0.5
		Redundancy / resiliency	0.25	2	0.5
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \sum p$			1.5
Combined Safety Factor, $S_{total} = S_A \times S_B$				4	
Observed Infiltration Rate, inch.hr, $K_{observed}$ (corrected for test-specific bias)				0.57	
Design Infiltration Rae, in/hr, $K_{design} = K_{observed} / S_{total}$				0.143	
Supporting Data					
Briefly describe infiltration test and provide reference to test forms: Assumed Rate from soils maps, regional area, and USDA NRCS National Engineering Handbook Chapter 7. Perc tests to be performed during ministerial phase to determine true infiltration rate. Treatment facilities to be revised as needed during that phase					

Design Capture Volume		Worksheet B.2-1		
1	85th Percentile 24-hr storm depth from Figure b.1-1	d =	0.57	inches
2	Area tributary to BMP (s)	A =	0.18	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1	C =	0.704	unitless
4	Street trees volume reduction	TCV =	0	cubic-feet
5	Rain barrels volume reduction	RCV =	0	cubic-feet
6	Calculated DCV = (3630 x C x d x A) - TCV - RCV	DCV =	262.20	cubic-feet

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1	
1	Remaining DCV after implementing retention BMPs	262.20	cubic-feet
Partial Retantion			
2	Infiltration from Worksheet D.5-1 if partial infiltration is feasible	0.1425	in / hr
3	Allowable drawdown time for aggregate storage below underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	5.13	inches
5	Aggregate pore space	0.4	in / in
6	Required depth of gravel below the underdrain [Line 4 / Line 5]	12.825	inches
7	Assumed surface area of the biofiltration BMP	178.88	sq-ft
8	Media retained pore space	0.1	in / in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	103.3032	cubic-feet
10	DCV that requires biofiltration [Line 1 - Line 9]	158.89	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inches minimum, 12 inches maximum]	9	inches
12	Media Thickness [18 inches minimum]	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) - use 0 inches for sizing if the aggegate is not over the entire bottom surface area	0	inches
14	Media available pore space	0.2	in / in
15	Media filtration rate to be used for sizing	5	in / hr
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11+ (Line 12 x Line 14) + (Line 13 x Line 5)]	12.60	inches
19	Total Depth Treated [Line 17 + Line 18]	42.6	inches
Option 1 - Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	238.34	cubic-feet
21	Required Footprint [Line 20 / Line 19] x 12	67.14	sq-ft
Option 2 - Store 0.75 of the remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	119.17	cubic-feet
23	Required Footprint [Line 22 / Line 18] x 12	113.50	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	7861	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.704	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	166.02	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 26)	166.02	sq-ft
Footprint of the BMP			
29	Calculate the frationof DCV retained in the BMP [Line 9/Line 1]	0.393992	unitless
30	Minimum required fraction of DCV retained for patial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in line 26 until the answer is yes for this criterion	Yes X	No

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Site Information			
Project Name:	Nicholas Residence	Hydrologic Unit:	908.21
Project Applicant:	Jim Nicholas	Rain Guage:	Lindbergh
Jurisdiction	City of San Diego	Total Project Area:	7861
APN:	443-631-01, -02	Low Flow Threshold:	0.1Q2
BMP Name:	Retention Modules (4)	BMP Type:	Cistern

Areas Draining to BMP						Sizing Factors			Min. BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (From Table G.2-1)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (CF)	Subsurface Volume (cf)
B.1	1561	D	Low	Roofs	1	N/A	0.26	N/A		405.86	
B.2	3414	D	Low	Roofs	1	N/A	0.26	N/A		887.64	
B.2	1332	D	Low	Concrete	1	N/A	0.26	N/A		346.32	
B.2	1554	D	Low	Landscape	0.1	N/A	0.26	N/A		40.404	
Total DMA Area	7861							Minimum BMP Size*		1680.224	
								Proposed BMP Size*		1731	

(1) $Q=C_d \times A \times (2gH)^{0.5}$ Orifice Discharge Equation

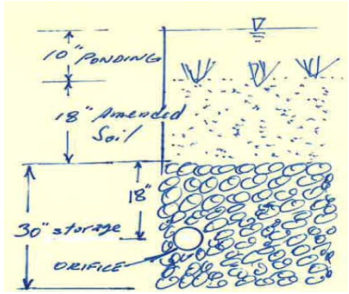
(2) $A= [0.1Q_2 \times A_{DMA}]/C_d \times (2gH)^{0.5}$ Orifice Area Equation (for 0.1Q2 as lower limit threshold)

Cd = 0.58 dimensionless

g = 32.2 ft/s2

H = 5 ft

Q_2s provided (see 2012 Methodology, Page 1-30, Sec. 1.6, Table 1-6)



Dimentional Analysis indicates a factor of 144 is required:
in2 = {(ft3/sec x acre)x(acre of DMA)/[(ft/sec2)xft]^0.5} x 144 in2/ft2

	Rain Gage	Soil Type	Cover	Slope	Q2 Sizing Factor	DMA Area (ac)	Lower Limit of Q2	**Orifice Area (in2)**	
DMA B (B.1+B.2)	Lindbergh	D	Scrub	Flat	0.05	0.18	0.1	**0.01**	**0.01**

0.01	**0.13**
Tot. Orifice Area	**Orifice Dia**

Table 1-6. Unit Runoff Ratios

Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lindbergh	D	Scrub	Low	0.05	0.228

Drawdown Time

Orifice Flow Rate: $Q = C_d \times A \times (2gH)^{0.5}$

Where: Q = Orifice Flow Rate
C_d = Discharge Coefficient (0.58 dimensionless)
A = Orifice Area (.01 in^2)
g = Gravitational Constant (32.2 ft/s^2)
H = Water Column Height (5 ft)

Solving for:

Q = Orifice Flow Rate

$Q = 0.58 \times (0.01\ in^2 \times 1/144\ ft^2/in^2) \times (2 \times 32.2 ft/s^2 \times 5ft)^{0.5}$

Q = .00072cfs

Total underground storage volume = 1731 ft^3 = 577 ft^3 x 3 retention modules

t = V/Q

Solving for:

t = Draw Down Time

t = 1731 ft3 / .00072 cfs

t = 2,404,166s = 2,404,166 s / 86400 days = 27.83 days > 4 days X

Drawdown time is not acceptable.

Vector management program will be utilized.

Appendix C-Supplemental Documents

THE CITY OF SAN DIEGO
City of San Diego
Development Services
1222 First Ave., MS-302
San Diego, CA 92101
(619) 446-5000

Storm Water Requirements Applicability Checklist

FORM
DS-560
FEBRUARY 2016

Project Address:	Project Number *(for City Use Only):*

SECTION 1. Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the Storm Water Standards Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP)[1] , which is administered by the State Water Resources Control Board.

For all project complete PART A: If project is required to submit a SWPPP or WPCP, continue to PART B.

PART A: Determine Construction Phase Storm Water Requirements.

1. Is the project subject to California's statewide General NPDES permit for Storm Water Discharges Associated with Construction Activities, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

   ❑ Yes; SWPPP required, skip questions 2-4 ☒ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity that results in ground disturbance and contact with storm water runoff?

   ☒ Yes; WPCP required, skip 3-4 ❑ No; next question

3. Does the project propose routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (Projects such as pipeline/utility replacement)

   ❑ Yes; WPCP required, skip 4 ❑ No; next question

4. Does the project only include the following Permit types listed below?
   - Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
   - Individual Right of Way Permits that exclusively include only ONE of the following activities: water service, sewer lateral, or utility service.
   - Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, pot holing, curb and gutter replacement, and retaining wall encroachments.

   ❑ Yes; no document required

   Check one of the boxes to the right, and continue to PART B:

   ❑ If you checked "Yes" for question 1, **a SWPPP is REQUIRED. Continue to PART B**

   ❑ If you checked "No" for question 1, and checked "Yes" for question 2 or 3, **a WPCP is REQUIRED.** If the project proposes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to PART B.**

   ❑ If you checked "No" for all questions 1-3, and checked "Yes" for question 4 PART B **does not apply and no document is required. Continue to Section 2.**

1. More information on the City's construction BMP requirements as well as CGP requirements can be found at: www.sandiego.gov/stormwater/regulations/index.shtml

PART B: Determine Construction Site Priorit

This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a "high threat to water quality." The City has aligned the local definition of "high threat to water quality" to the risk determination approach of the State Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **NOTE:** The construction priority does **NOT** change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by city staff.

Complete PART B and continued to Section 2

1. ❑ **ASBS**

a. Projects located in the ASBS watershed.

2. ❑ **High Priority**

a. Projects 1 acre or more determined to be Risk Level 2 or Risk Level 3 per the Construction General Permit and not located in the ASBS watershed.

b. Projects 1 acre or more determined to be LUP Type 2 or LUP Type 3 per the Construction General Permit and not located in the ASBS watershed.

3. ❑ **Medium Priority**

a. Projects 1 acre or more but not subject to an ASBS or high priority designation.

b. Projects determined to be Risk Level 1 or LUP Type 1 per the Construction General Permit and not located in the ASBS watershed.

4. ☒ **Low Priority**

a. Projects requiring a Water Pollution Control Plan but not subject to ASBS, high, or medium priority designation.

SECTION 2. Permanent Storm Water BMP Requirements.

Additional information for determining the requirements is found in the Storm Water Standards Manual.

PART C: Determine if Not Subject to Permanent Storm Water Requirements.

Projects that are considered maintenance, or otherwise not categorized as "new development projects" or "redevelopment projects" according to the Storm Water Standards Manual are not subject to Permanent Storm Water BMPs.

If "yes" is checked for any number in Part C, proceed to Part F and check "Not Subject to Permanent Storm Water BMP Requirements".

If "no" is checked for all of the numbers in Part C continue to Part D.

1.	Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact storm water?	❑ Yes	☒ No
2.	Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?	❑ Yes	☒ No
3.	Does the project fall under routine maintenance? Examples include, but are not limited to: roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay, and pothole repair).	❑ Yes	☒ No

PART D: PDP Exempt Requirements.

PDP Exempt projects are required to implement site design and source control BMPs.

If "yes" was checked for any questions in Part D, continue to Part F and check the box labeled "PDP Exempt."

If "no" was checked for all questions in Part D, continue to Part E.

1. Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:
   - Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   - Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;
   - Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Storm Water Standards manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Storm Water Standards Manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; project not exempt. PDP requirements apply

PART E: Determine if Project is a Priority Development Project (PDP).
Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

If "yes" is checked for any number in PART E, continue to PART F.

If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Development Project".

1.	**New Development that creates 10,000 square feet or more of impervious surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☐ Yes ☒ No
2.	**Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces**. This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☐ Yes ☒ No
3.	**New development or redevelopment of a restaurant.** Facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC 5812), and where the land development creates and/or replace 5,000 square feet or more of impervious surface.	☐ Yes ☒ No
4.	**New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater.	☐ Yes ☒ No
5.	**New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).**	☐ Yes ☒ No
6.	**New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).	☐ Yes ☒ No

7. **New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). ☒ Yes ☐ No

8. **New development or redevelopment projects of a retail gasoline outlet (RGO) that create and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. ☐ Yes ☒ No

9. **New development or redevelopment projects of an automotive repair shops that creates and/or replaces 5,000 square feet or more of impervious surfaces.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539. ☐ Yes ☒ No

10. **Other Pollutant Generating Project.** The project is not covered in the categories above, results in the disturbance of one or more acres of land and is expected to generate pollutants post construction, such as fertilizers and pesticides. This does not include projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces of if they sheet flow to surrounding pervious surfaces. ☐ Yes ☒ No

PART F: Select the appropriate category based on the outcomes of PART C through PART E.

1. The project is **NOT SUBJECT TO STORM WATER REQUIREMENTS.** ☐

2. The project is a **STANDARD DEVELOPMENT PROJECT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance. ☐

3. The project is **PDP EXEMPT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance. ☐

4. The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control, and structural pollutant control BMP requirements apply. See the Storm Water Standards Manual for guidance on determining if project requires a hydromodification plan management ☒

Name of Owner or Agent *(Please Print)*: Michael Rein

Title: Agent

Signature: Michael Rein

Date: 2/25/16

THE CITY OF SAN DIEGO

RECORDING REQUESTED BY:
THE CITY OF SAN DIEGO
AND WHEN RECORDED MAIL TO:
Jim Nicholas
3593 5th Avenue, Suite C
San Diego, CA 92103

(THIS SPACE IS FOR RECORDER'S USE ONLY)

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPROVAL NUMBER:	ASSESSORS PARCEL NUMBER:	PROJECT NUMBER:
	443-631-01 & 443-631-02	432759

This agreement is made by and between the City of San Diego, a municipal corporation [City] and Jim Nicholas, the owner or duly authorized representative of the owner [Property Owner] of property located at 1826 Washington Place, San Diego CA 92103 (PROPERTY ADDRESS) and more particularly described as: Lots 95 and 96 of Mission Hills, according to Map No. 1115 (LEGAL DESCRIPTION OF PROPERTY) in the City of San Diego, County of San Diego, State of California.

Property Owner is required pursuant to the City of San Diego Municipal Code, Chapter 4, Article 3, Division 3, Chapter 14, Article 2, Division 2, and the Land Development Manual, Storm Water Standards to enter into a Storm Water Management and Discharge Control Maintenance Agreement [Maintenance Agreement] for the installation and maintenance of Permanent Storm Water Best Management Practices [Permanent Storm Water BMP's] prior to the issuance of construction permits. The Maintenance Agreement is intended to ensure the establishment and maintenance of Permanent Storm Water BMP's onsite, as described in the attached exhibit(s), the project's Water Quality Technical Report [WQTR] and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): 432759.

Property Owner wishes to obtain a building or engineering permit according to the Grading and/or Improvement Plan Drawing No(s) or Building Plan Project No(s): 432759.

Continued on Page 2

NOW, THEREFORE, the parties agree as follows:

1. Property Owner shall have prepared, or if qualified, shall prepare an Operation and Maintenance Procedure [OMP] for Permanent Storm Water BMP's, satisfactory to the City, according to the attached exhibit(s), consistent with the Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): 432759.

2. Property Owner shall install, maintain and repair or replace all Permanent Storm Water BMP's within their property, according to the OMP guidelines as described in the attached exhibit(s), the project's WQTR and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s) 432759.

3. Property Owner shall maintain operation and maintenance records for at least five (5) years. These records shall be made available to the City for inspection upon request at any time.

This Maintenance Agreement shall commence upon execution of this document by all parties named hereon, and shall run with the land.

Executed by the City of San Diego and by Property Owner in San Diego, California.

See Attached Exhibit(s): 'A', 'B', 'C', 'D', 'E'

_____
(Owner Signature)

Jim Nicholas
(Print Name and Title)

_____
(Company/Organization Name)

_____
(Date)

THE CITY OF SAN DIEGO

APPROVED:

_____
(City Control Engineer Signature)

_____
(Print Name)

_____
(Date)

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDGMENTS PER CIVIL CODE SEC. 1180 ET.SEQ.

Reset Button Page 2

EXHIBIT 'A'

LEGEND:

PROPERTY LINE — P/L

ROW CENTERLINE — ℄

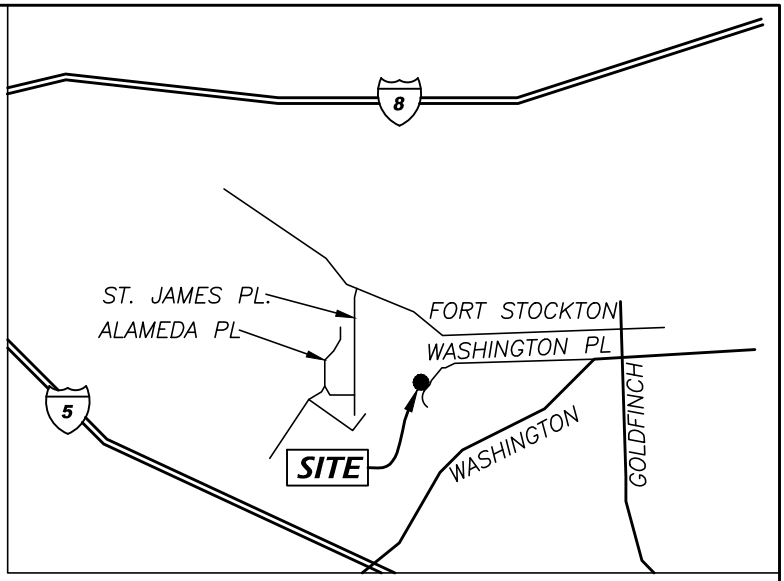
RIGHT OF WAY — R/W

STORM WATER BMP:

BIO-RETENTION AREA

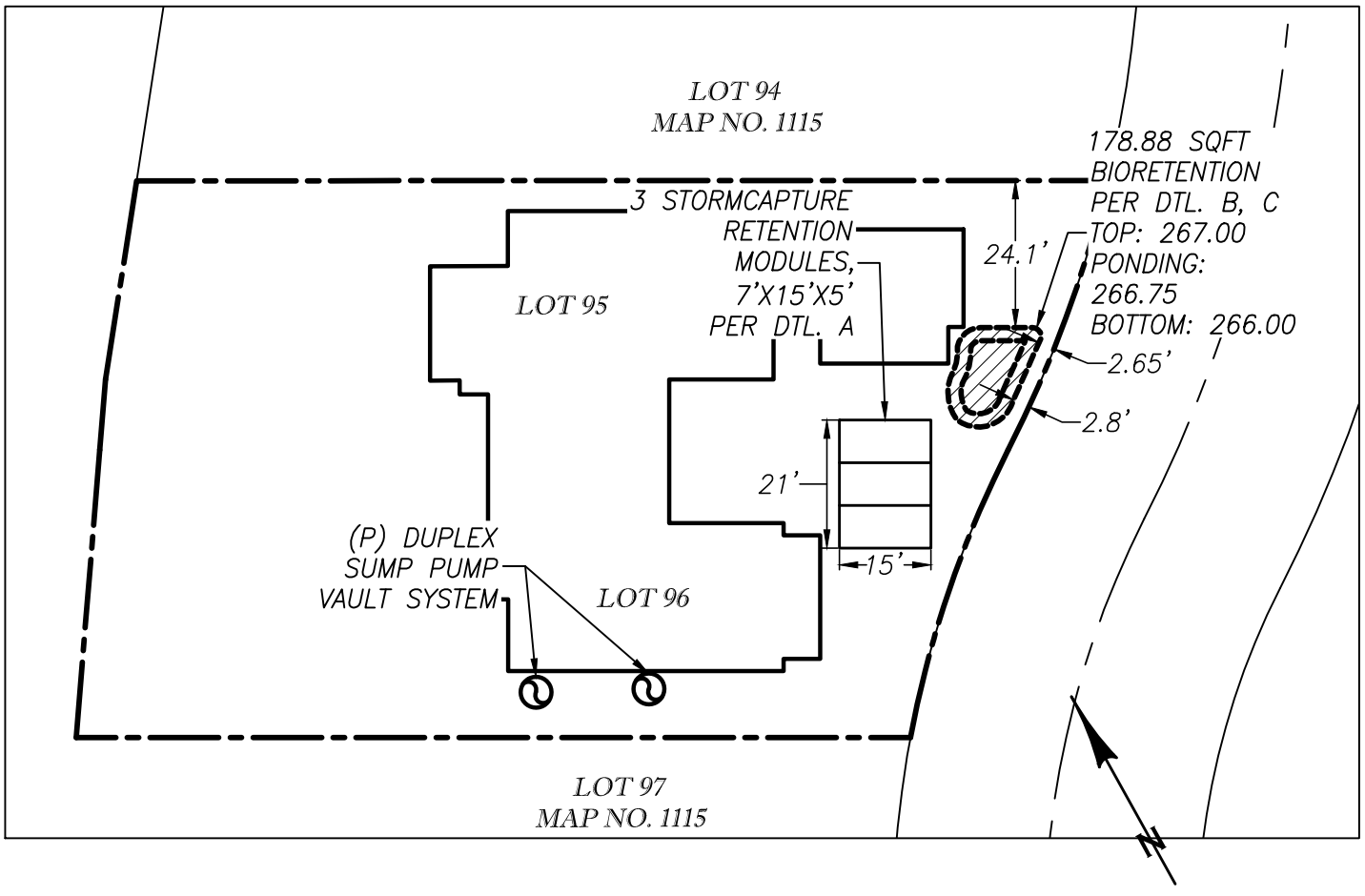
CISTERN

SUMP PUMP



VICINITY MAP

THOMAS BROS. MAP 1268-H5
NO SCALE

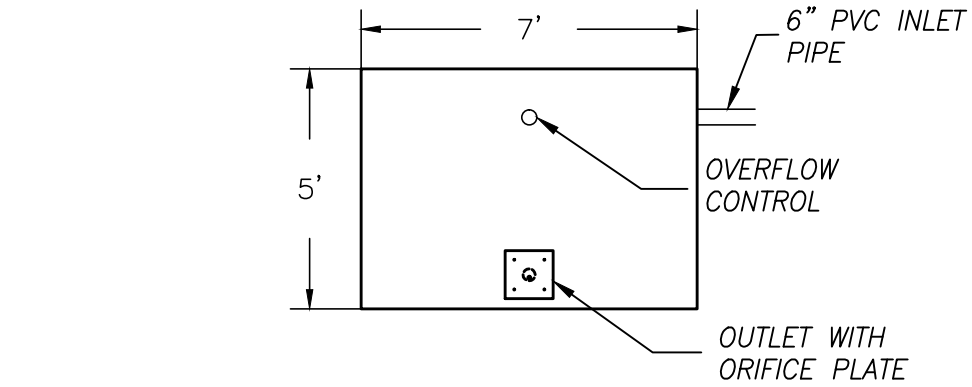


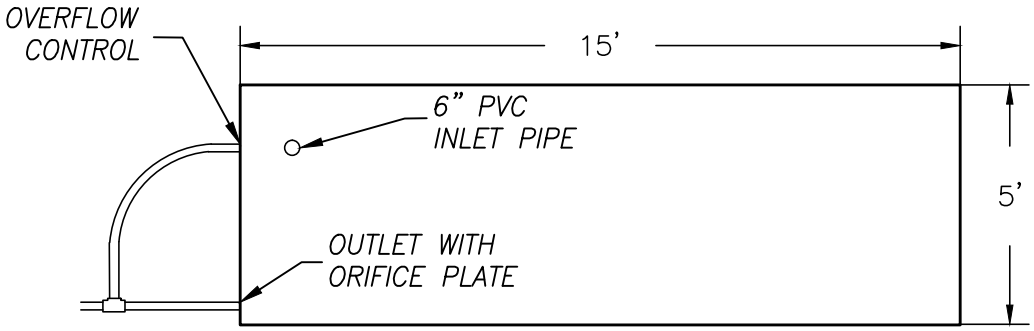
SCALE 1"=30'

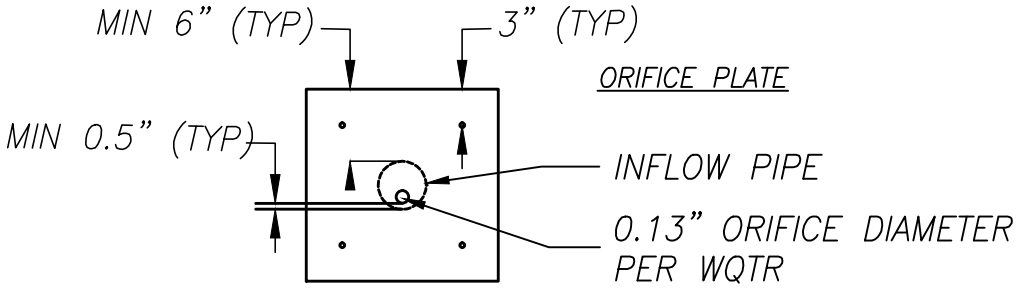
COFFEY ENGINEERING, INC.

1826 Washington Pl,
San Diego, CA. 92103

EXHIBIT 'B'







ORIFICE PLATE: HOT-DIP GALVANIZED PLATE AFTER HOLES HAVE BEEN DRILLED

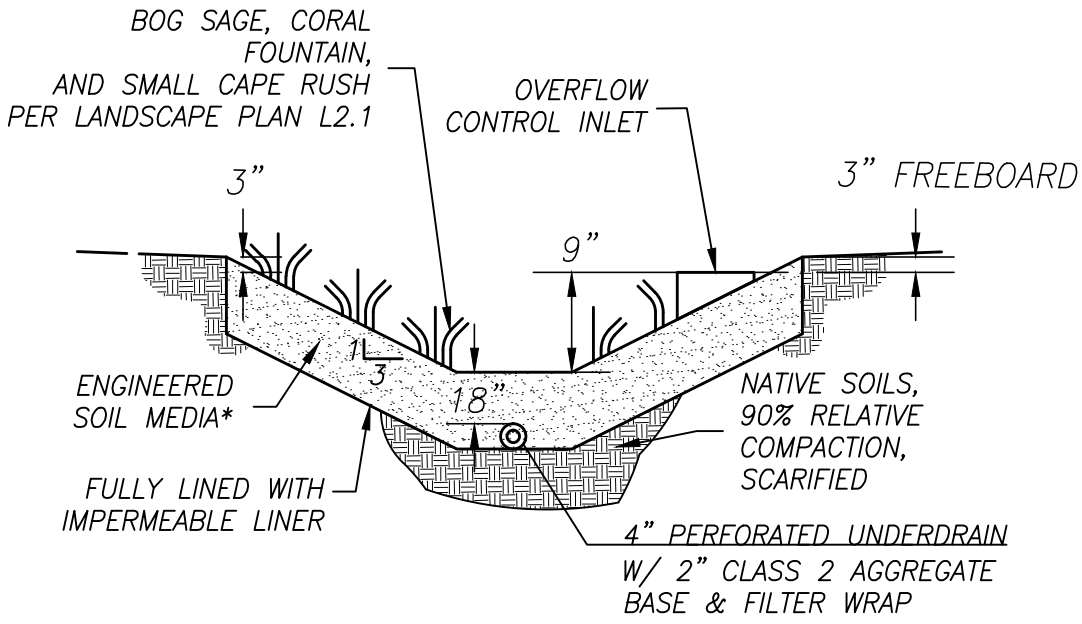
DETAIL 'A' - STORMCAPTURE 13000 GALLON BELOW GROUND WATER RETENTION MODULE WITH ORIFICE PLATE

NO SCALE

COFFEY ENGINEERING, INC.

1826 Washington Pl,
San Diego, CA. 92103

EXHIBIT 'C'



DETAIL 'B'

BIO-RETENTION FACILITY

NOT TO SCALE

*ENGINEERED SOIL MEDIA CONSISTS OF 85% WASHED COURSE SAND, 10% FINES (RANGE: 8–12%; 8% = 2 IN/HR INFILTRATION RATE, 12% = 1 IN/HR INFILTRATION RATE), AND 5% ORGANIC MATTER. FOR ADDITIONAL STANDARDS SEE SAN DIEGO LOW IMPACT DEVELOPMENT DESIGN MANUAL SECTION 1.2.4.2 SOIL MEDIA MUST MAINTAIN A MINIMUM INFILTRATION RATE OF 5 IN/HR

COFFEY ENGINEERING, INC.

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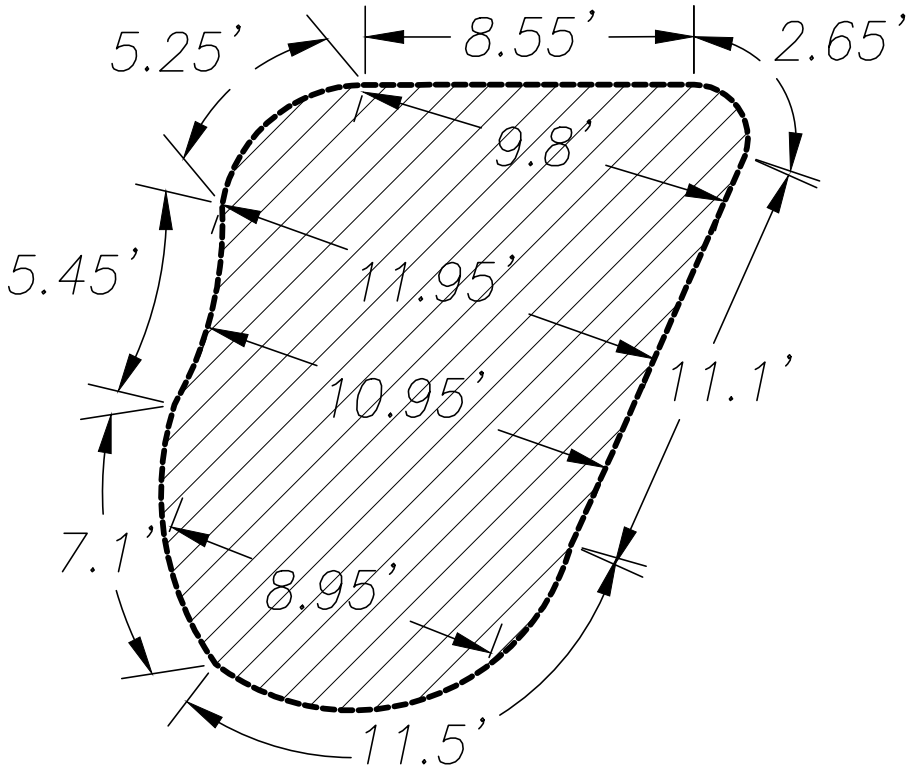
San Diego, CA. 92103

EXHIBIT 'D'



DETAIL 'C'

BIO-RETENTION FACILITY - PLAN VIEW

NOT TO SCALE

COFFEY ENGINEERING, INC.

1826 Washington Pl,
San Diego, CA. 92103

EXHIBIT 'E'

COFFEY ENGINEERING, INC.

1826 Washington Pl,
San Diego, CA. 92103

POST-CONSTRUCTION PERMANENT BMP OPERATION & MAINTENANCE PROCEDURE DETAILS

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT APPROVAL NO.:

O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNER

BMP DESCRIPTION	INSPECTION FREQUENCY	MAINTENANCE FREQUENCY	MAINTENANCE METHOD	QUANTITY	SHEET NUMBER(S)
SITE DESIGN					
DISPERSE RUNOFF TO ADJACENT LANDSCAPING	WEEKLY	MONTHLY	CLEAR EXCESS VEGETATION/DEBRIS		C.1
NATIVE OR DROUGHT TOLERANT VEGETATION	WEEKLY	MONTHLY	REPLACE DYING/DEAD VEGETATION		C.1
SOURCE CONTROL					
EFFICIENT IRRIGATION SYSTEMS	WEEKLY	MONTHLY	REPLACE/REPAIR DAMAGED COMPONENTS		C.1
TRASH STORAGE	WEEKLY	WEEKLY	DISPOSE OF TRASH REGULARLY		C.1
MATERIAL STORAGE	WEEKLY	WEEKLY	KEEP STORED MATERIALS AWAY FROM RUNOFF		C.1
INTEGRATED PEST MANAGEMENT PRACTICES	WEEKLY	MONTHLY	REMOVE NON-PEST RESISTANT VEGETATION (WEEDS)		C.1
MANAGE AIR CONDITIONING CONDENSATE	MONTHLY	MONTHLY	CLEAR BLOCKED CONDENSATE LINES		C.1
TREATMENT CONTROL					
BIORETENTION BASIN	RAINY SEASON-WEEKLY	ANNUALLY	CLEAR EXCESS VEGETATION/DEBRIS	1 EA.	C.1
HMP FACILITY					
CISTERN	RAINY SEASON-WEEKLY	ANNUALLY	CLEAR EXCESS VEGETATION/DEBRIS	4 EA.	C.1
OUTFLOW ORIFICE	RAINY SEASON-WEEKLY	ANNUALLY	CLEAR ANY BLOCKAGES	1 EA.	C.1

B.1.1 Runoff Factor

Estimate the area weighted runoff factor for the tributary area to the BMP using runoff factor (from Table B.1-1) and area of each surface type in the tributary area and the following equation.

Equation B.1-2: Estimating Runoff Factor for Area

$$C = \frac{\sum C_x A_x}{\sum A_x}$$

where:

C_x = Runoff factor for area X

A_x = Tributary area X (acres)

These runoff factors apply to areas receiving direct rainfall only. For conditions in which runoff is routed onto a surface from an adjacent surface, see Section B.2 for determining composite runoff factors for these areas.

Table B.1-1: Runoff factors for surfaces draining to BMPs – Pollutant Control BMPs

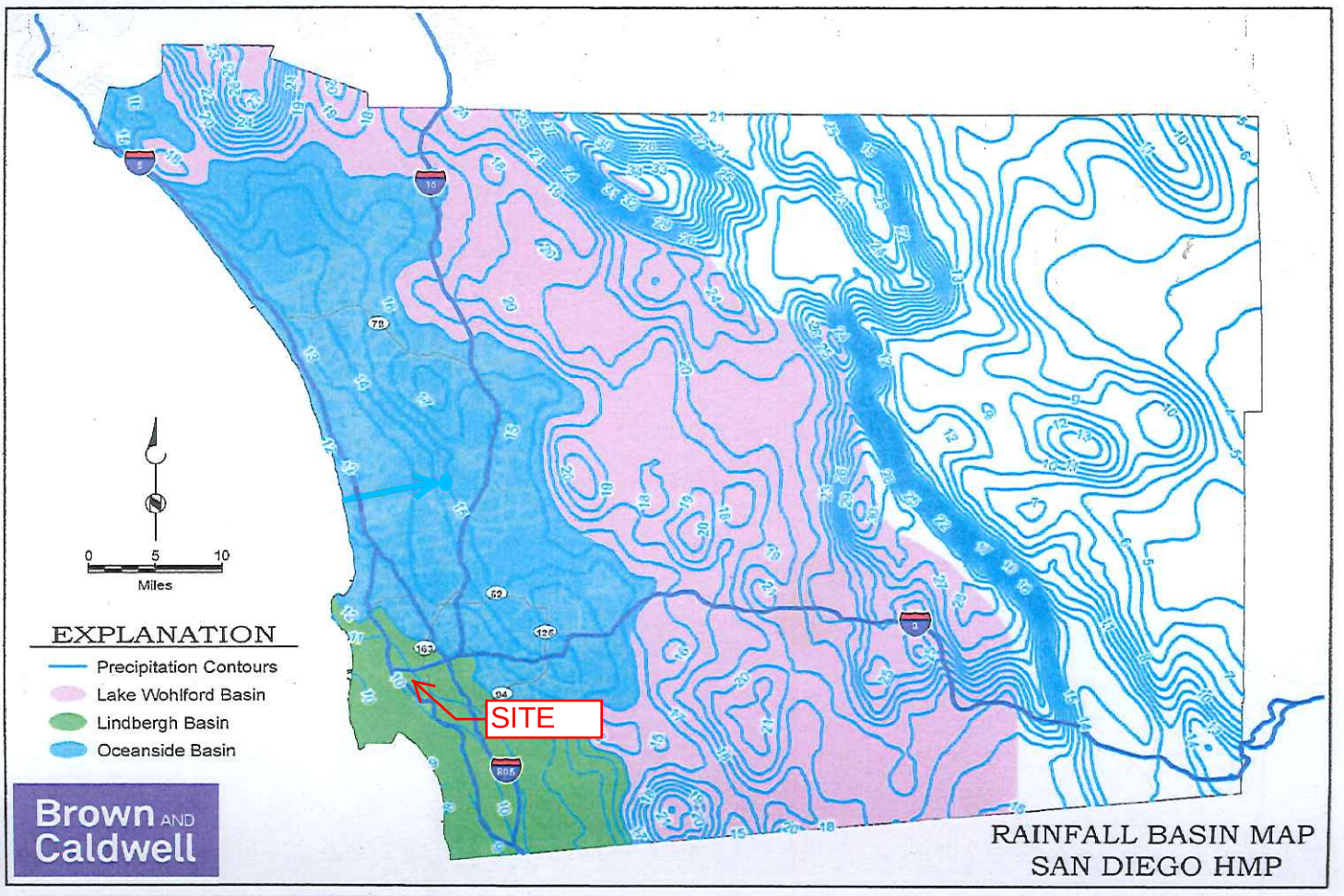
Surface	Runoff Factor
Roofs[1]	0.90
Concrete or Asphalt[1]	0.90
Unit Pavers (grouted)[1]	0.90
Decomposed Granite	0.30
Cobbles or Crushed Aggregate	0.30
Amended, Mulched Soils or Landscape[2]	0.10
Compacted Soil (e.g., unpaved parking)	0.30
Natural (A Soil)	0.10
Natural (B Soil)	0.14
Natural (C Soil)	0.23
Natural (D Soil)	0.30

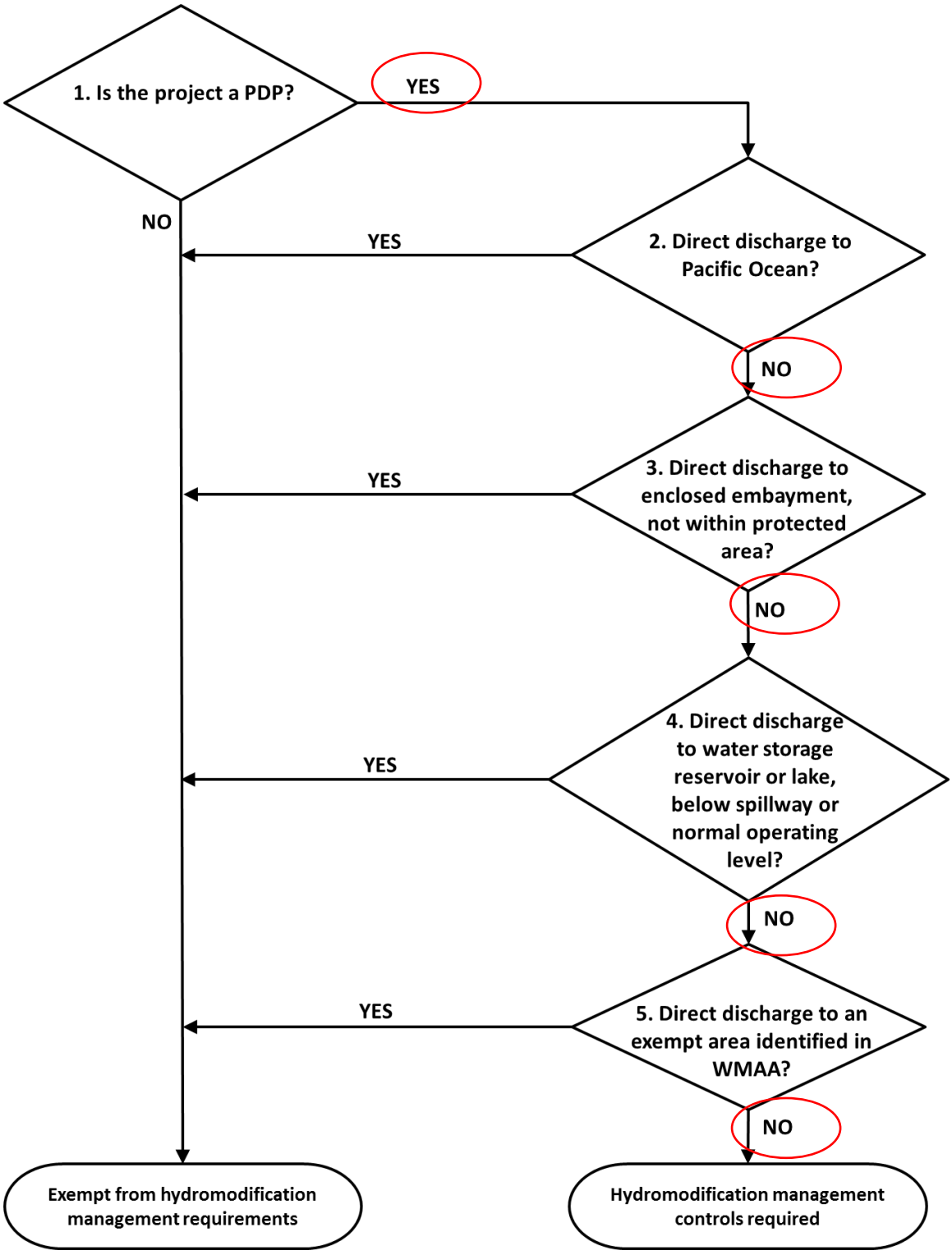
[1]Surface is considered impervious and could benefit from use of Site Design BMPs and adjustment of the runoff factor per Section B.2.1.

[2]Surface shall be designed in accordance with SD-4 (Amended soils) fact sheet in Appendix E

Table G.2-1: Runoff factors for surfaces draining to BMPs for Hydromodification Sizing Factor Method

Surface	Runoff Factor
Roofs	1.0
Concrete	1.0
Pervious Concrete	0.10
Porous Asphalt	0.10
Grouted Unit Pavers	1.0
Solid Unit Pavers on granular base, min. 3/16 inch joint space	0.20
Crushed Aggregate	0.10
Turf block	0.10
Amended, mulched soils	0.10
Landscape	0.10


0 5 10
Miles
EXPLANATION
Precipitation Contours
Lake Wohlford Basin
Lindbergh Basin
Oceanside Basin
SITE
Brown AND Caldwell
RAINFALL BASIN MAP
SAN DIEGO HMP



*Direct discharge refers to an uninterrupted hardened conveyance system; Note to be used in conjunction with Node Descriptions.

Figure 1-2. Applicability of Hydromodification Management BMP Requirements

San Diego County
85th Percentile Isopluvials
Draft 8/7/2003

Legend

- 85th Percentile Rainfall in Inches
- Roads
- Municipal Boundaries
- Lakes

NOTE:
The 85th percentile is a 24-hour rainfall total. It represents a value such that 85% of the observed 24-hour rainfall totals will be less than that value.

SITE=0.57

N
W E
S

0 1 2 4 Miles

DPW GIS
Department of Public Works
Geographic Information Services

SANGIS

Map Document: (E:\dpwplots\dpw\precip\percent85_rev20030818\pct85revision.mxd)
8/29/2003 -- 1:50:55 PM

STORM® CAPTURE

Total Stormwater
Management System

Oldcastle Precast®

DETENTION

RETENTION

HARVESTING

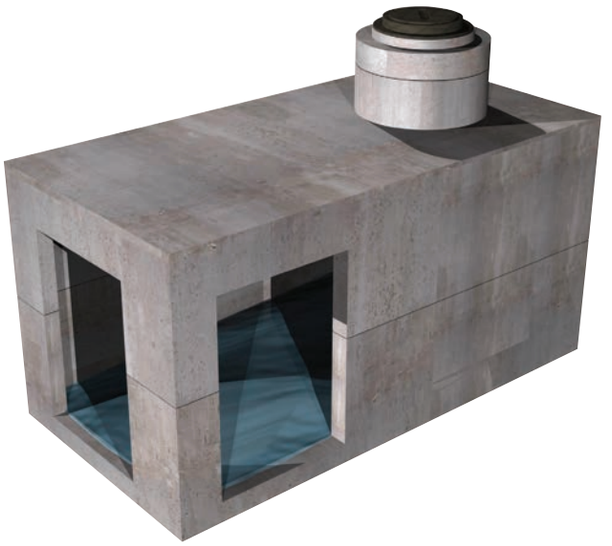
TREATMENT

PERMECAPTURE

INFILTRATION

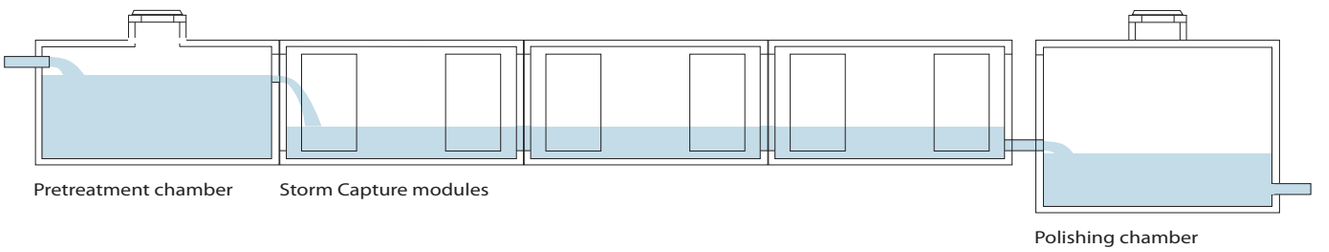
CISTERNS

From Oldcastle Precast, the leading manufacturer of precast concrete in the U.S., comes the Storm Capture Total Stormwater Management System.



Whether your site needs a simple detention system to slow down runoff to prevent storm drain overloading, a groundwater recharge system for low-impact-development, a storm-water treatment system to treat water quality, or a complete stormwater harvesting system, Storm Capture will provide your solutions.

TREATMENT TRAIN SOLUTIONS



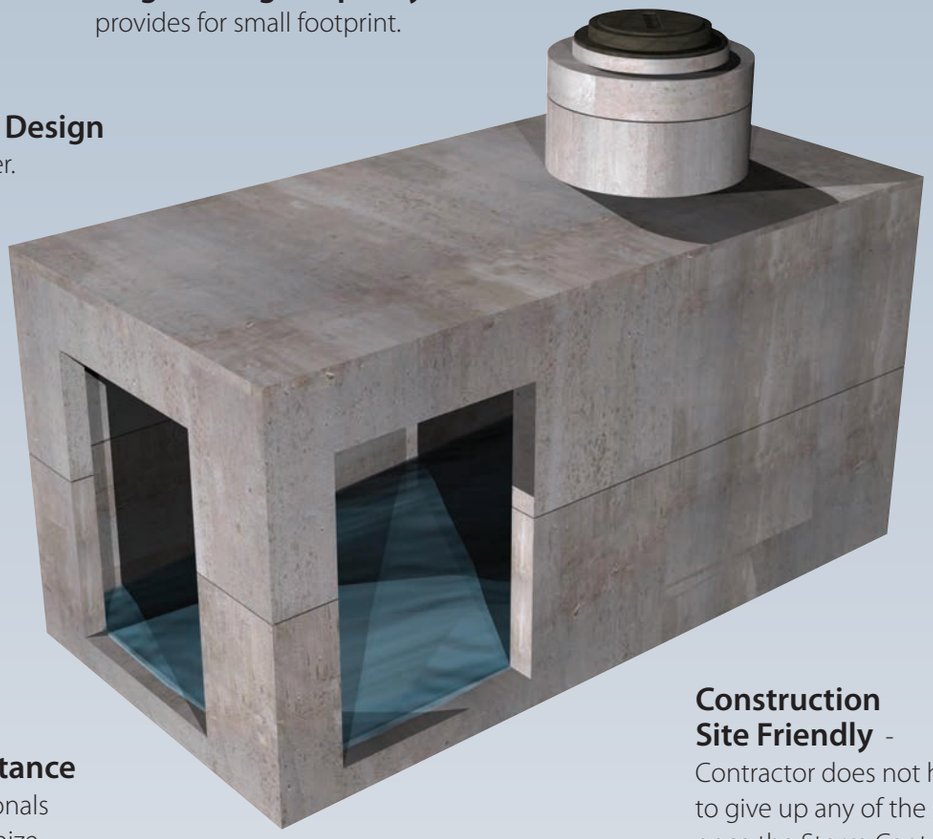
Storm Capture Module

Description
7' x 15' with a 14' maximum/ adjustable height, the largest capacity in the industry.

Large Storage Capacity
provides for small footprint.

Easy to Install
modules for fast installation.

Traffic Loading Design
with only 6" of cover.



Flexible Heights
Available in heights from 2' to 14' to best-fit site needs.

Backfill
Modules do not rely on backfill for storage, and are typically backfilled with existing site materials.

Construction Site Friendly -
Contractor does not have to give up any of the site once the Storm Capture system is installed.

Design Assistance
Let our professionals help you customize an application for your needs.

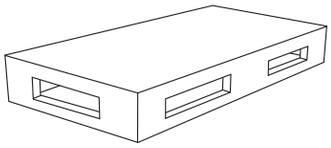
Treatment Train
Available with treatment train capability, pretreatment, post treatment, or both.

Storm Capture Benefits

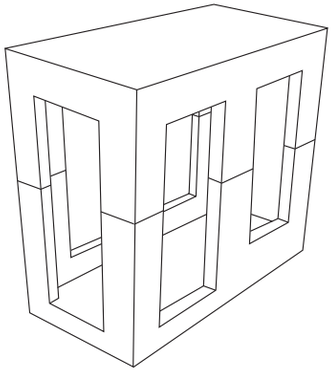
- **Fast service** - Quick and easy project help by our national engineering team with layouts and specifications to meet each project's requirements.
- **Cost savings** - Highly competitive installed and life-cycle costs.
- **Manufactured** to the rigid standards of the Oldcastle quality control program at Oldcastle facilities around the country.
- **Codes** - Designed to the latest codes for HS-20-44 (full truck load plus impact).
- **Sustainability** - The system is maintainable for long-term sustainability.
- **LID** - Ideal for Low Impact Development (LID).
- **LEED** - Manufactured locally with recycled material for potential LEED credits. *LEED 2009 for New Construction & Major Renovation, US Green Building Council: Sustainable Sites (5.1, 5.2, 6.1, 6.2), Materials & Resources (4.1, 4.2, 5.1, 5.2), Water Efficiency (1.1, 1,2, 3.1, 3.2)*

INSTALLED IN ONE DAY

Module Sizes



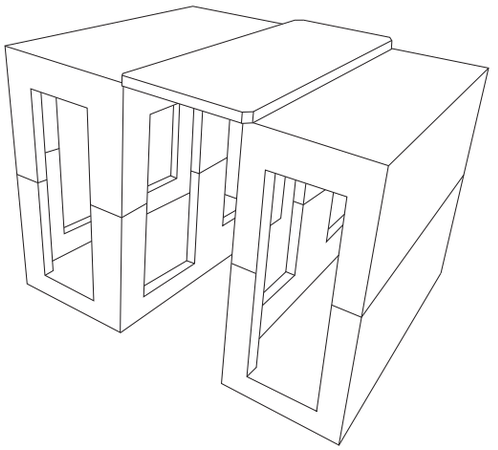
SC1 – one piece modules can be used for applications from 2' to 7' tall. These are appropriate for cisterns, infiltration, detention, and retention systems. SC1 modules are typically installed on a minimal compacted gravel base, dependent on specific project requirements.



SC2 – two piece modules can be used for applications from 7' all the way up to 14' tall for maximum storage capacity in the smallest footprint. These are appropriate for cisterns, infiltration, detention, and retention systems. SC2 modules are typically installed on a compacted native subgrade.

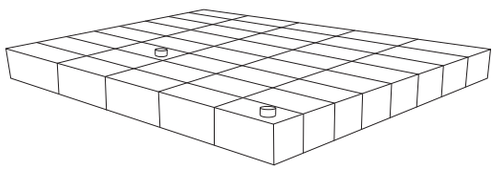
Size	Capacity	Size	Capacity
7x15x2	226 ft^3	7x15x9	1027 ft^3
7x15x3	343 ft^3	7x15x10	1144 ft^3
7x15x4	460 ft^3	7x15x11	1257 ft^3
7x15x5	577 ft^3	7x15x12	1374 ft^3
7x15x6	690 ft^3	7x15x13*	1491 ft^3
7x15x7	807 ft^3	7x15x14*	1608 ft^3
7x15x8	910 ft^3		

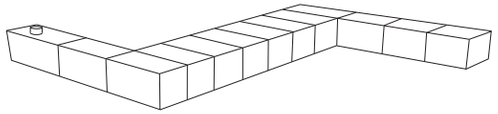
* Special design considerations required and limited availability

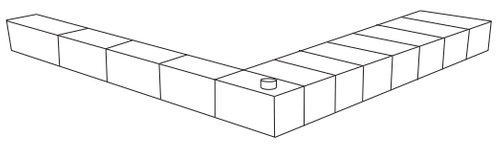


Link Slab – for large storage assemblies, the unique link slab design allows significant reduction in the quantity of modules and associated costs, while providing the maximum in storage capacity.

Endless Configurations





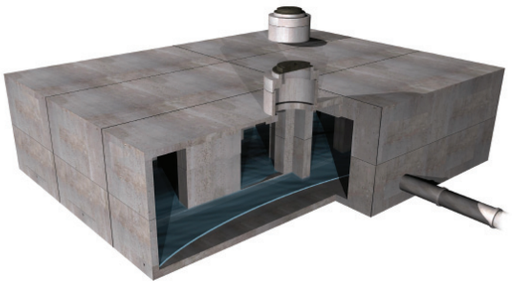


Applications

Storm Capture has many solutions for detention, retention, treatment, and harvesting that involve a combination of many parts designed to solve your stormwater management needs.

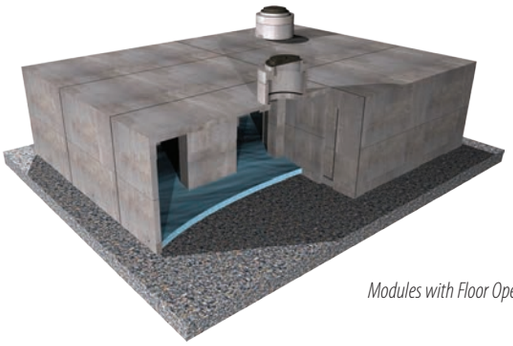
Let us show you how we can design and customize a solution for you.

Maintenance Module



DETENTION

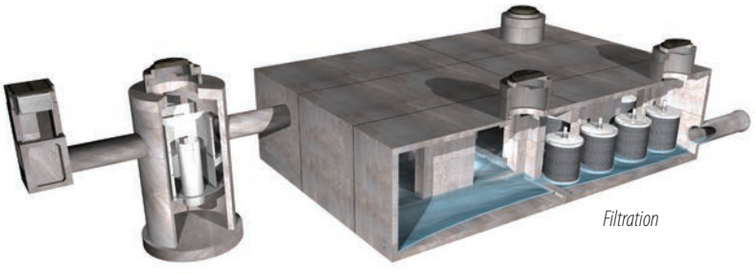
Storm Capture provides cost-effective solutions for site applications where stormwater needs to be detained and allowed to discharge at a controlled rate.



Modules with Floor Openings

INFILTRATION

Eliminate the issues created with discharging stormwater offsite by using Storm Capture to infiltrate stormwater into the soil for natural treatment and to replenish local aquifers.

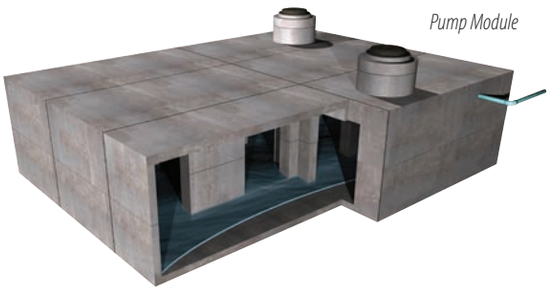


Filtration

Pretreatment

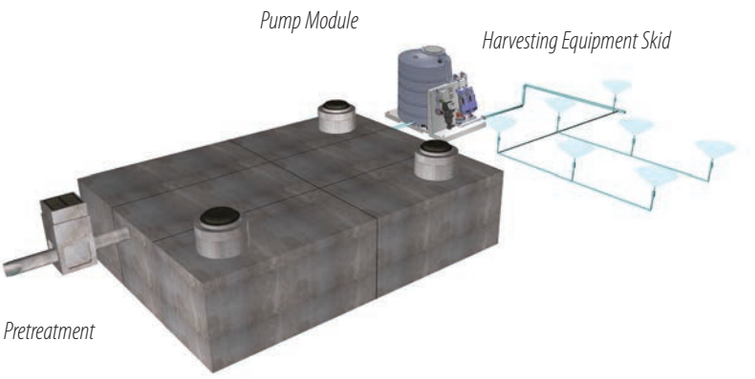
TREATMENT

Stormwater treatment options such as pretreatment, oil water separation, and media filtration are available as stand-alone systems, as well as integrated with Storm Capture.



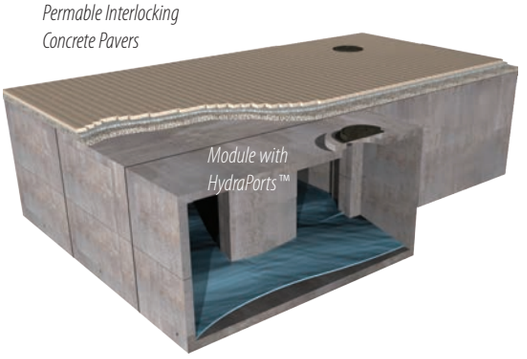
RETENTION

Storm Capture retention systems are best for applications where the goal is to retain rainwater or stormwater for harvesting applications.



HARVESTING

Water harvesting is the collection, storage, cleaning, and recycling of stormwater and greywater to reduce or replace the consumption of municipal potable water.



PERMECAPTURE®

PermeCapture combines the advantages and versatility of Storm Capture® structural precast concrete underground storage modules with the aesthetics and performance of Belgard® permeable interlocking concrete pavers to provide a stand-alone, low maintenance, LID green solution for total stormwater management.

CISTERNS

Storm Capture Cisterns provide space-efficient and sustainable long-term storage for harvesting rainwater, stormwater, and greywater. Single or multi-module cisterns available.

LOCAL MANUFACTURING

Manufacturing of Storm Capture takes place at Oldcastle Precast facilities around the country. Our national footprint allows us to service anywhere in the continental United States and Hawaii. Dealing directly with Oldcastle means there are no third parties involved that may hinder fast service and delivery.

Oldcastle Precast uses state of the art tooling to manufacture products of the highest quality. In addition, Oldcastle's plants are held to the rigid standards of the Oldcastle quality control program, as well as industry certifications.

ENGINEERING

Storm Capture is supported by Oldcastle's national engineering and sales staff. Contact our staff for quick layouts and quotes. Our designs are completed to the latest codes for HS-20-44 with full truck load plus impact.

Design Loadings

- HS-20-44 for full truck load plus impact
- Standard design for 6" to 5'-0" earth cover
- Equivalent fluid pressure of 45 PCF
- Lateral live load surcharge = 80 PSF
- Assumed water table below bottom
- 6,000 PSI concrete 28 day strength

INSTALLATION

Each Storm Capture module has a large storage capacity that minimizes module quantities and provides for easy and rapid installation. Some of the installation benefits with Storm Capture include:

- Backfilling typically with existing site material; meaning no imported backfill
- No poured concrete footings required
- Closed bottom (SC2) styles are typically set on compacted native subgrade
- Open bottom (SC1) styles have a thin compacted gravel foundation
- Large storage per module provides rapid installation
- Durable structural concrete modules withstand rigors of construction
- Construction traffic can travel over installed modules with 6" of cover

Oldcastle Precast provides an Installation Manual for the Storm Capture system. The local Storm Capture Technical Representative is available for preconstruction conferences to discuss the most efficient delivery sequence and timing, as well as to offer guidance in preparing for and during each installation.

DELIVERY

In most geographic markets, Storm Capture is manufactured at the local Oldcastle Precast facility. Local manufacturing means less hassle with unexpected delivery delays.




MAINTENANCE

The Storm Capture system excels where most other systems fail, incorporating features providing for maximum system performance and life cycle. As with all stormwater BMPs, inspection and maintenance of the Storm Capture system is vital for satisfactory performance and extended life cycle.

Maintenance Modules™

The Storm Capture design provides manway access through Maintenance Modules for ease of inspection and maintenance. Typically, Maintenance Modules are provided at all inlets and outlets to provide clear access to these maintenance critical points. Removable roof sections may also be incorporated to provide larger access points.

In addition to providing access to the Storm Capture system, Maintenance Modules may incorporate weirs or baffles to enhance reduction or removal of sediments and Total Suspended Solids (TSS), as well as other pollutants from the stormwater. Lastly, for open bottom systems with no concrete floor (SC1 style), concrete dissipater pads may be installed in Maintenance Modules below inlet pipes to prevent base erosion.

Grated Inlet Options

Grated inlets may also be incorporated to accommodate surface stormwater flows directly into the Storm Capture system, reducing the requirements for conventional site drainage components. Any grated inlets may also include pretreatment devices for pollutant removal. For open bottom systems (SC1style), concrete dissipater pads may be installed below inlet grates to prevent base erosion.

Other Maintenance Features

The standard Storm Capture Module design incorporates lateral and longitudinal passageways between modules to accommodate free movement between modules for inspection and maintenance. For many systems, sediment baffles are left below internal conveyance windows to aid in settling and trapping of sediments.

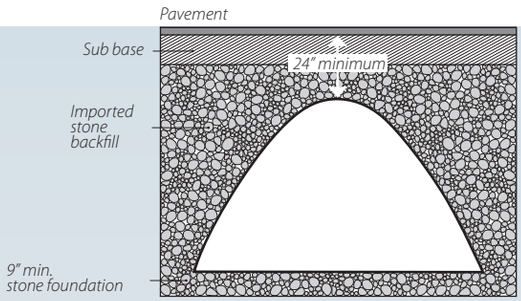
Manufactured BMPs

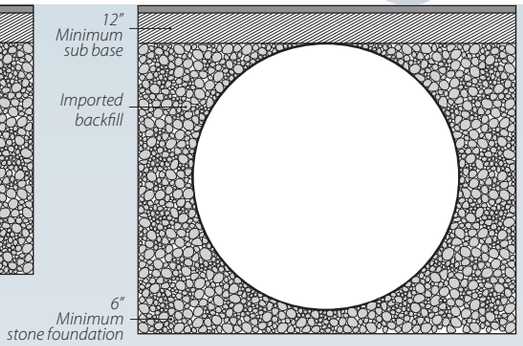
Oldcastle Precast manufactures a variety of hydrodynamic separators for pretreatment, as well as a full line of filter systems for advanced treatment. Many of these treatment BMPs can be fully integrated within the Storm Capture system.

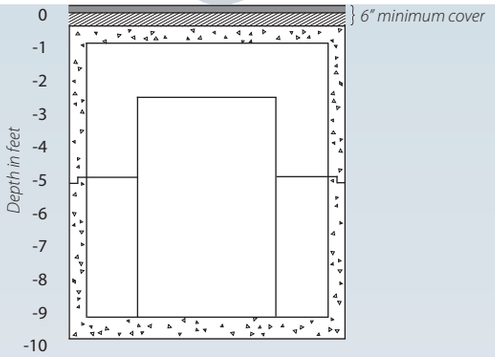
SUPPORT

Oldcastle Precast is the leading manufacturer of precast concrete, polymer concrete, and plastic products in the United States. With a nationwide network of facilities, our products are always close at hand. Our employees are committed to upholding core values of reliability, quality, and service in revolutionary ways. Our attention to detail exceeds the expectations of customers from small companies to some of the largest companies in the US across a spectrum of industries.

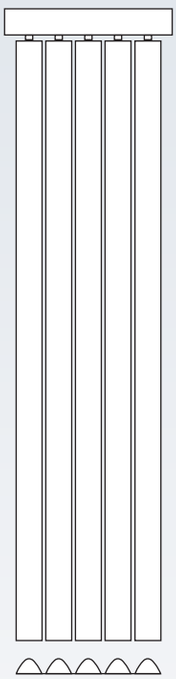
Competing Systems Comparison

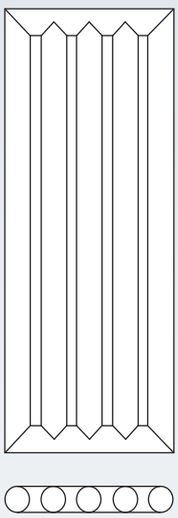


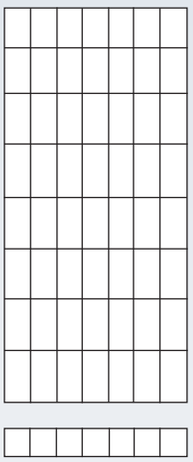




5' Plastic Arch Chamber	8' Dia. Corrugated Metal Pipe	8' Storm Capture
• *29.8 CF storage / LF*	• *50.2 CF storage / LF*	• **56 CF Storage / LF**
• *40 CF/LF stone backfill + sub base per LF*	• *43.2 CF/LF Select backfill + additional sub base per LF*	• **No imported backfill**







The smallest footprint!
Smaller footprint available with 10', 11', 12', 14' tall modules!

	Plastic Chamber	Corrugated Metal Pipe	Storm Capture
Earth cover	Minimum 24" + pavement	Minimum 18" + pavement	**Minimum 6"**
Stone or select backfill	28,973 CF + extra sub base	38,726 CF + extra sub base	**None**
Maintenance	Not Accessible	Somewhat	**100% Accessible**
Footprint	10,439 SF	7,124 SF	**6,293 SF**
Backfill process	Complicated	Complicated	**Easy!**

STORM® CAPTURE

www.stormcapture.com

888-965-3227

E.12. PR-1 Biofiltration with Partial Retention

Location: 805 and Bonita Road, Chula Vista, CA.

MS4 Permit Category
NA
Manual Category
Partial Retention
Applicable Performance Standard
Pollutant Control Flow Control
Primary Benefits
Volume Reduction Treatment Peak Flow Attenuation

Description

Biofiltration with partial retention (partial infiltration and biofiltration) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to infiltrating into native soils, discharge via underdrain, or overflow to the downstream conveyance system. Where feasible, these BMPs have an elevated underdrain discharge point that creates storage capacity in the aggregate storage layer. Biofiltration with partial retention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed in ground or partially aboveground, such as planter boxes with open bottoms to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

Typical biofiltration with partial retention components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side Slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer (aka choking layer) consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Uncompacted native soils at the bottom of the facility
- Overflow structure

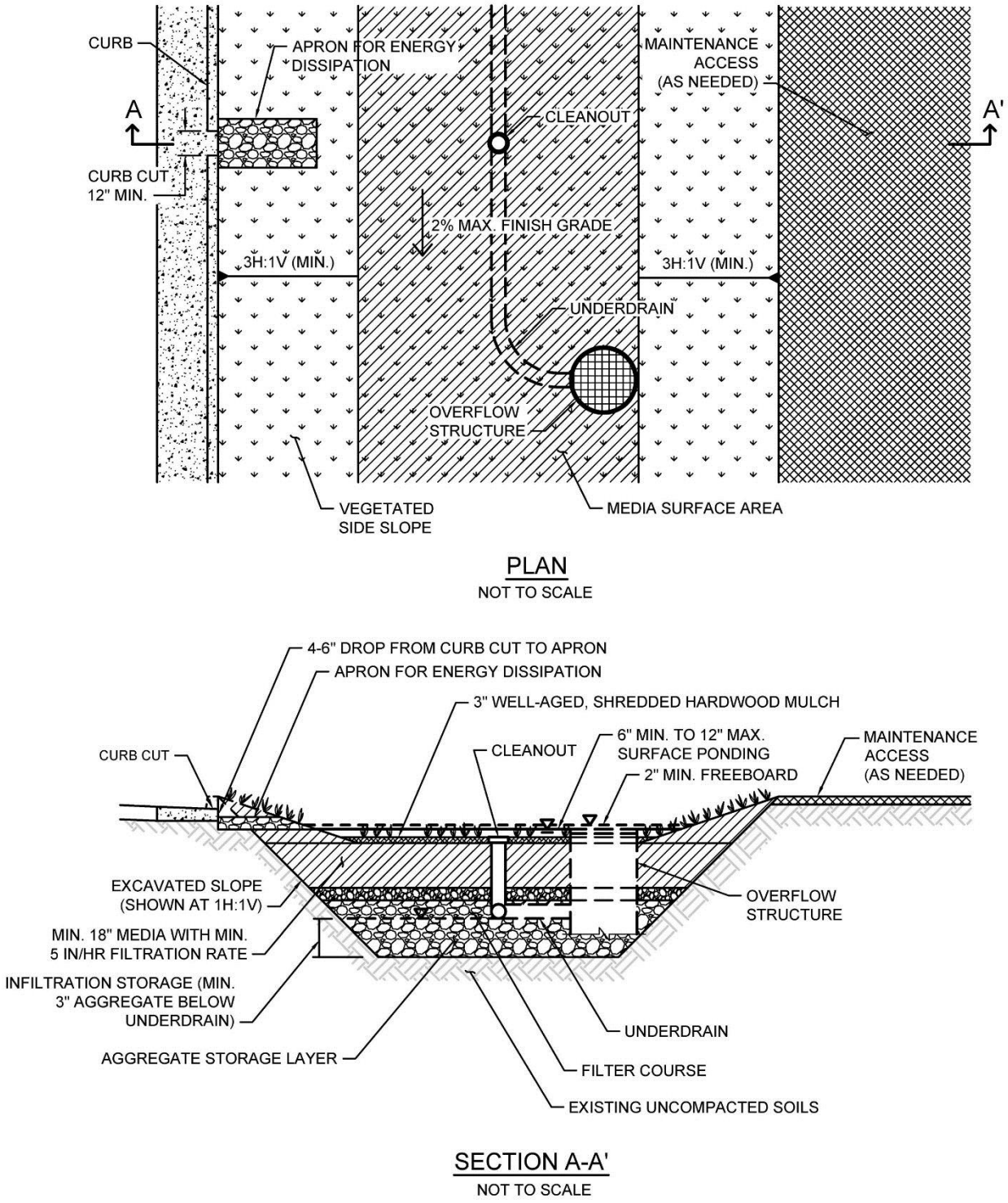


Figure E.12-E.12-1: Typical plan and Section view of a Biofiltration with Partial Retention BMP

Design Adaptations for Project Goals

Partial infiltration BMP with biofiltration treatment for storm water pollutant control. Biofiltration with partial retention can be designed so that a portion of the DCV is infiltrated by

providing infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered biofiltration treatment. Storage provided above the underdrain within surface ponding, media, and aggregate storage is included in the biofiltration treatment volume.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer. This will allow for significant detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Biofiltration with partial retention must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

	Siting and Design	Intent/Rationale
□	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
□	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a partial infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
□	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
□	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		
□	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.

	Siting and Design	Intent/Rationale
□	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
□	A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
□	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
□	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20	Plants suited to the climate and ponding depth are more likely to survive.
□	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Mandatory)		
□	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		

	Siting and Design	Intent/Rationale
□	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. Additional Criteria for media hydraulic conductivity described in the bioretention soil media model specification (Appendix F.4)	A filtration rate of at least 5 inches per hour allows soil to drain between events, and allows flows to relatively quickly enter the aggregate storage layer, thereby minimizing bypass. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
□	Media is a minimum 18 inches deep, meeting the following media specifications: Model bioretention soil media specification provided in Appendix F.4 or County of San Diego Low Impact Development Handbook: Appendix G - Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
□	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
□	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		

	Siting and Design	Intent/Rationale
□	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade and can result in poor water quality performance for turbidity and suspended solids. Filter fabric is more likely to clog.
□	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility
□	To reduce clogging potential, a two-layer filter course (aka choking stone system) is used consisting of one 3" layer of clean and washed ASTM 33 Fine Aggregate Sand overlying a 3" layer of ASTM No 8 Stone (Appendix F.5)	This specification has been developed to maintain permeability while limiting the migration of media material into the stone reservoir and underdrain system.
Aggregate Storage Layer		
□	ASTM #57 open graded stone is used for the storage layer and a two layer filter course (detailed above) is used above this layer	This layer provides additional storage capacity. ASTM #8 stone provides an acceptable choking/bridging interface with the particles in ASTM #57 stone.
□	Maximum aggregate storage layer depth below the underdrain invert is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time is needed for vector control and to facilitate providing storm water storage for the next storm event.
Inflow, Underdrain, and Outflow Structures		
□	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
□	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
□	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
□	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
□	Minimum underdrain diameter is 8 inches.	Smaller diameter underdrains are prone to clogging.

	Siting and Design	Intent/Rationale
□	Underdrains should be affixed with an upturned elbow to an elevation at least 9 to 12 inches above the invert of the underdrain.	An upturned elbow reduces velocity in the underdrain pipe and can help reduce mobilization of sediments from the underdrain and media bed.
□	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
□	An underdrain cleanout with a minimum 8-inch diameter and lockable cap is placed every 50 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
□	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design biofiltration with partial retention and an underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Generalized sizing procedure is presented in Appendix B.5. The surface ponding should be verified to have a maximum 24-hour drawdown time. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention and/or infiltration storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention

storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.

3. If biofiltration with partial retention cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After biofiltration with partial retention has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

Appendix F

Biofiltration Standard and Checklist

Introduction

The MS4 Permit and this manual define a specific category of storm water pollutant treatment BMPs called "biofiltration BMPs." The MS4 Permit (Section E.3.c.1) states:

Biofiltration BMPs must be designed to have an appropriate hydraulic loading rate to maximize storm water retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP, and must be sized to:

a) **Treat 1.5 times the DCV not reliably retained onsite, OR**

b) **Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite.**

A project applicant must be able to affirmatively demonstrate that a given BMP is designed and sized in a manner consistent with this definition to be considered as a "biofiltration BMP" as part of a compliant storm water management plan. Retention is defined in the MS4 Permit as evapotranspiration, infiltration, and harvest and use of storm water vs. discharge to a surface water system.

Contents and Intended Uses

This appendix contains a checklist of the key underlying criteria that must be met for a BMP to be considered a biofiltration BMP. The purpose of this checklist is to facilitate consistent review and approval of biofiltration BMPs that meet the "biofiltration standard" defined by the MS4 Permit.

This checklist includes specific design criteria that are essential to defining a system as a biofiltration BMP; however it does not present a complete design basis. This checklist was used to develop BMP Fact Sheets for PR-1 biofiltration with partial retention and BF-1 biofiltration, which do present a complete design basis. Therefore, biofiltration BMPs that substantially meet all aspects of the Fact sheets PR-1 or BF-1 should be able to complete this checklist without additional documentation beyond what would already be required for a project submittal.

Other biofiltration BMP designs7 (including both non-proprietary and proprietary designs) may also meet the underlying MS4 Permit requirements to be considered biofiltration BMPs. These BMPs may

7 Defined as biofiltration designs that do not conform to the specific design criteria described in Fact Sheets PR-1 or BF-1. This category includes proprietary BMPs that are sold by a vendor as well as non-proprietary BMPs that are designed and constructed of primarily of more elementary construction materials.

be classified as biofiltration BMPs if they (1) meet the minimum design criteria listed in this appendix, including the pollutant treatment performance standard in Appendix F.1, (2) are designed and maintained in a manner consistent with their performance certifications (See explanation in Appendix F.2), if applicable, and (3) are acceptable at the discretion of the City Engineer. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met.

Organization

The checklist in this appendix is organized into the seven (7) main objectives associated with biofiltration BMP design. It describes the associated minimum criteria that must be met in order to qualify a biofiltration BMP as meeting the biofiltration standard. The seven main objectives are listed below. Specific design criteria and associated manual references associated with each of these objectives is provided in the checklist in the following section.

1. Biofiltration BMPs shall be allowed only as described in the BMP selection process in this manual (i.e., retention feasibility hierarchy).
2. Biofiltration BMPs must be sized using acceptable sizing methods described in this manual.
3. Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration.
4. Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control/sequestration processes, and minimize potential for pollutant washout.
5. Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.
6. Biofiltration BMPs must be designed to prevent erosion, scour, and channeling within the BMP.
7. Biofiltration BMP must include operations and maintenance design features and planning considerations to provide for continued effectiveness of pollutant and flow control functions.

Biofiltration Criteria Checklist

The applicant shall provide documentation of compliance with each criterion in this checklist as part of the project submittal. The right column of this checklist identifies the submittal information that is recommended to document compliance with each criterion. Biofiltration BMPs that substantially meet all aspects of Fact Sheets PR-1 or BF-1 should still use this checklist; however additional documentation (beyond what is already required for project submittal) should not be required.

1	**Biofiltration BMPs shall be allowed to be used only as described in the BMP selection process based on a documented feasibility analysis.** Intent: This manual defines a specific prioritization of pollutant treatment BMPs, where BMPs that retain water (retained includes evapotranspired, infiltrated, and/or harvested and used) must be used before considering BMPs that have a biofiltered discharge to the MS4 or surface waters. Use of a biofiltration BMP in a manner in conflict with this prioritization (i.e., without a feasibility analysis justifying its use) is not permitted, regardless of the adequacy of the sizing and design of the system.	
☑	The project applicant has demonstrated that it is not technically feasible to retain the full DCV onsite.	Document feasibility analysis and findings in SWQMP per Appendix C.
☑	**Biofiltration BMPs must be sized using acceptable sizing methods.** Intent: The MS4 Permit and this manual defines specific sizing methods that must be used to size biofiltration BMPs. Sizing of biofiltration BMPs is a fundamental factor in the amount of storm water that can be treated and also influences volume and pollutant retention processes.	
☑	The project applicant has demonstrated that biofiltration BMPs are sized to meet one of the biofiltration sizing options available (Appendix B.5).	Submit sizing worksheets (Appendix B.5) or other equivalent documentation with the SWQMP.
3	**Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration.** Intent: Various decisions about BMP placement and design influence how much water is retained via infiltration and evapotranspiration. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention (evapotranspiration and infiltration) of storm water volume.	
☑	The biofiltration BMP is sited to allow for maximum infiltration of runoff volume based on the feasibility factors considered in site planning efforts. It is also designed to maximize evapotranspiration through the use of amended media and plants (biofiltration designs without amended media and plants may be permissible; see Item 5).	Document site planning and feasibility analyses in SWQMP per Section 5.4.
☑	For biofiltration BMPs categorized as "Partial Infiltration Condition," the infiltration storage depth in the biofiltration design has been selected to drain in 36 hours (+/-25%) or an alternative value shown to maximize infiltration on the site.	Included documentation of estimated infiltration rate per Appendix D; provide calculations using Appendix B.4 and B.5 to show that the infiltration storage depth meets this criterion. Note, depths that are too shallow or too deep may not be acceptable.

☑	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the infiltration storage is over the entire bottom of the biofiltration BMP footprint.	Document on plans that the infiltration storage covers the entire bottom of the BMP (i.e., not just underdrain trenches); or an equivalent footprint elsewhere on the site.
☑	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the sizing factor used for the infiltration storage area is not less than the minimum biofiltration BMP sizing factors calculated using Worksheet B.5.1.	Provide a table that compares the minimum sizing factor per Worksheet B.5.1 to the provided sizing factor. Note: The infiltration storage area could be a separate storage feature located downstream of the biofiltration BMP, not necessarily within the same footprint.
☑	An impermeable liner or other hydraulic restriction layer is only used when needed to avoid geotechnical and/or subsurface contamination issues in locations identified as "No Infiltration Condition."	If using an impermeable liner or hydraulic restriction layer, provide documentation of feasibility findings per Appendix C that recommend the use of this feature.
☑	The use of "compact" biofiltration BMP design[8] is permitted only in conditions identified as "No Infiltration Condition" and where site-specific documentation demonstrates that the use of larger footprint biofiltration BMPs would be infeasible.	Provide documentation of feasibility findings that recommend no infiltration is feasible. Provide site-specific information to demonstrate that a larger footprint biofiltration BMP would not be feasible.
4	**Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control processes, and minimize potential for pollutant washout.** Intent: Various decisions about biofiltration BMP design influence the degree to which pollutants are retained. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention of storm water pollutants.	

[8]Compact biofiltration BMPs are defined as features with infiltration storage footprint less than the minimum sizing factors required to achieve 40% volume retention. Note that if a biofiltration BMP is accompanied by an infiltrating area downstream that has a footprint equal to at least the minimum sizing factors calculated using Worksheet B.5.1 assuming a partial infiltration condition, then it is not considered to be a compact biofiltration BMP for the purpose of Item 4 of the checklist. For potential configurations with a higher rate biofiltration BMP upstream of an larger footprint infiltration area, the BMP would still need to comply with Item 5 of this checklist for pollutant treatment effectiveness.

☑	Media selected for the biofiltration BMP meets minimum quality and material specifications per Appendix F.4 or County LID Manual, including the maximum allowable design filtration rate and minimum thickness of media. OR	Provide documentation that media meets the specifications in Appendix F.4 or County LID Manual.
☐	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in Appendix F.4 or County LID Manual, field scale testing data are provided to demonstrate that proposed media meets the pollutant treatment performance criteria in Section F.1 below.	Provide documentation of performance information as described in Section F.1.
☑	To the extent practicable, filtration rates are outlet controlled (e.g., via an underdrain and orifice/weir) instead of controlled by the infiltration rate of the media.	Include outlet control in designs or provide documentation of why outlet control is not practicable.
☑	The water surface drains to at least 12 inches below the media surface within 24 hours from the end of storm event flow to preserve plant health and promote healthy soil structure.	Include calculations to demonstrate that drawdown rate is adequate. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
☑	If nutrients are a pollutant of concern, design of the biofiltration BMP follows nutrient-sensitive design criteria.	Follow specifications for nutrient sensitive design in Fact Sheet BF-2. Or provide alternative documentation that nutrient treatment is addressed and potential for nutrient release is minimized.
☑	Media gradation calculations demonstrate that migration of media between layers will be prevented and permeability will be preserved.	Follow specification for choking layer in Fact Sheet PR-1 or BF-1. Or include calculations to demonstrate that choking layer is appropriately specified.

5 **Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.**

Intent: Biological processes are an important element of biofiltration performance and longevity.

☑	Plants have been selected to be tolerant of project climate, design ponding depths and the treatment media composition.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.
☑	Plants have been selected to minimize irrigation requirements.	Provide documentation describing irrigation requirements for establishment and long term operation.
☑	Plant location and growth will not impede expected long-term media filtration rates and will enhance long term infiltration rates to the extent possible.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.
☑	If plants are not part of the biofiltration design, other biological processes are supported as needed to sustain treatment processes (e.g., biofilm in a subsurface flow wetland).	For biofiltration designs without plants, describe the biological processes that will support effective treatment and how they will be sustained. Refer to Appendix F.3
6	**Biofiltration BMPs must be designed with a hydraulic loading rate to prevent erosion, scour, and channeling within the BMP.** Intent: Erosion, scour, and/or channeling can disrupt treatment processes and reduce biofiltration effectiveness.	
☑	Scour protection has been provided for both sheet flow and pipe inflows to the BMP, where needed.	Provide documentation of scour protection as described in Fact Sheets PR-1 or BF-1 or approved equivalent.
☑	Where scour protection has not been provided, flows into and within the BMP are kept to non-erosive velocities.	Provide documentation of design checks for erosive velocities as described in Fact Sheets PR-1 or BF-1 or approved equivalent.
☐	For proprietary BMPs, the BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification[9] (i.e., maximum tributary area, maximum inflow velocities, etc., as applicable).	Provide copy of manufacturer recommendations and conditions of third-party certification.

[9]Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the New Jersey Corporation for Advanced Technology programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification

7	**Biofiltration BMP must include operations and maintenance design features and planning considerations for continued effectiveness of pollutant and flow control functions.** Intent: Biofiltration BMPs require regular maintenance in order provide ongoing function as intended. Additionally, it is not possible to foresee and avoid potential issues as part of design; therefore plans must be in place to correct issues if they arise.	
☑	The biofiltration BMP O&M plan describes specific inspection activities, regular/periodic maintenance activities and specific corrective actions relating to scour, erosion, channeling, media clogging, vegetation health, and inflow and outflow structures.	Include O&M plan with project submittal as described in Chapter 7.
☑	Adequate site area and features have been provided for BMP inspection and maintenance access.	Illustrate maintenance access routes, setbacks, maintenance features as needed on project water quality plans.
☐	For proprietary biofiltration BMPs, the BMP maintenance plan is consistent with manufacturer guidelines and conditions of its third-party certification (i.e., maintenance activities, frequencies).	Provide copy of manufacturer recommendations and conditions of third-party certification.

Appendix D-Hydrology Study

COFFEY ENGINEERING, INC.

Drainage Study

Nicholas Residence
APN 443-631-01, -02
1826 Washington Pl

San Diego, CA. 92103

PROJECT NO. 432759

Prepared For:

Jim Nicholas
and
The City of San Diego

July 7, 2016

9666 Businesspark avenue, suite 210 San Diego, CA 92131 Phone: (858)831-0111 Fax: (858)831-0179

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1. **Existing Conditions**

The project is located on two developed lots totaling 0.31 acres (APN 443-631-01 - 0.16 AC and 443-631-02 – 0.15 AC) lying west of the intersection of Washington Pl & Portola Pl in San Diego, 92103. The drainage pattern through the site slopes east to west, with a more drastic slope at the edge of the residence where the canyon hillside begins. The site lies within a drainage path that ultimately flows to the San Diego Harbor (approximately 1.5 miles from the site) through natural drainage courses and the public storm drainage system. Refer to Drainage Map 'A.' found in Appendix A of this report for existing conditions.

2. **Proposed Project**

Proposed is the construction of a 4,976 ft^2 single family residence with attached garage. Grading operations for the structure will disturb approximately 0.19 AC. The earthwork quantities have been roughly estimated to be 580 CY of cut, 10 CY of fill with a net export of approximately 570 CY.

Drainage for the proposed site shall be designed to discharge at two different points. A series of connected downspouts collecting from the west roof ridge will drain to a sump pump located on the side yard patio, where it will be pumped to the bioretention area (Basin B.1). The remaining roof drains will direct storm water runoff through landscape areas before sheet flowing to the bioretention area as well. All hardscape except for the patio will be included in this drainage basin (Basin B.2). After treatment, runoff will flow into water retention modules to satisfy hydromodification requirements. Stormwater from the retention tanks will then be pumped to the northeast corner of the site where it will discharge to Washington Place through a D-25 curb outlet. The patio drainage, constituting a very minor percentage of impervious area, will be incorporated into the undisturbed hillside (Basin A). This basin will be considered self-treating; therefore it will not be necessary to route to the bioretention area. This discharge to the hillside will replicate the existing drainage pattern, while drastically reducing hillside receiving waters.

Refer to Drainage Map 'B' found in Appendix A for the proposed post construction drainage conditions.

3. **Purpose and Scope of Report**

This report will evaluate the pre-construction hydrologic conditions as well as the post-construction conditions to quantify increases or decreases in runoff from the project and for the design of drainage system components for a 100-yr design storm for flood control purposes.

4. **Method of Calculations**

The Rational Method, as defined by the *County of San Diego Hydrology Manual (2003)*, will be used to calculate storm water flow rates. Where noted, the following calculations were used to determine flow properties:

Rainfall Characteristics

$Q = C * I * A$, where

Q = Flow rate (ft^3/sec)
C = Runoff coefficient
(Runoff coefficient per County of San Diego Hydrology Manual Table 3-1 reproduced in Appendix C. Soil type D determined from the *Soil Hydrologic Groups* map from the County of San Diego Hydrology Manual reproduced in Appendix C also.)
I = Rainfall intensity (in/hr)
A = Area (acres)

Rainfall Intensity (per County of San Diego Hydrology Manual Figure 3-1 reproduced in Appendix C)

$I = 7.44 * P_6 * D^{-0.645}$, where

I = Rainfall intensity (in/hr)
P_6 = Adjusted 6-hour precipitation (inches)
D = Storm duration (min), equal to T_c for time-of-concentration storms

Tc = Ti+Tt+Tp (time-of-concentration), where
Ti=Over land initial time.
Tt=Travel time on natural watersheds.
Tp=Travel time on drainage structures (pipes, brow ditch, gutter etc.)

Overland Time of Flow (per County of San Diego Hydrology Manual Figure 3-3 reproduced in Appendix C)

$Ti = 1.8(1.1-C) D^{0.50} / (s^{0.33})$ (Overland initial time of concentration formula),where

D= Watercourse Distance (feet)(see table 3-2 for the max. overland flow length)
s = Slope (%)
C= Runoff Coefficient
Ti=Initial time of concentration (min.)

Time of Concentration (T_C) or Travel Time (T_t) for Natural Watersheds (per County of San Diego Hydrology Manual Figure 3-4 reproduced in Appendix C)

$T_t = (11.9*L^3 / \Delta H)^{0.385}$ (formula for travel time for natural watersheds), where

T_c = Time of Concentration or Travel time (hours)
L = Length of watercourse (miles)
ΔH = Change in effective slope height (ft)

Pipe and Open Channel Flow Characteristics

$V = 1/n * R^{2/3} * S^{1/2}$ (from Manning), where

V = Average cross-sectional velocity (ft/sec)
n = Manning roughness coefficient
R = Hydraulic radius (ft)
S = Slope of water surface (ft height/ft length)

$p/\gamma + V^2/2g + z_1 + h_L = p/\gamma + V^2/2g + z_2$ (from Bernoulli), where

p = pressure (lbs/ft^2)
γ = density (lbs/ft^3)
V = velocity (ft/sec)
g = gravity (ft/sec/sec)
z = height of fluid (ft)
h_L = head loss (ft)

5. **Results and Conclusions:**

The net area draining from the property as well as the land use (single family residential) will remain unchanged. Referring to Drainage Maps 'A' and 'B' shows the creation of two separate basins (A, B), with the second divided into sub-basins (B.1, B.2) from the existing basin (1). The overall 100-year-storm site runoff down the undisturbed hillside will decrease in post-construction conditions, from 0.67 CFS to 0.21 CFS. There will be an increase in flow from 0.00 CFS to 0.62 CFS heading to Washington Pl due to basins B.1 and B.2.

6. **Declaration of Responsible Charge**

I hereby declare that I am the Civil Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

7/07/16

Michael Kinnear
RCE 76785
Exp. 12-31-16

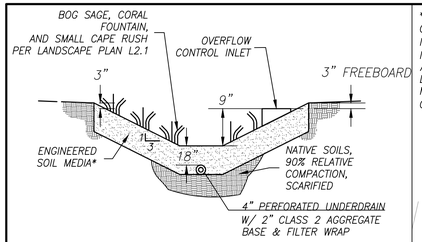
Date

Bibliography

- County of San Diego. 2005. *Drainage Design Manual* http://www.sdcounty.ca.gov/dpw/floodcontrol/drainage.html

- County of San Diego. 2003. *Hydrology Manual* http://www.sdcounty.ca.gov/dpw/floodcontrol/hydrologymanual.html

Appendix A – Referenced Plans & Drainage Maps



*ENGINEERED SOIL MEDIA CONSISTS OF 85% WASHED COURSE SAND, 10% FINES (RANGE: 8–12%; 8% = 2 IN/HR INFILTRATION RATE, 12% = 1 IN/HR INFILTRATION RATE), AND 5% ORGANIC MATTER. FOR ADDITIONAL STANDARDS SEE SAN DIEGO LOW IMPACT DEVELOPMENT DESIGN MANUAL SECTION 1.2.4.2 SOIL MEDIA MUST MAINTAIN A MINIMUM INFILTRATION RATE OF 5 IN/HR

DETAIL 'A'
BIO-RETENTION FACILITY
NOT TO SCALE

LEGEND

DESCRIPTION	STD DWG	SYMBOL
STREET CENTERLINE		℄
PROPERTY LINE		N45°45'45"W
EXISTING CONTOUR		90
EXISTING SPOT ELEVATION		100.00
PROPOSED CONTOUR		90
PROPOSED SPOT ELEVATION		100.00
DRAINAGE SWALE OR DIRECTION OF FLOW		
PVC DRAIN LINE		
6" LANDSCAPE DRAIN		Ø
5" HARDSCAPE DRAIN		
BUILDING FOOTPRINT		
CMU RETAINING WALL		
CMU RETAINING WALL		
EXISTING GAS LINE		G
EXISTING SEWER–MAIN		S
EXISTING TELEPHONE LINE		T
EXISTING WATER MAIN		W
P.C.C. DRIVEWAY	SDG–160	
4" TIGHT LINE PIPE (PVT)		

PERMANENT BMP LEGEND

SOURCE CONTROL BMPs *

3.1.6	EFFICIENT IRRIGATION
3.1.7	TRASH STORAGE
3.1.8	MATERIALS STORAGE
3.1.10	EMPLOY INTEGRATED PEST MANAGEMENT PRINCIPLES
3.1.13	MANAGE AIR CONDITIONING CONDENSATE
3.1.14	USE NON–TOXIC ROOFING MATERIALS WHERE FEASIBLE
3.1.15	OTHER SOURCE CONTROL REQUIREMENTS

LID & SITE DESIGN BMPs

LID–1	OPTIMIZE SITE LAYOUT
LID–2	MINIMIZE IMPERVIOUS FOOTPRINT
LID–3	DISPERSE RUNOFF TO ADJACENT LANDSCAPING
LID–4	CONSTRUCTION CONSIDERATIONS

* REFER TO WATER QUALITY STUDY AND STORM WATER STANDARDS 2012 FOR DETAILS

BENCHMARK

N'LY BP IN TOP OF CURB AT WASHINGTON PLACE AND PRINGLE STREET
EL: 272.027 FEET. DATUM: NGVD 29 (CITY OF SAN DIEGO MSL)

LEGAL DESCRIPTION

LOTS 95 & 96 OF MISSION HILLS, IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP NO. 1115, ON FILE IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY.

APN: 443–631–01 & 443–631–02

EASEMENTS

THIS PLAN WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT. EASEMENTS MAY BE PRESENT ON AND AFFECT THE SUBJECT PROPERTY.

CIVIL ENGINEER:

JOHN S. COFFEY
COFFEY ENGINEERING, INC.
9666 BUSINESSPARK AVE., SUITE 210
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(858) 831–0111
FAX: (858) 831–0179

REGISTERED PROFESSIONAL ENGINEER JOHN S. COFFEY No. 062716 CIVIL STATE OF CALIFORNIA

PRELIMINARY

JOHN S. COFFEY DATE
RCE 062716

ABBREVIATIONS

AC	ASPHALTIC CONCRETE
APN	ASSESSOR'S PARCEL NUMBER
BRW	BOTTOM OF RETAINING WALL GRADE
℄	CENTER LINE
CB	CATCH BASIN
CO	CLEANOUT
CONC	CONCRETE
(E); EX	EXISTING
EL	ELEVATION
FF	FINISH FLOOR
℄; FL	FLOW LINE
H	HEIGHT
IE	INVERT ELEVATION
MAT'L	MATERIAL
MAX	MAXIMUM
MIN	MINIMUM
(P); PR	PROPOSED
PCC	PORTLAND CEMENT CONCRETE
PLTR	PLANTER/PLANTING AREA
PP	POWER POLE
S	SEWER
SD	STORM DRAIN
SF	SQUARE FEET
TC	TOP OF CURB
TG	TOP OF GRATE (DRAIN)
TRW	TOP OF RETAINING WALL GRADE
TYP	TYPICAL
W	WATER
WM	WATER METER

TOPOGRAPHY NOTE

WE PREPARED THIS GRADING PLAN WITH THE BENEFIT OF A TOPOGRAPHY AND/OR A RECORD DRAWINGS PROVIDED BY THE OWNER, ANOTHER SURVEYOR, AND/OR A GOVERNMENT AGENCY. THEREFORE, WE WILL NOT BE HELD RESPONSIBLE FOR CONSTRUCTION CONFLICTS, DELAYS, OR ADDITIONAL COSTS INCURRED AS A RESULT OF INACCURATE TOPOGRAPHIC INFORMATION. FURTHERMORE, THE PLOTTING OF EXISTING UTILITIES ON THIS PLAN DOES NOT CONSTITUTE A GUARANTEE OF THEIR LOCATION, SLOPE, DEPTH, SIZE, OR TYPE. EXACT LOCATION, DEPTH, SIZE, OR TYPE OF LINES AND FACILITIES CAN ONLY BE DETERMINED BY FIELD EXPLORATION (I.E. POTHOLING, EXCAVATION) PRIOR TO CONSTRUCTION. WE WILL NOT BE HELD RESPONSIBLE FOR COSTS INCURRED IN THE EVENT THAT EXISTING UTILITIES WERE NOT OF THE LOCATION, SLOPE, DEPTH, SIZE, OR TYPE INDICATED.

GRADING PLAN NOTES

A. PRIOR TO THE ISSUANCE OF ANY CONSTRUCTION PERMIT, THE APPLICANT SHALL INCORPORATE ANY CONSTRUCTION BEST MANAGEMENT PRACTICES NECESSARY TO COMPLY WITH CHAPTER 14, ARTICLE 2, DIVISION 1 (GRADING REGULATIONS) OF THE SAN DIEGO MUNICIPAL CODE, INTO THE CONSTRUCTION PLANS OR SPECIFICATIONS.

B. PRIOR TO THE ISSUANCE OF ANY CONSTRUCTION PERMIT THE APPLICANT SHALT SUBMIT A WATER POLLUTION CONTROL PLAN (WPCP). THE WPCPW SHALL BE PREPARED IN ACCORDANCE WITH THE GUIDELINES IN APPENDIX E OF THE CITY'S STORM WATER STANDARDS.

SOURCE OF TOPOGRAPHY

WOODS LAND SURVEYING, INC
2180 GARNET AVE., SUITE 3K SAN DIEGO, CA 92109
PH: (858) 273–4700 FAX: (858) 273–4922 E–MAIL: survey@woodslandsurveying.com
STEVEN L. WOODS, RLS NO. 6427 DATE OF SURVEY: SEPTEMBER, 2014

GRADING TABULATIONS

TOTAL AMOUNT OF SITE TO BE GRADED:	0.19	ACRES	% OF TOTAL SITE:	61%	
AMOUNT OF CUT:	580	CUBIC YARDS	MAXIMUM DEPTH OF CUT:	11.62 *	FEET
AMOUNT OF FILL:	10	CUBIC YARDS	MAXIMUM DEPTH OF FILL:	3	FEET
MAXIMUM HEIGHT OF FILL SLOPE(S):	2	FEET	SLOPE RATIO:	N/A	
MAXIMUM HEIGHT OF CUT SLOPE(S):	N/A	FEET	SLOPE RATIO:	N/A	
AMOUNT OF ~~IMPORT~~/ EXPORT SOIL:	570	CUBIC YARDS			
RETAINING/ ~~CRIB WALLS~~:	LENGTH 75	FEET	MAXIMUM HEIGHT:	6	FEET

* INSIDE THE BUILDING

DRAINAGE NOTES

1. ALL MAIN DRAIN LINES SHOWN TO BE 6" PVC @ 1% MINIMUM SLOPE UNLESS OTHERWISE NOTED.
2. ALL CATCH BASIN LEADS TO BE 4" PVC @ 2% MINIMUM SLOPE UNLESS OTHERWISE NOTED.
3. HARDSCAPE GRADES TO BE 1% MINIMUM TO DRAINS AND AWAY FROM STRUCTURE.
4. SOFTSCAPE GRADES TO BE 2% MINIMUM TO DRAINS (1% WHERE FLOW IS CONCENTRATED) AND 2% MINIMUM AWAY FROM STRUCTURE.
5. SOIL COVER ABOVE DRAIN LINES SHALL BE 12" MINIMUM UNLESS OTHERWISE NOTED.
6. NOTIFY CIVIL ENGINEER IF ANY NON–DRAINING SUMP CONDITIONS BECOME APPARENT DURING CONSTRUCTION.
7. THIS PROJECT WILL NOT DISCHARGE ANY INCREASE IN STORM WATER RUN–OFF ONTO THE EXISTING HILLSIDE AREAS.
8. AT THE STORM WATER DISCHARGE LOCATIONS, SUITABLE ENERGY DISSIPATERS ARE TO BE INSTALLED TO REDUCE THE DISCHARGE TO NON–ERODIBLE VELOCITIES.
9. NO ADDITIONAL RUN–OFF IS PROPOSED FOR THE DISCHARGE LOCATIONS.

INTERIM BINDER NOTE

GRADED, DISTURBED, OR ERODED AREAS TO BE TREATED WITH A NON–IRRIGATED HYDROSEED MIX SHALL RECEIVE AN INTERIM BINDER/TACKIFIER AS NEEDED BETWEEN APRIL 2 AND AUGUST 31 FOR DUST EROSION CONTROL WITH SUBSEQUENT APPLICATION OF HYDROSEED MIX DURING THE RAINY SEASON BETWEEN OCTOBER 1 AND APRIL 1.

COFFEY ENGINEERING, INC.
9666 BUSINESSPARK AVENUE, SUITE 210, SAN DIEGO, CA 92131 PH (858)831-0111 FAX (858)831-0179

CITY OF SAN DIEGO, CALIFORNIA

SITE DEVELOPMENT PERMIT

WASHINGTON PLACE RESIDENCE
1826 - 1836 Washington Place
San Diego, CA 92103

ORIGINAL 12/19/16

REVISIONS

GRADING & DRAINAGE PLAN — C.1

DRAWN BY: DTK
CHECKED BY: JSC

SHEET 1 OF 2

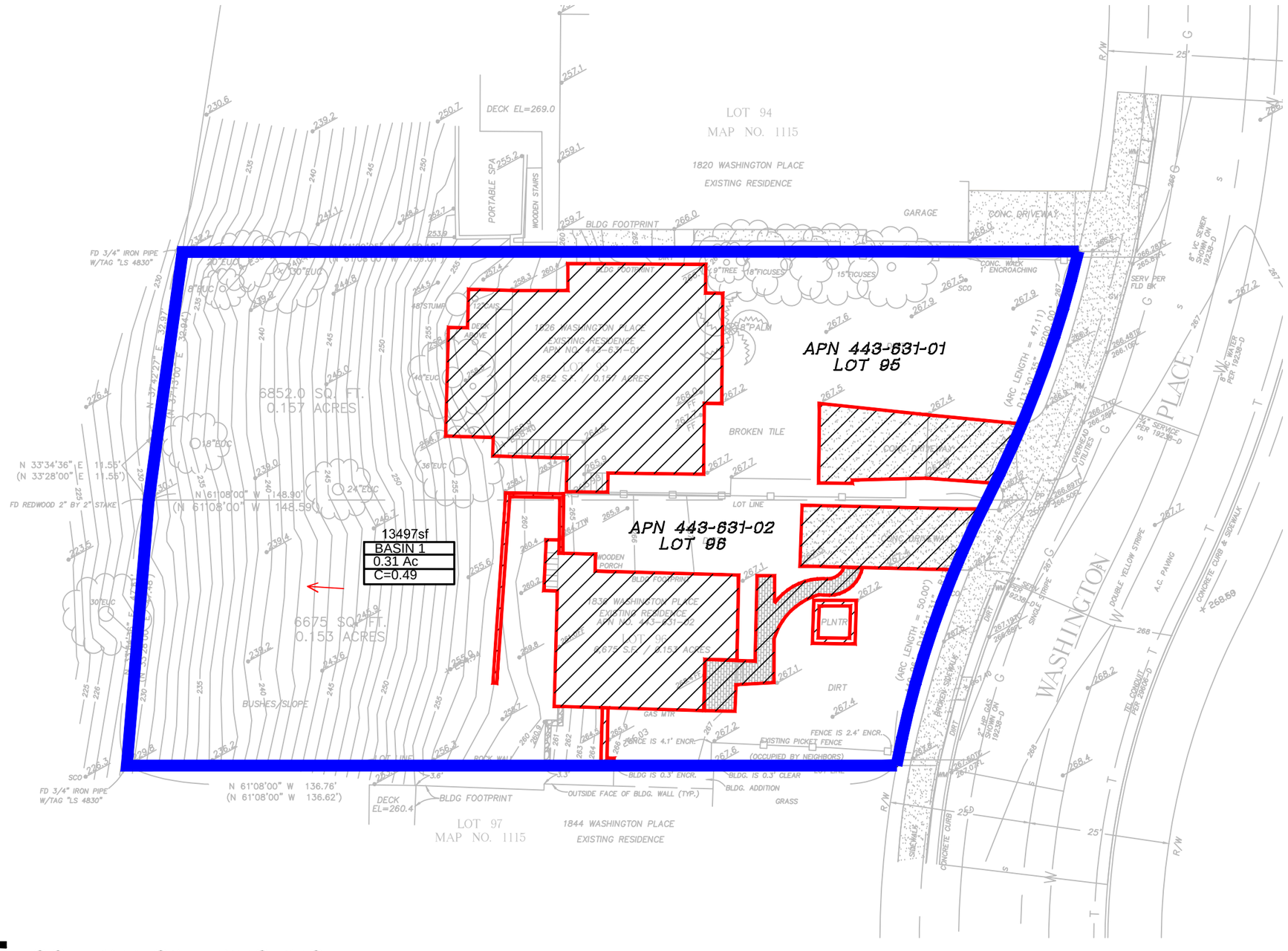
BASIN ID → A.1
BASIN AREA → A=1.00 AC
RUNOFF COEF. → Coef.

RUNOFF ID → X.1 → RUNOFF DIRECTION

LEGEND

DESCRIPTION	SYMBOL
EXISTING CONTOUR	90
DIRECTION OF FLOW	
IN-SITE IMPERVIOUS AREA	
IN-SITE BASIN LIMIT	

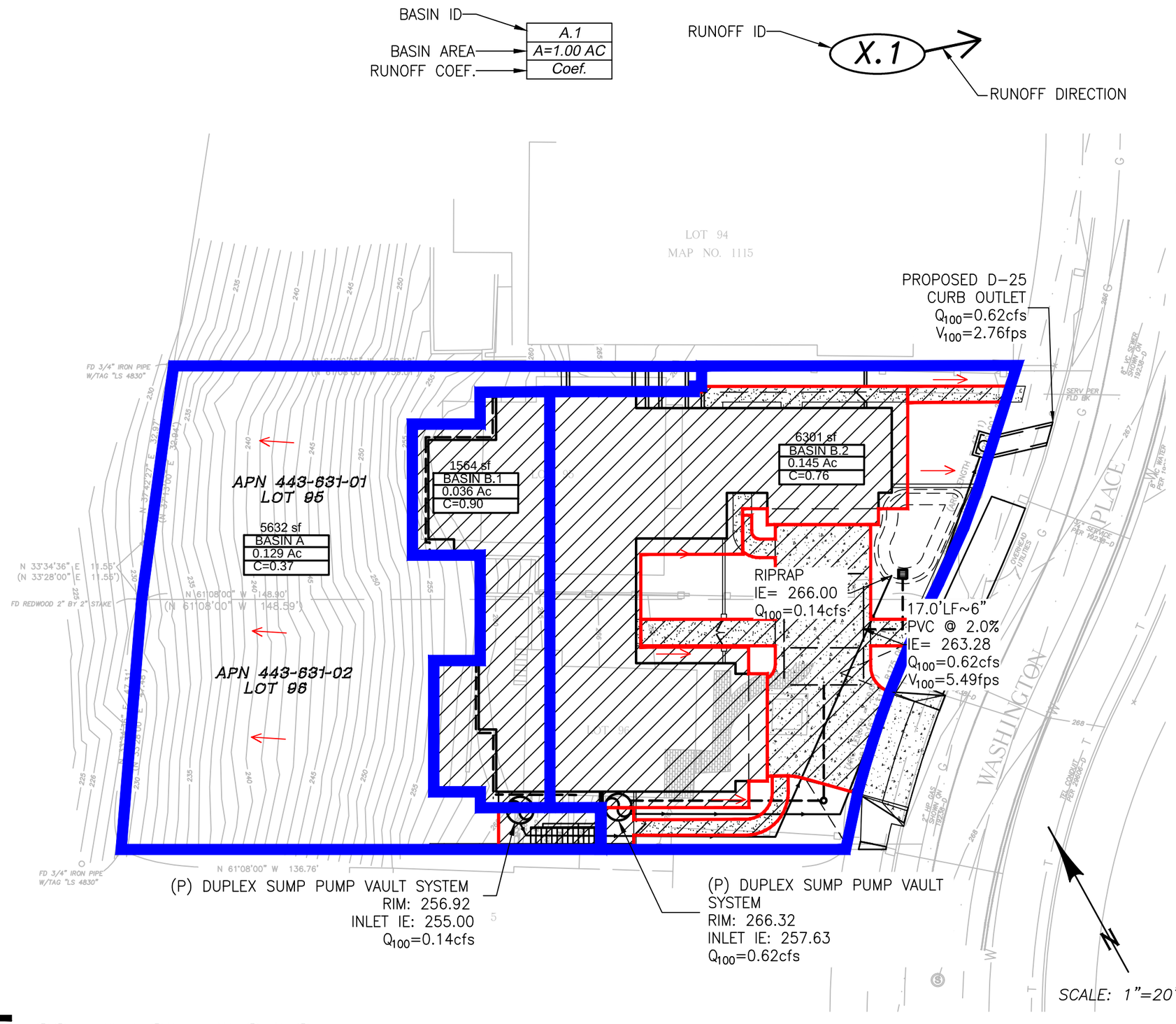
BASIN A: SOIL TYPE D
RUNOFF COEFFICIENT: 0.49
TOTAL AREA: 13,497 SQFT = 0.31AC
IMPERVIOUS AREA: 3,325 SQFT
PERVIOUS AREA: 10,172 SQFT
SURFACE COVER: LANDSCAPE AREA, CONCRETE



SCALE: 1"=20'

COFFEY ENGINEERING, INC.

DRAINAGE MAP 'A'
EXISTING CONDITIONS
SCALE: 1"=20'



LEGEND

DESCRIPTION	SYMBOL
EXISTING CONTOUR	90
DIRECTION OF FLOW	
IN-SITE IMPERVIOUS AREA	
IN-SITE BASIN LIMIT	

BASIN A: SOIL TYPE D
RUNOFF COEFFICIENT: 0.37
TOTAL AREA: 5632 SQFT = 0.129AC
IMPERVIOUS AREA: 143 SQFT
PERVIOUS AREA: 5489 SQFT
SURFACE COVER: LANDSCAPE AREA, CONCRETE

BASIN B.1: SOIL TYPE D
RUNOFF COEFFICIENT: 0.90
TOTAL AREA: 1564 SQFT = 0.036AC
IMPERVIOUS AREA: 1564 SQFT
PERVIOUS AREA: 0 SQFT
SURFACE COVER: ROOF

BASIN B.2: SOIL TYPE D
RUNOFF COEFFICIENT: 0.76
TOTAL AREA: 6301 SQFT = 0.145 AC
IMPERVIOUS AREA: 4747 SQFT
PERVIOUS AREA: 1554 SQFT
SURFACE COVER: ROOF, LANDSCAPE AREA, CONCRETE

TOTAL: PROJECT AREA: 13,497 SQFT = 0.31 AC
IMPERVIOUS AREA: 6,454 SQFT
PERVIOUS AREA: 7,043 SQFT

COFFEY ENGINEERING, INC.

DRAINAGE MAP 'B'
PROPOSED CONDITIONS
SCALE: 1"=20'

Appendix B – Calculations/Evaluations

100 Year Storm

Table B - Pre Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
1	0.49	5.00	4.40	0.310	**0.67**	1	Developed Site, Sheet Flow to Hillside
				Sum =	0.67		

Table B - Post Construction Flow Conditions						Table B - Hydraulics of Proposed Structures	
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
A	0.37	5.00	4.40	0.129	**0.21**	A	Rear Yard Vegetated Slope
B.1	0.90	5.00	4.40	0.036	**0.14**	B.1	Roof, Treated Runoff to Street
B.2	0.76	5.00	4.40	0.145	**0.48**	B.2	Roof, Pump to Bioretention
				Sum =	0.84		

10 Year Storm

Table B - Pre Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
1	0.49	5.00	3.40	0.31	**0.52**	1	Developed Site, Sheet Flow to Hillside
				Sum =	0.52		

Table B - Post Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
A	0.38	5.00	3.40	0.129	**0.17**	A	Rear Yard Vegetated Slope
B.1	0.90	5.00	3.40	0.036	**0.11**	B.1	Roof, Treated Runoff to Street
B.2	0.76	5.00	3.40	0.145	**0.37**	B.2	Roof, Pump to Bioretention
				Sum =	0.65		

2 Year Storm

Table B - Pre Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
1	0.49	5.00	2.40	0.31	**0.36**	1	Developed Site, Sheet Flow to Hillside
				Sum =	0.36		

Table B - Post Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
A	0.38	5.00	2.40	0.129	**0.12**	A	Rear Yard Vegetated Slope
B.1	0.90	5.00	2.40	0.036	**0.08**	B.1	Roof, Treated Runoff to Street
B.2	0.76	5.00	2.40	0.145	**0.26**	B.2	Roof, Pump to Bioretention
				Sum =	0.46		

Water Quality Event

Table B - Pre Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
1	0.49	5.00	0.20	0.31	**0.03**	1	Developed Site, Sheet Flow to Hillside
				Sum =	0.03		

Table B - Post Construction Flow Conditions							
		Summary					
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
A	0.38	5.00	0.20	0.129	**0.01**	A	Rear Yard Vegetated Slope
B.1	0.90	5.00	0.20	0.036	**0.01**	B.1	Roof, Treated Runoff to Street
B.2	0.76	5.00	0.20	0.145	**0.02**	B.2	Roof, Pump to Bioretention
				Sum =	0.04		

Appendix C – Reference Tables & Figures (County of San Diego Hydrology Manual, FEMA Floodplain Map)

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

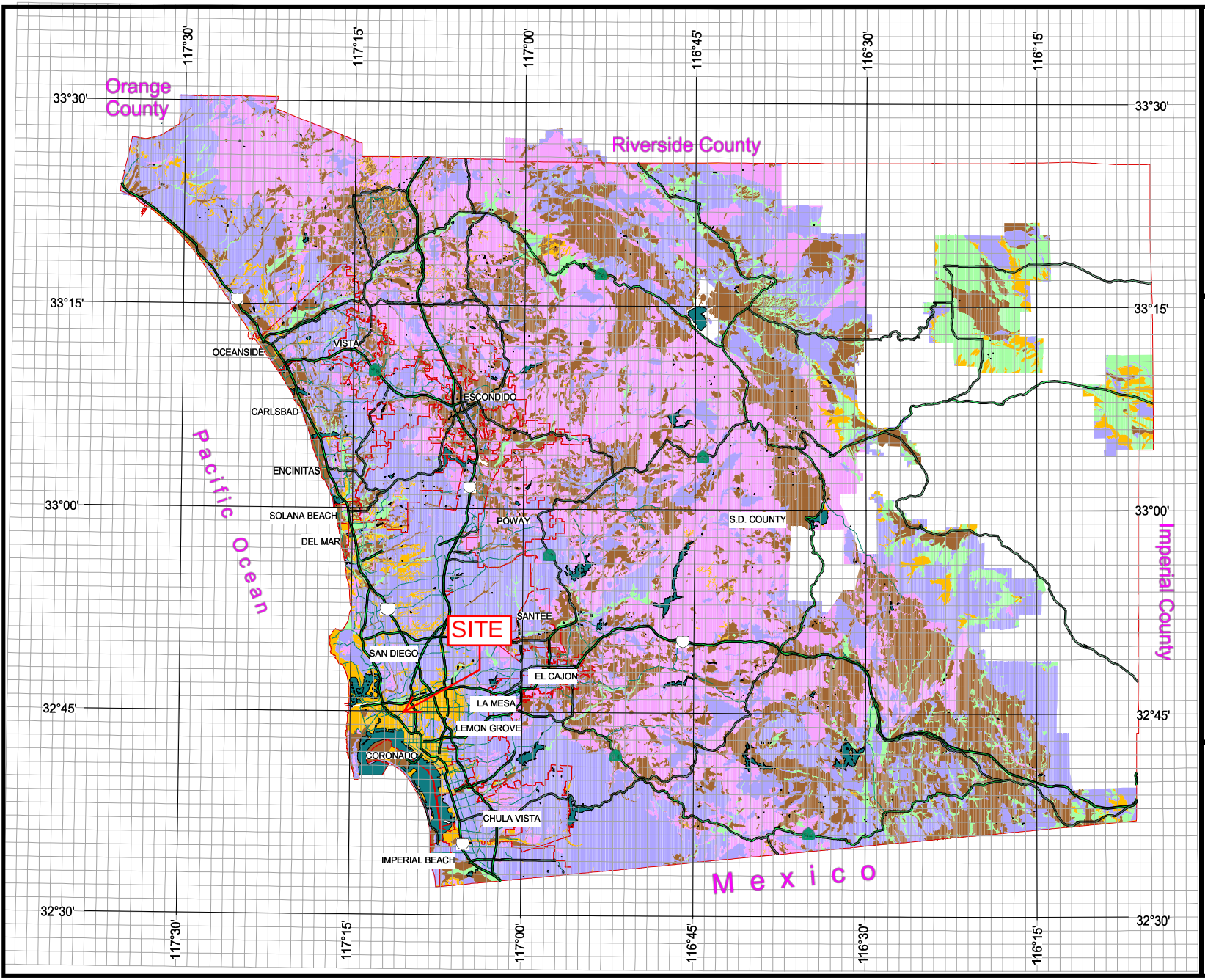
Land Use		Runoff Coefficient "C"					
			Soil Type				
NRCS Elements	County Elements	% IMPER.	A	B	C	D	
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35	
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41	.37
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46	
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49	.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52	
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57	
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60	
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63	
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71	.76
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79	
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79	
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82	
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85	
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85	
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87	.90

A)3
1) 25
B.2)75
B.1)100

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

6" PVC Pipe @ 2% serving Basin B.2

(1) Diameter (inches) ... 6. (2) Mannings n ..... .010

(3) slope (ft/ft) ..... .0200 (4) Q (cfs) 0.62

(5) depth (ft) ..... 0.28 (6) depth/Diameter ... 0.56

Velocity (fps) ..... 5.49 Velocity Head 0.47

Area (Sq. Ft.) 0.11

Critical Depth ..... 0.40 Critical Slope ... 0.0076

Critical Velocity ... 3.68 Froude Number 2.03

Capacity of 6" PVC Pipe @ 2% serving Basin B.2

(1) Diameter (inches) ... 6. (2) Mannings n ..... .010

(3) slope (ft/ft) ..... .0200 (4) Q (cfs) 1.03

(5) depth (ft) ..... 0.50 (6) depth/Diameter ... 1.00

Velocity (fps) ..... 5.25 Velocity Head 0.43

Area (Sq. Ft.) 0.20

Critical Depth ..... 0.48 Critical Slope ... 0.0173

Critical Velocity ... 5.35 Froude Number .... N/A

D-25 @ 2% serving Basin B.2

(1) INVERT WIDTH (feet) ... 3.00 (2) Mannings n ..... .013

(3) SLOPE (ft/ft) ..... .0200 (4) Q (cfs) 0.62

(5) LEFT SIDE (6) RIGHT SIDE

SLOPE (X to 1) ..... 0.00 SLOPE (X to 1) ... 0.00

(7) DEPTH (ft) ..... 0.08 TOP WIDTH (FT) ... 3.00

VELOCITY (fps) ..... 2.76 VEL. HEAD (ft) ... 0.12

AREA (sq. ft) ..... 0.23 P + M (pounds) ... 4

CRITICAL DEPTH ..... 0.11 CRITICAL SLOPE ... 0.0056

CRITICAL VELOCITY ..... 1.88 FROUDE NUMBER 1.77