CITY OF CHULA VISTA

PDP SWQMP

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

Project Name Nakano

Assessor's Parcel Number(s) 624-071-02

Permit Application Number City of Chula Vista TM#PCS21-000 City of San Diego PTS#647766

Drawing Numbers ____________

CIVIL ENGINEER NAME: Chelisa Pack; **PE #** 71026

REGISTERED PROFESSIONAL ENGINEER CHELISA A. PACK No. 71026 EXP. 06-30-23 CIVIL STATE OF CALIFORNIA

____
Wet Signature and Stamp

PREPARED FOR: Applicant Name: TriPointe Homes
Address: 13400 Sabre Springs Parkway, Suite 200
San Diego, CA 92128
Telephone # 858.794.2500

PREPARED BY: Company Name: Project Design Consultants
Address: 701 B Street, Suite 800
San Diego, CA, 92101
Telephone # 619-235-6471

DATE: January 9, 2023

Approved By: City of Chula Vista Date:
(print Name & Sign)

P:\4409\Engr\Reports-4409.02-Nakano\Entitlement\SWQMP
Job# 4409.02

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Project Name/ Nakano

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ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

Project Name/ Nakano

Certification Page

Project Name: Nakano

Permit Application Number: ____________________

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Chula Vista BMP Design Manual, which is based on the requirements of the San Diego Regional Water Quality Control Board 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 BMP Design Manual. 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 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.

[signature], 1/9/2023

Engineer of Work's Signature — Date

71026, 6/30/23

PE # — Expiration Date

Chelisa Pack

Print Name

Project Design Consultants

Company

REGISTERED PROFESSIONAL ENGINEER
CHELISA A. PACK
No. 71026
EXP. 06-30-23
CIVIL
STATE OF CALIFORNIA

Engineer's Seal

Nakano

Project Name/______________________________

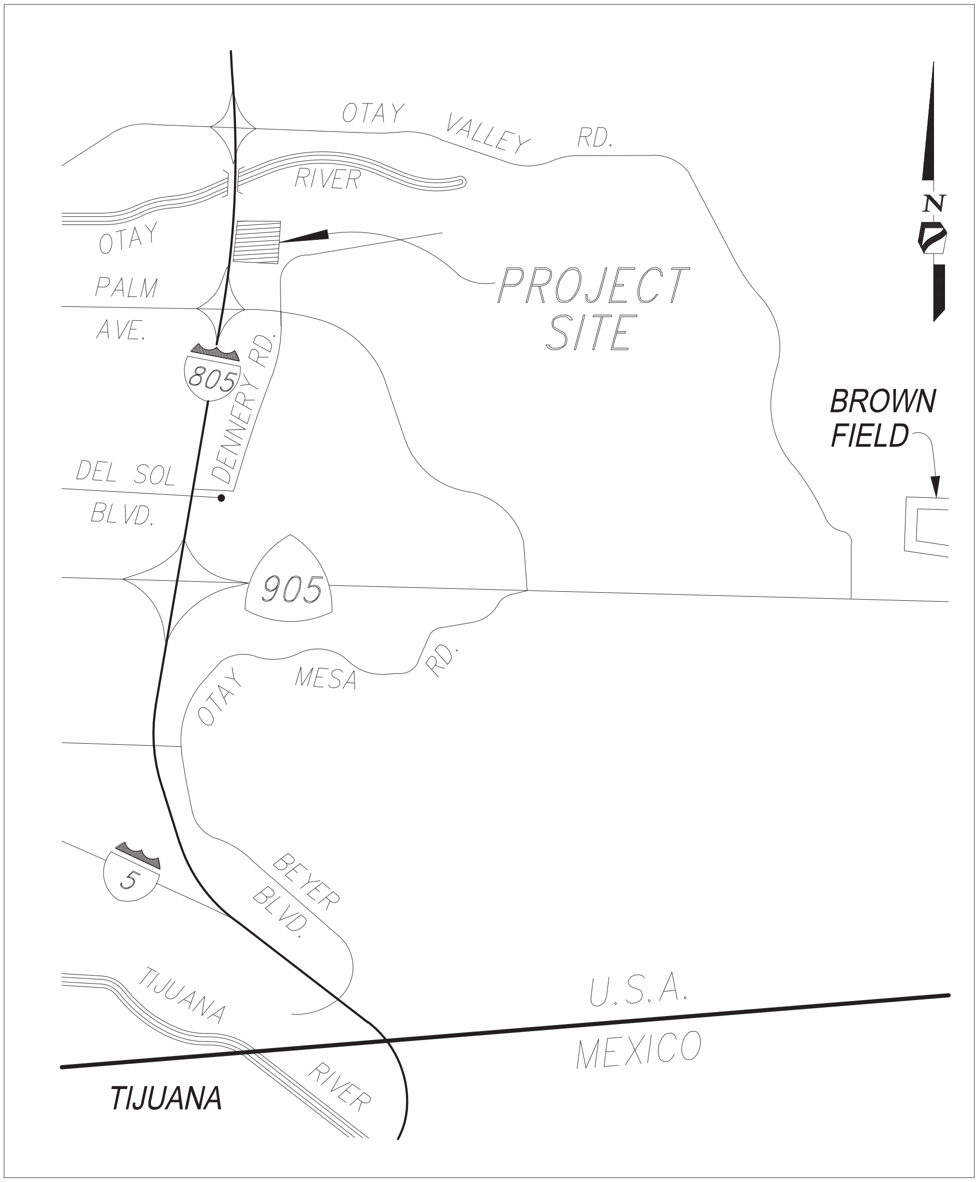
SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Summary of Changes
1		☒ Preliminary Design / Planning/ CEQA ☐ Final Design	Initial Submittal
2		☒ Preliminary Design / Planning/ CEQA ☐ Final Design	2nd Submittal- Revised Site Plan to add secondary access & avoid Caltrans drainage easement
3		☒ Preliminary Design / Planning/ CEQA ☐ Final Design	
4		☒ Preliminary Design / Planning/ CEQA ☐ Final Design	
5	1/9/23	Preliminary Design	5th Submittal - Updated to include additional City of SD-formatted version of infiltration feasibility letter in Att 1D

Project Name/ Nakano

Project Vicinity Map



VICINITY MAP

NO SCALE

CITY OF CHULA VISTA	Storm Water Requirements Applicability Checklist for All Permit Applications	Intake Form March 2019 Update

Project Information

Project Address: North of the intersection of Dennery Rd & Regatta Lane, Chula Vista, CA 92154	Project Application #
Project Name: Nakano	APN(s) 624-071-01

Brief Description of Work Proposed: Construction of 157 residential units, two biofiltration basins and a park lookout to Otay River.

The project is (select one):

☑ New Development Total Impervious Area 566445 ft²

☐ Redevelopment Total new and/or replaced Impervious Area ________ ft²
(Redevelopment is the creation and/or replacement of impervious surface on an already developed site).

☐ *Others* ________

Name of Person Completing this Form: Chelisa Pack (Agent on behalf of Pardee Homes)

Role: ☐ Property Owner ☐ Contractor ☐ Architect ☑ Engineer ☐ Other ________

Email: chelisap@projectdesign.com Phone: (619) 881-2575

Signature: [signature] Date Completed: 9/9/2020

Answer each section below, starting with Section 1 and progressing through each section. Additional information for determining the requirements is found in the Chula Vista BMP Design Manual available on the City's website at http://www.chulavistaca.gov/departments/public-works/services/storm-water-pollution-prevention/documents-and-reports.

SECTION 1: Storm Water BMP Requirements

Does the project consist of **one or both** of the following: • Repair or improvements to an existing building or structure that don't alter the size such as: tenant improvements, interior remodeling, electrical work, fire alarm, fire sprinkler system, HVAC work, Gas, plumbing, etc. • Routine maintenance activities such as: roof or exterior structure surface replacement; resurfacing existing roadways and parking lots including dig outs, slurry seal, overlay and restriping; repair damaged sidewalks or pedestrian ramps on existing roads without expanding the impervious footprint; routine replacement of damaged pavement, trenching and resurfacing associated with utility work (i.e. sewer, water, gas or electrical laterals, etc.) and pot holing or geotechnical investigation borings.	☐ **Yes**	**Project is NOT Subject to Permanent Storm Water BMP requirements.** **BUT IS** subject to Construction BMP requirements. Review & sign "Construction Storm Water BMP Certification Statement" on page 2.
	☑ **No**	**Continue to Section 2, page 3.**

Construction Storm Water BMP Certification Statement

The following stormwater quality protection measures are required by City Chula Vista Municipal Code Chapter 14.20 and the City's Jurisdictional Runoff Management Program.

1. All applicable construction BMPs and non-stormwater discharge BMPs shall be installed and maintained for the duration of the project in accordance with the Appendix K "Construction BMP Standards" of the Chula Vista BMP Design Manual.
2. Erosion control BMPs shall be implemented for all portions of the project area in which no work has been done or is planned to be done over a period of 14 or more days. All onsite drainage pathways that convey concentrated flows shall be stabilized to prevent erosion.
3. Run-on from areas outside the project area shall be diverted around work areas to the extent feasible. Run-on that cannot be diverted shall be managed using appropriate erosion and sediment control BMPs.
4. Sediment control BMPs shall be implemented, including providing fiber rolls, gravel bags, or other equally effective BMPs around the perimeter of the project to prevent transport of soil and sediment offsite. Any sediment tracked onto offsite paved areas shall be removed via sweeping at least daily.
5. Trash and other construction wastes shall be placed in a designated area at least daily and shall be disposed of in accordance with applicable requirements.
6. Materials shall be stored to avoid being transported in storm water runoff and non-storm water discharges. Concrete washout shall be directed to a washout area and shall not be washed out to the ground.
7. Stockpiles and other sources of pollutants shall be covered when the chance of rain within the next 48 hours is at least 50%.

I certify that the stormwater quality protection measures listed above will be implemented at the project described on Intake Form. I understand that failure to implement these measures may result in monetary penalties or other enforcement actions. This certification is signed under penalty of perjury and does not require notarization.

Name: ______________________________ Title: ______________________

Signature: ____________________________ Date: ____________________

Section 2: Determine if Project is a Standard Project or Priority Development Project

Is the project in any of the following categories, (a) through (j)?

(a) New development that **creates 10,000 square feet** or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land. ☑ **Yes** ☐ **No**

(b) Redevelopment project that **creates and/or replaces 5,000 square feet** or more of impervious surface (collectively over the entire project site 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**

(c) New development or redevelopment projects that **creates and/or replaces a combined total of 5,000 square feet** or more of impervious surface (collectively over the entire project site) and support one or more of the following uses: ☑ **Yes** ☐ **No**

(i) **Restaurant.** This This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification Code 5812).

(ii) **Hillside development projects**. This category includes development on any natural slope that is twenty-five percent or greater.

(iii) **Parking Lots**. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.

(iv) **Streets, roads, highways, freeways, and driveways**. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

(d) New development or redevelopment project that **creates and/or replaces 2,500 square feet** or more of impervious surface (collectively over the entire project site), discharging 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**

(e) New development or redevelopment project that creates and/or replaces a combined total of 5,000 square feet or more of impervious surface, that support one or more of the following used: ☐ **Yes** ☑ **No**

(i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

(ii) Retail gasoline outlets. This category includes retail gasoline outlets that meet the meet one of the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.

(f) New development or redevelopment that result in the disturbance of **one or more acres** of land and are expected to generate pollutants post construction. 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**

The project is (select one):

☐ If "No" is checked for every category in Section 2, **Project is "Standard Development Project".** Site design and source control BMP requirements apply. **Complete and submit Standard SWQMP** (refer to Chapter 4 & Appendix E of the BMP Design Manual for guidance). Continue to Section 4.

☑ If "Yes" is checked for ANY category in Section 2, **Project is "Priority Development Project (PDP)".** Complete below, if applicable, and continue to Section 3.

Complete for PDP Redevelopment Projects ONLY:

The total existing (pre-project) impervious area at the project site is: ______________ ft^2 (A)

The total proposed newly created or replaced impervious area is ______________ ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: ____________%

The percent impervious surface created or replaced is (select one based on the above calculation):

☐ less than or equal to fifty percent (50%) – **only new impervious areas are considered a PDP**
OR

☐ greater than fifty percent (50%) – **the entire project site is considered a PDP**

☐ **Continue to Section 3**

Section 3: Determine if project is PDP Exempt

1. Does the project ONLY include new or retrofit sidewalk, bicycle lane 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 or roads? Or;
   - Are designed and constructed with permeable pavements or surfaces in accordance with USEPA Green Streets guidance?

☐ **Yes. Project is PDP Exempt.**

Complete and submit **Standard SWQMP** (refer to Chapter 4 of the BMP Design Manual for guidance). **Continue to Section 4.**

☑ **No. Next question**

2. Does the project ONLY include retrofitting or redevelopment of existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets standards?

☐ **Yes.**
Project is PDP Exempt.
Complete and submit Standard SWQMP (refer to Chapter 4 of the BMP Design Manual for guidance). **Continue to Section 4.**

☑ **No.**
Project is PDP.
Site design, source control and structural pollutant control BMPs apply. Complete and submit PDP SWQMP (refer to Chapters 4, 5 & 6 of the BMP Design Manual for guidance). **Continue to Section 4.**

SECTION 4: Construction Storm Water BMP Requirements:

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

1. Does the project include Building/Grading/Construction permits proposing less than 5,000 square feet of ground disturbance and has less than 5-foot elevation change over the entire project area?

☐ Yes; review & sign Construction Storm Water Certification Statement, 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 other activity that results in ground disturbance of less than one acre and more than 5,000 square feet?

☐ Yes. complete & submit Construction Storm Water Pollution Control Plan (CSWPCP), skip questions 3-4

☑ No; next question

3. Does the project results in disturbance of an acre or more of total land area and are considered regular maintenance projects performed to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (Projects such as sewer/storm drain/utility replacement)

☐ Yes. complete & submit Construction Storm Water Pollution Control Plan (CSWPCP), skip question 4

☑ No; next question

4. Is the project proposing land disturbance greater than or equal to one acre OR the project is part of a larger common plan of development disturbing 1 acre or more?

☑ Yes; Storm Water Pollution Prevention Plan (SWPPP) is required. Refer to online CASQA or Caltrans Template. Visit the SWRCB web site at http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

Note: for Projects that result in disturbance of one to five acres of total land area and can demonstrate that there will be no adverse water quality impacts by applying for a Construction Rainfall Erosivity Waiver, may be allowed to submit a CSWPCP in lieu of a SWPPP.

Nakano

Project Name/____

HMP Exemption Exhibit

Attach this Exhibit (if Applicable) that shows direct storm water runoff discharge from the project site to HMP exempt area. Include project area, applicable underground storm drains line and/or concrete lined channels, outfall information and exempt waterbody. Reference applicable drawing number(s). **Exhibit must be provided on 11"x17" or larger paper.**

Nakano

Project Name: ______________________________

Site Information Checklist	Form I-3B
Project Summary Information	
Project Name	Nakano
Project Address	North of the intersection of Dennery Rd & Regatta Lane, Chula Vista, CA 92154
Assessor's Parcel Number(s) (APN(s))	624-071-02
Permit Application Number	
Project Watershed	☒ San Diego Bay
Hydrologic Subarea name with Numeric Identifier up to two decimal places	Select One: ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☒ Otay 910
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	23.77 Acres (1,035,418 Square Feet)
Area to be Disturbed by the Project (Project Footprint)	20.30 Acres (884,389 Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	13.00 Acres (566,445 Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	4.45 Acres (198,057 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition	64 %

Project Name: Nakano

Form I-3B Page 3 of 10
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☐ Existing development ☒ Previously graded but not built out ☐ Demolition completed without new construction ☐ Agricultural or other non-impervious use ☒ Vacant, undeveloped/natural Description / Additional Information: Presently the site is undeveloped, mostly vacant and natural other than small utilities facilities.
Existing Land Cover Includes (select all that apply): ☒ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Description / Additional Information: Presently the site is undeveloped and natural with grassland, hillside, utilities facilities and a small dirt path traversing the property.
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☒ NRCS Type C ☒ NRCS Type D
Approximate Depth to Groundwater (GW): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☐ 10 feet < GW Depth < 20 feet ☒ GW Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☒ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information: Runon from the south flows north along the eastern edge of the project in an existing natural channel which is within a CDFW jurisdictional area.

Nakano

Project Name: ____________________

Form I-3B Page 3 of 10
Description of Existing Site Drainage Patterns

How is storm water runoff conveyed from the site? At a minimum, this description should answer:

1. whether existing drainage conveyance is natural or urban;
2. Is runoff from offsite conveyed through the site? if yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
3. Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
4. Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:

1.The existing drainage conveyance is mostly natural with minimal drainage improvements.
2.There are about 10.1 acres of runon areas draining onto the site from upstream areas from Kaiser Permanente and flows to the northeast of project site through natural conveyance to the northerly property line. Most of this portion of the runon from the north flows through the site and also along the western edge of the project site. A pipe will covey most of the runon flows through the site and out the center outfall of the proposed conditions. A low flow splitter will be utilized to maintain flow in the natural conveyance along the east portion of the project.
3.There are currently minimal drainage improvements within the project boundary.
4.The majority of the project drains to the north towards Otay River. The onsite portion sheet flows across the property to the north which eventually flows to Otay River. A clear natural channel is not defined though.

Refer to the project drainage study for additional information.

Project Name: Nakano

Form I-3B Page 4 of 10
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities: The Nakano project proposes a total of 61 detached condominiums, 84 duplexes, and 70 multi-family dwelling units. Two biofiltration basins will be installed, one in the northwest corner of the site and center east side of the project as well as a detention vault and modular wetland unit for water quality treatment. Two mini parks will be constructed in the center north and northwest locations of the project.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): The impervious features of the project consist of building roofs, driveways, streets, concrete sidewalks, and other miscellaneous improvements.
List/describe proposed pervious features of the project (e.g., landscape areas): The pervious features of the project consist of landscaping areas, two biofiltration basins and a proposed park.
Does the project include grading and changes to site topography? ☒ Yes ☐ No Description / Additional Information: The site will be mass graded to build the residential units, but the proposed grading maintains similar slope to existing condition.

Nakano

Project Name: ______________________________

Form I-3B Page 5 of 10

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☒ Yes

☐ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:

The project site will include a storm drain system consisting of roof drains, inlets, pipes, brow ditches, and water quality features/detention basin.
The proposed drainage improvements include private storm drain improvements serving the private development lots. The site generally maintains the natural drainage, flowing to the north.

Nakano

Project Name: __________

Form I-3B Page 6 of 10

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

- ☒ On-site storm drain inlets
- ☐ Interior floor drains and elevator shaft sump pumps
- ☐ Interior parking garages
- ☐ Need for future indoor & structural pest control
- ☒ Landscape/Outdoor Pesticide Use
- ☐ Pools, spas, ponds, decorative fountains, and other water features
- ☐ Food service
- ☒ Refuse areas
- ☐ Industrial processes
- ☐ Outdoor storage of equipment or materials
- ☐ Vehicle and Equipment Cleaning
- ☐ Vehicle/Equipment Repair and Maintenance
- ☐ Fuel Dispensing Areas
- ☐ Loading Docks
- ☒ Fire Sprinkler Test Water
- ☒ Miscellaneous Drain or Wash Water
- ☒ Plazas, sidewalks, and parking lots

Description / Additional Information:

The project will have features typical of proposed land uses including parks, residential units with landscaped areas, sidewalks and onsite storm drain inlets.

Nakano

Project Name: ______________________

Form I-3B Page 7 of 10
Identification and Narrative of Receiving Water and Pollutants of Concern
Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable): The majority of the project drains to the north and sheet flows towards Otay River.There is no storm drain conveyance system or facilities onsite. Otay River then flows to the San Diego Bay.
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
San Diego Bay	Mercury, PAHs, PCBs	Mercury, PAHs, PCBs

Identification of Project Site Pollutants*
*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated) Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Expected from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☐	☐	☐
Nutrients	☐	☐	☐
Heavy Metals	☐	☐	☐
Organic Compounds	☐	☐	☐
Trash & Debris	☐	☐	☐
Oxygen Demanding Substances	☐	☐	☐
Oil & Grease	☐	☐	☐
Bacteria & Viruses	☐	☐	☐
Pesticides	☐	☐	☐

Project Name: Nakano

Form I-3B Page 8 of 10
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6)? ☒ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above): Note: If "No" answer has been selected the SWQMP must include an exhibit that shows the storm water conveyance system from the project site to an exempt water body. The exhibit should include details about the conveyance system and the outfall to the exempt water body.
Critical Coarse Sediment Yield Areas* ***This Section only required if hydromodification management requirements apply**
Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint? ☒ Yes ☐ No Description / Additional Information: Yes, a small portion of CCSYAs exist on the project footprint. One CCSYA area is draining onto the project will be mitigated by using the avoidance metric per Section H.2.1 of the City of Chula Vista BMP Design Manual. The disturbed onsite CCSYA Area of 6,441 SF is less than 5% of the area draining to POC 2 (172,005 SF). The CCSYA area is 3.7% of the area draining to the POC. The second CCSYA area is a hillslope area and will be bypassed and flow into a drainage ditch to the northeast corner of the project. The drainage ditch will convey bed sediment from the hillslope to the downstream waters by maintaining a peak velocity of greater than 3 ft/s for the 2-year, 24 hour runoff event per Section H.3.1. Continued below.

Step 1 identified the CCSYA. Step 2 avoidance of this hillslope was not possible. Step 3 bypass of CCSYA was completed. No net impact analysis is not required by meeting the guidance for Step 3 bypass of hillslope CCSYA.

Nakano

Project Name: ______________________________

Form I-3B Page 9 of 10
Flow Control for Post-Project Runoff* ***This Section only required if hydromodification management requirements apply**
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project HMP Exhibit. POC 1 is located in the northwest protion of the project site. POC 2 is located in the center north area of the project site.
Has a geomorphic assessment been performed for the receiving channel(s)? ☒ No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: Discussion / Additional Information: (optional)

Nakano

Project Name: ____

Form I-3B Page 10 of 10
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

Nakano

Project Name: ____________________

Source Control BMP Checklist for All Development Projects			Form I-4
All development projects must implement source control BMPs. Refer to **Chapter 4** and **Appendix E** of the BMP Design Manual for information to implement BMPs shown in this checklist. **Note: All selected BMPs must be shown on the site/construction plans.** Answer each category below pursuant to the following: • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.			
Source Control Requirement	**Applied?**		
4.2.1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.1 not implemented:			
4.2.2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.2 not implemented:			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if 4.2.3 not implemented: No outdoor material storage areas planned.			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if 4.2.4 not implemented:			
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if 4.2.5 not implemented: Trash storage areas will be located indoors and/or trash receptacles with lids will be used.			

Nakano

Project Name: ______________________________

Source Control BMP Checklist for All Development Projects			Form I-4 (Page 2 of 2)
4.2.6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)	☒ Yes	☐ No	☐ N/A
SC-A Onsite storm drain inlets	☒ Yes	☐ No	☐ N/A
SC-B Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☒ N/A
SC-C Interior parking garages	☐ Yes	☐ No	☒ N/A
SC-D1 Need for future indoor & structural pest control	☐ Yes	☐ No	☒ N/A
SD-D2 Landscape/outdoor pesticide use	☒ Yes	☐ No	☐ N/A
SC-E Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	☒ N/A
SC-F Food Service	☐ Yes	☐ No	☒ N/A
SC-G Refuse areas	☒ Yes	☐ No	☐ N/A
SC-H Industrial processes	☐ Yes	☐ No	☒ N/A
SC-I Outdoor storage of equipment or materials	☐ Yes	☐ No	☒ N/A
SC-J Vehicle and equipment cleaning	☐ Yes	☐ No	☒ N/A
SC-K Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☒ N/A
SC-L Fuel dispensing areas	☐ Yes	☐ No	☒ N/A
SC-M Loading docks	☐ Yes	☐ No	☒ N/A
SC-N Fire sprinkler test water	☒ Yes	☐ No	☐ N/A
SC-O Miscellaneous drain or wash water	☒ Yes	☐ No	☐ N/A
SC-P Plazas, sidewalks, and parking lots	☒ Yes	☐ No	☐ N/A
SC-Q: Large Trash Generating Facilities	☐ Yes	☐ No	☒ N/A
SC-R: Animal Facilities	☐ Yes	☐ No	☒ N/A
SC-S: Plant Nurseries and Garden Centers	☐ Yes	☐ No	☒ N/A
SC-T: Automotive Facilities	☐ Yes	☐ No	☒ N/A
Discussion / justification if 4.2.6 not implemented. Justification must be provided for all "No" answers shown above.			

Nakano

Project Name.: ______

Site Design BMP Checklist for All Development Projects	Form I-5

All development projects must implement site design BMPs where applicable and feasible. See **Chapter 4 and Appendix E** of the manual for information to implement site design BMPs shown in this checklist. **Note: All selected BMPs must be shown on the site/construction plans.**

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

Site Design Requirement	Applied?		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	☒Yes	☐No	☐N/A
4.3.2 Conserve Natural Areas, Soils, and Vegetation	☒Yes	☐No	☐N/A
4.3.3 Minimize Impervious Area	☒Yes	☐No	☐N/A
4.3.4 Minimize Soil Compaction	☒Yes	☐No	☐N/A
4.3.5 Impervious Area Dispersion	☒Yes	☐No	☐N/A

Nakano

Project Name/Address/N ____________________

Site Design BMP Checklist for All Development Projects			Form I-5
Site Design Requirement	**Applied?**		
4.3.6 Runoff Collection	☐Yes	☐No	☒N/A
4.3.7 Landscaping with Native or Drought Tolerant Species	☒Yes	☐No	☐N/A
4.3.8 Harvesting and Using Precipitation	☐Yes	☒No	☐N/A
Discussion / justification for all "No" answers shown above: Harvest and Reuse not feasible per calculations in Form I-7.			

Nakano

Project Name: ____________________

Summary of PDP Structural BMPs	Form I-6

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see **Chapter 5 of the manual**). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in **Chapter 5**. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see **Chapter 6 of the manual**). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by City at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity (**see Section 7 of the manual**).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page **3 of this form**) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

The project geotechnical engineer has deemed the entire site to be a no-infiltration site for stormwater purposes. Harvest and reuse calculations showed that stormwater reuse was deemed infeasible for this project site. Due to the "no infiltration" conditions, two biofiltration basins and a detention vault in a combination with a Modular Wetland Unit will be used for pollutant control and volume retention requirements. Some slopes to the western perimeter will be graded and drain directly off site without any imperviousness and will therefore be treated as self-mitigating. Refer to Attachment 1A for the identification of the areas.

The biofiltration basins combined with the detention vault and the Modular Wetland Unit will individually meet pollutant treatment requirements for the drainage areas. The volume retention is analyzed for the entire site and will be met with a combination of biofiltration basins, and impervious dispersion of hardscape to landscape areas. These dispersion areas utilized for the volume retention credit are located within the non-contiguious sidewalks and adjacent landscaping strips along the Private Drives throughout the project. Refer to the DMA exhibit for further information. The dispersion to landscape area will be less than 10 feet, but it meets the criteria when the contributing flow path length of the impervious area / pervious area width is less than or equal to 2 and a maximum slope of 5% (See page B-48 of the 2021 City of Chula Vista BMP Design Manual)

Nakano

Project Name: ____________________

Summary of PDP Structural BMPs	Form I-6

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see **Chapter 5 of the manual**). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in **Chapter 5**. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see **Chapter 6 of the manual**). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by City at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity (**see Section 7 of the manual**).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page **3 of this form**) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

The project geotechnical engineer has deemed the entire site to be a no-infiltration site for stormwater purposes. Harvest and reuse calculations showed that stormwater reuse was deemed infeasible for this project site. Due to the "no infiltration" conditions, two biofiltration basins and a detention vault in a combination with a Modular Wetland Unit will be used for pollutant control and volume retention requirements. Some slopes to the western perimeter will be graded and drain directly off site without any imperviousness and will therefore be treated as self-mitigating. Refer to Attachment 1A for the identification of the areas.

The biofiltration basins combined with the detention vault and the Modular Wetland Unit will individually meet pollutant treatment requirements for the drainage areas. The volume retention is analyzed for the entire site and will be met with a combination of biofiltration basins, and impervious dispersion of hardscape to landscape areas. These dispersion areas utilized for the volume retention credit are located within the non-contigiuous sidewalks and adjacent landscaping strips along the Private Drives throughout the project. Refer to the DMA exhibit for further information. The dispersion to landscape area will be less than 10 feet, but it meets the criteria when the contributing flow path length of the impervious area / pervious area width is less than or equal to 2 and a maximum slope of 5% (See page B-48 of the 2021 City of Chula Vista BMP Design Manual)

Nakano

Project Name: ______________________________

Summary of PDP Structural BMPs	Form I-6

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see **Chapter 5 of the manual**). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in **Chapter 5**. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see **Chapter 6 of the manual**). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by City at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity (**see Section 7 of the manual**).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page **3 of this form**) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

DMA 1 is the northwest portion of residential units that flows via the gutter system towards a reverse curb outlet and enters a lined biofiltration basin (BMP#1) in the northwest corner of the project site.

DMA 3 collects a majority of the onsite project site of residential units and streets. This DMA will be treated by one planted-type modular wetland unit (BMP#3) downstream a detention vault which will detain 2.6DCV with a drawdown time less than 96 hrs. Because the unit is situated downstream of the vault, and the vault detains the water quality capture volume the modular wetland unit is sized based on a volume-basis in combination with the vault. Based on the Percent Capture method, capturing and treating 1.25DCV with a 24 hour drawdown is equivalent to a 2.6 DCV capture with a 96-hour drawdown. The "default" sizing methodology for proprietary biofiltration is 1.5 WQF, but in this case the project will size the BMP based on the percent capture method and the volume-based sizing methodology, to ensure that the vault and proprietary biofiltration downstream of the vault are both sized adequately.

DMA 2 collects a portion of the center east project site area and is drained to a lined biofiltration basin (BMP#2).

Nakano

Project Name: ____________________

Form I-6 Page 3 of 8 *(Copy and attach as many as needed)*	
Structural BMP ID No. 1	
Construction Plan Sheet No.	
Type of structural BMP: ☐ Retention by harvest and use (e.g. HU-1, cistern) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☐ Hydromodification control only ☒ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the City Engineer (See Section 1.12 of the manual)	Chelisa Pack, RCE 71026 Project Design Consultants 619.235.6471
Who will be the final owner of this BMP?	HOA
Who will maintain this BMP into perpetuity?	HOA
What is the funding mechanism for maintenance?	HOA

CITY OF CHULA VISTA

Nakano

Project Name: ______________________________

Form I-6 Page 4 *of* 8 *(Copy and attach as many as needed)*
Structural BMP ID No. 1
Construction Plan Sheet No.
Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP): BMP#1 is a lined biofiltration basin with a bottom footprint of 3,608 SF. This basin consists of 12" of aggregate storage, 3" of ASTM No. 8 Stone, 18" biofiltration media, 3" of ASTM 33 fine aggregate sand and 3" mulch with 6" of ponding.

Nakano

Project Name: ______

Form I-6 Page 6 *of* 8 *(Copy and attach as many as needed)*
Structural BMP ID No. 2
Construction Plan Sheet No.
Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP): BMP#2 is a lined biofiltration basin with a bottom footprint of 4,523 SF. This basin consists of 12" of aggregate storage, 3" of ASTM No. 8 Stone, 18" biofiltration media, 3" of ASTM 33 fine aggregate sand and 3" mulch with 6" of ponding.

Nakano

Project Name: ______________________________

Form I-6 Page 8 *of* 8 *(Copy and attach as many as needed)*
Structural BMP ID No. 3
Construction Plan Sheet No.
Discussion (as needed, must include worksheets showing BMP sizing calculations in the SWQMP): BMP#3 is a compact biofiltration BF-3 type Modular Wetland Unit(planted 8-24 model) from the manufacturer Bioclean. This BMP will be downstream of a detention vault. The flow will enter the detention vault with a footprint of 12,736 SF and 5 feet tall. This vault has a capacity of 63,680 CF to detain the capture volume dictated by the drawdown time. The MWS unit model utilizes two orifices within the unit. Two 1.48" orifices within the MWS unit will build enough head in vault to treat the required volume through the unit. The MWS unit is sized based on volume to treat the detained flow out from the water quality capture volume in the upstream vault. In the hydromodification SWMM model an equivalent single 2.2" orifice was modeled to achieve the same flow out. See hydromodification study in Attachment 2. Additional cross sections and calculations can be found in Attachment 1e.

ATTACHMENT 1

Backup for PDP Pollutant Control BMPs

Project Name/ Nakano

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 1A	**DMA Exhibit (Required)** See DMA Exhibit Checklist.	☐ Included
Attachment 1B	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☒ Included on DMA Exhibit in Attachment 1A ☐ Included as Attachment 1B, separate from DMA Exhibit
Attachment 1C	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☒ Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1D	Infiltration Feasibility Information. Contents of Attachment 1D depend on the infiltration condition: ☒ **No Infiltration Condition**: ☐ Infiltration Feasibility Condition ☒ Letter (***Note: must be stamped & signed by licensed geotechnical engineer***) ☐ Form I-8A (optional) ☒ Form I-8B (optional) ☐ **Partial Infiltration Condition**: ☒ Infiltration Feasibility Condition ☐ Letter (***Note: must be stamped & signed by licensed geotechnical engineer***) ☐ Form I-8A ☐ Form I-8B ☐ **Full Infiltration Condition:** ☐ Form I-8A ☐ Form I-8B ☐ Worksheet C.4-3 ☐ Form I-9 Refer to Appendices C and D of the BMP Design Manual for guidance.	☒ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1E	**Pollutant Control BMP Design Worksheets/ Calculations (Required)** Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines	☒ Included

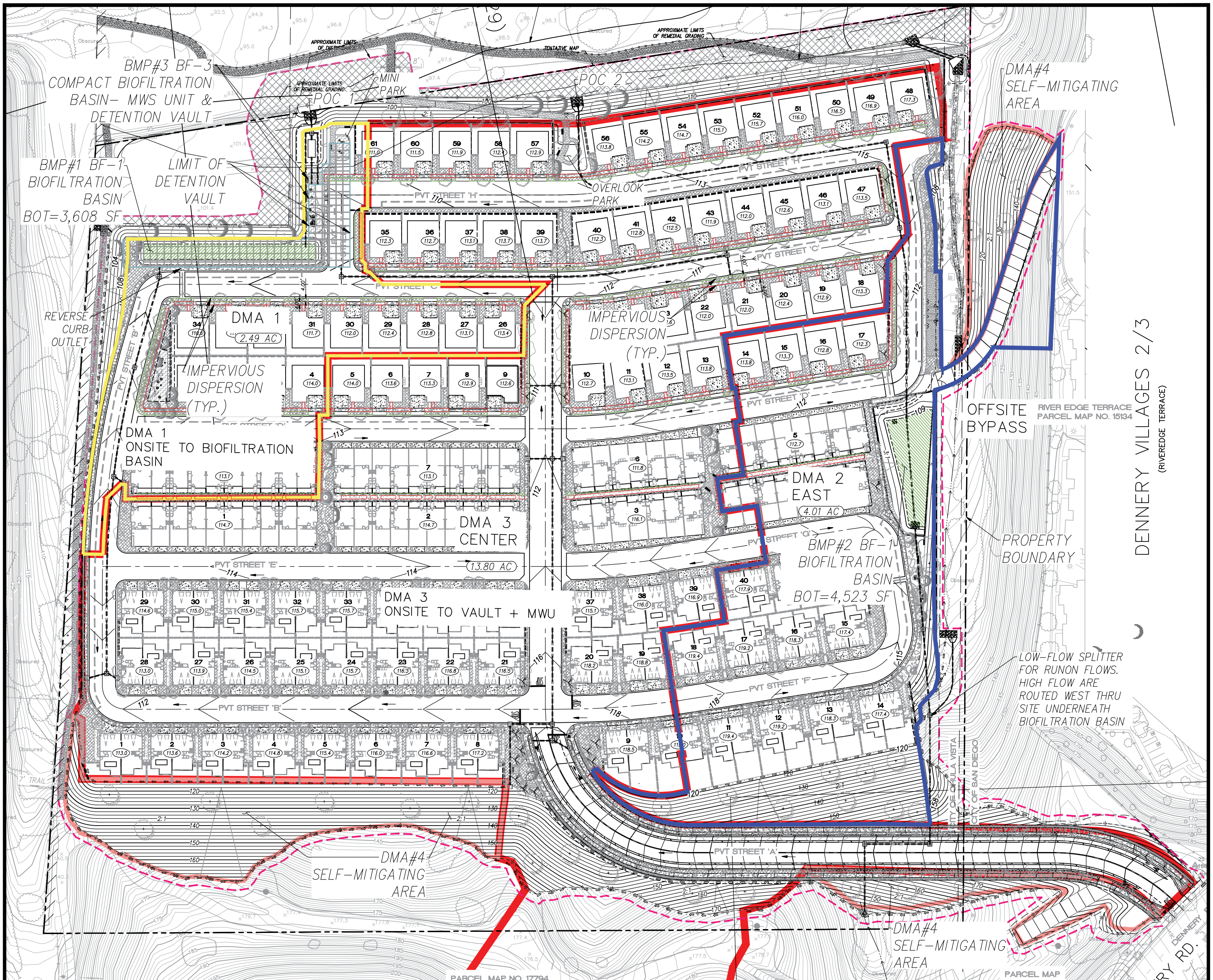
Project Name/ Nakano

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify all the following:

- ☒ Underlying hydrologic soil group
- ☒ Approximate depth to groundwater
- ☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☒ Critical coarse sediment yield areas to be protected
- ☒ Existing topography and impervious areas
- ☒ Existing and proposed site drainage network and connections to drainage offsite
- ☒ Proposed grading
- ☒ Proposed impervious features
- ☒ Proposed design features and surface treatments used to minimize imperviousness
- ☒ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
- ☒ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
- ☒ Structural BMPs (identify location, type of BMP, and size/detail, and include cross-sections)

ATTACHMENT 1A,1B – DMA MAP



DMA SUMMARY

DMA #	DMA TYPE	BMP TYPE	DRAINAGE AREA (Ac)	BMP Footprint (SF)
1	Drains to BMP	BF-1 LINED BIOFILTRATION	2.49	3608
2	Drains to BMP	BF-1 LINED BIOFILTRATION	4.01	4523
3	Drains to BMP	BF-3 COMPACT BIOFILTRATION & DETENTION VAULT	13.80	VAULT: 12736
4	SELF-MITIGATING	–	1.59	–

LEGEND

- DRAINAGE MANAGEMENT AREA #1
- DRAINAGE MANAGEMENT AREA #2
- DRAINAGE MANAGEMENT AREA #3
- DRAINAGE MANAGEMENT AREA #4
- BIOFILTRATION BASIN
- DRAINAGE FLOWPATH
- IMPERVIOUS DISPERSION (IMP TO PERV)
- DETENTION/HYDROMODIFICATION VAULT

TABULAR SUMMARY OF IMPERVIOUS DISPERSION

TOTAL IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)
13551	11151

40 20 0 40
SCALE: 1"=40'

N

SCALE: 1"=40'
JOB #: 4409.02
CREATED: 3/11/20

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Environmental | Engineering | Survey
701 B Street, Suite 800 San Diego, CA 92101
619.235.6471 Tel 619.234.0349 Fax

CITY OF CHULA VISTA

NAKANO

DMA EXHIBIT
PROPOSED CONDITIONS
EXHIBIT B

P:\4409\Engr\Reports-4409.02-Nakano\Entitlement\SWQMP\ATTACHMENTS\A1-Pollutant Control BMPs\4409.02 DMA Exhibit.dwg 11/3/2022 9:24:40 AM

Project Name: Nakano

Tabular Summary of DMAs							Worksheet B-1		
DMA Unique Identifier	Area (acres)	Impervious Area (acres)	% Imp	HSG	Area Weighted Runoff Coefficient	DCV (Cubic feet)	Treated by (BMP ID)	Pollutant Control Type	Drains to (POC ID)
1	2.49	1.72	69.2	C/D	0.69	3,108	1	BF-1	1
2	4.01	2.33	58.0	C			2	BF-1	2
3	13.80	8.95	64.8	C			3	BF-3	1
4	1.59	0	0	C		0	-	-	1/2
Summary of DMA Information (Must match Project description and SWQMP narrative)									
No. of DMAs	Total DMA Area (acres)	Total Impervious Area (acres)	% Impervious		Area Weighted Runoff Coefficient	DCV (Cubic feet)	Total Area Treated (acres)		No. of POCs
3*	20.30	13.00	64.0	C/D	0.63	24,074	20.30	BF-1&BF-3	2

Where:
DMA = Drainage Management Area; Imp = Imperviousness; ID = identifier
HSG = Hydrologic Soil Group; DCV= Design Capture Volume; No. = Number
BMP = Best Management Practice; POC = Point of Compliance

*Volume Retention for the site as a whole will be met with Biofiltration Basins and Impervious Dispersion.

ATTACHMENT 1C – HARVEST & USE FEASIBILITY CHECKLIST

Nakano

Project Name: ______________________________

Harvest and Use Feasibility Screening		FORM I-7 (Worsksheet B.3-1)
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☒ Toilet and urinal flushing ☒ Landscape irrigation ☐ Other:____________		
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. [Provide a summary of calculations here] Total Demand = 874 + 733 = 1607 CF Landscape Irrigation: Landscaping area = 4.45 ac Assume Mod. Water Use: 1470 g/ac/36 hours x 4.45 Ac. = 6541.5 gallons (CF/7.48 gallons) = 874 CF Expected Total Population: 157 x 2.5 = 393 36 hr Demand = 9.3 gal/res/day x 1.5 days/36 hr x 393 pop = 5482 gallons (CF/7.48 gal) = 733 CF		
3. Calculate the DCV using worksheet B-2.1. [Provide a result here] 3 DMAs including Roof from residential units, at grade hardscape and landscape. See BMP Summary Worksheet. DMA = 24,074 CF		
3a. Is the 36-hour demand greater than or equal to the DCV? Yes / No ⇨ ⇩	3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV? Yes / No ⇨ ⇩ 0.25DCV= 6,019 CF	3c. Is the 36-hour demand less than 0.25DCV? Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

Note: 36-hour demand calculations are for feasibility analysis only, once the feasibility analysis is complete the applicant may be allowed to use a different drawdown time provided they meet the 80 percent of average annual (long term) runoff volume performance standard.

ATTACHMENT 1D – INFILTRATION FEASIBILITY LETTER

Note: This attachment includes two infiltration feasibility letters. The first is formatted for the City of San Diego, and is included for review by the City of San Diego. The second is formatted for the City of Chula Vista, and is included for review by the City of Chula Vista.

City of San Diego Infiltration Feasibility Letter

(For Review by City of San Diego LDR-Engineering and LDR-Geology)

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. 07516-42-02
January 9, 2023

Tri Pointe Homes
13520 Evening Creek Drive North, Suite 300
San Diego, California 92128

Attention: Mr. Allen Kashani

Subject: STORMWATER MANAGEMENT RECOMMENDATIONS
NAKANO
SAN DIEGO, CALIFORNIA

Reference: *Update Geotechnical Investigation, Nakano Property, Chula Vista, California* prepared by Geocon Incorporated dated September 18, 2020 (Project No. 07516-42-02).

Dear Mr. Kashani:

In response to City of San Diego review comments, we have prepared this report to provide stormwater management recommendations for the Nakano project. We previously performed an infiltration study on the property. A summary of our study and stormwater management recommendations are provided in Appendix C of the referenced report. The report was prepared in accordance with City of Chula Vista requirements. Provided herein are stormwater recommendations in accordance with the City of San Diego Stormwater Standards.

Based on the results of our study, full and partial infiltration is considered infeasible due to the presence undocumented fills, low infiltration characteristics, and existing nearby utilities. Basins should utilize a liner to prevent infiltration from causing adverse settlement, migrating to adjacent slopes, utilities, and foundations.

STORM WATER MANAGEMENT

We understand storm water management devices are being proposed in accordance with the current stormwater standards. If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties and improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table 1 presents the descriptions of the hydrologic soil groups. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

TABLE 1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The property is underlain by undocumented fill, surficial deposits such as topsoil, colluvium and alluvium, Terrace Deposits, and the Mission Valley Formation. Table 2 presents the information from the USDA website for the subject property.

TABLE 2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group
Olivenhain cobbly loam, 9 to 30 percent slopes	OhE	5.0	D
Riverwash	Rm	18.5	D
Salinas clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	SbA	76.6	C

Infiltration Testing

We performed two borehole infiltration tests at the locations shown on Figure 1. The tests were performed in 8-inch-diameter, drilled borings. Table 3 presents the results of the testing. The calculation sheets are provided herein.

We used the guidelines presented in the Riverside County Low Impact Development BMP Design Handbook. Based on this widely accepted guideline, the saturated hydraulic conductivity (Ksat) is equivalent to the infiltration rate. Therefore, the Ksat value determined from our testing is assumed to be the unfactored infiltration rate.

TABLE 3
UNFACTORED, FIELD-SATURATED, INFILTRATION TEST RESULTS

Test No.	Depth (inches)	Geologic Unit	Field Infiltration Rate, I (in/hr)	Factored* Field Infiltration Rate, I (in/hr)
A-1	68	Qt	0.004	0.002
A-2	92	Qt	0.082	0.041

* Factor of Safety of 2.0 for feasibility determination.

STORM WATER MANAGEMENT CONCLUSIONS

Soil Types

Undocumented Fill (Qpudf) – We encountered undocumented fill up to 18 feet thick at the north end of the property. The undocumented fill within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into the undocumented fill or compacted fill will cause settlement. Therefore, full and partial infiltration should be considered infeasible within fill.

Topsoil (Unmapped) – We encountered topsoil varying between 0.5 and 3 feet thick across the site. Topsoil within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into the topsoil will cause settlement. Therefore, full and partial infiltration should be considered infeasible within topsoil.

Colluvium (Qcol) – We encountered colluvium on the north-facing slopes at the south property boundary, varying between 0.5 and 5 feet thick. Colluvium within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into colluvium will cause settlement. Therefore, full and partial infiltration should be considered infeasible within areas underlain by colluvium.

Alluvium (Qal) – Alluvium is present in a drainage located at the southeast corner of the property. Alluvium was also encountered in Trench T-20 beneath undocumented fill at the north end of the site. Alluvium within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into alluvium will cause settlement. Therefore, full and partial infiltration should be considered infeasible within areas underlain by alluvium.

Terrace Deposits (Qt) – We encountered Terrace Deposits underlying most of the site below the artificial fill, topsoil, and alluvium. The Terrace Deposits are comprised of very dense, clayey, conglomerate. Infiltration into the Terrance Deposits is not feasible due to its low infiltration characteristics.

Mission Valley Formation (Tmv) – We encountered age Mission Valley in slopes along the southern portion of the site. Mission Valley Formation may also be present underlying the Terrace Deposits in the central portion of the site Infiltration into the Mission Valley Formation is not feasible due to low infiltration characteristics.

Groundwater Elevation

Groundwater was not encountered in our borings or trenches to a depths explored. Infiltration should not impact groundwater.

Existing Utilities

Existing utilities are located on the north side of the property and along the west and east property margins. Infiltration near these utilities is considered infeasible. Otherwise, infiltration due to utility concerns would be feasible.

Soil or Groundwater Contamination

We are unaware of contaminated soil or groundwater on the property. Therefore, full and partial infiltration associated with this risk is considered feasible.

Slopes

There are no existing slopes that would be impacted by infiltration. There are proposed fill slopes where infiltration adjacent to the slopes is not feasible.

Infiltration Rates

Our test results indicated slow infiltration rates. The factored rates were 0.002 and 0.082 inches per hour. The infiltration rates are not high enough to support full or partial infiltration.

Storm Water Management Devices

Liners should be incorporated in the proposed basin. The liner should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride**,** PVC). Penetration of the liners should be properly sealed. The devices should also be installed in accordance with the manufacturer's recommendations. Overflow protection devices should also be incorporated into the design and construction of the storm water management device.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet Form D.5-1) that helps the project civil engineer estimate the factor of safety based on several factors. Table 4 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE 4
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., Infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Table 5 presents the estimated factor values for the evaluation of the factor of safety. This table only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

TABLE 5
FACTOR OF SAFETY WORKSHEET D.5-1 DESIGN VALUES[1]

Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	2	0.50
Predominant Soil Texture	0.25	3	0.75
Site Soil Variability	0.25	2	0.50
Depth to Groundwater/Impervious Layer	0.25	1	0.25
Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.0

[1] The project civil engineer should complete Worksheet D.5-1 using the data on this table. Additional information is required to evaluate the design factor of safety.

CONCLUSIONS

Our results indicate the site has relatively slow infiltration characteristics and should be considered as having a “no infiltration” condition. Because of the site conditions, it is our opinion that there is a potential for lateral water migration if infiltration were to be allowed. Undocumented and previously placed fill exists on the property and has a high potential for adverse settlement when wetted. It is our opinion that full or partial infiltration is infeasible on this site. Our evaluation included the soil and geologic conditions, estimated settlement and volume change of the underlying soil, slope stability, utility considerations, groundwater mounding, retaining walls, foundations and existing groundwater elevations.

If there are any questions regarding this correspondence, or if we may be of further service, please contact the undersigned at your convenience.

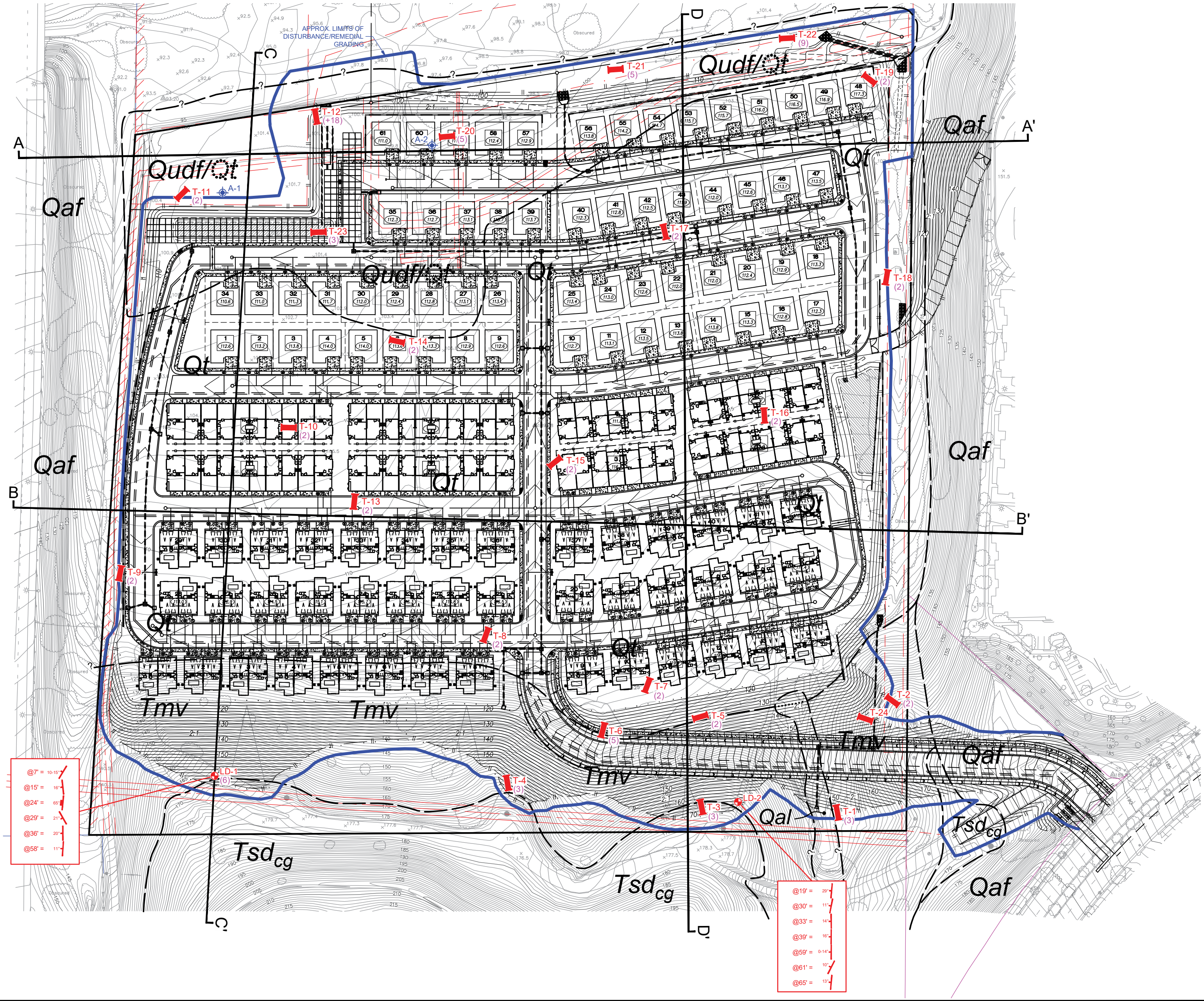
Very truly yours,

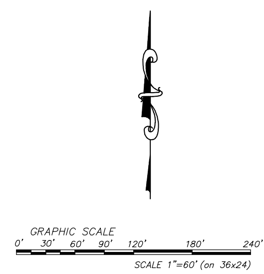
GEOCON INCORPORATED

Rodney C. Mikesell
GE 2533

RCM:arm

(e-mail) Addressee





GEOCON LEGEND

Qudf	UNDOCUMENTED FILL
Qaf	ARTIFICIAL FILL
Qal	ALLUVIUM
Qt	TERRACE DEPOSITS (Dotted Where Buried)
Tsd_{cg}	SAN DIEGO FORMATION (Conglomerate)
Tmv	MISSION VALLEY FORMATION
~?~	APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
LD-2	APPROX. LOCATION OF BORING
T-24	APPROX. LOCATION OF TRENCH
A-2	APPROX. LOCATION OF INFILTRATION TEST
(5)	APPROX. DEPTH OF REMEDIAL GRADING (In Feet, MSL)
D D'	APPROX. LOCATIION OF GEOLOGIC CROSS SECTION

GEOLOGIC MAP

NAKANO
CHULA VISTA, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE	DATE	
1" = 60'	02 - 09 - 2022	
PROJECT NO. 07516 - 42 - 02		FIGURE 1
SHEET 1 OF 1		

Plotted:02/10/2022 7:48AM | By:ALVIN LADRILLONO | File Location:W:\1_GEOTECH\07000\07500\07516-42-02\2022-02-09\07516-42-02 Geo Map.30.dwg

Aardvark Permeameter Data Analysis

Project Name: Nakano
Project Number: 07516-42-02
Test Number: A-1

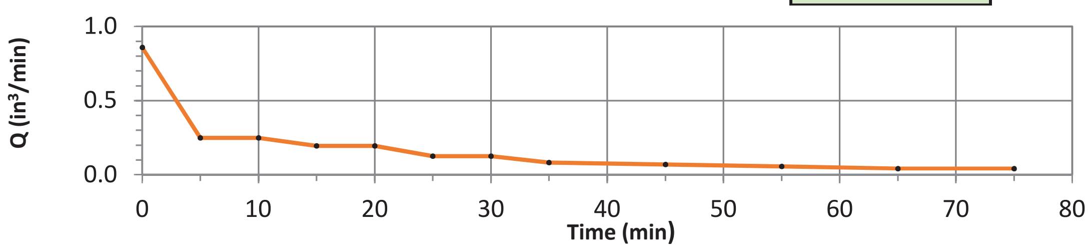
Date: 12/20/2019
By: BRK

Borehole Diameter, d (in.): 8.00
Borehole Depth, **H** (in): 68.00
Distance Between Reservoir & Top of Borehole (in.) 26.00
Height APM Raised from Bottom (in.): 2.00
Pressure Reducer Used: No

Ref. EL (feet, MSL): 102.0
Bottom EL (feet, MSL): 96.3

Distance Between Resevoir and APM Float, **D** (in.): 84.75
Head Height Measured, **h** (in.): 5.50

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	11.530	319.29	63.858
3	5.00	1.665	46.11	9.222
4	5.00	0.155	4.29	0.858
5	5.00	0.045	1.25	0.249
6	5.00	0.045	1.25	0.249
7	5.00	0.035	0.97	0.194
8	5.00	0.035	0.97	0.194
9	10.00	0.045	1.25	0.125
10	10.00	0.045	1.25	0.125
11	10.00	0.030	0.83	0.083
12	10.00	0.025	0.69	0.069
13	10.00	0.020	0.55	0.055
14	10.00	0.015	0.42	0.042
15	10.00	0.015	0.42	0.042
			Steady Flow Rate, Q (in^3/min):	0.046



Soil Matric Flux Potential, Φ_m

Φ_m= 0.00060 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

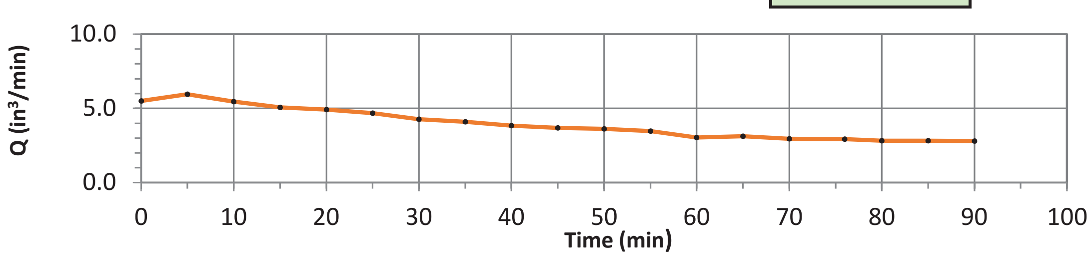
K_{sat} = 6.07E-05 in/min 0.004 in/hr

Borehole Infiltration Test

Project Name:	Nakano	Date:	12/20/2019
Project Number:	07516-42-02	By:	BRK
Test Number:	A-2	Ref. EL (feet, MSL):	100.0
		Bottom EL (feet, MSL):	92.3

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	92.00
Distance Between Reservoir & Top of Borehole (in.)	26.00
Height APM Raised from Bottom (in.):	2.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	108.75
Head Height Measured, **h** (in.):	4.75

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	11.255	311.68	62.335
3	5.00	1.095	30.32	6.065
4	5.00	0.315	8.72	1.745
5	5.00	0.995	27.55	5.511
6	5.00	1.075	29.77	5.954
7	5.00	0.985	27.28	5.455
8	5.00	0.915	25.34	5.068
9	5.00	0.890	24.65	4.929
10	5.00	0.845	23.40	4.680
11	5.00	0.770	21.32	4.265
12	5.00	0.740	20.49	4.098
13	5.00	0.695	19.25	3.849
14	5.00	0.665	18.42	3.683
15	5.00	0.655	18.14	3.628
16	6.00	0.750	20.77	3.462
17	4.00	0.440	12.18	3.046
18	5.00	0.565	15.65	3.129
19	5.00	0.535	14.82	2.963
20	5.00	0.530	14.68	2.935
21	5.00	0.510	14.12	2.825
22	6.00	0.610	16.89	2.815
23	4.00	0.405	11.22	2.804
			Steady Flow Rate, Q (in^3/min):	2.815



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0538 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.37E-03 in/min 0.082 in/hr

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition Based on Geotechnical Conditions[9]

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]
Part 1 - Full Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		**Project Phase:**
Entire Site		Design
Criteria 1: Infiltration Rate Screening		
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[11]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☒ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☐ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).	
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☐ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.	
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☐ No; full infiltration is not required. Answer "No" to Criteria 1 Result.	
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.	

[9] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[10] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site stormwater design.

[11] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[10]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☒ No; full infiltration is not required. Skip to Part 1 Result.
We performed two borehole infiltration tests in the area of the proposed basin. The test results are summarized below. The rates are not high enough to support full or partial infiltration. A-1: 0.004 in/hr (0.002 in/hr using a factor of 2 for feasibility determination) A-2: 0.082 in/hr (0.041 in/hr using a factor of 2 for feasibility determination)	

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered "Yes," continue to Step 2B. For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☐ Yes	☐ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening [12]	Result
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	☐ Full infiltration Condition ☒ Complete Part 2

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

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		**Project Phase:**
Entire Site		Design
Criteria 3 : Infiltration Rate Screening		
3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☒ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.	
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ☐ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ☒ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.	
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ☐ Yes; Continue to Criteria 4. ☒ No: Skip to Part 2 Result.	
We performed two borehole infiltration tests in the area of the proposed basin. The test results are summarized below. The rates are not high enough to support full or partial infiltration. A-1: 0.004 in/hr (0.002 in/hr using a factor of 2 for feasibility determination) A-2: 0.082 in/hr (0.041 in/hr using a factor of 2 for feasibility determination)		

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☐ Yes	☐ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1 If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[10]	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☐ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[10]
Summarize findings and basis; provide references to related reports or exhibits.	

Part 2 – Partial Infiltration Geotechnical Screening Result[13]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ Partial Infiltration Condition ☒ No Infiltration Condition

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

City of Chula Vista Infiltration Feasibility Letter
(For Review by City of Chula Vista)

APPENDIX C

STORM WATER MANAGEMENT

We understand storm water management devices are being proposed in accordance with the current Storm Water Standards (SWS). If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties and improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table C-1 presents the descriptions of the hydrologic soil groups. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

TABLE C-1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The property is underlain by undocumented fill, surficial deposits such as topsoil, colluvium and alluvium, Terrace Deposits, and the Mission Valley Formation. Table C-2 presents the information from the USDA website for the subject property.

TABLE C-2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group
Olivenhain cobbly loam, 9 to 30 percent slopes	OhE	5.0	D
Riverwash	Rm	18.5	D
Salinas clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	SbA	76.6	C

Infiltration Testing

We performed two borehole infiltration tests at the locations shown on Figure 2. The tests were performed in 8-inch-diameter, drilled borings. Table C-3 presents the results of the testing. The calculation sheets are provided herein.

We used the guidelines presented in the Riverside County Low Impact Development BMP Design Handbook. Based on this widely accepted guideline, the saturated hydraulic conductivity (Ksat) is equivalent to the infiltration rate. Therefore, the Ksat value determined from our testing is assumed to be the unfactored infiltration rate.

TABLE C-3
UNFACTORED, FIELD-SATURATED, INFILTRATION TEST RESULTS

Test No.	Depth (inches)	Geologic Unit	Field Infiltration Rate, I (in/hr)	Factored* Field Infiltration Rate, I (in/hr)
A-1	68	Qudf	0.004	0.002
A-2	92	Qudf	0.244	0.12

* Factor of Safety of 2.0 for feasibility determination.

STORM WATER MANAGEMENT CONCLUSIONS

Soil Types

Undocumented Fill (Qpudf) – We encountered undocumented fill up to 18 feet thick at the north end of the property. The undocumented fill within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into the undocumented fill or compacted fill will cause settlement. Therefore, full and partial infiltration should be considered infeasible within fill.

Topsoil (Unmapped) – We encountered topsoil varying between 0.5 and 3 feet thick across the site. Topsoil within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into the topsoil will cause settlement. Therefore, full and partial infiltration should be considered infeasible within topsoil.

Colluvium (Qcol) – We encountered colluvium on the north-facing slopes at the south property boundary, varying between 0.5 and 5 feet thick. Colluvium within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into colluvium will cause settlement. Therefore, full and partial infiltration should be considered infeasible within areas underlain by colluvium.

Alluvium (Qal) – Alluvium is present in a drainage located at the southeast corner of the property. Alluvium was also encountered in Trench T-20 beneath undocumented fill at the north end of the site. Alluvium within structural improvement areas will be removed and replaced with compacted fill. Water that is allowed to migrate into alluvium will cause settlement. Therefore, full and partial infiltration should be considered infeasible within areas underlain by alluvium.

Terrace Deposits (Qt) – We encountered Terrace Deposits underlying most of the site below the artificial fill, topsoil, and alluvium. Infiltration into Terrace Deposits may be possible.

Mission Valley Formation (Tmv) – We encountered age Mission Valley in slopes along the southern portion of the site. Mission Valley Formation may also be present underlying the Terrace Deposits in the central portion of the site Infiltration into the Mission Valley Formation is not feasible due to low infiltration characteristics.

Groundwater Elevation

Groundwater was not encountered in our borings or trenches to a depths explored. Infiltration should not impact groundwater.

Existing Utilities

Existing utilities are located on the north side of the property and along the west and east property margins. Infiltration near these utilities is considered infeasible. Otherwise, infiltration due to utility concerns would be feasible.

Soil or Groundwater Contamination

We are unaware of contaminated soil or groundwater on the property. Therefore, full and partial infiltration associated with this risk is considered feasible.

Slopes

There are no existing slopes that would be impacted by infiltration. There are proposed fill slopes where infiltration adjacent to the slopes is not feasible.

Infiltration Rates

Our test results indicated slow infiltration rates. The factored rates were 0.002 and 0.12 inches per hour. The infiltration rates are not high enough to support full or partial infiltration in the area of the proposed BMP.

Storm Water Management Devices

Liners should be incorporated in the proposed basin. The liner should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride**,** PVC). Penetration of the liners should be properly sealed. The devices should also be installed in accordance with the manufacturer's recommendations. Overflow protection devices should also be incorporated into the design and construction of the storm water management device.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet Form D.5-1) that helps the project civil engineer estimate the factor of safety based on several factors. Table C-4 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE C-4
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., Infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Table C-5 presents the estimated factor values for the evaluation of the factor of safety. This table only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

TABLE C-5
FACTOR OF SAFETY WORKSHEET D.5-1 DESIGN VALUES[1]

Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	2	0.50
Predominant Soil Texture	0.25	3	0.75
Site Soil Variability	0.25	2	0.50
Depth to Groundwater/Impervious Layer	0.25	1	0.25
Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.0

[1] The project civil engineer should complete Worksheet D.5-1 using the data on this table. Additional information is required to evaluate the design factor of safety.

CONCLUSIONS

Our results indicate the site has relatively slow infiltration characteristics. Because of the site conditions, it is our opinion that there is a potential for lateral water migration. Undocumented and previously placed fill exists on the property and has a high potential for adverse settlement when wetted. It is our opinion that full or partial infiltration is infeasible on this site. Our evaluation included the soil and geologic conditions, estimated settlement and volume change of the underlying soil, slope stability, utility considerations, groundwater mounding, retaining walls, foundations and existing groundwater elevations.

Aardvark Permeameter Data Analysis

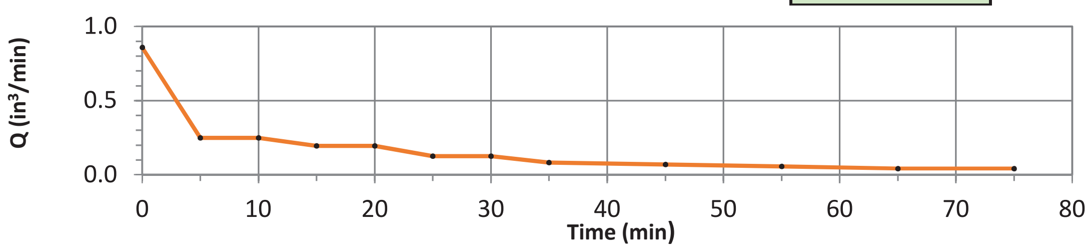
Project Name:	Nakano	Date:	12/20/2019
Project Number:	07516-42-02	By:	BRK
Test Number:	A-1		

Borehole Diameter, d (in.):	8.00	Ref. EL (feet, MSL):	102.0
Borehole Depth, **H** (in):	68.00	Bottom EL (feet, MSL):	96.3
Distance Between Reservoir & Top of Borehole (in.)	26.00		
Height APM Raised from Bottom (in.):	2.00		
Pressure Reducer Used:	No		

Distance Between Resevoir and APM Float, **D** (in.): 84.75

Head Height Measured, **h** (in.): 5.50

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	11.530	319.29	63.858
3	5.00	1.665	46.11	9.222
4	5.00	0.155	4.29	0.858
5	5.00	0.045	1.25	0.249
6	5.00	0.045	1.25	0.249
7	5.00	0.035	0.97	0.194
8	5.00	0.035	0.97	0.194
9	10.00	0.045	1.25	0.125
10	10.00	0.045	1.25	0.125
11	10.00	0.030	0.83	0.083
12	10.00	0.025	0.69	0.069
13	10.00	0.020	0.55	0.055
14	10.00	0.015	0.42	0.042
15	10.00	0.015	0.42	0.042
			Steady Flow Rate, Q (in^3/min):	0.046



Soil Matric Flux Potential, Φ_m

Φ_m= 0.00060 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 6.07E-05 in/min 0.004 in/hr

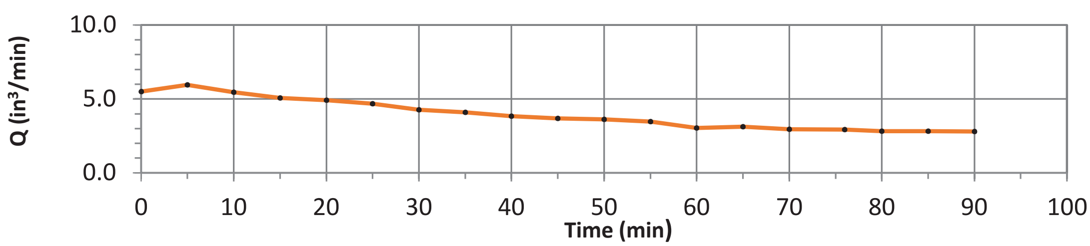
GEOCON

Borehole Infiltration Test

Project Name:	Nakano	Date:	12/20/2019
Project Number:	07516-42-02	By:	BRK
Test Number:	A-2	Ref. EL (feet, MSL):	100.0
		Bottom EL (feet, MSL):	92.3

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	92.00
Distance Between Reservoir & Top of Borehole (in.)	26.00
Height APM Raised from Bottom (in.):	2.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	108.75
Head Height Measured, **h** (in.):	4.75

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	11.255	311.68	62.335
3	5.00	1.095	30.32	6.065
4	5.00	0.315	8.72	1.745
5	5.00	0.995	27.55	5.511
6	5.00	1.075	29.77	5.954
7	5.00	0.985	27.28	5.455
8	5.00	0.915	25.34	5.068
9	5.00	0.890	24.65	4.929
10	5.00	0.845	23.40	4.680
11	5.00	0.770	21.32	4.265
12	5.00	0.740	20.49	4.098
13	5.00	0.695	19.25	3.849
14	5.00	0.665	18.42	3.683
15	5.00	0.655	18.14	3.628
16	6.00	0.750	20.77	3.462
17	4.00	0.440	12.18	3.046
18	5.00	0.565	15.65	3.129
19	5.00	0.535	14.82	2.963
20	5.00	0.530	14.68	2.935
21	5.00	0.510	14.12	2.825
22	6.00	0.610	16.89	2.815
23	4.00	0.405	11.22	2.804
			Steady Flow Rate, Q (in^3/min):	2.815



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0538 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.37E-03 in/min 0.082 in/hr

NAKANO

Project Name: ____________________

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)
Part 1 - Full Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		**Project Phase:**
Entire Site		Planning
Criteria 1: Infiltration Rate Screening		
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[2]? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ☒ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ☐ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).	
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ☒ Yes; Continue to Step 1C. ☐ No; Skip to Step 1D.	
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ☒ No; full infiltration is not required. Answer "No" to Criteria 1 Result.	
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ☐ Yes; continue to Step 1E. ☐ No; select an appropriate infiltration testing method.	
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ☐ Yes; continue to Step 1F. ☐ No; conduct appropriate number of tests.	

[1] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.
[2] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

NAKANO

Project Name: ____________________

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)
1F	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ☐ Yes; continue to Step 1G. ☐ No; select appropriate factor of safety.	
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ☐ Yes; answer "Yes" to Criteria 1 Result. ☐ No; answer "No" to Criteria 1 Result.	
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ☒ No; full infiltration is not required. Skip to Part 1 Result.	
Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report. Infiltration was performed at two locations within the project site using borehole infiltration tests. The test results were as follows: A-1: 0.004 in/hr (0.002 in/hr using a factor of safety of 2.0 for feasibility determination) A-2: 0.082 in/hr (0.041 in/hr using a factor of safety of 2.0 for feasibility determination) Infiltration test information is contained in the geotechnical investigation dated September 18, 2020.		
Criteria 2: Geologic/Geotechnical Screening		
2A	**If all questions in Step 2A are answered "Yes," continue to Step 2B.** For any "No" answer in Step 2A answer "No" to Criteria 2 and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.	

CITY OF CHULA VISTA

NAKANO

Project Name: ______________________________

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	☐ Yes	☐ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No

NAKANO

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	☐ Yes	☐ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening [3]	**Result**
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	☐ **Full infiltration Condition** ☒ **Complete Part 2**

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

NAKANO

Project Name: ____

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
Entire Site	Planning
Criteria 3 : Infiltration Rate Screening	
3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☐ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ☒ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ☐ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ☒ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ☐ Yes; Continue to Criteria 4. ☒ No: Skip to Part 2 Result.

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

Infiltration testing was performed in the area of the proposed storm water BMP at the northwest corner of the property. The test results were as follows:

A-1: 0.004 in/hr (0.002 in/hr using a factor of safety of 2.0 for feasibility determination)
A-2: 0.082 in/hr (0.041 in/hr using a factor of safety of 2.0 for feasibility determination)

This rate is not fast enough for partial infiltration.

Infiltration test information is contained in the geotechnical investigation dated September 18, 2020.

NAKANO

Project Name: ____________________

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	☐ Yes	☐ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	☐ Yes	☐ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	☐ Yes	☐ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	☐ Yes	☐ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	☐ Yes	☐ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	☐ Yes	☐ No

Project Name: ____________________

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Form I-8A[1] (Worksheet C.4-1)	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	☐ Yes	☐ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	☐ Yes	☐ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	☐ Yes	☐ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	☐ Yes	☐ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	☐ Yes	☐ No

NAKANO

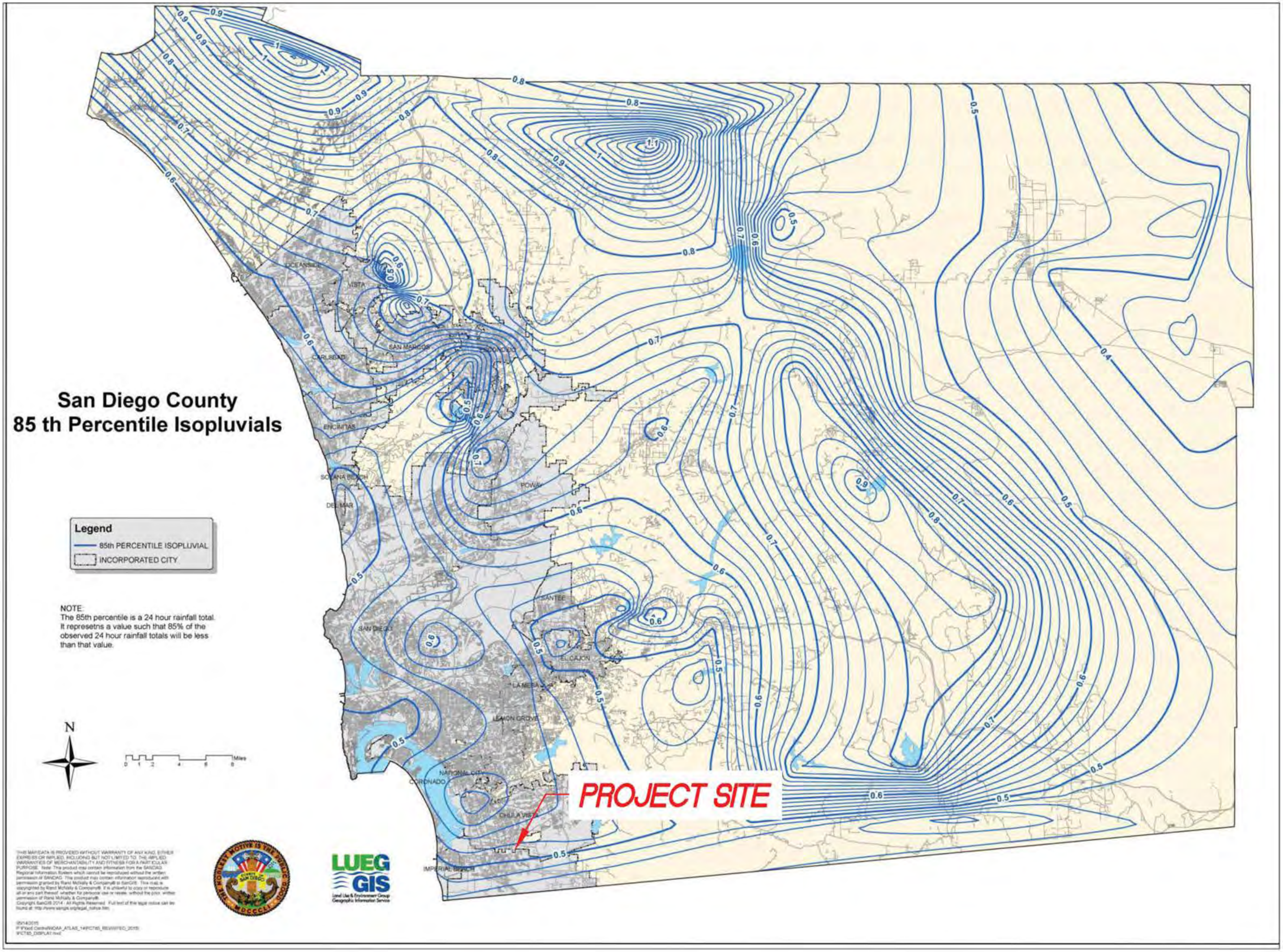
Project Name: ____________________

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Form I-8A[1] (Worksheet C.4-1)
Summarize findings and basis; provide references to related reports or exhibits.	

Part 2 – Partial Infiltration Geotechnical Screening Result[4]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	☐ **Partial Infiltration Condition** ☒ **No Infiltration Condition**

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

ATTACHMENT 1E – POLLUTANT CONTROL BMP DESIGN WORKSHEETS/CALCULATIONS


San Diego County
85 th Percentile Isopluvials
Legend
85th PERCENTILE ISOPLUVIAL
INCORPORATED CITY
NOTE:
The 85th percentile is a 24 hour rainfall total.
It represetns a value such that 85% of the
observed 24 hour rainfall totals will be less
than that value.
N
Miles
0 1 2 4 6 8
PROJECT SITE
LUEG
GIS
OCEANSIDE
VISTA
SAN MARCOS
ESCONDIDO
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
NATIONAL CITY
CORONADO
CHULA VISTA
IMPERIAL BEACH

ATTACHMENT 1B: Worksheet B.2-1: DCV

85th percentile 24-hr storm depth from Figure B.1.= 0.515 in

DMA ID	BMP ID	BMP Drainage Area (ac)	BMP Drainage Area (SF)	Impervious Area (ac)	Amended Soils (ac) (C=0.1)	Natural A Soils (ac) (C=0.1)	Natural B Soils (ac) (C=0.14)	Natural C Soils (ac) (C=0.23)	Natural D Soils (ac) (C=0.3)	% Impervious	Composite C[1]	Tree Credit Volume (cf)	Rain Barrels Credit Volume (cf)	Design Capture Volume (DCV) (CF)
Project Site	1,2,3	20.3	884339	13.08	4.47			2.75	0	64.4%	0.633			24027

Notes:

1) Equation for composite C factor = (0.9*Impervious Area +C*Pervious Area)/Total Area per BMP Design Manual.

C factors are from Table B.1-1 of August 2021 City BMP Design Manual.

2) Volume Retention will be met with Biofiltration Basins and Impervious Dispersion

CITY OF CHULA VISTA	**Project Name**	Nakano
	BMP ID	Site

Sizing Method for Volume Retention Criteria		**Worksheet B.5-2**	
1	Area draining to the BMP	**884339**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.633078818**	
3	85^{th} percentile 24-hour rainfall depth	**0.515**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**24027**	**cu. ft.**
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30 When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05	**0**	**in/hr.**
6	Factor of safety	**2**	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6]	**0**	**in/hr.**
8	Average annual volume reduction target (Figure B.5-2) When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 ≤ 0.01 in/hr. = 3.5%	**3.5**	**%**
9	Fraction of DCV to be retained (Figure B.5-3) When Line 8 > 8% = $0.0000013 \times \text{Line } 8^3 - 0.000057 \times \text{Line } 8^2 + 0.0086 \times \text{Line } 8 - 0.014$ When Line 8 ≤ 8% = 0.023	**0.023**	
10	Target volume retention [Line 9 x Line 4]	**553**	**cu. ft.**

CITY OF CHULA VISTA	Project Name	Nakano
	BMP ID	Site

Volume Retention for No Infiltration Condition — Worksheet B.5-6

1	Area draining to the biofiltration BMP					884339	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)					0.63307882	
3	Effective impervious area draining to the BMP [Line 1 x Line 2]					559856	sq. ft.
4	Required area for Evapotranspiration [Line 3 x 0.03]					16796	sq. ft.
5	Biofiltration BMP Footprint					8131	sq. ft.
Landscape Area (must be identified on DS-3247)							
	Identification	**1**	**2**	**3**	**4**	**5**	
6	Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.)	11469					
7	Impervious area draining to the landscape area (sq. ft.)	13651					
8	Impervious to Pervious Area ratio [Line 7/Line 6]	1.19	0.00	0.00	0.00	0.00	
9	Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5]	9101	0	0	0	0	
10	Sum of Landscape area [sum of Line 9 Id's 1 to 5]					9101	sq. ft.
11	Provided footprint for evapotranspiration [Line 5 + Line 10]					17232	sq. ft.
Volume Retention Performance Standard							
12	Is Line 11 ≥ Line 4?	Volume Retention Performance Standard is Met					
13	Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4]					1.03	
14	Target Volume Retention [Line 10 from Worksheet B.5.2]					553	cu. ft.
15	Volume retention required from other site design BMPs [(1-Line 13) x Line 14]					-16.57874435	cu. ft.
Site Design BMP							
	Identification	**Site Design Type**				**Credit**	
16	1						cu. ft.
	2						cu. ft.
	3						cu. ft.
	4						cu. ft.
	5						cu. ft.
	Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP.					0	cu. ft.
17	Is Line 16 ≥ Line 15?	Volume Retention Performance Standard is Met					

ATTACHMENT 1B: Worksheet B.2-1: DCV

85th percentile 24-hr storm depth from Figure B.1.= 0.515 in

DMA ID	BMP ID	BMP Drainage Area (ac)	BMP Drainage Area (SF)	Impervious Area (ac)	Amended Soils (ac) (C=0.1)	Natural A Soils (ac) (C=0.1)	Natural B Soils (ac) (C=0.14)	Natural C Soils (ac) (C=0.23)	Natural D Soils (ac) (C=0.3)	% Impervious	Composite C[1]	Tree Credit Volume (cf)	Rain Barrels Credit Volume (cf)	Design Capture Volume (DCV) (CF)
1	1	2.49	108312	1.77	0.72			0		71.1%	0.669			3108

Notes:

1) Equation for composite C factor = (0.9*Impervious Area +C*Pervious Area)/Total Area per BMP Design Manual.

C factors are from Table B.1-1 of August 2021 City BMP Design Manual.

CALCULATION FOR MEDIA FILTRATION RATE WHEN CONTROLLED BY UNDERDRAIN ORIFICE

Surface ponding [6 inch minimum, 12 inch maximum]	6	
Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	24	
Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	
Diameter of underdrain orifice	1	in
H	3.46	
Max hydromod Q through underdrain	0.04884	cfs
Footprint of the BMP	3608	ft^2
Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	**0.58**	in/hr

CITY OF CHULA VISTA	**Project Name**	Nakano	
	BMP ID	1	
Sizing Method for Pollutant Removal Criteria		**Worksheet B.5-1**	
1	Area draining to the BMP	**108312**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.668674699**	
3	85th percentile 24-hour rainfall depth	**0.515**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**3108**	**cu. ft.**
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	**6**	**inches**
6	Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	**24**	**inches**
7	Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	**12**	**inches**
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	**3**	**inches**
9	Freely drained pore storage of the media	**0.2**	**in/in**
10	Porosity of aggregate storage	**0.4**	**in/in**
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	**0.58**	**in/hr.**
Baseline Calculations			
12	Allowable routing time for sizing	**6**	**hours**
13	Depth filtered during storm [Line 11 x Line 12]	**3.48**	**inches**
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	**16.8**	**inches**
15	Total Depth Treated [Line 13 + Line 14]	**20.28**	**inches**
Option 1 – Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	**4662**	**cu. ft.**
17	Required Footprint [Line 16/ Line 15] x 12	**2759**	**sq. ft.**
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	**2331**	**cu. ft.**
19	Required Footprint [Line 18/ Line 14] x 12	**1665**	**sq. ft.**
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4)	**0.03**	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	**2173**	**sq. ft.**
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	**2173**	**sq. ft.**
23	Provided BMP Footprint	**3608**	**sq. ft.**
24	Is Line 23 ≥ Line 22?	**Yes, Performance Standard is Met**	

ATTACHMENT 1B: Worksheet B.2-1: DCV

85th percentile 24-hr storm depth from Figure B.1.= 0.515 in

DMA ID	BMP ID	BMP Drainage Area (ac)	BMP Drainage Area (SF)	Impervious Area (ac)	Amended Soils (ac) (C=0.1)	Natural A Soils (ac) (C=0.1)	Natural B Soils (ac) (C=0.14)	Natural C Soils (ac) (C=0.23)	Natural D Soils (ac) (C=0.3)	% Impervious	Composite C[1]	Tree Credit Volume (cf)	Rain Barrels Credit Volume (cf)	Design Capture Volume (DCV) (CF)
2	2	4.01	174893	2.41	0.75			0.86		60.1%	0.609			4571

Notes:

1) Equation for composite C factor = (0.9*Impervious Area +C*Pervious Area)/Total Area per BMP Design Manual.

C factors are from Table B.1-1 of Aug 2021 City BMP Design Manual.

CALCULATION FOR MEDIA FILTRATION RATE WHEN CONTROLLED BY UNDERDRAIN ORIFICE

Surface ponding [6 inch minimum, 12 inch maximum]	6	
Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	24	
Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	
Diameter of underdrain orifice	1	in
H	3.46	
Max hydromod Q through underdrain	0.04884	cfs
Footprint of the BMP	684	ft^2
Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	**3.08**	in/hr

	Project Name	Nakano	
	BMP ID	2	
Sizing Method for Pollutant Removal Criteria		**Worksheet B.5-1**	
1	Area draining to the BMP	**174893**	**sq. ft.**
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	**0.608927681**	
3	85th percentile 24-hour rainfall depth	**0.515**	**inches**
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	**4571**	**cu. ft.**
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	**6**	**inches**
6	Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations	**24**	**inches**
7	Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	**15**	**inches**
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	**3**	**inches**
9	Freely drained pore storage of the media	**0.2**	**in/in**
10	Porosity of aggregate storage	**0.4**	**in/in**
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)	**3.08**	**in/hr.**
Baseline Calculations			
12	Allowable routing time for sizing	**6**	**hours**
13	Depth filtered during storm [Line 11 x Line 12]	**18.5069092**	**inches**
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	**18**	**inches**
15	Total Depth Treated [Line 13 + Line 14]	**36.5069092**	**inches**
Option 1 – Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	**6856**	**cu. ft.**
17	Required Footprint [Line 16/ Line 15] x 12	**2254**	**sq. ft.**
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	**3428**	**cu. ft.**
19	Required Footprint [Line 18/ Line 14] x 12	**2285**	**sq. ft.**
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4)	**0.03**	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	**3195**	**sq. ft.**
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	**3195**	**sq. ft.**
23	Provided BMP Footprint	**4523**	**sq. ft.**
24	Is Line 23 ≥ Line 22?	**Yes, Performance Standard is Met**	

ATTACHMENT 1B: Worksheet B.2-1: DCV

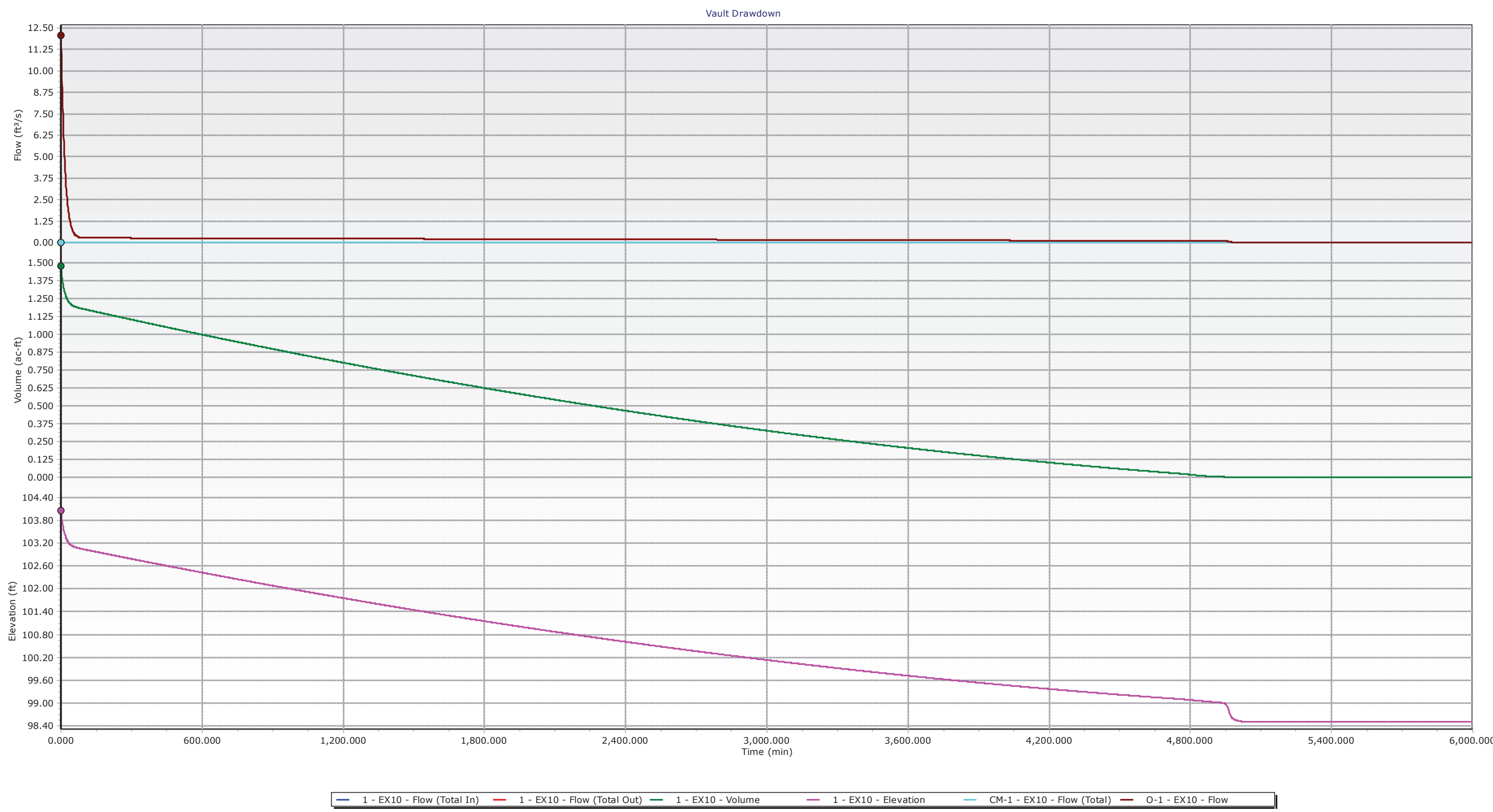
85th percentile 24-hr storm depth from Figure B.1.= 0.515 in

DMA ID	BMP ID	BMP Drainage Area (ac)	BMP Drainage Area (SF)	Impervious Area (ac)	Amended Soils (ac) (C=0.1)	Natural A Soils (ac) (C=0.1)	Natural B Soils (ac) (C=0.14)	Natural C Soils (ac) (C=0.23)	Natural D Soils (ac) (C=0.3)	% Impervious	Composite C[1]	Tree Credit Volume (cf)	Rain Barrels Credit Volume (cf)	Design Capture Volume (DCV) (CF)
3	3	13.8	601134	8.95	2.95			1.9	0	64.9%	0.637			16427

Notes:

1) Equation for composite C factor = (0.9*Impervious Area +C*Pervious Area)/Total Area per BMP Design Manual.

C factors are from Table B.1-1 of Aug 2021 City BMP Design Manual.



Vault Drawdown
Flow (ft³/s)
12.50
11.25
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.00
Volume (ac-ft)
1.500
1.375
1.250
1.125
1.000
0.875
0.750
0.625
0.500
0.375
0.250
0.125
0.000
Elevation (ft)
104.40
103.80
103.20
102.60
102.00
101.40
100.80
100.20
99.60
99.00
98.40
0.000
600.000
1,200.000
1,800.000
2,400.000
3,000.000
3,600.000
4,200.000
4,800.000
5,400.000
6,000.000
Time (min)
1 - EX10 - Flow (Total In)
1 - EX10 - Flow (Total Out)
1 - EX10 - Volume
1 - EX10 - Elevation
CM-1 - EX10 - Flow (Total)
O-1 - EX10 - Flow

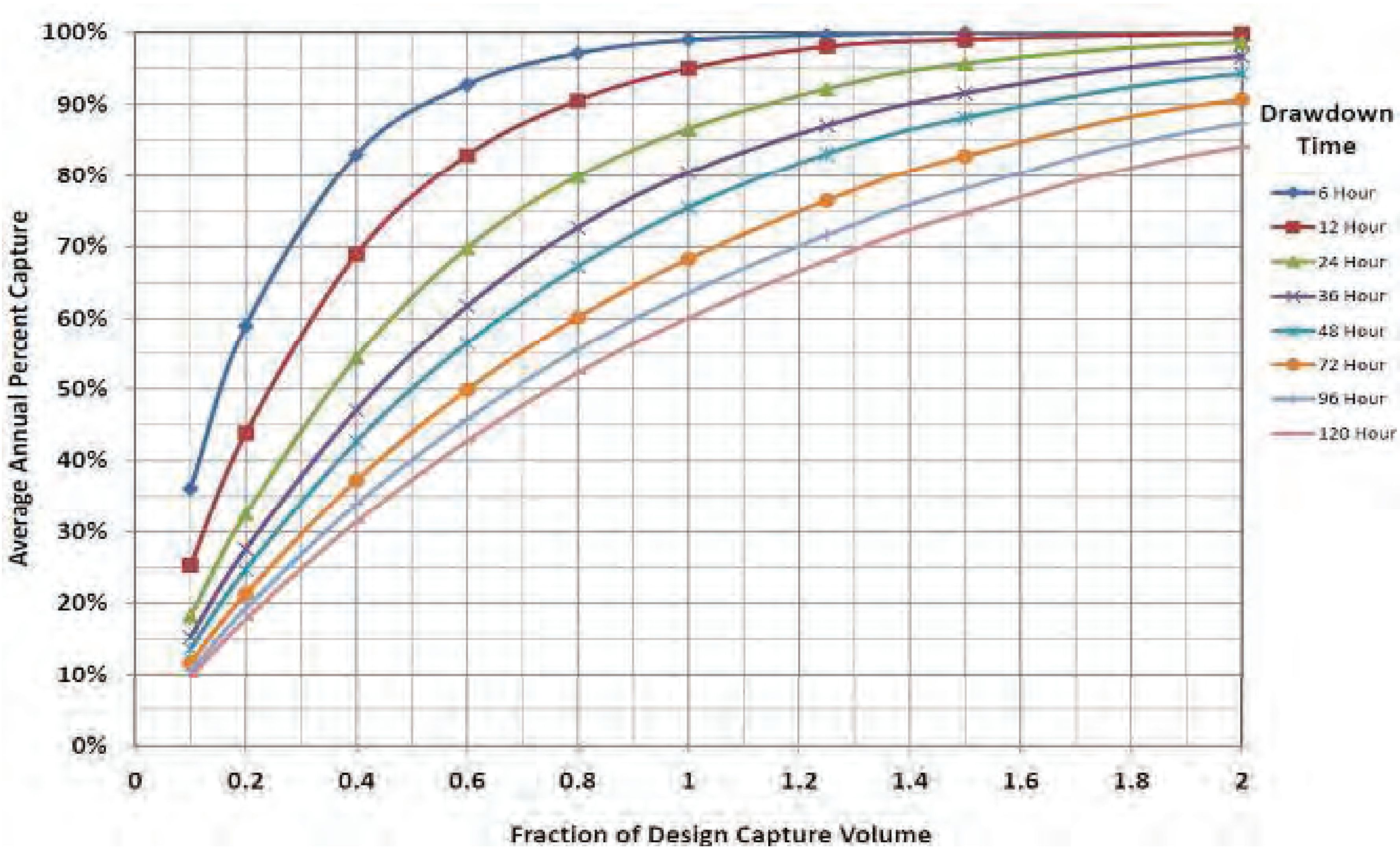


Figure B.4-1: Percent Capture Nomograph

B.5.2.2 Sizing Biofiltration BMPs Downstream of a Storage Unit

Introduction

In scenarios, where the BMP footprint is governed based on Option 1 (Line 17 of Worksheet B.5-1) or the required volume reduction for partial infiltration conditions (Line 10 of Worksheet B.5-2) the footprint of the biofiltration BMP can be reduced using the sizing calculations in this **Appendix B.5.2.2** when there is an upstream storage unit (e.g. cistern) that can be used to regulate the flows through the biofiltration BMP.

When this approach is used for sizing biofiltration BMPs the applicant must also verify that the storage unit meets the hydromodification management drawdown requirements and the discharge from the downstream biofiltration BMP will still meet the hydromodication flow control requirements. These calculations must be documented in the PDP SWQMP.

This methodology is **not** applicable when the minimum footprint factor is governed based on the alternative minimum footprint sizing factor calculated using Worksheet B.5-4 (Line 11). A biofiltration BMP smaller than the alternative minimum footprint sizing factor is considered compact biofiltration BMP and may be allowed at the discretion of the City Engineer if the BMP meets the requirements in **Appendix F** and the applicant submits a completed Form I-10.

Sizing Calculation

Sizing calculations for the biofiltration footprint must demonstrate that one of the following two equivalent performance standards is met:

1. Use continuous simulation and demonstrate the following is met:
   (a) The BMP or series of BMPs biofilters at least 92 percent of average annual (long term) runoff volume and achieves a volume reduction equivalent to Line 10 of **Worksheet B.5-2**. This can be demonstrated through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in **Appendix G**, as acceptable to the City Engineer. The 92 percent of average annual runoff treatment corresponds to the average capture achieved by implementing a BMP with 1.5 times the DCV and a drawdown time of 36 hours (**Appendix B.4.2**).
2. Use the simple optimized method in **Worksheet B.5-5**. The applicant is also required to complete Worksheet B.5-1, B.5-2 and B.5-4 when the applicant elects to use Worksheet B.5-5 to reduce the biofiltration BMP footprint. **Worksheet B.5-5** was developed to satisfy the following two criteria as applicable:
   (a) Greater than 92 percent of the average annual runoff volume from the storage unit is routed to the biofiltration BMP through the low flow orifice and the peak flow from the low flow orifice can instantaneously be filtered through the biofiltration media. If the outlet design for the storage unit includes orifices at different elevations and an overflow structure, only flows from the overflow structure should be excluded from the calculation (both for 92 percent capture and for peak flow to the biofiltration BMP that needs to be instantaneously filtered), unless the flows from other orifices also bypass the biofiltration BMP, in which case flows from the orifices that bypass should also be excluded.

Table B.5-5

Drawdown Time (hours)	Storage requirement (below the overflow elevation, or below outlet elevation that bypass the biofiltration BMP)
12	0.85 DCV
24	1.25 DCV
36	1.50 DCV
48	1.80 DCV
72	2.20 DCV
96	2.60 DCV
120	2.80 DCV

PROJECT DESIGN CONSULTANTS

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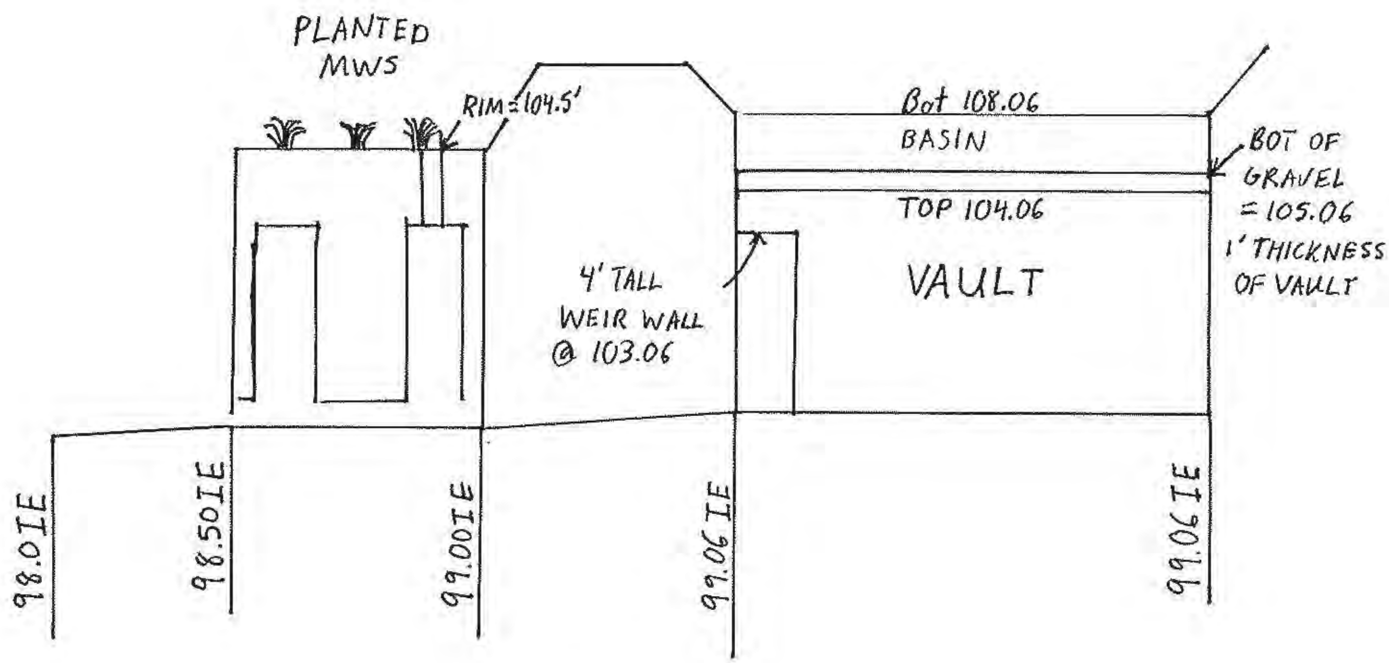
PROJECT NAKANO BMP System
SUBJECT
PAGE: ____ OF ____ JOB NO.: ____
DRAWN BY: J.N. DATE: 6/22/22
CHECKED BY: ____ DATE: ____



VAULT
12,376 ft^2 AREA
5 ft DEPTH

2 - 1.48" ORIFICES @ BOT MWS ELEV = 98.5' (EQUATES TO 1-2.2" ORIFICE)

4' WEIR WALL @ 103.06' w/ 8' LENGTH

FOR BYPASS + EMERGENCY OVERFLOW

Nakano Project MWS Calculations

Project Site DCV=	16427	ft^3		
96 hour drawdown=2.6*DCV				
2.6*DCV=	42710	ft^3		
Q_{avg}= Volume/(96*3600)				
Q_{avg}=	0.124	cfs		
			Conversion	
Q_{avg}=	55.46	gpm	448.8 gpm/cfs	
Volume based loading rate	0.28	gpm/sf		
Loading Rate = Q_{avg}/A_{filter}				
A_{filter}= Perimeter length * Height		Height used=	4.5	ft
P=	44.02	ft		
Perimeter Capacity of 8-24 Unit=	88.8	ft		
44.02 ft<			88.8 ft	

MWS 8-24 Unit will work

SITE SPECIFIC DATA			
PROJECT NUMBER	14850		
PROJECT NAME	NAKANO		
PROJECT LOCATION	CHULA VISTA, CA		
STRUCTURE ID	N/A		
TREATMENT REQUIRED			
VOLUME BASED (CF)	FLOW BASED (CFS)		
42,710	N/A		
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			N/A
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	99.00	PVC	8"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	98.50	PVC	8"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	104.50	104.50	104.50
SURFACE LOAD	PEDESTRIAN	N/A	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	2EA ø30"
WETLANDMEDIA VOLUME (CY)			18.00
ORIFICE SIZE (DIA. INCHES)			ø1.48 EA

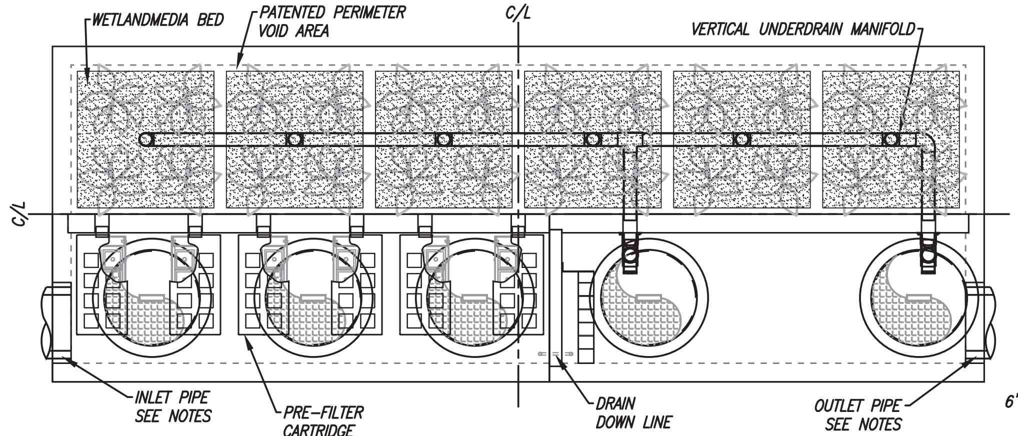
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.
UPSTREAM BYPASS WEIR SET AT 103.06

INSTALLATION NOTES

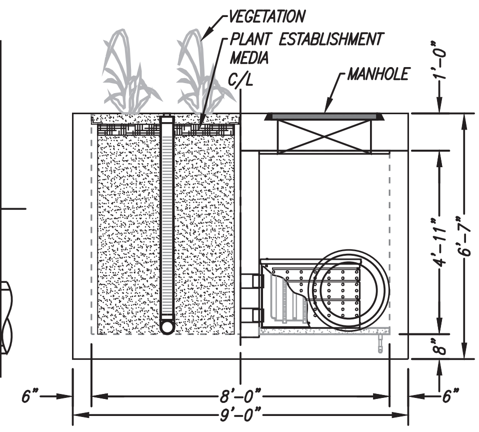
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS' SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL PIPES, RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO USE GROUT AND/OR BRICKS TO MATCH COVERS WITH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

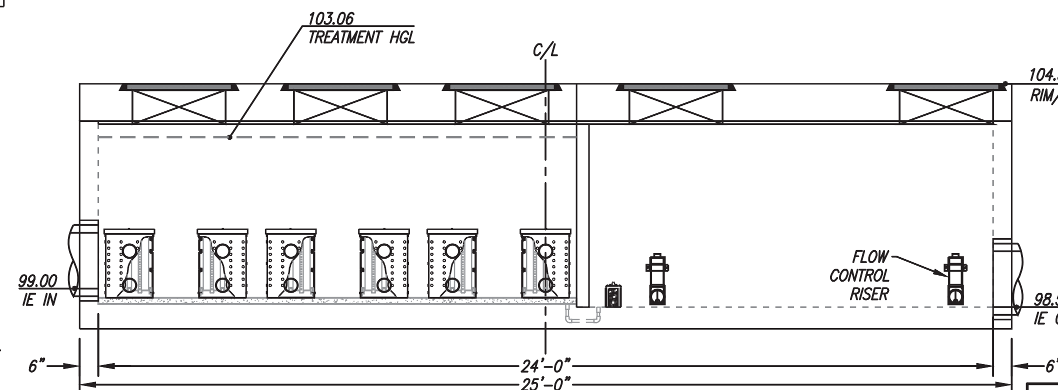
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



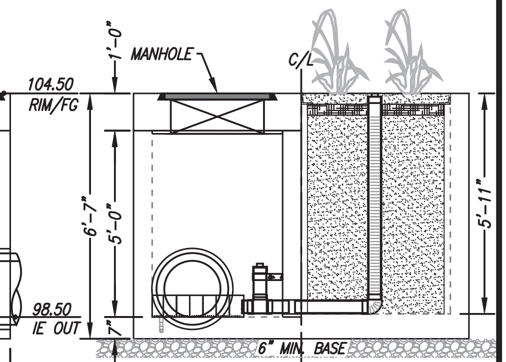
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

REQUIRED TREATMENT VOLUME (CF)	42,710
DRAINDOWN DURATION (HOURS)	82
AVERAGE DISCHARGE RATE PER MWS UNIT(GPM)	110.69
OPERATING HEAD (FT)	4.5
WETLANDMEDIA INFILTRATION RATE (IN/HR)	27.7
OR	
WETLANDMEDIA LOADING RATE (GPM/SF)	0.28

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

Bio Clean
A Forterra Company

MWS-L-8-24-5'-11"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

6/23/22MBILLINGS

MWS SIZING
Nakano
Chula Vista, CA

Mike Billings
06/23/2022

398 Via El Centro, Oceanside, CA 92058
(469) 458-7973 • Fax (760) 433-3176
www.biocleanenvironmental.com

The MWS Linear will be sized in accordance with its TAPE GULD approval. The system is approved at a loading rate of 1 gpm/sq ft. The MWS Linear has General Use Level Designation at this loading rate for TSS (Basic), phosphorous and dissolved metals (Enhanced). For this project design, sizing, loading will be reviewed by a Modular Wetland representative for final approval to ensure the system is sized appropriately.

For this project we are sizing the MWS units to treat a large volume. Due to this large volume, we are using a 72% safety factor on our media loading rate and only sizing at a loading rate of 0.277 gpm/sf. Using a safety factor between 65% and 75% will greatly prolong the life of the WetlandMEDIA and decrease the long-term maintenance costs.

The orifice has been sized using the standard orifice sizing below. Sizing is based on the discharge rate of 110.69 gpm split between the two orifices. 110.69 gpm/2 = 55.35 gpm

MWS ORIFICE SIZING

$$Given\ that: Q = VA;\ \ Q = treatment\ flow\ rate, V = \ c_d\sqrt{2gh}\ , A = \frac{\pi D^2}{4}$$

$$c_d\ is\ the\ discharge\ coefficent\ \&\ h\ is\ the\ treatment\ HGL$$

$$Rewrite\ to\ solve\ for\ the\ diameter\ of\ the\ orifice.$$

$$\left[A = \frac{Q}{V}\right] \xrightarrow[rewrite]{} \frac{\pi D^2}{4} = \frac{Q}{c_d\sqrt{2gh}}$$

$$D = \sqrt{\frac{4Q}{\pi c_d\sqrt{2gh}}};\ c_d = \ c_v c_c = (0.98)(0.62) = 0.6076$$

MWS-L-8-24-V-HC:

$$Given: Q = 55.35\ gpm(per\ orifice) = \mathbf{0.123\ cfs}\ , h = 4.5\ ft$$

$$D = \sqrt{\frac{4(0.123)}{\pi(0.6076)\sqrt{2(32.17)(4.5)}}} = 0.123' = \boxed{1.48"\ each}$$

The diameter of each orifice needs to be 1.48" *in order to produce a head of* 4.5′ *in the MWS unit.*

WASHINGTON STATE DEPARTMENT OF ECOLOGY

July 2017

GENERAL USE LEVEL DESIGNATION FOR BASIC, ENHANCED, AND PHOSPHORUS TREATMENT

For the

MWS-Linear Modular Wetland

Ecology's Decision:

Based on Modular Wetland Systems, Inc. application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Basic treatment
   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.
2. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Phosphorus treatment
   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.
3. General use level designation (GULD) for the MWS-Linear Modular Wetland Stormwater Treatment System for Enhanced treatment
   - Sized at a hydraulic loading rate of 1 gallon per minute (gpm) per square foot (sq ft) of wetland cell surface area. For moderate pollutant loading rates (low to medium density residential basins), size the Prefilters at 3.0 gpm/sq ft of cartridge surface area. For high loading rates (commercial and industrial basins), size the Prefilters at 2.1 gpm/sq ft of cartridge surface area.

4. Ecology approves the MWS - Linear Modular Wetland Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:

   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.2.5 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

5. These use level designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use:

Applicants shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the MWS – Linear Modular Wetland Stormwater Treatment System units, in accordance with Modular Wetland Systems, Inc. applicable manuals and documents and the Ecology Decision.
2. Each site plan must undergo Modular Wetland Systems, Inc. review and approval before site installation. This ensures that site grading and slope are appropriate for use of a MWS – Linear Modular Wetland Stormwater Treatment System unit.
3. MWS – Linear Modular Wetland Stormwater Treatment System media shall conform to the specifications submitted to, and approved by, Ecology.
4. The applicant tested the MWS – Linear Modular Wetland Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to MWS – Linear Modular Wetland Stormwater Treatment Systems whether plants are included in the final product or not.
5. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

   - Typically, Modular Wetland Systems, Inc. designs MWS - Linear Modular Wetland systems for a target prefilter media life of 6 to 12 months.
   - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
   - Owners/operators must inspect MWS - Linear Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific

maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
  - Standing water remains in the vault between rain events, or
  - Bypass occurs during storms smaller than the design storm.
  - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
  - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6. Discharges from the MWS - Linear Modular Wetland Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Modular Wetland Systems, Inc.
Applicant's Address: *PO. Box 869*
Oceanside, CA 92054

Application Documents:

- *Original Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011
- *Quality Assurance Project Plan*: Modular Wetland system – Linear Treatment System performance Monitoring Project, draft, January 2011.
- *Revised Application for Conditional Use Level Designation*, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011
- *Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014*
- *Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014.*

Applicant's Use Level Request:

General use level designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The MWS – Linear Modular wetland is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 50-percent of Total Phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 30-percent of dissolved Copper from stormwater with influent concentrations between 0.005 and 0.020 mg/l.
- The MWS – Linear Modular wetland is capable of removing a minimum of 60-percent of dissolved Zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/l.

Ecology Recommendations:

- Modular Wetland Systems, Inc. has shown Ecology, through laboratory and field-testing, that the MWS - Linear Modular Wetland Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Total phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The MWS-Linear Modular wetland has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Modular Wetland Systems, Inc. should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Modular Wetland Systems, Inc. should use these data to establish required maintenance cycles.
2. Modular Wetland Systems, Inc. should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Modular Wetland Systems, Inc. will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at http://www.modularwetlands.com/

Contact Information:

Applicant: Zach Kent
BioClean A Forterra Company.
398 Vi9a El Centro
Oceanside, CA 92058
zach.kent@forterrabp.com

Applicant website: http://www.modularwetlands.com/

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Revision History

Date	**Revision**
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS-Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)

Project Name/ Nakano

ATTACHMENT 2

Backup for PDP Hydromodification Control Measures

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Project Name/ Nakano

Indicate which Items are Included

Attachment Sequence	Contents	Checklist
Attachment 2A	Hydromodification Management Exhibit (Required)	☒ Included See Hydromodification Management Exhibit Checklist.
Attachment 2B	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☐ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map **(Required)** Optional analyses for Critical Coarse Sediment Yield Area Determination ☒ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☒ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2C	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☐ Not performed ☒ Included ☐ Submitted as separate stand-alone document
Attachment 2D	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each Structural BMP See Chapter 6 and Appendix G of the BMP Design Manual	☐ Included ☐ Submitted as separate stand-alone document

FOR HYDROMODIFICATION MANAGEMENT EXHIBIT SEE ATTACHMENT A OF HYDROMODIFICATION STUDY IN ATTACHMENT 2D

ATTACHMENT 2B

MANAGEMENT OF CRITICAL COARSE SEDIMENT YIELD AREAS

LEGEND

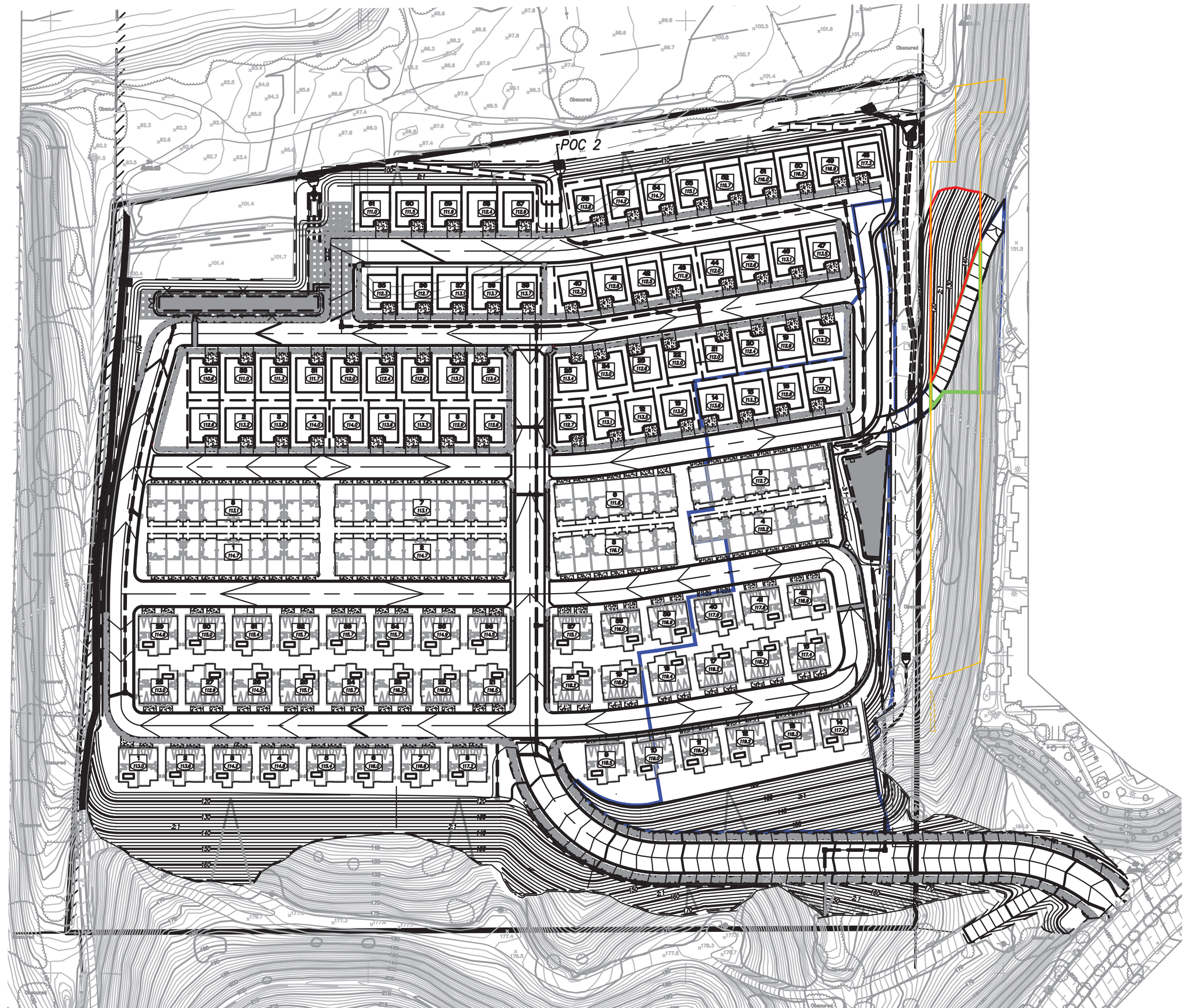
- WMAA CCSYA (yellow outline)
- BYPASS WMAA CCSYA (red outline)
- ONSITE WMAA CCSYA (green outline)
- TOTAL DRAINAGE AREA TO POC 2 (blue outline)

ONSITE CCSYA SUMMARY		
	AREA	% OF SITE
ONSITE CCSYA AREA 1	6441 SF	3.7
TOTAL DRAINAGE AREA TO POC 2	174,893 SF	
3.7% LESS THAN 5% ALLOWANCE THEREFORE ONSITE CCSYA AREA IS ACCOUNTED FOR VIA H.2.1 AVOIDANCE METRICS IN THE 2021 CITY OF CHULA VISTA BMP DESIGN MANUAL		

BYPASS CCSYA NOTE:

HILLSLOPE CCSYA WILL BE BYPASSED THE PROJECT SITE AND WILL FLOW INTO A DRAINAGE DITCH TO THE NORTHEAST CORNER OF THE PROJECT. THE DRAINAGE DITCH WILL CONVEY BED SEDIMENT FROM HILLSOPES TO DOWNSTREAM WATERS BY MAINTAINING A PEAK VELOCITY GREATER THAN OF 3 FEET PER SECOND FOR THE 2-YEAR, 24 HOUR RUNOFF EVENT.

STEP 1 IDENTIFIED THE CCSYA. STEP 2 AVOIDANCE OF THIS HILLSLOPE WAS NOT POSSIBLE. STEP 3 BYPASS OF CCSYA WAS COMPLETED. NO NET IMPACT ANALYSIS IS NOT REQUIRED BY MEETING THE GUIDANCE FOR STEP 3 BYPASS OF HILLSLOPE CCSYA.



N

PREPARED BY:
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CITY OF CHULA VISTA

NAKANO

Attachment 2B
CCSYA VICINITY MAP

SCALE: 1" = 150' JOB #: 4409.00 CREATED: 02/09/22

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ATTACHMENT 2D

FLOW CONTROL FACILITY DESIGN AND STRUCTURAL BMP DRAWDOWN CALCULATIONS

Preliminary Hydromodification Management Study

NAKANO

City of Chula Vista TM#PCS21-0001,
City of San Diego PTS 647766

City of Chula Vista CA
November 3, 2022

Prepared for:
TriPointe Homes
13400 Sabre Springs Parkway, Suite 200
San Diego, California 92128

Prepared By:

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PDC Job No. 4409.02

REGISTERED PROFESSIONAL ENGINEER
CHELISA A. PACK
No. 71026
EXP. 06-30-23
CIVIL
STATE OF CALIFORNIA

Prepared by: J. Novoa, PE
Under the supervision of

Chelisa A. Pack

Chelisa Pack, PE RCE 71026
Registration Expires 06/30/23

1. INTRODUCTION

This report summarizes the preliminary hydromodification design for the Nakano development Project for a Tentative Map (TM) submittal located in the City of Chula Vista, CA. The hydromodification calculations were performed utilizing continuous simulation analysis to size the storm water treatment and control facilities. Storm Water Management Model (SWMM) version 5.1 distributed by USEPA is the basis of both existing and proposed conditions modeling within this report. The biofiltration basin/hydromodification basin sizing and link configuration with the specialized outlet configuration ensures compliance with the Hydromodification Management Plan (HMP) requirements from the San Diego Regional Water Quality Control Board (SDRWQCB).

2. HYDROMODIFICATION MODELING OVERVIEW

2. 1 Model Description

PCSWMM is a proprietary software which utilizes the EPA's Stormwater Management Model (SWMM) as its computational engine, while providing added processing and analytical capabilities to streamline design. PCSWMM is essentially a user-friendly shell for SWMM that allows rapid development and analysis of SWMM models.

PCSWMM was employed for this study based on the ability to efficiently create, edit and compare models, perform detention routing with the same software, and moreover, due to the tendency for SWMM to produce results that have been found to more accurately represent San Diego area watersheds than the alternative San Diego Hydrology Model (SDHM).

SWMM is a semi-distributed hydrologic and hydraulic modeling software that simulates the rainfall-runoff response of a watershed based on linear-reservoir overland flow routing. This overland flow routine accounts for the connectedness of pervious, impervious, and Low Impact Development (LID) BMPs to the drainage system. LID BMPs are represented with a module in SWMM that simulates the water balance through standard LID BMP components, accounting for soil percolation, evapotranspiration, underdrain outflow, various media layer storage and subgrade infiltration (if applicable). These controls provide a wide range of customizability between the various associated parameters and the ability to route underdrain or overflow to other SWMM elements, like Storages Nodes and conduits to represent almost any conceivable LID system.

The outflow from these LID controls, storage components or watersheds is translated into the hydraulic component of the model that utilizes energy and momentum principles to determine flow through conduits, orifices and other structures. The hydraulics may be computed based on either the kinematic or dynamic-wave equations. In this study the former was used because there was no need to take downstream hydraulic grade line effects into consideration.

2.2 Hydromodification Criteria

The San Diego Regional Water Quality Control Board (SDRWQCB) requires the exceedance duration of post-developed flow rates be maintained to within 10% of the pre-developed flow durations. This must occur for flow frequencies ranging from a fraction of the 2-year flow (Q2) to the 10-year flow (Q10). These flow frequency values may be calculated directly from SWMM statistics or estimated based on accepted USGS regression equations. These equations estimate flows based on a correlation with watershed area and the mean annual rainfall developed for the region. For this project the SWMM output was used because of the exceedingly small values calculated by regression equations, which were developed with data from significantly larger watersheds.

The fraction of the Q2 that must be controlled is dependent on the relative erodibility of the channel being discharged to, categorized as either High, Medium, or Low susceptibility. By default it is assumed that all channels have a High susceptibility, and that therefore the low flow threshold of 0.1 of the Q2 must be controlled. A Geomorphic Assessment of Receiving Channels may be performed to indicate whether the channel erosion susceptibility can be categorized as Medium or Low, allowing control to 0.3 or 0.5 of the Q2, respectively.

The low-flow threshold used in the analysis for Nakano project for POCs 1 and 2 are the default 0.1Q2 low-flow threshold, as determined as “high susceptibility”. A geomorphic assessment report may be completed in the future to achieve a low or medium susceptibility, but is not completed as this time.

2.3 Model Development

The inputs required for a SWMM model include rainfall, evapotranspiration rates, watershed characteristics and BMP configurations. The sources for some of these parameters are provided in Table 1 below.

Table 1: Hydrology Criteria

Rain Gage	'Bonita' – from Project Clean Water website
Evapotranspiration	Daily E-T Rates taken from Table G.1-1 in the City of Chula Vista BMP Design Manual based on location in Zone 6 of California irrigation Management Information System "Reference Evapotranspiration Zones"
Overland Flow Path Length	Based on available digital topographic data for pre-development conditions and proposed grading plan for post-project conditions.
Soils/Green-Ampt Parameters	Values for Hydrologic Soil Group 'C and D' taken from Table G.1-4 in the City of San Diego BMP Design Manual. A 25% reduction is applied whenever native soils are compacted.

The drainage area to each point of compliance (POC) was delineated with the project boundary plus adjacent land that drain through the site for both existing and proposed conditions. For the proposed model this drainage area has been broken up into the contributing drainage management (DMA) areas that drain to BMPs. DMAs 1 and 3 flow to POC 1 and outlet via sheet to the flow north. POC 2 contains flow from DMA 2 and outlets east of POC 1 via sheet flow north as well. See the Storm Water Quality Management Plan (SWQMP) for more information regarding the pollutant control strategy and DMAs.

The overland flow path lengths were drawn from a visual inspection of the watershed contours, extending from the upper ridge to the apparent flow path, perpendicular to the contours. The percent imperviousness was calculated based on the estimated imperviousness in the site plan to develop the same values used to calculate the Design Capture Volume provided in Attachment 1e of the SWQMP.

3. Modeling for Hydromodification Compliance

The pre-developed conditions for the site were modelled based on the existing topography and landcover with zero imperviousness. For the post-developed condition, the proposed site footprint was represented as an equivalent imperviousness and a short overland flow path length typical of urban drainage systems. The lined biofiltration basins were modelled by coupling the bioretention LID component to properly represent the media and underdrain, with the storage component to represent the basin surface storage. The parameters utilized for the biofiltration parameters were based on the published values in the City of Chula Vista BMP Design Manual. The basins outlet to new proposed private storm drains that discharges and sheet flow north just before Otay River.

It was determined that this suite of BMPs would be sufficient to provide flow control with the storage depths and outlet size provided herein based on the SWMM modeling results. The Status Report SWMM output files for the existing condition models are provided in Attachment D.

3.1 Flow Frequency Analysis

The SWMM statistics calculator was used to determine the pre-developed and post developed flow rates for the 2, 5, and 10-year recurrence intervals. These are provided below with the resultant low flow threshold. The SWMM output used to calculate these values is provided in Attachment E.

The low-flow threshold used in the analysis for Nakano project for POCs 1 and 2 are the default 0.1Q2 low-flow threshold, as determined as "high susceptibility".

Table 2 – Pre-Developed and Post-Mitigated Flows for POC 1 (BMP Basin 1 & BMP 3 MWS & Vault)

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)
LF = 0.1xQ2	0.326	0.327
2-year	3.263	3.274
5-year	4.477	4.516
10-year	5.760	5.804

Table 3 – Pre-Developed and Post-Mitigated Flows for POC 2 (BMP Basin 2)

Return Period	Pre-project Qpeak (cfs)	Post-project - Mitigated Q (cfs)
LF = 0.1xQ2	0.072	0.028
2-year	0.720	0.277
5-year	1.054	0.945
10-year	1.276	1.257

3.2 Biofiltration Basins

The basins are composed of above ground storage as well as biofiltration media. These components were represented as an LID control ("Bio-retention cell") in series with a storage node as simulated in SWMM. The module allows the user to represent the various stages of a biofiltration basin including ponding, media, and gravel storage above and below the underdrain. These layer depths were assigned per the design developed for pollutant control as shown in Table 4 and the parameter values were assigned with the standard values taken from Table G.1-7 in the BMP Design Manual (with some refinement). The underdrain is offset to allow for the dead storage needed. The drain coefficients are calculated based on media infiltration of 5 in/hr and basin layer depth and listed in Table 4. Drain coefficient calculation is based on C factor calculation equation in the BMP Design Manual (Page G-27).

$$C = c_g\left(\frac{605}{A_{LID}}\right)\left(\frac{\pi D^2}{8}\right)\sqrt{\frac{g}{6}}$$

where,

cg is the orifice discharge coefficient, typically 0.60-0.65 for thin walled plates and higher for thicker walls;
ALID is the cumulative footprint area (ft^2) of all LID controls;
D is the underdrain orifice diameter (in); and
g is the gravitational constant (32.2 ft/s^2).

Table 4 – Biofiltration Model Summary

Biofiltration BMP #	Surface Area (sf)	Layer Depth			Underdrain Orifice (in)	Drain Coefficient
		Ponding (in)	Soil (in)	Gravel Storage (in)		
1	3,608	6	24	12	1	0.0908
2	4,523	6	24	12	0.8	0.0593
Media and storage parameters taken from Table G.1-7 in BMP Design Manual, including media infiltration = 5 in/hr						

To control the flows with this configuration, except for underdrain orifices, a series of flow orifices were connected between the biofiltration basin storage node connected to the point of compliance. The orifice design is summarized in Table 5. Additional screenshots of orifices and weirs are provided in Attachment B. The offset elevation of the above ground orifices are taken from the bottom of the storage node in PCSWMM which is the elevation above the water quality ponding depth, typically 0.75' above the basin bottom (0.5' of WQ ponding and 0.25' of mulch).

Table 5 – Biofiltration Orifice Design

Biofiltration BMP #	Low Flow Orifice		Overflow Weir	
	Dia. (in)	Offset (ft)	Type	Offset (ft)
1	0.8	0.0	Modified G-3 Riser	0.5
2	1	0.0	Modified G-3 Riser	1

3.3 Detention/Hydromodification Underground Vault

A multi-use underground storage vault is utilized for DMA 3. The underground vault will detain flows for the 100-year storm event, provide storage for hydromodification requirements and is also utilized for storage upstream of a modular wetland unit for water quality treatment purposes. The underground vault consists of a 5' depth and approx. 12,736 bottom footprint, which contains a weir wall within the vault. See below for the vault characteristics and parameters.

Table 6 –Underground Vault Storage Summary

Hydromod BMP #	Bottom Footprint (sf)	Depth (ft)
BMP3	12,736	5

BMP #3		
Riser Structure Parameters	Size	Height (ft)
	2.2” orifice (within MWS)*	0.0
	Weir Wall L=8’	4.5

*One single orifice was modeled in the SWMM model. The MWS Unit utilizes two 1.48” orifices. The equivalent flow out was calculated to be the same for the single orifice and two orifices, so they act similarly.

3.4 Flow Duration Curves for Hydromodification Compliance

The pre and post developed flow duration exceedance curves were developed for the hourly flow data using an automatic partial duration series calculator in PCSWMM. These curves are graphed over the flow ranges listed in Tables 2 and 3 and are provided in Attachment F. In all cases the duration of post developed flows are brought to well within that of the pre developed flows within the low flow and high flow thresholds, indicating that the suite of BMPs will provide the flow attenuation required for compliance.

4.0 SUMMARY

The predeveloped conditions of the Nakano project were modelled in SWMM to determine a baseline of flow durations that would need to be controlled in the post-developed conditions. The proposed development was also modelled in SWMM with biofiltration basins with storage as well as detention/hydromodification vault. Based on the SWMM model results for this study it is determined that the combination of two biofiltration basin and a hydromodification vault LID BMPs will be able to satisfy the hydromodification criteria. This study is intended to demonstrate that these controls as sized are capable of providing hydromodification compliance for the project.

Attachments

A – Hydromodification Management Exhibit

B – SWMM Model w/ Subcatchment Schematics

C – SWMM Output – Existing Condition

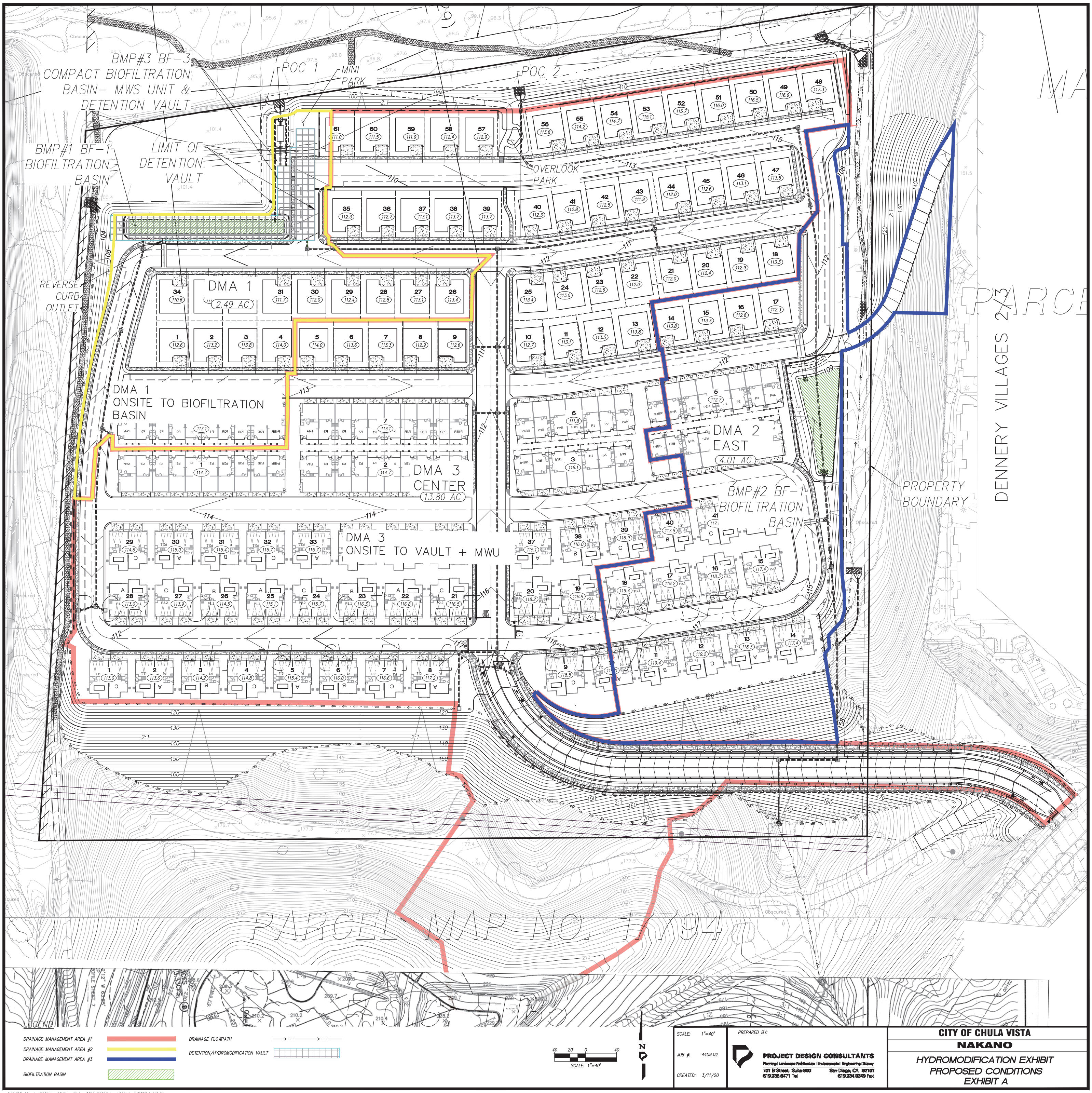
D – SWMM Output – Proposed Conditions

E – Flow Frequency Statistical Analysis results

F – Flow Duration Curves

ATTACHMENT A

Hydromodification Management Exhibit


BMP#3 BF-3
COMPACT BIOFILTRATION
BASIN- MWS UNIT &
DETENTION VAULT
POC 1
MINI
PARK
POC 2
BMP#1 BF-1
BIOFILTRATION
BASIN
LIMIT OF
DETENTION
VAULT
OVERLOOK
PARK
REVERSE
CURB
OUTLET
DMA 1
2.49 AC
DMA 1
ONSITE TO BIOFILTRATION
BASIN
DMA 3
CENTER
13.80 AC
DMA 3
ONSITE TO VAULT + MWU
DMA 2
EAST
4.01 AC
BMP#2 BF-1
BIOFILTRATION
BASIN
PROPERTY
BOUNDARY
DENNERY VILLAGES 2/3
PARCEL MAP NO. 17794
LEGEND
DRAINAGE MANAGEMENT AREA #1
DRAINAGE MANAGEMENT AREA #2
DRAINAGE MANAGEMENT AREA #3
BIOFILTRATION BASIN
DRAINAGE FLOWPATH
DETENTION/HYDROMODIFICATION VAULT
SCALE: 1"=40'
SCALE: 1"=40'
JOB #: 4409.02
CREATED: 3/11/20
PREPARED BY:
PROJECT DESIGN CONSULTANTS
701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax
CITY OF CHULA VISTA
NAKANO
HYDROMODIFICATION EXHIBIT
PROPOSED CONDITIONS
EXHIBIT A

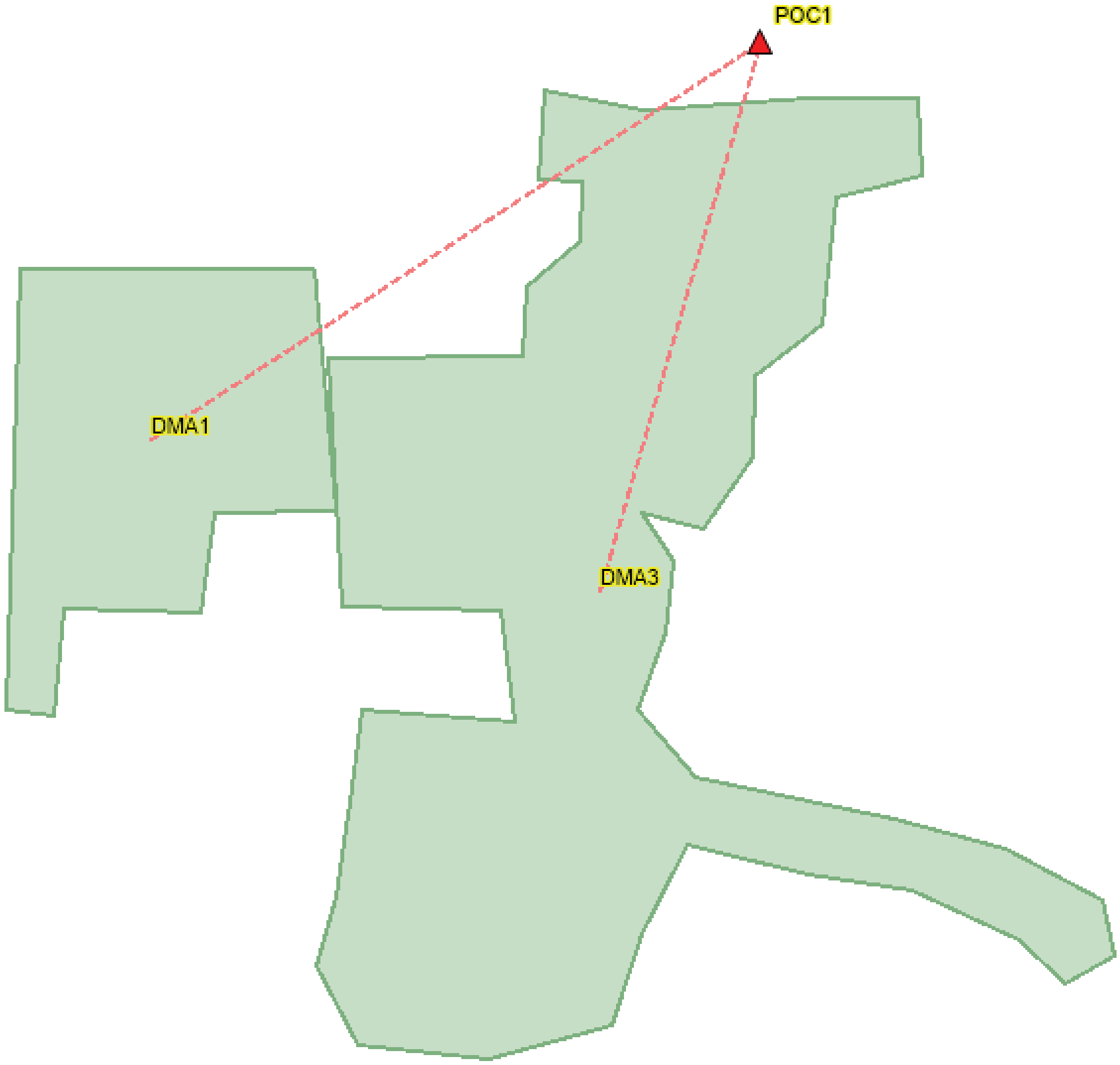
ATTACHMENT B

SWMM Model with

Sub-catchment Parameters and Schematic

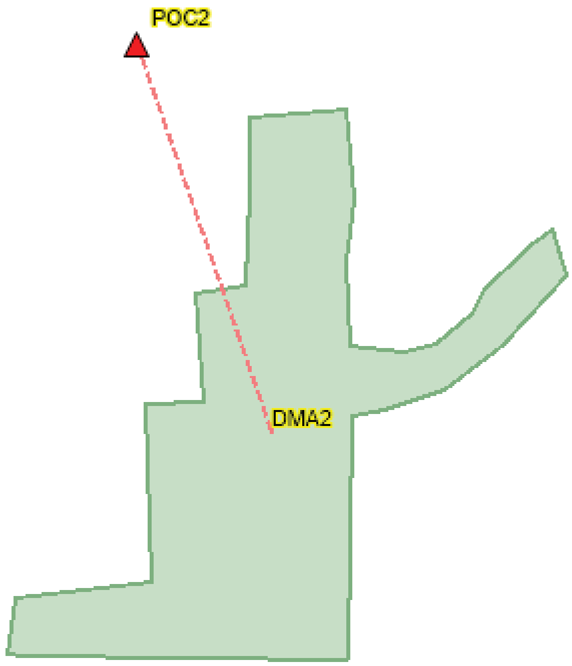
Existing Conditions

POC 1



Name	Rain Gage	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (in)	Dstore Perv (in)	Infiltration Method	Suction Head (in)	Conductivity (in/hr)	Initial Deficit (frac.)
DMA1	Bonita	POC1	2.49	520	208.5...	5	0	0.012	0.15	0.05	0.1	GREEN_AMPT	6	0.1	0.31
DMA3	Bonita	POC1	13.8	631	952.6...	15	0	0.012	0.15	0.05	0.1	GREEN_AMPT	6	0.1	0.31

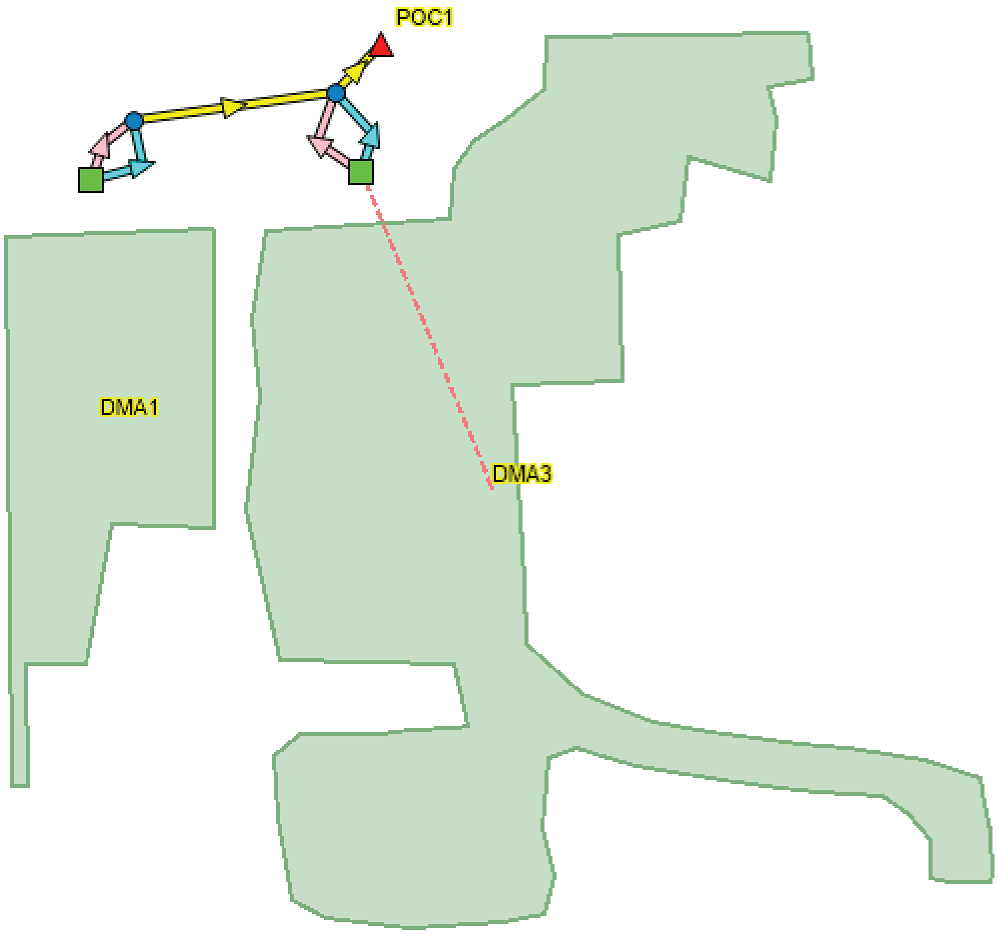
POC 2



Name	Rain Gage	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (in)	Dstore Perv (in)	Zero Imperv (%)	Subarea Routing	Percent Routed (%)	Suction Head (in)	Conductivity (in/hr)	Initial Deficit (frac.)
DMA2	Bonita	POC2	4.01	342	510.747	9.5	0	0.012	0.15	0.05	0.1	25	OUTLET	100	6	0.1	0.31

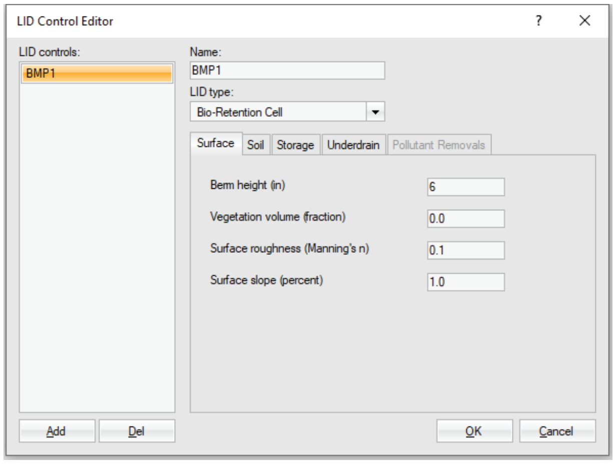
Proposed Conditions

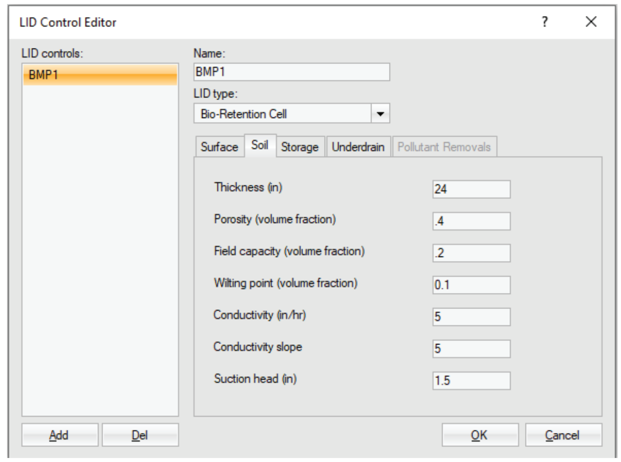
POC 1

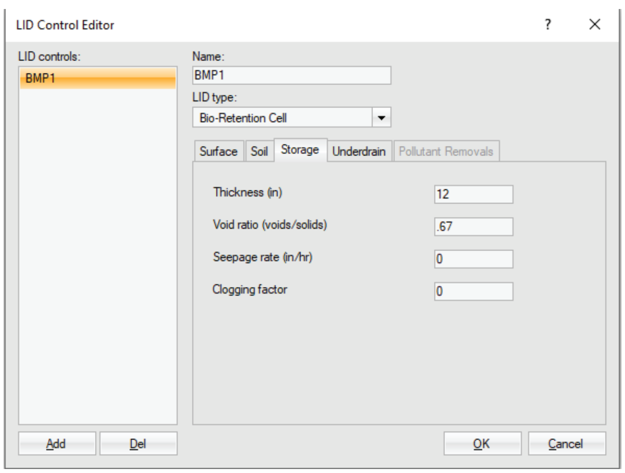


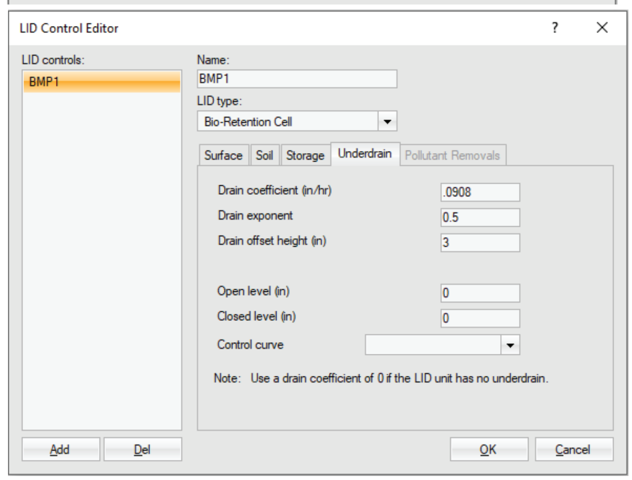
Name	Rain Gage	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (in)	Dstore Perv (in)	LID Controls	LID Names	Infiltration Method	Suction Head (in)	Conductivity (in/hr)	Initial Deficit (frac.)
DMA1	Bonita	SU1	2.49	520	208.585	3.5	69	0.012	0.15	0.05	0.1	1	BMP1	GREEN_AMPT	6	0.075	0.31
DMA3	Bonita	SU2	13.8	420	1431.257	8.2	64.8	0.012	0.15	0.05	0.1	0		GREEN_AMPT	6	0.075	0.31

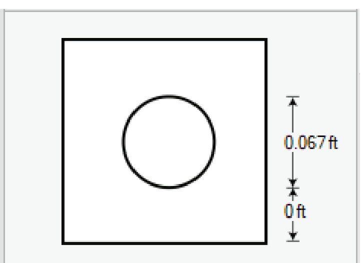
Basin 1 PCSWMM LID & Orifice Parameters





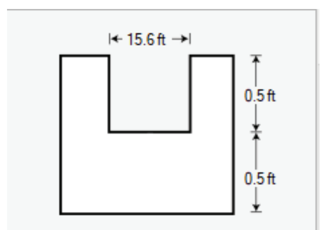






Orifice: OR2

Attributes	
Name	OR2
Inlet Node	SU1
Outlet Node	J2
Description	
Tag	
Type	SIDE
Cross-Section	CIRCULAR
Height (ft)	0.067
Width (ft)	0
Inlet Offset (ft)	0
Discharge Coeff.	0.6
Flap Gate	NO
Time to Open/Clos	0
Control Rules	NO



Weir: W2

Attributes	
Name	W2
Inlet Node	SU1
Outlet Node	J2
Description	
Tag	
Type	TRANSVERSE
Height (ft)	0.5
Length (ft)	15.6
Side Slope (ft/ft)	0
Inlet Offset (ft)	0.5
Discharge Coeff. (C	3
Flap Gate	NO
End Contractions	0
End Coeff. (CFS)	0
Can Surcharge	YES
Coeff. Curve	
Road Width (ft)	0
Road Surface	PAVED
Control Rules	NO

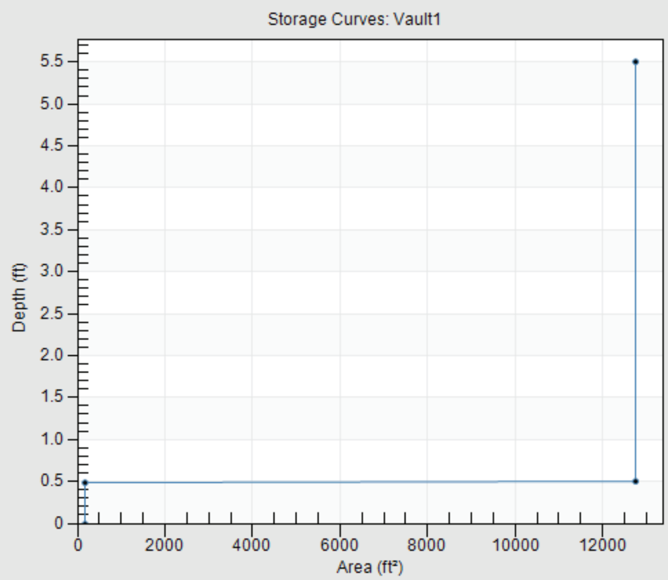
Vault PCSWMM Orifice Parameters

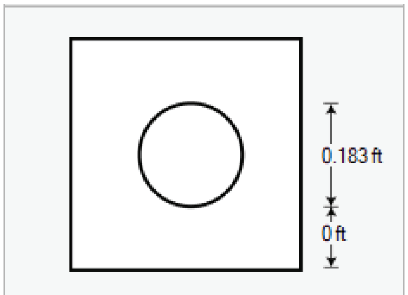
Name: Vault1

Description:

Data:

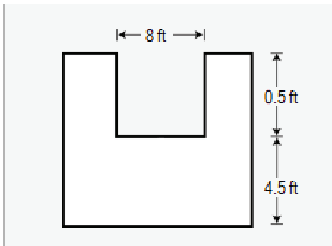
	Depth (ft)	Area (ft²)
1	0	160
2	0.49	160
3	0.5	12736
4	5.5	12736
5		
6		
7		
8		
9		
10		
11		
12		





Orifice: OR1

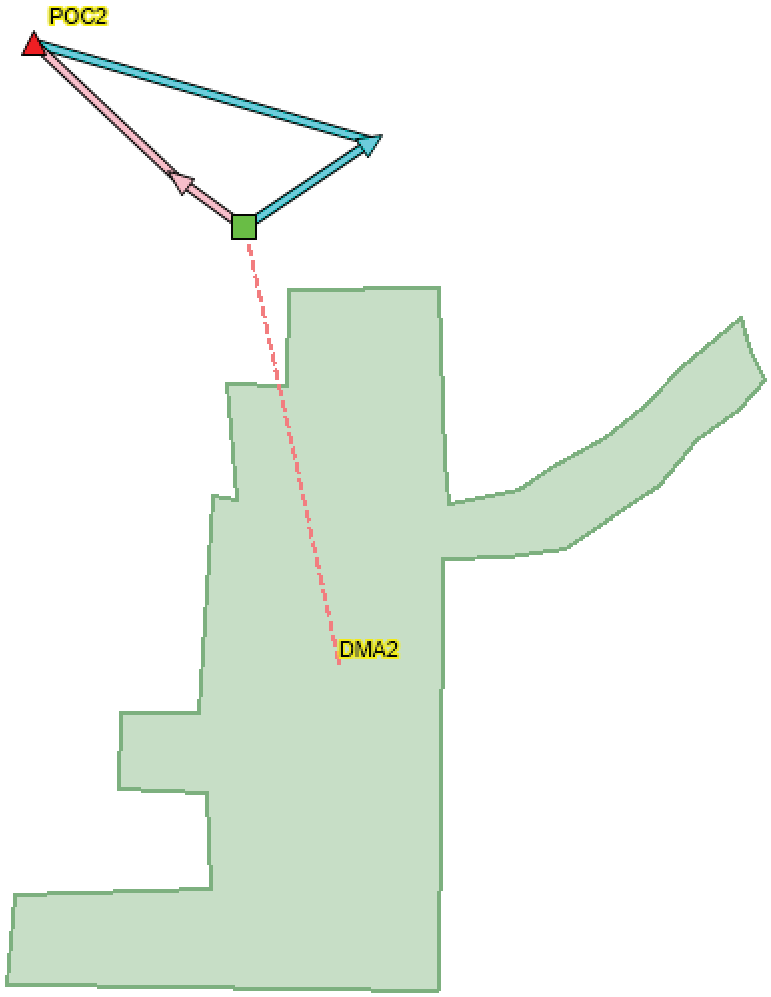
Attributes	
Name	OR1
Inlet Node	SU2
Outlet Node	J1
Description	
Tag	
Type	SIDE
Cross-Section	CIRCULAR
Height (ft)	0.183
Width (ft)	0
Inlet Offset (ft)	0
Discharge Coeff.	0.6
Flap Gate	NO
Time to Open/Clos	0
Control Rules	NO



Weir: W1

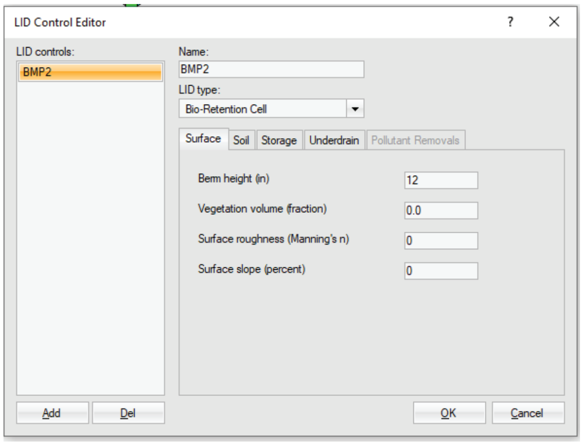
Attributes	
Name	W1
Inlet Node	SU2
Outlet Node	J1
Description	
Tag	
Type	TRANSVERSE
Height (ft)	0.5
Length (ft)	8
Side Slope (ft/ft)	0
Inlet Offset (ft)	4.5
Discharge Coeff. (C	3
Flap Gate	NO
End Contractions	0
End Coeff. (CFS)	0
Can Surcharge	YES
Coeff. Curve	
Road Width (ft)	0
Road Surface	PAVED
Control Rules	NO

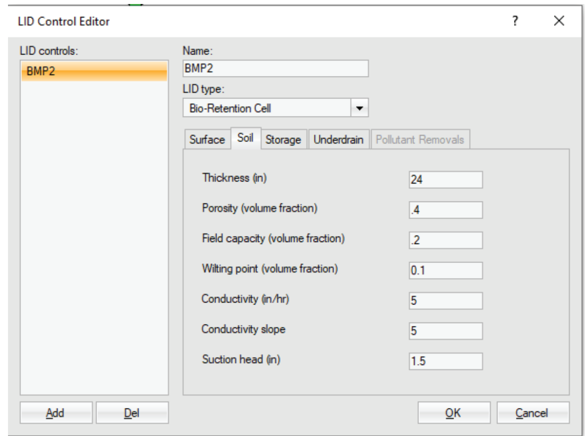
POC 2

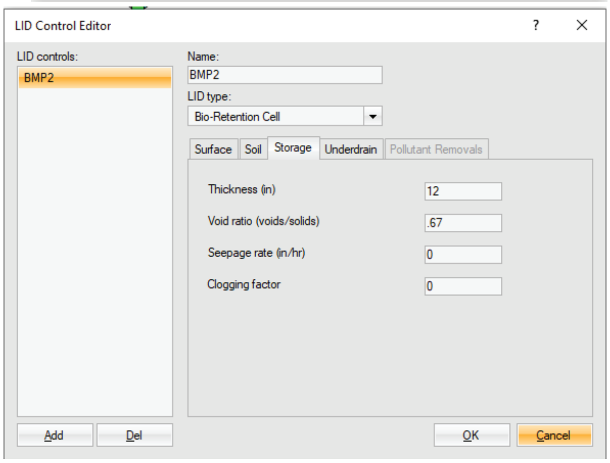


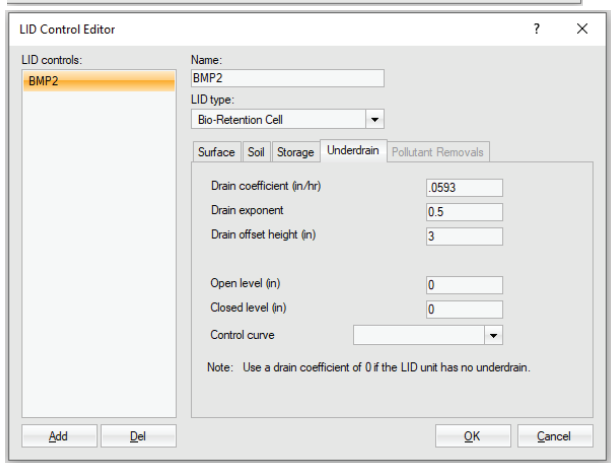
Name	Rain Gage	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (in)	Dstore Perv (in)	Zero Imperv (%)	LID Controls	LID Names	Suction Head (in)	Conductivity (in/hr)	Initial Deficit (frac.)
DMA2	Bonita	SU1	4.01	329	530.929	5	58	0.012	0.15	0.05	0.1	25	1	BMP2	6	0.075	0.31

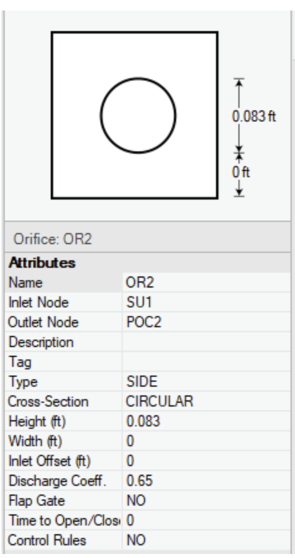
Basin 2 PCSWMM LID & Orifice Parameters

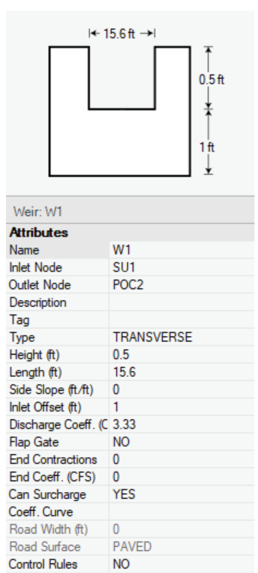


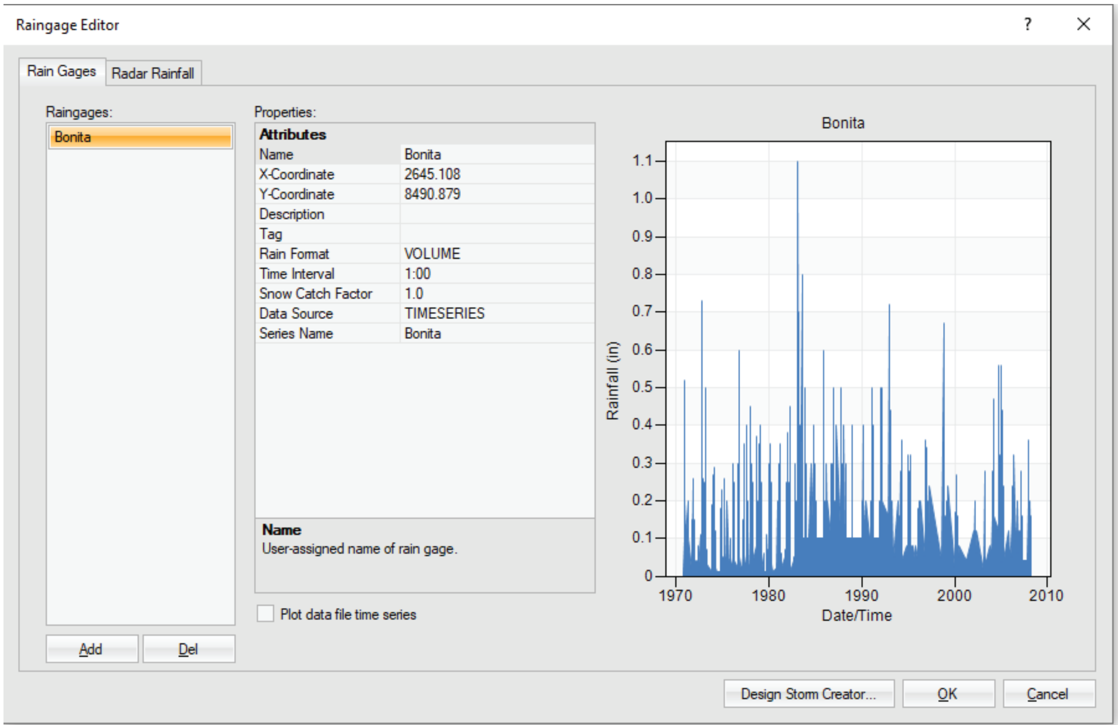











Raingage Editor
Rain Gages
Radar Rainfall
Raingages:
Bonita
Properties:
Attributes
Name Bonita
X-Coordinate 2645.108
Y-Coordinate 8490.879
Description
Tag
Rain Format VOLUME
Time Interval 1:00
Snow Catch Factor 1.0
Data Source TIMESERIES
Series Name Bonita
Name
User-assigned name of rain gage.
Plot data file time series
Bonita
Rainfall (in)
Date/Time
Add
Del
Design Storm Creator...
OK
Cancel

ATTACHMENT C

SWMM Output – Existing Conditions

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------
Pre Condition Nakano POC 1-DMA 1&3

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 10/03/1970 05:00:00
Ending Date .............. 05/25/2008 22:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 00:15:00

**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       460.288       339.070
Evaporation Loss .........         2.974         2.191
Infiltration Loss ........       442.120       325.687
Surface Runoff ...........        15.795        11.635
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.131

**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......        15.795         5.147
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........        15.795         5.147
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000

***************************
Subcatchment Runoff Summary
***************************

----------------------------------------------------------------------------------------------------------------------------------
                           Total      Total      Total      Total     Imperv       Perv      Total       Total     Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff   Runoff   Coeff
Subcatchment                  in         in         in         in         in         in         in    10^6 gal      CFS
----------------------------------------------------------------------------------------------------------------------------------
DMA1                      339.07       0.00       2.11     323.95       0.00      13.63      13.63        0.92     2.41   0.040
DMA3                      339.07       0.00       2.20     326.00       0.00      11.28      11.28        4.23    11.46   0.033

Analysis begun on:  Thu Jun 16 11:03:51 2022
Analysis ended on:  Thu Jun 16 11:04:04 2022
Total elapsed time: 00:00:13
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

Pre Condition Nakano POC 2- DMA 2

```
*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Starting Date ............ 10/03/1970 05:00:00
Ending Date .............. 05/25/2008 22:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 00:15:00

**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......       113.306       339.070
Evaporation Loss .........         0.725         2.169
Infiltration Loss ........       108.638       325.102
Surface Runoff ...........         4.106        12.288
Final Storage ............         0.000         0.000
Continuity Error (%) .....        -0.144

**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         4.106         1.338
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         4.106         1.338
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.000

***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA2	339.07	0.00	2.17	325.10	0.00	12.29	12.29	1.34	3.64	0.036

Analysis begun on: Thu Jun 16 10:50:43 2022
Analysis ended on: Thu Jun 16 10:50:55 2022
Total elapsed time: 00:00:12

ATTACHMENT D

SWMM Output – Proposed Conditions

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
--------------------------------------------------------------

Post Condition Nakano POC 1- DMA 1&3

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 10/03/1970 05:00:00
Ending Date .............. 05/25/2008 22:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 00:15:00
Routing Time Step ........ 15.00 sec


**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Initial LID Storage ......         0.017         0.012
Total Precipitation ......       460.288       339.070
Evaporation Loss .........        64.370        47.418
Infiltration Loss ........       149.852       110.388
Surface Runoff ...........       217.862       160.488
LID Drainage .............        32.164        23.694
Final Storage ............         0.017         0.012
Continuity Error (%) .....        -0.860


**************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       250.026        81.475
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       249.978        81.459
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.019


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    15.00 sec
Average Time Step           :    15.00 sec
Maximum Time Step           :    15.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00


***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA1	339.07	0.00	64.77	95.29	188.48	5.82	183.70	12.42	2.68	0.542
DMA3	339.07	0.00	44.29	113.11	178.91	5.36	184.27	69.05	14.42	0.543

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
DMA1	BMP1	6180.55	658.30	0.00	862.45	4660.03	2.40	2.40	-0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
J1	JUNCTION	0.01	0.59	1.59	5532 14:01	0.59
J2	JUNCTION	0.00	0.36	2.36	4532 12:01	0.36
POC1	OUTFALL	0.01	0.59	0.59	5532 14:01	0.59
SU1	STORAGE	0.00	0.64	0.64	4532 12:01	0.64
SU2	STORAGE	0.07	4.91	4.91	5532 14:01	4.91

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1	JUNCTION	0.00	7.99	5532 14:01	0	71	0.000
J2	JUNCTION	0.00	2.56	4532 12:01	0	1.94	0.000
POC1	OUTFALL	0.04	8.03	5532 14:01	10.5	81.5	0.000
SU1	STORAGE	2.65	2.65	4532 12:00	1.94	1.94	0.000
SU2	STORAGE	14.42	14.42	4532 12:00	69	69	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
SU1	0.020	1	0	0	3.173	85	4532 12:01	2.56
SU2	0.556	1	0	0	56.348	98	5532 14:01	6.65

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC1	8.37	0.11	8.03	81.453
System	8.37	0.11	8.03	81.453

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	7.99	5532 14:01	8.13	0.08	0.20
C2	CONDUIT	2.56	4532 12:01	5.96	0.04	0.14
OR1	ORIFICE	0.28	5532 14:01			0.00
OR2	ORIFICE	0.01	4532 12:01			0.00
W1	WEIR	6.37	5532 14:01			0.00
W2	WEIR	2.55	4532 12:01			0.00

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Tue Jun 21 14:31:26 2022
Analysis ended on:  Tue Jun 21 14:32:43 2022
Total elapsed time: 00:01:17
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

Post Condition POC 2-DMA 2

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****

```
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ 10/03/1970 05:00:00
Ending Date .............. 05/25/2008 22:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 00:15:00
Routing Time Step ........ 15.00 sec
```

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Initial LID Storage	0.021	0.062
Total Precipitation	113.306	339.070
Evaporation Loss	18.245	54.599
Infiltration Loss	43.736	130.881
Surface Runoff	6.230	18.643
LID Drainage	46.227	138.336
Final Storage	0.021	0.062
Continuity Error (%)	-1.000	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	52.457	17.094
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	52.457	17.094
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Highest Flow Instability Indexes
****

All links are stable.

****
Routing Time Step Summary
****

```
Minimum Time Step           :    15.00 sec
Average Time Step           :    15.00 sec
Maximum Time Step           :    15.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Imperv Runoff in	Perv Runoff in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA2	339.07	0.00	54.60	130.88	158.40	6.91	156.98	17.09	4.25	0.463

****
LID Performance Summary

****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
DMA2	BMP2	6723.76	661.32	0.00	720.02	5342.66	2.40	2.40	-0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
POC2	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU1	STORAGE	0.00	1.16	1.16	4532 12:05	1.11

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
POC2	OUTFALL	0.05	3.28	4532 12:05	15.1	17.1	0.000
SU1	STORAGE	4.20	4.20	4532 12:00	2.03	2.03	0.004

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
SU1	0.022	0	0	0	6.178	92	4532 12:05	3.23

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC2	7.80	0.02	3.28	17.093
System	7.80	0.02	3.28	17.093

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
OR2	ORIFICE	0.03	4532 12:05			0.00
W1	WEIR	3.20	4532 12:05			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Wed Jun 22 08:12:37 2022
Analysis ended on: Wed Jun 22 08:13:14 2022
Total elapsed time: 00:00:37

ATTACHMENT E

Flow Frequency Statistical Analysis

Pre-project Flow Frequency - Long-term Simulation

Statistics - Node POC1 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	3/1/1983	30	14.967	1.28	39
2	11/25/1985	16	6.514	2.56	19.5
3	1/11/2005	5	6.181	3.85	13
4	3/24/1983	2	5.725	5.13	9.75
5	12/21/1970	2	5.455	6.41	7.8
6	1/16/1978	3	5.273	7.69	6.5
7	10/19/2004	32	4.864	8.97	5.57
8	11/11/1972	1	4.395	10.26	4.88
9	2/21/2005	3	4.356	11.54	4.33
10	1/3/2005	21	4.278	12.82	3.9
11	2/28/1991	11	3.908	14.1	3.55
12	3/27/1991	2	3.885	15.38	3.25
13	8/16/1977	6	3.828	16.67	3
14	4/1/1982	2	3.796	17.95	2.79
15	2/22/2004	5	3.767	19.23	2.6
16	3/2/2004	2	3.642	20.51	2.44
17	1/31/1979	11	3.461	21.79	2.29
18	3/19/1983	1	3.4	23.08	2.17
19	12/7/1992	3	3.394	24.36	2.05
20	2/19/1993	2	3.131	25.64	1.95
21	1/29/1980	5	2.95	26.92	1.86
22	11/29/1970	3	2.83	28.21	1.77
23	2/23/2005	1	2.468	29.49	1.7
24	1/4/1995	5	2.446	30.77	1.63
25	12/27/1984	22	2.357	32.05	1.56
26	3/1/1978	1	2.313	33.33	1.5
27	3/6/1980	5	2.261	34.62	1.44
28	4/28/1994	2	2.205	35.9	1.39
29	3/1/1981	10	2.032	37.18	1.34
30	1/15/1993	19	1.886	38.46	1.3
31	3/2/1992	4	1.836	39.74	1.26
32	12/4/1992	1	1.802	41.03	1.22
33	3/10/1975	2	1.628	42.31	1.18
34	3/17/1982	9	1.571	43.59	1.15
35	2/6/1992	4	1.466	44.87	1.11
36	3/21/1983	1	1.453	46.15	1.08
37	11/10/1982	1	1.284	47.44	1.05
38	12/7/1986	1	1.23	48.72	1.03
39	3/7/1992	1	1.203	50	1
40	9/10/1976	14	1.182	51.28	0.98
41	2/10/1978	2	1.175	52.56	0.95
42	11/12/1976	1	1.167	53.85	0.93
43	2/20/1980	21	1.162	55.13	0.91
44	10/10/1986	4	1.088	56.41	0.89
45	12/29/1977	1	1.066	57.69	0.87
46	3/7/1974	1	1.04	58.97	0.85
47	8/14/1983	1	1.024	60.26	0.83
48	1/25/1995	2	0.971	61.54	0.81
49	1/12/1993	3	0.935	62.82	0.8
50	1/29/1983	2	0.896	64.1	0.78
51	12/11/1984	4	0.864	65.38	0.76
52	3/5/2000	1	0.724	66.67	0.75
53	3/16/1986	1	0.672	67.95	0.74
54	2/26/1987	1	0.562	69.23	0.72
55	10/11/1987	1	0.53	70.51	0.71
56	2/26/2004	1	0.529	71.79	0.7
57	10/23/1976	1	0.511	73.08	0.68
58	3/20/1973	1	0.481	74.36	0.67
59	1/1/1982	2	0.454	75.64	0.66
60	10/30/1998	1	0.438	76.92	0.65
61	2/8/1976	5	0.405	78.21	0.64
62	2/14/1995	1	0.398	79.49	0.63
63	3/20/1991	1	0.396	80.77	0.62
64	2/2/1988	2	0.394	82.05	0.61
65	11/14/1978	1	0.377	83.33	0.6
66	3/5/1978	1	0.373	84.62	0.59
69	12/19/1970	1	0.321	88.46	0.57
69	1/6/1993	17	0.321	88.46	0.57
69	1/7/1974	25	0.321	88.46	0.57
70	3/11/1978	3	0.32	89.74	0.56
71	4/29/1980	1	0.286	91.03	0.55
72	11/22/1984	1	0.207	92.31	0.54
73	1/15/1978	1	0.202	93.59	0.53
74	1/4/1974	1	0.137	94.87	0.53
75	2/2/1983	1	0.083	96.15	0.52

(years)

10-year Q:	5.760	cfs
5-year Q:	4.477	cfs
2-year Q:	3.263	cfs
Lower Flow Threshold:	10%	
0.1xQ2	0.326	cfs

Post-project Flow Frequency - Long-term Simulation

Statistics - Node POC1 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	3/1/1983	30	14.961	1.28	39
2	11/25/1985	16	6.548	2.56	19.5
3	1/11/2005	5	6.206	3.85	13
4	3/24/1983	2	5.771	5.13	9.75
5	12/21/1970	2	5.485	6.41	7.8
6	1/16/1978	3	5.272	7.69	6.5
7	10/19/2004	32	4.903	8.97	5.57
8	11/11/1972	1	4.434	10.26	4.88
9	2/21/2005	3	4.346	11.54	4.33
10	1/3/2005	21	4.297	12.82	3.9
11	2/28/1991	11	3.944	14.1	3.55
12	3/27/1991	2	3.905	15.38	3.25
13	8/16/1977	6	3.844	16.67	3
14	4/1/1982	2	3.828	17.95	2.79
15	2/22/2004	5	3.793	19.23	2.6
16	3/2/2004	2	3.674	20.51	2.44
17	1/31/1979	11	3.465	21.79	2.29
18	3/19/1983	1	3.431	23.08	2.17
19	12/7/1992	3	3.385	24.36	2.05
20	2/19/1993	2	3.162	25.64	1.95
21	1/29/1980	5	2.948	26.92	1.86
22	11/29/1970	3	2.834	28.21	1.77
23	2/23/2005	1	2.492	29.49	1.7
24	1/4/1995	5	2.45	30.77	1.63
25	12/27/1984	22	2.375	32.05	1.56
26	3/1/1978	1	2.33	33.33	1.5
27	3/6/1980	5	2.256	34.62	1.44
28	4/28/1994	2	2.228	35.9	1.39
29	3/1/1981	10	2.053	37.18	1.34
30	1/15/1993	19	1.89	38.46	1.3
31	3/2/1992	4	1.856	39.74	1.26
32	12/4/1992	1	1.819	41.03	1.22
33	3/10/1975	2	1.635	42.31	1.18
34	3/17/1982	9	1.585	43.59	1.15
35	2/6/1992	4	1.471	44.87	1.11
36	3/21/1983	1	1.467	46.15	1.08
37	11/10/1982	1	1.298	47.44	1.05
38	12/7/1986	1	1.243	48.72	1.03
39	3/7/1992	1	1.216	50	1
40	9/10/1976	14	1.194	51.28	0.98
41	2/10/1978	2	1.184	52.56	0.95
42	11/12/1976	1	1.177	53.85	0.93
43	2/20/1980	21	1.173	55.13	0.91
44	10/10/1986	4	1.099	56.41	0.89
45	12/29/1977	1	1.077	57.69	0.87
46	3/7/1974	1	1.05	58.97	0.85
47	8/14/1983	1	1.031	60.26	0.83
48	1/25/1995	2	0.977	61.54	0.81
49	1/12/1993	3	0.94	62.82	0.8
50	1/29/1983	2	0.905	64.1	0.78
51	12/11/1984	4	0.868	65.38	0.76
52	3/5/2000	1	0.731	66.67	0.75
53	3/16/1986	1	0.677	67.95	0.74
54	2/26/1987	1	0.568	69.23	0.72
55	2/26/2004	1	0.534	70.51	0.71
56	10/11/1987	1	0.533	71.79	0.7
57	10/23/1976	1	0.514	73.08	0.68
58	3/20/1973	1	0.484	74.36	0.67
59	1/1/1982	2	0.457	75.64	0.66
60	10/30/1998	1	0.44	76.92	0.65
61	2/8/1976	5	0.407	78.21	0.64
62	2/14/1995	1	0.402	79.49	0.63
63	3/20/1991	1	0.397	80.77	0.62
64	2/2/1988	2	0.396	82.05	0.61
65	11/14/1978	1	0.38	83.33	0.6
66	3/5/1978	1	0.377	84.62	0.59
67	3/11/1978	3	0.324	85.9	0.58
70	12/19/1970	1	0.323	89.74	0.56
70	1/7/1974	25	0.323	89.74	0.56
70	1/6/1993	17	0.323	89.74	0.56
71	4/29/1980	1	0.287	91.03	0.55
72	11/22/1984	1	0.208	92.31	0.54
73	1/15/1978	1	0.204	93.59	0.53
74	1/4/1974	1	0.137	94.87	0.53
75	2/2/1983	1	0.084	96.15	0.52

10-year Q:	5.804	cfs
5-year Q:	4.516	cfs
2-year Q:	3.274	cfs
Lower Flow Threshold:	10%	
0.1xQ2:	0.327	cfs

Pre-project Flow Frequency - Long-term Simulation

DMA 2 POC 2

Statistics - Node POC2 Total Inflow

Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	3/1/1983	31	3.562	1.32	39
2	11/25/1985	16	1.486	2.63	19.5
3	1/11/2005	5	1.423	3.95	13
4	3/24/1983	2	1.264	5.26	9.75
5	1/16/1978	3	1.252	6.58	7.8
6	12/21/1970	2	1.243	7.89	6.5
7	10/19/2004	32	1.075	9.21	5.57
8	2/21/2005	3	1.049	10.53	4.88
9	1/3/2005	21	0.982	11.84	4.33
10	11/11/1972	1	0.958	13.16	3.9
11	3/27/1991	2	0.886	14.47	3.55
12	8/16/1977	6	0.877	15.79	3.25
13	2/28/1991	11	0.849	17.11	3
14	2/22/2004	5	0.845	18.42	2.79
15	4/1/1982	2	0.833	19.74	2.6
16	12/7/1992	3	0.816	21.05	2.44
17	1/31/1979	11	0.809	22.37	2.29
18	3/2/2004	2	0.797	23.68	2.17
19	3/19/1983	1	0.739	25	2.05
20	1/29/1980	5	0.701	26.32	1.95
21	2/19/1993	2	0.67	27.63	1.86
22	11/29/1970	3	0.663	28.95	1.77
23	1/4/1995	5	0.571	30.26	1.7
24	3/6/1980	5	0.543	31.58	1.63
25	2/23/2005	1	0.527	32.89	1.56
26	12/27/1984	23	0.526	34.21	1.5
27	3/1/1978	1	0.515	35.53	1.44
28	4/28/1994	2	0.463	36.84	1.39
29	1/15/1993	19	0.441	38.16	1.34
30	3/1/1981	10	0.423	39.47	1.3
31	3/2/1992	4	0.379	40.79	1.26
32	3/10/1975	2	0.372	42.11	1.22
33	12/4/1992	1	0.354	43.42	1.18
34	3/17/1982	9	0.343	44.74	1.15
35	2/6/1992	4	0.34	46.05	1.11
36	3/21/1983	1	0.286	47.37	1.08
37	2/10/1978	2	0.263	48.68	1.05
38	11/10/1982	1	0.259	50	1.03
39	12/7/1986	1	0.246	51.32	1
40	3/7/1992	1	0.24	52.63	0.98
41	9/10/1976	14	0.236	53.95	0.95
42	2/20/1980	21	0.234	55.26	0.93
43	11/12/1976	1	0.226	56.58	0.91
44	1/25/1995	2	0.221	57.89	0.89
45	10/10/1986	4	0.215	59.21	0.87
46	12/29/1977	1	0.211	60.53	0.85
47	1/12/1993	3	0.209	61.84	0.83
48	3/7/1974	1	0.205	63.16	0.81
49	12/11/1984	4	0.194	64.47	0.8
50	8/14/1983	1	0.191	65.79	0.78
51	1/29/1983	2	0.174	67.11	0.76
52	3/5/2000	1	0.139	68.42	0.75
53	3/16/1986	1	0.127	69.74	0.74
54	2/26/1987	1	0.113	71.05	0.72
55	2/26/2004	1	0.101	72.37	0.71
56	10/11/1987	1	0.097	73.68	0.7
57	10/23/1976	1	0.095	75	0.68
58	2/8/1976	5	0.09	76.32	0.67
59	3/20/1973	1	0.089	77.63	0.66
60	1/1/1982	2	0.085	78.95	0.65
61	10/30/1998	1	0.08	80.26	0.64
62	2/14/1995	1	0.078	81.58	0.63
63	3/5/1978	1	0.077	82.89	0.62
64	2/2/1988	2	0.072	84.21	0.61
65	3/20/1991	1	0.072	85.53	0.6
66	11/14/1978	1	0.072	86.84	0.59
67	3/11/1978	3	0.067	88.16	0.58
70	12/19/1970	1	0.059	92.11	0.56
70	1/6/1993	17	0.059	92.11	0.56
70	1/7/1974	25	0.059	92.11	0.56
71	4/29/1980	1	0.052	93.42	0.55
72	1/15/1978	1	0.038	94.74	0.54
73	11/22/1984	1	0.037	96.05	0.53
74	1/4/1974	1	0.024	97.37	0.53
75	2/2/1983	1	0.016	98.68	0.52

(years)

10-year Q:	1.276	cfs
5-year Q:	1.054	cfs
2-year Q:	0.720	cfs
Lower Flow Threshold:	10%	
0.1xQ2:	0.072	cfs

Post-project Flow Frequency - Long-term Simulation

DMA 2 POC 2

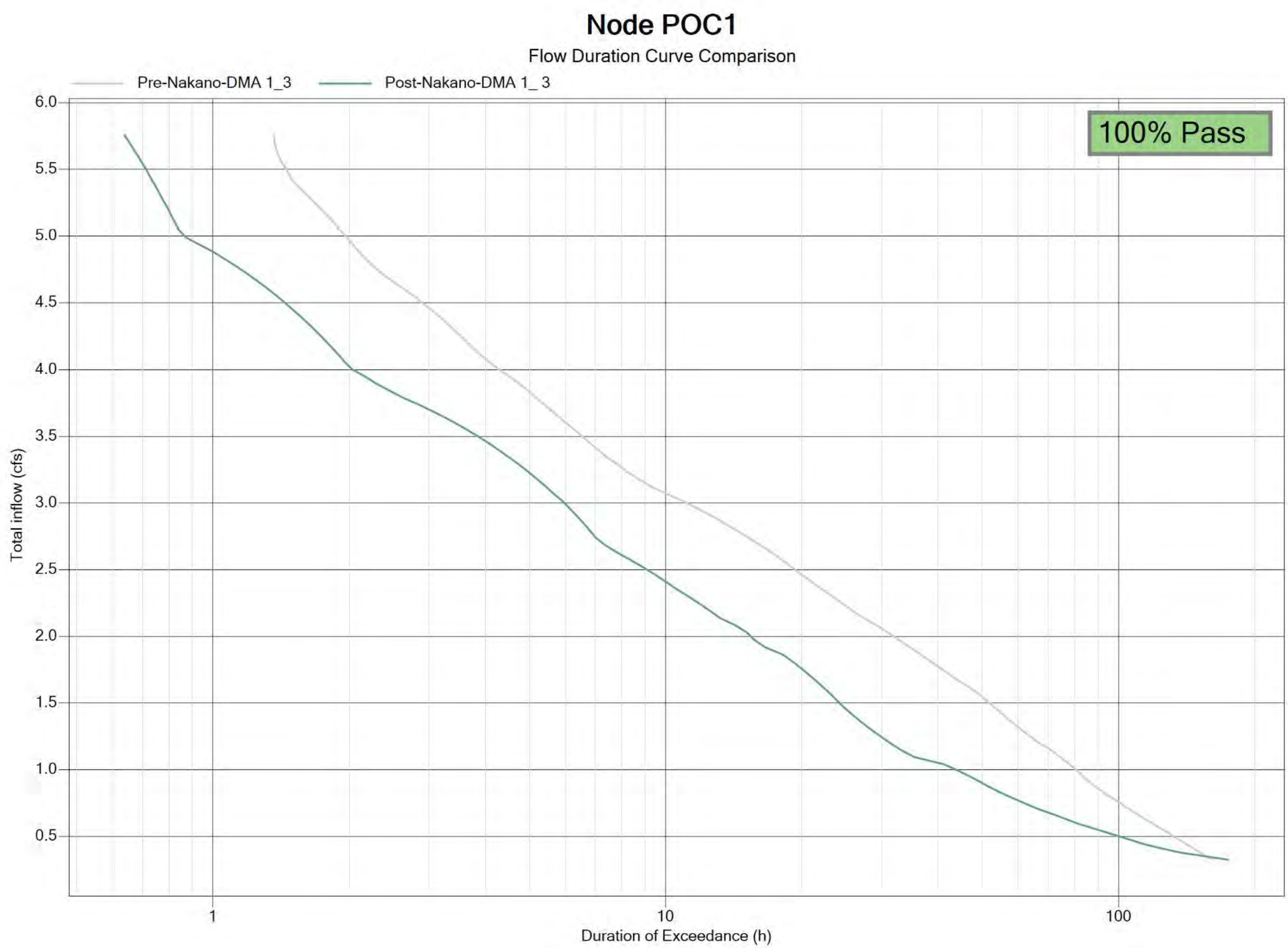
Statistics - Node POC2 Total Inflow

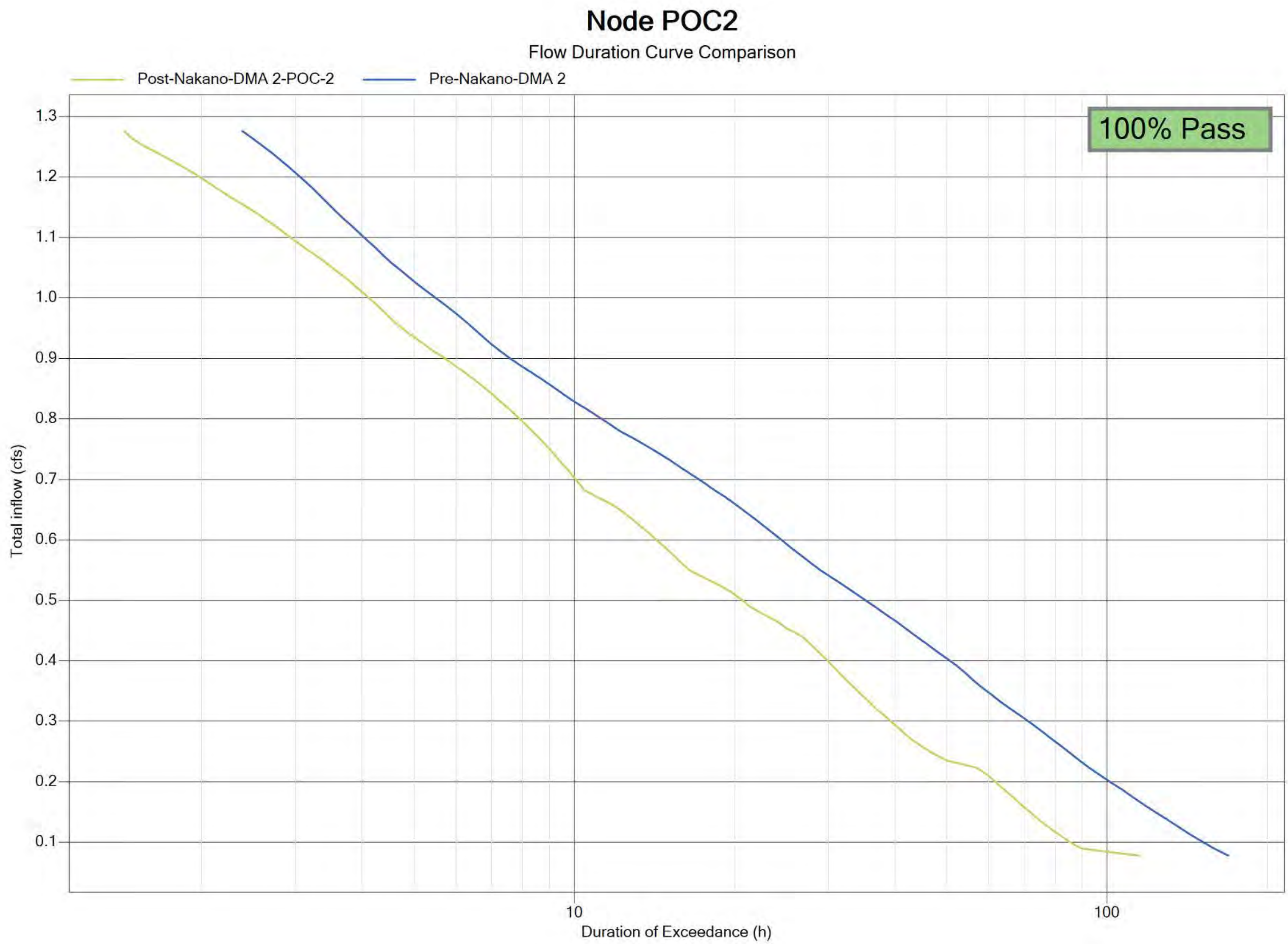
Rank	Start Date	Event Duration (hours)	Event Peak (CFS)	Exceedance Frequency (percent)	Return Period (years)
1	11/24/1985	160	2.06	0.26	39
2	2/24/1983	264	1.541	0.53	19.5
3	12/4/1992	159	1.267	0.79	13
4	1/31/1979	122	1.256	1.06	9.75
5	2/18/2005	195	1.172	1.32	7.8
6	2/21/2004	156	1.083	1.58	6.5
7	10/17/2004	165	0.958	1.85	5.57
8	2/27/1991	117	0.942	2.11	4.88
9	1/28/1980	122	0.917	2.37	4.33
10	1/3/2005	268	0.647	2.64	3.9
11	1/14/1978	159	0.563	2.9	3.55
12	1/12/1993	204	0.548	3.17	3.25
13	12/28/2004	113	0.533	3.43	3
14	3/14/1982	161	0.524	3.69	2.79
15	1/3/1995	145	0.377	3.96	2.6
16	1/6/1993	133	0.364	4.22	2.44
17	2/4/1976	224	0.339	4.49	2.29
18	12/17/1970	182	0.278	4.75	2.17
19	12/27/1984	101	0.277	5.01	2.05
20	2/6/1992	256	0.077	5.28	1.95
21	3/2/1992	87	0.073	5.54	1.86
22	3/6/1980	78	0.072	5.8	1.77
23	2/27/1978	193	0.072	6.07	1.7
24	8/16/1977	83	0.071	6.33	1.63
25	3/25/1991	119	0.071	6.6	1.56
26	11/11/1985	86	0.07	6.86	1.5
27	11/10/1972	158	0.07	7.12	1.44
28	3/4/2005	75	0.07	7.39	1.39
29	3/15/2003	81	0.068	7.65	1.34
30	2/15/1986	78	0.068	7.92	1.3
31	3/19/1991	126	0.068	8.18	1.26
32	12/16/1987	115	0.067	8.44	1.22
33	3/5/1995	85	0.066	8.71	1.18
34	10/27/2004	79	0.065	8.97	1.15
35	12/10/1984	86	0.064	9.23	1.11
36	2/19/2007	118	0.064	9.5	1.08
37	2/14/1995	84	0.064	9.76	1.05
38	11/21/1996	78	0.064	10.03	1.03
39	11/12/1976	72	0.063	10.29	1
40	3/17/1983	241	0.063	10.55	0.98
41	2/28/1981	181	0.062	10.82	0.95
42	1/24/1995	111	0.059	11.08	0.93
43	2/2/1988	81	0.059	11.35	0.91
44	1/25/1999	105	0.058	11.61	0.89
45	11/29/1970	72	0.057	11.87	0.87
46	3/6/1975	208	0.055	12.14	0.85
47	2/18/1993	215	0.054	12.4	0.83
48	1/5/1979	75	0.054	12.66	0.81
49	8/14/1983	127	0.05	12.93	0.8
50	11/30/2007	74	0.05	13.19	0.78
51	12/17/1978	118	0.05	13.46	0.76
52	1/20/1982	81	0.05	13.72	0.75
53	12/6/1986	98	0.05	13.98	0.74
54	2/19/1980	106	0.05	14.25	0.72
55	3/20/1973	69	0.05	14.51	0.71
56	11/9/1982	82	0.05	14.78	0.7
57	1/5/2008	109	0.05	15.04	0.68
58	1/5/1987	92	0.05	15.3	0.67
59	2/2/1983	84	0.05	15.57	0.66
60	2/11/2005	98	0.049	15.83	0.65
61	12/4/1972	128	0.049	16.09	0.64
62	3/10/1980	65	0.049	16.36	0.63
63	5/8/1977	70	0.049	16.62	0.62
64	12/25/1988	83	0.049	16.89	0.61
65	4/1/1982	62	0.049	17.15	0.6
66	2/24/1987	102	0.049	17.41	0.59
67	3/11/1995	76	0.048	17.68	0.58
68	10/9/1986	66	0.048	17.94	0.57
69	3/2/2004	58	0.048	18.21	0.57
70	10/11/1987	81	0.048	18.47	0.56
71	9/25/1986	58	0.048	18.73	0.55
72	9/10/1976	72	0.048	19	0.54
73	1/4/1974	159	0.048	19.26	0.53
74	1/5/1992	88	0.048	19.53	0.53
75	1/12/1997	110	0.048	19.79	0.52

10-year Q:	1.257	cfs
5-year Q:	0.945	cfs
2-year Q:	0.277	cfs
Lower Flow Threshold:	10%	
0.1xQ2:	0.028	cfs

ATTACHMENT F

Flow Duration Comparison Curve


Node POC1
Flow Duration Curve Comparison
Pre-Nakano-DMA 1_3
Post-Nakano-DMA 1_ 3
100% Pass
Total inflow (cfs)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
1
10
100
Duration of Exceedance (h)



Node POC2
Flow Duration Curve Comparison
Post-Nakano-DMA 2-POC-2
Pre-Nakano-DMA 2
100% Pass
Total inflow (cfs)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
10
100
Duration of Exceedance (h)