# APPENDIX 7

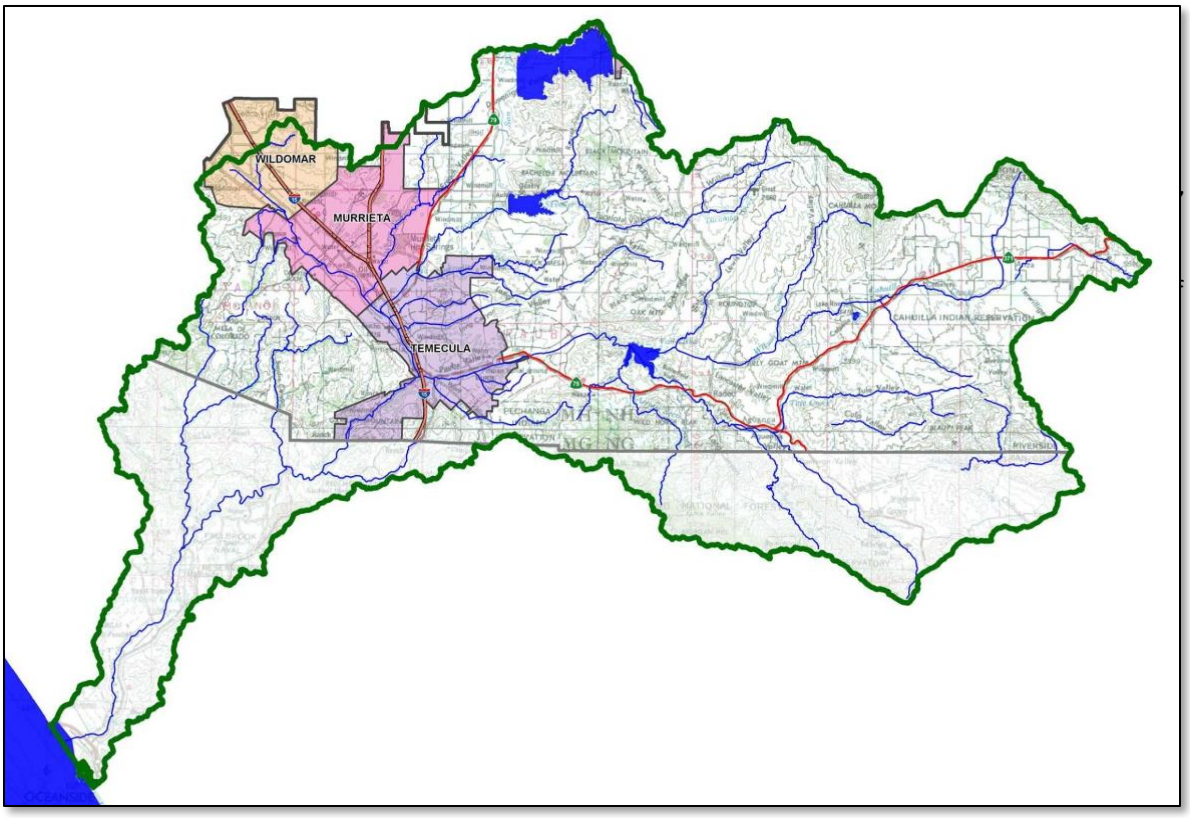
# Project Specific Water Quality Management Plan

*A Template for preparing Project Specific WQMPs for Priority Development Projects located within the **Santa Margarita Region** of Riverside County*

**Project Title:** Jefferson Apartments

**Development No:** TBD

**Design Review/Case No:** TBD




☒ **Preliminary**
☐ **Final**

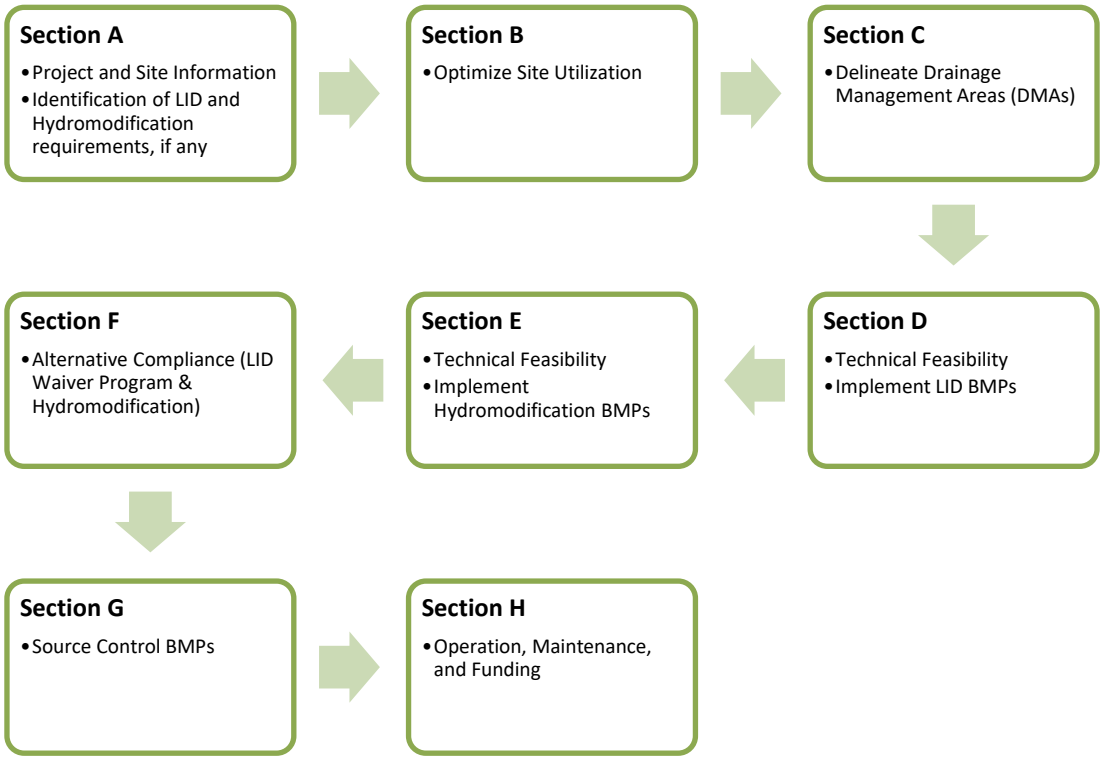
**Original Date Prepared**: 03/05/20

**Revision Date(s)**:

*Prepared for Compliance with*
*Regional Board Order No*. **TBD**

## A Brief Introduction

The Municipal Separate Stormwater Sewer System (MS4) Permit[1] for the **Santa Margarita Region** (SMR) requires preparation of a Project-Specific Water Quality Management Plan (WQMP) for all Development Projects as defined in section F.1.d.(1) of the Permit. This Project-Specific WQMP Template for Development Projects in the **Santa Margarita Region** has been prepared to help document compliance and prepare a WQMP submittal. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.




[1] Order No. R9-2010-0016, NPDES No. CAS0108766, Waste Discharge Requirements for Discharges from the MS4 Draining the County of Riverside, the Incorporated Cities of Riverside County, and the Riverside County Flood Control and Water Conservation District within the San Diego Region, California Regional Water Quality Control Board, November 10, 2010.

## OWNER'S CERTIFICATION

This Project-Specific WQMP has been prepared for Pacific West Development, LP by DRC Engineering for the Nutmeg Apartments project.

This WQMP is intended to comply with the requirements of The City of Murrieta for Municipal Code Section 8.36 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater Best Management Practices until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under The City of Murrieta Water Quality Ordinance (Municipal Code Section 8.36).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

| | |
|---|---|
| Owner's Signature | Date |
| Andrew Dixon | Owner |
| Owner's Printed Name | Owner's Title/Position |

## PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control Best Management Practices in this plan meet the requirements of Regional Water Quality Control Board Order No. **R9-2010-0016** and any subsequent amendments thereto."

| | |
|---|---|
| Preparer's Signature | Date |
| Matthew Hellesen | Project Manager |
| Preparer's Printed Name | Preparer's Title/Position |

Preparer's Licensure:

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## List of Appendices

# Section A: Project and Site Information

| | | |
|---|---|---|
| **PROJECT INFORMATION** | | |
| Type of Project: | Residential | |
| Planning Area: | | |
| Community Name: | Jefferson Apartments | |
| Development Name: | Jefferson Apartments | |
| **PROJECT LOCATION** | | |
| Latitude & Longitude (DMS): 33.58, -117.23 | | |
| Project Watershed and Sub-Watershed: Santa Margarita | | |
| APN(s): 906-020-012-4, 906-020-013-5, & 906-020-092-6 | | |
| Map Book and Page No.: Thomas Guide 927, G4 | | |
| **PROJECT CHARACTERISTICS** | | |
| Proposed or potential land use(s) | Mulitiple-Family Residential - MFR | |
| Proposed or Potential SIC Code(s) | 1520 | |
| Area of Impervious Project Footprint (SF) | 399,784 | |
| Total area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement | 399,784 | |
| Total Project Area (ac) | 9.18 | |
| Does the project consist of offsite road improvements? | ☐ Y | ☒ N |
| Does the project propose to construct unpaved roads? | ☐ Y | ☒ N |
| Is the project part of a larger common plan of development (phased project)? | ☐ Y | ☒ N |
| Is the project exempt from HMP Performance Standards? | ☐ Y | ☒ N |
| **EXISTING SITE CHARACTERISTICS** | | |
| Total area of existing Impervious Surfaces within the project limits (SF) | 0 | |
| Is the project located within any Multi-Species Habitat Conservation Plan (MSHCP Criteria Cell? | ☐ Y | ☒ N |
| If so, identify the Cell number: | | |
| Are there any natural hydrologic features on the project site? | ☐ Y | ☒ N |
| Is a Geotechnical Report attached? | ☒ Y | ☐ N |
| If no Geotech. Report, list the Natural Resources Conservation Service (NRCS) soils type(s) present on the site (A, B, C and/or D) | C | |
| What is the Water Quality Design Storm Depth for the project? | 0.80 | |

## A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the Project vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas (DMAs)
- Proposed Structural Best Management Practices (BMPs)
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces

- Drainage Path
- Drainage infrastructure, inlets, overflows
- Standard Labeling

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the co-permittee plan reviewer must be able to easily analyze your Project utilizing this template and its associated site plans and maps.

## A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the Receiving Waters that the Project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated Beneficial Uses, and proximity, if any, to a RARE Beneficial Use. Include a map of the Receiving Waters in Appendix 1. *(http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/)*

**Table A.1** Identification of Receiving Waters

| Receiving Waters | USEPA Approved 303(d) List Impairments | Designated Beneficial Uses | Proximity to RARE Beneficial Use |
|---|---|---|---|
| Warm Springs Creek | Iron, manganese, nitrogen, and phosphorus | MUN, AGR, IND, PROC, REC-1, REC-2, WARM, and WILD | |
| Murrieta Creek | Copper | MUN, AGR, IND, PROC, REC-1, REC-2, WARM, and WILD | |
| Santa Margarita River | | MUN, AGR, IND, PROC, REC-1, REC-2, WARM, COLD, WILD, and RARE | 12 Miles |

## A.3 Drainage System Susceptibility to Hydromodification

Using Table A.2 below, list in order of the point of discharge at the project site down to the Santa Margarita River, each drainage system or receiving water that the project site is tributary to. Continue to fill each row with the material of the drainage system, the storm drain susceptibility using the SWCT2 (Stormwater & Water Conservation Tracking Tool - http://rivco.permitrack.com/) or Map 2 of the Hydromodification Susceptibility Documentation Report and Mapping: Santa Margarita Region (Appendix D of the SMR HMP), and the condition for exempting the drainage system, if applicable. If the exemption includes receiving waters that were not evaluated in Appendix D, provide supporting documentation in Appendix 7 to demonstrate that they classify as Engineered, Fully Hardened and Maintained (EFHM) channels, consistent with the definition provided in Appendix D. Include a map exhibiting each drainage system and the associated susceptibility in Appendix 1.

**Table A.2** Identification of Susceptibility to Hydromodification

| Drainage System | Drainage System Material | Susceptibility of Drainage System | Hydromodification Exemption |
|---|---|---|---|
| Warm Springs Creek | Unimproved natural channel | Susceptable to hydromodication | NONE. |
| Murrieta Creek | Unimproved natural channel | Susceptable to hydromodication | NONE. |
| | | | |

## A.4 Additional Permits/Approvals required for the Project:

**Table A.3** Other Applicable Permits

| Agency | Permit Required | |
|---|---|---|
| State Department of Fish and Game, 1602 Streambed Alteration Agreement | ☐ Y | ☒ N |
| State Water Resources Control Board, Clean Water Act Section 401 Water Quality Certification | ☐ Y | ☒ N |
| US Army Corps of Engineers, Clean Water Act Section 404 Permit | ☐ Y | ☒ N |
| US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion | ☐ Y | ☒ N |
| Statewide Construction General Permit Coverage | ☐ Y | ☒ N |
| Statewide Industrial General Permit Coverage | ☐ Y | ☒ N |
| Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP) | ☐ Y | ☒ N |
| Other *(please list in the space below as required)* | ☐ Y | ☐ N |

After the project is completed, runoff from the site will drain through an on-site storm drain. The various areas on the site will drain into underground detention that will manipulate the peak flows to keep them close to what the predeveloped flows were. Before passing through the detention, the storm water will route through an above ground bio-filtration basin. This system will clean out various pollutants associated with a residential center. After the detention system, the storm water drains into one of two proposed storm drain outlet structures to the area west of the site.

Owner is responsible for the ongoing implementation of the operations and maintenance plan, see appendix 9. Owner is responsible for making the Inspection and maintenance checklist available to the city and regional board upon request.

The use of broadcast fertilizers will be prohibited. Fertilizer will be applied as a liquid through the irrigation system. The use of this restriction will reduce the amount of nitrogen and phosphorus that can be washed into the stormwater system. This will allow for a lower removal efficiency of the water quality system for these pollutants.

# Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, constraints might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. Opportunities might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for LID Bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your Low Impact Development (LID) design and explain your design decisions to others.

The 2010 SMR MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

## Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

*Yes, the runoff points from the site will remain the same and the outlets from the storm drain system will keep the peak flows within 10% of the existing peak flows.*

Did you identify and protect existing vegetation? If so, how? If not, why?

*No, there is no existing vegetation to preserve.*

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

*No, soil does not infiltrate.*

Did you identify and minimize impervious area? If so, how? If not, why?

*Yes, the use of impervious surfaces throughout the landscaped areas has been minimized and consists predominantly of parking, drive isles, and sidewalks necessary for accessibility.*

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

*Yes, drainage will be captured via surface flow into onsite drop inlets and catch basins throughout the site. Drainage will then be directed via onsite storm drains to the biofiltration ponds throughout the site.*

# Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your Project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

**Table C.1** DMA Classifications

| DMA Name or Identification | Surface Type(s)[1] | Area (Sq. Ft.) | DMA Type |
|---|---|---|---|
| A-1 | Landscaping | *60,630* | D |
| A-2 | Hardscape/Paving | *82,870* | D |
| A-3 | Roof Area | *32,000* | D |
| B-1 | Landscaping | *77,840* | D |
| B-2 | Hardscape/Paving | *104,700* | D |
| B-3 | Roof Area | *41,750* | D |

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*

**Table C.2** Type 'A', Self-Treating Areasd

| DMA Name or Identification | Area (Sq. Ft.) | Stabilization Type | Irrigation Type (if any) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

**Table C.3** Type 'B', Self-Retaining Areas

| Self-Retaining Area | | | | Type 'C' DMAs that are draining to the Self-Retaining Area | | |
|---|---|---|---|---|---|---|
| DMA Name/ ID | Post-project surface type | Area (square feet) [A] | Storm Depth (inches) [B] | DMA Name / ID | [C] from Table C.4 = [C] | Required Retention Depth (inches) [D] |
| | | | | | | |
| | | | | | | |
| | | | | | | |

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

**Table C.4** Type 'C', Areas that Drain to Self-Retaining Areas

| DMA | Receiving Self-Retaining DMA |
|---|---|

| DMA Name/ ID | Area (square feet) | Post-project surface type | Runoff factor | Product | DMA name /ID | Area (square feet) | Ratio |
|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] = [A] x [B] | | [D] | [C]/[D] |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

*Note: (See Section 3.3 of WQMP Guidance Document) Ensure that partially pervious areas draining to a Self-Retaining area do not exceed the following ratio:*

$$\left(\frac{2}{Impervious\ Fraction}\right) : 1$$

(Tributary Area**:** Self-Retaining Area)

**Table C.5** Type 'D', Areas Draining to BMPs

| DMA Name or ID | BMP Name or ID |
|---|---|
| A-1 | Bio-Filtration Basin |
| A-2 | Bio-Filtration Basin |
| A-3 | Bio-Filtration Basin |
| B-1 | Bio-Filtration Basin |
| B-2 | Bio-Filtration Basin |
| B-3 | Bio-Filtration Basin |

*Note: More than one DMA may drain to a single LID BMP; however, one DMA may not drain to more than one BMP.*

# Section D: Implement LID BMPs

## D.1 Infiltration Applicability

An assessment of the feasibility of utilizing Infiltration BMPs is required for all projects, *except in the following case:*

☐ Harvest and Use BMPs will be implemented to address the Design Capture Volume (see the Harvest and Use Assessment below) for all Drainage Management Areas AND the project is exempt from HMP Performance Standards (*Proceed to Section D.2 and Section E*).

If the above box remains unchecked, perform a site-specific evaluation of the feasibility of Infiltration BMPs using each of the applicable criteria identified in Chapter 3.4.1 of the WQMP Guidance Document and complete the remainder of Section D.1.

Is there an infiltration concern (see discussion in Chapter 2.3.4 of the WQMP Guidance Document for further details)? ☒ Y ☐ N

If yes has been checked, both Infiltration BMPs and Hydrologic Control BMPs that include infiltration functionalities may not be feasible for the site. It is recommended that you contact your Co-permittee to verify whether or not infiltration within the Project is infeasible.

### Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Co-permittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

### Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.3.4. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

**Table D.1** Infiltration Feasibility

| Does the project site… | YES | NO |
|---|---|---|
| …have any DMAs with a seasonal high groundwater mark shallower than 10 feet? | | X |
| If Yes, list affected DMAs: | | |
| …have any DMAs located within 100 feet of a water supply well? | | X |
| If Yes, list affected DMAs: | | |
| …have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact? | | X |
| If Yes, list affected DMAs: | | |
| …have measured in-situ infiltration rates of less than 1.6 inches / hour? | X | |
| If Yes, list affected DMAs: A through F | | |
| …have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface? | | X |
| If Yes, list affected DMAs: | | |
| …have any contaminated groundwater plume in the vicinity of the site? | | X |
| If Yes, list affected DMAs: | | |
| …geotechnical report identifies other site-specific factors that would preclude effective and safe infiltration? | | X |
| Describe here: | | |

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

## D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the Project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Co-permittee).

☒The Design Capture Volume (DCV) will be addressed using Biofiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the DCV will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site.

## D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.3 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

*Select one of the following:*

☒LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the Project as noted below in Section D.4

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5.

## D.4 Other Limiting Geotechnical Conditions

Onsite retention may not be feasible due to specific geotechnical concerns identified in the Geotechnical Report. If any, describe below. If no, write N/A:

N/A

**Table D.2** Geotechnical Concerns for Onsite Retention Table

| Type of Geotechnical Concern | DMAs Feasible (By Name or ID) | DMAs Infeasible (By Name or ID) |
|---|---|---|
| Collapsible Soil | | |
| Expansive Soil | | |
| Slopes | | |
| Liquefaction | | |
| Other | | |

## D.5 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.3 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

**Table D.3** LID Prioritization Summary Matrix

| DMA Name/ID | LID BMP Hierarchy | | | | No LID (Alternative Compliance) |
|---|---|---|---|---|---|
| | 1. Infiltration | 2. Harvest and use | 3. Bioretention | 4. Biotreatment | |
| A | ☐ | ☐ | ☐ | ☒ | ☐ |
| B | ☐ | ☐ | ☐ | ☒ | ☐ |
| C | ☐ | ☐ | ☐ | ☒ | ☐ |

## D.6 LID BMP Sizing

Each LID BMP must be designed to ensure that the DCV will be addressed by the selected BMPs. First**,** calculate the DCV for each LID BMP using the $V_{BMP}$ worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required $V_{BMP}$ using a method approved by the Co-permittee with jurisdiction over the Project site. Utilize the worksheets found in the LID BMP Design Handbook or consult with the Co-permittee to assist you in correctly sizing your LID BMPs. Complete Table D.4 below to document the DCV and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

**Table D.4** DCV Calculations for LID BMPs

| DMA Type/ID | DMA (sf) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Biofiltration Pond A* | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| **DMA A-1** | *60,630* | *Landscape* | *0.1* | *0.11* | *6,669* | *85TH Percentile Rainfall Depth* | *Design Treatment Volume [0.75 x* $V_{BMP}$ *(CF)]* | *Proposed treatment volume on Plans [*$V_{biofiltered\_static}$ *(CF)]* |
| ***DMA A-2*** | *82,870* | *Hardscape/Paving* | *1.0* | *0.89* | *73,754* | | | |
| ***DMA A-3*** | *32,000* | *Roof Area* | *1.0* | *0.89* | *28,480* | | | |
| | | | | | | | | |
| | 175,500 | | | | 108,903 | 0.80 | 3,950 | ***5,151*** |

Table D.5 DCV Calculations for LID BMPs

| DMA Type/ID | DMA (sf) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Biofiltration Pond B* | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| **DMA B-1** | *77,840* | *Landscape* | *0.1* | *0.11* | *5,673* | *85TH Percentile Rainfall Depth* | *Design Treatment Volume [0.75 x* $V_{BMP}$ *(CF)]* | *Proposed treatment volume on Plans [*$V_{biofiltered\_static}$ *(CF)]* |
| ***DMA B-2*** | *104,700* | *Hardscape/Paving* | *1.0* | *0.89* | *61,184* | | | |
| ***DMA B-3*** | *41,750* | *Roof Area* | *1.0* | *0.89* | *36,357* | | | |
| | | | | | | | | |
| | *224,290* | | | | 103,214 | 0.75 | 5,048 | ***6,869*** |

[B], [C] is obtained as described in Section 2.5 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

See Excel Calcs

# Section E: Implement Hydrologic Control BMPs and Sediment Supply BMPs

If a completed Table A.2 demonstrates that the project is exempt from HMP Performance Standards, specify N/A of proceed to Section F, if applicable, and Section G.

## E.1 Onsite Feasibility of Hydrologic Control BMPs

An assessment of the feasibility of implementing onsite Hydrologic Control BMPs is required for all projects.

*Select one of the following:*

☒ Yes – The implementation of Hydrologic Control BMPs is feasible onsite. *(Proceed to Step E.3 and Step E.4)*

- *Or* -

☐ No – The project site is larger than one acre and the implementation of Hydrologic Control BMPs is not feasible onsite. *(Proceed to Step E.5 and Step F for Alternative Compliance upon approval of the Technical Feasibility Assessment by the Co-permittee)*

☐ No – The project site is smaller than one acre and the implementation of Hydrologic Control BMPs is not feasible onsite. *(Proceed to Step E.2)*

If the reasons for infeasibility are different from those listed in Section D.1, describe the technical or spatial reasons that preclude the implementation of onsite Hydrologic Control BMPs. If none, write N/A:

N/A

Approval of the condition for infeasibility, if any, is required by the Co-permittee. Has the condition for infeasibility been approved by the Co-permittee?

☐ Y ☐ N ☒ N/A

## E.2 Meeting the HMP Performance Standard for Small Project Sites

*Select one of the following:*

☐ Yes – The project site is equal to or larger than one acre. *(Proceed to Step E.3, Step E.4, and Step E.5)*

- *Or* -

☐ No – The project site is less than one acre. *(Follow the remainder of Step E.2)*

Only a Simplified Technical Feasibility Study is required from the applicant. Complete the Simplified Technical Feasibility Study in Appendix 7, which must include, at a minimum, the soil conditions at the PDP, a demonstration of the lack of available space for onsite Hydrologic Control BMPs, an explanation of prohibitive costs to implement Hydrologic Control BMPs, and a written opinion from a Registered Geotechnical Engineer identifying the infeasibility due to geotechnical concerns.

*Select one of the following:*

☐ Yes – Onsite Hydrologic Control BMPs are feasible. *(Proceed to Step E., Step E.4, and Step E.5)*

- *Or* -

☐ No – Onsite Hydrologic Control BMPs are not feasible per the Simplified Technical Feasibility Study. *(Proceed to Section E.5 for Sediment Supply Performance Standard and Section F for Alternative Compliance)*

## E.3 Hydrologic Control BMP Selection

Capture of the DCV and achievement of the Hydrologic Performance Standard may be met by combined and/or separate structural BMPs. Similarly, compliance with the two identified requirements may be fully or partially achieved onsite.

For each DMA, identify in Table E.1 if the DCV is fully or partially captured onsite, if the Hydrologic Performance Standard is fully or partially met onsite (by using the SMRHM identified in Step E.4), and if structural BMPs for compliance with the LID requirement and the Hydrologic Performance Standard are combined.

**Table E.1 LID &** Hydromodification BMP Location

| DMA | LID BMP | Hydrologic Control BMP | Combined BMP | BMP type and ID |
|---|---|---|---|---|
| A | ☒ Onsite<br>☐ Partially Onsite<br>☐ Offsite<br>☐ None Required | ☒ Onsite<br>☐ Partially Onsite<br>☐ Offsite<br>☐ None Required | ☒ Yes<br>☐ No | N/A |
| B | ☒ Onsite<br>☐ Partially Onsite<br>☐ Offsite<br>☐ None Required | ☒ Onsite<br>☐ Partially Onsite<br>☐ Offsite<br>☐ None Required | ☒ Yes<br>☐ No | N/A |

For each DMA provide a narrative describing if the DCV and the Hydrologic Performance Standard are to be fully managed onsite. If not, the narrative should detail how and where offsite structural BMPs will achieve management of the DCV and the Hydrologic Performance Standard. N/A

## E.4 Hydrologic Control BMP Sizing

Each Hydrologic Control BMP must be designed to ensure that the flow duration curve of the post-development DMA will not exceed that of the pre-existing, naturally occurring, DMA by more than ten percent over a one-year period. Using SMRHM, the applicant shall demonstrate that the performance of

each designed Hydrologic Control BMP complies with the Hydrologic Performance Standard. Complete Table E.2 below and identify, for each DMA, the type of Hydrologic Control BMP, if the SMRHM model confirmed the management (Identified as "passed" in SMRHM), the total volume capacity of the Hydrologic Control BMP, the Hydrologic Control BMP footprint at top floor elevation, and the drawdown time of the Hydrologic Control BMP. SMRHM summary reports should be documented in Appendix 7. Refer to the SMRHM Guidance Document for additional information on SMRHM. You can add rows to the table as needed.

**Table E.2** Hydrologic Control BMP Sizing

| BMP Name / ID | DMA No. | BMP Type / Description | SMRHM Passed | BMP Volume (ac-ft) | BMP Footprint (ac) | Drawdown time (hr) |
|---|---|---|---|---|---|---|
| A | A | 48" HDPE Storm Drain | ☒ | | | |
| B | B | 48" HDPE Storm Drain | ☒ | | | |

## E.5 Implement Sediment Supply BMPs

The applicant may refer to Section 2.3 of the SMR HMP for a comprehensive description of the methodology to meet the Sediment Supply Performance Standard. Complete the following steps to determine compliance with the Sediment Supply Performance Standard:

Step 1: Identify if the site is a Significant Source of Bed Sediment Supply to the receiving channel

☐ Step 1.A – Is the Bed Sediment of onsite streams similar to that of receiving streams?

Rate the similarity:
☐ High
☐ Medium
☒ Low

Results from the geotechnical and sieve analysis to be performed both onsite and in the receiving channel should be documented in Appendix 7. Of particular interest, the results of the sieve analysis, the soil erodibility factor, a description of the topographic relief of the project area, and the lithology of onsite soils should be reported in Appendix 7.

☐ Step 1.B – Are onsite streams capable of delivering Bed Sediment Supply from the site, if any, to the receiving channel?

Rate the potential:
☐ High
☐ Medium
☒ Low

Results from the analyses of the sediment delivery potential to the receiving channel should be documented in Appendix 7 and identify, at a minimum, the Sediment Source, the distance to the receiving channel, the onsite channel density, the project watershed area, the slope, length, land use, and rainfall intensity.

☐ Step 1.C – Will the receiving channel adversely respond to a change in Bed Sediment Load?

Rate the need for bed sediment supply:

☐ High

☐ Medium

☒ Low

Results from the in-stream analysis to be performed both onsite should be documented in Appendix 7. The analysis should, at a minimum, quantify the bank stability and the degree of incision, provide a gradation of the Bed Sediment within the receiving channel, and identify if the channel is sediment supply-limited.

☐ Step 1.D – Summary of Step 1

Summarize in Table E.3 the findings of Step 1 and associate a score (in parenthesis) to each step. The sum of the three individual scores determines if a stream is a significant contributor to the receiving stream.

- Sum is equal to or greater than eight - Site is a significant source of sediment bed material – all on-site streams must be preserved or by-passed within the site plan. The applicant shall proceed to Step 2 for all onsite streams.
- Sum is greater than five but lower than eight. Site is a source of sediment bed material – some of the on-site streams must be preserved (with identified streams noted). The applicant shall proceed to Step 2 for the identified streams only.
- Sum is equal to or lower than five. Site is not a significant source of sediment bed material. The applicant may advance to Section F.

**Table E.3** Triad Assessment Summary

| Step | Rating | | | Total Score |
|---|---|---|---|---|
| 1.A | ☐ High (3) | ☐ Medium (2) | ☒ Low (1) | 1 |
| 1.B | ☐ High (3) | ☐ Medium (2) | ☒ Low (1) | 1 |
| Significant Source Rating of Bed Sediment to the receiving channel(s) | | | | 2 |

Step 2: Preservation of Identified Onsite Channels

Onsite streams identified as a Significant Source of Bed Sediment should be avoided in the site design.

*Check one of the following:*

☐ The site design does avoid all onsite channels identified as a Significant Source of Bed Sediment *(The applicant may disregard subsequent steps of Section E.5 and directly advance directly to Section F.*)

- *Or* -

☐ The site design **does NOT avoid** all onsite channels identified as a Significant Source of Bed Sediment *(The applicant may proceed with the subsequent steps of Section E.5).*

Provide in Appendix 7 a site map that identifies all onsite channels and highlights those onsite channels that were identified as a Significant Source of Bed Sediment. The site map shall demonstrate, if feasible, that the site design avoids those onsite channels identified as a Significant Source of Bed Sediment. In addition, the applicant shall describe the characteristics of each onsite channel identified as a Significant Source of Bed Sediment. If the design plan cannot avoid the onsite channels, please provide a rationale for each channel individually.

Identified Channel #1 - Insert narrative description here

Identified Channel #2 - Insert narrative description here

Identified Channel #3 - Insert narrative description here

Step 3: By-Pass of Upstream Drainage(s) to Preserve the discharge of Bed Sediment Supply to the receiving channel(s)

Onsite channels identified as a Significant Source of Bed Sediment Supply should be by-passed the discharge of Bed Sediment Supply to the receiving channel(s).

*Check one of the following:*

☐ The site design does avoid and/or bypass all onsite channels identified as a source of Bed Sediment Supply *(The applicant may directly advance to Section F.*)

- *Or* -

☐ The site design **does NOT avoid or by-pass** all onsite channels identified as a source of Bed Sediment Supply *(The applicant may proceed to an Alternative Approach, as defined in Section F).*

Provide in Appendix 7 a site map that identifies all onsite channels and highlights those onsite channels that were identified as a Significant Source of Bed Sediment Supply. The site map shall demonstrate, if feasible, that the site design avoids or by-passes those onsite channels of significant Bed Sediment Supply to the receiving channel(s). In addition, the applicant shall describe the characteristics of each onsite channel identified as a Significant Source of Bed Sediment Supply. If the design plan cannot avoid or by-pass the onsite channels, please provide a rationale for each channel individually.

Identified Channel #1 - Insert narrative description here

Identified Channel #2 - Insert narrative description here

Identified Channel #3 - Insert narrative description here

# Section F: Alternative Compliance

LID BMPs and Hydrologic Control BMPs are expected to be feasible on virtually all projects. Where LID BMPs and/or Hydrologic Control BMPs have been demonstrated to be infeasible as documented in Section D and/or Section E, respectively, other Treatment Control BMPs or alternative compliance approaches must be used (subject LID waiver and/or HMP alternative compliance approval by the Co-permittee).

In addition, if supporting documentation demonstrates the infeasibility to implement Sediment Supply BMPs onsite (See Section E.5), the applicant may refer to Section F.5.

Check one of the following boxes:

☒ LID Principles, LID BMPs, Hydrologic Control BMPs, and Sediment Supply BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ LID Principles and LID BMPs have NOT been incorporated into the site design to fully address the LID requirements for all Drainage Management Areas AND HMP Performance Standards are not fully addressed in the following Drainage Management Areas.

- The following Drainage Management Areas are unable to be addressed using LID BMPs. A site specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-permittee and included in Appendix 5. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated. The applicant should complete Section F.1, Section F.2, and Section F.3, as applicable.
- A site specific analysis demonstrating technical infeasibility of Hydrologic Control BMPs and Sediment Supply BMPs has been approved by the Co-permittee and included in Appendix 7. Projects less than one acre have completed the Simplified Technical Feasibility Study. The applicant should complete Section F.5 and/or Section F.6, as applicable.

List DMAs Here.

- *Or* -

☐ LID Principles and LID BMPs have been incorporated into the site design to fully address the DCV for all Drainage Management Areas. However, HMP Performance Standards are not fully addressed in the following Drainage Management Areas. A site specific analysis demonstrating technical infeasibility of Hydrologic Control BMPs and Sediment Supply BMPs has been

approved by the Co-permittee and included in Appendix 7. Projects less than one acre have completed the Simplified Technical Feasibility. The applicant should complete Section F.5 and/or Section F.6, as applicable.

List DMAs Here.

# F.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's Receiving Waters and their associated USEPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table F.1 below. If the identified General Pollutant Categories are the same as those listed for your Receiving Waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

**Table F.1** Potential Pollutants by Land Use Type

| Priority Development Project Categories and/or Project Features (check those that apply) | General Pollutant Categories | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Bacterial Indicators | Metals | Nutrients | Pesticides | Toxic Organic Compounds | Sediments | Trash & Debris | Oil & Grease |
| ☒ Detached Residential Development | P | N | P | P | N | P | P | P |
| ☒ Attached Residential Development | P | N | P | P | N | P | P | P(2) |
| ☐ Commercial/Industrial Development | P(3) | P | P(1) | P(1) | P(5) | P(1) | P | P |
| ☐ Automotive Repair Shops | N | P | N | N | P(4, 5) | N | P | P |
| ☐ Restaurants (>5,000 ft$^2$) | P | N | N | N | N | N | P | P |
| ☐ Hillside Development (>5,000 ft$^2$) | P | N | P | P | N | P | P | P |
| ☒ Parking Lots (>5,000 ft$^2$) | P(6) | P | P(1) | P(1) | P(4) | P(1) | P | P |
| ☐ Retail Gasoline Outlets | N | P | N | N | P | N | P | P |
| **Project Priority Pollutant(s) of Concern** | ☒ | ☒ | ☐ | ☐ | ☒ | ☐ | ☒ | ☒ |

*P = Potential*

*N = Not Potential*

*(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected*

*(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected*

*(3) A potential Pollutant is land use involving animal waste*

*(4) Specifically petroleum hydrocarbons*

*(5) Specifically solvents*

*(6) Bacterial indicators are routinely detected in pavement runoff*

## F.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement Smart Growth Principles are potentially eligible for Stormwater Credits. Utilize Table 3-7 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

**Table F.2 Stormwater** Credits

| Qualifying Project Categories | Credit Percentage[2] |
|---|---|
| N/A | |
| | |
| | |
| *Total Credit Percentage[1]* | |

*[1]Cannot Exceed 50%*
*[2]Obtain corresponding data from Table 3-7 in the WQMP Guidance Document*

## F.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your Project, utilize Table F.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.5 of the WQMP Guidance Document for further information.

**Table F.3** Treatment Control BMP Sizing

| DMA Type/ID | DMA (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA x Runoff Factor | | *Enter BMP Name / Identifier Here* | | |
|---|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | | |
| A | | | | | | *Design Storm Depth (in)* | *Minimum DCV or Design Flow Rate (cubic feet or cfs)* | *Total Storm Water Credit % Reduction* | *Proposed Volume or Flow on Plans (cubic feet or cfs)* |
| B | | | | | | | | | |
| C | | | | | | | | | |
| | | | | | | | | | |
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| | | | | | | | | | |

[B], [C] is obtained as described in Section 2.5 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Stormwater Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

## F.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential Pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

**Table F.4** Treatment Control BMP Selection

| Selected Treatment Control BMP Name or ID[1] | Priority Pollutant(s) of Concern to Mitigate[2] | Removal Efficiency Percentage[3] |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

*[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.*
*[2] Cross Reference Table E.1 above to populate this column.*
*[3] As documented in a Co-permittee Approved Study and provided in Appendix 6.*

## F.5 Hydrologic Performance Standard – Alternative Compliance Approach

Alternative compliance options are only available if the governing Co-permittee has acknowledged the infeasibility of onsite Hydrologic Control BMPs and approved an alternative compliance approach. Attach to Appendix 7 the Technical Feasibility Study (Projects equal or greater than one acre) or Simplified Technical Feasibility Study (Projects less than one acre) along with a written approval from the Co-permittee. The applicant may refer to Section 2.2.iv of the SMR HMP for extensive guidelines on the alternative compliance approach.

*Select the pursued alternative and describe the specifics of the alternative:*

☐ Offsite Hydrologic Control Management within the same channel system

Insert narrative description here

☐ In-Stream Restoration Project

Insert narrative description here

**For Offsite Hydrologic Control BMP Option**

Each Hydrologic Control BMP must be designed to ensure that the flow duration curve of the post-development DMA will not exceed that of the pre-existing, naturally occurring, DMA by more than ten percent over a one-year period. Using SMRHM, the applicant shall demonstrate that the performance of each designed Hydrologic Control BMP is equivalent with the Hydrologic Performance Standard for onsite conditions. Complete Table F.4 below and identify, for each Hydrologic Control BMP, the equivalent DMA the Hydrologic Control BMP mitigates, that the SMRHM model passed, the total volume capacity of the BMP, the BMP footprint at top floor elevation, and the drawdown time of the BMP. SMRHM summary reports for the alternative approach should be documented in Appendix 7. Refer to the SMRHM Guidance Document for additional information on SMRHM. You can add rows to the table as needed.

**Table F.5** Offsite Hydrologic Control BMP Sizing

| BMP Name / Type | Equivalent DMA (ac) | SMRHM Passed | BMP Volume (ac-ft) | BMP Footprint (ac) | Drawdown time (hr) |
|---|---|---|---|---|---|
| | | ☐ | | | |
| | | ☐ | | | |
| | | ☐ | | | |
| | | ☐ | | | |

**For Instream Restoration Option**

Attach to Appendix 7 the technical report detailing the condition of the receiving channel subject to the proposed hydrologic and sediment regimes. Provide the full design plans for the in-stream restoration project that have been approved by the Co-permittee.

## F.6 Sediment Supply Performance Standard - Alternative Compliance

The alternative compliance option to the Sediment Supply Performance Standard is only available if the governing Co-permittee has approved the investigation of alternative Bed Sediment Supply options. Attach to Appendix 7 the Technical Feasibility Study, along with the modeling analysis, the long-term monitoring program, and the potential corrective actions, that demonstrate the performance of the overall alternative compliance program. The applicant may refer to Section 2.3.ii of the SMR HMP for extensive guidelines on the alternative compliance approach.

Provide a narrative describing the alternative Bed Sediment Supply approach, including the long-term monitoring program and the findings of the numerical modeling.

–

# Section G: Source Control BMPs

Source Control BMPs include permanent, structural features that may be required in your Project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular

sweeping and "housekeeping", that must be implemented by the site's occupant or user. The Maximum Extent Practicable (MEP) standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective structural BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources*:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit*:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative*:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Co-permittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

**Table G.1** Structural and Operational Source Control BMP

| Potential Sources of Runoff Pollutants | Structural Source Control BMPs | Operational Source Control BMPs |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

# Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

**Table H.1** Construction Plan Cross-reference

| BMP No. or ID | BMP Identifier and Description | Corresponding Plan Sheet(s) |
|---|---|---|
| | | |
| | | |
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| | | |
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| | | |
| | | |

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. The Co-permittee with jurisdiction over the Project site can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

# Section I: Operation, Maintenance and Funding

The Co-permittee with jurisdiction over the Project site will periodically verify that BMPs on your Project are maintained and continue to operate as designed. To make this possible, the Co-permittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement maintenance of BMPs in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized Operations and Maintenance or inspections but will require typical landscape maintenance as noted in Chapter 5, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

The Co-permittee with jurisdiction over the Project site will also require that you prepare and submit a detailed BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

**Maintenance Mechanism:** -

Will the proposed BMPs be maintained by a Homeowners' Association (HOA) or Property Owners Association (POA)?

☒ Y ☐ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

# Acronyms, Abbreviations and Definitions

| | |
|---|---|
| 2010 SMR MS4 Permit | Order No. R9-2010-0016, an NPDES Permit issued by the San Diego Regional Water Quality Control Board. |
| Applicant | Public or private entity seeking the discretionary approval of new or replaced improvements from the Co-permittee with jurisdiction over the project site. The Applicant has overall responsibility for the implementation and the approval of a Priority Development Project. The WQMP uses consistently the term "user" to refer to the applicant such as developer or project proponent.<br>The WQMP employs also the designation "user" to identify the Registered Professional Civil Engineer responsible for submitting the Project-Specific WQMP, and designing the required BMPs. |
| Best Management Practice (BMP) | Defined in 40 CFR 122.2 as schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. In the case of municipal storm water permits, BMPs are typically used in place of numeric effluent limits. |
| BMP Fact Sheets | BMP Fact Sheets are available in the LID BMP Design Handbook. Individual BMP Fact Sheets include sitting considerations, and design and sizing guidelines for seven types of structural BMPs (infiltration basin, infiltration trench, permeable pavement, harvest-and-use, bioretention, extended detention basin, and sand filter). |
| California Stormwater Quality Association (CASQA) | Publisher of the California Stormwater Best Management Practices Handbooks, available at www.cabmphandbooks.com. |
| Conventional Treatment Control BMP | A type of BMP that provides treatment of stormwater runoff. Conventional treatment control BMPs, while designed to treat particular Pollutants, typically do not provide the same level of volume reduction as LID BMPs, and commonly require more specialized maintenance than LID BMPs. As such, the 2010 SMR MS4 Permit and this WQMP require the use of LID BMPs wherever feasible, before Conventional Treatment BMPs can be considered or implemented. |
| Co-permittees | The 2010 SMR MS4 Permit identifies the Cities of Murrieta, Temecula, and Wildomar, the County, and the District, as Co-permittees for the SMR. |
| County | The abbreviation refers to the County of Riverside in this document. |

| | |
|---|---|
| CEQA | California Environmental Quality Act - a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. |
| CIMIS | California Irrigation Management Information System - an integrated network of 118 automated active weather stations all over California managed by the California Department of Water Resources. |
| CWA | Clean Water Act - is the primary federal law governing water pollution. Passed in 1972, the CWA established the goals of eliminating releases of high amounts of toxic substances into water, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human sports and recreation by 1983.<br>CWA Section 402(p) is the federal statute requiring NPDES permits for discharges from MS4s. |
| CWA Section 303(d) Waterbody | Impaired water in which water quality does not meet applicable water quality standards and/or is not expected to meet water quality standards, even after the application of technology based pollution controls required by the CWA. The discharge of urban runoff to these water bodies by the Co-permittees is significant because these discharges can cause or contribute to violations of applicable water quality standards. |
| Design Storm | The 2010 SMR MS4 Permit has established the 85th percentile, 24-hour storm event as the "Design Storm". The applicant may refer to Exhibit A to identify the applicable Design Storm Depth (D85) to the project. |
| DCV | Design Capture Volume (DCV) is the volume of runoff produced from the Design Storm to be mitigated through LID Retention BMPs, Other LID BMPs and Volume Based Conventional Treatment BMPs, as appropriate. |
| Design Flow Rate | The design flow rate represents the minimum flow rate capacity that flow-based conventional treatment control BMPs should treat to the MEP, when considered. |
| DCIA | Directly Connected Impervious Areas - those impervious areas that are hydraulically connected to the MS4 (i.e. street curbs, catch basins, storm drains, etc.) and thence to the structural BMP without flowing over pervious areas. |
| Discretionary Approval | A decision in which a Co-permittee uses its judgment in deciding whether and how to carry out or approve a project. |
| District | Riverside County Flood Control and Water Conservation District. |
| DMA | A Drainage Management Area - a delineated portion of a project site that is hydraulically connected to a common structural BMP or conveyance point. The Applicant may refer to Section 3.3 for further guidelines on how to delineate DMAs. |

| | |
|---|---|
| Drawdown Time | Refers to the amount of time the design volume takes to pass through the BMP. The specified or incorporated drawdown times are to ensure that adequate contact or detention time has occurred for treatment, while not creating vector or other nuisance issues. It is important to abide by the drawdown time requirements stated in the fact sheet for each specific BMP. |
| Effective Area | Area which 1) is suitable for a BMP (for example, if infiltration is potentially feasible for the site based on infeasibility criteria, infiltration must be allowed over this area) and 2) receives runoff from impervious areas. |
| ESA | An Environmental Sensitive Area (ESA) designates an area "in which plants or animals life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments". (Reference: California Public Resources Code § 30107.5). |
| ET | Evapotranspiration (ET) is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues). It is also an indicator of how much water crops, lawn, garden, and trees need for healthy growth and productivity |
| FAR | The Floor Area Ratio (FAR) is the total square feet of a building divided by the total square feet of the lot the building is located on. |
| Flow-Based BMP | Flow-based BMPs are conventional treatment control BMPs that are sized to treat the design flow rate. |
| FPPP | Facility Pollution Prevention Plan |
| HCOC | Hydrologic Condition of Concern - Exists when the alteration of a site's hydrologic regime caused by development would cause significant impacts on downstream channels and aquatic habitats, alone or in conjunction with impacts of other projects. |
| HMP | Hydromodification Management Plan – Plan defining Performance Standards for PDPs to manage increases in runoff discharge rates and durations. |
| Hydrologic Control BMP | BMP to mitigate the increases in runoff discharge rates and durations and meet the Performance Standards set forth in the HMP. |
| HSG | Hydrologic Soil Groups – soil classification to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSGs are A (very low runoff potential/high infiltration rate), B, C, and D (high runoff potential/very low infiltration rate) |

| | |
|---|---|
| Hydromodification | The 2010 SMR MS4 Permit identifies that increased volume, velocity, frequency and discharge duration of storm water runoff from developed areas has the potential to greatly accelerate downstream erosion, impair stream habitat in natural drainages, and negatively impact beneficial uses. |
| JRMP | A separate Jurisdictional Runoff Management Plan (JRMP) has been developed by each Co-permittee and identifies the local programs and activities that the Co-permittee is implementing to meet the 2010 SMR MS4 Permit requirements. |
| LID | Low Impact Development (LID) is a site design strategy with a goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques. LID site design BMPs help preserve and restore the natural hydrologic cycle of the site, allowing for filtration and infiltration which can greatly reduce the volume, peak flow rate, velocity, and pollutant loads of storm water runoff. |
| LID BMP | A type of stormwater BMP that is based upon Low Impact Development concepts. LID BMPs not only provide highly effective treatment of stormwater runoff, but also yield potentially significant reductions in runoff volume – helping to mimic the pre-project hydrologic regime, and also require less ongoing maintenance than Treatment Control BMPs. The applicant may refer to Chapter 2. |
| LID BMP Design Handbook | The LID BMP Design Handbook was developed by the Co-permittees to provide guidance for the planning, design and maintenance of LID BMPs which may be used to mitigate the water quality impacts of PDPs within the County. |
| LID Bioretention BMP | LID Bioretention BMPs are bioretention areas are vegetated (i.e., landscaped) shallow depressions that provide storage, infiltration, and evapotranspiration, and provide for pollutant removal (e.g., filtration, adsorption, nutrient uptake) by filtering stormwater through the vegetation and soils. In bioretention areas, pore spaces and organic material in the soils help to retain water in the form of soil moisture and to promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants use soil moisture and promote the drying of the soil through transpiration.<br>The 2010 SMR MS4 Permit defines "retain" as to keep or hold in a particular place, condition, or position without discharge to surface waters. |
| LID Biotreatment BMP | BMPs that reduce stormwater pollutant discharges by intercepting rainfall on vegetative canopy, and through incidental infiltration and/or evapotranspiration, and filtration, and other biological and chemical processes. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded, and sequestered by the soil and plants, and collected through an underdrain. |

| | |
|---|---|
| LID Harvest and Reuse BMP | BMPs used to facilitate capturing Stormwater Runoff for later use without negatively impacting downstream water rights or other Beneficial Uses. |
| LID Infiltration BMP | BMPs to reduce stormwater runoff by capturing and infiltrating the runoff into in-situ soils or amended onsite soils. Typical LID Infiltration BMPs include infiltration basins, infiltration trenches and pervious pavements. |
| LID Retention BMP | BMPs to ensure full onsite retention without runoff of the DCV such as infiltration basins, bioretention, chambers, trenches, permeable pavement and pavers, harvest and reuse. |
| LID Principles | Site design concepts that prevent or minimize the causes (or drivers) of post-construction impacts, and help mimic the pre-development hydrologic regime. |
| MEP | Maximum Extent Practicable - standard established by the 1987 amendments to the CWA for the reduction of Pollutant discharges from MS4s. Refer to Attachment C of the 2010 SMR MS4 Permit for a complete definition of MEP. |
| MF | Multi-family – zoning classification for parcels having 2 or more living residential units. |
| MS4 | Municipal Separate Storm Sewer System (MS4) is a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or designated and approved management agency under section 208 of the CWA that discharges to waters of the United States; (ii) Designated or used for collecting or conveying storm water; (iii) Which is not a combined sewer; (iv) Which is not part of the Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.26. |
| New Development Project | Defined by the 2010 MS4 permit as 'Priority Development Projects' if the project, or a component of the project meets the categories and thresholds described in Section 1.1.1. |
| NPDES | National Pollution Discharge Elimination System - Federal program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of the CWA. |
| NRCS | Natural Resources Conservation Service |

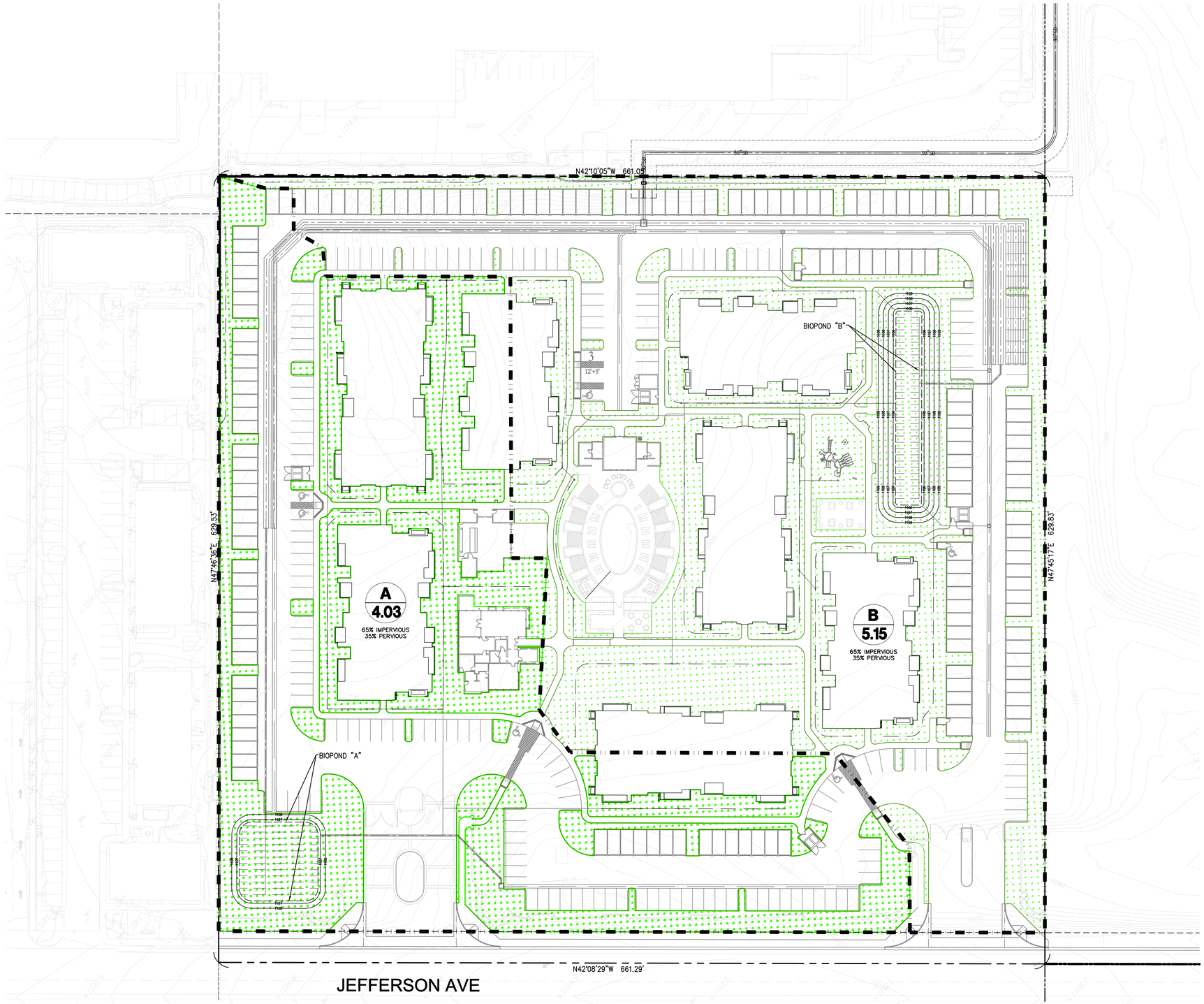
| | |
|---|---|
| PDP | Priority Development Project - Includes New Development and Redevelopment project categories listed in Section F.1.d(2) of Order No. R9-2009-0002. |
| Priority Pollutants of Concern | Pollutants expected to be present on the project site and for which a downstream water body is also listed as Impaired under the CWA Section 303(d) list or by a TMDL. |
| Project-Specific WQMP | A plan specifying and documenting permanent LID Principles and Stormwater BMPs to control post-construction Pollutants and stormwater runoff for the life of the PDP, and the plans for operation and maintenance of those BMPs for the life of the project. |
| Receiving Waters | Waters of the United States. |
| Redevelopment Project | The creation, addition, and or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include trenching and resurfacing associated with utility work; resurfacing existing roadways; new sidewalk construction, pedestrian ramps, or bike lane on existing roads; and routine replacement of damaged pavement, such as pothole repair.<br>Project that meets the criteria described in Section 1. |
| Runoff Fund | Runoff Funds have not been established by the Co-permittees and are not available to the Applicant.<br>If established, a Runoff Fund will develop regional mitigation projects where PDPs will be able to buy mitigation credits if it is determined that implementing onsite controls is infeasible. |
| San Diego Regional Board | San Diego Regional Water Quality Control Board - The term "Regional Board", as defined in Water Code section 13050(b), is intended to refer to the California Regional Water Quality Control Board for the San Diego Region as specified in Water Code Section 13200. State agency responsible for managing and regulating water quality in the SMR. |
| SCCWRP | Southern California Coastal Water Research Project |
| Site Design BMP | Site design BMPs prevent or minimize the causes (or drivers) of post-construction impacts, and help mimic the pre-development hydrologic regime. |
| SF | Parcels with a zoning classification for a single residential unit. |
| SMC | Southern California Stormwater Monitoring Coalition |
| SMR | The Santa Margarita Region (SMR) represents the portion of the Santa Margarita Watershed that is included within the County of Riverside. |

| | |
|---|---|
| Source Control BMP | Source Control BMPs land use or site planning practices, or structural or nonstructural measures that aim to prevent runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between Pollutants and runoff. |
| Stormwater Credit | Stormwater Credit can be claimed by an Applicant if certain development practices that provide broad-scale environmental benefits to communities are incorporated into the project design. Refer to Section 3.5.4 for additional information on Stormwater Credits. |
| Structural BMP | Structures designed to remove pollutants from stormwater runoff and mitigate hydromodification impacts. |
| SWPPP | Storm Water Pollution Prevention Plan |
| Tentative Tract Map | Tentative Tract Maps are required for all subdivision creating five (5) or more parcels, five (5) or more condominiums as defined in Section 783 of the California Civil Code, a community apartment project containing five (5) or more parcels, or for the conversion of a dwelling to a stock cooperative containing five (5) or more dwelling units. |
| TMDL | Total Maximum Daily Load - the maximum amount of a Pollutant that can be discharged into a waterbody from all sources (point and non-point) and still maintain Water Quality Standards. Under CWA Section 303(d), TMDLs must be developed for all waterbodies that do not meet Water Quality Standards after application of technology-based controls. |
| USEPA | United States Environmental Protection Agency |
| Volume-Based BMP | Volume-Based BMPs applies to BMPs where the primary mode of pollutant removal depends upon the volumetric capacity such as detention, retention, and infiltration systems. |
| WQMP | Water Quality Management Plan |
| Wet Season | The 2010 SMR MS4 Permit defines the wet season from October 1 through April 30. |

# Appendix 1: Maps and Site Plans

*Location Map, WQMP Site Plan and Receiving Waters Map*

## Location Map




## LEGEND

- DRAINAGE SUBAREA BOUNDARY
- DRAINAGE FLOW PATH
- X / X.XX — DRAINAGE SUBAREA DESIGNATION / DRAINAGE SUBAREA IN ACRES
- LANDSCAPE AREA

PROJECT SITE = 9.18 ACRES (416,328 SF)
DISTURBED AREA = 9.18 ACRES (416,328 SF)

TOTAL IMPERVIOUS AREA = 6.22 ACRES (67.8%)
TOTAL PERVIOUS AREA = 2.96 ACRES (32.2%)

20' 0' 20' 40' 60'
GRAPHIC SCALE: 1"=20'

NOT FOR CONSTRUCTION


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

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


NO.: REVISION: DATE:

PROJECT: PWD JEFFERSON APARTMENTS
MURRIETA, CA 92562
DRAWING NAME: WQMP SITE MAP

| | |
|---|---|
| ISSUE: | WQMP |
| DATE: | 5/12/2020 |
| CHECKED: MH | DRAWN: DG |
| DRAWING FILE: | |
| PROJECT NO.: | 19-062 |
| SHEET NUMBER: | 1 |
| OF 1 | SHEETS |
| SCALE: | AS SHOWN |



FILENAME: M:\2019\19-062 PWD Jefferson Apartments Murrieta\WQMP\19062_WQ MAP.dwg, LAST SAVED ON: May 13 2020 12:30pm PLOTTED BY: DANIEL, ON: May 13 2020 12:30pm, CFG:

# Appendix 2: Construction Plans

*Grading and Drainage Plans*

# Appendix 3: Soils Information

*Geotechnical Study and Other Infiltration Testing Data*

# PRELIMINARY PERCOLATION EVALUATION

**Proposed 9-acre Jefferson Street Multi-family Project**
**Jefferson Avenue and Murrieta Hot Springs Road**
**City of Murrieta, Riverside County, California**
**Parcel Map 31078**

**September 11, 2019**

**EEI Project PWD-72978.4**

3146 Tiger Run Court., Suite 118, Carlsbad, CA 92010 * Ph: (760) 431-3747 www.eeitiger.com

**PRELIMINARY PERCOLATION EVALUATION**

Prepared for:

Mr. Dan Dobron
Pacific West Development, LP
32823 Temecula Parkway, Suite A
Temecula, CA 92592

Subject Property Location:

Proposed 9-acre Jefferson Street Multi-family Project
Jefferson Avenue and Murrieta Hot Springs Road
City of Murrieta, Riverside County, California
Parcel Map 31078

Prepared by:

Emilio Haro Jarvis
Staff Geologist

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GE 2199 (exp. 6/30/20)
Senior Geotechnical Engineer

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Carlsbad, California 92010

**EEI Project PWD-72978.4**

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**Distribution:** (2) Addressee one electronic copy

## 1.0 INTRODUCTION

### 1.1 Purpose

The purpose of this Preliminary Percolation Evaluation is to provide preliminary percolation information to Pacific West Development, LP regarding the subject property in the City of Murrieta, Riverside County, California (**Figure 1** -Site Vicinity Map, **Figure 2**-Aerial Site Map), for onsite stormwater design purposes. The location and approximate depth of the percolation tests were provided by our client; Pacific West Development, LP.

This evaluation has been conducted in general accordance with accepted geotechnical engineering principles and in general conformance with the approved proposal and cost estimate for the project by EEI, dated August 14th, 2019.

### 1.2 Project Description

Based on information provided by the Client and a recent site plan provided by DRC (undated), we understand that development of the subject property will consist of 9 multi-story apartment structures, as well as a central leasing office. However; it is understood that project is undergoing plan revisions. No further information is known at this time. No detailed grading plans were provided to EEI at the time of our preparation of this report.

### 1.3 Scope of Services

The scope of our services included:

- A review of readily available data pertinent to the subject property, including published and unpublished geologic reports/maps, and soils data for the area (**References**).
- Conducting a geotechnical reconnaissance of the subject property and nearby vicinity.
- Coordination with Underground Service Alert (USA) to identify the presence of underground utilities for clearance of proposed boring locations.
- Drilling and logging of five (5) pairs of 6-inch diameter borings with a truck-mounted CME-75 drill rig. Borings were advanced at approximate locations designated by DRC to depths of approximately 3 feet to 8 feet below the ground surface (bgs).
- Conducting percolation testing at each of the ten (10) boring locations. The approximate locations of each of the borings and percolation tests are presented on **Figure 3** (Percolation Locations Map).
- Preparation of this report to presents our preliminary findings.

## 2.0 BACKGROUND

### 2.1 Subject Property Description

Based on the information provided by Client and review of the GoogleEarth® online imagery, the subject property consists of approximately 9-acres and is located roughly 1,200-feet west of the intersection of Jefferson Avenue and Murrieta Hot Springs Road, in the City of Murrieta, Riverside County, California. The site is underlain by Pauba Formation sediments, and groundwater depth is expected to be relatively shallow. The subject property has been identified as Parcel Map 3108. The overall property is undeveloped. The subject property is bound by commercial developments to the northwest side and northeast side. The property is identified by the Assessor's Parcel Numbers (APNs) is 949-220-048.

At the time of the field study, there was an abandoned pump station house located near Jefferson Avenue. The pump statio is approximately 10'x15', made of grout and stone, and is associated with an abandoned water well. Vegetation across the site was light to moderate and consisted of grasses, weeds and bushes.

The center of the subject property is approximately situated at 33.554546° north latitude and -117.201727° west longitude (GoogleEarth®, 2019).

### 2.2 Topography

The subject property is located within the 7.5-minute Murrieta Quadrangle. The property is mostly flat lying with relatively higher ground-level along the south side of the property. The elevation varies from 1102 to 1112 feet above sea level (Google Earth, 2019). Surface drainage appears to be from northwest to southeast.

## 3.0 FIELD EXPLORATION AND PERCOLATION TESTING

### 3.1 Field Exploration

EEI conducted onsite field exploration and field work on August 27$^{th}$, 28$^{th}$ and 29$^{th}$ 2019, and included drilling of five (5) pairs of 6-inch diameter borings with a truck-mounted CME-75 drill rig. Borings were advanced at approximate locations designated by DRC to depths of approximately 3 feet to 8 feet below the ground surface (bgs). Each boring was logged by EEI's field geologists. Blow count (N) values were determined utilizing a 140-pound hammer, falling 30-inches onto a Standard Penetration Test (SPT) split-spoon sampler). Representative bulk samples were also collected. The soils were classified in accordance with the Unified Soil Classification System (ASTM, 2015).

Percolation tests were then performed in each of our borings. Percolation testing was performed in general accordance with the County of Riverside guidelines for percolation testing. The approximate locations of the borings are presented on the Percolation Locations Map **– Figure 3.** Boring logs are presented in **Appendix A.** The results of the percolation tests are presented in **Appendix B**.

### 3.2 Percolation Testing

EEI conducted percolation testing in ten (10) exploratory borings (five 3 feet borings: P-1A through P-5A; and five 8 feet borings: P-1B through P-5B). The presoaking and percolation testing were performed in general accordance with Riverside County Design Handbook for Low Impact Development BMP (Riverside County, 2011).

Percolation test wells were constructed by inserting 3-inch-diameter perforated PVC pipes in the borings and backfilling the annular space with 3/8-inch gravel to prevent caving during the percolation test. Following construction of the percolation test wells, they were filled with water and pre-saturated for a minimum of 24-hour period prior to the start of percolation testing. The percolation testing was then performed. Percolation testing was performed until consistent results were obtained. The results were used to calculate the pre-adjusted percolation rate for the test hole. Upon conclusion of testing, the perforated PVC pipe was removed from the test holes and the test excavations were backfilled.

**Table 1** presents the measured percolation rate and corresponding infiltration rate calculated for the test holes using the Porchet Method. Percolation test results are presented in Appendix B.

**TABLE 1**
**Summary of Percolation Testing**

| Location | Depth (ft) | Pre-Adjusted (Percolation Rate (in/hr) | Infiltration Rate (in/hr)* |
|---|---|---|---|
| P-1A | 3 | 2.16 | 0.27 |
| P-2A | 3 | 0.00 | 0.00 |
| P-3A | 3 | 3.84 | 0.185 |
| P-4A | 3 | 0.00 | 0.00 |
| P-5A | 3 | 6.00 | 0.41 |
| P-1B | 8 | 9.84 | 0.275 |
| P-2B | 8 | 0.00 | 0.00 |
| P-3B | 8 | 0.48 | 0.015 |
| P-4B | 8 | 1.92 | 0.02 |
| P-5B | 8 | 1.92 | 0.025 |

*Feasibility factor of safety of 2.0 is included

### 3.3 Groundwater

Groundwater was not encountered in any of our other exploratory borings. Nearby monitoring wells indicate that the groundwater level varies in the surrounding region from approximately 39 to over 75.95 feet bgs (GeoTracker, 2019; CDWR, 2019). It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, rainfall, irrigation, and other factors that may not have been evident at the time of our subsurface exploration.

An old existing geotechnical report dated December 12, 2000 made by EnGEN Corporation indicates that groundwater was encountered at a depth of approximately 23-feet below ground surface in boring B-1 located on the upper right corner of the project site.

### 3.4 Structure Setback from Retention Devices

We recommend that storm-water disposal systems be situated at least three times their depth, or a minimum of 15 feet (whichever is greater), from the outside bottom edge of structural foundations. Structural foundations include (but are not limited to) buildings, loading docks, retaining walls, and screen walls. The invert of storm-water infiltration should be outside a 1:1 (H:V) plane projected from the bottom of adjacent foundations.

Stormwater disposal systems should be checked and maintained on regular intervals. Stormwater devices including bio-swales that are located closer than 10 feet from any foundations/footings should be lined with an impermeable membrane to reduce the potential for saturation of foundation soils. Foundations may also need to be deepened.

Stormwater infiltration should not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill.

## 4.0 LIMITATIONS

This report has been conducted in accordance with generally accepted geotechnical engineering principles and practices. Findings provided herein are cursory in nature, and have been derived in accordance with current standards of practice, and no warranty is expressed or implied.

Standards of practice are subject to change with time. This report has been prepared for the sole use Pacific West Development, LP within a reasonable time from its authorization. Site conditions, land use (both onsite and offsite), or other factors may change as a result of manmade influences, and additional work may be required with the passage of time. EEI's field observations are reflective of conditions encountered in each location. As with any site, subsurface conditions are known to vary from place to place due in part to the accuracy and consistency of the equipment.

This report should not be relied upon by other parties without the express written consent of EEI and the Client; therefore, any use or reliance upon this geotechnical report by a party other than the Client shall be solely at the risk of such third party and without legal recourse against EEI, its employees, officers, or directors, regardless of whether the action in which recovery of damages is brought or based upon contract, tort, statue, or otherwise. This report is not designed as a specification document, and may not contain sufficient information for use without additional assessment. EEI assumes no responsibility or liability for work or testing performed by others.

## 5.0 REFERENCES

American Society of Civil Engineers (ASCE), 2010, Minimum Design Loads for Buildings and Other Structures, ASCE Document ASCE/SEI 7-10.

American Society for Testing and Materials (ASTM), 2015, Annual Book of ASTM Standards, Volume 04.08, Construction: Soil and Rock (I), Standards D 420 - D 5876.

California Building Code (CBC), 2016, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, California Building Standards Commission, Based on 2015 International Building Code; 2016 California Historical Building Code, Title 24, Part 8; and 2013 California Existing Building Code, Title 24, Part 10, effective January 1, 2017.

California Geological Survey (CGS), 2002, California Geomorphic Provinces Note 36, Electronic Copy, Revised December 2002.

Federal Emergency Management Agency (FEMA), 2008, Flood Insurance Rate Map 06065C2705G, Riverside County, California, dated August 28, 2008.

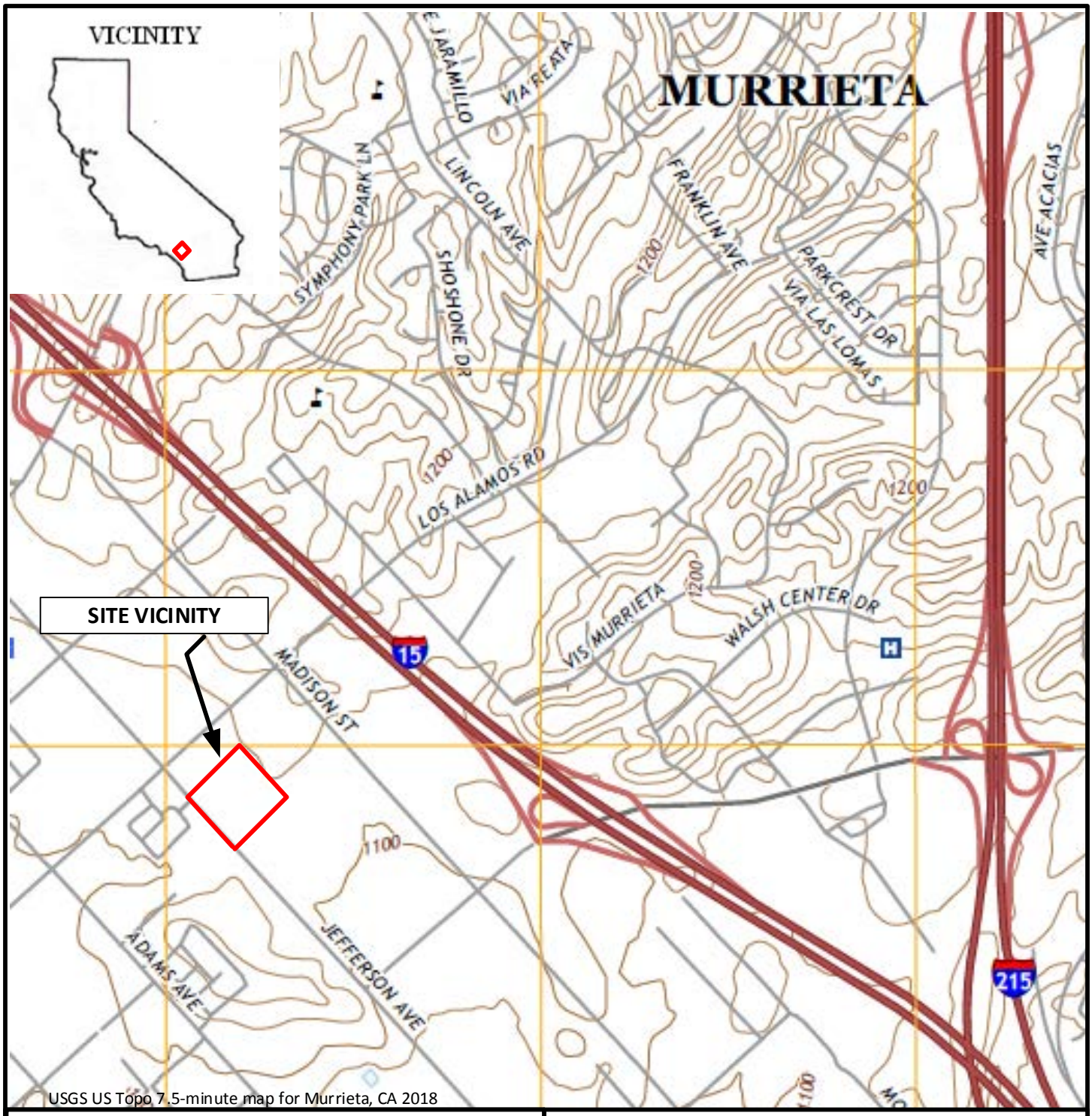
GeoTracker Website, 2019, State Water Resources Control Board, website address - *http://geotracker.waterboards.ca.gov/*, accessed December 2018.

Morton, 2004, Preliminary Geologic Map of the Santa Ana 30’ x 60’ Quadrangle, California, California Geological Survey (CGS) and U.S. Geological Survey (USGS), Open-File Report 99-172, Sheet 1 of 2, scale 1:100,000.

Riverside County Flood Control and Water Conservation District, 2011, Design Handbook for Low Impact Development Best Management Practices, dated September 2011.

United States Geological Survey (USGS), 2018, 7.5-Minute Topographic Map, Murrieta, California Quadrangle, scale 1:24,000.

# FIGURES




**LEGEND**

N

**Scale: 1" = 1250 feet**

0 625 ft 1250 ft 2500 ft

Note: All Locations Are Approximate

# SITE VICINITY MAP

Pacific West Development, LP

**9-acre Jefferson Street Multi-family Project**

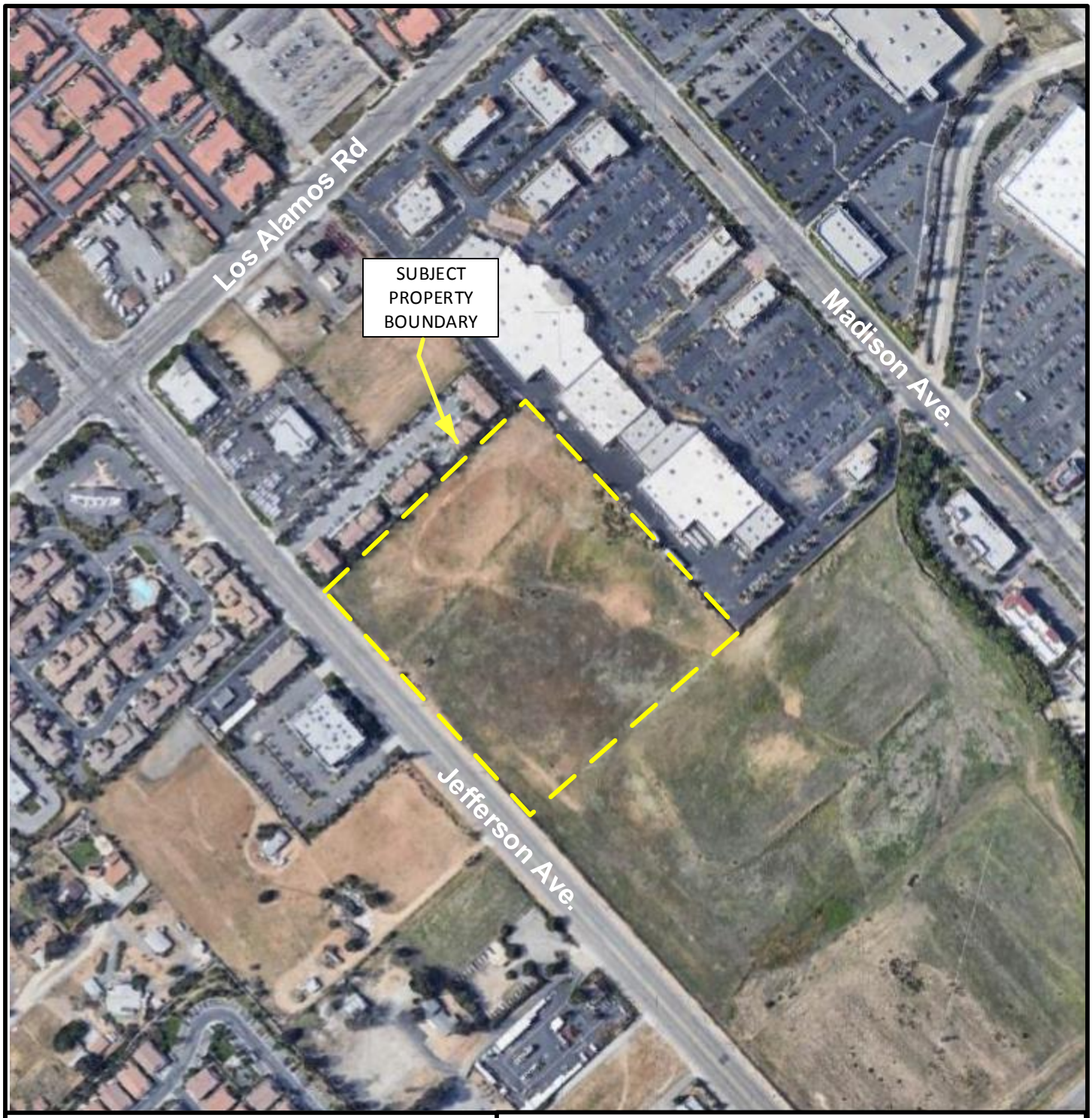
**NWC Jefferson Street and Murrieta Hot Springs Road**

City of Murrieta, CA

EEI Project PWD-72978.4

EEI Engineering Solutions

**FIGURE 1**




Source: Google Earth, 2019

N

**Scale: 1" = 500'**

0 250 ft 500 ft 1000 ft

Note: All Locations Are Approximate

## AERIAL SITE MAP

Pacific West Development, LP

**9-acre Jefferson Street Multi-family Project**

**NWC Jefferson Street and Murrieta Hot Springs Road**

City of Murrieta, CA

EEI Project PWD-72978.4

EEI Engineering Solutions

**FIGURE 2**


○ *Approximate Location of 3-feet depth borings/Percolation Tests P-1A/P-5A*

● *Approximate Location of 8-feet depth borings/Percolation Tests P-1B/P-6B*

Af *Artificial Fill*

Qal/Qp

*Pauba Formation: Light-brown moderately well-indurated, extensively crossbedded, channeled and filled sandstone and siltstone that contains occasional intervening cobble-and-boulder conglomerate beds; Circled where buried.*

Scale: 1" = 500'

0 250 ft 500 ft 1000 ft

Note: All Locations Are Approximate

N

# PERCOLATION LOCATIONS MAP

Pacific West Development, LP

**9-acre Jefferson Street Multi-family Project**

**NWC Jefferson Street and Murrieta Hot Springs Road**

City of Murrieta, CA

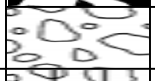
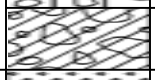
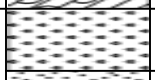
EEI Project PWD-72978.4

EEI Engineering Solutions

**FIGURE 3**

# APPENDIX A
# SOIL CLASSIFICATION CHART AND BORING LOGS

## UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

| MAJOR DIVISIONS | | | SYMBOLS GRAPH | SYMBOLS LETTER | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS | GRAVEL AND GRAVELLY SOILS | CLEAN GRAVELS (LITTLE OR NO FINES) |  | GW | WELL-GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES |
| | MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SEIVE | |  | GP | POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES |
| | | GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES) |  | GM | SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES |
| | | |  | GC | CLAYEY GRAVELS, GRAVEL-SAND- CLAY MIXTURES |
| MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | SAND AND SANDY SOILS | CLEAN SANDS (LITTLE OR NO FINES) |  | SW | WELL-GRADED SANDS,GRAVELLY SANDS, LITTLE OR NO FINES |
| | MORE THAN 50% OF COARSE FRACTION REATINED ON NO. 4 SEIVE | |  | SP | POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES |
| | | SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES) |  | SM | SILTY-SANDS, SAND – SILT MIXTURES |
| | | |  | SC | CLAYEY SANDS, SAND – CLAY MIXTURES |
| FINE GRAINED SOILS | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 |  | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | |  | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | |  | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 |  | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS |
| | | |  | CH | INORGANIC CLAYS OF HIGH PLASTICITY |
| | | |  | OH | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |

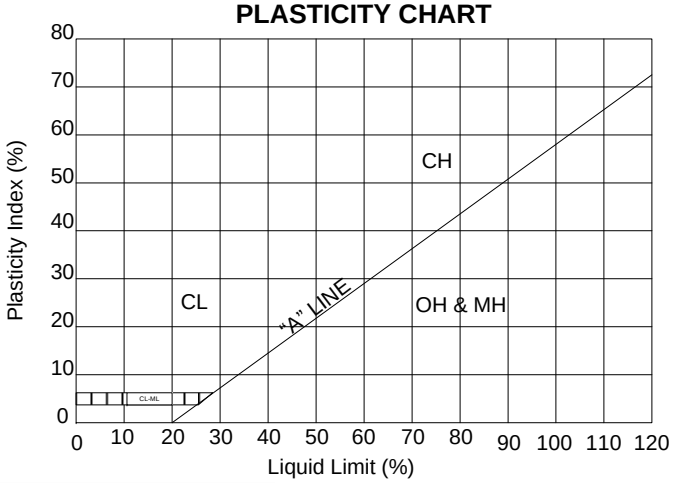
### SAMPLER TYPES

- SPT
- Modified California (2.5" I.D.)
- Bulk
- Rock Core
- Shelby Tube
- Water Level

### OTHER TESTS

ATT – Atterberg Limit (Plasticity Index)
CD – Consolidated Drained Triaxial
CON – Consolidation
COR – Corrosivity)
DS – Direct Shear
EI – Expansion Index
MAX – Maximum Density
RV – R-Value
SA – Sieve Analysis
-#200 - Percent Passing #200 Sieve
TV – Torvane Shear
UU – Unconsolidated Undrained Triaxial

### PLASTICITY CHART




PENETRATION RESISTANCE
(Recorded As Blows/Foot)

| SAND & GRAVEL | | SILT & CLAY | | |
|---|---|---|---|---|
| Relative Density | Blows/Foot* $N_{60}$ | Consistency | Blows/Foot* $N_{60}$ | Strength**(KSF) |
| Very Loose | 0-4 | Very Soft | 0 - 2 | 0 – 0.5 |
| Loose | 4-10 | Soft | 2 - 4 | 0.5 – 1.0 |
| Medium Dense | 10-30 | Medium Stiff | 4 - 8 | 1.0 – 2.0 |
| Dense | 30-50 | Stiff | 8 - 15 | 2.0 – 4.0 |
| Very Dense | Over 50 | Very Stiff | 15 - 30 | 4.0 – 8.0 |
| | | Hard | Over 30 | Over 8.0 |

* Number of blows of 140LB hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split barrel sampler the last 12 inches of an 18-inch drive (ASTM-1586 Standard Penetration Test)

** Undrained shear strength in kips/sq. ft. As determined by laboratory testing or approximated by the standard penetration test, pocket penetrometer, torvane, or visual observation

# BORING NUMBER P-1 A



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1119 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |

Total Depth: 3'
No groundwater encountered
Pecolation Test
Backfilled with native soil

GEOTECH LOG - COLUMNS PWD-72978.4.GPJ GINT STD US LAB.GDT 8/30/19

# BORING NUMBER P-1 B



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1119 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL**<br>Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | BULK | | | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | **PAUBA FORMATION**<br>silty SAND, brown, slightly moist, dense, trace clay. | SM | SPT | 14<br>15<br>16 | 31 | | | | | | |
| 8 | | | | | | | | | | | | |

Total depth: 6.5'
No groundwater encountered
Percolation test
Backfilled with native soil

# BORING NUMBER P-2 A



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1103 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |

Total Depth: 3'
No groundwater encountered
Pecolation Test
Backfilled with native soil

GEOTECH LOG - COLUMNS PWD-72978.4.GPJ GINT STD US LAB.GDT 8/30/19

# BORING NUMBER P-2 B



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1103 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL**<br>Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | BULK | | | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | **PAUBA FORMATION**<br>silty SAND, brown, redish-brown oxide streaks slightly moist, dense, trace clay. | SM | SPT | 12<br>14 | | | | | | | |
| 8 | | | | | | | | | | | | |

Total depth: 6.5'
No groundwater encountered
Percolation test
Backfilled with native soil

# BORING NUMBER P-3 A



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1109 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |

Total Depth: 3'
No groundwater encountered
Pecolation Test
Backfilled with native soil

GEOTECH LOG - COLUMNS PWD-72978.4.GPJ GINT STD US LAB.GDT 8/30/19

# BORING NUMBER P-3 B



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1109 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, common roots, trace clay. | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | SM | BULK | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | **PAUBA FORMATION** | SM | SPT | 12<br>14<br>15 | 29 | | | | | | |
| 8 | | silty SAND, brown, redish-brown oxide streaks, slightly moist, dense, trace clay. | | | | | | | | | | |

Total depth: 6.5'
No groundwater encountered
Percolation test
Backfilled with native soil

# BORING NUMBER P-4 A



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1108 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |

Total Depth: 3'
No groundwater encountered
Pecolation Test
Backfilled with native soil

# BORING NUMBER P-4 B



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1108 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL**<br>Silty SAND, Light brown, damp, loose, common roots, trace clay. | SM | BULK | | | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | **PAUBA FORMATION**<br>silty SAND, brown, redish-brown iron oxide streaks and presence of manganese spots, slightly moist, dense. | SM | SPT | 16<br>18<br>22 | 40 | | | | | | |
| 8 | | | | | | | | | | | | |

Total depth: 6.5'
No groundwater encountered
Percolation test
Backfilled with native soil

# BORING NUMBER P-5 A



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1110 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, trace clay. | SM | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |

Total Depth: 3'
No groundwater encountered
Pecolation Test
Backfilled with native soil

GEOTECH LOG - COLUMNS PWD-72978.4.GPJ GINT STD US LAB.GDT 8/30/19

# BORING NUMBER P-5 B



**CLIENT** Pacific West Development **PROJECT NAME** Jefferson Ave

**PROJECT NUMBER** PWD-72978.4 **PROJECT LOCATION** Jefferson Ave. & Murrieta Hot Springs Rd.

**DATE STARTED** 8/27/19 **COMPLETED** 8/28/19 **GROUND ELEVATION** 1110 feet **BORING DIAMETER** 6"

**EQUIPMENT / RIG** Truck Mounted CME-55 **HAMMER EFFICIENCY (%)** 60

**METHOD** 6.0" Hollow Stem Auger 140 lb Auto Hammer **SPT CORRECTION** 1.00 **CAL CORRECTION** 0.55

**LOGGED BY** EHJ **CHECKED BY** CCC **GROUNDWATER DEPTH (ft)** Not Encountered

**NOTES**

| DEPTH (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | USCS SYMBOL | SAMPLE TYPE | PENETRATION RESISTANCE (blows/6-inches) | SPT N60 | POCKET PEN (tsf) | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ATTERBERG LIMITS (PI:LL) | FINES CONTENT (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | **ARTIFICIAL FILL** | | | | | | | | | | |
| 1 | | Silty SAND, Light brown, damp, loose, common roots, trace clay. | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | SM | BULK | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | **PAUBA FORMATION** | SM | SPT | 10<br>12<br>13 | 25 | | | | | | |
| 8 | | silty SAND, brown, tanned brown iron oxide streaks and presence of manganese spots, slightly moist, dense. | | | | | | | | | | |

Total depth: 6.5'
No groundwater encountered
Percolation test
Backfilled with native soil

# APPENDIX B

## PERCOLATION TABLES

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-1 A | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 9:01 AM | Boring Depth | 3.0 feet |
| Testing Completion | 13:01PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 9:01 | 9:31 | 1.67 | 2.00 | 30 | 3.96 | 7.92 |
| 2 | 9:31 | 10:01 | 2.00 | 2.25 | 30 | 3.00 | 6.00 |
| 3 | 10:01 | 10:31 | 2.25 | 2.42 | 30 | 2.04 | 4.08 |
| 4 | 10:31 | 11:01 | 2.42 | 2.50 | 30 | 0.96 | 1.92 |
| 5 | 11:01 | 11:31 | 2.50 | 2.50 | 30 | 0.00 | 0.00 |
| 6 | 11:31 | 12:01 | 2.50 | 2.58 | 30 | 0.96 | 1.92 |
| 7 | 12:01 | 12:31 | 2.58 | 2.58 | 30 | 0.00 | 0.00 |
| 8 | 12:31 | 13:01 | 2.58 | 2.67 | 30 | 1.08 | 2.16 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Stabilized Percolation Rate = 2.16 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-1 B | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 9:05 AM | Boring Depth | 8.0 feet |
| Testing Completion | 13:05:00 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate | |
|---|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | | |
| | | | ft. | ft. | min. | in. | in./hr. | |
| 1 | 9:05 | 9:35 | 3.92 | 4.33 | 30 | 4.92 | 9.84 | |
| 2 | 9:35 | 10:05 | 4.33 | 4.58 | 30 | 3.00 | 6.00 | |
| 3 | 10:05 | 10:35 | 4.58 | 5.00 | 30 | 5.04 | 10.08 | ADD WATER |
| 4 | 10:35 | 11:05 | 4.50 | 4.75 | 30 | 3.00 | 6.00 | |
| 5 | 11:05 | 11:35 | 4.75 | 5.25 | 30 | 6.00 | 12.00 | ADD WATER |
| 6 | 11:35 | 12:05 | 4.75 | 5.33 | 30 | 6.96 | 13.92 | |
| 7 | 12:05 | 12:35 | 5.33 | 5.92 | 30 | 7.08 | 14.16 | ADD WATER |
| 8 | 12:35 | 13:05 | 5.67 | 6.08 | 30 | 4.92 | 9.84 | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |

Stabilized Percolation Rate = 9.84 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-2 A | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 9:11 AM | Boring Depth | 3.0 feet |
| Testing Completion | 1:11 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 9:11 | 9:41 | 1.42 | 1.50 | 30 | 0.96 | 1.92 |
| 2 | 9:41 | 10:11 | 1.50 | 1.58 | 30 | 0.96 | 1.92 |
| 3 | 10:11 | 10:41 | 1.58 | 1.58 | 30 | 0.00 | 0.00 |
| 4 | 10:41 | 11:11 | 1.58 | 1.58 | 30 | 0.00 | 0.00 |
| 5 | 11:11 | 11:41 | 1.58 | 1.58 | 30 | 0.00 | 0.00 |
| 6 | 11:41 | 12:11 | 1.58 | 1.58 | 30 | 0.00 | 0.00 |
| 7 | 12:11 | 12:41 | 1.58 | 1.58 | 30 | 0.00 | 0.00 |
| 8 | 12:41 | 13:11 | 1.58 | 1.58 | 30 | 0.00 | 0.00 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Stabilized Percolation Rate = 0.00 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-2 B | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 9:11 AM | Boring Depth | 8.0 feet |
| Testing Completion | 13:11:00 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 9:11 | 9:41 | 3.08 | 3.25 | 30 | 2.04 | 4.08 |
| 2 | 9:41 | 10:11 | 3.25 | 3.33 | 30 | 0.96 | 1.92 |
| 3 | 10:11 | 10:41 | 3.33 | 3.33 | 30 | 0.00 | 0.00 |
| 4 | 10:41 | 11:11 | 3.33 | 3.33 | 30 | 0.00 | 0.00 |
| 5 | 11:11 | 11:41 | 3.33 | 3.42 | 30 | 1.08 | 2.16 |
| 6 | 11:41 | 12:11 | 3.42 | 3.42 | 30 | 0.00 | 0.00 |
| 7 | 12:11 | 12:41 | 3.42 | 3.42 | 30 | 0.00 | 0.00 |
| 8 | 12:41 | 13:11 | 3.42 | 3.42 | 30 | 0.00 | 0.00 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Stabilized Percolation Rate = 0.00 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-3 A | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 8:45 AM | Boring Depth | 3.0 feet |
| Testing Completion | 12:45 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 8:45 | 9:15 | 1.83 | 2.25 | 30 | 5.04 | 10.08 |
| 2 | 9:15 | 9:45 | 1.91 | 2.25 | 30 | 4.08 | 8.16 |
| 3 | 9:45 | 10:15 | 2.00 | 2.17 | 30 | 2.04 | 4.08 |
| 4 | 10:15 | 10:45 | 1.91 | 2.08 | 30 | 2.04 | 4.08 |
| 5 | 10:45 | 11:15 | 1.91 | 2.08 | 30 | 2.04 | 4.08 |
| 6 | 11:15 | 11:45 | 1.83 | 2.00 | 30 | 2.04 | 4.08 |
| 7 | 11:45 | 12:15 | 1.75 | 1.91 | 30 | 1.92 | 3.84 |
| 8 | 12:15 | 12:45 | 1.75 | 1.91 | 30 | 1.92 | 3.84 |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |

Stabilized Percolation Rate = 3.84 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-3 B | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 8:45 AM | Boring Depth | 8.0 feet |
| Testing Completion | 12:45 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 8:45 | 9:15 | 6.08 | 6.10 | 30 | 0.24 | 0.48 |
| 2 | 9:15 | 9:45 | 6.10 | 6.12 | 30 | 0.24 | 0.48 |
| 3 | 9:45 | 10:15 | 6.12 | 6.14 | 30 | 0.24 | 0.48 |
| 4 | 10:15 | 10:45 | 6.14 | 6.16 | 30 | 0.24 | 0.48 |
| 5 | 10:45 | 11:15 | 6.16 | 6.18 | 30 | 0.24 | 0.48 |
| 6 | 11:15 | 11:45 | 6.18 | 6.20 | 30 | 0.24 | 0.48 |
| 7 | 11:45 | 12:15 | 6.00 | 6.02 | 30 | 0.24 | 0.48 |
| 8 | 12:15 | 12:45 | 6.02 | 6.04 | 30 | 0.24 | 0.48 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |

Stabilized Percolation Rate = 0.48 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-4 A | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 8:53 AM | Boring Depth | 3.0 feet |
| Testing Completion | 12:53 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 8:53 | 9:23 | 1.16 | 1.50 | 30 | 4.08 | 8.16 |
| 2 | 9:23 | 9:53 | 1.50 | 1.58 | 30 | 0.96 | 1.92 |
| 3 | 9:53 | 10:23 | 1.58 | 1.67 | 30 | 1.08 | 2.16 |
| 4 | 10:23 | 10:53 | 1.67 | 1.75 | 30 | 0.96 | 1.92 |
| 5 | 10:53 | 11:23 | 1.75 | 2.00 | 30 | 3.00 | 6.00 |
| 6 | 11:23 | 11:53 | 2.00 | 2.00 | 30 | 0.00 | 0.00 |
| 7 | 11:53 | 12:23 | 2.00 | 2.08 | 30 | 0.96 | 1.92 |
| 8 | 12:23 | 12:53 | 2.08 | 2.08 | 30 | 0.00 | 0.00 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Stabilized Percolation Rate = 0.00 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-4 B | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 8:53 AM | Boring Depth | 8.0 feet |
| Testing Completion | 12:53 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 8:53 | 9:23 | 2.42 | 2.42 | 30 | 0.00 | 0.00 |
| 2 | 9:23 | 9:53 | 2.42 | 2.42 | 30 | 0.00 | 0.00 |
| 3 | 9:53 | 10:23 | 2.42 | 2.50 | 30 | 0.96 | 1.92 |
| 4 | 10:23 | 10:53 | 2.50 | 2.50 | 30 | 0.00 | 0.00 |
| 5 | 10:53 | 11:23 | 2.50 | 2.50 | 30 | 0.00 | 0.00 |
| 6 | 11:23 | 11:53 | 2.50 | 2.50 | 30 | 0.00 | 0.00 |
| 7 | 11:53 | 12:23 | 2.50 | 2.50 | 30 | 0.00 | 0.00 |
| 8 | 12:23 | 12:53 | 2.50 | 2.58 | 30 | 0.96 | 1.92 |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |

Stabilized Percolation Rate = 1.92 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-5 A | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 8:33 AM | Boring Depth | 3.0 feet |
| Testing Completion | 12:33 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 8:33 | 9:03 | 1.83 | 2.17 | 30 | 4.08 | 8.16 |
| 2 | 9:03 | 9:33 | 2.00 | 2.25 | 30 | 3.00 | 6.00 |
| 3 | 9:33 | 10:03 | 2.00 | 2.25 | 30 | 3.00 | 6.00 |
| 4 | 10:03 | 10:33 | 2.00 | 2.25 | 30 | 3.00 | 6.00 |
| 5 | 10:33 | 11:03 | 2.00 | 2.25 | 30 | 3.00 | 6.00 |
| 6 | 11:03 | 11:33 | 2.08 | 2.33 | 30 | 3.00 | 6.00 |
| 7 | 11:33 | 12:03 | 2.08 | 2.33 | 30 | 3.00 | 6.00 |
| 8 | 12:03 | 12:33 | 2.08 | 2.33 | 30 | 3.00 | 6.00 |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |

Stabilized Percolation Rate = 6.00 in/hr

EEI Geotechnical & Environmental Solutions

Project: Jefferson Ave | By: EJ

Client: Pacific West Development | Date: 8/29/2019

Proj. No.: PWD-72978.4 | Page: 1 of 1

# PERCOLATION TEST

| | | | |
|---|---|---|---|
| Borehole ID | P-5 B | Contractor | Cal Pac |
| | | Equipment/Rig | Truck Mounted Hollow Stem |
| Presoak Start | 8:00 AM (8/28/2019) | Boring Diameter | 6-inches |
| Testing Start | 8:33 AM | Boring Depth | 8.0 feet |
| Testing Completion | 12:33 PM | Well Installed? | ☐ Yes ■ No |
| Notes | | | |

| Reading | Time | | Depth to Water | | Elapsed Time | Water Drop | Perc. Rate |
|---|---|---|---|---|---|---|---|
| | Start | Finish | Start | Finish | | | |
| | | | ft. | ft. | min. | in. | in./hr. |
| 1 | 8:33 | 9:03 | 3.08 | 3.33 | 30 | 3.00 | 6.00 |
| 2 | 9:03 | 9:33 | 3.17 | 3.33 | 30 | 1.92 | 3.84 |
| 3 | 9:33 | 10:03 | 3.17 | 3.33 | 30 | 1.92 | 3.84 |
| 4 | 10:03 | 10:33 | 3.17 | 3.25 | 30 | 0.96 | 1.92 |
| 5 | 10:33 | 11:03 | 3.17 | 3.25 | 30 | 0.96 | 1.92 |
| 6 | 11:03 | 11:33 | 3.17 | 3.25 | 30 | 0.96 | 1.92 |
| 7 | 11:33 | 12:03 | 3.17 | 3.25 | 30 | 0.96 | 1.92 |
| 8 | 12:03 | 12:33 | 3.08 | 3.16 | 30 | 0.96 | 1.92 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Stabilized Percolation Rate = 1.92 in/hr

March 18, 2020

Mr. Dan Dobron
Pacific West Development, LP
32823 Temecula Parkway, Suite A
Temecula, CA 92592

**Subject:** **Geotechnical Consulting**
**9-acre Development Site**
**Jefferson Avenue and Murrieta Hot Springs Road, City of Murrieta, Riverside County, CA**
**Parcel Map 31078**
**EEI Project PWD-72978**

*References*: Geotechnical Report:

EnGEN Corporation: "FAULT HAZARD INVESTIGATION"
Jefferson II, Proposed Apartment Structures, APN 949-220-021
Jefferson Avenue Northwest of Murrieta Hot Springs Road
City of Murrieta, Riverside County, California, dated December 7, 2000
Project Number: T2221-FS

Dear Mr. Dobron:

In accordance with your request and authorization, EEI has performed a review of the above-referenced report for the subject project. The purpose of this review and supplemental consulting was to provide our opinion with regard to the potential for fault rupture within the reported Alquist – Priolo (AP) fault zone within the property.

According to the existing published geological information, the southwestern portion of the site is partially located within the (AP) zone. The above referenced report has provided the results of the specific fault study performed at the site to determine the possibility of the fault rupture. No indication of active (Holocene-Age) faulting was found during this investigation. This report has recommended establishment of "Restricted Use Zone (RUZ)" for building setback.

EEI has reviewed the available published information and supporting data and concurs with the findings and recommendations of the above referenced report.

We trust this is the information you require at this time. Please contact us should you need further information. We appreciate the opportunity to be of continued service.

Respectfully submitted,
**EEI**


Mohamaad Joolazadeh
GE 2199 (exp. 6/30/20)
Senior Geotechnical Engineer


Craig C. Chase
CEG 2225 (exp. 6/30/21)
Senior Project Geologist

P:\EEI Projects\PACIFIC WEST DEV (PWD)\PWD-72978 Jefferson St Murietta\EEI FAULT LETTERS 03.20\PWD-72978 Fault Letter 9 Acres (FNL MJ CCC cea 03.18.2020).doc

# Appendix 4: Historical Site Conditions

*Phase I Environmental Site Assessment or Other Information on Past Site Use*

# Appendix 5: LID Infeasibility

*LID Technical Infeasibility Analysis*

# Appendix 6: BMP Design Details

*BMP Sizing, Design Details and other Supporting Documentation*

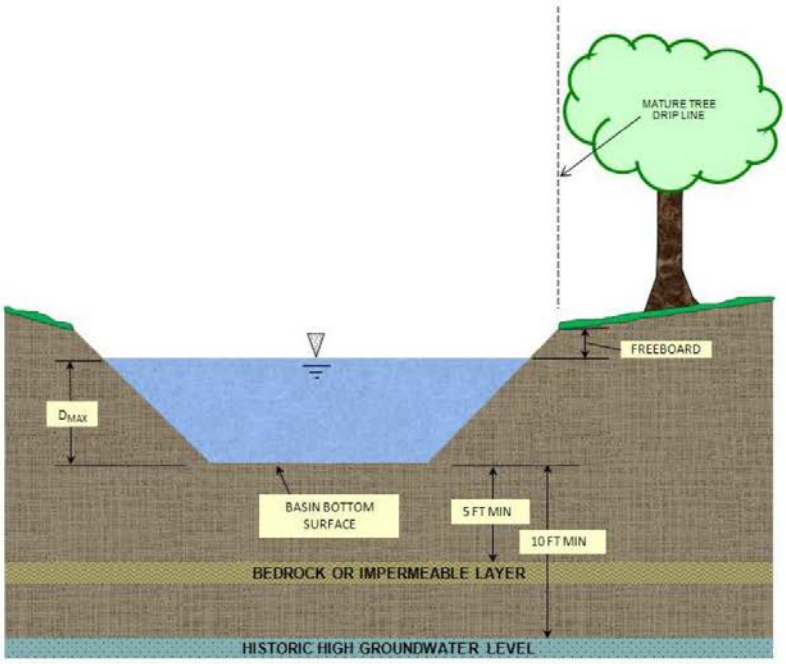



**Figure 1 : Setback Recommendations for a Bioretention Facility**

## Pretreatment

Pretreatment should be considered to prevent premature clogging of bioretention BMPs. Pretreatment is strongly encouraged where the BMP will receive runoff from high traffic parking lots or roads, mixed land uses (with some erodible areas), or other land uses likely to generate elevated sediment.

For BMPs receiving overland flow, pretreatment may be provided using forebays with a volume equivalent to at least 10 percent (preferably 20 percent) of $V_{BMP}$. A forebay is effectively the first cell in the bioretention system, separated from the remaining area by a berm or cross plate. The forebay is designed to maximize sedimentation and will require more frequent, but more spatially-focused maintenance. This portion of the system can be concrete lined to facilitate simpler maintenance.

For BMPs with piped inlets, a forebay or sedimentation manhole may be applicable. In these systems, it is also necessary to consider energy dissipation near the inlet pipe, such as via a gravel/rock pad and berm system or concrete splash block, to avoid erosion of the bioretention media bed.

If the BMP will receive runoff primarily from roofs, low-traffic impervious surface, or similar low sediment generating surfaces, then pre-treatment is not necessary, but energy dissipation should still be considered, particularly if there is a piped inflow such as a downspout.

## Design and Sizing Criteria

This section summarizes the recommended design parameters for Bioretention Facilities. Use of the recommended parameters will help provide the expected treatment and long term performance of the BMP. Deviations from the recommended parameters may be warranted and approved by the local jurisdiction based on site specific considerations. The recommended cross section for a Bioretention Facility includes:

- Vegetated area
- 6" minimum, 12" maximum, surface ponding, measured from the top of the mulch layer (for designs with deeper depths, consult Fact Sheet 3.7)
- Mulch layer (non-floating organic mulch or rock mulch)
- 24" recommended minimum depth of engineered soil media (36" preferred; 18" allowed in vertically-constrained conditions at the discretion of the local jurisdiction)
- Engineered soil media design filtration rate of 2.5 inches per hour (initial filtration rate should be higher).
- 6" optional filter course layer (required if aggregate storage layer is included)
- Optional gravel storage layer below media
- Optional capped underdrain pipe (see Resilient Design Features section below for specific criteria and conditions related to this option)

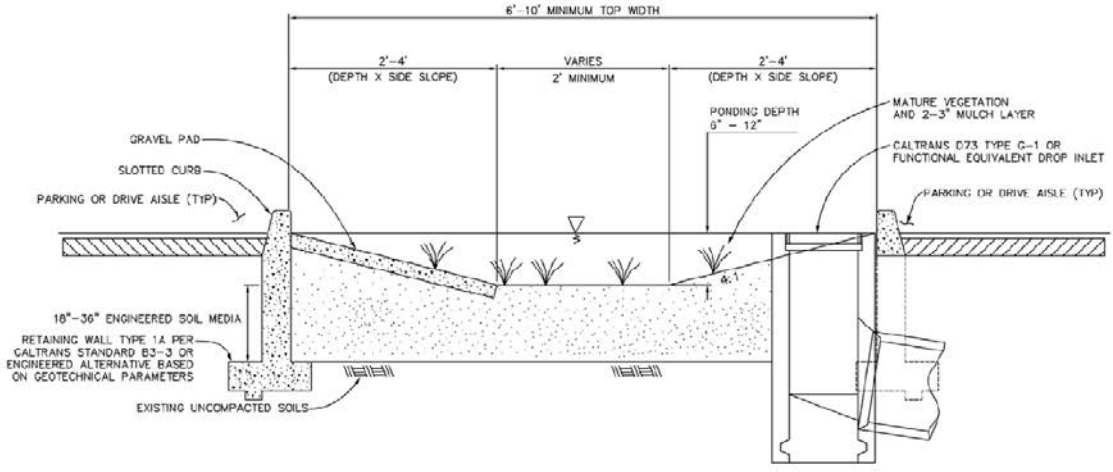



**Figure 2: Standard Cross Section for a Bioretention Facility**

Pore space in the soil and gravel layer can be credited as storage volume. However, several considerations must be noted:

- Ponding depth above the soil surface (6 to 12 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil infiltration rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be used for the gravel and filter course layers.
- Additional depth below the storage layer (via gravel) may be used to increase retention storage, under the following conditions:
    - The total system infiltrates the stored water in less than 72 hours
    - The depth below the media does not exceed the amount of water that can be filtered through the media during a typical DCV storm duration (5 hours, unless otherwise documented).

## Adaptable/Resilient Design Option

At the discretion of the engineer and with the approval of the local jurisdiction, bioretention BMPs may be designed with a gravel drainage layer and a **capped** underdrain. This is effectively a biofiltration design (Fact Sheet 3.5), but there is no design discharge from the underdrains. The benefit of this configuration is that it allows simpler adaptation to a biofiltration BMP if this is warranted, documented, and approved.

This option **may only** be approved for use under the conditions described in Section 2.3.3.g of the WQMP, including:

1) The BMP must meet applicable infiltration BMP sizing standards without any discharge through the underdrain.

2) The Project-Specific WQMP must also meet all applicable sizing standards (biofiltration sizing, hydromodification, if applicable) standards if the underdrain is uncapped.

3) The underdrain must remain capped. Inspections conducted as part of the O&M Plan must corroborate that the underdrain remains capped.

4) If conditions are identified that require the underdrain to be uncapped to allow the BMP to be enlarged or otherwise modified to remedy the documented unacceptable performance, this must include: (a) documentation of the conditions that prompt and justify the require design revision, (b) revision of the Project-Specific WQMP to reflect the revised configuration, and (c) jurisdictional review, approval, and recordation of the revised Project Specific WQMP with commensurate updates to the O&M Plan.

See Section 5.3.6 for guidance on Project-Specific WQMP updates. Note that this is the same process that would be required to wholly redesign and reconstruct an underperforming BMP. However, if adaptable design features are included, the actual physical change could be limited to uncapping the underdrain.

## Design Adaptations

Bioretention facilities can be designed to meet both pollutant control and hydromodification control performance standards. Combined facilities typically include increased storage (surface and or subsurface) and flow control devices (i.e. outlet orifices and/or weirs). Outlets elevations must be set above the $V_{BMP}$ ponding level and the facilities must satisfy both the pollutant control and hydromodification control performance standards.

For systems exceeding 12 inches ponding depth and/or 5 acres tributary area, see additional design considerations in Fact Sheet 3.7.

Subsurface storage is not required but may be provided in the form of a gravel storage layer. Refer to the Subsurface Storage Requirements section for additional information and criteria.

## Engineered Soil Media and Filter Course Aggregate Requirements

Refer to Fact Sheet 3.8 for specifications for engineered soil media and aggregate layers serving as filter course and drain rock in bioretention BMPs.

## Subsurface Storage Requirements

Applicants may choose to provide a portion of the BMP storage volume as subsurface storage in a gravel storage layer. Use of subsurface storage instead of surface storage can be useful when the available surface ponding depth is limited or when a deeper profile is desired to reduce footprint requirements.

The gravel storage layer shall not provide a greater storage volume than can be routed through the soil media during the typical design storm duration (i.e. 2.5 inches/hour x 5 hours = 12 inches effective water depth). Alternatively, a separate routing calculation may be performed by the applicant to demonstrate that the provided volume does not result in surface overflow (bypass of the BMP) before the gravel storage layer is full.

When gravel storage layers are used, the filter course layer should be specifically designed to prevent migration of the engineered soil media into the storage layer. Refer to Fact Sheet 3.8 for filter course requirements. Inclusion of a filter course layer is mandatory unless filter fabric is allowed per manufacturer's recommendation and is acceptable to the local jurisdiction.

## Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways,

# Santa Margarita Watershed

$V_{BMP}$ and $Q_{BMP}$ worksheets

These worksheets are to be used to determine the required

Design Capture Volume ($V_{BMP}$)
or the
Design Flow Rate ($Q_{BMP}$)

for BMPs in the Santa Margarita Watershed

To verify which watershed your project is located within, visit

www.rcflood.org/npdes

and use the 'Locate my Watershed' tool

**If your project is not located in the Santa Margarita Watershed,**

Do not use these worksheets! Instead visit

www.rcflood.org/npdes/developers.aspx

To access worksheets applicable to your watershed

**Use the tabs across the bottom**
**to access the worksheets for the Santa Margarita Watershed**

# Santa Margarita Watershed

BMP Design Volume, $V_{BMP}$ (Rev. 03-2012)

Legend: Required Entries / Calculated Cells

(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)

| | | | |
|---|---|---|---|
| Company Name | DRC, Engineering | Date | |
| Designed by | Mattew Hellesen | County/City Case No | |
| Company Project Number/Name | Jefferson Apartments | | |
| Drainage Area Number/Name | Area A | | |

Enter the Area Tributary to this Feature $A_T$ = 4.03 acres

## 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

Site Location

Township

Range

Section

Enter the 85th Percentile, 24-hour Rainfall Depth $D_{85}$ = 0.80

## Determine the Effective Impervious Fraction

Type of post-development surface cover (use pull down menu): Mixed Surface Types

Effective Impervious Fraction $I_f$ = 0.65

## Calculate the composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ C = 0.45

## Determine Design Storage Volume, $V_{BMP}$

Calculate $V_U$, the 85% Unit Storage Volume $V_U = D_{85} \times C$ $V_u$ = 0.36 (in*ac)/ac

Calculate the design storage volume of the BMP, $V_{BMP}$.

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12\ (in/ft)}$$

$V_{BMP}$ = 5,266 $ft^3$

Notes:

| Biofiltration with No Infiltration Facility - Design Procedure | BMP ID: Pond A | Legend: | Required Entries / Calculated Cells |
|---|---|---|---|
| Company Name: | DRC, Engineering | Date: | |
| Designed by: | Matthew Hellesen | County/City Case No.: | |

## Design Volume

| | | | |
|---|---|---|---|
| Enter the area tributary to this feature | $A_T$ = | 4.03 | acres |
| Enter $V_{BMP}$ determined from Section 2.1 of this Handbook | $V_{BMP}$ = | 5,266 | $ft^3$ |
| Estimated footprint of BMP, $Area_{BMP}$ (available space or 3% imp. area) | $Area_{BMP}$ = | 4,121 | $ft^2$ |

Note: This area shall be measured at the mid-ponding depth of the BMP. For systems with side-slopes, this should be the contour that is midway between the floor of the basin and the maximum water quality ponding elevation of the basin. The underlying gravel layer for drain pipes should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

## Biofiltration with No Infiltration Facility Surface Area

| | | | |
|---|---|---|---|
| Depth of Surface Ponding Layer (6" minimum, 12" maximum) | $d_P$ = | 6.0 | inches |
| Depth of Engineered Soil Media ( 24" to 36"; 18" if vertically constrained) | $d_S$ = | 30.0 | inches |
| Design Media Filtration Rate (2.5 in/hr) | $I_{design}$ = | 2.5 | in/hr |
| Allowable Routing Period, $T_{routing}$ (5 hrs) | $T_{routing}$ = | 5.0 | hr |

Effective Biofiltration Depth, $d_{E\_bio}$

$d_{E\_bio}$ (ft) = ($d_P$ + (0.3 x $d_S$) + ($I_{design}$ * $T_{routing}$)) (ft) — $d_{E\_bio}$ = 2.3 ft

Effective Static Depth, $d_{E\_bio\_static}$

$d_{E\_bio\_static}$ = ($d_P$ + (0.3 * $d_S$) ) (ft) — $d_{E\_bio\_static}$ = 1.3 ft

$V_{biofiltered}$ = $d_{E\_bio}$ * $Area_{BMP}$ — $V_{biofiltered}$ = 9444.0 $ft^3$

$V_{biofiltered\_static}$ = $d_{E\_bio\_static}$ * $Area_{BMP}$ — $V_{biofiltered\_static}$ = 5151.3 $ft^3$

## Sizing Option 1 Result

Criteria 1: $V_{biofiltered\ (with\ routing)} \geq 150\%$ of $V_{BMP}$ — Results: PASS

## Sizing Option 2 Result

Criteria 2: $V_{biofiltered\_static} \geq 0.75$ x $V_{BMP}$ — Results: PASS

## Note

If neither of these criteria are met increase the footprint and rerun calculations. This calculation is inherently iterative.

| Biofiltration with No Retention Facility Properties | | |
|---|---|---|
| Side Slopes in Partial Retention with Biofiltration Facility | z = 4 | :1 |
| Diameter of Underdrain | 6 | inches |
| Longitudinal Slope of Site (3% maximum) | | % |
| Check Dam Spacing | | feet |
| Describe Vegetation: | | |

Notes:

# Santa Margarita Watershed

BMP Design Volume, $V_{BMP}$ (Rev. 03-2012)

Legend: Required Entries / Calculated Cells

(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)

| | | | |
|---|---|---|---|
| Company Name | DRC, Engineering | Date | |
| Designed by | Matthew Hellesen | County/City Case No | |
| Company Project Number/Name | Jefferson Apartments | | |
| Drainage Area Number/Name | Area B | | |

Enter the Area Tributary to this Feature $A_T$ = 5.15 acres

## 85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

Site Location

Township

Range

Section

Enter the 85th Percentile, 24-hour Rainfall Depth $D_{85}$ = 0.80

## Determine the Effective Impervious Fraction

Type of post-development surface cover (use pull down menu): Mixed Surface Types

Effective Impervious Fraction $I_f$ = 0.65

## Calculate the composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ C = 0.45

## Determine Design Storage Volume, $V_{BMP}$

Calculate $V_U$, the 85% Unit Storage Volume $V_U = D_{85} \times C$ $V_u$ = 0.36 (in*ac)/ac

Calculate the design storage volume of the BMP, $V_{BMP}$.

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12\ (in/ft)}$$

$V_{BMP}$ = 6,730 $ft^3$

Notes:

| Biofiltration with No Infiltration Facility - Design Procedure | BMP ID: Pond B | Legend: | Required Entries / Calculated Cells |
|---|---|---|---|
| Company Name: DRC, Engineering | | Date: | |
| Designed by: Matthew Hellesen | | County/City Case No.: | |

## Design Volume

| | | | |
|---|---|---|---|
| Enter the area tributary to this feature | $A_T$ = | 5.15 | acres |
| Enter $V_{BMP}$ determined from Section 2.1 of this Handbook | $V_{BMP}$ = | 6,730 | $ft^3$ |
| Estimated footprint of BMP, $Area_{BMP}$ (available space or 3% imp. area) | $Area_{BMP}$ = | 3,925 | $ft^2$ |

Note: This area shall be measured at the mid-ponding depth of the BMP. For systems with side-slopes, this should be the contour that is midway between the floor of the basin and the maximum water quality ponding elevation of the basin. The underlying gravel layer for drain pipes should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

## Biofiltration with No Infiltration Facility Surface Area

| | | | |
|---|---|---|---|
| Depth of Surface Ponding Layer (6" minimum, 12" maximum) | $d_P$ = | 12.0 | inches |
| Depth of Engineered Soil Media ( 24" to 36"; 18" if vertically constrained) | $d_S$ = | 30.0 | inches |
| Design Media Filtration Rate (2.5 in/hr) | $I_{design}$ = | 2.5 | in/hr |
| Allowable Routing Period, $T_{routing}$ (5 hrs) | $T_{routing}$ = | 5.0 | hr |
| Effective Biofiltration Depth, $d_{E\_bio}$<br>$d_{E\_bio}$ (ft) = ($d_P$ + (0.3 x $d_S$) + ($I_{design}$ * $T_{routing}$)) (ft) | $d_{E\_bio}$ = | 2.8 | ft |
| Effective Static Depth, $d_{E\_bio\_static}$<br>$d_{E\_bio\_static}$ = ($d_P$ + (0.3 * $d_S$) ) (ft) | $d_{E\_bio\_static}$ = | 1.8 | ft |
| $V_{biofiltered}$ = $d_{E\_bio}$ * $Area_{BMP}$ | $V_{biofiltered}$ = | 10957.3 | $ft^3$ |
| $V_{biofiltered\_static}$ = $d_{E\_bio\_static}$ * $Area_{BMP}$ | $V_{biofiltered\_static}$ = | 6868.8 | $ft^3$ |

## Sizing Option 1 Result

Criteria 1: $V_{biofiltered\ (with\ routing)} \geq 150\%$ of $V_{BMP}$ — Results: PASS

## Sizing Option 2 Result

Criteria 2: $V_{biofiltered\_static} \geq 0.75$ x $V_{BMP}$ — Results: PASS

## Note

If neither of these criteria are met increase the footprint and rerun calculations. This calculation is inherently iterative.

| Biofiltration with No Retention Facility Properties | | |
|---|---|---|
| Side Slopes in Partial Retention with Biofiltration Facility | z = 4 | :1 |
| Diameter of Underdrain | 6 | inches |
| Longitudinal Slope of Site (3% maximum) | | % |
| Check Dam Spacing | | feet |
| Describe Vegetation: | | |

Notes:

# Appendix 7: Hydromodification

*Supporting Detail Relating to compliance with the HMP Performance Standards*

## *Hydromodification Narrative:*

For our basin routing calculations, we used AutoCAD's Hyrdaflow Hydrograph's program. This program uses a stage storage relationship to calculate the discharge of storm water after being routed through our proposed underground detention systems. Hydraflow Hydrograph's describes this as reservoir routing. Reservoir routing is the process of passing a flood hydrograph through a storage reservoir or detention pond. This process changes the pattern of flow with respect to time but conserves volume. The purpose of reservoir routing is usually to reduce the peak flow to a predetermined level or to delay the peak. The routing procedure used by Hydraflow is known as the Storage Indication Method and begins with a stage/storage/discharge relationship, an inflow hydrograph and the following relationship: inflow minus outflow equals change in storage.

As water is collected and treated through the biofiltration pond, flow is discharged into a manhole with a restrictor plate and orifice/weir structure. Water then backs up into underground storage pipes and fills up the required storage volume while slowly discharging through the restrictor plate at peak-flows at or below the pre-developed condition.

The Hyrdaflow Hydrograph's program allows you to design a restrictor plate with orifice and weir structures in conjunction with the storage volume provided, in order to knock down the peak-flows for each sub-area. Peak-flow data was generated for the 2-Year, 5-year, 10-year, and 100-year return periods at 1-hour, 3-hour, 6-hour, and 24-hour frequencies. This data was inputted into the Hyrdaflow Hydrograph's program to generate hydrograph reports, showing the peak discharge of each sub-area after passing through the storage volumes and restrictor plates. The detention pond and restrictor plates were designed so that post-developed peak flows were mitigated to at or below the pre-developed peak flows for each of the storm return period and frequency.

In this Appendix, we have included the technical data generated by AutoCAD's Hydraflow Hydrograph's. Detail of the various orifices in the restrictor plate located at the manholes are provided in the section titled "Pond Report" for each sub-area. The volume of water being stored onsite, or stage-storage relationship, is provided under the section titled "Stage Storage Calculations" as well as written calculations for reference under "Detention Pond Written Calcs". In the section titled "Hydrograph Summary Report" the peak flows for each storm return period and frequency can be seen along with the mitigated peak flows once gone through the "reservoir"

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Manual | 13.21 | 5 | 55 | 13,800 | ------ | ------ | ------ | Entire Site 2-yr 1-hr |
| 2 | Manual | 6.080 | 5 | 160 | 20,343 | ------ | ------ | ------ | Entire Site 2-yr 3-hr |
| 3 | Manual | 5.800 | 5 | 335 | 28,851 | ------ | ------ | ------ | Entire Site 2-yr 6-hr |
| 4 | Manual | 1.840 | 5 | 800 | 48,720 | ------ | ------ | ------ | Entire Site 2-yr 24-hr |
| 6 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 1-hr |
| 7 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 3-hr |
| 8 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 6-hr |
| 9 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 24-hr |
| 11 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 1-hr |
| 12 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 3-hr |
| 13 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 6-hr |
| 14 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 24-hr |
| 16 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 1-hr |
| 17 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 3-hr |
| 18 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 6-hr |
| 19 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 24-hr |
| 21 | Reservoir | 0.441 | 5 | 70 | 13,800 | 1 | 1102.79 | 12,492 | Entire Site 2yr 1-hr |
| 22 | Reservoir | 0.475 | 5 | 185 | 20,343 | 2 | 1103.21 | 16,504 | Entire Site 2yr 3-hr |
| 23 | Reservoir | 0.513 | 5 | 355 | 28,851 | 3 | 1103.70 | 21,233 | Entire Site 2yr 6-hr |
| 24 | Reservoir | 0.543 | 5 | 970 | 48,720 | 4 | 1104.09 | 24,676 | Entire Site 2yr 24-hr |
| 26 | Reservoir | 0.000 | 5 | n/a | 0 | 6 | 1100.20 | 0.000 | Entire Site 5yr 1-hr |
| 27 | Reservoir | 0.000 | 5 | n/a | 0 | 7 | 1100.20 | 0.000 | Entire Site 5yr 3-hr |
| 28 | Reservoir | 0.000 | 5 | n/a | 0 | 8 | 1100.20 | 0.000 | Entire Site 5yr 6-hr |
| 29 | Reservoir | 0.000 | 5 | n/a | 0 | 9 | 1100.20 | 0.000 | Entire Site 5yr 24-hr |
| 31 | Reservoir | 0.000 | 5 | n/a | 0 | 11 | 1100.20 | 0.000 | Entire Site 10yr 1-hr |
| 32 | Reservoir | 0.000 | 5 | n/a | 0 | 12 | 1100.20 | 0.000 | Entire Site 10yr 3-hr |
| 33 | Reservoir | 0.000 | 5 | n/a | 0 | 13 | 1100.20 | 0.000 | Entire Site 10yr 6-hr |
| 34 | Reservoir | 0.000 | 5 | n/a | 0 | 14 | 1100.20 | 0.000 | Entire Site 10yr 24-hr |
| 36 | Reservoir | 0.000 | 5 | n/a | 0 | 16 | 1100.20 | 0.000 | Entire Site 100yr 1-hr |
| 37 | Reservoir | 0.000 | 5 | n/a | 0 | 17 | 1100.20 | 0.000 | Entire Site 100yr 3-hr |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 38 | Reservoir | 0.000 | 5 | n/a | 0 | 18 | 1100.20 | 0.000 | Entire Site 100yr 6-hr |
| 39 | Reservoir | 0.000 | 5 | n/a | 0 | 19 | 1100.20 | 0.000 | Entire Sit 100yr 24-hr |

# Pond Report



## Pond No. 1 - DETENTION POND

### Pond Data

**Pond storage is based on user-defined values.**

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 1100.20 | n/a | 0 | 0 |
| 0.48 | 1100.68 | n/a | 49 | 49 |
| 0.97 | 1101.17 | n/a | 1,029 | 1,078 |
| 1.45 | 1101.65 | n/a | 2,147 | 3,225 |
| 1.94 | 1102.14 | n/a | 3,498 | 6,723 |
| 2.42 | 1102.62 | n/a | 4,093 | 10,816 |
| 2.90 | 1103.10 | n/a | 4,677 | 15,493 |
| 3.39 | 1103.59 | n/a | 4,717 | 20,210 |
| 3.87 | 1104.07 | n/a | 4,352 | 24,562 |
| 4.36 | 1104.56 | n/a | 3,629 | 28,191 |
| 4.84 | 1105.04 | n/a | 2,384 | 30,575 |
| 5.13 | 1105.33 | n/a | 1,129 | 31,704 |
| 5.30 | 1105.50 | n/a | 362 | 32,066 |
| 6.30 | 1106.50 | n/a | 5,104 | 37,170 |
| 6.80 | 1107.00 | n/a | 2,568 | 39,738 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 1.00 | 3.00 | Inactive | 0.00 |
| **Span (in)** | = 8.25 | 8.50 | 24.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 1 | 0 |
| **Invert El. (ft)** | = 1100.20 | 1104.10 | 1105.00 | 0.00 |
| **Length (ft)** | = 1.00 | 1.00 | 1.00 | 0.00 |
| **Slope (%)** | = 2.00 | 2.00 | 2.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

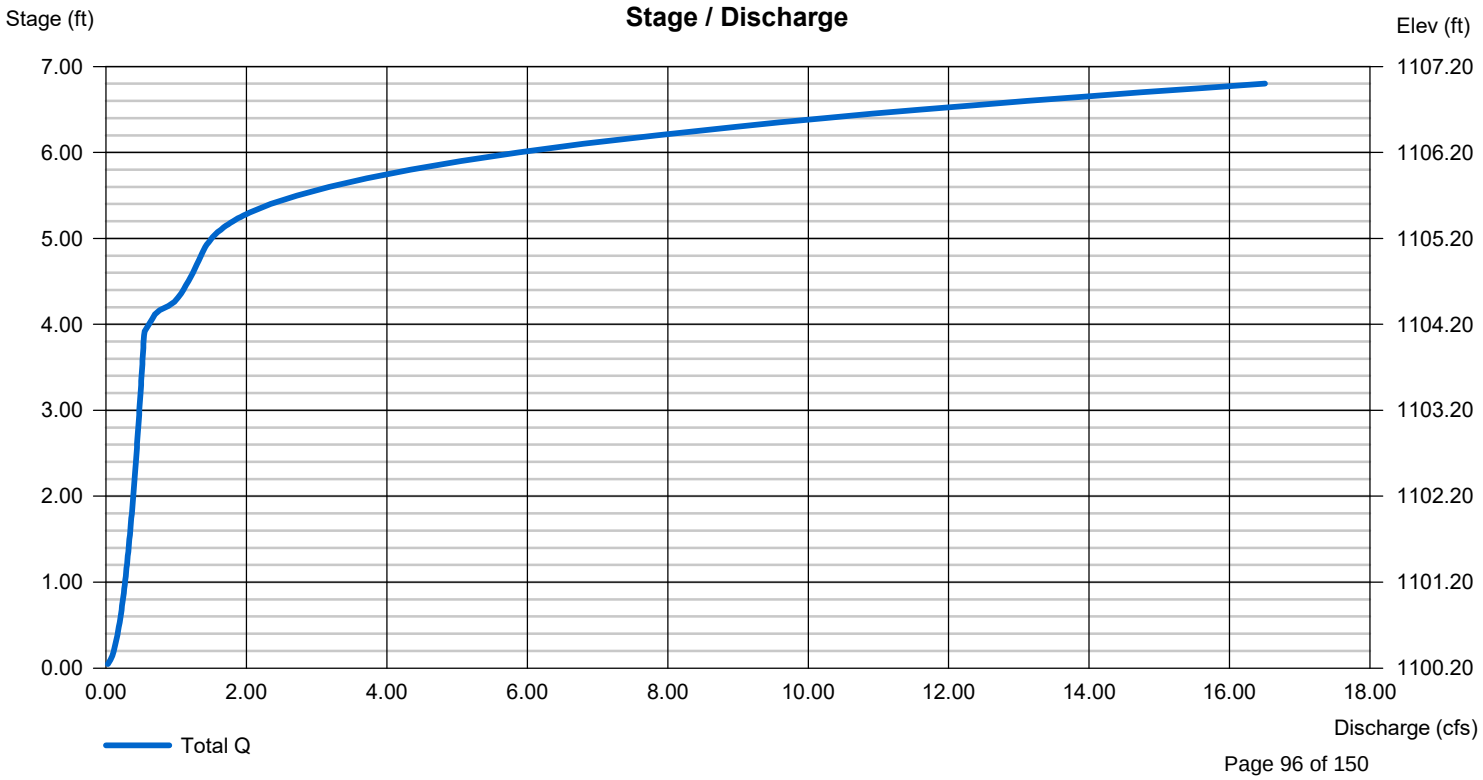
### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 1105.00 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.54 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = 90 degV | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



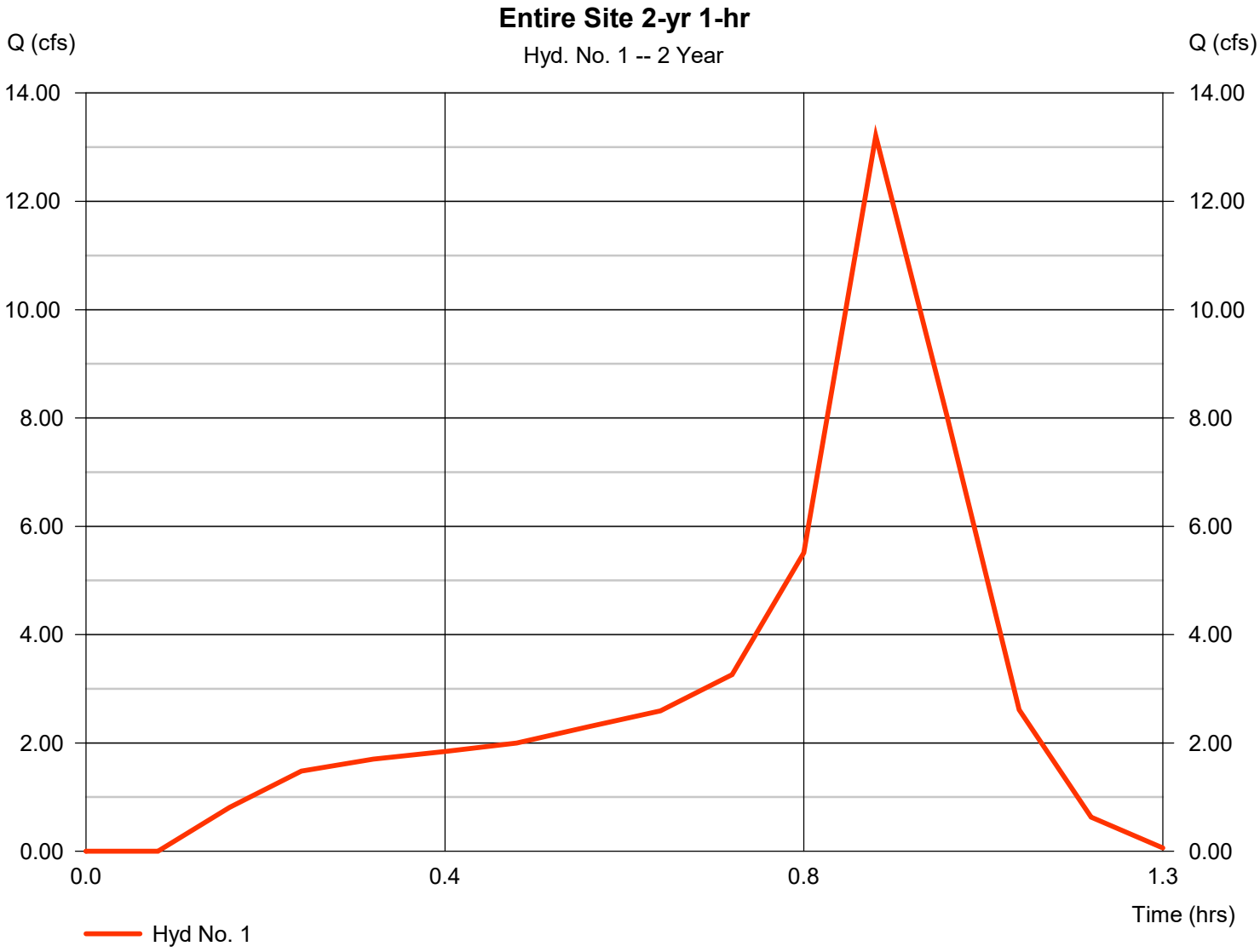
# Hydrograph Report



## Hyd. No. 1

Entire Site 2-yr 1-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 13.21 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 0.92 hrs |
| Time interval | = 5 min | Hyd. volume | = 13,800 cuft |



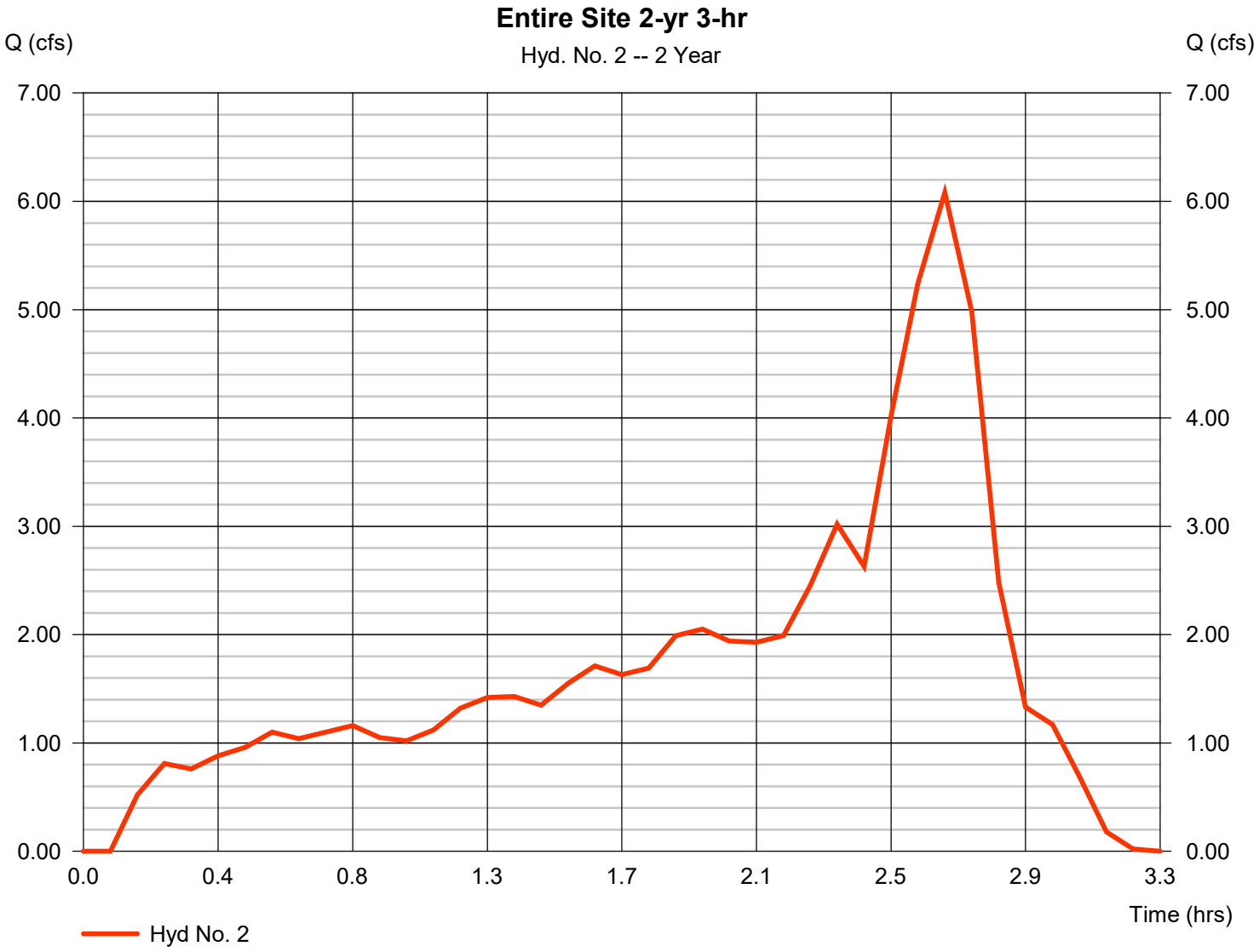
# Hydrograph Report



## Hyd. No. 2

Entire Site 2-yr 3-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 6.080 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 2.67 hrs |
| Time interval | = 5 min | Hyd. volume | = 20,343 cuft |



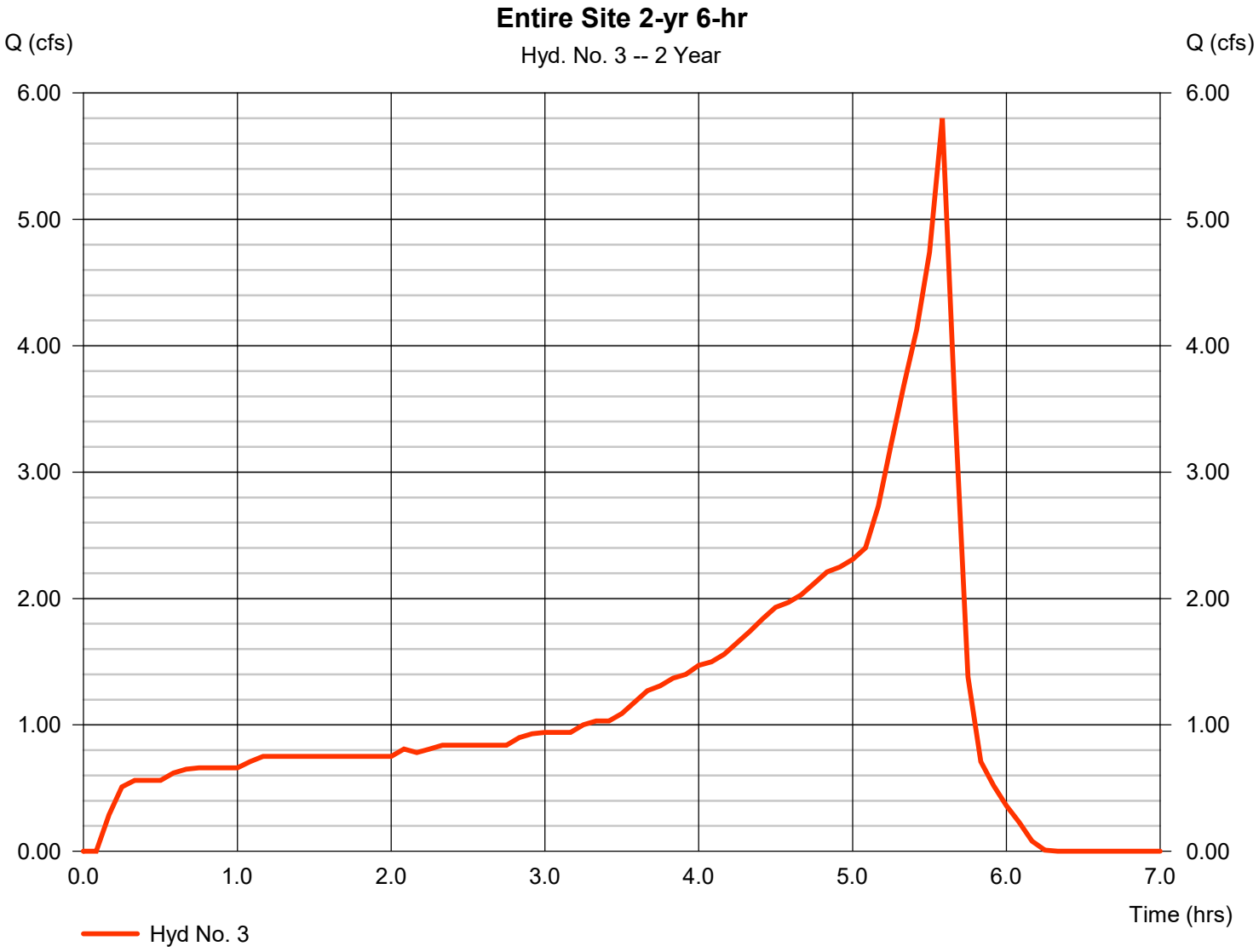
# Hydrograph Report



## Hyd. No. 3

Entire Site 2-yr 6-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 5.800 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 5.58 hrs |
| Time interval | = 5 min | Hyd. volume | = 28,851 cuft |



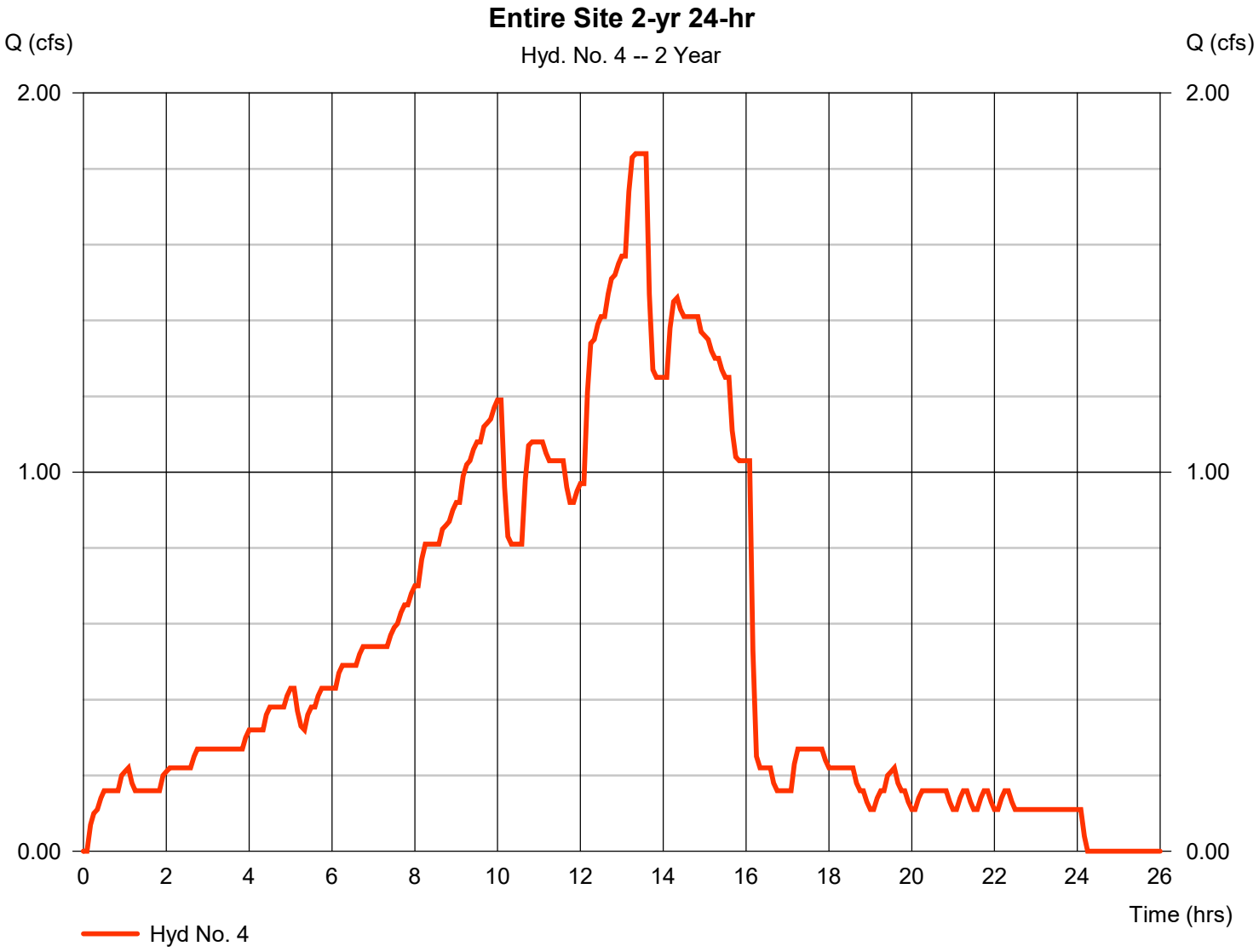
# Hydrograph Report



## Hyd. No. 4

Entire Site 2-yr 24-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 1.840 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 13.33 hrs |
| Time interval | = 5 min | Hyd. volume | = 48,720 cuft |



# Hydrograph Report

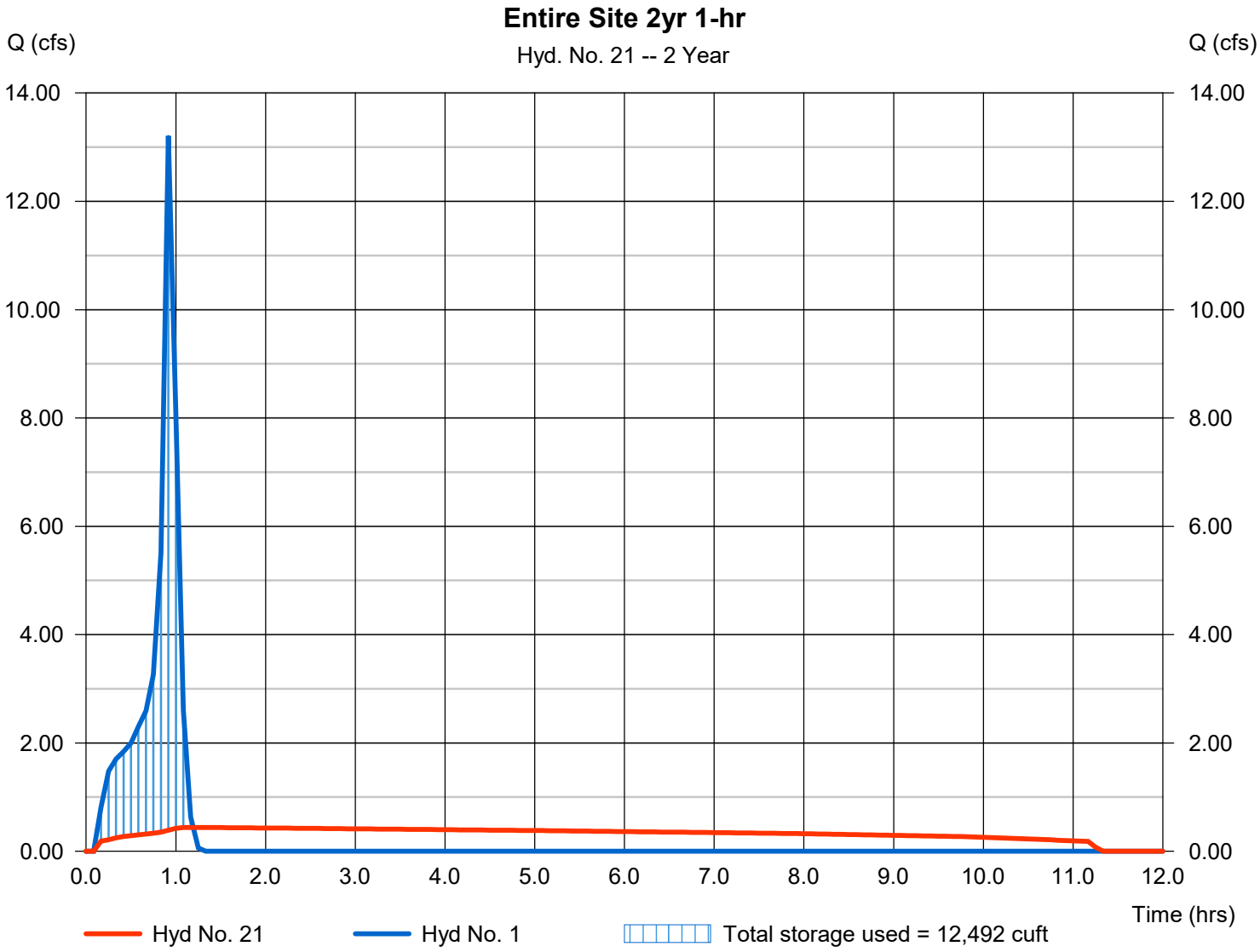


## Hyd. No. 21

Entire Site 2yr 1-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.441 cfs |
| Storm frequency | = | 2 yrs | Time to peak | = | 1.17 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 13,800 cuft |
| Inflow hyd. No. | = | 1 - Entire Site 2-yr 1-hr | Max. Elevation | = | 1102.79 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 12,492 cuft |

Storage Indication method used.



# Hydrograph Report

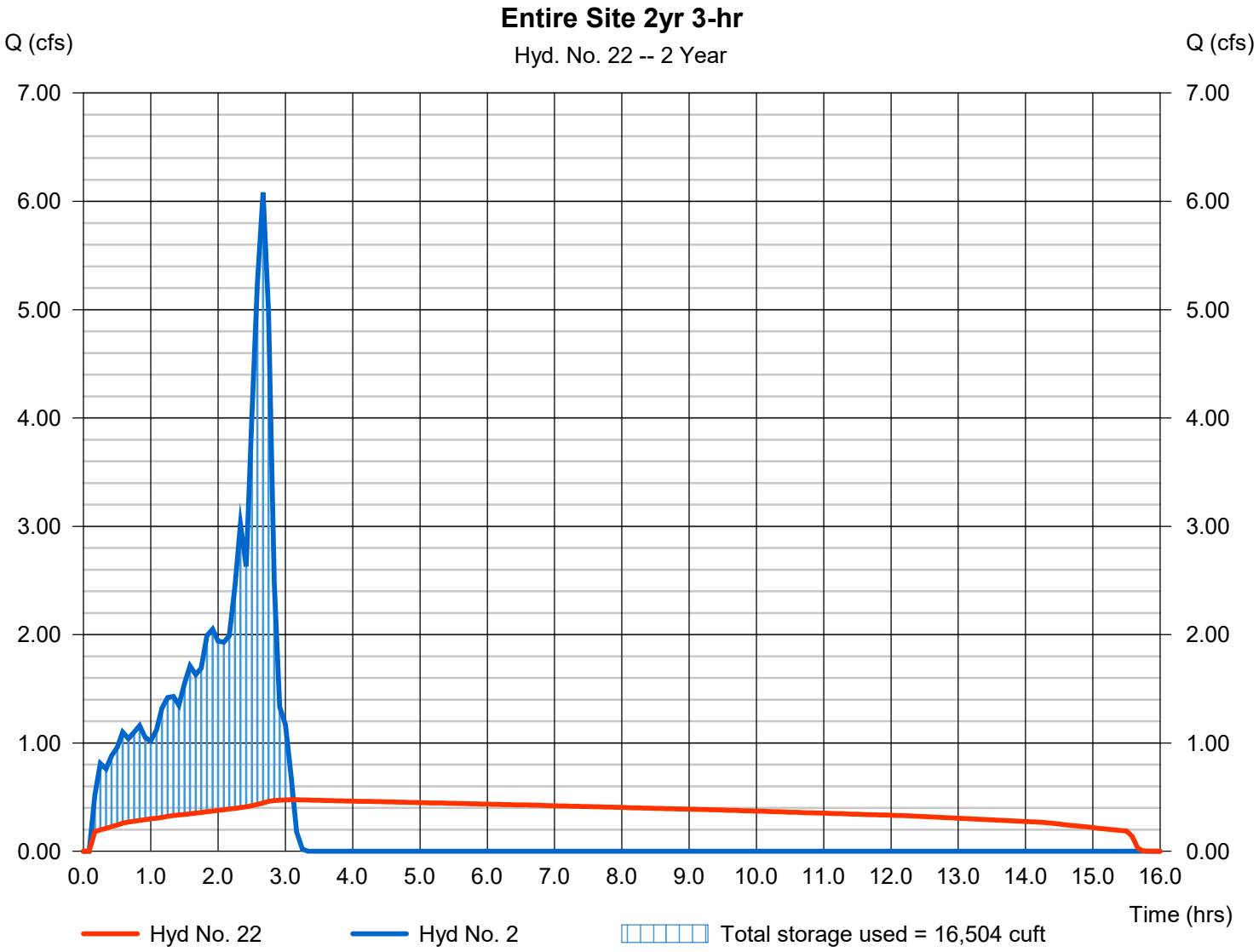


## Hyd. No. 22

Entire Site 2yr 3-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.475 cfs |
| Storm frequency | = | 2 yrs | Time to peak | = | 3.08 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 20,343 cuft |
| Inflow hyd. No. | = | 2 - Entire Site 2-yr 3-hr | Max. Elevation | = | 1103.21 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 16,504 cuft |

Storage Indication method used.



# Hydrograph Report

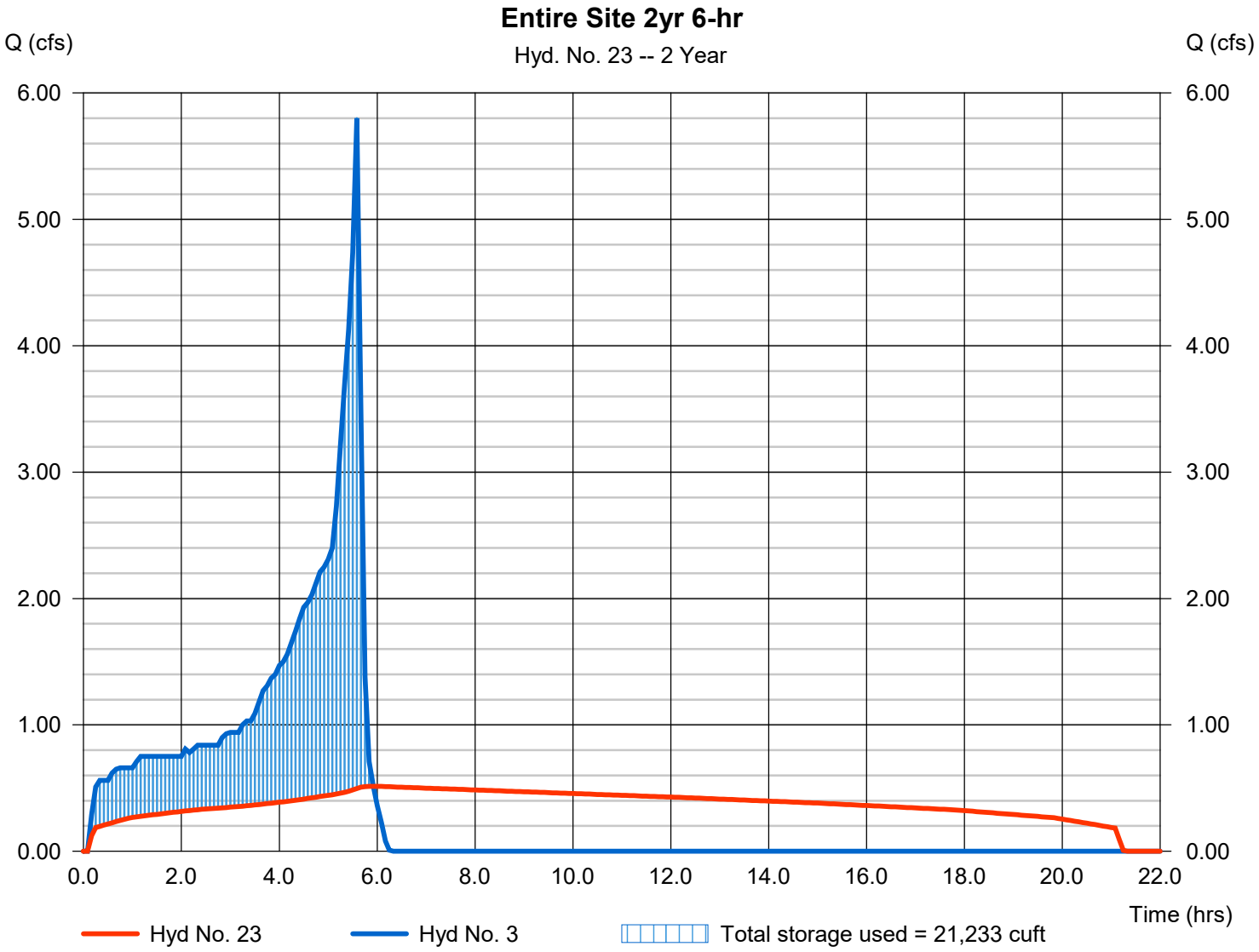


## Hyd. No. 23

Entire Site 2yr 6-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.513 cfs |
| Storm frequency | = | 2 yrs | Time to peak | = | 5.92 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 28,851 cuft |
| Inflow hyd. No. | = | 3 - Entire Site 2-yr 6-hr | Max. Elevation | = | 1103.70 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 21,233 cuft |

Storage Indication method used.



# Hydrograph Report

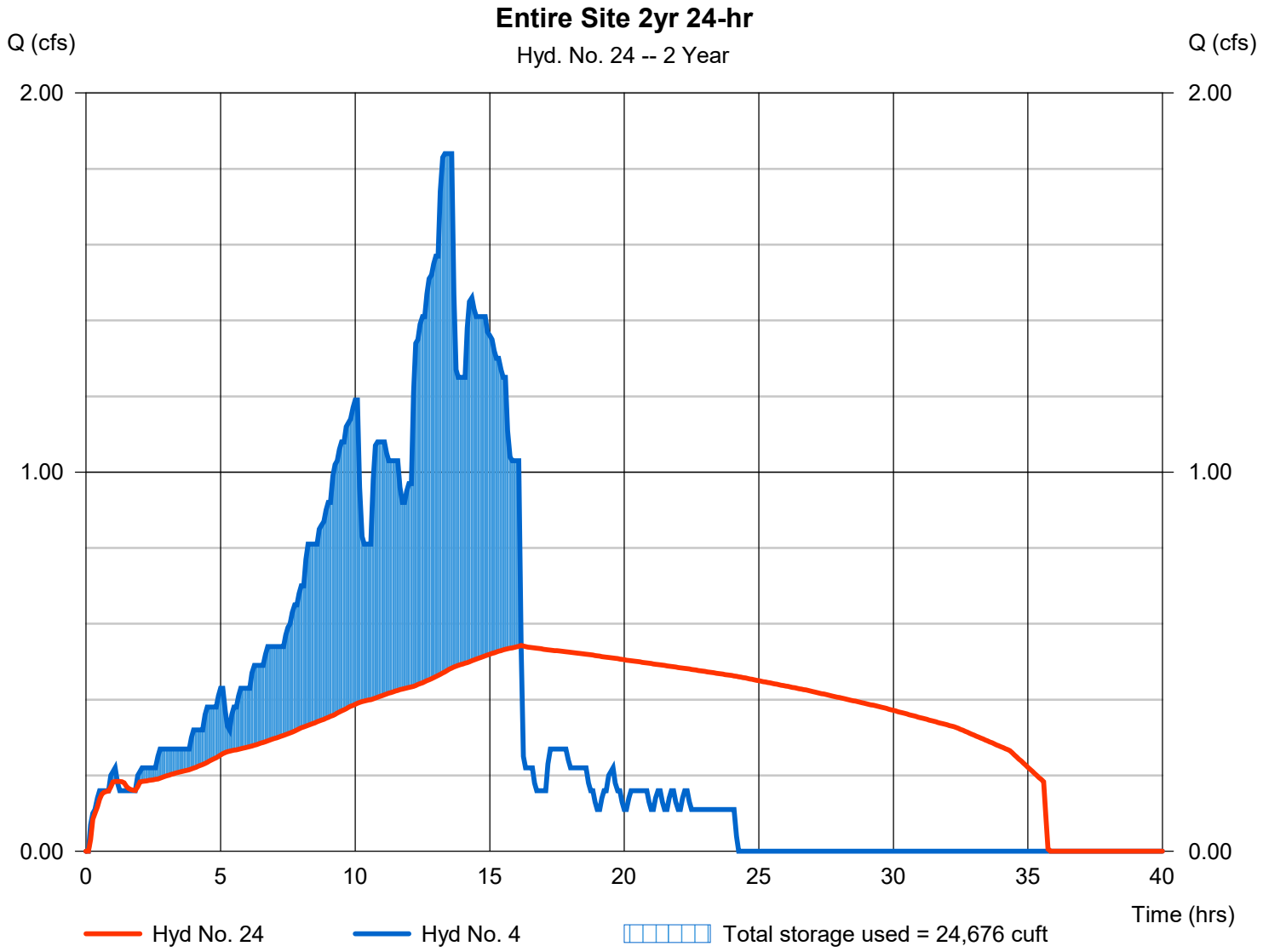


## Hyd. No. 24

Entire Site 2yr 24-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 0.543 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 16.17 hrs |
| Time interval | = 5 min | Hyd. volume | = 48,720 cuft |
| Inflow hyd. No. | = 4 - Entire Site 2-yr 24-hr | Max. Elevation | = 1104.09 ft |
| Reservoir name | = DETENTION POND | Max. Storage | = 24,676 cuft |

Storage Indication method used.



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 1-hr |
| 2 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 3-hr |
| 3 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 6-hr |
| 4 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 24-hr |
| 6 | Manual | 18.00 | 5 | 55 | 18,849 | ------ | ------ | ------ | Entire Site 5-yr 1-hr |
| 7 | Manual | 8.320 | 5 | 160 | 26,955 | ------ | ------ | ------ | Entire Site 5-yr 3-hr |
| 8 | Manual | 8.120 | 5 | 335 | 38,592 | ------ | ------ | ------ | Entire Site 5-yr 6-hr |
| 9 | Manual | 2.370 | 5 | 800 | 62,709 | ------ | ------ | ------ | Entire Site 5-yr 24-hr |
| 11 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 1-hr |
| 12 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 3-hr |
| 13 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 6-hr |
| 14 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 24-hr |
| 16 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 1-hr |
| 17 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 3-hr |
| 18 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 6-hr |
| 19 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 24-hr |
| 21 | Reservoir | 0.000 | 5 | n/a | 0 | 1 | 1100.20 | 0.000 | Entire Site 2yr 1-hr |
| 22 | Reservoir | 0.000 | 5 | n/a | 0 | 2 | 1100.20 | 0.000 | Entire Site 2yr 3-hr |
| 23 | Reservoir | 0.000 | 5 | n/a | 0 | 3 | 1100.20 | 0.000 | Entire Site 2yr 6-hr |
| 24 | Reservoir | 0.000 | 5 | n/a | 0 | 4 | 1100.20 | 0.000 | Entire Site 2yr 24-hr |
| 26 | Reservoir | 0.482 | 5 | 70 | 18,849 | 6 | 1103.31 | 17,415 | Entire Site 5yr 1-hr |
| 27 | Reservoir | 0.526 | 5 | 190 | 26,955 | 7 | 1103.88 | 22,802 | Entire Site 5yr 3-hr |
| 28 | Reservoir | 1.256 | 5 | 350 | 38,592 | 8 | 1104.84 | 29,548 | Entire Site 5yr 6-hr |
| 29 | Reservoir | 1.335 | 5 | 945 | 62,709 | 9 | 1104.97 | 30,221 | Entire Site 5yr 24-hr |
| 31 | Reservoir | 0.000 | 5 | n/a | 0 | 11 | 1100.20 | 0.000 | Entire Site 10yr 1-hr |
| 32 | Reservoir | 0.000 | 5 | n/a | 0 | 12 | 1100.20 | 0.000 | Entire Site 10yr 3-hr |
| 33 | Reservoir | 0.000 | 5 | n/a | 0 | 13 | 1100.20 | 0.000 | Entire Site 10yr 6-hr |
| 34 | Reservoir | 0.000 | 5 | n/a | 0 | 14 | 1100.20 | 0.000 | Entire Site 10yr 24-hr |
| 36 | Reservoir | 0.000 | 5 | n/a | 0 | 16 | 1100.20 | 0.000 | Entire Site 100yr 1-hr |
| 37 | Reservoir | 0.000 | 5 | n/a | 0 | 17 | 1100.20 | 0.000 | Entire Site 100yr 3-hr |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 38 | Reservoir | 0.000 | 5 | n/a | 0 | 18 | 1100.20 | 0.000 | Entire Site 100yr 6-hr |
| 39 | Reservoir | 0.000 | 5 | n/a | 0 | 19 | 1100.20 | 0.000 | Entire Sit 100yr 24-hr |

## Pond No. 1 - DETENTION POND

### Pond Data

**Pond storage is based on user-defined values.**

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 1100.20 | n/a | 0 | 0 |
| 0.48 | 1100.68 | n/a | 49 | 49 |
| 0.97 | 1101.17 | n/a | 1,029 | 1,078 |
| 1.45 | 1101.65 | n/a | 2,147 | 3,225 |
| 1.94 | 1102.14 | n/a | 3,498 | 6,723 |
| 2.42 | 1102.62 | n/a | 4,093 | 10,816 |
| 2.90 | 1103.10 | n/a | 4,677 | 15,493 |
| 3.39 | 1103.59 | n/a | 4,717 | 20,210 |
| 3.87 | 1104.07 | n/a | 4,352 | 24,562 |
| 4.36 | 1104.56 | n/a | 3,629 | 28,191 |
| 4.84 | 1105.04 | n/a | 2,384 | 30,575 |
| 5.13 | 1105.33 | n/a | 1,129 | 31,704 |
| 5.30 | 1105.50 | n/a | 362 | 32,066 |
| 6.30 | 1106.50 | n/a | 5,104 | 37,170 |
| 6.80 | 1107.00 | n/a | 2,568 | 39,738 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 1.00 | 3.00 | Inactive | 0.00 |
| **Span (in)** | = 8.25 | 8.50 | 24.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 1 | 0 |
| **Invert El. (ft)** | = 1100.20 | 1104.10 | 1105.00 | 0.00 |
| **Length (ft)** | = 1.00 | 1.00 | 1.00 | 0.00 |
| **Slope (%)** | = 2.00 | 2.00 | 2.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

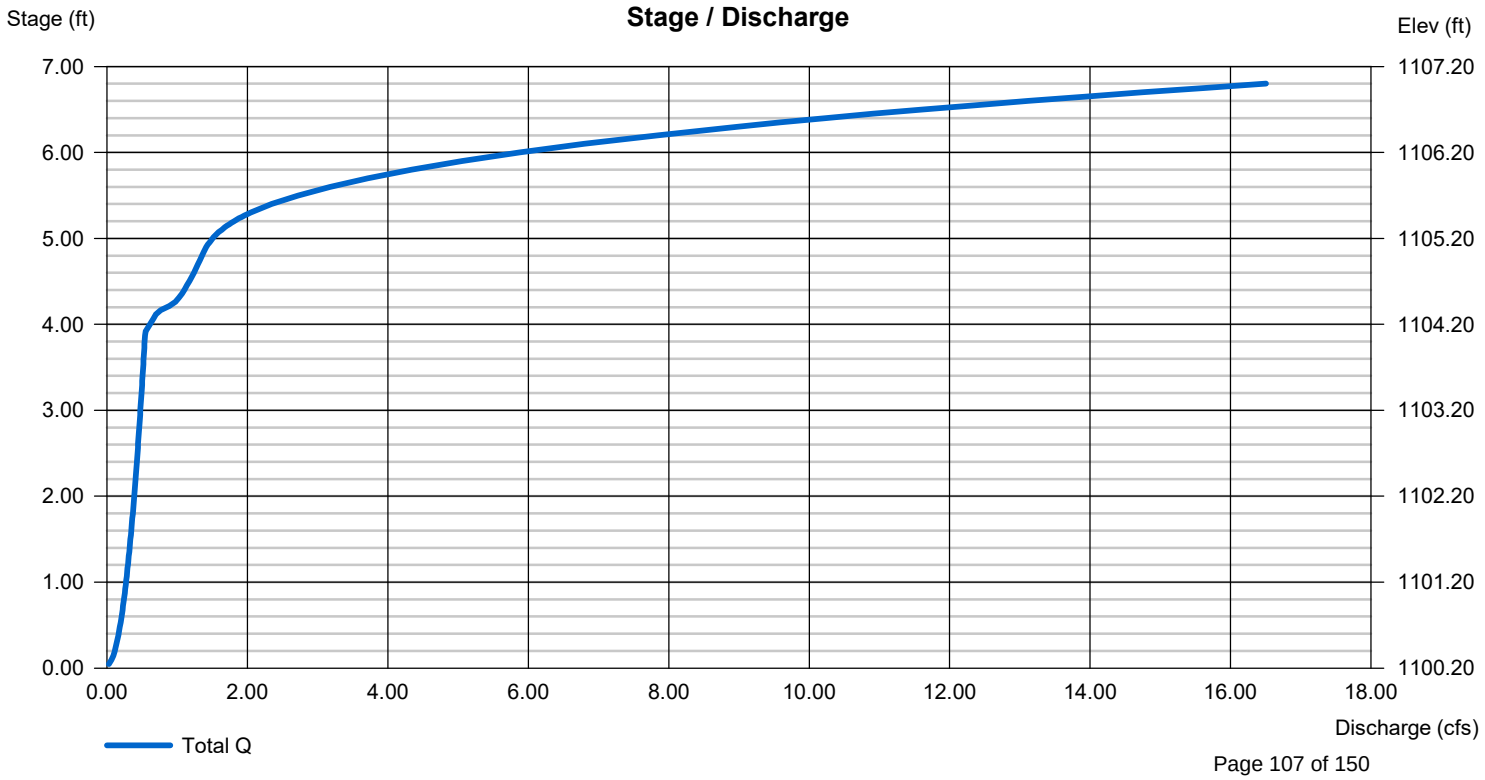
### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 1105.00 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.54 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = 90 degV | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



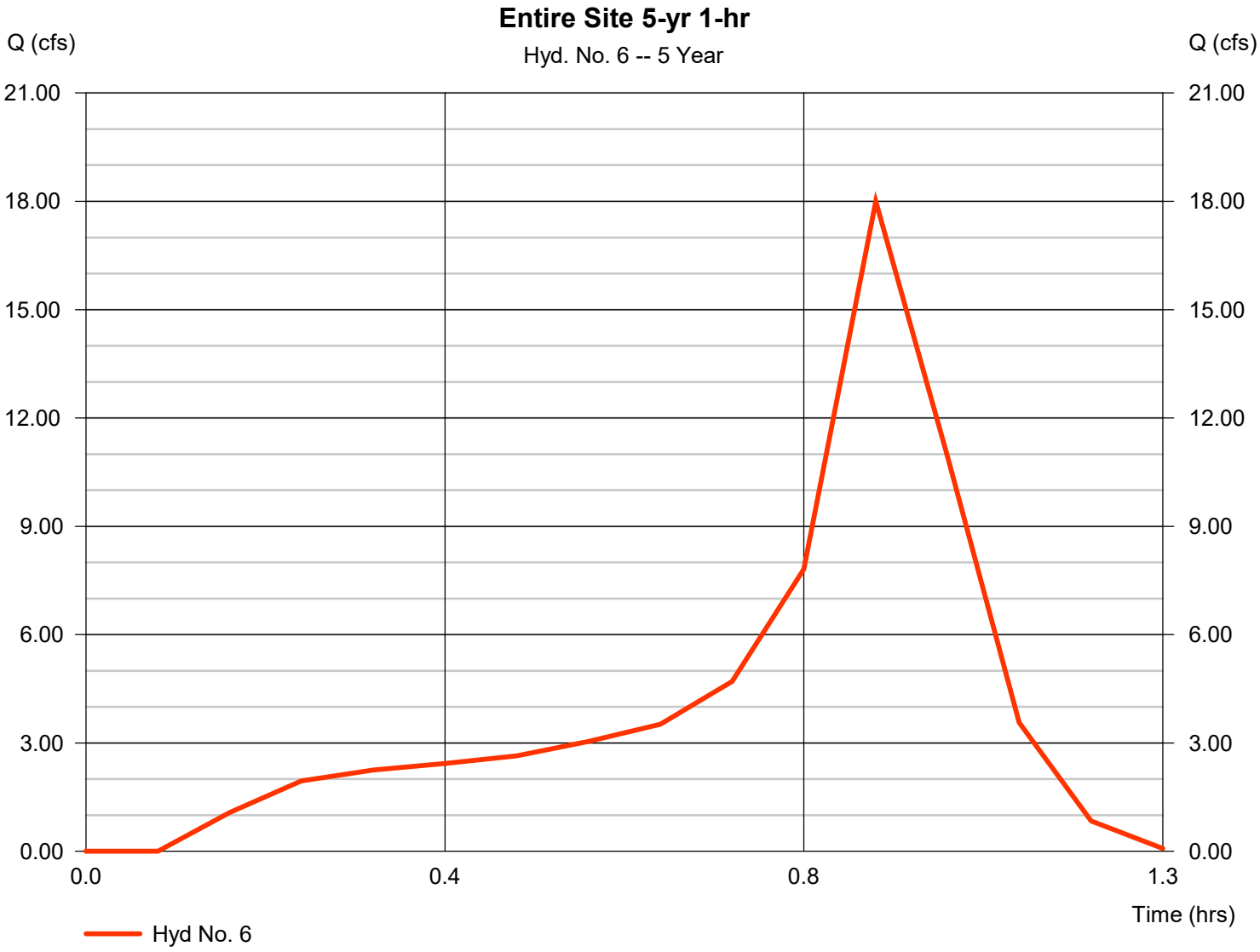
# Hydrograph Report



## Hyd. No. 6

Entire Site 5-yr 1-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 18.00 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 0.92 hrs |
| Time interval | = 5 min | Hyd. volume | = 18,849 cuft |



# Hydrograph Report



## Hyd. No. 7

Entire Site 5-yr 3-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 8.320 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 2.67 hrs |
| Time interval | = 5 min | Hyd. volume | = 26,955 cuft |

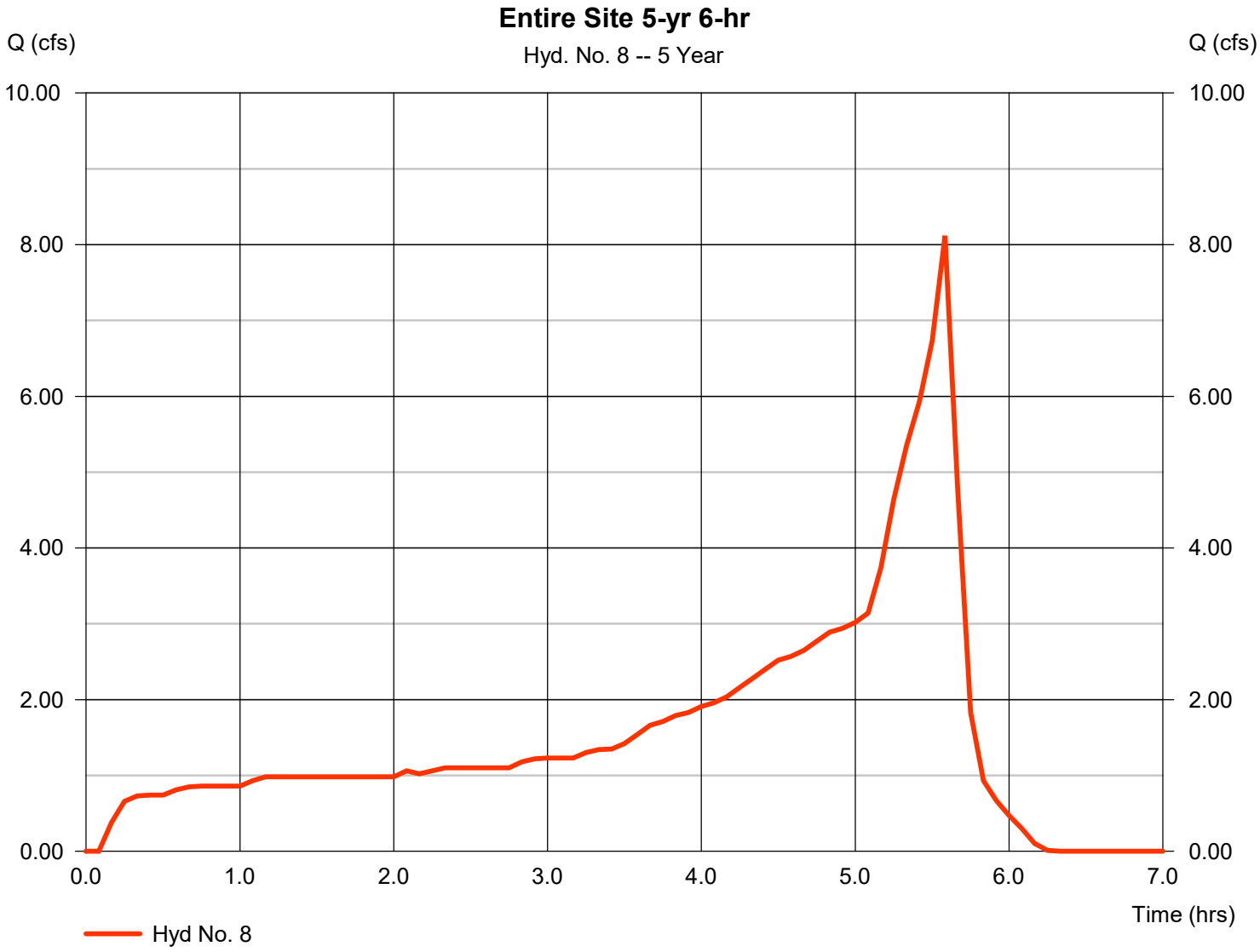
# Hydrograph Report



## Hyd. No. 8

Entire Site 5-yr 6-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 8.120 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 5.58 hrs |
| Time interval | = 5 min | Hyd. volume | = 38,592 cuft |



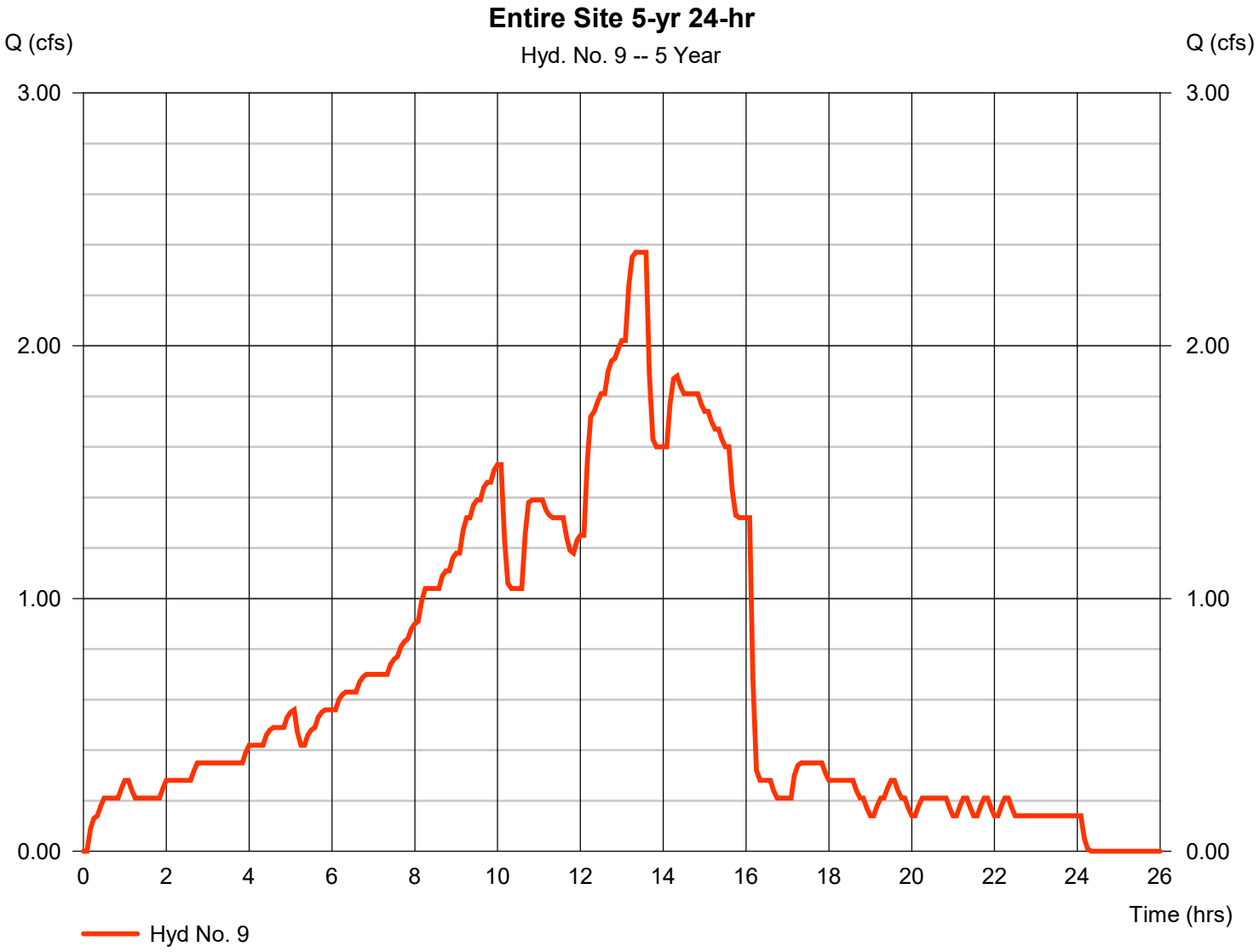
# Hydrograph Report



## Hyd. No. 9

Entire Site 5-yr 24-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 2.370 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 13.33 hrs |
| Time interval | = 5 min | Hyd. volume | = 62,709 cuft |



# Hydrograph Report

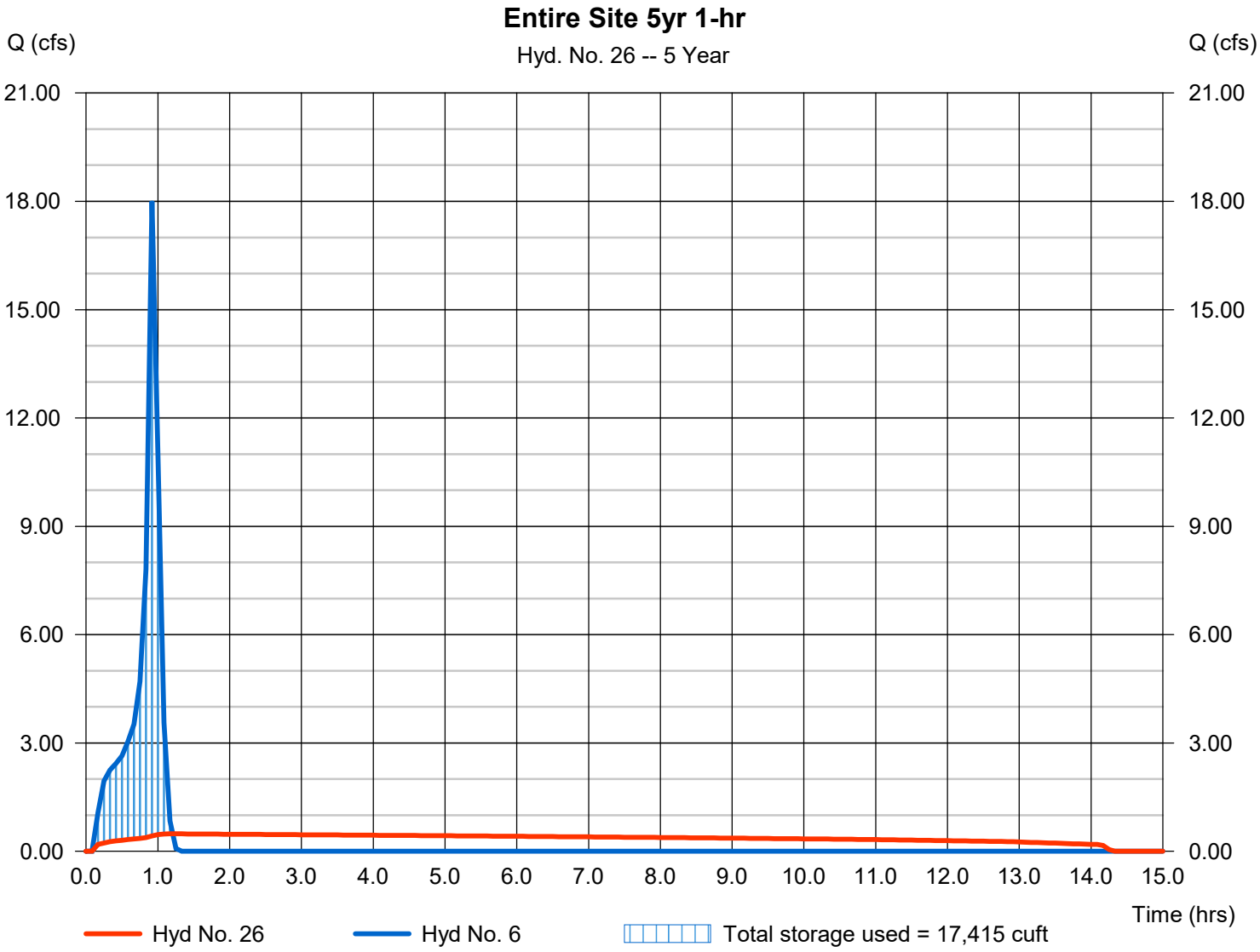


## Hyd. No. 26

Entire Site 5yr 1-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.482 cfs |
| Storm frequency | = | 5 yrs | Time to peak | = | 1.17 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 18,849 cuft |
| Inflow hyd. No. | = | 6 - Entire Site 5-yr 1-hr | Max. Elevation | = | 1103.31 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 17,415 cuft |

Storage Indication method used.



# Hydrograph Report

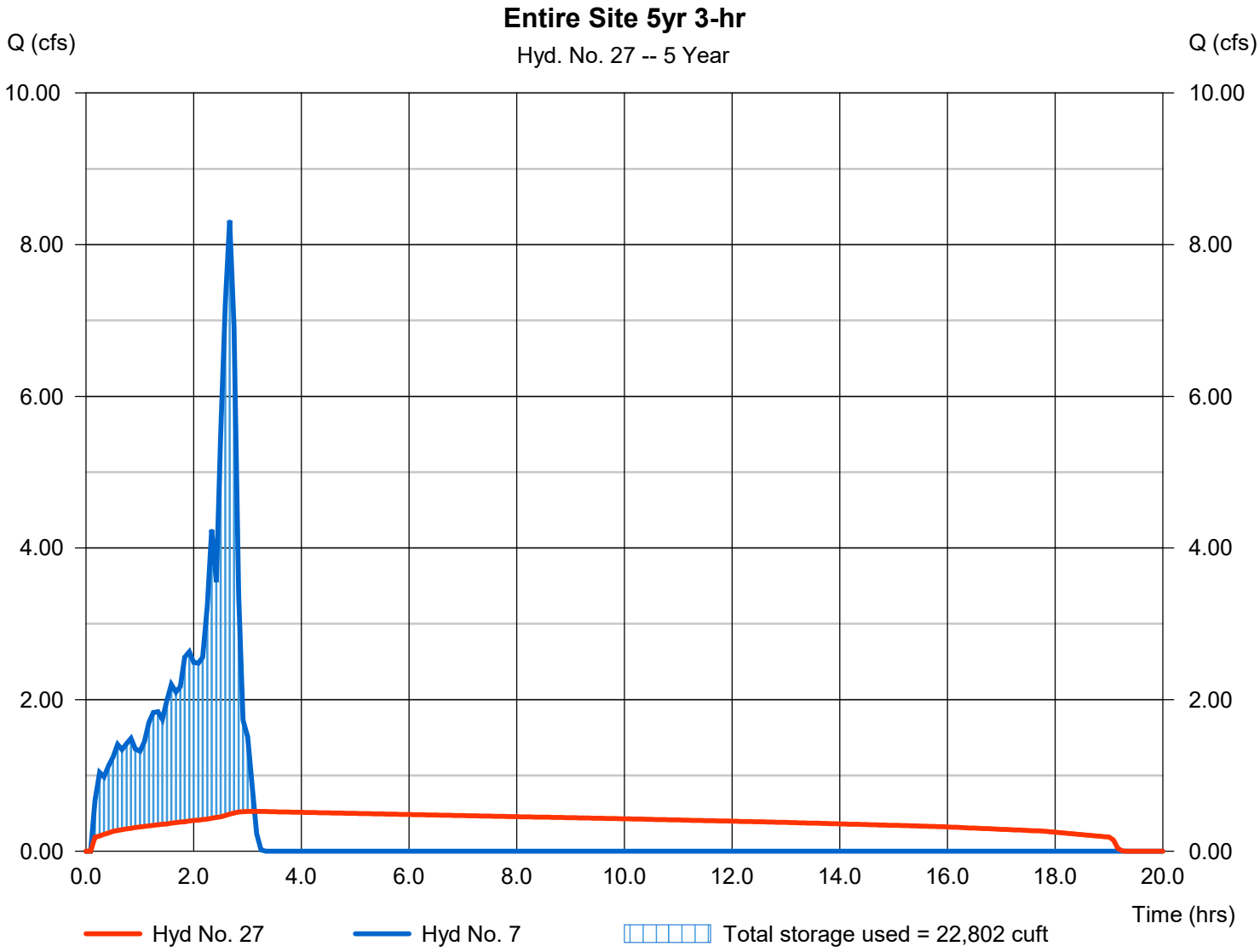


## Hyd. No. 27

Entire Site 5yr 3-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.526 cfs |
| Storm frequency | = | 5 yrs | Time to peak | = | 3.17 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 26,955 cuft |
| Inflow hyd. No. | = | 7 - Entire Site 5-yr 3-hr | Max. Elevation | = | 1103.88 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 22,802 cuft |

Storage Indication method used.



# Hydrograph Report

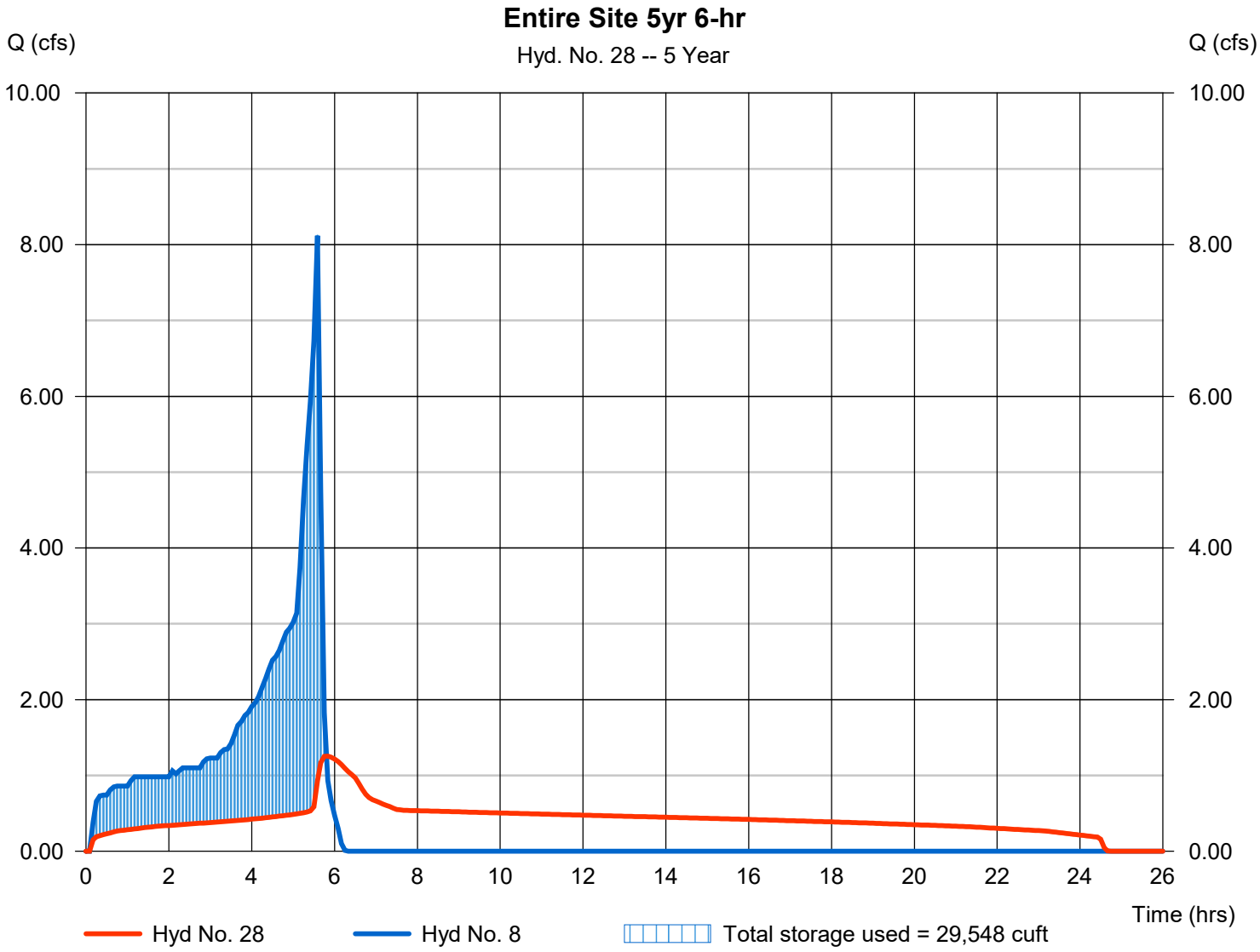


## Hyd. No. 28

Entire Site 5yr 6-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 1.256 cfs |
| Storm frequency | = | 5 yrs | Time to peak | = | 5.83 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 38,592 cuft |
| Inflow hyd. No. | = | 8 - Entire Site 5-yr 6-hr | Max. Elevation | = | 1104.84 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 29,548 cuft |

Storage Indication method used.



# Hydrograph Report

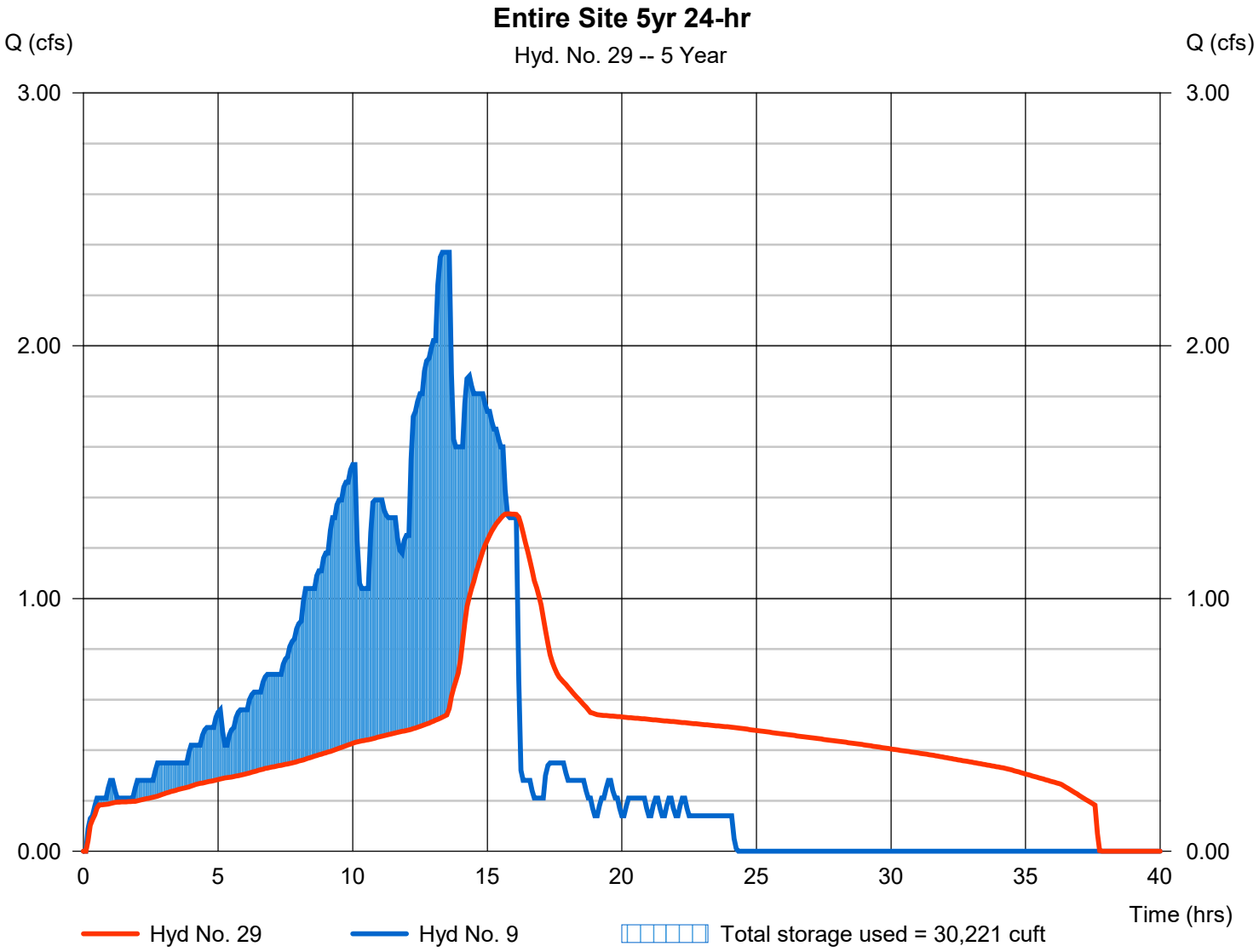


## Hyd. No. 29

Entire Site 5yr 24-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 1.335 cfs |
| Storm frequency | = | 5 yrs | Time to peak | = | 15.75 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 62,709 cuft |
| Inflow hyd. No. | = | 9 - Entire Site 5-yr 24-hr | Max. Elevation | = | 1104.97 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 30,221 cuft |

Storage Indication method used.



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 1-hr |
| 2 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 3-hr |
| 3 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 6-hr |
| 4 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 24-hr |
| 6 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 1-hr |
| 7 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 3-hr |
| 8 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 6-hr |
| 9 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 24-hr |
| 11 | Manual | 22.31 | 5 | 55 | 24,783 | ------ | ------ | ------ | Entire Site 10-yr 1-hr |
| 12 | Manual | 10.71 | 5 | 160 | 34,803 | ------ | ------ | ------ | Entire Site 10-yr 3-hr |
| 13 | Manual | 10.57 | 5 | 335 | 49,779 | ------ | ------ | ------ | Entire Site 10-yr 6-hr |
| 14 | Manual | 3.340 | 5 | 810 | 76,728 | ------ | ------ | ------ | Entire Site 10-yr 24-hr |
| 16 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 1-hr |
| 17 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 3-hr |
| 18 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 6-hr |
| 19 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 100-yr 24-hr |
| 21 | Reservoir | 0.000 | 5 | n/a | 0 | 1 | 1100.20 | 0.000 | Entire Site 2yr 1-hr |
| 22 | Reservoir | 0.000 | 5 | n/a | 0 | 2 | 1100.20 | 0.000 | Entire Site 2yr 3-hr |
| 23 | Reservoir | 0.000 | 5 | n/a | 0 | 3 | 1100.20 | 0.000 | Entire Site 2yr 6-hr |
| 24 | Reservoir | 0.000 | 5 | n/a | 0 | 4 | 1100.20 | 0.000 | Entire Site 2yr 24-hr |
| 26 | Reservoir | 0.000 | 5 | n/a | 0 | 6 | 1100.20 | 0.000 | Entire Site 5yr 1-hr |
| 27 | Reservoir | 0.000 | 5 | n/a | 0 | 7 | 1100.20 | 0.000 | Entire Site 5yr 3-hr |
| 28 | Reservoir | 0.000 | 5 | n/a | 0 | 8 | 1100.20 | 0.000 | Entire Site 5yr 6-hr |
| 29 | Reservoir | 0.000 | 5 | n/a | 0 | 9 | 1100.20 | 0.000 | Entire Site 5yr 24-hr |
| 31 | Reservoir | 0.529 | 5 | 75 | 24,783 | 11 | 1103.93 | 23,229 | Entire Site 10yr 1-hr |
| 32 | Reservoir | 1.260 | 5 | 185 | 34,803 | 12 | 1104.85 | 29,584 | Entire Site 10yr 3-hr |
| 33 | Reservoir | 6.251 | 5 | 340 | 49,779 | 13 | 1106.24 | 35,846 | Entire Site 10yr 6-hr |
| 34 | Reservoir | 2.330 | 5 | 895 | 76,728 | 14 | 1105.59 | 32,549 | Entire Site 10yr 24-hr |
| 36 | Reservoir | 0.000 | 5 | n/a | 0 | 16 | 1100.20 | 0.000 | Entire Site 100yr 1-hr |
| 37 | Reservoir | 0.000 | 5 | n/a | 0 | 17 | 1100.20 | 0.000 | Entire Site 100yr 3-hr |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 38 | Reservoir | 0.000 | 5 | n/a | 0 | 18 | 1100.20 | 0.000 | Entire Site 100yr 6-hr |
| 39 | Reservoir | 0.000 | 5 | n/a | 0 | 19 | 1100.20 | 0.000 | Entire Sit 100yr 24-hr |

# Pond Report



## Pond No. 1 - DETENTION POND

### Pond Data

**Pond storage is based on user-defined values.**

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 1100.20 | n/a | 0 | 0 |
| 0.48 | 1100.68 | n/a | 49 | 49 |
| 0.97 | 1101.17 | n/a | 1,029 | 1,078 |
| 1.45 | 1101.65 | n/a | 2,147 | 3,225 |
| 1.94 | 1102.14 | n/a | 3,498 | 6,723 |
| 2.42 | 1102.62 | n/a | 4,093 | 10,816 |
| 2.90 | 1103.10 | n/a | 4,677 | 15,493 |
| 3.39 | 1103.59 | n/a | 4,717 | 20,210 |
| 3.87 | 1104.07 | n/a | 4,352 | 24,562 |
| 4.36 | 1104.56 | n/a | 3,629 | 28,191 |
| 4.84 | 1105.04 | n/a | 2,384 | 30,575 |
| 5.13 | 1105.33 | n/a | 1,129 | 31,704 |
| 5.30 | 1105.50 | n/a | 362 | 32,066 |
| 6.30 | 1106.50 | n/a | 5,104 | 37,170 |
| 6.80 | 1107.00 | n/a | 2,568 | 39,738 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 1.00 | 3.00 | Inactive | 0.00 |
| **Span (in)** | = 8.25 | 8.50 | 24.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 1 | 0 |
| **Invert El. (ft)** | = 1100.20 | 1104.10 | 1105.00 | 0.00 |
| **Length (ft)** | = 1.00 | 1.00 | 1.00 | 0.00 |
| **Slope (%)** | = 2.00 | 2.00 | 2.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

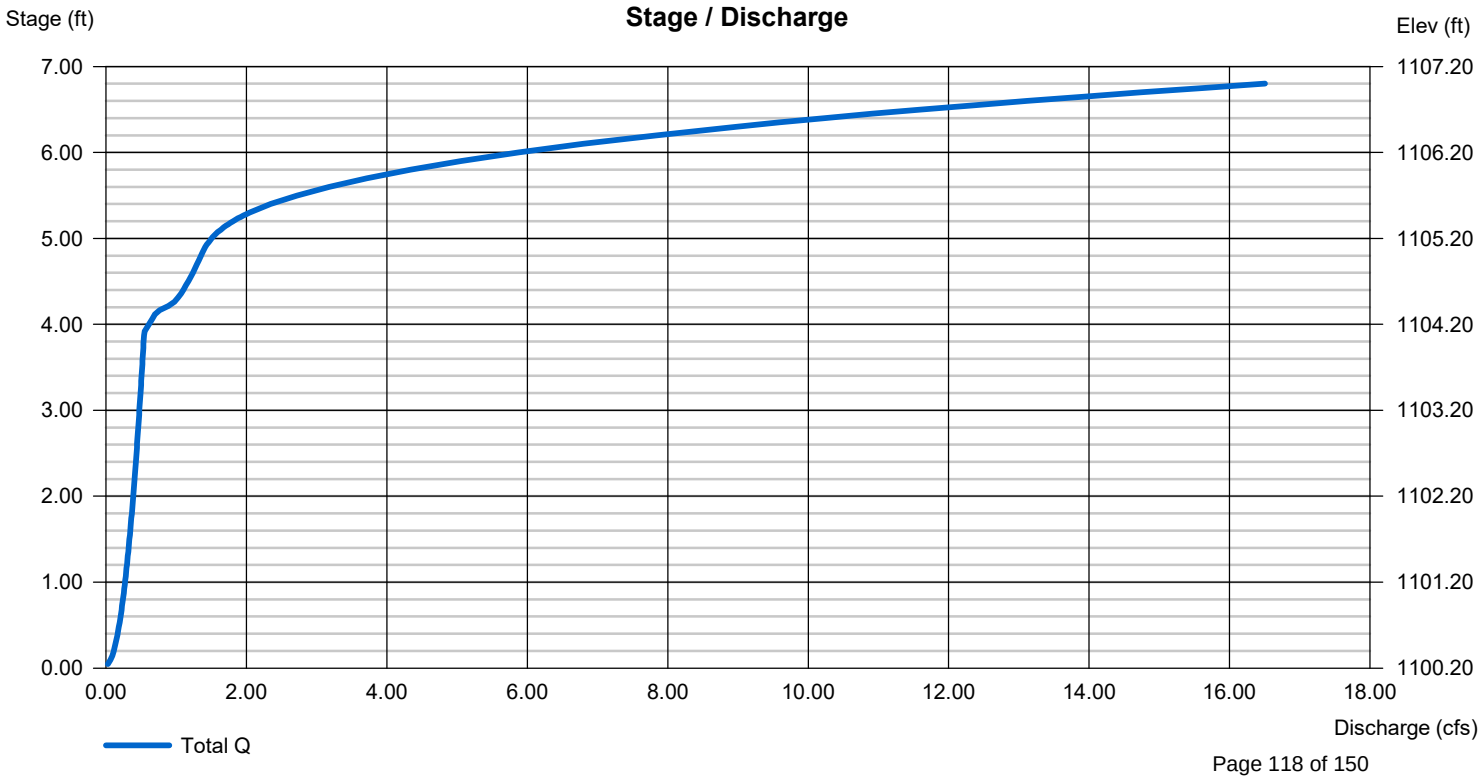
### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 1105.00 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.54 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = 90 degV | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



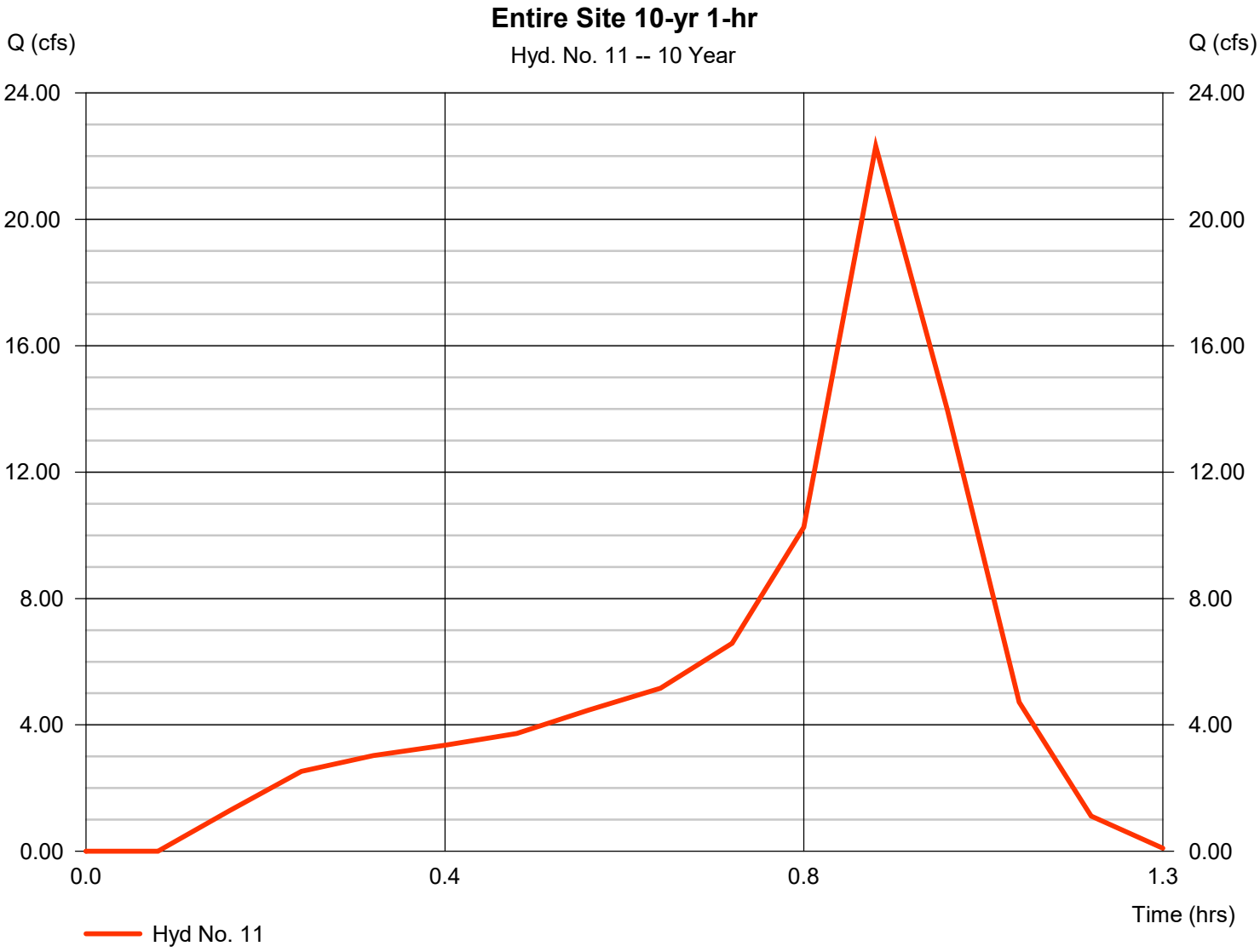
# Hydrograph Report



## Hyd. No. 11

Entire Site 10-yr 1-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 22.31 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 0.92 hrs |
| Time interval | = 5 min | Hyd. volume | = 24,783 cuft |



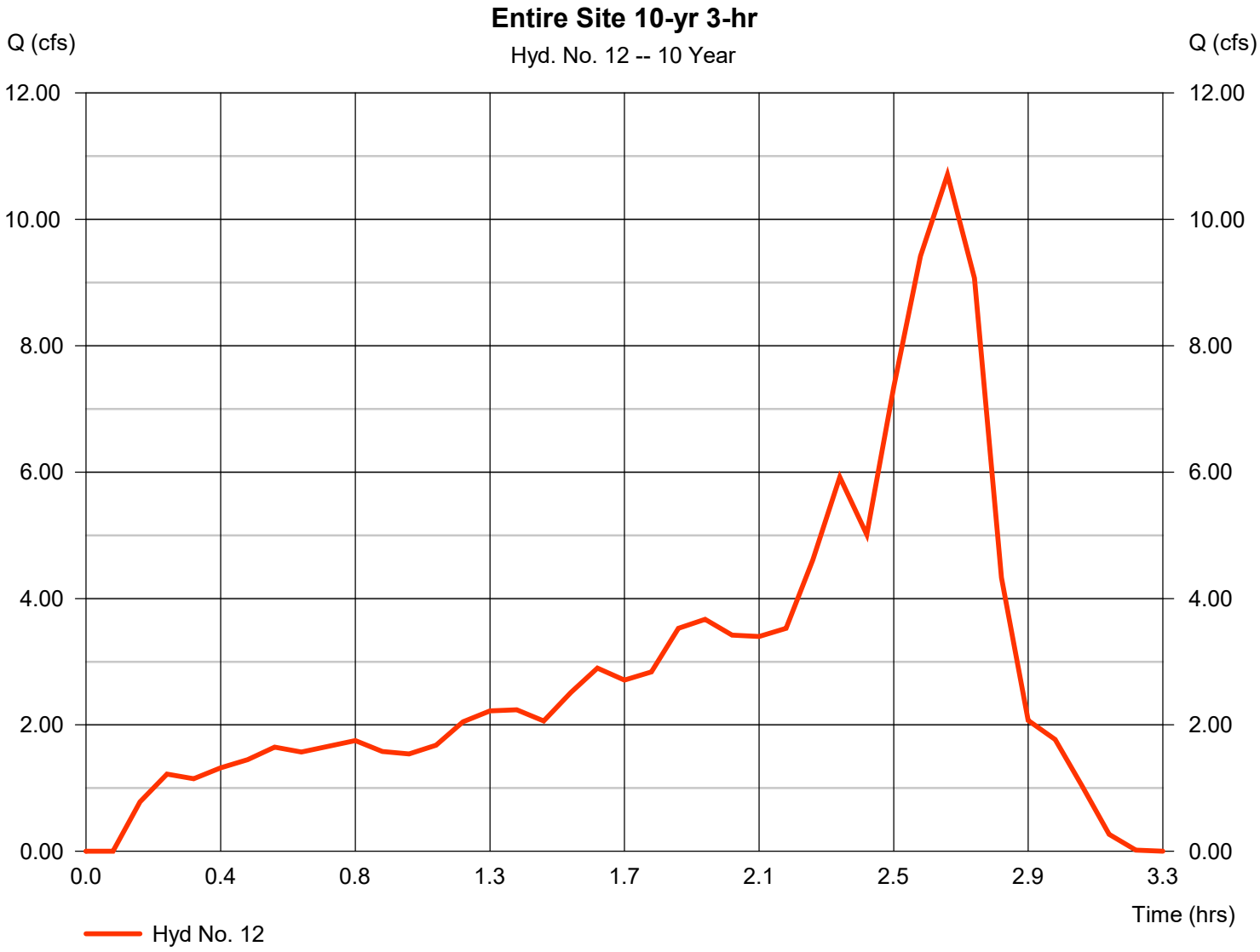
# Hydrograph Report



## Hyd. No. 12

Entire Site 10-yr 3-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 10.71 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 2.67 hrs |
| Time interval | = 5 min | Hyd. volume | = 34,803 cuft |



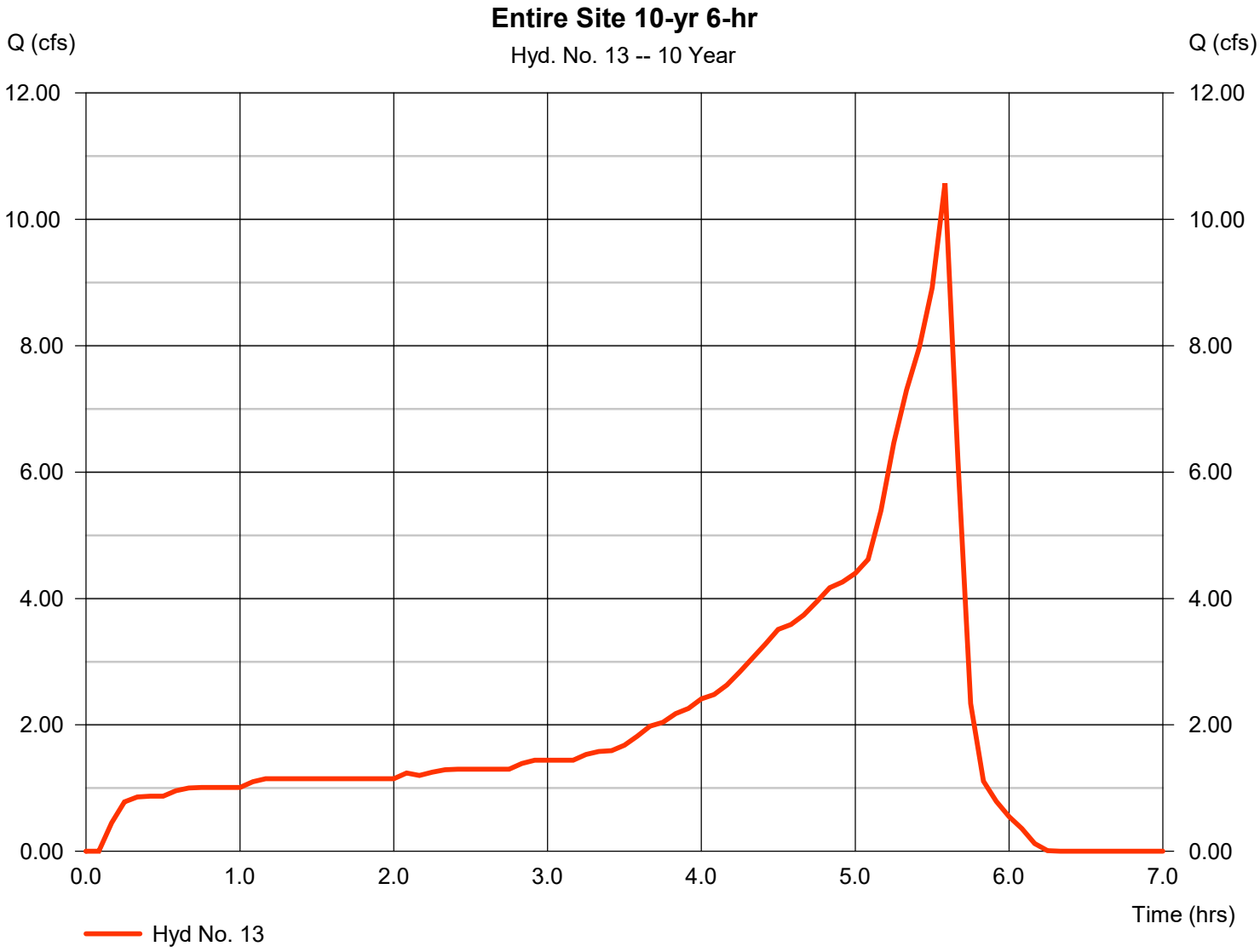
# Hydrograph Report



## Hyd. No. 13

Entire Site 10-yr 6-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 10.57 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 5.58 hrs |
| Time interval | = 5 min | Hyd. volume | = 49,779 cuft |



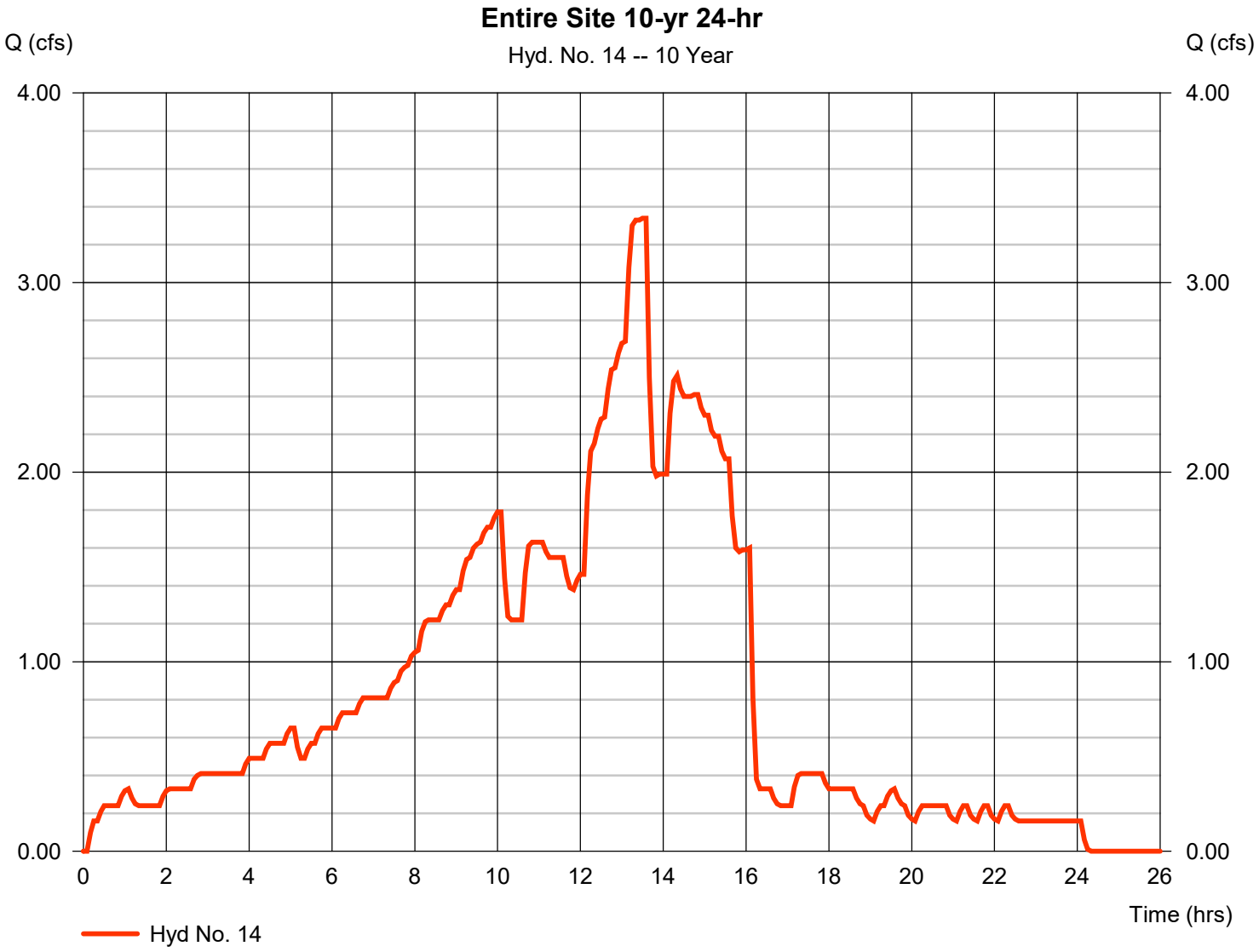
# Hydrograph Report



## Hyd. No. 14

Entire Site 10-yr 24-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 3.340 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 13.50 hrs |
| Time interval | = 5 min | Hyd. volume | = 76,728 cuft |



# Hydrograph Report

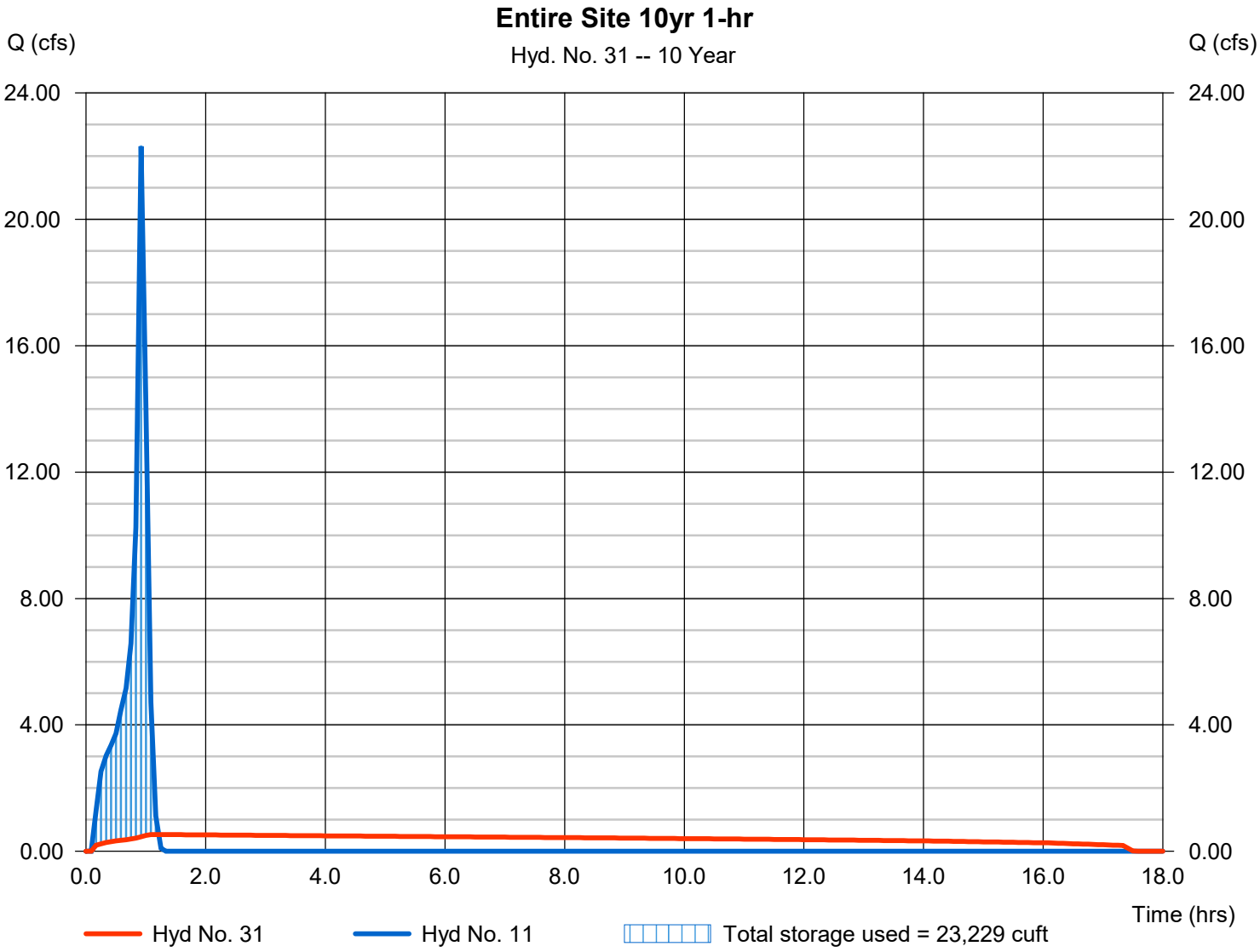


## Hyd. No. 31

Entire Site 10yr 1-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 0.529 cfs |
| Storm frequency | = | 10 yrs | Time to peak | = | 1.25 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 24,783 cuft |
| Inflow hyd. No. | = | 11 - Entire Site 10-yr 1-hr | Max. Elevation | = | 1103.93 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 23,229 cuft |

Storage Indication method used.



# Hydrograph Report

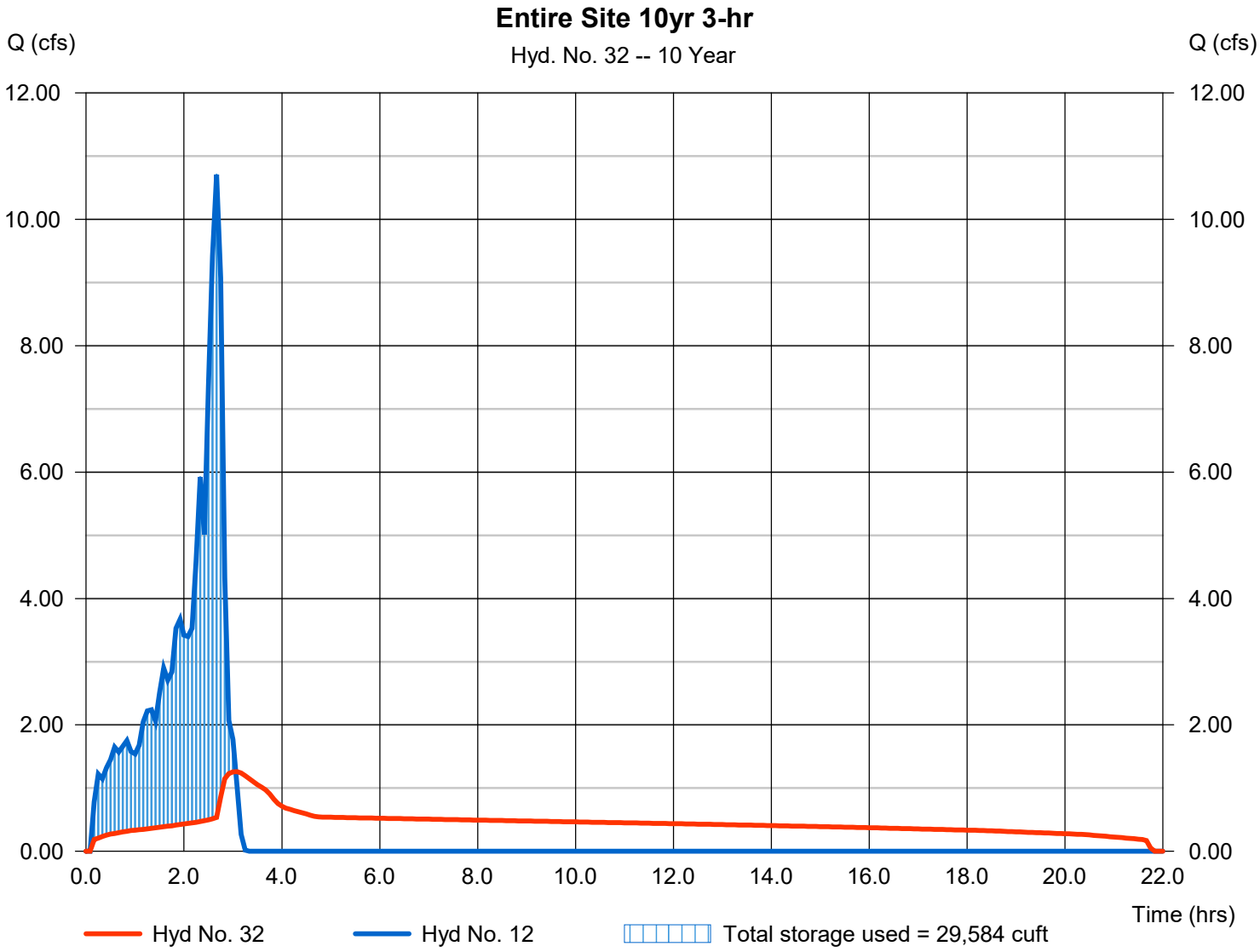


## Hyd. No. 32

Entire Site 10yr 3-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 1.260 cfs |
| Storm frequency | = | 10 yrs | Time to peak | = | 3.08 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 34,803 cuft |
| Inflow hyd. No. | = | 12 - Entire Site 10-yr 3-hr | Max. Elevation | = | 1104.85 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 29,584 cuft |

Storage Indication method used.



# Hydrograph Report

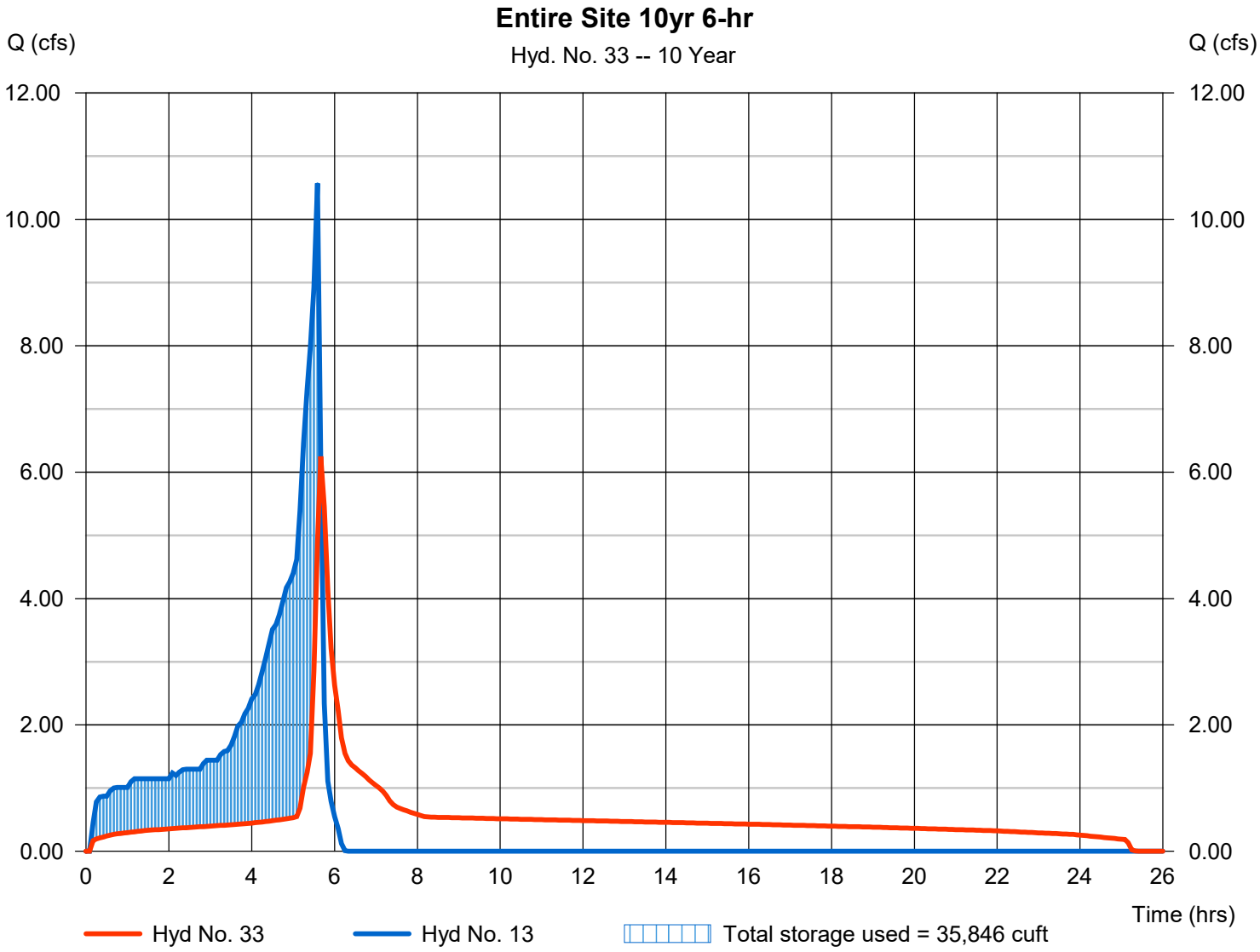


## Hyd. No. 33

Entire Site 10yr 6-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 6.251 cfs |
| Storm frequency | = | 10 yrs | Time to peak | = | 5.67 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 49,779 cuft |
| Inflow hyd. No. | = | 13 - Entire Site 10-yr 6-hr | Max. Elevation | = | 1106.24 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 35,846 cuft |

Storage Indication method used.



# Hydrograph Report

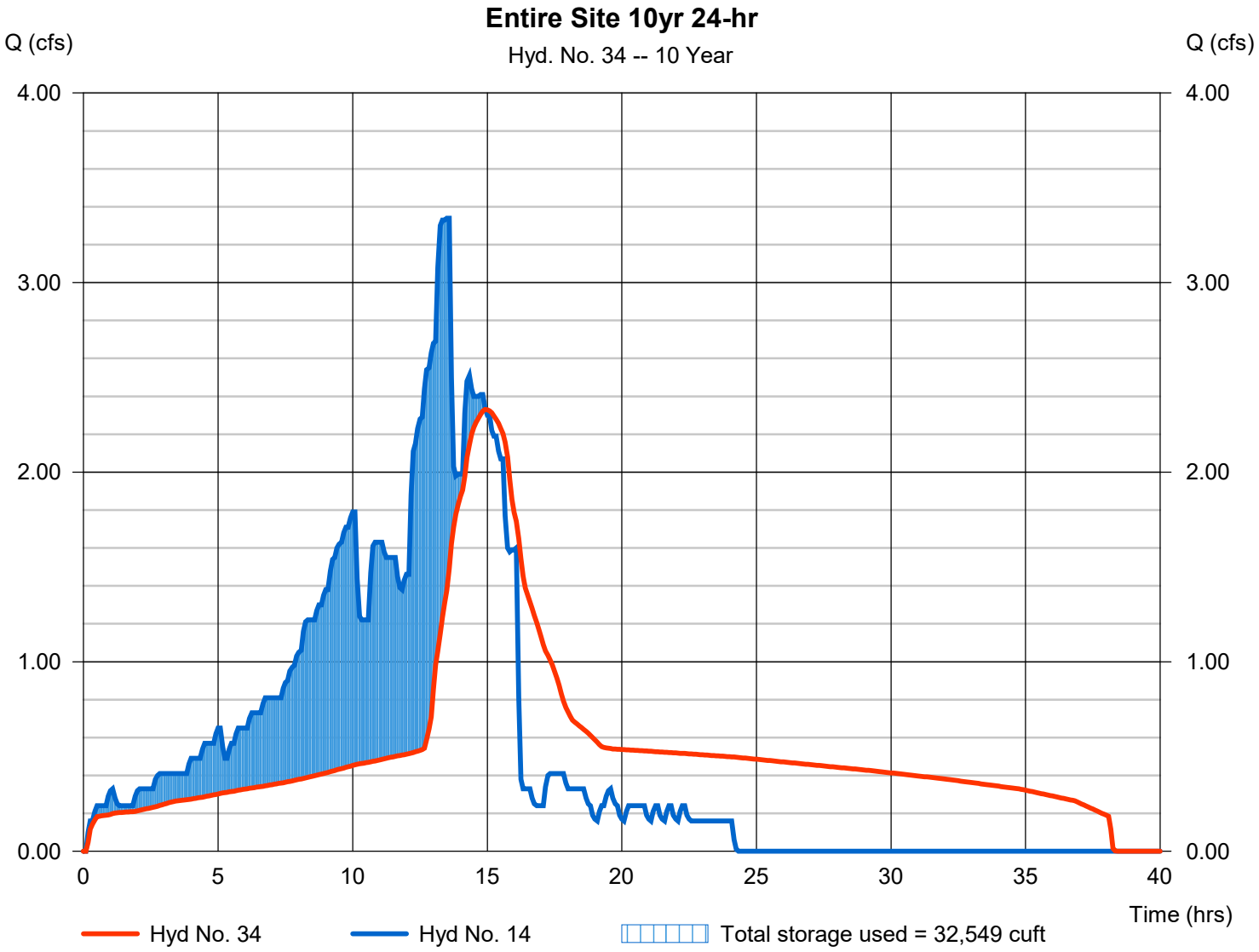


## Hyd. No. 34

Entire Site 10yr 24-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 2.330 cfs |
| Storm frequency | = | 10 yrs | Time to peak | = | 14.92 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 76,728 cuft |
| Inflow hyd. No. | = | 14 - Entire Site 10-yr 24-hr | Max. Elevation | = | 1105.59 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 32,549 cuft |

Storage Indication method used.



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 1-hr |
| 2 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 3-hr |
| 3 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 6-hr |
| 4 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 2-yr 24-hr |
| 6 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 1-hr |
| 7 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 3-hr |
| 8 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 6-hr |
| 9 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 5-yr 24-hr |
| 11 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 1-hr |
| 12 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 3-hr |
| 13 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 6-hr |
| 14 | Manual | 0.000 | 5 | n/a | 0 | ------ | ------ | ------ | Entire Site 10-yr 24-hr |
| 16 | Manual | 34.85 | 5 | 55 | 41,382 | ------ | ------ | ------ | Entire Site 100-yr 1-hr |
| 17 | Manual | 16.87 | 5 | 160 | 60,864 | ------ | ------ | ------ | Entire Site 100-yr 3-hr |
| 18 | Manual | 16.91 | 5 | 335 | 88,548 | ------ | ------ | ------ | Entire Site 100-yr 6-hr |
| 19 | Manual | 5.830 | 5 | 800 | 134,862 | ------ | ------ | ------ | Entire Site 100-yr 24-hr |
| 21 | Reservoir | 0.000 | 5 | n/a | 0 | 1 | 1100.20 | 0.000 | Entire Site 2yr 1-hr |
| 22 | Reservoir | 0.000 | 5 | n/a | 0 | 2 | 1100.20 | 0.000 | Entire Site 2yr 3-hr |
| 23 | Reservoir | 0.000 | 5 | n/a | 0 | 3 | 1100.20 | 0.000 | Entire Site 2yr 6-hr |
| 24 | Reservoir | 0.000 | 5 | n/a | 0 | 4 | 1100.20 | 0.000 | Entire Site 2yr 24-hr |
| 26 | Reservoir | 0.000 | 5 | n/a | 0 | 6 | 1100.20 | 0.000 | Entire Site 5yr 1-hr |
| 27 | Reservoir | 0.000 | 5 | n/a | 0 | 7 | 1100.20 | 0.000 | Entire Site 5yr 3-hr |
| 28 | Reservoir | 0.000 | 5 | n/a | 0 | 8 | 1100.20 | 0.000 | Entire Site 5yr 6-hr |
| 29 | Reservoir | 0.000 | 5 | n/a | 0 | 9 | 1100.20 | 0.000 | Entire Site 5yr 24-hr |
| 31 | Reservoir | 0.000 | 5 | n/a | 0 | 11 | 1100.20 | 0.000 | Entire Site 10yr 1-hr |
| 32 | Reservoir | 0.000 | 5 | n/a | 0 | 12 | 1100.20 | 0.000 | Entire Site 10yr 3-hr |
| 33 | Reservoir | 0.000 | 5 | n/a | 0 | 13 | 1100.20 | 0.000 | Entire Site 10yr 6-hr |
| 34 | Reservoir | 0.000 | 5 | n/a | 0 | 14 | 1100.20 | 0.000 | Entire Site 10yr 24-hr |
| 36 | Reservoir | 7.198 | 5 | 65 | 41,382 | 16 | 1106.37 | 36,347 | Entire Site 100yr 1-hr |
| 37 | Reservoir | 14.53 | 5 | 165 | 60,864 | 17 | 1106.89 | 39,155 | Entire Site 100yr 3-hr |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 38 | Reservoir | 14.68 | 5 | 335 | 88,548 | 18 | 1106.96 | 39,202 | Entire Site 100yr 6-hr |
| 39 | Reservoir | 5.734 | 5 | 815 | 134,862 | 19 | 1106.19 | 35,550 | Entire Sit 100yr 24-hr |

# Pond Report



## Pond No. 1 - DETENTION POND

### Pond Data

**Pond storage is based on user-defined values.**

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 1100.20 | n/a | 0 | 0 |
| 0.48 | 1100.68 | n/a | 49 | 49 |
| 0.97 | 1101.17 | n/a | 1,029 | 1,078 |
| 1.45 | 1101.65 | n/a | 2,147 | 3,225 |
| 1.94 | 1102.14 | n/a | 3,498 | 6,723 |
| 2.42 | 1102.62 | n/a | 4,093 | 10,816 |
| 2.90 | 1103.10 | n/a | 4,677 | 15,493 |
| 3.39 | 1103.59 | n/a | 4,717 | 20,210 |
| 3.87 | 1104.07 | n/a | 4,352 | 24,562 |
| 4.36 | 1104.56 | n/a | 3,629 | 28,191 |
| 4.84 | 1105.04 | n/a | 2,384 | 30,575 |
| 5.13 | 1105.33 | n/a | 1,129 | 31,704 |
| 5.30 | 1105.50 | n/a | 362 | 32,066 |
| 6.30 | 1106.50 | n/a | 5,104 | 37,170 |
| 6.80 | 1107.00 | n/a | 2,568 | 39,738 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 1.00 | 3.00 | Inactive | 0.00 |
| **Span (in)** | = 8.25 | 8.50 | 24.00 | 0.00 |
| **No. Barrels** | = 1 | 1 | 1 | 0 |
| **Invert El. (ft)** | = 1100.20 | 1104.10 | 1105.00 | 0.00 |
| **Length (ft)** | = 1.00 | 1.00 | 1.00 | 0.00 |
| **Slope (%)** | = 2.00 | 2.00 | 2.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

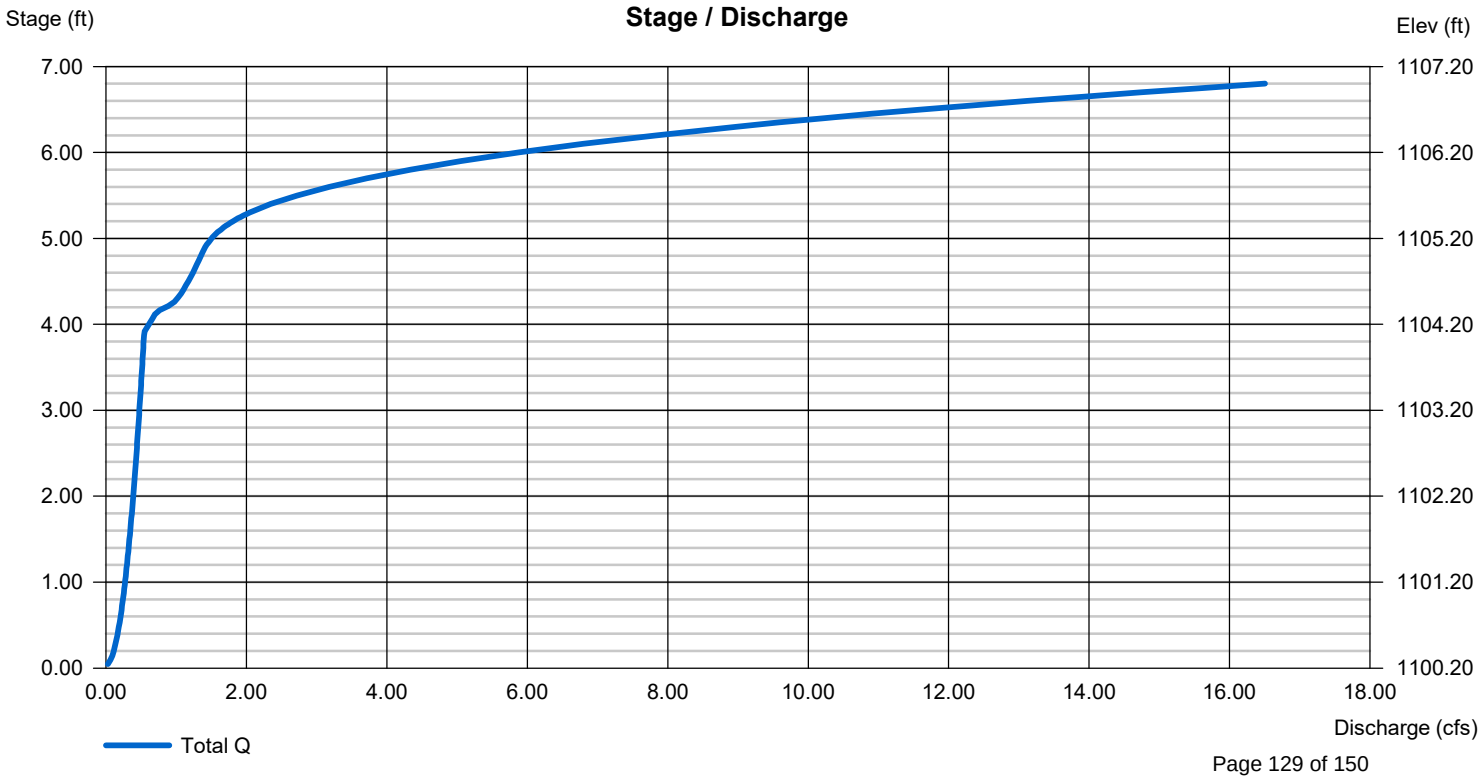
### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 0.00 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 1105.00 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 2.54 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = 90 degV | --- | --- | --- |
| **Multi-Stage** | = No | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



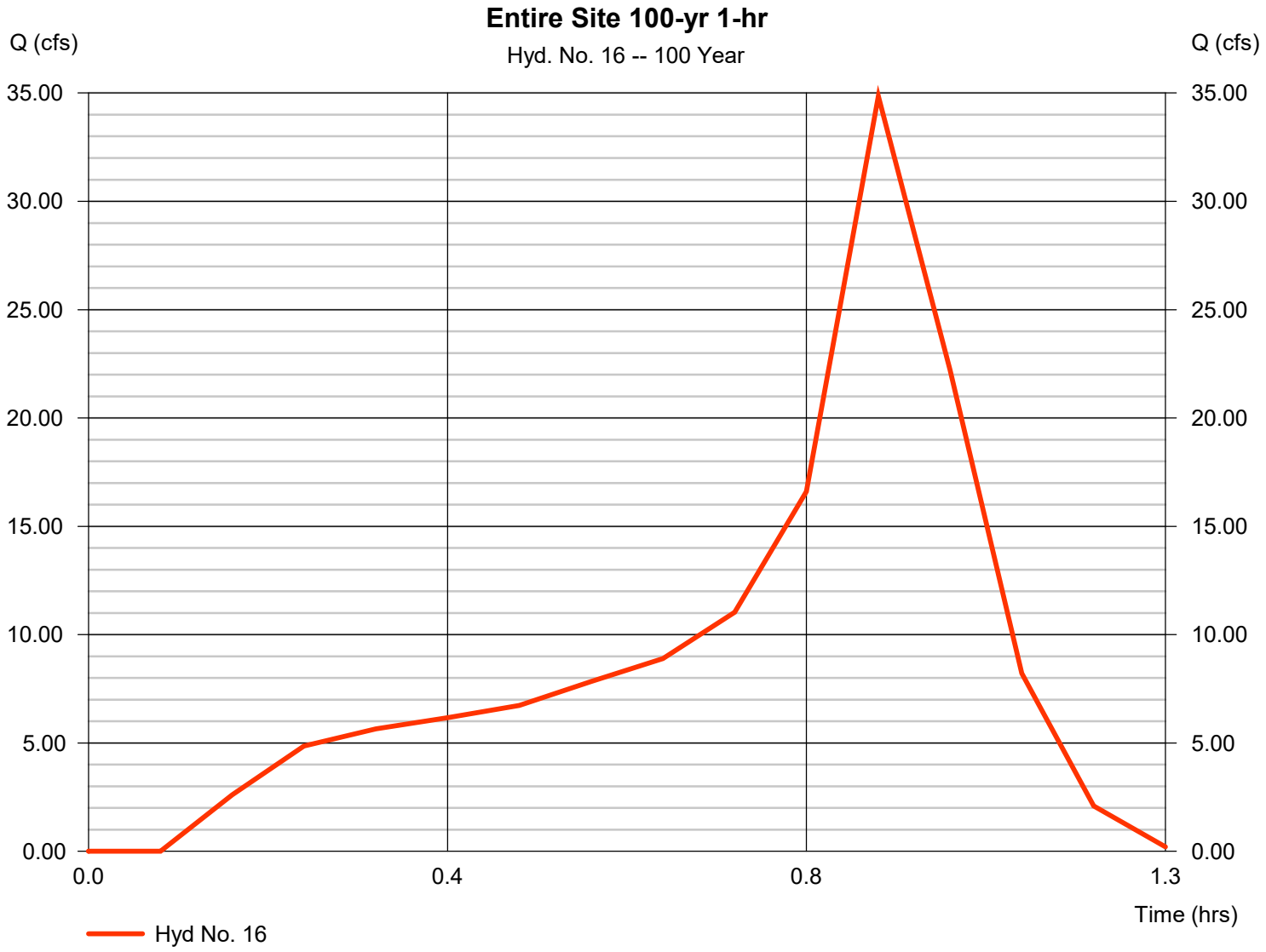
# Hydrograph Report



## Hyd. No. 16

Entire Site 100-yr 1-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 34.85 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 0.92 hrs |
| Time interval | = 5 min | Hyd. volume | = 41,382 cuft |



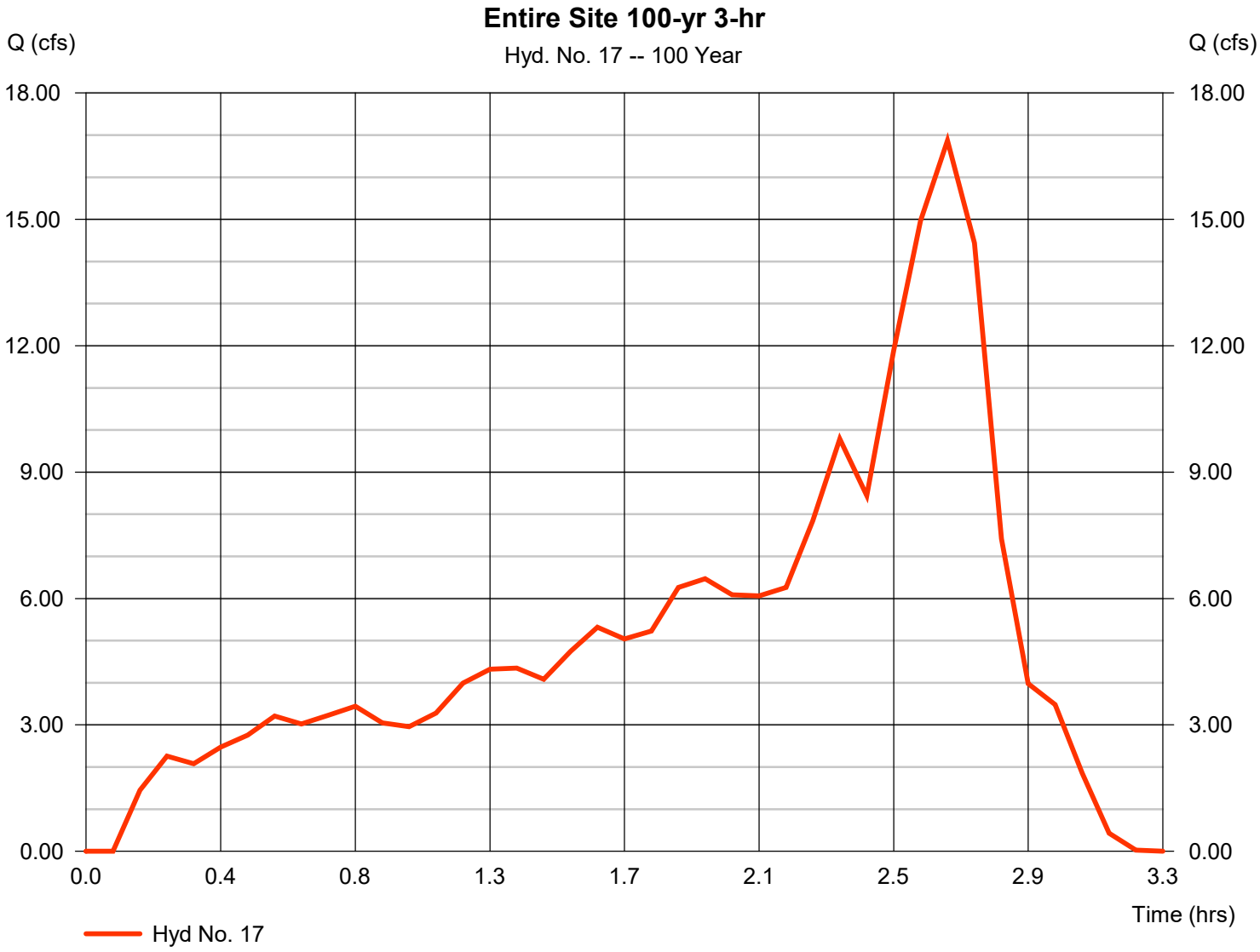
# Hydrograph Report



## Hyd. No. 17

Entire Site 100-yr 3-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 16.87 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 2.67 hrs |
| Time interval | = 5 min | Hyd. volume | = 60,864 cuft |



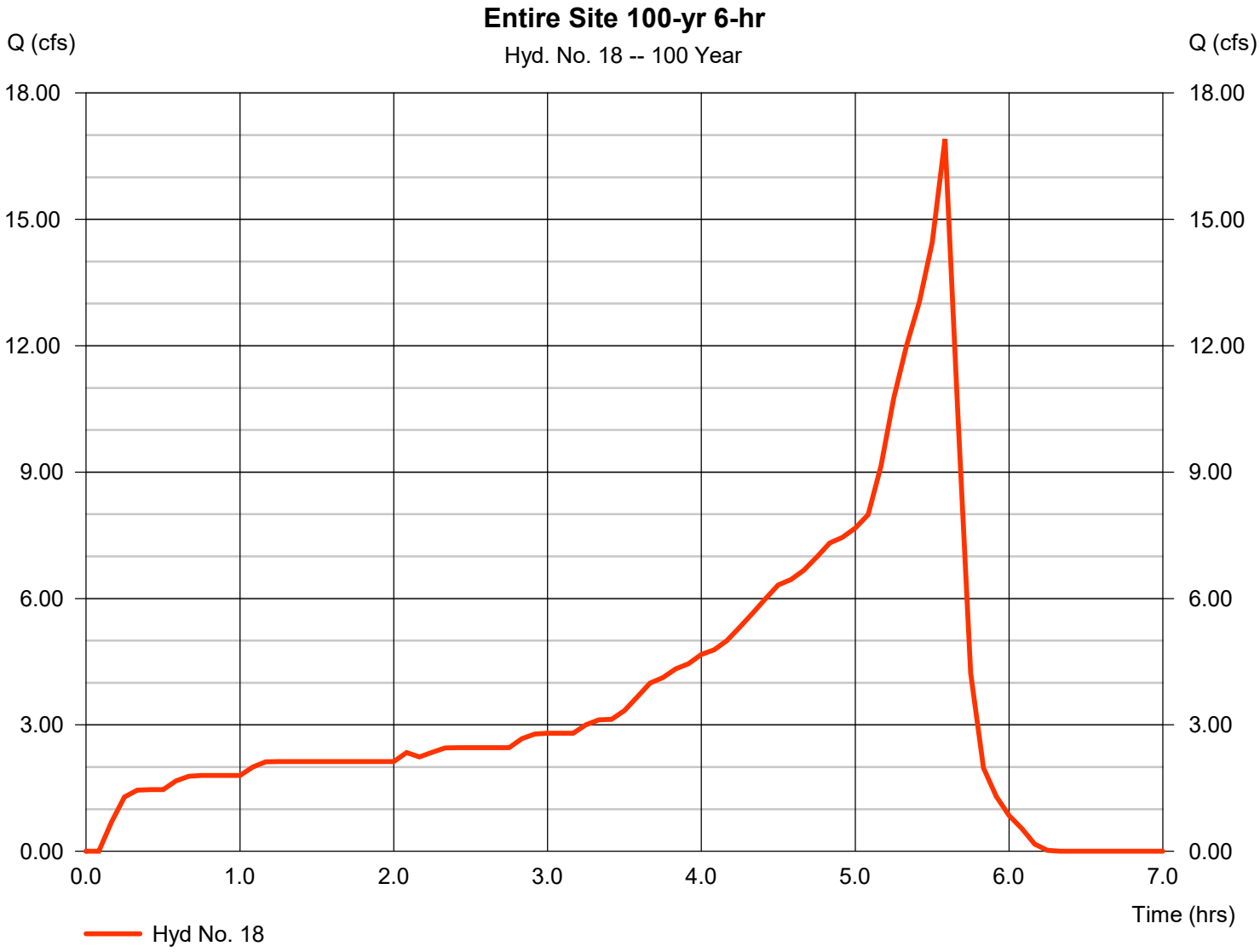
# Hydrograph Report



## Hyd. No. 18

Entire Site 100-yr 6-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 16.91 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 5.58 hrs |
| Time interval | = 5 min | Hyd. volume | = 88,548 cuft |



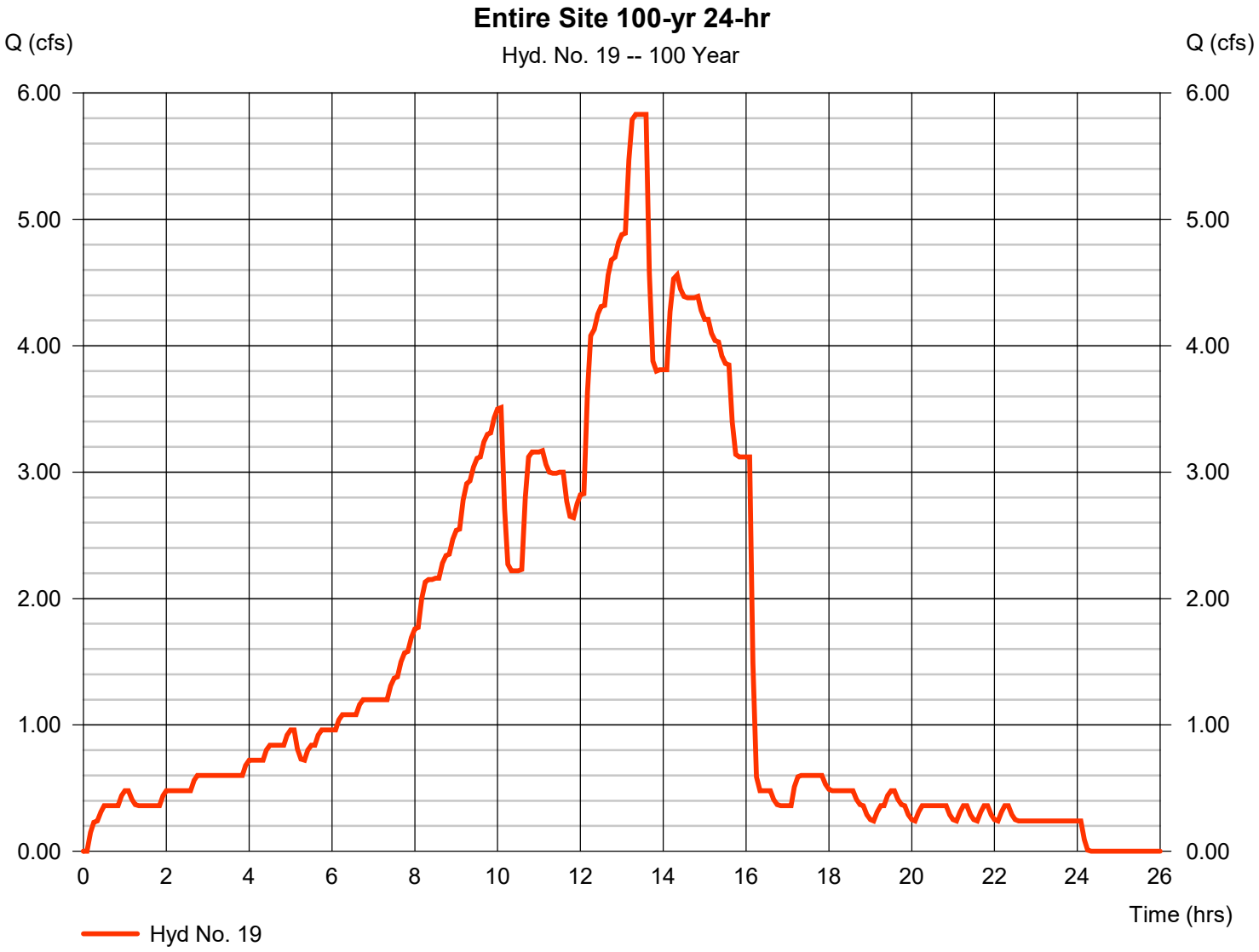
# Hydrograph Report



## Hyd. No. 19

Entire Site 100-yr 24-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 5.830 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 13.33 hrs |
| Time interval | = 5 min | Hyd. volume | = 134,862 cuft |



# Hydrograph Report

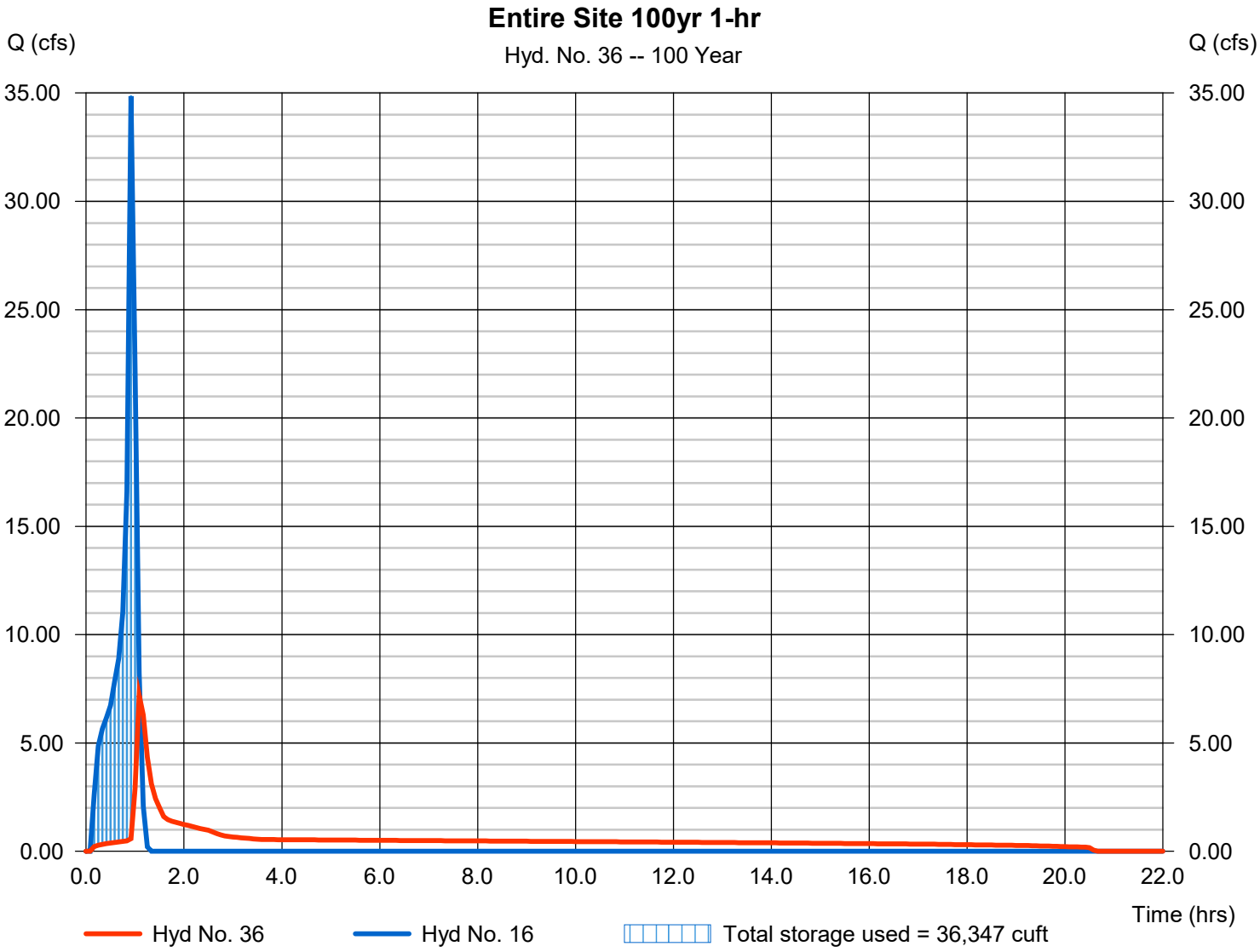


## Hyd. No. 36

Entire Site 100yr 1-hr

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 7.198 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 1.08 hrs |
| Time interval | = 5 min | Hyd. volume | = 41,382 cuft |
| Inflow hyd. No. | = 16 - Entire Site 100-yr 1-hr | Max. Elevation | = 1106.37 ft |
| Reservoir name | = DETENTION POND | Max. Storage | = 36,347 cuft |

Storage Indication method used.



# Hydrograph Report

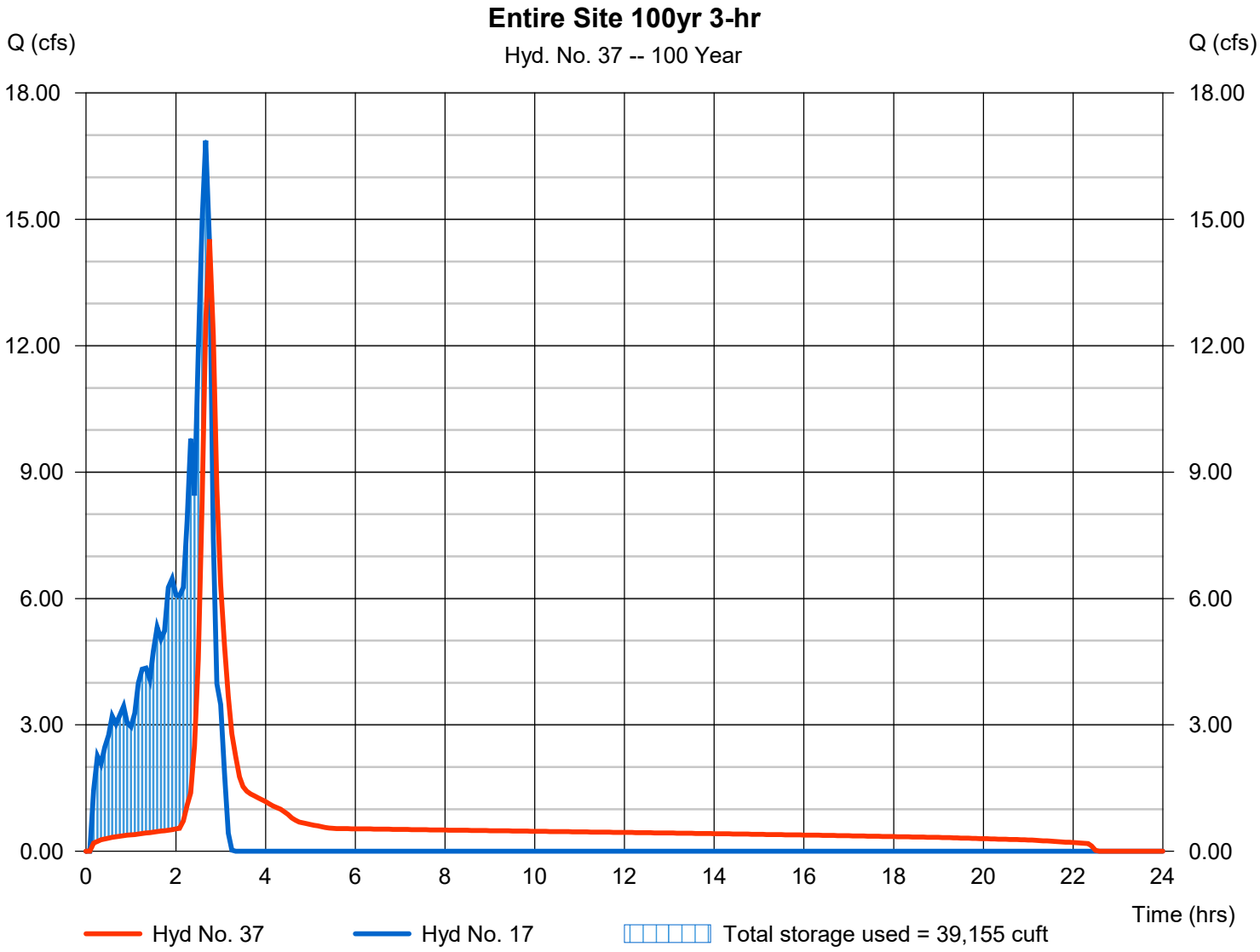


## Hyd. No. 37

Entire Site 100yr 3-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 14.53 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 2.75 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 60,864 cuft |
| Inflow hyd. No. | = | 17 - Entire Site 100-yr 3-hr | Max. Elevation | = | 1106.89 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 39,155 cuft |

Storage Indication method used.



# Hydrograph Report

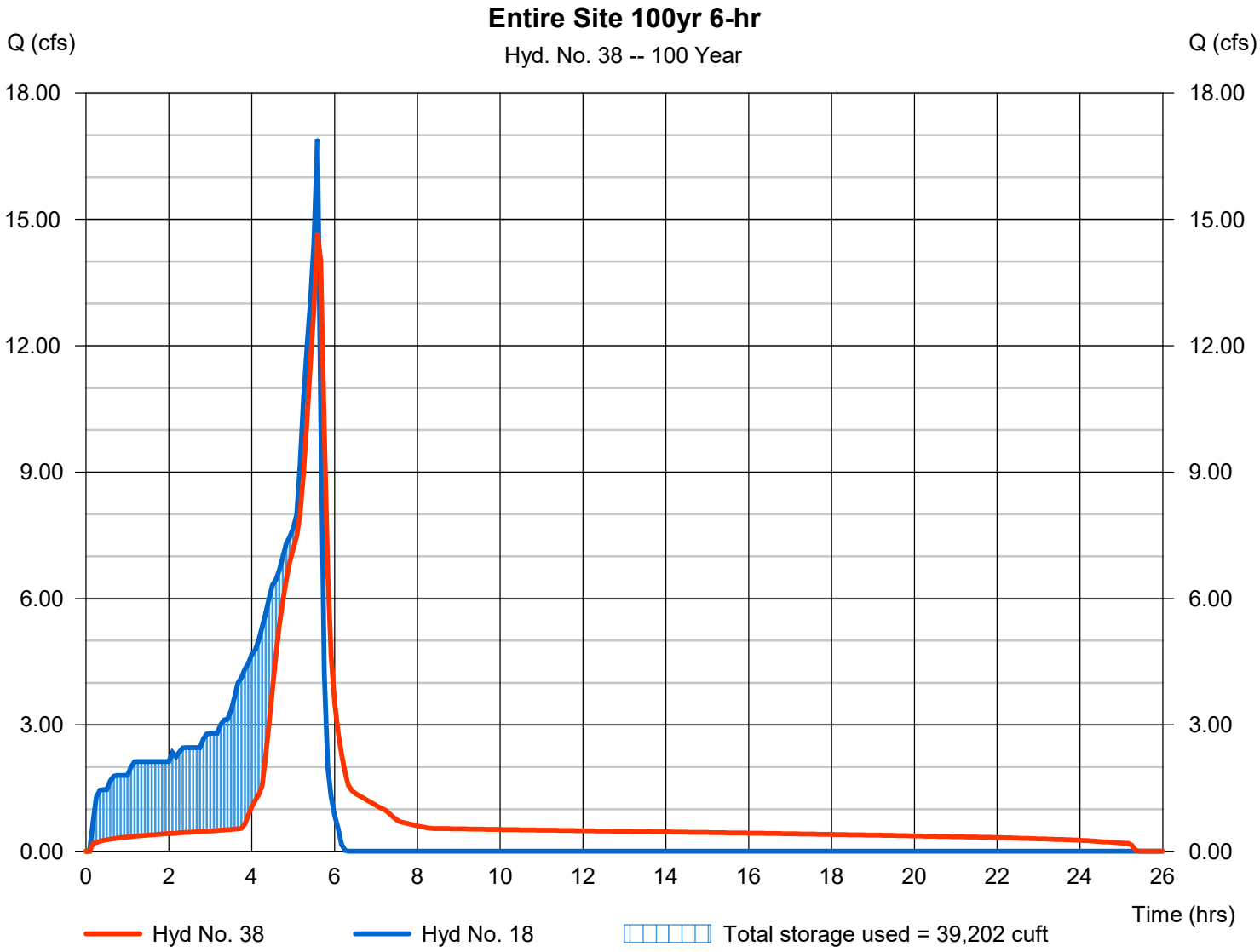


## Hyd. No. 38

Entire Site 100yr 6-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 14.68 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 5.58 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 88,548 cuft |
| Inflow hyd. No. | = | 18 - Entire Site 100-yr 6-hr | Max. Elevation | = | 1106.96 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 39,202 cuft |

Storage Indication method used.



# Hydrograph Report

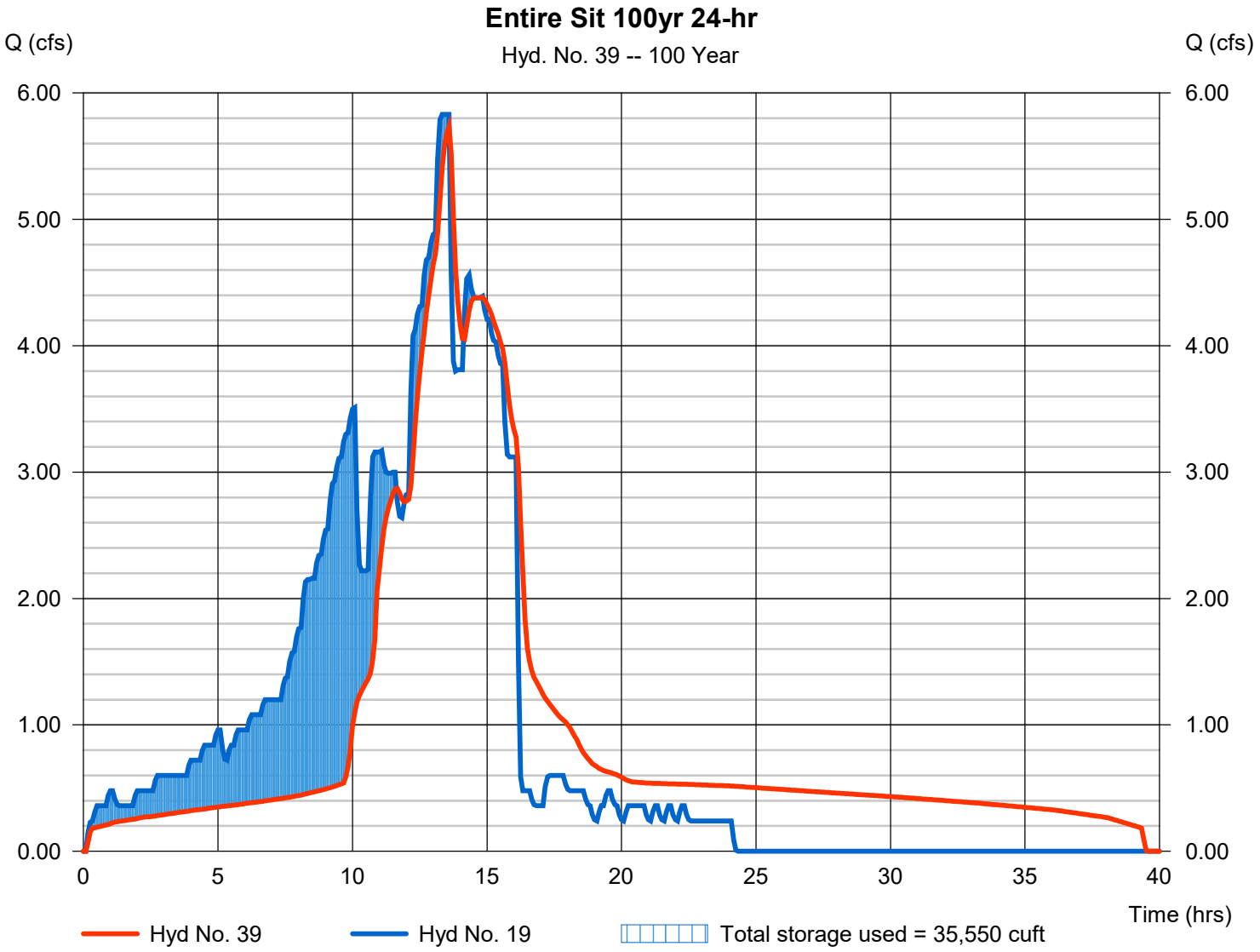


## Hyd. No. 39

Entire Sit 100yr 24-hr

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 5.734 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 13.58 hrs |
| Time interval | = | 5 min | Hyd. volume | = | 134,862 cuft |
| Inflow hyd. No. | = | 19 - Entire Site 100-yr 24-hr | Max. Elevation | = | 1106.19 ft |
| Reservoir name | = | DETENTION POND | Max. Storage | = | 35,550 cuft |

Storage Indication method used.



## *Pond B - Stage Storage Calculations*

| *Segment #1* | | |
|---|---|---|
| ***Stage*** | ***Incrimental Storage (ft$^3$ )*** | ***Total Storage (ft3)*** |
| **1100.2** | 0 | 0 |
| **1100.68** | 48.5 | 48.5 |
| **1101.17** | 260 | 308.5 |
| **1101.65** | 420 | 728.5 |
| **1102.14** | 498 | 1226.5 |
| **1102.62** | 533 | 1759.5 |
| **1103.1** | 533 | 2292.5 |
| **1103.59** | 499 | 2791.5 |
| **1104.07** | 420 | 3211.5 |
| **1104.56** | 260 | 3471.5 |
| **1105.04** | 48.3 | 3519.8 |

| *Segment #2* | | |
|---|---|---|
| ***Stage*** | ***Incrimental Storage (ft3)*** | ***Total Storage (ft3)*** |
| **1100.2** | 0 | 0 |
| **1100.68** | 0 | 0 |
| **1101.17** | 99 | 99 |
| **1101.65** | 495 | 621 |
| **1102.14** | 881 | 1596 |
| **1102.62** | 1056 | 2764 |
| **1103.1** | 1136 | 4005 |
| **1103.59** | 1144 | 5304 |
| **1104.07** | 1143 | 6505 |
| **1104.56** | 1015 | 7536 |
| **1105.04** | 808 | 8202 |
| **1105.33** | 965 | 8371 |

| *Segment #3* | | |
|---|---|---|
| ***Stage*** | ***Incrimental Storage (ft3)*** | ***Total Storage (ft3)*** |
| **1100.2** | 0 | 0 |
| **1100.68** | 0 | 0 |
| **1101.17** | 536 | 670 |
| **1101.65** | 1147 | 1731 |
| **1102.14** | 1710 | 3283 |
| **1102.62** | 2039 | 5072 |
| **1103.1** | 2166 | 6953 |
| **1103.59** | 2141 | 8827 |
| **1104.07** | 1959 | 10537 |
| **1104.56** | 1506 | 11830 |
| **1105.04** | 853 | 12478 |
| **1105.33** | 524 | 12820 |

| *Storage Provided by Biopond A* | | |
|---|---|---|
| ***Stage*** | ***Incrimental Storage (ft$^3$ )*** | ***Total Storage (ft3)*** |
| - | 0 | 0 |
| - | 0 | 0 |
| - | 0 | 0 |
| - | 0 | 0 |
| **1102.5** | 0 | 0 |
| **1102.62** | 140 | 140 |
| **1103.1** | 559 | 699 |
| **1103.59** | 571 | 1270 |
| **1104.07** | 559 | 1829 |
| **1104.56** | 571 | 2400 |
| **1105.04** | 559 | 2959 |
| 1105.33 | 338 | 3297 |
| **1105.5** | 198 | 3495 |
| **1106.5** | 1165 | 4660 |
| **1107** | 2568.1 | 7228 |

| Storage Provided by Biopond B | | |
|---|---|---|
| **Stage** | **Incremental Storage ($ft^3$)** | **Total Storage (ft3)** |
| - | 0 | 0 |
| - | 0 | 0 |
| **1101.5** | 0 | 0 |
| **1101.65** | 145 | 145 |
| **1102.14** | 473 | 618 |
| **1102.62** | 463 | 1081 |
| **1103.1** | 463 | 1544 |
| **1103.59** | 473 | 2017 |
| **1104.07** | 463 | 2480 |
| **1104.56** | 473 | 2953 |
| **1105.04** | 463 | 3416 |
| 1105.33 | 280 | 3696 |
| **1105.5** | 164 | 3860 |
| **1106.5** | 3939 | 7799 |

| Above Ground Basin A Characteristics | |
|---|---|
| **Basin Bottom Area ($ft^2$)** | 3883 |
| **Basin Top Area (ft2)** | 5405 |

| Above Ground Basin B Characteristics | |
|---|---|
| **Basin Bottom Area ($ft^2$)** | 3217 |
| **Basin Top Area (ft2)** | 4662 |

| Total Storage Provided | | |
|---|---|---|
| **Stage** | **Incremental Storage ($ft^3$)** | **Total Storage (ft3)** |
| **1100.2** | 0 | 0 |
| **1100.68** | 49 | 49 |
| **1101.17** | 895 | 1078 |
| **1101.65** | 2207 | 3225 |
| **1102.14** | 3562 | 6723 |
| **1102.62** | 4230 | 10816 |
| **1103.1** | 4857 | 15493 |
| **1103.59** | 4827 | 20210 |
| **1104.07** | 4544 | 24562 |
| **1104.56** | 3825 | 28191 |
| **1105.04** | 2732 | 30575 |
| 1105.33 | 2107 | 31704 |
| **1105.5** | 362 | 32066 |
| **1106.5** | 5104 | 37170 |
| **1107** | 2568.1 | 39738 |

# Appendix 8: Source Control

*Pollutant Sources/Source Control Checklist*

# Section H: Source Control BMPs

Source Control BMPs include permanent, structural features that may be required in your Project plans, such as roofs over and berms around trash and recycling areas, and Operational BMPs, such as regular sweeping and "housekeeping," that must be implemented by the site's occupant or user. The Maximum Extent Practicable (MEP) standard typically requires both types of BMPs. In general, Operational Source Control BMPs cannot be substituted for a feasible and effective Structural Source Control BMP. Complete checklist below to determine applicable Source Control BMPs for your site.

## Project-Specific WQMP Source Control BMP Checklist

All development projects must implement Source Control BMPs. Source Control BMPs are used to minimize pollutants that may discharge to the MS4. Refer to Chapter 3 (Section 3.8) of the SMR WQMP for additional information. Complete Steps 1 and 2 below to identify Source Control BMPs for the project site.

### Step 1: Identify Pollutant Sources

Review project site plans and identify the applicable pollutant sources. "Yes" indicates that the pollutant source is applicable to project site. "No" indicates that the pollutant source is not applicable to project site.

| | | | | | |
|---|---|---|---|---|---|
| ☒ Yes ☐ No | Storm Drain Inlets | | ☐ Yes ☐ No | Outdoor storage areas | |
| ☐ Yes ☐ No | Floor Drains | | ☐ Yes ☐ No | Material storage areas | |
| ☐ Yes ☐ No | Sump Pumps | | ☐ Yes ☐ No | Fueling areas | |
| ☐ Yes ☐ No | Pets Control/Herbicide Application | | ☐ Yes ☐ No | Loading Docks | |
| ☐ Yes ☐ No | Food Service Areas | | ☐ Yes ☐ No | Fire Sprinkler Test/Maintenance water | |
| ☐ Yes ☐ No | Trash Storage Areas | | ☐ Yes ☐ No | Plazas, Sidewalks and Parking Lots | |
| ☐ Yes ☐ No | Industrial Processes | | ☐ Yes ☐ No | Pools, Spas, Fountains and other water features | |
| ☐ Yes ☐ No | Vehicle and Equipment Cleaning and Maintenance/Repair Areas | | | | |

### Step 2: Required Source Control BMPs

List each Pollutant source identified above in column 1 and fill in the corresponding Structural Source Control BMPs and Operational Control BMPs by referring to the Stormwater Pollutant Sources/Source Control Checklist included in Appendix 8. The resulting list of structural and operational source control BMPs must be implemented as long as the associated sources are present on the project site. Add additional rows as needed.

| Pollutant Source | Structural Source Control BMP | Operational Source Control BMP |
|---|---|---|
| Storm Drain Inlets | KriStar Filter Inserts | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# Appendix 9: O&M

*Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms*

# Appendix 10: Educational Materials

*BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information*

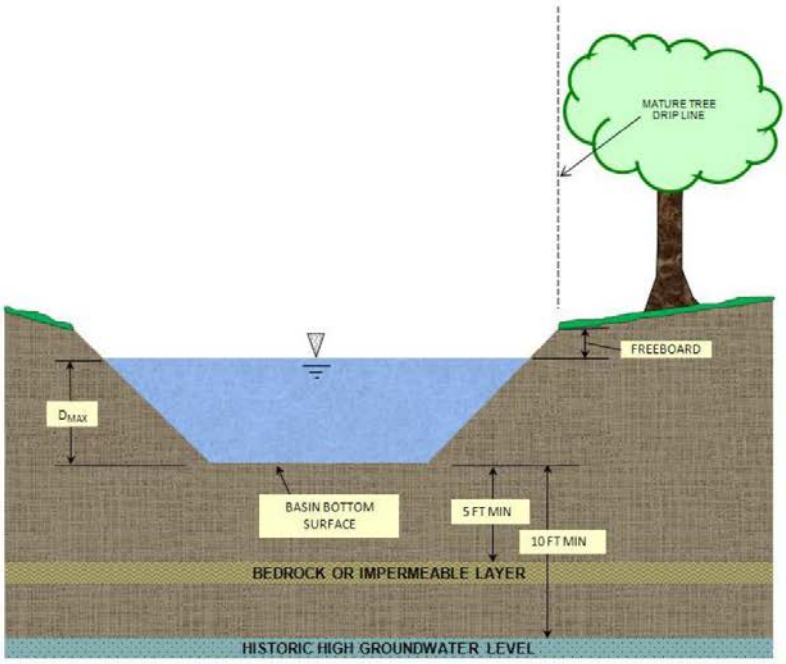



**Figure 1 : Setback Recommendations for a Bioretention Facility**

## Pretreatment

Pretreatment should be considered to prevent premature clogging of bioretention BMPs. Pretreatment is strongly encouraged where the BMP will receive runoff from high traffic parking lots or roads, mixed land uses (with some erodible areas), or other land uses likely to generate elevated sediment.

For BMPs receiving overland flow, pretreatment may be provided using forebays with a volume equivalent to at least 10 percent (preferably 20 percent) of $V_{BMP}$. A forebay is effectively the first cell in the bioretention system, separated from the remaining area by a berm or cross plate. The forebay is designed to maximize sedimentation and will require more frequent, but more spatially-focused maintenance. This portion of the system can be concrete lined to facilitate simpler maintenance.

For BMPs with piped inlets, a forebay or sedimentation manhole may be applicable. In these systems, it is also necessary to consider energy dissipation near the inlet pipe, such as via a gravel/rock pad and berm system or concrete splash block, to avoid erosion of the bioretention media bed.

If the BMP will receive runoff primarily from roofs, low-traffic impervious surface, or similar low sediment generating surfaces, then pre-treatment is not necessary, but energy dissipation should still be considered, particularly if there is a piped inflow such as a downspout.

## Design and Sizing Criteria

This section summarizes the recommended design parameters for Bioretention Facilities. Use of the recommended parameters will help provide the expected treatment and long term performance of the BMP. Deviations from the recommended parameters may be warranted and approved by the local jurisdiction based on site specific considerations. The recommended cross section for a Bioretention Facility includes:

- Vegetated area
- 6" minimum, 12" maximum, surface ponding, measured from the top of the mulch layer (for designs with deeper depths, consult Fact Sheet 3.7)
- Mulch layer (non-floating organic mulch or rock mulch)
- 24" recommended minimum depth of engineered soil media (36" preferred; 18" allowed in vertically-constrained conditions at the discretion of the local jurisdiction)
- Engineered soil media design filtration rate of 2.5 inches per hour (initial filtration rate should be higher).
- 6" optional filter course layer (required if aggregate storage layer is included)
- Optional gravel storage layer below media
- Optional capped underdrain pipe (see Resilient Design Features section below for specific criteria and conditions related to this option)

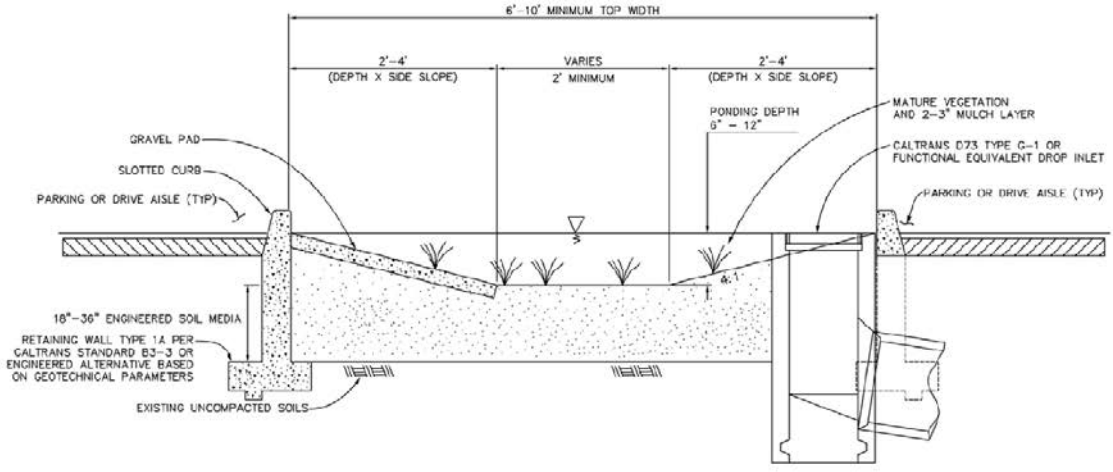



**Figure 2: Standard Cross Section for a Bioretention Facility**

Pore space in the soil and gravel layer can be credited as storage volume. However, several considerations must be noted:

- Ponding depth above the soil surface (6 to 12 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil infiltration rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be used for the gravel and filter course layers.
- Additional depth below the storage layer (via gravel) may be used to increase retention storage, under the following conditions:
    - The total system infiltrates the stored water in less than 72 hours
    - The depth below the media does not exceed the amount of water that can be filtered through the media during a typical DCV storm duration (5 hours, unless otherwise documented).

## Adaptable/Resilient Design Option

At the discretion of the engineer and with the approval of the local jurisdiction, bioretention BMPs may be designed with a gravel drainage layer and a **capped** underdrain. This is effectively a biofiltration design (Fact Sheet 3.5), but there is no design discharge from the underdrains. The benefit of this configuration is that it allows simpler adaptation to a biofiltration BMP if this is warranted, documented, and approved.

This option **may only** be approved for use under the conditions described in Section 2.3.3.g of the WQMP, including:

1) The BMP must meet applicable infiltration BMP sizing standards without any discharge through the underdrain.

2) The Project-Specific WQMP must also meet all applicable sizing standards (biofiltration sizing, hydromodification, if applicable) standards if the underdrain is uncapped.

3) The underdrain must remain capped. Inspections conducted as part of the O&M Plan must corroborate that the underdrain remains capped.

4) If conditions are identified that require the underdrain to be uncapped to allow the BMP to be enlarged or otherwise modified to remedy the documented unacceptable performance, this must include: (a) documentation of the conditions that prompt and justify the require design revision, (b) revision of the Project-Specific WQMP to reflect the revised configuration, and (c) jurisdictional review, approval, and recordation of the revised Project Specific WQMP with commensurate updates to the O&M Plan.

See Section 5.3.6 for guidance on Project-Specific WQMP updates. Note that this is the same process that would be required to wholly redesign and reconstruct an underperforming BMP. However, if adaptable design features are included, the actual physical change could be limited to uncapping the underdrain.

## Design Adaptations

Bioretention facilities can be designed to meet both pollutant control and hydromodification control performance standards. Combined facilities typically include increased storage (surface and or subsurface) and flow control devices (i.e. outlet orifices and/or weirs). Outlets elevations must be set above the $V_{BMP}$ ponding level and the facilities must satisfy both the pollutant control and hydromodification control performance standards.

For systems exceeding 12 inches ponding depth and/or 5 acres tributary area, see additional design considerations in Fact Sheet 3.7.

Subsurface storage is not required but may be provided in the form of a gravel storage layer. Refer to the Subsurface Storage Requirements section for additional information and criteria.

## Engineered Soil Media and Filter Course Aggregate Requirements

Refer to Fact Sheet 3.8 for specifications for engineered soil media and aggregate layers serving as filter course and drain rock in bioretention BMPs.

## Subsurface Storage Requirements

Applicants may choose to provide a portion of the BMP storage volume as subsurface storage in a gravel storage layer. Use of subsurface storage instead of surface storage can be useful when the available surface ponding depth is limited or when a deeper profile is desired to reduce footprint requirements.

The gravel storage layer shall not provide a greater storage volume than can be routed through the soil media during the typical design storm duration (i.e. 2.5 inches/hour x 5 hours = 12 inches effective water depth). Alternatively, a separate routing calculation may be performed by the applicant to demonstrate that the provided volume does not result in surface overflow (bypass of the BMP) before the gravel storage layer is full.

When gravel storage layers are used, the filter course layer should be specifically designed to prevent migration of the engineered soil media into the storage layer. Refer to Fact Sheet 3.8 for filter course requirements. Inclusion of a filter course layer is mandatory unless filter fabric is allowed per manufacturer's recommendation and is acceptable to the local jurisdiction.

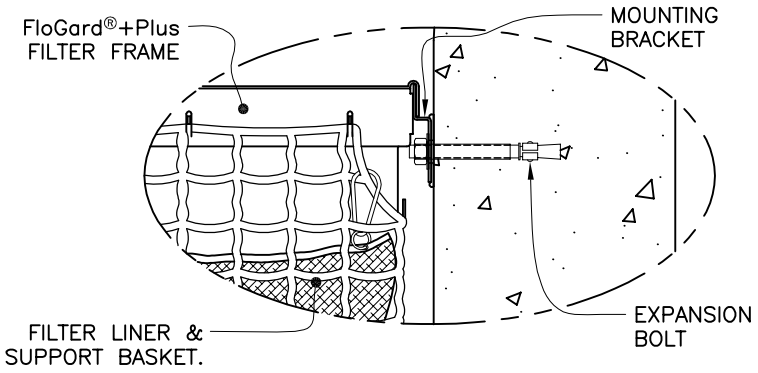
## Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways,

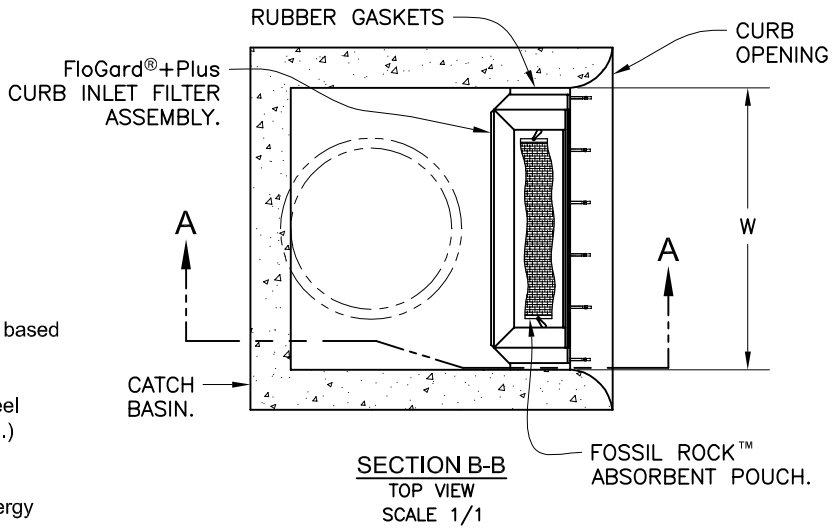
FGP-0002

## SPECIFIER CHART

| MODEL NO. | Curb Opening Width - W - | Storage Capacity - Cu. Ft. - | Filtered Flow Rate - GPM/CFS - | Bypass Flow Rate - GPM/CFS - |
|---|---|---|---|---|
| FGP-24CI | 2.0' (24") | .95 | 338 / .75 | 2,513 / 5.6 |
| FGP-30CI | 2.5' (30") | 1.20 | 450 / 1.00 | 3,008 / 6.7 |
| FGP-36CI | 3.0' (36") | 1.50 | 563 / 1.25 | 3,547 / 7.9 |
| FGP-42CI | 3.5' (42") | 1.80 | 675 / 1.50 | 3,951 / 8.8 |
| FGP-48CI | 4.0' (48") | 2.10 | 768 / 1.76 | 4,445 / 9.9 |
| FGP-5.0CI | 5.0' (60") | 2.40 | 900 / 2.00 | 5,208 / 11.6 |
| FGP-6.0CI | 6.0' (72") | 3.05 | 1,126 / 2.51 | 6,196 / 13.8 |
| FGP-7.0CI | 7.0' (84") | 3.65 | 1,350 / 3.01 | 7,139 / 15.9 |
| FGP-8.0CI | 8.0' (96") | 4.25 | 1,576 / 3.51 | 8,082 / 18.0 |
| FGP-10.0CI | 10.0' (120") | 4.85 | 1,800 / 4.01 | 9,833 / 21.9 |
| FGP-12.0CI | 12.0' (144") | 6.10 | 2,252 / 5.02 | 11,764 / 26.2 |
| FGP-14.0CI | 14.0' (168") | 7.30 | 2,700 / 6.02 | 13,515 / 30.1 |
| FGP-16.0CI | 16.0' (192") | 8.55 | 3.152 / 7.02 | 15,446 / 34.4 |
| FGP-18.0CI | 18.0' (216") | 9.45 | 3,490 / 7.78 | 17,152 / 38.2 |
| FGP-21.0CI | 21.0' (252") | 10.95 | 4,050 / 9.02 | 19,891 / 44.3 |
| FGP-28.0CI | 28.0 (336") | 14.60 | 5,400 / 12.03 | 26,311 / 58.6 |



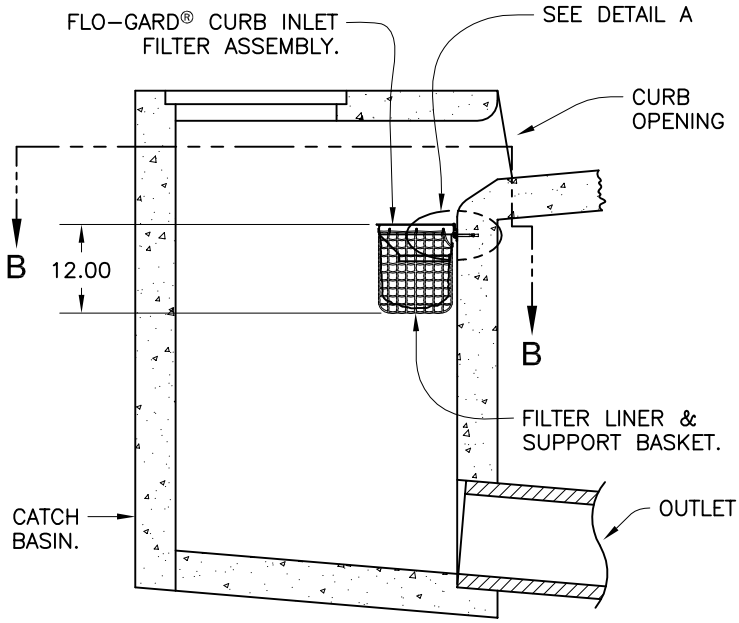

DETAIL A
MOUNTING BRACKET & EXPANSION BOLTS
SEE NOTE 2
SCALE 6/1




SECTION B-B
TOP VIEW
SCALE 1/1

NOTES:

1. FloGard®+PLUS filter inserts shall be installed across the entire width of curb opening. Storage capacity and clean flow rates are based on full width installation.
2. Filter insert shall be attached to the catch basin with stainless steel expansion anchor bolts & washers (3/8" x 2-1/2" minimum length.) See detail A.
3. FloGard®+PLUS filter inserts are designed with a debris trap/energy dissipator for the retention of floatables and collected sediments .
4. Filter support frame shall be constructed from stainless steel Type 304.
5. Filter liner shall be constructed from durable polypropylene, woven, monofilament, geotextile. Filter liner shall not allow the retention of water between storm events.
6. Filter inserts are supplied with "clip-in" filter pouches utilizing FOSSIL ROCK™ filter medium for the collection and retention of petroleum hydrocarbons (oils & greases).
7. FloGard®+PLUS filter inserts and FOSSIL ROCK ™ filter medium pouches must be maintained in accordance with manufacturer recommendations.
8. FloGard +PLUS filter inserts are available in standard lengths of 24", 30",35", 42" & 48" and may be installed in various length combinations (end to end) to fit length of noted catch basin.
9. Clean flow rates are "calculated" based on liner flow rate of 140 gallons per minute per square foot of material, a factor of .50 has been applied to allow for anticipated sediment & debris loading. An additional safety factor of between .25 & .50 may be applied to allow for site specific sediment loading.
10. Storage capacity reflects maximum solids collection prior to impending "initial" filtering bypass. The "ultimate" high-flow bypass will not become impeded due to maximum solids loading.




SECTION A-A
SIDE VIEW
SCALE 1/1

TITLE

FloGard® +PLUS
CATCH BASIN FILTER INSERT
(Curb Inlet Style)

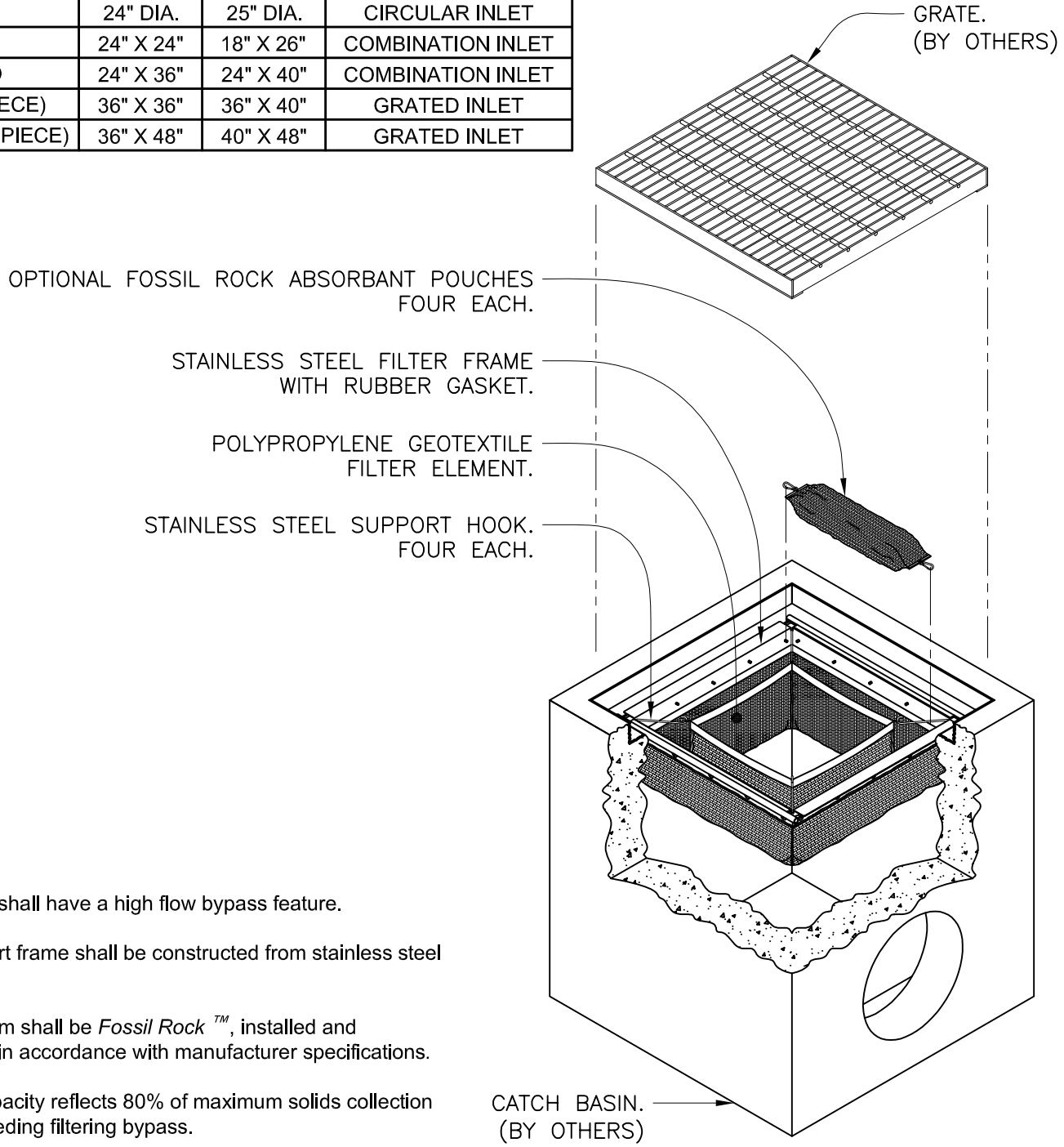
KriStar Enterprises, Inc.
360 Sutton Place, Santa Rosa, CA 95407
Ph: 800.579.8819, Fax: 707.524.8186, www.kristar.com



| DRAWING NO. | REV | ECO | DATE | SHEET |
|---|---|---|---|---|
| FGP-0002 | D | 0059 JPR 12/30/08 | JPR 11/3/06 | SHEET 1 OF 1 |

FG-0001

| SPECIFIER CHART | | | |
|---|---|---|---|
| MODEL | INLET ID | GRATE OD | COMMENTS |
| FF-12D | 12" X 12" | 15" X 15" | GRATED INLET |
| FF-16D | 16" X 16" | 18" X 18" | GRATED INLET |
| FF-18D | 18" X 18" | 20" X 20" | GRATED INLET |
| FF-1836SD | 18" X 36" | 18" X 40" | GRATED INLET |
| FF-1836DGO | 18" X 36" | 18" X 40" | COMBINATION INLET |
| FF-24D | 24" X 24" | 26" X 26" | GRATED INLET |
| FF-2436D | 24" X 36" | 24" X 40" | GRATED INLET |
| FF-RF24D | 24" DIA. | 25" DIA. | CIRCULAR INLET |
| FF-24DGO | 24" X 24" | 18" X 26" | COMBINATION INLET |
| FF-2436DGO | 24" X 36" | 24" X 40" | COMBINATION INLET |
| FF-36D (2 PIECE) | 36" X 36" | 36" X 40" | GRATED INLET |
| FF-3648D (2 PIECE) | 36" X 48" | 40" X 48" | GRATED INLET |




NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter support frame shall be constructed from stainless steel Type 304.
3. Filter medium shall be *Fossil Rock* ™, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.

Inlet Filtration

# *FloGard®*

## *Catch Basin Insert Filter*

### *Grated Inlet Style*

Oldcastle® Stormwater Solutions

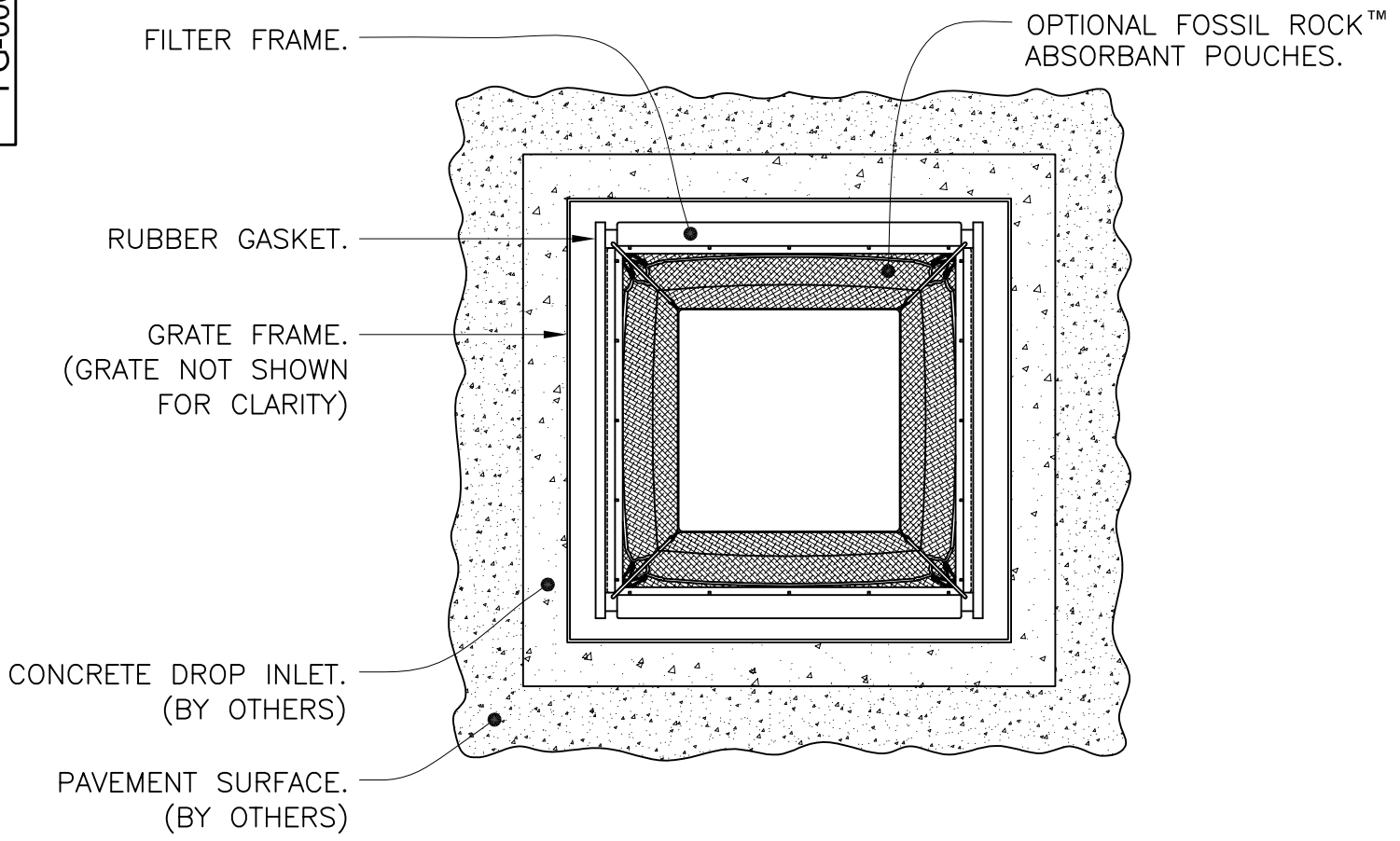
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

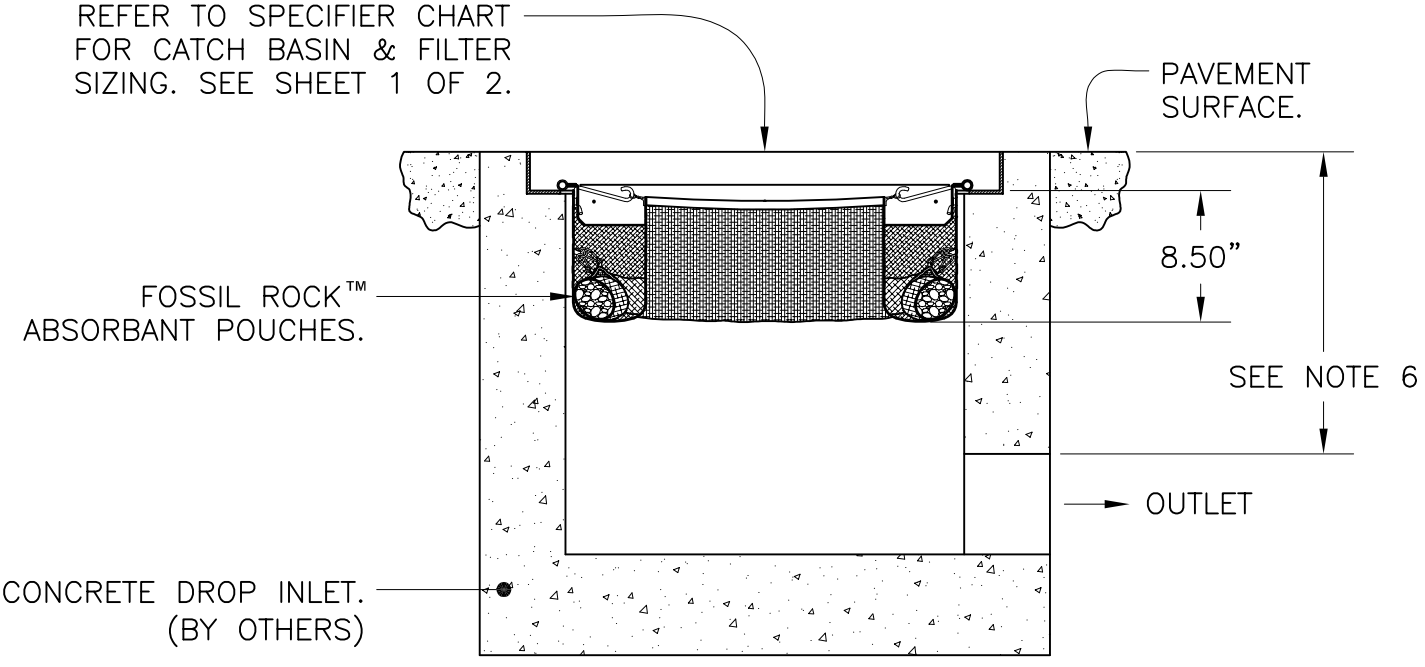




| DRAWING NO. | REV | ECO | DATE | |
|---|---|---|---|---|
| FG-0001 | D | ECO-0127 JPR 5/18/15 | JPR 12/18/06 | SHEET 1 OF 2 |

FG-0001




## SECTION VIEW

Inlet Filtration

# FloGard®

## Catch Basin Insert Filter

## Grated Inlet Style

Oldcastle® Stormwater Solutions

7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com





| DRAWING NO. | REV | ECO | DATE | |
|---|---|---|---|---|
| FG-0001 | D | ECO-0127 JPR 5/18/15 | JPR 12/18/06 | SHEET 2 OF 2 |