# DRAINAGE REPORT
# FOR
# THE GATEWAY AT VISTOSO PRESERVE

Town of Oro Valley, Arizona

20 December 2024

TOV Case Number: 2401047


PREPARED FOR

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DESCRIPTION

Parcels #219-19-1910
#219-19-1890
SE ¼ of Section 23, T-11-S, R-13-E
G.&S.R.M., Oro Valley, Pima County, Arizona

SITE ADDRESS

945 & 955 Vistoso Highlands Dr.
Oro Valley, Arizona 85755

PLANS REVIEWED AND ACCEPTED FOR CODE COMPLIANCE

Stormwater: droberts 06/13/2025

*The issuance of a permit shall not be construed to be a permit or approval of any violation of the codes or ordinances of the Town of Oro Valley*



PREPARED BY

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Tucson, Arizona 85712
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**APPENDICES**



*(Digital Files of HEC-RAS Models to be provided separately)*

**PURPOSE**

This Drainage Report is to accompany the Civil Improvement Plan (CIP) for *The Gateway at Vistoso Preserve* project (hereinafter "Project"), located off W Vistoso Highlands Drive, Town of Oro Valley, Pima County, Arizona. The project site is identified with Assessor's Parcel Numbers (APNs) #219-19-1910 and 219-19-1840. A small portion of parcel ID: 219-19-1950 also forms part of this project. The intent of this Drainage Report is to discuss the existing drainage conditions present at the project site and describe the proposed drainage of the site in the developed condition.

**PROJECT DESCRIPTION AND LOCATION**

The Project area is located at 945 and 955 West Vistoso Highlands Drive in Oro Valley, Arizona and is within the southeast ¼ of Section 23, Township 11 South, Range 13 East, G&SRM. The Project occupies approximately ±9.33 gross acres (approximately 6.8 acres onsite, 2.53 acres offsite work that is part of the project). The offsite area includes the area south of south property line up to the southern disturbed limits. The project site is currently developed with several structures and paved parking areas that used to function as a golf course clubhouse development. This project consists of the redevelopment of the entire site with a new multi-family development consisting of eight (8) three-story apartment buildings, a maintenance building and a community clubhouse center building and the associated paved access, parking, landscaping, utility, and drainage improvements. There are currently two paved driveway entrances into the Project area off Vistoso Highlands Drive (*see Appendix A for Location Map and Aerial Photo*).

Per the Oro Valley Drainage Criteria Manual, current edition, "all basins within the Town of Oro Valley shall be considered Critical Basins." As a result of this Critical Basin designation, the 100-year flood stormwater flows exiting the site in the proposed condition are required to match the existing condition flows or be reduced further by means of detention and/or other rainwater harvesting techniques.

According to the Federal Emergency Management Agency Flood Insurance Rate Map Panel FM04019C1080L, dated June 16, 2011, the Project is located in un-shaded Zone X, which is an area determined to be outside the 500-year floodplain (*see Appendix A for FEMA FIRM Map*).

**HYDROLOGY**

*Onsite Existing Conditions*

The Project lies within an area of predominantly desert brush ground cover vegetation, dense mature trees and is on a gentle hillside that descends from north to south with varying slopes generally ranging from 1% to 3%. Soils within the site are classified as 100% hydrologic soil

group “D” by the Natural Resource Conservation Service (NRCS). There are no existing drainage improvements located on the site as all existing flows are conveyed as surface flows.

Due to the existing roadway elevations and curbing along Vistoso Highlands Drive, coupled with an existing public storm drain system in the roadway, it is determined there is no significant runoff entering the Project area from the existing roadway, only negligible amounts during very low frequency rain events. As such, there are no existing offsite watersheds contributing to the flows generated onsite. There are two onsite existing watersheds that have been identified by investigation of the existing contours.

The first existing onsite watershed, EWS1, consists primarily of the existing paved parking lot but also some existing undeveloped areas along the east side of the site. This watershed is 2.9 acres in size and generates approximately 26.1 cfs of stormwater runoff in the 100-year flood condition, 15.8 cfs in the 10-yr and 9.3 cfs in the 2yr flood condition (see Appendix B for Existing Hydrology Calculations). This runoff is conveyed as sheet flow within the paved parking areas to the east and southeast areas where it exits the site and enters the Highlands Wash area immediately adjacent to the east side of the Project (see Appendix B for Existing Conditions Watershed Map).

The second existing onsite watershed, EWS2, consists of the remaining west portion of the Project area and includes the three existing buildings on site and adjacent undeveloped areas. This watershed is 3.8 acres in size and generates approximately 31.6 cfs of stormwater runoff in the 100-year flood condition, 18.2 cfs in the 10-yr and 10.0 cfs in the 2yr flood condition (see Appendix B for Existing Hydrology Calculations). This runoff is conveyed as sheet flow to the west and southwest areas where it exists the site and enters the Unnamed Wash area immediately adjacent to the west side of the Project (see Appendix B for Existing Conditions Watershed Map).

The following table summarizes the existing conditions hydrology for the project site:

| Watershed | Drainage Area (ac) | Q100 (cfs) | Q10 (cfs) | Q2 (cfs) |
|---|---|---|---|---|
| EWS1 | 2.9 | 26.1 | 15.8 | 9.3 |
| EWS2 | 3.8 | 31.6 | 18.2 | 10.0 |
| OFF1 | 1.95 | 13.9 | 7.4 | 3.5 |
| TOTALS | 8.65 | 71.6 | 41.4 | 22.8 |

Total onsite runoff from the site in the existing condition is 57.7 cfs in the 100-year flood condition, 34.0 cfs in the 10-year and 19.3 cfs in the 2-year. The total runoff shown above includes the offsite portion of the Town’s property covered by or disturbed as part of this development.

*Offsite Drainage Conditions*

There are two watercourses that flow adjacent to the site: to the east is the Highland Wash and to the west is an Unnamed Wash. These washes converge approximately 500 feet downstream of the project where the wash continues solely as the Highlands Wash. As such, all runoff from the project ends up in the Highlands Wash. The washes were previously analyzed by the Pima County Flood Control District (RFCD) and summarized in the *Catalina Foothills Watercourse Studies: Technical Data Notebook for Hydrologic and Hydraulic Mapping of the Highlands Wash and its Tributaries*, dated July 2011 (hereinafter the "RFCD Report"). Rick Engineering Company has reviewed this Report and accepts its findings as discussed herein.

The Highland Wash, per the RFCD Report exhibits, conveys a 100-year flow of 1,075 cfs at its convergence with the west wash (see Appendix B for the RFCD Report Excerpts). The Unnamed Wash, per the RFCD Report exhibits, conveys a 100-year flow of 1,040 cfs at its point of convergence with the east wash (see Appendix B for RFCD Report Excerpts). These flows were used to estimate both existing and post-development water surface elevation of the two washes within the project limit.

*Developed Conditions*

In the developed condition, the onsite watersheds will be altered due to the design of the development although historic drainage patterns will not be altered to any degree of significance. Outfall from the development will occur at three major locations with runoff being directed to the adjacent wash areas to match existing conditions. Developed flows will also be attenuated with shallow water harvesting areas throughout the development and two large basin areas at the south end of the Project area. There are 12 proposed sub-watersheds for the development. RFCD's PC-HYDRO V7.3 was used to estimate post-development peak flow discharges from the project site. The watersheds are shown on Proposed Conditions Drainage Map in Appendix C. The hydrologic data sheets for each sub-watershed in included in Appendix C.

Sub-watershed PWS1 consists of the north portion of the site to include Building #1, all of Building #2 and eastern two-third of Building #3. This watershed is 1.30 acres in size and generates approximately 12.9 cfs of stormwater runoff during a 100-year storm event (see Appendix C for Proposed Hydrology Calculations). This runoff is conveyed as sheet flow within the watershed to multiple storm drain area inlets that will be collected in an 18" storm drain main line that conveys the flow east to its outfall at the east boundary where it exits the pipe system and enters the Highland Wash.

Sub-watershed PWS2 consists of the eastern PAAL area from the driveway connection at Vistoso Highlands Drive on the north end to the area just north of Building #6 on the south end. A small east portion of Building #5 is also included in this watershed. This watershed is 0.79 acres in size and generates approximately 7.9 cfs of stormwater runoff during a 100-year storm event. This runoff is conveyed as sheet flow within paved PAAL area to a scupper where it is

then conveyed to a minor water harvesting basin (SWHB 1) offering approximately 1,300 cf of storage volume at a 4" maximum depth. The overflow from this basin drains east into the Highland Wash area. Although this harvesting basin results in peak discharge reduction, it is only intended to retain First Flush from Sub-watershed PWS2.

Sub-watershed PWS3 consists of the majority of Building #5 and all of Building #6 and associated adjacent PAAL and parking areas in the southeast corner of the Project area. This watershed is 1.71 acres in size and generates approximately 17.2 cfs of stormwater runoff in the 100-year flood condition. This runoff is conveyed as sheet flow within the watershed to the south and ultimately into the East Detention Basin via curb opening *(See detention/retention & stormwater harvesting section for more information).*

Sub-watershed PWS4 consists of a small west portion of Buildings #3 and #4, eastern portion of Buildings #8, and large portion of the west PAAL area and parking. This watershed is 1.05 acres in size and generates approximately 10.4 cfs of stormwater runoff in the 100-year flood condition. This runoff is conveyed as sheet flow within the watershed to the south/southeast to a scupper where it is conveyed into PWS5 and ultimately into the West Detention Basin via curb opening *(See detention/retention & stormwater harvesting section for more information).*

Sub-watershed PWS5 consists of the majority of Building #4, all of Building #7 and the adjacent paved PAAL and parking areas. This watershed is 1.71 acres in size and generates approximately 17.2 cfs of stormwater runoff in the 100-year flood condition. As mentioned, the 10.4 cfs runoff from PWS4 enters PWS5 at its northwest corner for a total 100-year combined flow in the watershed of 27.6 cfs. This runoff is conveyed as sheet flow within the watershed to the south and ultimately into the West Detention Basin via curb opening *(See detention/retention & stormwater harvesting section for more information).*

Sub-watershed PWS6 consists of the western portion of Building #8 and the adjacent paved PAAL and parking areas. This watershed is 0.60 acres in size and generates approximately 6.0 cfs of stormwater runoff in the 100-year flood condition (see Appendix C for Proposed Hydrology Calculations). This runoff is conveyed as sheet flow within the watershed and directly deposited into the adjacent Unnamed Wash to the west via a curb opening and wall opening.

Sub-watershed PWS7 consists of areas north of Building #8 and south of north property line. This watershed is 0.15 acres in size and generates approximately 1.1 cfs of stormwater runoff in the 100-year flood. This runoff is directly conveyed as sheet flow within the watershed and directly deposited into the proposed stormwater harvesting basin. The overflow from this basin drains south into sub-watershed PWS6 and ultimately into the Unnamed Wash

Sub-watershed PWS8 consists of areas north of Buildings #1, #2 and #3 and south of north property line. This watershed is 0.44 acres in size and generates approximately 3.1 cfs of stormwater runoff in the 100-year flood. This runoff is directly conveyed as sheet flow within the watershed and directly deposited into the proposed stormwater harvesting basin. The

overflow from the stormwater harvesting basin will enter PWS1 and is conveyed through the proposed storm drain systems into the Highlands Wash.

Sub-watershed PWS9 is a portion of Unnamed Wash within the project site (west of the proposed perimeter wall). This watershed is 0.15 acres in size and generates approximately 1.1 cfs of stormwater runoff in the 100-year flood. This runoff is conveyed as sheet flow within the watershed and directly deposited into the Unnamed Wash to the west.

Sub-watersheds B1, B2, and B3 represent the basin areas of West Detention Basin, East Detention Basin and SWHB 1, respectively. The stormwater runoff from these areas is directly conveyed into the respective basins.

The following table summarizes the proposed conditions hydrology for the project site:

| Summary of Developed Stormwater Runoff | | | | |
|---|---|---|---|---|
| Watershed IDs | Drainage Area (ac) | Q100 (cfs) | Q10 (cfs) | Q2 (cfs) |
| PWS1 | 1.30 | 12.9 | 8.1 | 5.0 |
| PWS2 | 0.79 | 7.9 | 5.0 | 3.1 |
| PWS3 | 1.71 | 17.2 | 10.8 | 6.7 |
| PWS4 | 1.05 | 10.4 | 6.5 | 4.0 |
| PWS5 | 1.71 | 17.2 | 10.8 | 6.7 |
| PWS6 | 0.60 | 6.0 | 3.8 | 2.4 |
| PWS7 | 0.15 | 1.1 | 0.6 | 0.3 |
| PWS8 | 0.44 | 3.1 | 1.7 | 0.7 |
| PWS9 | 0.15 | 1.1 | 0.6 | 0.3 |
| B1 | 0.21 | 1.5 | 0.8 | 0.4 |
| B2 | 0.38 | 2.7 | 1.4 | 0.7 |
| B3 | 0.12 | 0.9 | 0.5 | 0.2 |
| Total Developed | 8.61 | 82.0 | 50.6 | 30.5 |

Note that the total area in developed condition is slightly less than existing conditions. This difference (area = 0.04 ac) represents a small strip of land between the proposed eastern wall and the east property line. This area directly discharges into the Highlands Wash following historical drainage patterns.

The table below summarizes direct summation of peak discharges for both existing and post-project flow conditions at the project's outfall locations (i.e, the two adjacent washes). The offsite portion of this site is also included.

Summary of pre- vs post-development peak discharge.

| | 2-Yr Q (cfs) | | 10-Yr Q (cfs) | | 100-Yr Q (cfs) | |
|---|---|---|---|---|---|---|
| | **Existing** | **Proposed** | **Existing** | **Proposed** | **Existing** | **Proposed** |
| Total Peak Qs | 22.8 | 30.5 | 41.4 | 50.6 | 71.6 | 82.0 |
| Net increase (cfs) | 7.7 | | 9.2 | | 10.4 | |

The proposed development will result in a net increase of 10.4 cfs during a 100-year storm event. Stormwater harvesting basins and detention basins are proposed throughout the site to attenuate peak discharge increments.

**ONSITE HYDRAULICS**

The proposed onsite drainage facilities designed to safely convey post-development peak flows include storm drain systems, curb openings, sidewalk scuppers per PAG standard details 204 and 205, detention basins and its associated outlet structures, and erosion control mechanisms.

*Inlet Sizing*

An excel spreadsheet based upon applicable equations from City of Tucson's SMDDFM manual was used for sizing the curb openings and sidewalk scuppers. The proposed inlets are designed to capture 10-year flows within the top of curb. The curb openings are modeled as a broad-crested weir. Detailed calculations are included in Appendix E.

For grated area inlets within sub-watershed PWS1, multiple 8" Nyloplast® domes are proposed to intercept and convey flow with the proposed storm drain system. An excel spreadsheet based upon equations 10.10 and 10.11 from City of Tucson's SMDDFM manual was used to determine appropriate size of the domes. The area and perimeter of the domes are per manufacturers recommendations. Detailed calculations are included in Appendix E.

*Storm drain Analysis*

Bentley's StormCAD Connect Edition is used for storm drain design and analysis. The proposed storm drain system is designed to convey combined runoff from stormwater harvesting basin located within sub-watershed PWS8 and sub-watershed PWS1 into Highlands Wash. The proposed storm drain system is sized for a 10-year storm event and is designed to maintain a minimum of 1 foot of freeboard between the HGL and rim elevations of the most upstream grate inlet structure during a 10-year storm event. The controlling tailwater elevations is the crown elevation of the outfall pipe during a 10-year storm event. The upstream BFE is less than the invert elevation of the outfall pipe, and therefore, backflow through the proposed storm drain system is not anticipated during a 100-year storm event. Losses such as junction loss,

bend loss, etc. with storm drain system are also accounted for. The proposed storm drain system layout is simplified for modeling purposes and is modeled with a single inlet representing multiple inlet locations. The modeled single inlet is placed at the most upstream area inlet location. Manholes are added at appropriate locations as well. The proposed storm drain system is sufficiently designed to convey flows from the contributing drainage areas. The StormCAD output report is included in Appendix E.

*Erosion Control*

Riprap aprons are proposed at the downstream ends of curb opening, storm drain, and detention basin outlets. The apron design is based on equations specified in USDOT, *Hydraulic Design of Energy Dissipators for Culverts and Channels, Hydraulic Engineering Circular No. 14*, 3rd Edition. The riprap apron dimensions, rock-sizes, and minimum thickness are shown on the Improvement Plan prepared by RICK. The detailed calculations are included in Appendix E. Design of erosion protection mechanisms downstream of the existing cross-drainage culverts (for both adjacent washes) is beyond the scope of this project.

**HYDRAULICS OF ADJACENT WASHES**

*HEC-RAS Modeling – General Method Description*

A one-dimensional hydraulic analysis of the Highlands Wash and the Unnamed Wash was performed using USACE's HEC-RAS Version 6.3. The topographic data used to model both existing and post-project conditions are described below. Default values of expansion and contraction coefficients were used in both models. A steady flow analysis (with subcritical flow regime) was performed to determine 100-year water surface elevations. Normal depth with slope of 0.010 ft/ft was assumed as the downstream boundary condition for the existing conditions model while the computed water surface elevation from the existing condition model determined at the downstream cross-section was defined for project proposed model. Other modeling considerations such as ineffective flow areas and vertical obstructions were manually added to both models.

*Existing Conditions Model*

Digital Elevation Model (DEM) tiff file was generated from survey data for the existing conditions model. The reach flowline and channel banks were defined using a combination of 2022 PAG aerial photos from PimaMaps and topography survey data. Manning's n-values were per Chow, 1959 Manning's *n-value* Table; with n-value of 0.05 defined for the main channel and 0.08 defined for the overbanks *(see Appendix E for the specified Manning's n-values)*.

*Proposed Conditions Model*

The topographic data used to develop post-project conditions model was a composite surface generated from the proposed grading and existing topography. DEM tiff file was generated

from the 2 feet contour composite surface. The roughness coefficient values were kept the same as existing conditions models for the undisturbed Highlands Wash. For the Unnamed Wash, Manning's n-values for the banks were varied in cross-sections with proposed bank protection. The flowline of Highlands Wash is the same in both existing and proposed conditions. In cross-section where the proposed wall encroaches into the existing erosion hazard setback (XS: 774.55), an effective flow area is defined for the right bank. The rest of the other model parameters are the same as the existing conditions model.

The proposed development encroaches into the existing floodway and floodplain of the Unnamed Wash. A diversion channel is proposed to route the floodway segment of wash away from the proposed development. Therefore, the wash flowline is different in proposed conditions *(See Appendix C for the wash flowlines).* Some HEC-RAS cross-sections are modified to reflect the proposed flowline. The Manning's n-values were revised. For the dredged/disturbed portion of the Wash, Manning's n-value of 0.025 was used for the main channel and 0.04 for the overbanks to reflect the proposed bank protection. Multiple cross-sections are added to the model to model the proposed grade control structures (GCS). Manning's n-value for the main channel at the crest and toe of each of the three GCS was modified to 0.015. The computed water surface elevation at the downstream cross-sections was defined as boundary conditions for the post-project model.

*Floodplain and Floodway Modeling*

As a result of the proposed development footprint, the Unnamed Wash to the west of the development will require minor channel re-aligning. This will require approximately 300 feet of the wash to be re-graded/re-aligned in order to avoid conflict with the proposed development and existing pathways. An encroachment analysis was undertaken to determine the appropriate size of the diversion channel that will result in no-rise conditions at the downstream boundary. The conceptual diversion channel design is shown on the Development Plan. The existing and proposed floodplains for both washes are shown on the exhibits in Appendix C.

*Adverse Impact Analysis*

Section 17-5-8 (A) (b) of Town of Oro Valley Floodplain Ordinance, as it pertains to developments within floodway fringe areas, limits increase in the base flood elevation (BFE) to no more than 0.1' where only one side of the development is owned, as is the case for this project. As shown in the table below, the change is BFE for Highlands wash is zero. The change in average wash velocity is also zero as this project will not encroach into the existing conveyance limits of the Highlands Wash. HEC-RAS output report is included in Appendix E.
. The BFE and channel velocity comparison for the Highlands Wash is summarized below:

Existing vs Proposed WSEL change for Highlands Wash

| River Sta | Q100 (cfs) | WSEL [NAVD88] | | Change in WSEL (ft) [Prop – Ex] |
|---|---|---|---|---|
| | | Existing (ft) | Proposed (ft) | |
| 774.55 | 1,075 | 2957.96 | 2957.96 | 0.00 |
| 700.00 | 1,075 | 2956.84 | 2956.84 | 0.00 |
| 625.28 | 1,075 | 2955.30 | 2955.30 | 0.00 |
| 563.48 | 1,075 | 2954.51 | 2954.51 | 0.00 |
| 400.00 | 1,075 | 2953.29 | 2953.29 | 0.00 |
| 348.68 | 1,075 | 2952.49 | 2952.49 | 0.00 |
| 298.98 | 1,075 | 2952.14 | 2952.14 | 0.00 |
| 266.83 | 1,075 | 2951.39 | 2951.39 | 0.00 |
| 199.40 | 1,075 | 2950.26 | 2950.26 | 0.00 |
| 150.00 | 1,075 | 2949.35 | 2949.35 | 0.00 |

For the diversion channel, due to the difference in wash geometry between existing and post-project conditions, the cross-section locations are different in both models. Therefore, direct comparison of the computed water surface elevation (WSEL) and velocity is not appropriate in most of the cross-sections. In the cross-sections where direct comparisons are deemed appropriate, the change in flood depth and velocity is directly compared and computed. However, in the cross-sections where direct comparison is not feasible, an average WSEL and channel velocity is calculated and compared. The results are summarized below:

Existing WSEL and Channel Velocity for the Unnamed Wash

| Ex. River Sta | Q100 (cfs) | Thalweg Elev (ft) | WSEL (ft) | Flow Depth, Y (ft) | Vavg (ft/s) |
|---|---|---|---|---|---|
| 1800.00 | 1,040 | 2,959.90 | 2,962.67 | 2.77 | 7.79 |
| 1760.84 | 1,040 | 2,958.69 | 2,962.03 | 3.34 | 7.02 |
| 1700.00 | 1,040 | 2,958.07 | 2,960.59 | 2.52 | 5.90 |
| 1638.03 | 1,040 | 2,957.03 | 2,960.26 | 3.23 | 3.00 |
| 1400.00 | 1,040 | 2,954.50 | 2,958.64 | 4.14 | 5.86 |
| 1322.63 | 1,040 | 2,953.20 | 2,958.00 | 4.80 | 5.72 |
| 1200.00 | 1,040 | 2,951.97 | 2,957.19 | 5.22 | 6.71 |
| 1100.00 | 1,040 | 2,950.68 | 2,955.15 | 4.47 | 10.71 |
| 1024.58 | 1,040 | 2,949.96 | 2,954.43 | 4.47 | 6.03 |

Post-project WSEL and Channel Velocity for the Unnamed Wash

| Prop. River Sta | Q100 (cfs) | Thalweg Elev (ft) | WSEL (ft) | Flow Depth, Y (ft) | Vavg (ft/s) |
|---|---|---|---|---|---|
| 1628.16 | 1,040 | 2959.77 | 2962.91 | 3.14 | 6.16 |
| 1589 | 1,040 | 2958.72 | 2962.19 | 3.47 | 8.16 |
| 1528.16 | 1,040 | 2957.78 | 2961.71 | 3.93 | 5.55 |
| 1503.25 | 1,040 | 2957.25 | 2961.01 | 3.76 | 7.82 |
| 1471.73 | 1,040 | 2957.03 | 2960.16 | 3.13 | 6.59 |
| 1466.73 | 1,040 | 2956.99 | 2960.13 | 3.14 | 6.61 |
| 1462.77 | 1,040 | 2955.81 | 2960.34 | 4.53 | 4.88 |
| 1457.77 | 1,040 | 2955.64 | 2960.38 | 4.74 | 4.46 |
| 1438 | 1,040 | 2955.47 | 2960.3 | 4.83 | 4.91 |
| 1377.45 | 1,040 | 2955 | 2958.9 | 3.9 | 9.9 |
| 1330 | 1,040 | 2954.62 | 2958.49 | 3.87 | 9.95 |
| 1318.23 | 1,040 | 2954.53 | 2958.39 | 3.86 | 9.97 |
| 1313.23 | 1,040 | 2954.48 | 2958.33 | 3.85 | 9.95 |
| 1310.23 | 1,040 | 2953.48 | 2957.36 | 3.88 | 10.01 |
| 1305.23 | 1,040 | 2953.44 | 2957.3 | 3.86 | 9.96 |
| 1250 | 1,040 | 2952.88 | 2956.76 | 3.88 | 9.96 |
| 1192.09 | 1,040 | 2952.43 | 2956.41 | 3.98 | 9.57 |
| 1160.22 | 1,040 | 2952.16 | 2956.64 | 4.48 | 7.94 |
| 1155.23 | 1,040 | 2952.12 | 2956.05 | 3.93 | 9.68 |
| 1152.23 | 1,040 | 2951.12 | 2954.98 | 3.86 | 10.04 |
| 1147.23 | 1,040 | 2951.06 | 2954.93 | 3.87 | 9.98 |
| 1130.21 | 1,040 | 2950.94 | 2954.83 | 3.89 | 9.79 |
| 1105.54 | 1,040 | 2950.72 | 2954.58 | 3.86 | 10.05 |
| 1024.58 | 1,040 | 2949.97 | 2954.43 | 4.46 | 6.01 |

Existing vs Proposed WSEL change for the Unnamed Wash

| Compared XS | | Q100 (cfs) | WSEL [NAVD88] | | ΔWSEL (ft) [Prop–Ex] | Average Velocity | | ΔVavg (ft/s) [Prop–Ex] |
|---|---|---|---|---|---|---|---|---|
| Ex. River Sta | Prop. River Sta | | Existing (ft) | Prop (ft) | | Existing (ft/s) | Proposed (ft/s) | |
| 1800.00* | 1628.16 | 1,040 | 2,962.67 | 2962.91 | 0.24 | 7.79 | 6.16 | -1.63 |
| 1760.84* | 1589.00 | 1,040 | 2,962.03 | 2962.19 | 0.16 | 7.02 | 8.16 | 1.14 |
| 1700.00* | 1528.16 | 1,040 | 2,960.59 | 2961.71 | 1.12 | 5.90 | 5.55 | -0.35 |
| 1332.13** | 1302.37* | 1,040 | 2957.85 | 2957.81 | -0.04 | 6.4 | 8.6 | 2.20 |
| 1024.58* | 1024.58 | 1,040 | 2,954.43 | 2954.43 | 0 | 6.03 | 6.01 | -0.02 |

*Directly compared cross-sections. The WSEL and velocity is from HEC-RAS output report.

**Average of the rest of the remaining cross-sections for both existing and proposed conditions. The cross-section identifier in the table above (i.e., 1332.13) is average the lumped cross-sections and is not a defined cross-section in the model. The WSEL and velocity are calculated as averages of the WSEL and velocity from the remainder of the cross-sections and not computed value from HEC-RAS.

Per Tables above, for the Unnamed Wash, this development will result in an increase in water surface elevation that's above the allowable increment of 0.1' per Section 17-5-8 (A) (b) of Town of Oro Valley Floodplain Ordinance. Per prior discussion with the Town of Oro Valley, a relief of the requirements of section 17-5-8 (A) (b) of the Town of Oro Valley Floodplain Ordinance is requested. To accommodate this development, a diversion channel is proposed (within the limits of TOV property) in order to route the flow within the Unnamed Wash westward away from the proposed development. As previously mentioned, section 17-5-8 (A) (b) of Town of Oro Valley Floodplain Ordinance, as it pertains to developments within floodway fringe areas, limits increases in the base flood elevation (BFE) to no more than 0.1' where only one side of the development is owned, as is the case for this project. The proposed development will reduce the conveyance width of the Unnamed Wash and therefore, will result in post-development BFE increment that is significantly more than the allowable 0.1' (*see Table above*). The reduction in the BFE increment to 0.1' will require: 1) a significant increase in disturbance limits within the Town's property which potentially could result in removal and re-location of a portion of the existing pathway and potential further disturbance downstream of the project area; and 2) complete re-design of the diversion channel from what has been previously presented to the public, the Planning and Zoning Commission and the Town Mayor and Council.

As shown in BFE comparison table above, although the BFE increment is largely more than 0.1' within the project limits, the said increment will dissipate at the tie-in location (XS: 1024.58) where the developed conditions BFE matches the existing conditions BFE. As such, there is no adverse impact to downstream properties in addition to no adverse impacts to any adjacent private properties to the west. The only affected property is the Town-owned property where the conveyance channel occurs, with the disturbance being minimal in nature. Due to the

hardship stated above, this report shall serve as a formal application for request of relief from the requirements of Section 17-5-8 (A) (b) of the Town of Oro Valley Floodplain Ordinance.

*Erosion Hazard Setback*

The east wash, the Highlands Wash, per the RFCD Report exhibits, convey a 100-year peak flow of 1,075 cfs at its convergence with the west wash (*see Appendix B for the RFCD Report Excerpts*). This flow has an associated erosion hazard setback of 33' (per Equation 7.8a of the City of Tucson Standards Manual for Drainage Design and Floodplain Management) measured from the top of bank (*see exhibits in Appendix C*)

The west wash, the Unnamed Wash, per the RFCD Report exhibits, convey a 100-year peak flow of 1040 cfs at its confluence with the east wash (*see Appendix B for RFCD Report Excerpts*). This flow has an associated erosion hazard setback of 33' (per Equation 7.8a of the City of Tucson Standards Manual for Drainage Design and Floodplain Management) measured from the top of bank (*see exhibits in Appendix C*).

Scour wall is proposed along a portion of the proposed wall adjacent to the Unnamed Wash up to the upstream limits of the diversion channel (XS: 1503.25). The banks of the proposed diversion channel are proposed to be stabilized. The toe-down elevation of both the wall and bank protection is proposed to be set at minimum, the calculated scour depth below the thalweg elevation. Detailed wall profile or elevation is shown on the IP prepared by RICK. The post-project erosion hazard setback of the Unnamed Wash is set at a minimum 15' from the proposed top of bank due to the proposed bank protection.

*Equilibrium Slope, Sediment Transport, and Grade Control Structure Design*

The proposed drainage improvements of the Unnamed Wash encompass diversion of the wash alignment and stabilization of the wash banks. Due to the proposed modification of the natural wash, a sediment transport analysis was performed. A representative cross-section downstream of each of the proposed GCS is chosen to determine the sediment transport rate of the proposed diversion channel. Similarly, three cross-sections within the disturbance limits are chosen to determine the sediment transport rate of the natural wash. It was determined that there are no anticipated sediment transport issues. The long-term degradation of the wash bed in proposed conditions is approximately 0.12' and therefore, the proposed diversion will not alter the existing sediment supply and wash bed degradation is not exacerbated. The detailed calculation is included in Appendix E.

Post-project equilibrium of slope of the Unnamed Wash was also analyzed and calculated using equation 5.34 of TOV DCM (2020 Edition). It was determined that the proposed diversion channel trends towards degradation more than aggradation. The detailed calculation is included in Appendix E. Within the diversion section, the natural slope of the Wash is approximately 1.65% and is greater than the calculated equilibrium slope. Three Grade control structures are proposed to be installed within the diversion section. The GCS are proposed to

be sloped for ease of drivability of the maintenance vehicle along the wash bottom. The toe-down greater than or equal to the calculated scour depth downstream of the GCS is proposed to be provided. The detailed calculation is included in Appendix E. The design parameters of the GCS are summarized below:

Summary of Design Parameters of the Proposed GCS

| GCS IDs | Station | Drop height (ft) | Scour Depth (ft) | Total Scour Length (ft) | Distance to Max. Scour (ft) |
|---|---|---|---|---|---|
| 1 | 14+66.73 | 1.32 | 6.1 | 73 | 37 |
| 2 | 13+13.23 | 1 | 4.8 | 58 | 29 |
| 3 | 11+55.23 | 1 | 4.8 | 58 | 29 |

*Freeboard Calculation*

The proposed top of bank elevations and the finished grade of the scour wall are designed with sufficient freeboard above the computed post-development WSEL. The minimum freeboard requirements for the Wash were computed using equation 8.4 of Pima County/City of Tucson's SMDDFM manual. If the calculated minimum freeboard is less than 1', at least 1' of freeboard is proposed to be provided. The detailed calculation is included in Appendix E.

*Scour Analysis and Perimeter Wall Toe-Downs*

The scour depth downstream of the proposed GCS is conservatively calculated assuming vertical drop in the structure. The scour depth and distance to maximum scour is summarized above. Beyond the maximum scour length, the toe-down is proposed to be tapered back to the toe-down elevation calculated from normal scour. RFCD's PC-SCOUR spreadsheet was used to determine the anticipated scour depth. For the wash section between the proposed GCS, a representative cross-section that's located downstream of the calculated total scour length above, was chosen as the flow regime is anticipated to be subcritical and normal scour is anticipated to occur. The chosen cross-sections are 1377.45, 1250, and 1105.54. Scour depths are measured from the thalweg elevation of each of the cross-sections. PC-SCOUR output report is included in Appendix E. The calculated scour depth is summarized below:

Summary of Scour depth and toe-elevation

| Prop. River Sta | Q100 (cfs) | Thalweg Elev (ft) | Calc. Scour depth (ft) | Design Scour (ft) | Toe-down Elev (ft) |
|---|---|---|---|---|---|
| 1628.19 | 1,040 | 2959.77 | 2 | 3 | 2956.77 |
| 1589 | 1,040 | 2958.72 | 1.3 | 3 | 2955.72 |
| 15828.16 | 1,040 | 2957.78 | 1.8 | 3 | 2954.78 |
| 1503.25 | 1,040 | 2957.25 | 2.6 | 3 | 2954.25 |
| 1377.45 | 1,040 | 2955 | 3.6 | 3.6 | 2951.4 |
| 1250 | 1,040 | 2952.88 | 4.2 | 4.2 | 2948.68 |
| 1105.54 | 1,040 | 2950.72 | 6.3 | 6.3 | 2944.42 |

**DETENTION BASIN ROUTING & STORMWATER HARVESTING BASINS**

*Detention Basin Routing*

As previously mentioned, the project site is in a designated Critical Basin. Per Town of Oro Valley's Drainage Criteria Manual, the 100-year, 10-year, and 2-year peak discharge exiting the site in the developed condition are required to match the existing condition flows or be reduced to a maximum 10% of existing flows by means of detention and/or other rainwater harvesting techniques. This will be achieved by means of stormwater harvesting basins located throughout the site in the landscaped areas and by means of two larger detention basins located along the south property line denoted as the West Detention Basin and the East Detention Basin. RFCD's PC-ROUTE spreadsheet was used for detention routing.

The first basin, the East Basin, will accept a total of 20.3 cfs from PWS3 and B2, as previously mentioned, via two 6-foot curb openings along the southernmost curb. This East Basin will be approximately 1.50 feet in total depth with 4:1 Side slopes and a 100-year water-surface-elevation (WSEL) of 1.36 feet above the basin floor. Installation of security barrier is not required for this detention basin. The routing exercise for this basin involved generating a hydrograph for sub-watershed B2 and PWS3 from RFCD's PC-HYDRO V7.3 and entering the hydrographs of the 2-year, 10-year, and 100-year storm events into the PC-ROUTE spreadsheet. Stage-storage information for the basin and proposed outlet hydraulic structure is also entered into PC-ROUTE. The outlet structure of this basin is 3- 6" bleeder pipes with invert elevation at 4" above the basin floor elevation. The maximum 100-year outflow from this basin is 2.8 cfs. Outflow from this basin is conveyed south into the existing natural flow paths consistent with historical drainage patterns. This basin will drain in less than 12 hours per PC-ROUTE output report. The routing report is included in Appendix D.

The second basin, the West Basin, will accept a total of 29.1 cfs from PWS4, PWS5 and B1, as previously mentioned, via three 6-foot curb openings along the southernmost curb. This West Basin will be 2 feet in total depth with 4:1 side slopes and a 100-year water-surface-elevation (WSEL) of 1.68 feet above the basin floor elevation. Installation of security barrier is not required for this detention basin. This basin will outlet via a 4-foot-long weir structure at the west end to outflow to the west where the flow is discharged into the Unnamed Wash flows. The weir invert elevation is 4" above the basin floor elevation. The maximum 100-year outflow from this basin is 18.7 cfs. This basin will drain in less than 12 hours per PC-ROUTE output report. The routing report is included in Appendix D.

The third stormwater harvesting basin, labeled herein as North SWHB, located with sub-watershedPWS8, will accept a total of 3.1 cfs during a 100-year storm event. This basin has a maximum depth of 9" with 4:1 side slope. This basin will outlet via an 8" Nyloplast® dome with rim elevation set at 4" above the basin flow elevation. The Nyloplast done and its outlet pipe is modeled as a culvert for routing purposes. The maximum 10-year and 100-year outflow from this basin is 0.0 cfs, and 0.2 cfs, respectively. This basin will drain in less than 12 hours per PC-ROUTE output report. The routing report is included in Appendix D.

These two larger detention basins and multiple onsite stormwater harvesting basins are sufficient to ensure that developed condition discharges from the site will not exceed 90% of existing peak discharge levels. Post-project outflow from the basins and other pertinent information are summarized as follows:

| Detention Basin Summary | | | | | | |
|---|---|---|---|---|---|---|
| Basin ID | Q100in (cfs) | Q100out (cfs) | Depth (ft) | Ponding Volume* ($ft^3$) | 100-Yr WSEL Depth (ft) | Storage Capacity (cf) |
| West Basin | 29.1 | 18.7 | 2.0 | 1,716 | 1.68 | 12,922 |
| East Basin | 20.3 | 2.8 | 1.5 | 3,487 | 1.36 | 18,223 |
| North SWHB | 3.1 | 0.2 | 0.75 | 1,351 | 0.75 | 3,464 |

*Stored/retained volume below the invert of outlet structure (see Appendix D).

The total retained stormwater volume within the basins as detailed in the table above is 6,554 cf. Since the invert of the outlet structures are a maximum of 4" above the basin floor elevation, an infiltration test is not required. Basin floor surface infiltration alone is anticipated to be sufficient to drain the stored stormwater within 12 hours.

Both detention basin areas and stormwater harvesting areas will be re-vegetated with native desert plants to restore the former natural desert aesthetics of the area.

*Stormwater Harvesting Basins*

In addition to the provided detention basins, there will be smaller, shallower (4" deep maximum) stormwater harvesting areas proposed throughout the site. The largest of these is at the south end of watershed PWS2 (denoted as the SWHB 1). The rest of the proposed water harvesting areas are rainfall-only, non-contributing basins, hence do not require any routing analysis nor are needed to provide peak discharge reduction.

The proposed maximum depth of this harvesting basin is 4" with 4:1 Side slopes. This basin is large enough to retain the required FF volume from watershed PWS2. Although further peak discharge reduction is anticipated due to this harvesting basin, this basin is not intended to provide post-development peak reduction as the overall required reduction has been achieved for the project site. The overflow from SWHB 1 directly discharges into the Highlands Wash.

The proposed grading is such that overland flow pathway is available for the overflows from the interior stormwater harvesting basins. The Finished Floor Elevations of the proposed buildings are elevated at least 1 foot above the water surface elevation in the stormwater harvesting basins, particularly Building #8.

**FIRST FLUSH**

In conformance with the Town of Oro Valley's Drainage Criteria Manual, this development is required to provide first flush volume for stormwater leaving paved areas. This requirement will be met mostly through the two large basin areas plus the large water harvesting area as previously described. The total combined basin volume, as calculated herein, equates to close to 44,000 cubic feet of storage volume. Based on Section 11.7.2 of the Drainage Criteria Manual the Project requires approximately 4,682 cf of first flush volume:

$V_{ff}$ = (0.5"/12)(paved area in acres)
= (0.0416667)(2.58 ac)
= 0.1075 ac-ft
= 4,682 $ft^3$

At all curb openings, first flush treatment will be placed in the form of T-DAM filters by Revel Environmental Manufacturing Inc. (or approved equal) while first flush treatment at any storm drain inlets will be provided by Flo-Guard catch basin inserts or approved equal (see Appendix C for First Flush Treatment Device Information).

The provided retention in the two detention basins is larger than the required FF retention volume. Therefore, FF required retention is achieved.

**OFFSITE DOWN-STREAM IMPACTS**

This development has two historical outfall locations: The Highlands Wash and the Unnamed Wash. The project has direct and immediate access to these two watercourses. This development is not anticipated to adversely impact existing downstream drainage conditions. The proposed detention basins have sufficient capacities to provide peak discharge reduction for 2-year, 10-year, and 100-year storm events as well as retained the required FF retention volumes.

The combined unattenuated 100-year, 10-year, and 2-year peak discharges from the site into the two washes are 29.9 cfs, 18.6 cfs, and 11.3 cfs respectively. The combined maximum 100-year, 10-year, and 2-year peak discharges from the three detention basins into the two washes are 21.7 cfs, 12.1 cfs, and 6.3 cfs, respectively. The total outflows into the washes from this site in developed conditions during 100-year, 10-year, and 2-year storm events are 51.6 cfs, 30.7 cfs, 17.6 cfs, respectively.

The pre vs post analysis is summarized as follows:

| | **2-Yr Q (cfs)** | | **10-Yr Q (cfs)** | | **100-Yr Q (cfs)** | |
|---|---|---|---|---|---|---|
| | **Existing** | **Proposed** | **Existing** | **Proposed** | **Existing** | **Proposed** |
| Combined Q | 20.5* | 17.6 | 37.3* | 30.7 | 64.4* | 51.6 |
| Excess (cfs) | -2.9 | | -6.6 | | -12.8 | |
| % Reduction** | 14.2 | | 17.6 | | 19.9 | |

* The target outflow discharge which is 90% of existing runoff for 2-,10-, and 100-year return levels.
**Comparison of reduced post-development outflow from the site to the target discharges rates

The negative values represent excess attenuation than required. The proposed basins resulted in post-development runoff from the project site into the two washes to be much less than 90% of existing peak discharge levels. Therefore, the required attenuation for a designated critical basin has been met or exceeded.

Runoff from the Project flows into either the Highland Wash to the east or the Unnamed Wash to the west. These two watercourses combine with the confluence approximately 500 feet downstream of the site. This wash continues its path south as the Highland Wash and is confined within its natural banks to where it ultimately converges with the Canyon Del Oro Wash downstream. It is not anticipated that any downstream habitat will be inadvertently starved of pre-development runoff resources as a consequence of this development.

**MAINTENANCE OF PROPOSED DRAINAGE IMPROVEMENTS**

*Wash Maintenance*

The wash bottom has been redesigned to have a minimum bottom width of 20'. A 16-wide maintenance access is proposed to be provided to properly maintain the wash per section 4.5.9 of DCM. A concrete access ramp to the wash bottom, with upstream toe-down of a minimum of 3', is also proposed to be provided. The cross-slope of the access path is ~1.5% and the path is proposed to be compacted to 95%. Owing to the wash being privately maintained and per discussion with the Town, one-lane access is provided. The proposed grades and control points of the maintenance path are shown on the IP prepared by RICK. The best management practices and recommended corrective actions are summarized below:

Summary of Best Management Practices (BMPs)

| Components | Frequency of Inspection | Inspection Item | Suggested corrective actions, if maintenance is required |
|---|---|---|---|
| Bank Slopes and Wash bottom | Annual/Major storm event | ✓ Damages/cracks<br>✓ Debris<br>✓ Vegetation growth<br>✓ Other | • Repair any observed damage caused by settling, vegetation growth, erosion or other causes.<br>• Remove all trash, debris, and other obstructive materials.<br>• Sediments at depths ≥10% of Wash depth to be removed. The Wash bed to be constructed to the as-built conditions.<br>• Repair riprap if underlying filter fabric is visible or stones are dislodged.<br>• Remove any vegetation growing through lining material.<br>• Remove invasive non-native plants or excessive vegetation growth within the Wash bottom. |
| GCS | Annual/Major storm event | ✓ Damages/cracks | • Repair any observed cracks/damages |
| Access path | Annual/Major storm event | ✓ Damages<br>✓ Vegetation growth | • Inspect any slope erosion<br>• Cut/control any woody vegetation on both sides of the path.<br>• Inspect the ramp and repair any concrete cracks/damages. |

*Detention Basin Maintenance*

The proper functioning of the proposed drainage improvements described herein are dependent on the owner/developer or HOA providing continuous maintenance to the proposed drainage facilities, which is necessary for proper functioning of the proposed stormwater management facilities. The HOA is responsible for maintenance of all drainage improvements stated herein, including the proposed diversion channel and the detention basins on the Town's property. The HOA representative is advised to follow the Pima County Detention/Retention Basin Inspection and Maintenance Checklist as well as section 11.6 of the Town's Drainage Criteria Manual to ensure that the proposed drainage facilities are maintained for it to function as designed. A copy of this maintenance checklist is included in Appendix F.

Maintenance easements shall be dedicated per Final Plat or Improvement Plan for the HOA to access and maintain the proposed diversion channel and the basins.

**SECTION 404 COMPLIANCE STATEMENT**

*The Gateway at Vistoso Preserve* is a multi-family residential development project on approximately ±9.29 gross acres located in Section 23, Township 11 South, Range 13 East, Gila and Salt River Meridian, Pima County, Arizona.

I, Kevin Hall, am a Registered Professional Civil Engineer in the State of Arizona and am responsible for the preparation of the report for the above-referenced project. I attest to the following statement:

The drainages present on the site have been evaluated and that, under current regulations, there are no jurisdictional waters on the site. Therefore, this project has been determined to be non-jurisdictional pursuant to Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 USC 1334. Both Highlands Wash and Unnamed Wash are ephemeral streams and fall under exceptions to 33 CFR328.3(a)(3).

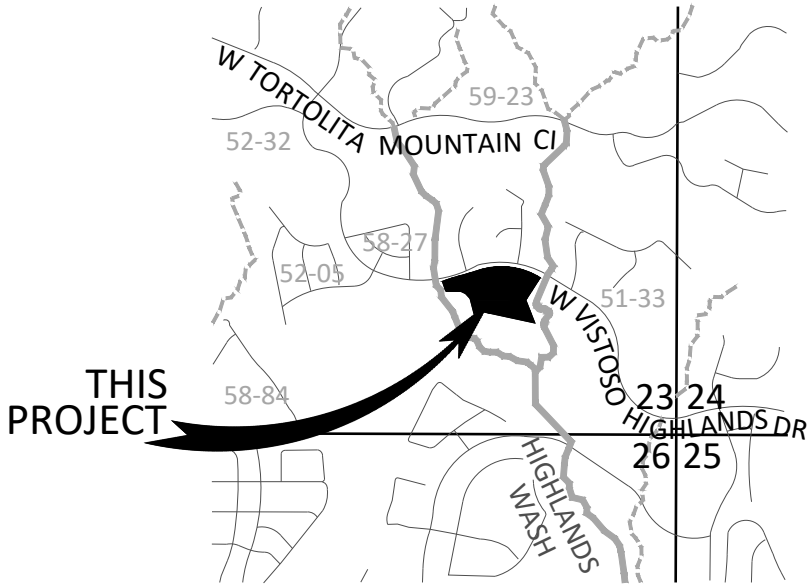
**CONCLUSION**

The Gateway at Vistoso Preserve project is a proposed development in Oro Valley, Arizona located on approximately 6.7 onsite gross acres. The proposed development will not adversely impact the existing drainage patterns and will reduce stormwater runoff to less than existing conditions. This Drainage Report is to accompany the Development Plan for the Gateway at Vistoso Preserve development project. This Report was written utilizing generally accepted engineering practices and all information herein has been researched through archived documents and all calculations were accomplished through applying the Oro Valley Drainage Criteria Manual, current edition, the Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona and the Stormwater Detention/Retention Manual published by the Pima County Department of Transportation and Flood Control District.

The analysis presented in this report evaluates stormwater runoff resulting from a statistical evaluation of storm events of particular duration and frequency up to and including a 100-year frequency event. A storm event exceeding the 100-year frequency may cause or create the risk of greater flood impact than is addressed and presented herein.

The scope of this assessment does not include evaluation of stormwater runoff resulting from storm events exceeding the 100-year frequency. Rick Engineering Company assumes no responsibility for actual flood damage, increased risks of flood damage, or increased construction or development cost resulting from or related to any such events, nor shall Rick Engineering Company be responsible for any changes in, or additions to, regulatory requirements which may result from, or be related to, any such events or changes in hydrologic or hydraulic conditions within the watershed.

# APPENDIX A




IN THE NW ¼ OF THE SE ¼ OF SECTION 23, T. 11 S., R. 13 E.,
G.&S.R.M., TOWN OF ORO VALLEY, PIMA COUNTY, ARIZONA

# LOCATION MAP

NORTH

3" = 1 MILE

# PimaMaps Print


Legend

Parcels

Notes:

10/13/2023

400.0 0 200.00

Feet

PIMA COUNTY GEOGRAPHIC INFORMATION SYSTEMS

This map is static output from an internet mapping site and no warranty is expressed or implied as to the accuracy, reliability, currency or completeness of the data, and is for reference only

# National Flood Hazard Layer FIRMette

FEMA

110°59'21"W 32°27'40"N


110°58'43"W 32°27'9"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

*Basemap Imagery Source: USGS National Map 2023*

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

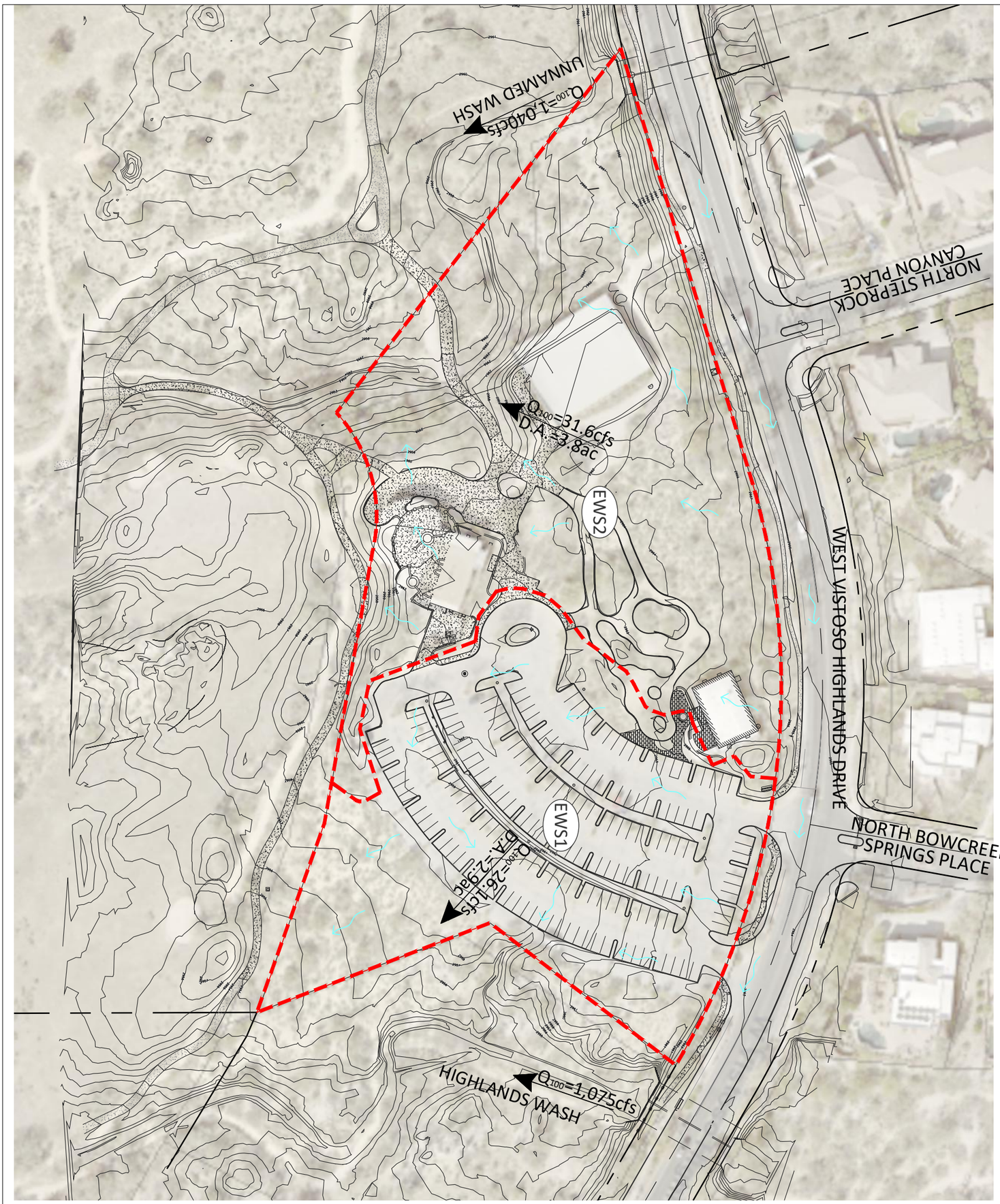
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/11/2023 at 5:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

# APPENDIX B




Aerial Photo per PAG2022
Obtained from PimaMaps

## LEGEND

- $Q_{100}$=1cfs, D.A.=1.0ac — CONCENTRATION POINT
- WATERSHED BOUNDARY
- FLOW DIRECTION
- (EWS1) — WATERSHED DESIGNATOR

SCALE 1"=100'
C.I. = 1 foot

# EXISTING CONDITIONS WATERSHED MAP
for
# THE GATEWAY AT VISTOSO PRESERVE


PROJECT NO: T22061

RICK ENGINEERING COMPANY

3945 E FORT LOWELL ROAD - STE #111
TUCSON, AZ 85712
520.795.1000
info@cypresscivil.com
rickengineering.com

San Diego - Riverside - San Luis Obispo - Sacramento - Orange - Tucson - Phoenix - Las Vegas - Denver

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | EWS1 | Job # | T22061 |
| Watershed Area: | 2.9 Acres | Watershed Type | Suburban Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 7 | 475 | 0.0147 | 0.035 |

| | | | | | |
|---|---|---|---|---|---|
| Length of Watercourse (Lc): | 475 | feet | Mean Slope: | 0.0147 | |
| Length to Cen. of Gravity (Lca): | 238 | feet | Weighted Basin Fac: | 0.035 | |
| Veg. Cover Type(s): | Desert Brush | | Veg. Cover Density: | 30 | |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-10-12 12:26:15 PM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Runoff Coef. (C) |
|---|---|---|---|
| B | - | - | - |
| C | - | - | - |
| D | 0100 | 90 | 0.641 |
| Imp. | 65 | 99 | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.85 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 8.94 | in/hr |
| **PEAK DISCHARGE:** | 26.1 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | EWS1 | Job # | T22061 |
| Watershed Area: | 2.9 Acres | Watershed Type | Suburban Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 7 | 475 | 0.0147 | 0.035 |

| | | | | | |
|---|---|---|---|---|---|
| Length of Watercourse (Lc): | 475 | feet | Mean Slope: | 0.0147 | |
| Length to Cen. of Gravity (Lca): | 238 | feet | Weighted Basin Fac: | 0.035 | |
| Veg. Cover Type(s): | Desert Brush | | Veg. Cover Density: | 30 | |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-10-12 12:26:15 PM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Runoff Coef. (C) |
|---|---|---|---|
| B | - | - | - |
| C | - | - | - |
| D | 0100 | 90 | 0.514 |
| Imp. | 65 | 99 | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.79 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 5.39 | in/hr |
| **PEAK DISCHARGE:** | 15.8 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | EWS1 | Job # | T22061 |
| Watershed Area: | 2.9 Acres | Watershed Type | Suburban Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 7 | 475 | 0.0147 | 0.035 |

| | | | | | |
|---|---|---|---|---|---|
| Length of Watercourse (Lc): | 475 | feet | Mean Slope: | 0.0147 | |
| Length to Cen. of Gravity (Lca): | 238 | feet | Weighted Basin Fac: | 0.035 | |
| Veg. Cover Type(s): | Desert Brush | | Veg. Cover Density: | 30 | |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-10-12 12:26:15 PM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Runoff Coef. (C) |
|---|---|---|---|
| B | - | - | - |
| C | - | - | - |
| D | 0100 | 90 | 0.367 |
| Imp. | 65 | 99 | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.71 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.17 | in/hr |
| **PEAK DISCHARGE:** | 9.3 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | EWS2 | Job # | T22061 |
| Watershed Area: | 3.8 Acres | Watershed Type | Suburban Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 11 | 500 | 0.022 | 0.035 |

| | | | | | |
|---|---|---|---|---|---|
| Length of Watercourse (Lc): | 500 | feet | Mean Slope: | 0.022 | |
| Length to Cen. of Gravity (Lca): | 250 | feet | Weighted Basin Fac: | 0.035 | |
| Veg. Cover Type(s): | Desert Brush | | Veg. Cover Density: | 70 | |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-10-12 12:26:15 PM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Runoff Coef. (C) |
|---|---|---|---|
| B | - | - | - |
| C | - | - | - |
| D | 100 | 92.3 | 0.713 |
| Imp. | 28 | 99 | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.78 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 8.25 | in/hr |
| **PEAK DISCHARGE:** | 31.6 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | EWS2 | Job # | T22061 |
| Watershed Area: | 3.8 Acres | Watershed Type | Suburban Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 11 | 500 | 0.022 | 0.035 |

| | | | | | |
|---|---|---|---|---|---|
| Length of Watercourse (Lc): | 500 | feet | Mean Slope: | 0.022 | |
| Length to Cen. of Gravity (Lca): | 250 | feet | Weighted Basin Fac: | 0.035 | |
| Veg. Cover Type(s): | Desert Brush | | Veg. Cover Density: | 70 | |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-10-12 12:26:15 PM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Runoff Coef. (C) |
|---|---|---|---|
| B | - | - | - |
| C | - | - | - |
| D | 100 | 92.3 | 0.601 |
| Imp. | 28 | 99 | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.69 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 4.75 | in/hr |
| **PEAK DISCHARGE:** | 18.2 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | EWS2 | Job # | T22061 |
| Watershed Area: | 3.8 Acres | Watershed Type | Suburban Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 11 | 500 | 0.022 | 0.035 |

| | | | | | |
|---|---|---|---|---|---|
| Length of Watercourse (Lc): | 500 | feet | Mean Slope: | 0.022 | |
| Length to Cen. of Gravity (Lca): | 250 | feet | Weighted Basin Fac: | 0.035 | |
| Veg. Cover Type(s): | Desert Brush | | Veg. Cover Density: | 70 | |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-10-12 12:26:15 PM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Runoff Coef. (C) |
|---|---|---|---|
| B | - | - | - |
| C | - | - | - |
| D | 100 | 92.3 | 0.462 |
| Imp. | 28 | 99 | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.59 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 2.6 | in/hr |
| **PEAK DISCHARGE:** | 10 | cfs |

Portion of Town's Property Disturbed by This Development (See Grading Plan for grading limits)

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | OFF1 | Job # | T22061 |
| Watershed Area: | 1.95 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5 | 168 | 0.0298 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 168 feet | Mean Slope: | 0.0298 |
| Length to Cen. of Gravity (Lca): | 84 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 3.5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | OFF1 | Job # | T22061 |
| Watershed Area: | 1.95 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5 | 168 | 0.0298 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 168 feet | Mean Slope: | 0.0298 |
| Length to Cen. of Gravity (Lca): | 84 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 7.4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | OFF1 | Job # | T22061 |
| Watershed Area: | 1.95 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5 | 168 | 0.0298 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 168 feet | Mean Slope: | 0.0298 |
| Length to Cen. of Gravity (Lca): | 84 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 13.9 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | OFF1 | Job # | T22061 |
| Watershed Area: | 1.95 Acres | Watershed Type | Undeveloped-Foothills |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5 | 168 | 0.0298 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 168 feet | Mean Slope: | 0.0298 |
| Length to Cen. of Gravity (Lca): | 84 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 3.5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | OFF1 | Job # | T22061 |
| Watershed Area: | 1.95 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5 | 168 | 0.0298 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 168 feet | Mean Slope: | 0.0298 |
| Length to Cen. of Gravity (Lca): | 84 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 7.4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | OFF1 | Job # | T22061 |
| Watershed Area: | 1.95 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5 | 168 | 0.0298 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 168 feet | Mean Slope: | 0.0298 |
| Length to Cen. of Gravity (Lca): | 84 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 13.9 | cfs |

**Catalina Foothills Watercourse Studies:**
**Technical Data Notebook for Hydrologic and Hydraulic Mapping of the Highland Wash and its Tributaries,**
**Pima County Arizona.**
FEMA FIRM Panels 04019C-1030K, 04019C-1040K

Prepared by

Eric Shepp, P.E.
Deputy Director

July, 2011

Pima County Regional Flood Control District
97 E Congress Street
Tucson Arizona, 85701

HW010d
HW010e
CP 010d
CP 010e
HW010b
HW010c
HW009a
HW009
CP 010c
CP 010b
CP 009
HW010a
CP 010
HW008b
HW007
HW008a
CP 008b
CP 007
CP 008
CP 007/008
HW006
HW005
HW004
CP 006
CP 005
CP 004
HW003
CP 003
HW001
CP 001
HW002
CP 002
E RANCHO VISTOSO BL
N RANCHO VISTOSO BL
W MOORE RD
N ORACLE RD
E TANGERINE RD
W TANGERINE RD
W NARANJA DR
E NARANJA DR
N LA CANADA DR
N 1ST AV
E LAMBERT LN
W LAMBERT LN
0.5 0.25 0 0.5 Miles
Map 5
Map 4
Map 3
Map 2
Map 1

# Figure 1. Highland Wash Watershed and 100-yr Floodplain

**Legend**

- Concentration Points
- Major Streets
- Study Limits
- Sub-watersheds
- 100-yr Floodplain

N W E S

Scale: 1:36,000

Pima County Regional Flood Control District
97 E Congress - 3rd Floor
Tucson, Arizona 85701-1207
(520) 243-1867, FAX: (520)243-1821
http://www.rfcd.pima.gov

**Table 8 - Summary of the Hydrologic Analysis of Concentration Points used in the Hydraulic Model**

| Concentration Point | Location | Method | Total Area above concentration point (sq-mi) | Areal Reduced Rainfall Depth (in) | Discharge (cfs) | Time to Peak (hr:min) |
|---|---|---|---|---|---|---|
| CP 001 | At Lambert Lane | HEC-HMS | 2.63 | 2.98 | 2160 | 2:59 |
| CP 002 | At CDO | HEC-HMS | 2.67 | 2.98 | 2165 | 3:01 |
| CP 003 | At Naranja | HEC-HMS | 2.45 | 2.99 | 2139 | 2:49 |
| CP 004 | Near Montera Vista Dr. | HEC-HMS | 2.02 | 3.04 | 2323 | 2:29 |
| CP 005 | Tributary near Montana Vista Dr. | PC Hydro | 0.20 | 3.22 | 525 | 0:22 |
| CP 006 | At Tangerine Rd. | HEC-HMS | 1.86 | 3.05 | 2261 | 2:23 |
| CP 007 | Outlet of Detention Basin M1 | HEC_HMS | 1.21 | 3.05 | 1925 | 2:03 |
| CP 007/008 | Downstream of Moore Rd | HEC-HMS | 1.42 | 3.05 | 2233 | 2:01 |
| CP 008 | Outlet of Detention Basin M2 | PC Hydro | 0.21 | 3.23 | 635 | 0:24 |
| CP008B | Tributary near Woodland Dr. | PC Hydro | 0.14 | 3.23 | 487 | 0:20 |
| CP 009 | Tributary at Pebble Creek Dr. | PC Hydro | 0.21 | 3.25 | 671 | 0:24 |
| CP009A | Tributary near vistoso Highlands Dr. | PC Hydro | 0.06 | 3.25 | 274 | 0:16 |
| CP 010 | At Desert Fairways | PC Hydro | 0.84 | 3.28 | 1934 | 0:30 |
| CP 010B | West Branch near Vistoso Highlands Dr. | PC Hydro | 0.38 | 3.26 | 1040 | 0:24 |
| CP 010C | East Branch near Vistoso Highlands Dr | PC Hydro | 0.35 | 3.26 | 1075 | 0:22 |
| CP 010D | West Branch at Tortolita Mtn Cr | PC Hydro | 0.28 | 3.28 | 920 | 0:20 |
| CP 010E | East Branch at Tortolita Mtn Cr | PC Hydro | 0.27 | 3.28 | 1067 | 0:18 |

# Highland Wash 100-yr Floodplain - Map 5

## Legend

- Contours 2-ft
- Highland Wash Cross Sections
- Major Streets
- Study Limits
- 100-yr Floodplain
- Parcels

2500 Water Surface Elevation NAVD 88
1000 Cross Section Station

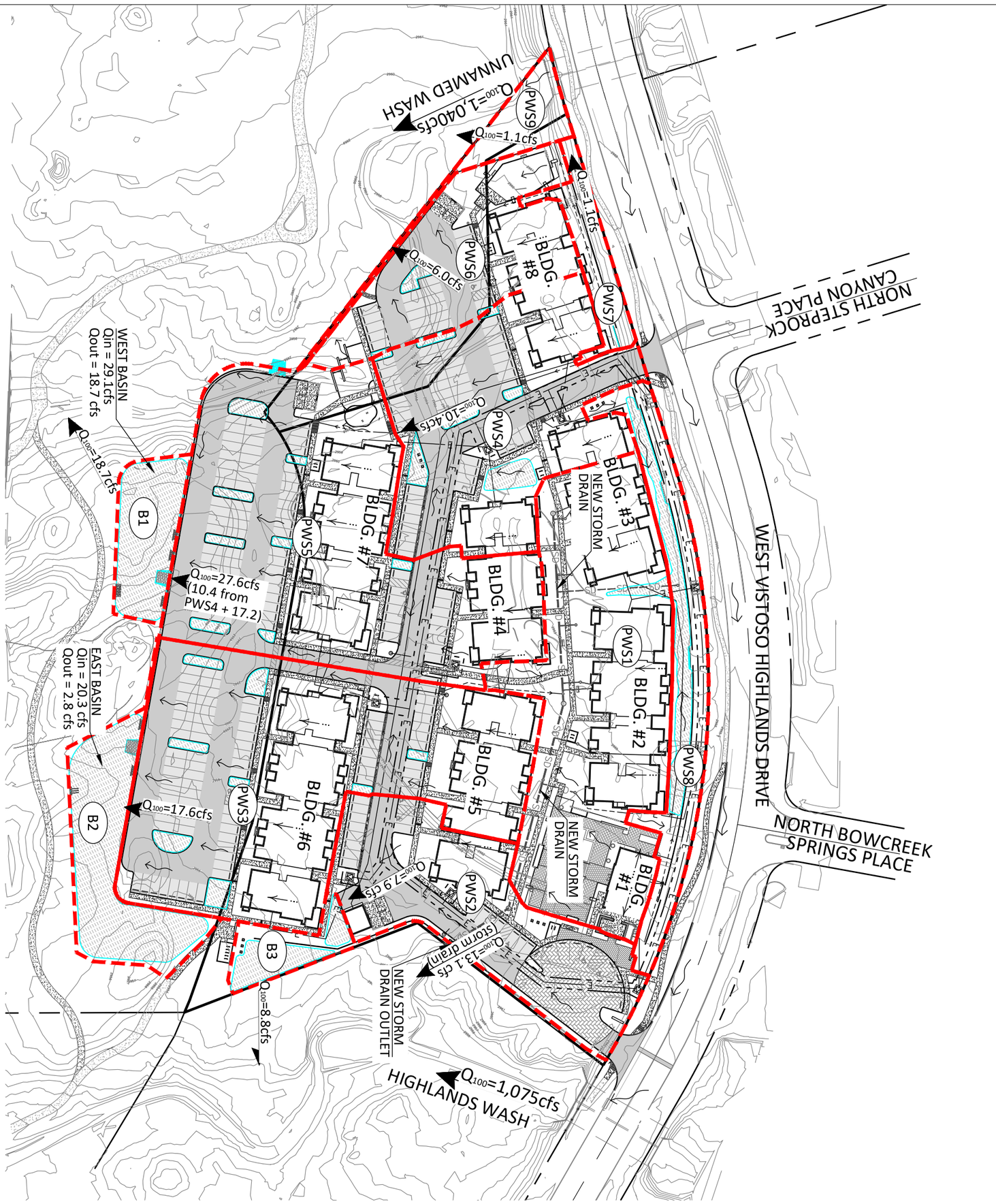
Map 1
Map 2
Map 3
Map 4
Map 5

490 245 0 490 Feet

Scale: 1:2,000

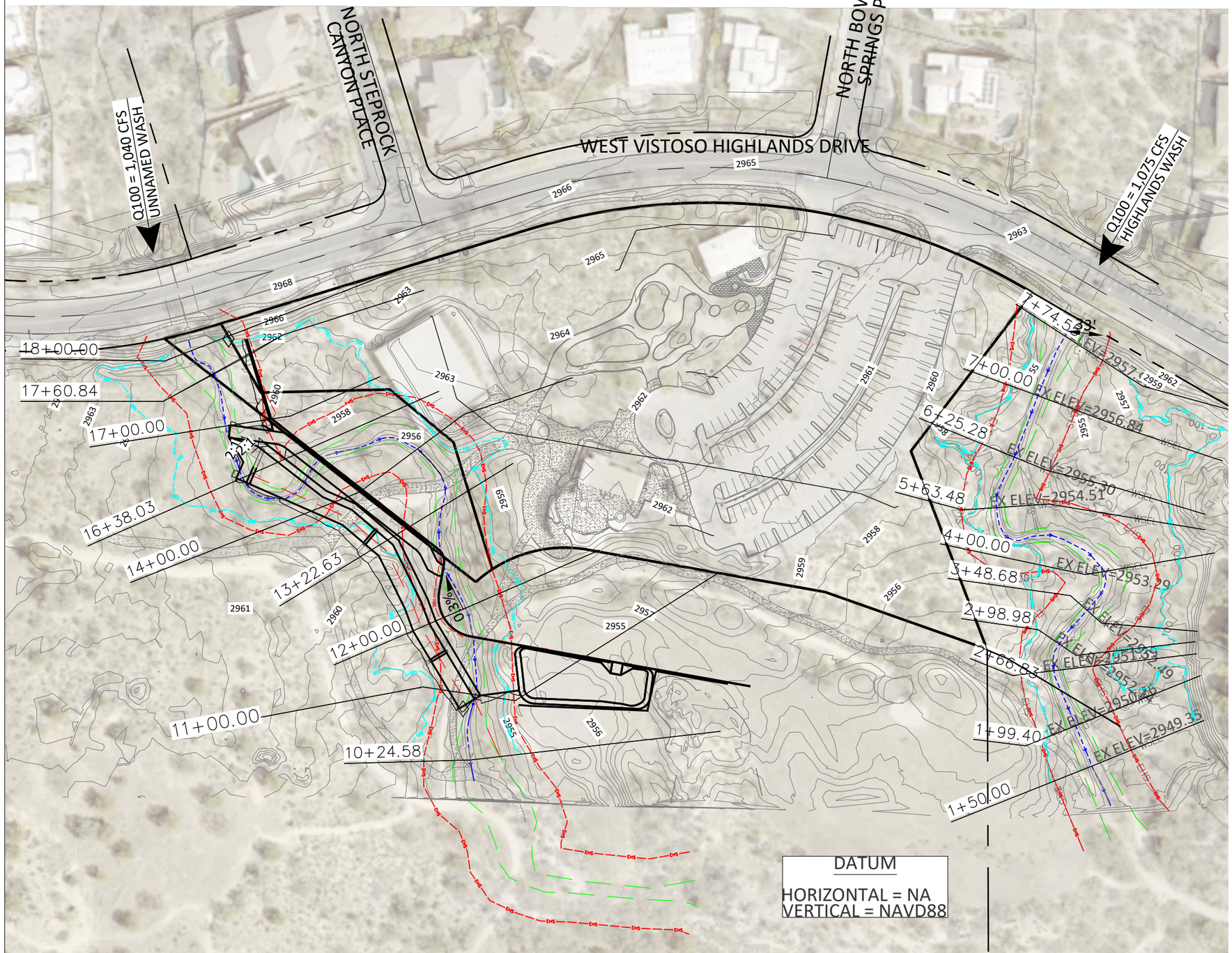
Pima County Regional Flood Control District
97 E Congress - 3rd Floor
Tucson, Arizona 85701-1207
(520) 243-1867, FAX: (520)243-1821
http://www.rfcd.pima.gov

# APPENDIX C




# PROPOSED CONDITIONS WATERSHED MAP
for
# THE GATEWAY AT VISTOSO PRESERVE


PROJECT NO: T22061
RICK ENGINEERING COMPANY
3945 E FORT LOWELL ROAD - STE #111
TUCSON, AZ 85712
520.795.1000
info@cypresscivil.com
rickengineering.com
San Diego - Riverside - San Luis Obispo - Sacramento - Orange - Tucson - Phoenix - Las Vegas - Denver




SCALE 1"=120'
C.I. = 1 foot

## LEGEND

- $Q_{100}$=1cfs — 100-YR PEAK FLOW
- 100 — EXISTING 100-YEAR FLOOD LIMITS
- TOP OF BANK
- EHS — EHS — EROSION HAZARD SETBACK
- WASH FLOWLINE

UNNAMED WASH WSEL SUMMARY

| Ex. River Sta | Q100 (cfs) | Thalweg Elev (ft) | WSEL (ft) |
|---|---|---|---|
| 1800.00 | 1,040 | 2,959.90 | 2,962.67 |
| 1760.84 | 1,040 | 2,958.69 | 2,962.03 |
| 1700.00 | 1,040 | 2,958.07 | 2,960.59 |
| 1638.03 | 1,040 | 2,957.03 | 2,960.26 |
| 1400.00 | 1,040 | 2,954.50 | 2,958.64 |
| 1322.63 | 1,040 | 2,953.20 | 2,958.00 |
| 1200.00 | 1,040 | 2,951.97 | 2,957.19 |
| 1100.00 | 1,040 | 2,950.68 | 2,955.15 |
| 1024.58 | 1,040 | 2,949.96 | 2,954.43 |

HIGHLANDS WASH WSEL SUMMARY

| River Sta | Q100 (cfs) | WSEL (ft) |
|---|---|---|
| 774.55 | 1075 | 2957.96 |
| 700.00 | 1075 | 2956.84 |
| 625.28 | 1075 | 2955.3 |
| 563.48 | 1075 | 2954.51 |
| 400.00 | 1075 | 2953.29 |
| 348.68 | 1075 | 2952.49 |
| 298.98 | 1075 | 2952.14 |
| 266.83 | 1075 | 2951.39 |
| 199.4 | 1075 | 2950.26 |

PROJECT NO: T22061
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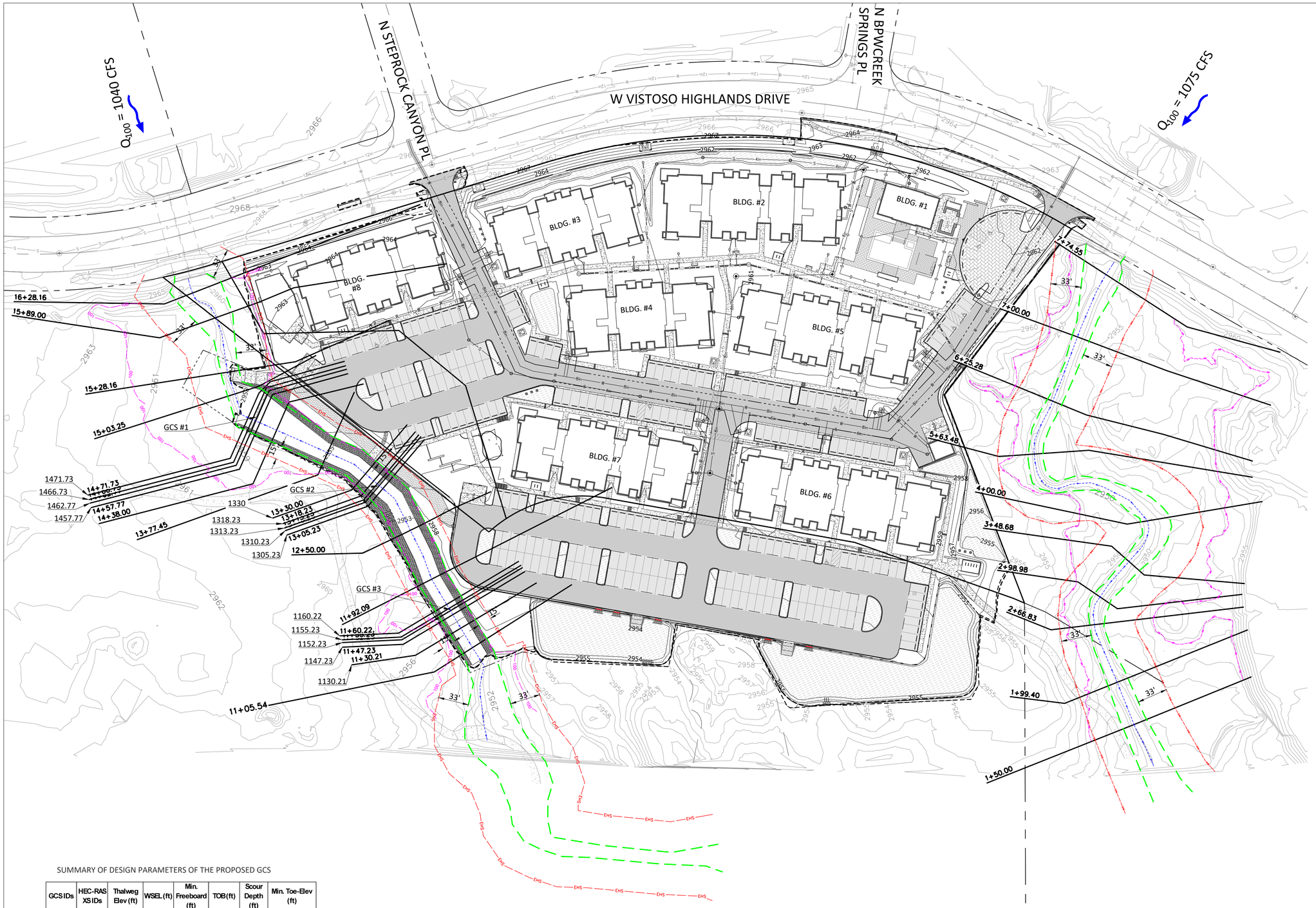
RICK ENGINEERING COMPANY
San Diego - Riverside - San Luis Obispo - Sacramento - Orange - Tucson - Phoenix - Las Vegas - Denver

# EXISTING CONDITIONS WORK MAP for THE GATEWAY AT VISTOSO PRESERVE




SCALE 1"=50'
C.I. = 1 ft

LEGEND

- PROPOSED EROSION HAZARD SETBACK
- PROPOSED FLOWLINE
- PROPOSED TOP OF BANK
- PROPOSED 100-YR FLOOD LIMITS

SUMMARY OF WATER SURFACE ELEVATION (WSEL) FOR UNNAMED WASH IN PROPOSED CONDITIONS

| Prop. River Sta | Q100 (cfs) | Thalweg Elev (ft) | WSEL (ft) |
|---|---|---|---|
| 1628.16 | 1,040 | 2959.77 | 2962.91 |
| 1589 | 1,040 | 2958.72 | 2962.19 |
| 1528.16 | 1,040 | 2957.78 | 2961.71 |
| 1503.25 | 1,040 | 2957.25 | 2961.01 |
| 1471.73 | 1,040 | 2957.03 | 2960.16 |
| 1466.73 | 1,040 | 2956.99 | 2960.13 |
| 1462.77 | 1,040 | 2955.81 | 2960.34 |
| 1457.77 | 1,040 | 2955.64 | 2960.38 |
| 1438 | 1,040 | 2955.47 | 2960.3 |
| 1377.45 | 1,040 | 2955 | 2958.9 |
| 1330 | 1,040 | 2954.62 | 2958.49 |
| 1318.23 | 1,040 | 2954.53 | 2958.39 |
| 1313.23 | 1,040 | 2954.48 | 2958.33 |
| 1310.23 | 1,040 | 2953.48 | 2957.36 |
| 1305.23 | 1,040 | 2953.44 | 2957.3 |
| 1250 | 1,040 | 2952.88 | 2956.76 |
| 1192.09 | 1,040 | 2952.43 | 2956.41 |
| 1160.22 | 1,040 | 2952.16 | 2956.64 |
| 1155.23 | 1,040 | 2952.12 | 2956.05 |
| 1152.23 | 1,040 | 2951.12 | 2954.98 |
| 1147.23 | 1,040 | 2951.06 | 2954.93 |
| 1130.21 | 1,040 | 2950.94 | 2954.83 |
| 1105.54 | 1,040 | 2950.72 | 2954.58 |
| 1024.58 | 1,040 | 2949.97 | 2954.43 |

SUMMARY OF WATER SURFACE ELEVATION (WSEL) FOR HIGHLANDS WASH IN PROPOSED CONDITIONS

| River Sta | Q100 (cfs) | WSEL (ft) |
|---|---|---|
| 774.55 | 1075 | 2957.96 |
| 700.00 | 1075 | 2956.84 |
| 625.28 | 1075 | 2955.3 |
| 563.48 | 1075 | 2954.51 |
| 400.00 | 1075 | 2953.29 |
| 348.68 | 1075 | 2952.49 |
| 298.98 | 1075 | 2952.14 |
| 266.83 | 1075 | 2951.39 |
| 199.4 | 1075 | 2950.26 |

SUMMARY OF DESIGN PARAMETERS OF THE PROPOSED GCS

| GCS IDs | HEC-RAS XS IDs | Thalweg Elev (ft) | WSEL (ft) | Min. Freeboard (ft) | TOB (ft) | Scour Depth (ft) | Min. Toe-Elev (ft) |
|---|---|---|---|---|---|---|---|
| 1 | 1466.73 | 2956.99 | 2960.13 | 1 | 2961.13 | 6.1 | 2950.89 |
| | 1462.77 | 2955.81 | 2960.34 | 1 | 2961.34 | 6.1 | 2949.58 |
| 2 | 1313.23 | 2954.48 | 2958.33 | 1 | 2959.33 | 4.8 | 2949.68 |
| | 1310.23 | 2953.48 | 2957.36 | 1 | 2958.36 | 4.8 | 2948.68 |
| 3 | 1155.23 | 2952.12 | 2956.05 | 1 | 2957.05 | 4.8 | 2947.32 |
| | 1152.23 | 2951.12 | 2954.98 | 1 | 2955.98 | 4.8 | 2946.32 |

RICK
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520-795-1000
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DRAWN BY: AJH
DATE: 12/20/2024
PROJECT NO: T22.061

# PROPOSED CONDITIONS WORK MAP for THE GATEWAY AT VISTOSO PRESERVE

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS1 | Job # | T22061 |
| Watershed Area: | 1.30 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 3 | 102 | 0.0294 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 102 feet | Mean Slope: | 0.0294 |
| Length to Cen. of Gravity (Lca): | 50 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.449 |
| Imp. | 90 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.86 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.8 | in/hr |
| **PEAK DISCHARGE:** | 5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS1 | Job # | T22061 |
| Watershed Area: | 1.30 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 3 | 102 | 0.0294 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 102 feet | Mean Slope: | 0.0294 |
| Length to Cen. of Gravity (Lca): | 50 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.589 |
| Imp. | 90 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.9 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 6.16 | in/hr |
| **PEAK DISCHARGE:** | 8.1 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS1 | Job # | T22061 |
| Watershed Area: | 1.30 Acres | Watershed Type | High Density Urbanized |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 3 | 102 | 0.0294 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 102 feet | Mean Slope: | 0.0294 |
| Length to Cen. of Gravity (Lca): | 50 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.703 |
| Imp. | 90 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.93 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 9.84 | in/hr |
| **PEAK DISCHARGE:** | 12.9 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS2 | Job # | T22061 |
| Watershed Area: | 0.79 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 4.9 | 332 | 0.0148 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 332 feet | Mean Slope: | 0.0148 |
| Length to Cen. of Gravity (Lca): | 166 feet | Weighted Basin Fac: | 0.02 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

**Default Vegetation Percentages Not Used**

| Soil Type | Percent | Veg % | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|---|
| D | 100 | 10 | 92 | Desert Brush | 0.449 |
| Imp. | 95 | - | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.88 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.9 | in/hr |
| **PEAK DISCHARGE:** | 3.1 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS2 | Job # | T22061 |
| Watershed Area: | 0.79 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 4.9 | 332 | 0.0148 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 332 feet | Mean Slope: | 0.0148 |
| Length to Cen. of Gravity (Lca): | 166 feet | Weighted Basin Fac: | 0.02 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

## Default Vegetation Percentages Not Used

| Soil Type | Percent | Veg % | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|---|
| D | 100 | 10 | 92 | Desert Brush | 0.589 |
| Imp. | 95 | - | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.92 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 6.28 | in/hr |
| **PEAK DISCHARGE:** | 5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS2 | Job # | T22061 |
| Watershed Area: | 0.79 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 4.9 | 332 | 0.0148 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 332 feet | Mean Slope: | 0.0148 |
| Length to Cen. of Gravity (Lca): | 166 feet | Weighted Basin Fac: | 0.02 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

## Default Vegetation Percentages Not Used

| Soil Type | Percent | Veg % | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|---|
| D | 100 | 10 | 92 | Desert Brush | 0.703 |
| Imp. | 95 | - | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.94 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 9.98 | in/hr |
| **PEAK DISCHARGE:** | 7.9 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS3 | Job # | T22061 |
| Watershed Area: | 1.71 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.5 | 552 | 0.01 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 552 feet | Mean Slope: | 0.01 |
| Length to Cen. of Gravity (Lca): | 276 feet | Weighted Basin Fac: | 0.02 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

## Default Vegetation Percentages Not Used

| Soil Type | Percent | Veg % | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|---|
| D | 100 | 10 | 92 | Desert Brush | 0.449 |
| Imp. | 95 | - | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.88 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.9 | in/hr |
| **PEAK DISCHARGE:** | 6.7 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS3 | Job # | T22061 |
| Watershed Area: | 1.71 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.5 | 552 | 0.01 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 552 feet | Mean Slope: | 0.01 |
| Length to Cen. of Gravity (Lca): | 276 feet | Weighted Basin Fac: | 0.02 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

**Default Vegetation Percentages Not Used**

| Soil Type | Percent | Veg % | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|---|
| D | 100 | 10 | 92 | Desert Brush | 0.589 |
| Imp. | 95 | - | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.92 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 6.28 | in/hr |
| **PEAK DISCHARGE:** | 10.8 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS3 | Job # | T22061 |
| Watershed Area: | 1.71 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.5 | 552 | 0.01 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 552 feet | Mean Slope: | 0.01 |
| Length to Cen. of Gravity (Lca): | 276 feet | Weighted Basin Fac: | 0.02 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

## Default Vegetation Percentages Not Used

| Soil Type | Percent | Veg % | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|---|
| D | 100 | 10 | 92 | Desert Brush | 0.703 |
| Imp. | 95 | - | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.94 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 9.98 | in/hr |
| **PEAK DISCHARGE:** | 17.2 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS4 | Job # | T22061 |
| Watershed Area: | 1.05 Acres | Watershed Type | High Density Urbanized |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 7.6 | 260 | 0.0292 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 260 feet | Mean Slope: | 0.0292 |
| Length to Cen. of Gravity (Lca): | 130 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.449 |
| Imp. | 90 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.86 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.8 | in/hr |
| **PEAK DISCHARGE:** | 4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS4 | Job # | T22061 |
| Watershed Area: | 1.05 Acres | Watershed Type | High Density Urbanized |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 7.6 | 260 | 0.0292 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 260 feet | Mean Slope: | 0.0292 |
| Length to Cen. of Gravity (Lca): | 130 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.589 |
| Imp. | 90 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.9 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 6.16 | in/hr |
| **PEAK DISCHARGE:** | 6.5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS4 | Job # | T22061 |
| Watershed Area: | 1.05 Acres | Watershed Type | High Density Urbanized |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 7.6 | 260 | 0.0292 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 260 feet | Mean Slope: | 0.0292 |
| Length to Cen. of Gravity (Lca): | 130 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.703 |
| Imp. | 90 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.93 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 9.84 | in/hr |
| **PEAK DISCHARGE:** | 10.4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS5 | Job # | T22061 |
| Watershed Area: | 1.71 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.5 | 472 | 0.0117 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 472 feet | Mean Slope: | 0.0117 |
| Length to Cen. of Gravity (Lca): | 236 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.449 |
| Imp. | 95 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.88 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.9 | in/hr |
| **PEAK DISCHARGE:** | 6.7 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS5 | Job # | T22061 |
| Watershed Area: | 1.71 Acres | Watershed Type | High Density Urbanized |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.5 | 472 | 0.0117 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 472 feet | Mean Slope: | 0.0117 |
| Length to Cen. of Gravity (Lca): | 236 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.589 |
| Imp. | 95 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.92 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 6.28 | in/hr |
| **PEAK DISCHARGE:** | 10.8 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS5 | Job # | T22061 |
| Watershed Area: | 1.71 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.5 | 472 | 0.0117 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 472 feet | Mean Slope: | 0.0117 |
| Length to Cen. of Gravity (Lca): | 236 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.703 |
| Imp. | 95 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.94 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 9.98 | in/hr |
| **PEAK DISCHARGE:** | 17.2 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS6 | Job # | T22061 |
| Watershed Area: | 0.60 Acres | Watershed Type | High Density Urbanized |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 6.4 | 332 | 0.0193 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 332 feet | Mean Slope: | 0.0193 |
| Length to Cen. of Gravity (Lca): | 166 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.449 |
| Imp. | 95 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.88 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.9 | in/hr |
| **PEAK DISCHARGE:** | 2.4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS6 | Job # | T22061 |
| Watershed Area: | 0.60 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 6.4 | 332 | 0.0193 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 332 feet | Mean Slope: | 0.0193 |
| Length to Cen. of Gravity (Lca): | 166 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.589 |
| Imp. | 95 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.92 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 6.28 | in/hr |
| **PEAK DISCHARGE:** | 3.8 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS6 | Job # | T22061 |
| Watershed Area: | 0.60 Acres | Watershed Type | High Density Urbanized |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 6.4 | 332 | 0.0193 | 0.02 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 332 feet | Mean Slope: | 0.0193 |
| Length to Cen. of Gravity (Lca): | 166 feet | Weighted Basin Fac: | 0.02 |
| | | Veg. Cover Density: | 10 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 92 | Desert Brush | 0.703 |
| Imp. | 95 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.94 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 9.98 | in/hr |
| **PEAK DISCHARGE:** | 6 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS7 | Job # | T22061 |
| Watershed Area: | 0.15 Acres | Watershed Type | Undeveloped-Foothills |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.6 | 20 | 0.28 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 20 feet | Mean Slope: | 0.28 |
| Length to Cen. of Gravity (Lca): | 10 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 0.3 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS7 | Job # | T22061 |
| Watershed Area: | 0.15 Acres | Watershed Type | Undeveloped-Foothills |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.6 | 20 | 0.28 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 20 feet | Mean Slope: | 0.28 |
| Length to Cen. of Gravity (Lca): | 10 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 0.6 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS7 | Job # | T22061 |
| Watershed Area: | 0.15 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 5.6 | 20 | 0.28 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 20 feet | Mean Slope: | 0.28 |
| Length to Cen. of Gravity (Lca): | 10 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 1.1 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS8 | Job # | T22061 |
| Watershed Area: | 0.44 Acres | Watershed Type | Undeveloped-Foothills |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 1.5 | 269 | 0.0056 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 269 feet | Mean Slope: | 0.0056 |
| Length to Cen. of Gravity (Lca): | 134 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 6.4 | min |
| Rainfall Intensity (i) @ Tc: | 3.95 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.61 | in/hr |
| **PEAK DISCHARGE:** | 0.7 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS8 | Job # | T22061 |
| Watershed Area: | 0.44 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 1.5 | 269 | 0.0056 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 269 feet | Mean Slope: | 0.0056 |
| Length to Cen. of Gravity (Lca): | 134 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 1.7 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 10/09/2023 |
| Concentration Point: | PWS8 | Job # | T22061 |
| Watershed Area: | 0.44 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 1.5 | 269 | 0.0056 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 269 feet | Mean Slope: | 0.0056 |
| Length to Cen. of Gravity (Lca): | 134 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 3.1 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | PWS9 | Job # | T22061 |
| Watershed Area: | 0.15 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 8 | 116 | 0.069 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 116 feet | Mean Slope: | 0.069 |
| Length to Cen. of Gravity (Lca): | 58 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 0.3 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | PWS9 | Job # | T22061 |
| Watershed Area: | 0.15 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 8 | 116 | 0.069 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 116 feet | Mean Slope: | 0.069 |
| Length to Cen. of Gravity (Lca): | 58 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 0.6 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | PWS9 | Job # | T22061 |
| Watershed Area: | 0.15 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 8 | 116 | 0.069 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 116 feet | Mean Slope: | 0.069 |
| Length to Cen. of Gravity (Lca): | 58 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 1.1 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B1 | Job # | T22061 |
| Watershed Area: | 0.21 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 10 | 0.2 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 10 feet | Mean Slope: | 0.2 |
| Length to Cen. of Gravity (Lca): | 5 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 0.4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B1 | Job # | T22061 |
| Watershed Area: | 0.21 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 10 | 0.2 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 10 feet | Mean Slope: | 0.2 |
| Length to Cen. of Gravity (Lca): | 5 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 0.8 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B1 | Job # | T22061 |
| Watershed Area: | 0.21 Acres | Watershed Type | Undeveloped-Foothills |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 10 | 0.2 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 10 feet | Mean Slope: | 0.2 |
| Length to Cen. of Gravity (Lca): | 5 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 1.5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B2 | Job # | T22061 |
| Watershed Area: | 0.38 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 10 | 0.2 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 10 feet | Mean Slope: | 0.2 |
| Length to Cen. of Gravity (Lca): | 5 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 0.7 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B2 | Job # | T22061 |
| Watershed Area: | 0.38 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 10 | 0.2 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 10 feet | Mean Slope: | 0.2 |
| Length to Cen. of Gravity (Lca): | 5 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 1.4 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B2 | Job # | T22061 |
| Watershed Area: | 0.38 Acres | Watershed Type | Undeveloped-Foothills |

**Watercourse Data By Reach**

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 10 | 0.2 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 10 feet | Mean Slope: | 0.2 |
| Length to Cen. of Gravity (Lca): | 5 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 2.7 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B3 | Job # | T22061 |
| Watershed Area: | 0.12 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 30 | 0.0667 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 30 feet | Mean Slope: | 0.0667 |
| Length to Cen. of Gravity (Lca): | 15 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 2-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.37 | 0.56 | 0.69 | 0.93 | 1.15 | 1.3 | 1.38 | 1.58 | 1.79 | 2.08 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.406 |
| Imp. | 0 | 99 | - | 0.902 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.41 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 4.44 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 1.8 | in/hr |
| **PEAK DISCHARGE:** | 0.2 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B3 | Job # | T22061 |
| Watershed Area: | 0.12 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 30 | 0.0667 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 30 feet | Mean Slope: | 0.0667 |
| Length to Cen. of Gravity (Lca): | 15 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 10-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.57 | 0.87 | 1.08 | 1.45 | 1.8 | 2 | 2.09 | 2.33 | 2.6 | 3.05 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.55 |
| Imp. | 0 | 99 | - | 0.936 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.55 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 6.84 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 3.76 | in/hr |
| **PEAK DISCHARGE:** | 0.5 | cfs |

PIMA COUNTY
FLOOD CONTROL

# HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

**Generated using methonds provided by Pima County Regional Flood Control District**

| | | | |
|---|---|---|---|
| Client: | OV132 LLC | Prepared by: | Rick Engineering |
| Project Name: | Gateway at Vistoso Preserve | Date: | 01/09/2024 |
| Concentration Point: | B3 | Job # | T22061 |
| Watershed Area: | 0.12 Acres | Watershed Type | Undeveloped-Foothills |

## Watercourse Data By Reach

| Reach No. | Height (Hi) | Length (Li) | Slope (Si) | Basin Factor (Nb) |
|---|---|---|---|---|
| 1 | 2 | 30 | 0.0667 | 0.035 |

| | | | |
|---|---|---|---|
| Length of Watercourse (Lc): | 30 feet | Mean Slope: | 0.0667 |
| Length to Cen. of Gravity (Lca): | 15 feet | Weighted Basin Fac: | 0.035 |
| | | Veg. Cover Density: | 20 |

**RETURN PERIOD: 100-years NOAA Data Obtained: 2023-11-21 08:13:05 AM**

Rainfall Depths: NOAA Atlas 14 (90% UCL) @ Latitude: 32.4566 Longitude: -110.9831

| Duration: | 5-min | 10-min | 15-min | 30-min | 1-hr | 2-hr | 3-hr | 6-hr | 12-hr | 24-hr |
|---|---|---|---|---|---|---|---|---|---|---|
| Point Values (in): | 0.88 | 1.34 | 1.66 | 2.24 | 2.78 | 3.09 | 3.26 | 3.59 | 3.92 | 4.67 |

| Soil Type | Percent | Curve # (CN) | Veg. Cover Type(s): | Runoff Coef. (C) |
|---|---|---|---|---|
| D | 100 | 91 | Desert Brush | 0.672 |
| Imp. | 0 | 99 | - | 0.958 |

| | | |
|---|---|---|
| Weighted Runoff Coef. (Cw): | 0.67 | |
| Time of Concentration: | 5 | min |
| Rainfall Intensity (i) @ Tc: | 10.56 | in/hr |
| Runoff Supply Rate (q) @ Tc: | 7.09 | in/hr |
| **PEAK DISCHARGE:** | 0.9 | cfs |

# TRITON TDAM SERIES by REM Inc.

***Additional Overflow***
*Top Sections of TDAM'S are mounted so that they leave at least a 25% opening between the top of the filter and the bottom of the grate. This opening has been designed to allow for large storm events to bypass TDAM Filter when needed.*

***TRITON TDAM Filters have been designed to be used universally in the many different and unique types of catch basins both above and below ground infrastructures. They are designed to take advantage of each catch basin's dimensions and size, maximizing for the best flow and capture area possible.***

**MADE IN USA**


***TDAM - Installed, before service*** ***TDAM - After service***


***TDAM – BFTG - FOG Installed in a curb***

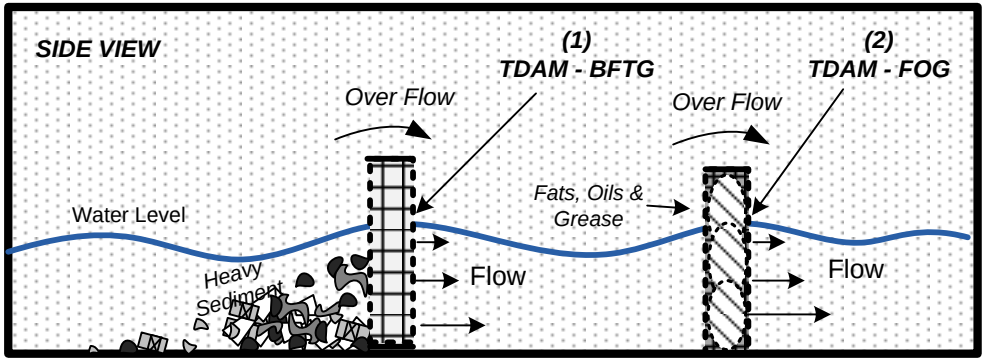
***TDAM - FOG Installed in a trench drain***

## Notes:

- *REM TRITON TDAM Filters can be sized to fit most industry standard trench drains, parkway drains, shallow structures, catch basins, etc. REM also designs custom filters for unique storm water infrastructures and applications.*
- *REM TRITON TDAM filter cartridge housings are constructed utilizing Type 304 Stainless Steel, with 1" X 1" welded square openings.*
- *Multiple TDAM Filter Inserts can be staged in line with one another in order to provide additional levels of filtration (Battery Series).*
- *REM TRITON replacement Filter Media Packs are charged with REM FOG media an expanded volcanic ash medium treated to be highly hydrophobic housed in a durable geo-textile perforated polypropylene woven fabric. REM FOG media effectively encapsulates liquefied petroleum hydrocarbons (Fats, Oils & Grease including animal fats). The media's hydrophobic characteristic allows for greater polishing of flow resulting in the reduction of Total Suspended Solids (TSS). Suspended solid reduction includes but is not limited to debris, trash, silt sediment and agglomerated heavy metals. (Additional media options are available including mixed blends of granulated carbon [AC] and Zeolite [ZEO].*
- *Filter Height should be designed to allow for a high flow overflow bypass to eliminate pooling or flooding during heavy rain events.*
- *REM's disposable Media Filter Packs are easily removed for maintenance.*
- *See REM Specifier Sheets for size, model and flow rate information.*
- *REM TRITON filters are to be installed and maintained in accordance with manufacturer recommendations.*
- *Maintenance information and replacement REM Media Packs are available upon request by contacting REM at sales@remfilters.com or (888) 526-4736.*
- *Made in the USA.*

## *TDAM – Battery Series:*

*Shown with the TDAM – BFTG (1), to capture larger debris, such as trash and sediment. Second layer of filtering to be done with the TDAM – FOG (2) to capture hydrocarbons and other finer polutants.*






# REM Inc.

## TRITON TDAM FILTER
(Multiple Applications for REM Filters)

PH: (888) 526-4736

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

| SIZE | DRAWN BY: | FOR: | REV |
|---|---|---|---|
| | C.F. | Trash-filtering and polishing | |
| SCA | 1/4 : 1 | DATE: 1/22/2012 | SHE 1 OF 1 |

# *Sizing Guide for Trench Drains*

## REM Inc.

**TRENCH DRAIN SIZING GUIDE**

(Designed to help determine what size filters are required for each catch basin on site)

For Curb, Drop Inlets or other questions please call (888) 526-4736.

Once you have sized your drains you may either fax or email back your measurements to:

**Fax: (925) 676-8676**
**Or**
**Email: Sales@remfilters.com**

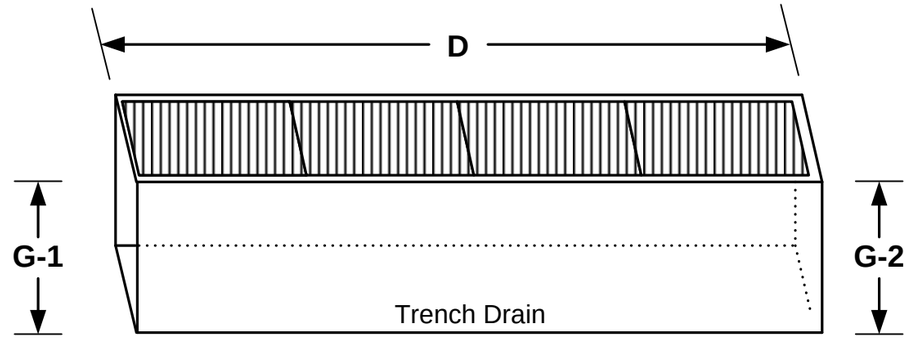
Customer:_____ Contact:_____

Ph: (____)_____ Fax: (____)_____

Project/Tract#:_____

Location: _____ Page_____of_____

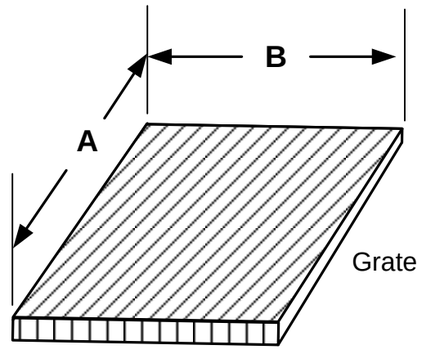
| Drain # | Quantity | Grate Dimensions | | | | Trench Drain I.D. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | A | B | E | F | C | D | G-1 | G-2 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |




**NOTES:**

1. Please fill in all dimensions that apply within 1/8".
2. Please mark or draw in the location of the exit pipes for drain and any obstructions within drain.
3. Dimensions C & D are the clear openings (or inside throat) of the trench drain.
4. Dimension G is measured from the bottom of the grate to the bottom of the trench drain. Most trench drains have a slope to them, G-1 is at one end and G-2 is at the other for each drain.

**COMMENTS:**

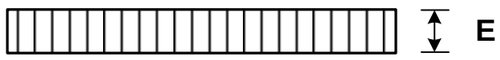



***Most Trench drain grates will come in multiple section due to their lengths.***

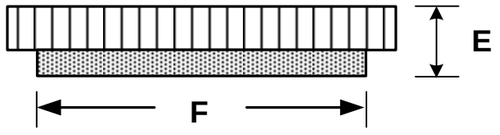
**E & F – Dimensions:**

**Grate Type, Mark one.**

☐ 1 **Flat Bottom** →



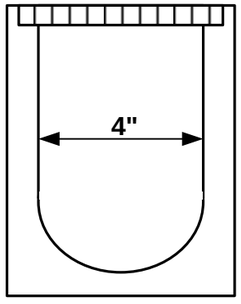

☐ 2 **"Keyhole" / Coped Bottom** →

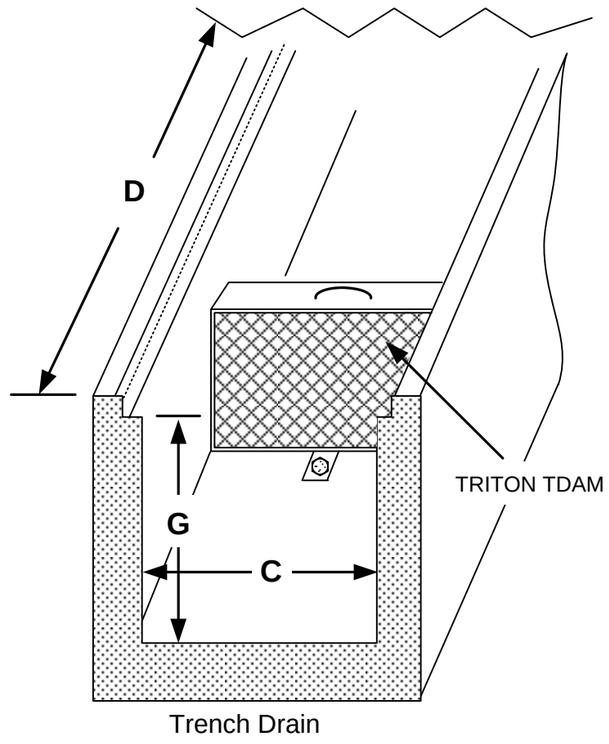



***Some smaller trench drains may have curved bottoms Please mark the box below if this is the type of trench drain that you have.***

☐ **YES**

☐ **NO**




REM Inc.

## REM TRITON Filter Recommended Maintenance Procedures:

### ***Maintenance and Inspections:***

In order to ensure proper operation, REM (Revel Environmental Manufacturing, Inc.) recommends that REM Stormwater filters be serviced and maintained when debris and pollutant accumulations exceed no more than 80% of the filter's capacity. REM recommends that the filters are inspected and serviced at a minimum of three times (3X's) per seasonal cycle year. The frequency and length of duration between inspections and maintenance may fluctuate based on specific site conditions such as local weather conditions, site use, and pollutant type and loading volume.

### ***Filter Media Replacement:***

In order to ensure proper operation, REM recommends that the FOG Media, or other specified media (such as Activated Carbon, and/or Zeolite) be replaced when the outer surface of media is no more than 50% coated with contaminants. (The surface area of REM's standard FOG media is stark white in color. The media will blacken with encapsulated contaminants over time.) It is recommended that REM media packs and Bioflex be replaced a minimum of one time (1X) per seasonal cycle year. Sites with higher pollutant loading concentrations may require more frequent service and media replacement. Purchase replacement media packs from REM at (888) 526-4736 or sales@remfilters.com. Custom media configurations are available upon.

### ***Disposal:***

Captured pollutant debris and spent media must be disposed of in accordance with all Federal, State, and Local Laws and Regulations.

### ***On-site Procedures for Triton Catch Basin Filter Inserts:***

1. Secure area (proceed with traffic and pedestrian control plan).
2. Clean surface area immediately around each storm drain utilizing a stiff bristled push-broom, flat shovel or industrial vacuum.
3. Proceed with confined space procedures as necessary.
4. Remove grate or manhole cover and set aside.
5. Inspect perimeter filter flange gasket. Confirm media cartridge is secure in the filter basin.
6. Remove debris trapped in grate slot openings.
7. Utilize an industrial vacuum to remove debris from within filter basin.
8. Pressure wash media pack through the stainless steel cartridge. (Avoid discharge by utilizing an industrial vacuum to remove excess water while pressure washing).
9. Inspect media housed inside stainless steel cartridge. REM recommends replacing the filter media a minimum of once a year (see *Filter Media Replacement* above).
10. Place grate or manhole cover back on catch basin grate frame.
11. Secure dated service lock-out tag on grate lid.
12. Identify catch basin on site map for tracking and reporting.
13. Note observations, concerns or recommendation regarding specific filter on maintenance report.
14. Remove pedestrian and/or traffic control barricades.

# FloGard +Plus® Catch Basin Insert Filter

Inlet Filtration

## *Removes pollutants from runoff at the source*

*FloGard +Plus is a catch basin insert filter designed to remove sediment, gross solids, trash, and petroleum hydrocarbons from stormwater runoff. FloGard +Plus is ideally suited for removal of primary pollutants from paved surfaces in commercial and residential areas. Rated filter flow capacities are designed to exceed the required "first flush" treatment flow rate, and the unique dual-bypass design typically exceeds catch basin inlet capacity.*

### Economical Treatment
Quick, easy, and cost-effective to install, inspect, and maintain.

### Efficient Performance
Removes pollutants at the inlet where they are easiest to catch.

### Versatile Applications
Appropriate and easy to use on new construction or retrofit projects.

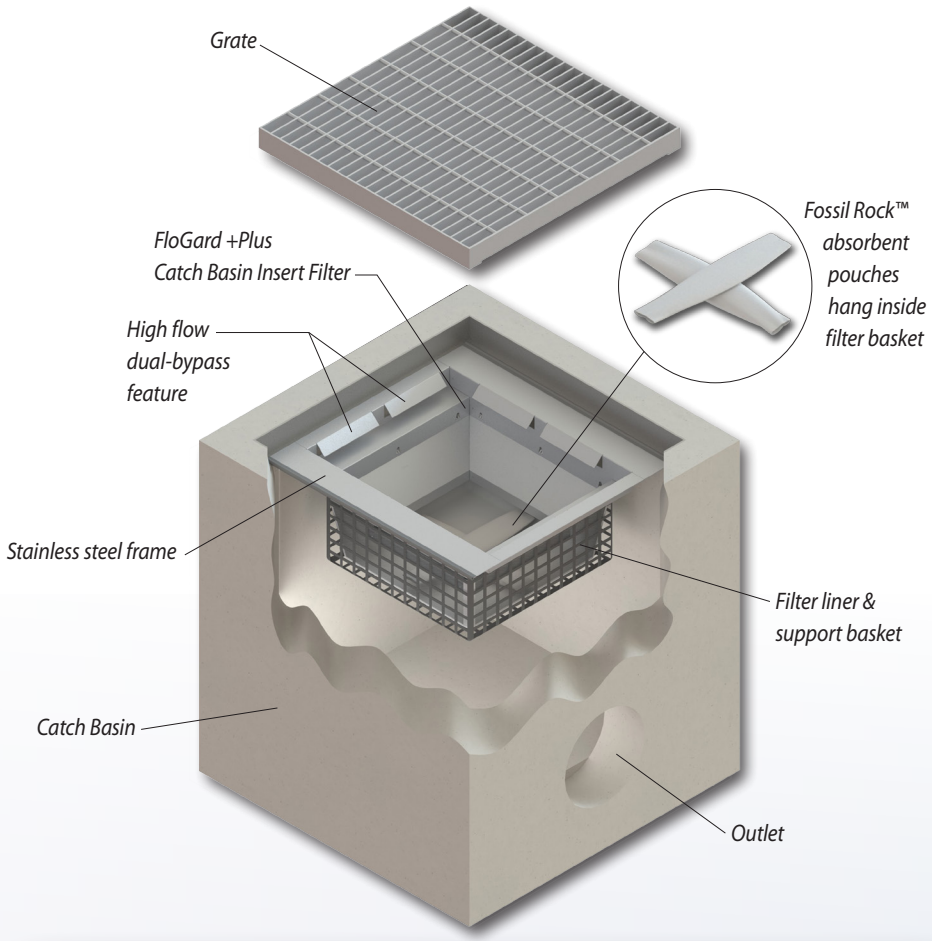
### Flexible Design
Available in a wide variety of sizes and configurations, including custom options.

### Durable Construction
Built to last and withstand the loads from captured pollutants.

### Environmentally Friendly
No standing water minimizes vector, bacteria, and odor problems.

### Proven Performance
Field and laboratory tested with up to 86%[1] removal of TSS and 80%[2] removal of oils and grease.

1. *University of Auckland laboratory testing of local street sweep material.*
2. *UCLA laboratory study.*




### How It Works:

Flows entering the unit pass through the filter liner basket for removal of sediment, trash, and debris. Optional Fossil Rock™ sorbent pouches installed in the basket effect hydrocarbon capture. As the storm flow exceeds the treatment flow rate, treatment will continue and excess flows will pass through the dual-bypass openings near the top of the unit.

# FloGard +Plus Catch Basin Insert Filter

*Catch basin insert designed to capture sediment, gross solids, trash, and petroleum hydrocarbons from low (first flush) flows, even during the most extreme weather conditions.*

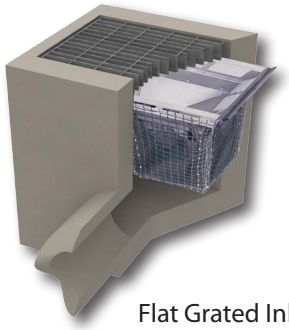
## Example Types, Sizes, and Capacities

*Additional sizes, including regional and custom options are available.*

| FloGard Combination Inlet SPECIFIER CHART | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MODEL NO. STANDARD DEPTH | STANDARD & SHALLOW DEPTH (Data in these columes is the same for both STANDARD & SHALLOW versions) | | | STANDARD DEPTH -20 Inches- | | MODEL NO. SHALLOW DEPTH | SHALLOW DEPTH -12 Inches- | |
| | INLET ID Inside Dimension (inch x inch) | GRATE OD Outside Dimension (inch x inch) | TOTAL BYPASS CAPACITY (cu. ft. / sec.) | SOLIDS STORAGE CAPACITY (cu. ft.) | FILTERED FLOW (cu. ft. / sec.) | | SOLIDS STORAGE CAPACITY (cu. ft.) | FILTERED FLOW (cu. ft. / sec.) |
| FGP-1633FGO | 16 X 33 | 18 X 36 | 7.0 | 2.5 | 1.7 | FGP-1633FGO8 | 1.4 | 1.1 |
| FGP-1836FGO | 18 X 36 | 18 X 40 | 6.9 | 2.3 | 1.6 | FGP-1836FGO8 | 1.3 | .9 |
| FGP-2234FGO | 22 X 34 | 24 X 36 | 8.1 | 3.6 | 2.1 | FGP-2234FGO8 | 2.1 | 1.4 |
| FGP-2436FGO | 24 X 36 | 24 X 40 | 8.0 | 3.4 | 2.0 | FGP-2436FGO8 | 1.95 | 1.15 |

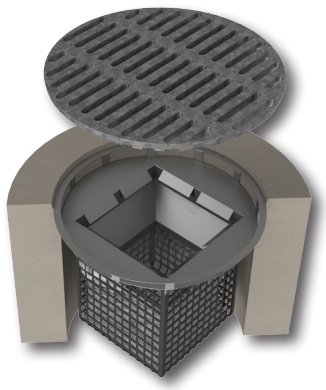
Combination Inlet

| FloGard Flat Grated Inlet SPECIFIER CHART | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MODEL NO. STANDARD DEPTH | STANDARD & SHALLOW DEPTH (Data In these columes Is the same for both STANDARD & SHALLOW versions) | | | STANDARD DEPTH -20 Inches- | | MODEL NO. SHALLOW DEPTH | SHALLOW DEPTH -12 Inches- | |
| | INLET ID Inside Dimension (inch x inch) | GRATE OD Outside Dimension (inch x inch) | TOTAL BYPASS CAPACITY (cu. ft. / sec.) | SOLIDS STORAGE CAPACITY (cu. ft.) | FILTERED FLOW (cu. ft. / sec.) | | SOLIDS STORAGE CAPACITY (cu. ft.) | FILTERED FLOW (cu. ft. / sec.) |
| FGP-12F | 12 X 12 | 12 X 14 | 2.8 | 0.3 | 0.4 | FGP-12F8 | .15 | .25 |
| FGP-16F | 16 X 16 | 16 X 19 | 4.7 | 0.8 | 0.7 | FGP-16F8 | .45 | .4 |
| FGP-18F | 18 X 18 | 18 X 20 | 4.7 | 0.8 | 0.7 | FGP-18F8 | .45 | .4 |
| FGP-1836F | 18 X 36 | 18 X 40 | 6.9 | 2.3 | 1.6 | FGP-1836F8 | 1.3 | .9 |
| FGP-21F | 22 X 22 | 22 X 24 | 6.1 | 2.2 | 1.5 | FGP-21F8 | 1.25 | .85 |
| FGP-24F | 24 X 24 | 24 X 27 | 6.1 | 2.2 | 1.5 | FGP-24F8 | 1.25 | .85 |
| FGP-2436F | 24 X 36 | 24 X 40 | 8.0 | 3.4 | 2.0 | FGP-2436F8 | 1.95 | 1.15 |
| FGP-2448F | 24 X 48 | 24 X 48 | 9.3 | 4.4 | 2.4 | FGP-2448F8 | 2.5 | 1.35 |
| FGP-32F-TN | 28 X 28 | 32 X 32 | 6.3 | 2.2 | 1.5 | FGP-32F8-TN | 1.25 | .85 |
| FGP-30F | 30 X 30 | 30 X 34 | 8.1 | 3.6 | 2.0 | FGP-30F8 | 2.05 | 1.15 |
| FGP-36F | 36 X 36 | 36 X 40 | 9.1 | 4.6 | 2.4 | FGP-36F8 | 2.65 | 1.35 |
| FGP-3648F | 36 X 48 | 40 X 48 | 11.5 | 6.8 | 3.2 | FGP-3648F8 | 3.9 | 1.85 |
| FGP-48F | 48 X 48 | 48 X 54 | 13.2 | 9.5 | 3.9 | FGP-48F8 | 5.45 | 2.25 |
| FGP-1633F | 16 X 34 | 18 X 36 | 6.9 | 2.3 | 1.6 | FGP-1633F8 | 1.3 | .9 |
| FGP-2234F | 22 X 34 | 24 X 36 | 8.0 | 3.4 | 2.0 | FGP-2234F8 | 1.95 | 1.15 |



Flat Grated Inlet

| FloGard Circular Grated Inlet SPECIFIER CHART | | | | | |
|---|---|---|---|---|---|
| MODEL NUMBER | INLET ID (Ø INCHES) | GRATE OD (Ø INCHES) | SOLIDS STORAGE CAPACITY (CU FT) | FILTERED FLOW (CFS) | TOTAL BYPASS CAPACITY (CFS) |
| FGP-RF15F | 15 | 18 | 0.3 | 0.4 | 2.8 |
| FGP-RF18F | 18 | 20 | 0.8 | 0.7 | 4.7 |
| FGP-RF20F | 20 | 23 | 0.8 | 0.7 | 4.7 |
| FGP-RF21F | 21 | 23.5 | 0.8 | 0.7 | 4.7 |
| FGP-RF22F | 22 | 24 | 0.8 | 0.7 | 4.7 |
| FGP-RF24F | 24 | 26 | 0.8 | 0.7 | 4.7 |
| FGP-RF30F | 30 | 32 | 2.2 | 1.5 | 6.1 |
| FGP-RF36F | 36 | 39 | 3.6 | 2.0 | 8.1 |



Circular Frame Catch Basin

**Visit our website: oldcastlestormwater.com or call (800) 579-8819 for additional sizes and options.**

**GENERAL SPECIFICATIONS FOR MAINTENANCE OF**
***FLO-GARD+PLUS*® CATCH BASIN INSERT FILTERS**

**SCOPE:**

Federal, State and Local Clean Water Act regulations and those of insurance carriers require that stormwater filtration systems be maintained and serviced on a recurring basis. The intent of the regulations is to ensure that the systems, on a continuing basis, efficiently remove pollutants from stormwater runoff thereby preventing pollution of the nation's water resources. These specifications apply to the FloGard+Plus® Catch Basin Insert Filter.

**RECOMMENDED FREQUENCY OF SERVICE:**

Drainage Protection Systems (DPS) recommends that installed Flo-Gard+Plus® Catch Basin Insert Filters be serviced on a recurring basis. Ultimately, the frequency depends on the amount of runoff, pollutant loading and interference from debris (leaves, vegetation, cans, paper, etc.); however, it is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. DPS technicians are available to do an on-site evaluation, upon request.

**RECOMMENDED TIMING OF SERVICE:**

DPS guidelines for the timing of service are as follows:

1. For areas with a definite rainy season: Prior to, during and following the rainy season.
2. For areas subject to year-round rainfall: On a recurring basis (at least three times per year).
3. For areas with winter snow and summer rain: Prior to and just after the snow season and during the summer rain season.
4. For installed devices not subject to the elements (washracks, parking garages, etc.): On a recurring basis (no less than three times per years).

**SERVICE PROCEDURES:**

1. The catch basin grate shall be removed and set to one side. The catch basin shall be visually inspected for defects and possible illegal dumping. If illegal dumping has occurred, the proper authorities and property owner representative shall be notified as soon as practicable.
2. Using an industrial vacuum, the collected materials shall be removed from the liner. (Note: DPS uses a truck-mounted vacuum for servicing Flo-Gard+Plus® catch basin inserts.)
3. When all of the collected materials have been removed, the filter medium pouches shall be removed by unsnapping the tether from the D-ring and set to one side. The filter liner, gaskets, stainless steel frame and mounting brackets, etc. shall be inspected for continued serviceability. Minor damage or defects found shall be corrected on-the-spot and a notation made on the Maintenance Record. More extensive deficiencies that affect the efficiency of the filter (torn liner, etc.), if approved by the customer representative, will be corrected and an invoice submitted to the representative along with the Maintenance Record.
4. The filter medium pouches shall be inspected for defects and continued serviceability and replaced as necessary and the pouch tethers re-attached to the liner's D-ring. See below.
5. The grate shall be replaced.

**REPLACEMENT AND DISPOSAL OF EXPOSED FILTER MEDIUM AND COLLECTED DEBRIS**

The frequency of filter medium pouch exchange will be in accordance with the existing DPS-Customer Maintenance Contract. DPS recommends that the medium be changed at least once per year. During the appropriate service, or if so determined by the service technician during a non-scheduled service, the filter medium pouches will be replaced with new pouches. Once the exposed pouches and debris have been removed, DPS has possession and must dispose of it in accordance with local, state and federal agency requirements.

**DPS also has the capability of servicing all manner of catch basin inserts and catch basins without inserts, underground oil/water separators, stormwater interceptors and other such devices. All DPS personnel are highly qualified technicians and are confined space trained and certified. Call us at (888) 950-8826 for further information and assistance.**

# APPENDIX D

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Input the Inflow Hydrograph, & Automatically Perform the Routing Calculations using the Stage-Volume data, Volume-Outflow data, & SO Working Curve

PIMA COUNTY FLOOD CONTROL

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | **Project Address** |
| AJH | **Designer** |
| Friday, July 19, 2024 | **Run Date** |
| East Basin Routing.xls | **Program File Name** |

Rev. 10/20

**GOVERNING EQUATION:** *Ref: Applied Hydrology (Ven Te Chow, Editor 1964)*

Mass Conservation: $0.5 * (I_1 + I_2) * \Delta t - 0.5 * (O_1 + O_2) * \Delta t = S_2 - S_1$

Isolate, divide by $\Delta t$: $0.5 * (I_1 + I_2) + S_1 / \Delta t - 0.5 * O_1 = S_2 / \Delta t + 0.5 * O_2$

**VARIABLES:**

| | |
|---|---|
| $\Delta t$ | time interval between hydrograph discharges. |
| $I_1$, $I_2$ | inflow rate into facility at start and end of time interval from inflow hydrograph |
| $O_1$, $O_2$ | facility outflow rate at start & end of time interval |
| $S_1$, $S_2$ | stormwater in storage in the facility at start and end of time interval |

**Note:** Input $\Delta t$, target discharges & inflow hydrographs for 3 storm frequencies into blue cells. Outflow hydrographs (yellow) are calculated from specified outlet configuration (**vol-outflow** tab) and facility geometry (**Stage-Vol** tab). To add rows to this worksheet, add them in roughly the center of the range, then unhide all columns and copy hidden equations into the new rows. Zero discharge within and beyond the end of the hydrograph will not affect the routing. **All blue cells in this spreadsheet must either be blank (highlight, right-click, Clear Contents) or must contain a number. In addition, the Stage - Volume data must be entered in numerically ascending order. This spreadsheet does not have a "clear" button to clear all input data in one action; to accomplish this, restart Excel using a blank copy of the spreadsheet.**

**RESULTS:**

| | max inflow | | max outflow | | total inflow volume | | | | max stage (H) * | | | | target ** discharge | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100-Year | 20.3 | cfs | 2.8 | cfs | 21081 | $ft^3$ | 0.484 | af | 1.36 | ft | 35 | min | 24.2 | cfs |
| 10-Year | 12.5 | cfs | 1.5 | cfs | 12981 | $ft^3$ | 0.298 | af | 0.92 | ft | 36 | min | 10.6 | csf |
| 2-Year | 7.6 | cfs | 0.5 | cfs | 7892 | $ft^3$ | 0.181 | af | 0.63 | ft | 42 | min | 4.0 | cfs |

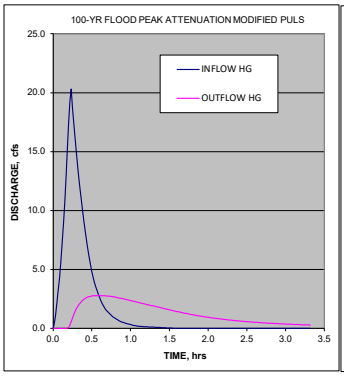
* Max Design Stage = 1.50 ft

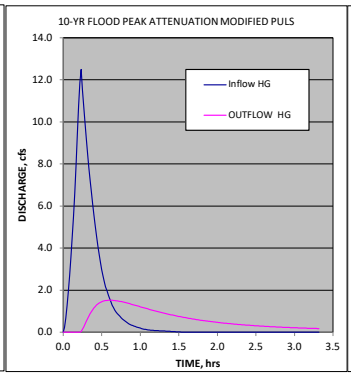
NOTE: IF H > MAX DESIGN STAGE, EXTEND STAGE-VOL DATA TO A HIGHER STAGE

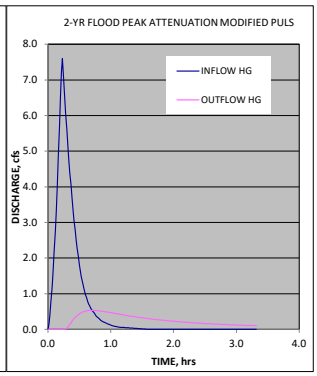
** target discharges not used in calculations; for informational use only

$\Delta t$ = 1.00 min 0.0167 hr inflow hydrograph time interval

| | 100-Year | | | 10-Year | | 2-Year | | 100-Year | | 10-Year | | 2-Year | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| index count | Inflow I, cfs | time t, hr | S/Δt+O/2 cfs | Inflow I, cfs | S/Δt+O/2 cfs | Inflow I, cfs | S/Δt+O/2 cfs | outflow O, cfs | Stage H, ft | outflow O, cfs | Stage H, ft | outflow O, cfs | Stage H, ft |
| 0 | 0.00 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 | 0.37 | 0.0167 | 0.19 | 0.23 | 0.12 | 0.14 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1.10 | 0.0333 | 0.92 | 0.68 | 0.57 | 0.41 | 0.35 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | 2.07 | 0.0500 | 2.51 | 1.28 | 1.55 | 0.78 | 0.94 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 |
| 4 | 3.16 | 0.0667 | 5.13 | 1.95 | 3.16 | 1.18 | 1.92 | 0.00 | 0.03 | 0.00 | 0.02 | 0.00 | 0.01 |
| 5 | 4.39 | 0.0833 | 8.90 | 2.70 | 5.48 | 1.64 | 3.33 | 0.00 | 0.05 | 0.00 | 0.03 | 0.00 | 0.02 |
| 6 | 5.79 | 0.1000 | 13.99 | 3.57 | 8.62 | 2.17 | 5.24 | 0.00 | 0.08 | 0.00 | 0.05 | 0.00 | 0.03 |
| 7 | 7.34 | 0.1167 | 20.56 | 4.52 | 12.66 | 2.75 | 7.69 | 0.00 | 0.12 | 0.00 | 0.07 | 0.00 | 0.04 |
| 8 | 8.90 | 0.1333 | 28.68 | 5.48 | 17.66 | 3.33 | 10.74 | 0.00 | 0.16 | 0.00 | 0.10 | 0.00 | 0.06 |
| 9 | 10.72 | 0.1500 | 38.49 | 6.60 | 23.70 | 4.02 | 14.41 | 0.00 | 0.22 | 0.00 | 0.13 | 0.00 | 0.08 |
| 10 | 12.85 | 0.1667 | 50.28 | 7.91 | 30.96 | 4.81 | 18.82 | 0.00 | 0.29 | 0.00 | 0.18 | 0.00 | 0.11 |
| 11 | 15.25 | 0.1833 | 64.33 | 9.39 | 39.61 | 5.71 | 24.08 | 0.01 | 0.36 | 0.00 | 0.22 | 0.00 | 0.14 |
| 12 | 17.47 | 0.2000 | 80.68 | 10.76 | 49.69 | 6.54 | 30.21 | 0.10 | 0.45 | 0.00 | 0.28 | 0.00 | 0.17 |
| 13 | 19.29 | 0.2167 | 98.97 | 11.88 | 61.00 | 7.22 | 37.09 | 0.29 | 0.54 | 0.00 | 0.35 | 0.00 | 0.21 |
| 14 | 20.30 | 0.2333 | 118.47 | 12.50 | 73.19 | 7.60 | 44.50 | 0.56 | 0.64 | 0.04 | 0.41 | 0.00 | 0.25 |
| 15 | 18.71 | 0.2500 | 137.41 | 11.52 | 85.16 | 7.00 | 51.80 | 0.87 | 0.73 | 0.14 | 0.47 | 0.00 | 0.29 |
| 16 | 17.44 | 0.2667 | 154.61 | 10.74 | 96.15 | 6.53 | 58.57 | 1.17 | 0.82 | 0.26 | 0.53 | 0.00 | 0.33 |
| 17 | 16.19 | 0.2833 | 170.26 | 9.97 | 106.25 | 6.06 | 64.86 | 1.43 | 0.89 | 0.39 | 0.58 | 0.01 | 0.37 |
| 18 | 14.98 | 0.3000 | 184.41 | 9.22 | 115.46 | 5.61 | 70.69 | 1.67 | 0.96 | 0.52 | 0.62 | 0.03 | 0.40 |
| 19 | 13.81 | 0.3167 | 197.13 | 8.50 | 123.80 | 5.17 | 76.04 | 1.86 | 1.02 | 0.65 | 0.67 | 0.06 | 0.43 |
| 20 | 12.70 | 0.3333 | 208.52 | 7.82 | 131.32 | 4.76 | 80.95 | 2.02 | 1.07 | 0.77 | 0.70 | 0.10 | 0.45 |
| 21 | 11.73 | 0.3500 | 218.72 | 7.22 | 138.07 | 4.39 | 85.42 | 2.16 | 1.12 | 0.88 | 0.74 | 0.14 | 0.48 |
| 22 | 10.84 | 0.3667 | 227.84 | 6.67 | 144.13 | 4.06 | 89.51 | 2.28 | 1.16 | 0.99 | 0.77 | 0.18 | 0.50 |
| 23 | 9.90 | 0.3833 | 235.93 | 6.10 | 149.53 | 3.71 | 93.21 | 2.38 | 1.19 | 1.08 | 0.79 | 0.22 | 0.52 |
| 24 | 9.02 | 0.4000 | 243.01 | 5.56 | 154.28 | 3.38 | 96.53 | 2.47 | 1.23 | 1.16 | 0.82 | 0.26 | 0.53 |
| 25 | 8.20 | 0.4167 | 249.15 | 5.05 | 158.42 | 3.07 | 99.49 | 2.55 | 1.25 | 1.23 | 0.84 | 0.30 | 0.55 |
| 26 | 7.44 | 0.4333 | 254.42 | 4.58 | 162.01 | 2.78 | 102.13 | 2.61 | 1.28 | 1.29 | 0.85 | 0.33 | 0.56 |
| 27 | 6.70 | 0.4500 | 258.88 | 4.13 | 165.07 | 2.51 | 104.44 | 2.66 | 1.30 | 1.34 | 0.87 | 0.36 | 0.57 |
| 28 | 6.07 | 0.4667 | 262.61 | 3.74 | 167.66 | 2.27 | 106.47 | 2.70 | 1.31 | 1.39 | 0.88 | 0.39 | 0.58 |
| 29 | 5.46 | 0.4833 | 265.67 | 3.36 | 169.81 | 2.04 | 108.24 | 2.73 | 1.33 | 1.42 | 0.89 | 0.41 | 0.59 |
| 30 | 4.86 | 0.5000 | 268.10 | 2.99 | 171.57 | 1.82 | 109.76 | 2.75 | 1.34 | 1.45 | 0.90 | 0.43 | 0.60 |
| 31 | 4.39 | 0.5167 | 269.97 | 2.71 | 172.96 | 1.64 | 111.05 | 2.76 | 1.34 | 1.48 | 0.91 | 0.45 | 0.60 |
| 32 | 3.93 | 0.5333 | 271.37 | 2.42 | 174.04 | 1.47 | 112.16 | 2.77 | 1.35 | 1.50 | 0.91 | 0.47 | 0.61 |
| 33 | 3.52 | 0.5500 | 272.32 | 2.17 | 174.84 | 1.32 | 113.08 | 2.78 | 1.35 | 1.51 | 0.92 | 0.48 | 0.61 |
| 34 | 3.20 | 0.5667 | 272.90 | 1.97 | 175.40 | 1.20 | 113.86 | 2.79 | 1.36 | 1.52 | 0.92 | 0.49 | 0.62 |
| 35 | 2.88 | 0.5833 | 273.15 | 1.77 | 175.75 | 1.08 | 114.50 | 2.79 | 1.36 | 1.52 | 0.92 | 0.50 | 0.62 |
| 36 | 2.60 | 0.6000 | 273.10 | 1.60 | 175.91 | 0.97 | 115.02 | 2.79 | 1.36 | 1.53 | 0.92 | 0.51 | 0.62 |
| 37 | 2.35 | 0.6167 | 272.79 | 1.44 | 175.91 | 0.88 | 115.43 | 2.78 | 1.36 | 1.53 | 0.92 | 0.52 | 0.62 |
| 38 | 2.09 | 0.6333 | 272.22 | 1.29 | 175.75 | 0.78 | 115.75 | 2.78 | 1.35 | 1.52 | 0.92 | 0.52 | 0.63 |
| 39 | 1.91 | 0.6500 | 271.44 | 1.17 | 175.45 | 0.71 | 115.97 | 2.77 | 1.35 | 1.52 | 0.92 | 0.53 | 0.63 |
| 40 | 1.73 | 0.6667 | 270.48 | 1.06 | 175.05 | 0.65 | 116.13 | 2.77 | 1.35 | 1.51 | 0.92 | 0.53 | 0.63 |
| 41 | 1.56 | 0.6833 | 269.36 | 0.96 | 174.55 | 0.59 | 116.21 | 2.76 | 1.34 | 1.50 | 0.91 | 0.53 | 0.63 |
| 42 | 1.45 | 0.7000 | 268.11 | 0.90 | 173.98 | 0.54 | 116.25 | 2.75 | 1.34 | 1.49 | 0.91 | 0.53 | 0.63 |
| 43 | 1.35 | 0.7167 | 266.76 | 0.83 | 173.35 | 0.50 | 116.24 | 2.74 | 1.33 | 1.48 | 0.91 | 0.53 | 0.63 |
| 44 | 1.24 | 0.7333 | 265.32 | 0.76 | 172.66 | 0.46 | 116.20 | 2.72 | 1.32 | 1.47 | 0.91 | 0.53 | 0.63 |
| 45 | 1.13 | 0.7500 | 263.78 | 0.70 | 171.91 | 0.42 | 116.11 | 2.71 | 1.32 | 1.46 | 0.90 | 0.53 | 0.63 |
| 46 | 1.02 | 0.7667 | 262.14 | 0.63 | 171.11 | 0.38 | 115.98 | 2.70 | 1.31 | 1.45 | 0.90 | 0.53 | 0.63 |
| 47 | 0.94 | 0.7833 | 260.43 | 0.58 | 170.27 | 0.35 | 115.82 | 2.68 | 1.30 | 1.43 | 0.89 | 0.52 | 0.63 |
| 48 | 0.87 | 0.8000 | 258.65 | 0.54 | 169.40 | 0.33 | 115.64 | 2.66 | 1.29 | 1.42 | 0.89 | 0.52 | 0.63 |
| 49 | 0.80 | 0.8167 | 256.83 | 0.49 | 168.49 | 0.30 | 115.43 | 2.64 | 1.29 | 1.40 | 0.88 | 0.52 | 0.62 |
| 50 | 0.73 | 0.8333 | 254.95 | 0.45 | 167.56 | 0.27 | 115.20 | 2.62 | 1.28 | 1.39 | 0.88 | 0.51 | 0.62 |
| 51 | 0.66 | 0.8500 | 253.03 | 0.40 | 166.60 | 0.25 | 114.94 | 2.59 | 1.27 | 1.37 | 0.88 | 0.51 | 0.62 |
| 52 | 0.60 | 0.8667 | 251.06 | 0.37 | 165.62 | 0.22 | 114.67 | 2.57 | 1.26 | 1.35 | 0.87 | 0.51 | 0.62 |
| 53 | 0.56 | 0.8833 | 249.07 | 0.35 | 164.62 | 0.21 | 114.38 | 2.55 | 1.25 | 1.34 | 0.87 | 0.50 | 0.62 |
| 54 | 0.52 | 0.9000 | 247.07 | 0.32 | 163.62 | 0.20 | 114.08 | 2.52 | 1.24 | 1.32 | 0.86 | 0.50 | 0.62 |
| 55 | 0.49 | 0.9167 | 245.05 | 0.30 | 162.61 | 0.18 | 113.77 | 2.50 | 1.23 | 1.30 | 0.86 | 0.49 | 0.62 |
| 56 | 0.45 | 0.9333 | 243.02 | 0.28 | 161.59 | 0.17 | 113.45 | 2.47 | 1.23 | 1.28 | 0.85 | 0.49 | 0.62 |
| 57 | 0.41 | 0.9500 | 240.98 | 0.25 | 160.57 | 0.15 | 113.13 | 2.45 | 1.22 | 1.27 | 0.85 | 0.48 | 0.61 |
| 58 | 0.38 | 0.9667 | 238.93 | 0.23 | 159.55 | 0.14 | 112.79 | 2.42 | 1.21 | 1.25 | 0.84 | 0.48 | 0.61 |
| 59 | 0.35 | 0.9833 | 236.87 | 0.22 | 158.52 | 0.13 | 112.45 | 2.39 | 1.20 | 1.23 | 0.84 | 0.47 | 0.61 |
| 60 | 0.32 | 1.0000 | 234.81 | 0.20 | 157.50 | 0.12 | 112.10 | 2.37 | 1.19 | 1.21 | 0.83 | 0.47 | 0.61 |
| 61 | 0.29 | 1.0167 | 232.75 | 0.18 | 156.47 | 0.11 | 111.75 | 2.34 | 1.18 | 1.20 | 0.83 | 0.46 | 0.61 |
| 62 | 0.26 | 1.0333 | 230.68 | 0.16 | 155.44 | 0.10 | 111.39 | 2.32 | 1.17 | 1.18 | 0.82 | 0.46 | 0.60 |
| 63 | 0.24 | 1.0500 | 228.61 | 0.15 | 154.41 | 0.09 | 111.02 | 2.29 | 1.16 | 1.16 | 0.82 | 0.45 | 0.60 |
| 64 | 0.22 | 1.0667 | 226.55 | 0.14 | 153.39 | 0.08 | 110.65 | 2.26 | 1.15 | 1.14 | 0.81 | 0.45 | 0.60 |
| 65 | 0.21 | 1.0833 | 224.50 | 0.13 | 152.38 | 0.08 | 110.29 | 2.24 | 1.14 | 1.13 | 0.81 | 0.44 | 0.60 |
| 66 | 0.19 | 1.1000 | 222.47 | 0.12 | 151.38 | 0.07 | 109.92 | 2.21 | 1.13 | 1.11 | 0.80 | 0.44 | 0.60 |
| 67 | 0.18 | 1.1167 | 220.44 | 0.11 | 150.38 | 0.07 | 109.55 | 2.18 | 1.13 | 1.09 | 0.80 | 0.43 | 0.60 |
| 68 | 0.16 | 1.1333 | 218.43 | 0.10 | 149.39 | 0.06 | 109.18 | 2.16 | 1.12 | 1.08 | 0.79 | 0.43 | 0.59 |
| 69 | 0.16 | 1.1500 | 216.43 | 0.10 | 148.41 | 0.06 | 108.82 | 2.13 | 1.11 | 1.06 | 0.79 | 0.42 | 0.59 |
| 70 | 0.15 | 1.1667 | 214.46 | 0.09 | 147.45 | 0.06 | 108.45 | 2.10 | 1.10 | 1.04 | 0.78 | 0.42 | 0.59 |
| 71 | 0.14 | 1.1833 | 212.50 | 0.09 | 146.50 | 0.05 | 108.09 | 2.08 | 1.09 | 1.03 | 0.78 | 0.41 | 0.59 |
| 72 | 0.14 | 1.2000 | 210.57 | 0.09 | 145.56 | 0.05 | 107.74 | 2.05 | 1.08 | 1.01 | 0.77 | 0.41 | 0.59 |
| 73 | 0.13 | 1.2167 | 208.65 | 0.08 | 144.63 | 0.05 | 107.38 | 2.02 | 1.07 | 0.99 | 0.77 | 0.40 | 0.59 |
| 74 | 0.13 | 1.2333 | 206.76 | 0.08 | 143.72 | 0.05 | 107.03 | 2.00 | 1.07 | 0.98 | 0.76 | 0.40 | 0.58 |
| 75 | 0.12 | 1.2500 | 204.88 | 0.07 | 142.81 | 0.05 | 106.68 | 1.97 | 1.06 | 0.96 | 0.76 | 0.39 | 0.58 |
| 76 | 0.12 | 1.2667 | 203.03 | 0.07 | 141.92 | 0.04 | 106.33 | 1.95 | 1.05 | 0.95 | 0.75 | 0.39 | 0.58 |
| 77 | 0.11 | 1.2833 | 201.19 | 0.07 | 141.04 | 0.04 | 105.99 | 1.92 | 1.04 | 0.93 | 0.75 | 0.38 | 0.58 |
| 78 | 0.10 | 1.3000 | 199.38 | 0.06 | 140.18 | 0.04 | 105.65 | 1.90 | 1.03 | 0.92 | 0.75 | 0.38 | 0.58 |
| 79 | 0.10 | 1.3167 | 197.59 | 0.06 | 139.32 | 0.04 | 105.31 | 1.87 | 1.02 | 0.90 | 0.74 | 0.37 | 0.58 |
| 80 | 0.09 | 1.3333 | 195.81 | 0.06 | 138.47 | 0.03 | 104.97 | 1.84 | 1.02 | 0.89 | 0.74 | 0.37 | 0.57 |
| 81 | 0.09 | 1.3500 | 194.05 | 0.05 | 137.64 | 0.03 | 104.63 | 1.82 | 1.01 | 0.88 | 0.73 | 0.36 | 0.57 |
| 82 | 0.08 | 1.3667 | 192.32 | 0.05 | 136.81 | 0.03 | 104.30 | 1.79 | 1.00 | 0.86 | 0.73 | 0.36 | 0.57 |
| 83 | 0.07 | 1.3833 | 190.60 | 0.05 | 136.00 | 0.03 | 103.97 | 1.77 | 0.99 | 0.85 | 0.73 | 0.35 | 0.57 |
| 84 | 0.07 | 1.4000 | 188.90 | 0.04 | 135.19 | 0.03 | 103.65 | 1.74 | 0.98 | 0.83 | 0.72 | 0.35 | 0.57 |
| 85 | 0.06 | 1.4167 | 187.23 | 0.04 | 134.40 | 0.02 | 103.32 | 1.71 | 0.98 | 0.82 | 0.72 | 0.35 | 0.57 |
| 86 | 0.06 | 1.4333 | 185.58 | 0.04 | 133.61 | 0.02 | 103.00 | 1.69 | 0.97 | 0.81 | 0.71 | 0.34 | 0.56 |
| 87 | 0.05 | 1.4500 | 183.94 | 0.03 | 132.84 | 0.02 | 102.67 | 1.66 | 0.96 | 0.80 | 0.71 | 0.34 | 0.56 |
| 88 | 0.05 | 1.4667 | 182.33 | 0.03 | 132.07 | 0.02 | 102.36 | 1.63 | 0.95 | 0.78 | 0.71 | 0.33 | 0.56 |
| 89 | 0.04 | 1.4833 | 180.74 | 0.02 | 131.31 | 0.01 | 102.04 | 1.61 | 0.94 | 0.77 | 0.70 | 0.33 | 0.56 |
| 90 | 0.03 | 1.5000 | 179.17 | 0.02 | 130.57 | 0.01 | 101.72 | 1.58 | 0.94 | 0.76 | 0.70 | 0.32 | 0.56 |
| 91 | 0.03 | 1.5167 | 177.62 | 0.02 | 129.83 | 0.01 | 101.41 | 1.56 | 0.93 | 0.75 | 0.70 | 0.32 | 0.56 |
| 92 | 0.02 | 1.5333 | 176.08 | 0.01 | 129.09 | 0.01 | 101.10 | 1.53 | 0.92 | 0.73 | 0.69 | 0.32 | 0.55 |
| 93 | 0.02 | 1.5500 | 174.57 | 0.01 | 128.37 | 0.01 | 100.79 | 1.50 | 0.91 | 0.72 | 0.69 | 0.31 | 0.55 |
| 94 | 0.01 | 1.5667 | 173.08 | 0.01 | 127.66 | 0.00 | 100.48 | 1.48 | 0.91 | 0.71 | 0.68 | 0.31 | 0.55 |
| 95 | 0.00 | 1.5833 | 171.61 | 0.00 | 126.95 | 0.00 | 100.17 | 1.45 | 0.90 | 0.70 | 0.68 | 0.30 | 0.55 |
| 96 | 0.00 | 1.6000 | 170.16 | 0.00 | 126.25 | 0.00 | 99.87 | 1.43 | 0.89 | 0.69 | 0.68 | 0.30 | 0.55 |
| 97 | 0.00 | 1.6167 | 168.73 | 0.00 | 125.57 | 0.00 | 99.57 | 1.41 | 0.89 | 0.68 | 0.67 | 0.30 | 0.55 |


100-YR FLOOD PEAK ATTENUATION MODIFIED PULS
INFLOW HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs


10-YR FLOOD PEAK ATTENUATION MODIFIED PULS
Inflow HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs


2-YR FLOOD PEAK ATTENUATION MODIFIED PULS
INFLOW HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Input the Stage - Volume Relationship for the Facility

PIMA COUNTY FLOOD CONTROL

Rev.4/17

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | **Project Address** |
| AJH | **Designer** |
| Friday, July 19, 2024 | **Run Date** |
| East Basin Routing.xls | **Program File Name** |

**GOVERNING EQUATIONS:** ***Ref: HEC-1 Flood Hydrograph Package User's Manual (USACOE September 1990)***

Conic method for reservoir volume: $\Delta V_{1\text{-}2} = 0.33 * h * (A_1 + A_2 + (A_1 * A_2)^{0.5})$ (see "**Conic Proj**" tab)

**VARIABLES:**

| | |
|---|---|
| $\Delta V_{1\text{-}2}$ | incremental facility storage volume between stages $H_1$ and $H_2$ |
| h | elevation difference between $A_1$ and $A_2$ |
| A1, A2 | facility surface area at stages $H_1$ and $H_2$ |

1.50 = max design stage (ft)

| stage H, ft | area A, ac | volume ΔV, af | for information only: area A, ft² | for information only: volume ΔV, ft³ | for information only: Σ ΔV S, ft³ | Σ ΔV S, af | index for interpolation |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.23246 | 0 | 10126 | 0 | 0 | 0 | 1 |
| 0.33 | 0.25286 | 0.081 | 11015 | 3522 | 3522 | 0.08086 | 2 |
| 0.50 | 0.26317 | 0.043 | 11464 | 1873 | 5395 | 0.12386 | 3 |
| 1.00 | 0.29448 | 0.139 | 12827 | 6070 | 11465 | 0.26320 | 4 |
| 1.50 | 0.32636 | 0.155 | 14216 | 6758 | 18223 | 0.41834 | 5 |
| | | | | | | | 6 |
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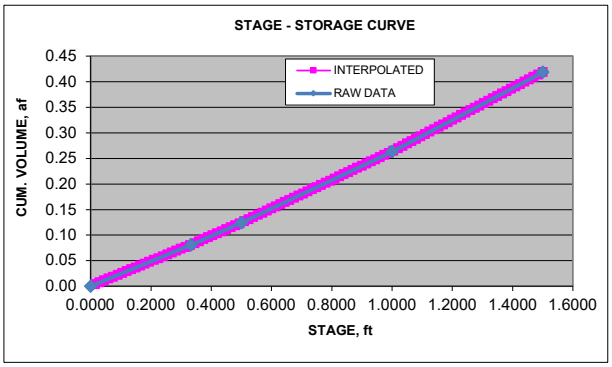
| | | | | | | | 26 |

**Note:** Develop stage-storage curve on this worksheet by either entering in the blue shaded column the planimetered basin areas (in acres) at various stages or by entering facility stages and corresponding incremental volumes (acre-feet, purple shaded column). Graph of the stage-storage curve shown to verify proper interpolation (purple points) of facility volume by **Vol Outflow** tab. **You may insert rows into the middle of this table** to accomodate the size of your data set; empty rows below the extent of your data will not cause a problem. **Stage - Volume data must begin at stage = 0 ft with a volume of 0 af. Stage - Volume data must be entered in ascending order. Blue cells below the entered data must remain empty (highlight, right-click, clear contents). All blue cells must eigther be blank or must contain a number.**



# PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Develop the Stage - Discharge Characteristics of the Outlet Works for the Facility

Rev. 3/18

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | Project Address |
| AJH | Designer |
| Friday, July 19, 2024 | Run Date |
| East Basin Routing.xls | Program File Name |

**Note:** Populate characteristics of selected outflow elements corresponding to facility outlet configuration (blue cells), or overwrite purple cells with outflows calculated outside this worksheet, as a function of the given facility stages. Storage (last column) at each stage is interpolated from stage-volume relationship (see **Stage Vol"** tab). **Do not add rows** to this worksheet; it automatically divides maximum facility design stage into 100 increments to develop the volume-outflow curve.

**GOVERNING EQUATIONS:**

Orifice equation: $Q_o = C * A * (2 * g * H)^{0.5}$ and see weir flow equation on "**Orifice**" tab

Rectangular Weir Equation: $Q_w = C * L * H^{1.5}$

Triangular Weir Equation: $Q_w = C_1 * Tan(\Theta/2) * H^{2.5}$

Box Culvert Equation: See Box Culvert equations for Inlet Control on **"RCBC"** tab

**ORIFICE PLATE OUTFLOW ELEMENT**

| | | | | |
|---|---|---|---|---|
| $d_o$ (in) = | 6.0 | diameter | area (ft²) = | 0.196 |
| C = | 0.67 | disch coefficient | | |
| $E_o$ (ft) = | 0.58 | stage @ orifice center | inv (in) = | 4.00 |
| N = | 3 | nbr identical openings | inv (ft) = | 0.333 |

**TRIANGULAR WEIR OUTFLOW ELEMENT**

| | | |
|---|---|---|
| Z = | | side slope |
| $E_w$ (ft) = | | stage at crest |
| $C_1$ = | | disch coefficient |
| Θ (deg) = | | notch angle |

**RECTANGULAR WEIR OUTFLOW ELEMENT(S)**

| | rect 1 | rect 2 | rect 3 | |
|---|---|---|---|---|
| L (ft) = | | | | crest length |
| C = | | | | disch coefficient |
| $E_w$ (ft) = | | | | stage at crest |

**BOX or ROUND CULVERT OUTFLOW ELEMENT**

| | circ pipe | RCBC | |
|---|---|---|---|
| D (ft) = | | | barrel rise, dia |
| B (ft) = | | | barrel span |
| $E_b$ (ft) = | | | barrel invert |
| n (dim) = | | | Manning's coef |
| S (ft/ft) = | | | barrel slope |
| L (ft) = | | | barrel length |
| $K_e$ (dim)= | | | ent loss coef |
| TW (ft) = | | | tailwater depth |

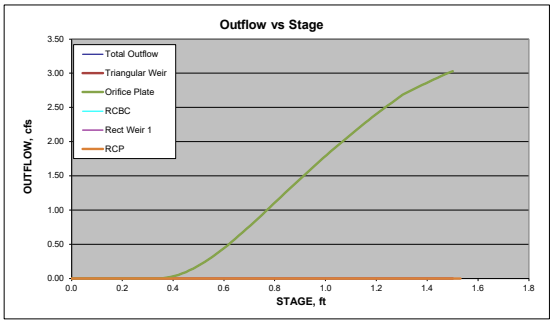
| Stage | Orifice Plate | Weir Element(s) Triang 1 | Rect 1 | Rect 2 | Rect 3 | RCP | RCBC | Outflow | Σ vol |
|---|---|---|---|---|---|---|---|---|---|
| H, ft | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | O, cfs | S, af |
| 0.0000 | | | | | | | | 0.00 | 0.00000 |
| 0.0150 | | | | | | | | 0.00 | 0.00364 |
| 0.0300 | | | | | | | | 0.00 | 0.00728 |
| 0.0450 | | | | | | | | 0.00 | 0.01092 |
| 0.0600 | | | | | | | | 0.00 | 0.01456 |
| 0.0750 | | | | | | | | 0.00 | 0.01819 |
| 0.0900 | | | | | | | | 0.00 | 0.02183 |
| 0.1050 | | | | | | | | 0.00 | 0.02547 |
| 0.1200 | | | | | | | | 0.00 | 0.02911 |
| 0.1350 | | | | | | | | 0.00 | 0.03275 |
| 0.1500 | | | | | | | | 0.00 | 0.03639 |
| 0.1650 | | | | | | | | 0.00 | 0.04003 |
| 0.1800 | | | | | | | | 0.00 | 0.04367 |
| 0.1950 | | | | | | | | 0.00 | 0.04731 |
| 0.2100 | | | | | | | | 0.00 | 0.05094 |
| 0.2250 | | | | | | | | 0.00 | 0.05458 |
| 0.2400 | | | | | | | | 0.00 | 0.05822 |
| 0.2550 | | | | | | | | 0.00 | 0.06186 |
| 0.2700 | | | | | | | | 0.00 | 0.06550 |
| 0.2850 | | | | | | | | 0.00 | 0.06914 |
| 0.3000 | | | | | | | | 0.00 | 0.07278 |
| 0.3150 | | | | | | | | 0.00 | 0.07642 |
| 0.3300 | | | | | | | | 0.00 | 0.08006 |
| 0.3450 | 0.00 | | | | | | | 0.00 | 0.08387 |
| 0.3600 | 0.01 | | | | | | | 0.01 | 0.08774 |
| 0.3750 | 0.01 | | | | | | | 0.01 | 0.09161 |
| 0.3900 | 0.02 | | | | | | | 0.02 | 0.09548 |
| 0.4050 | 0.04 | | | | | | | 0.04 | 0.09935 |
| 0.4200 | 0.05 | | | | | | | 0.05 | 0.10322 |
| 0.4350 | 0.07 | | | | | | | 0.07 | 0.10709 |
| 0.4500 | 0.09 | | | | | | | 0.09 | 0.11096 |
| 0.4650 | 0.12 | | | | | | | 0.12 | 0.11483 |
| 0.4800 | 0.15 | | | | | | | 0.15 | 0.11870 |
| 0.4950 | 0.18 | | | | | | | 0.18 | 0.12257 |
| 0.5100 | 0.21 | | | | | | | 0.21 | 0.12665 |
| 0.5250 | 0.24 | | | | | | | 0.24 | 0.13083 |
| 0.5400 | 0.28 | | | | | | | 0.28 | 0.13501 |
| 0.5550 | 0.32 | | | | | | | 0.32 | 0.13919 |
| 0.5700 | 0.36 | | | | | | | 0.36 | 0.14337 |
| 0.5850 | 0.40 | | | | | | | 0.40 | 0.14755 |
| 0.6000 | 0.44 | | | | | | | 0.44 | 0.15173 |
| 0.6150 | 0.49 | | | | | | | 0.49 | 0.15591 |
| 0.6300 | 0.53 | | | | | | | 0.53 | 0.16009 |
| 0.6450 | 0.58 | | | | | | | 0.58 | 0.16427 |
| 0.6600 | 0.63 | | | | | | | 0.63 | 0.16845 |
| 0.6750 | 0.68 | | | | | | | 0.68 | 0.17263 |
| 0.6900 | 0.73 | | | | | | | 0.73 | 0.17681 |
| 0.7050 | 0.78 | | | | | | | 0.78 | 0.18099 |
| 0.7200 | 0.83 | | | | | | | 0.83 | 0.18517 |
| 0.7350 | 0.88 | | | | | | | 0.88 | 0.18935 |
| 0.7500 | 0.93 | | | | | | | 0.93 | 0.19353 |
| 0.7650 | 0.98 | | | | | | | 0.98 | 0.19771 |
| 0.7800 | 1.04 | | | | | | | 1.04 | 0.20189 |
| 0.7950 | 1.09 | | | | | | | 1.09 | 0.20607 |
| 0.8100 | 1.14 | | | | | | | 1.14 | 0.21025 |
| 0.8250 | 1.19 | | | | | | | 1.19 | 0.21443 |
| 0.8400 | 1.25 | | | | | | | 1.25 | 0.21861 |
| 0.8550 | 1.30 | | | | | | | 1.30 | 0.22279 |
| 0.8700 | 1.35 | | | | | | | 1.35 | 0.22697 |
| 0.8850 | 1.40 | | | | | | | 1.40 | 0.23115 |
| 0.9000 | 1.45 | | | | | | | 1.45 | 0.23533 |
| 0.9150 | 1.51 | | | | | | | 1.51 | 0.23951 |
| 0.9300 | 1.56 | | | | | | | 1.56 | 0.24369 |
| 0.9450 | 1.61 | | | | | | | 1.61 | 0.24787 |
| 0.9600 | 1.66 | | | | | | | 1.66 | 0.25205 |
| 0.9750 | 1.71 | | | | | | | 1.71 | 0.25623 |
| 0.9900 | 1.76 | | | | | | | 1.76 | 0.26041 |
| 1.0050 | 1.81 | | | | | | | 1.81 | 0.26475 |
| 1.0200 | 1.85 | | | | | | | 1.85 | 0.26941 |
| 1.0350 | 1.90 | | | | | | | 1.90 | 0.27406 |
| 1.0500 | 1.95 | | | | | | | 1.95 | 0.27871 |
| 1.0650 | 2.00 | | | | | | | 2.00 | 0.28337 |
| 1.0800 | 2.04 | | | | | | | 2.04 | 0.28802 |
| 1.0950 | 2.09 | | | | | | | 2.09 | 0.29268 |
| 1.1100 | 2.14 | | | | | | | 2.14 | 0.29733 |
| 1.1250 | 2.18 | | | | | | | 2.18 | 0.30199 |
| 1.1400 | 2.23 | | | | | | | 2.23 | 0.30664 |
| 1.1550 | 2.27 | | | | | | | 2.27 | 0.31129 |
| 1.1700 | 2.31 | | | | | | | 2.31 | 0.31595 |
| 1.1850 | 2.36 | | | | | | | 2.36 | 0.32060 |
| 1.2000 | 2.40 | | | | | | | 2.40 | 0.32526 |
| 1.2150 | 2.44 | | | | | | | 2.44 | 0.32991 |
| 1.2300 | 2.49 | | | | | | | 2.49 | 0.33457 |
| 1.2450 | 2.53 | | | | | | | 2.53 | 0.33922 |
| 1.2600 | 2.57 | | | | | | | 2.57 | 0.34387 |
| 1.2750 | 2.61 | | | | | | | 2.61 | 0.34853 |
| 1.2900 | 2.65 | | | | | | | 2.65 | 0.35318 |
| 1.3050 | 2.69 | | | | | | | 2.69 | 0.35784 |
| 1.3200 | 2.72 | | | | | | | 2.72 | 0.36249 |
| 1.3350 | 2.74 | | | | | | | 2.74 | 0.36715 |
| 1.3500 | 2.77 | | | | | | | 2.77 | 0.37180 |
| 1.3650 | 2.80 | | | | | | | 2.80 | 0.37645 |
| 1.3800 | 2.83 | | | | | | | 2.83 | 0.38111 |
| 1.3950 | 2.85 | | | | | | | 2.85 | 0.38576 |
| 1.4100 | 2.88 | | | | | | | 2.88 | 0.39042 |
| 1.4250 | 2.91 | | | | | | | 2.91 | 0.39507 |
| 1.4400 | 2.93 | | | | | | | 2.93 | 0.39972 |
| 1.4550 | 2.96 | | | | | | | 2.96 | 0.40438 |
| 1.4700 | 2.98 | | | | | | | 2.98 | 0.40903 |
| 1.4850 | 3.01 | | | | | | | 3.01 | 0.41369 |
| 1.5000 | 3.03 | | | | | | | 3.03 | 0.41834 |
| 1.5300 | 3.08 | | | | | | | 3.08 | 0.42765 |

last two cells in cum.vol column contain non-standard equations

**ROUTING RESULTS FOR DESIGN OF OUTLET WORKS**

Max Design Stage = 1.50 ft

| | Max Inflow | Max Outflow | Max Stage | | | target discharges |
|---|---|---|---|---|---|---|
| 100-Yr | 20.3 cfs | 2.8 cfs | 1.36 ft @ | 35 min | | 24.2 cfs |
| 10-Yr | 12.5 cfs | 1.5 cfs | 0.92 ft @ | 36 min | | 10.6 cfs |
| 2 -yr | 7.6 cfs | 0.5 cfs | 0.63 ft @ | 42 min | | 4.0 cfs |



# PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

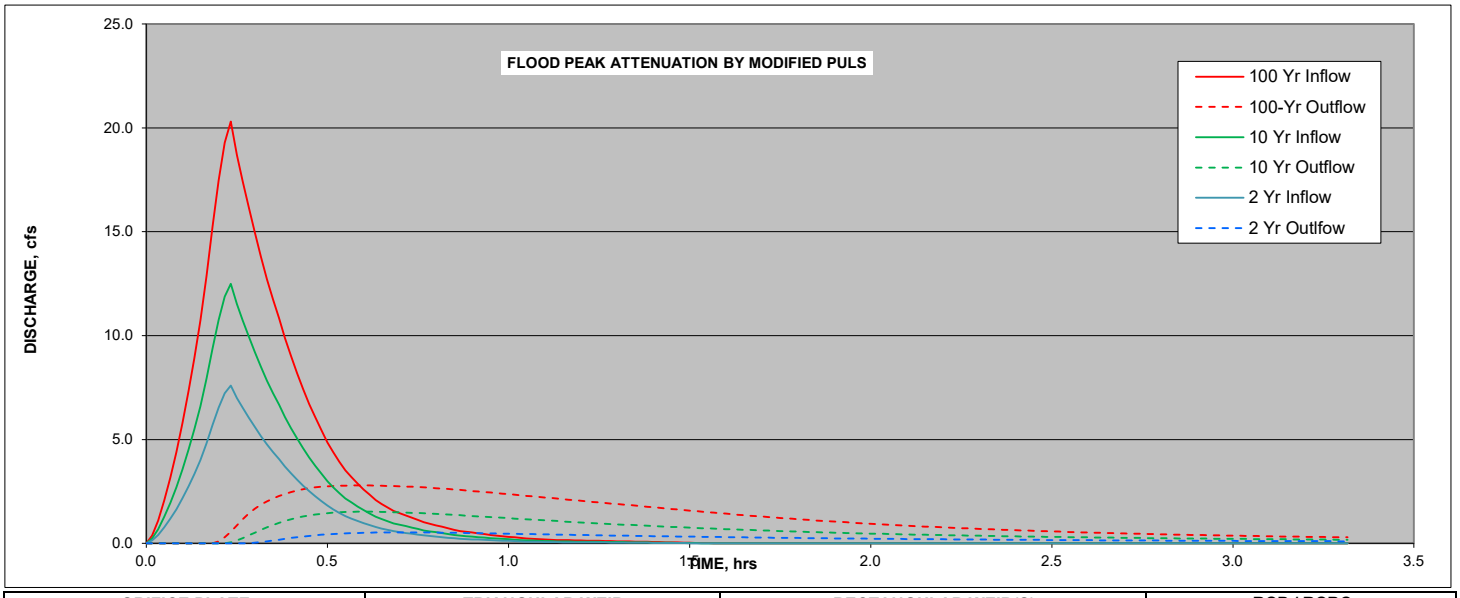
**THIS TAB CONTAINS NO INPUT DATA**

Summary of Reservoir Routing of the Inflow Hydrograph using the Specified Detention Facility and Outlet Works

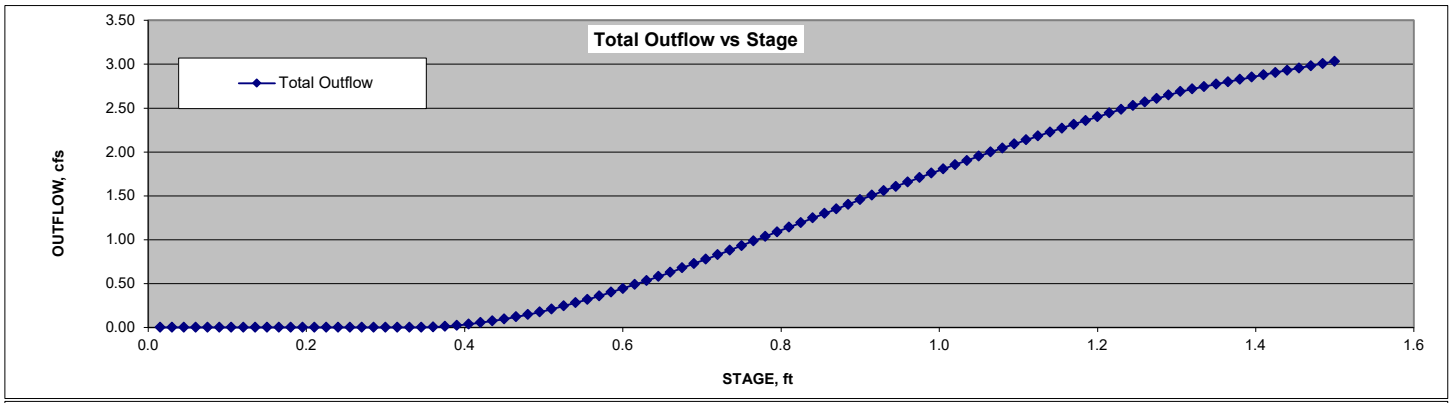
PIMA COUNTY FLOOD CONTROL

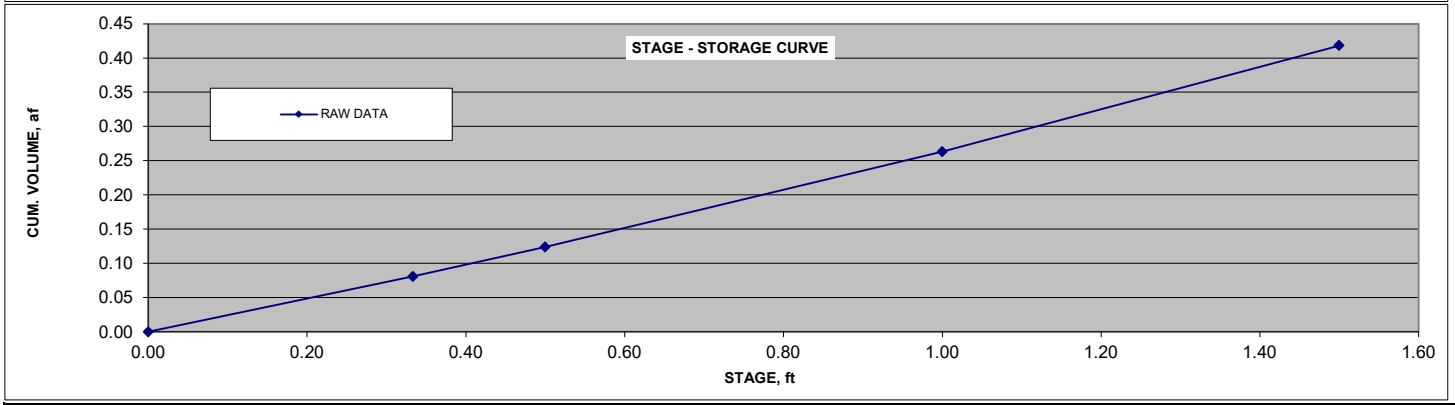
Rev.04/17

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | Project Address |
| AJH | Designer |
| Friday, July 19, 2024 | Run Date |
| East Basin Routing.xls | Program File Name |




| ORIFICE PLATE | | | TRIANGULAR WEIR | | | RECTANGULAR WEIR(S) | | | | | RCP / RCBC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | rect 1 | rect 2 | rect 3 | | | RCP | RCBC | |
| $d_o$ (in) = | 6.0 | diameter | Z = | 0.0 | side slope | | | | | | | | |
| C (dim) = | 0.7 | discharge coefficient | $E_w$ (ft) = | 0.00 | stage at weir crest | L (ft) = | 0.0 | 0.0 | 0.0 | crest length | 0.0 | 0.0 | D (ft) rise / diameter |
| N = | 3.0 | nbr identical openings | Θ = | | ° notch angle | C = | 0.0 | 0.0 | 0.0 | discharge coef | | 0.0 | B (ft) span |
| inv (ft) = | 0.33 | stage at invert | $C_1$ = | 0 | discharge coefficient | $E_w$ (ft) = | 0.00 | 0.00 | 0.00 | stage at crest | 0.00 | 0.00 | $E_b$ (ft) stage at invert |




**RESULTS:**

| | max inflow | max outflow | target discharge | total inflow volume | | max stage (H) * | | |
|---|---|---|---|---|---|---|---|---|
| 100-Year | 20.3 cfs | 2.8 cfs | 24.2 cfs | 21081 $ft^3$ | 0.484 af | 1.36 ft at | 35 | min |
| 10-Year | 12.5 cfs | 1.5 cfs | 10.6 cfs | 12981 $ft^3$ | 0.298 af | 0.92 ft at | 36 | min |
| 2-Year | 7.6 cfs | 0.5 cfs | 4 cfs | 7892 $ft^3$ | 0.181 af | 0.63 ft at | 42 | min |

* Max Design Stage (ft) = 1.50

NOTE: IF H > MAX DESIGN STAGE, EXTEND STAGE-VOL DATA TO A HIGHER STAGE

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Input the Inflow Hydrograph, & Automatically Perform the Routing Calculations using the Stage-Volume data, Volume-Outflow data, & SO Working Curve

PIMA COUNTY FLOOD CONTROL

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | Project Address |
| AJH | Designer |
| Friday, July 19, 2024 | Run Date |
| West Basin Routing.xls | Program File Name |

Rev. 10/20

**GOVERNING EQUATION:** *Ref: Applied Hydrology (Ven Te Chow, Editor 1964)*

Mass Conservation: $0.5 * (I_1 + I_2) * \Delta t - 0.5 * (O_1 + O_2) * \Delta t = S_2 - S_1$

Isolate, divide by $\Delta t$: $0.5 * (I_1 + I_2) + S_1 / \Delta t - 0.5 * O_1 = S_2 / \Delta t + 0.5 * O_2$

**VARIABLES:**

| | |
|---|---|
| $\Delta t$ | time interval between hydrograph discharges. |
| $I_1, I_2$ | inflow rate into facility at start and end of time interval from inflow hydrograph |
| $O_1, O_2$ | facility outflow rate at start & end of time interval |
| $S_1, S_2$ | stormwater in storage in the facility at start and end of time interval |

**Note:** Input $\Delta t$, target discharges & inflow hydrographs for 3 storm frequencies into blue cells. Outflow hydrographs (yellow) are calculated from specified outlet configuration (**vol-outflow** tab) and facility geometry (**Stage-Vol** tab). To add rows to this worksheet, add them in roughly the center of the range, then unhide all columns and copy hidden equations into the new rows. Zero discharge within and beyond the end of the hydrograph will not affect the routing. **All blue cells in this spreadsheet must either be blank (highlight, right-click, Clear Contents) or must contain a number. In addition, the Stage - Volume data must be entered in numerically ascending order. This spreadsheet does not have a "clear" button to clear all input data in one action; to accomplish this, restart Excel using a blank copy of the spreadsheet.**

**RESULTS:**

| | max inflow | | max outflow | | total inflow volume | | | max stage (H) * | | | | target ** discharge | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100-Year | 29.1 | cfs | 18.7 | cfs | 30220 | $ft^3$ | 0.694 af | 1.68 | ft | 20 | min | 24.2 | cfs |
| 10-Year | 18.1 | cfs | 10.6 | cfs | 18796 | $ft^3$ | 0.431 af | 1.26 | ft | 21 | min | 10.6 | csf |
| 2-Year | 11.1 | cfs | 5.8 | cfs | 11527 | $ft^3$ | 0.265 af | 0.95 | ft | 22 | min | 4.0 | cfs |

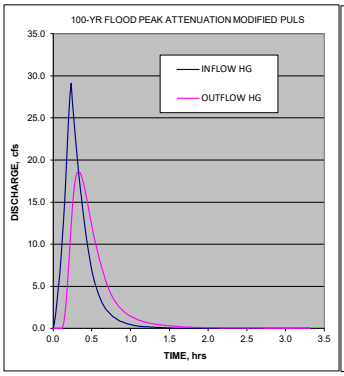
* Max Design Stage = 2.00 ft

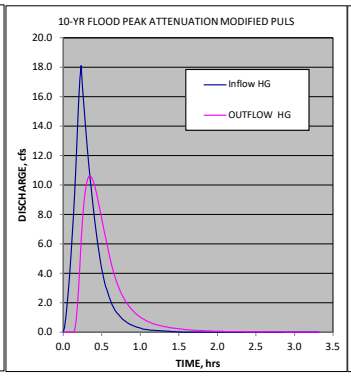
NOTE: IF H > MAX DESIGN STAGE, EXTEND STAGE-VOL DATA TO A HIGHER STAGE

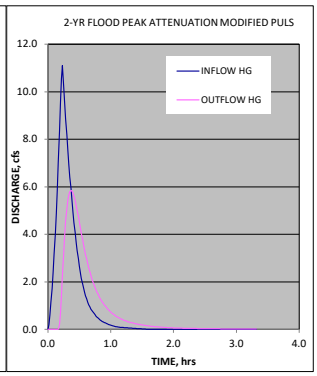
** target discharges not used in calculations; for informational use only

$\Delta t$ = 1.00 min 0.0167 hr inflow hydrograph time interval

| | 100-Year | | | 10-Year | | 2-Year | | 100-Year | | 10-Year | | 2-Year | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| index count | Inflow I, cfs | time t, hr | S/Δt+O/2 cfs | Inflow I, cfs | S/Δt+O/2 cfs | Inflow I, cfs | S/Δt+O/2 cfs | outflow O, cfs | Stage H, ft | outflow O, cfs | Stage H, ft | outflow O, cfs | Stage H, ft |
| 0 | 0.00 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 | 0.54 | 0.0167 | 0.27 | 0.33 | 0.17 | 0.20 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1.58 | 0.0333 | 1.32 | 0.98 | 0.82 | 0.60 | 0.51 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 |
| 3 | 2.97 | 0.0500 | 3.60 | 1.85 | 2.24 | 1.13 | 1.37 | 0.00 | 0.04 | 0.00 | 0.03 | 0.00 | 0.02 |
| 4 | 4.53 | 0.0667 | 7.35 | 2.82 | 4.57 | 1.73 | 2.80 | 0.00 | 0.08 | 0.00 | 0.05 | 0.00 | 0.03 |
| 5 | 6.29 | 0.0833 | 12.76 | 3.91 | 7.94 | 2.40 | 4.87 | 0.00 | 0.15 | 0.00 | 0.09 | 0.00 | 0.06 |
| 6 | 8.31 | 0.1000 | 20.05 | 5.17 | 12.47 | 3.17 | 7.65 | 0.00 | 0.23 | 0.00 | 0.14 | 0.00 | 0.09 |
| 7 | 10.52 | 0.1167 | 29.47 | 6.54 | 18.33 | 4.01 | 11.24 | 0.01 | 0.34 | 0.00 | 0.21 | 0.00 | 0.13 |
| 8 | 12.77 | 0.1333 | 41.10 | 7.94 | 25.57 | 4.87 | 15.68 | 0.51 | 0.45 | 0.00 | 0.30 | 0.00 | 0.18 |
| 9 | 15.37 | 0.1500 | 54.66 | 9.56 | 34.32 | 5.86 | 21.05 | 1.53 | 0.59 | 0.15 | 0.39 | 0.00 | 0.24 |
| 10 | 18.43 | 0.1667 | 70.03 | 11.46 | 44.67 | 7.03 | 27.49 | 3.05 | 0.73 | 0.74 | 0.49 | 0.00 | 0.32 |
| 11 | 21.86 | 0.1833 | 87.12 | 13.60 | 56.46 | 8.34 | 35.18 | 5.08 | 0.90 | 1.69 | 0.60 | 0.19 | 0.40 |
| 12 | 25.05 | 0.2000 | 105.50 | 15.58 | 69.36 | 9.55 | 43.93 | 7.40 | 1.06 | 2.97 | 0.73 | 0.69 | 0.48 |
| 13 | 27.65 | 0.2167 | 124.44 | 17.20 | 82.77 | 10.55 | 53.29 | 9.77 | 1.21 | 4.53 | 0.86 | 1.41 | 0.57 |
| 14 | 29.10 | 0.2333 | 143.05 | 18.10 | 95.89 | 11.10 | 62.70 | 12.29 | 1.35 | 6.23 | 0.98 | 2.28 | 0.66 |
| 15 | 26.82 | 0.2500 | 158.72 | 16.68 | 107.05 | 10.23 | 71.08 | 14.54 | 1.47 | 7.59 | 1.07 | 3.16 | 0.74 |
| 16 | 25.00 | 0.2667 | 170.08 | 15.55 | 115.57 | 9.54 | 77.80 | 16.25 | 1.56 | 8.64 | 1.14 | 3.93 | 0.81 |
| 17 | 23.21 | 0.2833 | 177.94 | 14.44 | 121.92 | 8.85 | 83.07 | 17.46 | 1.62 | 9.45 | 1.19 | 4.57 | 0.86 |
| 18 | 21.47 | 0.3000 | 182.82 | 13.35 | 126.37 | 8.19 | 87.02 | 18.22 | 1.65 | 10.02 | 1.22 | 5.06 | 0.90 |
| 19 | 19.80 | 0.3167 | 185.23 | 12.31 | 129.18 | 7.55 | 89.83 | 18.61 | 1.67 | 10.40 | 1.24 | 5.43 | 0.92 |
| 20 | 18.21 | 0.3333 | 185.63 | 11.33 | 130.60 | 6.95 | 91.65 | 18.67 | 1.68 | 10.59 | 1.25 | 5.66 | 0.94 |
| 21 | 16.82 | 0.3500 | 184.47 | 10.46 | 130.91 | 6.42 | 92.67 | 18.49 | 1.67 | 10.63 | 1.26 | 5.80 | 0.95 |
| 22 | 15.54 | 0.3667 | 182.16 | 9.66 | 130.35 | 5.93 | 93.04 | 18.12 | 1.65 | 10.55 | 1.25 | 5.85 | 0.95 |
| 23 | 14.19 | 0.3833 | 178.91 | 8.83 | 129.04 | 5.41 | 92.86 | 17.61 | 1.62 | 10.38 | 1.24 | 5.83 | 0.95 |
| 24 | 12.93 | 0.4000 | 174.86 | 8.05 | 127.10 | 4.93 | 92.21 | 16.98 | 1.59 | 10.12 | 1.23 | 5.74 | 0.94 |
| 25 | 11.76 | 0.4167 | 170.23 | 7.31 | 124.66 | 4.49 | 91.18 | 16.27 | 1.56 | 9.80 | 1.21 | 5.60 | 0.94 |
| 26 | 10.66 | 0.4333 | 165.17 | 6.63 | 121.83 | 4.07 | 89.85 | 15.50 | 1.52 | 9.43 | 1.19 | 5.43 | 0.92 |
| 27 | 9.61 | 0.4500 | 159.80 | 5.98 | 118.70 | 3.67 | 88.29 | 14.70 | 1.48 | 9.03 | 1.16 | 5.23 | 0.91 |
| 28 | 8.70 | 0.4667 | 154.25 | 5.41 | 115.36 | 3.32 | 86.55 | 13.89 | 1.44 | 8.61 | 1.13 | 5.00 | 0.89 |
| 29 | 7.82 | 0.4833 | 148.63 | 4.86 | 111.88 | 2.98 | 84.70 | 13.08 | 1.39 | 8.18 | 1.11 | 4.77 | 0.87 |
| 30 | 6.96 | 0.5000 | 142.94 | 4.33 | 108.30 | 2.66 | 82.75 | 12.27 | 1.35 | 7.74 | 1.08 | 4.53 | 0.86 |
| 31 | 6.30 | 0.5167 | 137.29 | 3.92 | 104.68 | 2.40 | 80.75 | 11.49 | 1.30 | 7.31 | 1.05 | 4.28 | 0.84 |
| 32 | 5.63 | 0.5333 | 131.77 | 3.50 | 101.09 | 2.15 | 78.75 | 10.74 | 1.26 | 6.88 | 1.02 | 4.04 | 0.82 |
| 33 | 5.04 | 0.5500 | 126.37 | 3.14 | 97.52 | 1.92 | 76.74 | 10.02 | 1.22 | 6.46 | 0.99 | 3.80 | 0.80 |
| 34 | 4.58 | 0.5667 | 121.15 | 2.85 | 94.06 | 1.75 | 74.77 | 9.35 | 1.18 | 5.99 | 0.96 | 3.58 | 0.78 |
| 35 | 4.12 | 0.5833 | 116.16 | 2.56 | 90.78 | 1.57 | 72.86 | 8.71 | 1.14 | 5.55 | 0.93 | 3.36 | 0.76 |
| 36 | 3.73 | 0.6000 | 111.37 | 2.32 | 87.67 | 1.42 | 70.99 | 8.12 | 1.10 | 5.15 | 0.90 | 3.15 | 0.74 |
| 37 | 3.36 | 0.6167 | 106.80 | 2.09 | 84.73 | 1.28 | 69.19 | 7.56 | 1.07 | 4.77 | 0.87 | 2.96 | 0.73 |
| 38 | 3.00 | 0.6333 | 102.42 | 1.86 | 81.93 | 1.14 | 67.45 | 7.04 | 1.03 | 4.43 | 0.85 | 2.77 | 0.71 |
| 39 | 2.73 | 0.6500 | 98.25 | 1.70 | 79.29 | 1.04 | 65.77 | 6.55 | 1.00 | 4.11 | 0.82 | 2.59 | 0.69 |
| 40 | 2.48 | 0.6667 | 94.30 | 1.54 | 76.80 | 0.94 | 64.17 | 6.02 | 0.96 | 3.81 | 0.80 | 2.43 | 0.68 |
| 41 | 2.24 | 0.6833 | 90.64 | 1.39 | 74.46 | 0.85 | 62.64 | 5.53 | 0.93 | 3.54 | 0.78 | 2.28 | 0.66 |
| 42 | 2.08 | 0.7000 | 87.27 | 1.30 | 72.26 | 0.80 | 61.19 | 5.09 | 0.90 | 3.29 | 0.76 | 2.13 | 0.65 |
| 43 | 1.93 | 0.7167 | 84.18 | 1.20 | 70.21 | 0.74 | 59.82 | 4.70 | 0.87 | 3.07 | 0.74 | 2.00 | 0.64 |
| 44 | 1.77 | 0.7333 | 81.32 | 1.10 | 68.30 | 0.68 | 58.52 | 4.35 | 0.84 | 2.86 | 0.72 | 1.88 | 0.62 |
| 45 | 1.62 | 0.7500 | 78.67 | 1.01 | 66.49 | 0.62 | 57.29 | 4.03 | 0.82 | 2.67 | 0.70 | 1.77 | 0.61 |
| 46 | 1.46 | 0.7667 | 76.18 | 0.91 | 64.78 | 0.56 | 56.11 | 3.74 | 0.79 | 2.49 | 0.68 | 1.66 | 0.60 |
| 47 | 1.35 | 0.7833 | 73.84 | 0.84 | 63.16 | 0.52 | 54.99 | 3.47 | 0.77 | 2.33 | 0.67 | 1.56 | 0.59 |
| 48 | 1.25 | 0.8000 | 71.67 | 0.78 | 61.64 | 0.48 | 53.93 | 3.23 | 0.75 | 2.18 | 0.65 | 1.47 | 0.58 |
| 49 | 1.15 | 0.8167 | 69.64 | 0.71 | 60.21 | 0.44 | 52.92 | 3.00 | 0.73 | 2.04 | 0.64 | 1.38 | 0.57 |
| 50 | 1.04 | 0.8333 | 67.73 | 0.65 | 58.85 | 0.40 | 51.95 | 2.80 | 0.71 | 1.91 | 0.63 | 1.30 | 0.56 |
| 51 | 0.94 | 0.8500 | 65.92 | 0.59 | 57.56 | 0.36 | 51.04 | 2.61 | 0.69 | 1.79 | 0.61 | 1.22 | 0.55 |
| 52 | 0.86 | 0.8667 | 64.21 | 0.53 | 56.33 | 0.33 | 50.16 | 2.43 | 0.68 | 1.68 | 0.60 | 1.15 | 0.54 |
| 53 | 0.80 | 0.8833 | 62.61 | 0.50 | 55.17 | 0.31 | 49.32 | 2.27 | 0.66 | 1.57 | 0.59 | 1.09 | 0.53 |
| 54 | 0.75 | 0.9000 | 61.11 | 0.47 | 54.07 | 0.29 | 48.53 | 2.13 | 0.65 | 1.48 | 0.58 | 1.02 | 0.53 |
| 55 | 0.70 | 0.9167 | 59.71 | 0.43 | 53.04 | 0.27 | 47.78 | 1.99 | 0.64 | 1.39 | 0.57 | 0.97 | 0.52 |
| 56 | 0.64 | 0.9333 | 58.38 | 0.40 | 52.07 | 0.25 | 47.07 | 1.87 | 0.62 | 1.31 | 0.56 | 0.91 | 0.51 |
| 57 | 0.59 | 0.9500 | 57.13 | 0.37 | 51.14 | 0.22 | 46.39 | 1.75 | 0.61 | 1.23 | 0.55 | 0.86 | 0.51 |
| 58 | 0.55 | 0.9667 | 55.95 | 0.34 | 50.26 | 0.21 | 45.74 | 1.64 | 0.60 | 1.16 | 0.54 | 0.82 | 0.50 |
| 59 | 0.50 | 0.9833 | 54.83 | 0.31 | 49.43 | 0.19 | 45.12 | 1.54 | 0.59 | 1.09 | 0.54 | 0.77 | 0.49 |
| 60 | 0.46 | 1.0000 | 53.76 | 0.29 | 48.63 | 0.18 | 44.53 | 1.45 | 0.58 | 1.03 | 0.53 | 0.73 | 0.49 |
| 61 | 0.42 | 1.0167 | 52.75 | 0.26 | 47.87 | 0.16 | 43.97 | 1.37 | 0.57 | 0.97 | 0.52 | 0.69 | 0.48 |
| 62 | 0.37 | 1.0333 | 51.78 | 0.23 | 47.14 | 0.14 | 43.42 | 1.28 | 0.56 | 0.92 | 0.51 | 0.66 | 0.48 |
| 63 | 0.34 | 1.0500 | 50.85 | 0.21 | 46.44 | 0.13 | 42.90 | 1.21 | 0.55 | 0.87 | 0.51 | 0.62 | 0.47 |
| 64 | 0.32 | 1.0667 | 49.97 | 0.20 | 45.78 | 0.12 | 42.41 | 1.14 | 0.54 | 0.82 | 0.50 | 0.59 | 0.47 |
| 65 | 0.30 | 1.0833 | 49.14 | 0.18 | 45.15 | 0.11 | 41.93 | 1.07 | 0.53 | 0.78 | 0.49 | 0.56 | 0.46 |
| 66 | 0.28 | 1.1000 | 48.36 | 0.17 | 44.55 | 0.11 | 41.48 | 1.01 | 0.53 | 0.73 | 0.49 | 0.53 | 0.46 |
| 67 | 0.25 | 1.1167 | 47.61 | 0.16 | 43.98 | 0.10 | 41.05 | 0.95 | 0.52 | 0.69 | 0.48 | 0.51 | 0.45 |
| 68 | 0.23 | 1.1333 | 46.90 | 0.14 | 43.44 | 0.09 | 40.64 | 0.90 | 0.51 | 0.66 | 0.48 | 0.48 | 0.45 |
| 69 | 0.23 | 1.1500 | 46.23 | 0.14 | 42.93 | 0.09 | 40.25 | 0.85 | 0.50 | 0.62 | 0.47 | 0.46 | 0.45 |
| 70 | 0.22 | 1.1667 | 45.59 | 0.13 | 42.44 | 0.08 | 39.88 | 0.81 | 0.50 | 0.59 | 0.47 | 0.43 | 0.44 |
| 71 | 0.21 | 1.1833 | 45.00 | 0.13 | 41.98 | 0.08 | 39.52 | 0.76 | 0.49 | 0.56 | 0.46 | 0.41 | 0.44 |
| 72 | 0.20 | 1.2000 | 44.44 | 0.12 | 41.54 | 0.08 | 39.19 | 0.73 | 0.49 | 0.53 | 0.46 | 0.39 | 0.44 |
| 73 | 0.19 | 1.2167 | 43.91 | 0.12 | 41.13 | 0.07 | 38.87 | 0.69 | 0.48 | 0.51 | 0.45 | 0.38 | 0.43 |
| 74 | 0.18 | 1.2333 | 43.40 | 0.11 | 40.73 | 0.07 | 38.56 | 0.66 | 0.48 | 0.49 | 0.45 | 0.36 | 0.43 |
| 75 | 0.17 | 1.2500 | 42.93 | 0.11 | 40.36 | 0.07 | 38.27 | 0.62 | 0.47 | 0.46 | 0.45 | 0.34 | 0.43 |
| 76 | 0.17 | 1.2667 | 42.47 | 0.10 | 40.00 | 0.06 | 37.99 | 0.59 | 0.47 | 0.44 | 0.44 | 0.33 | 0.42 |
| 77 | 0.16 | 1.2833 | 42.04 | 0.10 | 39.66 | 0.06 | 37.72 | 0.57 | 0.46 | 0.42 | 0.44 | 0.31 | 0.42 |
| 78 | 0.15 | 1.3000 | 41.63 | 0.09 | 39.33 | 0.06 | 37.46 | 0.54 | 0.46 | 0.40 | 0.44 | 0.30 | 0.42 |
| 79 | 0.14 | 1.3167 | 41.23 | 0.09 | 39.02 | 0.05 | 37.22 | 0.52 | 0.46 | 0.39 | 0.43 | 0.29 | 0.42 |
| 80 | 0.13 | 1.3333 | 40.85 | 0.08 | 38.72 | 0.05 | 36.98 | 0.49 | 0.45 | 0.37 | 0.43 | 0.28 | 0.41 |
| 81 | 0.12 | 1.3500 | 40.49 | 0.08 | 38.43 | 0.05 | 36.75 | 0.47 | 0.45 | 0.35 | 0.43 | 0.27 | 0.41 |
| 82 | 0.12 | 1.3667 | 40.13 | 0.07 | 38.15 | 0.04 | 36.53 | 0.45 | 0.45 | 0.34 | 0.43 | 0.26 | 0.41 |
| 83 | 0.11 | 1.3833 | 39.79 | 0.07 | 37.88 | 0.04 | 36.32 | 0.43 | 0.44 | 0.32 | 0.42 | 0.24 | 0.41 |
| 84 | 0.10 | 1.4000 | 39.47 | 0.06 | 37.62 | 0.04 | 36.11 | 0.41 | 0.44 | 0.31 | 0.42 | 0.23 | 0.41 |
| 85 | 0.09 | 1.4167 | 39.15 | 0.06 | 37.37 | 0.03 | 35.91 | 0.39 | 0.44 | 0.30 | 0.42 | 0.22 | 0.40 |
| 86 | 0.08 | 1.4333 | 38.84 | 0.05 | 37.12 | 0.03 | 35.72 | 0.38 | 0.43 | 0.28 | 0.42 | 0.22 | 0.40 |
| 87 | 0.07 | 1.4500 | 38.54 | 0.05 | 36.89 | 0.03 | 35.53 | 0.36 | 0.43 | 0.27 | 0.41 | 0.21 | 0.40 |
| 88 | 0.06 | 1.4667 | 38.25 | 0.04 | 36.66 | 0.03 | 35.36 | 0.34 | 0.43 | 0.26 | 0.41 | 0.20 | 0.40 |
| 89 | 0.06 | 1.4833 | 37.97 | 0.04 | 36.43 | 0.02 | 35.18 | 0.33 | 0.42 | 0.25 | 0.41 | 0.19 | 0.40 |
| 90 | 0.05 | 1.5000 | 37.69 | 0.03 | 36.22 | 0.02 | 35.01 | 0.31 | 0.42 | 0.24 | 0.41 | 0.18 | 0.39 |
| 91 | 0.04 | 1.5167 | 37.42 | 0.02 | 36.00 | 0.02 | 34.84 | 0.30 | 0.42 | 0.23 | 0.40 | 0.18 | 0.39 |
| 92 | 0.03 | 1.5333 | 37.16 | 0.02 | 35.79 | 0.01 | 34.68 | 0.29 | 0.42 | 0.22 | 0.40 | 0.17 | 0.39 |
| 93 | 0.02 | 1.5500 | 36.90 | 0.01 | 35.59 | 0.01 | 34.52 | 0.27 | 0.41 | 0.21 | 0.40 | 0.16 | 0.39 |
| 94 | 0.01 | 1.5667 | 36.64 | 0.01 | 35.39 | 0.01 | 34.36 | 0.26 | 0.41 | 0.20 | 0.40 | 0.16 | 0.39 |
| 95 | 0.01 | 1.5833 | 36.39 | 0.00 | 35.20 | 0.00 | 34.21 | 0.25 | 0.41 | 0.19 | 0.40 | 0.15 | 0.39 |
| 96 | 0.00 | 1.6000 | 36.15 | 0.00 | 35.01 | 0.00 | 34.06 | 0.24 | 0.41 | 0.18 | 0.39 | 0.14 | 0.39 |
| 97 | 0.00 | 1.6167 | 35.91 | 0.00 | 34.83 | 0.00 | 33.92 | 0.22 | 0.40 | 0.18 | 0.39 | 0.14 | 0.38 |


100-YR FLOOD PEAK ATTENUATION MODIFIED PULS
INFLOW HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5


10-YR FLOOD PEAK ATTENUATION MODIFIED PULS
Inflow HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5


2-YR FLOOD PEAK ATTENUATION MODIFIED PULS
INFLOW HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
1.0
2.0
3.0
4.0

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Input the Stage - Volume Relationship for the Facility

PIMA COUNTY FLOOD CONTROL Rev.4/17

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | **Project Address** |
| AJH | **Designer** |
| Friday, July 19, 2024 | **Run Date** |
| West Basin Routing.xls | **Program File Name** |

**GOVERNING EQUATIONS:** ***Ref: HEC-1 Flood Hydrograph Package User's Manual (USACOE September 1990)***

Conic method for reservoir volume: $\Delta V_{1\text{-}2} = 0.33 * h * (A_1 + A_2 + (A_1 * A_2)^{0.5})$ (see "**Conic Proj**" tab)

**VARIABLES:**

| | |
|---|---|
| $\Delta V_{1\text{-}2}$ | incremental facility storage volume between stages $H_1$ and $H_2$ |
| h | elevation difference between $A_1$ and $A_2$ |
| A1, A2 | facility surface area at stages $H_1$ and $H_2$ |

2.00 = max design stage (ft)

| stage H, ft | area A, ac | volume ΔV, af | for information only: area A, ft² | volume ΔV, ft³ | Σ ΔV S, ft³ | Σ ΔV S, af | index for interpolation |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.11365 | 0 | 4951 | 0 | 0 | 0 | 1 |
| 0.33 | 0.12483 | 0.040 | 5438 | 1731 | 1731 | 0.03973 | 2 |
| 1.00 | 0.14802 | 0.091 | 6448 | 3957 | 5688 | 0.13057 | 3 |
| 2.00 | 0.18480 | 0.166 | 8050 | 7234 | 12922 | 0.29664 | 4 |
| | | | | | | | 5 |
| | | | | | | | 6 |
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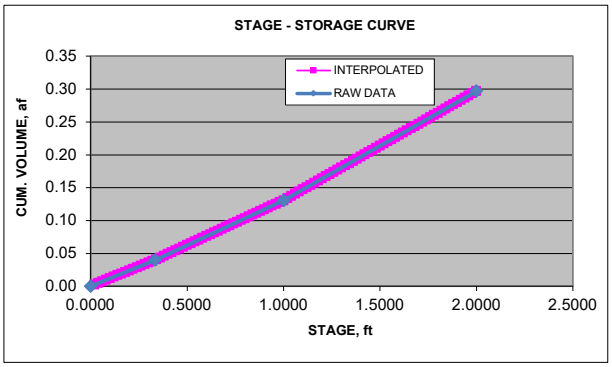
| | | | | | | | 25 |
| | | | | | | | 26 |

**Note:** Develop stage-storage curve on this worksheet by either entering in the blue shaded column the planimetered basin areas (in acres) at various stages or by entering facility stages and corresponding incremental volumes (acre-feet, purple shaded column). Graph of the stage-storage curve shown to verify proper interpolation (purple points) of facility volume by **Vol Outflow** tab. **You may insert rows into the middle of this table** to accomodate the size of your data set; empty rows below the extent of your data will not cause a problem. **Stage - Volume data must begin at stage = 0 ft with a volume of 0 af. Stage - Volume data must be entered in ascending order. Blue cells below the entered data must remain empty (highlight, right-click, clear contents). All blue cells must eigther be blank or must contain a number.**



**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Develop the Stage - Discharge Characteristics of the Outlet Works for the Facility

Rev. 3/18

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | Project Address |
| AJH | Designer |
| Friday, July 19, 2024 | Run Date |
| West Basin Routing.xls | Program File Name |

**Note:** Populate characteristics of selected outflow elements corresponding to facility outlet configuration (blue cells), or overwrite purple cells with outflows calculated outside this worksheet, as a function of the given facility stages. Storage (last column) at each stage is interpolated from stage-volume relationship (see **Stage Vol**" tab). **Do not add rows** to this worksheet; it automatically divides maximum facility design stage into 100 increments to develop the volume-outflow curve.

**GOVERNING EQUATIONS:**

Orifice equation: $Q_o = C * A * (2 * g * H)^{0.5}$ and see weir flow equation on "**Orifice**" tab

Rectangular Weir Equation: $Q_w = C * L * H^{1.5}$

Triangular Weir Equation: $Q_w = C_1 * Tan(\Theta/2) * H^{2.5}$

Box Culvert Equation: See Box Culvert equations for Inlet Control on **"RCBC"** tab

**ORIFICE PLATE OUTFLOW ELEMENT**

| | | | | |
|---|---|---|---|---|
| $d_o$ (in) = | | diameter | area (ft²) = | 0.000 |
| C = | | disch coefficient | | |
| $E_o$ (ft) = | | stage @ orifice center | inv (in) = | 0.00 |
| N = | | nbr identical openings | inv (ft) = | 0.000 |

**TRIANGULAR WEIR OUTFLOW ELEMENT**

| | | |
|---|---|---|
| Z = | | side slope |
| $E_w$ (ft) = | | stage at crest |
| $C_1$ = | | disch coefficient |
| Θ (deg) = | | notch angle |

**RECTANGULAR WEIR OUTFLOW ELEMENT(S)**

| | rect 1 | rect 2 | rect 3 | |
|---|---|---|---|---|
| L (ft) = | 4.0 | | | crest length |
| C = | 3.00 | | | disch coefficient |
| $E_w$ (ft) = | 0.33 | | | stage at crest |

**BOX or ROUND CULVERT OUTFLOW ELEMENT**

| | circ pipe | RCBC | |
|---|---|---|---|
| D (ft) = | | | barrel rise, dia |
| B (ft) = | | | barrel span |
| $E_b$ (ft) = | | | barrel invert |
| n (dim) = | | | Manning's coef |
| S (ft/ft) = | | | barrel slope |
| L (ft) = | | | barrel length |
| $K_e$ (dim)= | | | ent loss coef |
| TW (ft) = | | | tailwater depth |

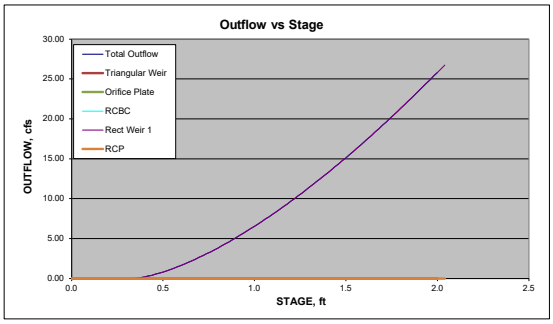
| Stage | Orifice Plate | Weir Element(s) Triang 1 | Rect 1 | Rect 2 | Rect 3 | RCP | RCBC | Outflow | Σ vol |
|---|---|---|---|---|---|---|---|---|---|
| H, ft | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | O, cfs | S, af |
| 0.0000 | | | | | | | | 0.00 | 0.00000 |
| 0.0200 | | | | | | | | 0.00 | 0.00238 |
| 0.0400 | | | | | | | | 0.00 | 0.00477 |
| 0.0600 | | | | | | | | 0.00 | 0.00715 |
| 0.0800 | | | | | | | | 0.00 | 0.00954 |
| 0.1000 | | | | | | | | 0.00 | 0.01192 |
| 0.1200 | | | | | | | | 0.00 | 0.01430 |
| 0.1400 | | | | | | | | 0.00 | 0.01669 |
| 0.1600 | | | | | | | | 0.00 | 0.01907 |
| 0.1800 | | | | | | | | 0.00 | 0.02146 |
| 0.2000 | | | | | | | | 0.00 | 0.02384 |
| 0.2200 | | | | | | | | 0.00 | 0.02622 |
| 0.2400 | | | | | | | | 0.00 | 0.02861 |
| 0.2600 | | | | | | | | 0.00 | 0.03099 |
| 0.2800 | | | | | | | | 0.00 | 0.03338 |
| 0.3000 | | | | | | | | 0.00 | 0.03576 |
| 0.3200 | | | | | | | | 0.00 | 0.03814 |
| 0.3400 | | | 0.01 | | | | | 0.01 | 0.04064 |
| 0.3600 | | | 0.05 | | | | | 0.05 | 0.04337 |
| 0.3800 | | | 0.12 | | | | | 0.12 | 0.04609 |
| 0.4000 | | | 0.21 | | | | | 0.21 | 0.04882 |
| 0.4200 | | | 0.31 | | | | | 0.31 | 0.05154 |
| 0.4400 | | | 0.42 | | | | | 0.42 | 0.05427 |
| 0.4600 | | | 0.54 | | | | | 0.54 | 0.05699 |
| 0.4800 | | | 0.67 | | | | | 0.67 | 0.05972 |
| 0.5000 | | | 0.82 | | | | | 0.82 | 0.06244 |
| 0.5200 | | | 0.97 | | | | | 0.97 | 0.06517 |
| 0.5400 | | | 1.13 | | | | | 1.13 | 0.06789 |
| 0.5600 | | | 1.29 | | | | | 1.29 | 0.07062 |
| 0.5800 | | | 1.47 | | | | | 1.47 | 0.07334 |
| 0.6000 | | | 1.65 | | | | | 1.65 | 0.07607 |
| 0.6200 | | | 1.84 | | | | | 1.84 | 0.07879 |
| 0.6400 | | | 2.04 | | | | | 2.04 | 0.08152 |
| 0.6600 | | | 2.24 | | | | | 2.24 | 0.08424 |
| 0.6800 | | | 2.45 | | | | | 2.45 | 0.08697 |
| 0.7000 | | | 2.66 | | | | | 2.66 | 0.08969 |
| 0.7200 | | | 2.89 | | | | | 2.89 | 0.09242 |
| 0.7400 | | | 3.11 | | | | | 3.11 | 0.09514 |
| 0.7600 | | | 3.34 | | | | | 3.34 | 0.09787 |
| 0.7800 | | | 3.58 | | | | | 3.58 | 0.10059 |
| 0.8000 | | | 3.83 | | | | | 3.83 | 0.10332 |
| 0.8200 | | | 4.07 | | | | | 4.07 | 0.10605 |
| 0.8400 | | | 4.33 | | | | | 4.33 | 0.10877 |
| 0.8600 | | | 4.59 | | | | | 4.59 | 0.11150 |
| 0.8800 | | | 4.85 | | | | | 4.85 | 0.11422 |
| 0.9000 | | | 5.12 | | | | | 5.12 | 0.11695 |
| 0.9200 | | | 5.39 | | | | | 5.39 | 0.11967 |
| 0.9400 | | | 5.67 | | | | | 5.67 | 0.12240 |
| 0.9600 | | | 5.95 | | | | | 5.95 | 0.12512 |
| 0.9800 | | | 6.24 | | | | | 6.24 | 0.12785 |
| 1.0000 | | | 6.53 | | | | | 6.53 | 0.13057 |
| 1.0200 | | | 6.83 | | | | | 6.83 | 0.13389 |
| 1.0400 | | | 7.13 | | | | | 7.13 | 0.13721 |
| 1.0600 | | | 7.43 | | | | | 7.43 | 0.14054 |
| 1.0800 | | | 7.74 | | | | | 7.74 | 0.14386 |
| 1.1000 | | | 8.06 | | | | | 8.06 | 0.14718 |
| 1.1200 | | | 8.37 | | | | | 8.37 | 0.15050 |
| 1.1400 | | | 8.69 | | | | | 8.69 | 0.15382 |
| 1.1600 | | | 9.02 | | | | | 9.02 | 0.15714 |
| 1.1800 | | | 9.35 | | | | | 9.35 | 0.16046 |
| 1.2000 | | | 9.68 | | | | | 9.68 | 0.16379 |
| 1.2200 | | | 10.02 | | | | | 10.02 | 0.16711 |
| 1.2400 | | | 10.36 | | | | | 10.36 | 0.17043 |
| 1.2600 | | | 10.70 | | | | | 10.70 | 0.17375 |
| 1.2800 | | | 11.05 | | | | | 11.05 | 0.17707 |
| 1.3000 | | | 11.41 | | | | | 11.41 | 0.18039 |
| 1.3200 | | | 11.76 | | | | | 11.76 | 0.18371 |
| 1.3400 | | | 12.12 | | | | | 12.12 | 0.18704 |
| 1.3600 | | | 12.48 | | | | | 12.48 | 0.19036 |
| 1.3800 | | | 12.85 | | | | | 12.85 | 0.19368 |
| 1.4000 | | | 13.22 | | | | | 13.22 | 0.19700 |
| 1.4200 | | | 13.59 | | | | | 13.59 | 0.20032 |
| 1.4400 | | | 13.97 | | | | | 13.97 | 0.20364 |
| 1.4600 | | | 14.35 | | | | | 14.35 | 0.20696 |
| 1.4800 | | | 14.73 | | | | | 14.73 | 0.21029 |
| 1.5000 | | | 15.12 | | | | | 15.12 | 0.21361 |
| 1.5200 | | | 15.51 | | | | | 15.51 | 0.21693 |
| 1.5400 | | | 15.91 | | | | | 15.91 | 0.22025 |
| 1.5600 | | | 16.30 | | | | | 16.30 | 0.22357 |
| 1.5800 | | | 16.70 | | | | | 16.70 | 0.22689 |
| 1.6000 | | | 17.11 | | | | | 17.11 | 0.23021 |
| 1.6200 | | | 17.51 | | | | | 17.51 | 0.23354 |
| 1.6400 | | | 17.92 | | | | | 17.92 | 0.23686 |
| 1.6600 | | | 18.34 | | | | | 18.34 | 0.24018 |
| 1.6800 | | | 18.75 | | | | | 18.75 | 0.24350 |
| 1.7000 | | | 19.17 | | | | | 19.17 | 0.24682 |
| 1.7200 | | | 19.59 | | | | | 19.59 | 0.25014 |
| 1.7400 | | | 20.02 | | | | | 20.02 | 0.25346 |
| 1.7600 | | | 20.45 | | | | | 20.45 | 0.25679 |
| 1.7800 | | | 20.88 | | | | | 20.88 | 0.26011 |
| 1.8000 | | | 21.31 | | | | | 21.31 | 0.26343 |
| 1.8200 | | | 21.75 | | | | | 21.75 | 0.26675 |
| 1.8400 | | | 22.19 | | | | | 22.19 | 0.27007 |
| 1.8600 | | | 22.64 | | | | | 22.64 | 0.27339 |
| 1.8800 | | | 23.08 | | | | | 23.08 | 0.27671 |
| 1.9000 | | | 23.53 | | | | | 23.53 | 0.28004 |
| 1.9200 | | | 23.98 | | | | | 23.98 | 0.28336 |
| 1.9400 | | | 24.44 | | | | | 24.44 | 0.28668 |
| 1.9600 | | | 24.90 | | | | | 24.90 | 0.29000 |
| 1.9800 | | | 25.36 | | | | | 25.36 | 0.29332 |
| 2.0000 | | | 25.82 | | | | | 25.82 | 0.29664 |
| 2.0400 | | | 26.75 | | | | | 26.75 | 0.30329 |

last two cells in cum.vol column contain non-standard equations

**ROUTING RESULTS FOR DESIGN OF OUTLET WORKS**

Max Design Stage = 2.00 ft

| | Max Inflow | Max Outflow | Max Stage | | | | target discharges |
|---|---|---|---|---|---|---|---|
| 100-Yr | 29.1 cfs | 18.7 cfs | 1.68 ft | @ | 20 min | | 24.2 cfs |
| 10-Yr | 18.1 cfs | 10.6 cfs | 1.26 ft | @ | 21 min | | 10.6 cfs |
| 2 -yr | 11.1 cfs | 5.8 cfs | 0.95 ft | @ | 22 min | | 4.0 cfs |



# PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

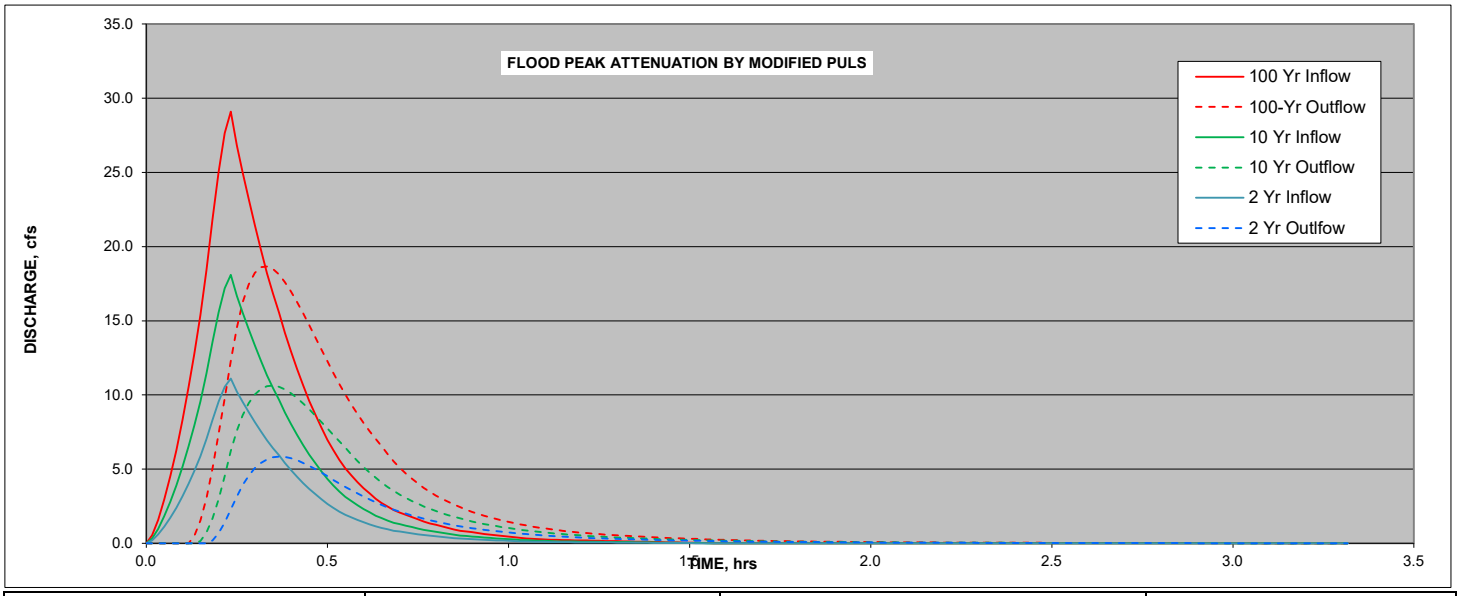
**THIS TAB CONTAINS NO INPUT DATA**

Summary of Reservoir Routing of the Inflow Hydrograph using the Specified Detention Facility and Outlet Works

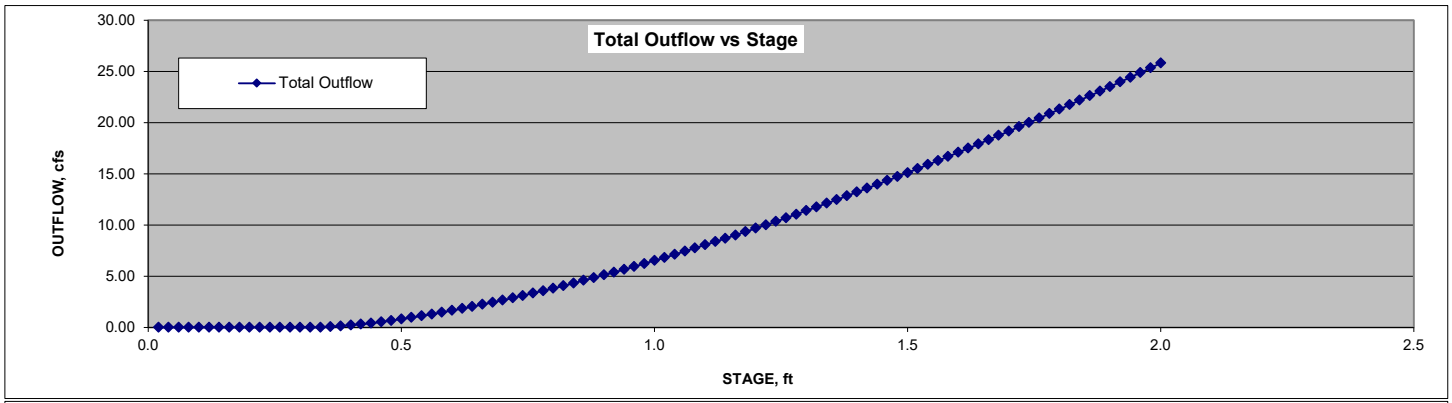
PIMA COUNTY FLOOD CONTROL

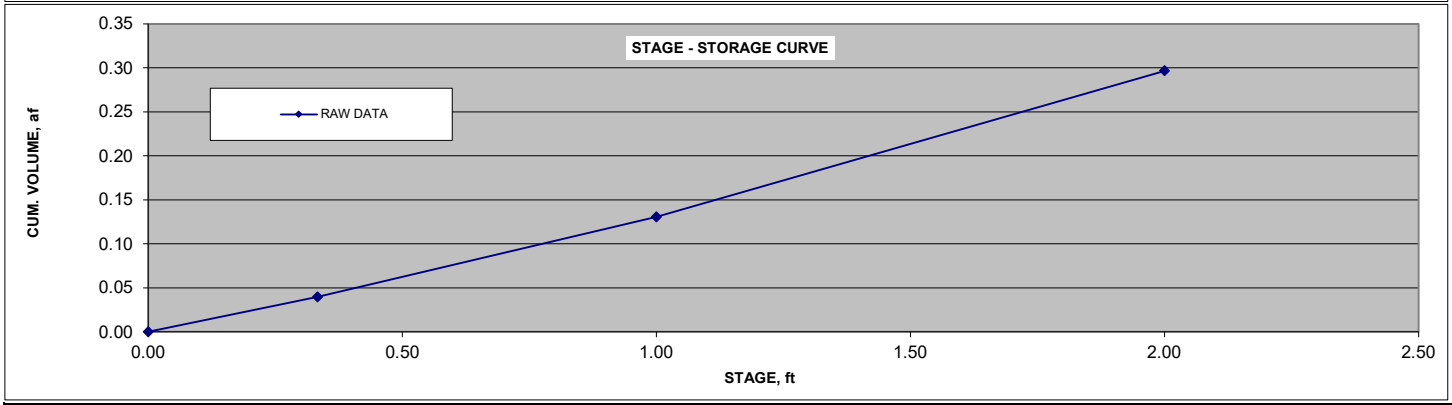
Rev.04/17

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | Project Address |
| AJH | Designer |
| Friday, July 19, 2024 | Run Date |
| West Basin Routing.xls | Program File Name |




| ORIFICE PLATE | | | TRIANGULAR WEIR | | | RECTANGULAR WEIR(S) | | | | | RCP / RCBC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | rect 1 | rect 2 | rect 3 | | RCP | RCBC | |
| $d_o$ (in) = | 0.0 | diameter | Z = | 0.0 | side slope | L (ft) = | 4.0 | 0.0 | 0.0 | crest length | 0.0 | 0.0 | D (ft) rise / diameter |
| C (dim) = | 0.0 | discharge coefficient | $E_w$ (ft) = | 0.00 | stage at weir crest | C = | 3.0 | 0.0 | 0.0 | discharge coef | | 0.0 | B (ft) span |
| N = | 0.0 | nbr identical openings | Θ = | | ° notch angle | $E_w$ (ft) = | 0.33 | 0.00 | 0.00 | stage at crest | 0.00 | 0.00 | $E_b$ (ft) stage at invert |
| inv (ft) = | 0.00 | stage at invert | $C_1$ = | 0 | discharge coefficient | | | | | | | | |




**RESULTS:**

| | max inflow | max outflow | target discharge | total inflow volume | | max stage (H) * | | |
|---|---|---|---|---|---|---|---|---|
| 100-Year | 29.1 cfs | 18.7 cfs | 24.2 cfs | 30220 $ft^3$ | 0.694 af | 1.68 ft at | 20 | min |
| 10-Year | 18.1 cfs | 10.6 cfs | 10.6 cfs | 18796 $ft^3$ | 0.431 af | 1.26 ft at | 21 | min |
| 2-Year | 11.1 cfs | 5.8 cfs | 4 cfs | 11527 $ft^3$ | 0.265 af | 0.95 ft at | 22 | min |

* Max Design Stage (ft) = 2.00

NOTE: IF H > MAX DESIGN STAGE, EXTEND STAGE-VOL DATA TO A HIGHER STAGE

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Input the Inflow Hydrograph, & Automatically Perform the Routing Calculations using the Stage-Volume data, Volume-Outflow data, & SO Working Curve

PIMA COUNTY FLOOD CONTROL

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | **Project Address** |
| AJH | **Designer** |
| Friday, July 19, 2024 | **Run Date** |
| North SWHB Routing.xls | **Program File Name** |

Rev. 10/20

**GOVERNING EQUATION:** *Ref: Applied Hydrology (Ven Te Chow, Editor 1964)*

Mass Conservation: $0.5 * (I_1 + I_2) * \Delta t - 0.5 * (O_1 + O_2) * \Delta t = S_2 - S_1$

Isolate, divide by $\Delta t$: $0.5 * (I_1 + I_2) + S_1 / \Delta t - 0.5 * O_1 = S_2 / \Delta t + 0.5 * O_2$

**VARIABLES:**

- $\Delta t$ time interval between hydrograph discharges.
- $I_1, I_2$ inflow rate into facility at start and end of time interval from inflow hydrograph
- $O_1, O_2$ facility outflow rate at start & end of time interval
- $S_1, S_2$ stormwater in storage in the facility at start and end of time interval

**Note:** Input $\Delta t$, target discharges & inflow hydrographs for 3 storm frequencies into blue cells. Outflow hydrographs (yellow) are calculated from specified outlet configuration (**Vol-outflow** tab) and facility geometry (**Stage-Vol** tab). To add rows to this worksheet, add them in roughly the center of the range, then unhide all columns and copy hidden equations into the new rows. Zero discharge within and beyond the end of the hydrograph will not affect the routing. **All blue cells in this spreadsheet must either be blank (highlight, right-click, Clear Contents) or must contain a number. In addition, the Stage - Volume data must be entered in numerically ascending order. This spreadsheet does not have a "clear" button to clear all input data in one action; to accomplish this, restart Excel using a blank copy of the spreadsheet.**

**RESULTS:**

| | max inflow | | max outflow | | total inflow volume | | | | max stage (H) * | | | | target ** discharge | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100-Year | 3.1 | cfs | 0.2 | cfs | 3219 | ft³ | 0.074 | af | 0.63 | ft | 42 | min | | cfs |
| 10-Year | 1.7 | cfs | 0.0 | cfs | 1766 | ft³ | 0.041 | af | 0.41 | ft | 67 | min | | csf |
| 2-Year | 0.7 | cfs | 0.0 | cfs | 776 | ft³ | 0.018 | af | 0.19 | ft | 100 | min | | cfs |

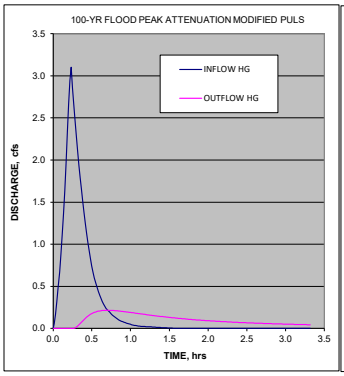
* Max Design Stage = 0.75 ft

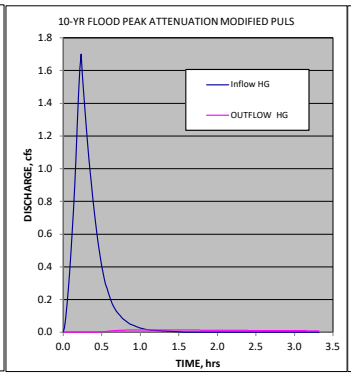
NOTE: IF H > MAX DESIGN STAGE, EXTEND STAGE-VOL DATA TO A HIGHER STAGE

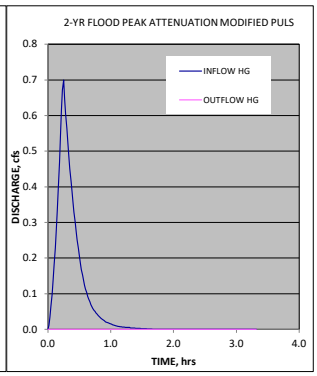
** target discharges not used in calculations; for informational use only

$\Delta t$ = 1.00 min 0.0167 hr inflow hydrograph time interval

| | 100-Year | | | 10-Year | | 2-Year | | 100-Year | | 10-Year | | 2-Year | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| index count | Inflow I, cfs | time t, hr | S/Δt+O/2 cfs | Inflow I, cfs | S/Δt+O/2 cfs | Inflow I, cfs | S/Δt+O/2 cfs | outflow O, cfs | Stage H, ft | outflow O, cfs | Stage H, ft | outflow O, cfs | Stage H, ft |
| 0 | 0.00 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 | 0.06 | 0.0167 | 0.03 | 0.03 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.17 | 0.0333 | 0.14 | 0.09 | 0.08 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | 0.32 | 0.0500 | 0.38 | 0.17 | 0.21 | 0.06 | 0.08 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | 0.48 | 0.0667 | 0.78 | 0.27 | 0.43 | 0.10 | 0.16 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 |
| 5 | 0.67 | 0.0833 | 1.36 | 0.37 | 0.74 | 0.14 | 0.28 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 |
| 6 | 0.89 | 0.1000 | 2.14 | 0.49 | 1.17 | 0.18 | 0.44 | 0.00 | 0.03 | 0.00 | 0.02 | 0.00 | 0.01 |
| 7 | 1.12 | 0.1167 | 3.14 | 0.61 | 1.72 | 0.23 | 0.64 | 0.00 | 0.05 | 0.00 | 0.03 | 0.00 | 0.01 |
| 8 | 1.36 | 0.1333 | 4.38 | 0.75 | 2.40 | 0.28 | 0.90 | 0.00 | 0.06 | 0.00 | 0.04 | 0.00 | 0.01 |
| 9 | 1.64 | 0.1500 | 5.88 | 0.90 | 3.22 | 0.33 | 1.20 | 0.00 | 0.09 | 0.00 | 0.05 | 0.00 | 0.02 |
| 10 | 1.96 | 0.1667 | 7.68 | 1.08 | 4.21 | 0.39 | 1.57 | 0.00 | 0.11 | 0.00 | 0.06 | 0.00 | 0.02 |
| 11 | 2.33 | 0.1833 | 9.82 | 1.28 | 5.39 | 0.47 | 2.00 | 0.00 | 0.14 | 0.00 | 0.08 | 0.00 | 0.03 |
| 12 | 2.67 | 0.2000 | 12.32 | 1.46 | 6.76 | 0.54 | 2.50 | 0.00 | 0.18 | 0.00 | 0.10 | 0.00 | 0.04 |
| 13 | 2.95 | 0.2167 | 15.13 | 1.62 | 8.29 | 0.62 | 3.08 | 0.00 | 0.22 | 0.00 | 0.12 | 0.00 | 0.05 |
| 14 | 3.10 | 0.2333 | 18.15 | 1.70 | 9.95 | 0.67 | 3.73 | 0.00 | 0.27 | 0.00 | 0.15 | 0.00 | 0.05 |
| 15 | 2.86 | 0.2500 | 21.13 | 1.57 | 11.59 | 0.70 | 4.41 | 0.00 | 0.31 | 0.00 | 0.17 | 0.00 | 0.06 |
| 16 | 2.66 | 0.2667 | 23.89 | 1.46 | 13.10 | 0.65 | 5.09 | 0.00 | 0.35 | 0.00 | 0.19 | 0.00 | 0.07 |
| 17 | 2.47 | 0.2833 | 26.46 | 1.36 | 14.51 | 0.61 | 5.71 | 0.01 | 0.38 | 0.00 | 0.21 | 0.00 | 0.08 |
| 18 | 2.29 | 0.3000 | 28.83 | 1.25 | 15.81 | 0.56 | 6.30 | 0.02 | 0.41 | 0.00 | 0.23 | 0.00 | 0.09 |
| 19 | 2.11 | 0.3167 | 31.01 | 1.16 | 17.02 | 0.53 | 6.84 | 0.03 | 0.43 | 0.00 | 0.25 | 0.00 | 0.10 |
| 20 | 1.94 | 0.3333 | 33.01 | 1.06 | 18.13 | 0.49 | 7.35 | 0.04 | 0.46 | 0.00 | 0.27 | 0.00 | 0.11 |
| 21 | 1.79 | 0.3500 | 34.83 | 0.98 | 19.15 | 0.45 | 7.81 | 0.06 | 0.48 | 0.00 | 0.28 | 0.00 | 0.11 |
| 22 | 1.66 | 0.3667 | 36.50 | 0.91 | 20.10 | 0.42 | 8.25 | 0.07 | 0.50 | 0.00 | 0.29 | 0.00 | 0.12 |
| 23 | 1.51 | 0.3833 | 38.01 | 0.83 | 20.97 | 0.39 | 8.65 | 0.09 | 0.51 | 0.00 | 0.31 | 0.00 | 0.13 |
| 24 | 1.38 | 0.4000 | 39.37 | 0.76 | 21.76 | 0.36 | 9.02 | 0.10 | 0.53 | 0.00 | 0.32 | 0.00 | 0.13 |
| 25 | 1.25 | 0.4167 | 40.58 | 0.69 | 22.48 | 0.33 | 9.37 | 0.12 | 0.54 | 0.00 | 0.33 | 0.00 | 0.14 |
| 26 | 1.14 | 0.4333 | 41.65 | 0.62 | 23.13 | 0.30 | 9.68 | 0.13 | 0.56 | 0.00 | 0.34 | 0.00 | 0.14 |
| 27 | 1.02 | 0.4500 | 42.60 | 0.56 | 23.73 | 0.28 | 9.97 | 0.14 | 0.57 | 0.00 | 0.34 | 0.00 | 0.15 |
| 28 | 0.93 | 0.4667 | 43.43 | 0.51 | 24.26 | 0.25 | 10.23 | 0.16 | 0.58 | 0.00 | 0.35 | 0.00 | 0.15 |
| 29 | 0.83 | 0.4833 | 44.15 | 0.46 | 24.74 | 0.23 | 10.47 | 0.17 | 0.59 | 0.00 | 0.36 | 0.00 | 0.15 |
| 30 | 0.74 | 0.5000 | 44.77 | 0.41 | 25.17 | 0.21 | 10.69 | 0.18 | 0.59 | 0.00 | 0.36 | 0.00 | 0.16 |
| 31 | 0.67 | 0.5167 | 45.30 | 0.37 | 25.56 | 0.19 | 10.89 | 0.18 | 0.60 | 0.00 | 0.37 | 0.00 | 0.16 |
| 32 | 0.60 | 0.5333 | 45.76 | 0.33 | 25.90 | 0.17 | 11.06 | 0.19 | 0.61 | 0.00 | 0.37 | 0.00 | 0.16 |
| 33 | 0.54 | 0.5500 | 46.14 | 0.30 | 26.21 | 0.15 | 11.22 | 0.20 | 0.61 | 0.01 | 0.37 | 0.00 | 0.16 |
| 34 | 0.49 | 0.5667 | 46.45 | 0.27 | 26.48 | 0.14 | 11.37 | 0.20 | 0.61 | 0.01 | 0.38 | 0.00 | 0.17 |
| 35 | 0.44 | 0.5833 | 46.72 | 0.24 | 26.73 | 0.12 | 11.50 | 0.20 | 0.62 | 0.01 | 0.38 | 0.00 | 0.17 |
| 36 | 0.40 | 0.6000 | 46.93 | 0.22 | 26.96 | 0.11 | 11.62 | 0.21 | 0.62 | 0.01 | 0.38 | 0.00 | 0.17 |
| 37 | 0.36 | 0.6167 | 47.10 | 0.20 | 27.15 | 0.10 | 11.73 | 0.21 | 0.62 | 0.01 | 0.39 | 0.00 | 0.17 |
| 38 | 0.32 | 0.6333 | 47.23 | 0.18 | 27.33 | 0.09 | 11.83 | 0.21 | 0.62 | 0.01 | 0.39 | 0.00 | 0.17 |
| 39 | 0.29 | 0.6500 | 47.32 | 0.16 | 27.49 | 0.09 | 11.91 | 0.21 | 0.62 | 0.01 | 0.39 | 0.00 | 0.17 |
| 40 | 0.26 | 0.6667 | 47.38 | 0.15 | 27.63 | 0.08 | 12.00 | 0.21 | 0.63 | 0.01 | 0.39 | 0.00 | 0.18 |
| 41 | 0.24 | 0.6833 | 47.42 | 0.13 | 27.76 | 0.07 | 12.07 | 0.22 | 0.63 | 0.01 | 0.39 | 0.00 | 0.18 |
| 42 | 0.22 | 0.7000 | 47.44 | 0.12 | 27.88 | 0.06 | 12.14 | 0.22 | 0.63 | 0.01 | 0.39 | 0.00 | 0.18 |
| 43 | 0.21 | 0.7167 | 47.43 | 0.11 | 27.98 | 0.06 | 12.20 | 0.22 | 0.63 | 0.01 | 0.40 | 0.00 | 0.18 |
| 44 | 0.19 | 0.7333 | 47.41 | 0.10 | 28.08 | 0.05 | 12.25 | 0.22 | 0.63 | 0.01 | 0.40 | 0.00 | 0.18 |
| 45 | 0.17 | 0.7500 | 47.38 | 0.10 | 28.17 | 0.05 | 12.30 | 0.21 | 0.63 | 0.01 | 0.40 | 0.00 | 0.18 |
| 46 | 0.16 | 0.7667 | 47.33 | 0.09 | 28.24 | 0.05 | 12.35 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 47 | 0.14 | 0.7833 | 47.27 | 0.08 | 28.31 | 0.04 | 12.40 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 48 | 0.13 | 0.8000 | 47.19 | 0.07 | 28.38 | 0.04 | 12.44 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 49 | 0.12 | 0.8167 | 47.11 | 0.07 | 28.43 | 0.04 | 12.47 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 50 | 0.11 | 0.8333 | 47.01 | 0.06 | 28.48 | 0.03 | 12.51 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 51 | 0.10 | 0.8500 | 46.91 | 0.06 | 28.53 | 0.03 | 12.54 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 52 | 0.09 | 0.8667 | 46.80 | 0.05 | 28.57 | 0.03 | 12.57 | 0.21 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 53 | 0.09 | 0.8833 | 46.68 | 0.05 | 28.60 | 0.03 | 12.60 | 0.20 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 54 | 0.08 | 0.9000 | 46.56 | 0.04 | 28.63 | 0.02 | 12.62 | 0.20 | 0.62 | 0.01 | 0.40 | 0.00 | 0.18 |
| 55 | 0.07 | 0.9167 | 46.43 | 0.04 | 28.66 | 0.02 | 12.64 | 0.20 | 0.61 | 0.01 | 0.40 | 0.00 | 0.19 |
| 56 | 0.07 | 0.9333 | 46.30 | 0.04 | 28.68 | 0.02 | 12.67 | 0.20 | 0.61 | 0.01 | 0.40 | 0.00 | 0.19 |
| 57 | 0.06 | 0.9500 | 46.17 | 0.03 | 28.71 | 0.02 | 12.68 | 0.20 | 0.61 | 0.01 | 0.40 | 0.00 | 0.19 |
| 58 | 0.06 | 0.9667 | 46.04 | 0.03 | 28.72 | 0.02 | 12.70 | 0.19 | 0.61 | 0.01 | 0.40 | 0.00 | 0.19 |
| 59 | 0.05 | 0.9833 | 45.90 | 0.03 | 28.74 | 0.02 | 12.72 | 0.19 | 0.61 | 0.01 | 0.40 | 0.00 | 0.19 |
| 60 | 0.05 | 1.0000 | 45.76 | 0.03 | 28.75 | 0.02 | 12.74 | 0.19 | 0.61 | 0.02 | 0.40 | 0.00 | 0.19 |
| 61 | 0.04 | 1.0167 | 45.61 | 0.02 | 28.76 | 0.01 | 12.75 | 0.19 | 0.60 | 0.02 | 0.40 | 0.00 | 0.19 |
| 62 | 0.04 | 1.0333 | 45.47 | 0.02 | 28.77 | 0.01 | 12.76 | 0.19 | 0.60 | 0.02 | 0.40 | 0.00 | 0.19 |
| 63 | 0.04 | 1.0500 | 45.32 | 0.02 | 28.78 | 0.01 | 12.78 | 0.18 | 0.60 | 0.02 | 0.41 | 0.00 | 0.19 |
| 64 | 0.03 | 1.0667 | 45.17 | 0.02 | 28.78 | 0.01 | 12.79 | 0.18 | 0.60 | 0.02 | 0.41 | 0.00 | 0.19 |
| 65 | 0.03 | 1.0833 | 45.02 | 0.02 | 28.78 | 0.01 | 12.80 | 0.18 | 0.60 | 0.02 | 0.41 | 0.00 | 0.19 |
| 66 | 0.03 | 1.1000 | 44.88 | 0.02 | 28.79 | 0.01 | 12.81 | 0.18 | 0.60 | 0.02 | 0.41 | 0.00 | 0.19 |
| 67 | 0.03 | 1.1167 | 44.73 | 0.02 | 28.79 | 0.01 | 12.82 | 0.17 | 0.59 | 0.02 | 0.41 | 0.00 | 0.19 |
| 68 | 0.03 | 1.1333 | 44.58 | 0.01 | 28.79 | 0.01 | 12.82 | 0.17 | 0.59 | 0.02 | 0.41 | 0.00 | 0.19 |
| 69 | 0.02 | 1.1500 | 44.43 | 0.01 | 28.78 | 0.01 | 12.83 | 0.17 | 0.59 | 0.02 | 0.41 | 0.00 | 0.19 |
| 70 | 0.02 | 1.1667 | 44.28 | 0.01 | 28.78 | 0.01 | 12.84 | 0.17 | 0.59 | 0.02 | 0.41 | 0.00 | 0.19 |
| 71 | 0.02 | 1.1833 | 44.14 | 0.01 | 28.78 | 0.01 | 12.85 | 0.17 | 0.59 | 0.02 | 0.41 | 0.00 | 0.19 |
| 72 | 0.02 | 1.2000 | 43.99 | 0.01 | 28.78 | 0.01 | 12.85 | 0.16 | 0.59 | 0.02 | 0.41 | 0.00 | 0.19 |
| 73 | 0.02 | 1.2167 | 43.85 | 0.01 | 28.77 | 0.01 | 12.86 | 0.16 | 0.58 | 0.02 | 0.40 | 0.00 | 0.19 |
| 74 | 0.02 | 1.2333 | 43.71 | 0.01 | 28.77 | 0.01 | 12.86 | 0.16 | 0.58 | 0.02 | 0.40 | 0.00 | 0.19 |
| 75 | 0.02 | 1.2500 | 43.56 | 0.01 | 28.76 | 0.01 | 12.87 | 0.16 | 0.58 | 0.02 | 0.40 | 0.00 | 0.19 |
| 76 | 0.02 | 1.2667 | 43.42 | 0.01 | 28.76 | 0.01 | 12.87 | 0.16 | 0.58 | 0.02 | 0.40 | 0.00 | 0.19 |
| 77 | 0.02 | 1.2833 | 43.29 | 0.01 | 28.75 | 0.01 | 12.88 | 0.15 | 0.58 | 0.02 | 0.40 | 0.00 | 0.19 |
| 78 | 0.02 | 1.3000 | 43.15 | 0.01 | 28.75 | 0.01 | 12.88 | 0.15 | 0.58 | 0.01 | 0.40 | 0.00 | 0.19 |
| 79 | 0.02 | 1.3167 | 43.01 | 0.01 | 28.74 | 0.00 | 12.89 | 0.15 | 0.57 | 0.01 | 0.40 | 0.00 | 0.19 |
| 80 | 0.01 | 1.3333 | 42.88 | 0.01 | 28.73 | 0.00 | 12.89 | 0.15 | 0.57 | 0.01 | 0.40 | 0.00 | 0.19 |
| 81 | 0.01 | 1.3500 | 42.74 | 0.01 | 28.73 | 0.00 | 12.90 | 0.15 | 0.57 | 0.01 | 0.40 | 0.00 | 0.19 |
| 82 | 0.01 | 1.3667 | 42.61 | 0.01 | 28.72 | 0.00 | 12.90 | 0.14 | 0.57 | 0.01 | 0.40 | 0.00 | 0.19 |
| 83 | 0.01 | 1.3833 | 42.47 | 0.01 | 28.71 | 0.00 | 12.90 | 0.14 | 0.57 | 0.01 | 0.40 | 0.00 | 0.19 |
| 84 | 0.01 | 1.4000 | 42.34 | 0.01 | 28.70 | 0.00 | 12.91 | 0.14 | 0.57 | 0.01 | 0.40 | 0.00 | 0.19 |
| 85 | 0.01 | 1.4167 | 42.21 | 0.01 | 28.69 | 0.00 | 12.91 | 0.14 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 86 | 0.01 | 1.4333 | 42.08 | 0.01 | 28.68 | 0.00 | 12.91 | 0.14 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 87 | 0.01 | 1.4500 | 41.95 | 0.00 | 28.67 | 0.00 | 12.92 | 0.14 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 88 | 0.01 | 1.4667 | 41.82 | 0.00 | 28.66 | 0.00 | 12.92 | 0.13 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 89 | 0.01 | 1.4833 | 41.69 | 0.00 | 28.65 | 0.00 | 12.92 | 0.13 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 90 | 0.01 | 1.5000 | 41.56 | 0.00 | 28.64 | 0.00 | 12.92 | 0.13 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 91 | 0.00 | 1.5167 | 41.44 | 0.00 | 28.63 | 0.00 | 12.93 | 0.13 | 0.56 | 0.01 | 0.40 | 0.00 | 0.19 |
| 92 | 0.00 | 1.5333 | 41.31 | 0.00 | 28.61 | 0.00 | 12.93 | 0.13 | 0.55 | 0.01 | 0.40 | 0.00 | 0.19 |
| 93 | 0.00 | 1.5500 | 41.19 | 0.00 | 28.60 | 0.00 | 12.93 | 0.13 | 0.55 | 0.01 | 0.40 | 0.00 | 0.19 |
| 94 | 0.00 | 1.5667 | 41.06 | 0.00 | 28.59 | 0.00 | 12.93 | 0.12 | 0.55 | 0.01 | 0.40 | 0.00 | 0.19 |
| 95 | 0.00 | 1.5833 | 40.94 | 0.00 | 28.57 | 0.00 | 12.93 | 0.12 | 0.55 | 0.01 | 0.40 | 0.00 | 0.19 |
| 96 | 0.00 | 1.6000 | 40.81 | 0.00 | 28.56 | 0.00 | 12.93 | 0.12 | 0.55 | 0.01 | 0.40 | 0.00 | 0.19 |
| 97 | 0.00 | 1.6167 | 40.69 | 0.00 | 28.55 | 0.00 | 12.93 | 0.12 | 0.55 | 0.01 | 0.40 | 0.00 | 0.19 |


100-YR FLOOD PEAK ATTENUATION MODIFIED PULS
INFLOW HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs


10-YR FLOOD PEAK ATTENUATION MODIFIED PULS
Inflow HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs


2-YR FLOOD PEAK ATTENUATION MODIFIED PULS
INFLOW HG
OUTFLOW HG
DISCHARGE, cfs
TIME, hrs

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Input the Stage - Volume Relationship for the Facility

PIMA COUNTY FLOOD CONTROL Rev.4/17

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | **Project Address** |
| AJH | **Designer** |
| Friday, July 19, 2024 | **Run Date** |
| North SWHB Routing.xls | **Program File Name** |

**GOVERNING EQUATIONS:** ***Ref: HEC-1 Flood Hydrograph Package User's Manual (USACOE September 1990)***

Conic method for reservoir volume: $\Delta V_{1\text{-}2} = 0.33 * h * (A_1 + A_2 + (A_1 * A_2)^{0.5})$ (see "**Conic Proj**" tab)

**VARIABLES:**

| | |
|---|---|
| $\Delta V_{1\text{-}2}$ | incremental facility storage volume between stages $H_1$ and $H_2$ |
| h | elevation difference between $A_1$ and $A_2$ |
| A1, A2 | facility surface area at stages $H_1$ and $H_2$ |

0.75 = max design stage (ft)

| | | | for information only | | | | |
|---|---|---|---|---|---|---|---|
| stage H, ft | area A, ac | volume ΔV, af | area A, $ft^2$ | volume ΔV, $ft^3$ | Σ ΔV S, $ft^3$ | Σ ΔV S, af | index for interpolation |
| 0.00 | 0.08710 | 0 | 3794 | 0 | 0 | 0 | 1 |
| 0.33 | 0.10108 | 0.031 | 4403 | 1365 | 1365 | 0.03133 | 2 |
| 0.75 | 0.13083 | 0.048 | 5699 | 2099 | 3464 | 0.07952 | 3 |
| | | | | | | | 4 |
| | | | | | | | 5 |
| | | | | | | | 6 |
| | | | | | | | 7 |
| | | | | | | | 8 |
| | | | | | | | 9 |
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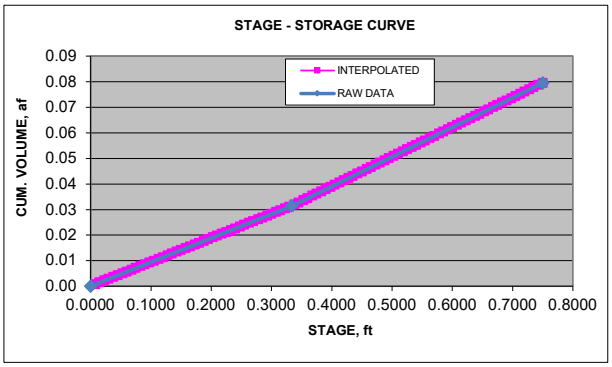
| | | | | | | | 18 |
| | | | | | | | 19 |
| | | | | | | | 20 |
| | | | | | | | 21 |
| | | | | | | | 22 |
| | | | | | | | 23 |
| | | | | | | | 24 |
| | | | | | | | 25 |
| | | | | | | | 26 |

**Note:** Develop stage-storage curve on this worksheet by either entering in the blue shaded column the planimetered basin areas (in acres) at various stages or by entering facility stages and corresponding incremental volumes (acre-feet, purple shaded column). Graph of the stage-storage curve shown to verify proper interpolation (purple points) of facility volume by **Vol Outflow** tab. **You may insert rows into the middle of this table** to accomodate the size of your data set; empty rows below the extent of your data will not cause a problem. **Stage - Volume data must begin at stage = 0 ft with a volume of 0 af. Stage - Volume data must be entered in ascending order. Blue cells below the entered data must remain empty (highlight, right-click, clear contents). All blue cells must eigther be blank or must contain a number.**



**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT**

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

Worksheet to Develop the Stage - Discharge Characteristics of the Outlet Works for the Facility

PIMA COUNTY FLOOD CONTROL

Rev. 3/18

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | **Project Address** |
| AJH | **Designer** |
| Friday, July 19, 2024 | **Run Date** |
| North SWHB Routing.xls | **Program File Name** |

**Note:** Populate characteristics of selected outflow elements corresponding to facility outlet configuration (blue cells), or overwrite purple cells with outflows calculated outside this worksheet, as a function of the given facility stages. Storage (last column) at each stage is interpolated from stage-volume relationship (see **Stage Vol**" tab). **Do not add rows** to this worksheet; it automatically divides maximum facility design stage into 100 increments to develop the volume-outflow curve.

**GOVERNING EQUATIONS:**

Orifice equation: $Q_o = C * A * (2 * g * H)^{0.5}$ and see weir flow equation on "**Orifice**" tab

Rectangular Weir Equation: $Q_w = C * L * H^{1.5}$

Triangular Weir Equation: $Q_w = C_1 * Tan(\Theta/2) * H^{2.5}$

Box Culvert Equation: See Box Culvert equations for Inlet Control on **"RCBC"** tab

**ORIFICE PLATE OUTFLOW ELEMENT**

| | | | | |
|---|---|---|---|---|
| $d_o$ (in) = | | diameter | area ($ft^2$) = | 0.000 |
| C = | | disch coefficient | | |
| $E_o$ (ft) = | | stage @ orifice center | inv (in) = | 0.00 |
| N = | | nbr identical openings | inv (ft) = | 0.000 |

**TRIANGULAR WEIR OUTFLOW ELEMENT**

| | | |
|---|---|---|
| Z = | | side slope |
| $E_w$ (ft) = | | stage at crest |
| $C_1$ = | | disch coefficient |
| Θ (deg) = | | notch angle |

**RECTANGULAR WEIR OUTFLOW ELEMENT(S)**

| | rect 1 | rect 2 | rect 3 | |
|---|---|---|---|---|
| L (ft) = | | | | crest length |
| C = | | | | disch coefficient |
| $E_w$ (ft) = | | | | stage at crest |

**BOX or ROUND CULVERT OUTFLOW ELEMENT**

| | circ pipe | RCBC | |
|---|---|---|---|
| D (ft) = | 0.7 | | barrel rise, dia |
| B (ft) = | | | barrel span |
| $E_b$ (ft) = | 0.33 | | barrel invert |
| n (dim) = | 0.015 | | Manning's coef |
| S (ft/ft) = | 0.006 | | barrel slope |
| L (ft) = | 117.0 | | barrel length |
| $K_e$ (dim)= | 0.70 | | ent loss coef |
| TW (ft) = | 0.00 | | tailwater depth |

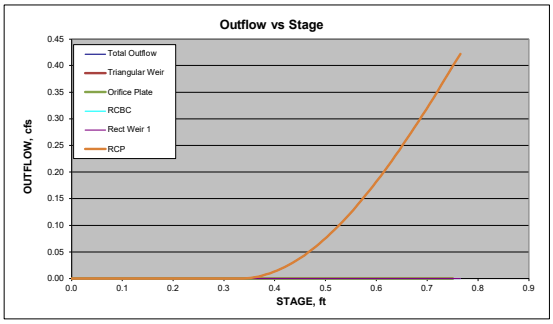
| Stage | Orifice Plate | Weir Element(s) Triang 1 | Rect 1 | Rect 2 | Rect 3 | RCP | RCBC | Outflow | Σ vol |
|---|---|---|---|---|---|---|---|---|---|
| H, ft | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | Q, cfs | O, cfs | S, af |
| 0.0000 | | | | | | | | 0.00 | 0.00000 |
| 0.0080 | | | | | | | | 0.00 | 0.00075 |
| 0.0150 | | | | | | | | 0.00 | 0.00141 |
| 0.0230 | | | | | | | | 0.00 | 0.00216 |
| 0.0300 | | | | | | | | 0.00 | 0.00282 |
| 0.0380 | | | | | | | | 0.00 | 0.00357 |
| 0.0450 | | | | | | | | 0.00 | 0.00423 |
| 0.0530 | | | | | | | | 0.00 | 0.00498 |
| 0.0600 | | | | | | | | 0.00 | 0.00564 |
| 0.0680 | | | | | | | | 0.00 | 0.00639 |
| 0.0750 | | | | | | | | 0.00 | 0.00705 |
| 0.0830 | | | | | | | | 0.00 | 0.00780 |
| 0.0900 | | | | | | | | 0.00 | 0.00846 |
| 0.0980 | | | | | | | | 0.00 | 0.00921 |
| 0.1050 | | | | | | | | 0.00 | 0.00987 |
| 0.1130 | | | | | | | | 0.00 | 0.01062 |
| 0.1200 | | | | | | | | 0.00 | 0.01128 |
| 0.1280 | | | | | | | | 0.00 | 0.01203 |
| 0.1350 | | | | | | | | 0.00 | 0.01269 |
| 0.1430 | | | | | | | | 0.00 | 0.01344 |
| 0.1500 | | | | | | | | 0.00 | 0.01410 |
| 0.1580 | | | | | | | | 0.00 | 0.01485 |
| 0.1650 | | | | | | | | 0.00 | 0.01551 |
| 0.1730 | | | | | | | | 0.00 | 0.01626 |
| 0.1800 | | | | | | | | 0.00 | 0.01692 |
| 0.1880 | | | | | | | | 0.00 | 0.01767 |
| 0.1950 | | | | | | | | 0.00 | 0.01833 |
| 0.2030 | | | | | | | | 0.00 | 0.01908 |
| 0.2100 | | | | | | | | 0.00 | 0.01974 |
| 0.2180 | | | | | | | | 0.00 | 0.02049 |
| 0.2250 | | | | | | | | 0.00 | 0.02115 |
| 0.2330 | | | | | | | | 0.00 | 0.02190 |
| 0.2400 | | | | | | | | 0.00 | 0.02256 |
| 0.2480 | | | | | | | | 0.00 | 0.02331 |
| 0.2550 | | | | | | | | 0.00 | 0.02397 |
| 0.2630 | | | | | | | | 0.00 | 0.02472 |
| 0.2700 | | | | | | | | 0.00 | 0.02538 |
| 0.2780 | | | | | | | | 0.00 | 0.02613 |
| 0.2850 | | | | | | | | 0.00 | 0.02679 |
| 0.2930 | | | | | | | | 0.00 | 0.02754 |
| 0.3000 | | | | | | | | 0.00 | 0.02820 |
| 0.3080 | | | | | | | | 0.00 | 0.02895 |
| 0.3150 | | | | | | | | 0.00 | 0.02961 |
| 0.3230 | | | | | | | | 0.00 | 0.03036 |
| 0.3300 | | | | | | | | 0.00 | 0.03102 |
| 0.3380 | | | | | | 0.00 | | 0.00 | 0.03187 |
| 0.3450 | | | | | | 0.00 | | 0.00 | 0.03268 |
| 0.3530 | | | | | | 0.00 | | 0.00 | 0.03361 |
| 0.3600 | | | | | | 0.00 | | 0.00 | 0.03442 |
| 0.3680 | | | | | | 0.00 | | 0.00 | 0.03534 |
| 0.3750 | | | | | | 0.01 | | 0.01 | 0.03615 |
| 0.3830 | | | | | | 0.01 | | 0.01 | 0.03708 |
| 0.3900 | | | | | | 0.01 | | 0.01 | 0.03789 |
| 0.3980 | | | | | | 0.01 | | 0.01 | 0.03881 |
| 0.4050 | | | | | | 0.02 | | 0.02 | 0.03962 |
| 0.4130 | | | | | | 0.02 | | 0.02 | 0.04055 |
| 0.4200 | | | | | | 0.02 | | 0.02 | 0.04136 |
| 0.4280 | | | | | | 0.03 | | 0.03 | 0.04228 |
| 0.4350 | | | | | | 0.03 | | 0.03 | 0.04309 |
| 0.4430 | | | | | | 0.03 | | 0.03 | 0.04402 |
| 0.4500 | | | | | | 0.04 | | 0.04 | 0.04482 |
| 0.4580 | | | | | | 0.04 | | 0.04 | 0.04575 |
| 0.4650 | | | | | | 0.05 | | 0.05 | 0.04656 |
| 0.4730 | | | | | | 0.05 | | 0.05 | 0.04748 |
| 0.4800 | | | | | | 0.06 | | 0.06 | 0.04829 |
| 0.4880 | | | | | | 0.07 | | 0.07 | 0.04922 |
| 0.4950 | | | | | | 0.07 | | 0.07 | 0.05003 |
| 0.5030 | | | | | | 0.08 | | 0.08 | 0.05095 |
| 0.5100 | | | | | | 0.08 | | 0.08 | 0.05176 |
| 0.5180 | | | | | | 0.09 | | 0.09 | 0.05269 |
| 0.5250 | | | | | | 0.10 | | 0.10 | 0.05350 |
| 0.5330 | | | | | | 0.11 | | 0.11 | 0.05442 |
| 0.5400 | | | | | | 0.11 | | 0.11 | 0.05523 |
| 0.5480 | | | | | | 0.12 | | 0.12 | 0.05616 |
| 0.5550 | | | | | | 0.13 | | 0.13 | 0.05697 |
| 0.5630 | | | | | | 0.14 | | 0.14 | 0.05789 |
| 0.5700 | | | | | | 0.15 | | 0.15 | 0.05870 |
| 0.5780 | | | | | | 0.16 | | 0.16 | 0.05963 |
| 0.5850 | | | | | | 0.16 | | 0.16 | 0.06044 |
| 0.5930 | | | | | | 0.17 | | 0.17 | 0.06136 |
| 0.6000 | | | | | | 0.18 | | 0.18 | 0.06217 |
| 0.6080 | | | | | | 0.19 | | 0.19 | 0.06310 |
| 0.6150 | | | | | | 0.20 | | 0.20 | 0.06390 |
| 0.6230 | | | | | | 0.21 | | 0.21 | 0.06483 |
| 0.6300 | | | | | | 0.22 | | 0.22 | 0.06564 |
| 0.6380 | | | | | | 0.23 | | 0.23 | 0.06656 |
| 0.6450 | | | | | | 0.24 | | 0.24 | 0.06737 |
| 0.6530 | | | | | | 0.25 | | 0.25 | 0.06830 |
| 0.6600 | | | | | | 0.26 | | 0.26 | 0.06911 |
| 0.6680 | | | | | | 0.27 | | 0.27 | 0.07003 |
| 0.6750 | | | | | | 0.28 | | 0.28 | 0.07084 |
| 0.6830 | | | | | | 0.30 | | 0.30 | 0.07177 |
| 0.6900 | | | | | | 0.31 | | 0.31 | 0.07258 |
| 0.6980 | | | | | | 0.32 | | 0.32 | 0.07350 |
| 0.7050 | | | | | | 0.33 | | 0.33 | 0.07431 |
| 0.7130 | | | | | | 0.34 | | 0.34 | 0.07524 |
| 0.7200 | | | | | | 0.35 | | 0.35 | 0.07605 |
| 0.7280 | | | | | | 0.36 | | 0.36 | 0.07697 |
| 0.7350 | | | | | | 0.37 | | 0.37 | 0.07778 |
| 0.7430 | | | | | | 0.39 | | 0.39 | 0.07871 |
| 0.7500 | | | | | | 0.40 | | 0.40 | 0.07952 |
| 0.7650 | | | | | | 0.42 | | 0.42 | 0.08125 |

last two cells in cum.vol column contain non-standard equations

**ROUTING RESULTS FOR DESIGN OF OUTLET WORKS**

Max Design Stage = 0.75 ft

| | Max Inflow | Max Outflow | Max Stage | | | | target discharges |
|---|---|---|---|---|---|---|---|
| 100-Yr | 3.1 cfs | 0.2 cfs | 0.63 ft | @ | 42 min | | 0.0 cfs |
| 10-Yr | 1.7 cfs | 0.0 cfs | 0.41 ft | @ | 67 min | | 0.0 cfs |
| 2 -yr | 0.7 cfs | 0.0 cfs | 0.19 ft | @ | 100 min | | 0.0 cfs |



# PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

**ROUTING OF A FLOOD HYDROGRAPH THROUGH A STORMWATER DETENTION / RETENTION FACILITY**

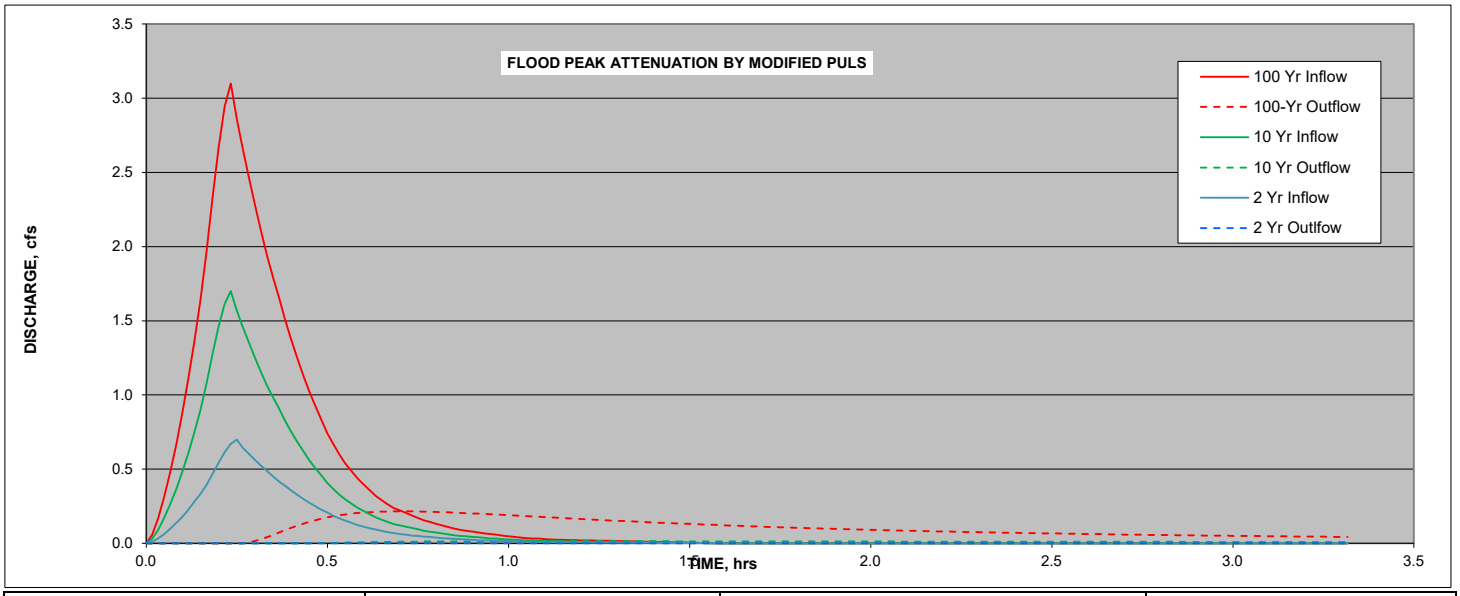
**THIS TAB CONTAINS NO INPUT DATA**

Summary of Reservoir Routing of the Inflow Hydrograph using the Specified Detention Facility and Outlet Works

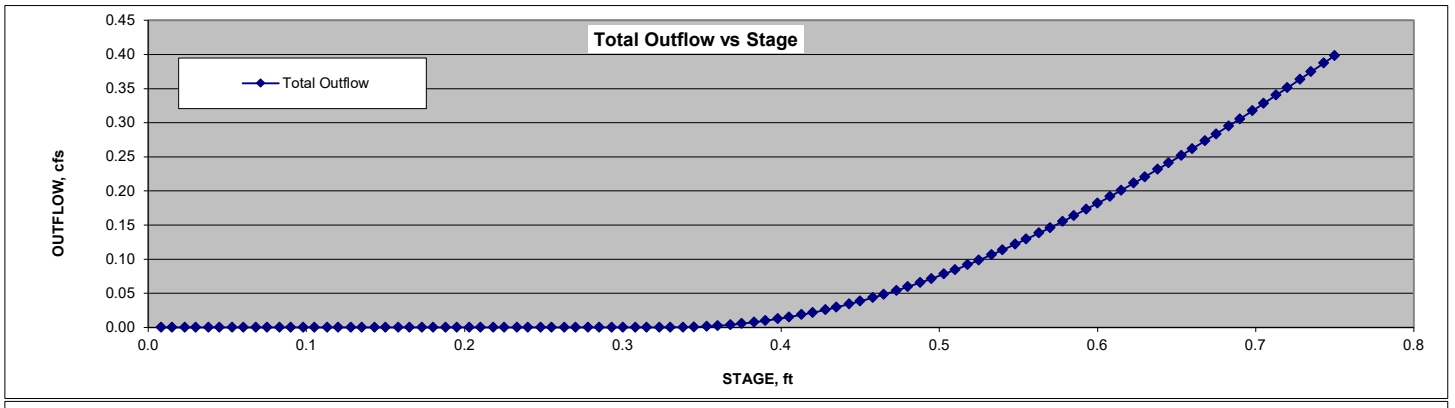
PIMA COUNTY FLOOD CONTROL

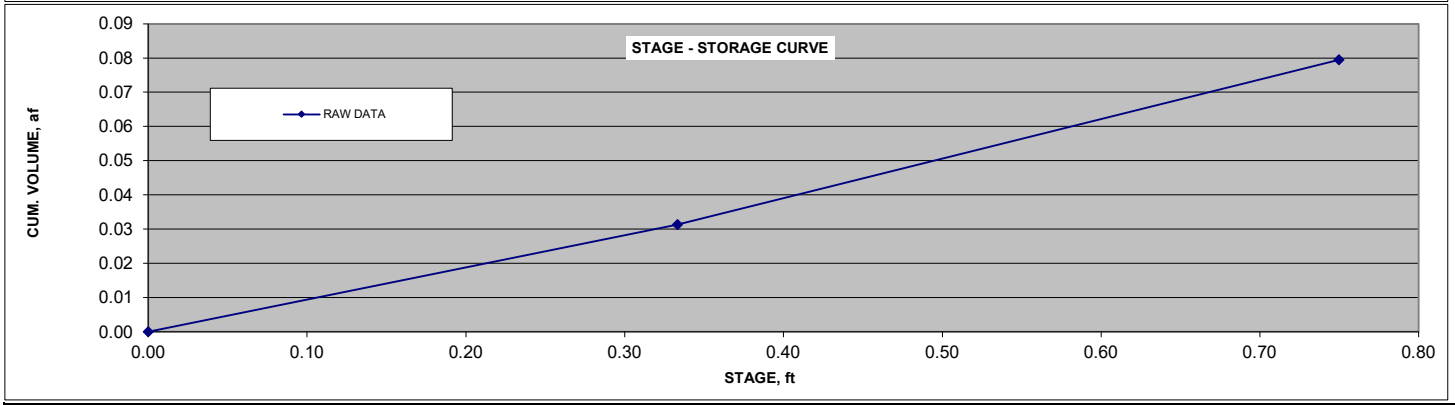
Rev.04/17

| | |
|---|---|
| 945&955 W Vistoso Highlands Drive, Oro Valley, AZ, 85755 | Project Address |
| AJH | Designer |
| Friday, July 19, 2024 | Run Date |
| North SWHB Routing.xls | Program File Name |




| ORIFICE PLATE | | | TRIANGULAR WEIR | | | RECTANGULAR WEIR(S) | | | | | RCP / RCBC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | rect 1 | rect 2 | rect 3 | | | RCP | RCBC | |
| $d_o$ (in) = | 0.0 | diameter | Z = | 0.0 | side slope | | | | | | | | |
| C (dim) = | 0.0 | discharge coefficient | $E_w$ (ft) = | 0.00 | stage at weir crest | L (ft) = | 0.0 | 0.0 | 0.0 | crest length | 0.7 | 0.0 | D (ft) rise / diameter |
| N = | 0.0 | nbr identical openings | Θ = | | ° notch angle | C = | 0.0 | 0.0 | 0.0 | discharge coef | | 0.0 | B (ft) span |
| inv (ft) = | 0.00 | stage at invert | $C_1$ = | 0 | discharge coefficient | $E_w$ (ft) = | 0.00 | 0.00 | 0.00 | stage at crest | 0.33 | 0.00 | $E_b$ (ft) stage at invert |




**RESULTS:**

| | max inflow | max outflow | target discharge | total inflow volume | max stage (H) * |
|---|---|---|---|---|---|
| 100-Year | 3.1 cfs | 0.2 cfs | 0 cfs | 3219 $ft^3$ 0.074 af | 0.63 ft at 42 min |
| 10-Year | 1.7 cfs | 0.0 cfs | 0 cfs | 1766 $ft^3$ 0.041 af | 0.41 ft at 67 min |
| 2-Year | 0.7 cfs | 0.0 cfs | 0 cfs | 776 $ft^3$ 0.018 af | 0.19 ft at 100 min |

* Max Design Stage (ft) = 0.75

NOTE: IF H > MAX DESIGN STAGE, EXTEND STAGE-VOL DATA TO A HIGHER STAGE

# APPENDIX E

RICK ENGINEERING COMPANY

| | |
|---|---|
| RICK Job #: | T22.061 |
| Designed by: | AJH |
| Date: | 7/19/2024 |

**Curb Opening Calculations**

**The Gateway at Vistoso Preserve**

*Weir Equation*

$Q = C\ L\ H^{1.5}$ eqn. 11.7 of COT Drainage Design Manual (SMDDFM), Revised 1998

Where: Q = Interception Capacity (cfs)
C = Weir Coefficient = 3.0
L = Length of curb opening (ft)
H = Depth at the lip of curb opening (ft)

**10-Year Design Summary**

| Watershed IDs | $Q_{10}$ (cfs) | H (ft) | Calculated Length (ft) | Provided Length (ft) | Max. Ponding Depth, H (in) | Opening Capacity (cfs) | Curb Overtopping? |
|---|---|---|---|---|---|---|---|
| PWS2 | 5.0 | 0.50 | 4.71 | 6.0 | 5.11 | 6.4 | NO |
| PWS3 | 10.8 | 0.50 | 10.18 | 12.0 | 5.38 | 12.7 | NO |
| PWS4+PWS5 | 17.3 | 0.50 | 16.31 | 18.0 | 5.62 | 19.1 | NO |
| PWS6 | 3.8 | 0.50 | 3.58 | 6.0 | 4.25 | 6.4 | NO |

**100-Year Design Check**

| Watershed IDs | $Q_{100}$ (cfs) | H (ft) | Calculated Length (ft) | Provided Length (ft) | Max. Ponding Depth, H (in) | Opening Capacity (cfs) | Curb Overtopping? |
|---|---|---|---|---|---|---|---|
| PWS2 | 7.9 | 0.50 | 7.45 | 6.0 | 6.93 | 6.4 | YES |
| PWS3 | 17.2 | 0.5 | 16.22 | 12.0 | 7.33 | 12.7 | YES |
| PWS4+PWS5 | 27.6 | 0.5 | 26.02 | 18.0 | 7.67 | 19.1 | YES |
| PWS6 | 6.0 | 0.50 | 5.66 | 6.0 | 5.77 | 6.4 | NO |

RICK ENGINEERING COMPANY

| | |
|---|---|
| RICK Job #: | T22.061 |
| Designed by: | AJH |
| Date: | 7/19/2024 |

**Sidewalk Scupper Sizing Calculations**

**The Gateway at Vistoso Preserve**

Sidewalk scupper per PAG Detail 205 (Type 2)

**References:**

(1) Standard Manual For Drainage design and Floodplain Management in Tucson, AZ, Revised July 1998

**Applicable Equations:**

Weir Eqn: $Q = C_w(L+1.8W)Y_i^{1.5}$ Eqn 10.14 (Ref. 1)

Orifice Eqn: $Q = C_oA(Y_i-0.5h)^{0.5}$ OR Eqn 10.16a (Ref. 1)

$Q = C_oA(Y_o)^{0.5}$ Eqn 10.16b (Ref. 1)

Where: Q = Rate of discharge into the inlet opening (cfs)

$C_w$ = Weir Coefficient = 2.30

$C_o$ = Orifice Coefficient = 5.35

W = Lateral Width of depression (ft) = 0.00

$Y_i$ = Depth at lip of curb inlet (ft) = 0.50 (Max allowable Headwater without Sidewalk Overtopping during a 10-year event)

h = height of curb-inlet orifice (ft) = 0.46 (Scupper opening per PAG Detail 205)

$Y_o$ = Effective head on the center of orifice throat, (ft) = 0.27

L = Length of curb inlet (ft)

A = Clear area of the Opening, $ft^2$

Ponding depth to Opening Ratio = 1.09 **Use Either Weir or Orifice Equation**

**10-Year Design**

| Watershed IDs | $Q_{10}$ (cfs) | Calculated Length - Orifice Eqn (ft) | Calculated Length - Weir Eqn (ft) | Controlling Calculated Length (ft) | Controlling Length x 1.0 clogging | # of Cells | Design Length (ft) | 10-YR Ponding Depth (in) | Scupper Capacity (cfs) |
|---|---|---|---|---|---|---|---|---|---|
| PWS4 | 6.5 | 5.09 | 7.99 | 7.99 | 7.99 | 4 | 10.00 | 5.17 | **8.13** |

**100-Year Sidewalk Overtopping Analysis**

| $Q_{100}$ (cfs) | # of cells | Design Length (ft) | 100-Year Ponding Depth - Weir Eqn (in) | 100-Year Ponding Depth - Orifice Eqn (in) | Controlling 100-Year Ponding Depth (in) | Sidewalk Overtopping? | Qovertop (cfs) |
|---|---|---|---|---|---|---|---|
| 10.4 | 4 | 10.00 | 7.07 | 4.91 | 7.07 | YES | 2.27 |

| | | |
|---|---|---|
| **Nyloplast Area Inlet on Sump** | RICK Job #: | T22.061 |
| **The Gateway at Vistoso Preserve** | Designed by: | AJH |
| | Date: | 7/19/2024 |

**ADS Nyloplast**

**References:**

(1)The Simons, Li & Associates, inc., Standards Manual for Drainage Design and Floodplain Management (SMDDFM) in Tucson , AZ, December 1989 (Revised July 1998).

**Equations**

1. Weir equation for grate inlet: $Q=C_wPd^{1.5}$ Eqn. 10.10 of SMDDFM

2. Orifice equation for grate inlet: $Q=C_oA_gd^{0.5}$ Eqn. 10.11 of SMDDFM

Where:

Q = Rate of Discharge into the grate opening (cfs)

$C_w$ = Weir coefficient

P = Perimeter of grate opening, disregarding bars (ft)

d = depth of water at the grate (ft)

$C_o$ = Orifice coefficient

$A_g$ = Clear opening area of the grate ($ft^2$)

d = depth of ponded water above the top of grate (ft)

| Input Variables | | Design Notes |
|---|---|---|
| Inlet Type = | **8" Dome** | |
| Area of single grate, $ft^2$ = | 0.21 | (1) Area and Perimeter per manufacturers recommendations |
| Perimeter of single grate, ft = | 2.09 | (2) Yi is assmumed to be max ponding without sidewalk overtopping |
| *Clogging Factor = | 50% | during a 10-year storm event |
| Weir Coefficient = | 3.00 | (3) 100-year max ponding deth allows for sidewalk overtopping |
| Orifice Coefficient = | 5.35 | (4) Maximum allowable ponding depth, in feet, is summarized as follows: |
| 10-yr Controlling Ponding Depth (ft) = | 0.50 | |
| Depth at Lip of curb Inlet, Yi (ft) = | 0.50 | |
| Effective Head of orifice, Yo (ft)= | 0.25 | |

| 10-year | 100-year** |
|---|---|
| 0.50 | 0.80 |

**10-Year Design Summary**

| Watershed ID | $Q_{10}$ (cfs) | # of Dome grates | Total Perimeter (ft) | Total Grate Opening Area ($ft^2$) | 10-Yr Ponding Depth - Weir Eqn (ft) | 10-Yr Ponding Depth - Orifice Eqn (ft) | Controlling Ponding Depth (ft) | Grate Capacity without Clogging (cfs) | Controlling Flow Type |
|---|---|---|---|---|---|---|---|---|---|
| PWS1 | 8.10 | 13.00 | 27.17 | 2.73 | 0.43 | 0.31 | 0.43 | 28.82 | Weir Flow |

**100-Year Design Check**

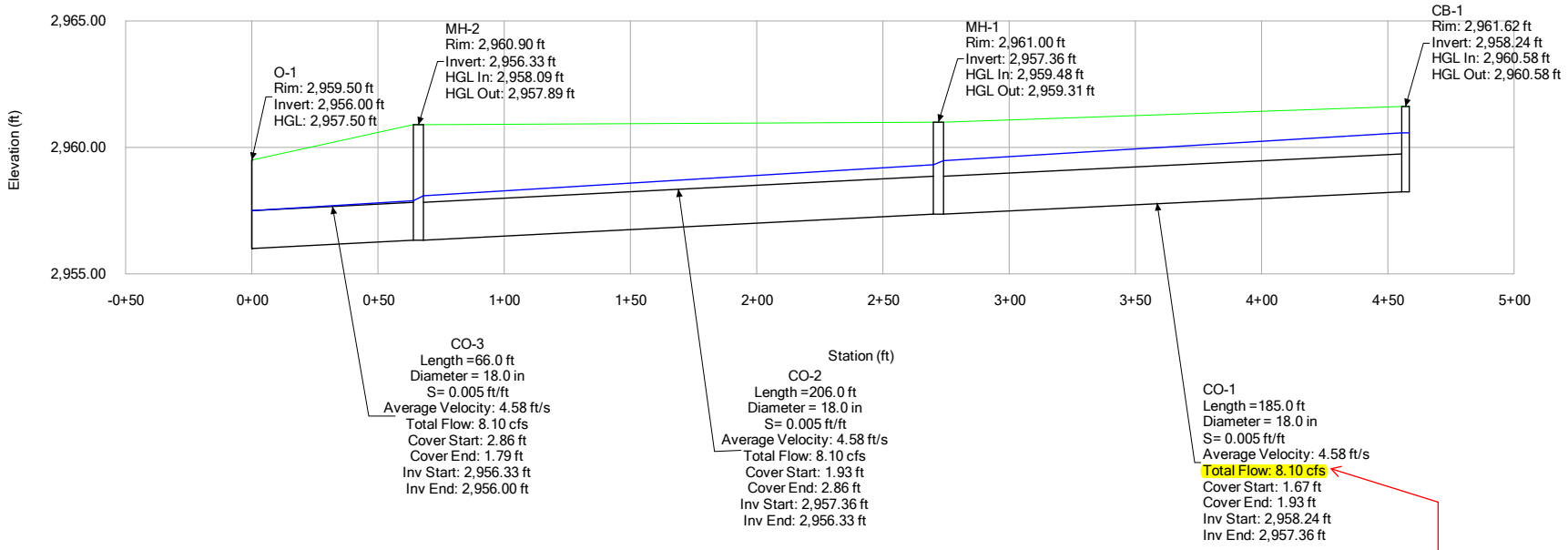
| Watershed ID | $Q_{100}$ (cfs) | # of Dome grates | Total Perimeter (ft) | Total Grate Opening Area ($ft^2$) | 100-Yr Ponding Depth - Weir Eqn (ft) | 100-Yr Ponding Depth - Orifice Eqn (ft) | Controlling Ponding Depth (ft) | Grate Capacity without Clogging (cfs) | Controlling Flow Type |
|---|---|---|---|---|---|---|---|---|---|
| PWS1 | 12.90 | 13.00 | 27.17 | 2.73 | 0.69 | 0.78 | 0.78 | 13.06 | Orifice Flow |

**Footnote:**

* Clogging factor applied per section 10.6.9 of SMDDFM Manual

** The 100-year ponding depth is assumed to be minimum grade difference between dome grate elevation and adjacent sidewalk elevation

# Profile Report
# Engineering Profile - CB-1 to O-1 (StormDrain Modeling -Revised.stsw)
# Active Scenario: 10-Year




Total inflow from PWS1 as inflow from PWS8 is 0 cfs during a 10-year storm event. See Appendix D for more information

# FlexTable: Conduit Table

## Active Scenario: 10-Year

| Label | Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (Scaled) (ft) | Slope (Calculated) (ft/ft) | Diameter (in) | Manning's n | Flow (cfs) | Velocity (ft/s) | Capacity (Full Flow) (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO-1 | CB-1 | MH-1 | 2,958.24 | 2,957.36 | 166.7 | 0.005 | 18.0 | 0.013 | 8.10 | 4.58 | 7.24 |
| CO-2 | MH-1 | MH-2 | 2,957.36 | 2,956.33 | 183.6 | 0.005 | 18.0 | 0.013 | 8.10 | 4.58 | 7.43 |
| CO-3 | MH-2 | O-1 | 2,956.33 | 2,956.00 | 142.6 | 0.005 | 18.0 | 0.013 | 8.10 | 4.58 | 7.43 |

# FlexTable: Manhole Table

## Active Scenario: 10-Year

| ID | Label | Elevation (Rim) (ft) | Elevation (Invert in 1) (ft) | Elevation (Invert Out) (ft) | Flow (Total Out) (cfs) | Hydraulic Grade Line (Out) (ft) | Hydraulic Grade Line (In) (ft) |
|---|---|---|---|---|---|---|---|
| 77 | MH-1 | 2,961.00 | 2,957.36 | 2,957.36 | 8.10 | 2,959.31 | 2,959.48 |
| 94 | MH-2 | 2,960.90 | 2,956.33 | 2,956.33 | 8.10 | 2,957.89 | 2,958.09 |

# FlexTable: Catch Basin Table

## Active Scenario: 10-Year

| ID | Label | Elevation (Rim) (ft) | Elevation (Invert) (ft) | Hydraulic Grade Line (In) (ft) |
|---|---|---|---|---|
| 73 | CB-1 | 2,961.62 | 2,958.24 | 2,960.58 |

# FlexTable: Outfall Table

## Active Scenario: 10-Year

| ID | Label | Elevation (Invert) (ft) | Boundary Condition Type | Hydraulic Grade (ft) | Flow (Total Out) (cfs) |
|---|---|---|---|---|---|
| 80 | O-1 | 2,956.00 | Crown | 2,957.50 | 8.10 |

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| | | |
|---|---|---|
| **Freeboard Calculations (Unnamed Wash)** | Job #: | T22.061 |
| | Designed by: | AJH |
| **The Gateway at Vistoso Preserve** | Date: | 12/19/2024 |

**References:** (1) Standard Manual For Drainage design and Floodplain Management in Tucson (SMDDFM), AZ, 1998

$$FB = 1/6 \left( Y_{max} + \frac{V^2}{2g} \right)$$

Eqn 8.4 (Ref. 1)

Where:

$FB$ = Freeboard, in feet;
$Y_{max}$ = Maximum depth of flow, in feet;
$V$ = Average velocity of flow, in feet per second; and,
$g$ = Acceleration due to gravity = 32.2 ft/sec$^2$.

| River Sta | $Q_{100}$ (cfs) | Min. Ch El (ft) | Prop. WSEL (ft) | $Y_{max}$ (ft) | Average Velocity (ft/s) | Calculated Freeboard [1] (ft) | Min. TOB [2] (ft) |
|---|---|---|---|---|---|---|---|
| 1628.16 | 1,040 | 2959.77 | 2962.91 | 3.14 | 6.16 | 0.62 | 2963.9 |
| 1589 | 1,040 | 2958.72 | 2962.19 | 3.47 | 8.16 | 0.75 | 2963.2 |
| 1528.16 | 1,040 | 2957.78 | 2961.71 | 3.93 | 5.55 | 0.73 | 2962.7 |
| 1503.25 | 1,040 | 2957.25 | 2961.01 | 3.76 | 7.82 | 0.78 | 2962.0 |
| 1471.73 | 1,040 | 2957.03 | 2960.16 | 3.13 | 6.59 | 0.63 | 2961.2 |
| 1466.73 | 1,040 | 2956.99 | 2960.13 | 3.14 | 6.61 | 0.64 | 2961.1 |
| 1462.77 | 1,040 | 2955.81 | 2960.34 | 4.53 | 4.88 | 0.82 | 2961.3 |
| 1457.77 | 1,040 | 2955.64 | 2960.38 | 4.74 | 4.46 | 0.84 | 2961.4 |
| 1438 | 1,040 | 2955.47 | 2960.3 | 4.83 | 4.91 | 0.87 | 2961.3 |
| 1377.45 | 1,040 | 2955.00 | 2958.9 | 3.90 | 9.90 | 0.90 | 2959.9 |
| 1330 | 1,040 | 2954.62 | 2958.49 | 3.87 | 9.95 | 0.90 | 2959.5 |
| 1318.23 | 1,040 | 2954.53 | 2958.39 | 3.86 | 9.97 | 0.90 | 2959.4 |
| 1313.23 | 1,040 | 2954.48 | 2958.33 | 3.85 | 9.95 | 0.90 | 2959.3 |
| 1310.23 | 1,040 | 2953.48 | 2957.36 | 3.88 | 10.01 | 0.91 | 2958.4 |
| 1305.23 | 1,040 | 2953.44 | 2957.3 | 3.86 | 9.96 | 0.90 | 2958.3 |
| 1250 | 1,040 | 2952.88 | 2956.76 | 3.88 | 9.96 | 0.90 | 2957.8 |
| 1192.09 | 1,040 | 2952.43 | 2956.41 | 3.98 | 9.57 | 0.90 | 2957.4 |
| 1160.22 | 1,040 | 2952.16 | 2956.64 | 4.48 | 7.94 | 0.91 | 2957.6 |
| 1155.23 | 1,040 | 2952.12 | 2956.05 | 3.93 | 9.68 | 0.90 | 2957.1 |
| 1152.23 | 1,040 | 2951.12 | 2954.98 | 3.86 | 10.04 | 0.90 | 2956.0 |
| 1147.23 | 1,040 | 2951.06 | 2954.93 | 3.87 | 9.98 | 0.90 | 2955.9 |
| 1130.21 | 1,040 | 2950.94 | 2954.83 | 3.89 | 9.79 | 0.90 | 2955.8 |
| 1105.54 | 1,040 | 2950.72 | 2954.58 | 3.86 | 10.05 | 0.90 | 2955.6 |

**Footnotes**

[1] Required minimum freeboard calculated using equation 8.4 of Reference 1.

[2] Min. finished grade of the proposed perimeter wall and top of bank.

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| | | |
|---|---|---|
| **Diversion Channel Equilibrium Slope & Grade Control Structure Spacing** | RICK Job #: | T22.061 |
| | Designed by: | AJH |
| **The Gateway at Vistoso Preserve** | Date: | 12/19/2024 |

## 1. Equilibrium Slope Calculation

### References:

(1)Town of Oro Valley Drainage Criteria Manual, 2020 Edition

(2) City of Tucson, Standards Manual for Drainage Design and Floodplain Management, Tucson, AZ, Revised July 1998

$$S_{eq} = \left(\left[\frac{Q_{Pu,10\%}}{Q_{Pn,10\%}}\right]^{-1.1}[1 - R_s]^{0.7}\right)S_n$$ Eqn 5.34 (Ref. 1)

Where: $S_{eq}$ = Equilibrium Slope (ft/ft)

$Q_{pu,10}$= Post-development 10-year discharge (cfs)

$Q_{pn,10}$= Pre-development 10-year discharge (cfs)

$R_s$ = Reduction factor for upstream sediment supply

$S_n$ = Natural or existing channel slope (ft/ft)

### Calculation Assumptions and Notes

1. The value of Rs is estimated based on preliminary review of upstream watershed characteristics (i.e., VLDR)
2. Natural channel slope, Sn, is an average slope between XS 1638.03 to XS 1100.

| Watercourse Name | $Q_{u,10}$ (cfs) [1] | $Q_{n,10}$ (cfs) [1] | $R_s$ | $S_n$ (ft/ft) | Design Slope (ft/ft) | $S_{eq}$ (ft/ft) |
|---|---|---|---|---|---|---|
| Unnamed Wash (XS: 1471.73 - 1105.54) | 416 | 416 | 0.15 | 0.0118 | 0.0165 | **0.0105** |

### Footnotes

[1] Calculated 10-year peak discharge rates for suburban watershed from 100-Year using ratios listed in Table 3-5 of Ref 1 .

### Conclusion

Since $S_{eq}$ is less than both average existing and design channel slopes, the Wash trends towards degradation more than aggradation. Therefore, grade control structures are required.

## 2. Evaluation of Grade Control Structure Spacing

$$L_r = \frac{H}{S_{ib} - S_{eq}}$$ *(Equation 5.30)*

Where,

| | | |
|---|---|---|
| $L_r$ | = | Reach length, or spacing, between adjacent grade-control strictures, in feet. |
| $H$ | = | Drop height downstream of the peak grade-control structure, in feet. |
| $S_{ib}$ | = | Initial channel bed slope, in feet per foot. |
| $S_{eq}$ | = | Channelized equilibrium bed slope, in feet per foot. |

*a) Evaluate total potential channel bed drop between the bounding cross-sections*

| | | |
|---|---|---|
| Seq (ft/ft) = | 0.0105 | |
| Design Slope (ft/ft) = | 0.0165 | |
| Total reach length (ft) = | 366 | |
| Total potential bed drop (ft) = | 2.2 | |
| *b) Determine GCS spacing* | | |
| Design drop height (ft) = | 1.0 | |
| GCS spacing (lf) | 168 | (based on Eqn. 5.3 of TOV DCM) |
| No. of GCS = | 3 | |

*c) Determine Proposed Depth of the GCS*

$$If \frac{h}{Y_1} < 1.0 \qquad Z_{LD} = 0.581 q_{P1\%}^{0.667} \left(\frac{h}{Y_{1\%}}\right)^{0.411} \left[1 - \left(\frac{h}{Y_{1\%}}\right)\right]^{-0.118} \qquad \textit{(Equation 5.24)}$$

Where,

| | | |
|---|---|---|
| $Z_{LD}$ | = | Local Scour contribution from a flow drop (i.e., a drop structure, such as a grade control) measured from thalweg downstream of control-point, in feet. |
| $H_T$ | = | Total drop in head (measured as the difference between upstream and downstream energy grade lines), in feet (normally, use the difference in WSELs, $Y_{1\%}$ - $TW$). |
| $Y_{1\%}$ | = | Upstream depth of flow during a 1% AEP flood, in feet. |
| $F_{ru}$ | = | Upstream Froude number, dimensionless. |
| $h$ | = | Exposed height on downstream side of drop structure, in feet. |
| $TW$ | = | Tailwater depth (downstream depth of flow) during a 1% AEP flood, in feet. |

Place the downstream GCS at station 11+55.23. Place additional GCS at the following station and maintain drop height and GCS total depth as specified below. The recommended GCS height, per table below, is 6'

| GCS ID | Sta | Drop height, h (ft) | UP HEC-RAS XS | Flow depth, Y (ft) | q100(cfs/ft) | Local Scour, Zld (ft) | GCS depth (ft) |
|---|---|---|---|---|---|---|---|
| 1 | 14+66.73 | 1.32 | 1466.73 | 3.14 | 52 | 6.1 | 7.4 |
| 2 | 13+13.23 | 1 | 1313.23 | 3.85 | 52 | 4.8 | 5.8 |
| 3 | 11+55.23 | 1 | 1155.23 | 3.93 | 52 | 4.8 | 5.8 |

*d) Extent of scour hole downstream of GCS*

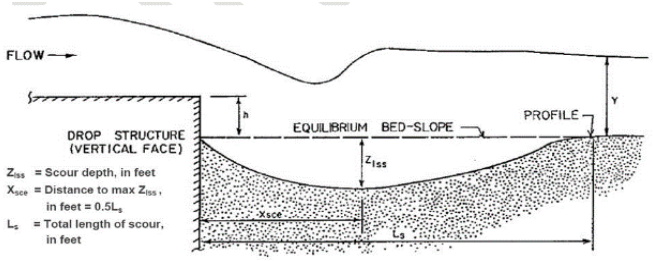


**Figure 5-2. Profile Characteristics of Scour Hole Downstream of a Drop Structure**

| GCS ID | Sta | Scour Length, Ls [(1)] (ft) | Xsce (ft) |
|---|---|---|---|
| 1 | 14+66.73 | 73 | 37 |
| 2 | 13+13.23 | 58 | 29 |
| 3 | 11+55.23 | 58 | 29 |

[(1)] Total length of the scour hole, Ls is computed using eqn. 6.16 of Ref. 2

**Conclusion:**

Provide bank protection toe-down downstream of the above proposed GCS and extend the toe-down depth a distance of Xsce above. Taper the toe-down back to the computed scour depth within a total distance of Ls above.

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| | |
|---|---|
| RICK Job #: | T22.061 |
| Designed by: | AJH |
| Date: | 12/19/2024 |

**Wash Bed Material Sediment Transport and Long-term Degradation**

The Gateway at Vistoso Preserve

**References:**

1. Town of Oro Valley Drainage Criteria Manual, 2020 Edition

$$Q_{sp} = 0.1453(S_c^{0.885} Q_{pe}^{1.44}) W_e^{-0.44}$$

**(Zeller, 2019)**
Equ. 5.41, of ToV's DCM,

$Q_{sp}$ = Bed-material sediment-transport rate (unbulked), in cfs, at the flood-peak discharge
$S_c$ = Channel slope, in ft./ft.
$Q_{pe}$ = Effective flood-peak discharge, in cfs (may include overbank flows, where applicable)
$W_e$ = Effective flow width at peak, in feet (may include overbank flow, where applicable)

**Diversion Channel Section of Unnamed Wash**

| HEC-RAS Sta | | Existing Conditions | | | | Proposed Conditions | | | | Comparison [Prop-Ex] |
|---|---|---|---|---|---|---|---|---|---|---|
| Prop Cond | Ex Cond | $S_c$ (ft/ft) | $Q_{pe}$ (cfs) | $W_e$ (ft) | $Q_{sp}$ (cfs) | $S_c$ (ft/ft)* | $Q_{pe}$ (cfs) | $W_e$ (ft) | $Q_{sp}$ (cfs) | $Q_{sp}$ (cfs) |
| 1377.45 | 1400.00 | 0.0168 | 1,040 | 193.30 | 8.517 | 0.0088 | 1,040 | 141.16 | 5.518 | -2.999 |
| 1250.00 | 1322.63 | 0.01 | 1,040 | 135.00 | 6.318 | 0.008 | 1,040 | 118.59 | 5.476 | -0.843 |
| 1105.54 | 1100.00 | 0.0095 | 1,040 | 160.62 | 5.603 | 0.0086 | 1,040 | 116.22 | 5.890 | 0.287 |

*maximum proposed channel slope along the wash with the proposed grade control structures

Average Qsp in proposed conditions (cfs) = 5.63
Average Qsp in existing conditions (cfs) = 6.81
Average Qsp increase (cfs) = -1.18

**Conclusion:**

The existing sediment transport rate is more than post-project sediment transport rate.
Therefore, long-term degradation of wash bed is anticipated to occur and there's no anticipated sediment transport issues.

**Long-term Degradation**

Assuming time taken to achieve the stable slope is less than the design life of the project (typical),
long-term degradation or scour depth is computed per equation 5.31 in ToV DCM, 2020 Edition

$$Z_{LTD} = \frac{8}{13}(S_n - S_{eq})L_{dc} \qquad \textit{(Equation 5.31)}$$

Where:
$Z_{ltd}$ = Long-term degradation, in feet
$S_n$ = natural or existing channel slope (ft/ft)
$S_{eq}$ = equlibrium slope (ft)
$L_{dc}$ = Estimated distance to downstream controls (ft)

| | |
|---|---|
| Seq (ft/ft) | 0.0105 |
| Sn (ft/ft) | 0.0118 |
| Ldc (ft) | 156 (based on max distance between the proposed GCS) |
| Zltd (ft) | 0.1218 |

**Conclusion:**

The computed anticipated long-term degradation is less than the desgin maximum long-term wash bed degration of 1 foot at the downstream side of Grade Control Structres (GCS), therefore, no sediment transport issues is anticipated. The long-term bed degradation is not accelerated compared to existing conditions.

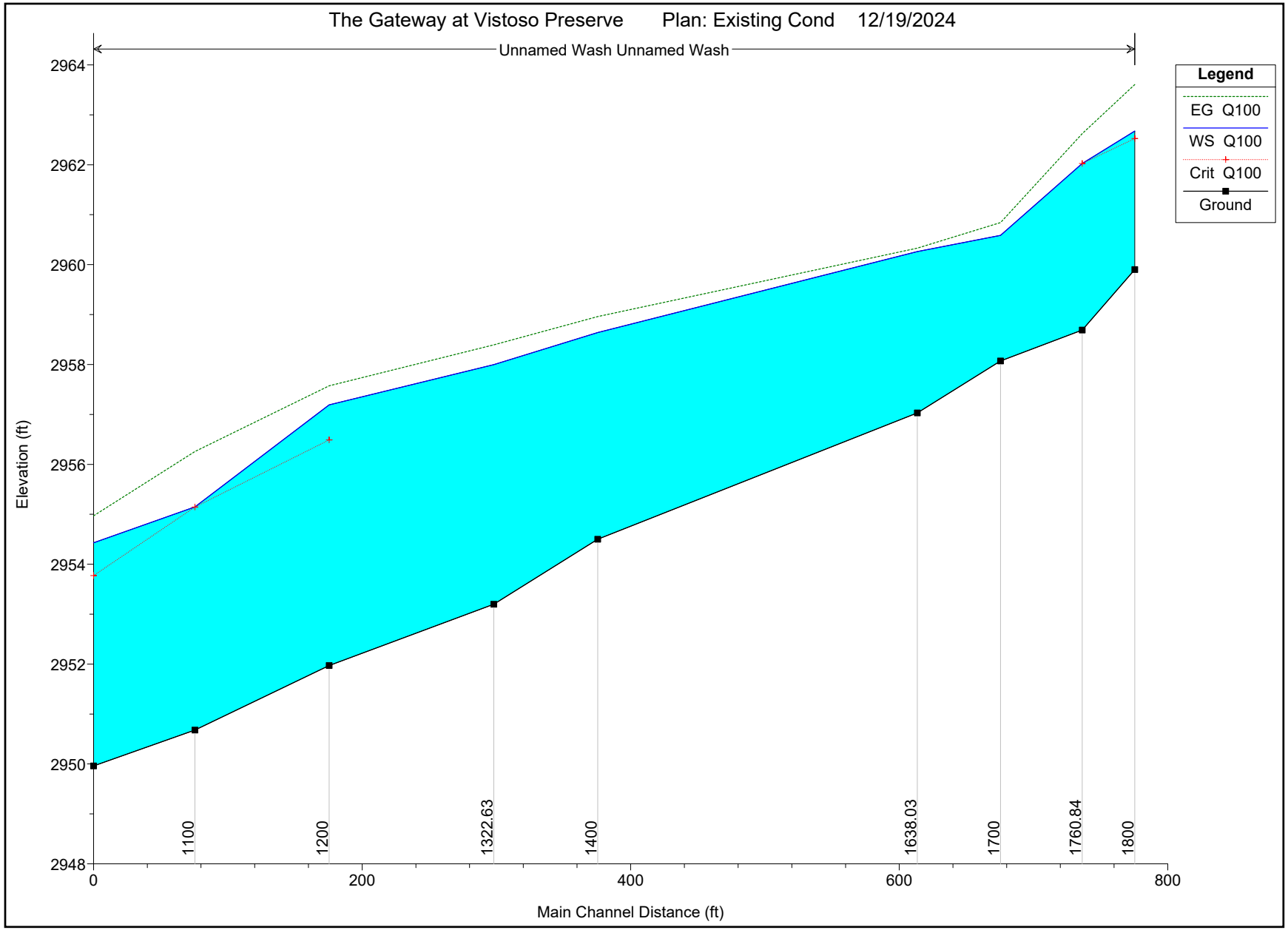
# Manning's n Values

Reference tables for Manning's n values for Channels, Closed Conduits Flowing Partially Full, and Corrugated Metal Pipes.

## Manning's n for Channels (Chow, 1959).

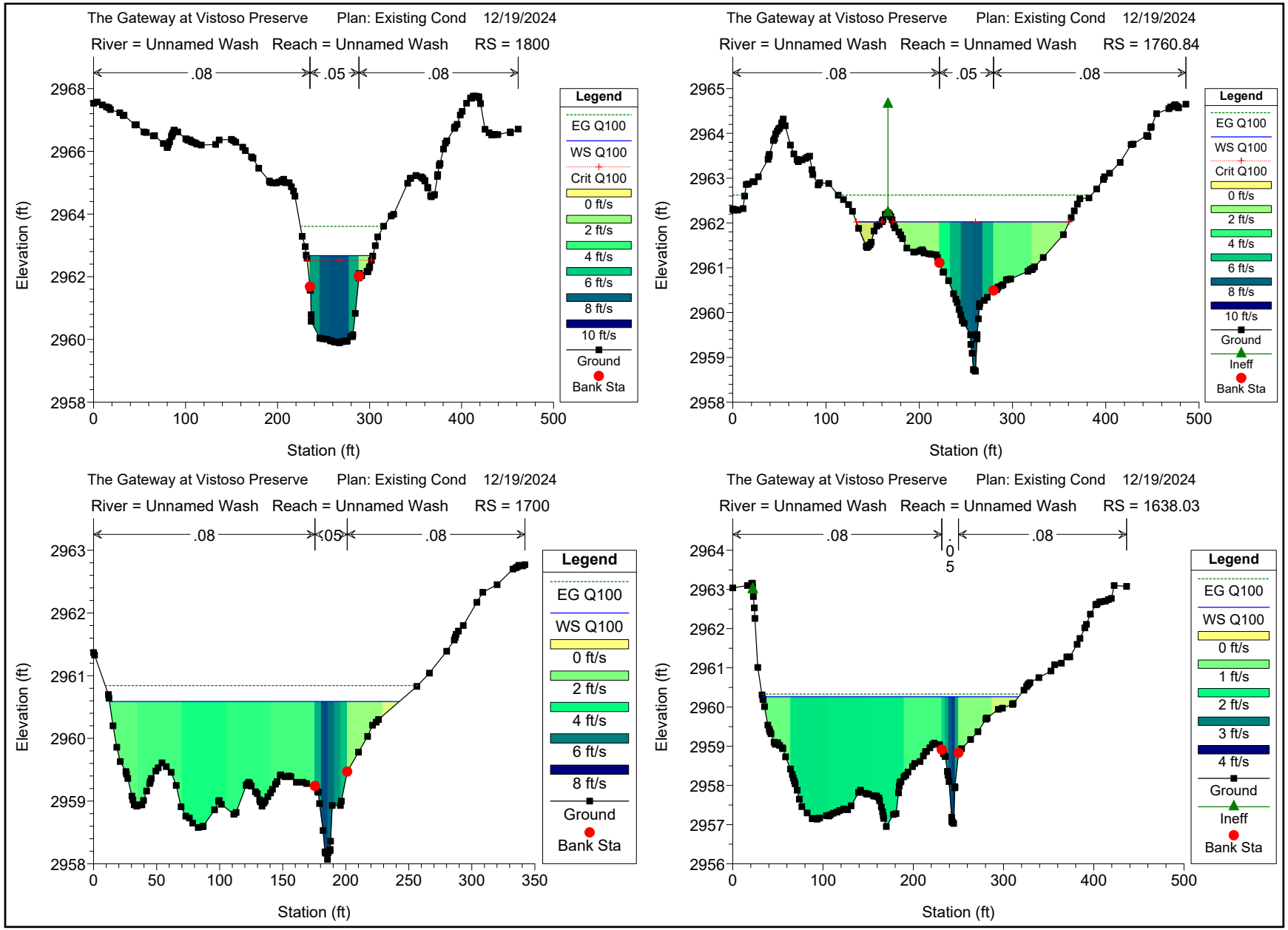
| Type of Channel and Description | Minimum | Normal | Maximum | |
|---|---|---|---|---|
| Natural streams - minor streams (top width at floodstage < 100 ft) | | | | |
| **1. Main Channels** | | | | |
| a. clean, straight, full stage, no rifts or deep pools | 0.025 | 0.03 | 0.033 | |
| b. same as above, but more stones and weeds | 0.03 | 0.035 | 0.04 | |
| c. clean, winding, some pools and shoals | 0.033 | 0.04 | 0.045 | |
| d. same as above, but some weeds and stones | 0.035 | 0.045 | 0.05 | => Existing Main Channel |
| e. same as above, lower stages, more ineffective slopes and sections | 0.04 | 0.048 | 0.055 | |
| f. same as "d" with more stones | 0.045 | 0.05 | 0.06 | |
| g. sluggish reaches, weedy, deep pools | 0.05 | 0.07 | 0.08 | |
| h. very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush | 0.075 | 0.1 | 0.15 | |
| **2. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged a high stages** | | | | |
| a. bottom: gravels, cobbles, and few boulders | 0.03 | 0.04 | 0.05 | |
| b. bottom: cobbles with large boulders | 0.04 | 0.05 | 0.07 | |
| **3. Floodplains** | | | | |
| a. Pasture, no brush | | | | |
| 1.short grass | 0.025 | 0.03 | 0.035 | |
| 2. high grass | 0.03 | 0.035 | 0.05 | |
| b. Cultivated areas | | | | |
| 1. no crop | 0.02 | 0.03 | 0.04 | |
| 2. mature row crops | 0.025 | 0.035 | 0.045 | |
| 3. mature field crops | 0.03 | 0.04 | 0.05 | |
| c. Brush | | | | |
| 1. scattered brush, heavy weeds | 0.035 | 0.05 | 0.07 | |
| 2. light brush and trees, in winter | 0.035 | 0.05 | 0.06 | |
| 3. light brush and trees, in summer | 0.04 | 0.06 | 0.08 | => Existing Right & Left banks |
| 4. medium to dense brush, in winter | 0.045 | 0.07 | 0.11 | |
| 5. medium to dense brush, in summer | 0.07 | 0.1 | 0.16 | |
| d. Trees | | | | |
| 1. dense willows, summer, straight | 0.11 | 0.15 | 0.2 | |
| 2. cleared land with tree stumps, no sprouts | 0.03 | 0.04 | 0.05 | |
| 3. same as above, but with heavy growth of sprouts | 0.05 | 0.06 | 0.08 | |
| 4. heavy stand of timber, a few down trees, little undergrowth, flood stage below branches | 0.08 | 0.1 | 0.12 | |
| 5. same as 4. with flood stage reaching branches | 0.1 | 0.12 | 0.16 | |
| **4. Excavated or Dredged Channels** | | | | |
| a. Earth, straight, and uniform | | | | |
| 1. clean, recently completed | 0.016 | 0.018 | 0.02 | |
| 2. clean, after weathering | 0.018 | 0.022 | 0.025 | |
| 3. gravel, uniform section, clean | 0.022 | 0.025 | 0.03 | |
| 4. with short grass, few weeds | 0.022 | 0.027 | 0.033 | |
| b. Earth winding and sluggish | | | | |
| 1. no vegetation | 0.023 | 0.025 | 0.03 | |
| 2. grass, some weeds | 0.025 | 0.03 | 0.033 | |
| 3. dense weeds or aquatic plants in deep channels | 0.03 | 0.035 | 0.04 | |
| 4. earth bottom and rubble sides | 0.028 | 0.03 | 0.035 | => Unnamed Wash Prop. Cond Main Channel |
| 5. stony bottom and weedy banks | 0.025 | 0.035 | 0.04 | |
| 6. cobble bottom and clean sides | 0.03 | 0.04 | 0.05 | |
| c. Dragline-excavated or dredged | | | | |
| 1. no vegetation | 0.025 | 0.028 | 0.033 | |
| 2. light brush on banks | 0.035 | 0.05 | 0.06 | |
| d. Rock cuts | | | | |
| 1. smooth and uniform | 0.025 | 0.035 | 0.04 | => Unnamed Wash Prop. Cond Left Bank |
| 2. jagged and irregular | 0.035 | 0.04 | 0.05 | |
| e. Channels not maintained, weeds and brush uncut | | | | |
| 1. dense weeds, high as flow depth | 0.05 | 0.08 | 0.12 | |
| 2. clean bottom, brush on sides | 0.04 | 0.05 | 0.08 | |
| 3. same as above, highest stage of flow | 0.045 | 0.07 | 0.11 | |
| 4. dense brush, high stage | 0.08 | 0.1 | 0.14 | |

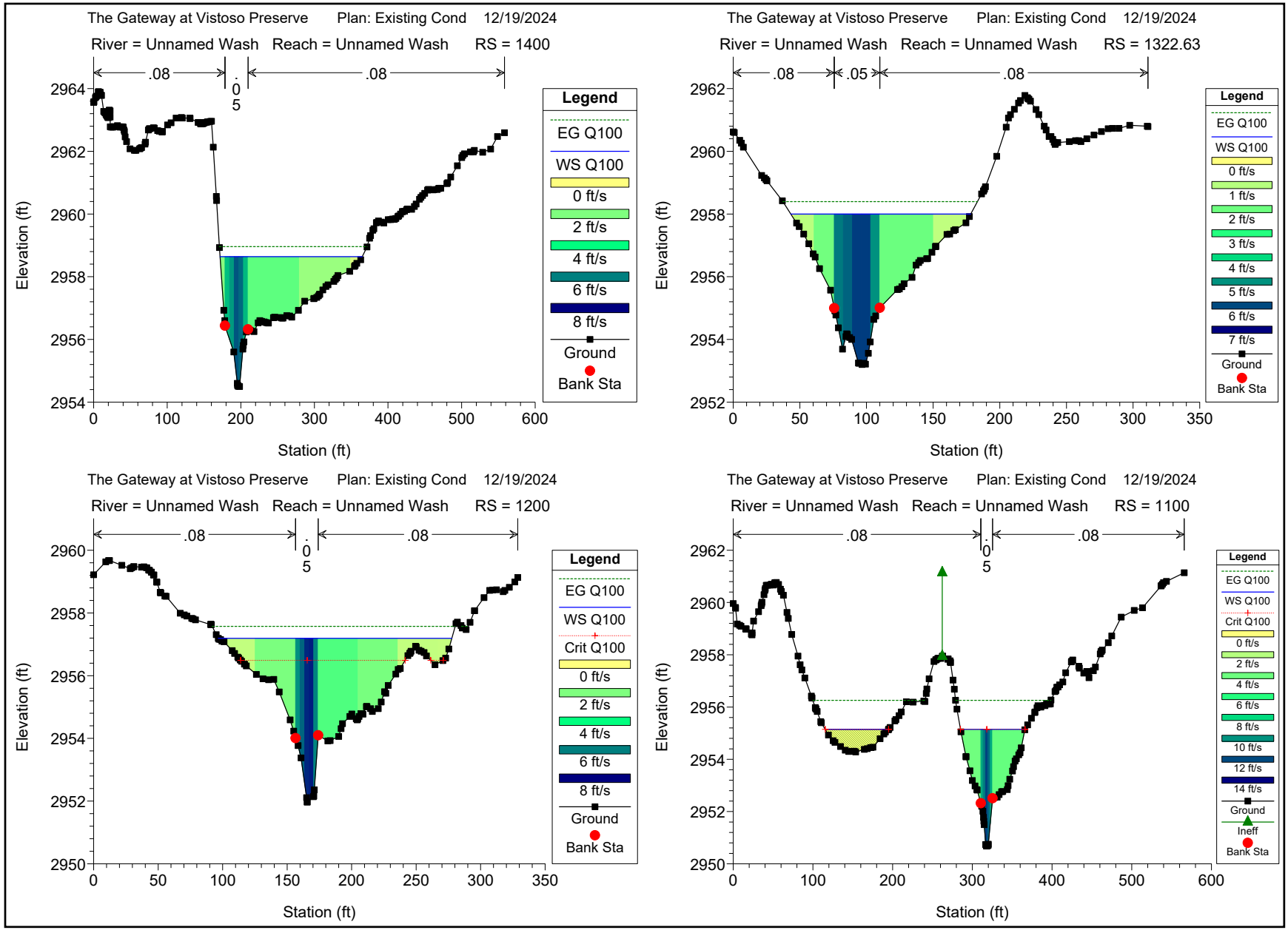
| **5. Lined or Constructed Channels** | | | |
|---|---|---|---|
| a. Cement | | | |
| 1. neat surface | 0.01 | 0.011 | 0.013 |
| 2. mortar | 0.011 | 0.013 | 0.015 |
| b. Wood | | | |
| 1. planed, untreated | 0.01 | 0.012 | 0.014 |
| 2. planed, creosoted | 0.011 | 0.012 | 0.015 |
| 3. unplaned | 0.011 | 0.013 | 0.015 |
| 4. plank with battens | 0.012 | 0.015 | 0.018 |
| 5. lined with roofing paper | 0.01 | 0.014 | 0.017 |
| c. Concrete | | | |
| 1. trowel finish | 0.011 | 0.013 | 0.015 |
| 2. float finish | 0.013 | 0.015 | 0.016 |
| 3. finished, with gravel on bottom | 0.015 | 0.017 | 0.02 |
| 4. unfinished | 0.014 | 0.017 | 0.02 |
| 5. gunite, good section | 0.016 | 0.019 | 0.023 |
| 6. gunite, wavy section | 0.018 | 0.022 | 0.025 |
| 7. on good excavated rock | 0.017 | 0.02 | |
| 8. on irregular excavated rock | 0.022 | 0.027 | |
| d. Concrete bottom float finish with sides of: | | | |
| 1. dressed stone in mortar | 0.015 | 0.017 | 0.02 |
| 2. random stone in mortar | 0.017 | 0.02 | 0.024 |
| 3. cement rubble masonry, plastered | 0.016 | 0.02 | 0.024 |
| 4. cement rubble masonry | 0.02 | 0.025 | 0.03 |
| 5. dry rubble or riprap | 0.02 | 0.03 | 0.035 |
| e. Gravel bottom with sides of: | | | |
| 1. formed concrete | 0.017 | 0.02 | 0.025 |
| 2. random stone mortar | 0.02 | 0.023 | 0.026 |
| 3. dry rubble or riprap | 0.023 | 0.033 | 0.036 |
| f. Brick | | | |
| 1. glazed | 0.011 | 0.013 | 0.015 |
| 2. in cement mortar | 0.012 | 0.015 | 0.018 |
| g. Masonry | | | |
| 1. cemented rubble | 0.017 | 0.025 | 0.03 |
| 2. dry rubble | 0.023 | 0.032 | 0.035 |
| h. Dressed ashlar/stone paving | 0.013 | 0.015 | 0.017 |
| i. Asphalt | | | |
| 1. smooth | 0.013 | 0.013 | |
| 2. rough | 0.016 | 0.016 | |
| j. Vegetal lining | 0.03 | | 0.5 |

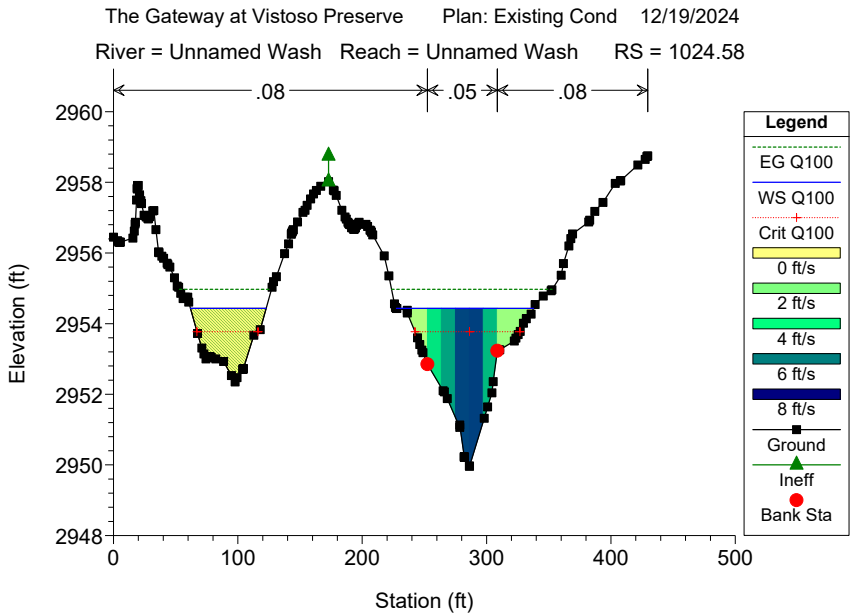

The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
Unnamed Wash Unnamed Wash
Legend
EG Q100
WS Q100
Crit Q100
Ground
Elevation (ft)
2964
2962
2960
2958
2956
2954
2952
2950
2948
0
200
400
600
800
Main Channel Distance (ft)
1100
1200
1322.63
1400
1638.03
1700
1760.84
1800

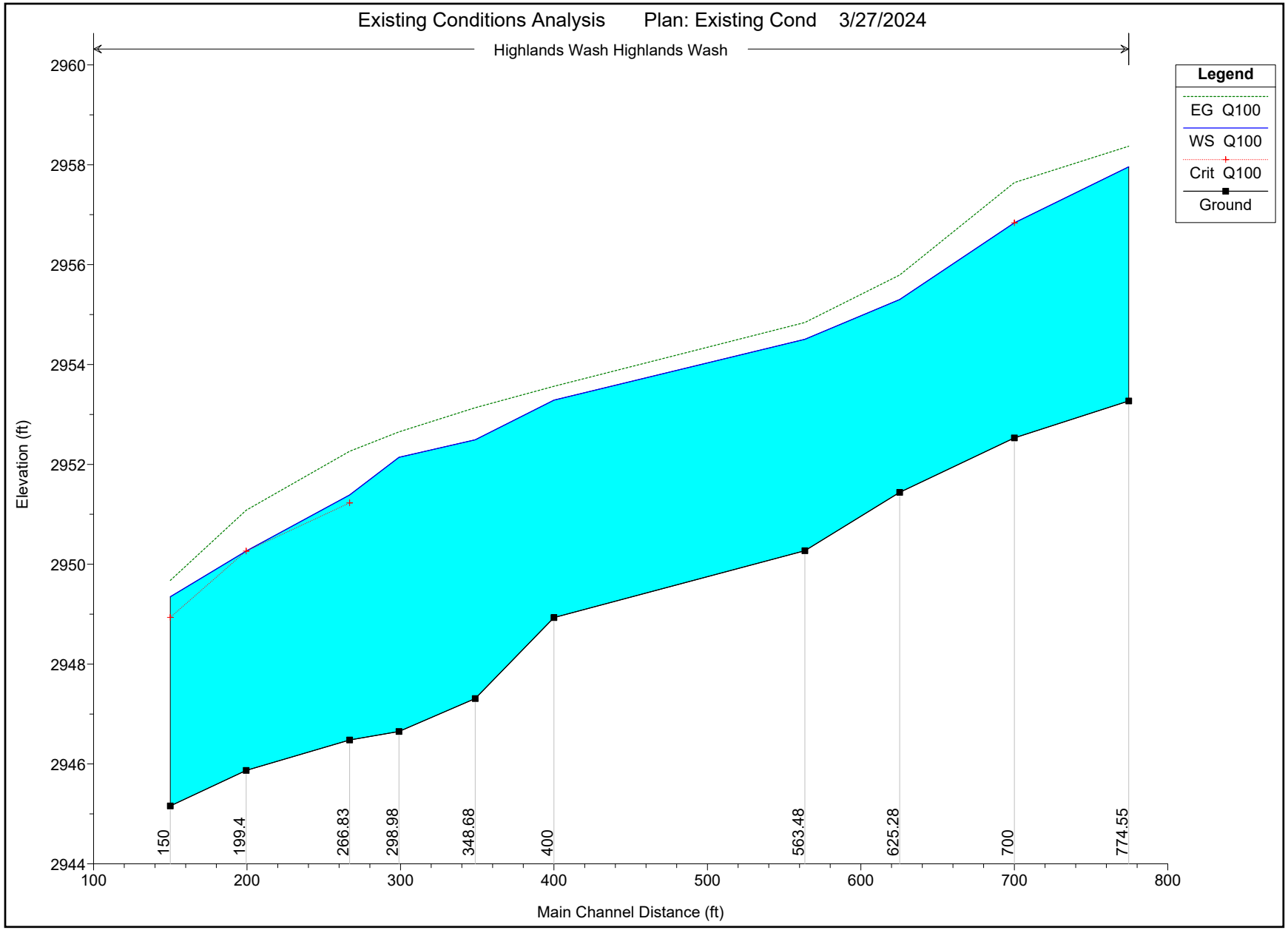
HEC-RAS Plan: Ex. Cond River: Unnamed Wash Reach: Unnamed Wash Profile: Q100

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Unnamed Wash | 1800 | Q100 | 1040.00 | 2959.90 | 2962.67 | 2962.53 | 2963.61 | 0.021165 | 7.79 | 140.44 | 72.24 | 0.87 |
| Unnamed Wash | 1760.84 | Q100 | 1040.00 | 2958.69 | 2962.03 | 2962.03 | 2962.62 | 0.024042 | 7.02 | 214.79 | 216.82 | 0.90 |
| Unnamed Wash | 1700 | Q100 | 1040.00 | 2958.07 | 2960.59 | | 2960.84 | 0.018720 | 5.90 | 296.09 | 229.83 | 0.78 |
| Unnamed Wash | 1638.03 | Q100 | 1040.00 | 2957.03 | 2960.26 | | 2960.33 | 0.003905 | 3.00 | 527.32 | 283.84 | 0.36 |
| Unnamed Wash | 1400 | Q100 | 1040.00 | 2954.50 | 2958.64 | | 2958.96 | 0.009034 | 5.86 | 317.14 | 193.30 | 0.59 |
| Unnamed Wash | 1322.63 | Q100 | 1040.00 | 2953.20 | 2958.00 | | 2958.39 | 0.005887 | 5.72 | 279.22 | 135.00 | 0.50 |
| Unnamed Wash | 1200 | Q100 | 1040.00 | 2951.97 | 2957.19 | 2956.49 | 2957.57 | 0.007584 | 6.71 | 322.02 | 181.10 | 0.57 |
| Unnamed Wash | 1100 | Q100 | 1040.00 | 2950.68 | 2955.15 | 2955.15 | 2956.26 | 0.023980 | 10.71 | 166.72 | 160.62 | 0.98 |
| Unnamed Wash | 1024.58 | Q100 | 1040.00 | 2949.96 | 2954.43 | 2953.77 | 2954.97 | 0.010009 | 6.03 | 199.39 | 171.11 | 0.62 |


The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1800
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1760.84
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Ineff
Bank Sta
The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1700
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1638.03
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Ineff
Bank Sta

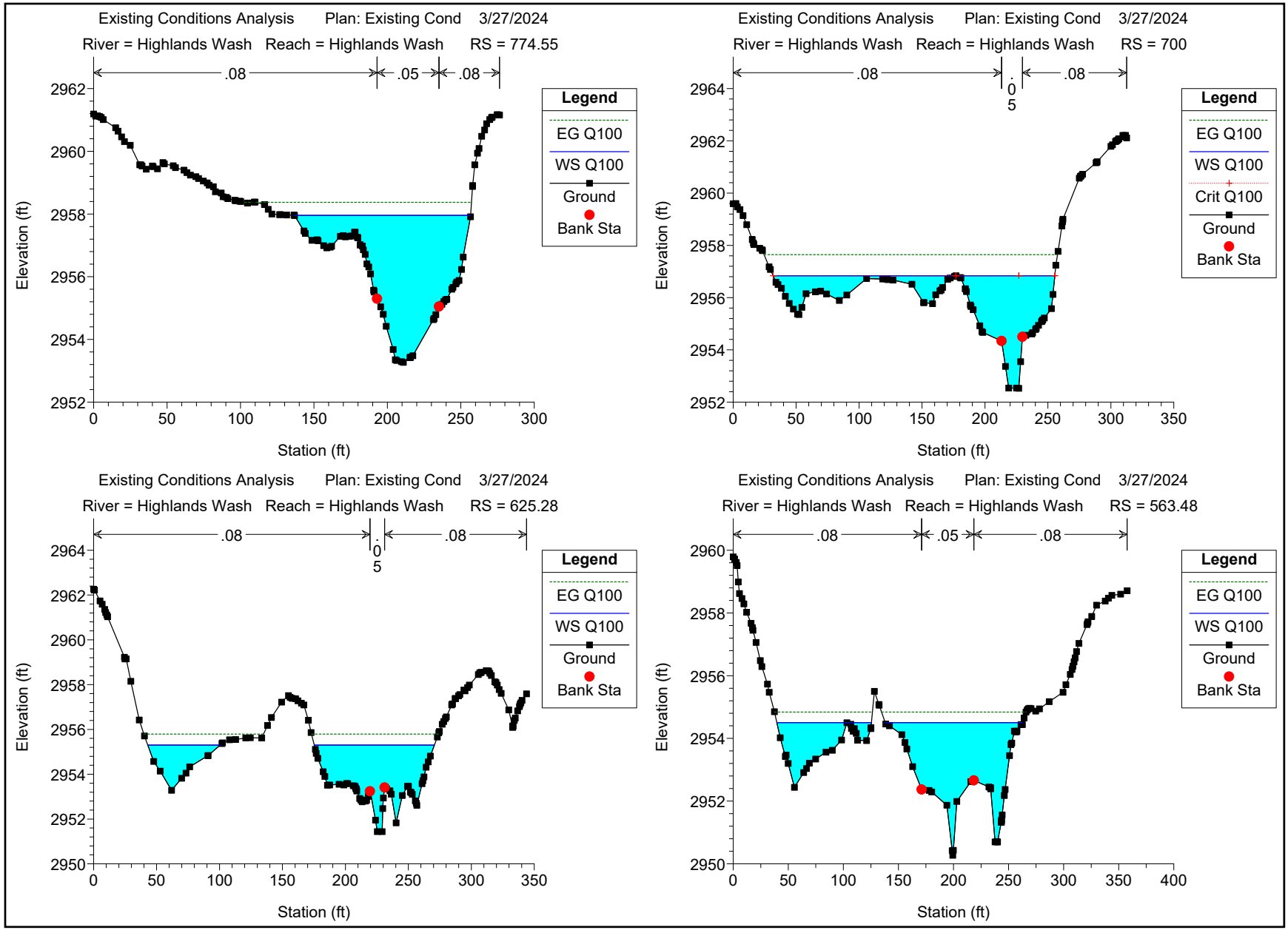

The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1400
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1322.63
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1200
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1100
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
14 ft/s
Ground
Ineff
Bank Sta

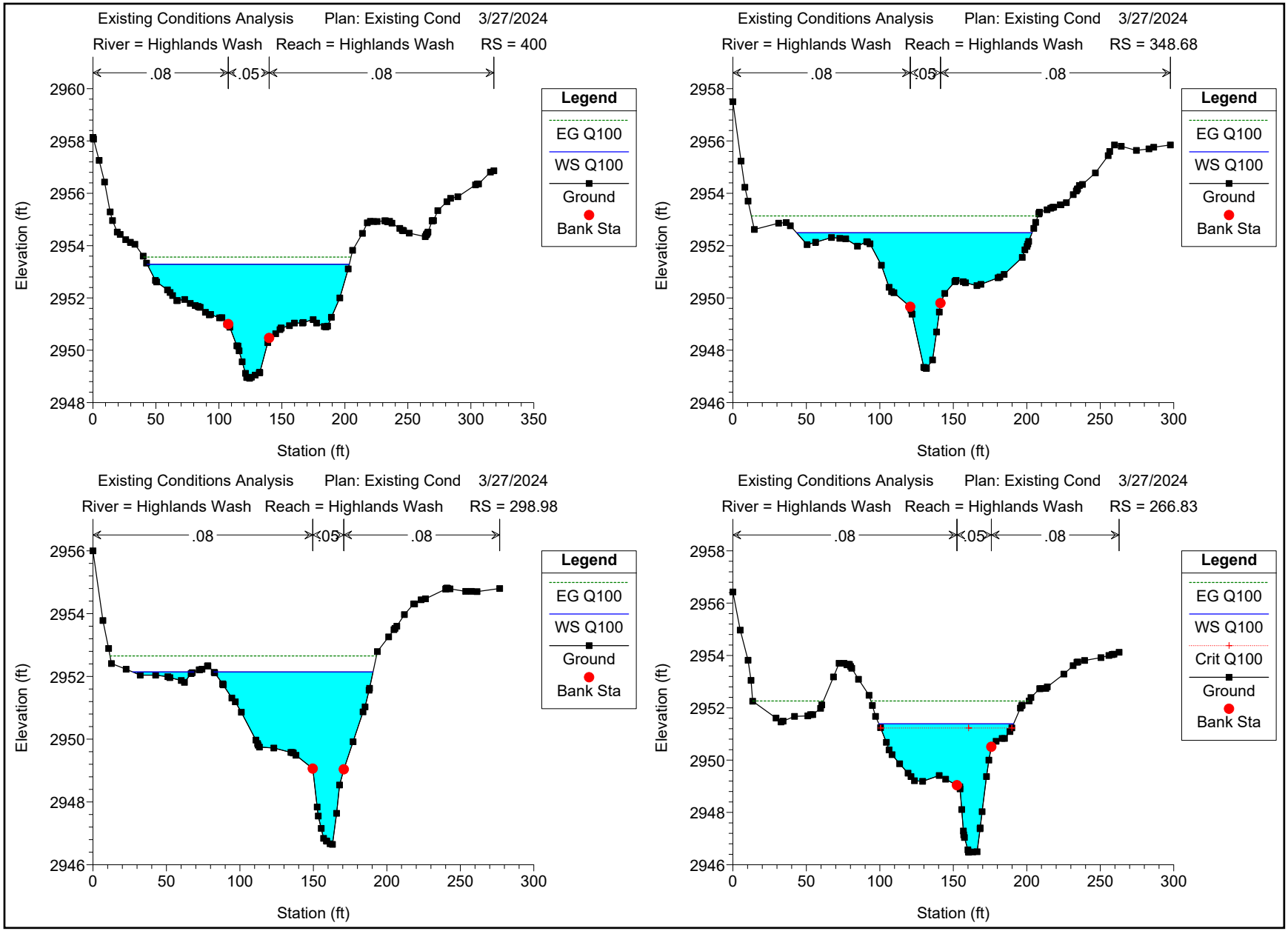

The Gateway at Vistoso Preserve Plan: Existing Cond 12/19/2024
River = Unnamed Wash Reach = Unnamed Wash RS = 1024.58
.08
.05
.08
Elevation (ft)
2960
2958
2956
2954
2952
2950
2948
0
100
200
300
400
500
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Ineff
Bank Sta

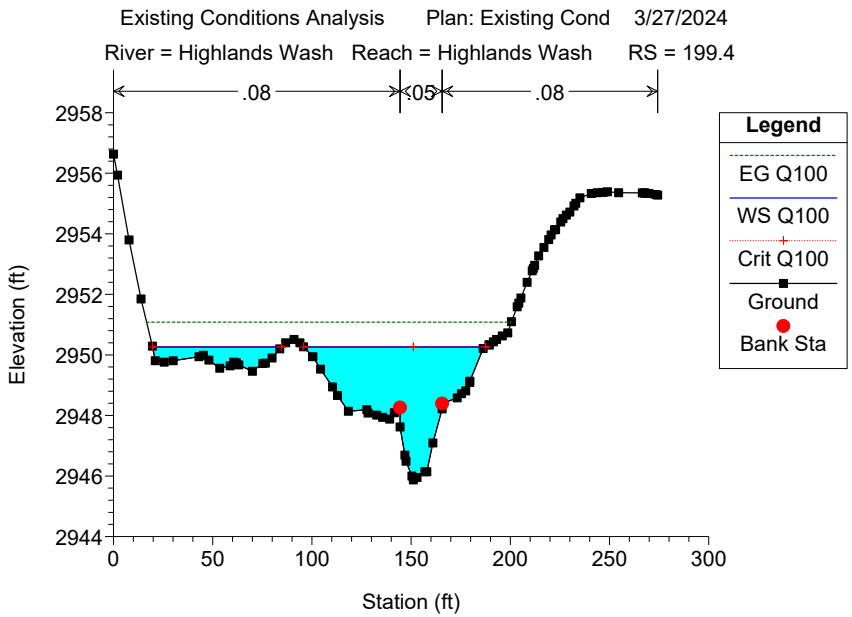

Existing Conditions Analysis Plan: Existing Cond 3/27/2024
Highlands Wash Highlands Wash
Legend
EG Q100
WS Q100
Crit Q100
Ground
Elevation (ft)
2960
2958
2956
2954
2952
2950
2948
2946
2944
100
200
300
400
500
600
700
800
Main Channel Distance (ft)
150
199.4
266.83
298.98
348.68
400
563.48
625.28
700
774.55

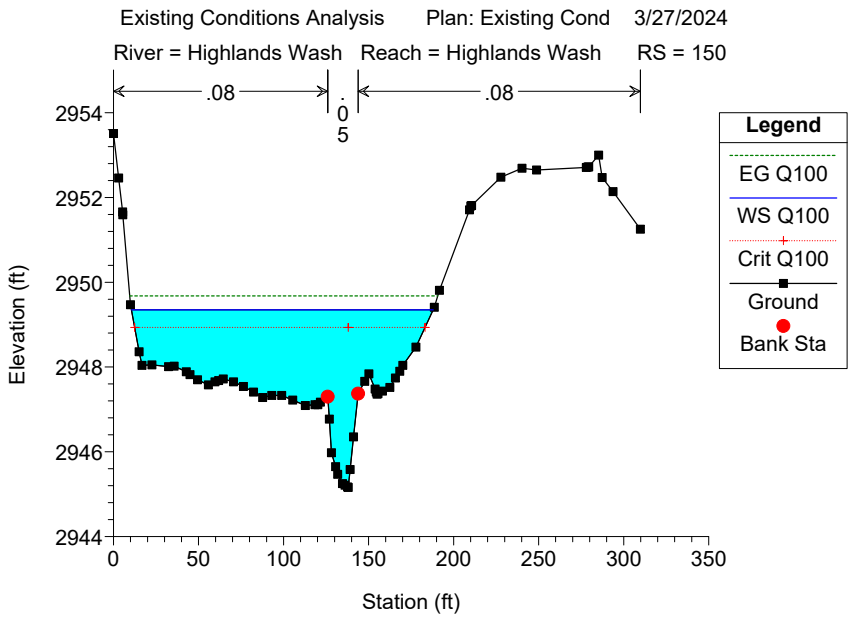
HEC-RAS Plan: Ex. Cond River: Highlands Wash Reach: Highlands Wash Profile: Q100

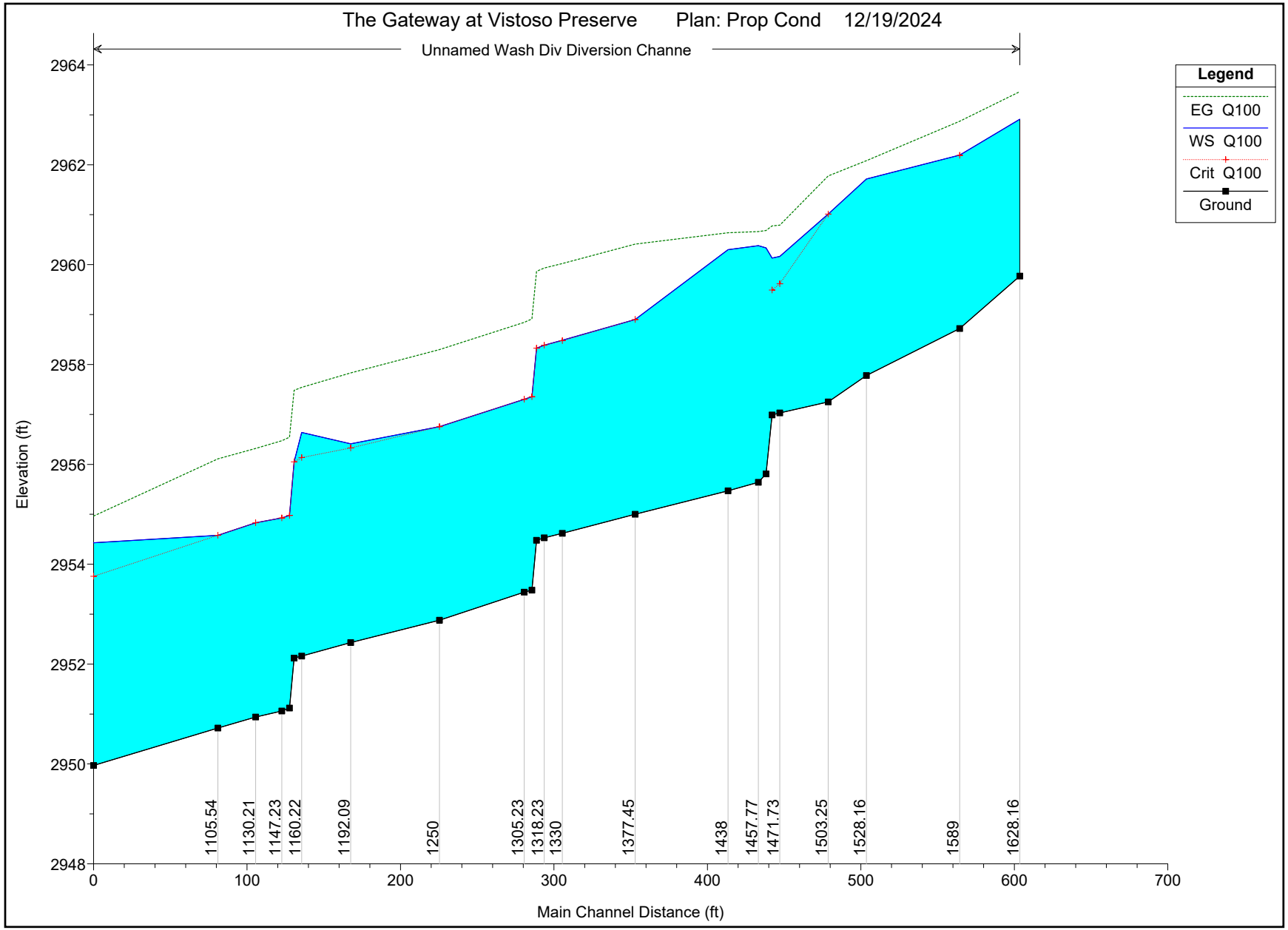
| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Highlands Wash | 774.55 | Q100 | 1075.00 | 2953.27 | 2957.96 | | 2958.37 | 0.005639 | 5.53 | 259.26 | 120.07 | 0.49 |
| Highlands Wash | 700 | Q100 | 1075.00 | 2952.53 | 2956.84 | 2956.84 | 2957.64 | 0.017825 | 9.35 | 245.23 | 223.60 | 0.84 |
| Highlands Wash | 625.28 | Q100 | 1075.00 | 2951.44 | 2955.30 | | 2955.79 | 0.020815 | 8.62 | 245.90 | 152.91 | 0.86 |
| Highlands Wash | 563.48 | Q100 | 1075.00 | 2950.27 | 2954.51 | | 2954.84 | 0.010860 | 5.61 | 302.60 | 210.93 | 0.63 |
| Highlands Wash | 400 | Q100 | 1075.00 | 2948.93 | 2953.29 | | 2953.56 | 0.005734 | 5.26 | 338.68 | 160.49 | 0.49 |
| Highlands Wash | 348.68 | Q100 | 1075.00 | 2947.31 | 2952.49 | | 2953.14 | 0.010628 | 7.85 | 256.63 | 160.19 | 0.67 |
| Highlands Wash | 298.98 | Q100 | 1075.00 | 2946.65 | 2952.14 | | 2952.65 | 0.007598 | 6.98 | 264.72 | 149.98 | 0.57 |
| Highlands Wash | 266.83 | Q100 | 1075.00 | 2946.48 | 2951.39 | 2951.23 | 2952.26 | 0.017211 | 8.76 | 184.72 | 91.75 | 0.82 |
| Highlands Wash | 199.4 | Q100 | 1075.00 | 2945.87 | 2950.26 | 2950.26 | 2951.08 | 0.017314 | 8.86 | 215.28 | 156.82 | 0.82 |
| Highlands Wash | 150 | Q100 | 1075.00 | 2945.16 | 2949.35 | 2948.94 | 2949.68 | 0.010007 | 6.63 | 319.67 | 177.45 | 0.63 |


Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 774.55
.08
.05
.08
Legend
EG Q100
WS Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 700
.08
.05
.08
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 625.28
.08
.05
.08
Legend
EG Q100
WS Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 563.48
.08
.05
.08
Legend
EG Q100
WS Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 400
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 348.68
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 298.98
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 266.83
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta

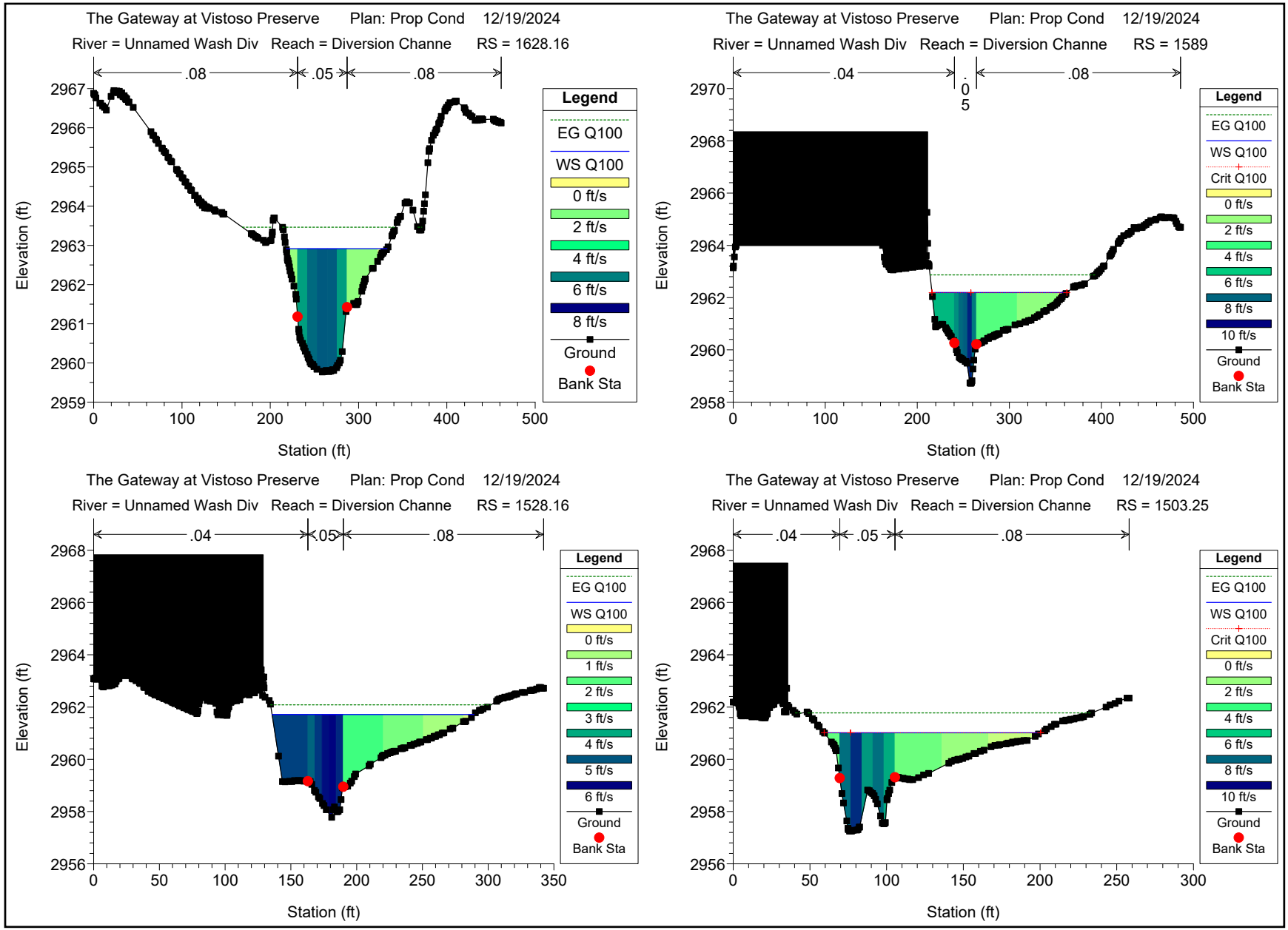

Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 199.4
.08
.05
.08
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
2958
2956
2954
2952
2950
2948
2946
2944
0
50
100
150
200
250
300

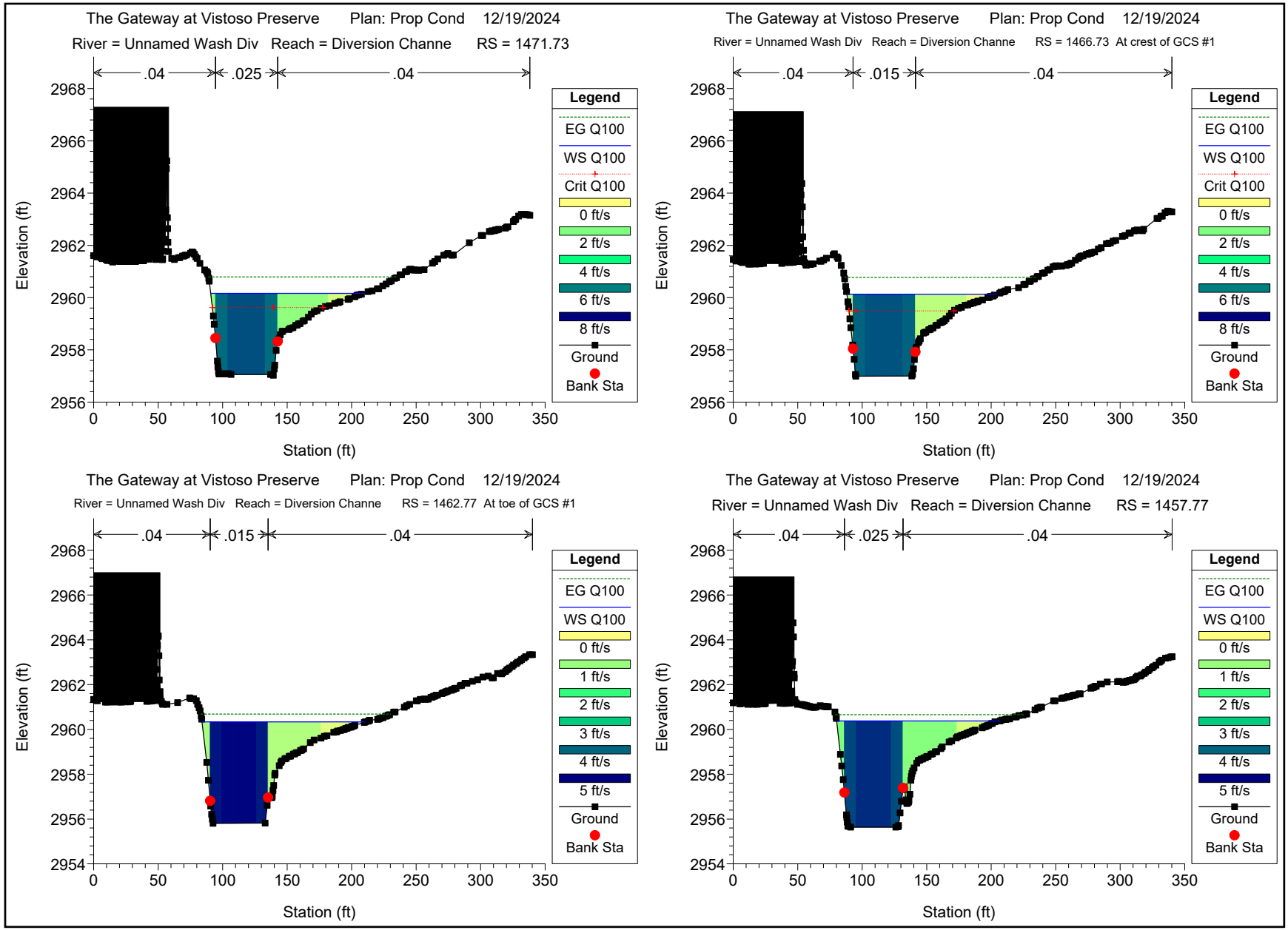

Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 150
.08
.05
.08
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
2954
2952
2950
2948
2946
2944
0
50
100
150
200
250
300
350

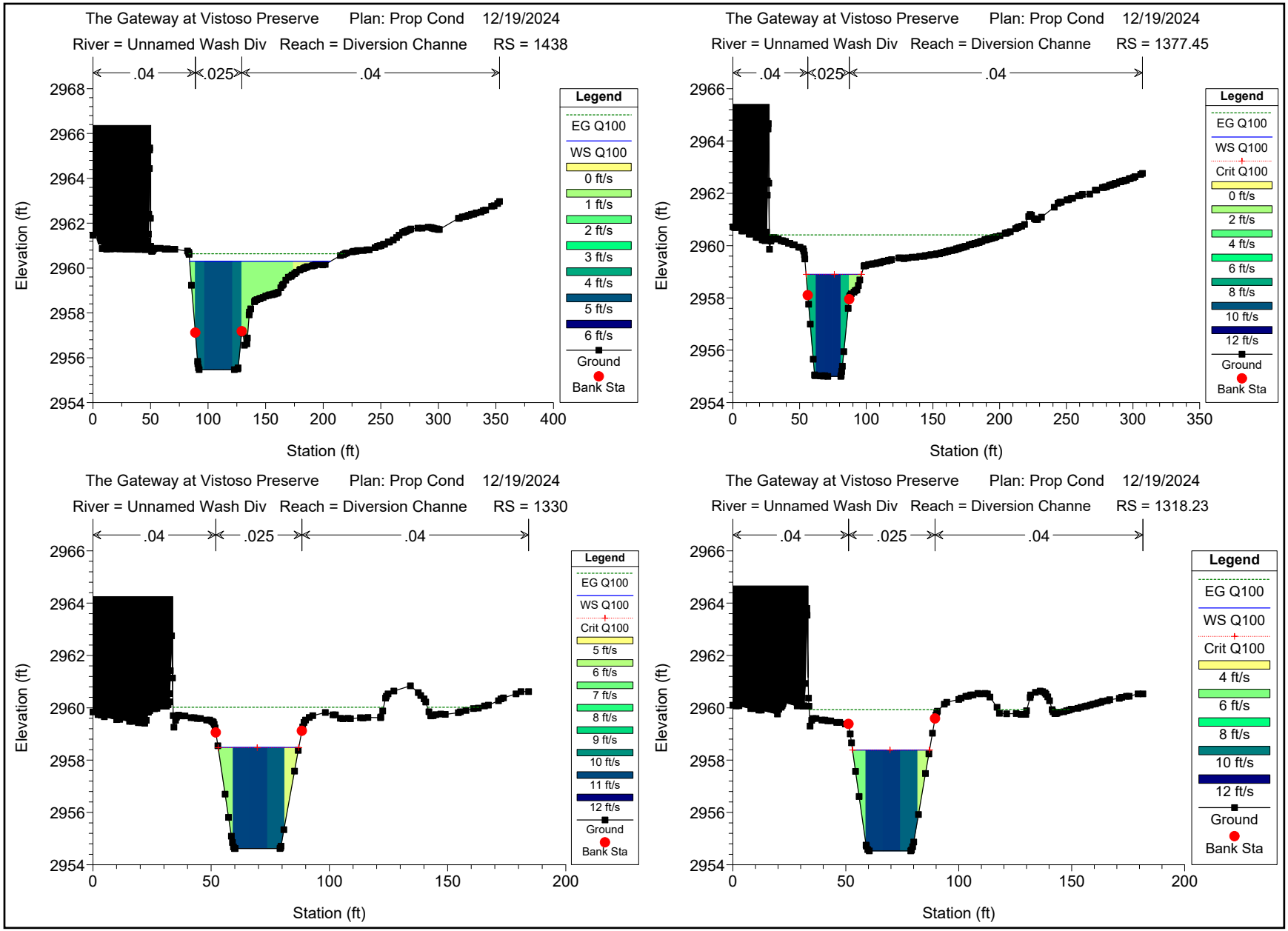

The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
Unnamed Wash Div Diversion Channe
Legend
EG Q100
WS Q100
Crit Q100
Ground
Elevation (ft)
2964
2962
2960
2958
2956
2954
2952
2950
2948
0
100
200
300
400
500
600
700
Main Channel Distance (ft)
1105.54
1130.21
1147.23
1160.22
1192.09
1250
1305.23
1318.23
1330
1377.45
1438
1457.77
1471.73
1503.25
1528.16
1589
1628.16

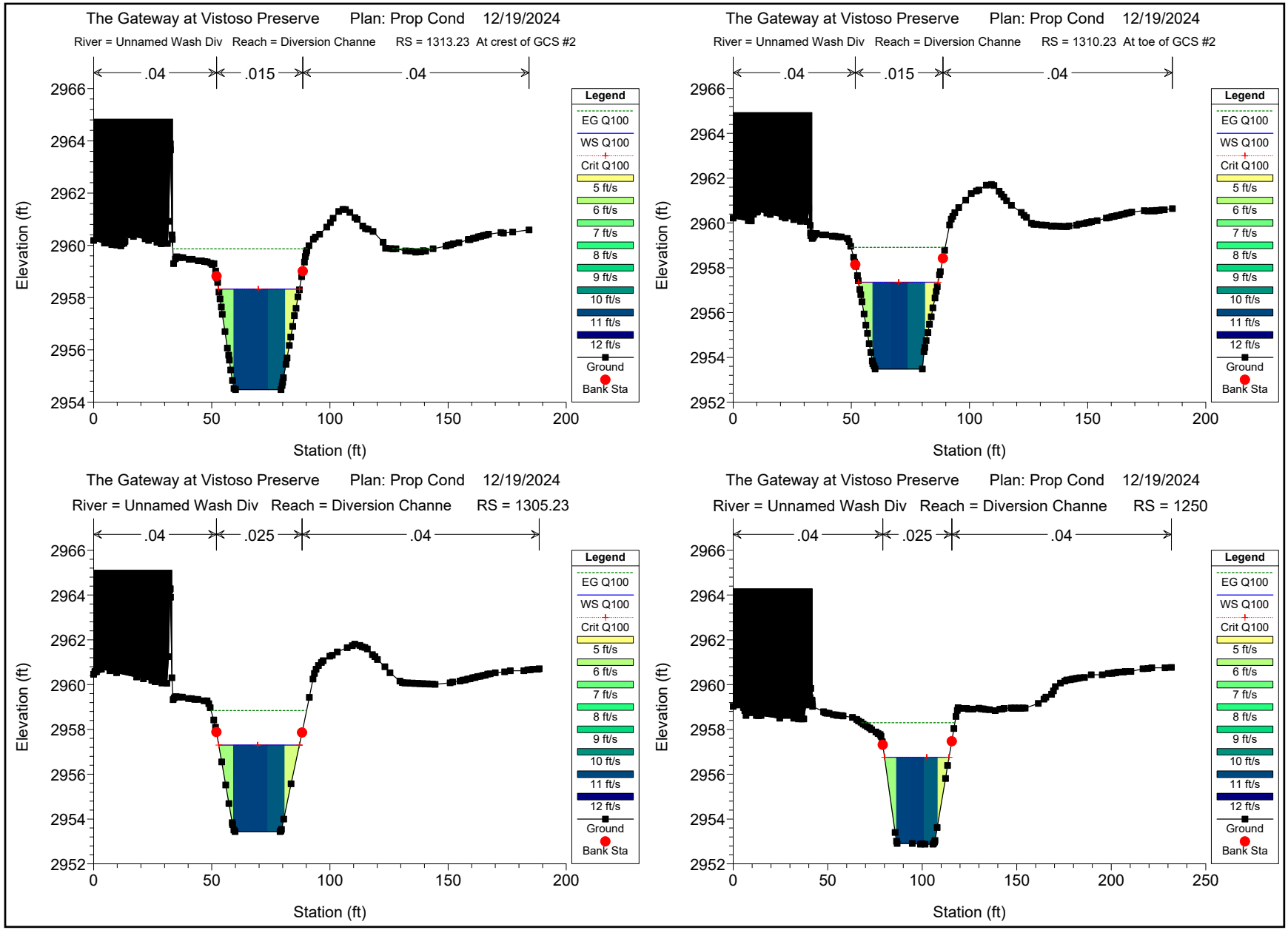
HEC-RAS Plan: Prop. Cond River: Unnamed Wash Div Reach: Diversion Channe Profile: Q100

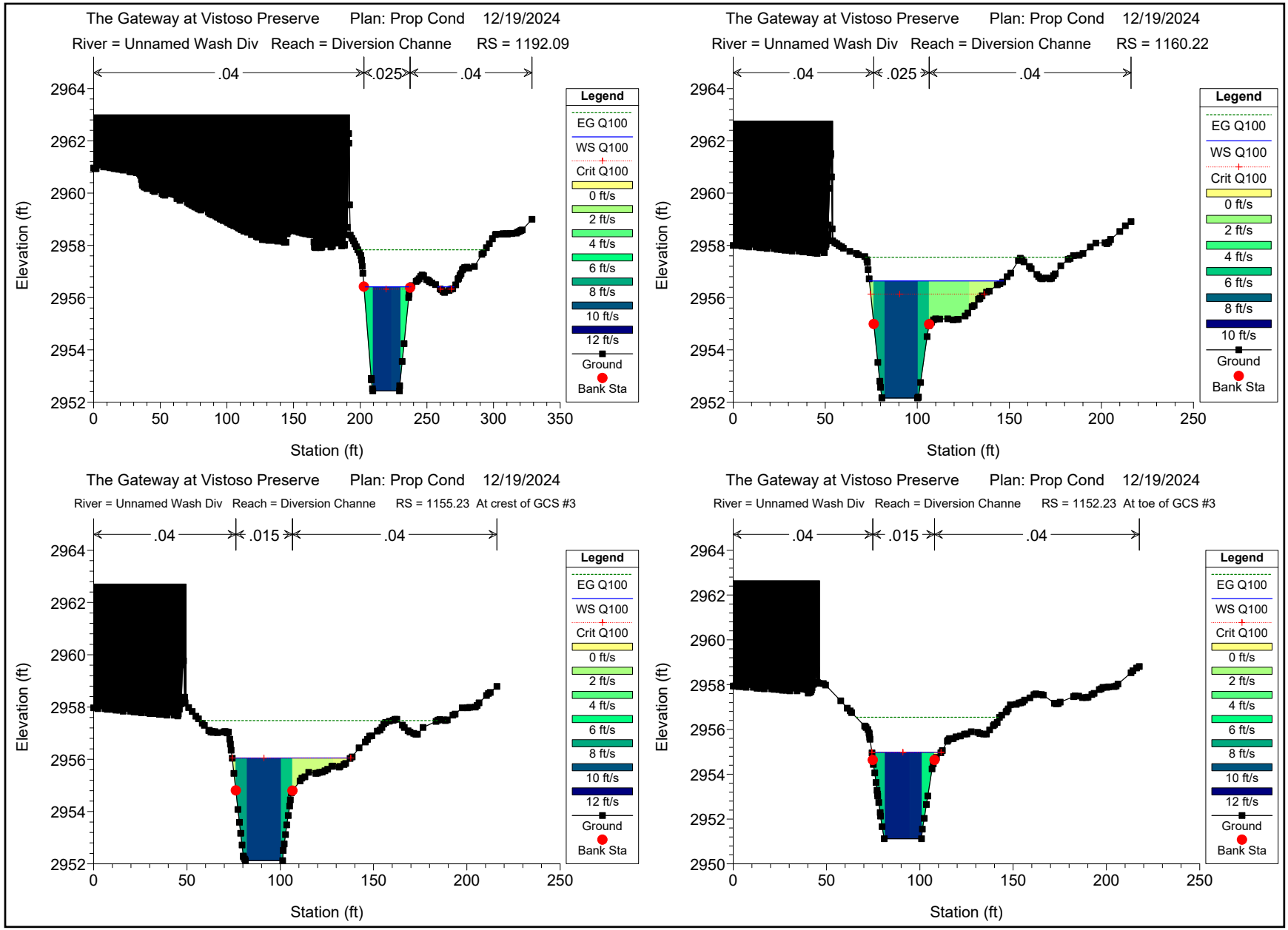
| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Diversion Channe | 1628.16 | Q100 | 1040.00 | 2959.77 | 2962.91 | | 2963.46 | 0.010975 | 6.16 | 202.10 | 114.19 | 0.65 |
| Diversion Channe | 1589 | Q100 | 1040.00 | 2958.72 | 2962.19 | 2962.19 | 2962.87 | 0.021100 | 8.16 | 205.45 | 146.70 | 0.89 |
| Diversion Channe | 1528.16 | Q100 | 1040.00 | 2957.78 | 2961.71 | | 2962.08 | 0.007159 | 5.55 | 275.15 | 153.51 | 0.54 |
| Diversion Channe | 1503.25 | Q100 | 1040.00 | 2957.25 | 2961.01 | 2961.01 | 2961.78 | 0.017556 | 7.82 | 198.54 | 141.16 | 0.81 |
| Diversion Channe | 1471.73 | Q100 | 1040.00 | 2957.03 | 2960.16 | 2959.62 | 2960.79 | 0.002867 | 6.59 | 196.00 | 118.59 | 0.67 |
| Diversion Channe | 1466.73 | Q100 | 1040.00 | 2956.99 | 2960.13 | 2959.49 | 2960.78 | 0.001001 | 6.61 | 201.86 | 116.22 | 0.66 |
| Diversion Channe | 1462.77 | Q100 | 1040.00 | 2955.81 | 2960.34 | | 2960.68 | 0.000335 | 4.88 | 287.23 | 126.55 | 0.41 |
| Diversion Channe | 1457.77 | Q100 | 1040.00 | 2955.64 | 2960.38 | | 2960.66 | 0.000749 | 4.46 | 302.57 | 126.67 | 0.37 |
| Diversion Channe | 1438 | Q100 | 1040.00 | 2955.47 | 2960.30 | | 2960.64 | 0.000891 | 4.91 | 280.54 | 122.43 | 0.40 |
| Diversion Channe | 1377.45 | Q100 | 1040.00 | 2955.00 | 2958.90 | 2958.90 | 2960.41 | 0.005901 | 9.90 | 109.59 | 41.52 | 0.95 |
| Diversion Channe | 1330 | Q100 | 1040.00 | 2954.62 | 2958.49 | 2958.48 | 2960.02 | 0.006777 | 9.95 | 104.57 | 34.14 | 1.00 |
| Diversion Channe | 1318.23 | Q100 | 1040.00 | 2954.53 | 2958.39 | 2958.39 | 2959.93 | 0.006829 | 9.97 | 104.26 | 34.11 | 1.01 |
| Diversion Channe | 1313.23 | Q100 | 1040.00 | 2954.48 | 2958.33 | 2958.33 | 2959.87 | 0.002454 | 9.95 | 104.54 | 34.28 | 1.00 |
| Diversion Channe | 1310.23 | Q100 | 1040.00 | 2953.48 | 2957.36 | 2957.36 | 2958.91 | 0.002469 | 10.01 | 103.91 | 33.69 | 1.00 |
| Diversion Channe | 1305.23 | Q100 | 1040.00 | 2953.44 | 2957.30 | 2957.30 | 2958.84 | 0.006808 | 9.96 | 104.42 | 34.14 | 1.00 |
| Diversion Channe | 1250 | Q100 | 1040.00 | 2952.88 | 2956.76 | 2956.76 | 2958.30 | 0.006816 | 9.96 | 104.38 | 34.13 | 1.00 |
| Diversion Channe | 1192.09 | Q100 | 1040.00 | 2952.43 | 2956.41 | 2956.33 | 2957.83 | 0.006108 | 9.57 | 110.04 | 47.32 | 0.95 |
| Diversion Channe | 1160.22 | Q100 | 1040.00 | 2952.16 | 2956.64 | 2956.14 | 2957.54 | 0.003001 | 7.94 | 162.77 | 72.90 | 0.70 |
| Diversion Channe | 1155.23 | Q100 | 1040.00 | 2952.12 | 2956.05 | 2956.05 | 2957.48 | 0.001938 | 9.68 | 123.24 | 63.58 | 0.92 |
| Diversion Channe | 1152.23 | Q100 | 1040.00 | 2951.12 | 2954.98 | 2954.98 | 2956.54 | 0.002413 | 10.04 | 104.17 | 37.06 | 1.00 |
| Diversion Channe | 1147.23 | Q100 | 1040.00 | 2951.06 | 2954.93 | 2954.93 | 2956.47 | 0.006773 | 9.98 | 104.43 | 35.49 | 1.00 |
| Diversion Channe | 1130.21 | Q100 | 1040.00 | 2950.94 | 2954.83 | 2954.83 | 2956.32 | 0.006892 | 9.79 | 106.26 | 36.20 | 1.01 |
| Diversion Channe | 1105.54 | Q100 | 1040.00 | 2950.72 | 2954.58 | 2954.58 | 2956.11 | 0.005733 | 10.05 | 113.96 | 65.79 | 0.95 |
| Diversion Channe | 1024.58 | Q100 | 1040.00 | 2949.97 | 2954.43 | 2953.76 | 2954.97 | 0.009858 | 6.01 | 200.31 | 170.41 | 0.62 |

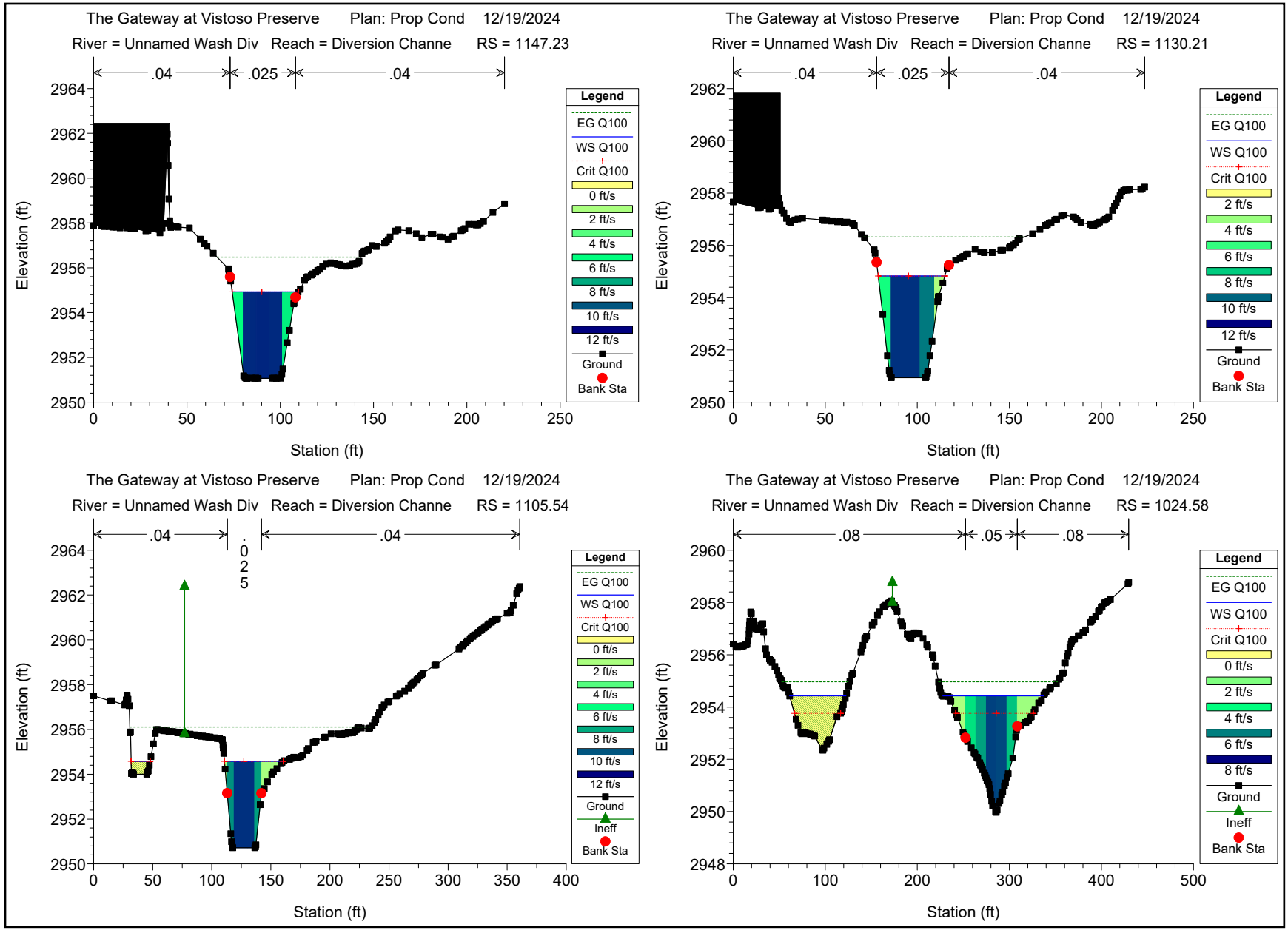

The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1628.16
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1589
.04
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1528.16
.04
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1503.25
.04
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

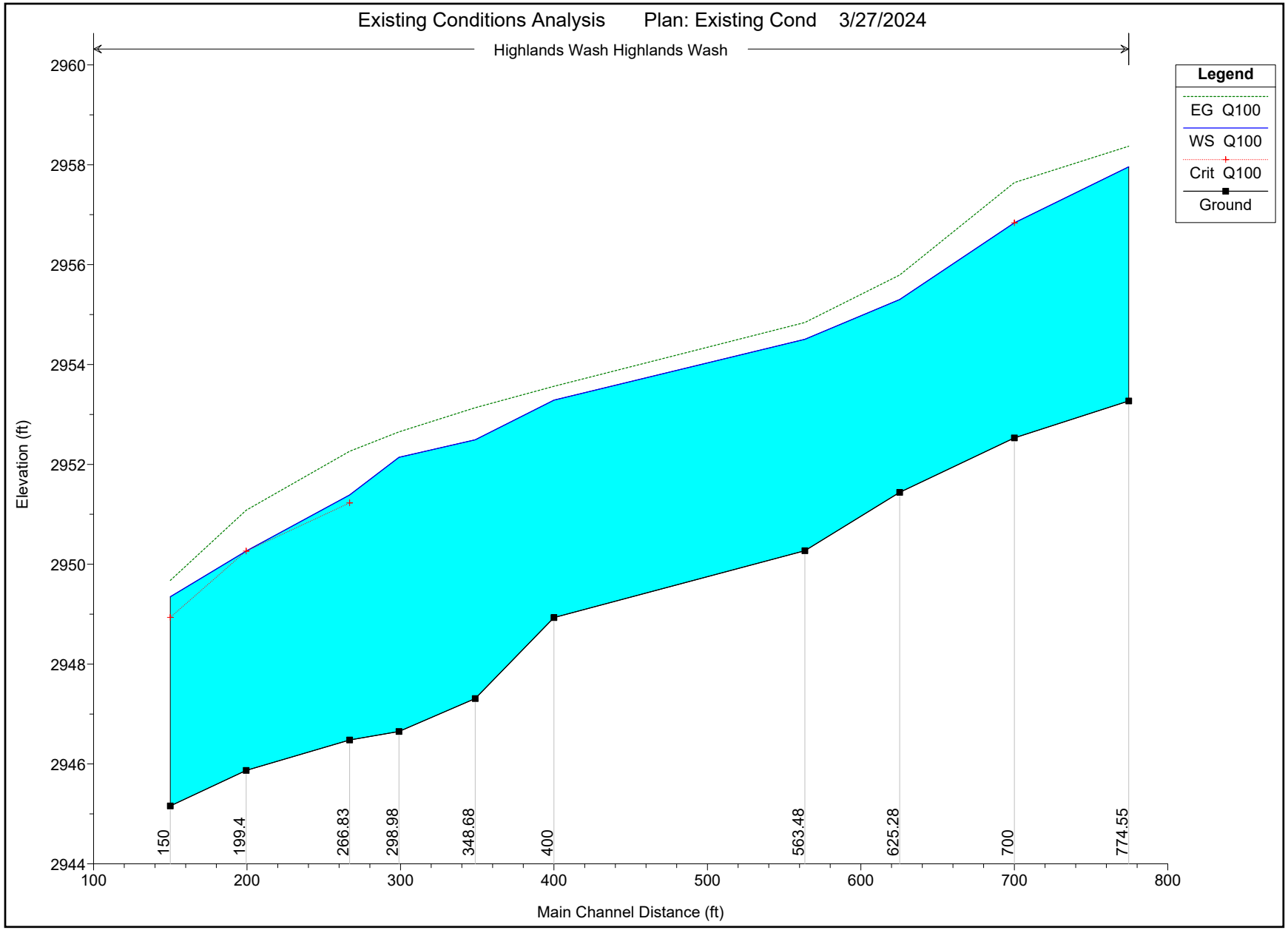

The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1471.73
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1466.73 At crest of GCS #1
.04
.015
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1462.77 At toe of GCS #1
.04
.015
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1457.77
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1438
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1377.45
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1330
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1318.23
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta


The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1313.23 At crest of GCS #2
.04
.015
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1310.23 At toe of GCS #2
.04
.015
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1305.23
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1250
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
12 ft/s
Ground
Bank Sta

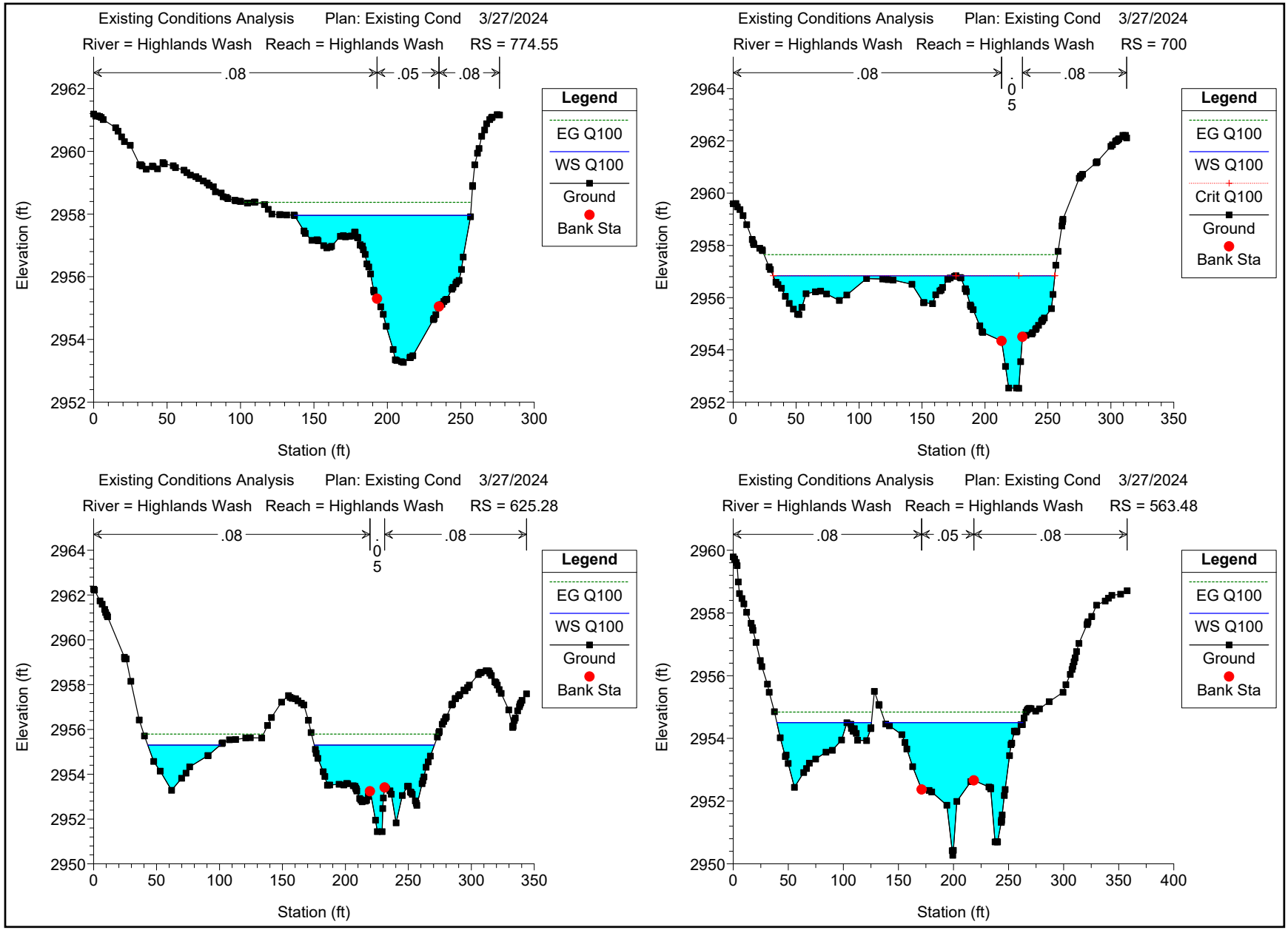

The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1192.09
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1160.22
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1155.23 At crest of GCS #3
.04
.015
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1152.23 At toe of GCS #3
.04
.015
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta

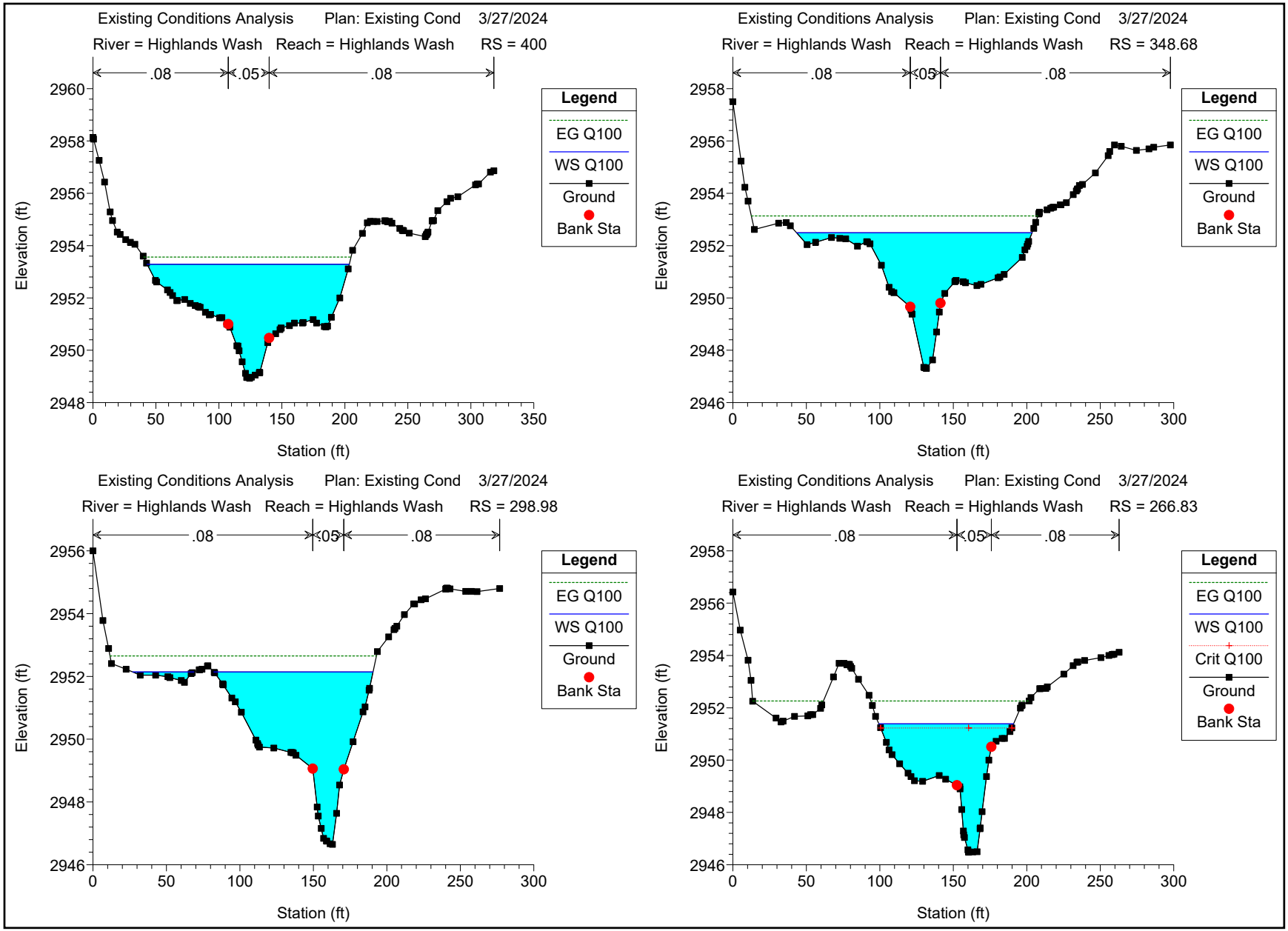

The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1147.23
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1130.21
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1105.54
.04
.025
.04
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Ineff
Bank Sta
The Gateway at Vistoso Preserve Plan: Prop Cond 12/19/2024
River = Unnamed Wash Div Reach = Diversion Channe RS = 1024.58
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Ineff
Bank Sta

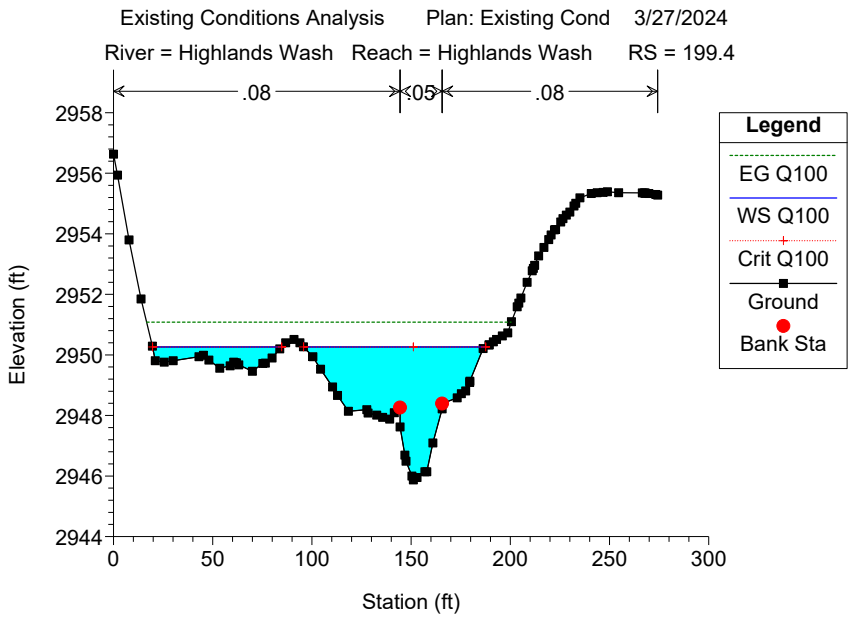

Existing Conditions Analysis Plan: Existing Cond 3/27/2024
Highlands Wash Highlands Wash
Legend
EG Q100
WS Q100
Crit Q100
Ground
Elevation (ft)
2960
2958
2956
2954
2952
2950
2948
2946
2944
100
200
300
400
500
600
700
800
Main Channel Distance (ft)
150
199.4
266.83
298.98
348.68
400
563.48
625.28
700
774.55

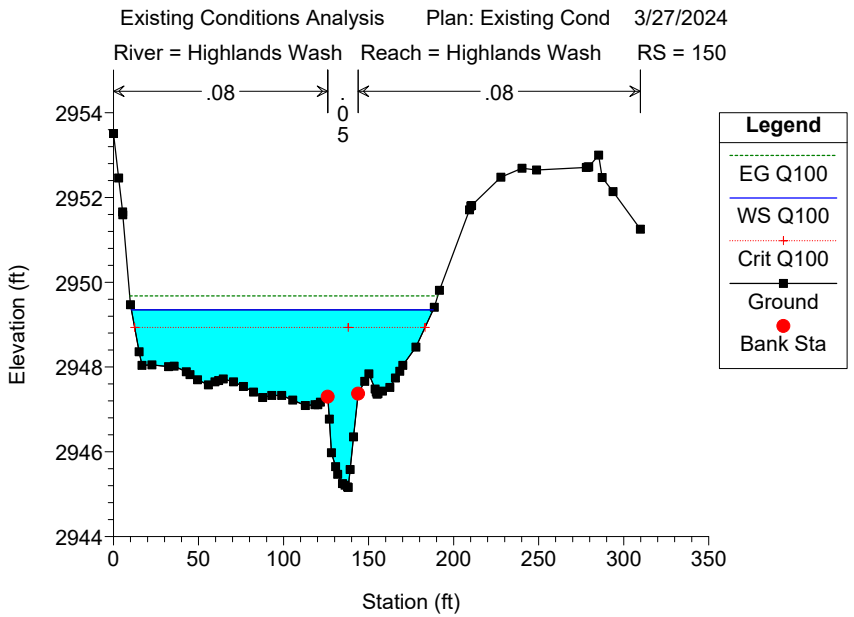
HEC-RAS Plan: Ex. Cond River: Highlands Wash Reach: Highlands Wash Profile: Q100

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Highlands Wash | 774.55 | Q100 | 1075.00 | 2953.27 | 2957.96 | | 2958.37 | 0.005639 | 5.53 | 259.26 | 120.07 | 0.49 |
| Highlands Wash | 700 | Q100 | 1075.00 | 2952.53 | 2956.84 | 2956.84 | 2957.64 | 0.017825 | 9.35 | 245.23 | 223.60 | 0.84 |
| Highlands Wash | 625.28 | Q100 | 1075.00 | 2951.44 | 2955.30 | | 2955.79 | 0.020815 | 8.62 | 245.90 | 152.91 | 0.86 |
| Highlands Wash | 563.48 | Q100 | 1075.00 | 2950.27 | 2954.51 | | 2954.84 | 0.010860 | 5.61 | 302.60 | 210.93 | 0.63 |
| Highlands Wash | 400 | Q100 | 1075.00 | 2948.93 | 2953.29 | | 2953.56 | 0.005734 | 5.26 | 338.68 | 160.49 | 0.49 |
| Highlands Wash | 348.68 | Q100 | 1075.00 | 2947.31 | 2952.49 | | 2953.14 | 0.010628 | 7.85 | 256.63 | 160.19 | 0.67 |
| Highlands Wash | 298.98 | Q100 | 1075.00 | 2946.65 | 2952.14 | | 2952.65 | 0.007598 | 6.98 | 264.72 | 149.98 | 0.57 |
| Highlands Wash | 266.83 | Q100 | 1075.00 | 2946.48 | 2951.39 | 2951.23 | 2952.26 | 0.017211 | 8.76 | 184.72 | 91.75 | 0.82 |
| Highlands Wash | 199.4 | Q100 | 1075.00 | 2945.87 | 2950.26 | 2950.26 | 2951.08 | 0.017314 | 8.86 | 215.28 | 156.82 | 0.82 |
| Highlands Wash | 150 | Q100 | 1075.00 | 2945.16 | 2949.35 | 2948.94 | 2949.68 | 0.010007 | 6.63 | 319.67 | 177.45 | 0.63 |


Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 774.55
.08
.05
.08
Legend
EG Q100
WS Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 700
.08
.05
.08
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 625.28
.08
.05
.08
Legend
EG Q100
WS Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 563.48
.08
.05
.08
Legend
EG Q100
WS Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 400
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 348.68
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 298.98
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Ground
Bank Sta
Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 266.83
.08
.05
.08
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta


Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 199.4
.08
.05
.08
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
2958
2956
2954
2952
2950
2948
2946
2944
0
50
100
150
200
250
300


Existing Conditions Analysis Plan: Existing Cond 3/27/2024
River = Highlands Wash Reach = Highlands Wash RS = 150
.08
.05
.08
Legend
EG Q100
WS Q100
Crit Q100
Ground
Bank Sta
Elevation (ft)
Station (ft)
2954
2952
2950
2948
2946
2944
0
50
100
150
200
250
300
350

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT** **Date:** 12/19/2024

MAXIMUM ANTICIPATED SCOUR DEPTH ( $Z_T$ ) FOR SIMPLE CURVED AND STRAIGHT REACHES OF NON-REGIONAL SAND BED CONVEYANCES (form rev. 06/01/09)

WITH LOCAL SCOUR AT ABUTMENTS AND BRIDGE PIERS

W/O LOCAL SCOUR AT DROPS OR LONG TERM DEGRADATION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 945&955 W Vistoso Highlands Dr,TOV, 85755 | | | | | **Project Address** |
| | | AJH | | | | | **Data Sheet Preparer** |
| **Step 1. Enter Project Information.** | | AVG SEC | AVG SEC | AVG SEC | AVG SEC | AVG SEC | **Conveyance Subsection** |
| **Step 2. Bend Scour? Enter N if no bend scour.** | **SEC =** | **1628.16** | **1589** | **1528.16** | **1503.25** | **0** | ***Description*** |
| **If Yes, Enter α.** | **α =** | N | N | N | N | N | (deg) Bend angle (See **BENDS** tab) |
| **Step 3a. Abutment scour per SMDDFM? Enter N if no.** | **$a_e$ =** | N | N | N | N | N | (ft) Length of abutment projected normal to flow |
| **If Yes, Enter $a_e$ & $\theta_a$.** | **$\theta_a$ =** | N | N | N | N | N | (deg) Slope angle of abutment face from horizontal |
| **Step 3b. Abutment scour per HEC-18 (FHWA NHI 01-001 5/01)?** | **L' =** | N | N | N | N | N | (ft) Length of abutment projected normal to flow |
| **Enter N if no local abutment scour.** | **$K_1$ =** | N | N | N | N | N | (dim) Coefficient for abutment shape (See **ABUTMENTS** tab) |
| **If Yes, Enter L', $K_1$, & θ.** | **θ =** | N | N | N | N | N | (deg) Abutment angle wrt bank (See **ABUTMENTS** tab) |
| **Step 4a. Pier scour per SMDDFM?** | **$b_p$ =** | N | N | N | N | N | (ft) Pier width, including anticipated debris blockage |
| **Enter N if no local pier scour.** | **L =** | N | N | N | N | N | (ft) Length of pier wall |
| **If Yes, enter $Y_1$, $b_p$, L, $\Phi_p$ & RF.** | **$Y_1$ =** | N | N | N | N | N | (ft) Flow depth upstream of pier (blank = max depth) |
| | **RF =** | N | N | N | N | N | (dim) Reduction factor for nose shape (See **PIERS** tab) |
| | **$\Phi_p$ =** | N | N | N | N | N | (deg) Angle of approach flow in relationship to pier wall |
| **Step 4b. Pier scour per HEC-18 (FHWA NHI 01-001 5/01)?** | **a =** | N | N | N | N | N | (ft) Pier width, including anticipated debris blockage |
| **Enter N if no local pier scour.** | **L =** | N | N | N | N | N | (ft) Length of pier wall |
| **If Yes, enter a, L, $K_1$, $K_3$, $\Phi_p$, $Y_1$, $D_{50}$, & $D_{95}$.** | **$K_1$ =** | N | N | N | N | N | (dim) Correction factor for nose shape (See **PIERS** tab) |
| | **$K_3$ =** | N | N | N | N | N | (dim) Correction factor for bed condition (See **PIERS** tab) |
| | **$\Phi_p$ =** | N | N | N | N | N | (deg) Flow direction with respect to pier wall |
| | **$Y_1$ =** | N | N | N | N | N | (ft) Flow depth upstream of pier (blank = max depth) |
| | **$D_{50}$ =** | N | N | N | N | N | (mm) Grain size for which 50% of bed material is finer |
| | **$D_{95}$ =** | N | N | N | N | N | (mm) Grain size for which 95% of bed material is finer |
| **Step 5. Enter safety factor for local (pier, abutment) scour.** | **SF =** | 2 | 1.3 | 1.3 | 1.3 | 2.0 | (dim) Blank = 1.3; text = 0 |

**Step 6. Enter hydraulic characteristics for up to 5 sections in the blue fields below. HEC-RAS output may be pasted into RAS OUT tab to facilitate data entry**

| *INPUT HYDRAULIC CHARACTERISTICS OF CONVEYANCE* | | | | | | | *CALCULATED CHARACTERISTICS* | | | | | | *CALCULATED INDIVIDUAL SCOUR COMPENENTS* (ft) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | V | A | T | WSL | ELMN | $S_E$ | Q | $Y_H$ | $Y_{MAX}$ | $F_u$ | $r_C/T$ | $Z_{GS}$ | $Z_{BS}$ | $Z_A$ | $Z_{LSP}$ | $Z_{LSE}$ | $Z_{LSP}$ | $Z_{LSE}$ | $Z_{LF}$ | $Z_T$ |
| E | (fps) | ($ft^2$) | (ft) | (ft) | (ft) | (dim) | (cfs) | (ft) | (ft) | (dim) | (dim) | SMDDFM | SMDDFM | SMDDFM | SMDDFM | SMDDFM | HEC-18 | HEC-18 | | (ft) |
| C | | | | | | | V*A | A/T | wsl-elmn | Eq 8.3 | | Eq 6.4 | Eq 6.6 | Eq 6.5 | Eq 6.9 | 6.11/6.12 | Eq 6.1 | Eq 7.1/7.2 | | Eq 6.3 |
| **1628.16** | **6.2** | **202.1** | **114.2** | **2962.9** | **2959.8** | **0.011** | 1245 | 1.8 | 3.1 | **0.8** | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.00 | 0.0 | **1.0** | **2.0** |
| **1589** | **8.2** | **205.5** | **146.7** | **2962.2** | **2958.7** | **0.021** | 1676 | 1.4 | 3.5 | **1.2** | 0.0 | 0.1 | 0.0 | 0.9 | 0.0 | 0.0 | 0.00 | 0.0 | **0.0** | **1.3** |
| **1528.16** | **5.6** | **275.2** | **153.5** | **2961.7** | **2957.8** | **0.007** | 1527 | 1.8 | 3.9 | **0.7** | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.00 | 0.0 | **1.0** | **1.8** |
| **1503.25** | **7.8** | **198.5** | **141.2** | **2961.0** | **2957.3** | **0.018** | 1553 | 1.4 | 3.8 | **1.2** | 0.0 | 0.2 | 0.0 | 0.8 | 0.0 | 0.0 | 0.00 | 0.0 | **1.0** | **2.6** |
| **0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.000** | 0 | 0.0 | 0.0 | **0.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | **0.0** | **0.0** |

**PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT** **Date:** 12/19/2024

MAXIMUM ANTICIPATED SCOUR DEPTH ( $Z_T$ ) FOR SIMPLE CURVED AND STRAIGHT REACHES OF NON-REGIONAL SAND BED CONVEYANCES (form rev. 06/01/09)

WITH LOCAL SCOUR AT ABUTMENTS AND BRIDGE PIERS

W/O LOCAL SCOUR AT DROPS OR LONG TERM DEGRADATION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 945&955 W Vistoso Highlands Dr,TOV, 85755 | | | | | **Project Address** |
| | | AJH | | | | | **Data Sheet Preparer** |
| **Step 1. Enter Project Information.** | | **AVG SEC** | **AVG SEC** | **N/A** | **N/A** | **N/A** | **Conveyance Subsection** |
| **Step 2. Bend Scour? Enter N if no bend scour.** | **SEC =** | **1377.45** | **1250** | **1105.54** | **0** | **0** | ***Description*** |
| **If Yes, Enter α.** | **α =** | N | 27.1 | N | N | N | (deg) Bend angle (See **BENDS** tab) |
| **Step 3a. Abutment scour per SMDDFM? Enter N if no.** | **$a_e$ =** | N | N | N | N | N | (ft) Length of abutment projected normal to flow |
| **If Yes, Enter $a_e$ & $\theta_a$.** | **$\theta_a$ =** | N | N | N | N | N | (deg) Slope angle of abutment face from horizontal |
| **Step 3b. Abutment scour per HEC-18 (FHWA NHI 01-001 5/01)?** | **L' =** | N | N | N | N | N | (ft) Length of abutment projected normal to flow |
| **Enter N if no local abutment scour.** | **$K_1$ =** | N | N | N | N | N | (dim) Coefficient for abutment shape (See **ABUTMENTS** tab) |
| **If Yes, Enter L', $K_1$, & θ.** | **θ =** | N | N | N | N | N | (deg) Abutment angle wrt bank (See **ABUTMENTS** tab) |
| **Step 4a. Pier scour per SMDDFM?** | **$b_p$ =** | N | N | N | N | N | (ft) Pier width, including anticipated debris blockage |
| **Enter N if no local pier scour.** | **L =** | N | N | N | N | N | (ft) Length of pier wall |
| **If Yes, enter $Y_1$, $b_p$, L, $\Phi_p$ & RF.** | **$Y_1$ =** | N | N | N | N | N | (ft) Flow depth upstream of pier (blank = max depth) |
| | **RF =** | N | N | N | N | N | (dim) Reduction factor for nose shape (See **PIERS** tab) |
| | **$\Phi_p$ =** | N | N | N | N | N | (deg) Angle of approach flow in relationship to pier wall |
| **Step 4b. Pier scour per HEC-18 (FHWA NHI 01-001 5/01)?** | **a =** | N | N | N | N | N | (ft) Pier width, including anticipated debris blockage |
| **Enter N if no local pier scour.** | **L =** | N | N | N | N | N | (ft) Length of pier wall |
| **If Yes, enter a, L, $K_1$, $K_3$, $\Phi_p$, $Y_1$, $D_{50}$, & $D_{95}$.** | **$K_1$ =** | N | N | N | N | N | (dim) Correction factor for nose shape (See **PIERS** tab) |
| | **$K_3$ =** | N | N | N | N | N | (dim) Correction factor for bed condition (See **PIERS** tab) |
| | **$\Phi_p$ =** | N | N | N | N | N | (deg) Flow direction with respect to pier wall |
| | **$Y_1$ =** | N | N | N | N | N | (ft) Flow depth upstream of pier (blank = max depth) |
| | **$D_{50}$ =** | N | N | N | N | N | (mm) Grain size for which 50% of bed material is finer |
| | **$D_{95}$ =** | N | N | N | N | N | (mm) Grain size for which 95% of bed material is finer |
| **Step 5. Enter safety factor for local (pier, abutment) scour.** | **SF =** | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | (dim) Blank = 1.3; text = 0 |

**Step 6. Enter hydraulic characteristics for up to 5 sections in the blue fields below. HEC-RAS output may be pasted into RAS OUT tab to facilitate data entry**

| | *INPUT HYDRAULIC CHARACTERISTICS OF CONVEYANCE* | | | | | | | *CALCULATED CHARACTERISTICS* | | | | | | *CALCULATED INDIVIDUAL SCOUR COMPENENTS* (ft) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S** | **V** | **A** | **T** | **WSL** | **ELMN** | **$S_E$** | **Q** | **$Y_H$** | **$Y_{MAX}$** | **$F_u$** | **$r_C/T$** | **$Z_{GS}$** | **$Z_{BS}$** | **$Z_A$** | **$Z_{LSP}$** | **$Z_{LSE}$** | **$Z_{LSP}$** | **$Z_{LSE}$** | **$Z_{LF}$** | **$Z_T$** |
| **E** | **(fps)** | **($ft^2$)** | **(ft)** | **(ft)** | **(ft)** | **(dim)** | **(cfs)** | **(ft)** | **(ft)** | **(dim)** | **(dim)** | **SMDDFM** | **SMDDFM** | **SMDDFM** | **SMDDFM** | **SMDDFM** | **HEC-18** | **HEC-18** | | **(ft)** |
| **C** | | | | | | | V*A | A/T | wsl-elmn | Eq 8.3 | | Eq 6.4 | Eq 6.6 | Eq 6.5 | Eq 6.9 | 6.11/6.12 | Eq 6.1 | Eq 7.1/7.2 | | Eq 6.3 |
| **1377.45** | **9.9** | **109.6** | **41.5** | **2958.9** | **2955.0** | **0.006** | 1085 | 2.6 | 3.9 | **1.1** | 0.0 | 1.4 | 0.0 | 1.3 | 0.0 | 0.0 | 0.00 | 0.0 | **0.0** | **3.6** |
| **1250** | **10.0** | **104.4** | **34.1** | **2956.8** | **2952.9** | **0.007** | 1040 | 3.1 | 3.9 | **1.0** | 4.1 | 0.9 | 1.0 | 1.4 | 0.0 | 0.0 | 0.00 | 0.0 | **0.0** | **4.2** |
| **1105.54** | **10.1** | **114.0** | **65.8** | **2954.6** | **2950.7** | **0.006** | 1145 | 1.7 | 3.9 | **1.3** | 0.0 | 2.5 | 0.0 | 1.4 | 0.0 | 0.0 | 0.00 | 0.0 | **1.0** | **6.3** |
| **0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.000** | 0 | 0.0 | 0.0 | **0.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | **0.0** | **0.0** |
| **0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.000** | 0 | 0.0 | 0.0 | **0.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | **0.0** | **0.0** |

RICK ENGINEERING COMPANY

| | | |
|---|---|---|
| **Riprap Apron Calculations at Curb Opening and Weir Outlets** | RICK Job #: | T22.061 |
| | Designed by: | AJH |
| **The Gateway at Vistoso Preserve** | Date: | 7/9/2024 |

**References:**


(1) USDOT, FHWA HEC-14, Hydraulic Design of Energy Dissipators for Culverts and Channels, 3rd Edition, July 2006
(2) PCRFCD, Drainage and Channel Design Standards for Local Drainage for Floodplain Management within Pima County, Arizona, June 1984
(3) City of Tucson, Standards Manual for Drainage Design and Floodplain Management, Tucson, AZ, Revised July 1998


**Design Notes:**

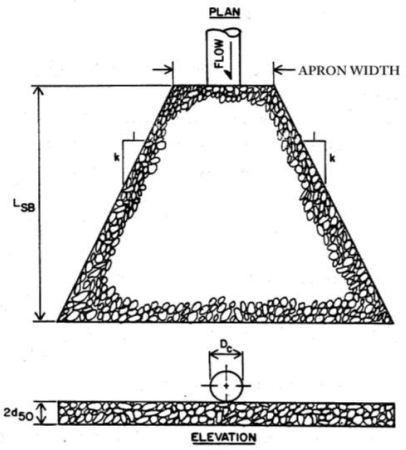
(1) The D50 riprap sizing for the spillway slope downstream of curb opening outlets are design using Reference 2 above.
(2) The weir outlets are modeled as rectangular channel to mimic the box culvert for which D50 equation below is developed for.
(3) Any deviations from note 1 above shall be specified in this page.

**Equations**

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$ 10.4 of Reference 1

Where:

$D_{50}$ = Median riprap Size (ft)
D = Culvert or Equivalent diameter (ft)
Q = Design peak discharge (cfs)
g = Acceleration due to gravity (32.2 ft/s$^2$)
TW = Tailwater depth (ft)
$L_{sb}$ = Length of scour basin or apron (ft)
k = Taper coefficient




Riprap apron size (D50), Apron length, and thickness per Table 10.1 of Reference 1

**Table 10.1. Example Riprap Classes and Apron Dimensions** (From Reference 1)

| Class | $D_{50}$ (mm) | $D_{50}$ (in) | Apron Length[1] | Apron Depth |
|---|---|---|---|---|
| 1 | 125 | 5 | 4D | $3.5D_{50}$ |
| 2 | 150 | 6 | 4D | $3.3D_{50}$ |
| 3 | 250 | 10 | 5D | $2.4D_{50}$ |
| 4 | 350 | 14 | 6D | $2.2D_{50}$ |
| 5 | 500 | 20 | 7D | $2.0D_{50}$ |
| 6 | 550 | 22 | 8D | $2.0D_{50}$ |

[1]D is the culvert rise.

**Curb Opening Outlet Riprap Apron Design Summary**

| Watershed IDs | 100-Yr Peak Discharge, Q (cfs) | Apron Width, $W_i$ (ft) | Min Design Width (ft) | Curb Opening Exit Velocity (ft/s) | Flow Depth (ft) | Equivalent Dia, D (ft) | Calculated D50 (in) | Design D50 (in) | Apron Length, $L_{sb}$ (ft) | Min. Apron Width (ft) | Taper Coeff, k | Max. Apron Width (ft) | Min. Apron Thickness (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PWS2 | 7.9 | 6.00 | 6.00 | 2.63 | 0.50 | 1.95 | 3.05 | 6.00 | 8.00 | 6.00 | 3.00 | 12.00 | 12.00 |
| PWS3 | 17.2 | 12.00 | 12.00 | 2.87 | 0.50 | 2.76 | 5.43 | 6.00 | 12.00 | 12.00 | 3.00 | 20.00 | 12.00 |
| PWS4+PWS5 | 9.2 | 6.00 | 6.00 | 3.07 | 0.50 | 1.95 | 3.74 | 6.00 | 8.00 | 6.00 | 3.00 | 12.00 | 12.00 |
| PWS6 | 6.0 | 6.00 | 6.00 | 2.00 | 0.50 | 1.95 | 2.12 | 6.00 | 8.00 | 6.00 | 3.00 | 12.00 | 12.00 |

**Weir Outlet Riprap Apron Design Summary**

| Basin IDs | 100-Yr Peak Discharge, Qout (cfs) | Weir Width, $W_i$ (ft) | Min Design Width (ft) | Weir Exit Velocity (ft/s) | Flow Depth (ft) | Equivalent Dia, D (ft) | Calculated D50 (in) | Design D50 (in) | Apron Length, $L_{sb}$ (ft) | Min. Apron Width (ft) | Taper Coeff, k | Max. Apron Width (ft) | Min. Apron Thickness (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West Basin | 18.7 | 4.00 | 6.00 | 3.46 | 1.35 | 3.21 | 1.84 | 6.00 | 13.00 | 6.00 | 3.00 | 15.00 | 12.00 |

**Footnotes**

At downstream end of PWS4+PWS5, the total length of the opening is assumed to be equally divided into (3)-6' opening.

| | | |
|---|---|---|
| **Riprap Apron Calculations at Storm Drain Outlets** | RICK Job #: | T22.061 |
| | Designed by: | AJH |
| **The Gateway at Vistoso Preserve** | Date: | 7/9/2024 |

**References:**

(1) USDOT, FHWA HEC-14, Hydraulic Design of Energy Dissipators for Culverts and Channels, 3rd Edition, July 2006

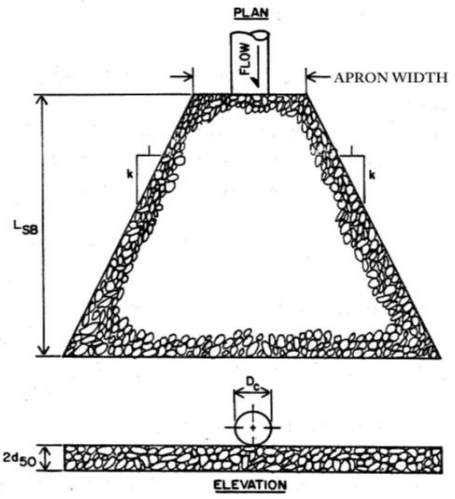
(2) PCRFCD, Drainage and Channel Design Standards for Local Drainage for Floodplain Management within Pima County, Arizona, June 1984

**Design Notes:**

(1) The riprap apron at the end of storm drain outlets are design using Reference 1 above.

**Equations**

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$ Eqn. 10.4 of Reference 1




Where:

| | |
|---|---|
| $D_{50}$ = | Median riprap Size (ft) |
| D = | Culvert diameter (ft) |
| Q = | Design peak discharge (cfs) |
| g = | Acceleration due to gravity (32.2 ft/s$^2$) |
| TW = | Tailwater depth (ft) |
| $L_{sb}$ = | Length of scour basin or apron (ft) |
| k = | Taper coefficient |

Riprap apron size (D50), Apron length, and thickness per Table 10.1 of Reference 1

**Table 10.1. Example Riprap Classes and Apron Dimensions** (From Reference 1)

| Class | $D_{50}$ (mm) | $D_{50}$ (in) | Apron Length[1] | Apron Depth |
|---|---|---|---|---|
| 1 | 125 | 5 | 4D | $3.5D_{50}$ |
| 2 | 150 | 6 | 4D | $3.3D_{50}$ |
| 3 | 250 | 10 | 5D | $2.4D_{50}$ |
| 4 | 350 | 14 | 6D | $2.2D_{50}$ |
| 5 | 500 | 20 | 7D | $2.0D_{50}$ |
| 6 | 550 | 22 | 8D | $2.0D_{50}$ |

[1]D is the culvert rise.

**Riprap Apron Design Summary**

| Contributing Watershed IDs | 100-Yr Peak Discharge, Q (cfs) | Culvert Dia, D (ft) | Tailwater, TW* (ft) | Calculated D50 (in) | Design D50 (in) | Apron Length, $L_{sb}$ (ft) | Min. Apron Width (ft) | Taper Coefficient, k | Max. Apron Width (ft) | Min. Apron Thickness (in) |
|---|---|---|---|---|---|---|---|---|---|---|
| PWS1+PWS8 | 16.00 | 1.50 | 1.50 | 3.71 | 6.00 | 6.00 | 5.00 | 3.00 | 9.00 | 12.00 |
| East Basin | 2.80 | 0.50 | 0.50 | 4.72 | 6.00 | 4.00 | 4.00 | 3.00 | 7.00 | 12.00 |

**Footnotes**

*maximum tailwater is analyzed assuming full flow

RICK ENGINEERING COMPANY

| | | |
|---|---|---|
| **Riprap Apron Calculations at Curb Opening and Weir Outlets** | RICK Job #: | T22.061 |
| | Designed by: | AJH |
| **The Gateway at Vistoso Preserve** | Date: | 7/9/2024 |

**References:**


(1) USDOT, FHWA HEC-14, Hydraulic Design of Energy Dissipators for Culverts and Channels, 3rd Edition, July 2006
(2) PCRFCD, Drainage and Channel Design Standards for Local Drainage for Floodplain Management within Pima County, Arizona, June 1984
(3) City of Tucson, Standards Manual for Drainage Design and Floodplain Management, Tucson, AZ, Revised July 1998


**Design Notes:**

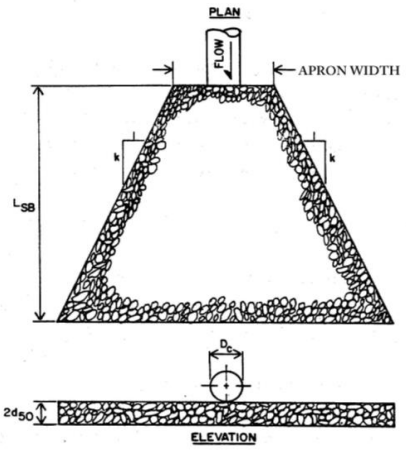
(1) The D50 riprap sizing for the spillway slope downstream of curb opening outlets are design using Reference 2 above.
(2) The weir outlets are modeled as rectangular channel to mimic the box culvert for which D50 equation below is developed for.
(3) Any deviations from note 1 above shall be specified in this page.

**Equations**

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$ 10.4 of Reference 1

Where:

$D_{50}$ = Median riprap Size (ft)
D = Culvert or Equivalent diameter (ft)
Q = Design peak discharge (cfs)
g = Acceleration due to gravity (32.2 ft/s$^2$)
TW = Tailwater depth (ft)
$L_{sb}$ = Length of scour basin or apron (ft)
k = Taper coefficient




Riprap apron size (D50), Apron length, and thickness per Table 10.1 of Reference 1

**Table 10.1. Example Riprap Classes and Apron Dimensions** (From Reference 1)

| Class | $D_{50}$ (mm) | $D_{50}$ (in) | Apron Length[1] | Apron Depth |
|---|---|---|---|---|
| 1 | 125 | 5 | 4D | $3.5D_{50}$ |
| 2 | 150 | 6 | 4D | $3.3D_{50}$ |
| 3 | 250 | 10 | 5D | $2.4D_{50}$ |
| 4 | 350 | 14 | 6D | $2.2D_{50}$ |
| 5 | 500 | 20 | 7D | $2.0D_{50}$ |
| 6 | 550 | 22 | 8D | $2.0D_{50}$ |

[1]D is the culvert rise.

**Curb Opening Outlet Riprap Apron Design Summary**

| Watershed IDs | 100-Yr Peak Discharge, Q (cfs) | Apron Width, $W_i$ (ft) | Min Design Width (ft) | Curb Opening Exit Velocity (ft/s) | Flow Depth (ft) | Equivalent Dia, D (ft) | Calculated D50 (in) | Design D50 (in) | Apron Length, $L_{sb}$ (ft) | Min. Apron Width (ft) | Taper Coeff, k | Max. Apron Width (ft) | Min. Apron Thickness (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PWS2 | 7.9 | 6.00 | 6.00 | 2.63 | 0.50 | 1.95 | 3.05 | 6.00 | 8.00 | 6.00 | 3.00 | 12.00 | 12.00 |
| PWS3 | 17.2 | 12.00 | 12.00 | 2.87 | 0.50 | 2.76 | 5.43 | 6.00 | 12.00 | 12.00 | 3.00 | 20.00 | 12.00 |
| PWS4+PWS5 | 9.2 | 6.00 | 6.00 | 3.07 | 0.50 | 1.95 | 3.74 | 6.00 | 8.00 | 6.00 | 3.00 | 12.00 | 12.00 |
| PWS6 | 6.0 | 6.00 | 6.00 | 2.00 | 0.50 | 1.95 | 2.12 | 6.00 | 8.00 | 6.00 | 3.00 | 12.00 | 12.00 |

**Weir Outlet Riprap Apron Design Summary**

| Basin IDs | 100-Yr Peak Discharge, Qout (cfs) | Weir Width, $W_i$ (ft) | Min Design Width (ft) | Weir Exit Velocity (ft/s) | Flow Depth (ft) | Equivalent Dia, D (ft) | Calculated D50 (in) | Design D50 (in) | Apron Length, $L_{sb}$ (ft) | Min. Apron Width (ft) | Taper Coeff, k | Max. Apron Width (ft) | Min. Apron Thickness (in) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West Basin | 18.7 | 4.00 | 6.00 | 3.46 | 1.35 | 3.21 | 1.84 | 6.00 | 13.00 | 6.00 | 3.00 | 15.00 | 12.00 |

**Footnotes**

At downstream end of PWS4+PWS5, the total length of the opening is assumed to be equally divided into (3)-6' opening.

| | | |
|---|---|---|
| **Riprap Apron Calculations at Storm Drain Outlets** | RICK Job #: | T22.061 |
| | Designed by: | AJH |
| **The Gateway at Vistoso Preserve** | Date: | 7/9/2024 |

**References:**

(1) USDOT, FHWA HEC-14, Hydraulic Design of Energy Dissipators for Culverts and Channels, 3rd Edition, July 2006

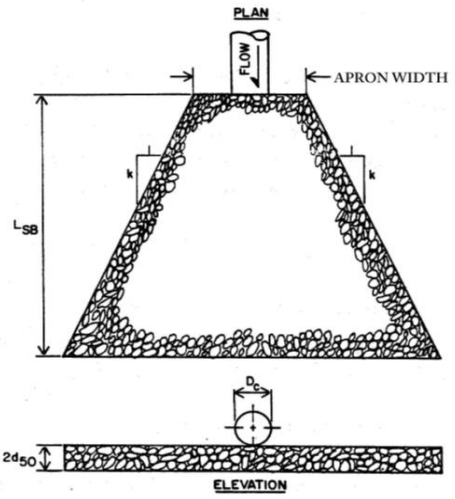
(2) PCRFCD, Drainage and Channel Design Standards for Local Drainage for Floodplain Management within Pima County, Arizona, June 1984

**Design Notes:**

(1) The riprap apron at the end of storm drain outlets are design using Reference 1 above.

**Equations**

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right)$$ Eqn. 10.4 of Reference 1




Where:

| | |
|---|---|
| $D_{50}$ = | Median riprap Size (ft) |
| D = | Culvert diameter (ft) |
| Q = | Design peak discharge (cfs) |
| g = | Acceleration due to gravity (32.2 ft/s$^2$) |
| TW = | Tailwater depth (ft) |
| $L_{sb}$ = | Length of scour basin or apron (ft) |
| k = | Taper coefficient |

Riprap apron size (D50), Apron length, and thickness per Table 10.1 of Reference 1

**Table 10.1. Example Riprap Classes and Apron Dimensions** (From Reference 1)

| Class | $D_{50}$ (mm) | $D_{50}$ (in) | Apron Length[1] | Apron Depth |
|---|---|---|---|---|
| 1 | 125 | 5 | 4D | $3.5D_{50}$ |
| 2 | 150 | 6 | 4D | $3.3D_{50}$ |
| 3 | 250 | 10 | 5D | $2.4D_{50}$ |
| 4 | 350 | 14 | 6D | $2.2D_{50}$ |
| 5 | 500 | 20 | 7D | $2.0D_{50}$ |
| 6 | 550 | 22 | 8D | $2.0D_{50}$ |

[1]D is the culvert rise.

**Riprap Apron Design Summary**

| Contributing Watershed IDs | 100-Yr Peak Discharge, Q (cfs) | Culvert Dia, D (ft) | Tailwater, TW* (ft) | Calculated D50 (in) | Design D50 (in) | Apron Length, $L_{sb}$ (ft) | Min. Apron Width (ft) | Taper Coefficient, k | Max. Apron Width (ft) | Min. Apron Thickness (in) |
|---|---|---|---|---|---|---|---|---|---|---|
| PWS1+PWS8 | 16.00 | 1.50 | 1.50 | 3.71 | 6.00 | 6.00 | 5.00 | 3.00 | 9.00 | 12.00 |
| East Basin | 2.80 | 0.50 | 0.50 | 4.72 | 6.00 | 4.00 | 4.00 | 3.00 | 7.00 | 12.00 |

**Footnotes**

*maximum tailwater is analyzed assuming full flow

# APPENDIX F

# Detention Basin Inspection and Maintenance Checklist

| Date: | Basin Name/Location: | |
|---|---|---|
| Inspector: | Title: | Affiliation: |
| Type of Inspection: ☐ Annual ☐ After a Significant Storm Event | | |

**General Requirements**

- Basins shall be maintained to perform as designed for the life of the project and shall not be converted to a different use without a Floodplain Use Permit. A Floodplain Use Permit is not required for maintenance activities.
- Basins shall be inspected annually and after significant storm events.
- The purpose of the inspection is to evaluate whether as-built characteristics are maintained.

| Basin Component | Inspection Item | Requires Maintenance | If maintenance is required, describe corrective action |
|---|---|---|---|
| **Inlet** | As-built grades and elevations | ☐ | |
| | Presence of obstructions | ☐ | Remove all debris/obstructions from inlet of pipes/roof drains. |
| | Evidence of material damage | ☐ | Repair pipe if/as needed. |
| **Outlet** | As-built grades and elevations | ☐ | |
| | Presence of obstructions | ☐ | Remove all debris/obstructions from outlet of pipes. |
| | Evidence of material damage | ☐ | Repair pipe if/as needed. Repair riprap near and downstream of outlet. |
| **Slopes** | As-built grades and elevations | ☐ | |
| | Invasive non-native plants | ☐ | Remove invasive plants as necessary. Clear debris. |
| | Slope treatment | ☐ | Repair/fill and/or reset riprap. Make sure filter fabric is intact. |
| **Retaining walls** | As-built grades and elevations | ☐ | |
| | Presence of damage or instability | ☐ | |
| | Drainage function | ☐ | |
| **Depth** | As-built grades and elevations | ☐ | Repair/fill/excavate as necessary to maintain clean bottom and slopes. |
| | Sediment accumulation >10% of design volume | ☐ | Scarify or remove silt and sedimentation. |
| **Floor** | As-built grades and elevations | ☐ | Repair/fill/excavate as necessary to maintain clean bottom and slopes. |
| | Presence of ponding | ☐ | Remove obstructions/debris/sediment. |
| | Evidence of oil, grease, chemicals or trash | ☐ | Eliminate sources of pollution. Clean/clear basin. |
| | Presence of invasive non-native plants | ☐ | Remove invasive plants as necessary. Remove debris. |

## Detention Basin Inspection and Maintenance Checklist (Continued)

| Date: | Basin Name/Location: |
|---|---|

| Basin Component | Inspection Item | Requires Maintenance | If maintenance is required, describe corrective action |
|---|---|---|---|
| **Perimeter Wall** | As-built grades and elevations | ☐ | |
| | Presence of damage or instability | ☐ | |
| | Drainage function | ☐ | |
| **Security Barrier** | Presence of damage or instability | ☐ | |
| **Access** | Presence of obstruction | ☐ | Remove obstructions. |
| **Landscaping** | Presence of overgrown vegetation | ☐ | Trim overgrowth. Remove the debris. |
| | Presence of invasive non-native plants | ☐ | Remove invasive plants. Remove debris. |
| | Damage to basin due to landscape elements | ☐ | Remove overgrowth. Repair basin bottom/slopes as necessary. |
| **Pump** | Alarm System | ☐ | |
| | Presence of obstruction | ☐ | |
| | As-built specifications | ☐ | |
| **Other** | | | |
| | | | |
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