



# PRELIMINARY DRAINAGE REPORT

**Harvest Crossing Subdivision Filing No. 02  
(PA-5, 6, & 7)**

Aurora, Colorado

## Richmond American Homes

**Prepared for:**

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| <b>Approved For One Year From This Date</b> |             |
| _____                                       |             |
| _____                                       | _____       |
| <b>City Engineer</b>                        | <b>Date</b> |
| _____                                       | _____       |
| <b>Water Department</b>                     | <b>Date</b> |



Project #: 196284001

Prepared: August 2022



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### **ENGINEER'S CERTIFICATION**

This report and plan for the drainage design of Harvest Crossing PA-5, 6, & 7 was prepared by me (or under my direct supervision) in accordance with the provisions of City of Aurora Storm Drainage Design and Technical Criteria and was designed to comply with the provisions thereof.

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Tamara Connolly, P.E.

Registered Professional Engineer

State of Colorado No. 52027

## A. Introduction

The purpose of this preliminary drainage report is to outline the Drainage Design for the proposed Harvest Crossing PA-5, 6, & 7 Development (The Site or the Project), located at the northeast corner of Harvest Road and North of E Yale Ave.

The purpose of this report is to demonstrate that the proposed single-family project conforms to the established drainage patterns set forth in the *Master Drainage Report for the Harvest Crossing/Villages at Murphy Creek*.

The Master Drainage Report referenced herein is EDN 221085 (The MASTER DRAINAGE REPORT), originally completed by Innovative Land Consultants, Inc. approved 04/05/2021. The drainage design will also conform to the current *City of Aurora Storm Drainage and Technical Criterial Manual* (The Criteria) which supplements the Mile High Flood District *Urban Storm Drainage Criteria Manual* (The Manual).

### 1. Location

The project is located in the west half of section 29, township 4 south, range 65 west of the sixth principle meridian, county of Arapahoe, State of Colorado. The site is bounded by E Warren Ave to the North and Harvest to the west, and undeveloped land to the east and south. Harvest Crossing Subdivision Filing No. 1 (RSN #1586661) is adjacent to the site to the north, future Murphy Creek Subdivision is to the west, and future Eastern Hills Subdivision is to the east.

A vicinity map is provided below for reference: (Not to Scale)



**Figure 1:** Vicinity Map

## **2. Proposed Development**

The proposed Site will consist of approximately 124 acres containing 435 single-family detached units along with associated infrastructure to support the community. Open park space is proposed at various locations within the community.

The site is currently zoned as R-2. The proposed detached single family lots shall comply with the general standards found in the Aurora Unified Development Ordinance, section 146-4.

The site's onsite imperviousness at full buildout is 34%. Composite imperviousness calculated utilizing The Criteria Table 1: Runoff Coefficients and Percent's Impervious. Please refer to Appendix C for Table 1, impervious computations, and hydraulic computations. There are no irrigation canals or ditches located on the property.

The planned design includes routing the developed runoff from the Site through grading and storm drain design to the proposed Ponds A & B. Pond A will be located on the west side of the site and Pond B is located towards the southwestern boundary of the site. This Preliminary Drainage Report includes the preliminary analysis of the drainage related to the site layout and grading of Harvest Crossing PA-5, 6, & 7. A Final Drainage Report for this site will be prepared with subsequent development submittals to ensure that storm drainage infrastructure is appropriately sized to serve the overall development at full build out.

### *Existing Geotechnical & Geologic Features*

A Draft Geotechnical Site Development Study dated May 28, 2021 was prepared by A.G. Wassenaar, Inc.

Per this report, Site development considerations should include provisions for the presence of expansive clays and shallow claystone bedrock and moderately to well cemented sandstone.

According to a USDA web soil report accessed May 10, 2022, the site is majority hydrologic soil group C and D soils. USDA web soil report is referenced in **Appendix B**.

### *Requested Variances*

1. **City of Aurora is allowing the following variances consistent with future revisions to the COA SDDTCM:**
  - a. **The detention pond may use nested volumes to detain the WQCV, EURV, and 100YR Volumes.**
  - b. **The required freeboard for the top-of-embankment must be at least 1-foot above the water surface elevation when the emergency spillway is conveying the maximum design or emergency flow.**

## **B. Historic Drainage**

### **1. Overall Sub-Basin Description**

Currently, the Site consists of undeveloped land. A natural ridgeline running north/south is located roughly in the center of the site. This natural ridge splits historic flow. The majority of the site flows towards the Murphy Creek basin, while the northeastern portion of the site flows towards the Coal Creek basin. Currently the site is covered by natural grasses and slopes on site are roughly between 3% - 9%.

The Site falls within Zone X according to FEMA FIRM map number 08005C0212K panel 0212K. The FEMA FRIM Map is referenced in **Appendix B**.

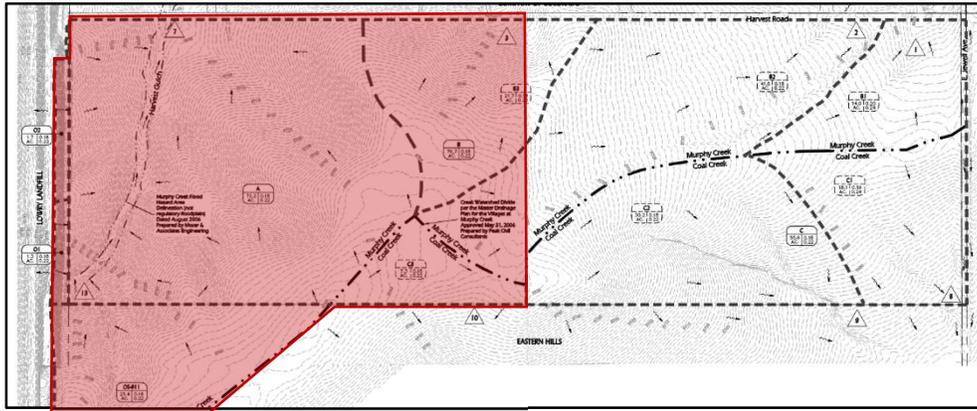
### **2. Drainage Patterns Through Property**

The Master Drainage Report identifies five existing drainage basins A, B2, B3, C3 and OS-911. Basin's A, B2, B3 and OS-911 flows to the west and is tributary to Murphy Creek. Basin C3 flows to the east and is tributary to Coal Creek. The majority of the site sheet flows to two small swales located on site (Design point 3 and 7, See Figure 2). There are two swales on the west side of the site. Basin C3 and B2 sheet flow to offsite basins. Basin OS-911 sheet flows into a swale within basin A. The swales located towards the edge of the site carry flow off the site to the ultimate outfall. There is no storm infrastructure currently onsite capturing any flow.

### **3. Outfalls Downstream from Property**

Murphy Creek is approximately 0.44 Miles to the West of the Site. The outlet structure and ultimate outfall of the western detention pond (Pond A) routes to an existing storm drain located in Harvest Road. The ultimate outfall being Murphy Creek. The outlet structure and ultimate outfall of the southwestern detention pond (Pond B) routes to the proposed Harvest Gulch improvements. Both these outfalls adhere to the historical drainage patterns.

Coal Creek is approximately 1.0 miles to the East of the site. Flows will outfall to existing storm to the north of the site, which will outfall within an existing swale east of S. Kewaunee Street and ultimately outfall into Coal Creek.



**Figure 2:** Snip of Master Drainage Plan (Full size in Appendix A-1). Red boundary indicates onsite area and offsite flows tributary to site.

## C. DRAINAGE DESIGN CRITERIA

### 1. List References

The “City of Aurora Storm Drainage Design and Technical Criteria”, revised October 2010 (the Criteria) and the “Urban Storm Drainage Criteria Manual” Volumes 1, 2, and 3 (The Manual), with latest revisions, were used when preparing the storm calculations. This report is intended to serve as a Site-Specific Preliminary Drainage Report for the Harvest Crossing PA-5, 6, & 7 Single Family Development.

### 2. Hydrologic Criteria

#### Rainfall and Storm Design Frequencies

According to the Criteria section 3.31, the design storms for the Project are the 2-year and 100-year frequency events.

Chapter 5 of the Criteria was used to determine the time of concentrations, rainfall intensities, and runoff coefficients to calculate the peak runoff for each storm event. The Manual, adopted by the City of Aurora, was used to calculate runoff using the Rational Method for sub-basins less than 90 acres in size.

“The Manual” figures RA-1 through RA-6, were used to determine the rainfall P1 values for the rainfall intensity values see **Appendix B**. One-hour rainfall depths used for the calculations at the site are as outlined below:

| Table 1: Rainfall Depths |        |        |         |         |         |          |
|--------------------------|--------|--------|---------|---------|---------|----------|
|                          | 2-year | 5-year | 10-year | 25-year | 50-year | 100-year |
| 1-hr                     | 0.99”  | 1.39”  | 1.62”   | 2.00”   | 2.34”   | 2.67”    |

Calculation Method

The rational method was used to calculate run-off coefficients of 2-yr and 100-yr flows. Three land uses for the calculations, Single-Family (which included half streets within the alleys), Paved Street and Landscape.

The 2-yr Coefficients used in calculations are 0.40 (Single-Family), 0.69 (Local), 0.72 (Harvest), 0.70 (Warren), 0.68 (Kewaunee), 0.60 (Yale), 0.87 (Paved Area) and 0.18 (Landscape Tract). The 100-yr Coefficients are 0.60 (Single-Family), 0.74 (Local), 0.78 (Harvest), 0.76 (Warren), 0.73 (Kewaunee), 0.65 (Yale), 0.93 (Paved Area) and 0.22 (Landscape Tract). See **Appendix C** for results.

Detention Volume Computation Method

The required detention volume was calculated using The Criteria outlined in section 6.30. The total required volume is equal to the 100-yr runoff volume plus half the EURV as well as an additional 20% of the Water Quality event to account for sedimentation. The water quality event and EURV were calculated using the methods outlined in Volume 2 of The Manual. The 100-year required storage was calculated using equations (6.1) outlined in section 6.33 of The Criteria Manual. The 100-year required storage was also calculated using the Mile High Flood District criteria and the more conservative of the two results was used. See **Appendix D** for results.

$$V = KA$$

$$\text{For the 100-year, } K_{100} = (1.78 - 0.002I^2 - 3.56)/900 \quad (6.1)$$

Where V=required volume for the 100

I= Developed basin imperviousness (%)

A= Tributary Area (acres)

**3. Hydraulic Criteria**

The storm sewer layout will be designed horizontally along with inlet locations to gravity-flow in the 2-year storm and to convey the 100-year storm with the HGLs one foot below the rim elevations of the storm structures. The HGLs associated with the 2-year and 100-year storm events will be modeled in AutoCAD Civil 3D Hydraflow Storm Sewers Extension and will be provided within a future Final Drainage Report. An emergency overtopping route has been designed to allow these flows to reach the Ponds if the underground infrastructure becomes clogged. The emergency outfall elevation is outlined and hatched in the Preliminary Drainage Plan shown in **Appendix A**.

## D. Drainage Plan

### 1. General Concept

Stormwater will generally flow to the west side of the site (Pond A), the Southwest area of the site (Pond B) and the to the north (anticipated existing Storm Infrastructure) in accordance with the Master Drainage report via overland flow, channelized flow within the roadway systems and ultimately storm sewer conveyance.

Offsite runoff is captured within basins B-15, B-20 and B-85 which are located on the south and southeast side of the site. These basins are discussed in further detail in descriptions below. Flows will be detained by the proposed detention ponds and release at flow rates required by The Criteria via outlet control structures. Pond outfall flows will then be conveyed by either the proposed Harvest Gulch improvements or storm infrastructure to the ultimate outfall to Murphy Creek and Coal Creek.

The property owner is responsible for maintaining the proposed storm infrastructure within the property, and the HOA is responsible for maintaining the proposed detention ponds.

Harvest Crossing Subdivision Filing No. 02 is proposed to be split into 4 phases. Phase 1 will include all Pond A infrastructure, Phase 2 will include all Pond B infrastructure, Phase 3 will continue to be tributary to Pond B, and Phase 4 flows will tie to existing storm infrastructure from Filing No. 1. See **Appendix A** for the Phasing Plan.

### 2. Specific Details

The proposed drainage of the project will adhere to the existing drainage pattern of the site. The existing ridgeline will be a high point on the site splitting the flows of the site. Detention ponds will on the west side of the site to capture the respective flows split by the ridgeline. Both Pond A and Pond B will ultimately outfall to the Murphy Creek. The remaining flow, delineated in Basin's B, C and E, will be captured via existing storm infrastructure and will ultimately outfall to Murphy Creek and Coal Creek.

Onsite flows within Basins C, D and E will be conveyed via storm drain to existing storm infrastructure to the north end of the site. The flows will be routed to existing detention ponds constructed within Harvest Crossing Filing No.1 designed by ILC Consultants shown in **Appendix C**. The Basins located within Harvest Crossing Filing No.1 correspond with the Harvest Crossing as follows. Basin C corresponds with ILC's Basin OB. Basin D corresponds with ILC's Basin OA2 Basin E corresponds with ILC's Basin OA1.

| Table 2: Basin Comparison |       |      |      |       |       |
|---------------------------|-------|------|------|-------|-------|
| Basin ID                  | AC    | C2   | C100 | Q2    | Q100  |
| OB (ILC)                  | 16.14 | 0.39 | 0.60 | 15.03 | 61.97 |
| C                         | 13.88 | 0.46 | 0.63 | 16.49 | 59.30 |
| OA1(ILC)                  | 4.17  | 0.39 | 0.59 | 3.67  | 14.75 |
| E                         | 4.86  | 0.44 | 0.61 | 5.46  | 20.38 |
| OA2(ILC)                  | 13.37 | 0.33 | 0.62 | 10.94 | 54.79 |
| D                         | 13.40 | 0.40 | 0.55 | 11.09 | 39.83 |

The above table highlights the differences between Harvest Crossing Filing No. 1 design (ILC) and the Filing No. 3 (Current) calculations. Acreages and runoff coefficients slightly vary which results in different Q2 and Q100 values. Site design will be revisited at final design to adjust the proposed (Current) acreages and runoff coefficients to be more inline with ILCs Filing No. 1 anticipated flow. In our previous work experience, design flow reduces approximately 20-30% after modeling the stormwater system and attenuating storm water runoff. We believe that using modeling software at the final design stage will ensure the proposed flows of Filing No. 3 are inline with the anticipated flows in Filing No. 1 analysis.

Basin A's flows will be conveyed via storm drain to propose detention Pond A located on the west edge of the site. Basin D and E flows will be conveyed via storm drain to existing infrastructure to the north end of the site and ultimately be detained offsite in Pond B2 per Master Drainage Report. Basin C flows will be conveyed via storm drain to existing infrastructure to the north end of the site and ultimately be detained offsite in Pond C3 per Master Drainage Report. Basin B's flows will be conveyed via storm drain to propose detention Pond B located on the southwest area of the site.

The proposed Ponds have been sized to attenuate the WQCV, EURV, and 100-year events, providing 2.99 acre-feet of storage for the western pond (Pond A). As well as 9.26 acre-feet of storage for the southwestern pond (Pond B).

After the water has been detained, Pond A will discharge into existing storm drain at a maximum rate of 7.32 cfs (10yr) and 24.41 cfs (100 yr). The existing infrastructure will route the flow to discharge into Murphy Creek. Pond B will detain and release flow at a maximum rate of 26.65 cfs (10 yr) and 88.83 cfs (100 yr) Pond B will discharge flow into the proposed Harvest Gulch improvements and ultimately into Murphy Creek. Release rates were calculated using City of Aurora Drainage Criteria Manual section 6.33.

Both Ponds will incorporate the use of forebay structures, trickle channels and micropools designed in accordance with the Manual. Ponds A and B will retain the WQCV for at least 40 hrs along with the EURV and 100-year for 72 hrs. Calculations for the detention Ponds are provided in **Appendix D**.

### **Harvest Gulch**

A Master Drainage Report was prepared for Harvest Crossing and Villages at Murphy Creek by ILC, Inc. and approved April 5<sup>th</sup>, 2021. Per the approved Master Drainage Report the Harvest Gulch (The Gulch) is being proposed on the southern portion of the site. All development upstream of Harvest Gulch will have full-spectrum detention ponds prior to being discharged into the natural channel onsite. Although detention will be utilized upstream, the drainageway will be sized for the undetained, developed flows tributary to the channel per MHFD direction. Basins A (per the Master Drainage Report, now known as Basin B in this Drainage Report), O1, O2, and OS-911 (basin names from ILC report) are all tributary to the Gulch. The Gulch corridor is sized for the undetained, developed flow of the tributary basins, however, detention Pond B attenuates the developed flow, resulting in a lower proposed flowrate contributing to Harvest Gulch. The normal depth shown in the Gulch is the historic peak runoff from the 2008 Murphy Creek Outfall Systems Planning Study by Moser and Associates. See **Appendix C** for reference.

Within the previous approved master report the Gulch was sized at 705' long by 123' wide. Currently the gulch is preliminary designed to have approximately 1.2% longitudinal slope with 4:1 maximum side banks. A 12' bench is shown on both sides of the gulch for pedestrian circulation and maintenance access. Material used to construct the Gulch will be determined at final design and proper erosion control measures will be taken to ensure channel geometry stays intact.

A low flow trickle condition will be designed during final construction documents per the criteria. landscaping will be proposed in the area. Spillways and outfall rip-rap systems will also be designed during final construction documents. The applicant will coordinate with the public works department on plant type and locations.

### **3. Sub-basin Description**

A standalone Drainage Area Map has been provided in this submittal, to illustrate the sub-basins proposed with this project. Individual sub-basin details such as runoff, coefficient calculations, and imperviousness percentages are provided in Appendix C. The 2-year and 100-year peak flows are provided below with full calculations provided in **Appendix C**.

#### **On-Site Basins**

##### **Sub-basins A-05**

Sub-basin A-05 is 1.47 acres and is located west side of the Site and is one of the 16 sub-basins on the Project that is tributary to Pond A at the west side of the Site. This sub-basin

flows to design point A05 within. This sub-basin will utilize natural slope of the land to flow to Pond A.

#### **Sub-basins A-10**

Sub-basin A-10 is 0.63 acres and is located on the west side of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A10, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-15**

Sub-basin A-15 is 2.57 acres and is located on the west area of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A15, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-20**

Sub-basin A-20 is 1.15 acres and is located on the west side of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A20, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-25**

Sub-basin A-25 is 2.13 acres and is located on west side of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A25, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-30**

Sub-basin A-30 is 2.18 acres and is located on the west towards the middle of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A30, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-35**

Sub-basin A-35 is 1.66 acres and is located toward the center of the northern portion of the Site. Basin A-35 is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A35, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins A-40**

Sub-basin A-40 is 0.90 acres and is located within the center of Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A40, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins A-45**

Sub-basin A-45 is 0.74 acres and is located within the center of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A45, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins A-50**

Sub-basin A-50 is 1.59 acres and is located within the center of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A50, which is an area inlet. This sub-basin will utilize sheet flow to facilitate flow to proposed storm sewer.

**Sub-basins A-55**

Sub-basin A-55 is 0.94 acres and is located near the center of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A-55, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins A-60**

Sub-basin A-60 is 2.79 acres and is located west side of Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A60, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins A-65**

Sub-basin A-65 is 1.29 acres and is located northwest area of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A65, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins A-70**

Sub-basin A-70 is 0.98 acres and is located on the west towards the center of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A70, which is a sump

inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-75**

Sub-basin A-75 is 1.14 acres and is located on the west towards the center of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A75, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins A-80**

Sub-basin A-80 is 2.28 acres and is located on the west towards the center of the Site and is one of the 16 sub-basins on the Project that drains via private storm drains to Pond A at the west side of the Site. This sub-basin flows to design point A80, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-05**

Sub-basin B-05 is 3.86 acres and is located in the southwest area of the Site and is one of the 35 sub-basins on the Project that drains via sheet flow to Pond B located at the southwest area of the Site. This sub-basin flows to design point B05, which is within Pond B. This sub-basin will utilize sheet flow and trickle-channel flow to facilitate flow to proposed pond.

#### **Sub-basins B-10**

Sub-basin B-10 is 2.40 acres and is located in the southeast of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B10, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-15**

Sub-basin B-15 is 6.49 acres and is located in the southeast corner of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B15, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-20**

Sub-basin B-20 is 18.09 acres and is located in the southeast area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B20, which is an

on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-25**

Sub-basin B-25 is 4.17 acres and is located in the south area of the site of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B25, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-30**

Sub-basin B-30 is 2.45 acres and is located on the south area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B30, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-35**

Sub-basin B-35 is 0.95 acres and is located on the south edge of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B35, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-40**

Sub-basin B-36 is 0.19 acres and is located in the southwest corner of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B40, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-45**

Sub-basin B-45 is 2.25 acres and is located in the southwest area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B45, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-50**

Sub-basin B-50 is 1.91 acres and is located in the southwest area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B50, which is a

sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-55**

Sub-basin B-55 is 1.15 acres and is located in the south area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B55, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-60**

Sub-basin B-60 is 2.62 acres and is located in the south area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B60, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-65**

Sub-basin B-65 is 1.85 acres and is located in the southeast area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B65, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-70**

Sub-basin B-70 is 2.29 acres and is located in the southeast area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B70, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-75**

Sub-basin B-75 is 0.22 acres and is located in the southeast area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B75, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-80**

Sub-basin B-80 is 1.00 acres and is located on the southeastern area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B80, which

is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-85**

Sub-basin B-85 is 4.92 acres and is located on the eastern edge of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B85, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-90**

Sub-basin B-90 is 1.32 acres and is located on eastern edge of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B90, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-95**

Sub-basin B-95 is 2.62 acres and is located on the eastern area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B95, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-100**

Sub-basin B-100 is 1.85 acres and is located in the southeast area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B100, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-105**

Sub-basin B-105 is 1.70 acres and is located in the eastern area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B105, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-110**

Sub-basin B-110 is 2.40 acres and is located in the eastern area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B110, which is a sump

inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-115**

Sub-basin B-115 is 1.51 acres and is located on the eastern edge of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B115, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-120**

Sub-basin B-120 is 1.72 acres and is located on the eastern edge of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B120, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-125**

Sub-basin B-125 is 4.43 acres and is located towards the eastern edge of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B125, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-130**

Sub-basin B-130 is 1.03 acres and is located near the center of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B130, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-140**

Sub-basin B-140 is 1.14 acres and is located near the center of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B140, which is an area inlet. This sub-basin will utilize sheet to facilitate flow to proposed storm sewer.

#### **Sub-basins B-145**

Sub-basin B-145 is 0.13 acres and is located near the center of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B145, which is an on-

grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-150**

Sub-basin B-150 is 0.13 acres and is located near the center of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B150, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-155**

Sub-basin B-155 is 3.00 acres and is located near the western area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B155, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-160**

Sub-basin B-160 is 1.74 acres and is located in the western area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B160, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-165**

Sub-basin B-165 is 0.18 acres and is located in the western area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B165, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins B-170**

Sub-basin B-170 is 1.37 acres and is located in the western area of the Site and is one of the 35 sub-basins on the Project that drains via private storm drains to Pond B located at the southwest area of the Site. This sub-basin flows to design point B170, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-5**

Sub-basin C-5 is 1.11 acres and is located on the northeast edge Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C5,

which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-10**

Sub-basin C-10 is 1.46 acres and is located on the northeastern edge of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C10, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-15**

Sub-basin C-15 is 0.92 acres and is located on the northeastern edge of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C15, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-20**

Sub-basin C-20 is 1.27 acres and is located on the northeastern edge of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C20, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-25**

Sub-basin C-25 is 0.79 acres and is located on the eastern edge of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C25, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-30**

Sub-basin C-30 is 0.96 acres and is located on the eastern boundary of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C30, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-35**

Sub-basin C-35 is 1.18 acres and is located on the eastern boundary of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point

C35, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-40**

Sub-basin C-40 is 1.77 acres and is located on the east side of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C40, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-50**

Sub-basin C-50 is 1.09 acres and is located towards the northeast area of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C50, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-55**

Sub-basin C-55 is 1.18 acres and is located towards the northeast area of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C55, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins C-60**

Sub-basin C-60 is 0.34 acres and is located towards the northeast area of the Site and is one of the 12 sub-basins on the Project that drains via private storm drains to existing storm infrastructure at the northeast side of the Site. This sub-basin flows to design point C60, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins D-5**

Sub-basin D-5 is 1.07 acres and is located on the north edge of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D5, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

#### **Sub-basins D-10**

Sub-basin D-10 is 3.61 acres and is located north edge of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D10, which is a sump inlet.

This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins D-15**

Sub-basin D-15 is 2.54 acres and is located on the north edge of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D15, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins D-20**

Sub-basin D-20 is 0.42 acres and is located on the northern edge of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D20, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins D-25**

Sub-basin D-25 is 0.48 acres and is located in the northern center of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D25, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins D-30**

Sub-basin D-30 is 1.92 acres and is located in the northern center of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D30, which is an area inlet. This sub-basin will utilize sheet flow and to facilitate flow to proposed storm sewer.

**Sub-basins D-35**

Sub-basin D-35 is 0.85 acres and is located in the northern center of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D35, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins D-40**

Sub-basin D-40 is 2.53 acres and is located in the northern center of the Site and is one of the 8 sub-basins on the Project that drains via private storm drains to existing storm infrastructure located north of the Site. This sub-basin flows to design point D40, which is

an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins E-5**

Sub-basin E-5 is 1.84 acres and is located on the northwestern edge of the Site and is one of the 3 sub-basins on the Project that drains via private storm drains to existing infrastructure at the northwestern area of the Site. This sub-basin flows to design point E5, which is a sump inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins E-10**

Sub-basin E-10 is 1.26 acres and is located on the northwestern area of the Site and is one of the 3 sub-basins on the Project that drains via private storm drains to existing infrastructure at the northwestern area of the Site. This sub-basin flows to design point E10, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**Sub-basins E-15**

Sub-basin E-15 is 1.76 acres and is located in the northwestern corner of the Site and is one of the 3 sub-basins on the Project that drains via private storm drains to existing infrastructure at the northwestern area of the Site. This sub-basin flows to design point E15, which is an on-grade inlet. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed storm sewer.

**4. Water Quality and Detention**

| Required Pond Volumes Table |            |            |
|-----------------------------|------------|------------|
| Description                 | Pond A     | Pond B     |
| WQCV                        | 0.45 ac-ft | 1.37 ac-ft |
| EURV                        | 0.96 ac-ft | 2.51 ac-ft |
| 100-yr                      | 2.16 ac-ft | 6.50 ac-ft |
| Bottom Elevation            | 5714.5     | 5691.9     |
| Top of Pond                 | 5719.26    | 5696.89    |
| Basin Properties            |            |            |

|                |             |             |
|----------------|-------------|-------------|
| Area           | 24.41 Acres | 88.83 Acres |
| Imperviousness | 42%         | 31%         |

**Summary of results:**

The Ponds will drain the WQCV and EURV within 40 hours and 72 Hours respectively, as outlines in the MHFD standards.

Service access for the pond is provided as described below:

The access from Pond A occurs from the northwest corner of the pond off Harvest Road. Service access of the pond bottom is provided along a gravel path this is designed to accordance with the criteria, having minimum width of 8', Maximum longitudinal slope of 10%. The outfall for the pond includes a storm sewer that discharges into an existing storm sewer infrastructure that ultimately discharges unto Murphy Creek.

The access from Pond B occurs from the northern area of the pond, south of E Yale ave. Service access of the pond bottom is provided along a gravel path this is designed to accordance with the criteria, having minimum width of 8', Maximum longitudinal slope of 10%. The outfall for the pond includes a storm sewer that discharges into an existing swale that conveys flows to existing storm sewer infrastructure that ultimately discharges unto Murphy Creek.

**E. Conclusion**

**1. Compliance with Standards**

The project complies with the City of Aurora criteria for storm drainage design. City of Aurora Storm Drainage Design and Technical Criteria and the Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3 have been adhered to in the design of the storm sewer system as well as Best Management Practices.

**2. Summary of Concept**

The project's runoff generated within the site will be collected using curb and gutter, swales, sheet flow and storm drain systems that will convey stormwater runoff to the proposed Ponds and existing storm infrastructure. Stormwater will be detained and released at a rate consistent with MHFD and City of Aurora Criteria Manual to the existing swale and storm drain system and comply with the applicable master plans and outfall systems planning studies as noted previously in this report.

## List of References

Storm Drainage Design and Technical Criteria, City of Aurora; October 2010.

Urban Storm Drainage Criteria Manual, Volumes 1-3, Urban Drainage and Flood Control District, Updated August 2018.

Harvest Crossing/The Villages at Murphy Creek Master Historic Drainage Plan (221085); ILC, April 5, 2021

Master Drainage Report (221085MD1 1900-ARAP-E 13W); ILC, April 5, 2021

Flood Insurance Rate Map, Map Number 08005CO212K, Federal Emergency Management Agency; December 17, 2010.

Custom Soil Resource Report, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. May 10, 2021.

## **Appendix A- Drainage Maps & Phasing Plan**









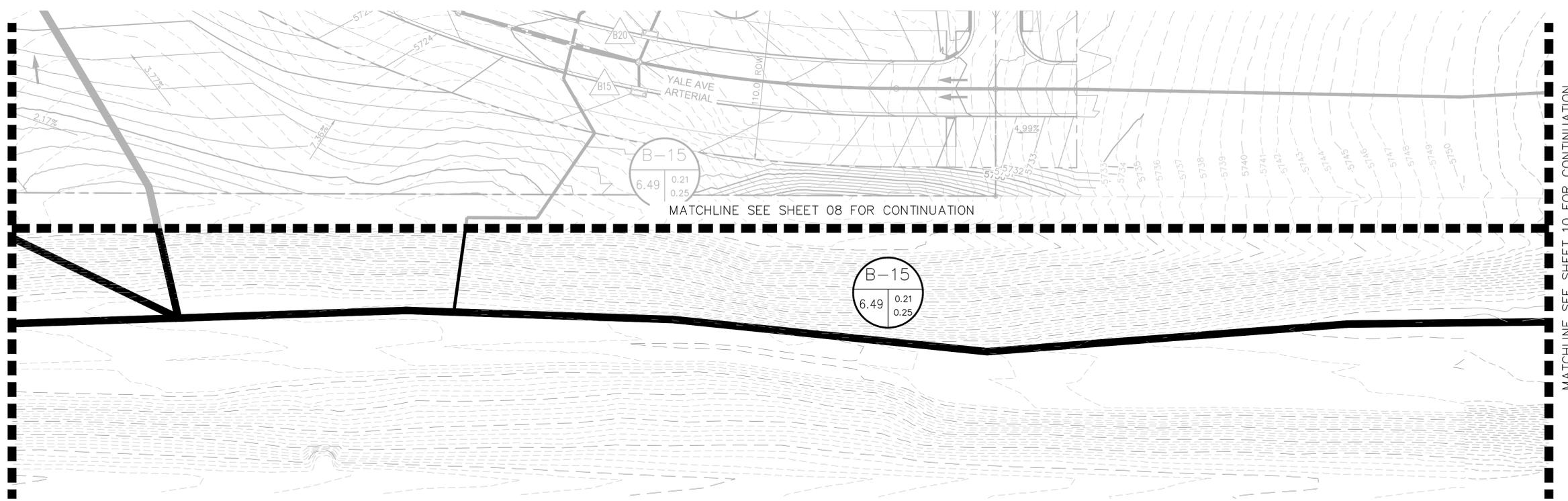
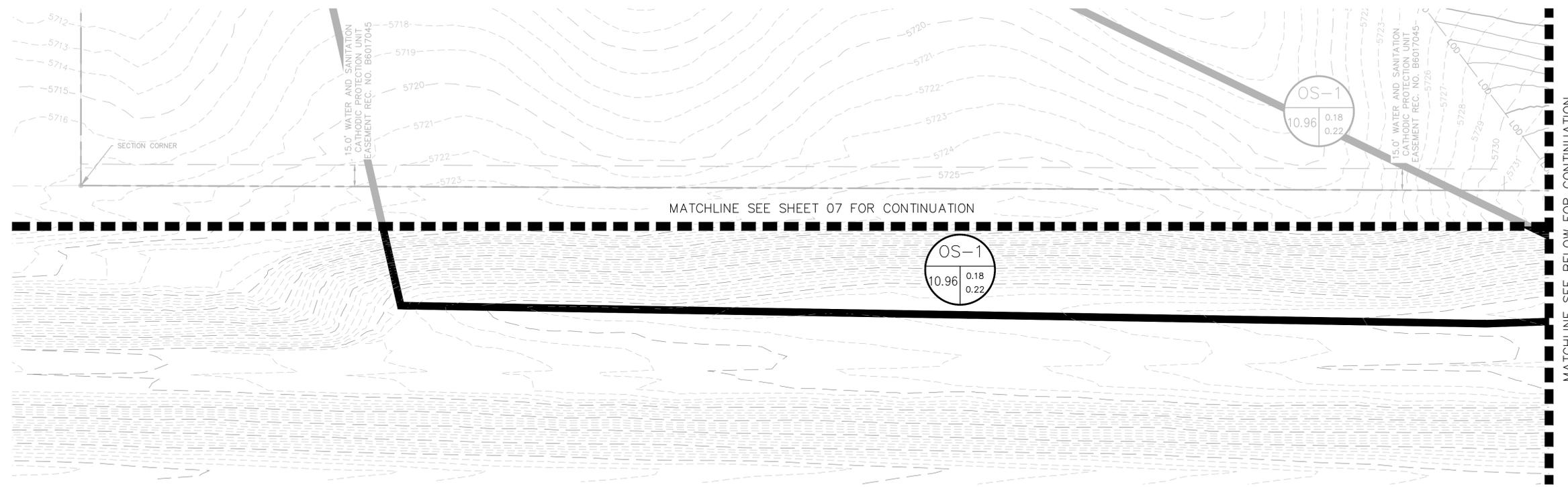








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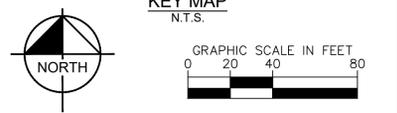
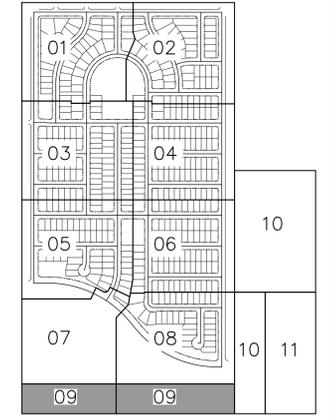


**PROPOSED DRAINAGE LEGEND**

- # = BASIN DESIGNATION
- AC = AREA IN ACRES
- C2 = 2-YR RUNOFF COEFFICIENT
- C100 = 100-YR RUNOFF COEFFICIENT
- # = DESIGN POINT
- PROPOSED BASIN BOUNDARY
- PROPOSED FLOW ARROW
- MAX SUMP INLET PONDING

**NOTE**  
 CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL PERFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

**SITE BENCHMARK**  
 CITY OF AURORA BENCHMARK #456518SW001 (AZTEC #407), RECOVERED A 3" BRASS CAP STAMPED "M-095" LOCATED ON THE NORTH SIDE OF EAST MISSISSIPPI AVE 300' MORE OR LESS EAST OF S COOLIDGE ST  
 ELEVATION = 5603.65 (NAVD 88).



HARVEST CROSSING, PLANNING AREAS 5, 6, & 7  
**PRELIMINARY DRAINAGE PLAN**

AURORA, CO

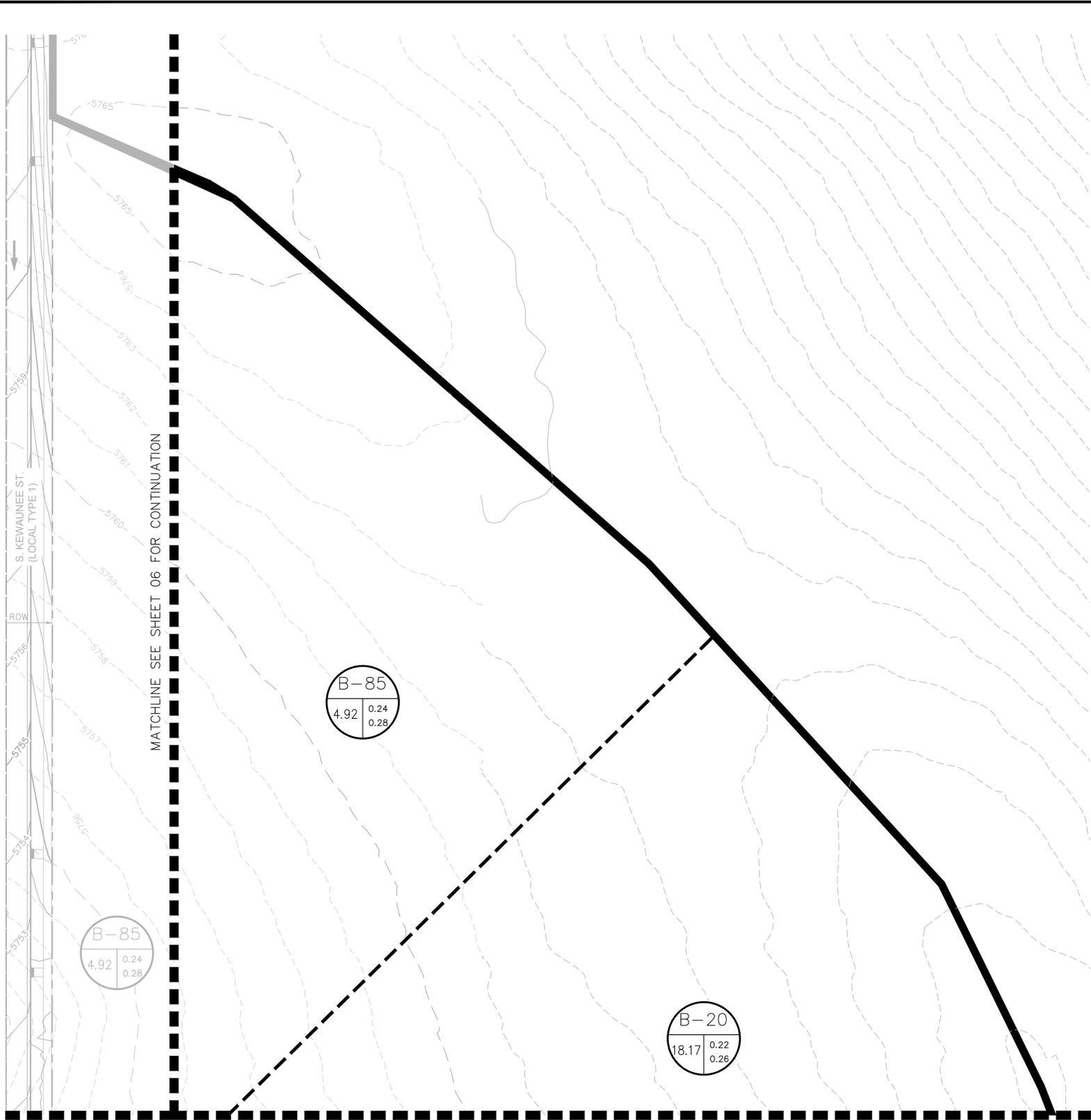


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 DENVER, CO 80237 (303) 228-2300

|   |                   |          |              |
|---|-------------------|----------|--------------|
| FOR CLIENT REVIEW - NOT FOR CONSTRUCTION. | DESIGNED          | DRAWN    | CHECKED      |
|   | JBP               | MSP      | TAF          |
|   | SCALE (H): 1"=40' |          |              |
|   | SCALE (V): N/A    |          |              |
|   | DATE:             | MAY 2022 |              |
| PROJECT NO.                               | 196284001         |          | 09           |
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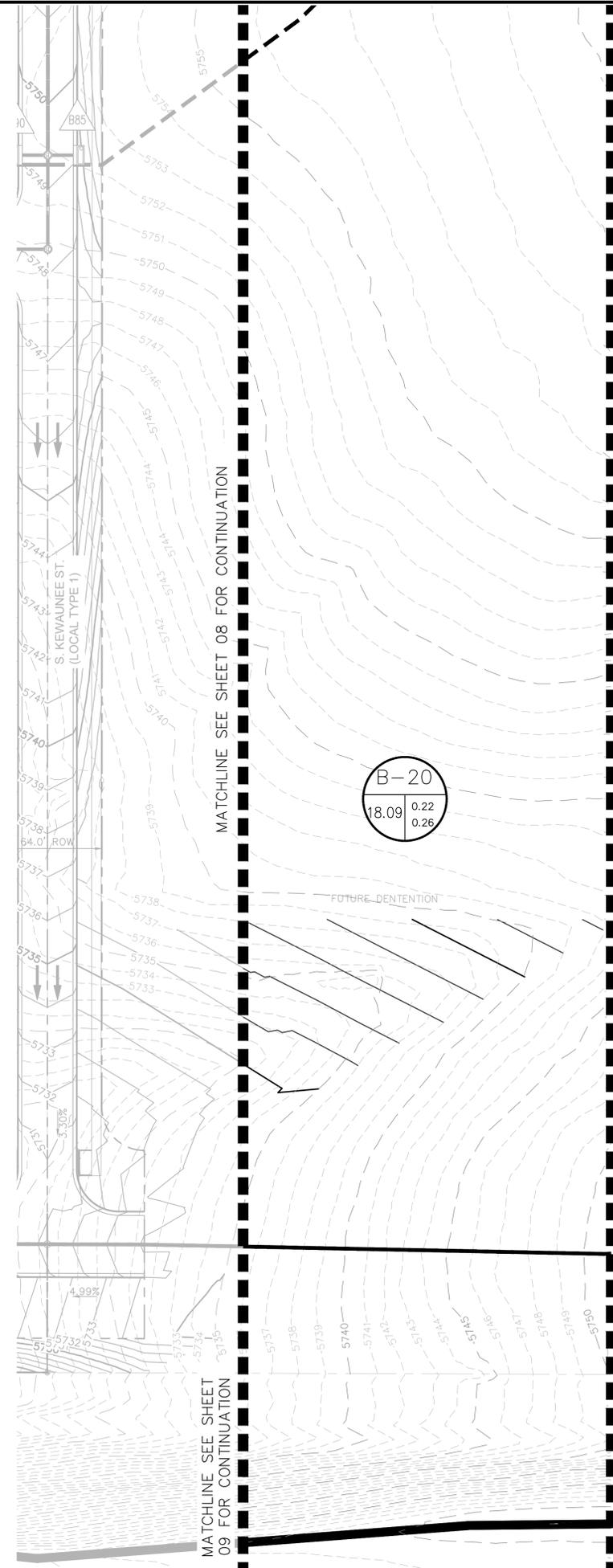
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MATCHLINE SEE SHEET 08 FOR CONTINUATION

MATCHLINE SEE SHEET 11 FOR CONTINUATION



MATCHLINE SEE SHEET 08 FOR CONTINUATION

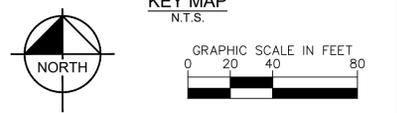
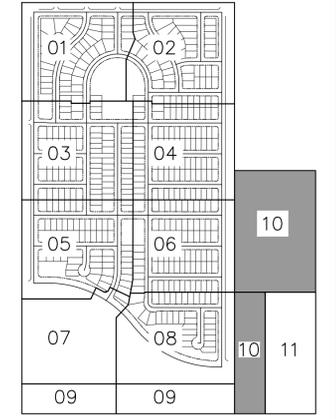
MATCHLINE SEE SHEET 11 FOR CONTINUATION

**PROPOSED DRAINAGE LEGEND**

- # = BASIN DESIGNATION  
AC = AREA IN ACRES  
C2 = 2-YR RUNOFF COEFFICIENT  
C100 = 100-YR RUNOFF COEFFICIENT
- # = DESIGN POINT
- PROPOSED BASIN BOUNDARY
- PROPOSED FLOW ARROW
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**SITE BENCHMARK**  
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 ELEVATION = 5603.65 (NAVD 88).



HARVEST CROSSING, PLANNING AREAS 5, 6, & 7  
**PRELIMINARY DRAINAGE PLAN**

AURORA, CO



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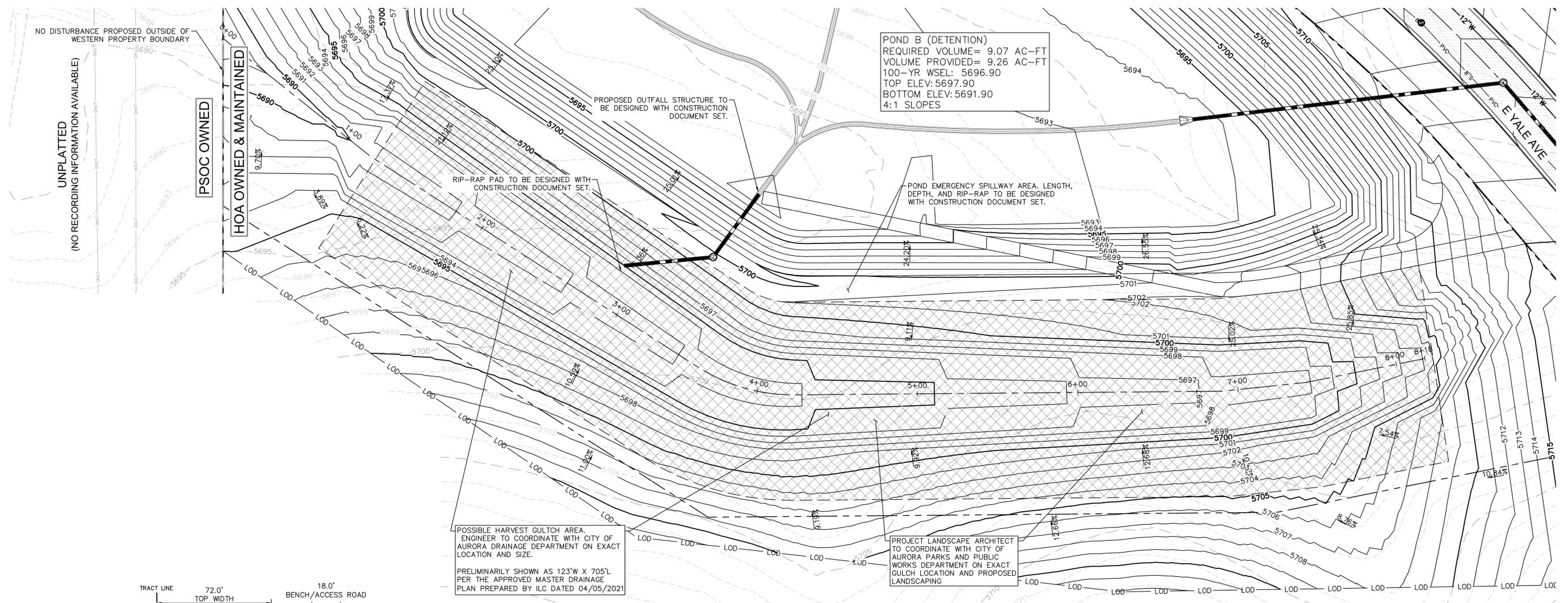
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| DATE:<br>MAY 2022        |              |                        |
| PROJECT NO.<br>196284001 |              |                        |
| DWG. NAME<br>PDP-PA5.dwg |              | of 12 sheets           |

CASE NO.: TBD









POND B (DETENTION)  
 REQUIRED VOLUME= 9.07 AC-FT  
 VOLUME PROVIDED= 9.26 AC-FT  
 100-YR WSEL: 5696.90  
 TOP ELEV: 5697.90  
 BOTTOM ELEV: 5691.90  
 4:1 SLOPES

PROPOSED OUTFALL STRUCTURE TO BE DESIGNED WITH CONSTRUCTION DOCUMENT SET.

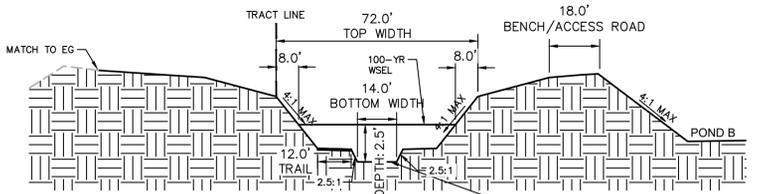
RIP-RAP PAD TO BE DESIGNED WITH CONSTRUCTION DOCUMENT SET.

POND EMERGENCY SPILLWAY AREA. LENGTH, DEPTH, AND RIP-RAP TO BE DESIGNED WITH CONSTRUCTION DOCUMENT SET.

POSSIBLE HARVEST GULCH AREA. ENGINEER TO COORDINATE WITH CITY OF AURORA DRAINAGE DEPARTMENT ON EXACT LOCATION AND SIZE.

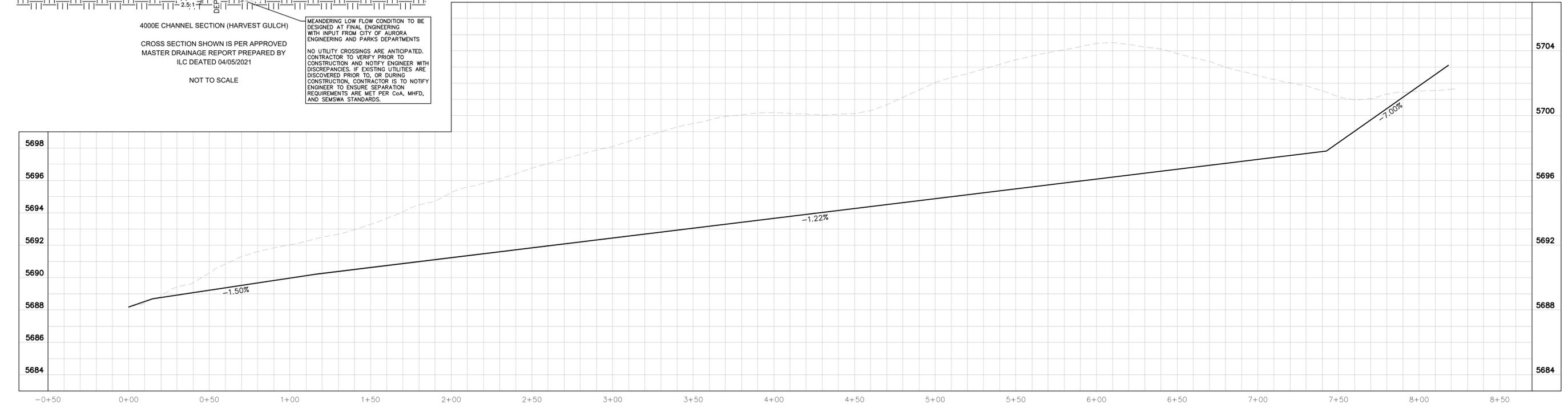
PRELIMINARILY SHOWN AS 123'W X 705'L PER THE APPROVED MASTER DRAINAGE PLAN PREPARED BY ILC DATED 04/05/2021

PROJECT LANDSCAPE ARCHITECT TO COORDINATE WITH CITY OF AURORA PARKS AND PUBLIC WORKS DEPARTMENT ON EXACT GULCH LOCATION AND PROPOSED LANDSCAPING



4000E CHANNEL SECTION (HARVEST GULCH)  
 CROSS SECTION SHOWN IS PER APPROVED MASTER DRAINAGE REPORT PREPARED BY ILC DEATED 04/05/2021  
 NOT TO SCALE

MEANDERING LOW FLOW CONDITION TO BE DESIGNED AT FINAL ENGINEERING WITH INPUT FROM CITY OF AURORA ENGINEERING AND PARKS DEPARTMENTS  
 NO UTILITY CROSSINGS ARE ANTICIPATED. CONTRACTOR TO VERIFY PRIOR TO CONSTRUCTION AND NOTIFY ENGINEER WITH DISCREPANCIES. IF EXISTING UTILITIES ARE DISCOVERED PRIOR TO, OR DURING CONSTRUCTION, CONTRACTOR IS TO NOTIFY ENGINEER TO ENSURE SEPARATION REQUIREMENTS ARE MET PER CoA, MHFD, AND SEMSWA STANDARDS.



UNPLATTED  
 (NO RECORDING INFORMATION AVAILABLE)

PSOC OWNED  
 HOA OWNED & MAINTAINED

ISSUE RECORD

|               |            |
|---------------|------------|
| SUBMITTAL # 1 | 06/06/2022 |
| SUBMITTAL # 2 | 08/10/2022 |

PROJECT INFORMATION

|             |           |
|-------------|-----------|
| PROJECT #:  | 196284001 |
| DRAWN BY:   | HEK       |
| CHECKED BY: | TAF       |

| OVERALL LOTTING TABLE - PER FILING          |  |            |             |
|---|--|------------|-------------|
| Filing No.                                  | Lot Type                                     | QTY.       | % By Filing |
| 1   | Front-Loaded Small Lots (Min. 46' x 103')    | 0          | 0%          |
|   | Front-Loaded Standard Lots (Min. 51' x 105') | 126        | 90%         |
|   | Front-Loaded Large Lots (Min. 61' x 105')    | 14         | 10%         |
| <b>Total F1 Lots:</b>                       |  | <b>140</b> | <b>100%</b> |
| 2   | Front-Loaded Small Lots (Min. 46' x 103')    | 98         | 23%         |
|   | Front-Loaded Standard Lots (Min. 51' x 105') | 271        | 62%         |
|   | Front-Loaded Large Lots (Min. 61' x 105')    | 66         | 15%         |
| <b>Total F2 Lots:</b>                       |  | <b>435</b> | <b>100%</b> |
| 3   | Rear-Loaded Duplex (Min. 28' x 80')          | 112        | 45%         |
|   | Rear-Loaded Townhomes (Min. 22' x 80')       | 137        | 55%         |
|   | <b>Total F3 Lots:</b>                        | <b>249</b> | <b>100%</b> |
| <b>Total Lots Per Harvest Crossing FDP:</b> |  | <b>824</b> |             |

Notes: Lot Totals Based Upon Actual Approved/Proposed Plat.

| OVERALL LOTTING TABLE - PER OVERALL FDP     |  |            |             |
|---|--|------------|-------------|
| FDP   | Lot Type                                     | QTY.       | % of Total  |
| Harvest Crossing at Village at Murphy Creek | Front-Loaded Small Lots (Min. 46' x 103')    | 98         | 12%         |
|   | Front-Loaded Standard Lots (Min. 51' x 105') | 397        | 48%         |
|   | Front-Loaded Large Lots (Min. 61' x 105')    | 80         | 10%         |
|   | Rear-Loaded Duplex (Min. 28' x 80')          | 112        | 14%         |
|   | Rear-Loaded Townhomes (Min. 22' x 80')       | 137        | 17%         |
| <b>Total Lots:</b>                          |  | <b>824</b> | <b>100%</b> |

Notes: Lot Totals Based Upon Actual Approved/Proposed Plat.

**REQUIREMENTS FOR PHASED CONSTRUCTION SITES AND PROJECTS**

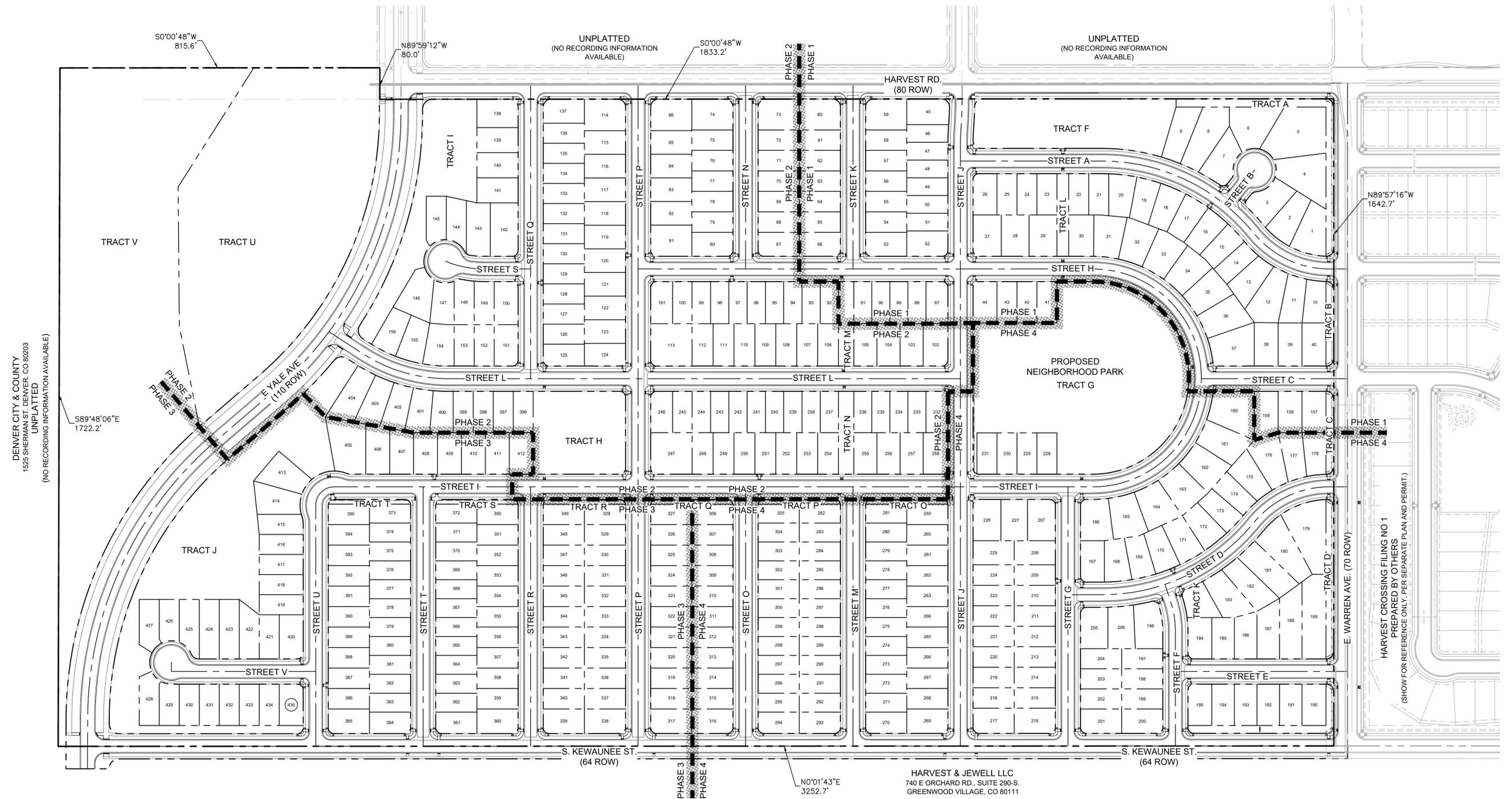
- PRIOR TO ANY ABOVE GROUND LEVEL CONSTRUCTION OR ERECTION OF A STRUCTURE, WHETHER THE PRINCIPAL STRUCTURE MATERIALS ARE COMBUSTIBLE OR OF A NON-COMBUSTIBLE NATURE, THERE SHALL BE ADEQUATE ALL-WEATHER ACCESS ROADWAYS PROVIDED FOR USE BY EMERGENCY VEHICLE APPARATUS. FIRE ACCESS PROVIDED BY THE PROPERTY OWNER SHALL BE MAINTAINED TO ADEQUATELY SUPPORT FIRE APPARATUS UP TO 85,000 LBS. THESE TEMPORARY SITE ACCESS ROADWAYS SHALL NOT BE LESS THAN 23 FT. WIDTH WITH A STANDING TURNING RADIUS OF 29 FT. INSIDE AND 52 FT. OUTSIDE. A HAMMERHEAD OR THREE-POINT TURNAROUND WILL BE REQUIRED ON DEAD END FIRE APPARATUS ROADS IN EXCESS OF 150 FT. THE MATERIAL USED TO CONSTRUCT THESE ROADWAYS MAY BE OF ANY ONE OF, OR A COMBINATION OF, SEVERAL AGGREGATE MATERIALS AVAILABLE. APPROVED MATERIALS INCLUDE PREMIXED ROAD BASE MATERIAL, 1 1/2-INCH RIVER ROCK, CRUSHED GRANITE OR OTHER AGGREGATE WITH NOT LESS THAN ONE-INCH NOMINAL SIZE DESIGNATION OR CRUSHED CONCRETE. THE FIRE CHIEF OR DESIGNATED REPRESENTATIVE MAY APPROVE OTHER ROADWAY MATERIALS. IN NO WAY SHALL THE DESIGNATIONS IN THIS POLICY BE INTENDED OR CONSTRUED AS TO INTEND TO PROHIBIT ASPHALT PAVING OR ADDITIONAL REQUIREMENTS AS NECESSARY.
- THE DEVELOPER SHALL PROVIDE TWO DISTINCT POINTS OF EMERGENCY ACCESS TO THE OVERALL SITE AND A LOOPED WATER SUPPLY TO EACH PHASE OF THE DEVELOPMENT AS APPROVED BY THE LIFE SAFETY REPRESENTATIVE FOR THE AURORA FIRE DEPARTMENT. THE DEVELOPER SHALL CONSTRUCT AND OFF SITE ROADWAY OR EMERGENCY CROSSINGS IMPROVEMENTS PER CITY STANDARDS NECESSARY TO FACILITATE EMERGENCY VEHICULAR ACCESS TO THE SITE.
- EACH PORTION OF THE OVERALL SITE IS REQUIRED TO HAVE TWO DISTINCT POINTS OF ACCESS DURING EACH PHASE OF CONSTRUCTION. EACH PHASE MUST PROVIDE SUFFICIENT ROADWAYS TO ASSURE EMERGENCY VEHICLE ACCESS TO WITHIN 150 FT. OF ALL EXTERIOR PORTIONS OF ALL BUILDINGS WITH SUFFICIENT FIRE HYDRANTS ON A LOOPED WATER LINE SYSTEM TO PROVIDE THE REQUIRED FIRE FLOWS FOR EACH SITE.
- ACCESS TO BUILDINGS FOR THE PURPOSE OF FIRE DEPARTMENT VEHICLE ACCESS SHALL BE PROVIDED AT ALL TIMES DURING CONSTRUCTION. CONSTRUCTION MATERIALS SHALL NOT BLOCK ACCESS TO BUILDINGS, HYDRANTS OR FIRE APPLIANCES.
- DEVELOPMENTS OF ONE- OR TWO-FAMILY DWELLINGS WHERE THE NUMBER OF DWELLINGS EXCEEDS 30 SHALL BE PROVIDED WITH SEPARATE AND APPROVED FIRE APPARATUS ROADS. (2015 IFC D107.1). THEY SHALL BE PLACED A DISTANT APART EQUAL TO NOT LESS THAN ONE-HALF OF THE LENGTH OF THE OVERALL MAXIMUM DIMENSION OF THE PROPERTY OR AREA TO BE SERVED, MEASURED IN A STRAIGHT LINE BETWEEN ACCESSES (2015 IFC D107.2).

**LEGEND**

CONCEPTUAL PHASE BOUNDARY

**PROPOSED PHASING DESCRIPTION:**

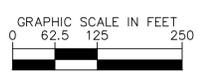
PHASING WILL ENSURE TWO POINTS OF EMERGENCY ACCESS IS MAINTAINED. DURING FINAL CIVIL DESIGN, PRESSURE ZONES AND WATER INFRASTRUCTURE WILL BE DESIGNED PER THE APPROVED MUS AND CURRENT COA STANDARDS. PHASE 1, 2, 3, AND 4 ARE PLANNED TO HAVE 74, 121, 110, AND 130 SINGLE-FAMILY LOTS, RESPECTIVELY.



DENVER CITY & COUNTY  
1525 SHERMAN ST. DENVER, CO 80203  
UNPLATTED  
(NO RECORDING INFORMATION AVAILABLE)

HARVEST & JEWELL LLC  
740 E ORCHARD RD., SUITE 290-S.  
GREENWOOD VILLAGE, CO 80111

UNPLATTED  
REC. NO. B8090223



**Kimley»Horn**  
© 2022 KIMLEY-HORN AND ASSOCIATES, INC.  
4582 SOUTH ULSTER STREET, SUITE 1500  
DENVER, CO 80237 (303) 228-2300

OWNER / CLIENT  
HARVEST AND JEWELL, LLC  
7100 E BELLEVUE AVE., SUITE 310  
BRIARCLIFF, CO 80111

PLANNER / LA  
PLANWEST  
767 SANTA FE DRIVE  
DENVER, CO 80204  
303-741-1411

SITE PLAN  
HARVEST CROSSING FILING NO. 2  
AURORA, COLORADO

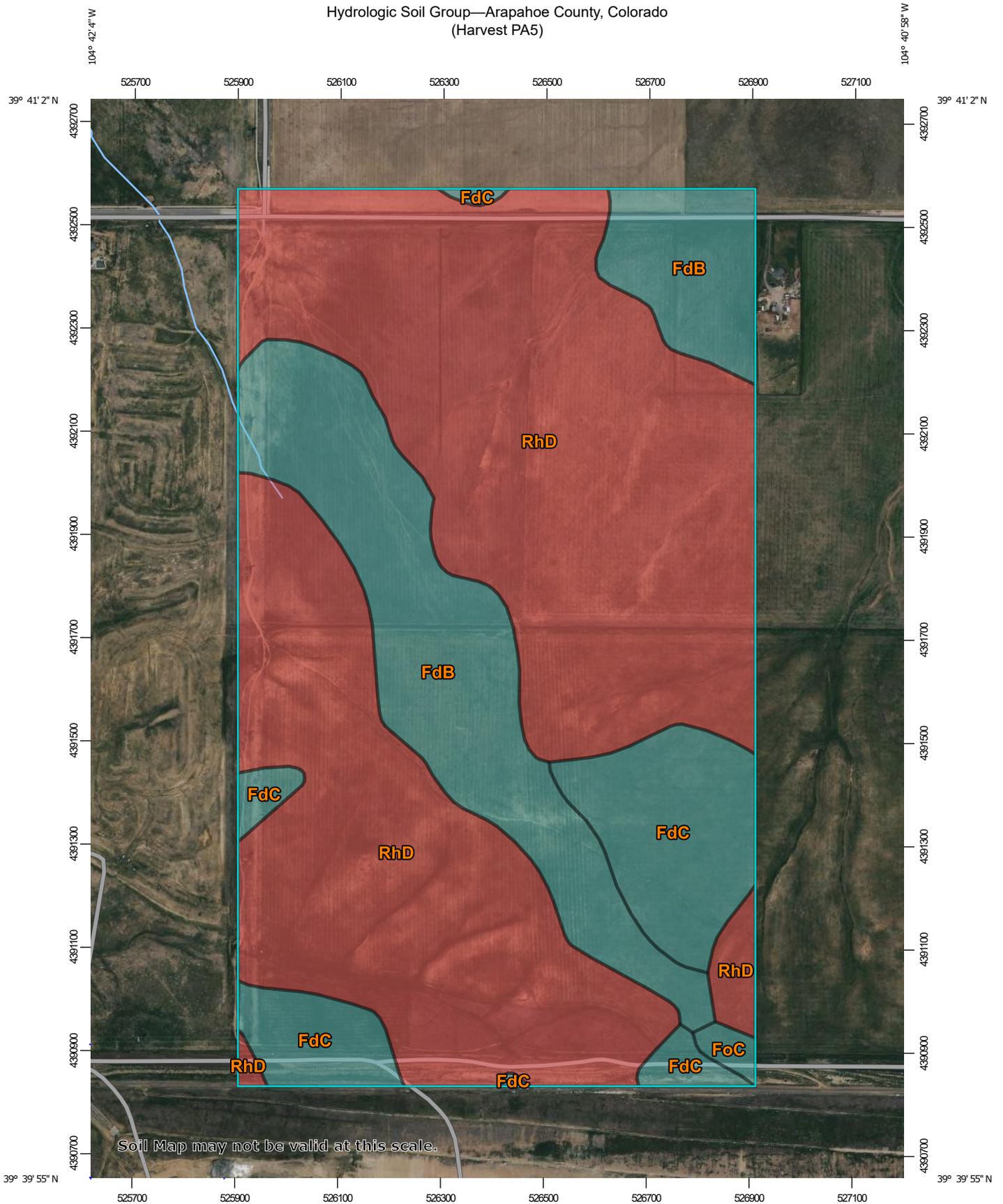
ISSUE RECORD  
SUBMITTAL #1 08/05/2022  
SUBMITTAL #2 08/10/2022

PROJECT INFORMATION  
PROJECT #:  
DRAWN BY:  
CHECKED BY:

CONTEXT MAP  
C.02  
C.02 OF 47

## **Appendix B- NRCS Soils Report, FEMA MAPS, Rainfall Depth Figures**

Hydrologic Soil Group—Arapahoe County, Colorado  
(Harvest PA5)



Map Scale: 1:10,200 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines

 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points

 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Arapahoe County, Colorado  
 Survey Area Data: Version 17, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydrologic Soil Group

| Map unit symbol                    | Map unit name                                  | Rating | Acres in AOI | Percent of AOI |
|------------------------------------|--|--------|--------------|----------------|
| FdB                                | Fondis silt loam, 1 to 3 percent slopes        | C      | 92.1         | 21.2%          |
| FdC                                | Fondis silt loam, 3 to 5 percent slopes        | C      | 48.9         | 11.3%          |
| FoC                                | Fondis-Colby silt loams, 3 to 5 percent slopes | C      | 2.2          | 0.5%           |
| RhD                                | Renohill-Buick loams, 3 to 9 percent slopes    | D      | 290.8        | 67.0%          |
| <b>Totals for Area of Interest</b> |  |        | <b>434.0</b> | <b>100.0%</b>  |

### Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method: Dominant Condition*

*Component Percent Cutoff: None Specified*

*Tie-break Rule: Higher*

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NNGS12  
National Geodetic Survey  
SSMCO-3, #0202  
1315 East-West Highway  
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov/>.

**Base map** information shown on this FIRM was provided by the Arapahoe County and Cities of Aurora and Littleton GIS depts. The coordinate system used for production of the digital FIRM is Universal Transverse Mercator, Zone 13N, referenced to the North American Datum of 1983 and the GRS 80 spheroid, Western Hemisphere.

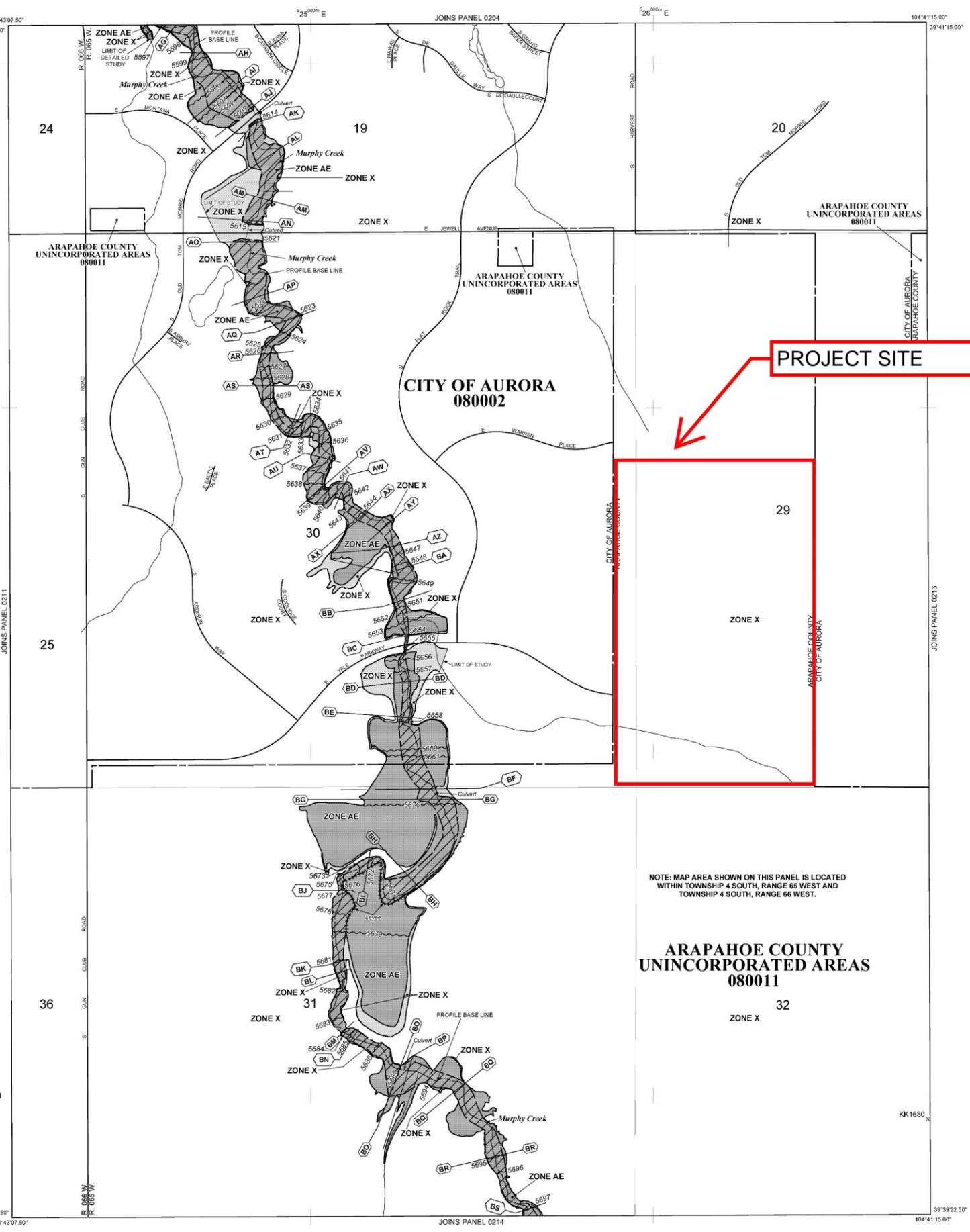
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA-MAP (1-877-336-2527) or visit the FEMA website at <http://www.fema.gov/>.

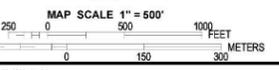


NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 4 SOUTH, RANGE 66 WEST AND TOWNSHIP 4 SOUTH, RANGE 66 WEST.

**ARAPAHOE COUNTY UNINCORPORATED AREAS 080011**

**LEGEND**

- SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**
- The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.
- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
- FLOODWAY AREAS IN ZONE AE**
- The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- OTHER FLOOD AREAS**
- ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- OTHER AREAS**
- ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D** Areas in which flood hazards are undetermined, but possible.
- COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**
- OTHERWISE PROTECTED AREAS (OPAs)**
- CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet\*  
(EL 987)
- Base Flood Elevation value where uniform within zone; elevation in feet\*\*
- \* Referenced to the North American Vertical Datum of 1988 (NAVD 88)
- Cross section line
- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks; New York State Plane coordinate system, east zone (FIPSZONE 3101), Transverse Mercator
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile
- MAP REPOSITORIES  
Refer to Map Repositories list on Map Index
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
April 17, 1989
- EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
March 4, 1991 December 3, 1992 August 15, 1995  
December 17, 2010 - to update map format, to change Special Flood Hazard Areas, and to change Base Flood Elevations.
- For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.
- To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0212K**

**FIRM FLOOD INSURANCE RATE MAP**

**ARAPAHOE COUNTY, COLORADO AND INCORPORATED AREAS**

**PANEL 212 OF 725**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

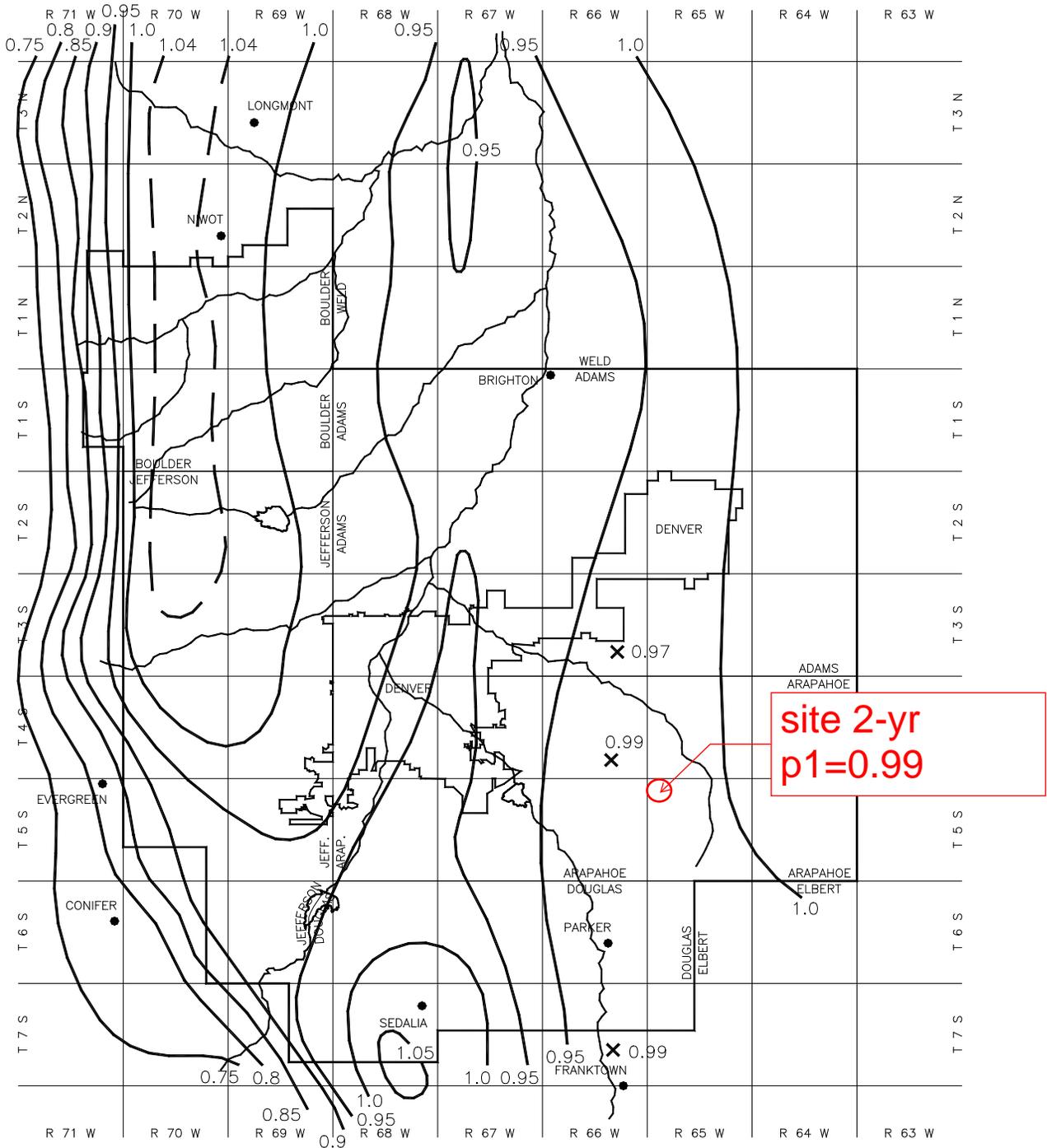
| COMMUNITY       | NUMBER | PANEL | SUFFIX |
|-----------------|--------|-------|--------|
| ARAPAHOE COUNTY | 080011 | 0212  | K      |
| AURORA, CITY OF | 080002 | 0212  | K      |

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

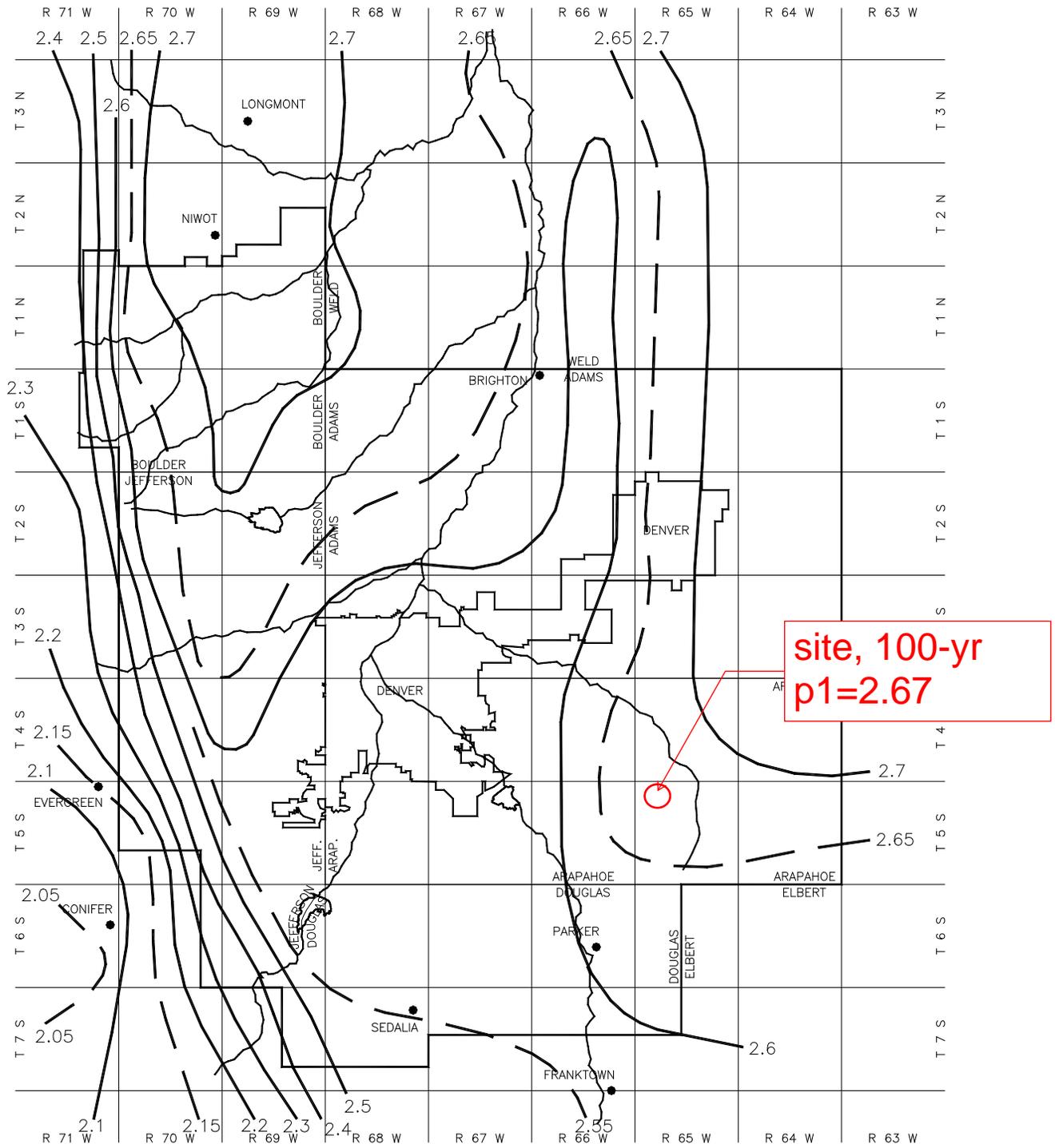
**MAP NUMBER 08005C0212K**

**MAP REVISED DECEMBER 17, 2010**

Federal Emergency Management Agency



**Figure 5-1. Rainfall depth-duration-frequency: 2-year, 1-hour rainfall**



**Figure 5-6. Rainfall depth-duration-frequency: 100-year, 1-hour rainfall**

## Appendix C- Hydrologic Computations

**IMPERVIOUS CALCS**

| <b>Basin D (North Outfall: Existing Storm)</b>        |              |              |        |
|---|--------------|--------------|--------|
| Type  | Area (Ac)    | Imperv Value | Result |
| Lots  | 8.69         | 45.0         | 391.1  |
| Local Row   | 1.32         | 74.8         | 98.7   |
| Landscape   | 2.43         | 5.0          | 12.1   |
| Warren  | 0.66         | 76.9         | 50.8   |
| Sidewalk  | 0.08         | 100.0        | 8.0    |
| Total   | 13.18        |              | 560.6  |
|   | <b>Total</b> | <b>42.6</b>  |        |
| <b>Basin C (North East Outfall: Existing Storm)</b>   |              |              |        |
| Type  | Area (Ac)    | Imperv Value | Result |
| Lots  | 10.39        | 45.0         | 467.6  |
| Local Row   | 0.46         | 74.8         | 34.4   |
| Landscape   | 0.21         | 5.0          | 1.1    |
| Warren  | 0.19         | 76.9         | 14.6   |
| Kewaunee  | 2.62         | 73.3         | 192.0  |
| Sidewalk  | 0.21         | 100.0        | 21.0   |
| Total   | 14.08        |              | 730.6  |
|   | <b>Total</b> | <b>51.9</b>  |        |
| <b>Basin A (Outfall: West Pond)</b>                   |              |              |        |
| Type  | Area (Ac)    | Imperv Value | Result |
| Lots  | 16.01        | 45.0         | 720.5  |
| Local Row (Full)                                      | 2.25         | 74.8         | 168.2  |
| Landscape   | 4.85         | 5.0          | 24.3   |
| Harvest   | 1.27         | 79.8         | 101.4  |
| Sidewalk  | 0.03         | 100.0        | 3.0    |
| Total   | 24.41        |              | 1017.3 |
|   | <b>Total</b> | <b>41.7</b>  |        |
| <b>Basin B (Outfall: South Pond)</b>                  |              |              |        |
| Type  | Area (Ac)    | Imperv Value | Result |
| Lots  | 39.65        | 45.0         | 1784.3 |
| Local Row (Full)                                      | 3.35         | 74.8         | 250.5  |
| Landscape   | 37.83        | 5.0          | 189.2  |
| Harvest   | 0.73         | 79.8         | 58.3   |
| Yale  | 5.10         | 62.9         | 320.6  |
| Sidewalk  | 0.04         | 100.0        | 3.7    |
| Kewaunee  | 2.62         | 73.3         | 192.0  |
| Total   | 89.32        |              | 2798.4 |
|   | <b>Total</b> | <b>31.3</b>  |        |
| <b>Basin E (NorthWestern Outfall: Existing Storm)</b> |              |              |        |
| Type  | Area (Ac)    | Imperv Value | Result |
| Lots  | 3.86         | 45.0         | 173.7  |
| Local Row   | 0.04         | 74.8         | 3.0    |
| Landscape   | 0.25         | 5.0          | 1.3    |
| Harvest   | 0.20         | 79.8         | 16.2   |
| Warren  | 0.45         | 76.9         | 34.9   |
| Sidewalk  | 0.06         | 100.0        | 5.8    |
| Total   | 4.87         |              | 234.9  |
|   | <b>Total</b> | <b>48.3</b>  |        |
| <b>Basin OS-1 (Outfall: South Gulch)</b>              |              |              |        |
| Type  | Area (Ac)    | Imperv Value | Result |
| Landscape   | 10.94        | 5.0          | 54.7   |
| Total   | 10.94        |              | 54.7   |
|   | <b>Total</b> | <b>5.00</b>  |        |

**WEIGHTED IMPERVIOUSNESS AND C VALUES FOR ROAD CROSS SECTIONS**

| <b>Weighted ROW Values</b> |              | Coefficient |              |      |      |      |      |                 |
|----------------------------|--------------|-------------|--------------|------|------|------|------|-----------------|
|                            |              | C2          | C5           | C10  | C100 |      |      |                 |
| Local                      |              | Length      | Imperv Value |      |      |      |      |                 |
|                            | PV           | 47          | 100          | 0.87 | 0.88 | 0.9  | 0.93 |                 |
|                            | LS           | 17          | 5            | 0.18 | 0.19 | 0.2  | 0.22 |                 |
|                            | <b>Total</b> |             | 74.77        | 0.69 | 0.70 | 0.71 | 0.74 | <b>Weighted</b> |
| Harvest                    |              | Length      | Imperv Value |      |      |      |      |                 |
|                            | PV           | 31.5        | 100          | 0.87 | 0.88 | 0.9  | 0.93 |                 |
|                            | LS           | 8.5         | 5            | 0.18 | 0.19 | 0.2  | 0.22 |                 |
|                            | <b>Total</b> |             | 79.81        | 0.72 | 0.73 | 0.75 | 0.78 | <b>Weighted</b> |
| Warren                     |              | Length      | Imperv Value |      |      |      |      |                 |
|                            | PV           | 26.5        | 100          | 0.87 | 0.88 | 0.9  | 0.93 |                 |
|                            | LS           | 8.5         | 5            | 0.18 | 0.19 | 0.2  | 0.22 |                 |
|                            | <b>Total</b> |             | 76.93        | 0.70 | 0.71 | 0.73 | 0.76 | <b>Weighted</b> |
| Kewaunee                   |              | Length      | Imperv Value |      |      |      |      |                 |
|                            | PV           | 46          | 100          | 0.87 | 0.88 | 0.9  | 0.93 |                 |
|                            | LS           | 18          | 5            | 0.18 | 0.19 | 0.2  | 0.22 |                 |
|                            | <b>Total</b> |             | 73.28        | 0.68 | 0.69 | 0.70 | 0.73 | <b>Weighted</b> |
| Yale                       |              | Length      | Imperv Value |      |      |      |      |                 |
|                            | PV           | 67          | 100          | 0.87 | 0.88 | 0.9  | 0.93 |                 |
|                            | LS           | 43          | 5            | 0.18 | 0.19 | 0.2  | 0.22 |                 |
|                            | <b>Total</b> |             | 62.86        | 0.60 | 0.61 | 0.63 | 0.65 | <b>Weighted</b> |

STANDARD FORM SF-1  
 RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROJECT NAME: Harvest Crossing PA-5  
 PROJECT NUMBER: 196284001  
 CALCULATED BY: JBP  
 CHECKED BY:

DATE: 8/5/2022

| SOIL:                        |              | LAND USE           |             |              |             |               |             |                 |                      | Assums predominant NRCS Soil Type D |             |             |             |             |            |
|------------------------------|--------------|--------------------|-------------|--------------|-------------|---------------|-------------|-----------------|----------------------|-------------------------------------|-------------|-------------|-------------|-------------|------------|
|                              |              | Single-Family AREA | Local AREA  | Harvest AREA | Warren AREA | Kewasnee AREA | Yale AREA   | Paved Area AREA | Landscape Tract AREA | TOTAL AREA (AC)                     | C(2)        | C(5)        | C(10)       | C(100)      | Imp %      |
| DESIGN BASIN                 | DESIGN POINT | (AC)               | (AC)        | (AC)         | (AC)        | (AC)          | (AC)        | (AC)            | (AC)                 | (AC)                                |             |             |             |             |            |
|                              |              | 0.40               | 0.69        | 0.72         | 0.70        | 0.68          | 0.60        | 0.87            | 0.18                 |                                     |             |             |             |             |            |
|                              |              | 0.45               | 0.70        | 0.73         | 0.71        | 0.69          | 0.61        | 0.88            | 0.19                 |                                     |             |             |             |             |            |
|                              |              | 0.50               | 0.71        | 0.75         | 0.73        | 0.70          | 0.63        | 0.90            | 0.20                 |                                     |             |             |             |             |            |
|                              |              | 0.60               | 0.74        | 0.78         | 0.76        | 0.73          | 0.65        | 0.93            | 0.22                 |                                     |             |             |             |             |            |
|                              |              | 45%                | 74.77%      | 79.81%       | 76.93%      | 73.28%        | 62.56%      | 100.00%         | 5%                   |                                     |             |             |             |             |            |
| A-05                         | A5           |                    |             |              |             |               |             |                 | 1.47                 | 1.47                                | 0.18        | 0.19        | 0.20        | 0.22        | 5%         |
| A-10                         | A10          | 0.28               | 0.35        |              |             |               |             |                 | 0.63                 | 0.63                                | 0.56        | 0.59        | 0.62        | 0.68        | 61%        |
| A-15                         | A15          | 2.42               |             |              |             |               |             |                 | 2.57                 | 2.57                                | 0.40        | 0.44        | 0.49        | 0.59        | 44%        |
| A-20                         | A20          | 0.82               | 0.33        |              |             |               |             |                 | 1.15                 | 1.15                                | 0.48        | 0.52        | 0.56        | 0.64        | 54%        |
| A-25                         | A25          | 2.12               |             |              |             |               |             |                 | 2.12                 | 2.12                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| A-30                         | A30          | 0.67               | 0.19        |              |             |               |             |                 | 3.08                 | 3.08                                | 0.26        | 0.28        | 0.30        | 0.33        | 18%        |
| A-35                         | A35          | 1.44               | 0.07        |              |             |               |             |                 | 1.14                 | 1.65                                | 0.39        | 0.44        | 0.48        | 0.57        | 43%        |
| A-40                         | A40          | 0.50               | 0.47        |              |             |               |             |                 | 0.97                 | 0.97                                | 0.54        | 0.57        | 0.60        | 0.67        | 59%        |
| A-45                         | A45          | 0.50               | 0.22        |              |             |               |             |                 | 0.03                 | 0.75                                | 0.48        | 0.51        | 0.55        | 0.63        | 52%        |
| A-50                         | A50          | 0.30               |             |              |             |               |             |                 | 0.30                 | 0.30                                | 0.18        | 0.19        | 0.20        | 0.22        | 5%         |
| A-55                         | A55          |                    |             |              |             |               |             |                 | 0.07                 | 0.94                                | 0.39        | 0.43        | 0.48        | 0.57        | 42%        |
| A-60                         | A60          | 2.16               | 0.57        |              |             |               |             |                 | 0.05                 | 2.78                                | 0.46        | 0.50        | 0.54        | 0.62        | 50%        |
| A-65                         | A65          | 0.38               | 0.04        | 0.75         |             |               |             |                 | 0.12                 | 1.29                                | 0.58        | 0.60        | 0.62        | 0.67        | 63%        |
| A-70                         | A70          | 0.77               |             |              |             |               |             |                 | 0.98                 | 0.98                                | 0.47        | 0.51        | 0.55        | 0.64        | 52%        |
| A-75                         | A75          | 1.09               | 0.05        |              |             |               |             |                 | 1.14                 | 1.14                                | 0.41        | 0.46        | 0.51        | 0.61        | 47%        |
| A-80                         | A80          | 2.02               |             | 0.26         |             |               |             |                 | 2.28                 | 2.28                                | 0.44        | 0.48        | 0.53        | 0.62        | 49%        |
| D-5                          | D5           | 0.60               | 0.13        |              | 0.11        |               |             | 0.01            | 0.22                 | 1.07                                | 0.43        | 0.46        | 0.49        | 0.56        | 44%        |
| D-10                         | D10          | 0.89               | 0.05        |              | 0.20        |               |             | 0.02            | 0.07                 | 1.24                                | 0.46        | 0.50        | 0.54        | 0.62        | 50%        |
| D-15                         | D15          | 2.14               | 0.18        |              | 0.04        |               |             | 0.00            | 0.18                 | 2.54                                | 0.41        | 0.45        | 0.50        | 0.59        | 45%        |
| D-20                         | D20          |                    |             |              | 0.29        |               |             | 0.04            | 0.09                 | 0.42                                | 0.60        | 0.61        | 0.63        | 0.66        | 63%        |
| D-25                         | D25          | 0.39               | 0.04        |              |             |               |             |                 | 0.05                 | 0.48                                | 0.40        | 0.45        | 0.49        | 0.57        | 44%        |
| D-30                         | D30          |                    |             |              |             |               |             |                 | 1.92                 | 1.92                                | 0.18        | 0.19        | 0.20        | 0.22        | 5%         |
| D-35                         | D35          | 0.30               | 0.54        |              |             |               |             |                 | 0.85                 | 0.85                                | 0.59        | 0.61        | 0.64        | 0.69        | 64%        |
| D-40                         | D40          | 2.23               | 0.30        |              |             |               |             |                 | 2.53                 | 2.53                                | 0.43        | 0.48        | 0.52        | 0.62        | 49%        |
| C-5                          | C5           | 0.89               | 0.02        |              | 0.14        |               |             | 0.01            | 0.04                 | 1.10                                | 0.44        | 0.48        | 0.53        | 0.61        | 49%        |
| C-10                         | C10          | 1.39               | 0.02        |              | 0.01        |               |             | 0.00            | 0.00                 | 1.43                                | 0.41        | 0.46        | 0.50        | 0.60        | 46%        |
| C-15                         | C15          | 0.20               | 0.24        |              |             | 0.32          |             |                 | 0.16                 | 0.92                                | 0.53        | 0.55        | 0.57        | 0.61        | 55%        |
| C-20                         | C20          |                    | 1.27        |              |             | 0.35          |             |                 | 0.16                 | 1.75                                | 0.64        | 0.65        | 0.66        | 0.69        | 68%        |
| C-25                         | C25          | 0.70               | 0.06        |              | 0.02        |               |             |                 | 0.79                 | 0.79                                | 0.43        | 0.48        | 0.52        | 0.62        | 48%        |
| C-30                         | C30          | 0.63               | 0.13        |              | 0.20        |               |             |                 | 0.96                 | 0.96                                | 0.50        | 0.53        | 0.57        | 0.65        | 55%        |
| C-35                         | C35          | 1.15               |             |              | 0.02        |               |             |                 | 1.17                 | 1.17                                | 0.41        | 0.45        | 0.50        | 0.60        | 46%        |
| C-40                         | C40          | 1.57               |             |              | 0.20        |               |             |                 | 1.77                 | 1.77                                | 0.43        | 0.48        | 0.52        | 0.61        | 48%        |
| C-45                         | C45          | 1.82               |             |              | 0.02        |               |             |                 | 1.84                 | 1.84                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| C-50                         | C50          | 0.88               |             |              | 0.20        |               |             |                 | 1.09                 | 1.09                                | 0.45        | 0.49        | 0.54        | 0.62        | 50%        |
| C-55                         | C55          | 1.16               |             |              | 0.02        |               |             |                 | 1.18                 | 1.18                                | 0.41        | 0.45        | 0.50        | 0.60        | 46%        |
| C-60                         | C60          |                    |             |              | 0.34        |               |             |                 | 0.34                 | 0.68                                | 0.69        | 0.70        | 0.73        | 73%         |            |
| B-05                         | B5           |                    |             |              |             |               |             |                 | 3.86                 | 3.86                                | 0.18        | 0.19        | 0.20        | 0.22        | 5%         |
| B-10                         | B10          |                    |             |              |             | 0.03          |             |                 | 1.46                 | 2.40                                | 0.24        | 0.25        | 0.27        | 0.30        | 23%        |
| B-15                         | B15          |                    |             |              |             | 0.45          |             |                 | 6.03                 | 6.48                                | 0.21        | 0.22        | 0.23        | 0.25        | 9%         |
| B-20                         | B20          |                    |             |              |             | 0.83          |             |                 | 16.76                | 18.06                               | 0.21        | 0.22        | 0.23        | 0.25        | 10%        |
| B-25                         | B25          | 1.06               |             |              |             | 0.89          |             |                 | 2.21                 | 4.16                                | 0.33        | 0.35        | 0.37        | 0.41        | 28%        |
| B-30                         | B30          | 0.08               | 0.01        |              |             | 1.00          |             | 0.04            | 1.33                 | 2.45                                | 0.37        | 0.38        | 0.40        | 0.42        | 32%        |
| B-35                         | B35          |                    |             |              |             | 0.96          |             |                 | 0.96                 | 0.96                                | 0.60        | 0.61        | 0.63        | 0.65        | 63%        |
| B-40                         | B40          |                    |             |              |             | 0.19          |             |                 | 0.19                 | 0.60                                | 0.60        | 0.61        | 0.63        | 0.65        | 63%        |
| B-45                         | B45          | 0.85               | 0.29        | 0.25         |             |               |             |                 | 0.65                 | 2.05                                | 0.41        | 0.44        | 0.47        | 0.52        | 41%        |
| B-50                         | B50          | 1.61               |             |              |             |               |             |                 | 1.91                 | 1.91                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-55                         | B55          | 1.02               | 0.10        |              |             |               |             |                 | 0.02                 | 1.14                                | 0.42        | 0.47        | 0.51        | 0.61        | 47%        |
| B-60                         | B60          | 2.55               | 0.03        |              |             |               |             |                 | 2.58                 | 2.58                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-65                         | B65          | 0.84               |             |              |             |               |             |                 | 0.84                 | 0.84                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-70                         | B70          | 2.29               |             |              |             |               |             |                 | 2.29                 | 2.29                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-75                         | B75          | 0.22               |             |              |             |               |             |                 | 0.22                 | 0.40                                | 0.45        | 0.50        | 0.60        | 45%         |            |
| B-80                         | B80          | 1.00               |             |              |             |               |             |                 | 1.00                 | 1.00                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-85                         | B85          |                    |             |              |             | 0.63          |             |                 | 4.92                 | 4.92                                | 0.24        | 0.25        | 0.26        | 0.29        | 14%        |
| B-90                         | B90          | 0.71               |             |              |             | 0.61          |             |                 | 1.21                 | 1.21                                | 0.53        | 0.56        | 0.59        | 0.66        | 58%        |
| B-95                         | B95          | 2.36               | 0.25        |              |             |               |             |                 | 2.61                 | 2.61                                | 0.43        | 0.47        | 0.52        | 0.61        | 48%        |
| B-100                        | B100         | 1.77               | 0.07        |              |             |               |             |                 | 1.84                 | 1.84                                | 0.41        | 0.46        | 0.51        | 0.61        | 46%        |
| B-105                        | B105         | 1.52               | 0.18        |              |             |               |             |                 | 1.70                 | 1.70                                | 0.43        | 0.48        | 0.52        | 0.61        | 48%        |
| B-110                        | B110         | 2.25               | 0.05        |              |             |               |             |                 | 2.29                 | 2.29                                | 0.41        | 0.45        | 0.50        | 0.60        | 46%        |
| B-115                        | B115         | 1.33               | 0.18        |              |             |               |             |                 | 1.51                 | 1.51                                | 0.43        | 0.48        | 0.53        | 0.62        | 49%        |
| B-120                        | B120         | 1.62               | 0.02        |              | 0.08        |               |             |                 | 1.72                 | 1.72                                | 0.42        | 0.46        | 0.51        | 0.61        | 47%        |
| B-125                        | B125         | 4.02               | 0.38        |              | 0.02        |               |             |                 | 4.42                 | 4.42                                | 0.43        | 0.47        | 0.52        | 0.61        | 48%        |
| B-130                        | B130         | 0.97               | 0.06        |              |             |               |             |                 | 1.03                 | 1.03                                | 0.42        | 0.46        | 0.51        | 0.61        | 47%        |
| B-140                        | B140         |                    |             |              |             |               |             |                 | 1.14                 | 1.14                                | 0.18        | 0.19        | 0.20        | 0.22        | 5%         |
| B-145                        | B145         |                    | 0.14        |              |             |               |             |                 | 0.14                 | 0.69                                | 0.70        | 0.71        | 0.74        | 75%         |            |
| B-150                        | B150         |                    | 0.14        |              |             |               |             |                 | 0.14                 | 0.69                                | 0.70        | 0.71        | 0.74        | 75%         |            |
| B-155                        | B155         | 2.97               |             | 0.03         |             |               |             |                 | 3.00                 | 3.00                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-160                        | B160         | 1.25               | 0.24        | 0.25         |             |               |             |                 | 1.74                 | 1.74                                | 0.49        | 0.52        | 0.56        | 0.65        | 54%        |
| B-165                        | B165         | 0.18               |             |              |             |               |             |                 | 0.18                 | 0.40                                | 0.45        | 0.50        | 0.60        | 45%         |            |
| B-170                        | B170         | 1.29               | 0.33        | 0.02         |             |               |             |                 | 2.13                 | 2.13                                | 0.45        | 0.49        | 0.53        | 0.62        | 50%        |
| B-175                        | B175         | 1.37               |             |              |             |               |             |                 | 1.37                 | 1.37                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| B-180                        | B180         | 3.26               | 0.40        |              |             |               |             |                 | 0.10                 | 3.75                                | 0.43        | 0.47        | 0.52        | 0.61        | 47%        |
| E-05                         | E5           | 1.10               |             | 0.20         | 0.29        |               |             | 0.04            | 0.20                 | 1.84                                | 0.47        | 0.50        | 0.54        | 0.61        | 51%        |
| E-10                         | E10          | 1.01               | 0.04        |              | 0.16        |               |             | 0.01            | 0.01                 | 1.23                                | 0.45        | 0.49        | 0.54        | 0.62        | 50%        |
| E-15                         | E15          | 1.76               |             |              |             |               |             |                 | 1.76                 | 1.76                                | 0.40        | 0.45        | 0.50        | 0.60        | 45%        |
| OS-1                         | OS1          |                    |             |              |             |               |             |                 | 10.94                | 10.94                               | 0.18        | 0.19        | 0.20        | 0.22        | 5%         |
| <b>BASIN SUBTOTAL</b>        |              | <b>76.99</b>       | <b>8.11</b> | <b>2.03</b>  | <b>1.25</b> | <b>3.84</b>   | <b>4.89</b> | <b>0.21</b>     | <b>56.40</b>         | <b>152.83</b>                       | <b>0.36</b> | <b>0.38</b> | <b>0.42</b> | <b>0.48</b> | <b>34%</b> |
| <b>Drainage Basin Totals</b> |              | <b>50%</b>         | <b>5%</b>   | <b>1%</b>    | <b>1%</b>   | <b>3%</b>     | <b>3%</b>   | <b>0%</b>       | <b>37%</b>           | <b>100%</b>                         |             |             |             |             |            |
| Basin A                      | Basin A      | 16.01              | 2.25        | 1.27         |             |               |             | 0.03            | 4.85                 | 24.41                               | 0.40        | 0.44        | 0.47        | 0.55        | 42%        |
| Basin B                      | Basin B      | 39.65              | 3.35        | 0.73         |             | 2.14          | 5.10        | 0.04            | 37.83                | 88.83                               | 0.34        | 0.37        | 0.39        | 0.45        | 31%        |
| Basin C                      | Basin C      | 10.39              | 0.46        |              | 0.19        | 2.62          |             | 0.01            | 11.88                | 14.66                               | 0.46        | 0.50        | 0.54        | 0.63        | 51%        |
| Basin D                      | Basin D      | 8.69               | 1.32        |              | 0.66        |               |             | 0.08            | 2.66                 | 13.40                               | 0.40        | 0.44        | 0.47        |             |            |



**STANDARD FORM SF-2**  
**Time of Concentration**

PROJECT NAME: Harvest Crossing PA-5  
 PROJECT NUMBER: 196284001  
 CALCULATED BY: JBP  
 CHECKED BY:

DATE: 8/5/2022

| SUB-BASIN DATA   |             |        | INITIAL TIME (T <sub>i</sub> ) |             |                         | TRAVEL TIME (T <sub>t</sub> ) |             |                    |              |                          | T <sub>c</sub> CHECK (URBANIZED BASINS) |                   |                  |                 | FINAL T <sub>c</sub>     |           |
|------------------|-------------|--------|--------------------------------|-------------|-------------------------|-------------------------------|-------------|--------------------|--------------|--------------------------|---|-------------------|------------------|-----------------|--------------------------|-----------|
| DESIGN BASIN (1) | AREA Ac (2) | C5 (3) | LENGTH Ft (4)                  | SLOPE % (5) | T <sub>i</sub> Min. (6) | LENGTH Ft. (7)                | SLOPE % (8) | C <sub>v</sub> (9) | VEL fps (11) | T <sub>t</sub> Min. (12) | COMP. t <sub>c</sub> (13)               | TOTAL LENGTH (14) | TOTAL SLOPE (15) | TOTAL IMP. (16) | T <sub>c</sub> Min. (17) | Min. (18) |
| <b>Basins</b>    |             |        |                                |             |                         |                               |             |                    |              |                          |   |                   |                  |                 |                          |           |
| A-05             | 1.470       | 0.190  | 45                             | 25.0%       | 3.8                     | 275                           | 0.5%        | 7.0                | 0.5          | 9.3                      | 13.1                                    | 320               | 3.9%             | 5%              | 27.9                     | 13.1      |
| A-10             | 0.625       | 0.588  | 24                             | 2.0%        | 3.7                     | 480                           | 2.4%        | 20.0               | 3.1          | 2.6                      | 6.2                                     | 504               | 2.4%             | 61%             | 18.6                     | 6.2       |
| A-15             | 2.570       | 0.443  | 165                            | 2.5%        | 11.4                    | 466                           | 2.5%        | 20.0               | 3.2          | 2.5                      | 13.9                                    | 631               | 2.5%             | 44%             | 22.9                     | 13.9      |
| A-20             | 1.150       | 0.522  | 50                             | 2.5%        | 5.5                     | 890                           | 2.3%        | 20.0               | 3.1          | 4.9                      | 10.4                                    | 940               | 2.3%             | 54%             | 23.1                     | 10.4      |
| A-25             | 2.120       | 0.450  | 126                            | 2.5%        | 9.9                     | 775                           | 2.6%        | 20.0               | 3.2          | 4.0                      | 13.9                                    | 901               | 2.5%             | 45%             | 24.5                     | 13.9      |
| A-30             | 3.080       | 0.278  | 210                            | 2.5%        | 16.1                    | 460                           | 1.7%        | 20.0               | 2.6          | 2.9                      | 19.0                                    | 670               | 2.0%             | 18%             | 29.8                     | 19.0      |
| A-35             | 1.650       | 0.439  | 170                            | 2.5%        | 11.7                    | 360                           | 1.8%        | 20.0               | 2.7          | 2.2                      | 13.9                                    | 530               | 2.0%             | 43%             | 22.8                     | 13.9      |
| A-40             | 0.970       | 0.571  | 58                             | 2.0%        | 5.9                     | 660                           | 2.7%        | 20.0               | 3.3          | 3.3                      | 9.2                                     | 718               | 2.7%             | 59%             | 20.1                     | 9.2       |
| A-45             | 0.746       | 0.513  | 75                             | 2.5%        | 6.9                     | 480                           | 2.7%        | 20.0               | 3.3          | 2.4                      | 9.3                                     | 555               | 2.7%             | 52%             | 20.6                     | 9.3       |
| A-50             | 0.300       | 0.190  | 100                            | 2.8%        | 11.9                    | 780                           | 2.8%        | 7.0                | 1.2          | 11.1                     | 23.0                                    | 880               | 2.8%             | 5%              | 34.2                     | 23.0      |
| A-55             | 0.937       | 0.434  | 165                            | 2.5%        | 11.6                    | 240                           | 2.5%        | 20.0               | 3.2          | 1.3                      | 12.8                                    | 405               | 2.5%             | 42%             | 21.6                     | 12.8      |
| A-60             | 2.780       | 0.497  | 100                            | 2.5%        | 8.2                     | 730                           | 1.8%        | 20.0               | 2.7          | 4.6                      | 12.7                                    | 830               | 1.9%             | 50%             | 23.7                     | 12.7      |
| A-65             | 1.289       | 0.597  | 20                             | 2.0%        | 3.3                     | 230                           | 1.5%        | 20.0               | 2.5          | 1.5                      | 4.8                                     | 250               | 1.6%             | 63%             | 17.2                     | 5.0       |
| A-70             | 0.980       | 0.510  | 75                             | 2.5%        | 6.9                     | 575                           | 2.9%        | 20.0               | 3.4          | 2.8                      | 9.7                                     | 650               | 2.8%             | 52%             | 21.0                     | 9.7       |
| A-75             | 1.140       | 0.462  | 110                            | 2.5%        | 9.0                     | 345                           | 4.3%        | 20.0               | 4.2          | 1.4                      | 10.4                                    | 455               | 3.9%             | 47%             | 20.6                     | 10.4      |
| A-80             | 2.283       | 0.482  | 95                             | 2.5%        | 8.1                     | 625                           | 2.0%        | 20.0               | 2.8          | 3.7                      | 11.8                                    | 720               | 2.1%             | 49%             | 22.9                     | 11.8      |
|                  |             |        |                                |             |                         |                               |             |                    |              |                          |   |                   |                  |                 |                          |           |
| D-5              | 1.068       | 0.458  | 130                            | 2.5%        | 9.9                     | 280                           | 4.2%        | 20.0               | 4.1          | 1.1                      | 11.0                                    | 410               | 3.7%             | 44%             | 20.8                     | 11.0      |
| D-10             | 1.238       | 0.495  | 140                            | 2.5%        | 9.7                     | 785                           | 2.7%        | 20.0               | 3.3          | 3.9                      | 13.6                                    | 925               | 2.7%             | 50%             | 23.3                     | 13.6      |
| D-15             | 2.540       | 0.454  | 160                            | 2.5%        | 11.0                    | 700                           | 3.3%        | 20.0               | 3.6          | 3.2                      | 14.3                                    | 860               | 3.1%             | 45%             | 23.7                     | 14.3      |
| D-20             | 0.418       | 0.613  | 25                             | 2.0%        | 3.5                     | 350                           | 78.0%       | 20.0               | 17.7         | 0.3                      | 3.9                                     | 375               | 72.9%            | 63%             | 15.6                     | 5.0       |
| D-25             | 0.482       | 0.445  | 75                             | 2.5%        | 7.7                     | 230                           | 1.2%        | 20.0               | 2.2          | 1.7                      | 9.4                                     | 305               | 1.5%             | 44%             | 21.3                     | 9.4       |
| D-30             | 1.917       | 0.190  | 100                            | 3.0%        | 11.6                    | 350                           | 3.3%        | 7.0                | 1.3          | 4.6                      | 16.2                                    | 450               | 3.2%             | 5%              | 29.4                     | 16.2      |
| D-35             | 0.846       | 0.611  | 28                             | 2.0%        | 3.8                     | 640                           | 1.9%        | 20.0               | 2.8          | 3.9                      | 7.6                                     | 668               | 1.9%             | 64%             | 19.6                     | 7.6       |
| D-40             | 2.525       | 0.479  | 110                            | 2.5%        | 8.8                     | 715                           | 1.7%        | 20.0               | 2.6          | 4.5                      | 13.3                                    | 825               | 1.8%             | 49%             | 24.2                     | 13.3      |
|                  |             |        |                                |             |                         |                               |             |                    |              |                          |   |                   |                  |                 |                          |           |
| C-5              | 1.103       | 0.483  | 95                             | 2.5%        | 8.1                     | 475                           | 3.2%        | 20.0               | 3.6          | 2.2                      | 10.3                                    | 570               | 3.1%             | 49%             | 21.1                     | 10.3      |
| C-10             | 1.426       | 0.455  | 135                            | 2.5%        | 10.1                    | 400                           | 3.5%        | 20.0               | 3.8          | 1.8                      | 11.9                                    | 535               | 3.3%             | 46%             | 21.5                     | 11.9      |
| C-15             | 0.923       | 0.551  | 60                             | 2.5%        | 5.7                     | 670                           | 2.6%        | 20.0               | 3.2          | 3.4                      | 9.2                                     | 730               | 2.6%             | 55%             | 21.1                     | 9.2       |
| C-20             | 1.753       | 0.650  | 16                             | 2.0%        | 2.6                     | 1,660                         | 2.0%        | 20.0               | 2.8          | 9.9                      | 12.5                                    | 1676              | 2.0%             | 68%             | 25.2                     | 12.5      |
| C-25             | 0.791       | 0.477  | 128                            | 2.5%        | 9.5                     | 280                           | 1.0%        | 20.0               | 2.0          | 2.3                      | 11.8                                    | 408               | 1.5%             | 48%             | 21.4                     | 11.8      |
| C-30             | 0.957       | 0.535  | 112                            | 2.5%        | 8.1                     | 610                           | 1.0%        | 20.0               | 2.0          | 5.1                      | 13.2                                    | 722               | 1.2%             | 55%             | 23.2                     | 13.2      |
| C-35             | 1.173       | 0.455  | 112                            | 2.5%        | 9.2                     | 370                           | 1.1%        | 20.0               | 2.1          | 3.0                      | 12.2                                    | 482               | 1.4%             | 46%             | 22.7                     | 12.2      |
| C-40             | 1.768       | 0.478  | 128                            | 2.5%        | 9.5                     | 690                           | 0.8%        | 20.0               | 1.8          | 6.3                      | 15.8                                    | 818               | 1.1%             | 48%             | 26.1                     | 15.8      |
| C-45             | 1.839       | 0.453  | 160                            | 2.5%        | 11.1                    | 450                           | 1.0%        | 20.0               | 2.0          | 3.8                      | 14.9                                    | 610               | 1.4%             | 45%             | 23.9                     | 14.9      |
| C-50             | 1.087       | 0.495  | 80                             | 2.5%        | 7.3                     | 605                           | 1.0%        | 20.0               | 2.0          | 5.1                      | 12.5                                    | 685               | 1.1%             | 50%             | 24.1                     | 12.5      |
| C-55             | 1.182       | 0.455  | 112                            | 2.5%        | 9.2                     | 380                           | 0.9%        | 20.0               | 1.9          | 3.3                      | 12.5                                    | 492               | 1.3%             | 46%             | 22.9                     | 12.5      |



**STANDARD FORM SF-2**  
**Time of Concentration**

PROJECT NAME: Harvest Crossing PA-5  
 PROJECT NUMBER: 196284001  
 CALCULATED BY: JBP  
 CHECKED BY:

DATE: 8/5/2022

| SUB-BASIN DATA   |             |        | INITIAL TIME (T <sub>i</sub> ) |             |                         | TRAVEL TIME (T <sub>t</sub> ) |             |                    |              |                          | T <sub>c</sub> CHECK (URBANIZED BASINS) |                   |                  |                 | FINAL T <sub>c</sub>     |      |
|------------------|-------------|--------|--------------------------------|-------------|-------------------------|-------------------------------|-------------|--------------------|--------------|--------------------------|---|-------------------|------------------|-----------------|--------------------------|------|
| DESIGN BASIN (1) | AREA Ac (2) | C5 (3) | LENGTH Ft (4)                  | SLOPE % (5) | T <sub>i</sub> Min. (6) | LENGTH Ft. (7)                | SLOPE % (8) | C <sub>v</sub> (9) | VEL fps (11) | T <sub>t</sub> Min. (12) | COMP. t <sub>c</sub> (13)               | TOTAL LENGTH (14) | TOTAL SLOPE (15) | TOTAL IMP. (16) | T <sub>c</sub> Min. (17) | Min. |
| C-60             | 0.338       | 0.690  | 16                             | 2.0%        | 2.4                     | 415                           | 2.1%        | 20.0               | 2.9          | 2.4                      | 4.8                                     | 431               | 2.0%             | 73%             | 16.1                     | 5.0  |
| B-05             | 3.857       | 0.190  | 120                            | 25.0%       | 6.3                     | 305                           | 0.5%        | 7.0                | 0.5          | 10.3                     | 16.5                                    | 425               | 7.4%             | 5%              | 27.8                     | 16.5 |
| B-10             | 2.396       | 0.354  | 70                             | 7.0%        | 6.0                     | 720                           | 1.5%        | 20.0               | 2.5          | 4.9                      | 10.8                                    | 790               | 2.0%             | 28%             | 28.5                     | 10.8 |
| B-15             | 6.478       | 0.219  | 130                            | 5.7%        | 10.3                    | 360                           | 2.4%        | 20.0               | 3.1          | 2.0                      | 12.2                                    | 490               | 3.3%             | 9%              | 28.9                     | 12.2 |
| B-20             | 18.060      | 0.224  | 36                             | 2.5%        | 7.1                     | 875                           | 2.7%        | 20.0               | 3.3          | 4.4                      | 11.5                                    | 911               | 2.7%             | 10%             | 33.3                     | 11.5 |
| B-25             | 4.161       | 0.346  | 200                            | 7.0%        | 10.2                    | 700                           | 1.6%        | 20.0               | 2.5          | 4.7                      | 14.9                                    | 900               | 2.8%             | 28%             | 28.3                     | 14.9 |
| B-30             | 2.451       | 0.382  | 100                            | 12.0%       | 5.7                     | 440                           | 2.1%        | 20.0               | 2.9          | 2.5                      | 8.3                                     | 540               | 3.9%             | 32%             | 24.0                     | 8.3  |
| B-35             | 0.957       | 0.610  | 27                             | 2.0%        | 3.7                     | 510                           | 2.7%        | 20.0               | 3.3          | 2.6                      | 6.3                                     | 537               | 2.7%             | 63%             | 18.4                     | 6.3  |
| B-40             | 0.187       | 0.610  | 27                             | 2.0%        | 3.7                     | 100                           | 1.0%        | 20.0               | 2.0          | 0.8                      | 4.5                                     | 127               | 1.2%             | 63%             | 16.4                     | 5.0  |
| B-45             | 2.048       | 0.438  | 112                            | 4.5%        | 7.8                     | 1,100                         | 2.2%        | 20.0               | 3.0          | 6.2                      | 13.9                                    | 1212              | 2.4%             | 41%             | 27.8                     | 13.9 |
| B-50             | 1.911       | 0.450  | 150                            | 2.5%        | 10.8                    | 250                           | 3.4%        | 20.0               | 3.7          | 1.1                      | 11.9                                    | 400               | 3.0%             | 45%             | 20.9                     | 11.9 |
| B-55             | 1.144       | 0.468  | 100                            | 2.5%        | 8.5                     | 510                           | 3.5%        | 20.0               | 3.8          | 2.3                      | 10.8                                    | 610               | 3.4%             | 47%             | 21.6                     | 10.8 |
| B-60             | 2.579       | 0.453  | 220                            | 2.5%        | 13.0                    | 530                           | 3.4%        | 20.0               | 3.7          | 2.4                      | 15.4                                    | 750               | 3.1%             | 45%             | 22.9                     | 15.4 |
| B-65             | 0.836       | 0.450  | 59                             | 2.5%        | 6.7                     | 650                           | 2.6%        | 20.0               | 3.2          | 3.4                      | 10.1                                    | 709               | 2.6%             | 45%             | 23.2                     | 10.1 |
| B-70             | 2.285       | 0.450  | 100                            | 2.5%        | 8.8                     | 400                           | 3.7%        | 20.0               | 3.8          | 1.7                      | 10.5                                    | 500               | 3.4%             | 45%             | 21.3                     | 10.5 |
| B-75             | 0.224       | 0.450  | 16                             | 2.0%        | 3.8                     | 270                           | 1.5%        | 20.0               | 2.4          | 1.9                      | 5.7                                     | 286               | 1.5%             | 45%             | 20.9                     | 5.7  |
| B-80             | 0.995       | 0.450  | 145                            | 2.5%        | 10.6                    | 270                           | 1.5%        | 20.0               | 2.4          | 1.9                      | 12.4                                    | 415               | 1.8%             | 45%             | 21.7                     | 12.4 |
| B-85             | 4.917       | 0.254  | 16                             | 2.0%        | 4.9                     | 850                           | 1.6%        | 20.0               | 2.6          | 5.5                      | 10.5                                    | 866               | 1.6%             | 14%             | 34.0                     | 10.5 |
| B-90             | 1.314       | 0.561  | 68                             | 2.3%        | 6.2                     | 770                           | 1.7%        | 20.0               | 2.6          | 5.0                      | 11.2                                    | 838               | 1.7%             | 58%             | 22.3                     | 11.2 |
| B-95             | 2.613       | 0.474  | 120                            | 2.5%        | 9.3                     | 527                           | 4.0%        | 20.0               | 4.0          | 2.2                      | 11.5                                    | 647               | 3.7%             | 48%             | 21.4                     | 11.5 |
| B-100            | 1.842       | 0.459  | 145                            | 2.5%        | 10.4                    | 475                           | 4.1%        | 20.0               | 4.1          | 2.0                      | 12.4                                    | 620               | 3.7%             | 46%             | 21.6                     | 12.4 |
| B-105            | 1.697       | 0.476  | 95                             | 2.5%        | 8.2                     | 805                           | 2.6%        | 20.0               | 3.2          | 4.2                      | 12.4                                    | 900               | 2.6%             | 48%             | 23.8                     | 12.4 |
| B-110            | 2.394       | 0.455  | 160                            | 2.5%        | 11.0                    | 575                           | 3.2%        | 20.0               | 3.5          | 2.7                      | 13.7                                    | 735               | 3.0%             | 46%             | 22.8                     | 13.7 |
| B-115            | 1.510       | 0.480  | 80                             | 2.5%        | 7.5                     | 805                           | 2.6%        | 20.0               | 3.2          | 4.1                      | 11.6                                    | 885               | 2.6%             | 49%             | 23.5                     | 11.6 |
| B-120            | 1.720       | 0.464  | 100                            | 2.5%        | 8.6                     | 655                           | 2.8%        | 20.0               | 3.4          | 3.3                      | 11.8                                    | 755               | 2.8%             | 47%             | 22.9                     | 11.8 |
| B-125            | 4.417       | 0.472  | 130                            | 2.5%        | 9.7                     | 805                           | 1.9%        | 20.0               | 2.8          | 4.9                      | 14.5                                    | 935               | 2.0%             | 48%             | 25.0                     | 14.5 |
| B-130            | 1.027       | 0.464  | 75                             | 2.5%        | 7.4                     | 505                           | 2.0%        | 20.0               | 2.8          | 3.0                      | 10.4                                    | 580               | 2.1%             | 47%             | 22.4                     | 10.4 |
| B-140            | 1.136       | 0.190  | 130                            | 6.0%        | 10.5                    | 250                           | 5.9%        | 7.0                | 1.7          | 2.4                      | 12.9                                    | 380               | 6.0%             | 5%              | 27.8                     | 12.9 |
| B-145            | 0.135       | 0.700  | 16                             | 2.0%        | 2.3                     | 177                           | 5.0%        | 20.0               | 4.5          | 0.7                      | 3.0                                     | 193               | 4.7%             | 75%             | 14.1                     | 5.0  |
| B-150            | 0.135       | 0.700  | 16                             | 2.0%        | 2.3                     | 177                           | 5.0%        | 20.0               | 4.5          | 0.7                      | 3.0                                     | 193               | 4.7%             | 75%             | 14.1                     | 5.0  |
| B-155            | 2.997       | 0.453  | 177                            | 2.5%        | 11.6                    | 640                           | 2.3%        | 20.0               | 3.0          | 3.6                      | 15.2                                    | 817               | 2.3%             | 45%             | 24.1                     | 15.2 |
| B-160            | 1.740       | 0.525  | 50                             | 2.5%        | 5.5                     | 1,170                         | 2.4%        | 20.0               | 3.1          | 6.3                      | 11.8                                    | 1220              | 2.4%             | 54%             | 24.8                     | 11.8 |
| B-165            | 0.177       | 0.450  | 17                             | 2.0%        | 3.9                     | 160                           | 2.5%        | 20.0               | 3.1          | 0.8                      | 4.7                                     | 177               | 2.4%             | 45%             | 19.6                     | 5.0  |
| B-170            | 2.132       | 0.491  | 165                            | 2.5%        | 10.6                    | 780                           | 2.0%        | 20.0               | 2.8          | 4.6                      | 15.1                                    | 945               | 2.1%             | 50%             | 24.3                     | 15.1 |
| B-175            | 1.370       | 0.450  | 146                            | 2.5%        | 10.6                    | 360                           | 1.4%        | 20.0               | 2.4          | 2.5                      | 13.1                                    | 506               | 1.7%             | 45%             | 22.5                     | 13.1 |
| B-180            | 3.754       | 0.470  | 120                            | 2.5%        | 9.3                     | 730                           | 1.7%        | 20.0               | 2.6          | 4.7                      | 14.0                                    | 850               | 1.8%             | 47%             | 24.7                     | 14.0 |
| E-05             | 1.838       | 0.504  | 100                            | 7.0%        | 5.7                     | 360                           | 0.7%        | 20.0               | 1.7          | 3.6                      | 9.3                                     | 460               | 2.1%             | 51%             | 20.7                     | 9.3  |
| E-10             | 1.229       | 0.493  | 95                             | 2.5%        | 8.0                     | 435                           | 1.8%        | 20.0               | 2.7          | 2.7                      | 10.7                                    | 530               | 1.9%             | 50%             | 21.5                     | 10.7 |

**STANDARD FORM SF-2  
Time of Concentration**

PROJECT NAME: Harvest Crossing PA-5  
 PROJECT NUMBER: 196284001  
 CALCULATED BY: JBP  
 CHECKED BY:

DATE: 8/5/2022

| SUB-BASIN DATA               |             |        | INITIAL TIME (T <sub>i</sub> ) |             |                         | TRAVEL TIME (T <sub>t</sub> ) |             |                    |              |                          | T <sub>c</sub> CHECK (URBANIZED BASINS) |                   |                  |                 | FINAL T <sub>c</sub>     |      |
|------------------------------|-------------|--------|--------------------------------|-------------|-------------------------|-------------------------------|-------------|--------------------|--------------|--------------------------|---|-------------------|------------------|-----------------|--------------------------|------|
| DESIGN BASIN (1)             | AREA Ac (2) | C5 (3) | LENGTH Ft (4)                  | SLOPE % (5) | T <sub>i</sub> Min. (6) | LENGTH Ft. (7)                | SLOPE % (8) | C <sub>v</sub> (9) | VEL fps (11) | T <sub>t</sub> Min. (12) | COMP. t <sub>c</sub> (13)               | TOTAL LENGTH (14) | TOTAL SLOPE (15) | TOTAL IMP. (16) | T <sub>c</sub> Min. (17) | Min. |
| E-15                         | 1.759       | 0.450  | 170                            | 2.5%        | 11.4                    | 385                           | 1.8%        | 20.0               | 2.7          | 2.4                      | 13.8                                    | 555               | 2.0%             | 45%             | 22.6                     | 13.8 |
| OS-1                         | 10.942      | 0.190  | 380                            | 7.0%        | 17.0                    | 750                           | 0.5%        | 15.0               | 1.1          | 11.8                     | 28.8                                    | 1130              | 2.7%             | 5%              | 37.0                     | 28.8 |
| <b>Drainage Basin Totals</b> |             |        |                                |             |                         |                               |             |                    |              |                          |   |                   |                  |                 |                          |      |
| Basin A                      | 24.412      | 0.436  | 100                            | 7.0%        | 6.4                     | 2,500                         | 0.5%        | 45.0               | 3.2          | 13.1                     | 19.5                                    | 2600              | 0.8%             |                 | 81.6                     | 19.5 |
| Basin B                      | 88.832      | 0.366  | 100                            | 11.4%       | 6.0                     | 1,200                         | 3.0%        | 45.0               | 7.8          | 2.6                      | 8.5                                     | 1300              | 3.6%             |                 | 38.6                     | 8.5  |
| Basin C                      | 13.884      | 0.504  | 100                            | 10.0%       | 5.1                     | 1,650                         | 1.8%        | 50.0               | 6.7          | 4.1                      | 9.2                                     | 1750              | 2.3%             | 42%             | 32.0                     | 9.2  |
| Basin D                      | 13.401      | 0.438  | 100                            | 2.5%        | 8.9                     | 900                           | 1.8%        | 45.0               | 6.0          | 2.5                      | 11.4                                    | 1000              | 1.9%             | 31%             | 29.8                     | 11.4 |
| Basin E                      | 4.861       | 0.480  | 100                            | 5.0%        | 6.7                     | 410                           | 2.5%        | 45.0               | 7.1          | 1.0                      | 7.6                                     | 510               | 3.0%             | 51%             | 20.3                     | 7.6  |
| Basin OS-1                   | 10.942      | 0.190  | 380                            | 7.0%        | 17.0                    | 750                           | 0.5%        | 15.0               | 1.1          | 11.8                     | 28.8                                    | 1130              | 2.7%             | 42%             | 26.6                     | 26.6 |

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

$$t_i = \frac{L_i}{60K\sqrt{S_o}} = \frac{L_i}{60V_i}$$

$$t_i = (26 - 17i) + \frac{L_i}{60(14i + 9)\sqrt{S_o}}$$













PROJECT NAME: Harvest Crossing PA-5  
 PROJECT NUMBER: 196284001  
 CALCULATED BY: JBP  
 CHECKED BY:

DATE: 8/9/2022

## RATIONAL CALCULATIONS SUMMARY

| DESIGN POINT  | TRIBUTARY BASINS | TRIBUTARY AREA (AC) | IMPERVIOUSNES S (%) | PEAK FLOWS (CFS) |       |
|---------------|------------------|---------------------|---------------------|------------------|-------|
|               |                  |                     |                     | Q2               | Q100  |
| <b>Basins</b> |                  |                     |                     |                  |       |
| A5            | A-05             | 1.47                | 5%                  | 0.63             | 2.09  |
| A10           | A-10             | 0.63                | 61%                 | 1.10             | 3.60  |
| A15           | A-15             | 2.57                | 44%                 | 2.37             | 9.47  |
| A20           | A-20             | 1.15                | 54%                 | 1.47             | 5.24  |
| A25           | A-25             | 2.12                | 45%                 | 1.97             | 7.99  |
| A30           | A-30             | 3.08                | 18%                 | 1.60             | 5.56  |
| A35           | A-35             | 1.65                | 43%                 | 1.51             | 5.95  |
| A40           | A-40             | 0.97                | 59%                 | 1.45             | 4.84  |
| A45           | A-45             | 0.75                | 52%                 | 0.98             | 3.47  |
| A50           | A-50             | 0.30                | 5%                  | 0.10             | 0.32  |
| A55           | A-55             | 0.94                | 42%                 | 0.88             | 3.50  |
| A60           | A-60             | 2.78                | 50%                 | 3.07             | 11.30 |
| A65           | A-65             | 1.29                | 63%                 | 2.49             | 7.87  |
| A70           | A-70             | 0.98                | 52%                 | 1.24             | 4.57  |
| A75           | A-75             | 1.14                | 47%                 | 1.24             | 4.92  |
| A80           | A-80             | 2.28                | 49%                 | 2.49             | 9.56  |
|               |                  |                     |                     |                  |       |
| D5            | D-5              | 1.07                | 44%                 | 1.17             | 4.14  |
| D10           | D-10             | 1.24                | 50%                 | 1.33             | 4.83  |
| D15           | D-15             | 2.54                | 45%                 | 2.40             | 9.23  |
| D20           | D-20             | 0.42                | 63%                 | 0.85             | 2.49  |
| D25           | D-25             | 0.48                | 44%                 | 0.53             | 2.05  |
| D30           | D-30             | 1.92                | 5%                  | 0.75             | 2.47  |
| D35           | D-35             | 0.85                | 64%                 | 1.47             | 4.66  |
| D40           | D-40             | 2.53                | 49%                 | 2.60             | 9.96  |
|               |                  |                     |                     |                  |       |
| C5            | C-5              | 1.10                | 49%                 | 1.28             | 4.82  |
| C10           | C-10             | 1.43                | 46%                 | 1.45             | 5.78  |
| C15           | C-15             | 0.92                | 55%                 | 1.36             | 4.23  |
| C20           | C-20             | 1.75                | 68%                 | 2.74             | 7.96  |
| C25           | C-25             | 0.79                | 48%                 | 0.85             | 3.28  |
| C30           | C-30             | 0.96                | 55%                 | 1.14             | 3.98  |
| C35           | C-35             | 1.17                | 46%                 | 1.17             | 4.70  |
| C40           | C-40             | 1.77                | 48%                 | 1.67             | 6.42  |
| C45           | C-45             | 1.84                | 45%                 | 1.67             | 6.74  |
| C50           | C-50             | 1.09                | 50%                 | 1.20             | 4.47  |
| C55           | C-55             | 1.18                | 46%                 | 1.17             | 4.69  |
| C60           | C-60             | 0.34                | 73%                 | 0.77             | 2.23  |
|               |                  |                     |                     |                  |       |
| B5            | B-05             | 3.86                | 5%                  | 1.49             | 4.91  |
| B10           | B-10             | 2.40                | 28%                 | 2.14             | 6.50  |
| B15           | B-15             | 6.48                | 9%                  | 3.34             | 10.75 |
| B20           | B-20             | 18.06               | 10%                 | 9.77             | 31.37 |

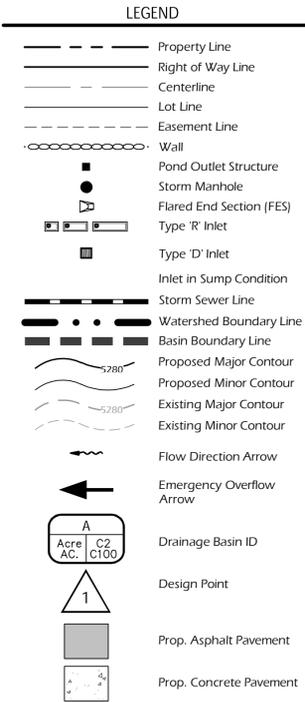
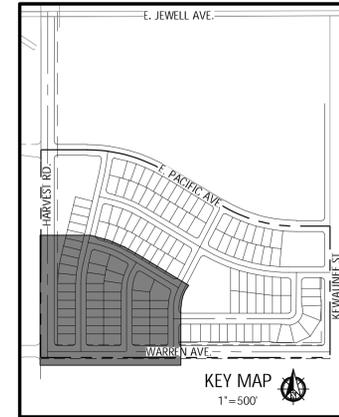
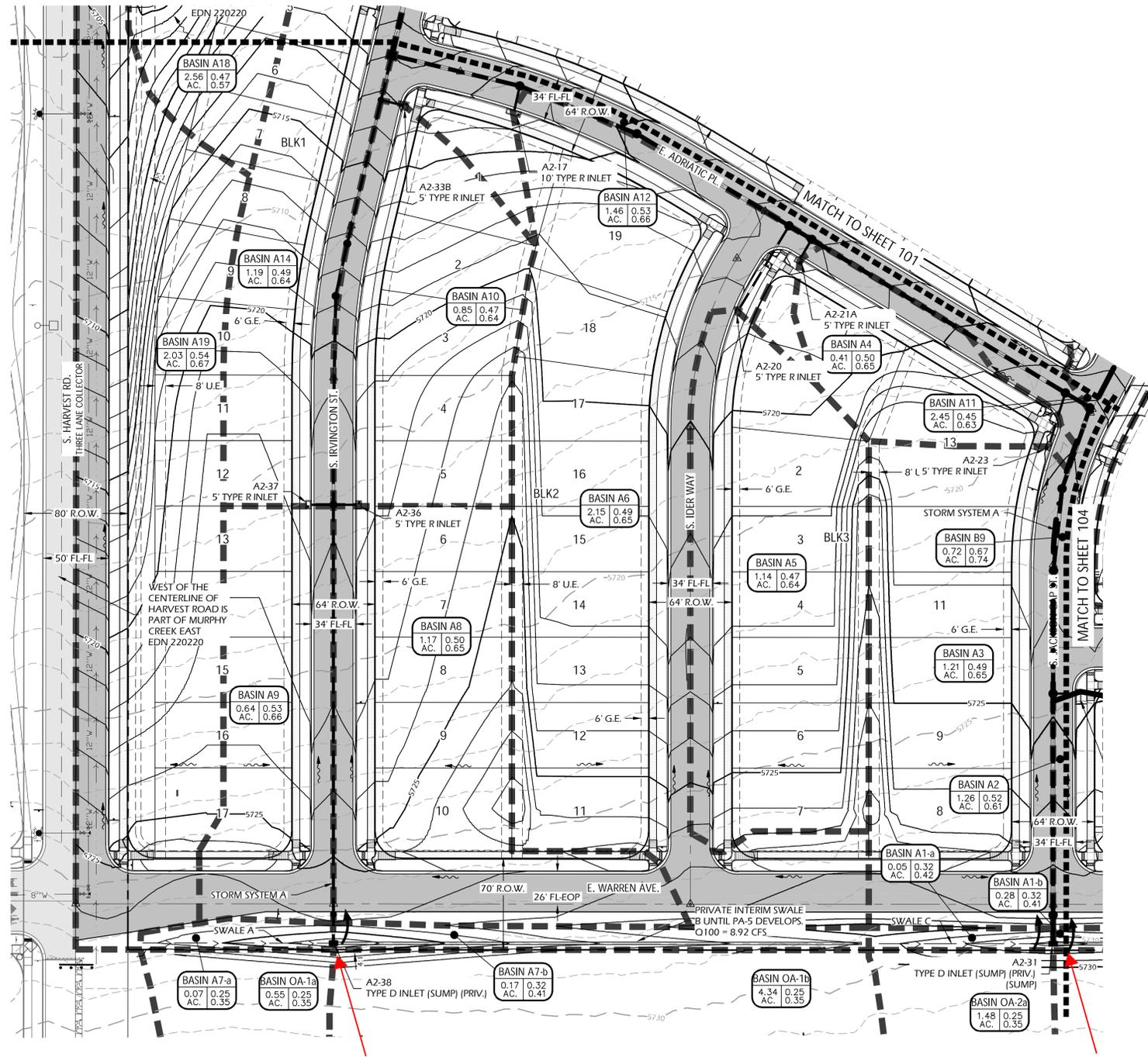
PROJECT NAME: Harvest Crossing PA-5  
 PROJECT NUMBER: 196284001  
 CALCULATED BY: JBP  
 CHECKED BY:

DATE: 8/9/2022

## RATIONAL CALCULATIONS SUMMARY

| DESIGN POINT                 | TRIBUTARY BASINS | TRIBUTARY AREA (AC) | IMPERVIOUSNES S (%) | PEAK FLOWS (CFS) |               |
|------------------------------|------------------|---------------------|---------------------|------------------|---------------|
|                              |                  |                     |                     | Q2               | Q100          |
| B25                          | B-25             | 4.16                | 28%                 | 3.06             | 10.35         |
| B30                          | B-30             | 2.45                | 32%                 | 2.61             | 7.99          |
| B35                          | B-35             | 0.96                | 63%                 | 1.81             | 5.28          |
| B40                          | B-40             | 0.19                | 63%                 | 0.38             | 1.10          |
| B45                          | B-45             | 2.05                | 41%                 | 1.96             | 6.71          |
| B50                          | B-50             | 1.91                | 45%                 | 1.91             | 7.71          |
| B55                          | B-55             | 1.14                | 47%                 | 1.26             | 4.86          |
| B60                          | B-60             | 2.58                | 45%                 | 2.31             | 9.29          |
| B65                          | B-65             | 0.84                | 45%                 | 0.89             | 3.61          |
| B70                          | B-70             | 2.29                | 45%                 | 2.40             | 9.71          |
| B75                          | B-75             | 0.22                | 45%                 | 0.29             | 1.18          |
| B80                          | B-80             | 1.00                | 45%                 | 0.97             | 3.94          |
| B85                          | B-85             | 4.92                | 14%                 | 3.16             | 9.95          |
| B90                          | B-90             | 1.31                | 58%                 | 1.78             | 5.99          |
| B95                          | B-95             | 2.61                | 48%                 | 2.83             | 10.96         |
| B100                         | B-100            | 1.84                | 46%                 | 1.86             | 7.37          |
| B105                         | B-105            | 1.70                | 48%                 | 1.79             | 6.90          |
| B110                         | B-110            | 2.39                | 46%                 | 2.27             | 9.11          |
| B115                         | B-115            | 1.51                | 49%                 | 1.65             | 6.33          |
| B120                         | B-120            | 1.72                | 47%                 | 1.79             | 7.04          |
| B125                         | B-125            | 4.42                | 48%                 | 4.29             | 16.64         |
| B130                         | B-130            | 1.03                | 47%                 | 1.13             | 4.44          |
| B140                         | B-140            | 1.14                | 5%                  | 0.49             | 1.62          |
| B145                         | B-145            | 0.14                | 75%                 | 0.31             | 0.90          |
| B150                         | B-150            | 0.14                | 75%                 | 0.31             | 0.90          |
| B155                         | B-155            | 3.00                | 45%                 | 2.70             | 10.87         |
| B160                         | B-160            | 1.74                | 54%                 | 2.11             | 7.57          |
| B165                         | B-165            | 0.18                | 45%                 | 0.24             | 0.96          |
| B170                         | B-170            | 2.13                | 50%                 | 2.13             | 8.02          |
| B175                         | B-175            | 1.37                | 45%                 | 1.31             | 5.30          |
| B180                         | B-180            | 3.75                | 47%                 | 3.71             | 14.23         |
| E5                           | E-05             | 1.84                | 51%                 | 2.38             | 8.36          |
| E10                          | E-10             | 1.23                | 50%                 | 1.44             | 5.39          |
| E15                          | E-15             | 1.76                | 45%                 | 1.64             | 6.64          |
| <b>TOTAL</b>                 |                  | <b>141.89</b>       |                     | <b>130.11</b>    | <b>470.15</b> |
| <b>Drainage Basin Totals</b> |                  |                     |                     |                  |               |
| Basin A                      | Basin A          | 24.41               | 42%                 | 24.60            | 90.26         |
| Basin B                      | Basin B          | 88.83               | 31%                 | 72.46            | 260.37        |
| Basin C                      | Basin C          | 13.88               | 51%                 | 16.49            | 59.30         |
| Basin D                      | Basin D          | 13.40               | 42%                 | 11.09            | 39.83         |
| Basin E                      | Basin E          | 4.86                | 48%                 | 5.46             | 20.38         |
| Basin OS-1                   | Basin OS-1       | 10.94               | 5%                  | 3.28             | 10.81         |
| <b>TOTAL</b>                 |                  | <b>156.33</b>       |                     | <b>133.39</b>    | <b>480.96</b> |

E:\JOB FOLDERS\1008 - SOUTH QUINCY RESIDENTIAL DEVELOPERS, INC.\1008-18\PROD\DRAWING\FINAL\FINAL.DWG PRINTED ON: 7/27/2022, 4:40 PM



**PRIVATE SWALE NOTE:**

1. PRIVATE INTERIM SWALES SHALL BE MAINTAINED BY THE HOA AND THE SLOPE OF LESS THAN 2% PERMITTED FOR UP TO 36 MONTHS; OTHERWISE REVISIONS SHALL BE SUBMITTED FOR CONCRETE LINING. IN ADDITION, THE CITY RESERVES THE RIGHT, PRIOR TO 36 MONTHS, TO REQUIRE THE SWALE TO BE CONCRETE LINED SHOULD THERE BE ISSUES WITH REDUCED CAPACITY, SEDIMENTATION, PONDING, OR OTHER ITEMS IDENTIFIED BY THE CITY ENGINEER

**NOTES:**

- CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETELY AND/OR ACCURACY OF THIS DOCUMENT.
- ALL STORM SEWER, INCLUDING ALL DETENTION POND FACILITIES, AND OTHER ASSOCIATED STORM STRUCTURES ARE PUBLIC UNLESS OTHERWISE NOTED.
- DETENTION PONDS ARE PRIVATE UNLESS OTHERWISE NOTED AND MAINTAINED BY THE HOA.
- THE STORM SEWER SYSTEM, IN COMBINATION WITH THE STREET, IS SIZED FOR THE 100 YEAR STORM EVENT. ROADWAY PAVING WILL NOT BE PERMITTED AND CERTIFICATES OF OCCUPANCY WILL NOT BE ISSUED UNTIL DOWNSTREAM PIPE AND OUTFALL HAVE BEEN CONSTRUCTED IN HARVEST ROAD AND INITIALLY ACCEPTED.
- FURTHER ADJACENT DOWNSTREAM DEVELOPMENT IS REQUIRED TO PROVIDE CONVEYANCE FOR EMERGENCY OVERFLOWS. CITY RECOMMENDS PRIVATE DRAINAGE EASEMENTS TO BE OBTAINED FOR ANY EMERGENCY FLOW PATHS NOT WITHIN ROW.

| Calculated Proposed Runoff Rates |              |                  |          |                     |                  |                                 |
|----------------------------------|--------------|------------------|----------|---------------------|------------------|---------------------------------|
| Basin ID                         | Design Point | Total Area (Ac.) | Tc (min) | Runoff Coefficients |                  | Peak Flow (cfs)                 |
|                                  |              |                  |          | C <sub>2</sub>      | C <sub>100</sub> | Q <sub>2</sub> Q <sub>100</sub> |
| A1                               | A2-31 (Int.) | 0.34             | 14.0     | 0.32                | 0.41             | 0.25 0.87                       |
| A2                               | A2-29        | 1.26             | 9.1      | 0.52                | 0.61             | 1.83 5.79                       |
| A3                               | A2-23        | 1.21             | 11.1     | 0.49                | 0.65             | 1.51 5.40                       |
| A4                               | A2-21A       | 0.41             | 8.4      | 0.50                | 0.65             | 0.59 2.06                       |
| A5                               | A2-20        | 1.14             | 11.7     | 0.47                | 0.64             | 1.35 4.91                       |
| A6                               | A2-17        | 2.15             | 13.2     | 0.49                | 0.65             | 2.52 8.98                       |
| A7                               | A2-38 (Int.) | 0.24             | 12.3     | 0.30                | 0.39             | 0.18 0.62                       |
| A8                               | A2-36        | 1.17             | 8.5      | 0.50                | 0.65             | 1.67 5.83                       |
| A9                               | A2-37        | 0.64             | 7.8      | 0.53                | 0.66             | 1.00 3.39                       |
| A10                              | A2-33B       | 0.85             | 10.8     | 0.47                | 0.64             | 1.04 3.80                       |
| A11                              | A2-12A       | 2.45             | 13.2     | 0.45                | 0.63             | 2.62 9.85                       |
| A12                              | A2-11        | 1.56             | 10.1     | 0.54                | 0.67             | 2.23 7.53                       |
| A14                              | A2-2         | 1.19             | 9.7      | 0.49                | 0.64             | 1.60 5.57                       |
| A15                              | A3-5         | 0.33             | 5.9      | 0.67                | 0.74             | 0.72 2.15                       |

(Int.) Indicates Interim Condition (D.B.O.) Indicates Designed by Others

| Calculated Proposed Runoff Rates |              |                  |          |                     |                  |                                 |
|----------------------------------|--------------|------------------|----------|---------------------|------------------|---------------------------------|
| Basin ID                         | Design Point | Total Area (Ac.) | Tc (min) | Runoff Coefficients |                  | Peak Flow (cfs)                 |
|                                  |              |                  |          | C <sub>2</sub>      | C <sub>100</sub> | Q <sub>2</sub> Q <sub>100</sub> |
| A16                              | A3-4         | 3.26             | 11.7     | 0.50                | 0.65             | 4.08 14.36                      |
| A17                              | A3-2         | 0.21             | 5.0      | 0.67                | 0.74             | 0.48 1.43                       |
| A18                              | A1-6         | 2.56             | 8.4      | 0.47                | 0.57             | 3.41 11.16                      |
| A19                              | A4-2         | 2.03             | 11.6     | 0.54                | 0.67             | 2.78 9.19                       |
| B1                               | B3-11        | 0.57             | 12.3     | 0.62                | 0.70             | 0.87 2.63                       |
| B1-a                             | B3-14 (Int.) | 0.10             | 8.1      | 0.25                | 0.35             | 0.07 0.28                       |
| B2                               | B3-7         | 3.67             | 14.2     | 0.42                | 0.58             | 3.58 13.24                      |
| B2-a                             | B3-8         | 0.20             | 5.3      | 0.60                | 0.70             | 0.39 1.24                       |
| B3                               | B3-5         | 1.02             | 8.1      | 0.56                | 0.68             | 1.66 5.43                       |
| B4                               | B3-6         | 3.76             | 13.9     | 0.35                | 0.64             | 3.08 15.25                      |
| B5                               | B3-2         | 1.08             | 11.6     | 0.54                | 0.67             | 1.46 4.92                       |
| B6                               | B4-2         | 0.17             | 9.0      | 0.67                | 0.74             | 0.32 0.96                       |
| B7                               | B2-13        | 0.25             | 6.3      | 0.55                | 0.68             | 0.44 1.45                       |
| B8                               | B2-12        | 1.12             | 12.3     | 0.45                | 0.62             | 1.23 4.65                       |
| B9                               | B2-9         | 0.89             | 6.4      | 0.64                | 0.72             | 1.78 5.44                       |

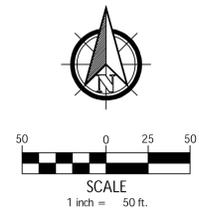
(Int.) Indicates Interim Condition (D.B.O.) Indicates Designed by Others

| Calculated Proposed Runoff Rates |              |                  |          |                     |                  |                                 |
|----------------------------------|--------------|------------------|----------|---------------------|------------------|---------------------------------|
| Basin ID                         | Design Point | Total Area (Ac.) | Tc (min) | Runoff Coefficients |                  | Peak Flow (cfs)                 |
|                                  |              |                  |          | C <sub>2</sub>      | C <sub>100</sub> | Q <sub>2</sub> Q <sub>100</sub> |
| B10                              | B2-4         | 0.55             | 9.1      | 0.67                | 0.74             | 1.03 3.05                       |
| B11                              | B2-2         | 1.70             | 13.0     | 0.45                | 0.62             | 1.83 6.88                       |
| B12                              | B1-1         | 1.35             | 5.0      | 0.49                | 0.58             | 2.23 7.14                       |
| C1                               | B1-2B        | 0.41             | 5.0      | 0.67                | 0.74             | 0.93 2.75                       |
| D1                               | C1-4         | 0.11             | 5.0      | 0.71                | 0.79             | 0.27 0.80                       |
| D2                               | C1-2         | 0.23             | 5.0      | 0.67                | 0.74             | 0.52 1.54                       |
| OA-1a                            | A2-38 (Int.) | 0.55             | 12.2     | 0.25                | 0.35             | 0.34 1.28                       |
| OA-2a                            | A2-31 (Int.) | 1.48             | 14.4     | 0.25                | 0.35             | 0.85 3.20                       |
| OB                               | B3-14 (Int.) | 0.61             | 6.7      | 0.25                | 0.35             | 0.38 1.43                       |
| OC                               | B4-4         | 0.54             | 5.3      | 0.67                | 0.74             | 1.21 3.59                       |
| OD                               | Pond T       | 1.39             | 13.4     | 0.25                | 0.35             | 0.82 3.11                       |
| OE                               | C2-2         | 0.89             | 6.5      | 0.67                | 0.75             | 1.86 5.62                       |
| OF                               | C2-5         | 1.00             | 9.4      | 0.57                | 0.66             | 1.56 4.90                       |
| OG                               | Pond T       | 10.96            | 15.2     | 0.26                | 0.36             | 6.42 23.85                      |

(Int.) Indicates Interim Condition (D.B.O.) Indicates Designed by Others



**PROJECT BENCHMARK:**  
CITY OF AURORA BENCHMARK #456529NE002 BEING A 3" BRASS CAP STAMPED "CITY OF AURORA, BM, 23-70, 0-110" ATOP A 30' LONG STEEL PIPE IN CONC. ON THE SOUTH SIDE OF E. JEWELL AVE. APPROX. 300 FT. WEST OF THE CENTERLINE OF A BRIDGE CROSSING COAL CREEK & AT THE SOUTHEAST CORNER OF INTERSECTION OF ROAD GOING SOUTHEAST FROM E. JEWELL AVE. EL. NAVD88 = 5623.18'



12071 Tejon Street, Suite 470  
Westminster, CO 80234  
303.421.4224  
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Harvest Crossing Subdivision Filing No. 1  
Aurora, Colorado  
Construction Documents  
Final Drainage Plan

Prepared By: XWL  
Approved By: XWL

Date: July 27, 2022  
Horizontal Scale: 1" = 50'  
Vertical Scale: N/A

Revision Type: \_\_\_\_\_  
No. 1 2 3 4 5 6  
Rev. Date: \_\_\_\_\_

Richmond American Homes  
Address: Greenwood Village, CO 80111  
4350 South Monaco Street  
Denver, Colorado 80237  
Contact: Eric Kuby  
Phone: 720-977-3827

811 Know what's below. Call before you dig.

Sheet: 102



## Time of Concentration

Project No.: 1008-18  
6/8/22

| Basin ID                            | C <sub>s</sub> | Initial Flow Time T <sub>i</sub> |           |                      | Travel Time T <sub>t</sub> |           |                 |                     |            |                      | T <sub>c</sub>             | T <sub>c</sub> Check |                                  | Final T <sub>c</sub> (min) |
|-------------------------------------|----------------|----------------------------------|-----------|----------------------|----------------------------|-----------|-----------------|---------------------|------------|----------------------|----------------------------|----------------------|----------------------------------|----------------------------|
|                                     |                | Length (ft)                      | Slope (%) | T <sub>i</sub> (min) | Length (ft)                | Slope (%) | Convey. Element | Convey. Coefficient | Vel. (fps) | T <sub>t</sub> (min) | Final T <sub>c</sub> (min) | Length (ft)          | T <sub>c</sub> =(L/180)+10 (min) |                            |
| <b>Off-site Interim Condition</b>   |                |                                  |           |                      |                            |           |                 |                     |            |                      |                            |                      |                                  |                            |
| OA-1a                               | 0.27           | 400                              | 3.36      | 20.1                 |                            |           | Grass           | 7                   |            | 0.0                  | 20.1                       | 400                  | 12.2                             | 12.2                       |
| OA-1a + A7-a                        | 0.27           | 310                              | 3.36      | 17.7                 | 240                        | 1.80      | Swale           | 7                   | 0.9        | 4.3                  | 21.9                       | 550                  | 13.1                             | 13.1                       |
| OA-1b                               | 0.27           | 500                              | 1.90      | 27.1                 | 590                        | 1.90      | Grass           | 7                   | 1.0        | 10.2                 | 37.3                       | 1,090                | 16.1                             | 16.1                       |
| OA-1b + A7-b                        | 0.27           | 500                              | 1.90      | 27.0                 | 190                        | 1.90      | Grass           | 7                   | 1.0        | 3.3                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 400                        | 1.50      | Swale           | 7                   | 0.9        | 7.8                  | 38.1                       | 1,090                | 16.1                             | 16.1                       |
| OA-2a                               | 0.27           | 500                              | 2.25      | 25.6                 | 300                        | 2.25      | Grass           | 7                   | 1.1        | 4.8                  | 30.4                       | 800                  | 14.4                             | 14.4                       |
| OA-2a + A1-a                        | 0.27           | 500                              | 2.25      | 25.6                 | 170                        | 2.25      | Grass           | 7                   | 1.1        | 2.7                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 120                        | 0.80      | Swale           | 7                   | 0.6        | 3.2                  | 31.5                       | 790                  | 14.4                             | 14.4                       |
| OA-2b                               | 0.27           | 500                              | 1.40      | 29.9                 | 1,740                      | 1.40      | Grass           | 7                   | 0.8        | 35.0                 | 64.9                       | 2,240                | 22.4                             | 22.4                       |
| OA-2b + A1-b                        | 0.27           | 500                              | 1.40      | 29.9                 | 1,030                      | 1.40      | Grass           | 7                   | 0.8        | 20.7                 |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 710                        | 1.80      | Swale           | 7                   | 0.9        | 12.6                 | 63.2                       | 2,240                | 22.4                             | 22.4                       |
| OB                                  | 0.27           | 400                              | 4.45      | 18.3                 | 0                          | 2.00      | Grass           | 7                   | 1.0        | 0.0                  | 18.3                       | 400                  | 12.2                             | 12.2                       |
| OB + B1-a                           | 0.27           | 270                              | 4.45      | 15.0                 | 200                        | 2.00      | Swale           | 7                   | 1.0        | 3.4                  | 18.4                       | 470                  | 12.6                             | 12.6                       |
| OC                                  | 0.68           | 38                               | 5.45      | 2.7                  | 702                        | 4.78      | Street          | 20                  | 4.4        | 2.7                  | 5.3                        | 740                  | 14.1                             | 5.3                        |
| OD                                  | 0.27           | 300                              | 2.50      | 19.2                 | 315                        | 1.00      | Grass           | 7                   | 0.7        | 7.5                  | 26.7                       | 615                  | 13.4                             | 13.4                       |
| OE                                  | 0.68           | 38                               | 2.00      | 3.7                  | 511                        | 2.30      | Street          | 20                  | 3.0        | 2.8                  | 6.5                        | 549                  | 13.1                             | 6.5                        |
| OF                                  | 0.58           | 62                               | 2.00      | 5.9                  | 597                        | 2.00      | Street          | 20                  | 2.8        | 3.5                  | 9.4                        | 659                  | 13.7                             | 9.4                        |
| OE + OF                             | 0.63           | 62                               | 2.00      | 5.3                  | 820                        | 2.00      | Street          | 20                  | 2.8        | 4.8                  | 10.2                       | 882                  | 14.9                             | 10.2                       |
| OG                                  | 0.28           | 300                              | 2.08      | 20.1                 | 642                        | 2.08      | Grass           | 7                   | 1.0        | 10.6                 | 30.7                       | 942                  | 15.2                             | 15.2                       |
| <b>Off-site Developed Condition</b> |                |                                  |           |                      |                            |           |                 |                     |            |                      |                            |                      |                                  |                            |
| OA1                                 | 0.45           | 100                              | 2.00      | 9.3                  | 840                        | 1.20      | Street          | 20                  | 2.2        | 6.4                  | 15.7                       | 940                  | 15.2                             | 15.2                       |
| OA1 + A7                            | 0.44           | 100                              | 2.00      | 9.4                  | 840                        | 1.20      | Street          | 20                  | 2.2        | 6.4                  | 15.8                       | 940                  | 15.2                             | 15.2                       |
| OA2                                 | 0.39           | 100                              | 2.00      | 10.2                 | 450                        | 4.80      | Street          | 20                  | 4.4        | 1.7                  | 11.9                       | 550                  | 13.1                             | 11.9                       |
| OA2 + A1                            | 0.39           | 100                              | 2.00      | 10.2                 | 450                        | 4.80      | Street          | 20                  | 4.4        | 1.7                  | 11.9                       | 550                  | 13.1                             | 11.9                       |
| OB                                  | 0.44           | 50                               | 2.00      | 6.7                  | 1750                       | 4.80      | Street          | 20                  | 4.4        | 6.7                  | 13.3                       | 1,800                | 20.0                             | 13.3                       |
| OB + B1-a                           | 0.44           | 50                               | 2.00      | 6.7                  | 1750                       | 4.80      | Street          | 20                  | 4.4        | 6.7                  | 13.3                       | 1,800                | 20.0                             | 13.3                       |
| OC                                  | 0.68           | 15                               | 2.00      | 2.3                  | 730                        | 4.80      | Street          | 20                  | 4.4        | 2.8                  | 5.1                        | 745                  | 14.1                             | 5.1                        |
| OD                                  | 0.00           | 300                              | 2.50      | 25.4                 | 315                        | 1.00      | Grass           | 7                   | 0.7        | 7.5                  | 32.9                       | 615                  | 13.4                             | 13.4                       |
| OE                                  | 0.72           | 38                               | 2.00      | 3.4                  | 511                        | 2.30      | Street          | 20                  | 3.0        | 2.8                  | 6.2                        | 549                  | 13.1                             | 6.2                        |
| OF                                  | 0.58           | 29                               | 2.00      | 4.0                  | 577                        | 1.92      | Street          | 20                  | 2.8        | 3.5                  | 7.5                        | 606                  | 13.4                             | 7.5                        |
| OG                                  | 0.00           | 300                              | 2.08      | 27.0                 | 642                        | 2.08      | Grass           | 7                   | 1.0        | 10.6                 | 37.6                       | 942                  | 15.2                             | 15.2                       |
| <b>Historic</b>                     |                |                                  |           |                      |                            |           |                 |                     |            |                      |                            |                      |                                  |                            |
| OC                                  | 0.27           | 75                               | 5.00      | 7.6                  | 195                        | 5.80      | Street          | 20                  | 4.8        | 0.7                  | 8.3                        | 270                  | 11.5                             | 8.3                        |
| OD                                  | 0.27           | 250                              | 2.60      | 17.3                 | 0                          | 1.00      | Grass           | 7                   | 0.7        | 0.0                  | 17.3                       | 250                  | 11.4                             | 11.4                       |
| OE                                  | 0.27           | 54                               | 3.90      | 7.0                  | 0                          | 1.00      | Street          | 20                  | 2.0        | 0.0                  | 7.0                        | 54                   | 10.3                             | 7.0                        |
| OF                                  | 0.37           | 72                               | 2.00      | 8.9                  | 0                          | 1.00      | Street          | 20                  | 2.0        | 0.0                  | 8.9                        | 72                   | 10.4                             | 8.9                        |
| <b>Ponds</b>                        |                |                                  |           |                      |                            |           |                 |                     |            |                      |                            |                      |                                  |                            |
| Pond A                              | 0.53           | 125                              | 2.00      | 9.2                  | 1,090                      | 2.50      | Street          | 20                  | 3.2        | 5.7                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 1,700                      | 0.40      | Pipe            | 25                  | 1.6        | 17.9                 | 32.9                       | 2,915                | 26.2                             | 26.2                       |
| Pond B                              | 0.50           | 300                              | 6.00      | 10.4                 | 490                        | 2.00      | Grass           | 7                   | 1.0        | 8.2                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 355                        | 2.50      | Street          | 20                  | 3.2        | 1.9                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 670                        | 0.40      | Pipe            | 25                  | 1.6        | 7.1                  | 27.5                       | 1,815                | 20.1                             | 20.1                       |
| <b>Ponds (Fully Developed)</b>      |                |                                  |           |                      |                            |           |                 |                     |            |                      |                            |                      |                                  |                            |
| Pond A                              | 0.47           | 125                              | 2.00      | 10.0                 | 1,085                      | 2.50      | Street          | 20                  | 3.2        | 5.7                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 2,000                      | 0.40      | Pipe            | 25                  | 1.6        | 21.1                 | 36.8                       | 3,210                | 27.8                             | 27.8                       |
| Pond B                              | 0.48           | 125                              | 2.00      | 10.0                 | 400                        | 1.00      | Street          | 20                  | 2.0        | 3.3                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 760                        | 1.80      | Street          | 20                  | 2.7        | 4.7                  |                            |                      |                                  |                            |
|                                     |                |                                  |           |                      | 1,440                      | 0.50      | Pipe            | 25                  | 1.8        | 13.6                 | 31.6                       | 2,725                | 25.1                             | 25.1                       |

### Basin Runoff Calculations - Direct Runoff

Project No.: 1008-18

8-Jun-22

| Basin ID                   | Design Point | Total Area (Ac.) | Imp (%) | Tc (min) | Runoff Coeff.  |                |                  | I <sub>2</sub> | I <sub>5</sub> | I <sub>100</sub> | Q <sub>2</sub> | Q <sub>100</sub> |
|----------------------------|--------------|------------------|---------|----------|----------------|----------------|------------------|----------------|----------------|------------------|----------------|------------------|
|                            |              |                  |         |          | C <sub>2</sub> | C <sub>5</sub> | C <sub>100</sub> |                |                |                  |                |                  |
| Off-site Interim Condition |              |                  |         |          |                |                |                  |                |                |                  |                |                  |
| OA-1a                      | A2-38 (Int.) | 0.55             | 5%      | 12.2     | 0.25           | 0.27           | 0.35             | 2.47           | 3.44           | 6.65             | 0.34           | 1.28             |
| OA-1a + A7-a               | A2-38 (Int.) | 0.62             | 5%      | 13.1     | 0.25           | 0.27           | 0.35             | 2.40           | 3.34           | 6.46             | 0.37           | 1.40             |
| OA-1b                      | A2-38 (Int.) | 4.34             | 5%      | 16.1     | 0.25           | 0.27           | 0.35             | 2.18           | 3.03           | 5.87             | 2.36           | 8.92             |
| OA-1b + A7-b               | A2-38 (Int.) | 4.51             | 5%      | 16.1     | 0.25           | 0.27           | 0.35             | 2.18           | 3.03           | 5.87             | 2.48           | 9.33             |
| OA-2a                      | A2-31 (Int.) | 1.48             | 5%      | 14.4     | 0.25           | 0.27           | 0.35             | 2.29           | 3.19           | 6.17             | 0.85           | 3.20             |
| OA-2a + A1-a               | A2-31 (Int.) | 1.53             | 5%      | 14.4     | 0.25           | 0.27           | 0.35             | 2.29           | 3.19           | 6.18             | 0.89           | 3.34             |
| OA-2b                      | A2-31 (Int.) | 17.59            | 5%      | 22.4     | 0.25           | 0.27           | 0.35             | 1.83           | 2.55           | 4.94             | 8.11           | 30.57            |
| OA-2b + A1-b               | A2-31 (Int.) | 17.87            | 5%      | 22.4     | 0.25           | 0.27           | 0.35             | 1.83           | 2.55           | 4.94             | 8.28           | 31.14            |
| OB                         | B3-14 (Int.) | 0.61             | 5%      | 12.2     | 0.25           | 0.27           | 0.35             | 2.47           | 3.44           | 6.65             | 0.38           | 1.43             |
| OB + B1-a                  | B3-14 (Int.) | 0.71             | 5%      | 12.6     | 0.25           | 0.27           | 0.35             | 2.43           | 3.39           | 6.56             | 0.43           | 1.64             |
| OC                         | B4-4         | 0.54             | 74%     | 5.3      | 0.67           | 0.68           | 0.74             | 3.30           | 4.60           | 8.90             | 1.21           | 3.59             |
| OD                         | Pond T       | 1.39             | 5%      | 13.4     | 0.25           | 0.27           | 0.35             | 2.37           | 3.30           | 6.38             | 0.82           | 3.11             |
| OE                         | C2-2         | 0.89             | 72%     | 6.5      | 0.67           | 0.68           | 0.75             | 3.11           | 4.34           | 8.40             | 1.86           | 5.62             |
| OF                         | C2-5         | 1.00             | 55%     | 9.4      | 0.57           | 0.58           | 0.66             | 2.74           | 3.83           | 7.40             | 1.56           | 4.90             |
| OG                         | Pond T       | 10.96            | 7%      | 15.2     | 0.26           | 0.28           | 0.36             | 2.23           | 3.11           | 6.02             | 6.42           | 23.85            |

#### Off-site Developed Condition

|           |      |                                  |     |      |      |      |      |      |      |      |       |       |
|-----------|------|----------------------------------|-----|------|------|------|------|------|------|------|-------|-------|
| OA1       | PA   | 3.93                             | 50% | 15.2 | 0.40 | 0.45 | 0.60 | 2.23 | 3.11 | 6.02 | 3.51  | 14.18 |
| OA1 + A7  | PA   | 4.17                             | 48% | 15.2 | 0.39 | 0.44 | 0.59 | 2.23 | 3.11 | 6.02 | 3.67  | 14.75 |
| OA2       | PA   | 13.03                            | 39% | 11.9 | 0.33 | 0.39 | 0.61 | 2.50 | 3.48 | 6.73 | 10.68 | 53.90 |
| OA2 + A1  | PA   | 13.37                            | 38% | 11.9 | 0.33 | 0.39 | 0.61 | 2.49 | 3.48 | 6.73 | 10.94 | 54.79 |
| OB        | PA   | 16.04                            | 49% | 13.3 | 0.39 | 0.44 | 0.60 | 2.37 | 3.31 | 6.40 | 14.98 | 61.77 |
| OB + B1-a | PA   | 16.14                            | 49% | 13.3 | 0.39 | 0.44 | 0.60 | 2.37 | 3.31 | 6.40 | 15.03 | 61.97 |
| OC        | B1-4 | 0.52                             | 74% | 5.1  | 0.67 | 0.68 | 0.74 | 3.34 | 4.66 | 9.01 | 1.18  | 3.50  |
| OD        | PT   | Not Applicable - Same as Interim |     |      |      |      |      |      |      |      |       |       |
| OE        | C2-2 | 0.81                             | 79% | 6.2  | 0.71 | 0.72 | 0.79 | 3.17 | 4.41 | 8.54 | 1.83  | 5.48  |
| OF        | C2-5 | 1.00                             | 55% | 7.5  | 0.57 | 0.58 | 0.66 | 2.98 | 4.15 | 8.03 | 1.70  | 5.32  |
| OG        | PT   | Not Applicable - Same as Interim |     |      |      |      |      |      |      |      |       |       |

#### Existing

|    |  |      |     |      |      |      |      |      |      |      |      |      |
|----|--|------|-----|------|------|------|------|------|------|------|------|------|
| OC |  | 0.60 | 5%  | 8.3  | 0.25 | 0.27 | 0.35 | 2.87 | 4.00 | 7.74 | 0.43 | 1.63 |
| OD |  | 1.39 | 5%  | 11.4 | 0.25 | 0.27 | 0.35 | 2.54 | 3.54 | 6.85 | 0.88 | 3.33 |
| OE |  | 0.81 | 5%  | 7.0  | 0.25 | 0.27 | 0.35 | 3.04 | 4.24 | 8.20 | 0.62 | 2.32 |
| OF |  | 0.97 | 21% | 8.9  | 0.36 | 0.37 | 0.45 | 2.81 | 3.91 | 7.57 | 0.97 | 3.32 |

#### Emergency Overflow Contributing Flows (Developed Condition)

|                 |  |       |     |      |      |      |      |      |      |      |       |        |
|-----------------|--|-------|-----|------|------|------|------|------|------|------|-------|--------|
| Pond A inflow   |  | 39.96 | 48% | 27.8 | 0.43 | 0.47 | 0.62 | 1.62 | 2.26 | 4.38 | 27.94 | 109.11 |
| Pond B inflow   |  | 33.00 | 49% | 25.1 | 0.43 | 0.48 | 0.62 | 1.72 | 2.40 | 4.64 | 24.59 | 94.99  |
| Pond T inflow   |  | 14.71 | 16% | 15.2 | 0.32 | 0.34 | 0.42 | 2.23 | 3.11 | 6.02 | 10.52 | 36.94  |
| Pond T + Pond A |  | 54.68 | 39% | 27.8 | 0.40 | 0.44 | 0.57 | 1.62 | 2.26 | 4.38 | 35.60 | 135.97 |

$$\text{Intensity} = \frac{28.5 * P_1}{(10 + T_c)^{0.786}}$$

|                           |      |        |
|---------------------------|------|--------|
| 2 Year P <sub>1</sub> =   | 0.99 | inches |
| 5 Year P <sub>1</sub> =   | 1.38 | inches |
| 100 Year P <sub>1</sub> = | 2.67 | inches |



## Appendix D- Detention Computations



4582 S. Ulster Street - Suite 1500  
Denver, Colorado 80237

Project: Harvest Crossing  
Project Number: 196284001  
Date: 8/8/2022

Prepared By: JBP  
Checked By: BPP

**Detention Storage Volume (V=KA Method) Entire Site**

| Contributing Basin Characteristics |              |             |
|------------------------------------|--------------|-------------|
| Basin                              | I (%)        | Area (AC)   |
| Major Basin A (A05-A70)            | 42%          | 24.41       |
| <b>Total</b>                       | <b>42.0%</b> | <b>24.4</b> |

| Water Quality Capture Volume          |  |                       |
|---------------------------------------|--|-----------------------|
| UDFCD V3 Equation 3-1                 | WQ Watershed Inches = $a*(0.91i^3 - 1.19i^2 + .78i)$ |                       |
| UDFCD V3 Equation 3-3                 | WQCV = (WQCV/12)*(Area)                              |                       |
| WQCV Impervious (Site) =              | 42.0%  |                       |
| a =                                   | 1.0  |                       |
| <b>WQ Watershed Inches (Site) =</b>   | <b>0.19</b>  |                       |
| Area (Site) =                         | 24.41  | AC                    |
| <b>WQ Capture Volume (Site) =</b>     | <b>0.375</b>   | <b>AC-FT</b>          |
|                                       | 16,335   | FT <sup>3</sup>       |
| <b>20% Increase for Sedimentation</b> | <b>0.450</b>   | <b>AC-FT</b>          |
| <b>Watershed Inches</b>               |  |                       |
| % Hydrologic Soil Group A =           | 0%   |                       |
| % Hydrologic Soil Group B =           | 0%   |                       |
| % Hydrologic Soil Group C/D =         | 100%   |                       |
| EURV <sub>C/D</sub> (USDCM 12-3) =    | 0.47   | in                    |
| <b>Total Watershed Inches =</b>       | <b>0.47</b>  | <b>in</b>             |
| EURV =                                | 0.956  | AC-FT                 |
|                                       |  | <b>Site WQ Volume</b> |
|                                       | WQCV   | 0.45 AC-FT            |
|                                       | EURV   | 0.96 AC-FT            |

| 100-Year Detention                       |  |            |
|--|--|------------|
| COA Eq. 6.1                              | $V_i = K_i A$                              |            |
|  | $K_{100} = (1.78I - .002I^2 - 3.56)/(900)$ |            |
| $k_{100} =$                              | 0.075                                      |            |
| 100-Yr Detention Volume CoA =            | 1.835                                      | AC-FT      |
| 100-Yr Detention Volume CoA =            | 79950.7                                    | Cu Ft      |
| 100-Yr Detention Volume (UD Detention) = | 2.082                                      | AC-FT      |
| includes 20% WQCV for Sedimentation      |  |            |
| WQ Capture Volume =                      |  | 0.45 AC-FT |
| Excess Urban Runoff Volume =             |  | 0.96 AC-FT |
| 100-Yr Volume =                          |  | 2.16 AC-FT |



4582 S. Ulster Street - Suite 1500  
Denver, Colorado 80237

Project: Harvest Crossing  
Project Number: 196284001  
Date: 8/8/2022

Prepared By: JBP  
Checked By: BPP

**Detention Storage Volume (V=KA Method) Entire Site**

| Contributing Basin Characteristics |            |             |
|------------------------------------|------------|-------------|
| Basin                              | I (%)      | Area (AC)   |
| Major Basin B<br>(B05-B170)        | 31%        | 88.83       |
| <b>Total</b>                       | <b>31%</b> | <b>88.8</b> |

| Water Quality Capture Volume       |  |                 |
|------------------------------------|--|-----------------|
| UDFCD V3 Equation 3-1              | WQ Watershed Inches = $a*(0.91i^3 - 1.19i^2 + .78i)$ |                 |
| UDFCD V3 Equation 3-3              | WQCV = (WQCV/12)*(Area)                              |                 |
| WQCV Impervious (Site) =           | 31.0%  |                 |
| a =                                | 1.0  |                 |
| WQ Watershed Inches (Site) =       | 0.15   |                 |
| Area (Site) =                      | 88.83  | AC              |
| WQ Capture Volume (Site) =         | 1.144  | AC-FT           |
|                                    | 49,833   | FT <sup>3</sup> |
| 20% Increase for Sedimentation     | 1.373  | AC-FT           |
| Watershed Inches                   |  |                 |
| % Hydrologic Soil Group A =        | 0%   |                 |
| % Hydrologic Soil Group B =        | 0.0%   |                 |
| % Hydrologic Soil Group C/D =      | 100.0%   |                 |
| EURV <sub>C/D</sub> (USDCM 12-3) = | 0.34   |                 |
| Total Watershed Inches =           | 0.34   |                 |
| EURV =                             | 2.507  | AC-FT           |
|                                    |  | Site WQ Volume  |
| WQCV                               |  | 1.37 AC-FT      |
| EURV                               |  | 2.51 AC-FT      |

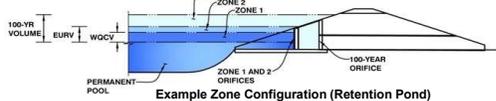
| 100-Year Detention                       |   |            |
|--|---|------------|
| COA Eq. 6.1                              | $V_1 = K_f A$<br>$K_{100} = (1.78I - .002I^2 - 3.56)/(900)$ |            |
| k <sub>100</sub> =                       | 0.055   |            |
| 100-Yr Detention Volume CoA =            | 4.905   | AC-FT      |
| 100-Yr Detention Volume CoA =            | 213670.2  | Cu Ft      |
| 100-Yr Detention Volume (UD Detention) = | 6.268   | AC-FT      |
| includes 20% WQCV for Sedimentation      |   |            |
| WQ Capture Volume =                      |   | 1.37 AC-FT |
| Excess Urban Runoff Volume =             |   | 2.51 AC-FT |
| 100-Yr Volume =                          |   | 6.50 AC-FT |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Harvest Crossing PA-5**

Basin ID: **Pond A**



**Watershed Information**

|   |                           |
|---|---------------------------|
| Selected BMP Type =                     | <b>EDB</b>                |
| Watershed Area =                        | 24.41 acres               |
| Watershed Length =                      | 1,755 ft                  |
| Watershed Length to Centroid =          | 450 ft                    |
| Watershed Slope =                       | 0.026 ft/ft               |
| Watershed Imperviousness =              | 42.00% percent            |
| Percentage Hydrologic Soil Group A =    | 0.0% percent              |
| Percentage Hydrologic Soil Group B =    | 0.0% percent              |
| Percentage Hydrologic Soil Groups C/D = | 100.0% percent            |
| Target WQCV Drain Time =                | 40.0 hours                |
| Location for 1-hr Rainfall Depths =     | Aurora - Municipal Center |

After providing required inputs above including 1-hour rainfall depths, click "Run CUHP" to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Optional User Overrides

|  |       |           |      |           |
|--|-------|-----------|------|-----------|
| Water Quality Capture Volume (WQCV) =  | 0.377 | acre-feet |      | acre-feet |
| Excess Urban Runoff Volume (EURV) =    | 0.956 | acre-feet |      | acre-feet |
| 2-yr Runoff Volume (P1 = 0.99 in.) =   | 0.813 | acre-feet | 0.99 | inches    |
| 5-yr Runoff Volume (P1 = 1.39 in.) =   | 1.508 | acre-feet | 1.39 | inches    |
| 10-yr Runoff Volume (P1 = 1.62 in.) =  | 1.951 | acre-feet | 1.62 | inches    |
| 25-yr Runoff Volume (P1 = 2 in.) =     | 2.806 | acre-feet | 2.00 | inches    |
| 50-yr Runoff Volume (P1 = 2.34 in.) =  | 3.513 | acre-feet | 2.34 | inches    |
| 100-yr Runoff Volume (P1 = 2.67 in.) = | 4.289 | acre-feet | 2.67 | inches    |
| 500-yr Runoff Volume (P1 = 3.39 in.) = | 5.808 | acre-feet | 3.39 | inches    |
| Approximate 2-yr Detention Volume =    | 0.696 | acre-feet |      |           |
| Approximate 5-yr Detention Volume =    | 1.198 | acre-feet |      |           |
| Approximate 10-yr Detention Volume =   | 1.368 | acre-feet |      |           |
| Approximate 25-yr Detention Volume =   | 1.618 | acre-feet |      |           |
| Approximate 50-yr Detention Volume =   | 1.750 | acre-feet |      |           |
| Approximate 100-yr Detention Volume =  | 2.082 | acre-feet |      |           |

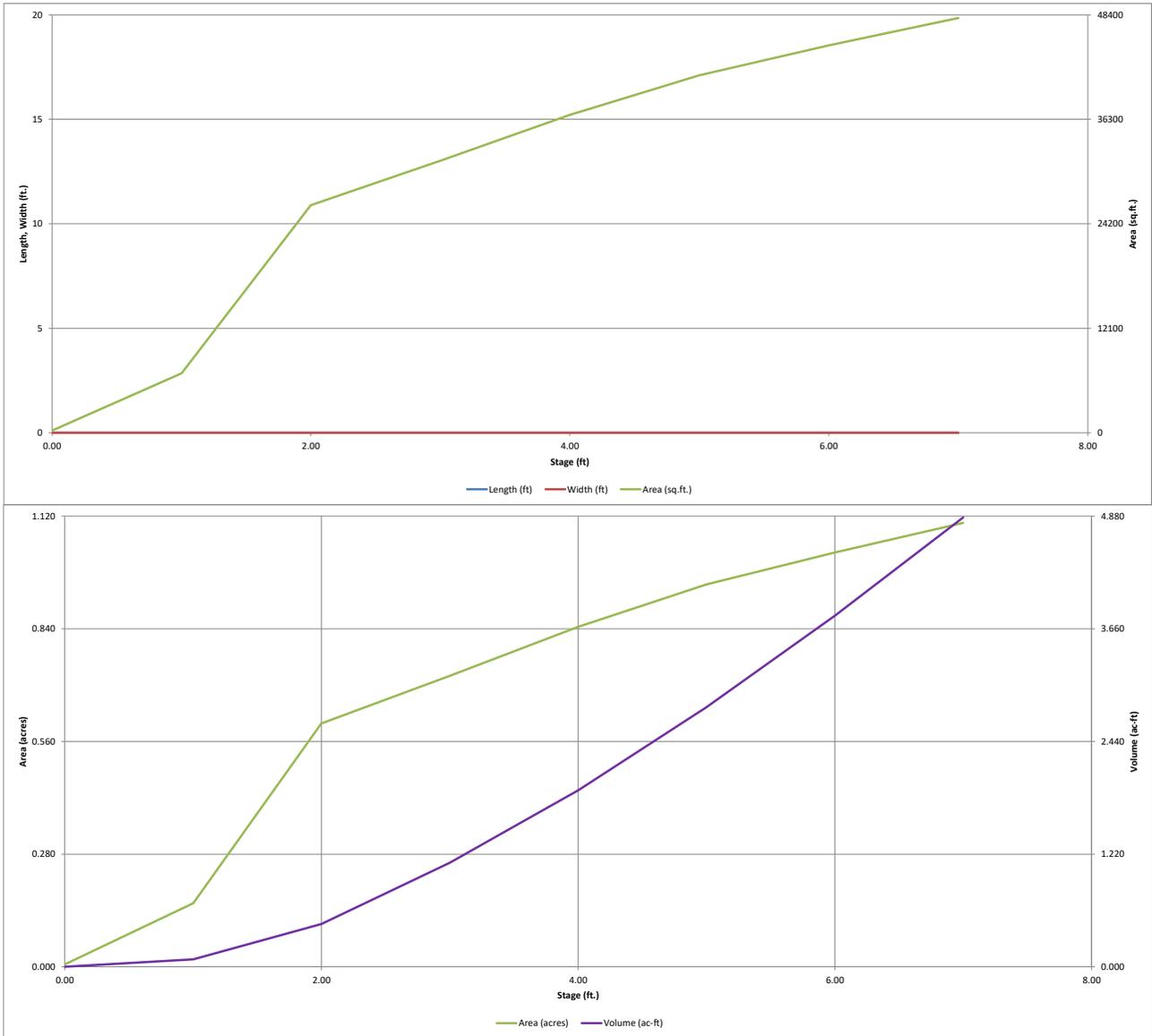
**Define Zones and Basin Geometry**

|   |       |                 |
|---|-------|-----------------|
| Zone 1 Volume (User Defined) =                          | 0.450 | acre-feet       |
| Zone 2 Volume (User Defined - Zone 1) =                 | 0.506 | acre-feet       |
| Zone 3 Volume (User Defined - Zones 1 & 2) =            | 1.200 | acre-feet       |
| Total Detention Basin Volume =                          | 2.156 | acre-feet       |
| Initial Surcharge Volume (ISV) =                        | user  | ft <sup>3</sup> |
| Initial Surcharge Depth (ISD) =                         | user  | ft              |
| Total Available Detention Depth (H <sub>total</sub> ) = | user  | ft              |
| Depth of Trickle Channel (H <sub>TC</sub> ) =           | user  | ft              |
| Slope of Trickle Channel (S <sub>TC</sub> ) =           | user  | ft/ft           |
| Slopes of Main Basin Sides (S <sub>main</sub> ) =       | user  | H:V             |
| Basin Length-to-Width Ratio (R <sub>LW</sub> ) =        | user  |                 |
|   |       |                 |
| Initial Surcharge Area (A <sub>ISV</sub> ) =            | user  | ft <sup>2</sup> |
| Surcharge Volume Length (L <sub>ISV</sub> ) =           | user  | ft              |
| Surcharge Volume Width (W <sub>ISV</sub> ) =            | user  | ft              |
| Depth of Basin Floor (H <sub>FLOOR</sub> ) =            | user  | ft              |
| Length of Basin Floor (L <sub>FLOOR</sub> ) =           | user  | ft              |
| Width of Basin Floor (W <sub>FLOOR</sub> ) =            | user  | ft              |
| Area of Basin Floor (A <sub>FLOOR</sub> ) =             | user  | ft <sup>2</sup> |
| Volume of Basin Floor (V <sub>FLOOR</sub> ) =           | user  | ft <sup>3</sup> |
| Depth of Main Basin (H <sub>MAIN</sub> ) =              | user  | ft              |
| Length of Main Basin (L <sub>MAIN</sub> ) =             | user  | ft              |
| Width of Main Basin (W <sub>MAIN</sub> ) =              | user  | ft              |
| Area of Main Basin (A <sub>MAIN</sub> ) =               | user  | ft <sup>2</sup> |
| Volume of Main Basin (V <sub>MAIN</sub> ) =             | user  | ft <sup>3</sup> |
| Calculated Total Basin Volume (V <sub>total</sub> ) =   | user  | acre-feet       |

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft <sup>2</sup> ) | Optional Override Area (ft <sup>2</sup> ) | Area (acre) | Volume (ft <sup>3</sup> ) | Volume (ac-ft) |
|-----------------------------|------------|------------------------------|-------------|------------|-------------------------|---|-------------|---------------------------|----------------|
| <b>Top of Micropool</b>     | --         | 0.00                         | --          | --         | --                      | 257                                       | 0.006       |                           |                |
| <b>5715.5</b>               | --         | 1.00                         | --          | --         | --                      | 6,896                                     | 0.158       | 3,577                     | 0.082          |
| <b>5716.5</b>               | --         | 2.00                         | --          | --         | --                      | 26,339                                    | 0.605       | 20,194                    | 0.464          |
| <b>5717.5</b>               | --         | 3.00                         | --          | --         | --                      | 31,515                                    | 0.723       | 49,122                    | 1.128          |
| <b>5718.5</b>               | --         | 4.00                         | --          | --         | --                      | 36,818                                    | 0.845       | 83,288                    | 1.912          |
| <b>5719.5</b>               | --         | 5.00                         | --          | --         | --                      | 41,412                                    | 0.951       | 122,403                   | 2.810          |
| <b>5720.5</b>               | --         | 6.00                         | --          | --         | --                      | 44,855                                    | 1.030       | 165,537                   | 3.800          |
| <b>5721.5</b>               | --         | 7.00                         | --          | --         | --                      | 48,047                                    | 1.103       | 211,987                   | 4.867          |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

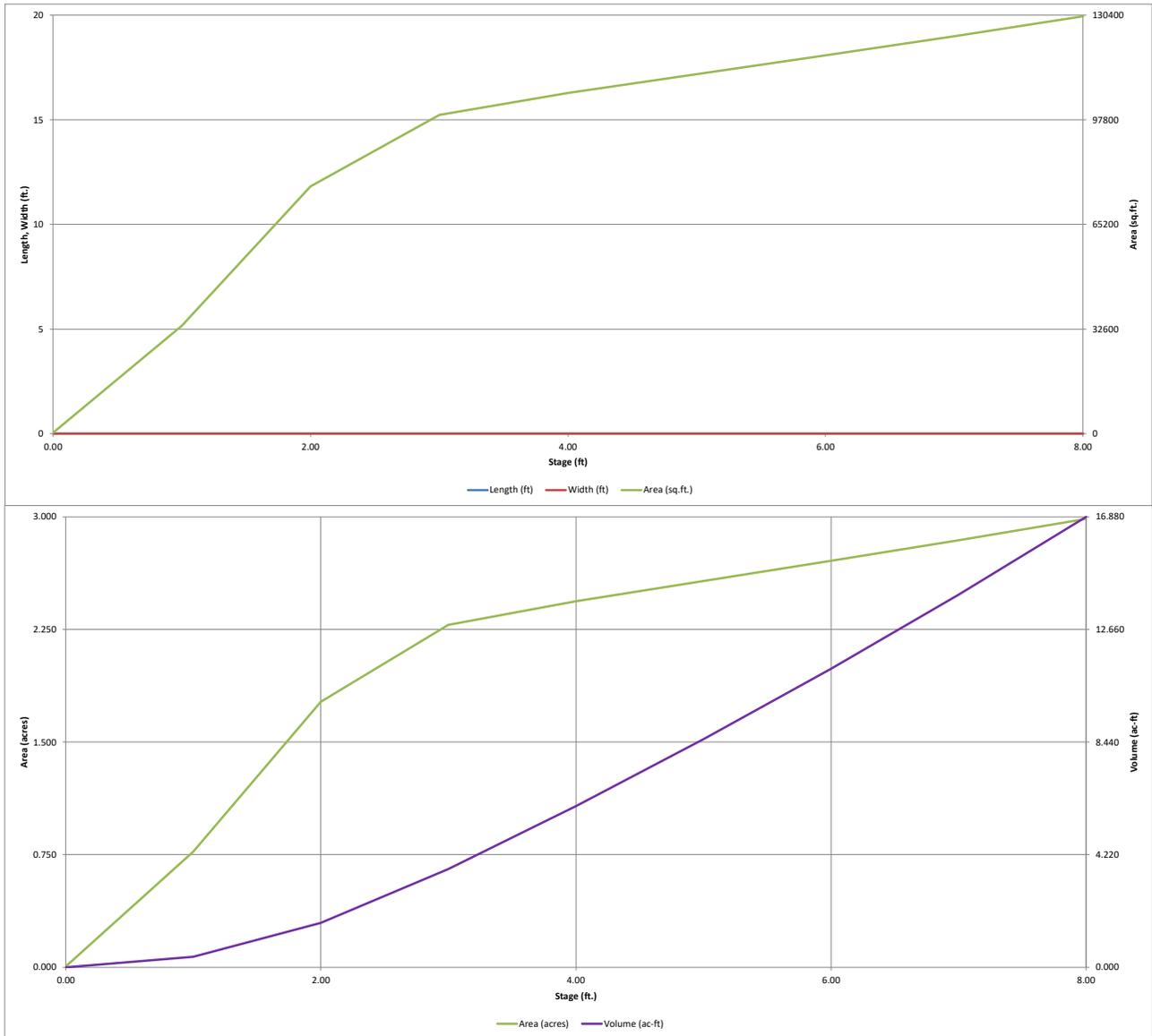
MHFD-*Detention*, Version 4.05 (January 2022)





# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-*Detention*, Version 4.05 (January 2022)



## Appendix E- Hydraulic Computations

## Worksheet for A-A

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 113.56 cfs     |
| Crest Elevation          | 5,701.15 ft    |
| Tailwater Elevation      | 5,701.15 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 177.60 degrees |

---

### Results

---

|                                 |                      |
|---------------------------------|----------------------|
| Headwater Elevation             | 5,702.13 ft          |
| Headwater Height Above<br>Crest | 0.98 ft              |
| Tailwater Height Above Crest    | 0.00 ft              |
| Flow Area                       | 46.2 ft <sup>2</sup> |
| Velocity                        | 2.46 ft/s            |
| Wetted Perimeter                | 93.9 ft              |
| Top Width                       | 93.88 ft             |

---

## Worksheet for B-B

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 9.71 cfs       |
| Crest Elevation          | 5,730.69 ft    |
| Tailwater Elevation      | 5,730.69 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 176.20 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,731.13 ft         |
| Headwater Height Above<br>Crest | 0.44 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 5.9 ft <sup>2</sup> |
| Velocity                        | 1.65 ft/s           |
| Wetted Perimeter                | 26.7 ft             |
| Top Width                       | 26.64 ft            |

---

## Worksheet for C-C

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 32.92 cfs      |
| Crest Elevation          | 5,729.04 ft    |
| Tailwater Elevation      | 5,729.04 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 177.70 degrees |

---

### Results

---

|                                 |                      |
|---------------------------------|----------------------|
| Headwater Elevation             | 5,729.63 ft          |
| Headwater Height Above<br>Crest | 0.59 ft              |
| Tailwater Height Above Crest    | 0.00 ft              |
| Flow Area                       | 17.3 ft <sup>2</sup> |
| Velocity                        | 1.90 ft/s            |
| Wetted Perimeter                | 58.7 ft              |
| Top Width                       | 58.69 ft             |

---

## Worksheet for D-D

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 7.71 cfs       |
| Crest Elevation          | 5,715.57 ft    |
| Tailwater Elevation      | 5,715.57 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 177.60 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,715.91 ft         |
| Headwater Height Above<br>Crest | 0.34 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 5.4 ft <sup>2</sup> |
| Velocity                        | 1.44 ft/s           |
| Wetted Perimeter                | 32.0 ft             |
| Top Width                       | 32.01 ft            |

---

## Worksheet for E-E

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 18.44 cfs      |
| Crest Elevation          | 5,713.02 ft    |
| Tailwater Elevation      | 5,713.02 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.80 degrees |

---

### Results

---

|                                 |                      |
|---------------------------------|----------------------|
| Headwater Elevation             | 5,713.38 ft          |
| Headwater Height Above<br>Crest | 0.36 ft              |
| Tailwater Height Above Crest    | 0.00 ft              |
| Flow Area                       | 12.4 ft <sup>2</sup> |
| Velocity                        | 1.49 ft/s            |
| Wetted Perimeter                | 68.8 ft              |
| Top Width                       | 68.77 ft             |

---

## Worksheet for F-F

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 49.85 cfs      |
| Crest Elevation          | 5,726.18 ft    |
| Tailwater Elevation      | 5,726.18 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.80 degrees |

---

### Results

---

|                                 |                      |
|---------------------------------|----------------------|
| Headwater Elevation             | 5,726.72 ft          |
| Headwater Height Above<br>Crest | 0.54 ft              |
| Tailwater Height Above Crest    | 0.00 ft              |
| Flow Area                       | 27.4 ft <sup>2</sup> |
| Velocity                        | 1.82 ft/s            |
| Wetted Perimeter                | 102.4 ft             |
| Top Width                       | 102.37 ft            |

---

## Worksheet for G-G

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                     |             |
|---------------------|-------------|
| Discharge           | 66.50 cfs   |
| Crest Elevation     | 5,722.48 ft |
| Tailwater Elevation | 5,722.48 ft |
| Crest Surface Type  | Paved       |
| Crest Breadth       | 2.00 ft     |
| Crest Length        | 80.0 ft     |

---

### Results

---

|                                 |                             |
|---------------------------------|-----------------------------|
| Headwater Elevation             | 5,722.90 ft                 |
| Headwater Height Above<br>Crest | 0.42 ft                     |
| Tailwater Height Above Crest    | 0.00 ft                     |
| Weir Coefficient                | 3.07 ft <sup>(1/2)</sup> /s |
| Submergence Factor              | 1.000                       |
| Adjusted Weir Coefficient       | 3.07 ft <sup>(1/2)</sup> /s |
| Flow Area                       | 33.5 ft <sup>2</sup>        |
| Velocity                        | 1.98 ft/s                   |
| Wetted Perimeter                | 80.8 ft                     |
| Top Width                       | 80.00 ft                    |

---

## Worksheet for H-H

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 5.56 cfs       |
| Crest Elevation          | 5,735.11 ft    |
| Tailwater Elevation      | 5,735.11 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.60 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,735.35 ft         |
| Headwater Height Above<br>Crest | 0.24 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 4.6 ft <sup>2</sup> |
| Velocity                        | 1.21 ft/s           |
| Wetted Perimeter                | 38.8 ft             |
| Top Width                       | 38.81 ft            |

---

## Worksheet for I-I

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 7.87 cfs       |
| Crest Elevation          | 5,720.27 ft    |
| Tailwater Elevation      | 5,720.27 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 179.50 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,720.45 ft         |
| Headwater Height Above<br>Crest | 0.18 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 7.5 ft <sup>2</sup> |
| Velocity                        | 1.05 ft/s           |
| Wetted Perimeter                | 82.7 ft             |
| Top Width                       | 82.73 ft            |

---

## Worksheet for J-J

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 13.07 cfs      |
| Crest Elevation          | 5,723.22 ft    |
| Tailwater Elevation      | 5,723.22 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.90 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,723.52 ft         |
| Headwater Height Above<br>Crest | 0.30 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 9.6 ft <sup>2</sup> |
| Velocity                        | 1.37 ft/s           |
| Wetted Perimeter                | 63.1 ft             |
| Top Width                       | 63.14 ft            |

---

## Worksheet for K-K

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 7.37 cfs       |
| Crest Elevation          | 5,735.15 ft    |
| Tailwater Elevation      | 5,735.15 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.90 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,735.39 ft         |
| Headwater Height Above<br>Crest | 0.24 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 6.1 ft <sup>2</sup> |
| Velocity                        | 1.22 ft/s           |
| Wetted Perimeter                | 50.2 ft             |
| Top Width                       | 50.21 ft            |

---

## Worksheet for L-L

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 9.11 cfs       |
| Crest Elevation          | 5,739.20 ft    |
| Tailwater Elevation      | 5,729.20 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.30 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,739.51 ft         |
| Headwater Height Above<br>Crest | 0.31 ft             |
| Tailwater Height Above Crest    | -10.00 ft           |
| Flow Area                       | 6.6 ft <sup>2</sup> |
| Velocity                        | 1.39 ft/s           |
| Wetted Perimeter                | 42.1 ft             |
| Top Width                       | 42.09 ft            |

---

## Worksheet for M-M

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 6.74 cfs       |
| Crest Elevation          | 5,750.28 ft    |
| Tailwater Elevation      | 5,750.28 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.90 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,750.51 ft         |
| Headwater Height Above<br>Crest | 0.23 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 5.6 ft <sup>2</sup> |
| Velocity                        | 1.20 ft/s           |
| Wetted Perimeter                | 48.4 ft             |
| Top Width                       | 48.45 ft            |

---

## Worksheet for N-N

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 7.13 cfs       |
| Crest Elevation          | 5,739.00 ft    |
| Tailwater Elevation      | 5,739.00 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 177.20 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,739.35 ft         |
| Headwater Height Above<br>Crest | 0.35 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 4.9 ft <sup>2</sup> |
| Velocity                        | 1.46 ft/s           |
| Wetted Perimeter                | 28.3 ft             |
| Top Width                       | 28.28 ft            |

---

## Worksheet for O-O

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 20.39 cfs      |
| Crest Elevation          | 5,725.70 ft    |
| Tailwater Elevation      | 5,725.70 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 179.40 degrees |

---

### Results

---

|                                 |                      |
|---------------------------------|----------------------|
| Headwater Elevation             | 5,725.98 ft          |
| Headwater Height Above<br>Crest | 0.28 ft              |
| Tailwater Height Above Crest    | 0.00 ft              |
| Flow Area                       | 15.4 ft <sup>2</sup> |
| Velocity                        | 1.32 ft/s            |
| Wetted Perimeter                | 108.5 ft             |
| Top Width                       | 108.52 ft            |

---

## Worksheet for P-P

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 20.98 cfs      |
| Crest Elevation          | 5,727.61 ft    |
| Tailwater Elevation      | 5,727.61 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 179.10 degrees |

---

### Results

---

|                                 |                      |
|---------------------------------|----------------------|
| Headwater Elevation             | 5,727.95 ft          |
| Headwater Height Above<br>Crest | 0.34 ft              |
| Tailwater Height Above Crest    | 0.00 ft              |
| Flow Area                       | 14.5 ft <sup>2</sup> |
| Velocity                        | 1.44 ft/s            |
| Wetted Perimeter                | 86.1 ft              |
| Top Width                       | 86.06 ft             |

---

## Worksheet for Q-Q

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                          |                |
|--------------------------|----------------|
| Discharge                | 11.72 cfs      |
| Crest Elevation          | 5,728.80 ft    |
| Tailwater Elevation      | 5,728.80 ft    |
| Coefficient of Discharge | 0.580          |
| Angle                    | 178.00 degrees |

---

### Results

---

|                                 |                     |
|---------------------------------|---------------------|
| Headwater Elevation             | 5,729.17 ft         |
| Headwater Height Above<br>Crest | 0.37 ft             |
| Tailwater Height Above Crest    | 0.00 ft             |
| Flow Area                       | 7.8 ft <sup>2</sup> |
| Velocity                        | 1.51 ft/s           |
| Wetted Perimeter                | 42.2 ft             |
| Top Width                       | 42.23 ft            |

---

## Worksheet for R-R

---

### Project Description

---

|           |                        |
|-----------|------------------------|
| Solve For | Headwater<br>Elevation |
|-----------|------------------------|

---

### Input Data

---

|                     |             |
|---------------------|-------------|
| Discharge           | 52.56 cfs   |
| Crest Elevation     | 5,731.76 ft |
| Tailwater Elevation | 5,731.76 ft |
| Crest Surface Type  | Paved       |
| Crest Breadth       | 2.00 ft     |
| Crest Length        | 210.2 ft    |

---

### Results

---

|                                 |                             |
|---------------------------------|-----------------------------|
| Headwater Elevation             | 5,731.95 ft                 |
| Headwater Height Above<br>Crest | 0.19 ft                     |
| Tailwater Height Above Crest    | 0.00 ft                     |
| Weir Coefficient                | 2.96 ft <sup>(1/2)</sup> /s |
| Submergence Factor              | 1.000                       |
| Adjusted Weir Coefficient       | 2.96 ft <sup>(1/2)</sup> /s |
| Flow Area                       | 40.5 ft <sup>2</sup>        |
| Velocity                        | 1.30 ft/s                   |
| Wetted Perimeter                | 210.6 ft                    |
| Top Width                       | 210.24 ft                   |

---