Community Design Solutions

HIGH MESA TRAIL OFFSITE DRAFT DESIGN ANALYSIS REPORT

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Community Design Solutions

CERTIFICATION

I, Cassy L. McClintock, do hereby certify that this report was duly prepared by me or under my direction and that I am a duly registered Professional Engineer under the laws of the state of New Mexico.

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Date

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INTRODUCTION

PURPOSE

Community Design Solutions, LLC (CDS) was engaged to perform a drainage analysis of the offsite watershed located upstream of the High Mesa Trail Subdivision. This Drainage Analysis Report (DAR) has been prepared to support the design and grading of the proposed ponding infrastructure, ensuring it meets downstream capacity requirements. For additional context regarding the project location, refer to Figure 1 – Project Vicinity Map.

Figure 1: Project Vicinity Map

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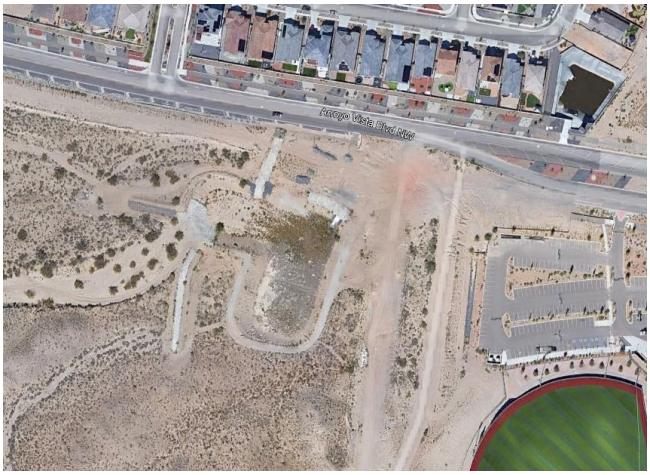
FIELD OBSERVATIONS

In March 2025, CDS conducted field observations of the High Mesa Trail Subdivision and the contributing offsite drainage basin. The purpose of this fieldwork was to verify existing site conditions and delineate watershed boundaries. An existing onsite pond, referred to as the WAHL Pond, was identified based on the *2019 Inspiration Subdivision – Offsite Plans* prepared by Bohannan Huston, Inc. (BHI). This pond is located at the southwest corner of Arroyo Vista Boulevard and High Mesa Drive.

According to the referenced design plans, the WAHL Pond has a bottom elevation of 5,494 feet and a top-of-pond elevation of 5,504.24 feet, with a maximum storage capacity of 8.81 acre-feet. The pond discharges through a storm drain outfall equipped with a 60-inch orifice plate.

Photographs 1 through 4 document the current condition of the WAHL Pond, while Photographs 5 through 8 depict the existing conditions of the offsite watershed. These offsite watershed conditions are critical to the drainage analysis and are discussed further in the Hydrologic Conditions section. A complete set of field photographs and their corresponding locations is provided in Appendix D.



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BACKGROUND INFORMATION

PREVIOUS STUDIES

The reports and plan set referenced in this DAR provide essential background and guidance regarding the capacity constraints that inform the design and grading of the proposed ponding infrastructure. These documents serve as the foundation for evaluating existing conditions and establishing design parameters. All referenced background materials are included in Appendix A for review.

- *West I-40 Uplands Drainage Management Plan (DMP) (BHI, February 2020)*
  This report serves as an update to the approved *West I-40 Drainage Management Plan (DMP) Update* prepared by BHI in December 2011. It specifically evaluates the proposed Upper Petroglyph development by Western Albuquerque Land Holdings (WALH) and outlines the infrastructure requirements necessary to ensure that downstream system capacities are not exceeded.

The *2011 West I-40 DMP Update* established ponding requirements to manage offsite runoff, redirecting flows into the Ladera system through a series of detention facilities, including: Paseo del Volcan Dam, A2 Dam, C Dam, D5 Dam, and Pond 5S, all ultimately discharging into Ladera Dam 5.

In the *2020 West I-40 Uplands DMP*, hydrologic modeling methods were updated from AHYMO '97 to the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS), following guidance from the Albuquerque Metropolitan Arroyo Flood Control Authority's (AMAFCA) White Paper (Stantec, 2018). The HEC-HMS model employed the SCS Curve Number (CN) Methodology, utilizing CN values from TR-55 Table 2-2d for desert shrub in fair condition, and applying a runoff-weighted CN approach.

Based on this updated analysis, the Ladera Watershed infrastructure recommendations included relocating C Dam closer to Arroyo Vista, removing D5 Dam, and increasing the storage capacity of Pond 5S. Additionally, the report evaluated downstream storm drainage infrastructure, noting: "For the existing storm drain between the APS site and Pond 5S, a detailed hydraulic analysis was performed for a design flow of 225 cfs. This was assumed to be the maximum capacity of the existing storm drain rather than the Manning's full flow capacity."

Figure 2 presents a portion of Figure 4 – Developed Conditions Facility Schematic from the *2020 West I-40 Uplands DMP*, illustrating the infrastructure capacity requirements.

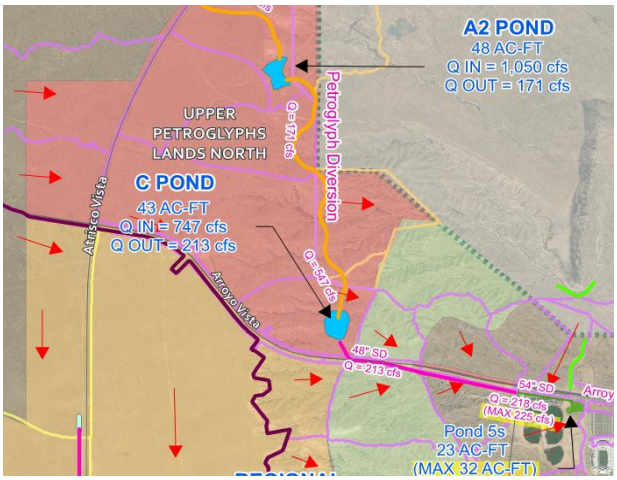

Figure 2: Developed Conditions Facility Schematic from the 2020 West I-40 Uplands DMP

- *Construction Plans for Inspiration Subdivision Offisite – Arroyo Vista Blvd. (BHI, November 2019)*

  The referenced plans also established the alignment and configuration of the existing storm drain infrastructure within Arroyo Vista Boulevard, located directly adjacent to the proposed High Mesa Trail Subdivision. According to these plans, a manhole invert elevation of 5,488.70 feet is identified at the WAHL Pond, which connects to a 54-inch storm drain running east along Arroyo Vista. This manhole is the basis of the capacity restrictions for the 225 cfs.

- *Upper Petroglyphs Sector Development Plan (April 2020)*

  This plan was formally adopted by the Bernalillo County Board of Commissioners on April 14, 2020, and was developed through a collaborative effort involving Consensus Planning, GDC Development and Asset Management, BHI, SEC Planning, Price Land Development Group, and Isaacson & Arfman Civil Engineering Consultants. The report provides master plan-level guidance for development within the Upper Petroglyph area, with the intent of ensuring that future development maintains a consistent quality and character throughout the region.

EXISTING FEMA FLOODPLAINS

According to the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA), Panel 35001C0307H, revised on August 16, 2012, the High Mesa Trail Subdivision is located within the center of a Zone A floodplain. This flood zone is associated with the Mirehaven Arroyo B. The referenced FIRM panel is included in Appendix A for further review.

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Figure 3: Existing FEMA Floodplains

HYDROLOGIC CONDITIONS

In the *2020 West I-40 Uplands DMP*, the D5 Dam was removed from the list of required infrastructure due to a reduction in peak discharge rates from the contributing basins. The D5 Dam was previously located directly west of the High Mesa Trail Subdivision and served to manage runoff from adjacent offsite areas.

The updated hydrologic modeling conducted as part of the *2020 West I-40 Uplands DMP*, using HEC-HMS, supported this change by demonstrating reduced flow volumes. Table 1 presents the relevant HEC-HMS model results that informed this decision.

Table 1: Results from the West I-40 Uplands HEC-HMS Developed Conditions Model

Basins	Area (square miles)	Curve Number	Impervious Percent	Lag Time (minutes)	Peak Discharge (cfs)	Volume (acre-feet)
OS.5a	0.0625	55	0	7.2	2.5	0.4
OS.5b	0.149	56	0	7.2	7.4	1.2
UD.5a	0.13952	71	0	10.2	62.7	4.7
UD.5d	0.04986	96	0	15.1	90.5	6.1
UD.5e	0.10578	55	0	7.2	4.2	0.7
UD.5f	0.01418	96	0	7.2	35.7	1.7

In reviewing the CN's used in the *2020 West I-40 Uplands DMP*, CDS determined it was necessary to reanalyze the contributing basins using CN's consistent with the City of Albuquerque (COA) Drainage Process Manual (DPM). While both the TR-55 and COA DPM methodologies utilize CNs to estimate runoff, it is important to note that they classify land cover and hydrologic conditions differently, and therefore the values are not directly interchangeable.

The TR-55 method defines CNs based on Hydrologic Soil Group (HSG) and land cover type, whereas the COA DPM bases its classification on land condition, particularly whether the area has been altered by human activity. These differences can significantly affect runoff estimates and, consequently, the design of stormwater infrastructure.

The following table presents a comparison of CN values from TR-55 and the corresponding classifications from the COA DPM, using abbreviated descriptions from Table 6.2.9 of the COA DPM.

Table 2: Comparison of TR-55 versus COA DPM CN's

Report	Cover Type	CN
TR-55	Desert shrub—major plants include saltbush, greasewood, creosote bush, blackbrush, bursage, palo verde, mesquite, and cactus.	Fair Condition Type A -55
		Poor Condition Type A -63
		Fair Condition Type B -72
		Poor Condition Type B -77
COA DPM	Soil uncompacted by human activity with 0 to 10% slopes. Native grasses, weeds, and shrubs in typical densities with minimal disturbance to grading, ground cover, and infiltration capacity.	Type A -77
	Irrigated lawns, parks and golf courses with 0 to 10% slopes. Native grasses, weeds and shrubs, and soil uncompacted by human activity with slopes greater than 10% and less than 20%.	Type B -79
	Soil compacted by human activity. Minimal vegetation. Unpaved parking, roads, trails. Most vacant lots. Gravel or rock (desert landscaping). Irrigated lawns and parks with slopes greater than 10%. Native grasses, weeds and shrubs, and soil uncompacted by human activity with slopes at 20% or greater.	Type C -86
	Impervious areas, pavement, and roofs.	Type D -98

*TR-55 land cover conditions are as follows: Poor <30% ground cover, Fair 30-70% ground cover and good > 70% ground cover.

Using the COA DPM as the basis for design guidance, CDS identified a significant difference in CN values when compared to those from TR-55. For example, a Type A soil in fair condition is assigned a CN of 55 under TR-55, whereas the COA DPM assigns a CN of 77 for similar conditions. This discrepancy has a substantial impact on estimated offsite runoff volumes.

As a result, CDS reanalyzed the offsite watersheds directly affected by this change to ensure that the proposed onsite infrastructure is appropriately sized to accommodate the revised runoff estimates. The following sections detail the analysis of both existing and proposed offsite hydrologic conditions.

OFFSITE HYDROLOGIC CONDITIONS

EXISTING CONDITIONS ANALYSIS

CDS initiated the hydrologic analysis using a base U.S. Army Corps of Engineers' (USACE) HEC-HMS model developed for the *2020 West I-40 Uplands DMP*. This model was updated to HEC-HMS version 4.13 and modified to include only the existing drainage basins that directly contribute runoff to the High Mesa Trail Subdivision. The selected basins include: UD.5a1, UD.5a2, OS.5a1, OS.5a2, UD.5e, OS.5b1, and OS.5b2.

The proposed High Mesa Trail Subdivision itself is represented by Basin UD.5c, which is addressed separately under the onsite developed hydrologic conditions prepared by BHI. In this analysis, UD.5c is included for visual reference only and does not contribute to the offsite runoff calculations. Basin naming conventions remain consistent with the original *2020 West I-40 Uplands DMP*, where "UD" denotes Upper Dam 5 Watershed and "OS" refers to Open Space basins.

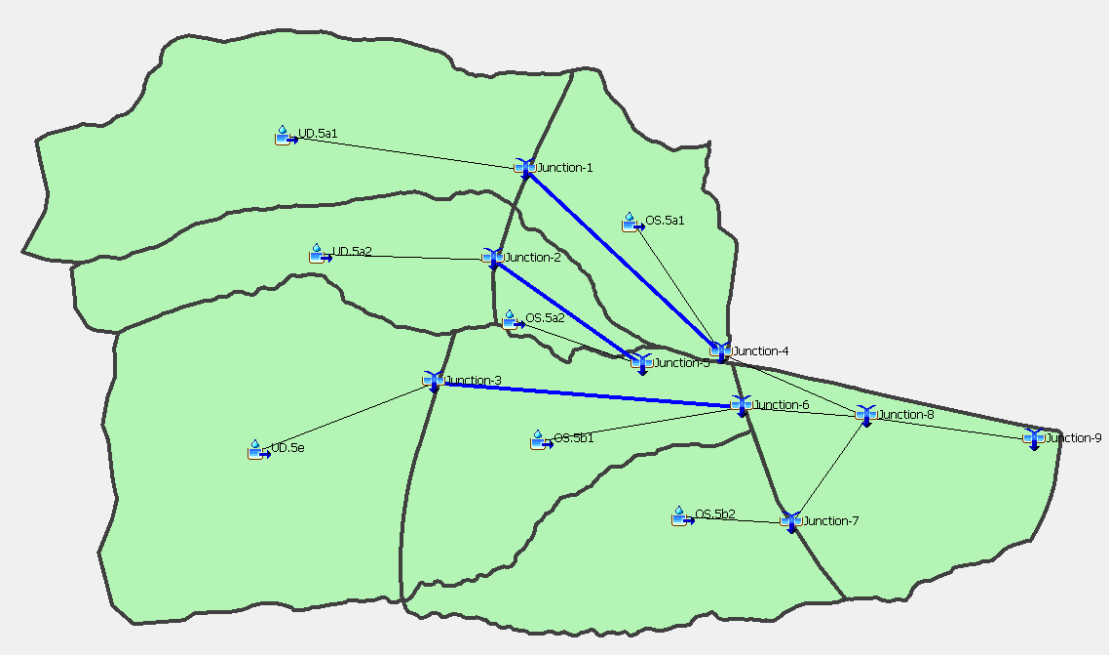

Figure 4: Existing Conditions HEC-HMS Model

Under existing conditions, Subbasin UD.5a1 is routed through OS.5a1, as illustrated in Photos 5 and 6, which depict the natural drainage crossing at the western edge of Arroyo Vista Boulevard. This flow path ultimately discharges into the WAHL Pond, which is represented in the HEC-HMS model as Junction 9. Similarly, Subbasin UD.5a2 is routed through OS.5a2, while UD.5e is routed through OS.5b1. Along with OS.5b2, these flow paths converge at Junction 8, which represents Basin UD.5c—the location of the proposed High Mesa Trail Subdivision—and ultimately discharge into the WAHL Pond.

BASIN DELINEATION

CDS utilized the subbasin delineations provided by BHI in the *2020 West I-40 Uplands DMP* as the foundation for watershed modeling. These subbasins were reviewed and modified based on updated topographic data and storm drainage infrastructure. Manual edits were performed in ArcGIS Pro using LiDAR data obtained from the Mid-Region Council of Governments (MRCOG, 2018). To validate and refine the delineations, CDS conducted field investigations to confirm basin boundaries, measure key structures within ponding facilities, and document features that influence natural flow paths—such as open channels, berms, and other constructed elements. Hydrologic maps showing the updated basin boundaries are included in Appendix D.

METEOROLOGICAL MODELS

For this model, point precipitation estimates were obtained from the NOAA Atlas 14 database. Precipitation data was extracted for the centroid of each watershed, and the values were averaged to generate a representative input for the HEC-HMS model. The meteorological model parameters included a frequency-based storm event, a 5-minute time step, a 1-day storm duration, and a 25% storm intensity position. Detailed rainfall tables used in the analysis are provided in Appendix B.

ROUTING REACHES

The Muskingum-Cunge routing method was applied within HEC-HMS to simulate hydrograph routing through defined channels. Manning's roughness coefficients were selected based on guidance from Table 6.16.26 of the COA DPM. Channel characteristics—including routing length, slope, and typical bottom width—were measured using LiDAR data from MRCOG 2018. Runoff losses due to infiltration and percolation along the channel beds were assumed to be negligible and were therefore not simulated. To stabilize routing computations in HEC-HMS Version 4.13, the model requires either a celerity (wave velocity) or an index flow. For this analysis, CDS implemented the Index Flow Method, as recommended by HEC. The index flow was defined as half of the upstream subbasin flow, reflecting the absence of base flow in the Ladera Basins.

CURVE NUMBER

For the analysis of existing conditions, Section 6-2(A) of the COA DPM was used to determine appropriate CN's. All offsite basins contributing to the High Mesa Trail Subdivision exhibit slopes ranging from 0% to 10% and are characterized as Open Space areas with native grasses, weeds, and shrubs, and minimal human disturbance. Based on these conditions, all basins were classified as Type A with a CN of 77 and 0% impervious cover.

TRANSFORM METHOD

To calculate hydrologic timing parameters, CDS followed the methodology outlined in Section 6-2(B) of the DPM. This included determining Time of Concentration (Tc), Lag Time (Lg), and Time to Peak (Tp) for each subbasin.
The selection of equations was based on subbasin reach lengths:

- For reaches less than 4,000 feet, the SCS Upland Method was applied.
- For reaches between 4,000 and 12,000 feet, a transition equation was used.
- For reaches greater than 12,000 feet, the U.S. Bureau of Reclamation Lag Time Equation was applied.

The following equations were used to compute lag time inputs for the HEC-HMS model:

Equation 1: SCS Upland Method Equation (COA DPM Equation 6.10)

$Tc= (L1/V1 + L2/V2 +....Ln/Vn)/3600$

Where *Vn* is the sub-reach velocity, calculated using:

Equation 2: Sub Reach Velocity

$Vn= 10K (s)^{0.5}$

Here, *K* is the conveyance condition factor, determined from Table 6.2.16 of the COA DPM, and *s* is the slope of the reach. Due to the presence of natural channels with slopes exceeding 4%, CDS applied additional adjustments per Section 6-2(B)(5) of the COA DPM. This section accounts for supercritical flow conditions, using Equations 6.19, 6.20, and 6.21 to adjust slope and conveyance factors accordingly. Final lag times were calculated using:

Equation 3: Lag Time

$Lg=0.6Tc$

And Time to Peak calculated by Equation 6.18 in the COA DPM

Equation 4: Time to Peak

$Tp=(2/3)Tc$

SEDIMENT BULKING FACTOR

By default, HEC-HMS simulates clear water hydrographs; however, to account for sediment transport and deposition, a "Flow Ratio" parameter—also known as sediment bulking—can be applied. For this analysis, CDS incorporated sediment bulking factors to more accurately represent runoff volumes influenced by sediment-laden flows. Bulking factors were initially derived from the *2020 West I-40 Uplands DMP* and served as the baseline for this study. CDS reviewed and updated these values to reflect current development conditions within the contributing watersheds, ensuring the model accurately represents present-day hydrologic behavior.

EXISTING PONDS AND DIVERSIONS

The WAHL Pond is located downstream of the proposed High Mesa Trail Subdivision. As there are no known capacity constraints associated with this facility, it was not included in the HEC-HMS model. The pond serves as the final discharge point for contributing offsite basins and does not influence upstream hydrologic routing or infrastructure sizing for the purposes of this analysis.

The following table represents the HEC-HMS input parameters for the existing conditions model.

Table 3: Existing Conditions HEC-HMS Input Parameters

Basins	Area (square miles)	Curve Number	Impervious Percent	Lag Time (minutes)	Bulking Factor	Peak Discharge (cfs)	Volume (acre-feet)
OS.5a1	0.05	77	0	7.2	1.12	55.2	2.8
OS.5a2	0.02	77	0	7.2	1.12	16.9	0.9
OS.5b1	0.08	77	0	7.2	1.12	75.7	3.9
OS.5b2	0.07	77	0	7.2	1.12	72.0	3.7
UD.5a1	0.11	77	0	7.8	1.08	106.8	5.7
UD.5a2	0.06	77	0	7.4	1.08	56.2	2.9
UD.5e	0.14	77	0	7.2	1.12	139.2	7.1

PROPOSED CONDITIONS ANALYSIS

The proposed conditions model builds upon the HEC-HMS framework developed for the *2020 West I-40 Uplands DMP*. The model was updated to incorporate only the drainage basins that directly contribute runoff to the High Mesa Trail Subdivision. CDS updated the model to include additional drainage basins from the Inspiration Subdivision, located north of Arroyo Vista Boulevard, as well as revised and newly delineated basins: UD.5d, UD.5f, UD.5a1, UD.5a2, OS.5a, UD.5e1, UD.5e2, OS.5b1, OS.5b2-e, OS.5b2-a, OS.5b2-b, OS.5b2-c, and OS.5b2-d. Basins UD.5c and UD.5c1, representing the proposed High Mesa Trail Subdivision, are addressed separately under the onsite developed hydrologic conditions prepared by BHI. These basins are included in the model for visual reference only and do not contribute to offsite runoff calculations.

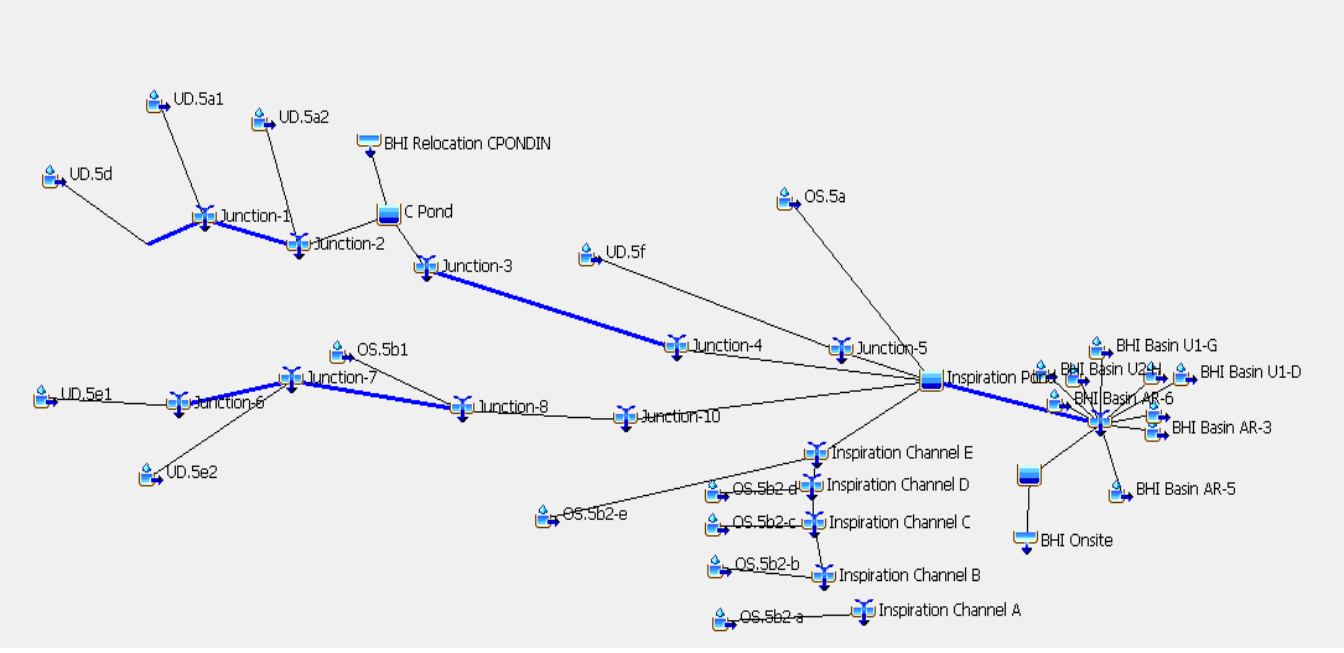

Figure 5: Proposed Conditions HEC-HMS Model

In the proposed model:

- Basins UD.5d, UD.5a1, and UD.5a2 are routed through the C Pond, consistent with the *2020 West I-40 Uplands DMP*.
- The remaining offsite basins within the Ladera Watershed are routed to a single junction labeled BHI Relocation CPONDIN. These basins were not reanalyzed for this report; their parameters were assumed to be accurate as previously approved.
- Basin OS.5a is modeled as discharging directly into the proposed Western Pond. Although the *2020 West I-40 Uplands DMP* originally showed this basin sheet-flowing down Arroyo Vista Boulevard, this is no longer viable due to downstream capacity constraints. As discussed in the background reports and further detailed in the Hydraulics section, allowing OS.5a to enter the Arroyo Vista storm drain would exceed the 225 cfs capacity established by BHI. Therefore, CDS redirected this basin to the Western Pond.
- Basins UD.5e1, UD.5e2, and OS.5b1 continue to follow natural flow paths through open space and discharge into the Western Pond.
- Basins OS.5b2-a through OS.5b2-d were delineated individually to appropriately size the offsite channel along the western boundary of the High Mesa Trail Subdivision:
    - OS.5b2-a enters the subdivision and is accounted for in the onsite hydrology (refer to the BHI Drainage Report for High Mesa Trail Subdivision).
    - OS.5b2-b, OS.5b2-c and OS.5b2-d are entering the channel from off-site
    - OS.5b2-e enters the final segment of the offsite channel before discharging into the Western Pond.
- Basin UD.5c1 is also addressed in the onsite hydrology (see BHI Drainage Report for High Mesa Trail Subdivision for details).
- Basins U1-G, U1-D, U2-H, AR-3, AR-5, and AR-6 are direct inputs from BHI's HEC-HMS model for the Inspiration Subdivision. As these areas are already developed and approved, no additional analysis was performed. They were included in the model to ensure accurate representation of hydrograph timing and capacity constraints within Arroyo Vista Boulevard.

BASIN DELINEATION

For the proposed conditions analysis, CDS utilized the basin delineations provided in the *2020 West I-40 Uplands DMP* and updated them to reflect the locations of proposed ponding facilities. To ensure accurate hydrologic modeling, the following criteria and methods were applied throughout the analysis:

- Subbasins draining directly to ponding facilities were identified and modeled as independent subbasins.
- Developed areas were delineated separately from undeveloped basins to reflect differences in runoff characteristics.
- Existing storm drain infrastructure was used to inform subbasin boundaries and flow paths.
- Unpaved roads intersecting basin boundaries were field-verified to confirm their influence on drainage patterns.

Hydrologic maps showing updated basin boundaries are provided in Appendix B.

METEOROLOGICAL MODELS

The same methodology described in the Existing Conditions section was applied to the proposed conditions analysis.

ROUTING REACHES

The same methodology described in the Existing Conditions section was applied to the proposed conditions analysis.

CURVE NUMBER

For the proposed conditions analysis, CN's were calculated using the same methodology described in the Existing Conditions section. However, to reflect future development, land use classifications were updated based on Exhibit 3 – Land Use from the *Upper Petroglyphs Sector Development Plan*.

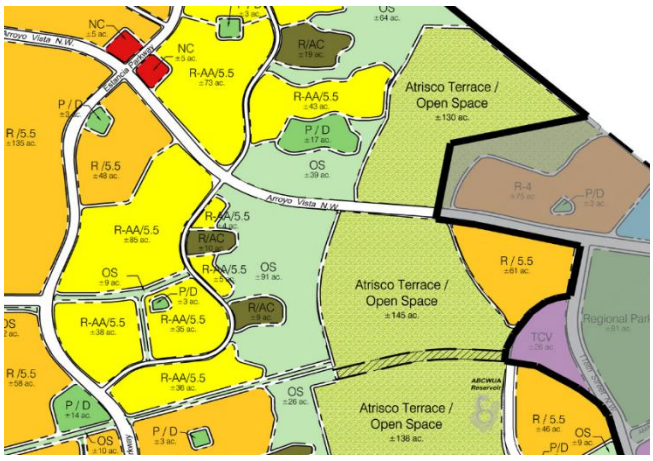

Figure 6: Land Use plans from the Upper Petroglyph Sector Development Plan

The land use categories shown in this exhibit were used to assign appropriate impervious surface percentages. These values were determined using Table 6.2.10 from the COA DPM, which provides percent impervious guidance for various land use types. The resulting CN values were then applied in the HEC-HMS model to represent future watershed conditions. A clipped portion of Exhibit 3 is provided in Figure 6 for reference.

TRANSFORM METHOD

The same methodology described in the Existing Conditions section was applied to the proposed conditions analysis.

The following table represents the HEC-HMS input parameters for the proposed conditions model.

Table 4: Proposed Conditions HEC-HMS Input Parameters

Basins	Area (square miles)	Curve Number	Impervious Percent	Lag Time (minutes)	Peak Discharge (cfs)	Volume (acre-feet)
OS.5a	0.06	77	0.0	7.2	60.3	3.1
OS.5b1	0.07	77	0.0	7.2	70.4	3.6
OS.5b2-a	0.0101	77	0.0	7.2	10.2	0.5
OS.5b2-b	0.0037	77	0.0	7.2	3.7	0.2
OS.5b2-c	0.0006	77	0.0	7.2	0.6	0.0
OS.5b2-d	0.0005	77	0.0	7.2	0.5	0.0
OS.5b2-e	0.057	77	0.0	7.2	57.3	2.9
UD.5a1	0.04	86	53	7.2	94.1	4.6
UD.5a2	0.09	78	8	7.2	108.9	5.5
UD.5d	0.05	98	0.0	15.3	102.1	6.7
UD.5e1	0.03	79	8	7.2	40.0	2.0
UD.5e2	0.1	77	0.0	7.2	100.5	5.1
UD.5f	0.01	98	0.0	7.2	29.1	1.3

PROPOSED PONDS AND DIVERSIONS

Under the proposed conditions scenario, CDS designed two detention ponds to manage offsite and onsite runoff in accordance with downstream capacity requirements:

- The Western Pond is designed to capture and control offsite flows from contributing basins.
- The Eastern Pond is dedicated to managing onsite runoff generated within the High Mesa Trail Subdivision.

Further details regarding the design, sizing, and hydraulic performance of each pond are provided in the following Hydraulic Conditions sections.

ONSITE HYDROLOGIC CONDITIONS

CDS is working in collaboration with BHI for the analysis of onsite hydrologic conditions. BHI is responsible for providing detailed calculations and modeling for the onsite drainage infrastructure. For more information regarding onsite hydrology, refer to the BHI Drainage Report for High Mesa Trail Subdivision.

HYDRAULIC CONDITIONS

DOWNSTREAM CAPACITY CONSTRAINTS

The *2020 West I-40 DMP Update* included a comprehensive analysis of downstream infrastructure capacities. For the purposes of this DAR, the primary capacity constraint affecting offsite flows is the existing storm drain within Arroyo Vista Boulevard. As stated in the *2020 West I-40 DMP Update*: "For the existing storm drain between the APS site and Pond 5S, a detailed hydraulic analysis was performed for a design flow of 225 cfs. This was assumed to be the maximum capacity of the existing storm drain rather than the Manning's full flow capacity." Accordingly, CDS adopted the 225 cfs design flow as the guiding constraint for sizing and modeling the discharge rates from the proposed detention ponds. This value was determined by BHI through their analysis of downstream infrastructure, ensuring that the flow rate would not exceed the capacity of existing ponds and storm drain systems.

PROPOSED PONDS

To manage runoff from the contributing offsite subbasins, CDS has designed two ponding facilities:

- The Western Pond, located onsite within the High Mesa Trail Subdivision, is intended to capture and control offsite flows from adjacent drainage basins.
- The Eastern Pond is a redesign of the existing WAHL Pond, modified to accommodate updated hydrologic conditions from the onsite drainage design.

WEST POND

The West Pond is located at the northwestern corner of the proposed High Mesa Trail Subdivision, adjacent to Arroyo Vista Boulevard (see Figure 7 for reference). This pond is designed to manage offsite runoff and ensure compliance with the 225 cfs capacity constraint of the downstream storm drain system. To achieve this, the Western Pond incorporates a low-flow channel and a depressed chamber within the pond designed to initiate early discharge. This configuration allows a portion of the hydrograph to exit the system before peak inflows from upstream basins arrive, utilizing the timing of the hydrographs to reduce the need for additional pond volume. The low-flow chamber (20 feet by 21 feet in width, 5 feet tall on the deepest end) utilizes head pressure to force the hydrograph out of the system early, optimizing the pond's volume requirements. Due to the limited space available at the site, CDS designed the pond with side slopes of 1.5H:1V, transitioning to 2H:1V near the channel to maximize storage volume while maintaining stability.

Key design parameters for the Western Pond include:

- Bottom of Pond: 5,554 feet
- Top of Pond: 5,574 feet
- Emergency Spillway Elevation: 5,573 feet
- Inflow: 355.1 cfs
- Outflow: 223.8 cfs
- Peak storage volume: 7.9 acre-feet
- Peak Water Surface Elevation: 5,572.1 feet
- Design volume to emergency spillway: 8.8 acre-feet
- Freeboard: 1.9 feet to the top of pond embankment
- Outfall: 46" Orifice plate

EAST POND

The East Pond has been engineered to manage onsite runoff generated by the High Mesa Subdivision. In collaboration with BHI, CDS ensured the design meets the required water quality volume standards while also regulating the pond's outflow to comply with the Arroyo Vista Storm Drain's capacity limit of 225 cfs. Given that the Western Pond utilizes the majority of the allowable discharge within the Arroyo Vista system, the Eastern Pond's outflow was minimized to the greatest extent feasible. This reduction was necessary due to the synchronization of peak flows from both ponds, which could otherwise exceed the system's capacity.

- Bottom of Pond: 5,490 feet
- Top of Pond: 5,505 feet
- Emergency Spillway Elevation: 5,504 feet
- Inflow: 149.9 cfs
- Outflow: 1.7 cfs
- Peak storage volume: 5.4 acre-feet
- Peak Water Surface Elevation: 5,501.0 feet
- Design volume to emergency spillway: 7.9 acre-feet
- Freeboard: 3 feet to the top of pond embankment
- Outfall: 5" Orifice plate
- Water quality volume from BHI: 0.91 acre-feet (39,462 cubic -feet)

SEE BHI HIGH MESA TRAIL SUBDIVISION PLANS FOR BUILD INFORMATION. SHOWN FOR REFERENCE ONLY.

SEE BHI HIGH MESA TRAIL SUBDIVISION PLANS FOR BUILD INFORMATION. SHOWN FOR REFERENCE ONLY.

BUILD PRINCIPAL SPILLWAY BOX PER DETAIL ON SHEET 16 THROUGH 20

SHOTCRETE EMERGENCY SPILLWAY (TYP)

GRADING THE SLOPES MATCH BHI ONSITE CONSTRUCTION PLANS

SHOTCRETE, ASPHALT CONCRETE OR ENGINEERED APPROVAL EQUAL ACCESS ROAD

WEST POND

RUNDOWN CHANNEL

SHOTCRETE ACCESS ROAD. SEE DETAIL 4 ON SHEET 11

PIPE RAIL SEE AMAFCA PIPE RAIL DETAIL SHEET 23

SHOTCRETE, ASPHALT CONCRETE OR ENGINEERED APPROVAL EQUAL ACCESS ROAD

SHOTCRETE, ASPHALT CONCRETE, COBBLE, NATURAL OR ENGINEERED APPROVED EQUAL CHANNEL

STA 1+00.73, 0.01' L BOTTOM CHANNEL EL=5567.01

STA 2+77.45, 0.00' CHANNEL BOTTOM EL=5570.15

SHOTCRETE SIDE SLOPES (TYP). SEE DETAILS 5, 6, AND 7 ON SHEET 11

PROPERTYLINE

2' WIDE AREA FOR FENCE

2' WIDE AREA FOR FENCE

MATCHLINE - SEE SHEET 6

SCALE: 1" = 20'

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PUBLIC WORKS DIVISION
TECHNICAL SERVICES DEPARTMENT

HIGH MESA TRAIL SUBDIVISION
OFF-SITE CHANNEL & POND PLANS
WEST POND GRADING PLAN

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO. XXXXXX | ZONE MAP NO. J-07-Z | SHEET OF FIGURE 7

AS-BUILT INFORMATION

CONTRACTOR DATE
STAKED BY
SURVEYED BY DATE
INSPECTORS
ACCEPTANCE BY DATE
AS-BUILT VERIFICATION BY DATE
DRAWINGS
DOCUMENTED BY DATE

MICRO-FILM INFORMATION

RECORDED BY DATE
NO. DATE

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

60% NOT FOR CONSTRUCTION

REMARKS

NO.	DATE	BY
	REVISIONS	
	DESIGN	
	DESIGNED BY CDS	DATE 7/23/2025
	CHECKED BY CDS	DATE 7/23/2025
	DRAWN BY CDS	DATE 7/23/2025

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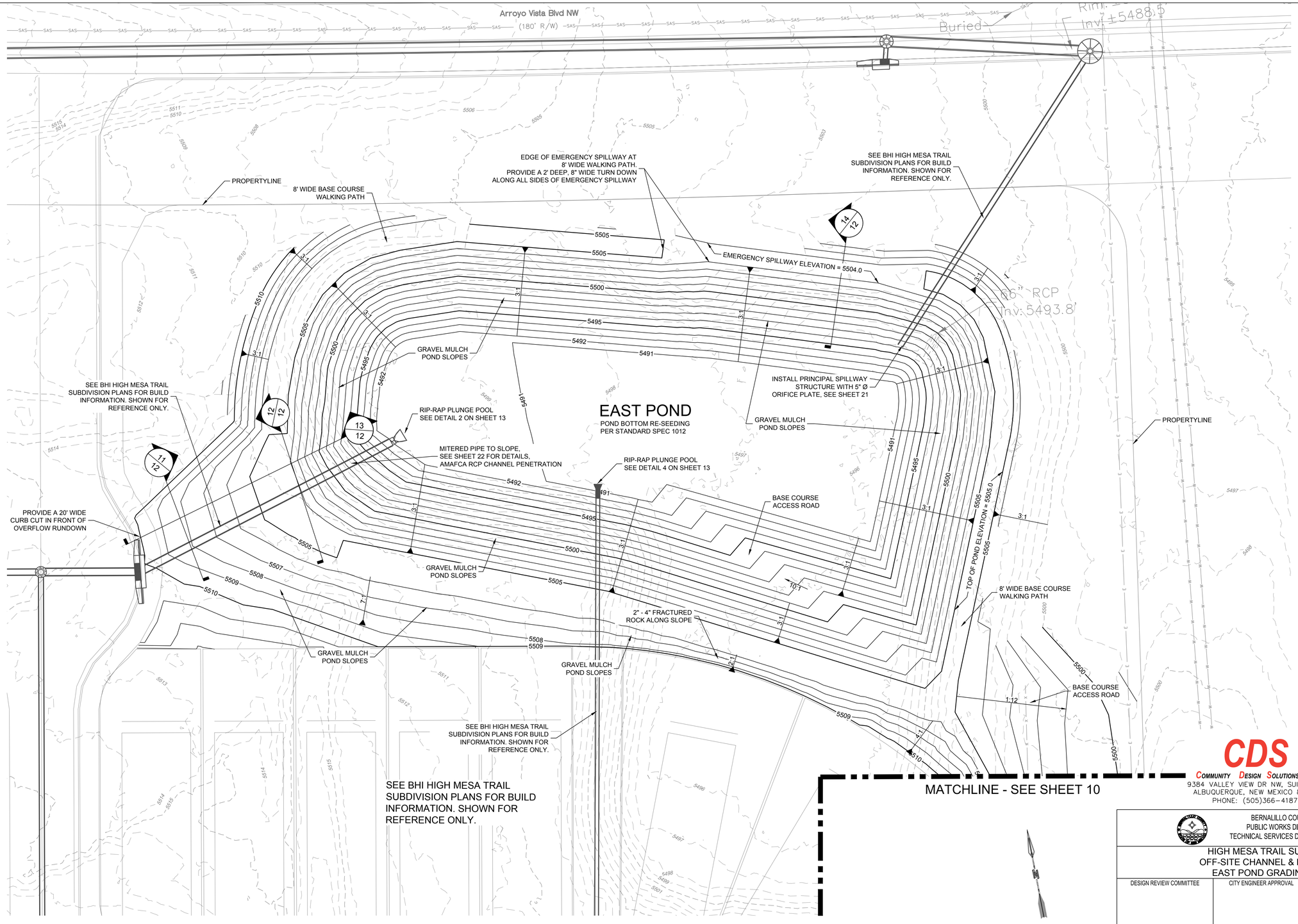

AS-BUILT INFORMATION

CONTRACTOR — DATE
STAKED BY — DATE
INSPECTORS — DATE
ACCEPTANCE BY — DATE
AS-BUILT VERIFICATION BY — DATE
DRAWINGS PREPARED BY

MICRO-FILM INFORMATION

RECORDED BY — DATE
NO. — DATE

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

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REMARKS

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	DRAWN BY	CDS

DATE 7/23/2025
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HIGH MESA TRAIL SUBDIVISION
OFF-SITE CHANNEL & POND PLANS
EAST POND GRADING PLAN

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO. XXXXXX

ZONE MAP NO. J-07-Z

SHEET OF FIGURE 8

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DESIGN CRITERIA

All proposed ponding facilities were designed with the New Mexico Office of the State Engineer (NMOSE) criteria to be classified as non-jurisdictional dams. This criteria states that ponds designed to hold more than 50 acre-feet of water must be less than 6 ft in height; see Figure 9 for full non-jurisdictional criteria. According to NMOSE, dam height is measured from the toe of the downstream dam embankment to the top of the pond, whereas the pond volume is measured to the emergency spillway. See table 5 for pond heights signifying non-jurisdictional classification.

Table 5: Pond Heights

Pond	Height to Top of Pond (feet)	Volume to Emergency Spillway (acre-feet)
Western	20	8.8
Eastern	15	7.9

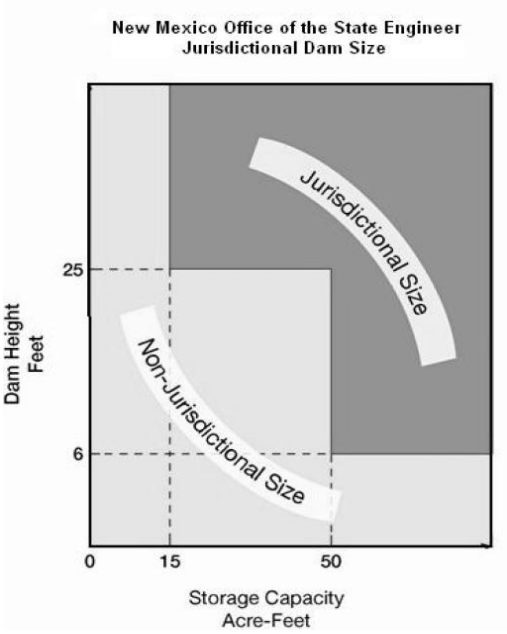


Figure 9: NMOSE Jurisdictional Dam Requirements

WEIR LENGTHS

The emergency spillways were designed to safely convey excess runoff during extreme storm events, ensuring structural integrity of the pond embankment. A broad crested weir calculation was performed using the following weir equation:

Equation 5: Weir Equation

$Q = C\ LH\ ^{(3/2)}$

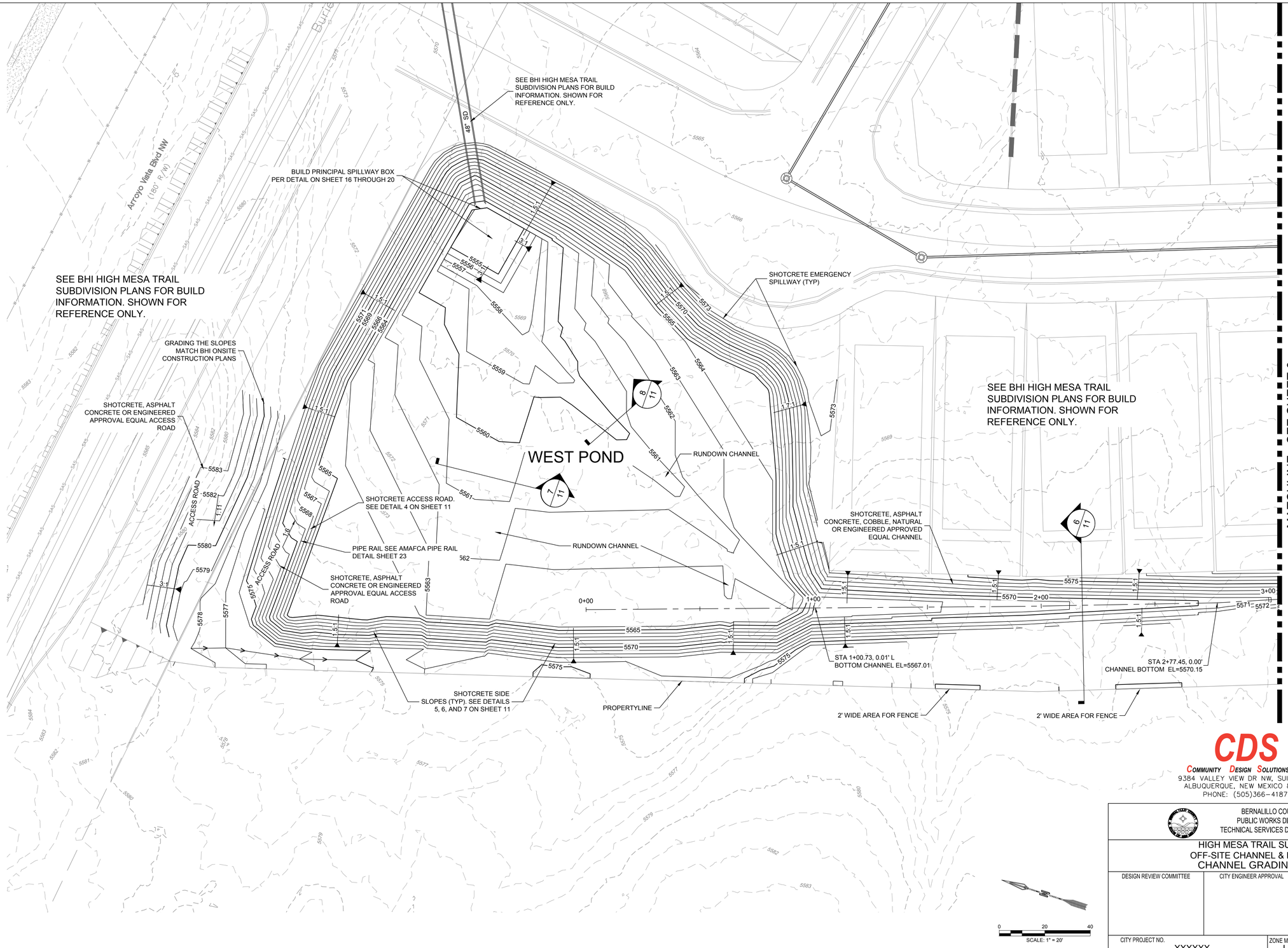
Where Qis the discharge from weir, C is the weir coefficient of 2.6, L is the length of weir and H is the height of weir.

Design parameters were selected to ensure the emergency spillway can accommodate the 100-year storm event without overtopping the pond embankment. The emergency spillway for the Western pond has a length of 141 feet, if activated will sheet flow through the High Mesa Subdivision with the ability to flow to the Eastern Pond. While the Eastern Pond has an emergency spillway of 75 feet along Arroyo Vista Boulevard.

CHANNEL GEOMETRY

In developing the proposed drainage channel, CDS prioritized preserving the natural character of the corridor to minimize impacts on the adjacent open space and reduce overall construction costs. The channel alignment and grading were carefully designed within the 50-foot buffer zone required by Bernalillo County, ensuring compliance with local development standards while maintaining hydraulic functionality.

The channel begins at the southwestern boundary of the High Mesa Trail Subdivision and extends northward along the western edge of the site, ultimately discharging into the Western Pond. To accommodate existing topography and maintain a consistent buffer between residential lots and the open space, retaining walls were strategically incorporated. These features are detailed in the grading plans provided in Figures 10-13, along with Manning's roughness coefficient calculations for each channel segment provided in Appendix C. To ensure the channel is properly sized, contributing subbasins were delineated under proposed conditions to reflect offsite inflows. Mannings calculations were ran to evaluate flow velocities and inform the selection of appropriate erosion control measures. Flow velocities range from approximately 3 feet per second at the upstream end to 9 feet per second near the downstream outlet. These conditions necessitate variable armoring treatments along the channel to ensure long-term stability and performance.



AS-BUILT INFORMATION	
CONTRACTOR	DATE
WORKS BY	
INSPECTORS	DATE
ACCEPTANCE BY	
CERTIFICATION BY	DATE
DRAWINGS	
DOCUMENTS BY	DATE

MICRO-FILM INFORMATION

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BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

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		DESIGN	

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TECHNICAL SERVICES DEPARTMENT

HIGH MESA TRAIL SUBDIVISION
OFF-SITE CHANNEL & POND PLANS
CHANNEL GRADING PLAN 1

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO. XXXXXX

ZONE MAP NO. J-07-Z

SHEET OF FIGURE 10

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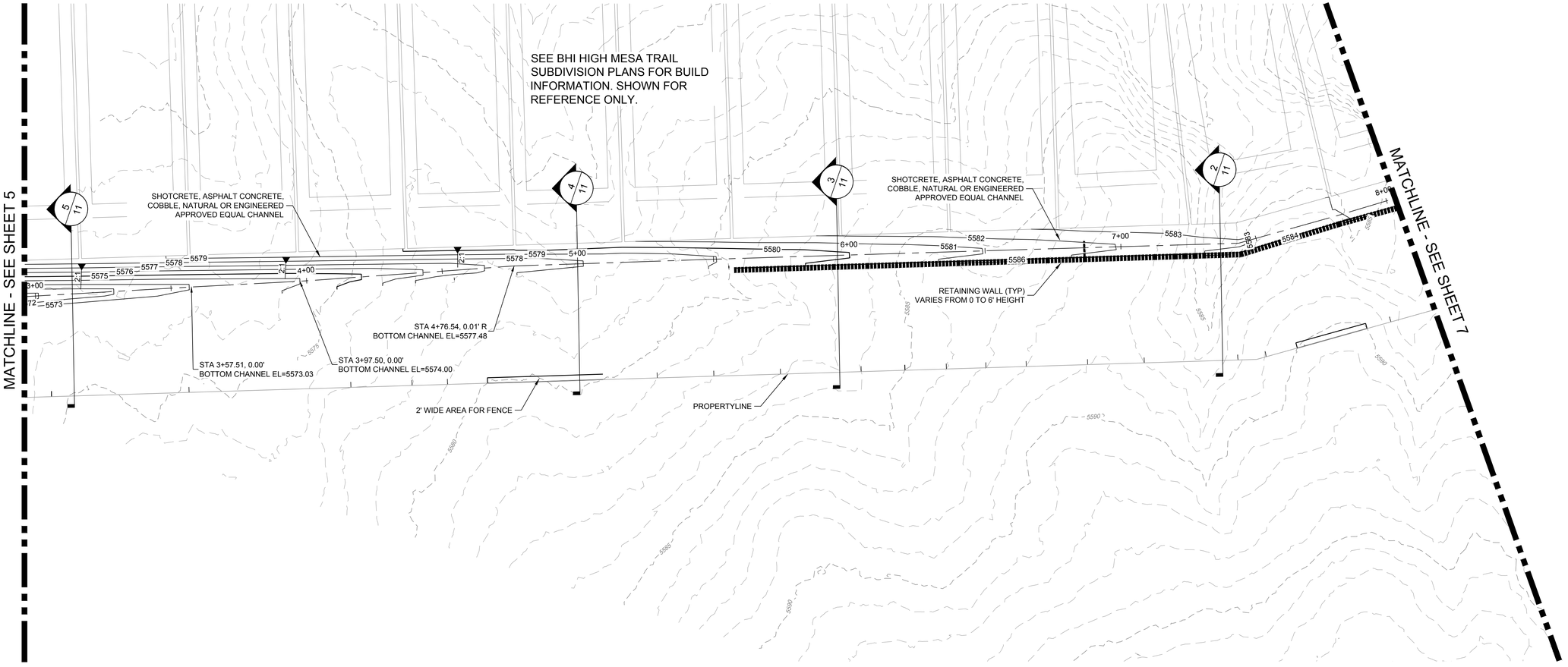

0 20 40
SCALE: 1" = 20'

AS-BUILT INFORMATION

CONTRACTOR DATE
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INSPECTORS DATE
ACCEPTANCE BY DATE
FIELD VERIFICATION BY DATE
DRAWINGS DATE
DOCUMENTED BY

MICRO-FILM INFORMATION

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NO. DATE

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FIELD NOTES

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	DESIGN	
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HIGH MESA TRAIL SUBDIVISION
OFF-SITE CHANNEL & POND PLANS
CHANNEL GRADING PLAN 2

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO. XXXXXX
ZONE MAP NO. J-07-Z
SHEET OF FIGURE 11

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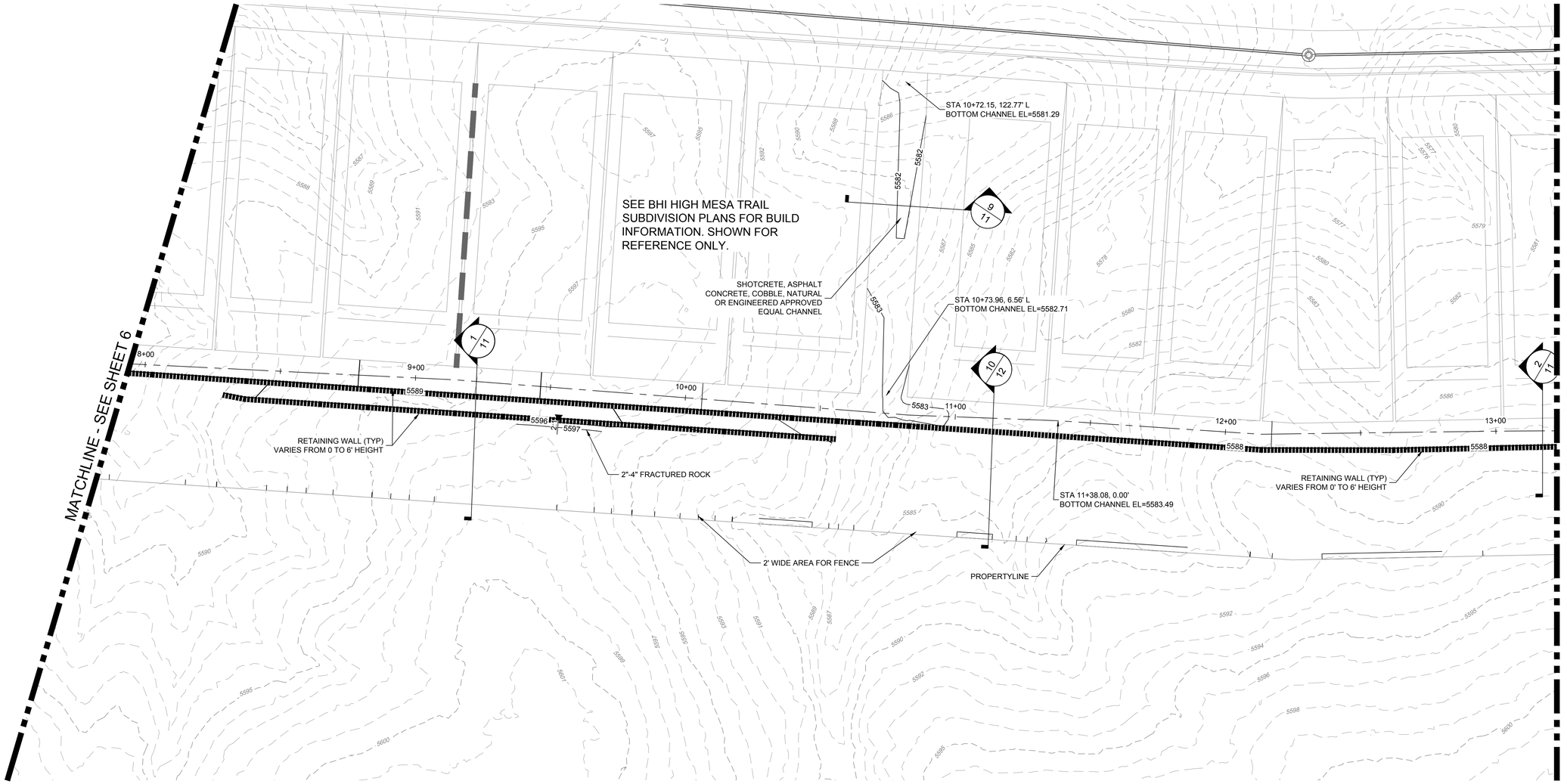

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SCALE: 1" = 20'

AS-BUILT INFORMATION

CONTRACTOR — DATE
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INSPECTORS ACCEPTANCE BY — DATE
AS-BUILT VERIFICATION BY — DATE
DRAWINGS CORRECTED BY — DATE

MICRO-FILM INFORMATION

RECORDED BY — DATE
NO. — DATE

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

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		DESIGN	
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CHECKED BY	CDS	DATE 7/23/2025	
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OFF-SITE CHANNEL & POND PLANS
CHANNEL GRADING PLAN 3

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
XXXXXX	J-07-Z	FIGURE 12	

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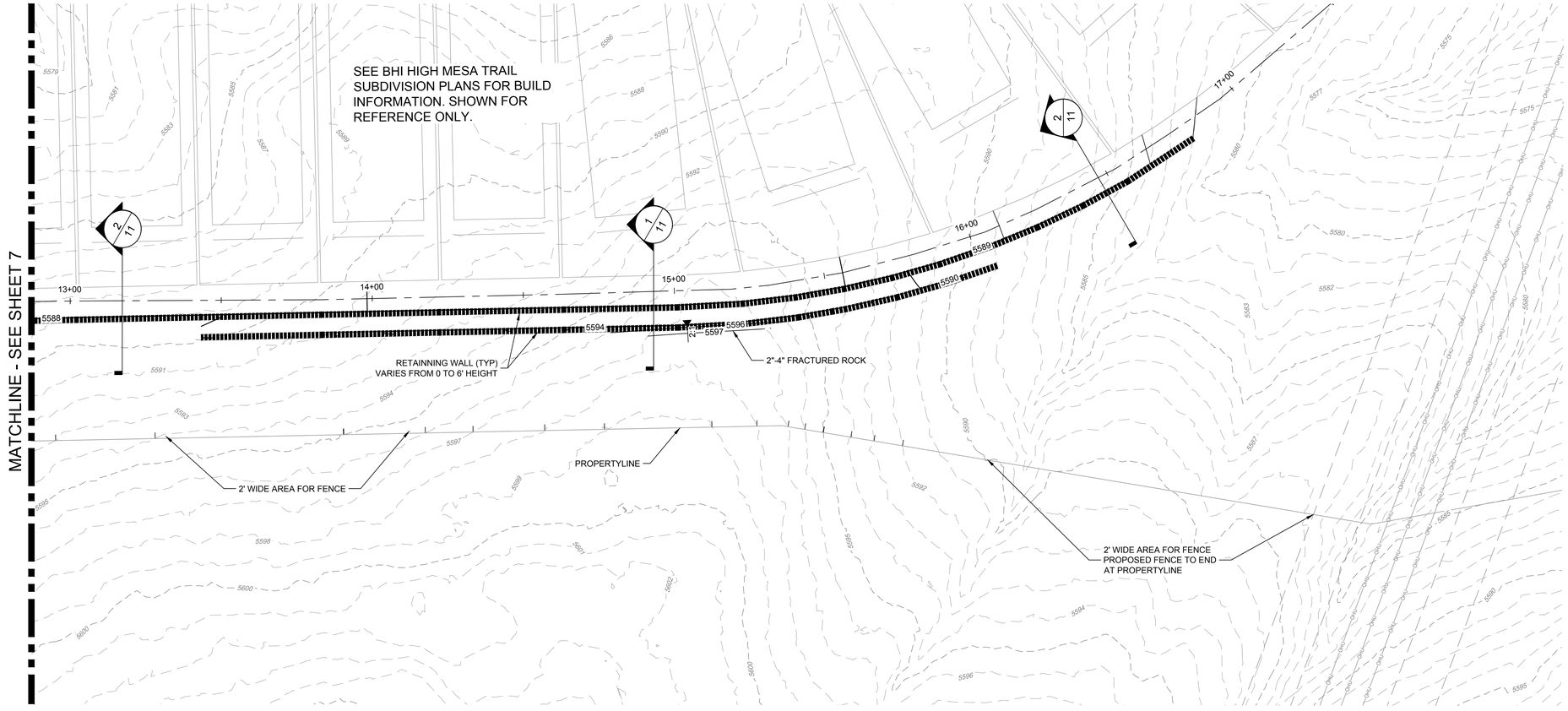

0 20 40

SCALE: 1" = 20'

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TECHNICAL SERVICES DEPARTMENT

HIGH MESA TRAIL SUBDIVISION
OFF-SITE CHANNEL & POND PLANS
CHANNEL GRADING PLAN 4

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CITY PROJECT NO. XXXXXX

ZONE MAP NO. J-07-Z

SHEET OF FIGURE 13

AS-BUILT INFORMATION

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INSPECTORS ACCEPTANCE BY DATE
AS-BUILT VERIFICATION BY DATE
DRAWINGS DOCUMENTED BY DATE

MICRO-FILM INFORMATION

RECORDED BY DATE
NO. DATE

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

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		DESIGN	
			DESIGNED BY CDS
		DATE 7/23/2025	CHECKED BY CDS
		DATE 7/23/2025	DRAWN BY CDS
		DATE 7/23/2025	

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CONCLUSION

CDS worked in collaboration with BHI for the design of the onsite infrastructure to ensure that the proposed stormwater infrastructure effectively manages both onsite and offsite runoff in accordance with the capacity constraints of the downstream Arroyo Vista storm drain system of 225 cfs. The Western Pond is designed to capture the majority of offsite runoff, incorporating a low-flow chamber to optimize discharge timing and reduce storage volume needs. The Eastern Pond, primarily serving onsite flows, was carefully engineered to minimize outflow due to the limited remaining capacity in the Arroyo Vista system. Emergency spillways for both ponds were sized using broad-crested weir calculations to safely convey overflow during extreme storm events without compromising embankment integrity.

REFERENCES

Community Design Solutions

APPENDIX A
ASBUILTS AND PAST REPORTS

Community Design Solutions

APPENDIX B
HYDROLOGY CALCULATIONS

Community Design Solutions

APPENDIX C
HYDRAULIC CALCULATIONS

Community Design Solutions

APPENDIX D
MAPS