

To: Lisa Gish
Engineering Inspector I
El Paso County Department of Public Works

From: Eric Gunderson, P.E.,
Kimley-Horn and Associates, Inc.

Date: April 6, 2023

Subject: Widefield Parks and Recreation – Recreation Center – Pond Outlet Structure

Based upon an email received by Kimley-Horn from Lisa Gish dated April 4, 2023 4:09PM, it is understood the proposed outlet structure in the extended detention basin at the subject site has been constructed differently than the approved plans dated 2/28/23. The approved plans call for a 5'x5' Type C CDOT structure with 4:1 sideslope/grate. Based upon the referenced email from the County, it is understood the structure was installed at 4'x4' and was installed with a flat top instead of the 4:1 sloping grate.

Attached is a markup of the approved pond plans showing the as constructed condition based upon the information above. Kimley-Horn redesigned the outlet structure using this information and the MHFD analysis has been included in this memo, following the plan markup.

Kimley-Horn proposes lowering the restrictor plate on the outlet pipe 6" for a total of 12" of clearance as noted. This will maintain the appropriate pre-development vs. post development flow ratios and drain times to be in compliance with the approved final drainage report for the project.

Final as-built drawings will be required to be provided to Kimley-Horn to perform the final pond certification following construction. The pond certification will then be submitted to El Paso County for their records.

Based upon the information above and analysis performed herein and the adjustment to the restrictor plate, the change in size and slope of the outlet structure is acceptable to the engineer of record.

Thank You,

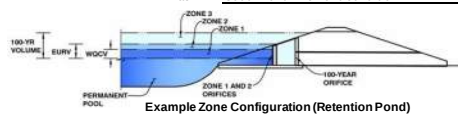
Eric Gunderson, PE

please provide all of this



MHFD-Detention, Version 4.06 (July 2022)

Basin ID: South Pond - As Built Condition



Example Zone Configuration (Retention Pond)

Selected BMP Type =	EDB	
Watershed Area =	22.04	acres
Watershed Length =	1,400	ft
Watershed Length to Centroid =	600	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	20.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Optional User Overrides

Water Quality Capture Volume (WQCV) =	0.212	acre-feet
Excess Urban Runoff Volume (EURV) =	0.393	acre-feet
2-yr Runoff Volume ($P1 = 1.19$ in.) =	0.248	acre-feet
5-yr Runoff Volume ($P1 = 1.5$ in.) =	0.358	acre-feet
10-yr Runoff Volume ($P1 = 1.75$ in.) =	0.460	acre-feet
25-yr Runoff Volume ($P1 = 2$ in.) =	0.797	acre-feet
50-yr Runoff Volume ($P1 = 2.25$ in.) =	1.118	acre-feet
100-yr Runoff Volume ($P1 = 2.55$ in.) =	1.599	acre-feet
500-yr Runoff Volume ($P1 = 3.14$ in.) =	2.515	acre-feet
Approximate 2-yr Detention Volume =	0.243	acre-feet
Approximate 5-yr Detention Volume =	0.327	acre-feet
Approximate 10-yr Detention Volume =	0.417	acre-feet
Approximate 25-yr Detention Volume =	0.541	acre-feet
Approximate 50-yr Detention Volume =	0.651	acre-feet
Approximate 100-yr Detention Volume =	0.876	acre-feet

	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.55	inches
	inches

Zone 1 Volume (WQCV) =	0.212	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.181	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.483	acre-feet
Total Detention Basin Volume =	0.876	acre-feet
Initial Surcharge Volume (ISV) =	user	ft ³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Initial Surcharge Area (A_{SIV})	=	user	ft ²
Surcharge Volume Length (L_{SIV})	=	user	ft
Surcharge Volume Width (W_{SIV})	=	user	ft
Depth of Basin Floor (H_{LFLOOR})	=	user	ft
Length of Basin Floor (L_{LFLOOR})	=	user	ft
Width of Basin Floor (W_{LFLOOR})	=	user	ft
Area of Basin Floor (A_{LFLOOR})	=	user	ft ²
Volume of Basin Floor (V_{LFLOOR})	=	user	ft ³
Depth of Main Basin (H_{MAIN})	=	user	ft
Length of Main Basin (L_{MAIN})	=	user	ft
Width of Main Basin (W_{MAIN})	=	user	ft
Area of Main Basin (A_{MAIN})	=	user	ft ²
Volume of Main Basin (V_{MAIN})	=	user	ft ³
Calculated Total Basin Volume (V_{TOTAL})	=	user	acre-feet

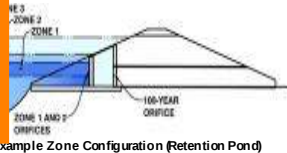
MHFD-Detention v4-06 As Built.xlsm, Basin

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Widefield Rec Center

Basin ID: South Pond - As Built Condition



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.71	0.212	Orifice Plate
Zone 2 (EURV)	3.47	0.181	Circular Orifice
Zone 3 (100-year)	5.06	0.483	Weir&Pipe (Restrict)
Total (all zones)		0.876	

CHANGES FROM APPROVED FDR AMENDMENT NO. 1 DATED 3/1/23 NOTED IN RED

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 15/16 inch)

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00					
Orifice Area (sq. inches)	0.67	0.67	0.67					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Zone 3 Weir ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Gate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Gate Type =
Debris Clogging % = %

Height of Gate Upper Edge, H₁ = feet
Overflow Weir Slope Length = feet
Gate Open Area / 100-yr Orifice Area =
Overflow Gate Open Area w/o Debris = ft²
Overflow Gate Open Area w/ Debris = ft²

5' PER FDR
4 PER FDR
5' PER FDR

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

18 PER FDR

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.55	3.14
One-Hour Rainfall Depth (in) =	0.212	0.393	0.248	0.358	0.460	0.797	1.118	1.599	2.515
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.248	0.358	0.460	0.797	1.118	1.599	2.515
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	0.4	0.5	4.9	9.8	16.6	28.6
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.02	0.02	0.22	0.44	0.76	1.30
Predevelopment Unit Peak Flow, q (ds/acre) =	N/A	N/A	3.4	5.0	6.3	11.7	16.9	24.1	36.8
Peak Inflow Q (cfs) =	0.1	0.2	0.1	0.2	0.6	5.3	9.9	14.8	23.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	1.2	1.1	1.0	0.9	0.8
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.5	0.9	1.3	1.5
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	46	59	51	58	61	57	54	50	43
Time to Drain 99% of Inflow Volume (hours) =	49	64	54	62	67	64	63	60	57
Maximum Ponding Depth (ft) =	2.71	3.47	2.79	3.23	3.54	3.81	3.99	4.31	5.39
Area at Maximum Ponding Depth (acres) =	0.21	0.26	0.22	0.25	0.27	0.28	0.29	0.31	0.36
Maximum Volume Stored (acre-ft) =	0.213	0.393	0.231	0.330	0.409	0.483	0.535	0.633	0.993