

	Memorandum
	ADO LICON
To:	Brad Walters, El Paso Count
From:	Andrew W. McCord, P.E.
Date:	January 19, 2021
Project:	Glen at Widefield Filing 9
Subject:	El Paso County Concerns from January 202 Field Inspection

## 1. Detention Basin Emergency Spillway Width

A. Original approved plans call for a spillway length of 66 feet on plan sheet 18, Detail 0/19. The 66-foot dimension was labeled incorrectly and should be 15 feet in accordance with the approved Drainage Report (see Exhibit 1).

## 2. Detention Basin Outlet Structure WQCV Well Screen

- A. Original approved plans call for a stainless-steel wire well screen on plan sheet 17, Detail J/18.
- B. A field change was made to an EPC approved "diamond" plate and is noted on the As Constructed Documents (see Exhibit 2).

#### 3. Buried Riprap at 30-inch Detention Basin Outlet

A. Original approved plans call for "EXPOSED TYPE M SOIL RIPRAP FOR CHANNEL BOTTOM" on plan sheet 18, Detail D/19. The word "EXPOSED" is incorrect and should be eliminated. Soil riprap is buried and not exposed. Existing field condition is correct.

#### 4. Emergency Spillway Runout is "Curved"

A. The emergency spillway runout was graded, as a field change, to direct emergency flows to the grass-lined swale from detention pond A. This condition is preferred over emergency flows sheet flowing across "level" ground, ultimately into the grass-lined swale approximately 230 feet downstream of the emergency spillway. This condition provides for better containment of the flows and is acceptable for this site.

## 5. 24-inch Culvert Pipes in Existing Channels Under the Gravel Trail

- A. Analyses of the east and west grass-lined swales and 24-inch culverts under the gravel trail was completed.
- B. Analysis of the east channel (flow from detention pond A) indicates that the installed 24inch PVC culvert under the gravel trail has enough capacity to pass 5-year and 100-year detained flows from detention pond A. (see Exhibit 3). However, if the detention pond A outlet structure ever became 100 percent clogged (no discharge), emergency flows will overtop the emergency spillway and enter the grass-lined swale, then continue to flow to the 24" PVC culvert under the gravel trail. In this condition the 24-inch culvert will create a

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backwater condition where flows will overtop the gravel trail at a depth of approximately  $3\frac{3}{4}$  inches (see Exhibit 4), which is an acceptable condition.

C. Analysis of the west channel (flow from 48-inch RCP) indicates that the installed 24-inch PVC culvert under the gravel trail does not have enough capacity to pass the 100-year flow from the upstream 48-inch RCP (see Exhibit 5). The 24-inch culvert will create a backwater condition where flows will overtop the west channel at a depth of approximately 6 inches (see Exhibit 6). It should be noted that this area will be inundated during a 100-year event, per FEMA Map No. 0804C0956G (see Exhibit 7), therefore lessening the erosion potential in the overtopping. This is an acceptable condition.

## 6. Installation of Emergency Spillway Cut-off Wall

A. The emergency spillway cut-off wall was installed per approved plan (see Exhibit 8).

## 7. Installation of Cut-off Walls at 48-inch and 30-inch Pipe Outlets

A. According to the field representative for Widefield Investment Group, cut-off walls were installed in accordance with the approved plans.

Detention Basin Outlet Structure Design									
UD-Detention, Version 3.07 (February 2017) Project:									
Basin ID:									
ZONE 3 ZONE 2 ZONE 1	$\sim$	_							
				Stage (ft)	Zone Volume (ac-ft)	Outlet Type	1		
			Zone 1 (WQCV)	1.58	0.222	Orifice Plate			
ZONE 1 AND 2	100-YEAI ORIFICE	R	Zone 2 (EURV)	2.56	0.322	Orifice Plate			
PERMANENT ORIFICES	PERMANENT ORIFICES (100+1/2WQCV) 4.38 0.722 Weir&Pipe (Restrict)								
Example Zolle (	Johnguration (Ret	ention Pond)			1.266	Total		0	
User Input: Orifice at Underdrain Outlet (typically u	sed to drain WQCV in	n a Filtration BMP)				Calculate	ed Parameters for Ur	nderdrain	
Underdrain Orifice Invert Depth =	N/A	ft (distance below th	e filtration media sur	face)	Unde	erdrain Orifice Area =	N/A	ft <sup>2</sup>	
Underdrain Orifice Diameter =	Underdrain Orifice Diameter = N/A inches Underdrain Orifice Centroid = N/A feet								
User Input: Orifice Plate with one or more orifices	or Elliptical Slot Weir	(typically used to dr:	ain WOCV and/or FU	RV in a sedimentatio	n RMP)	Calcu	lated Parameters for	Plate	
Invert of Lowest Orifice =	0.00	ft (relative to basin b	ottom at Stage = 0 ft	i)	WQ O	rifice Area per Row =	8.819E-03	ft <sup>2</sup>	
Depth at top of Zone using Orifice Plate =	2.56	ft (relative to basin b	ottom at Stage = 0 ft	.)	E	lliptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	10.20	inches	5	,	Elli	ptical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	1.27	sq. inches (diameter	= 1-1/4 inches)			Elliptical Slot Area =	N/A	ft <sup>2</sup>	
		•							
User Input: Stage and Total Area of Each Orifice	Row (numbered from	n 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	0.85	1.71						
Orifice Area (sq. inches)	1.27	1.27	1.27						
									1
Change of Orifice Control (11)	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 Onlice Centroid (It)									
Office Area (sq. inches)									
User Input: Vertical Orifice (Cin	cular or Rectangular)					Calculated	Parameters for Vert	ical Orifice	
,	Not Selected	Not Selected	]				Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin b	oottom at Stage = 0 ft	:) V	ertical Orifice Area =	N/A	N/A	ft <sup>2</sup>
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin b	oottom at Stage = 0 ft	) Verti	cal Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	NI/A	lanala a a						
	1977	N/A	Inches						
	19/73	IN/A	inches						
	1977	IV/A	inches						
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User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (O Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Calculated Runoff Volume (acre-ft) = OPTIONAL Override Runoff Volume (acre-ft) = OPTIONAL Override Runoff Volume (acre-ft) =	Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.40           15.00           4.00           0.00           0.33           0.00           4.00           0.222	Not Selected N/A N/A N/A N/A N/A N/A N/A Ctor Plate, or Rectang Not Selected N/A N/A t(relative to basin b feet EURV 1.07 0.544 0.543	ft (relative to basin bo feet H:V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches bottom at Stage = 0 ft 2 Year 1.19 0.506	ttom at Stage = 0 ft) lat grate) iotal area in bottom at Stage = 0 f Half-( ) 5 Year 1.50 0.790 0.789	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate O ( t) Out Central Angle of Rest Spillway Stage a Basin Area a 10 Year 1.75 1.066 1.065	Calculated Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calculated Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 1.560 1.559	Parameters for Ove           Zone 3 Weir           3.81           5.15           9.51           22.55           11.27   rs for Outlet Pipe w/ Zone 3 Restrictor           2.37           0.70           1.54           tted Parameters for S           0.88           6.28           0.52	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be $\geq$ 4 ft <sup>2</sup> ft <sup>2</sup> feet radians 500 Year 3.20 3.327
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User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length Overflow Weir Front Edge Length Overflow Weir Slope = Horiz. Length of Weir Slodes = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Crest Length Spillway End Slopes = Freeboard above Max Water Surface = Ereeboard above Max Water Surface = One-Hour Rainfail Depth (in) = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (d's/acre) Predevelopment Unit Peak Riow, q (d's/acre) Predevelopment Peak Q (cfs) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) =	Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.40           15.00           4.00           0.53           0.222           0.00           0.022           0.00           0.0           0.1	Not Selected           N/A           It (relative to basin b           feet           H:V           feet           1.07           0.544           0.00           0.0           0.044           0.00           0.00	ft (relative to basin bo feet H-V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches bottom at Stage = 0 ft <u>2 Year</u> 1.19 0.506 0.02 0.3 9.7 0.2	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-( ) 5 Year 1.50 0.790 0.15 2.3 15.1 2.5	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op ( 0 t) Central Angle of Rest Spillway Stage a Basin Area a 10 Year 1.75 1.066 0.41 6.1 20.3 6.6	Calculatec ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = ben Area w/ Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 1.550 1.559 0.93 14.0 29.6	Parameters for Ove           Zone 3 Weir           3.81           5.15           9.51           22.55           11.27   rs for Outlet Pipe w/           Zone 3 Restrictor           2.37           0.70           1.54   ted Parameters for S           0.88           6.28           0.52   50 Year           2.25           1.921           1.921           1.921           1.23           18.5           36.3           20.2	rflow Weir N/A N/A N/A N/A N/A N/A N/A Flow Restriction Plat Not Selected N/A N/A N/A N/A N/A Spillway feet feet feet acres 100 Year 2.52 2.374 2.373 1.59 23.9 44.8 22.1	feet feet should be $\geq$ 4 ft <sup>2</sup> ft <sup>2</sup> feet radians 500  Year 3.20 3.327 -3.327 -3.325 2.34 35.2 62.5 37.2
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Length Overflow Weir Stope = Horiz. Length of Weir Stope = Horiz. Length of Weir Stoge = Overflow Grate Open Area % Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Invert Stage= Spillway Crest Length = Spillway Erd Stopes = Freeboard above Max Water Surface = Restrictor Plate Height Above Max Water Surface = Restrictor Plate Height Above Pipe Invert stage= Spillway Crest Length = Spillway Erd Stopes = Freeboard above Max Water Surface = Routed Hydrograph Volume (acreft) = OPTIONAL Override Runoff Volume (acreft) = Predevelopment Unit Peak Flow, q (cfs/acreft) Predevelopment Peak Q (cfs) = Peak Untflow Q (cfs) = Peak Outflow Q (cfs) =	With           Grate (Flat or Sloped)           Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.00           1.00           WOCV           0.53           0.222           0.00           0.0           0.1           N/A	Not Selected           N/A           It (relative to basin b           feet           H:V           feet           0.544           0.00           0.010.4           0.2           N/A	Incres If (relative to basin bo feet It-V (enter zero for ff feet %, grate open area/t % gular Orifice) If (distance below basi inches inches bottom at Stage = 0 ft 2 Year 1.19 0.506 0.02 0.3 9.7 0.2 N/A	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 1.50 0.790 0.790 0.15 2.3 15.1 2.5 1.1	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op U Overflow Grate Op Overflow Grate Op Overf	Calculatec ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = ben Area w/ Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 1.560 1.559 0.93 14.0 29.6 14.4 1.0	Parameters for Ove           Zone 3 Weir           3.81           5.15           9.51           22.55           11.27   rs for Outlet Pipe w/           Zone 3 Restrictor           2.37           0.70           1.54   ted Parameters for S           0.88           6.28           0.52   50 Year 2.25 1.921 1.23 1.85 36.3 20.2 1.1	rflow Weir N/A N/A N/A N/A N/A N/A N/A Flow Restriction Plat Not Selected N/A N/A N/A N/A N/A Spillway feet feet feet acres 100 Year 2.374 2.	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup> feet radians 500  Year 3.20 3.20 3.327 3.20 3.20 3.20 3.327 3.20 3.327 3.20 3.327 3.20 3.20 3.22 3
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Stoles = Overflow Grate Open Area % Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (O Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Ent Stage Spillway Ent Stage One-Hour Rainfall Depth (in) Calculated Runoff Volume (arer-ft) Inflow Hydrograph Volume (arer-ft) Inflow Hydrograph Volume (arer-ft) Predevelopment Unit Peak Q (cfs) Peak Untflow Q (cfs) Ratio Peak Outflow Q (cfs) Ratio Peak Outflow I Predevelopment G	Srate (Flat or Sloped)           Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.40           15.00           4.00           1.00           WOCV           0.53           0.222           0.00           4.3           0.1           N/A           Plate	Not Selected N/A N/A N/A N/A N/A N/A N/A N/A Ctor Plate, or Rectang Not Selected N/A N/A I I I I I I I I I I I I I I I I I I I	ft (relative to basin bo feet H-V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches inches oottom at Stage = 0 ft 2 Year 1.19 0.506 0.02 0.3 9.7 0.2 N/A Plate	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate 1	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = ben Area w/ Debris = calculated Parameter Outlet Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 25 Year 2.00 1.560 1.559 0.93 14.0 29.6 14.4 1.0 Overflow Grate 1	Parameters for Ove           Zone 3 Weir           3.81           5.15           9.51           22.55           11.27   rs for Outlet Pipe w/           Zone 3 Restrictor           2.37           0.70           1.54   ted Parameters for S           0.88           6.28           0.52             50 Year           2.25           1.921           1.919           1.23           18.5           36.3           20.2           1.1           Overflow Grate 1	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be $\geq$ 4 ft <sup>2</sup> ft <sup>2</sup> e feet radians 3.20 3.327 3.327 3.327 3.327 3.325 2.34 3.52 62.5 37.2 1.1 Spillway
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Stdes = Overflow Grate Open Area % Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (O Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Crest Length = Spillway Crest = Predevelopment Q (cs) = Peak Outflow Q (cs) = Peak O	Srate (Flat or Sloped)           Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.00           15.00           4.00           0.33           30.00           14.60           gular or Trapezoidal)           4.00           1.00           0.222           0.022           0.222           0.00           4.3           0.1           N/A           Plate           N/A	Not Selected N/A N/A N/A N/A N/A N/A Ctor Plate, or Rectang Not Selected N/A N/A ft (relative to basin b feet H:V feet EURV 1.07 0.544 0.543 0.00 0.0 10.4 0.2 N/A Plate N/A Plate N/A	ft (relative to basin bo feet H-V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches bottom at Stage = 0 ft 2 Year 1.19 0.506 0.02 0.3 9.7 0.2 N/A Plate N/A	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 Half-0 0.789 0.789 0.15 2.3 15.1 2.5 1.1 Overflow Grate 1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate 1 0.3 0.41 0.3 0.41 0.41 0.41 0.41 0.41 0.41 0.41 0.41	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = an Area w/o Debris = ben Area w/o Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 1.559 0.93 14.0 29.6 14.4 1.0 Overflow Grate 1 0.6	Parameters for Ove           Zone 3 Weir           3.81           5.15           9.51           22.55           11.27   rs for Outlet Pipe w/ Zone 3 Restrictor           2.37           0.70           1.54   ted Parameters for S           0.88           6.28           0.52             50 Year           2.25           1.921           1.919           1.23           18.5           36.3           20.2           1.1           Overflow Grate 1           0.9           1.12	rflow Weir Not Selected N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should $be \ge 4$ ft <sup>2</sup> ft <sup>2</sup> feet radians $\frac{500 \text{ Year}}{3.20}$ 3.327 3.327 3.325 2.34 3.5.2 62.5 37.2 1.1 Spillway 1.1 1.1
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (O Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Invert Stage Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Noted Hydrograph Volume (acre-ft) = One-Hour Rainfall Depth (in) Calculated Runoff Volume (acre-ft) Predevelopment Unit Peak Flow, q (ds/acre) = Predevelopment Q = Peak Inflow Q (ds) = Peak Outflow Q (cfs) = Peak Outflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Fredevelopment Q = Structure Controlling Flow Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) =	With           Srate (Flat or Sloped)           Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orlfice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.00           1.00           0.53           0.222           0.00           0.0           4.3           0.1           N/A           N/A           N/A           N/A	Not Selected           N/A           ft (relative to basin b           feet           EURV           1.07           0.543           0.00           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.7      N	ft (relative to basin bo feet H-V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches inches oottom at Stage = 0 ft 0.505 0.02 0.3 9.7 0.2 N/A Plate N/A N/A N/A	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 Half-0 0.790 0.790 0.789 0.15 2.3 15.1 2.5 1.1 0.71 N/A 69	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate O Overflow Grate O Overflow Grate O Overflow Grate 1 0.04f 0.41 6.1 20.3 6.6 1.1 0.04f 0.3 N/A 67	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 1.559 0.93 14.0 1.559 0.93 14.0 0.93 14.4 1.0 Overflow Grate 1 0.6 N/X 64	Second State           1000000000000000000000000000000000000	rflow Weir N/A N/A N/A N/A N/A N/A N/A Plow Restriction Plat Not Selected N/A N/A N/A N/A N/A Spillway feet feet feet feet acres 100 Year 2.52 2.374 2.373 1.59 2.39 44.8 22.1 0.9 Outlet Plate 1 1.0 N/A	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup> e e feet radians 3.20 3.327 
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Length Overflow Weir Stope Horiz. Length of Weir Sides Overflow Grate Open Area % Debris Clogging % User Input: Outlet Pipe w/ Flow Restriction Plate (O Depth to Invert of Outlet Pipe Outlet Pipe Diameter Restrictor Plate Height Above Pipe Invert Spillway Invert Stage Spillway Invert Stage Spillway Crest Length Spillway Crest Length Spillway End Slopes Freeboard above Max Water Surface Design Storm Return Period OPTIONAL Override Runoff Volume (acre-ft) OPTIONAL Override Runoff Volume (acre-ft) Predevelopment Unit Peak Flow, q (dfs/acre) Predevelopment Q Predevelopment Q Ratio Peak Outflow to Predevelopment Q Max Velocity through Grate 1 (ftps) Max Velocity through Grate 1 (ftps) Max Velocity through Grate 1 (ftps) Time to Drain 97% of Inflow Volume (hours)	With           Srate (Flat or Sloped)           Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.00           1.00           0.222           0.00           0.222           0.00           0.1           N/A           N/A           N/A           39           41	Not Selected           N/A           ft (relative to basin b           feet           H:V           feet           0.543           0.00           0.0           0.04           0.2           N/A           Plate           N/A           67           70	Incress If (relative to basin bo feet H:V (enter zero for ff feet %, grate open area/t % gular Orifice) If (distance below basi inches inches bottom at Stage = 0 ft 2 Year 1.19 0.506 0.02 0.3 9.7 0.2 N/A Plate N/A N/A 64 68	ttom at Stage = 0 ft) lat grate) iotal area in bottom at Stage = 0 f Half-0 Half-0 0.789 0.789 0.789 0.789 0.789 0.789 0.75 2.3 15.1 2.5 1.1 Overflow Grate 1 0.1 N/A 69 74	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op ( t) Out Central Angle of Rest Spillway Stage a Basin Area a Basin Area a 10 Year 1.75 1.066 1.065 0.41 6.1 20.3 6.6 1.1 Overflow Grate 1 0.3 N/A 67 73	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/ Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 1.559 0.93 14.0 29.6 14.4 1.0 Overflow Grate 1 0.6 N/A 64 71	Second State           Sore 3 Weir           3.81           5.15           9.51           22.55           11.27   rs for Outlet Pipe w/ Zone 3 Restrictor           2.37           0.70           1.54   ted Parameters for S            0.70           1.54   ted Parameters for S              0.52             50 Year           2.25           1.921             1.919           1.23           18.5           36.3           20.2           1.1           Overflow Grate 1           0.9           N/A           62	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 $ft^2$ ft <sup>2</sup> e e tt <sup>2</sup> feet radians 3.20 3.327 3.327 3.325 2.34 3.325 2.34 3.5.2 3.7.2 1.1 Spillway 1.1 N/A 54 67
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Height, Ho Overflow Weir Front Edge Length Overflow Weir Stope Horiz. Length of Weir Sides Overflow Grate Open Area % Debris Clogging % User Input: Outlet Pipe w/ Flow Restriction Plate (O Depth to Invert of Outlet Pipe Outlet Pipe Diameter Restrictor Plate Height Above Pipe Invert User Input: Emergency Spillway (Rectan Spillway Invert Stage Spillway Invert Stage Spillway End Slopes Freeboard above Max Water Surface Neuted Hydrograph Odume (acre-ft) OPTIONAL Override Runoff Volume (acre-ft) Inflow Hydrograph Odume (acre-ft) OPTIONAL Override Runoff Volume (acre-ft) Predevelopment Unit Peak Flow, q (drs/acre) Predevelopment Ont Peak Nuflow Q (drs) Peak Untflow Q (drs) Ratio Peak Outflow to Predevelopment Q Max Velocity through Grate 2 (fc) Time to Drain 97% of Inflow Volume (hours) Time to Drain 97% of Inflow Volume (hours) Time to Drain 97% of Inflow Volume (hours)	Work           Srate (Flat or Sloped)           Zone 3 Weir           2.56           6.25           4.00           5.00           70%           50%           ircular Orifice, Restri           Zone 3 Restrictor           0.33           30.00           14.60           gular or Trapezoidal)           4.40           (15.00)           4.00           1.00           WOCV           0.53           0.222           0.00           0.1           N/A           Plate           N/A           N/A           39           41           1.54	Not Selected           N/A           ft (relative to basin b           feet           H:V           feet           0.543           0.00           0.0           0.04           0.2           N/A           Plate           N/A           N/A           A           0.2.49	If (relative to basin bo feet H-V (enter zero for ff feet %, grate open area/t % gular Orifice) If (distance below basi inches inches inches oottom at Stage = 0 ft 2 Year 1.19 0.506 0.02 0.3 9.7 0.2 N/A Plate N/A N/A 68 2.38	ttom at Stage = 0 ft) lat grate) iotal area in bottom at Stage = 0 f Half-0 Half-0 0.15 2.3 15.1 2.5 1.1 Overflow Grate 1 0.1 N/A 69 74 2.89	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op U U t) Out Central Angle of Rest Spillway Stage a Basin Area a Basin Area a 10 Year 1.75 1.066 0.41 6.1 20.3 6.6 1.1 0.41 6.7 1.73 3.17	Calculatec ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/ Debris = ben Area w/ Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 1.559 0.93 14.0 29.6 14.4 1.0 Overflow Grate 1 0.6 N/A 64 71 3.51	Solution         Solution           1000000000000000000000000000000000000	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup> e feet radians $\frac{500 \text{ Year}}{3.20}$ 3.327 3.327 3.325 2.34 3.52 62.5 37.2 1.1 Spillway 1.1 N/A 54 67 4.82

,



## CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

#### Project: Glen At Widefield Filing 9 Pipe ID: East grass-lined swale 24" culvert under gravel trail (100 yr detained flow)



## East Grass-Lined Swale Wier Calculation for Over Topping of Gravel Trail (Detention Basin Outlet Structure and 24" Culvert 100% Clogged)

Approximate Length of Wier	92.50 ft
Wier Elevation	69.00

Head / Flow Depth d	Weir Flow, Q			
0.00 ft	0.0  cfs			
0.00  ft	8.8 cfs			
0.10 ft	$24.8 \mathrm{cfs}$			
0.20  ft	24.8 CIS			
(Approx 23/" water denth even top of ensuel trail)				
	Head / Flow Depth, d 0.00 ft 0.10 ft 0.20 ft 0.31 ft			

## CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

#### Project: Glen at Widefield Filing 9 Pipe ID: West grass-lined swale 24" culvert under gravel trail



# West Grass-Lined Swale Wier Calculation for Over Topping of Channel (100 year flows)

Approximate Length of Wier	110.00 ft
Wier Elevation	70.00

Water	Head / Flow	Wain Flow		
Elevation	Depth, d	weir Flow, Q		
70.10	0.10 ft	0.0 cfs		
70.20	0.20 ft	29.5 cfs		
70.30	0.30 ft	54.2 cfs		
70.40	0.40 ft	83.5 cfs		
70.50	0.50 ft	116.7 cfs		
70.56	0.56 ft	137.7 cfs		
(Approx. 6" water depth over top of channel)				



