



321 W. Henrietta Ave
Suite A
Woodlan Park, CO 80814

August 21, 2024

El Paso County
Department of Public Works
3275 Akers Drive
Colorado Springs, CO 80922

The permanent stormwater Best Management Practices (BMPs) for The Villas at Claremont Ranch consist of development of a full spectrum extended detention basin located in the northern portion of the subdivision adjacent to Sand Creek. The pond requires 0.139 acre-feet of water quality capture volume and a total (100-YR) volume of 0.760 acre-ft. Catamount Engineering has reviewed the as-built survey of pond, and outlet structure prepared by M&S Land Surveys and performed field measurements of structures. The as-built drawings indicated that the overall pond volume, the pond inlet, and outlet structures were constructed in general conformance with the approved design. The facilities provide the required storage volume and will meet the required release rates (as documented by the attached MHFD design form), the stage areas, elevations, and outlet dimensions.

The site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, revegetation or other ground cover, and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements.

Deviations-

- The approved plans indicated an emergency overflow width of 20'. The emergency overflow was constructed 16' wide with required 4:1 side slopes. The 16' spillway width raises the water surface of the fully plugged overflow condition by 0.04' and adequate berm height exists to maintain the 1.0' freeboard required. The increase in unit flow will not change sizing of required buried riprap.
- The trickle channel was revised to a 1.0' width x 6" deep trapezoidal channel vs. the inverted crown design in the original plan. The original alignment was utilized and the trapezoidal channel was installed at a longitudinal slope of 0.5%. The trickle channel enters the micropool below the lip of the structure (initial surcharge volume) but above the micropool outfall depth.
- The pond outfall location was revised to eliminate crossing of CSU water transmission mains. The outfall maintains configuration of initial design outfalling 1.0' above the toe of the channel bank to a riprap energy dissipator that maintains positive grade in excess of 2.0% to the top of the defined low flow channel in the center of the creek.

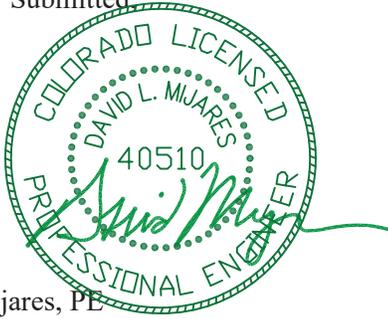
Based upon this information and information gathered during periodic site visits to the project during significant/key phases of the stormwater BMP installation, Catamount Engineering is of the opinion that the stormwater BMPs have been constructed in general compliance with the approved Erosion and Stormwater Quality Control Plan, Construction Plans, and Specifications as filed with the City.

Statement Of Engineer In Responsible Charge:

I, David Mijares a registered Professional Engineer in the State of Colorado, in accordance with Sections 5.2 and 5.3 of the Bylaws and Rules of the State Board of Registration for Professional Engineers and Professional Land Surveyors, do hereby certify that I or a person under my responsible charge periodically observed the construction of the above mentioned project.

Based on the on-site field observations and review of pertinent documentation, it is my professional opinion that the required permanent BMPs have been installed and are in general compliance with the approved Erosion and Stormwater Quality Control Plan, Construction Plans, and Specifications as filed with El Paso County.

Respectfully Submitted



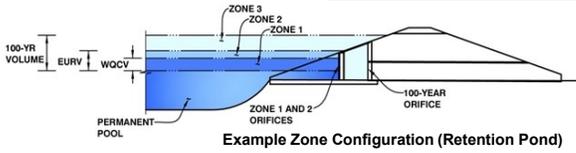
David L. Mijares, PE
Colorado PE 40510

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: VILLAS AT CLAREMONT RANCH

Basin ID: _____



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.07	0.139	Orifice Plate
Zone 2 (EURV)	4.10	0.314	Orifice Plate
Zone 3 (100-year)	5.48	0.307	Weir&Pipe (Restrict)
Total (all zones)		0.760	

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

Calculated Parameters for Underdrain

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)

Calculated Parameters for Plate

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = 4.06 ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = 16.20 inches
 Orifice Plate: Orifice Area per Row = N/A inches

WQ Orifice Area per Row = N/A ft²
 Elliptical Half-Width = N/A feet
 Elliptical Slot Centroid = N/A feet
 Elliptical Slot Area = N/A 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	1.35	2.71					
Orifice Area (sq. inches)	0.94	0.94	0.94					

	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)

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft ²
Vertical Orifice Centroid =	N/A	N/A	feet

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

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.06	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Gate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Gate Type =	Type C Gate	N/A	
Debris Clogging % =	50%	N/A	%

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H _g =	4.06	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	30.32	N/A	
Overflow Gate Open Area w/o Debris =	11.14	N/A	ft ²
Overflow Gate Open Area w/ Debris =	5.57	N/A	ft ²

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.70		inches

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.37	N/A	ft ²
Outlet Orifice Centroid =	0.23	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.07	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	16.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Spillway Design Flow Depth =	0.38	feet
Stage at Top of Freeboard =	7.38	feet
Basin Area at Top of Freeboard =	0.35	acres
Basin Volume at Top of Freeboard =	1.34	acre-ft

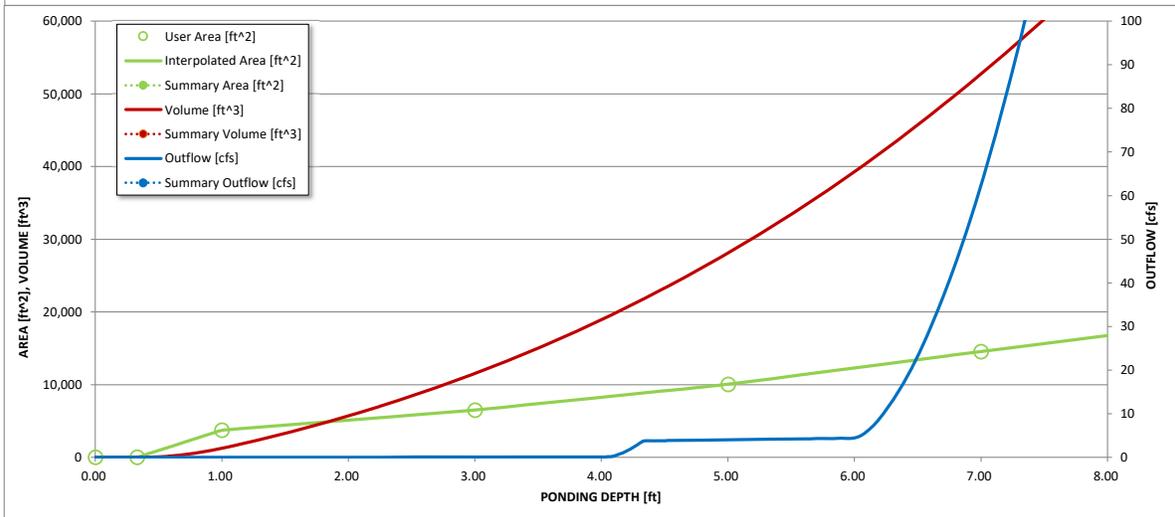
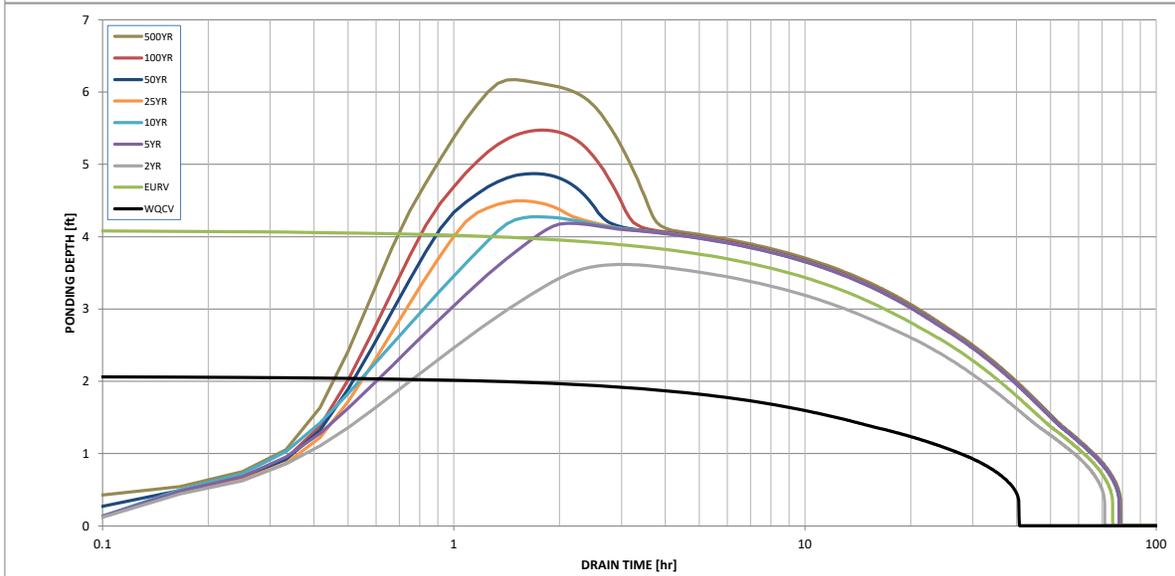
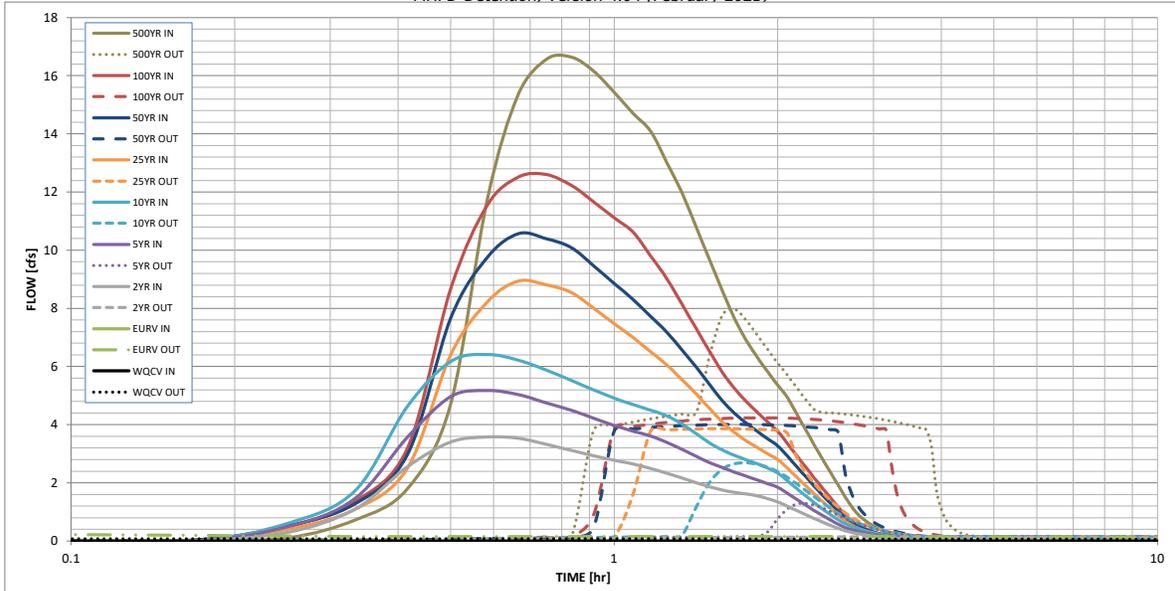
Routed Hydrograph Results

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	2.52	3.14
One-Hour Rainfall Depth (in) =	0.139	0.453	0.393	0.556	0.695	0.897	1.058	1.269	1.681
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.393	0.556	0.695	0.897	1.058	1.269	1.681
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.8	1.4	2.9	3.8	5.2	7.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.10	0.18	0.38	0.49	0.66	0.96
Peak Inflow Q (cfs) =	N/A	N/A	3.6	5.2	6.4	8.9	10.6	12.6	16.6
Peak Outflow Q (cfs) =	0.1	0.3	0.1	1.3	2.7	3.9	4.0	4.2	8.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.7	2.0	1.3	1.0	0.8	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	0.02	N/A	0.1	0.2	0.3	0.3	0.4	0.4
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) =	38	69	66	71	69	67	65	63	59
Time to Drain 99% of Inflow Volume (hours) =	40	73	69	76	75	74	73	73	71
Maximum Ponding Depth (ft) =	2.07	4.10	3.61	4.18	4.27	4.49	4.87	5.47	6.17
Area at Maximum Ponding Depth (acres) =	0.12	0.19	0.17	0.20	0.20	0.21	0.23	0.25	0.29
Maximum Volume Stored (acre-ft) =	0.140	0.454	0.364	0.470	0.488	0.533	0.613	0.757	0.948

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EUR [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.11
	0:15:00	0.00	0.00	0.30	0.49	0.60	0.40	0.51	0.49	0.73
	0:20:00	0.00	0.00	1.10	1.46	1.73	1.09	1.28	1.36	1.80
	0:25:00	0.00	0.00	2.56	3.58	4.64	2.52	2.98	3.21	4.70
	0:30:00	0.00	0.00	3.40	4.96	6.17	6.40	7.66	8.67	11.73
	0:35:00	0.00	0.00	3.58	5.18	6.41	8.22	9.74	11.54	15.37
	0:40:00	0.00	0.00	3.53	5.03	6.22	8.94	10.57	12.51	16.57
	0:45:00	0.00	0.00	3.32	4.75	5.88	8.80	10.39	12.60	16.64
	0:50:00	0.00	0.00	3.12	4.49	5.52	8.55	10.09	12.23	16.16
	0:55:00	0.00	0.00	2.93	4.22	5.20	8.00	9.46	11.66	15.42
	1:00:00	0.00	0.00	2.77	3.97	4.91	7.47	8.85	11.11	14.71
	1:05:00	0.00	0.00	2.65	3.78	4.69	7.00	8.31	10.62	14.09
	1:10:00	0.00	0.00	2.49	3.61	4.50	6.51	7.72	9.81	13.01
	1:15:00	0.00	0.00	2.33	3.39	4.30	6.05	7.18	9.01	11.96
	1:20:00	0.00	0.00	2.16	3.15	4.02	5.54	6.57	8.13	10.78
	1:25:00	0.00	0.00	2.01	2.91	3.68	5.05	5.97	7.29	9.65
	1:30:00	0.00	0.00	1.86	2.69	3.37	4.55	5.37	6.51	8.59
	1:35:00	0.00	0.00	1.75	2.53	3.12	4.08	4.81	5.79	7.63
	1:40:00	0.00	0.00	1.67	2.37	2.94	3.72	4.39	5.23	6.90
	1:45:00	0.00	0.00	1.61	2.23	2.79	3.45	4.05	4.80	6.32
	1:50:00	0.00	0.00	1.56	2.10	2.65	3.21	3.77	4.42	5.82
	1:55:00	0.00	0.00	1.45	1.97	2.51	3.00	3.51	4.09	5.36
	2:00:00	0.00	0.00	1.35	1.84	2.34	2.80	3.27	3.77	4.94
	2:05:00	0.00	0.00	1.19	1.64	2.07	2.50	2.91	3.35	4.38
	2:10:00	0.00	0.00	1.05	1.43	1.81	2.19	2.56	2.94	3.83
	2:15:00	0.00	0.00	0.91	1.24	1.56	1.90	2.22	2.55	3.32
	2:20:00	0.00	0.00	0.78	1.05	1.32	1.63	1.89	2.18	2.83
	2:25:00	0.00	0.00	0.66	0.88	1.11	1.37	1.59	1.83	2.37
	2:30:00	0.00	0.00	0.54	0.72	0.91	1.12	1.30	1.49	1.92
	2:35:00	0.00	0.00	0.43	0.58	0.73	0.89	1.02	1.17	1.50
	2:40:00	0.00	0.00	0.35	0.46	0.59	0.68	0.78	0.88	1.12
	2:45:00	0.00	0.00	0.29	0.38	0.49	0.52	0.60	0.67	0.85
	2:50:00	0.00	0.00	0.24	0.32	0.41	0.41	0.47	0.51	0.66
	2:55:00	0.00	0.00	0.20	0.27	0.34	0.33	0.38	0.40	0.51
	3:00:00	0.00	0.00	0.17	0.22	0.28	0.27	0.31	0.31	0.40
	3:05:00	0.00	0.00	0.14	0.19	0.24	0.22	0.25	0.24	0.31
	3:10:00	0.00	0.00	0.12	0.15	0.20	0.18	0.20	0.19	0.24
	3:15:00	0.00	0.00	0.10	0.13	0.16	0.15	0.16	0.15	0.19
	3:20:00	0.00	0.00	0.08	0.10	0.13	0.12	0.13	0.12	0.15
	3:25:00	0.00	0.00	0.07	0.08	0.10	0.10	0.11	0.10	0.12
	3:30:00	0.00	0.00	0.05	0.07	0.08	0.08	0.08	0.08	0.10
	3:35:00	0.00	0.00	0.04	0.05	0.06	0.06	0.07	0.06	0.08
	3:40:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.06
	3:45:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.03	0.04
	3:50:00	0.00	0.00	0.02	0.02	0.02	0.02	0.03	0.02	0.03
	3:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	4:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

