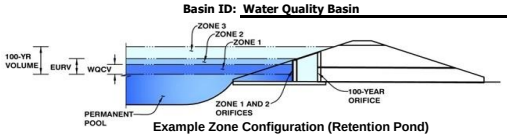
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Super Star Carwash

Basin ID: Water Quality Basin



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**RG**	
Watershed Area =	1.65	acres
Watershed Length =	330	ft
Watershed Length to Centroid =	165	ft
Watershed Slope =	0.013	ft/ft
Watershed Imperviousness =	50.00%	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 =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.023	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.095	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.068	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.091	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.108	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.137	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.164	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.199	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.275	acre-feet		inches
Approximate 2-yr Detention Volume =	0.061	acre-feet		
Approximate 5-yr Detention Volume =	0.081	acre-feet		
Approximate 10-yr Detention Volume =	0.098	acre-feet		
Approximate 25-yr Detention Volume =	0.120	acre-feet		
Approximate 50-yr Detention Volume =	0.134	acre-feet		
Approximate 100-yr Detention Volume =	0.151	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.023	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.023	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Total detention volume is less than 100-year volume.

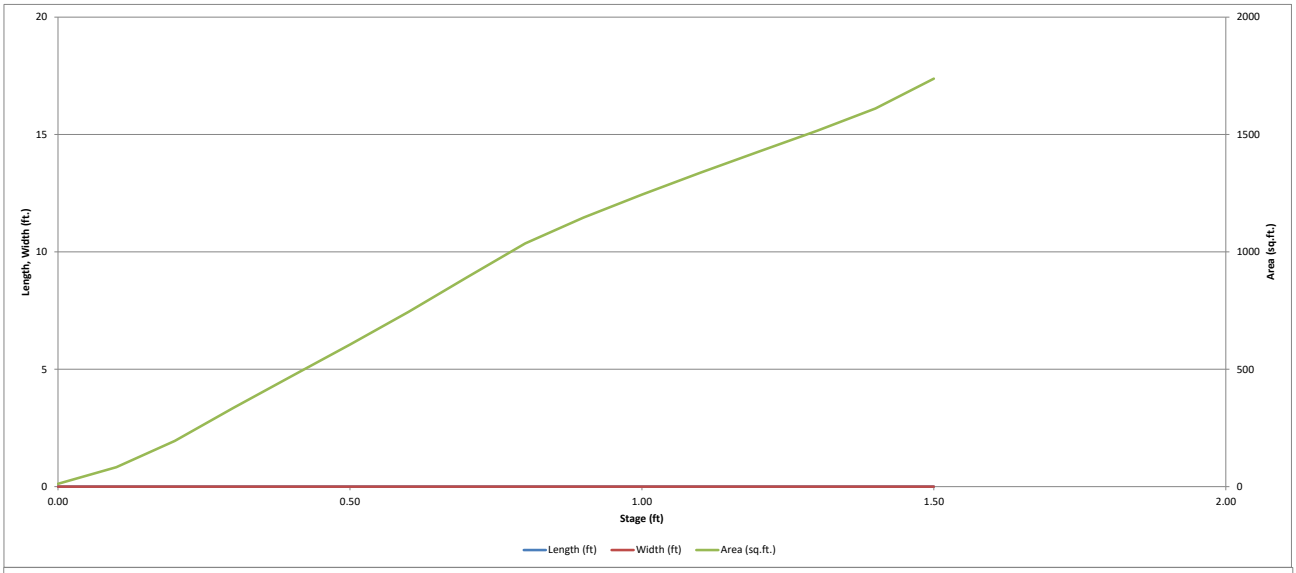
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	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

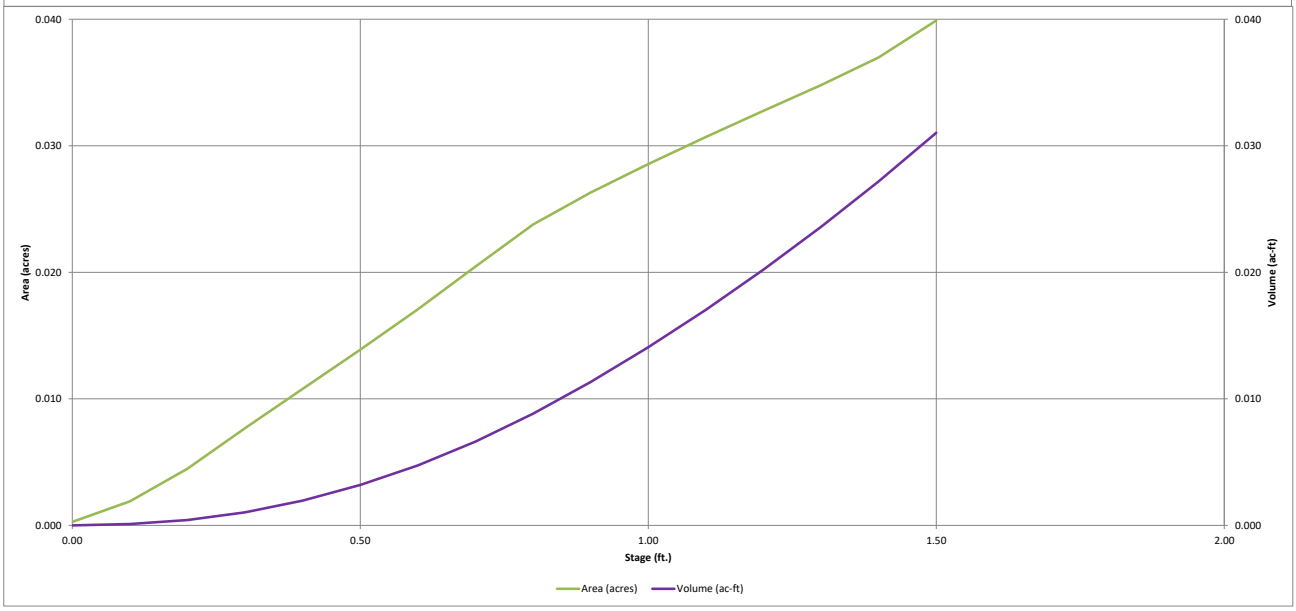
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	12	0.000		
77.6	--	0.10	--	--	--	83	0.002	5	0.000
77.7	--	0.20	--	--	--	195	0.004	19	0.000
77.8	--	0.30	--	--	--	335	0.008	45	0.001
77.9	--	0.40	--	--	--	470	0.011	85	0.002
78	--	0.50	--	--	--	605	0.014	139	0.003
78.1	--	0.60	--	--	--	744	0.017	207	0.005
78.2	--	0.70	--	--	--	891	0.020	288	0.007
78.3	--	0.80	--	--	--	1,036	0.024	385	0.009
78.4	--	0.90	--	--	--	1,146	0.026	494	0.011
78.5	--	1.00	--	--	--	1,244	0.029	613	0.014
78.6	--	1.10	--	--	--	1,337	0.031	742	0.017
78.7	--	1.20	--	--	--	1,427	0.033	881	0.020
78.8	--	1.30	--	--	--	1,516	0.035	1,028	0.024
78.9	--	1.40	--	--	--	1,611	0.037	1,184	0.027
79	--	1.50	--	--	--	1,738	0.040	1,351	0.031

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



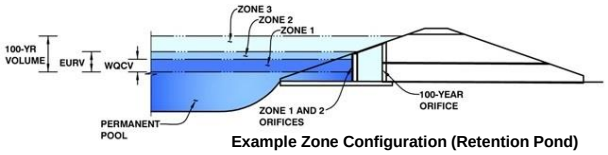


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Super Star Carwash**

Basin ID: **Water Quality Basin**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.28	0.023	Filtration Media
Zone 2			Not Utilized
Zone 3			
Total (all zones)		0.023	

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

Underdrain Orifice Invert Depth =	1.92	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Diameter =	0.73	inches	Underdrain Orifice Centroid =	0.03	feet

Calculated Parameters for Underdrain

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 =	N/A	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft^2
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

Calculated Parameters for Vertical Orifice

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =			feet
Overflow Weir Front Edge Length =			feet	Overflow Weir Slope Length =			feet
Overflow Weir Grate Slope =			H:V	Grate Open Area / 100-yr Orifice Area =			
Horiz. Length of Weir Sides =			feet	Overflow Grate Open Area w/o Debris =			ft^2
Overflow Grate Type =				Overflow Grate Open Area w/ Debris =			ft^2
Debris Clogging % =			%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =			ft^2
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =	feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =	acres
Freeboard above Max Water Surface =		feet	Basin Volume at Top of Freeboard =	acre-ft

Calculated Parameters for Spillway

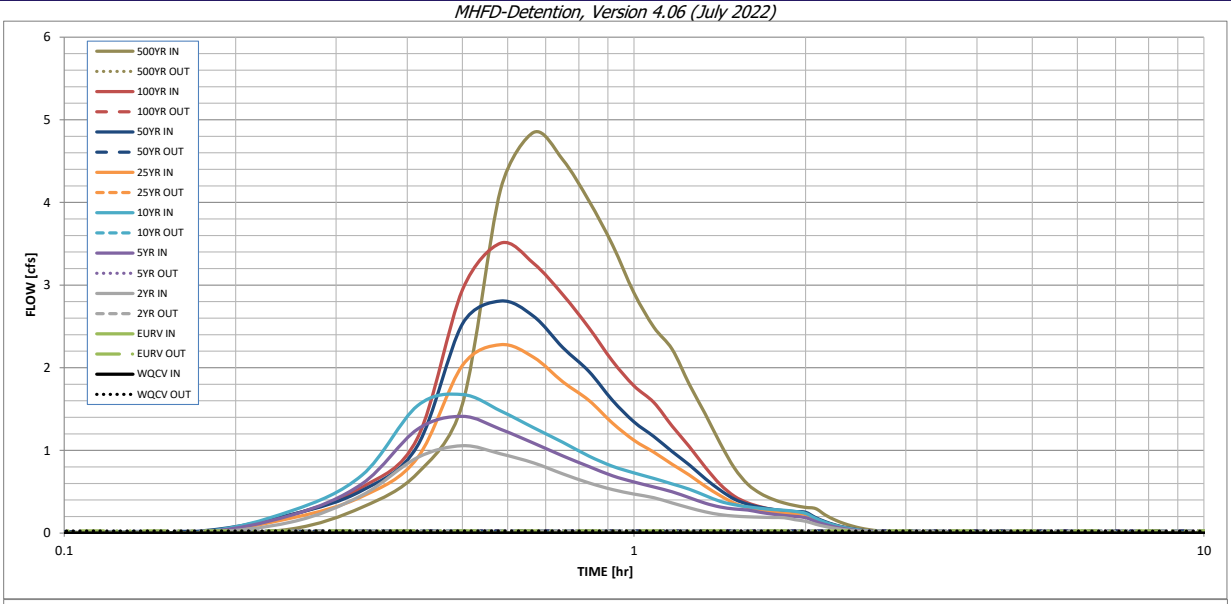
Routed Hydrograph Results

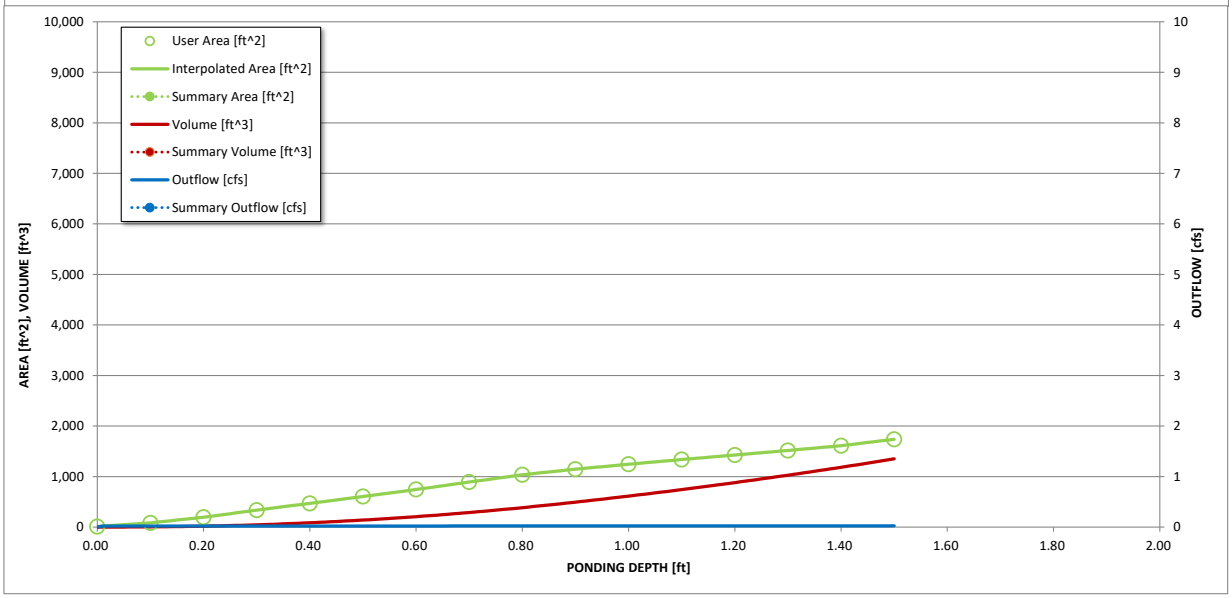
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.023	0.095	0.068	0.091	0.108	0.137	0.164	0.199	0.275
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.068	0.091	0.108	0.137	0.164	0.199	0.275
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.3	0.6	1.1	1.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.20	0.39	0.64	1.14
Peak Inflow Q (cfs) =	N/A	N/A	1.1	1.4	1.7	2.3	2.8	3.5	4.8
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.7	0.1	0.0	0.0	0.0
Structure Controlling Flow =	Filtration Media	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 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) =	12	44	32	43	51	63	76	92	>120
Time to Drain 99% of Inflow Volume (hours) =	**12**	45	33	44	52	65	78	94	>120
Maximum Ponding Depth (ft) =	1.29	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Area at Maximum Ponding Depth (acres) =	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Maximum Volume Stored (acre-ft) =	0.023	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)





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.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [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	0.02	0.00	0.05
	0:15:00	0.00	0.00	0.13	0.21	0.27	0.18	0.22	0.22	0.31
	0:20:00	0.00	0.00	0.46	0.60	0.70	0.44	0.51	0.55	0.72
	0:25:00	0.00	0.00	0.91	1.25	1.54	0.91	1.05	1.15	1.56
	0:30:00	0.00	0.00	1.06	1.41	1.68	2.03	2.53	2.94	4.16
	0:35:00	0.00	0.00	0.96	1.26	1.48	2.28	2.81	3.51	4.85
	0:40:00	0.00	0.00	0.85	1.09	1.27	2.13	2.62	3.26	4.52
	0:45:00	0.00	0.00	0.72	0.93	1.10	1.83	2.24	2.88	4.02
	0:50:00	0.00	0.00	0.61	0.81	0.93	1.61	1.96	2.48	3.49
	0:55:00	0.00	0.00	0.53	0.69	0.81	1.33	1.61	2.08	2.91
	1:00:00	0.00	0.00	0.47	0.62	0.73	1.12	1.34	1.78	2.49
	1:05:00	0.00	0.00	0.43	0.56	0.66	0.98	1.17	1.58	2.22
	1:10:00	0.00	0.00	0.36	0.50	0.59	0.83	0.99	1.29	1.80
	1:15:00	0.00	0.00	0.31	0.43	0.53	0.70	0.83	1.05	1.44
	1:20:00	0.00	0.00	0.26	0.36	0.45	0.57	0.66	0.80	1.09
	1:25:00	0.00	0.00	0.22	0.31	0.38	0.45	0.52	0.59	0.79
	1:30:00	0.00	0.00	0.21	0.29	0.34	0.36	0.41	0.45	0.59
	1:35:00	0.00	0.00	0.20	0.28	0.32	0.31	0.35	0.37	0.48
	1:40:00	0.00	0.00	0.19	0.25	0.30	0.28	0.31	0.32	0.41
	1:45:00	0.00	0.00	0.19	0.23	0.29	0.25	0.29	0.29	0.36
	1:50:00	0.00	0.00	0.19	0.21	0.28	0.24	0.27	0.26	0.33
	1:55:00	0.00	0.00	0.16	0.20	0.26	0.23	0.26	0.25	0.31
	2:00:00	0.00	0.00	0.14	0.19	0.24	0.22	0.25	0.24	0.30
	2:05:00	0.00	0.00	0.11	0.14	0.18	0.17	0.19	0.18	0.22
	2:10:00	0.00	0.00	0.08	0.10	0.13	0.12	0.14	0.13	0.16
	2:15:00	0.00	0.00	0.06	0.07	0.09	0.09	0.10	0.09	0.12
	2:20:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.07	0.08
	2:25:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.06
	2:30:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.04
	2:35:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	2:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	2:45:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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