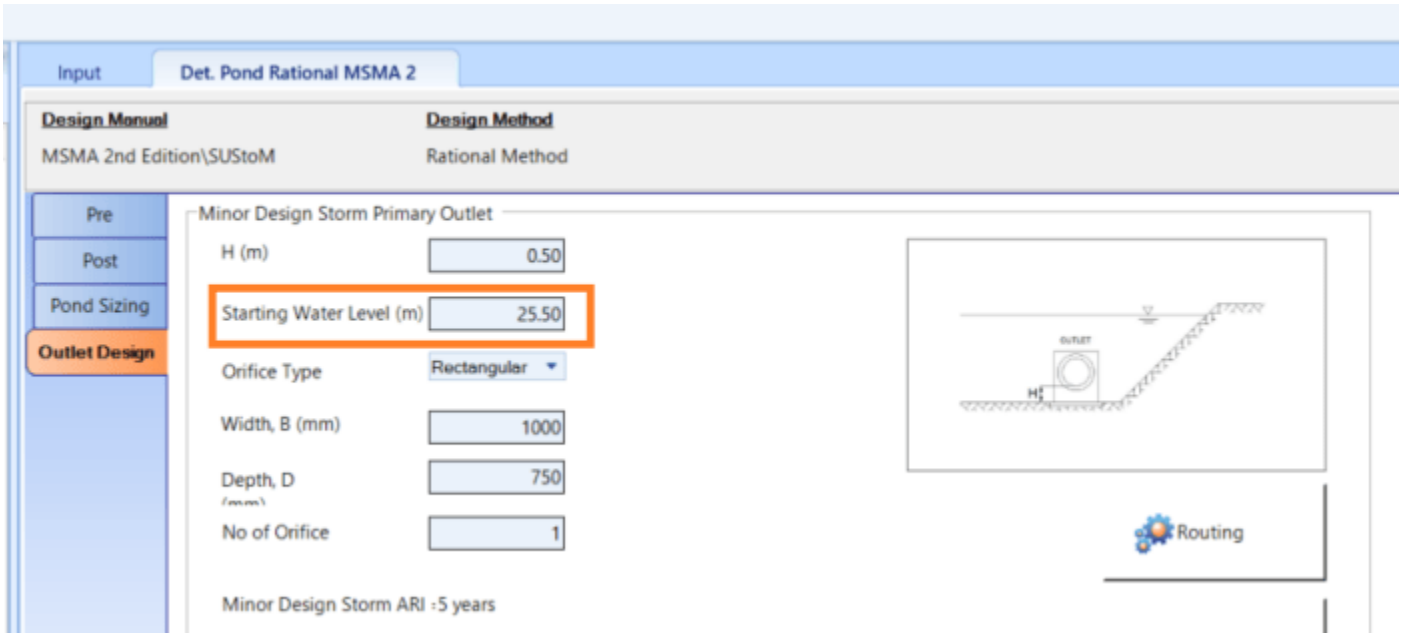
Starting Water Level for Retention Pond

MSMA · https://mes100.com/docs/starting-water-level-for-retention-pond/

Latest MiTS 1 and 2 allows users to compute the analysis at any level of Starting Water Level (SWL), especially for the retaining pond. Default value is maintained as before which is the total of Invert Level (IL) and Height of bottom orifice (Invert Level + H).

Project reference



Normally a retention pond will have a starting water level which is equal to the H, the height of the minor orifice from the Pond Invert Level, and during raining time, the water will start at the H, and gradually go up. When the rain stops, the water will always maintain the level of H.

Thus, in the above example, the Starting Water level = 25 (invert level)+0.5 (H)=25.5m.

However, there are some situations whereby the Starting Water Level for a retention pond is not 25.5m, but 25m -- at the Pond Invert Level, such as when the very first instance when the retention pond is being put to use, and before there is any water that is filling in it.

Thus we are allowing the user to change the starting water level to cater for the situation whereby the calculation for a retaining pond needs to be done from a dry pond, and the routing is computed

from the bed of the pond regardless of the H. If the analysis is required to be calculated from a dry pond, change the Starting Water Level (SWL) to be your invert level (ie 25 m based on this project file)

We believe that this flexibility also allows users to better understand the rises and falls of the flow depending on the starting water level.

Let’s take a look at how H and SWL can affect the result.

Stage-Storage Relationship

Do refer at **Section 6** in the output analysis

Stage storage explains the storage volume at every stage of the elevation, which as in the project shows at every 0.05 m depth and cumulatively calculates on how much the pond size can cater. This analysis is calculated from the bed of the pond (invert level) **regardless of the H and Start Water Level for.**

6. Stage-Storage Relationship

Eq 7.2

Double-end area formula

$V_{1,2} = 0.5(A_1 + A_2) \times h$

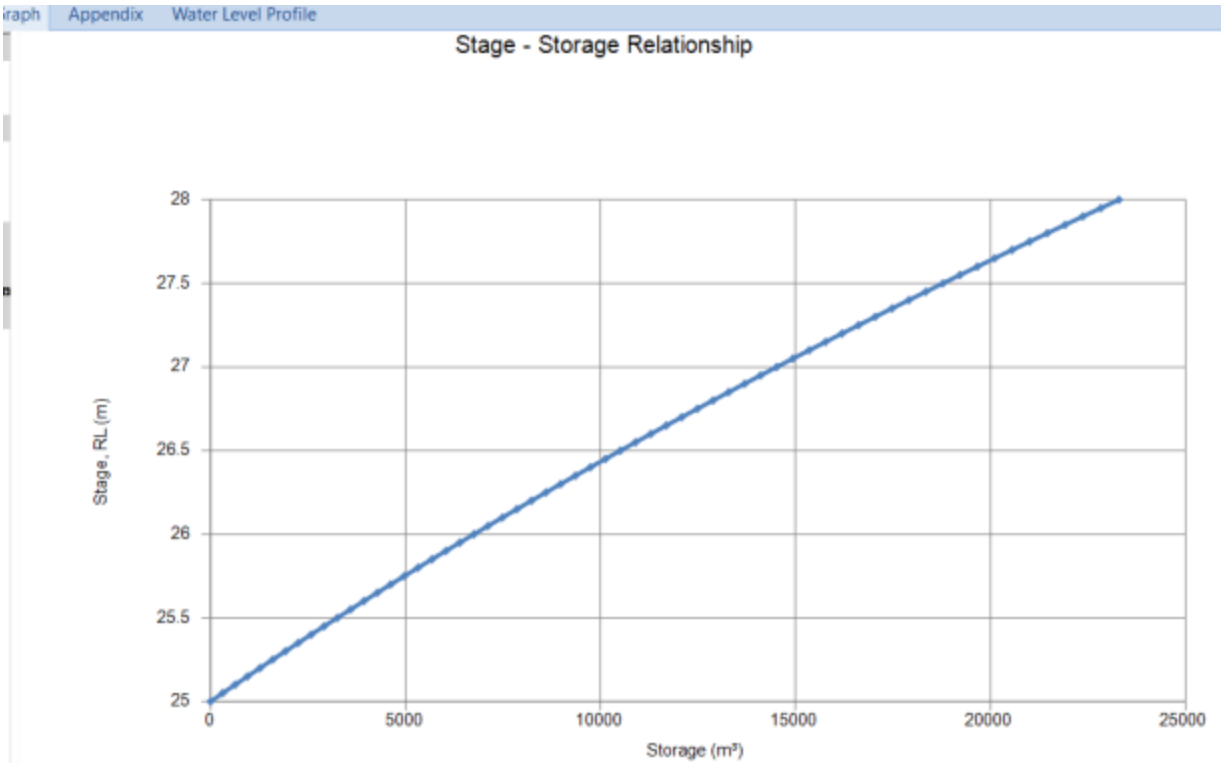
Stage incremental = 0.05 m

Stage (m)	Elevation (m)	Area (m^2)	Storage (m^3)	Cum. Storage, S (m^3)
0.00	25.00	6250.00	0.00	0.00
0.05	25.05	6300.47	313.76	313.76
0.10	25.10	6350.94	316.29	630.05
0.15	25.15	6401.41	318.81	948.86
0.20	25.20	6451.88	321.33	1270.19
0.25	25.25	6502.35	323.86	1594.04
0.30	25.30	6552.82	326.38	1920.42
0.35	25.35	6603.29	328.90	2249.33
0.40	25.40	6653.76	331.43	2580.75
0.45	25.45	6704.23	333.95	2914.70
0.50	25.50	6754.70	336.47	3251.18
0.55	25.55	6805.16	339.00	3590.17
0.60	25.60	6855.62	341.52	3931.69
0.65	25.65	6906.08	344.04	4275.73
0.70	25.70	6956.54	346.57	4622.30
0.75	25.75	7007.00	349.09	4971.39
0.80	25.80	7057.46	351.61	5323.00
0.85	25.85	7107.92	354.13	5677.13
0.90	25.90	7158.38	356.66	6033.79
0.95	25.95	7208.84	359.18	6392.97
1.00	26.00	7259.30	361.70	6754.68
1.05	26.05	7309.77	364.23	7118.90
1.10	26.10	7360.24	366.75	7485.65

Retention Pond/Wet Pond

The results for any SWL are the same since the analysis between the stage elevation and storage starts from the bed of the pond.

You can also refer to the Stage-Storage Relationship graph for a better understanding.



Stage-Discharge Relationship

Do refer at **Section 7** in the output analysis

Stage-Discharge explains the discharge and the depth of water from the outlet at every ARI year given the size of the orifice.

This is where the H will influence the result, which is the discharge. The discharge will be calculated starting from the H regardless of the SWL, because the water will be retained below the H so there will be no discharge below that. Therefore the SWL won't be affecting the calculation for the wet pond.

As example below, the H is located 0.5 m above the pond invert level. Result shows that the discharge starts right above the 0.5 m H which is at 25.55 m.

Calculation starts at 0.5 m and above

Elevation (m)	Minor Outlet		Q_I (m^3/s)	Major Outlet	
	H_o (m)	$C_oA_o(2g)^{0.5}$		H_o (m)	C_oA_o
25	0	NA	0.000	0.000	NA
25.05	0	NA	0.000	0.000	NA
25.1	0	NA	0.000	0.000	NA
25.15	0	NA	0.000	0.000	NA
25.2	0	NA	0.000	0.000	NA
25.25	0	NA	0.000	0.000	NA
25.3	0	NA	0.000	0.000	NA
25.35	0	NA	0.000	0.000	NA
25.4	0	NA	0.000	0.000	NA
25.45	0	NA	0.000	0.000	NA
25.5	0	NA	0.000	0.000	NA
25.55	0.05	NA	0.023	0.000	NA
[illegible]	[illegible]	NA	0.065	0.000	NA
25.65	0.15	NA	0.119	0.000	NA
25.7	0.2	NA	0.182	0.000	NA
25.75	0.25	NA	0.255	0.000	NA
25.8	0.3	NA	0.335	0.000	NA
25.85	0.35	NA	0.422	0.000	NA
25.9	0.4	NA	0.516	0.000	NA
25.95	0.45	NA	0.616	0.000	NA
26	0.5	NA	0.721	0.000	NA
26.05	0.55	NA	0.832	0.000	NA
26.1	0.6	NA	0.948	0.000	NA
26.15	0.65	NA	1.069	0.000	NA
26.2	0.7	NA	1.195	0.000	NA
26.25	0.75	NA	1.325	0.000	NA
26.3	0.4	2.551	1.614	0.000	NA
26.35	0.45	2.551	1.712	0.000	NA
26.4	0.5	2.551	1.804	0.000	NA

Wet Pond, Q calculation starts at 25.5 m

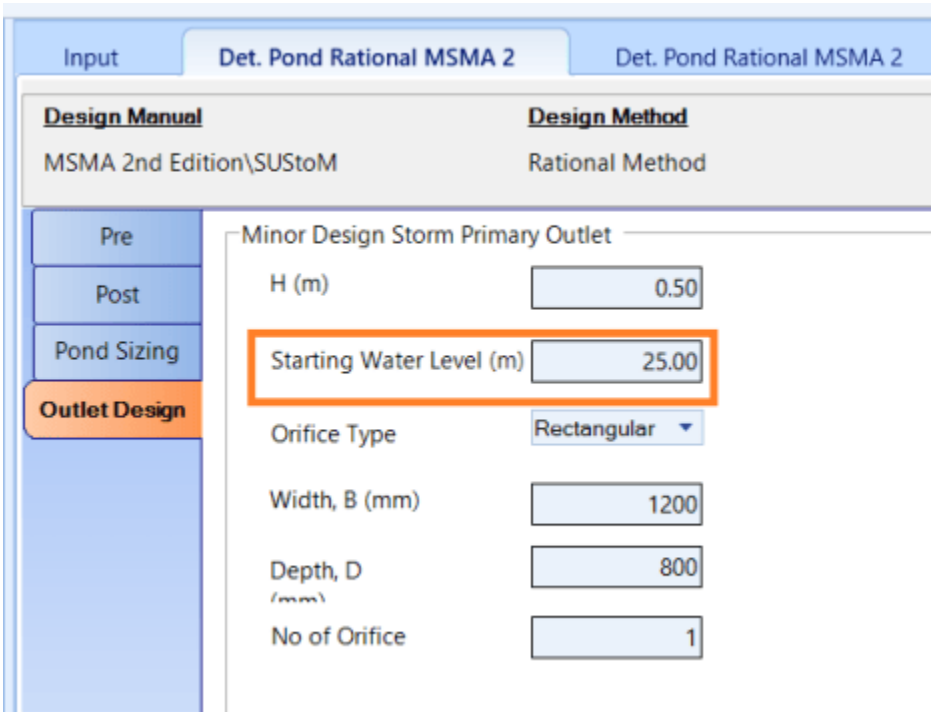
Hydrologic Pond Routing

Do refer at **Section 8** in the output analysis

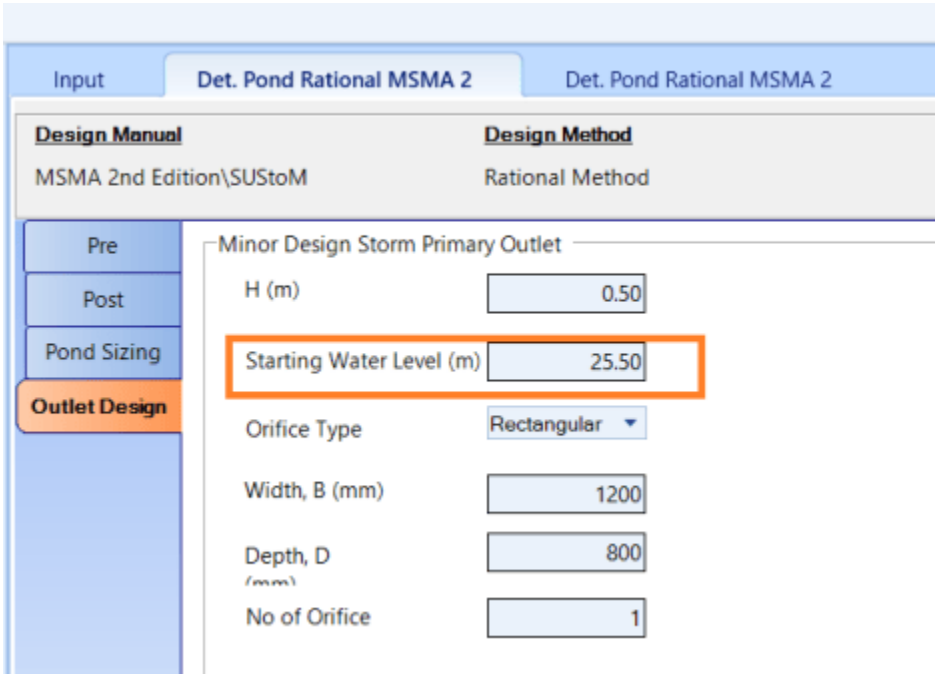
This section defines the relationships between the inflow and outflow hydrographs to duration. The storm durations will be routed in order to determine the critical duration that produces the highest water level and greatest discharge.

This section is affected by the H and SWL. The stage-discharge from the Section 7 will be considered in this pond routing which is affected by the H, therefore indirectly the result will be affected.

Some calculations need to be routed from a dry pond for a wet pond especially for new designs which acquire you to calculate from dry condition. Therefore, the SWL will be from the bed of the pond which is the invert level (i.e 25 m).



And as for the calculation for a wet pond assuming with a permanent retaining water depth, the calculation starts above the H (ie 25.5; invert level + H).



Wet Pond with 0.5 m H and 25 m SWL (routing is calculated from a dry pond):

The water level for the wet pond starts form the bed assuming it is calculated from a dry pond

From Section 7

Time, t_j (min)	Inflow, I_j (m^3/s)	$(I_1+I_2)/2$ (m^3/s)	$S_1/\Delta t-O_1/2$ (m^3/s)	$S_2/\Delta t+O_2/2$ (m^3/s)	Outflow (m^3/s)	Water Level (m)	$O_j=Q_1$ (m^3/s)	S_j (m^3)	$(S_j/\Delta t)+O_j/2$ (m^3/s)
0	0.000	0.000	0.000	0.000	0.000	25.000	0.000	0.000	0.000
5	0.647	0.324	0.000	0.324	0.000	25.013	0.000	313.762	1.046
10	1.295	0.971	0.324	1.295	0.000	25.062	0.000	630.047	2.100
15	1.942	1.619	1.295	2.914	0.000	25.138	0.000	948.856	3.163
20	2.590	2.266	2.914	5.180	0.000	25.244	0.000	1270.188	4.234
25	3.237	2.914	5.180	8.093	0.000	25.377	0.000	1594.044	5.313
30	3.885	3.561	8.093	11.654	0.000	25.536	0.000	1920.423	6.401
35	4.234	4.060	11.654	15.698	0.016	25.708	0.000	2249.326	7.498
40	4.234	4.234	15.698	19.738	0.194	25.874	0.000	2580.752	8.603
45	4.234	4.234	19.738	23.505	0.468	26.025	0.000	2914.702	9.716
50	4.234	4.234	23.505	26.963	0.776	26.159	0.000	3251.175	10.837
55	4.234	4.234	26.963	30.105	1.093	26.278	0.023	3590.172	11.979
60	4.234	4.234	30.105	32.855	1.484	26.381	0.065	3931.691	13.138
65	4.234	4.234	32.855	35.321	1.768	26.474	0.119	4275.734	14.312
70	4.234	4.234	35.321	37.624	1.932	26.560	0.182	4622.299	15.499
75	4.234	4.234	37.624	39.786	2.072	26.640	0.255	4971.388	16.699
80	4.234	4.234	39.786	41.827	2.194	26.715	0.335	5322.999	17.911
85	3.814	4.024	41.827	43.548	2.303	26.778	0.422	5677.134	19.135
90	3.166	3.490	43.548	44.647	2.390	26.818	0.516	6033.791	20.371
95	2.519	2.842	44.647	45.046	2.444	26.832	0.616	6392.972	21.618
100	1.871	2.195	45.046	44.778	2.463	26.822	0.721	6754.675	22.876
105	1.224	1.547	44.778	43.875	2.450	26.790	0.832	7118.902	24.146
110	0.576	0.900	43.875	42.369	2.406	26.735	0.948	7485.652	25.426
115	0.000	0.288	42.369	40.326	2.331	26.660	1.069	7854.926	26.718
120	0.000	0.000	40.326	38.102	2.224	26.578	1.195	8226.723	28.020
125	0.000	0.000	38.102	36.002	2.100	26.499	1.325	8601.044	29.333
130	0.000	0.000	36.002	34.027	1.975	26.425	1.614	8977.888	30.733
135	0.000	0.000	34.027	32.179	1.848	26.355	1.712	9357.256	32.047
140	0.000	0.000	32.179	30.458	1.721	26.290	1.804	9739.147	33.366
145	0.000	0.000	30.458	28.901	1.557	26.234	1.892	10123.562	34.691

The calculation starts at 25 m, assuming that the routing is computed from a dry pond

Wet Pond with 0.5 m H and 25.5 m SWL (assuming the routing is calculated from a permanent retaining pond):

Water level for the wet pond starts from the permanent retaining depth

From Section 7

Time, t_j (min)	Inflow, I_j (m^3/s)	$(I_1+I_2)/2$ (m^3/s)	$S_1/\Delta t-O_1/2$ (m^3/s)	$S_2/\Delta t+O_2/2$ (m^3/s)	Outflow (m^3/s)	Water Level (m)	$O_j=Q_1$ (m^3/s)	S_j (m^3)	$(S_j/\Delta t)+O_j/2$ (m^3/s)
0	0.000	0.000	0.000	0.000	0.000	25.500	0.000	0.000	0.000
5	0.755	0.377	10.837	11.215	0.000	25.517	0.000	313.762	1.046
10	1.510	1.132	11.215	12.339	0.008	25.566	0.000	630.047	2.100
15	2.264	1.887	12.339	14.190	0.036	25.645	0.000	948.856	3.163
20	3.019	2.642	14.190	16.719	0.113	25.751	0.000	1270.188	4.234
25	3.774	3.397	16.719	19.860	0.256	25.879	0.000	1594.044	5.313
30	4.529	4.152	19.860	23.534	0.477	26.026	0.000	1920.423	6.401
35	4.937	4.733	23.534	27.488	0.779	26.180	0.000	2249.326	7.498
40	4.937	4.937	27.488	31.282	1.143	26.321	0.000	2580.752	8.603
45	4.937	4.937	31.282	34.564	1.654	26.445	0.000	2914.702	9.716
50	4.937	4.937	34.564	37.617	1.884	26.559	0.000	3251.175	10.837
55	4.937	4.937	37.617	40.481	2.072	26.666	0.023	3590.172	11.979
60	4.937	4.937	40.481	43.186	2.232	26.765	0.065	3931.691	13.138
65	4.937	4.937	43.186	45.750	2.372	26.857	0.119	4275.734	14.312
70	4.242	4.589	45.750	47.844	2.496	26.933	0.182	4622.299	15.499
75	3.487	3.865	47.844	49.117	2.592	26.978	0.255	4971.388	16.699
80	2.732	3.110	49.117	49.577	2.649	26.994	0.335	5322.999	17.911
85	1.978	2.355	49.577	49.264	2.669	26.983	0.422	5677.134	19.135
90	1.223	1.600	49.264	48.209	2.655	26.946	0.516	6033.791	20.371
95	0.468	0.845	48.209	46.445	2.609	26.882	0.616	6392.972	21.618
100	0.000	0.234	46.445	44.150	2.529	26.800	0.721	6754.675	22.876
105	0.000	0.000	44.150	41.730	2.420	26.711	0.832	7118.902	24.146
110	0.000	0.000	41.730	39.432	2.298	26.627	0.948	7485.652	25.426
115	0.000	0.000	39.432	37.257	2.175	26.546	1.069	7854.926	26.718
120	0.000	0.000	37.257	35.206	2.051	26.469	1.195	8226.723	28.020
125	0.000	0.000	35.206	33.281	1.925	26.397	1.325	8601.044	29.333
130	0.000	0.000	33.281	31.483	1.798	26.329	1.614	8977.888	30.733
135	0.000	0.000	31.483	29.813	1.670	26.267	1.712	9357.256	32.047
140	0.000	0.000	29.813	28.389	1.424	26.214	1.804	9739.147	33.366

The calculation starts at 25.5 m, assuming that the routing is computed from a permanent water level

Summary:

	Wet Pond (from dry pond) H = 0.5, SWL = IL	Wet Pond (from a permanent depth) H = 0.5. SWL = IL + H
Stage-Storage	Calculation of storage starts from the bed, at 25 m	Calculation of storage starts from the bed, at 25 m
Stage-Discharge	Calculation of discharge starts above H (0.5 m), at 25.55 m SWL will not affect the calculation	Calculation of discharge starts above H (0.5 m), at 25.55 m SWL will not affect the calculation
Hydrologic Pond Routing	Inflow & Outflow hydrographs start from the SWL, at 25 m	Inflow & Outflow hydrographs start from the SWL, at 25.5 m

Related



Ngu Soon Hui

I'm the Benevolent Dictator for Life for MiTS Software cum Editor of this website. Read more here.

You can also contact me at soonhui@mes100.com