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MEMO

ASSIGNMENT	ASSIGNMENT LEADER	DATE
StormTac design criteria	Thomas Larm	18 October 2011
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General design criteria for wet ponds and wetlands for storm water treatment

General rules of thumb for the design of wet ponds and wetlands for storm water treatment are compiled in Table 1, with presentation of some of the parameters in Figure 1.

Table 1 Design criteria for wet ponds and wetlands for storm water treatment, standard (minimum-maximum) values.

Facility parameter	**Notation**	**Unit**	**Wet ponds**	**Wetlands**	**Ref**
Permanent water area (area for permanent pool volume V_p)	A_p	m^2/red ha*	150 (70-400)	300-500 (100-800)	1,2
Total area (area for flow detention volume V_d)	A_{tot}	m^2/red ha*	175 (80-500)	40-600 (125-1000)***	1
Length:width	L:W	-	3:1 (2:1 – 5:1)	3:1 (2:1 – 4:1)	1,2,3,5
Permanent water depth, mean	h’	m	1.2 (0.8-2.0)	0.5 (0.5-0.75)	1,2,4
Detention water depth**	h_r	m	0.5 (0.2-1.5)	<0.6	1,2
Shallow zone, width	W_w	m	2.0 (1.0-3.0)	>2.0	1,2,3
Shallow zone, depth	h_w	m	0.2 (0.15-0.5)	0.2 (0.15-0.5)	1,2,3
Slope	1:z	-	1:3 (1:10-1:2)	1:3 (1:10-1:2)	1,2,3,4
Share of aquatic vegetation in relation to A_p	S_v	-	0.25 (0-0.40)	0.6 (0.5-1.0)	2,3,4
Emptying time of detention volume	t_{out}	hours	12-24 (6-48)	12-24	1,2,7
Residence time, yearly average flow	t_r	days	>2	7-10	2

*) Red ha = reduced area in hectars = watershed area x runoff coefficient. Example runoff coefficients; see Table 2. **) Temporary water depth over permanent water depth ***) 1-2% of watershed area according to Ref 6.

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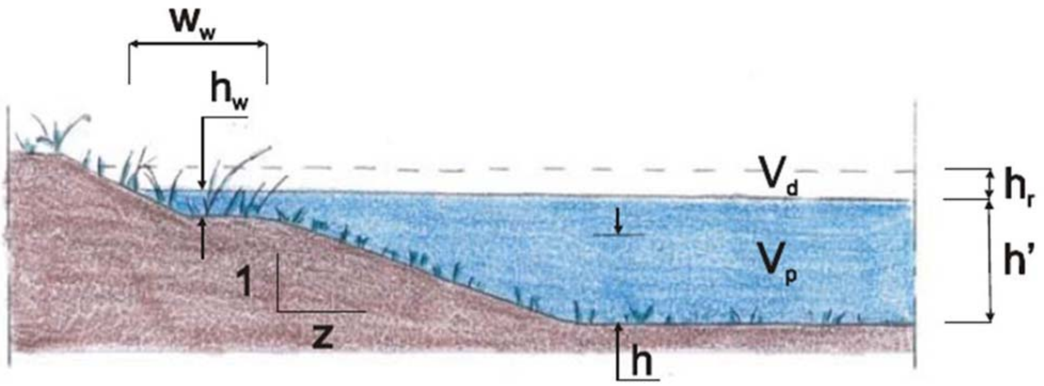

Figure 1 Section sketch (Ref 2).

Table 1 compiles land use specific runoff coefficients, to be used along with the design criteria in Table 1. Coefficients for more land uses are compiled in Ref 1.

Table 2 Runoff coefficients for different land uses (Ref 1)

Land use	**Standard**	**Min**	**Max**
Urban			
Roads	0.85	0.70	1.0
Parking	0.85	0.70	1.0
Detached houses, villas, residential area	0.25	0.20	0.40
Row houses, terraced houses, townhouses	0.32	0.30	0.50
Apartments, multifamily	0.45	0.35	0.60
Leisure houses, cottage area, vacation houses	0.20	0.050	0.50
Colony areas, garden plots	0.20	0.10	0.50
Commercial, center, downtown, shopping area	0.70	0.40	0.70
Industry	*0.50*	*0.50*	*0.80*
Park	0.18	0	0.30
Rural			
Forests, woodland	0.050	0.050	0.40
Farmland, agricultural land, arable land	0.26	0.10	0.30
Meadows	0.075	0	0.30
Wetland	0.20	0.10	0.40

Comments

The presented design rules are recommended to be used only in a planning level design phase since site specific conditions should be considered, such as maximum depth and slope from a geotechnical point of view. Furthermore, the required area and volume of the facility depends on other parameters, such as inlet concentrations and required outlet concentrations (Ref 1, 8).

Larger facilities generally results in higher reduction efficiency, chosen dimensions therefore are dependent on required reduction and outlet concentrations. A permanent pool results in higher reduction efficiency, and the outlet should preferably be placed under water to hinder e.g. floating oil to be transported out from the facility. The outlet can be designed smaller than the inlet resulting in a longer emptying time and residence time, but the highest permitted level of the detention volume (over the permanent volume) must be checked not to cause upstream flooding problems.

The detention volume should be designed for maximum (design) storms, with consideration to climate effects. The latter could be performed by multiplying the design rain intensities with a climate factor from regional climate models for e.g. calculating flows for the period 2071-2100. A return time for the design rain events should be chosen in consideration to possible risks for floods. If the wet ponds and wetlands are designed with a detention volume (together with smaller outlet dimensions) for larger rain events, the downstream transport system could be designed with smaller dimensions, for a maximum outflow from the upstream facility in addition to downstream added flows to the system.

References

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