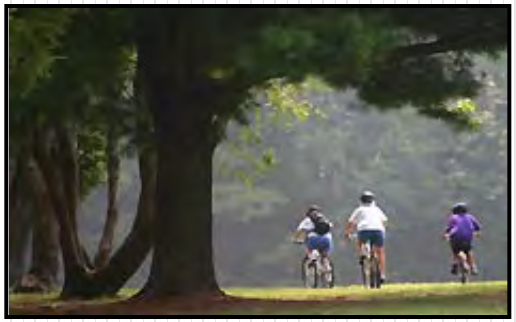
Authorization to Advertise Public Hearing
Hanover County Drainage Design Handbook

January 8, 2014

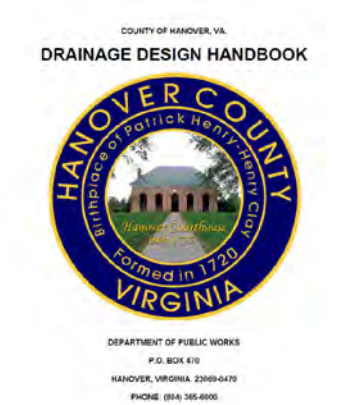
Ordinance 13-16



Drainage Design Handbook Establishes Standards for Design

- **Erosion & Sediment Control**
- **Chesapeake Bay Preservation**
- **Virginia Stormwater Management Program (VSMP)**
- **Construction General Permit VSMP Implementation**
- **Municipal Separate Storm Sewer System (MS4) General Permit (MCMs 4 & 5)**

Drainage Design Handbook Establishes Standards for Design **Summary of Changes**



- Updates references to ordinances
- Updates references to applicable design standards
- Clarify design requirements relating to permissible velocity for open man-made and natural channels
- Updates 'Stormwater Management" section IX to reference the "permissible velocity" approach as the local alternative to "energy balance" approach in the state regulation.

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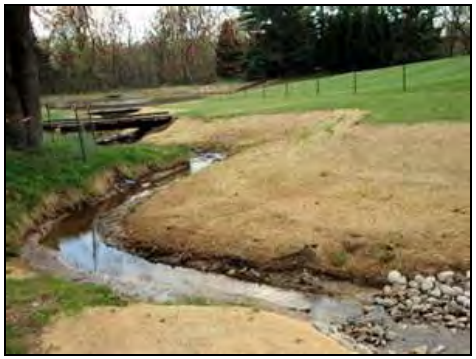
Water Quantity Criteria Changes

Situational Channel Protection Criteria

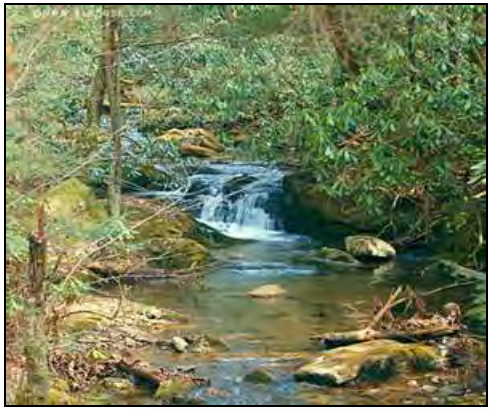
Manmade Stormwater Conveyance *Systems*

(2-yr, 24-hr storm)



Restored Stormwater Conveyance *Systems*

(1-yr, 24-hr storm)



Natural Stormwater Conveyance *Systems*

Proposing alternate criteria "Permissible Velocity"

in accordance with 9 VAC25-870-66.Bb

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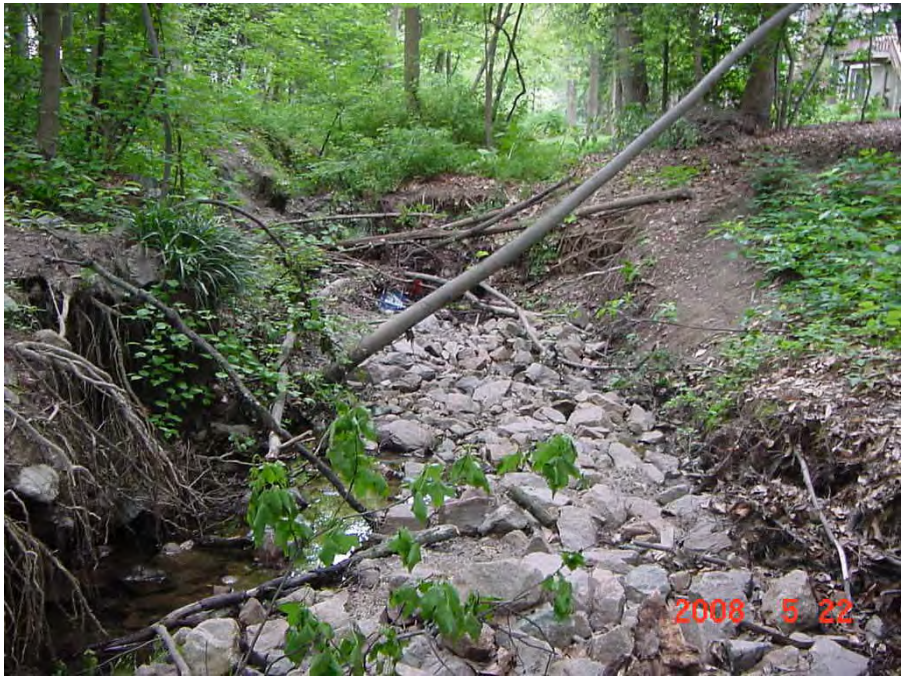
Goal to minimize design and construction cost and protect our natural and man-made channel systems.



Proposing an Alternative Stream Channel Design Criteria

Regulatory Criteria:

Equation 1 Energy Balance from the VSMP Permit Regulations (9VAC25-870-66)

$$Q_{Developed} \leq I.F. \times \frac{Q_{Pre-Developed} \times RV_{Pre-Developed}}{RV_{Developed}}$$

Under no condition shall $Q_{Developed}$ be greater than $Q_{Pre-Developed}$ nor shall $Q_{Developed}$ be required to be less than that calculated in the equation:

$$\frac{Q_{Forest} \times RV_{Forest}}{RV_{Developed}}$$

where:

I.F. (Improvement Factor) = 0.8 for sites > 1 acre or 0.9 for sites ≤ 1 acre
$Q_{Developed}$ = allowable peak flow rate of runoff from the developed site
$RV_{Developed}$ = volume of runoff from the site in the developed condition
$Q_{Pre-Developed}$ = peak flow rate of runoff from the site in the pre-developed condition
$RV_{Pre-Developed}$ = volume of runoff from the site in pre-developed condition
Q_{Forest} = peak flow rate of runoff from the site in a forested condition
RV_{Forest} = volume of runoff from the site in a forested condition

Permissible Velocity Overview:

Maximum Permissible Water Velocities as a Function of Soil Type based on the AASHTO Classification:

ASSHTO Classification	ASSHTO Soil Description	Fortier and Scobey Soil Description	Maximum Water Velocity (ft/s)
	BROKEN ROCK and COBBLES	Cobbles and Shingles	5.5
A-1-a	Stone fragments or **GRAVEL**, with or without well-graded 1 binder2	Coarse gravel, non-colloidal	4.5
A-1-a	Stone fragments or **GRAVEL**, with or without well-graded 1 binder2	Fine gravel	3.5
A-1-b	Coarse **SAND**, with or without well-graded 1 binder2	Graded loam to cobbles when non-colloidal	4.0
A-2 (A-2-4. A-2-5. A-2-6, A-2-7)	Mixture of **GRAVEL** and **SAND**, with silty or clay fines3, or nonplastic silt fines	Graded silts to cobbles when colloidal	4.5
A-2 (A-2-4. A-2-5. A-2-6, A-2-7)	Mixture of **GRAVEL** and **SAND**, with silty or clay fines3, or nonplastic silt fines	Sandy loam, non-colloidal	2.0
A-3	Fine **SAND**, without silty clay fines; e.g. beach sand or stream-deposited fine sand	Fine Sand, non-colloidal	1.5
A-3	Fine **SAND**, without silty clay fines; e.g. beach sand or stream-deposited fine sand	Silt loam, non-colloidal	2.3

1 and 2-year storms are different:

Table 5 24-Hour Precipitation for Hanover County, Virginia
(Virginia NRCS, 210-VI-EFH, Part 650, January 2008)

Return Event	Precipitation (inches)	Distribution
1-year	2.71	Type II
2-year	3.28	Type II

Example channels – different types:

Table 4 Receiving Channel Summary

Channel ID	Fortier and Scobey Description	AASHTO Classification	USCS Classification	Permissible Velocity (fps)
I	Sandy loam, non-colloidal	A2	SM	2.00
II	Graded loam to cobbles, non-colloidal	A1-b	SW	4.00

Study Conditions:

Table 6 Pre-Developed Hydrologic Input Summary

Condition ID	Land Cover	% Impervious	Area (acres)	Soil HSG	CN	Tc (hours)
A	Woods good	0	30	C	70	0.6
B	Row crops good (SR+CR)	0	30	C	84	0.5
C	Residential district (2 acres)	12	30	C	77	0.5
D	Residential district (1 acres)	20	30	C	79	0.5
E	Residential district (1/4 acres)	38	30	C	83	0.4
F	Townhouses (1/8 acres)	65	30	C	90	0.3
G	Commercial and business	85	30	C	94	0.2

Table 7 Developed Hydrologic Input Summary

Condition ID	Land Cover	% Impervious	Area (acres)	Soil HSG	CN	Tc (hours)
1	Residential district (1 acres)	20	30	C	79	0.5
2	Residential district (1/4 acres)	38	30	C	83	0.4
3	Townhouses (1/8 acres)	65	30	C	90	0.3
4	Commercial and business	85	30	C	94	0.2

Portion of: (WEG report)

Table 13 Routed Detention Basin Summary – Receiving Stream I (permissible velocity = 2.00 fps)

Scenario	Permissible Velocity				Energy Balance			
	$Q_{1\text{-Year}}$ (cfs)	$V_{1\text{-Year}}$ (ac-ft)	$Q_{2\text{-Year}}$ (cfs)	$V_{2\text{-Year}}$ (ac-ft)	$Q_{1\text{-Year}}$ (cfs)	$V_{1\text{-Year}}$ (ac-ft)	$Q_{2\text{-Year}}$ (cfs)	$V_{2\text{-Year}}$ (ac-ft)
A1	5.02	1.018	8.52	1.448	5.57	0.983	9.43	1.396
A2	5.28	1.438	8.52	1.979	4.56	1.492	7.37	2.054
A3	5.76	2.378	8.52	3.088	3.18	2.667	4.69	3.452
A4	6.06	3.071	8.53	3.856	2.62	3.554	3.68	4.454
B1	5.02	1.018	8.52	1.448	24.11	0.00	35.16	0.00
B2	5.28	1.438	8.52	1.979	27.34	0.496	39.79	0.639
B3	5.76	2.378	8.52	3.088	19.32	1.681	27.52	2.127
B4	6.06	3.071	8.53	3.856	16.03	2.482	22.11	3.075
C1	5.02	1.018	8.52	1.448	14.95	0.544	23.72	0.740
C2	5.28	1.438	8.52	1.979	11.97	1.090	18.79	1.472
C3	5.76	2.378	8.52	3.088	8.49	2.197	12.48	2.839
C4	6.06	3.071	8.53	3.856	7.02	2.995	9.87	3.758
D2	5.28	1.438	8.52	1.979	15.47	0.947	23.91	1.265
D3	5.76	2.378	8.52	3.088	10.93	2.062	15.94	2.652
D4	6.06	3.071	8.53	3.856	9.07	2.854	12.69	3.570
E3	5.76	2.378	8.52	3.088	19.69	1.666	27.99	2.106
E4	6.06	3.071	8.53	3.856	16.26	2.471	22.41	3.061
F4	6.06	3.071	8.53	3.856	37.89	1.651	50.43	1.999
G4	6.06	3.071	8.53	3.856	62.43	0.859	79.97	1.014

Portion of: (WEG report)

Table 14 Routed Detention Basin Summary – Receiving Stream II (permissible velocity = 4.00 fps)

	Permissible Velocity				Energy Balance			
Scenario	$Q_{1\text{-Year}}$ (cfs)	$V_{1\text{-Year}}$ (ac-ft)	$Q_{2\text{-Year}}$ (cfs)	$V_{2\text{-Year}}$ (ac-ft)	$Q_{1\text{-Year}}$ (cfs)	$V_{1\text{-Year}}$ (ac-ft)	$Q_{2\text{-Year}}$ (cfs)	$V_{2\text{-Year}}$ (ac-ft)
A1	15.82	0.504	24.93	0.684	5.57	0.983	9.43	1.396
A2	16.20	0.916	24.91	1.221	4.56	1.492	7.37	2.054
A3	17.39	1.756	24.92	2.232	3.18	2.667	4.69	3.452
A4	18.14	2.383	24.91	2.944	2.62	3.554	3.68	4.454
B1	15.82	0.504	24.93	0.684	24.11	0.00	35.16	0.00
B2	16.20	0.916	24.91	1.221	27.34	0.496	39.79	0.639
B3	17.39	1.756	24.92	2.232	19.32	1.681	27.52	2.127
B4	18.14	2.383	24.91	2.944	16.03	2.482	22.11	3.075
C1	15.82	0.504	24.93	0.684	14.95	0.544	23.72	0.740
C2	16.20	0.916	24.91	1.221	11.97	1.090	18.79	1.472
C3	17.39	1.756	24.92	2.232	8.49	2.197	12.48	2.839
C4	18.14	2.383	24.91	2.944	7.02	2.995	9.87	3.758
D2	16.20	0.916	24.91	1.221	15.47	0.947	23.91	1.265
D3	17.39	1.756	24.92	2.232	10.93	2.062	15.94	2.652
D4	18.14	2.383	24.91	2.944	9.07	2.854	12.69	3.570
E3	17.39	1.756	24.92	2.232	19.69	1.666	27.99	2.106
E4	18.14	2.383	24.91	2.944	16.26	2.471	22.41	3.061
F4	18.14	2.383	24.91	2.944	37.89	1.651	50.43	1.999
G4	18.14	2.383	24.91	2.944	62.43	0.859	79.97	1.014

Summary

- Permissible Velocity approach focuses more on the channel characteristics and does not require over design or under design.
- Permissible Velocity approach should generally result in overall less cost but will be site and condition specific. (*forested sites*)
- Permissible Velocity approach is more protective for the "*community*" and lowers the chance of problems that will have to be addressed through other mandates such as MS4, maintenance and other related problems.

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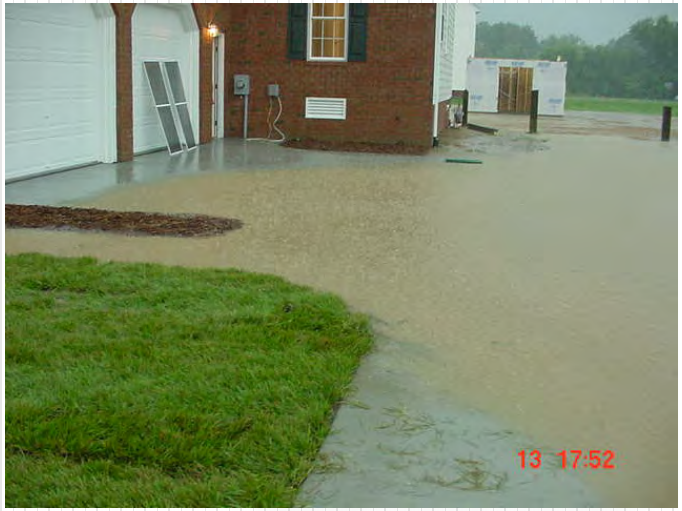
Note: VSMP Program Application

- Will continue to maintain existing alternate criteria for flooding as defined by the Handbook (Grandfathered).
- No automatic 10 year peak attenuation.
- Evaluate flooding for 100 year storm.



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Requested Action:

Motion to advertise a public hearing – Ordinance 13-16 – Amendments to the Hanover County Drainage Design Handbook, February 12, 2014 at 7:00 p.m.

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