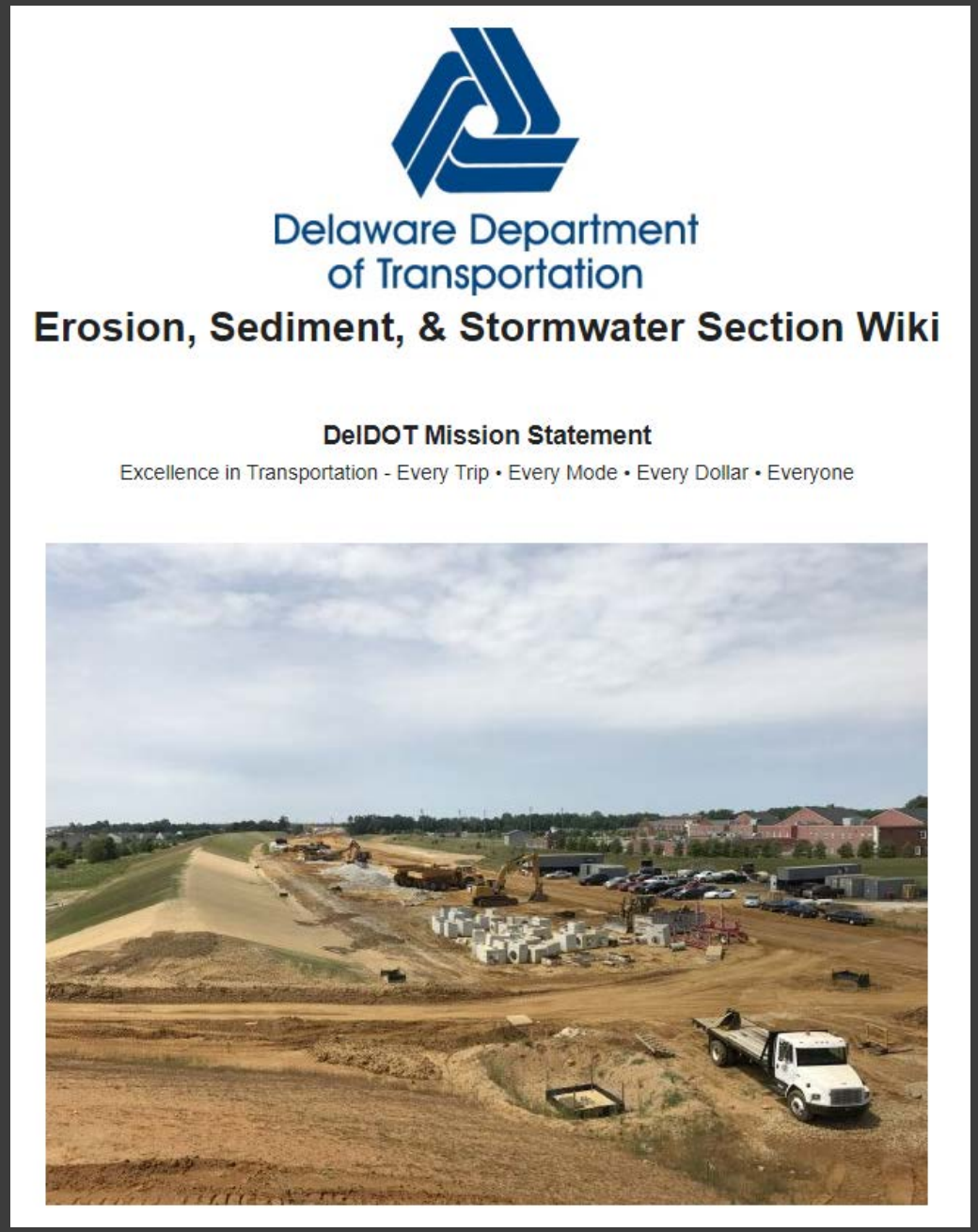
DelDOT ES_2M Wiki Page

https://es2mdesignguide.deldot.gov/index.php/Main_Page



Main Headings

E & S Design Guide

Erosion and Sediment Control Design Guide

$$\tau = \gamma \times d \times S$$

τ = Shear Stress (lb/ft^2)

γ = unit weight of water (assume 62.4 lb/ft^3)

d = depth of flow (ft)

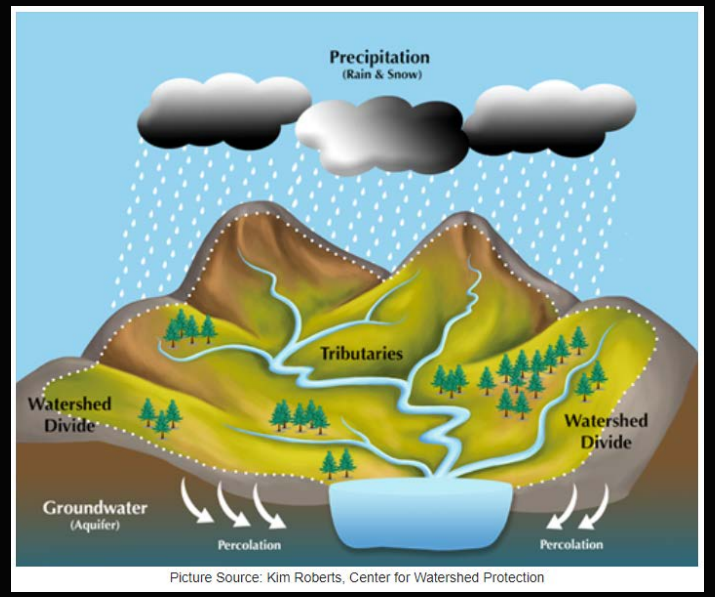
S = energy gradient (ft/ft)

SLOPE	STEEPNESS	MAXIMUM SLOPE LENGTH		
		SF	RSF	SSF
S < 33%	S < 3:1	L <= 75'	75' < L <= 150'	L > 150'
33% <= S < 50%	3:1 <= S < 2:1	L <= 50'	50' < L <= 100'	L > 100'
S >= 50%	S >= 2:1	N/A	L <= 50'	L> 50'

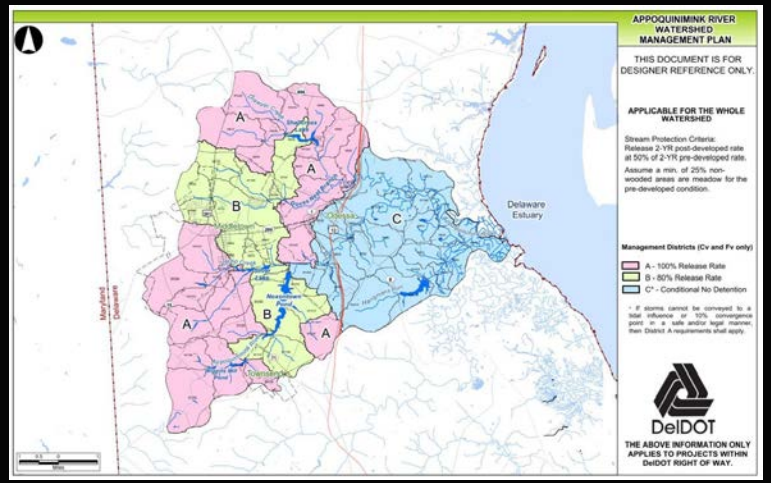
- Project Level DURMM
  - Currently being developed
  - Will be an explanation along with an example problem

- Hydraulics
  - Hydraulic Review and Basic Pipe Sizing Design Aid
    - Useful for a quick review of a drainage system as well as pipe sizing for something like a driveway culvert

- Hydrology
  - Watershed Delineation & Runoff Analysis
    - Explanation and example problem
  - Cv & Fv Compliance



Picture Source: Kim Roberts, Center for Watershed Protection



- Channel Lining Selection Chart
  - Easy chart for referencing which type of blanket to use
  - Will probably revisit the riprap selection in the future to consider some non-riprap options

- Pipe Outfall Design & Scour Protection
  - This is for pipe outfalls only
    - 3 options proposed
      - Non-riprap
      - Riprap apron
      - Riprap Basin / Energy Dissipator

Channel Lining Selection Chart
(As per calculated Shear Stress Values)

Erosion Control Blanket
Turf Reinforcement Mat, Type 1
Turf Reinforcement Mat, Type 2
Riprap

Depth (ft) \ Slope (ft/ft)	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.012	0.014	0.016	0.018	0.020	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065
0.1	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.06	0.07	0.09	0.10	0.11	0.12	0.16	0.19	0.22	0.25	0.28	0.31	0.34	0.37	0.41
0.3	0.02	0.04	0.06	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.26	0.30	0.34	0.37	0.47	0.56	0.66	0.75	0.84	0.94	1.03	1.12	1.22
0.5	0.03	0.06	0.09	0.12	0.16	0.19	0.22	0.25	0.28	0.31	0.37	0.44	0.50	0.56	0.62	0.78	0.94	1.09	1.25	1.40	1.56	1.72	1.87	2.03
0.7	0.04	0.09	0.13	0.17	0.22	0.26	0.31	0.35	0.39	0.44	0.52	0.61	0.70	0.79	0.87	1.09	1.31	1.53	1.75	1.97	2.18	2.40	2.62	2.84
1	0.06	0.12	0.19	0.25	0.31	0.37	0.44	0.50	0.56	0.62	0.75	0.87	1.00	1.12	1.25	1.56	1.87	2.18	2.50	2.81	3.12	3.43	3.74	4.06
1.2	0.07	0.15	0.22	0.30	0.37	0.45	0.52	0.60	0.67	0.75	0.90	1.05	1.20	1.35	1.50	1.87	2.25	2.62	3.00	3.37	3.74	4.12	4.49	4.87
1.4	0.09	0.17	0.26	0.35	0.44	0.52	0.61	0.70	0.79	0.87	1.05	1.22	1.40	1.57	1.75	2.18	2.62	3.06	3.49	3.93	4.37	4.80	5.24	5.68
1.6	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.20	1.40	1.60	1.80	2.00	2.50	3.00	3.49	3.99	4.49	4.99	5.49	5.99	6.49
1.8	0.11	0.22	0.34	0.45	0.56	0.67	0.79	0.90	1.01	1.12	1.35	1.57	1.80	2.02	2.25	2.81	3.37	3.93	4.49	5.05	5.62	6.18	6.74	7.30
2	0.12	0.25	0.37	0.50	0.62	0.75	0.87	1.00	1.12	1.25	1.50	1.75	2.00	2.25	2.50	3.12	3.74	4.37	4.99	5.62	6.24	6.86	7.49	8.11
2.2	0.14	0.27	0.41	0.55	0.69	0.82	0.96	1.10	1.24	1.37	1.65	1.92	2.20	2.47	2.75	3.43	4.12	4.80	5.49	6.18	6.86	7.55	8.24	8.92
2.4	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.10	2.40	2.70	3.00	3.74	4.49	5.24	5.99	6.74	7.49	8.24	8.99	9.73
2.6	0.16	0.32	0.49	0.65	0.81	0.97	1.14	1.30	1.46	1.62	1.95	2.27	2.60	2.92	3.24	4.06	4.87	5.68	6.49	7.30	8.11	8.92	9.73	10.55
2.8	0.17	0.35	0.52	0.70	0.87	1.05	1.22	1.40	1.57	1.75	2.10	2.45	2.80	3.14	3.49	4.37	5.24	6.12	6.99	7.86	8.74	9.61	10.48	11.36
3	0.19	0.37	0.56	0.75	0.94	1.12	1.31	1.50	1.68	1.87	2.25	2.62	3.00	3.37	3.74	4.68	5.62	6.55	7.49	8.42	9.36	10.30	11.23	12.17
3.2	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00	2.40	2.80	3.19	3.59	3.99	4.99	5.99	6.99	7.99	8.99	9.98	10.98	11.98	12.98
3.4	0.21	0.42	0.64	0.85	1.06	1.27	1.49	1.70	1.91	2.12	2.55	2.97	3.39	3.82	4.24	5.30	6.36	7.43	8.49	9.55	10.61	11.67	12.73	13.79
3.6	0.22	0.45	0.67	0.90	1.12	1.35	1.57	1.80	2.02	2.25	2.70	3.14	3.59	4.04	4.49	5.62	6.74	7.86	8.99	10.11	11.23	12.36	13.48	14.60
3.8	0.24	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.13	2.37	2.85	3.32	3.79	4.27	4.74	5.93	7.11	8.30	9.48	10.67	11.86	13.04	14.23	15.41
4	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.00	3.49	3.99	4.49	4.99	6.24	7.49	8.74	9.98	11.23	12.48	13.73	14.98	16.22
4.2	0.26	0.52	0.79	1.05	1.31	1.57	1.83	2.10	2.36	2.62	3.14	3.67	4.19	4.72	5.24	6.55	7.86	9.17	10.48	11.79	13.10	14.41	15.72	17.04
4.4	0.27	0.55	0.82	1.10	1.37	1.65	1.92	2.20	2.47	2.75	3.29	3.84	4.39	4.94	5.49	6.86	8.24	9.61	10.98	12.36	13.73	15.10	16.47	17.85
4.6	0.29	0.57	0.86	1.15	1.44	1.72	2.01	2.30	2.58	2.87	3.44	4.02	4.59	5.17	5.74	7.18	8.61	10.05	11.48	12.92	14.35	15.79	17.22	18.66
4.8	0.30	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.59	4.19	4.79	5.39	5.99	7.49	8.99	10.48	11.98	13.48	14.98	16.47	17.97	19.47
5	0.31	0.62	0.94	1.25	1.56	1.87	2.18	2.50	2.81	3.12	3.74	4.37	4.99	5.62	6.24	7.80	9.36	10.92	12.48	14.04	15.60	17.16	18.72	20.28
5.5	0.34	0.69	1.03	1.37	1.72	2.06	2.40	2.75	3.09	3.43	4.12	4.80	5.49	6.18	6.86	8.58	10.30	12.01	13.73	15.44	17.16	18.88	20.59	22.31
6	0.37	0.75	1.12	1.50	1.87	2.25	2.62	3.00	3.37	3.74	4.49	5.24	5.99	6.74	7.49	9.36	11.23	13.10	14.98	16.85	18.72	20.59	22.46	24.34
6.5	0.41	0.81	1.22	1.62	2.03	2.43	2.84	3.24	3.65	4.06	4.87	5.68	6.49	7.30	8.11	10.14	12.17	14.20	16.22	18.25	20.28	22.31	24.34	26.36
7	0.44	0.87	1.31	1.75	2.18	2.62	3.06	3.49	3.93	4.37	5.24	6.12	6.99	7.86	8.74	10.92	13.10	15.29	17.47	19.66	21.84	24.02	26.21	28.39

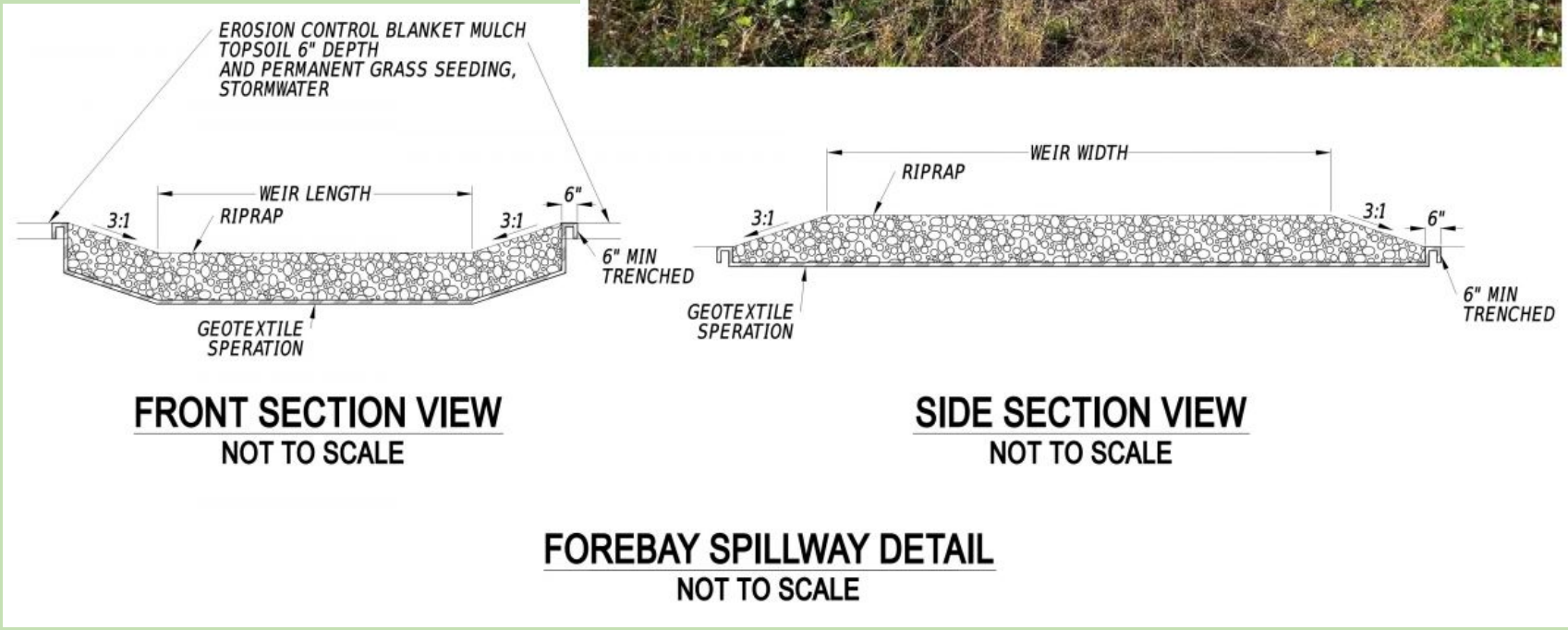
$\tau = \gamma S_o d$

(As Per HEC -15, Chapter 2)

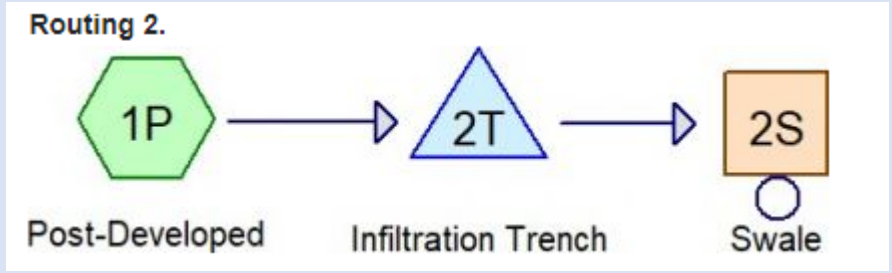
$\tau = 62.4$ lb/ft3 * Slope (ft/ft) * Depth of Design Storm (ft)

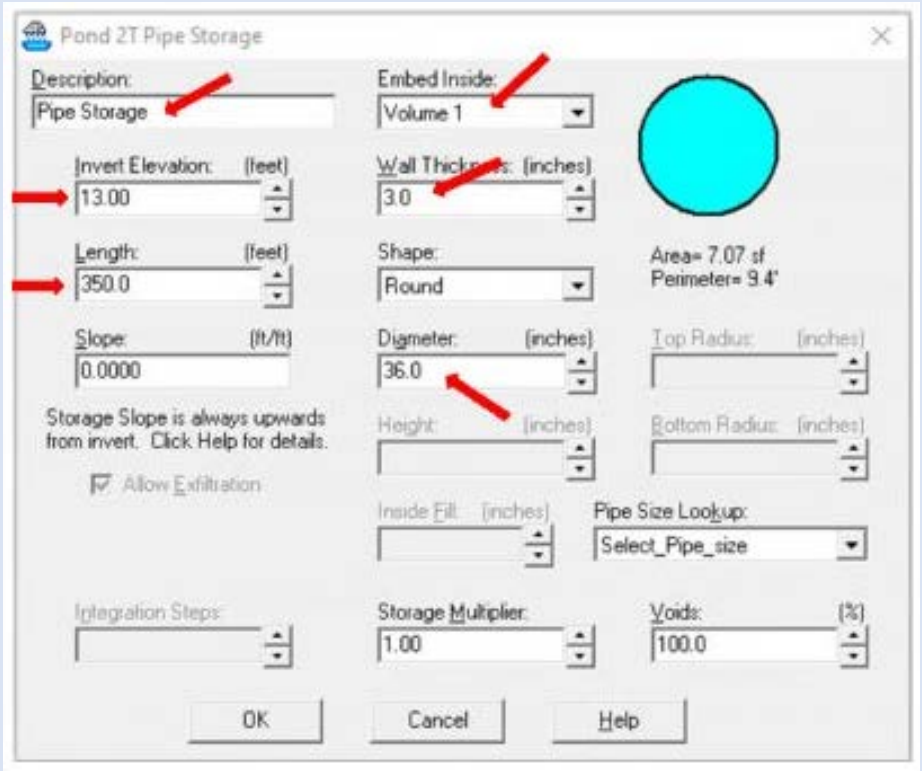
- Model SWM Plan Sheets
  - Link to DRC
  - Forebay Spillway Detail

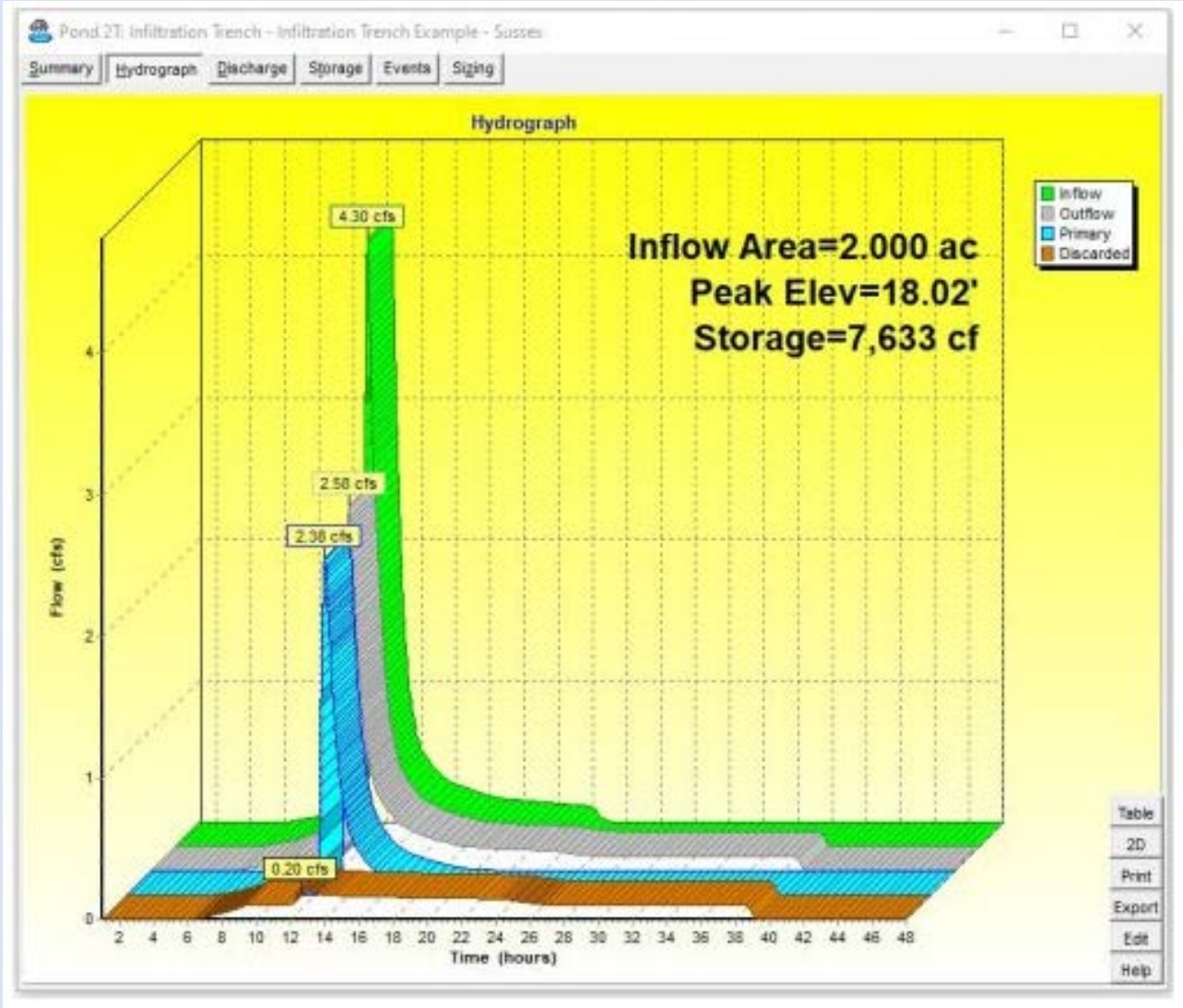
- SWM Facility Sequence of Construction
  - These are only guides
    - 5 facility sequences
      - Wet Pond
      - Dry Pond
      - Infiltration Basin
      - Bioretention
      - Infiltration Trench



- SWM Facility Design Guidance
  - 3 facilities currently shown
    - Infiltration Trench
    - Wet Pond
    - Bioretention
  - More to be added later
    - Bioswale
    - Infiltration Basin

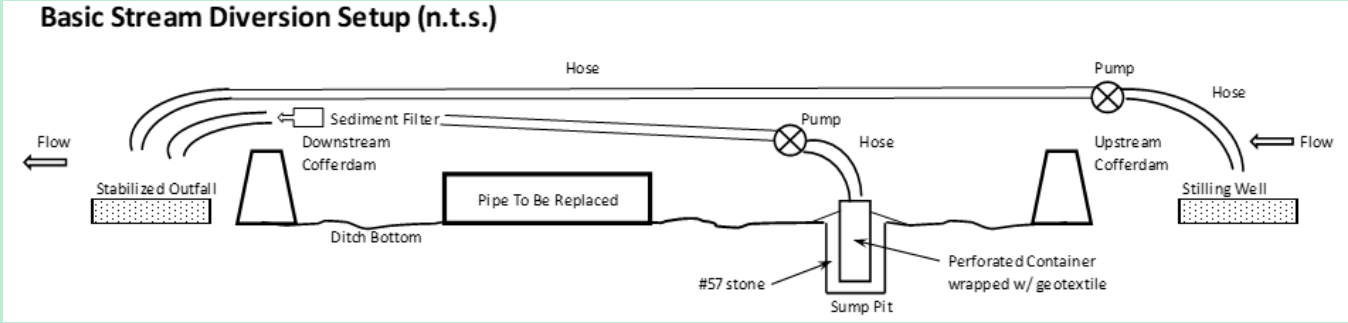


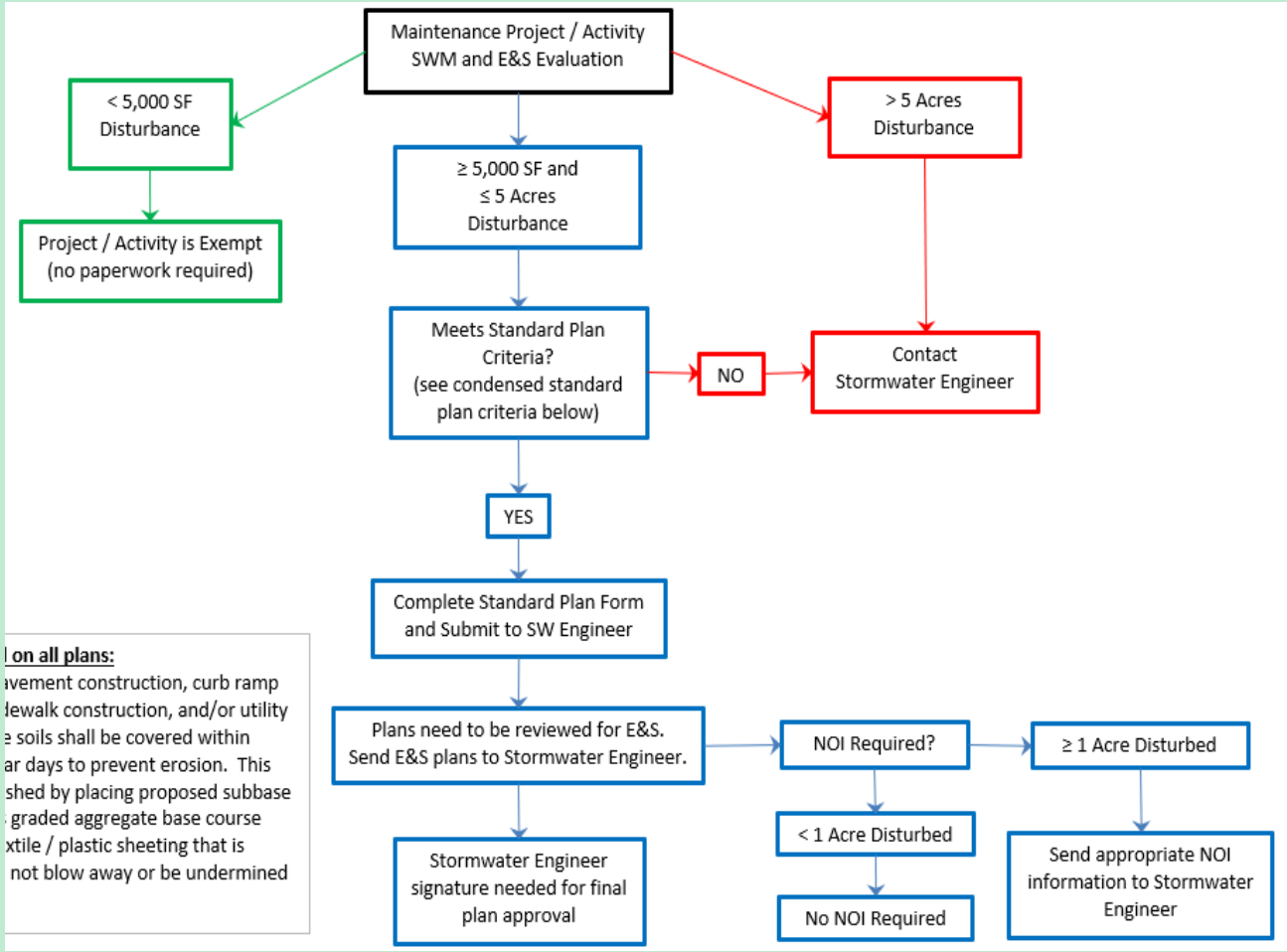




- SWM Facility Number Request
  - Downloadable form to fill out
- SWM Report Format
  - Lays out everything needed for a SWM Report submittal
- Standard Plan Documentation
  - Standard Plan v Detailed Plan
  - Downloadable forms for typical standard plans
    - Minor Bridge and Culvert
    - Sidewalk/Linear Impervious
    - BMP Construction/Retrofit
    - Demolition

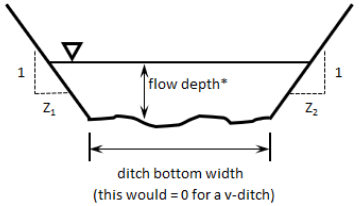
- DelDOT Maintenance Only
  - SWM involvement flow chart
  - Stream diversion guidance
  - Program to calculate flow
    - Stream/Ditch Flow
    - Pipe Flow
    - Slope determination
    - Pumps





Stream/Ditch Measurements (for any questions, please contact the Stormwater Section)

For trapezoidal or v-ditches



Z_1 and Z_2 are the side slope values. Most times, these values will be equal, but not always.
So, a 3:1 side slope (Z = 3) would be for every 1' vertical, it would take 3' horizontal to get back to the slope.

Slope. This would be better ascertained from a USGS map or online lidar, but it is possible to rough calculate this number from field measurements. Refer to the 'Slope Determination' tab below for different options.

ESTIMATED FLOW CALCULATION: (fill in highlighted blocks only)

Bottom Width = 2 ft — Z_1 = 3, Z_2 = 3

Flow Depth = 5 in — Manning's Number = 0.023 (pick from list below)

Slope = 0.002 ft/ft

Flow Rate = 2.0 cfs 911 gpm

*For a trapezoid ditch, the flow depth measurement is the average depth. Most stream bottoms are not perfectly flat; hence, multiple depth measurements may need to be taken. For example, if measured four depths of 9", 11", 10" and 10.5", you can either calculate a mean value or just pick 10".

*For a v-ditch, use a maximum depth, which should be in the middle.

- Future additions forthcoming
  - SWM facility design tables
  - Downstream analysis example (beat the peak)
  - More Cv & Fv compliance documentation
  - Explanation of different options for the Runoff, Reach Routing, and Pond Routing methods in HydroCAD
  - Drainage Manual
  - Any specific requests concerning SWM, E&S, or Drainage