Completing the Erosion Potential Analysis Form

Luzerne County MECC Workshop
11/20/26

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Learning Goals

- Recognize when an Erosion Potential (EP) Analysis is required and when it is not required
- Know what is required to be submitted for an EP Analysis
- Understand how to complete the EP Analysis Form

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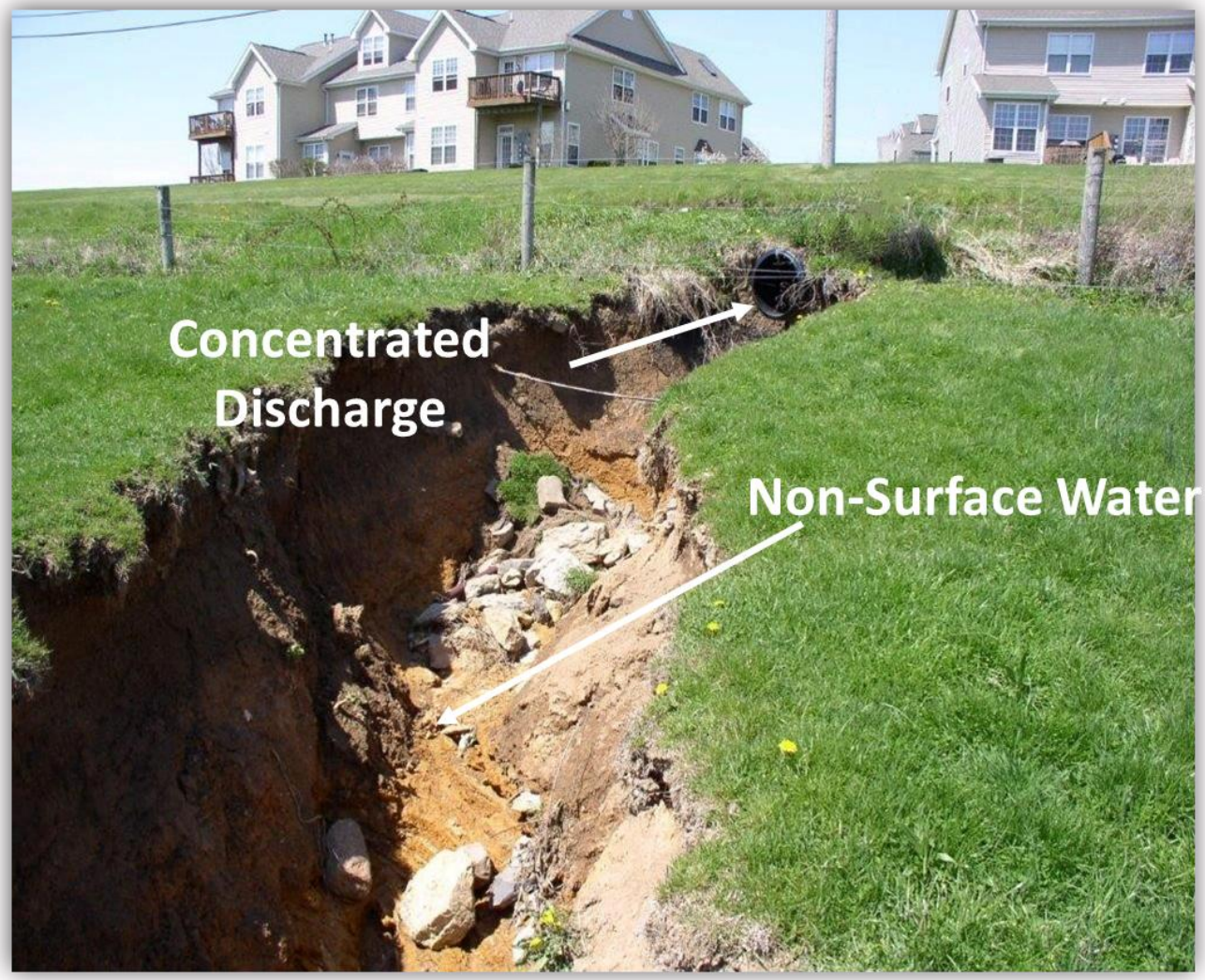
Purpose

- Prevent these situations
- Ensure existing flow paths will remain stable during and after construction



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What is an EP Analysis



Evaluation of the overland flow path during a 10-year/24-hour event from a discharge point (DP) to a surface water or storm sewer

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What is a Discharge Point vs a Point of Analysis?

- Discharge Point (DP):
  - Origin of concentrated flows during and following construction
  - Where there will be no concentrated flows during or following construction (e.g., site restoration) a DP should be identified for each surface water receiving discharges
- Point of Analysis (POA):
  - Location on project site boundary or surface water that is used for the pre- to post-construction stormwater analysis
  - Typically established by evaluating post-construction drainage areas and superimposing pre-construction land covers so the net change can be calculated.

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When is an EP Analysis Required



Required for concentrated flows that do not discharge directly to a surface water or storm sewer

Surface waters include:

- Perennial streams
- Intermittent streams
- Wetlands

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When is an EP Analysis Required



- A level spreader designed to produce shallow concentrated flow immediately below the level spreader
- Shallow concentrated flow depth is between 0.10 foot and 0.50 foot

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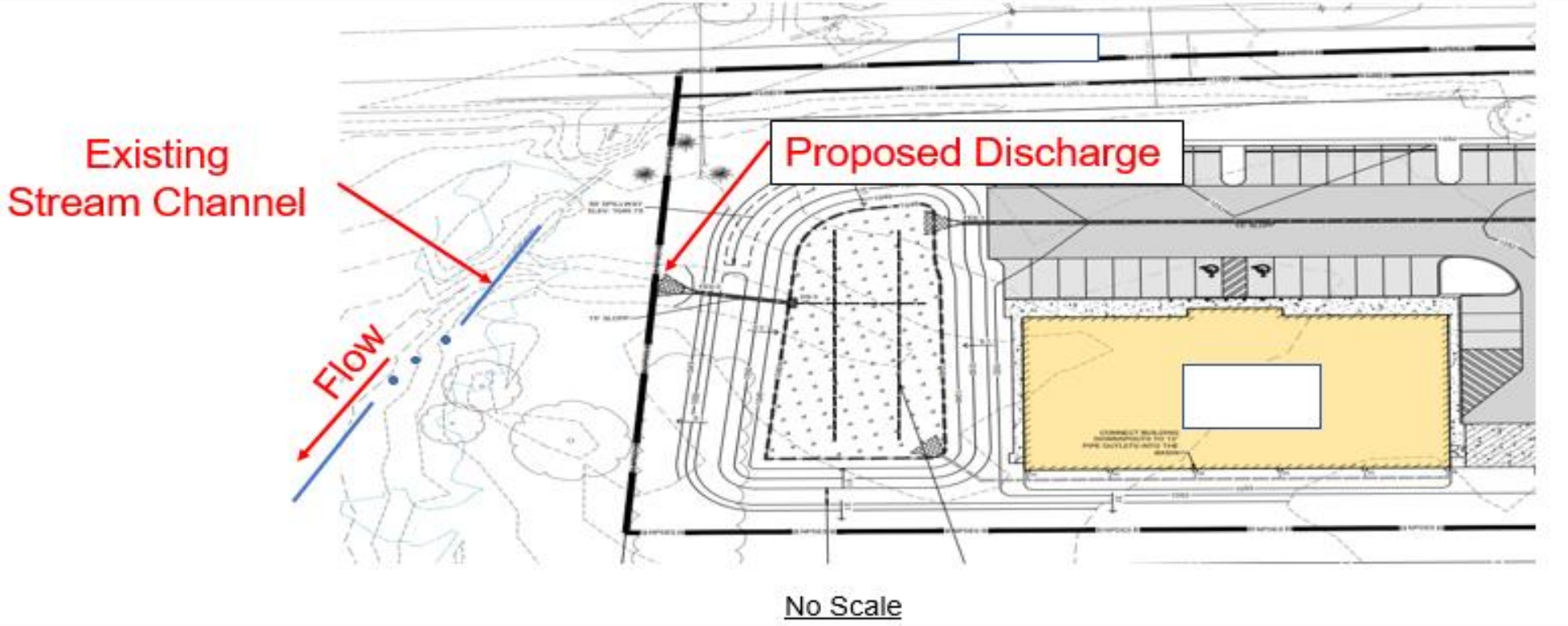
Would this proposed discharge require an EP analysis?



YES, and EP analysis would be required since the proposed discharge will not discharge directly to the surface water.

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When is an EP Analysis NOT Required



- A new channel will be designed and constructed to convey runoff in accordance with DEP's E&S Manual. If segments of the flow path will be partially improved, the segments of the flow path that will not be improved will need an EP Analysis.
- The permit application or NOI instructions do not require an EP Analysis

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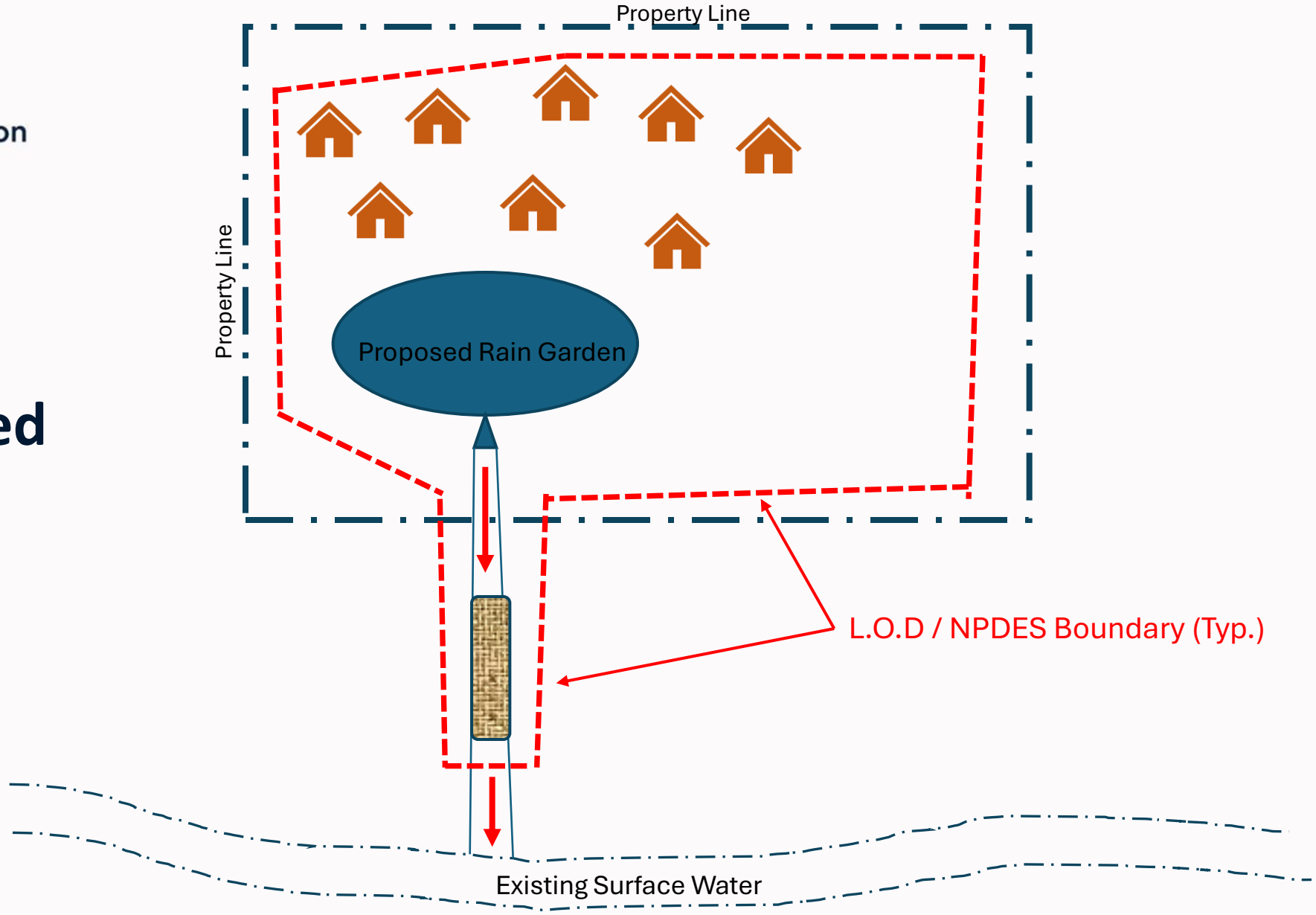
New Channel

Partially Improved Flow Path



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When is an EP Analysis NOT Required



- Level spreader designed to produce sheet flow immediately below the spreader
- Sheet flow depth is < 0.10 foot

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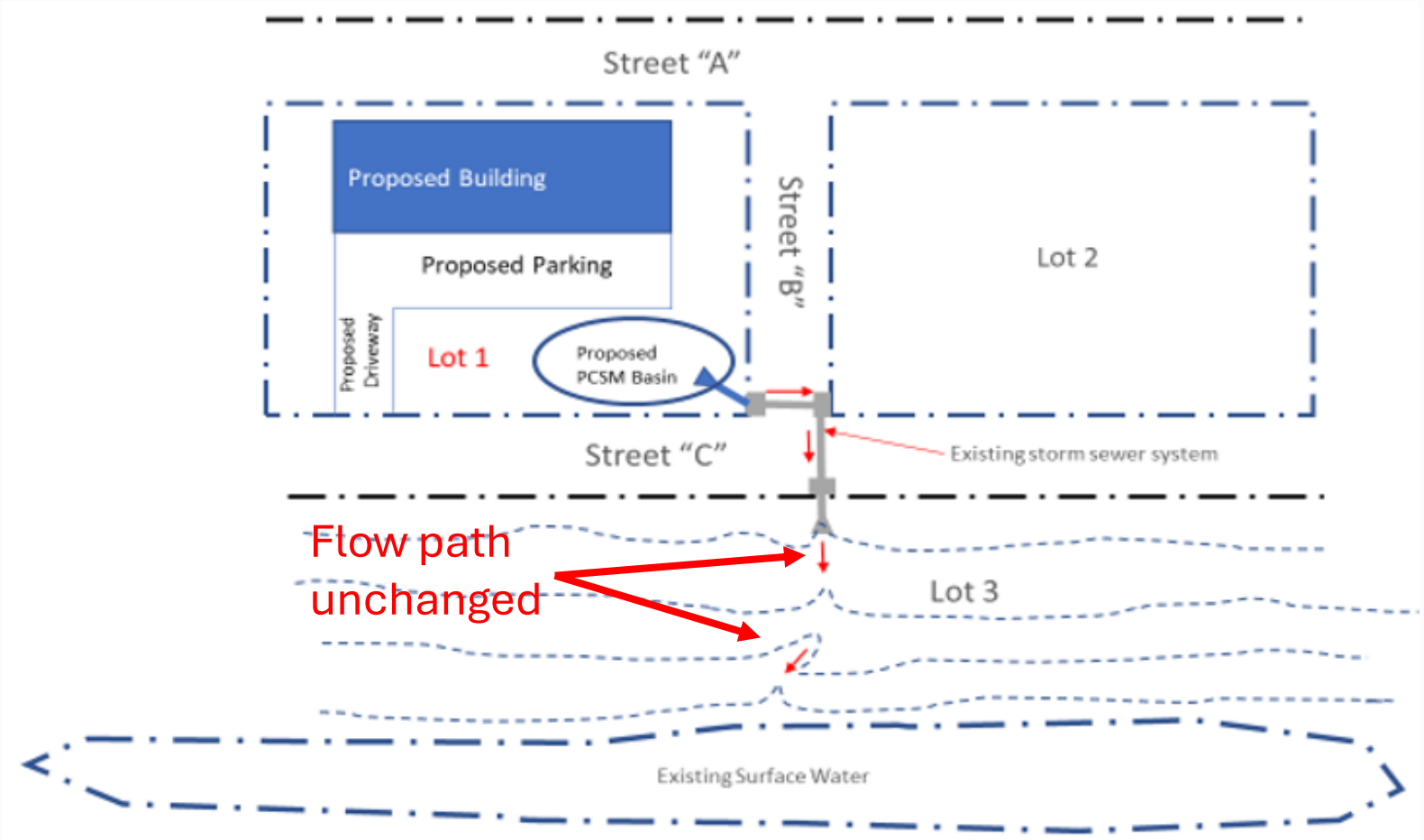
When is an EP Analysis NOT Required



The flow path characteristics will not change as a result of construction and calculations are provided to demonstrate that the 10-year/24-hour storm discharge rate will not increase.

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Stable Flow Path



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Unstable Flow Path



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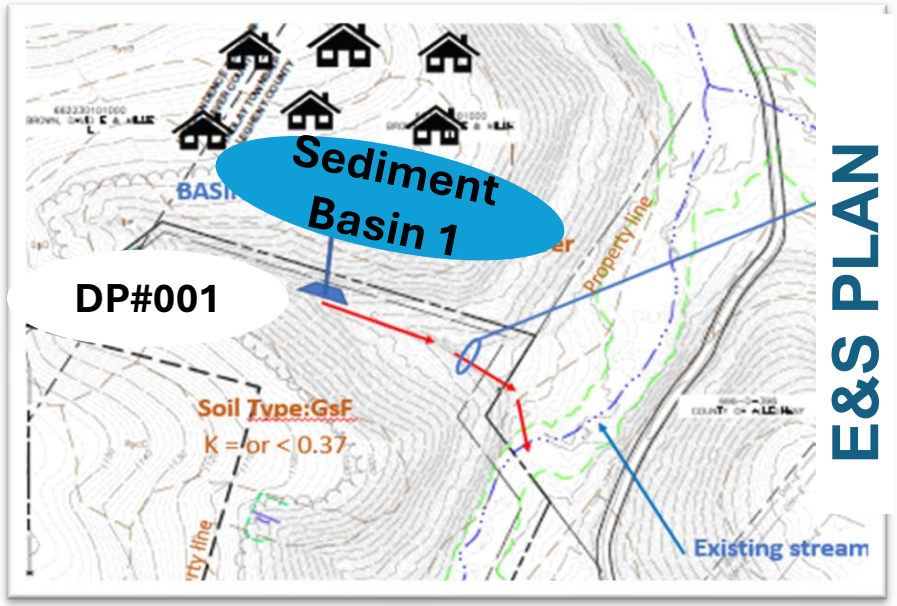
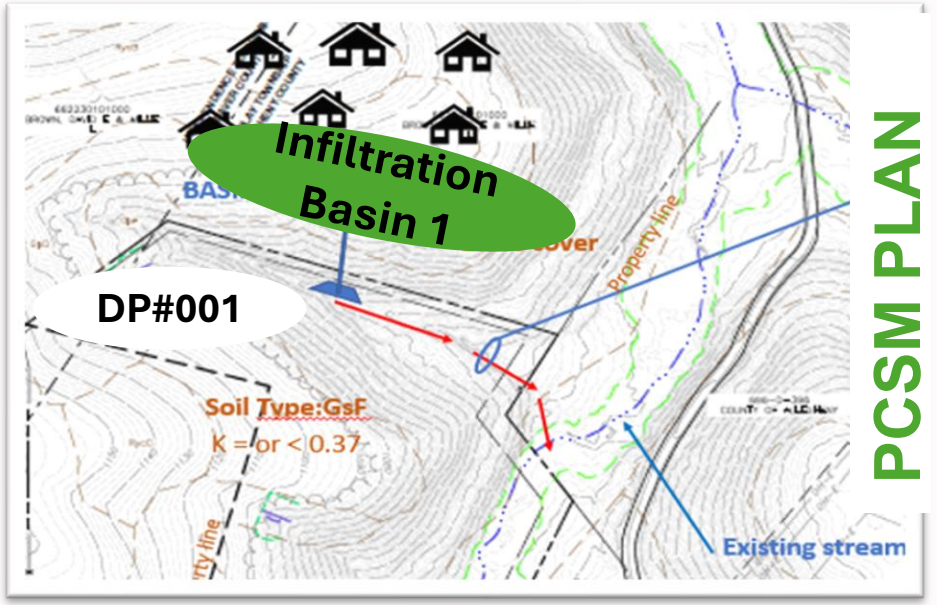
Completing the Form

Erosion Potential (EP) Analysis For Chapter 102 Permits

Applicant Name: _____ Project Site Name: _____

Discharge Point (DP) ID: 001 ☒ **During Construction** ☐ **Following Construction**





Determine maximum flow condition for the 10-year/24-hour storm

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Completing the Form

- [x] An EP Analysis is not required because:
  - [ ] Stormwater discharges will be directly to surface waters through an outfall or storm sewer.
  - [ ] A new channel will be designed and constructed to convey runoff in accordance with DEP's E&S Manual.
  - [ ] A level spreader is proposed and calculations are provided to demonstrate sheet flow below the level spreader.
  - [ ] Flow path characteristics will not change and calculations are provided to demonstrate that the 10-year/24-hour storm discharge rate will not increase.

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Conveyance Information

CONVEYANCE INFORMATION

Type of Conveyance:

- ☐ Existing channel/swale or other flow path that will be partially improved
- ☐ Existing channel/swale or other flow path that will not be improved

Distance to Property Boundary: _____ ft

Distance to Surface Water or Storm Sewer: _____ ft

Minimum 15 feet is recommended between a level spreader and property boundary



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Flow Path Information

FLOW PATH INFORMATION

The entire flow path is shown on: ☐ E&S ☐ PCSM Plan Drawings.

Plan Drawing No(s):

Description of land cover of flow path: **Bedrock and cobble**

☐ Photographs of the flow path are attached.







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Critical Section Data

Critical Section Data:

Peak discharge rate at 10-year/24-hour storm *(attach calculations or model output)*: _____ cfs

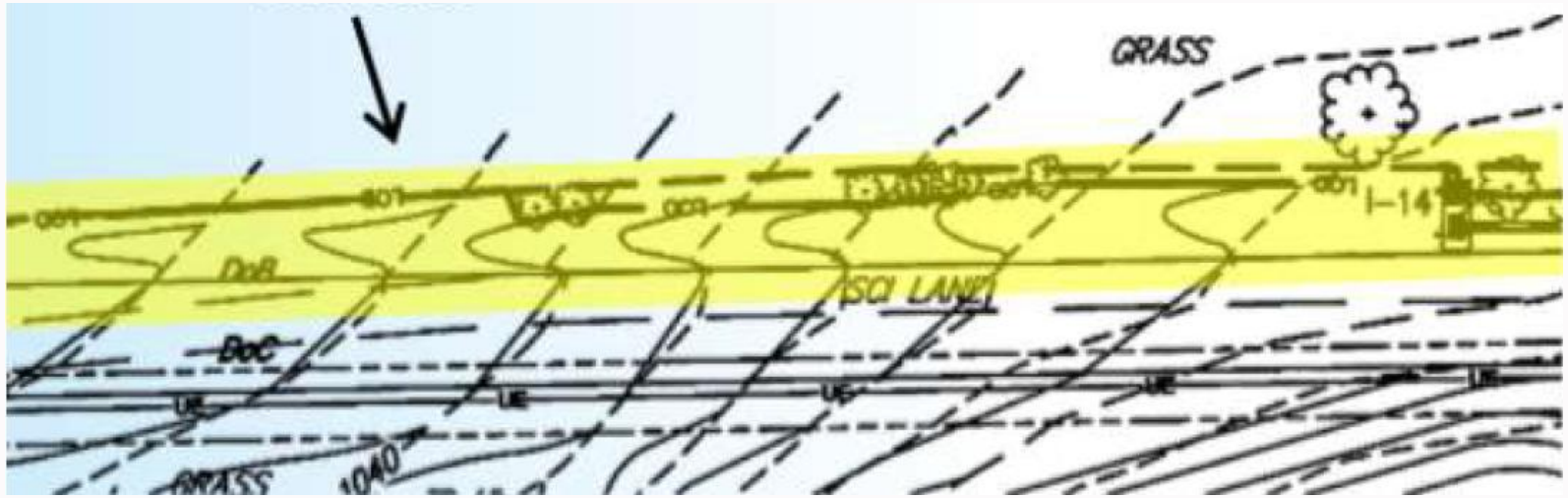
Slope: _____ % Soil type(s): _____ Soil Erodibility (k) factor: _____

Maximum Allowable Velocity: _____ fps Source: _____

Maximum Allowable Shear: _____ psf Source: _____

Calculated Maximum Velocity: _____ fps *(Attach calculations or model output)* **<10% SLOPE**

Calculated Maximum Shear: _____ psf *(Attach calculations or model output)* **ALL**



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Critical Section Data

Source of topographic data for flow path:

☒ The flow path will be improved as described below.

TRM lined channel #10





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Affected Landowners

Affected Landowners:

☒ Stormwater discharges will not flow off-site.

Landowner Name	Address	Phone No.	Email

☒ Landowner consent has been or will be obtained for stormwater discharges.

Landowner consent is not required to obtain permit coverage
but is required prior to discharging

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Signature

Name of Individual Completing Form

Date





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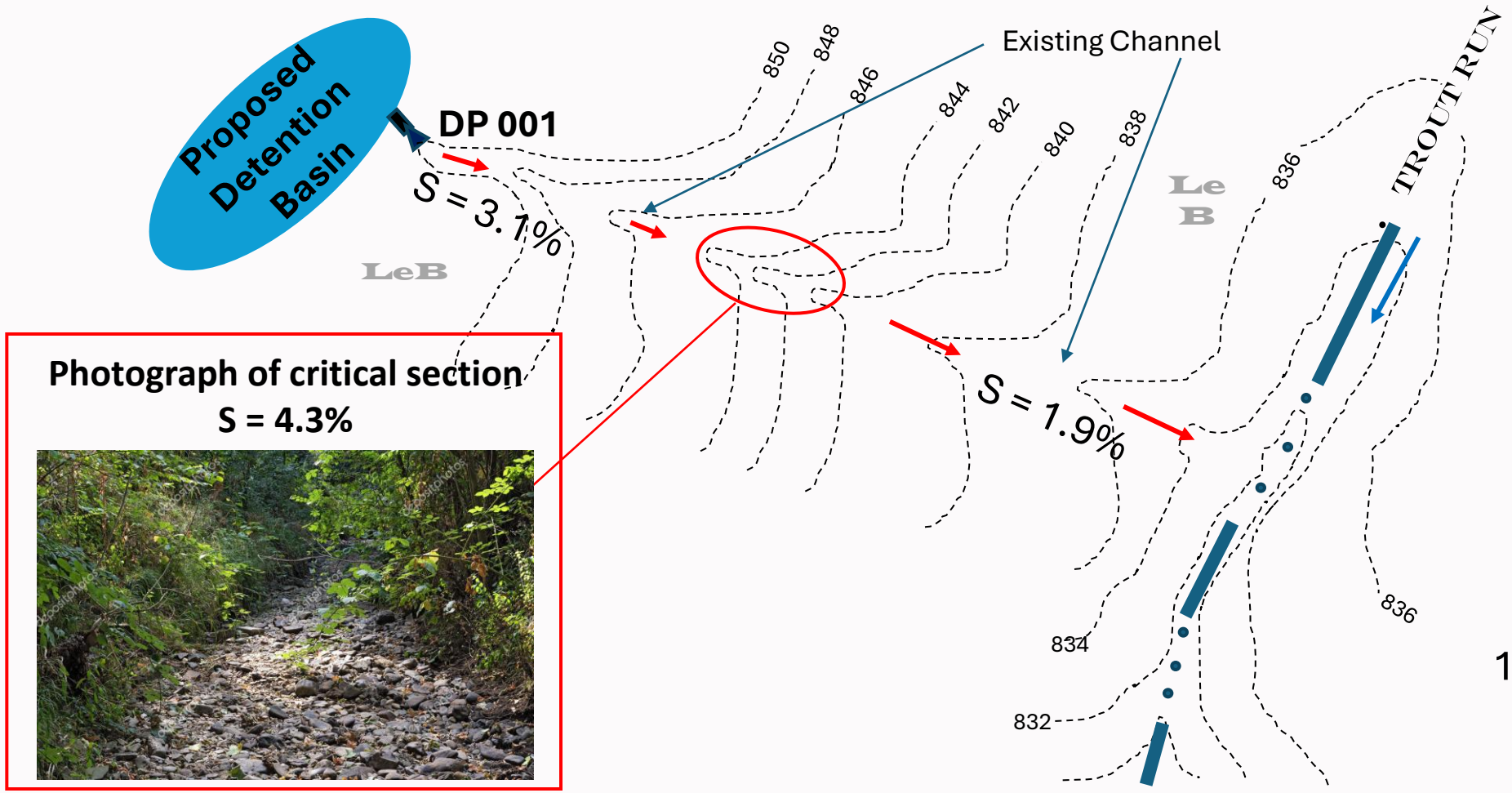
Example: Basin Discharge



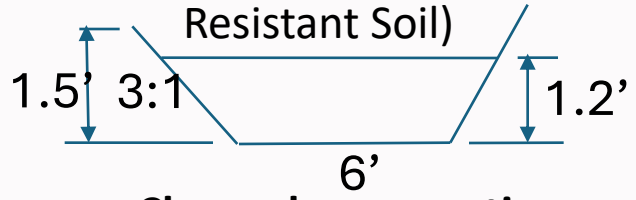
Photograph of critical section
S = 4.3%

Legend

- Flow Path
- Ex. Stream
- Ex. Contour

Soils:

LeB - Leck Kill channery silt loam
K = 0.17 (Erosion Resistant Soil)



Channel cross section

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Example: Basin Discharge

STANDARD E&S WORKSHEET # 11
Channel Design Data

PROJECT NAME: Downstream discharge Analysis
LOCATION:
PREPARED BY: DATE:
CHECKED BY: DATE:

CHANNEL OR CHANNEL SECTION		Exist'g				
TEMPORARY OR PERMANENT?	(T OR P)	P				
DESIGN STORM	(2, 5, OR 10 YR)	10 YR				
ACRES	(AC)	18.50				
MULTIPLIER	(1.6, 2.25, or 2.75)[1]	----				
Q_w (REQUIRED CAPACITY)	(CFS)	67.5				
Q (CALCULATED AT FLOW DEPTH d)	(CFS)	118.8				
PROTECTIVE LINING[2]		Natural				
n (MANNING'S COEFFICIENT)[2]		0.045	See Table 6.9			
V_w (ALLOWABLE VELOCITY)	(FPS)	6.5	See Table 6.6			
V (CALCULATED AT FLOW DEPTH d)	(FPS)	5.5				
τ_a (MAX ALLOWABLE SHEAR STRESS)	(LB/FT^2)	-----				
τ_d (CALC'D SHEAR STRESS AT FLOW DEPTH d)	(LB/FT^2)	-----				
CHANNEL BOTTOM WIDTH	(FT)	6				
CHANNEL SIDE SLOPES	(H:V)	10:1				
D (TOTAL DEPTH)	(FT)	1.5				
CHANNEL TOP WIDTH @ D	(FT)	36				
d (CALCULATED FLOW DEPTH)	(FT)	1.2				
CHANNEL TOP WIDTH @ FLOW DEPTH d	(FT)	30				
BOTTOM WIDTH: FLOW DEPTH RATIO	(12:1 MAX)	5				
d_{50} STONE SIZE	(IN)	3				
A (CROSS-SECTIONAL AREA)	(SQ. FT.)	31.5				
R (HYDRAULIC RADIUS)		.87				
S (BED SLOPE)[3]	(FT/FT)	.043				
S_c (CRITICAL SLOPE)	(FT/FT)					
$.7S_c$	(FT/FT)					
$1.3S_c$	(FT/FT)					
STABLE FLOW?	(Y/N)	-----				
FREEBOARD BASED ON UNSTABLE FLOW	(FT)	-----				
FREEBOARD BASED ON STABLE FLOW	(FT)	-----				
MINIMUM REQUIRED FREEBOARD[4]	(FT)	-----				
DESIGN METHOD FOR PROTECTIVE LINING[5] PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)		V				

TABLE 6.9
Recommended n Values to be Used with Manning's Equation When Doing Stability Analyses of Receiving Streams

Design values should be utilized unless documentation is provided (narrative/calculations) to show that another value within the minimum and maximum range is appropriate.

Surface	Min.	Design	Max.
Asphalt Lining		0.015	
Brick in cement mortar; brick sewers	0.012	0.015	0.017
Concrete-lined channel	0.012	0.015	0.018
Cement-rubble surface	0.017		0.030
Neat cement surfaces	0.010	0.012	0.013
Plastic-lined channel	0.012		0.014
Shotcrete	0.016		0.017
Asbestos Cement Pipe		0.009	
Concrete pipe	0.012	0.015	0.016
Vitrified Clay Pipe	0.010	0.013	0.017
Common-clay drainage tile	0.011	0.012	0.017
Semi-circular metal flumes, smooth	0.011		0.015
Corrugated	0.023	0.025	0.030
Channels and ditches			
Earth, straight and uniform	0.017	0.023	0.025
Rock cuts, smooth and uniform	0.025	0.030	0.035
jagged and irregular	0.035	0.040	
Dredged earth channels	0.025	0.028	0.033
Earth bottom, rubble sides	0.028	0.030	0.035
Natural Streams			
1. Clean, straight bank, full stage no rifts or deep pools	0.025		0.033
2. Same as 1, but some weeds and stones	0.030		0.040
3. Winding, some pools and shoals, clean	0.033		0.045
4. Same as 3, lower stages, more ineffective slope and sections	0.040		0.055
5. Same as 3, same weeds and stones	0.035		0.050
6. Same as 4, stony sections	0.045		0.060
7. Sluggish river reaches, rather weedy or	0.050		0.080

TABLE 6.6
Riprap Gradation, Filter Blanket Requirements, Maximum Velocities

Class, Size NO. / Rock Size (Inches)	Percent Passing (Square Openings) R-8	R-7	R-6	R-5	R-4	R-3
42	100					
30		100				
24	15-50		100			
18		15-50		100		
15	0-15					
12		0-15	15-50		100	
9				15-50		
6			0-15		15-50	100
4				0-15		
3					0-15	15-50
2						0-15
Nominal Placement Thickness (inches)	63	45	36	27	18	9
Filter Stone[1]	AASHTO #1	AASHTO #1	AASHTO #1	AASHTO #3	AASHTO #3	AASHTO #57
V_{max} (ft/sec)	17.0	14.5	13.0	11.5	9.0	6.5

Adapted from PennDOT Pub. 408, Section 703.2(c), Table C

1 This is a general standard. Soil conditions at each site should be analyzed to determine actual filter size. A suitable woven or non-woven geotextile underlayment, used according to the manufacturer's recommendations, may be substituted for the filter stone for gradients < 10%.

Standard E&S Worksheet #11 was completed to demonstrate there will be no accelerated erosion

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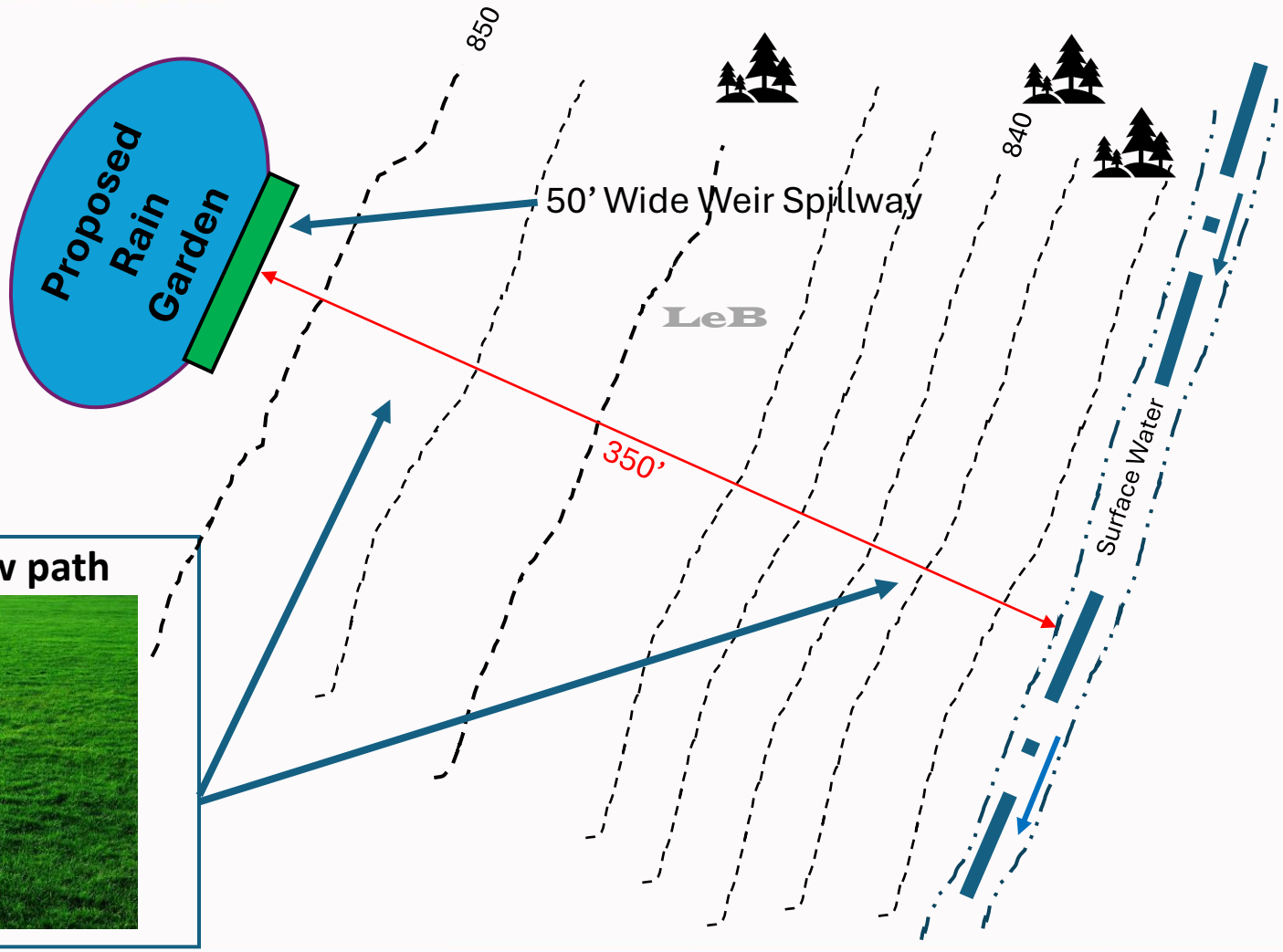
Example of Weir Discharge



Legend

- Flow Path
- Ex. Stream
- Ex. Contour

Soils:

LeB - Leck Kill channery silt loam
K = 0.17 (Erosion Resistant Soil)

Photograph of flow path



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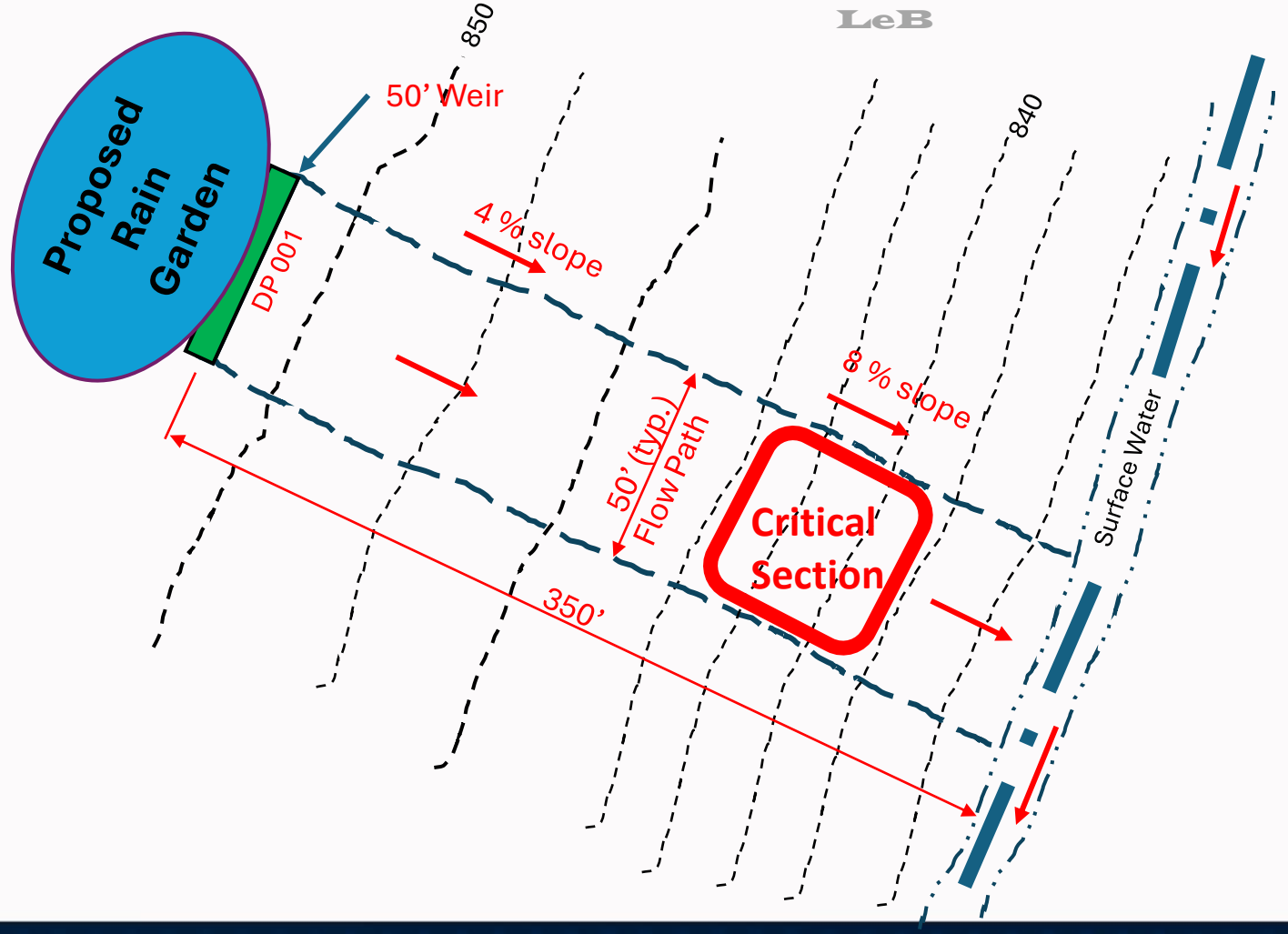
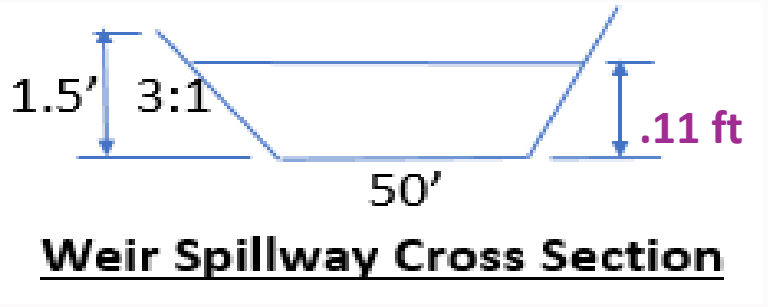
Example of Weir Discharge





Weir Spillway Cross Section

$H = [Q/CL]^{1/1.5}$

Where Q = flow = 5 cfs

C = weir coefficient = 2.6

L = length of weir = 50 ft.

$= [5/(2.6)(50)]^{1/1.5}$

$= 0.11$ ft.

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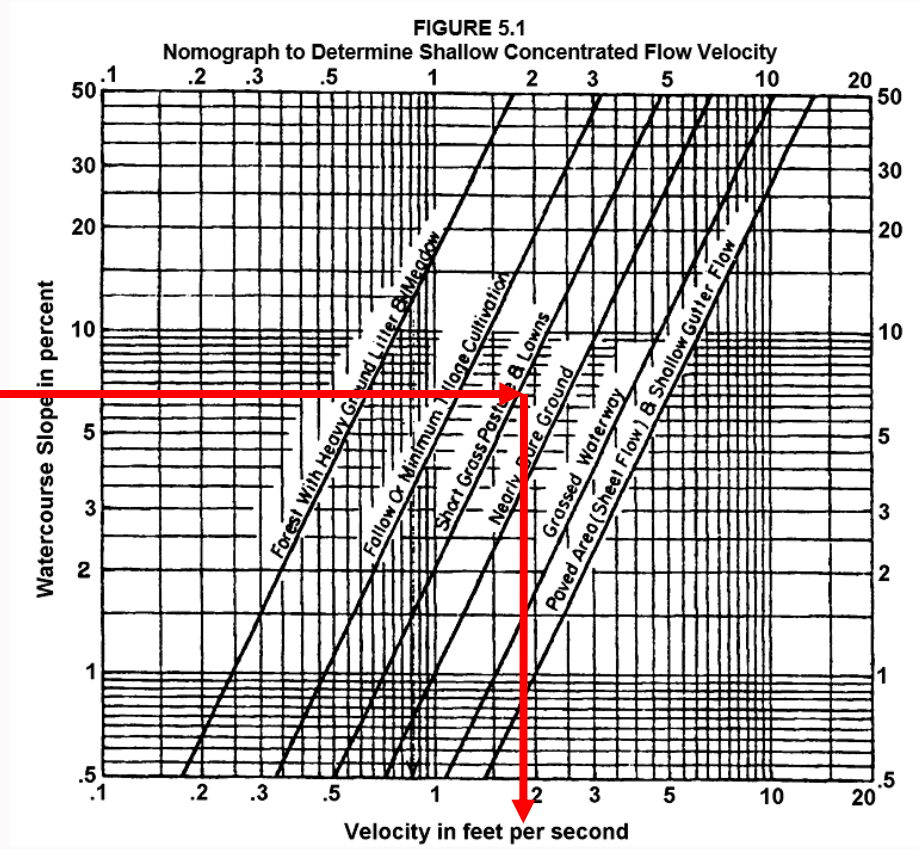
Example of Weir Discharge

FIGURE 5.1
Nomograph to Determine Shallow Concentrated Flow Velocity



2 ft./sec.

TABLE 6.4
Maximum Permissible Velocities (ft/sec) for Channels Lined with Vegetation

Cover	Slope Range Percent	Erosion Resistant Soil[1]	Easily Eroded Soil [2]
Bermuda Grass	0 - 5%	6.0 [3]	5.0
Kentucky Bluegrass		5.5 [3]	4.5
Tall Fescue (endophyte-free)		5.5 [3]	4.5
Grass Legume Mixture		4.5	3.5
Bermuda Grass	5-10 %	5.5 [3]	4.5
Kentucky Bluegrass		5.0	4.0
Tall Fescue (endophyte-free)		5.0	4.0
Grass Legume Mixture		3.5	3.0

Modified from USDA-NRCS

[1] Cohesive (clayey) fine grain soils and coarse grain soils with a plasticity index OF 10 TO 40 (CL, CH, SC and GC). **SOILS WITH K VALUES EQUAL TO OR LESS THAN 0.37**.

[2] **SOILS WITH K VALUES GREATER THAN 0.37**.

[3] Use velocities exceeding 5 ft/sec only where good cover and proper maintenance can be obtained.

NOTE: These values subject to the 7 limitations below

ADDITIONAL NOTES REGARDING THE USE OF TABLE 6.4

1. A velocity of 3.0 ft/sec should be the maximum if because of shade, soils or climate, only a sparse cover can be established or maintained.
2. **A velocity of 3.0 to 4.0 ft/sec should be used under normal conditions if the vegetation is to be established by seeding**.
3. A velocity of 4.0 to 5.0 ft/sec should be used only in areas if a dense, vigorous sod is obtained quickly or if water can be diverted out of the waterway while vegetation is being established.
4. A velocity of 5.0 to 6.0 ft/sec may be used on well established, good quality sod. Special maintenance may be required.
5. A velocity of 6.0 to 7.0 ft/sec may be used only on established, excellent quality sod, and only under special circumstances in which flow cannot be handled at a lower velocity. Under these conditions, special maintenance and appurtenant structures will be required.
6. If stone centers, or other erosion resistant materials supplement the vegetative lining, the velocities in the above table may be increased by 2.0 ft/sec.
7. When base flow exists, a rock lined low flow channel should be designed and incorporated into the vegetative lined channel section.

2.0 ft./sec < 5.0 ft./sec.

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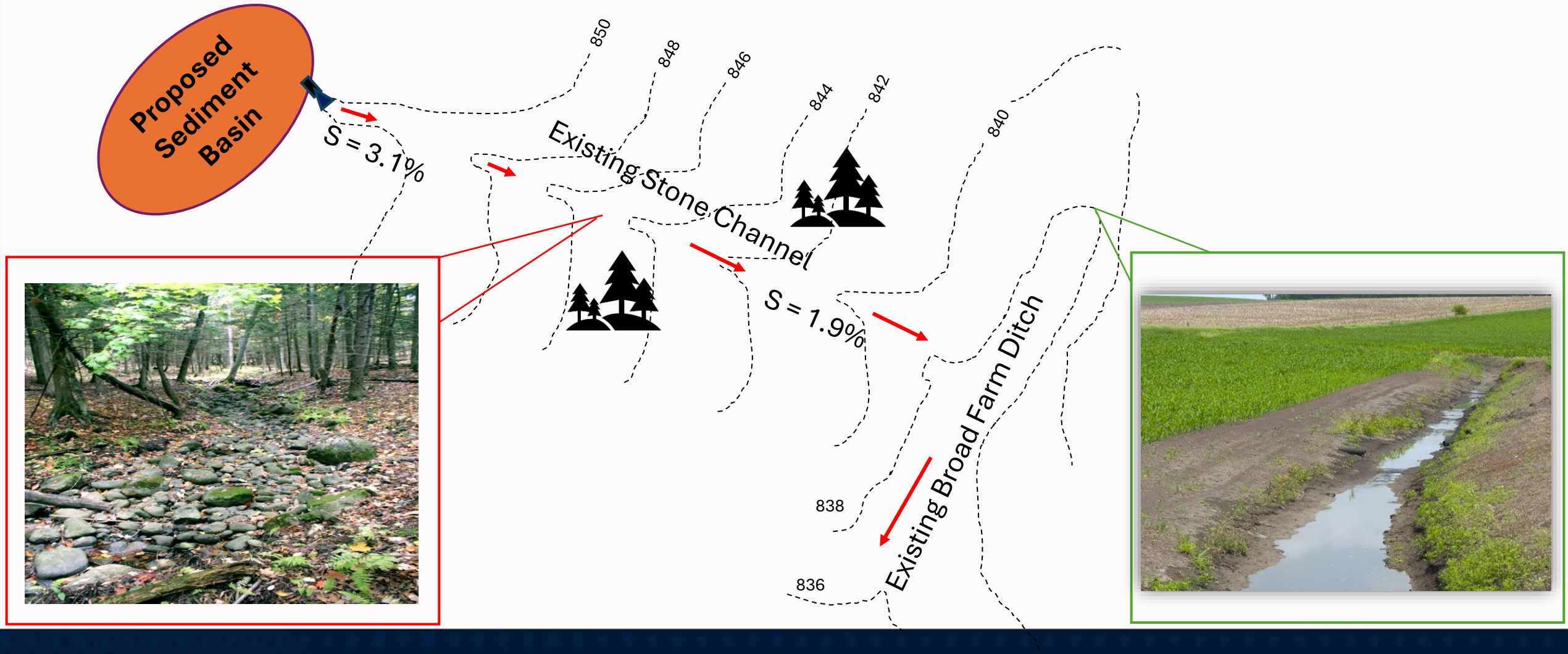
Example of Long Distance



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Example of Long Distance



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Example: Long Distance (cont.)



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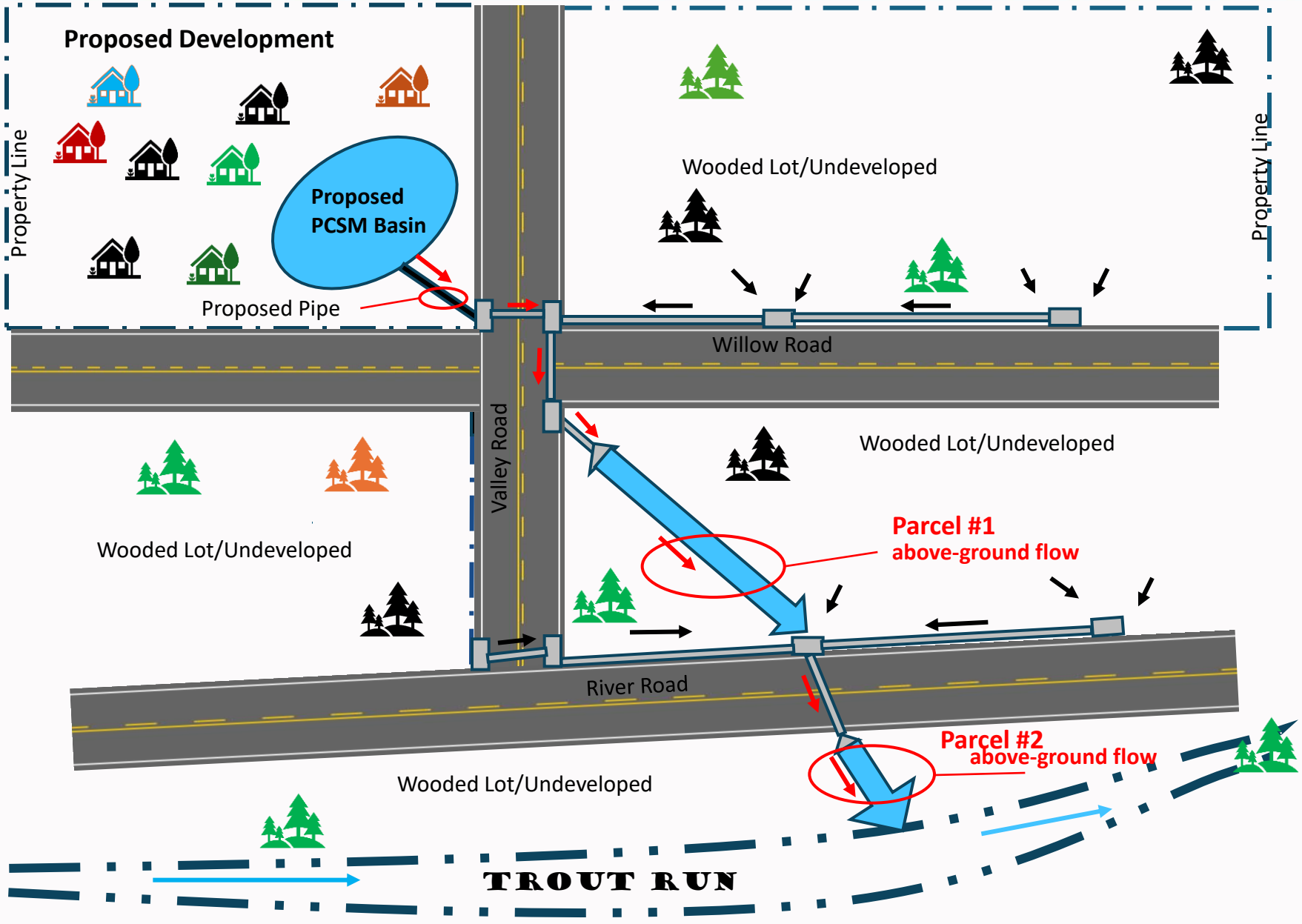
Example of Storm Sewer to Non-Surface Water



Legend

- Ex. Storm Sewers
- Overland Flow Path
- Flow Path Direction

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Summary

1. Understand the type of discharge and conveyance to surface water
2. Entire flow path should be shown on a plan with all affected landowner information
3. Critical section of the flow path should be analyzed for the 10-yr/24 hr storm
4. May require additional supporting information

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Contacts

Layla Denissen
Bureau of Clean Water
…
610-861-2159/ ldenissen@pa.gov

RA-EPCHAPTER102@pa.gov

The Department of Environmental Protection's mission is to protect Pennsylvania's air, land and water resources and to provide for the health and safety of its residents and visitors, consistent with the rights and duties established under the Environmental Rights Amendment (Article 1, Section 27 of the Pennsylvania Constitution).