

Hydraulic Analysis Report

Project Data

Project Title: Swale Analysis for Roberts Village Drive

Project Date: July 17, 2024

Project Units: U.S. Customary Units

***Analysis for all channels is based on the 100-yr storm event**

Channel Analysis: Swale 1A

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width 3.00 ft

Longitudinal Slope: 0.0200 ft/ft

Manning's n: 0.0434

Flow 8.3090 cfs

Result Parameters

Depth 0.6536 ft

Area of Flow 2.8151 ft²

Wetted Perimeter 5.9229 ft

Hydraulic Radius 0.4753 ft

Average Velocity 2.9516 ft/s

Top Width 5.6143 ft

Froude Number: 0.7346

Critical Depth 0.5454 ft

Critical Velocity 3.7240 ft/s

Critical Slope: 0.0387 ft/ft

Critical Top Width 5.18 ft

Calculated Max Shear Stress 0.8157 lb/ft²

Calculated Avg Shear Stress 0.5932 lb/ft²

Channel Lining Analysis: Swale 1A

Notes:

Lining Input Parameters

Channel Lining Type: Vegetation

Specific Weight of Water: 62.4 lb/ft³

Height of Vegetation: 0.333 ft

Vegetation Condition is good

Growth Form of Vegetation is mixed

Cf: 0.75

See HEC-15, Table 4.5 (default: 0.75 for Good cover factor and Mixed growth form)

soil is noncohesive

D75: 2 mm

Safety Factor: 1

Lining Results

Cn: 0.165205

Permissible Soil Shear Stress: 0.031496 lb/ft²

Mean Boundary Shear Stress: 0.593162 lb/ft²

Maximum Shear Stress on the Channel Bottom: 0.815676 lb/ft²

Manning's n: 0.0433644

Soil Grain Roughness: 0.0170218

Effective Shear Stress: 0.0277607 lb/ft²

Permissible Shear Stress on Vegetation: 0.817655 lb/ft²

This value is compared with the maximum shear stress times the safety factor to determine lining stability

This value is compared with the maximum shear stress times the safety factor to determine lining stability

Channel bottom is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: Swale 1A

Channel Analysis: Swale 1B

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width 3.00 ft

Longitudinal Slope: 0.0530 ft/ft

Manning's n: 0.0420

Flow 2.1400 cfs

Result Parameters

Depth 0.2263 ft

Area of Flow 0.7814 ft²

Wetted Perimeter 4.0121 ft

Hydraulic Radius 0.1948 ft

Average Velocity 2.7387 ft/s

Top Width 3.9053 ft

Froude Number: 1.0790

Critical Depth 0.2375 ft

Critical Velocity 2.5935 ft/s

Critical Slope: 0.0449 ft/ft

Critical Top Width 3.95 ft

Calculated Max Shear Stress 0.7485 lb/ft²

Calculated Avg Shear Stress 0.6441 lb/ft²

Channel Lining Analysis: Swale 1B

Notes:

Lining Input Parameters

Channel Lining Type: Vegetation

Specific Weight of Water: 62.4 lb/ft³

Height of Vegetation: 0.333 ft

Vegetation Condition is good

Growth Form of Vegetation is mixed

Cf: 0.75

See HEC-15, Table 4.5 (default: 0.75 for Good cover factor and Mixed growth form)

soil is noncohesive

D75: 2 mm

Safety Factor: 1

Lining Results

Cn: 0.165205

Permissible Soil Shear Stress: 0.031496 lb/ft²

Mean Boundary Shear Stress: 0.644102 lb/ft²

Maximum Shear Stress on the Channel Bottom: 0.748476 lb/ft²

Manning's n: 0.0419586

Soil Grain Roughness: 0.0170218

Effective Shear Stress: 0.0272092 lb/ft²

Permissible Shear Stress on Vegetation: 0.765501 lb/ft²

This value is compared with the maximum shear stress times the safety factor to determine lining stability

This value is compared with the maximum shear stress times the safety factor to determine lining stability

Channel bottom is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: Swale 1B

Channel Analysis: Swale 1C

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width 3.00 ft

Longitudinal Slope: 0.0410 ft/ft

Manning's n: 0.0468

Flow 1.6440 cfs

Result Parameters

Depth 0.2227 ft

Area of Flow 0.7674 ft²

Wetted Perimeter 3.9961 ft

Hydraulic Radius 0.1920 ft

Average Velocity 2.1422 ft/s

Top Width 3.8909 ft

Froude Number: 0.8501

Critical Depth 0.2009 ft

Critical Velocity 2.4053 ft/s

Critical Slope: 0.0584 ft/ft

Critical Top Width 3.80 ft

Calculated Max Shear Stress 0.5698 lb/ft²

Calculated Avg Shear Stress 0.4913 lb/ft²

Channel Lining Analysis: Swale 1C

Notes:

Lining Input Parameters

Channel Lining Type: Vegetation

Specific Weight of Water: 62.4 lb/ft³

Height of Vegetation: 0.333 ft

Vegetation Condition is good

Growth Form of Vegetation is mixed

Cf: 0.75

See HEC-15, Table 4.5 (default: 0.75 for Good cover factor and Mixed growth form)

soil is noncohesive

D75: 2 mm

Safety Factor: 1

Lining Results

Cn: 0.165205

Permissible Soil Shear Stress: 0.031496 lb/ft²

Mean Boundary Shear Stress: 0.491321 lb/ft²

Maximum Shear Stress on the Channel Bottom: 0.56984 lb/ft²

Manning's n: 0.0467581

Soil Grain Roughness: 0.0170218

Effective Shear Stress: 0.0166809 lb/ft²

Permissible Shear Stress on Vegetation: 0.950641 lb/ft²

This value is compared with the maximum shear stress times the safety factor to determine lining stability

This value is compared with the maximum shear stress times the safety factor to determine lining stability

Channel bottom is stable

Channel Lining Stability Results 2

The channel is stable

Channel Summary

Name of Selected Channel: Swale 1C