Built for Versatility

Beckwith North Stream Mitigation

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EcoStream
Stream Ecology and Restoration Conference

Project Background

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- 56-acre tract
- Proposed Warehouse distribution facility
  - Building (1,000,000 sq.ft.)
- Existing residence
  - Open grassland historically farmed with shallow bedrock

Project Background

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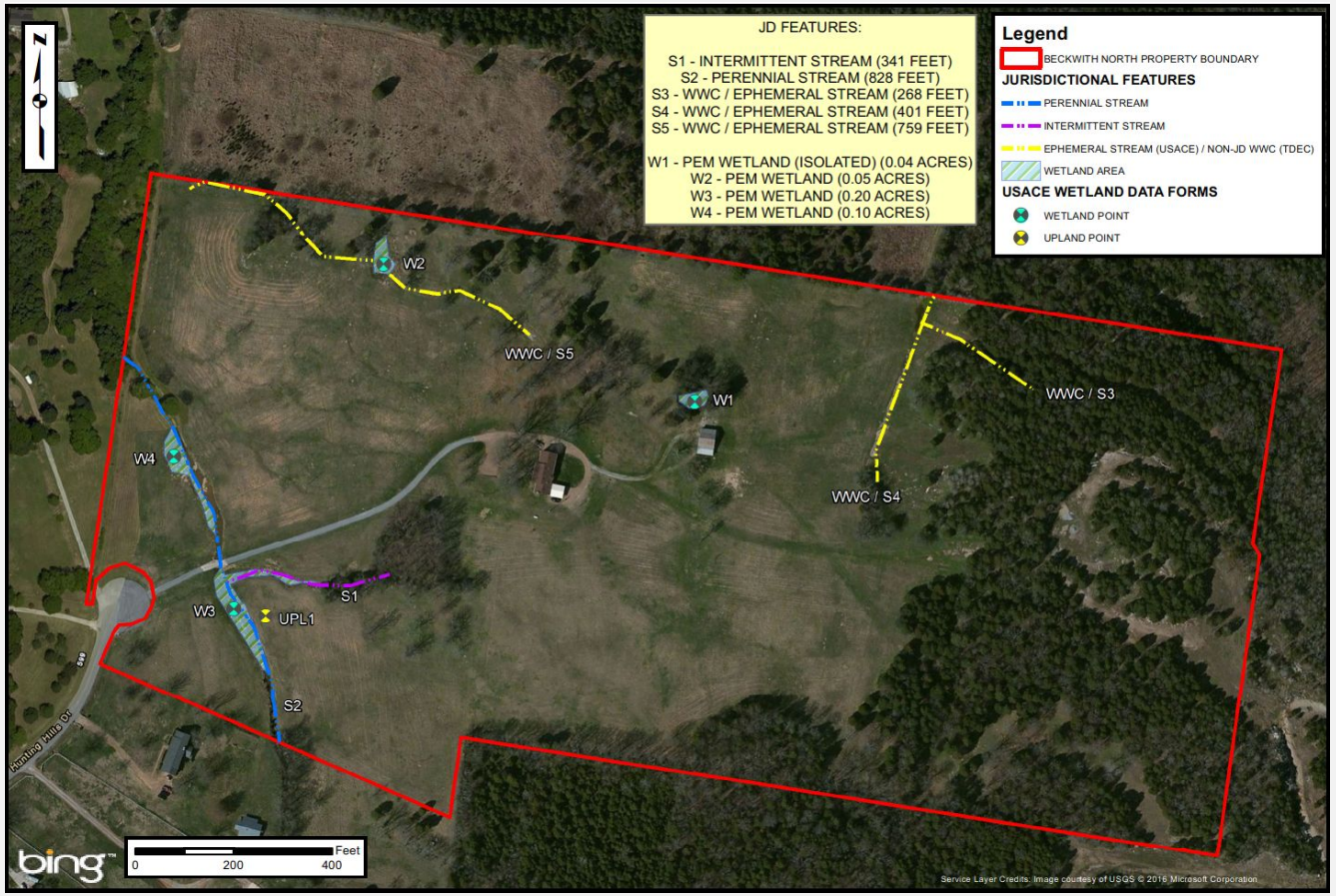
- Onsite Natural Resources
  - Wetlands
    -0.39 acres
  - Ephemeral stream
    - 1,428 ft.
  - Intermittent stream
    - 341 ft.
  - Perennial Stream
    - 850 ft.



Project Background

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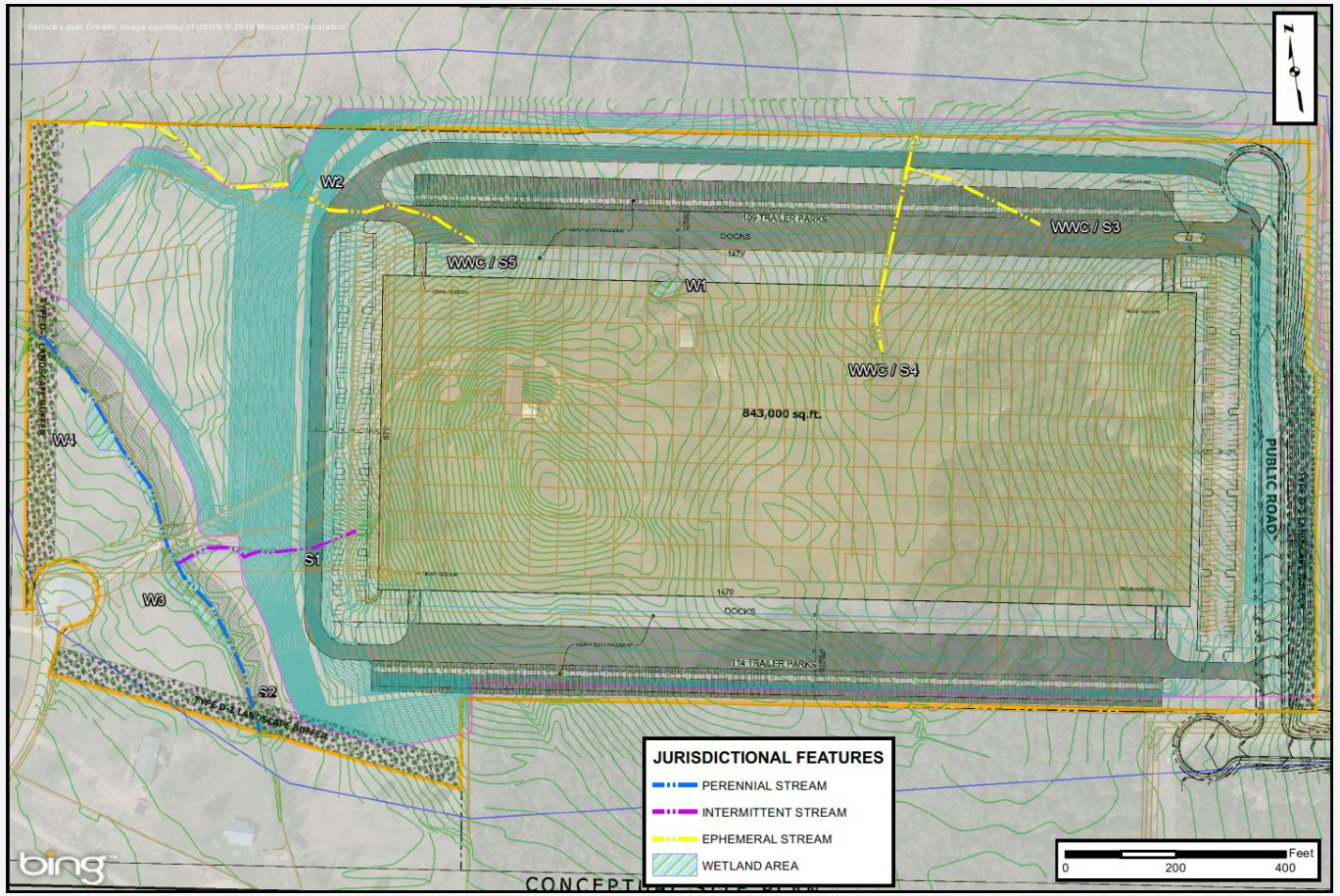
- **Proposed impacts**
  - Wetlands
    - -0.1 acres
  - Ephemeral stream
    - - 993 ft.
  - Intermittent stream
    - -283 ft.



Proposed Mitigation

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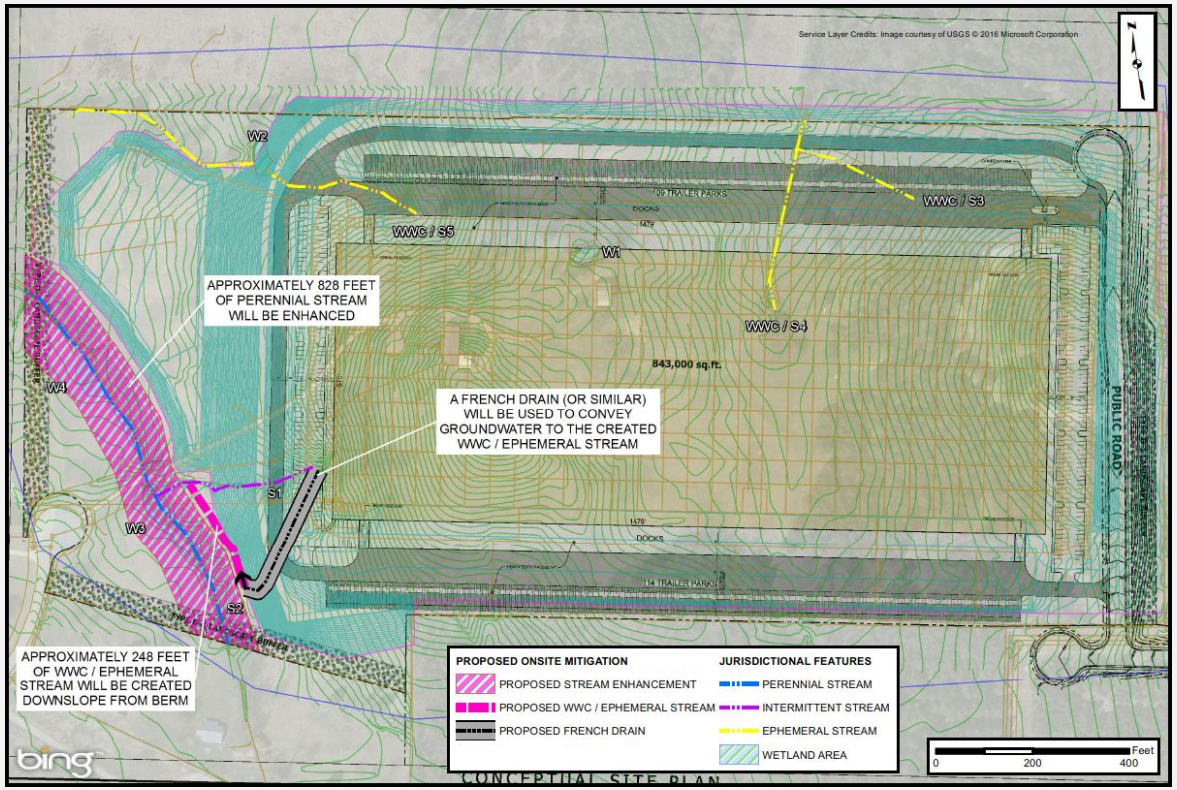
- 0.1 ac. Wetland
  - Purchase of 0.2 acres of wetland credits (2:1 Ratio)
- 283 ft. Intermittent Stream
  - 849 ft. Perennial Stream Enhancement II (3:1 Ratio)
- 993 ft. Ephemeral Stream
  - 356 ft. Ephemeral Stream Creation (0.25:1 Ratio)



Available Mitigation Resources

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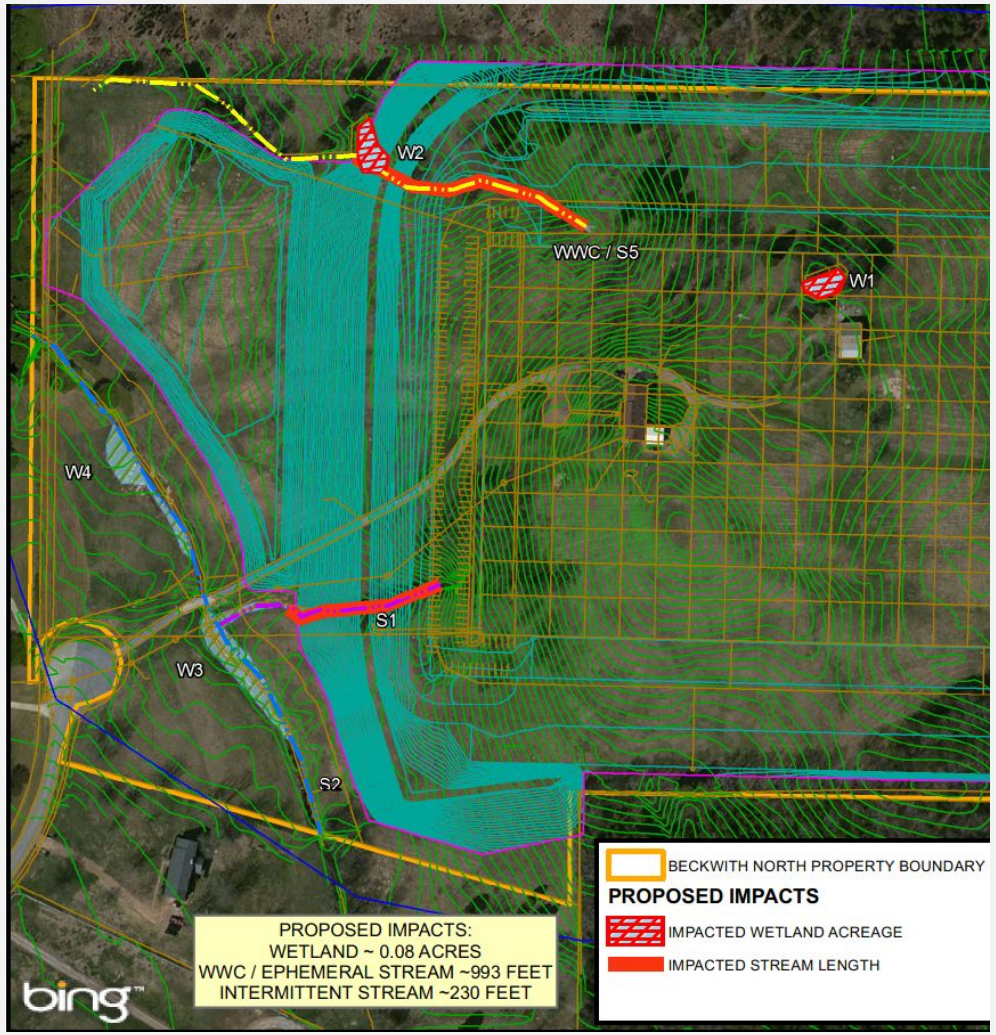
- Perennial Stream (850 ft.)
- Intermittent Stream (107 f t.)



Available Mitigation Resources (cont.)

- **Perennial Stream**
  - Impaired from past management practices
    - Historically Straightened
    - Poorly defined bed and banks
    - Lacks bed feature definition (riffles, pools, etc.)
    - Mowed / Grazed
    - No riparian buffer
    - Existing culverted stream crossing
    - Low sediment supply (bedrock bed)

Existing Conditions

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Existing Conditions

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Upstream

Downstream

Typical Restoration Approach

Natural Channel Design

- New channel dimension
- New pattern (meandering)
- New profile (riffles, pools, etc..)
- Reference reach based

Mitigation Restoration Approach

Potential Challenges

- Bedrock bottom channel
  - Limits creation of riffles/pools (profile)
  - Defines water flow path (plan form)
  - Blasting/hammering (expensive and risky)
- Adjacent wetlands / 0.29 ac. (planform)
- Absent banks / Shallow soils (channel dimension)

Mitigation Enhancement Approach

Potential Improvements

- Create defined channel cross section
  - width, depth, area
- Plant and preserve riparian buffer
  - trees, shrubs, forbs

Mitigation Enhancement Approach

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Developing Channel Cross Section

- Collect existing cross section data
- Determine slope from survey and field measurements
- Calibrate discharge (Q) with observed cross section and regional curves
- Use regional curves to approximate channel dimensions

Regional Curves

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- Use Stream Stats to approximate watershed size
- Verify using Topographic map

USGS StreamStats Version 3.0

Basin Characteristics Ungaged Site Report

Date: Wed Nov 9, 2016 1:44:15 PM GMT-5
Study Area: Tennessee
NAD 1983 Latitude: 36.1872 (36 11 14)
NAD 1983 Longitude: -86.4826 (-86 28 58)

Label	Value	Units	Definition
DRNAREA	0.39	square miles	Area that drains to a point on a stream
SOILPERM	0.52	inches per hour	Average Soil Permeability
CSL10_85	93.24	feet per mi	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known
TNSOILFAC	10	percent	Tennessee soil factor, percentage of area underlain by a soil permeability greater than or equal to 2 inches per hour
CLIMFAC2YR	2.317	dimensionless	Two-year climate factor from Litchy and Karlinger (1990)
CONTDA	0.39	square miles	Area that contributes flow to a point on a stream (total drainage area minus non-contributing areas within basin)
RECESS	32	days per log cycle	Number of days required for streamflow to recede one order of magnitude when hydrograph is plotted on logarithmic scale
TNCLFACT2	2.317	dimensionless	2-Year Climate Factor for Tennessee
PERMGTE2IN	10.001	percent	Percent of area underlain by soils with permeability greater than or equal to 2 inches per hour

Regional Curves

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- Use curves to approximate the width, mean depth, area, and for a given Q

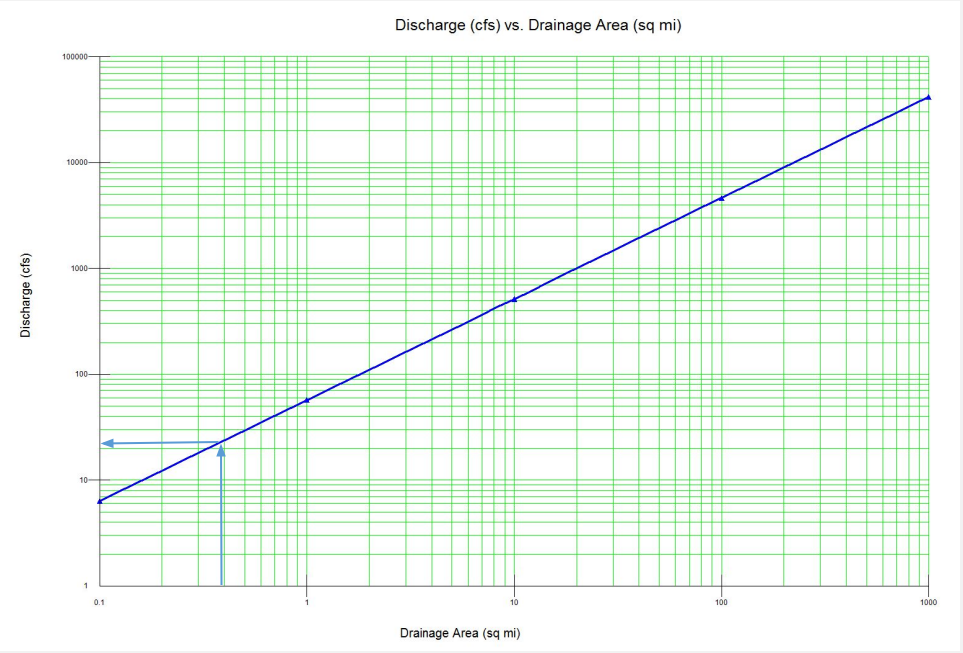

Table 2-1 Regional Curve Values for Drainage Area of 0.39 Square Miles.

Regional Curve	Riffle Cross Sectional Area (ft^2)	Width (ft)	Mean Depth (ft)	Discharge (ft^3/sec)
Eastern US/*North Carolina and Tennessee	11.34	9.95	1.13	*23
Tennessee Southern Ridge and Valley Physiographic Province	10	11	0.9	34
Existing Cross Section	30	40.5	0.76	33
Proposed Cross Section	15.6	13	1.2	23

*Note: * Discharge was derived from the North Carolina - Tennessee Regional curve as a discharge value for the Eastern US curve is not available.*

Note: Project predates the publication of TDEC regional curves

Construction Approach

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- Challenge: establish the desired cross section on bedrock with limited soil and adjacent wetlands.
- Typical approach of dig and fill will not work at this site.

Options

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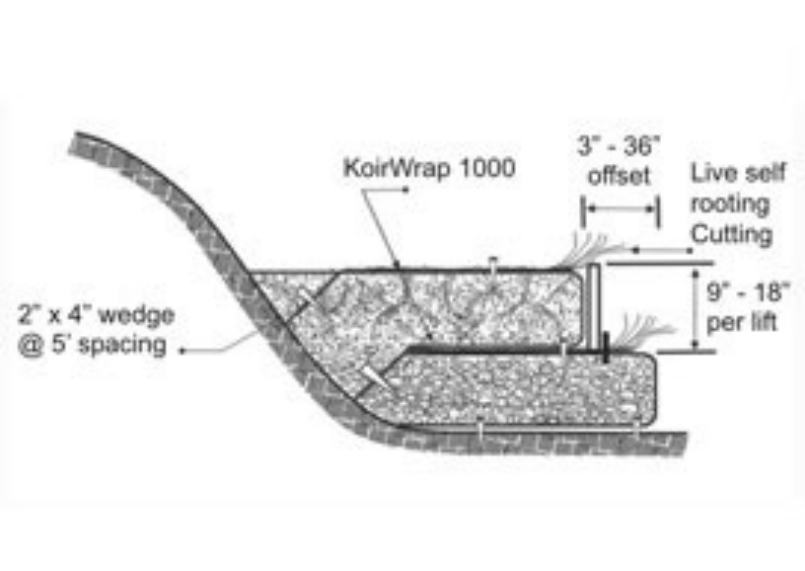
- Soil filled coir wraps
- width
- weight
- attachment



Options

- Coir logs
- Limited surface contact
- Backfill
- Attachment

BioD-Block™

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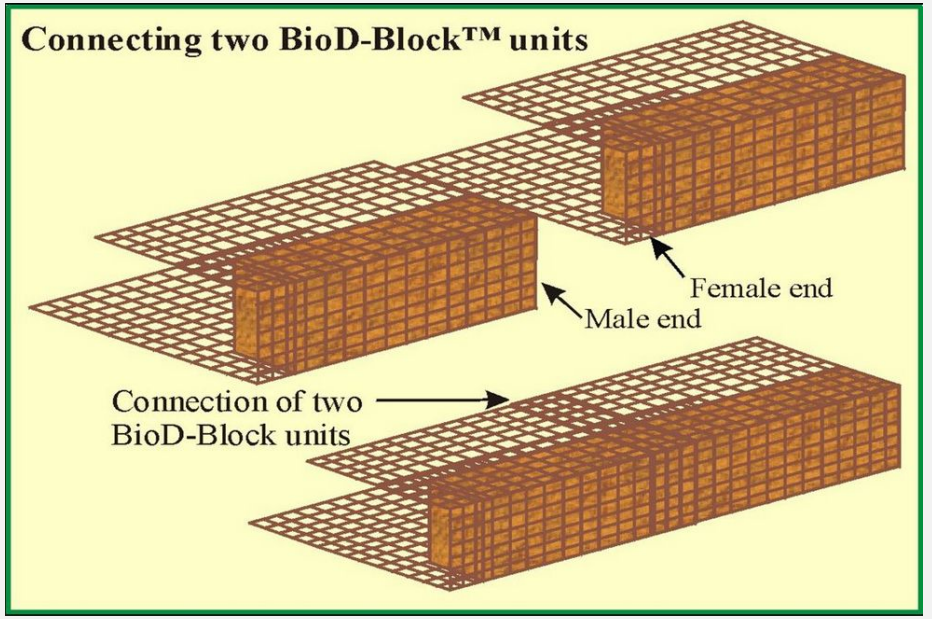
- **Best of both worlds**
  - **But how to you anchor it in bedrock?**



Design

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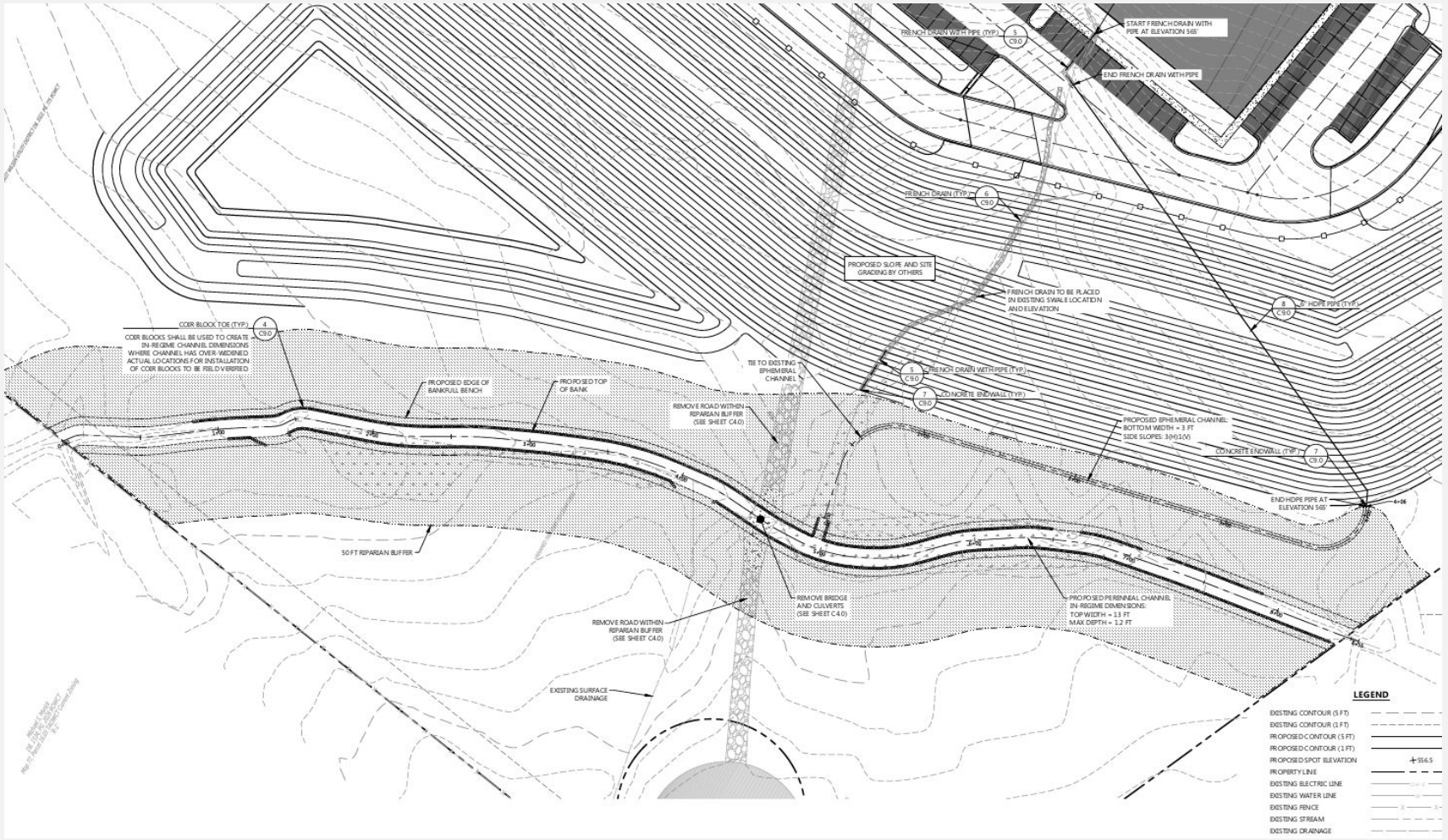

Design (cont.)

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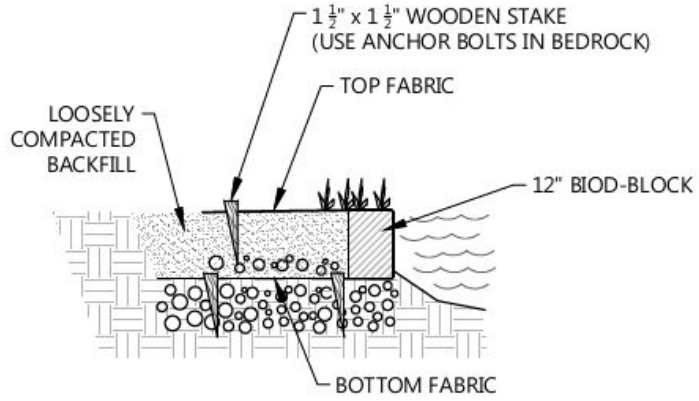
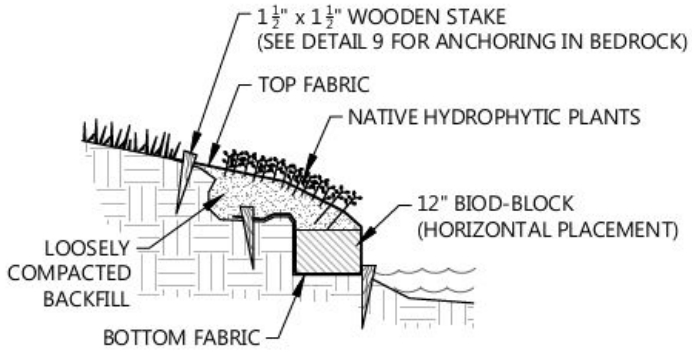
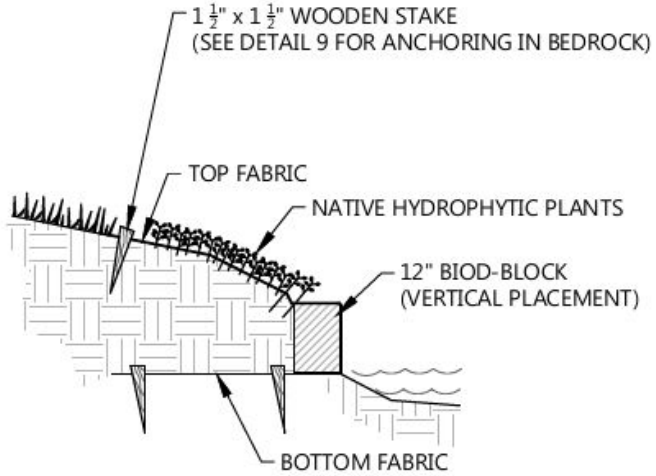


COIR BLOCK PLACEMENT WITHOUT BANK SUPPORT



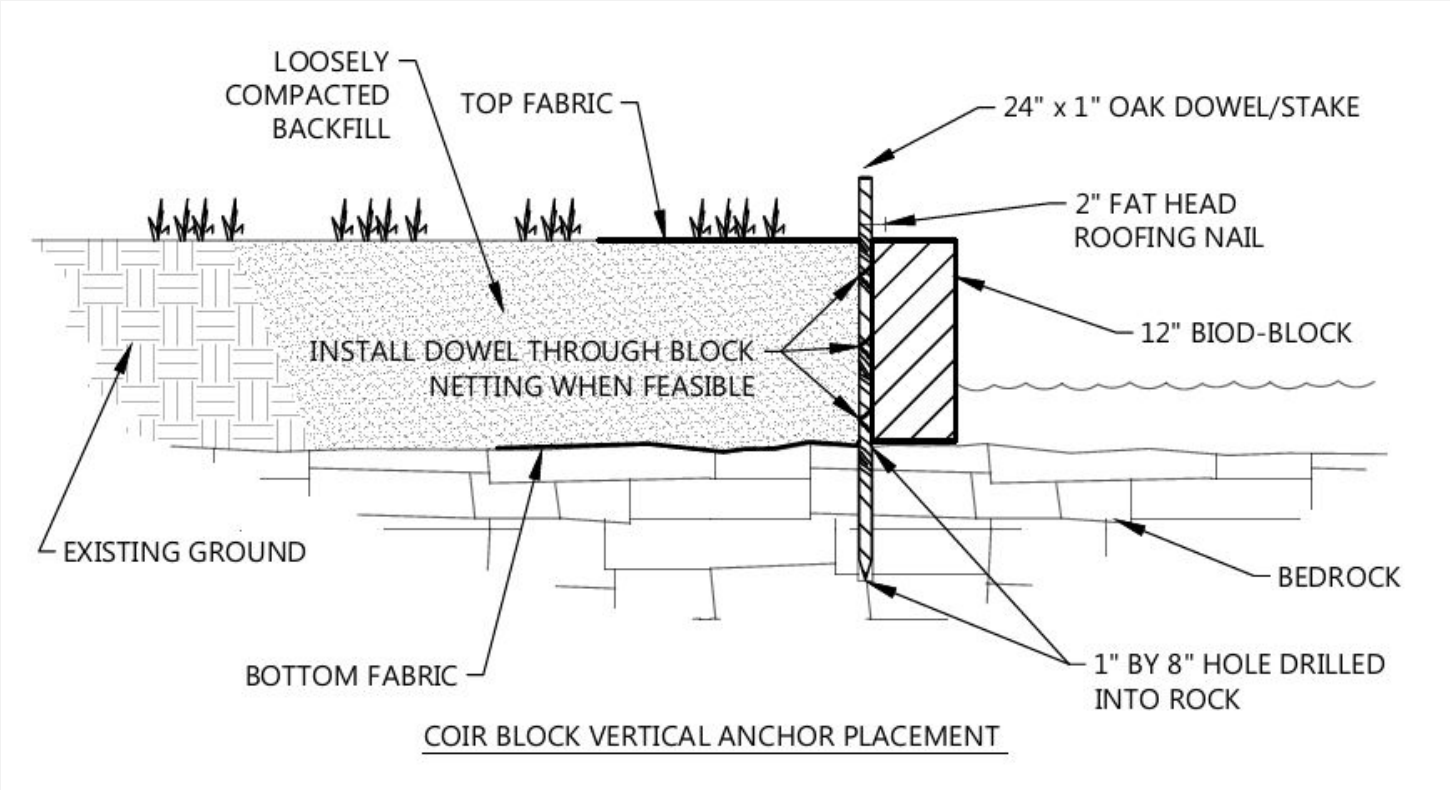
COIR BLOCK PLACEMENT WITH BANK SUPPORT (H)



COIR BLOCK PLACEMENT WITH BANK SUPPORT (V)

Design (cont.)

- BioD-Block Attachment



Construction

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Construction

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Construction

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Post-Construction

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Post-Construction

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Questions

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