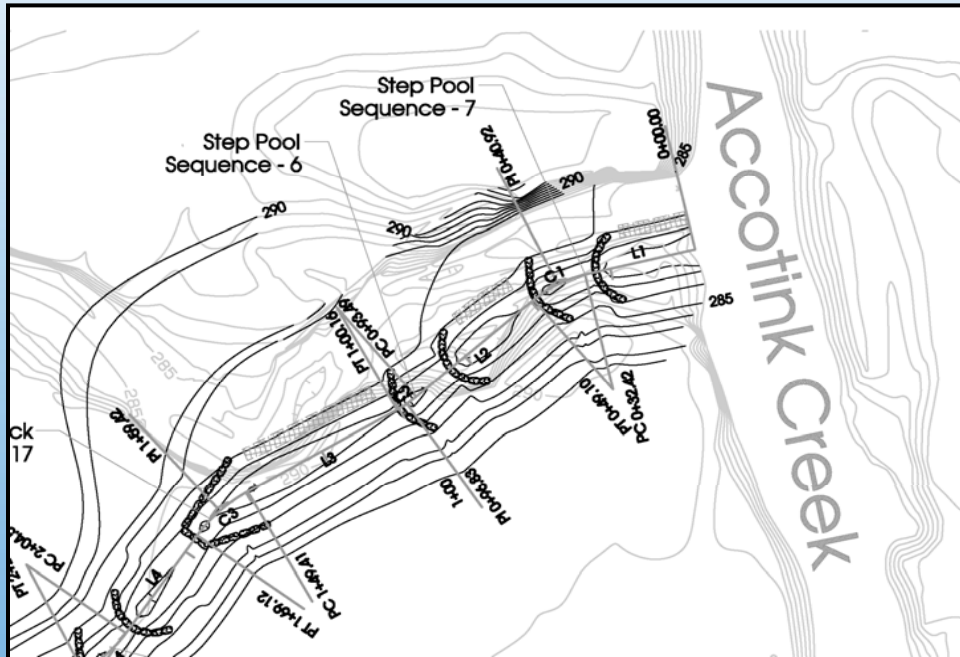


Natural Channel Design Review Checklist



Richard Starr
USFWS

2.0 Preliminary Design			
2.1 Goals and Restoration Potential			
Does the project have clear goals?			
Was the restoration potential based on the assessment data provided?			
Was a restoration strategy developed and explained based on the restoration potential?			
2.2 Design Criteria			
Were design criteria provided and explained?			
Is the design criteria representative of reference reaches within the project area or of the same valley type, geology, and land use?			
2.3 Conceptual Design			
Was the conceptual channel alignment provided and developed within the design criteria?			
Were typical bankfull cross sections provided and developed within the design criteria?			
Were typical drawings of in-stream structures provided and their use and location explained?			
Was a draft planting plan provided?			
Overall Conceptual Design Comment(s)			

Need for a Review Checklist

PROBLEMS

- Stream restoration design complexity
- Many different design methodologies
- Inconsistency in design deliverables
- Communication difficulties
- Many failed projects



Need for a Review Checklist

SOLUTION

- Outlined critical design steps established
- Defined design expectations
- Improved communication
- Increased successful projects
- NCD Methodology

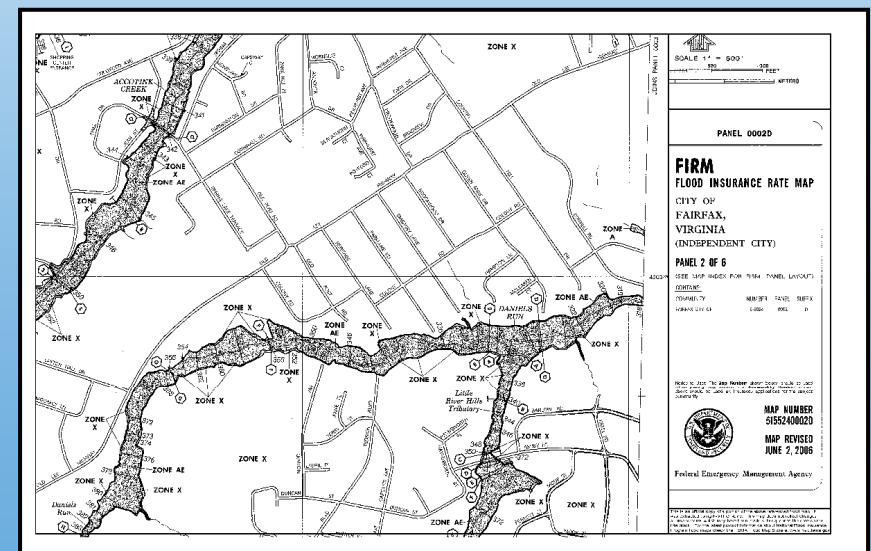


Checklist Components

- Watershed and Geomorphic Assessment
 - Watershed assessment
 - Basemapping
 - Geomorphic assessment
 - Bankfull verification
- Preliminary Design
 - Goals and restoration potential
 - Design criteria
 - Conceptual design
- Final Design
 - Natural channel design
 - Sediment transport
 - In-stream structures
 - Vegetation design
- Maintenance and Monitoring Plans
- Overall Design Review
- Site Visit

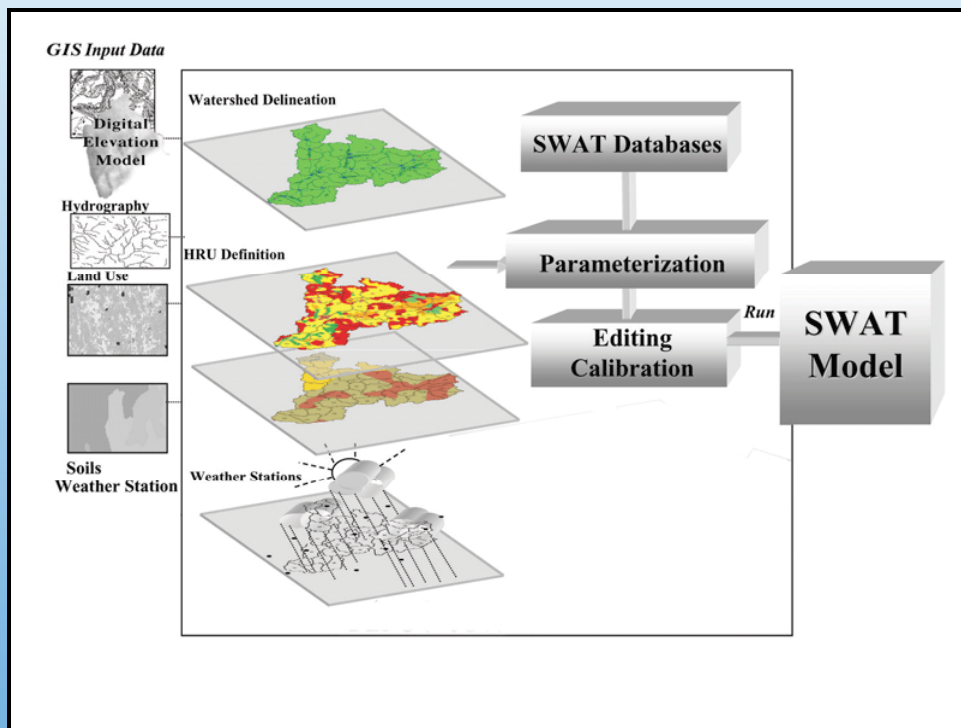
What is Not in the Checklist

- Additional design deliverables
- Permitting
- Erosion and sediment plans
- Flood studies
- Biological and physiochemical processes
- Construction methods
- Not a “how to” design document
- Not a text book



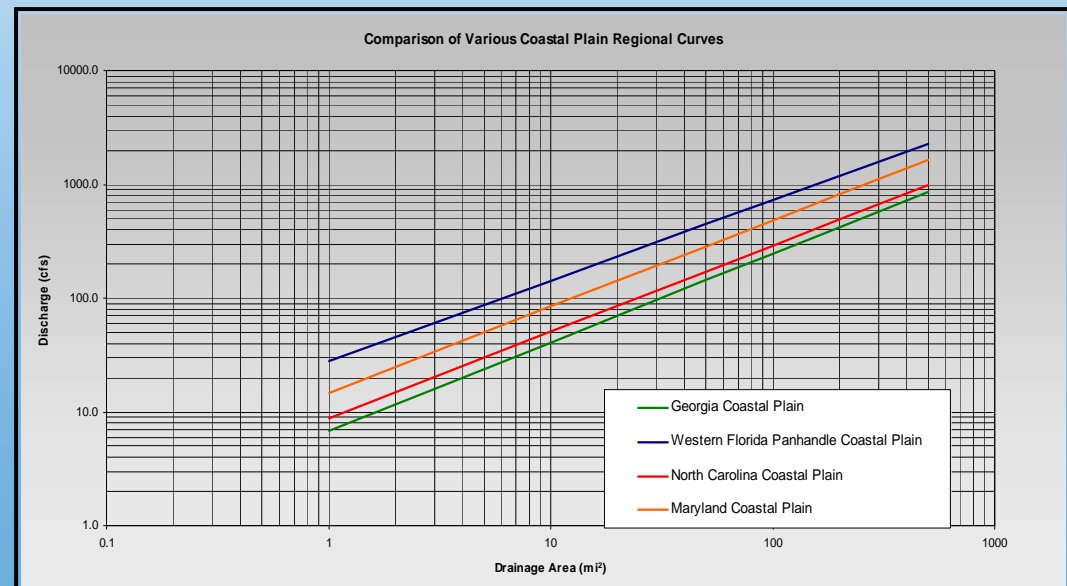
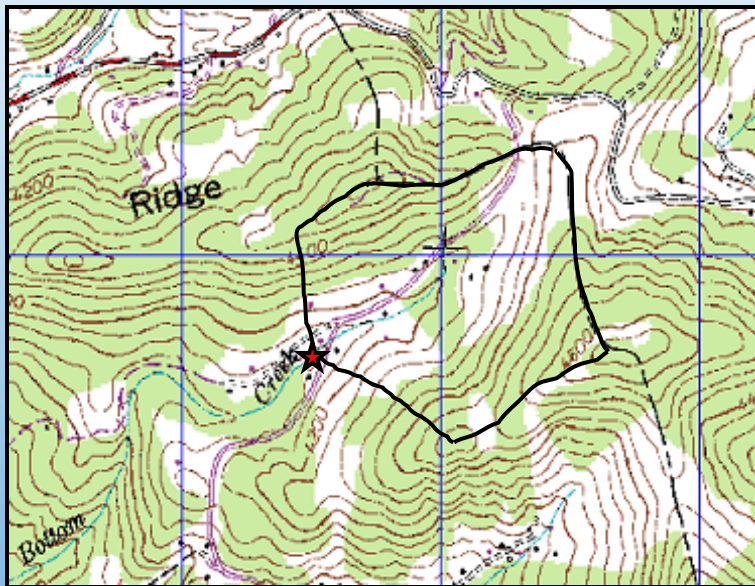
Watershed Assessment

Was the watershed assessment methodology described?



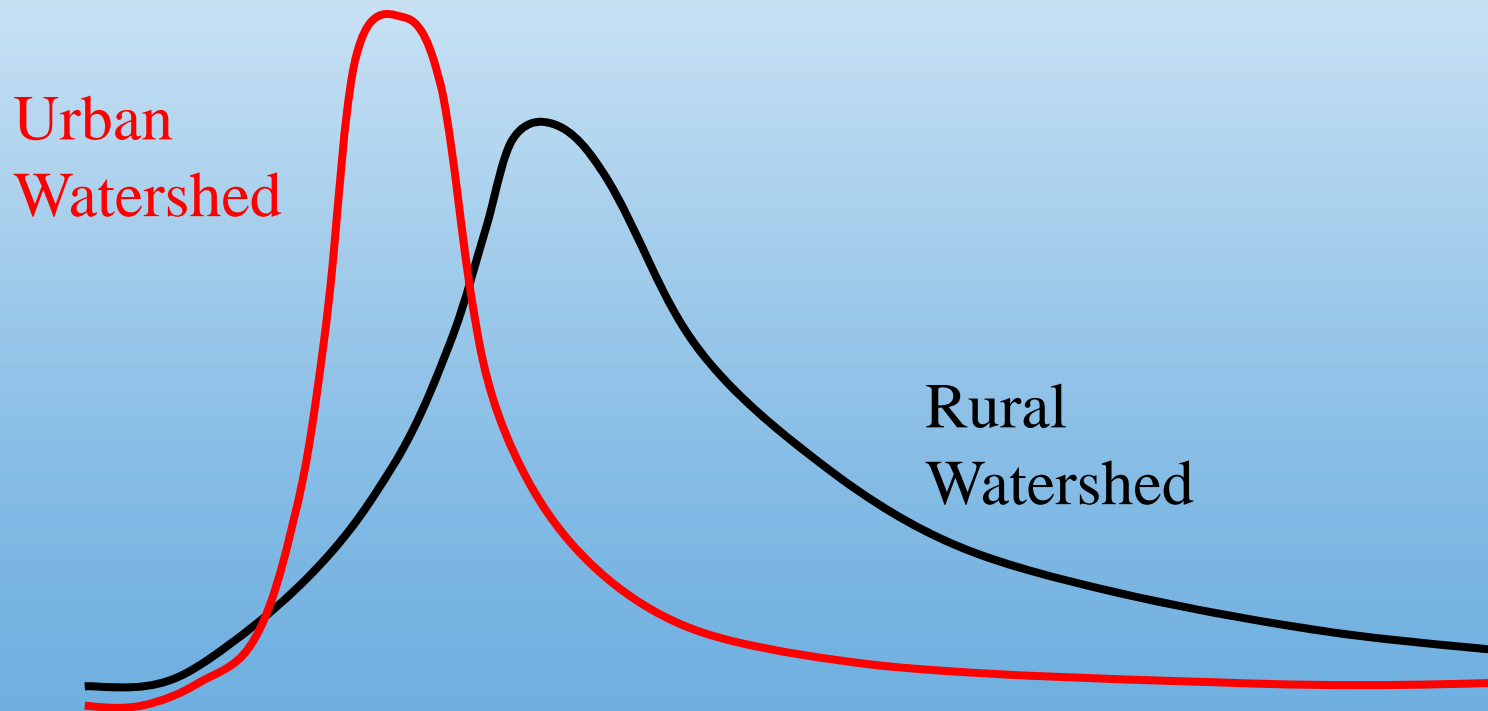
Watershed Assessment

Was the project drainage area provided?



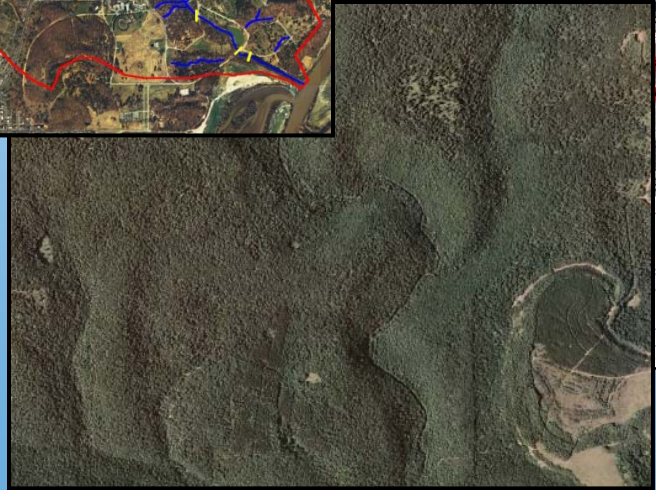
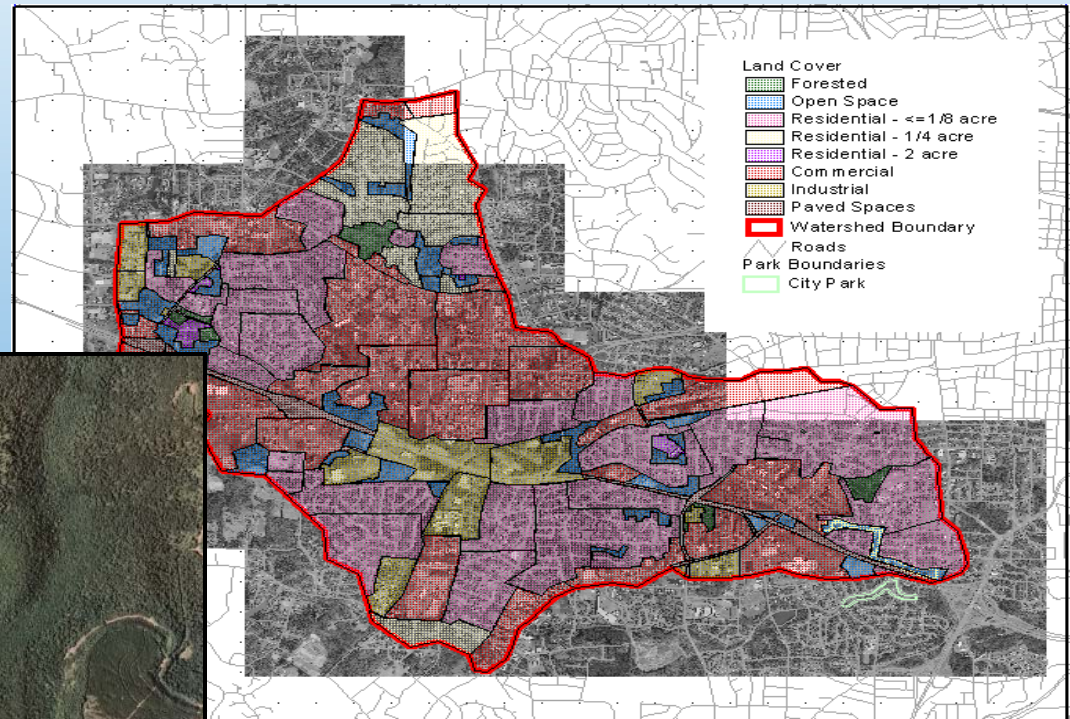
Watershed Assessment

Was the percent impervious cover for the watershed provided?



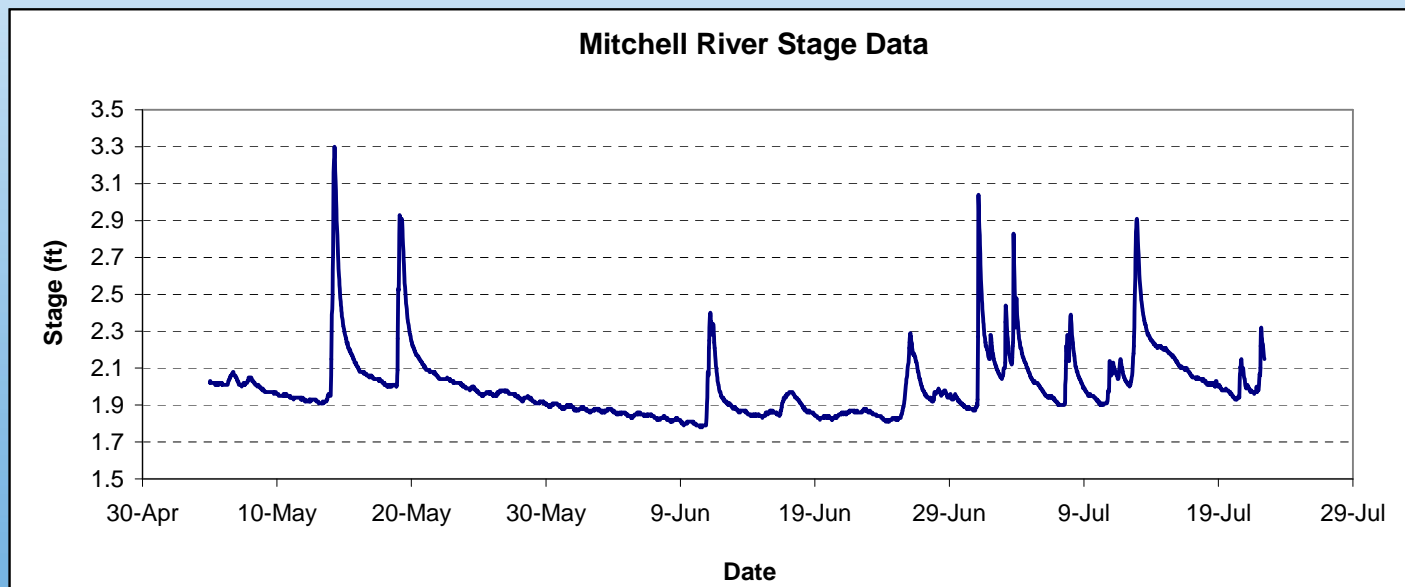
Watershed Assessment

Was the current land use described along with future conditions?



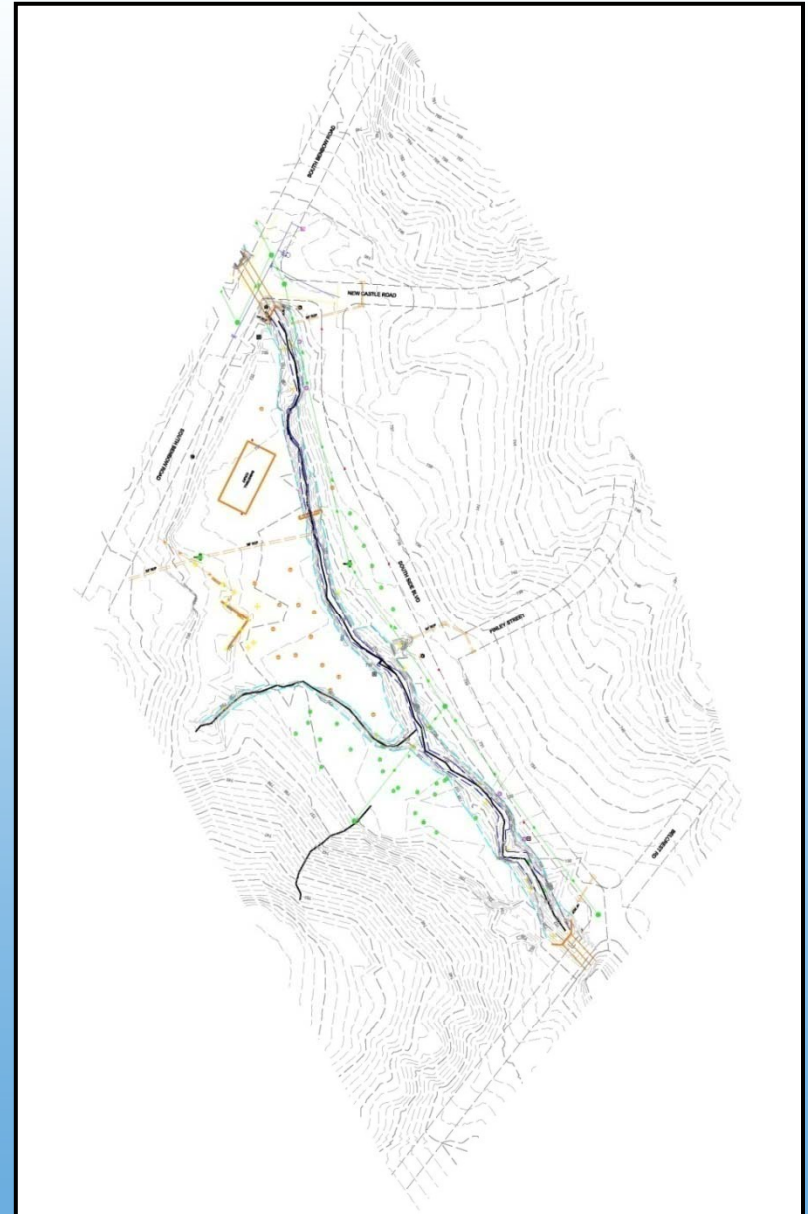
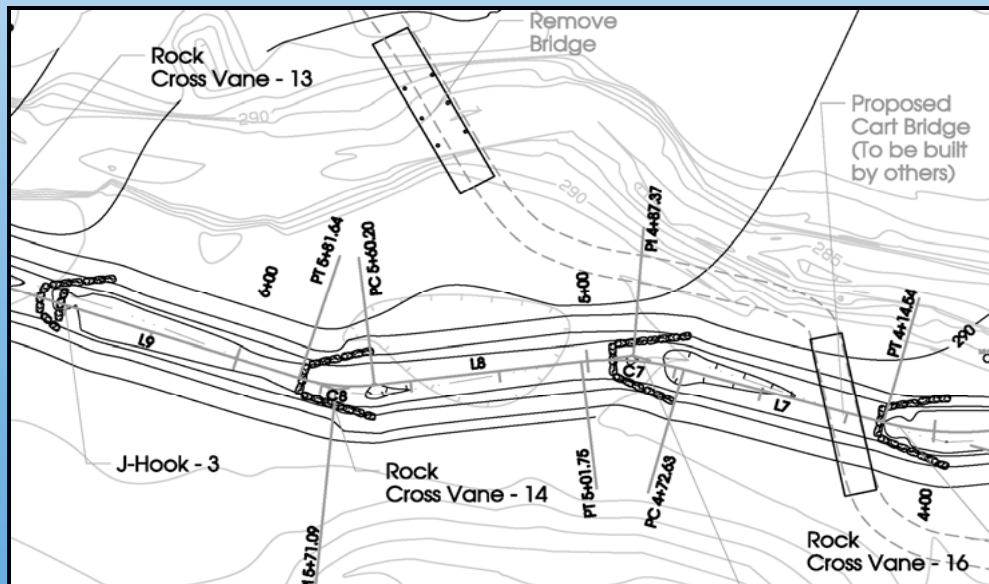
Watershed Assessment

Were watershed hydrology calculations performed?



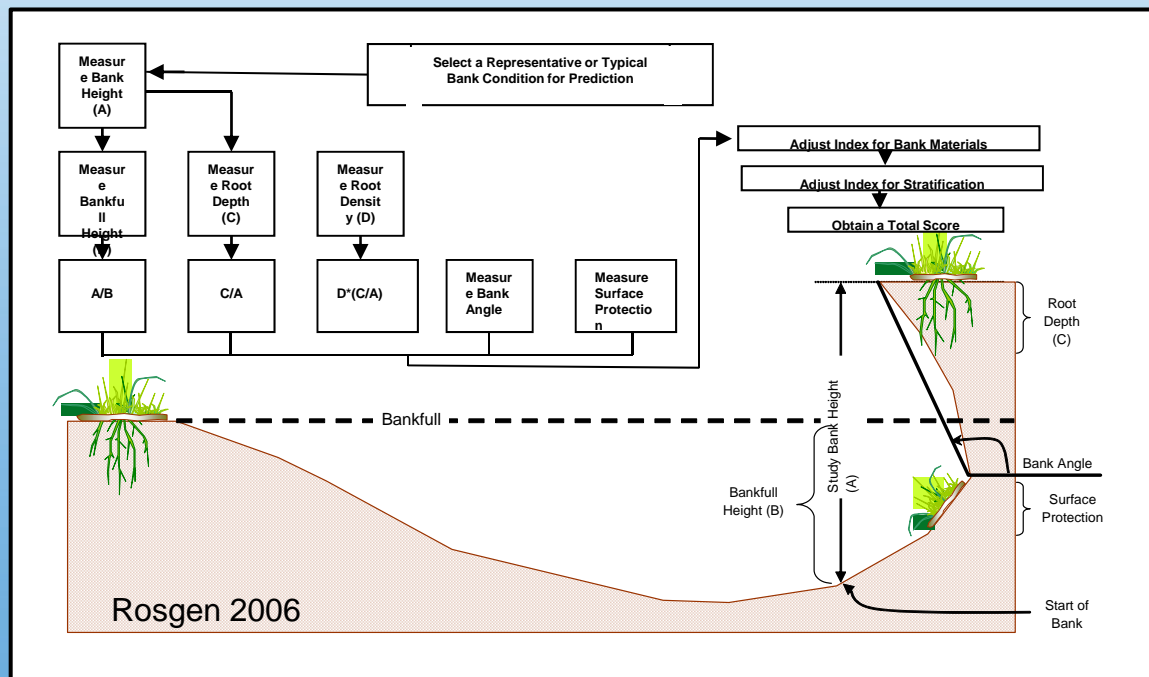
Base Mapping

Does the project include base mapping?



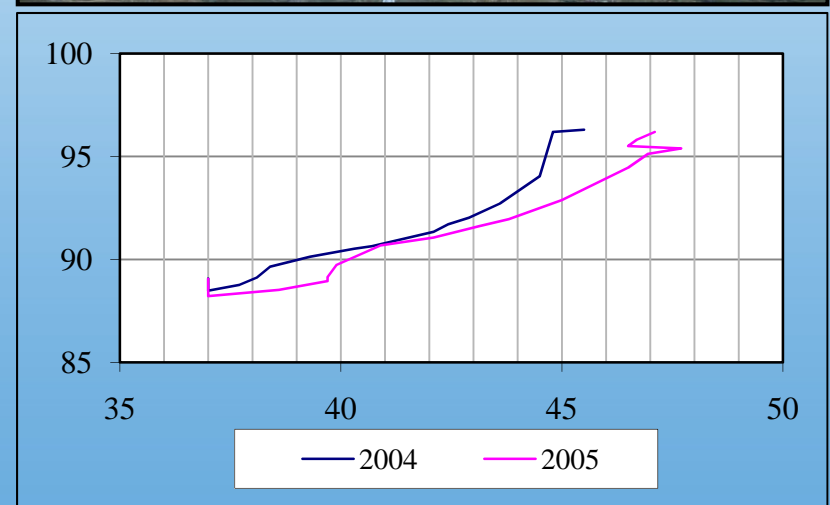
Geomorphic Assessment

Was the geomorphic assessment methodology described?



Geomorphic Assessment

Were vertical and lateral stability analyses completed?



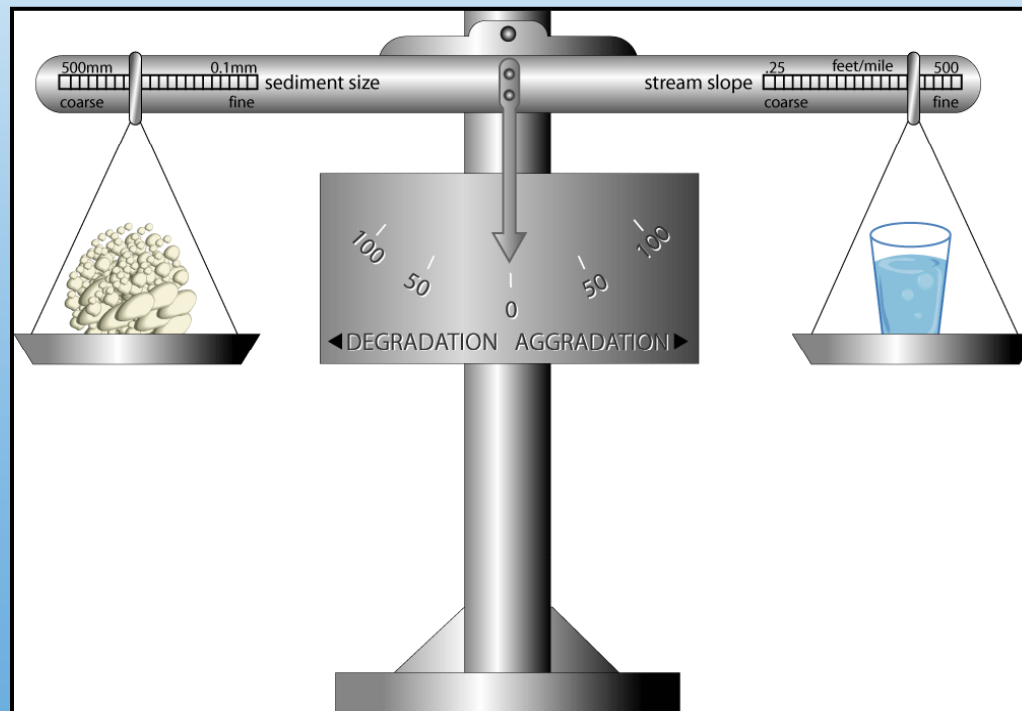
Geomorphic Assessment

Was it shown whether the instability was localized or system-wide?



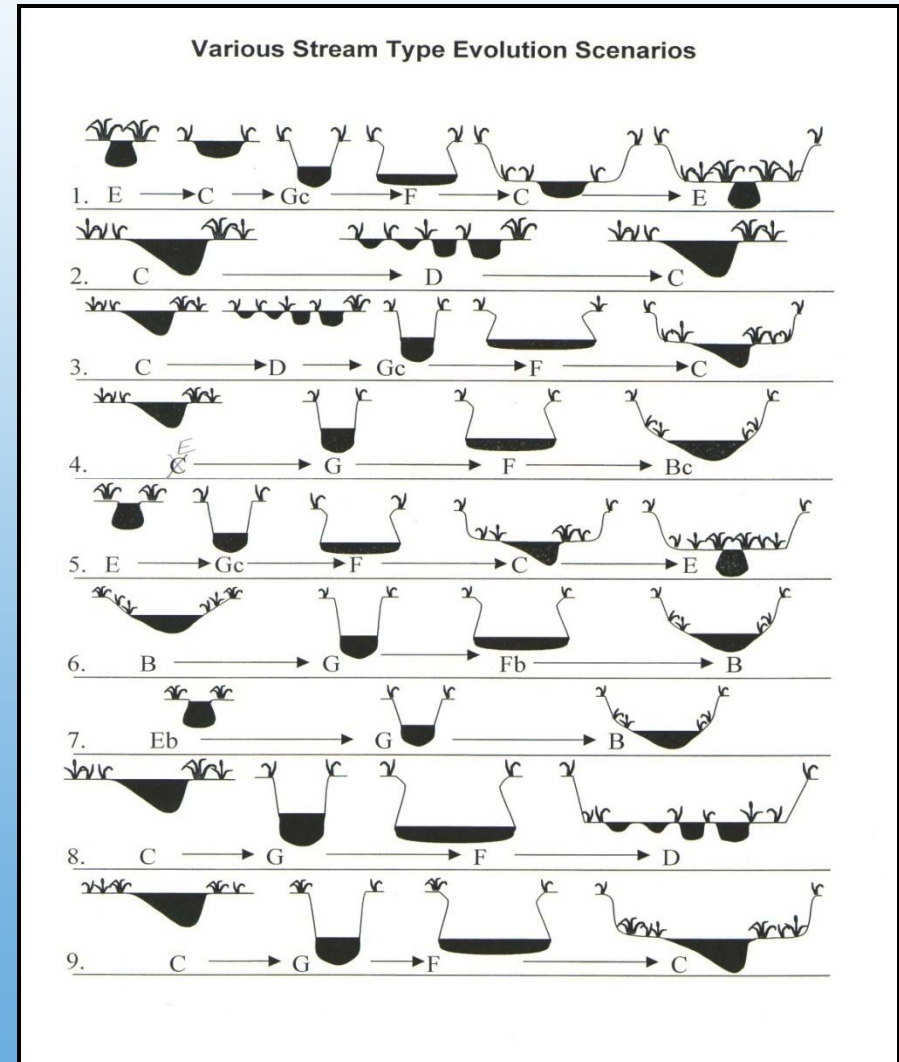
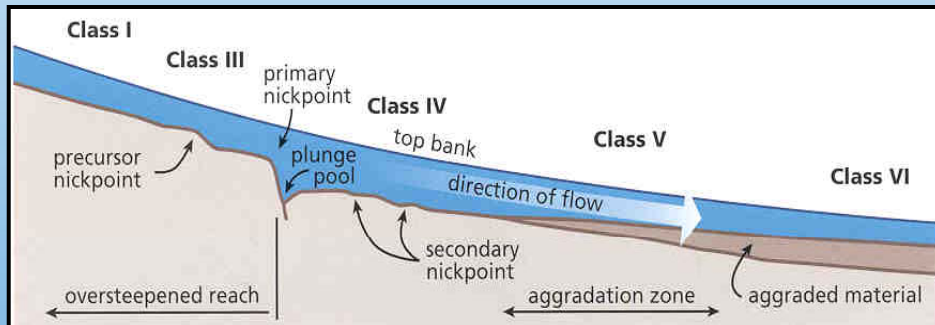
Geomorphic Assessment

Was the cause and effect relationship of the instability identified?



Geomorphic Assessment

Was the channel evolution predicted?



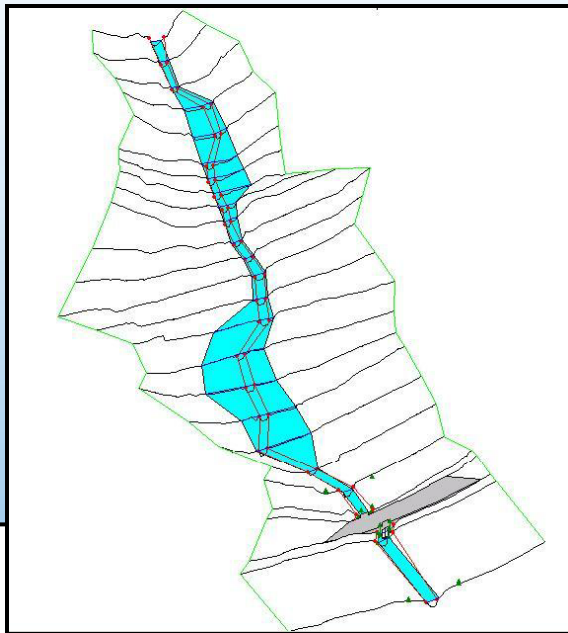
Geomorphic Assessment

Were constraints that would inhibit restoration identified?

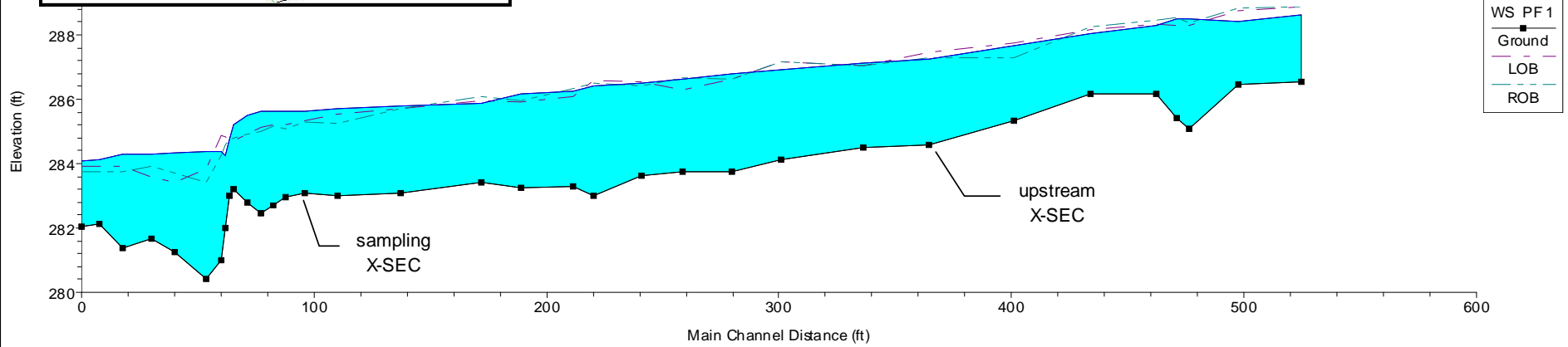


Hydraulic Assessment

Was a hydraulic assessment completed?



Chalybeate Springs Plan: Flow Range 2/1/2007
Chalybeate Reach 1



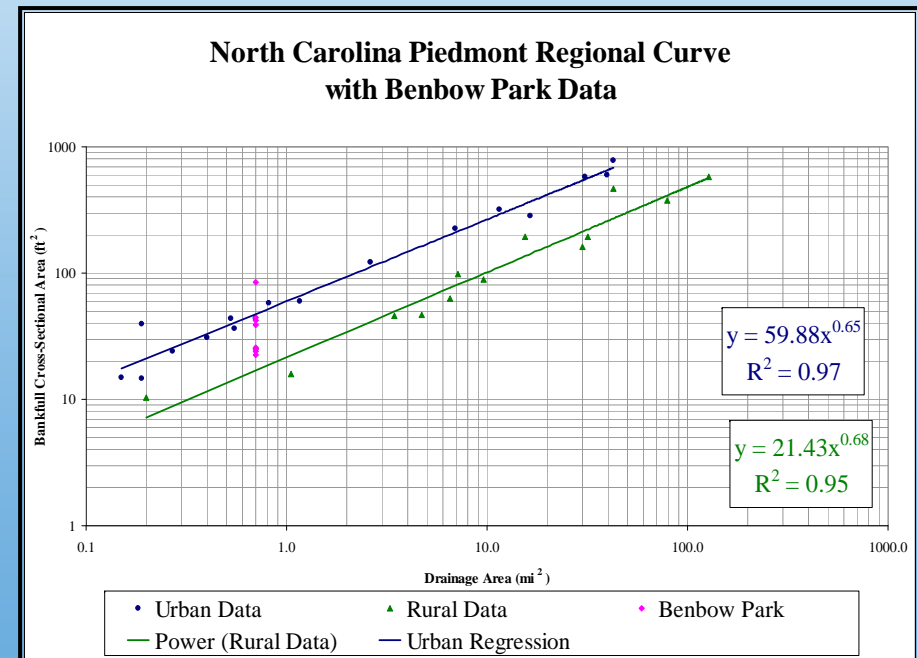
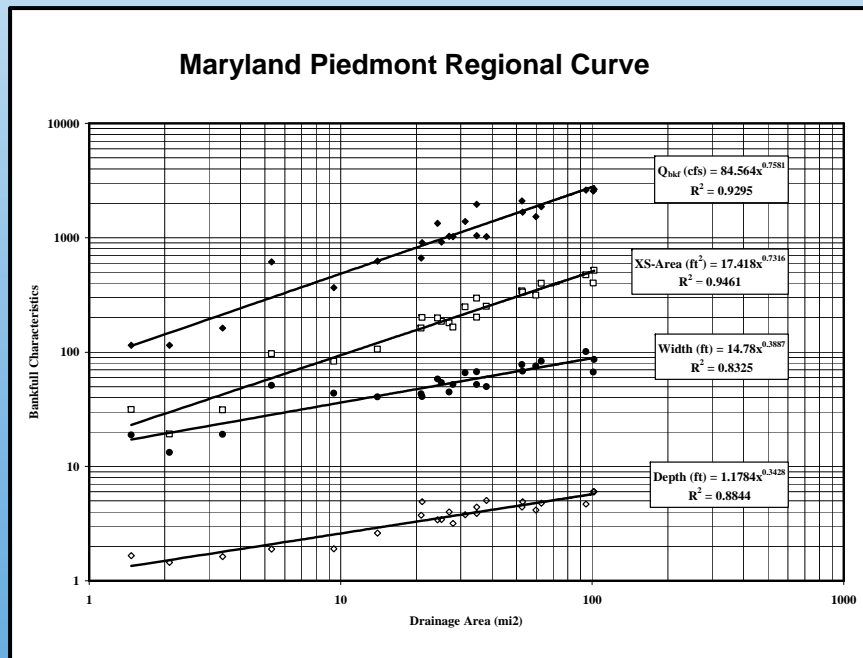
Hydraulic Assessment

Was stream velocity, shear stress, and stream power shown in relation to stage and discharge?



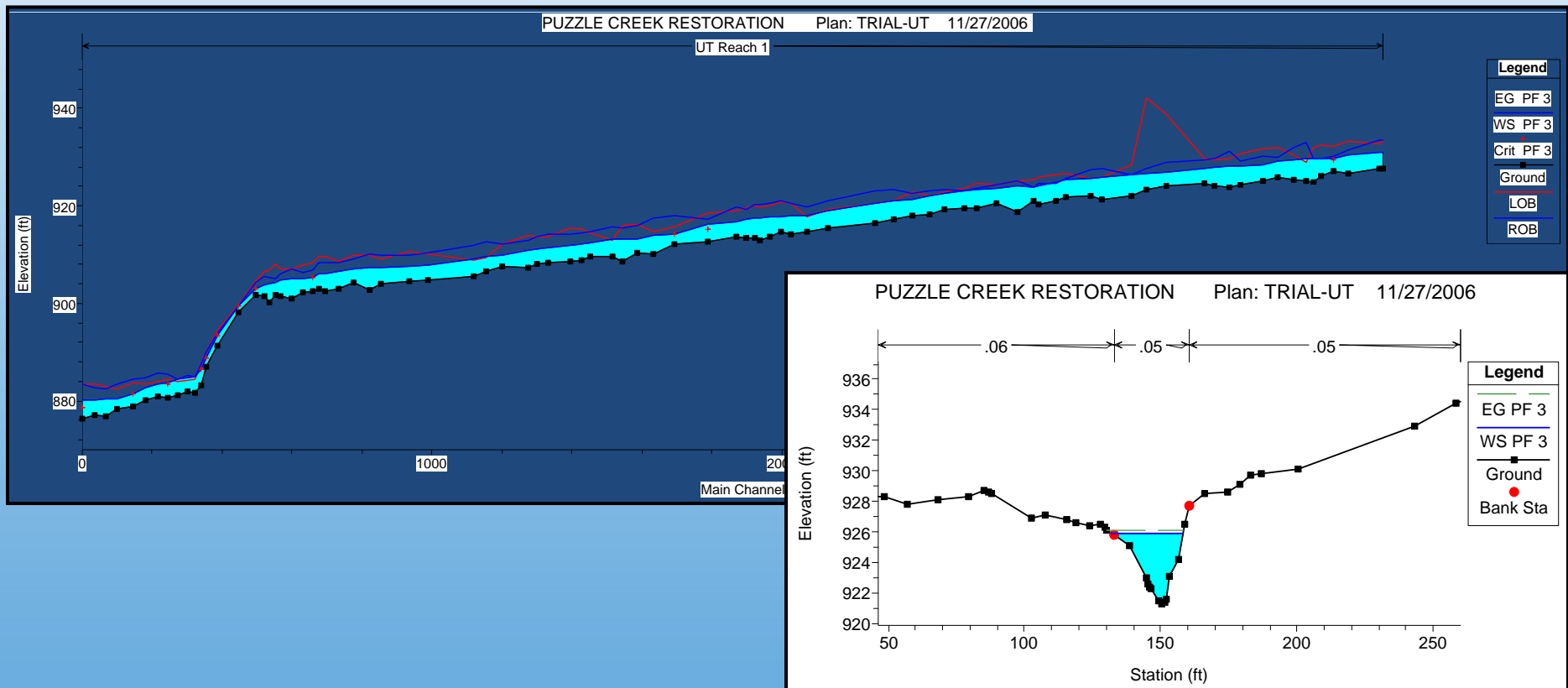
Bankfull Verification

- Was bankfull verification analysis completed?
- Were USGS gauges or regional curves used to validate bankfull discharge?



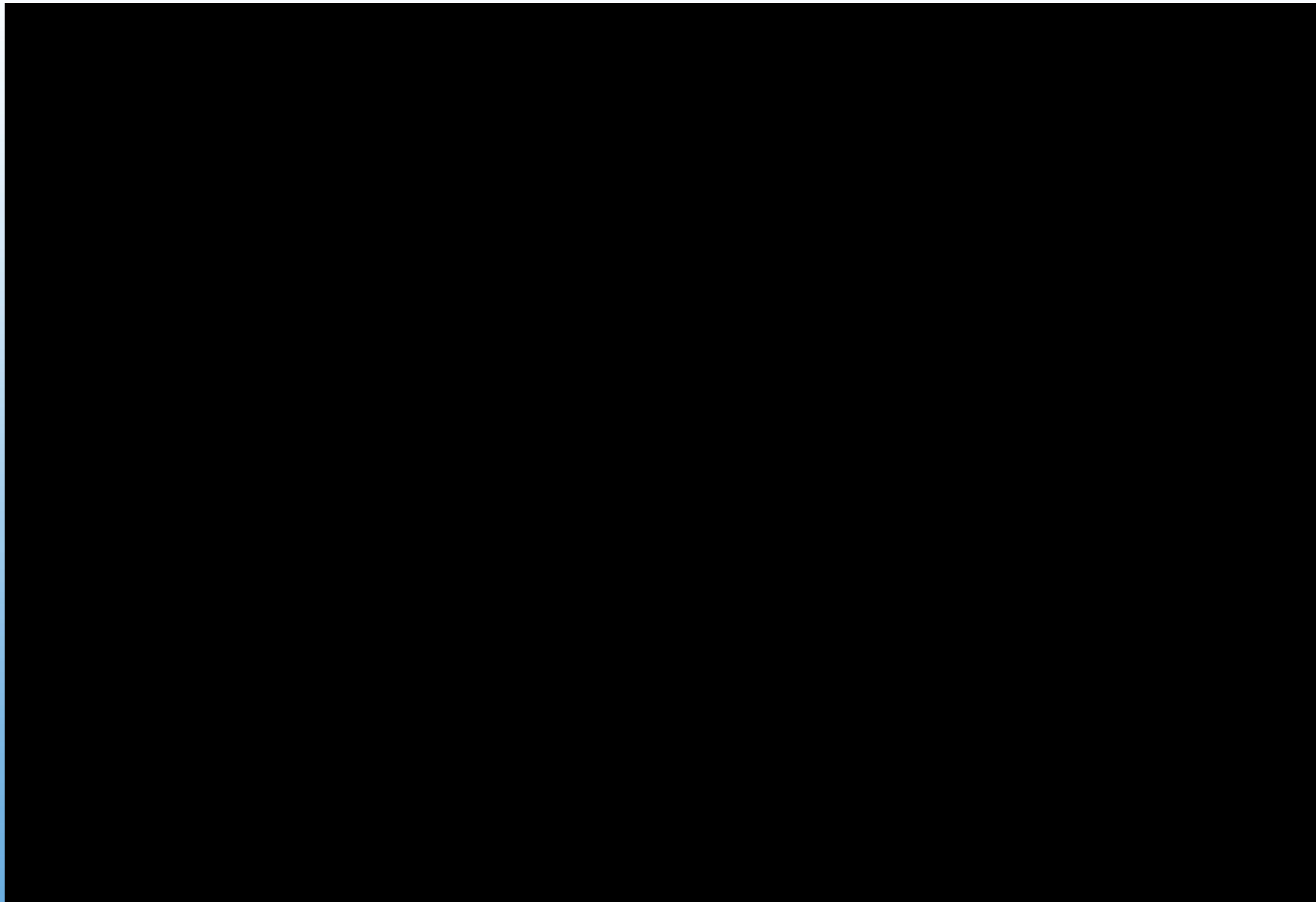
Bankfull Verification

If gauges or regional curves were not available, were other methods, such as hydrology and hydraulic models used?





INTERMISSION

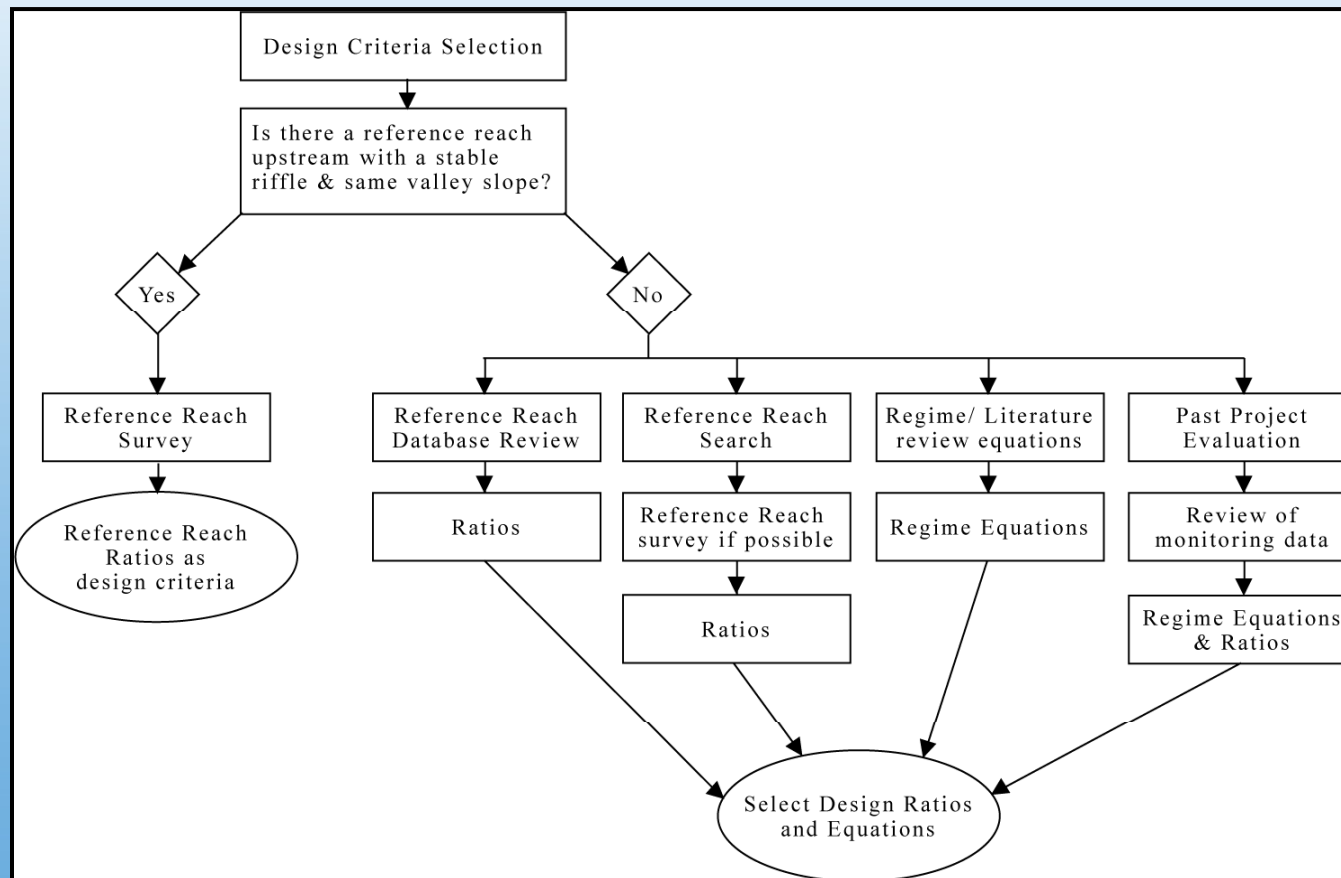


Goals and Restoration Potential

- Does the project have clear goals?
- Was the restoration potential based on the assessment data provided?
- Was a restoration strategy developed and explained based on the restoration potential?

Design Criteria

Were design criteria provided and explained?



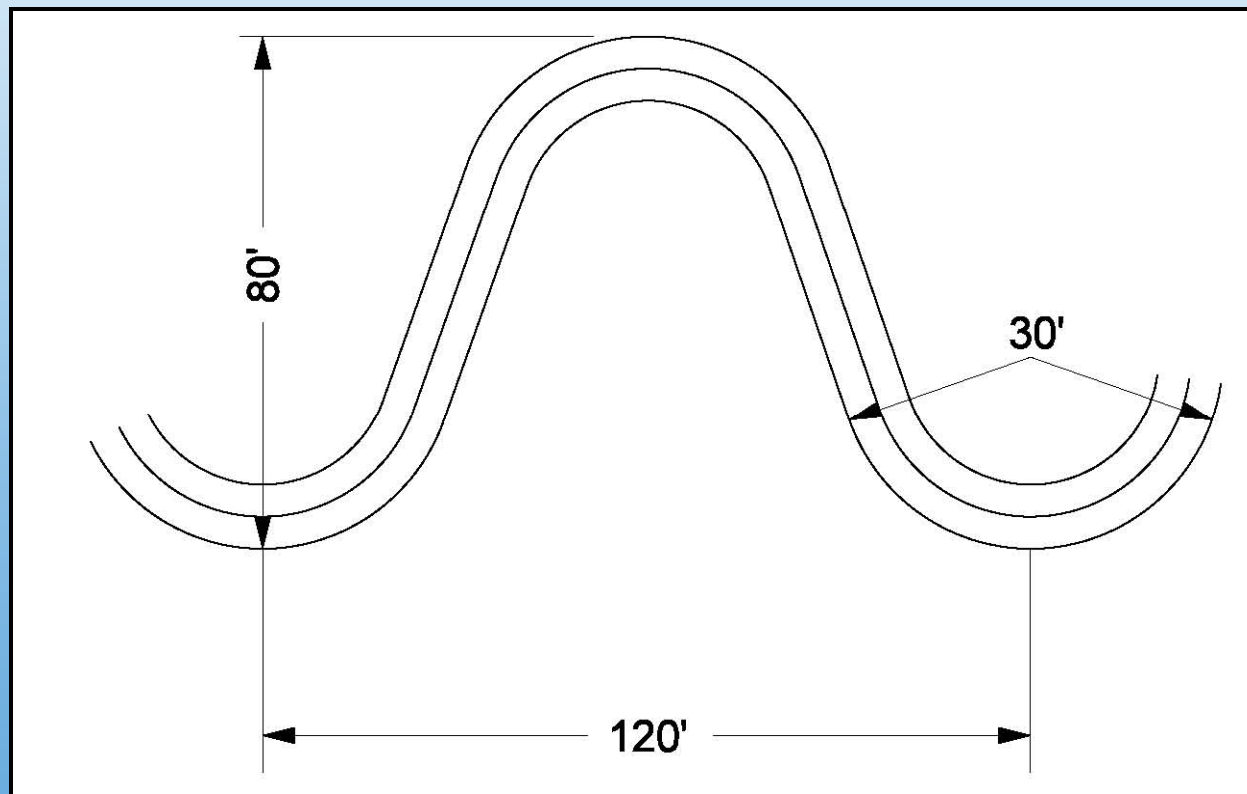
Design Criteria

Is the design criteria representative of reference reaches within the project area or of the same valley type, geology, and land use?

Parameter	Common Reference Reach Ratios			
	MIN	MAX	MIN	MAX
Stream Type (Rosgen)	C/E 4		B4	
Bankfull Mean Velocity, V_{bkf} (ft/s)	3.5	5.0	4.0	6.0
Width to Depth Ratio, W/D (ft/ft)	5.0	12.0	12.0	18.0
Riffle Max Depth Ratio, D_{max}/D_{bkf}	1.2	1.4	1.2	1.4
Bank Height Ratio, D_{tob}/D_{max} (ft/ft)	1.0	1.1	1.0	1.1
Meander Length Ratio, L_m/W_{bkf}	7.0	12.0	N/a	N/a
Rc Ratio, R_c/W_{bkf}	1.2	2.0	N/a	N/a
Meander Width Ratio, W_{blt}/W_{bkf}	2.0	8.0	N/a	N/a
Sinuosity, K	1.20	1.60	1.1	1.2
Valley Slope, S_{val} (ft/ft)	0.0050	0.0150	0.020	0.030
Riffle Slope Ratio, S_{rif}/S_{chan}	1.5	2.0	1.1	2.5
Run Slope Ratio, S_{run}/S_{rif}	0.50	0.80	N/a	N/a
Glide Slope Ratio, S_{glide}/S_{chan}	0.30	0.50	0.3	0.5
Pool Slope Ratio, S_{pool}/S_{chan}	0.00	0.20	0.0	0.4
Pool Max Depth Ratio, $D_{maxpool}/D_{bkf}$	2.0	3.5	2.0	3.5
Pool Width Ratio, W_{pool}/W_{bkf}	0.8	1.2	1.1	1.5
Pool-Pool Spacing Ratio, L_{ps}/W_{bkf}	2.5	7.0	1.5	5.0

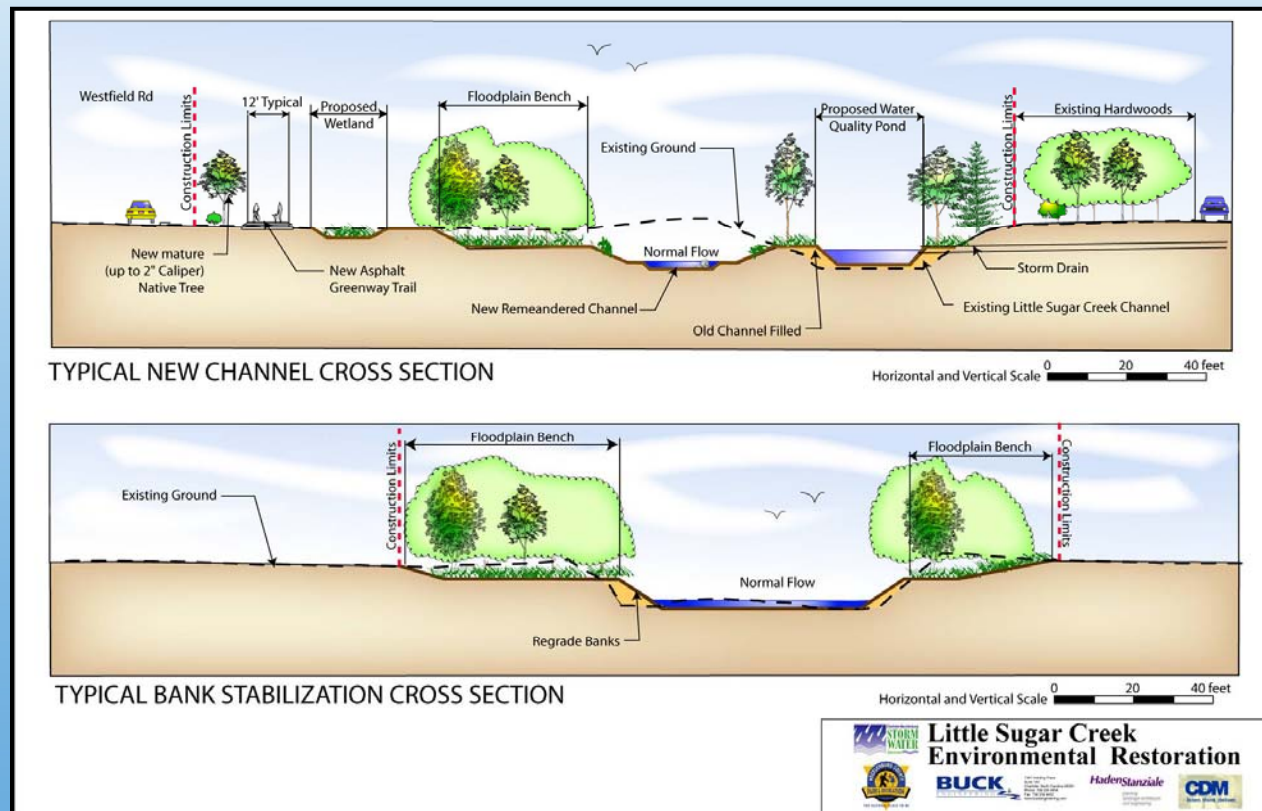
Conceptual Design

Was the concept channel alignment provided and developed within the design criteria?



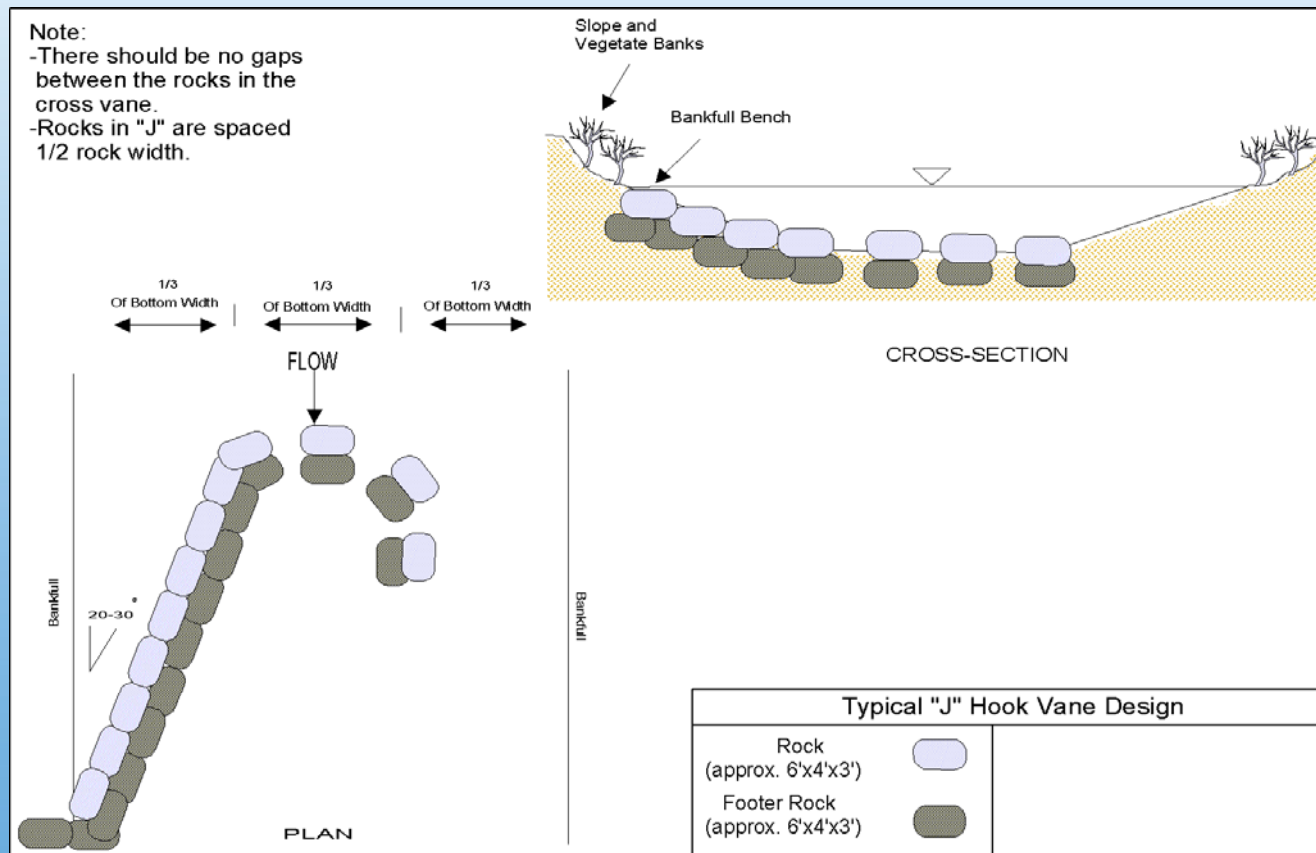
Conceptual Design

Were typical bankfull cross sections provided and developed within the design criteria?



Conceptual Design

Were typical drawings of in-stream structures provided and their use and location explained?

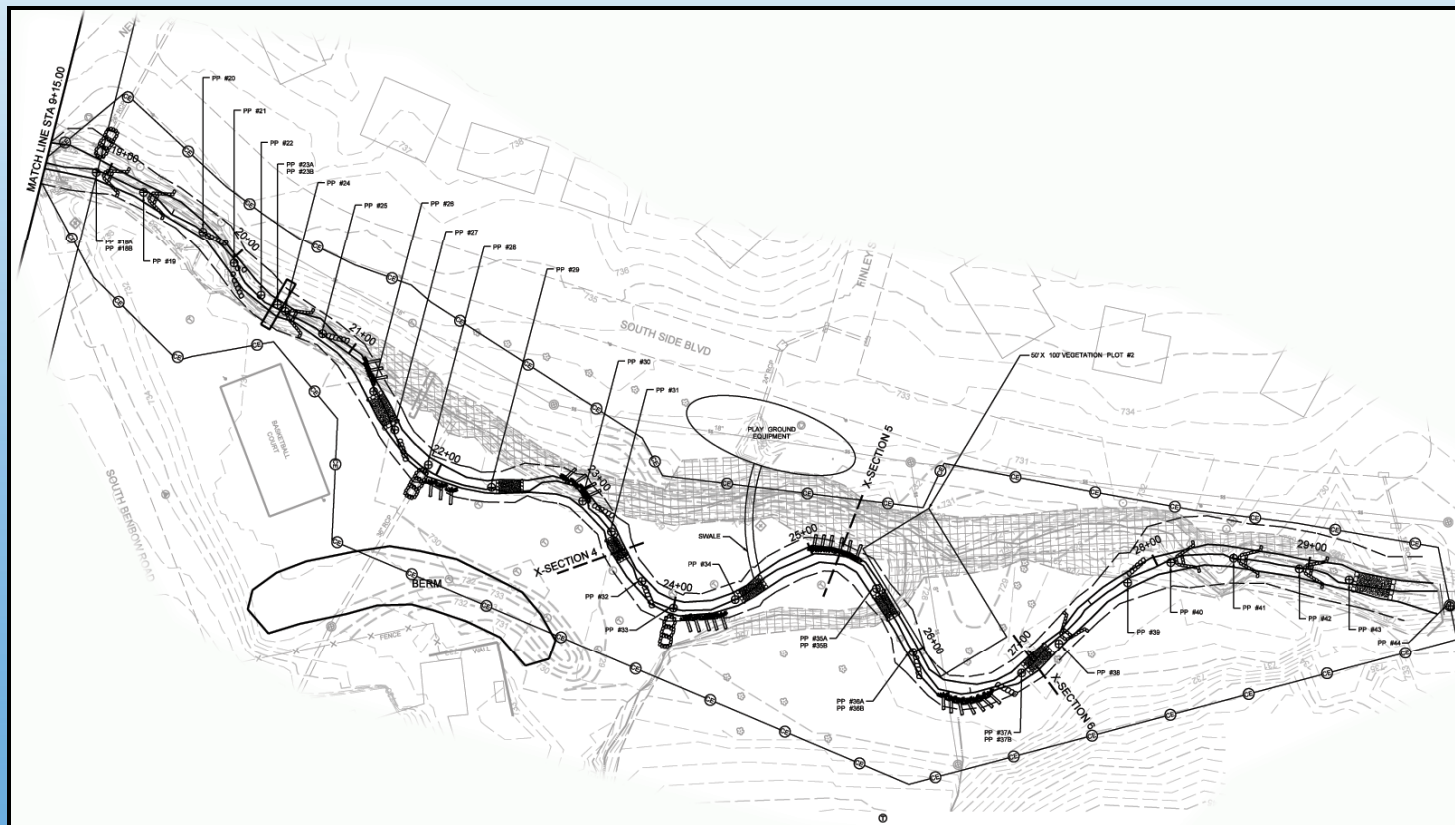


Conceptual Design

Was a draft planting plan provided?

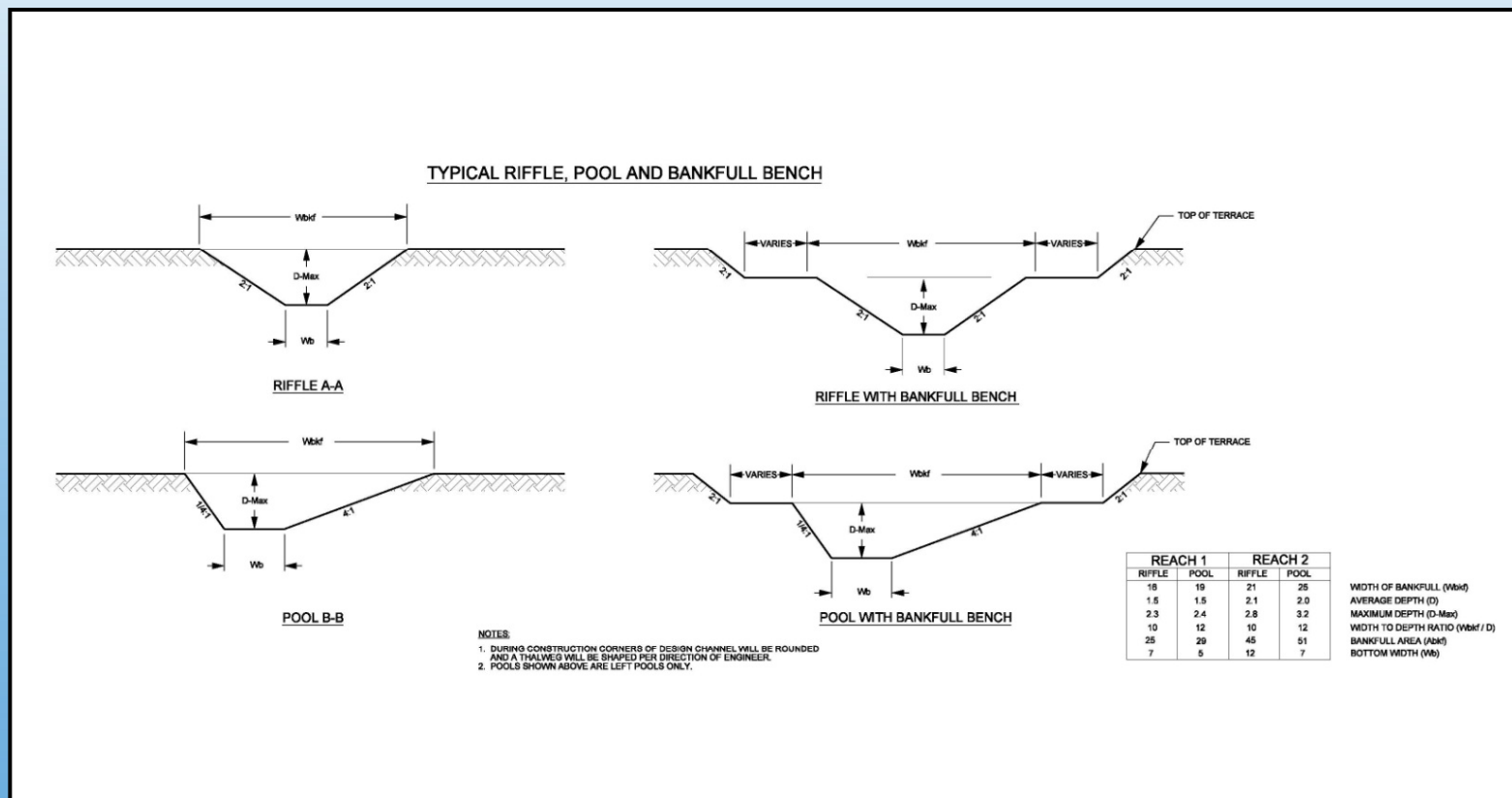
Natural Channel Design

Was a proposed channel alignment provided and developed within the design criteria?



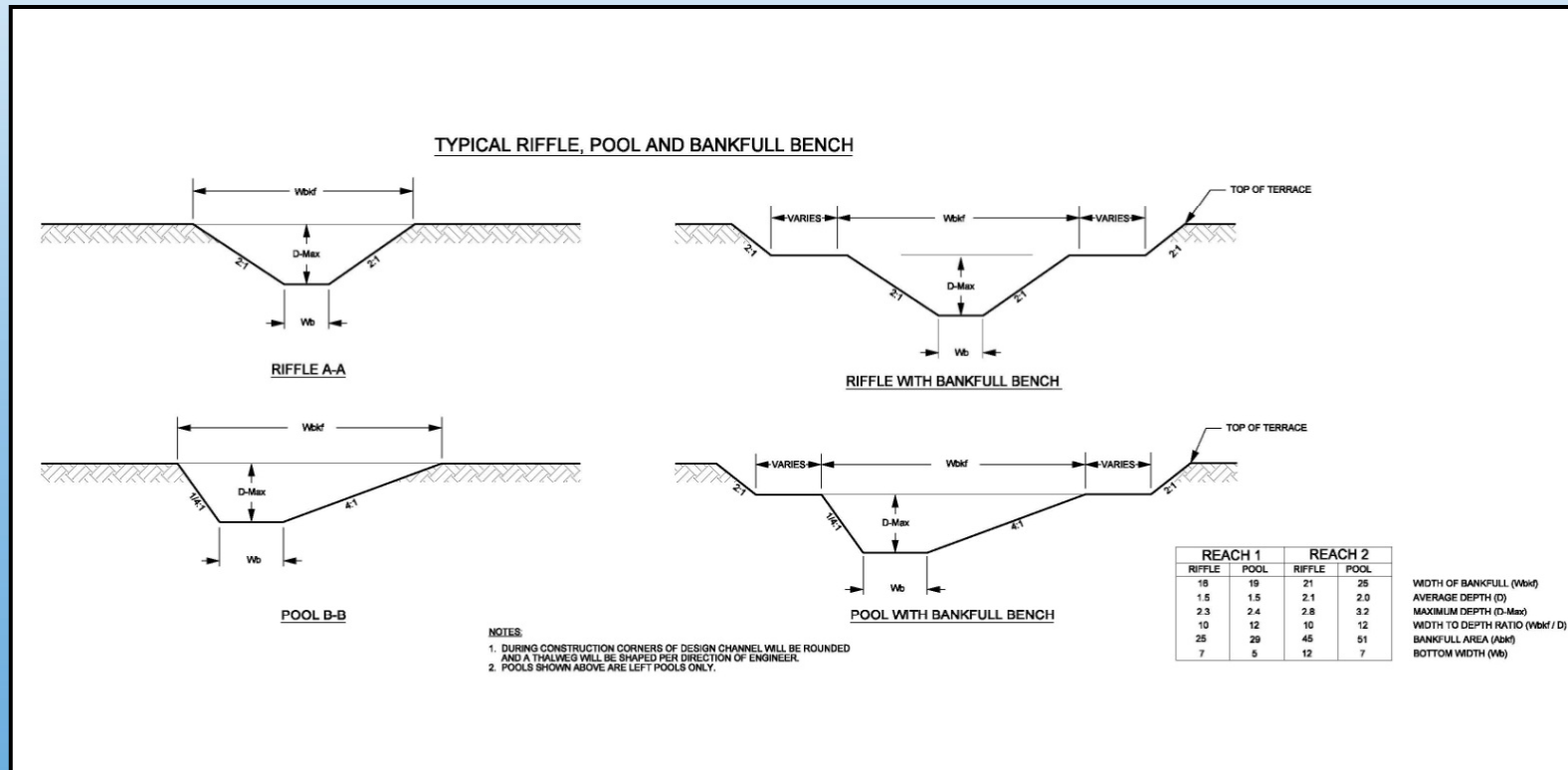
Natural Channel Design

Were proposed channel dimensions provided and developed within the design criteria?



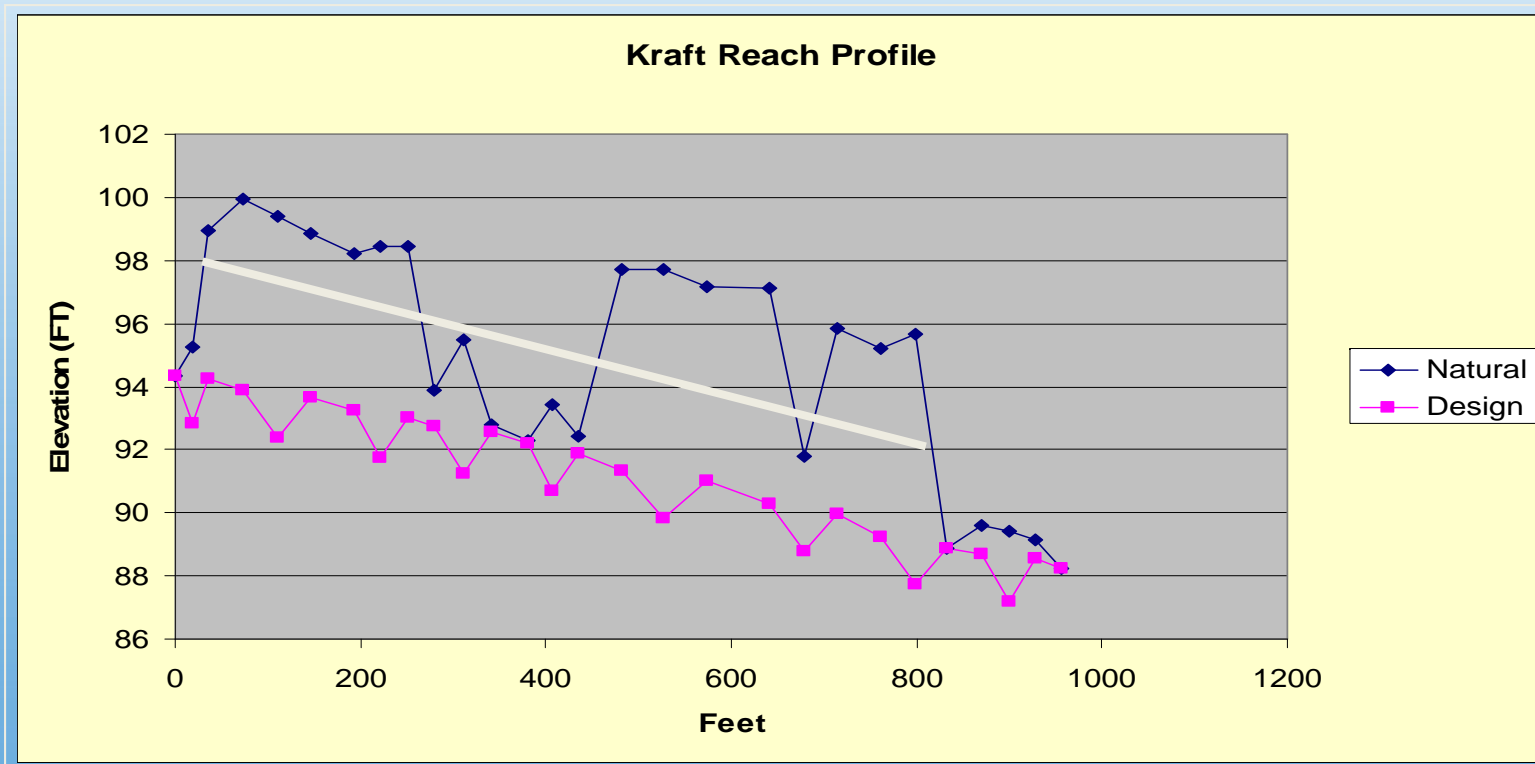
Natural Channel Design

Do the proposed channel dimensions show the adjacent floodplain or flood prone area?



Natural Channel Design

Was a proposed channel profile provided and developed within the design criteria.

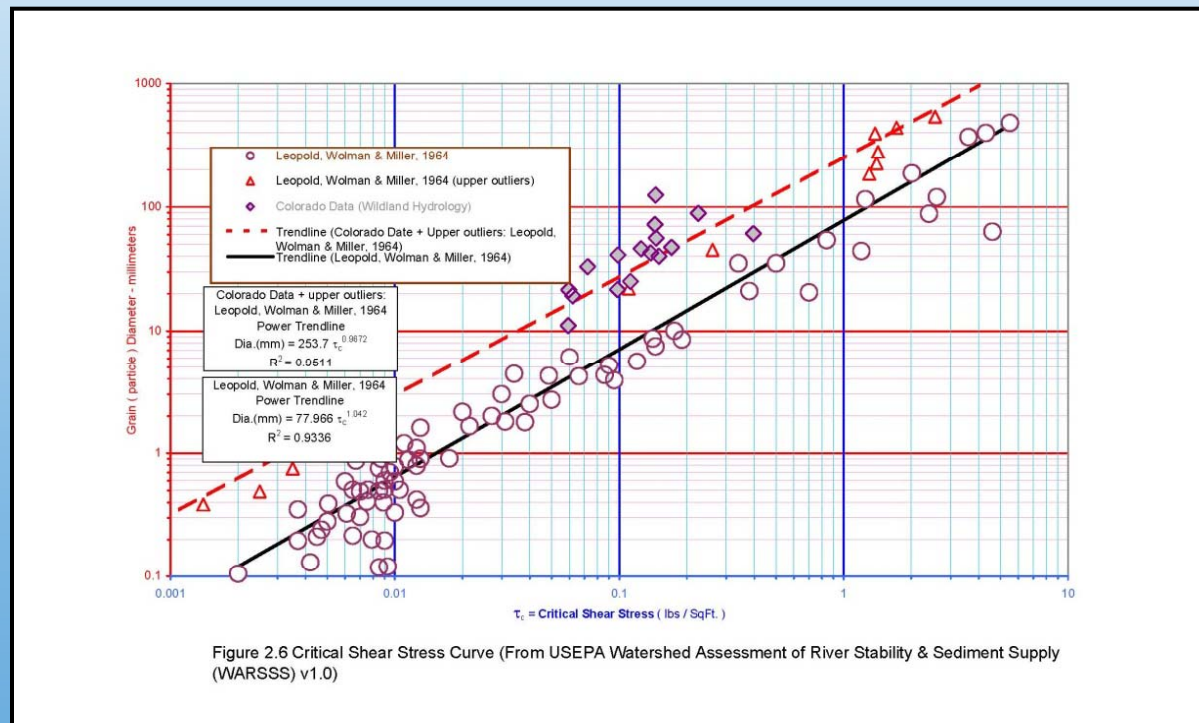


Sediment Transport

- Was sediment transport analysis required? If required, was the type of sediment transport analysis explained?
- Were existing versus design relationships of shear stress, velocity, and stream power versus stage or discharge provided?
- Did sediment transport capacity analyses show that the stream bed would not aggrade or degrade over time?

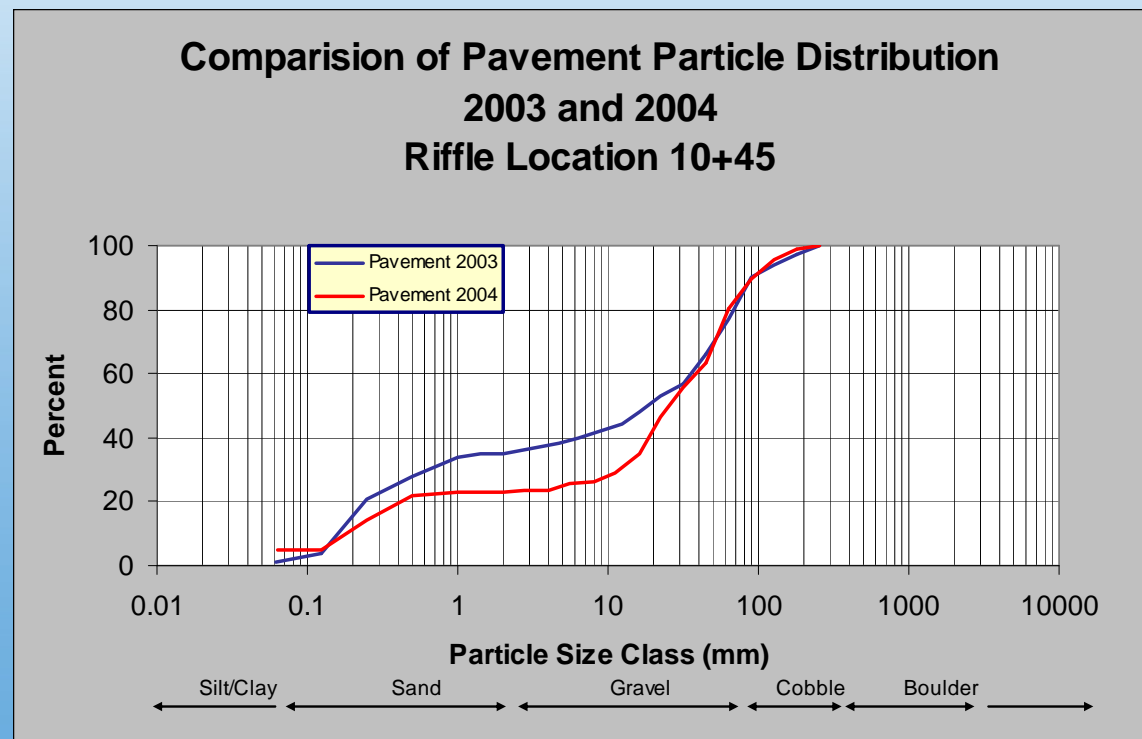
Sediment Transport

Did sediment transport competency analysis show what particle sizes would be transported with a bankfull discharge?



Sediment Transport

For gravel/cobble bed streams, does the proposed design move particles that are larger than the D100 of the stream bed?



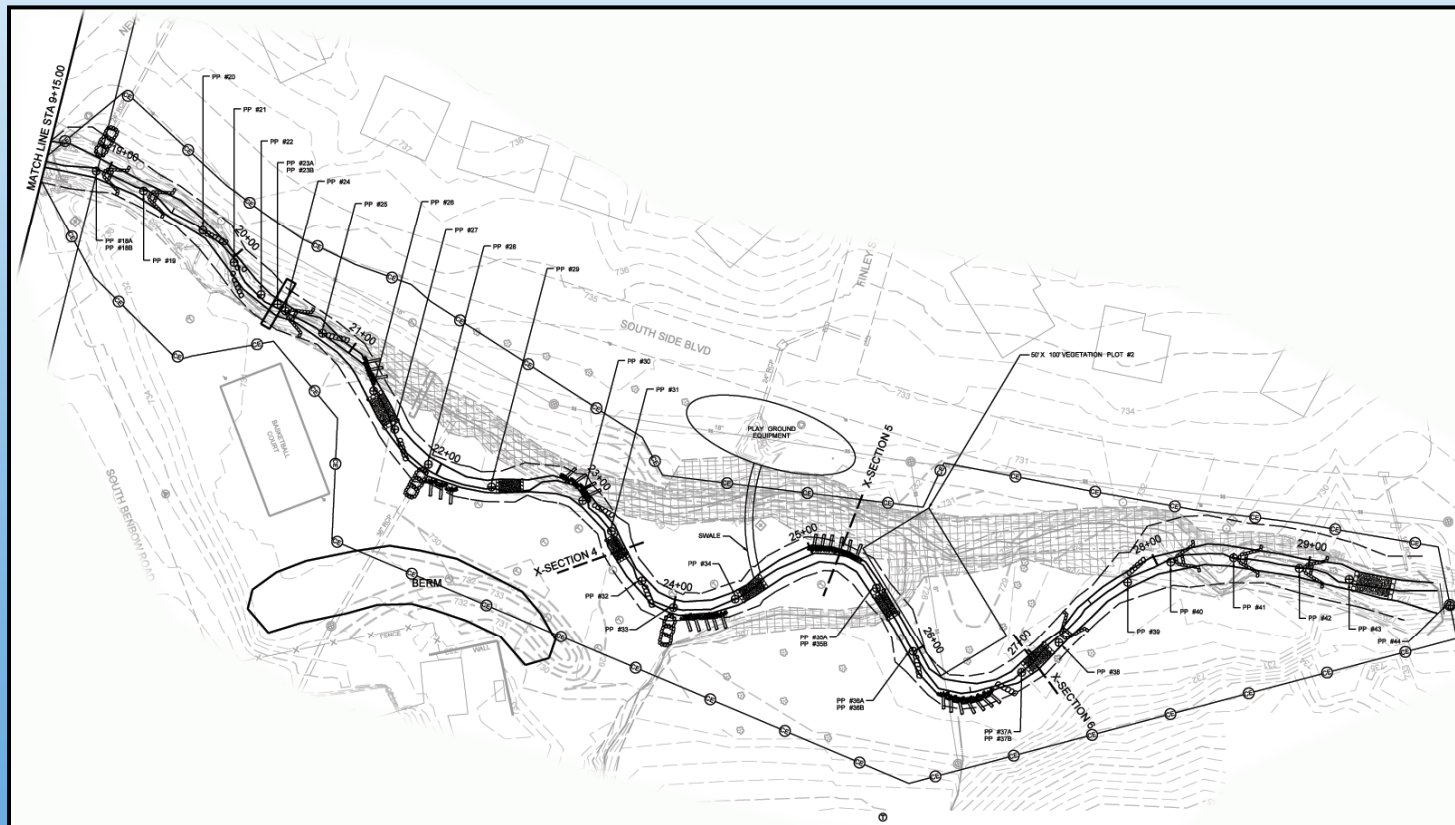
In-stream Structures

Were in-stream structures required?



In-stream Structures

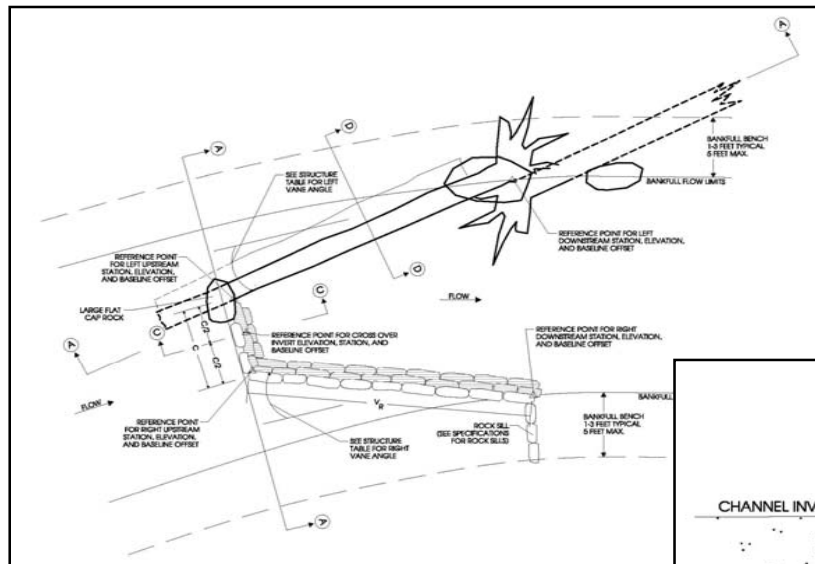
If required, was the reason for their location and use explained?



In-stream Structures

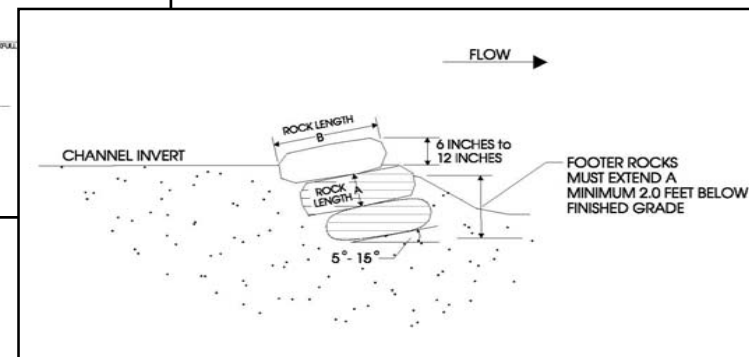
Was the relationship between the type of in-stream structure used and its role in providing stability explained?

ROCK/LOG VANE



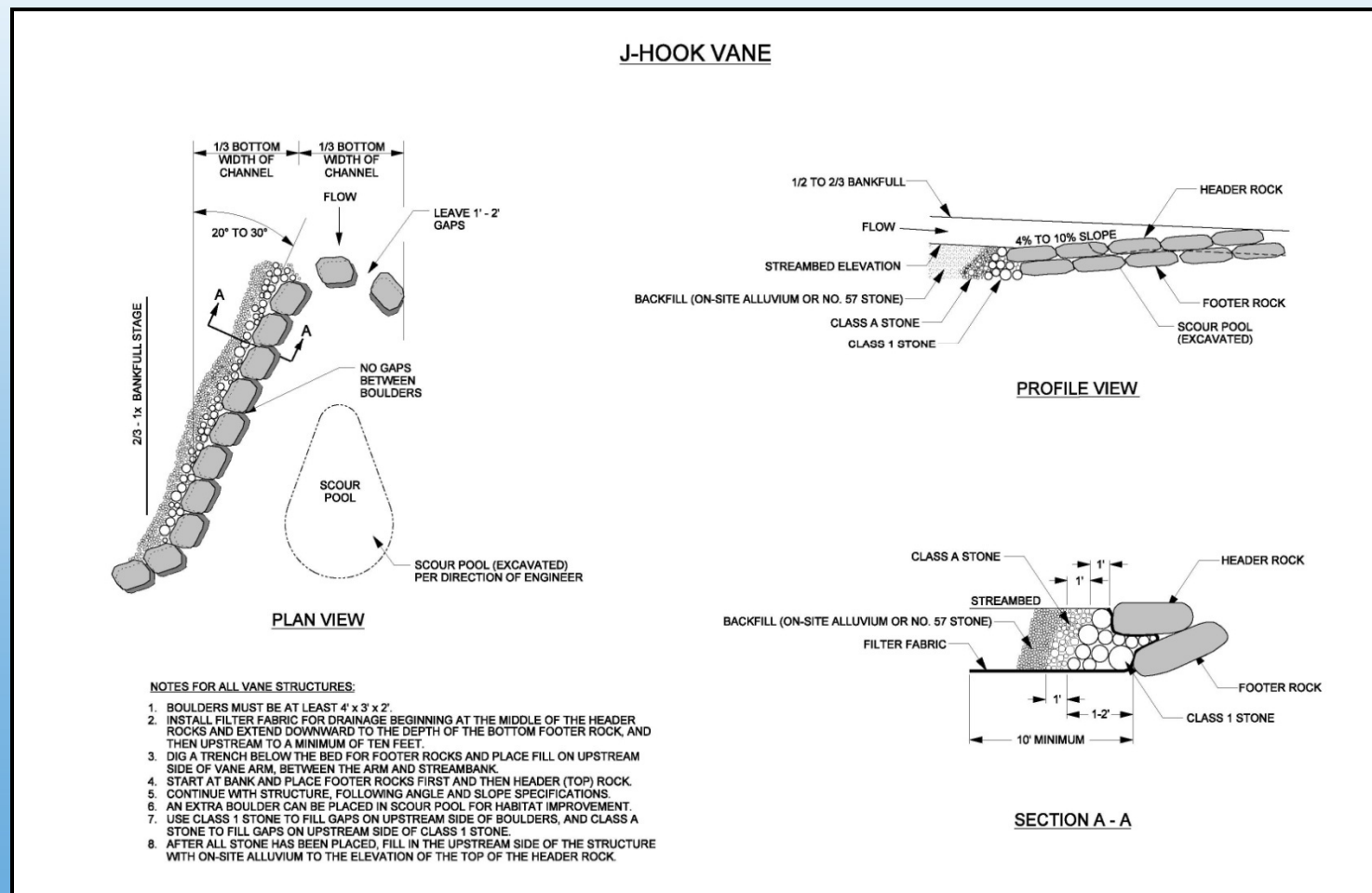
Plan View

Profile View



In-stream Structures

Were detail drawings provided for each in-stream structure?



Natural Channel Design

Were specifications provided and explained for in-stream structures and erosion control measures?

Section 5: Erosion and Sediment Control

A. DESCRIPTION

1. Erosion and Sediment Control shall be performed in accordance with the 2003 District of Columbia Standards and Specifications for Soil Erosion and Sediment Control, as published by Department of Health, Environmental Health Administration, Bureau of Environmental Quality, Watershed Protection Division.
2. Erosion and Sediment Control will consist of the installation, maintenance, and removal of all sediment control devices shown in the Construction Specifications and Plans, excluding the temporary stream diversion, and additional Erosion and Sediment Control measures required by the Project Inspector or the District Sediment Control Inspector.
3. The Contractor shall inspect and maintain (repair) all erosion and sediment controls daily to ensure that the controls are functioning properly.
4. All of the work shall be performed as indicated in the Construction Plans and Specifications, or as specified by the Project Inspector. Construction shall not begin until all Erosion and Sediment Control facilities have been installed and approved by the Project Inspector.
5. The Contractor shall stay within the limits of disturbance (LOD) shown on the Construction Plans, and minimize disturbance within the working area wherever possible.
6. It is the responsibility of the Contractor to prevent any mud and surface debris accumulation beyond the limit of disturbance, and is responsible for daily clean up.
7. All perimeter controls and erosion and sediment control structures and devices shall be maintained throughout the life of the project, conforming to the detailed sequence of construction, or as directed by the Project Inspector or the District Sediment Control Inspector.
8. Load Protection Mats are not included in this item.

B. MATERIALS

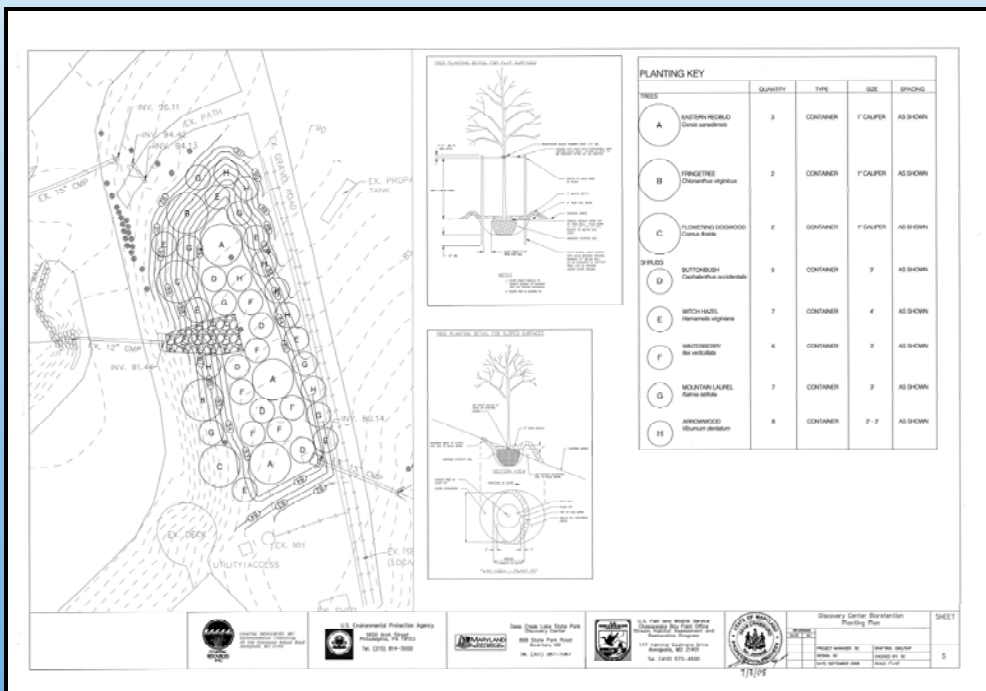
1. Temporary seeding shall conform to the requirements given for "Temporary Seeding" (Section 23).

C. MEASUREMENT AND PAYMENT

1. This item will not be measured but will be paid for at the Contract lump sum price for Erosion and Sediment Control per each Project Area. The lump sum price shall be full compensation for the installation, maintenance, and removal of all sediment control devices as indicated in the Construction Specifications and Plans, or as required by the Project Inspector or the District Sediment Control Inspector, excluding the "Temporary Stream Diversion" (Section 7). All labor, tools, equipment, and incidentals including temporary seeding necessary to complete the work are included in the lump sum price per each Project Area.
2. A Contingency item for Silt Fence is included on the bid itemization. Silt Fence shown on the Construction Plans shall be included in the lump sum price for Erosion

Vegetation Design

- Was a vegetation design provided?
- Does the design address the use of permanent vegetation for long term stability?





ASSURANCES



Maintenance Plan

Was a maintenance plan provided?

Maintenance Plan

Does it clearly state when maintenance will be required and if so, is it quantifiable?



Maintenance Plan

Does it clearly state how erosion will be addressed and by whom?



Monitoring Plan

- Was a monitoring plan provided?
- Does it have measurable, quantifiable performance standards?
- Does it have clearly defined thresholds of success and failure?

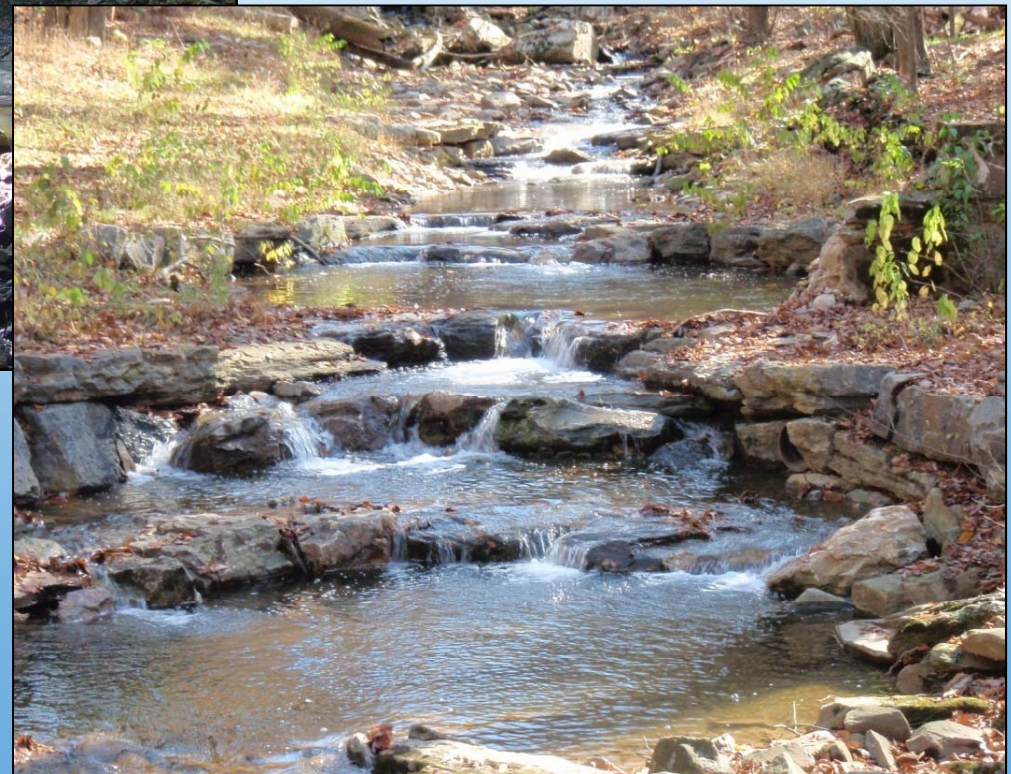
Monitoring Plan

- Is monitoring required for at least 3 years?
- Does it state who is required to conduct the monitoring?



Overall Design Review

- Does the design address the project objectives?
- Is there any component of the design that adversely affects the success of the project?



Geomorphic Assessment

Was the geomorphic assessment methodology described?



Stream:	HICKKEY RUN	Observer(s):	RKS, KDR	Date:	KR	QA/QC:	SD	Total Score:	41.94
Reach:	HR - 3	Comments:	GPS Coordinates: LM:38° 91' 29.8" / 76° 96' 56.3" +/-14' RM:38° 91' 27.8" / 76° 96' 58.9" +/-13'						
Location:	SS - 6							Very High	Left Bank - Took BP from cross-section, side of road flush with rebar cap closest to bank
Date:	3/17/2003								

Erodibility Variables						
Bank Height / Bankfull Height Ratio	Bank Height	Bankfull Height	Value	Index	Bank Erosion Potential	Notes
	5.82	0.57	10.00		Extreme	
Root Depth / Bank Height Ratio	Root Depth	Bank Height	Value	Index	Bank Erosion Potential	Notes
	1.0	8.82	0.17	7.60	High	
Weighted Root Density	Root Density (%)	Root Depth / Bank Height	Value	Index	Bank Erosion Potential	Notes
	15.00	0.17	12.89	8.12	Very High	
Bank Angle	Bank Angle (°)				Bank Erosion Potential	Notes
	82.00			6.21	High	
Surface Protection	Surface Protection (%)				Bank Erosion Potential	Notes
	3.00			10.00	Extreme	
Bank Materials	Adjustment					Notes
	0.00					
Bank Stratification	Adjustment					Notes
	0.00					
TOTAL SCORE					41.94	

Bank Erosion Potential							
	Very Low	Low	Moderate	High	Very High	Extreme	
Bank Height / Bankfull Height	Value	1.00-1.10	1.11-1.19	1.20-1.50	1.60-2.00	2.10-2.80	>2.80
	Index	1.0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.0	10
Root Depth / Bank Height	Value	1.00-0.90	0.89-0.50	0.49-0.30	0.29-0.15	0.14-0.05	<0.05
	Index	1.0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.0	10
Weighted Root Density	Value	100-80	79-55	54-30	29-15	14-5	<5
	Index	1.0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.0	10
Bank Angle	Value	0-20	21-60	61-80	81-90	91-119	>119
	Index	1.0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.0	10
Surface Protection	Value	100-80	79-55	54-30	29-15	14-10	<10
	Index	1.0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.0	10

Adjustments	
Bedrock	Bedrock banks have a very low erosion potential.
Boulders	Boulder banks have a low erosion potential.
Cobble	Subtract 10 points. No adjustment if sand/gravel compose greater than 50% of bank.
Sand/Silt/Clay Loam	Add 5 points.
Gravel	Add 5-10 points depending on percentage of bank material composed of sand.
Sand	Add 10 points.
Silt / Clay	No adjustment.
Stratification	
	Add 3-10 points depending on position of unstable layers in relation to bankfull stage.

Bank Profile		
Horizontal Distance	Vertical Height	Notes
(2.40)	(1.13)	SL BRK
(1.85)	(0.68)	SL BRK
1.20	(0.51)	GTPIN
1.20	0.00	TTPIN
1.78	(0.53)	GTPIN
2.35	1.00	SL BRK
2.76	1.50	SL BRK
2.91	2.00	SL BRK
3.25	2.50	SL BRK
3.80	3.20	SL BRK
3.96	4.10	SL BRK
4.18	5.24	UNDERCUT
3.53	5.64	SL BRK
3.59	5.82	TOE BANK
Bankfull		
Horizontal Distance	Vertical Height	Notes
2.00	0.73	
(2.40)	0.73	

