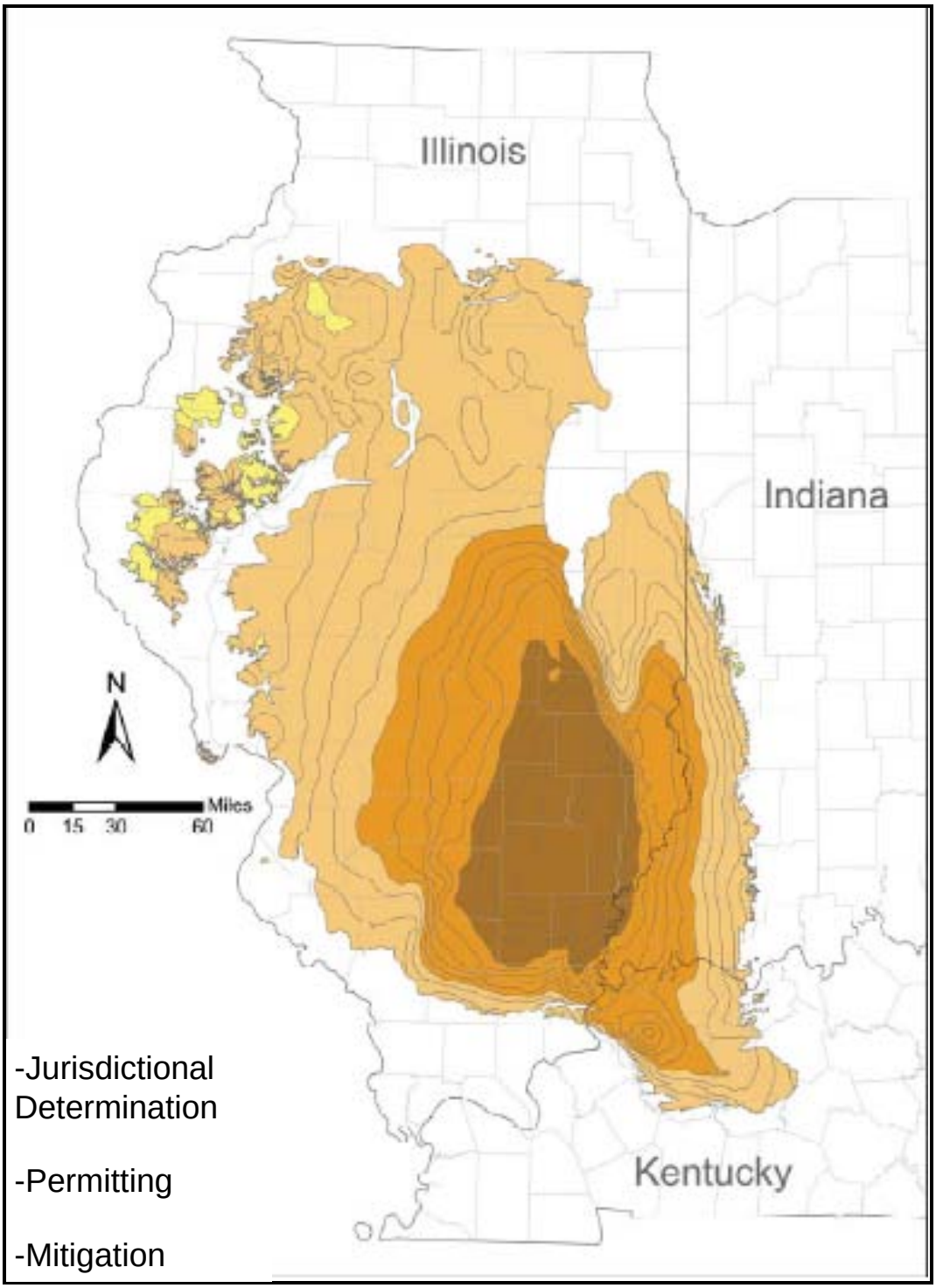
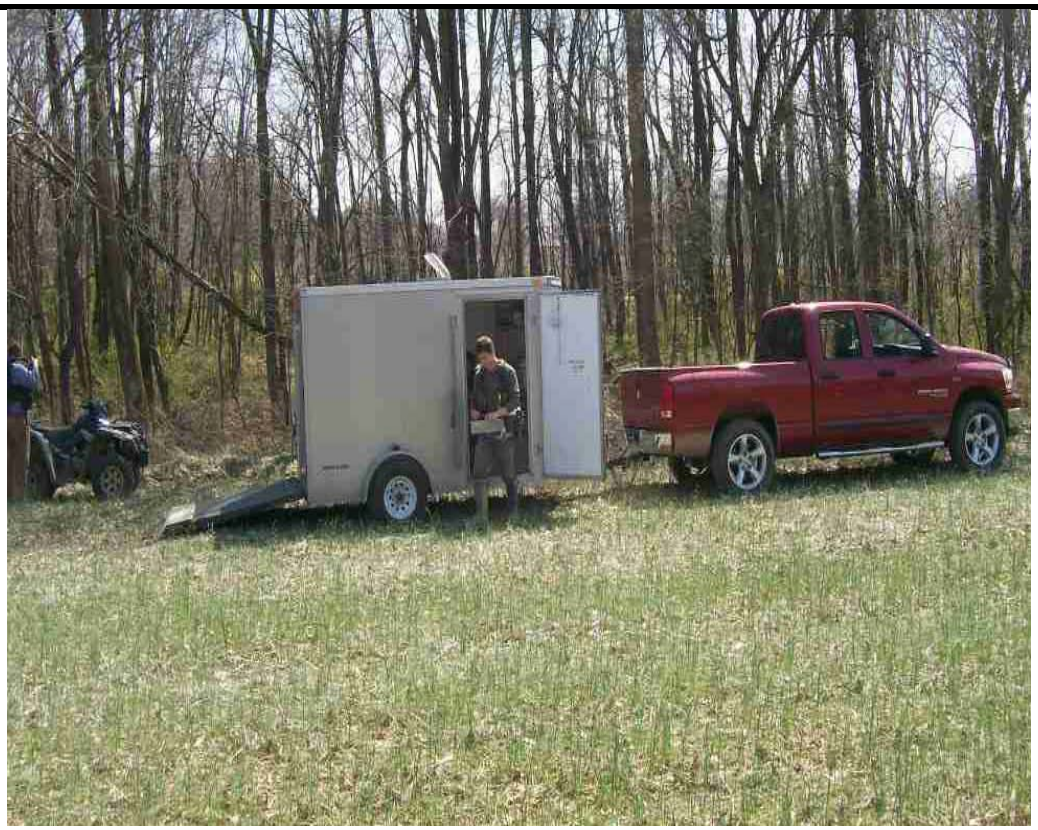
ANTHROPOGEOMORPHOLOGY OF STREAMS, WETLANDS & LANDSCAPES OF THE ILLINOIS BASIN, DATA COLLECTION & RESTORATION TECHNIQUES

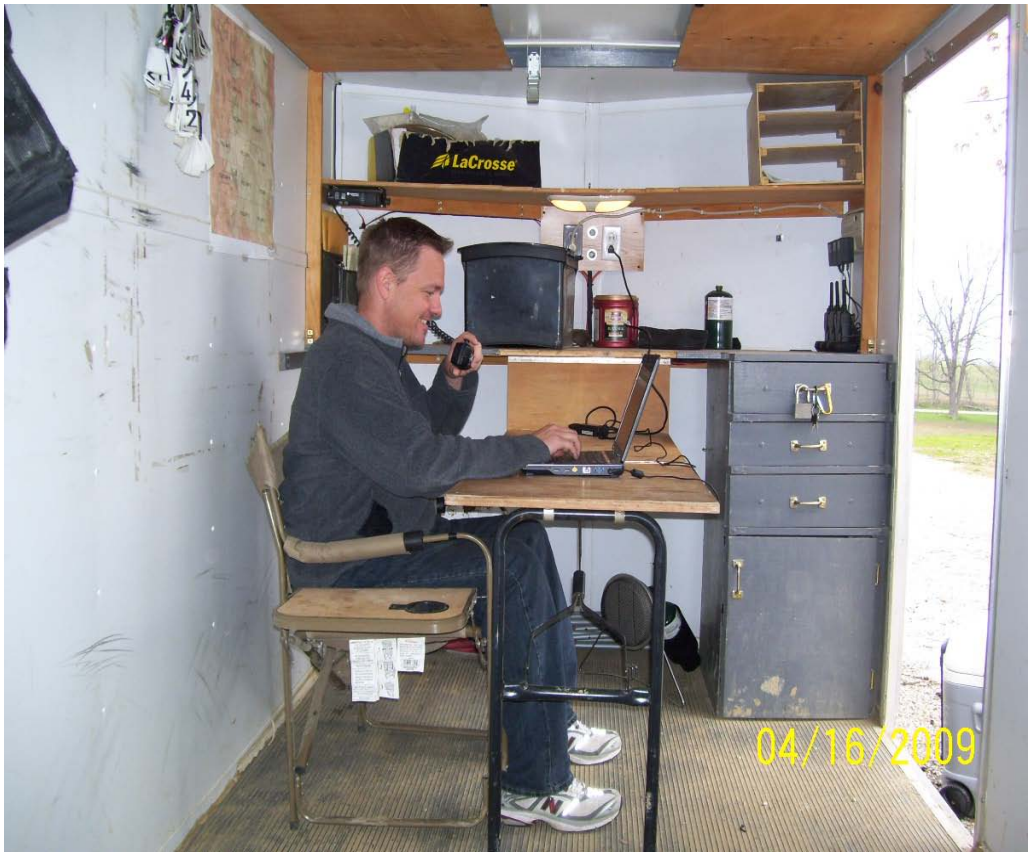


-Jurisdictional Determination

-Permitting

-Mitigation





Mobile Offices collect large datasets in remote locations.

Watershed Approach

Landuse Designations to reflect the conditions in which the jurisdictional waters are developed. These include Agriculture, Natural, Mixed, PreLaw, Reclaim, Excavated, Logged & Urban.

Unit Data	Unit Functionality	Cumulative Functionality
Length	Overall Stream	Linear feet of Fully Functional, Moderately Functional & Functionally Impaired Stream
Distance	Entrenchment	Average Floodplain Width
Sinuosity	Stream Type	Total Floodplain Area
Wbot	Vegetation Left Bank	Average Riparian Width
Wbkf	Vegetation Width	Total Riparian Area
Wfpa	Vegetation Right Bank	Existing conditions are compared to proposed mitigation to ensure a Net Cumulative Benefit in the watershed.
Dbkf	Vegetation Width	
Entrenchment Ratio	Bank Erosion	
Width/Depth Ratio	Channel Stability	
Classification	Aggradation/Degradation	
VegL	Alterations	
Width	Functionality determined by the Rosgen-based Missouri Protocol.	
VegR		
Width		
Flow		
Depositional Features		
Bank Erosion		
Agg/Deg		
Stability		
Alterations		
%Riffle		
%Run		
%Pool		

Agriculture after covering 60,000-acres it was determined that Ag has had the most widespread impact on streams in the Illinois Basin.

Mixed landuse streams generally occur on wooded sideslopes below a ridge that’s being farmed.

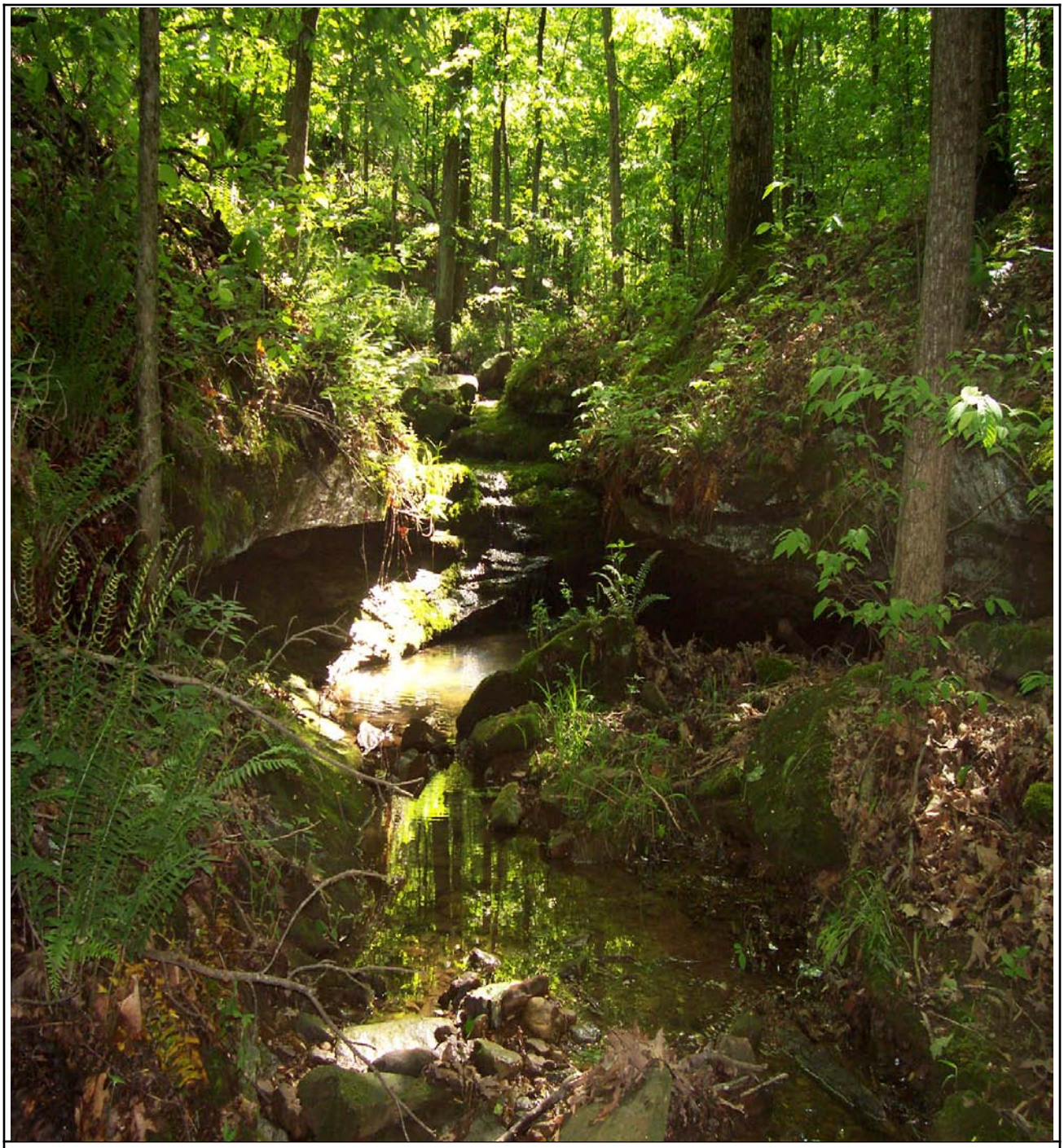
Natural streams generally still receive some degree of negative inputs.

PreLaw prior to SMCRA 1977.

Reclaim drains tend to be rock-lined either with overburden or rip-rap from local quarries.

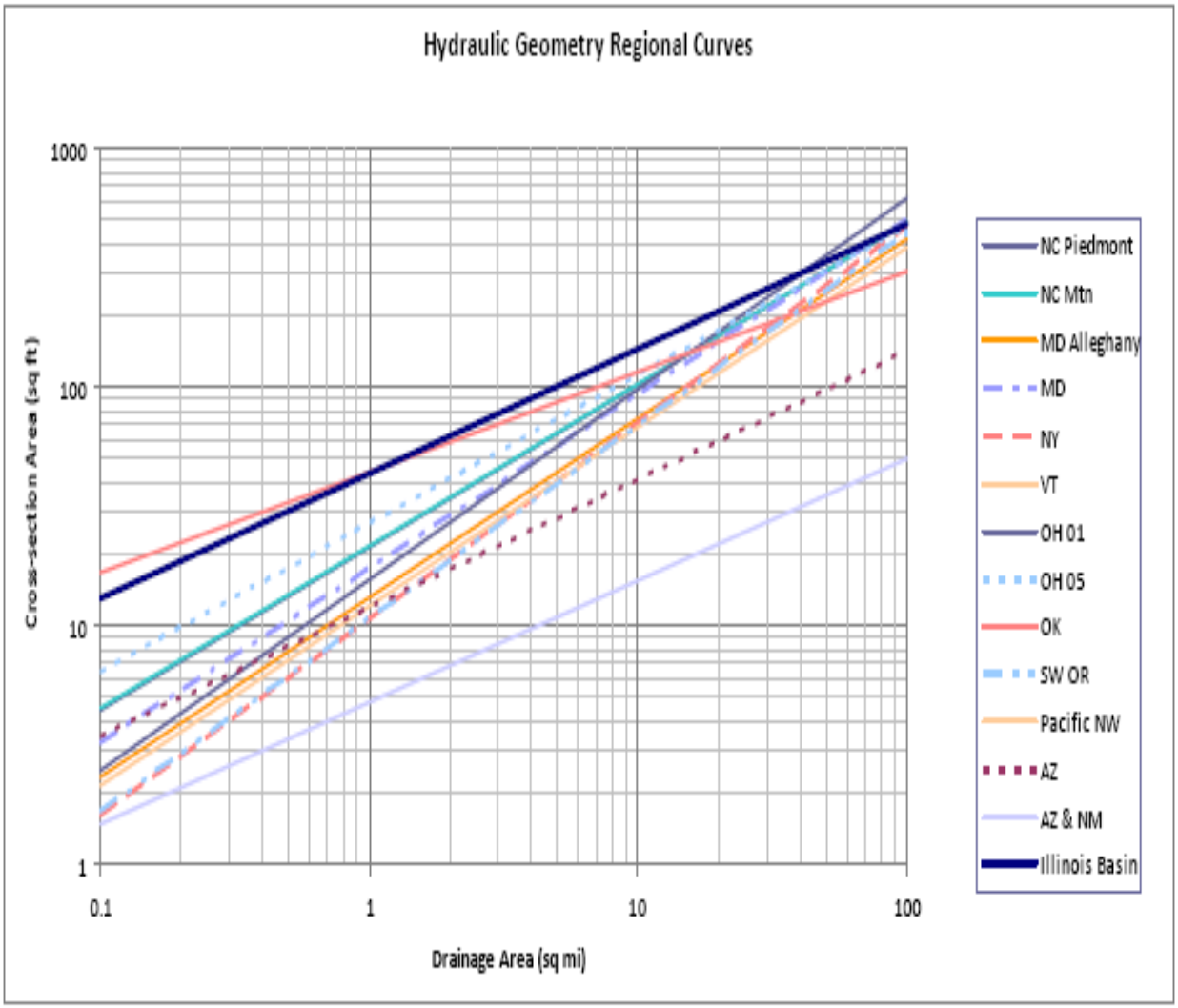
Logging without BMP's complicates stream assessment.

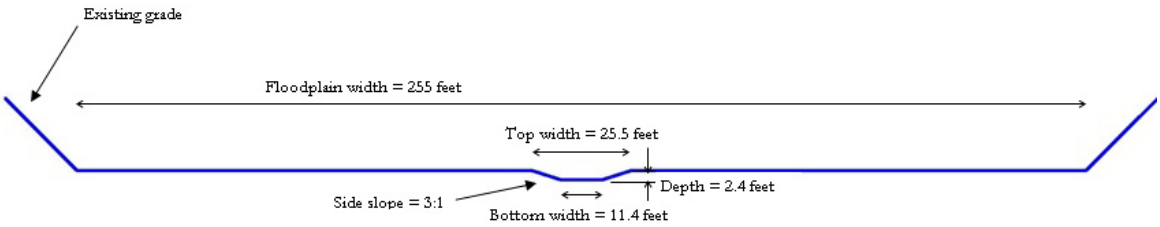
Excavated stream.



Undisturbed circumstances such as these are generally limited to high gradient forested areas controlled by state or federal agencies. The problem with using these areas as reference is that they are steeper than our target areas.

Restoration Goal: to develop a replicable stream construction program that creates a free-form channel, in dynamic equilibrium, with the ability to provide natural and sustainable stream function.	
Reference Parameters	
Bankfull Volume	Average velocity
Return Interval	Average shear stress
Width to Depth ratio	Meander length (L_m)
Channel average depth (D)	Beltwidth (W_{blt})
Channel top width - riffle (W_{riffle})	Riffle length (L_{riffle})
Channel cross-sectional area (A)	Run length (L_{run})
Channel depth - riffle (D_{riffle})	Pool length (L_{pool})
Channel bottom width (W_{bot})	Glide length (L_{glide})
Wetted perimeter (P)	Run depth (D_{run})
Hydraulic radius (R_h)	Glide depth (D_{glide})
Floodplain width (W_{fp})	Pool width (W_{pool})
Channel slope (S_{ave})	Pool depth (D_{pool})


Hydraulic Geometry Regional Curves
Cross-section Area (sq ft)
1000
100
10
1
0.1
1
10
100
Drainage Area (sq mi)
NC Piedmont
NC Mtn
MD Alleghany
MD
NY
VT
OH 01
OH 05
OK
SW OR
Pacific NW
AZ
AZ & NM
Illinois Basin


Existing grade
Floodplain width = 255 feet
Top width = 25.5 feet
Depth = 2.4 feet
Side slope = 3:1
Bottom width = 11.4 feet

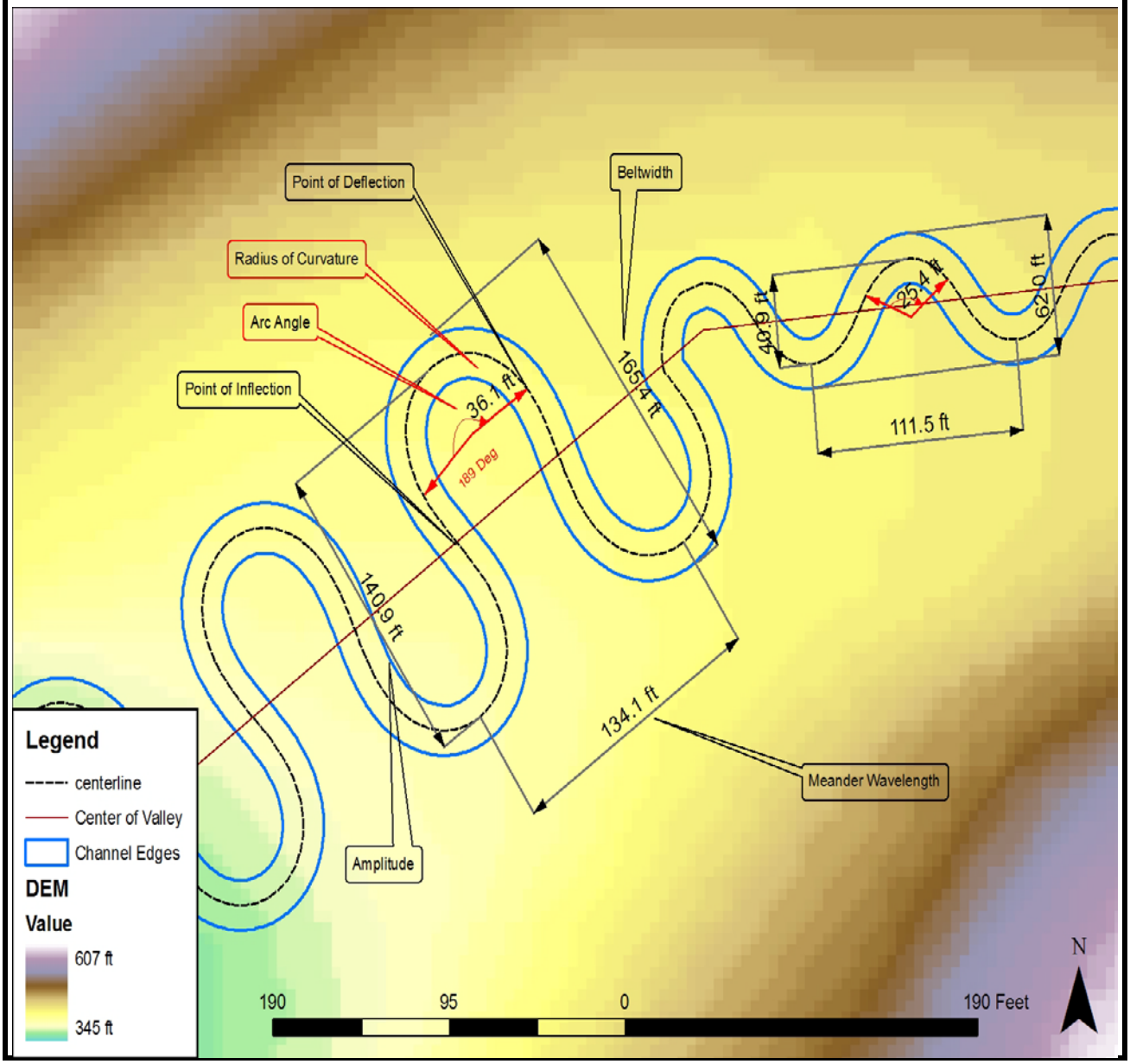
Stream Design The reference parameters were applied to database software. The user is required to input the Watershed Area & Valley Slope. The software outputs the stream design based on reference parameters.

Site-specific Input		
Watershed area =	640	acres
Valley slope =	0.01	ft/ft
Reference Parameters		
Width/Depth ratio =	15	
Manning's n =	0.035	
Channel side slope =	3	:1
Floodplain width ratio =	10	
Pool depth ratio =	2	
Point bar slope =	6	:1
Sinuosity =	1.3	
Meander length ratio =	9	

Riffle Cross-Section		
W_{fpa} =	102	ft
W_{riffle} =	10.2	ft
W_{bot} =	4.6	ft
D_{riffle} =	0.9	ft
M =	3	:1
W_{fp} =	102	ft
Pool Cross-Section		
W_{fpa} =	102	ft
W_{pool} =	18.7	ft
W_{bot} =	4.6	ft
D_{pool} =	1.9	ft
M =	3	:1
B =	6	:1
W_{fp} =	102	ft

Profile		
L_{riffle} =	20	ft
L_{run} =	9	ft
L_{pool} =	20	ft
L_{glide} =	9	ft
D_{riffle} =	0.9	ft
D_{run} =	1.3	ft
D_{pool} =	1.9	ft
D_{glide} =	1.3	ft
Plan View		
L_m =	92	ft
W_{blt} =	48	ft
W_{fp} =	102	ft
Riffle Material		
d84 =	64	mm
Substrate depth =	0.6	ft
Riffle length =	20	ft
Riffle width =	4.6	ft
Volume per riffle =	2.2	cu yds
Erosion Control Specs		
Average shear stress =	0.31	lbs/ft^2
Average velocity =	2.9	ft/sec

Implementation ArcView reads a DEM of the existing valley to continually resize and reconfigure the stream down slope.



Alluvial Valley ready for stream construction.

Layout and Construction of the basic channel. Materials including rock, logs, root wads should be spotted during the backhaul process.

3-year old channel with a high degree of both bank & channel stability .

Well vegetated bankfull indicators.

Ecological Lift & Net Cumulative Benefit in the watershed.