SCHEMATIC DESIGN DATA
EMERGENCY FLOOD DAMAGE RESTORATION

ESOPUS CREEK AT BROWN ROAD
SHANDAKEN, NEW YORK

October 18, 2010

MMI #3597-05

Prepared for:

New York City Department of Environmental Protection
Stream Management Program
Kingston, New York

Prepared by:

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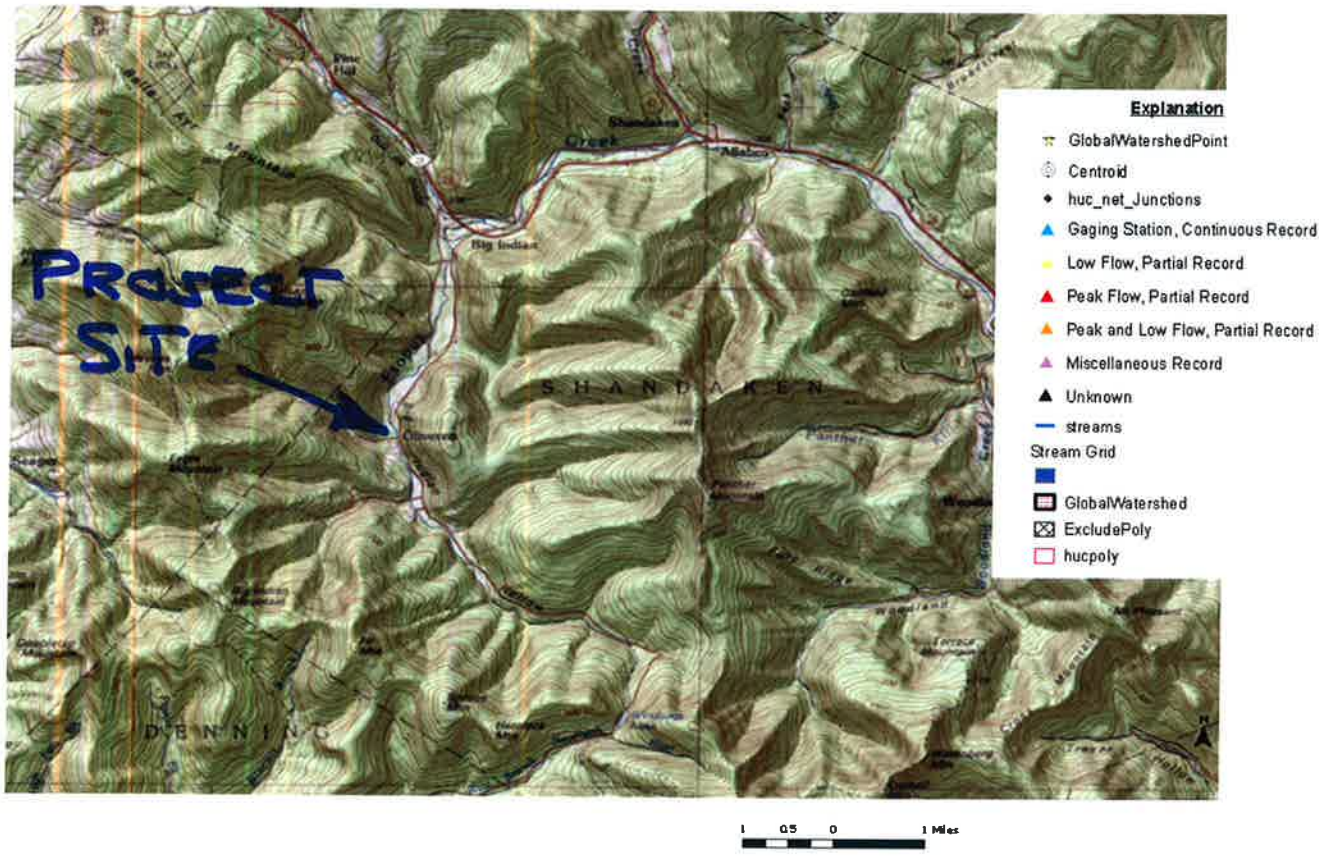
USGS New York StreamStats

StreamStats Print Page



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Pre Flood Channel, 2009

Pre Flood Channel

Previous Channel Repairs

April 22, 2008

Pre Flood Channel & Berm

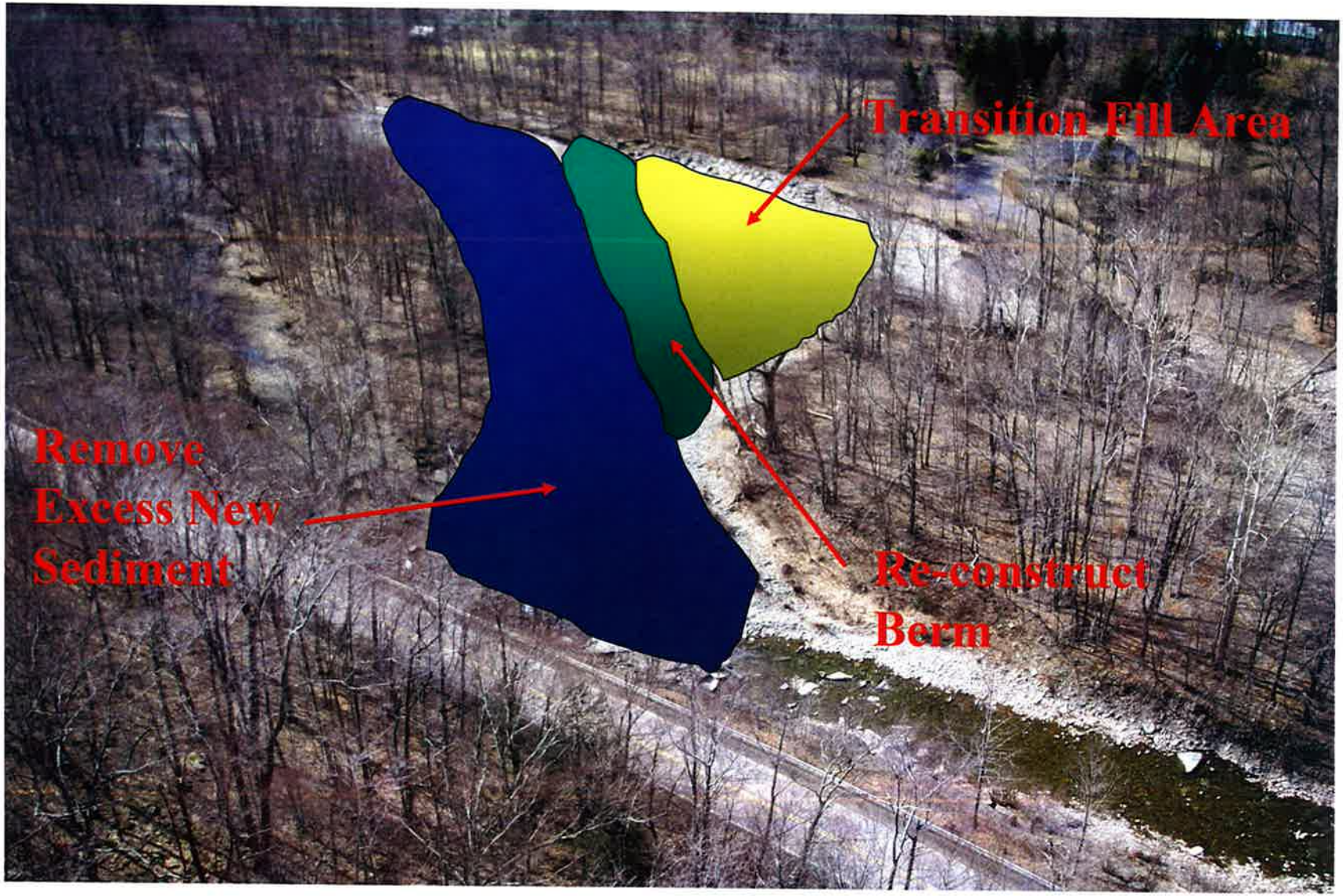
April 2010

New Avulsion
Oct 2010

New Side Channel
Oct 8, 2010

Post Flood Channel
Oct 8, 2010

Proposed Channel Restoration



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JOB BROWN ROAD, SHANDAKEN NY
SHEET NO. 1 OF
CALCULATED BY JGM DATE 10/15/10
CHECKED BY DATE
SCALE

HYDROLOGY

GOAL - Determine watershed area & peak flows with USGS STREAMSTAT WEB model

Location - BROWN ST @ RT 47 & ESOPUS Creek, U/S OF BIG INDIAN

BASIN Data - (FROM model)

AREA = 16.2 mi^2
% Urban = 0.019 %
Lag = 0.0313
Storage = 0.0469 %
mean RUNOFF = 39.3 inches

FREQ, YRS	Regression Q, CFS
1.5	1080
2	1460
5	2670
10	3710
25	5290
50	6670
100	8240

MAIN CHANNEL Slope = 201 FT/mile
Length = 6.31 miles
FOREST = 99.7 %
mean precip = 57.7 inches

USGS
New York StreamStats

Basin Characteristics Report

Date: Fri Oct 15 2010 10:33:59 Mountain Daylight Time
NAD27 Latitude: 42.0656 (42 03 56)
NAD27 Longitude: -74.4605 (-74 27 38)
NAD83 Latitude: 42.0657 (42 03 57)
NAD83 Longitude: -74.4601 (-74 27 36)
ReachCode: 02020006000342
Measure: 39.40

Parameter	Value
Area that drains to a point on a stream in square miles.	16.2
Main-channel 10-85 slope, in feet per mile	200
Main-channel stream length, in miles	6.33
10-85 slope of lower half of main channel in feet per mile.	88.1
10-85 slope of upper half of main channel in feet per mile.	450
Total length of all elevation contours in drainage area in miles	264
Average basin slope, in feet per mile.	1630
Slope ratio. Ratio of main channel slope to basin slope	0.12
Basin Lag factor.	0.0316
Percentage of basin at or above 1200 ft elevation	100
Basin storage. Percentage of total drainage area shown as lakes, ponds and swamps	0.0469
Percent of area covered by forest	99.7
Mean annual runoff in inches.	39.3
Seasonal maximum snow depth, 50th percentile, in inches	20.1
Mean annual precipitation in inches.	57.7

USGS
New York StreamStats

Streamstats Ungaged Site Report

Date: Fri Oct 15 2010 10:34:51 Mountain Daylight Time
Site Location: New_York
NAD27 Latitude: 42.0656 (42 03 56)
NAD27 Longitude: -74.4605 (-74 27 38)
NAD83 Latitude: 42.0657 (42 03 57)
NAD83 Longitude: -74.4601 (-74 27 36)
ReachCode: 02020006000342
Measure: 39.40
Drainage Area: 16.2 mi2
Percent Urban: 0.0193 %

Peak Flows Region Grid Basin Characteristics

100% 2006 Full Region 2 (16.2 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	16.2	1.93	996
Lag Factor (dimensionless)	0.0316	0.014	6.997
Percent Storage (percent)	0.0469	0	11.88
Mean Annual Runoff in inches (inches)	39.3 (above max value 33.95)	16.03	33.95

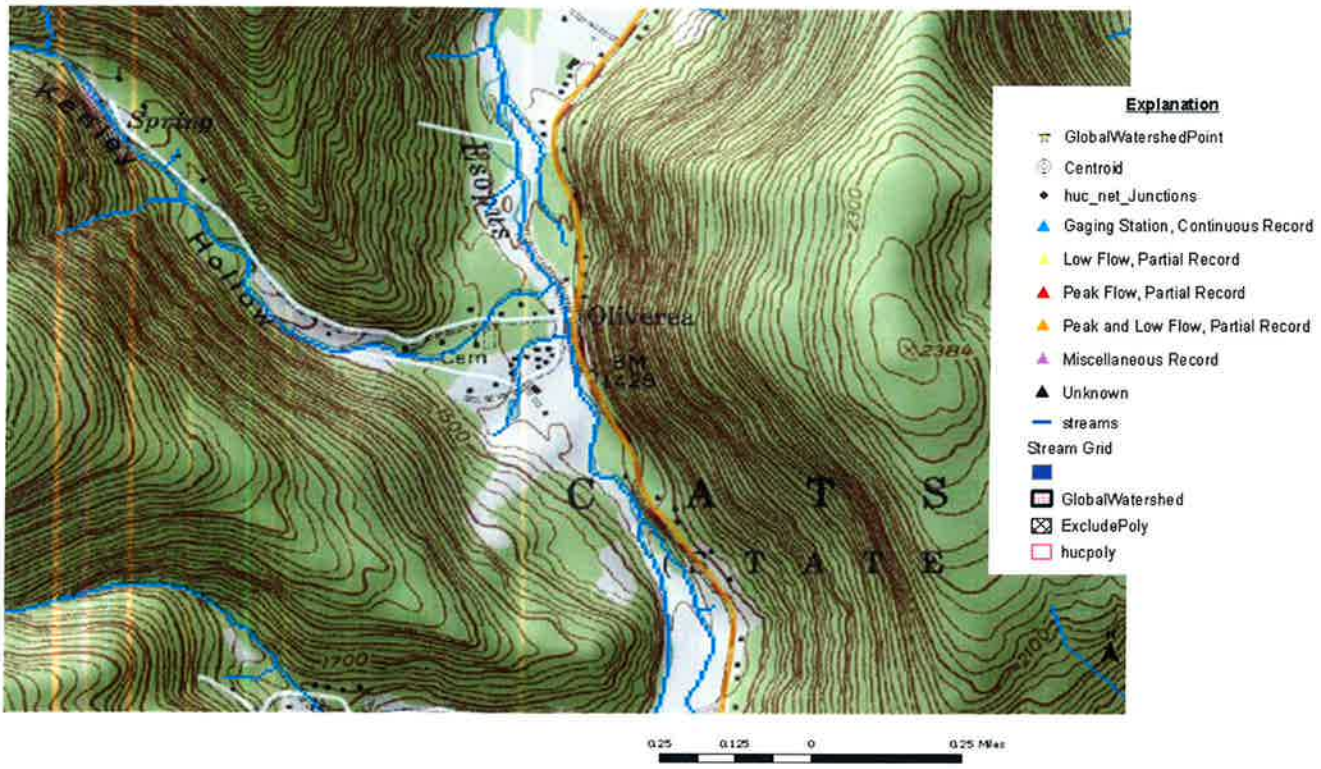
Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Region Grid Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK1_25	830		4.8		
PK1_5	1080		4.3		
PK2	1460		4.4		
PK5	2670		7.3		
PK10	3710		10		
PK25	5290		14		
PK50	6670		16		
PK100	8240		18		
PK200	10000		19		
PK500	12700		20		

USGS New York StreamStats

StreamStats Print Page



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JOB BROWN RD CHANNEL AVULSION
SHEET NO. 2 OF
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Geomorphic Data - BASED ON NYDEP
HGR method MILLER & DAVIS, 2002

USE Region 4 Data, w/ MAR > 2.3 CFSM For Peaks Region

$$Q_{BF} = 175.62 (DA)^{0.75}$$

DA = 16.2 SM (FROM Stream Stats

$$Q_{BF} = 175.62 (16.2)^{0.75} = 1418 \text{ CFS}$$

(Good Match w/ Q_2 = 1460 CFS)

Width $W_{BF} = 21.25 (DA)^{0.41}$

$$W_{BF} = 21.25 (16.2)^{0.41} = 66.6 \text{ FT}$$

DEPTH $D_{BF} = 1.15 (DA)^{0.31} =$

$$= 1.15 (16.2)^{0.31} = 2.73 \text{ FT}$$

Cross Section Area

$$A = 24.53 (DA)^{0.72}$$

$$= 24.53 (16.2)^{0.72} = 182 \text{ FT}^2$$

ck $\bar{W} \times \bar{D} = 66.6 \times 2.73 \text{ FT} = 181.8 \text{ FT}^2$ OK

$$\text{Vel} = \frac{Q}{A} = \frac{1418 \text{ CFS}}{181.8 \text{ FT}^2} = 7.8 \text{ FPS}$$ reasonable

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JOB Brown Rd Channel
SHEET NO. 3 OF
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Regime Method – Predict Channel Properties

Say Q_{bf} = 1418 cfs
Say D_{50} = 0.5 ft (observation)

1) Gravel Bed Rivers
Kellerhouse (in MacBroom, 2010)
$W = 1.8\,Q^{0.5}$
$= 1.8(1418)^{0.5} = 67.8$ ft

2) Eaton & Church (2007)
Gravel River w/ Thick Vegetation
$W = 1.86\,Q_{bf}^{0.54}$
$= 1.86(1418)^{0.54} = 93.6$ ft

3) Soar & Thorne (2001) @ 94 Sites
US Gravel Bed Rivers
$W = 2.03(Q_b)^{0.5}$
$= 2.03(1418)^{0.5} = 76.4$ ft

4) Corps (graphical, 1996)
Q = 1416, W = 80' (mid line)

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JOB BROWN CHANNEL -
SHEET NO. 4 OF
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Goal - Evaluate Channel Equilibrium w/ Sediment Model
Find optimum width, depth, slope

Given $Q_{bankfull}$ = 1416 CFS (FROM Regional Data)
GRADATION OF SUBSTRATE (FROM FIELD VISIT, NO COUNTS)
d_{84} = 6 inches = 150 MM
d_{50} = 3 inches = 75 MM
d_{16} = 1 inch = 25 MM

Optional Input For TRIALS — SAY INITIAL WIDTH = 75 FT
SAY Valley Slope = 2 %

Set Side Slope @ 2:1 FOR GRAVEL BANKS
Set MANNING N = 0.08 FOR wooded GRAVEL BANKS

A) Model Results (See attached print out) For BANKFULL Q

Base Width = 60 FT (print out Form)
Top width = 60 FT + Side Slopes = 60 + 2(2×3) = 72 Feet
Flow depth = 3.0 FT
Vel = 7.03 FPS
Shear = 1.84

B) Model Results For 10 year Flood
Q = 3710 CFS (StreamStats, USGS)
BASE Width = 86.2 FT
Top Width = 86.2 FT + Side Slopes = 86.2 + (2(2×4.4))
= 103.8 FT

DEPTH = 4.4 FT
Vel = 8.93 FPS
Shear = 2.69

BANKFULL Q

Stable Channel Design Results - Copeland Method

d84(mm) = 150, D50(mm) = 75, D16(mm) = 25

Temperature (F)		55	
Specific Gravity of Sediments	2.65		
Unit Weight of Water (lb/cu ft)	62.385		
Viscosity (sq ft/s)		1.315E-05	
Discharge (cfs)	1416		

Upstream Channel

Sediment Concentration (ppm)	12.43		
Base Width (ft)	75		
Channel Slope (ft/ft)	0.01		
		Left	Right
Side Slope	2	2	
Roughness Eq		Manning	Manning
Roughness Value		0.08	0.08

Stable Channel

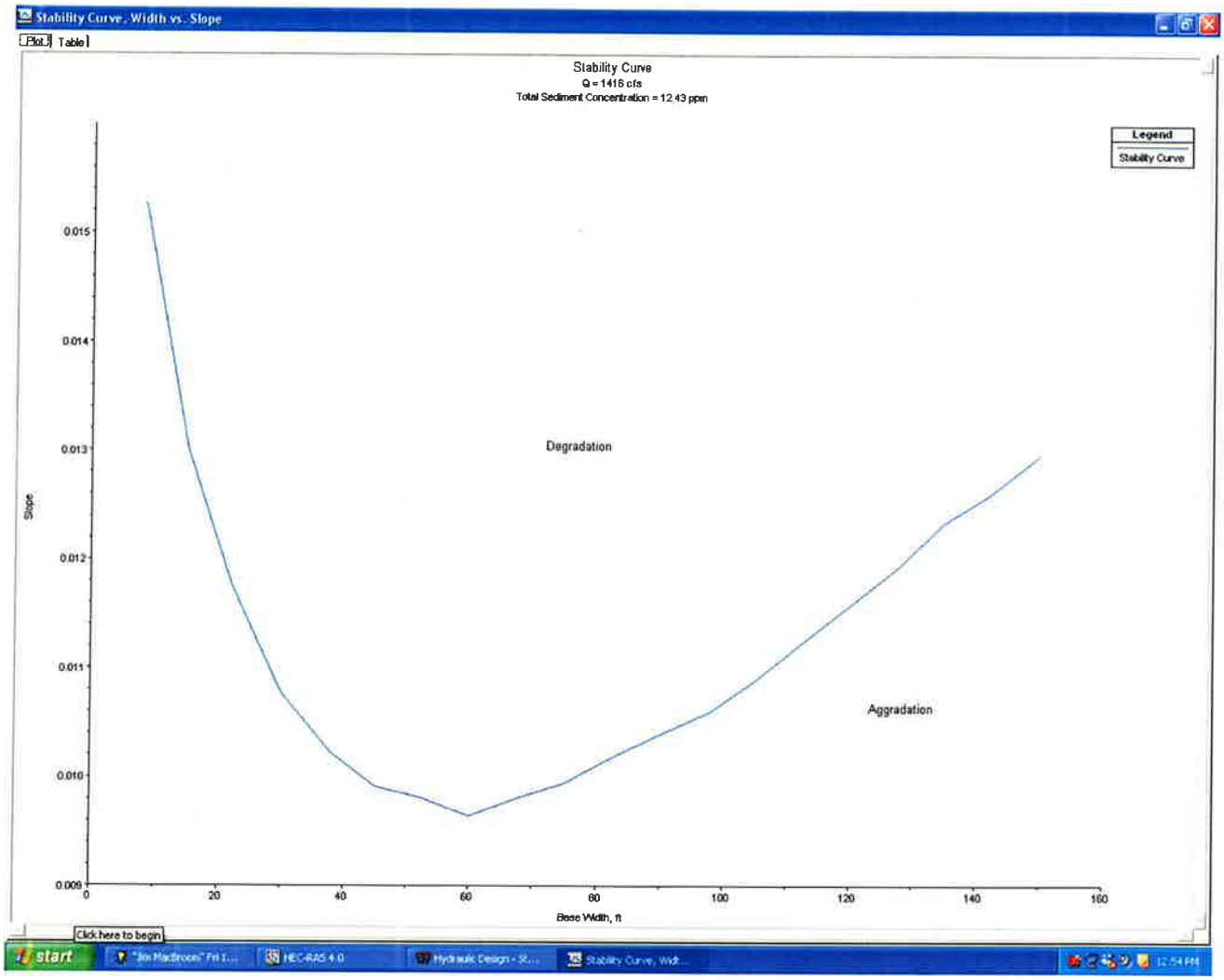
Median Channel Width (ft)	75		
Valley Slope(ft/ft)	0.02		
		Left	Right
Side Slope	2	2	
Roughness Eq		Manning	Manning
Roughness Value		0.08	0.08

Computed Stable Channels

Bottom Width	Depth	Energy Slope	Comp n-Value	Hyd Radius	Velocity	Froude Number	She Stre
8.0	8.3	0.015274	0.0728	4.54	6.95	0.43	7.9C
15.0	7.0	0.013005	0.0662	4.42	6.91	0.46	5.72
22.0	6.0	0.011752	0.0600	4.17	6.95	0.50	4.4C
30.0	5.1	0.010768	0.0542	3.85	6.99	0.55	3.39
38.0	4.3	0.010216	0.0494	3.51	7.02	0.59	2.76
45.0	3.8	0.009912	0.0462	3.25	7.03	0.63	2.37
52.0	3.4	0.009811	0.0436	3.00	7.03	0.67	2.1C
60.0	3.0	0.009640	0.0409	2.75	7.03	0.71	1.83
68.0	2.8	0.009812	0.0389	2.52	7.00	0.74	1.68
75.0	2.5	0.009941	0.0376	2.35	6.98	0.77	1.57
82.0	2.3	0.010167	0.0367	2.21	6.95	0.80	1.49
90.0	2.2	0.010397	0.0355	2.06	6.92	0.83	1.41
98.0	2.0	0.010603	0.0347	1.93	6.88	0.85	1.33
105.0	1.9	0.010885	0.0340	1.83	6.85	0.88	1.29
112.0	1.8	0.011220	0.0336	1.74	6.81	0.89	1.26
120.0	1.7	0.011580	0.0330	1.64	6.77	0.92	1.23
128.0	1.6	0.011942	0.0325	1.56	6.73	0.94	1.2C
135.0	1.5	0.012347	0.0323	1.49	6.70	0.95	1.18
142.0	1.5	0.012598	0.0319	1.43	6.66	0.97	1.15
150.0	1.4	0.012965	0.0316	1.37	6.63	0.99	1.13
*******Solution for Minimum Stream Power*******							
60.0	3.0	0.009696	0.0408	2.74	7.03	0.71	1.84

BASE WIDTH = 60 FT

TOP WIDTH = 60 + (2 SIDES × 6') = 72 FT


Stability Curve, Width vs. Slope
Plot
Table
Stability Curve
Q = 1416 cfs
Total Sediment Concentration = 12.43 ppm
Legend
Stability Curve
Degradation
Aggradation
Slope
0.015
0.014
0.013
0.012
0.011
0.010
0.009
0
20
40
60
80
100
120
140
160
Base Width, ft
Click here to begin
start
HEC-RAS 4.0
Hydraulic Design - St...
Stability Curve, Widt...

Stable Channel Design Results - Copeland Method

d84(mm) = 150, D50(mm) = 75, D16(mm) = 25

Temperature (F)		55	
Specific Gravity of Sediments	2.65		
Unit Weight of Water (lb/cu ft)	62.385		
Viscosity (sq ft/s)		1.315E-05	
Discharge (cfs)	3710		

Upstream Channel

Sediment Concentration (ppm)	109.96		
Base Width (ft)	75		
Channel Slope (ft/ft)	0.01		
		Left	Right
Side Slope	2	2	
Roughness Eq		Manning	Manning
Roughness Value		0.08	0.08

Stable Channel

Median Channel Width (ft)	75		
Valley Slope(ft/ft)	0.02		
		Left	Right
Side Slope	2	2	
Roughness Eq		Manning	Manning
Roughness Value		0.08	0.08

Computed Stable Channels

Bottom Width	Depth	Energy Slope	Comp n-Value	Hyd Radius	Velocity	Froude Number	She Stre
8.0	12.1	0.019859	0.0748	6.28	9.55	0.48	14.9
15.0	11.0	0.015929	0.0701	6.32	9.15	0.49	10.9
22.0	9.9	0.013886	0.0658	6.23	9.02	0.51	8.54
30.0	8.7	0.012457	0.0611	6.00	8.97	0.54	6.78
38.0	7.7	0.011542	0.0569	5.70	8.96	0.57	5.57
45.0	7.0	0.010996	0.0536	5.42	8.97	0.60	4.81
52.0	6.4	0.010595	0.0507	5.13	8.97	0.63	4.22
60.0	5.8	0.010301	0.0480	4.82	8.97	0.66	3.71
68.0	5.3	0.010131	0.0456	4.52	8.96	0.69	3.33
75.0	4.9	0.010106	0.0435	4.25	8.93	0.71	3.08
82.0	4.6	0.009910	0.0422	4.06	8.94	0.74	2.82
90.0	4.2	0.009908	0.0407	3.83	8.91	0.76	2.61
98.0	3.9	0.009986	0.0394	3.61	8.88	0.79	2.46
105.0	3.7	0.010115	0.0381	3.42	8.83	0.81	2.35
112.0	3.5	0.010196	0.0372	3.27	8.80	0.82	2.25
120.0	3.3	0.010304	0.0369	3.14	8.77	0.85	2.15
128.0	3.2	0.010448	0.0362	2.99	8.73	0.86	2.06
135.0	3.0	0.010594	0.0356	2.88	8.69	0.88	2.00
142.0	2.9	0.010745	0.0351	2.77	8.65	0.90	1.94
150.0	2.8	0.010920	0.0347	2.66	8.61	0.91	1.89
*******Solution for Minimum Stream Power*******							
86.2	4.4	0.009862	0.0415	3.95	8.93	0.75	2.69

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JOB BROWN: , ESOPUS CREEK
SHEET NO. _____ OF _____
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SUMMARY - CHANNEL SIZE

Method	BANKFULL width, FT	BANKFULL Depth, FT
NYDEP - HGR	66.6	2.73
Regime		
Kellerhouse	67.8	
Soar / Thorne	76.4	
Corps	80	
SEDIMENT Model	72	3.0
Conclusion → DESIGN*	70	3.0 (MIN.)

* PENDING FIELD CHECK OF EX. UPSTREAM CHANNEL

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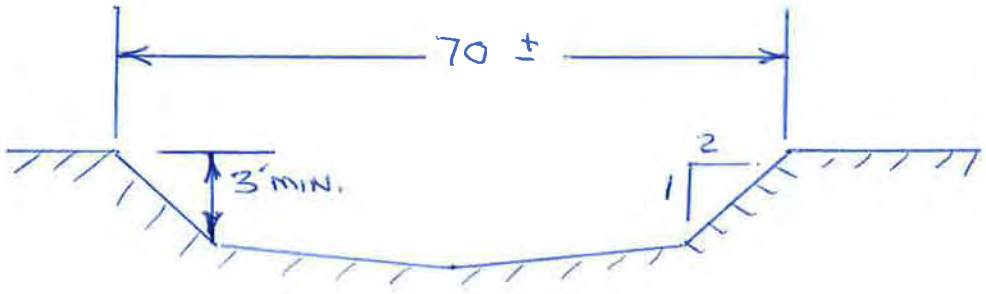
TYPICAL SECTION



NOTES

1) BLEND CHANNEL WIDTH TO MATCH EXISTING, UPSTRAM & DOWNSTREAM
2) VARY SIDE SLOPES ON BENDS
3) USE EXISTING GRAVEL & COBBLES FOR SUBSTRATE
4) PROVIDE ONE FOOT DEEP CENTER DEPRESSION FOR LOW FLOW
5) ADJUST ALIGNMENT TO SAVE EXISTING TREES

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JOB Brown - Esopus Creek
SHEET NO. _____ OF _____
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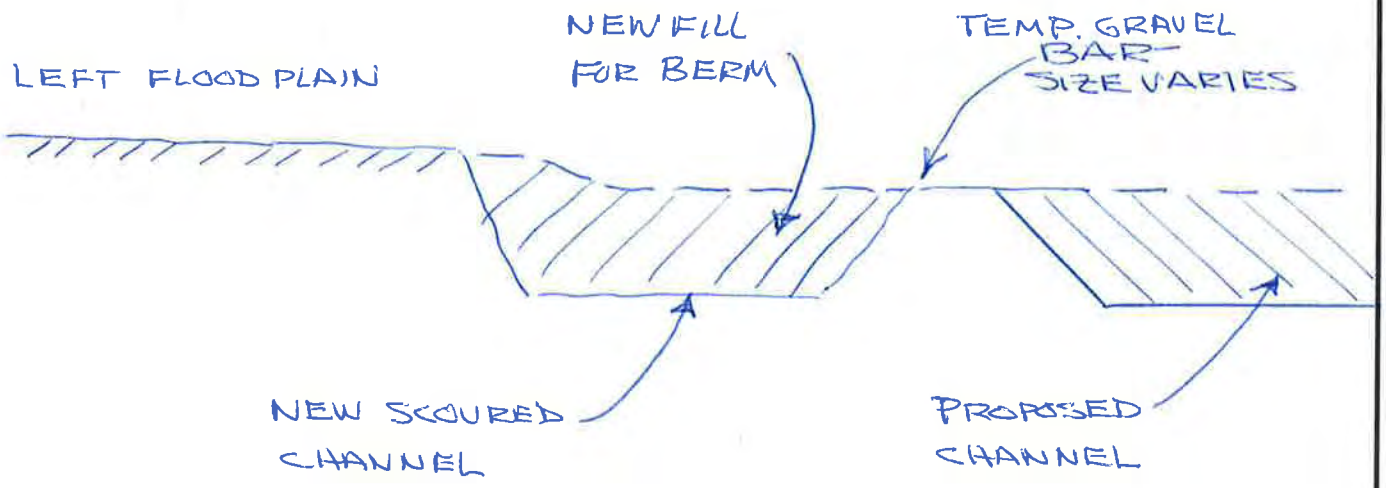
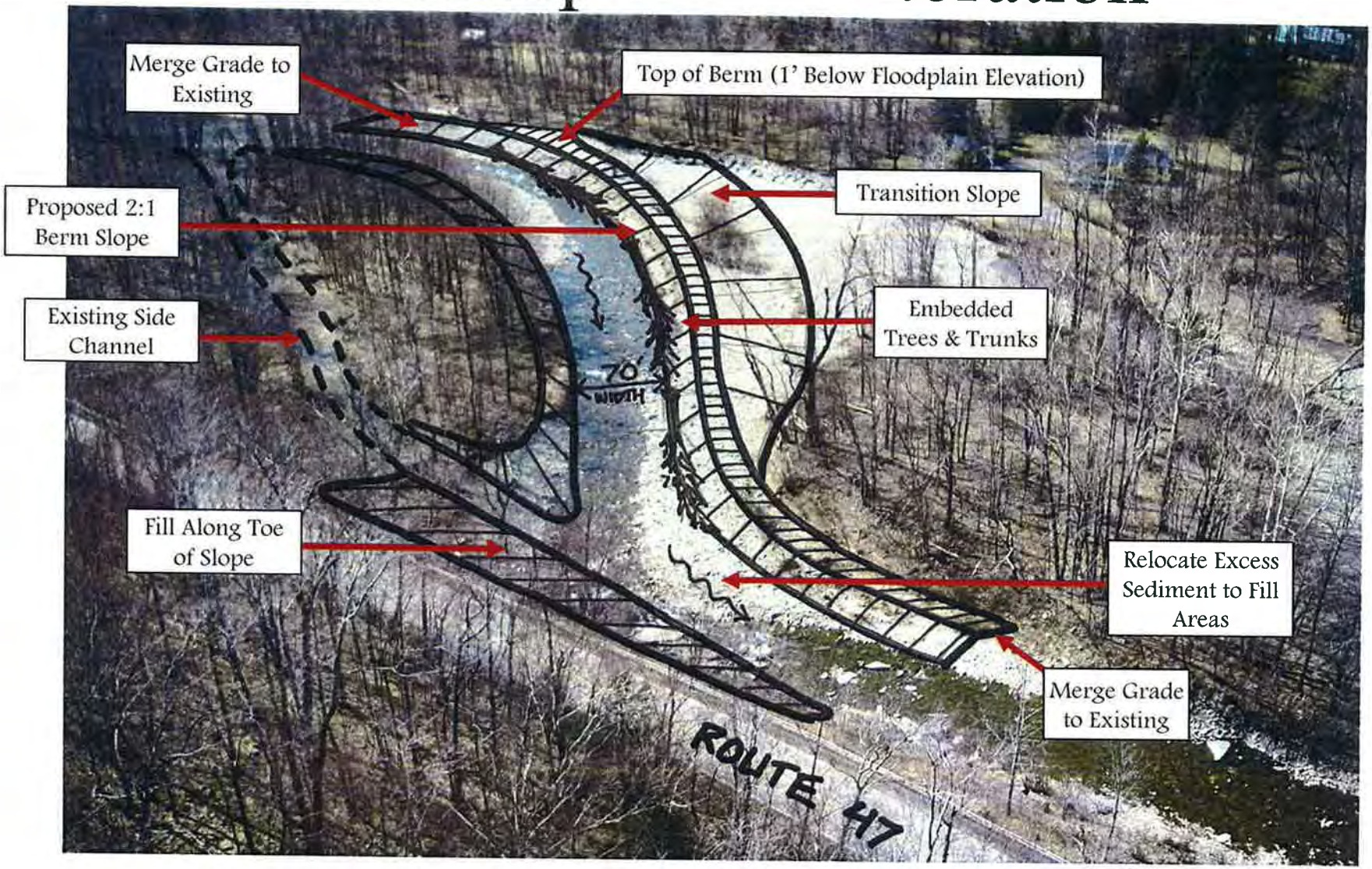
RE-CONSTRUCT FORMER BERM FROM LEFT BANK TO CENTER BAR (FACING DOWNSTREAM)



Pre Flood Channel
With Proposed Restoration



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