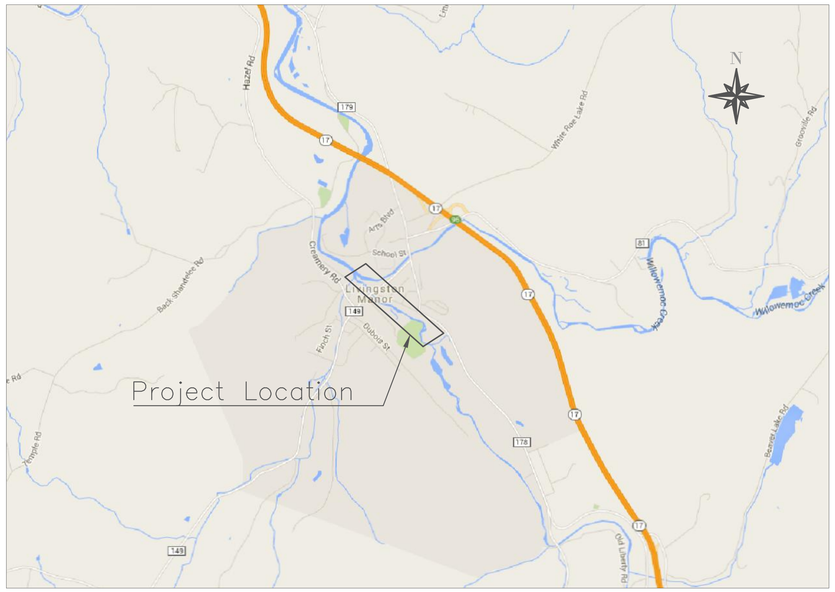
LITTLE BEAVERKILL STREAM RESTORATION
LIVINGSTON MANOR, NY
DRAFT 30% DESIGN



LIST OF SHEETS

1	Title Sheet
2–7	Proposed Conditions
8–10	Typicals

U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
Stream Habitat Assessment and
Restoration Program

177 Admiral Cochrane Drive
Annapolis, Maryland 21401

Tel. (410) 573-4583

Proposed Channel

Existing Channel

Project Limits for Stream Stability

Haul Roads

J–Hook

Cross Vane

Existing Roads

Wetland Area

Toe Wood

0 200 400 800 Feet

U.S. Fish & Wildlife Service
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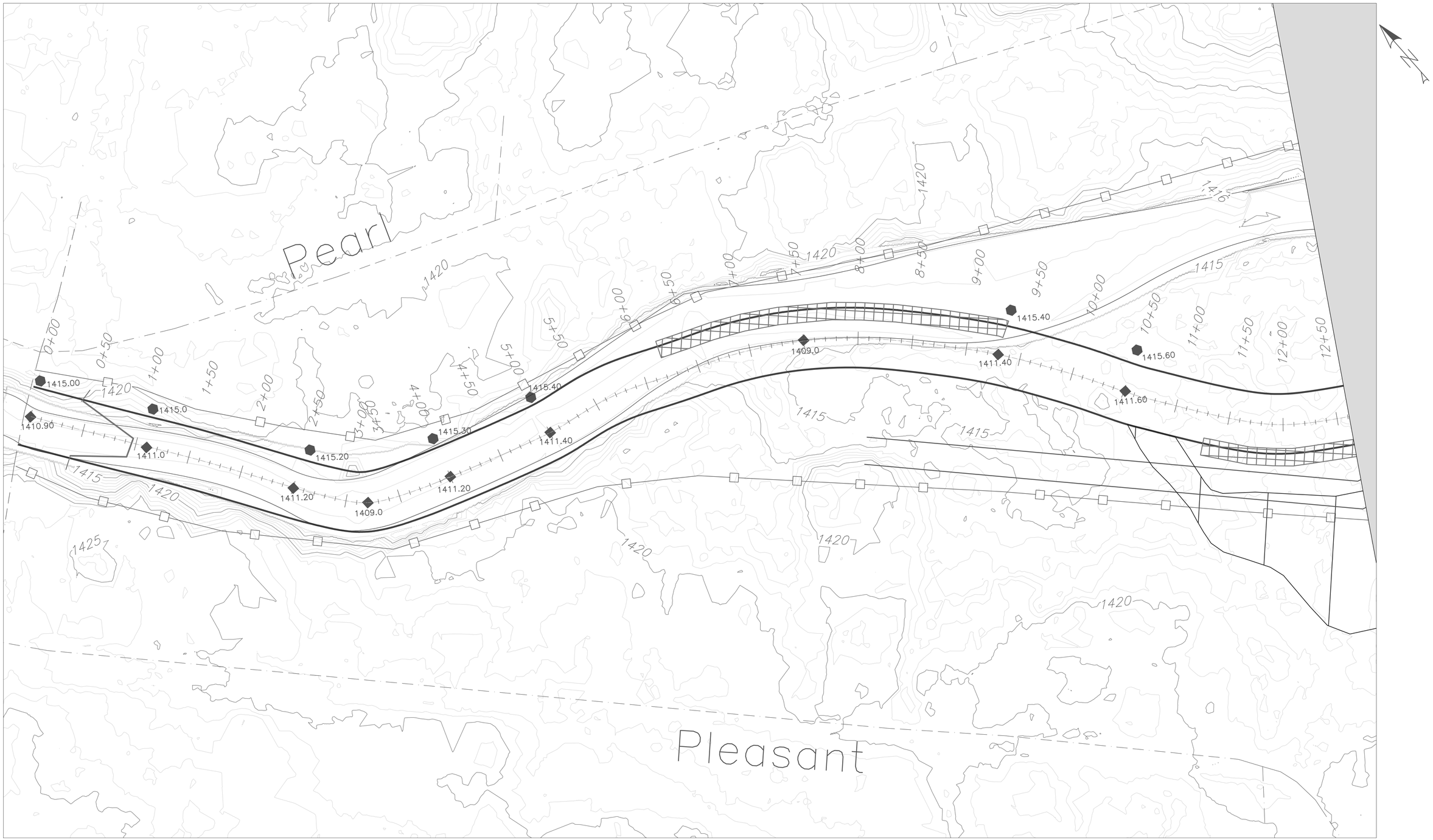
LIVINGSTON MANOR

REVISIONS		
DATE	BY	
		DRAFT 30% DESIGN PLAN

PROJECT MANAGER: RRS	DRAFTING: KC
DESIGN: RRS	CHECKED BY: BH
SCALE: 1:200	

SHEET 2 OF 10

PC–1



Proposed Thalweg Elevation

Proposed Bankfull Elevation

NOTE: Excavate floodplain, at proposed bankfull elevation, starting from channel TOB and extend to proposed wetland boundary or project limits, whichever is farthest from proposed channel edge.

0 80 160 Feet

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LIVINGSTON MANOR

DRAFT 30% DESIGN PLAN

REVISISIONS			
DATE	BY		
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		DESIGN: RRS	CHECKED BY: BH
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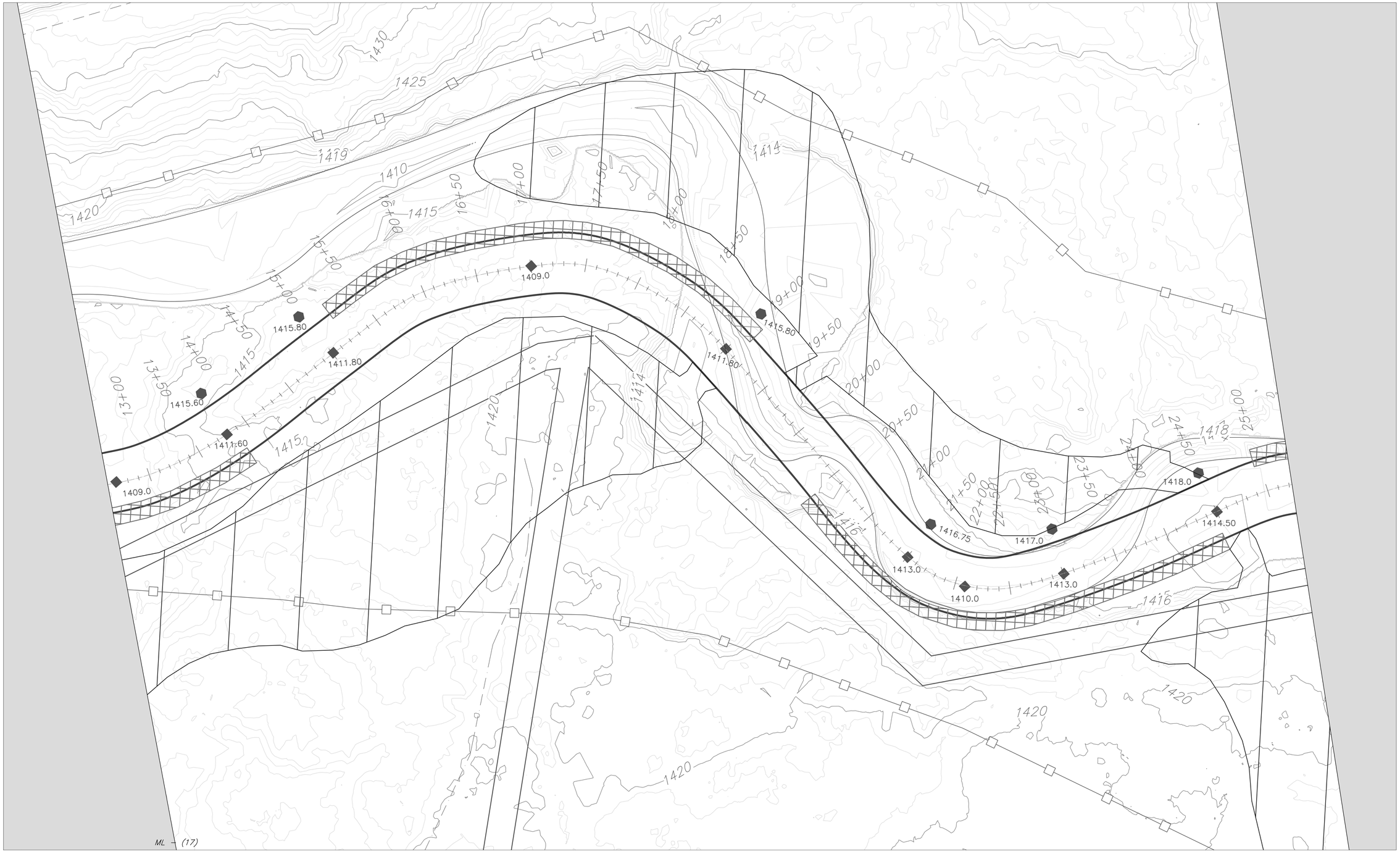
SHEET 3 OF 10

PC–2



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LIVINGSTON MANOR

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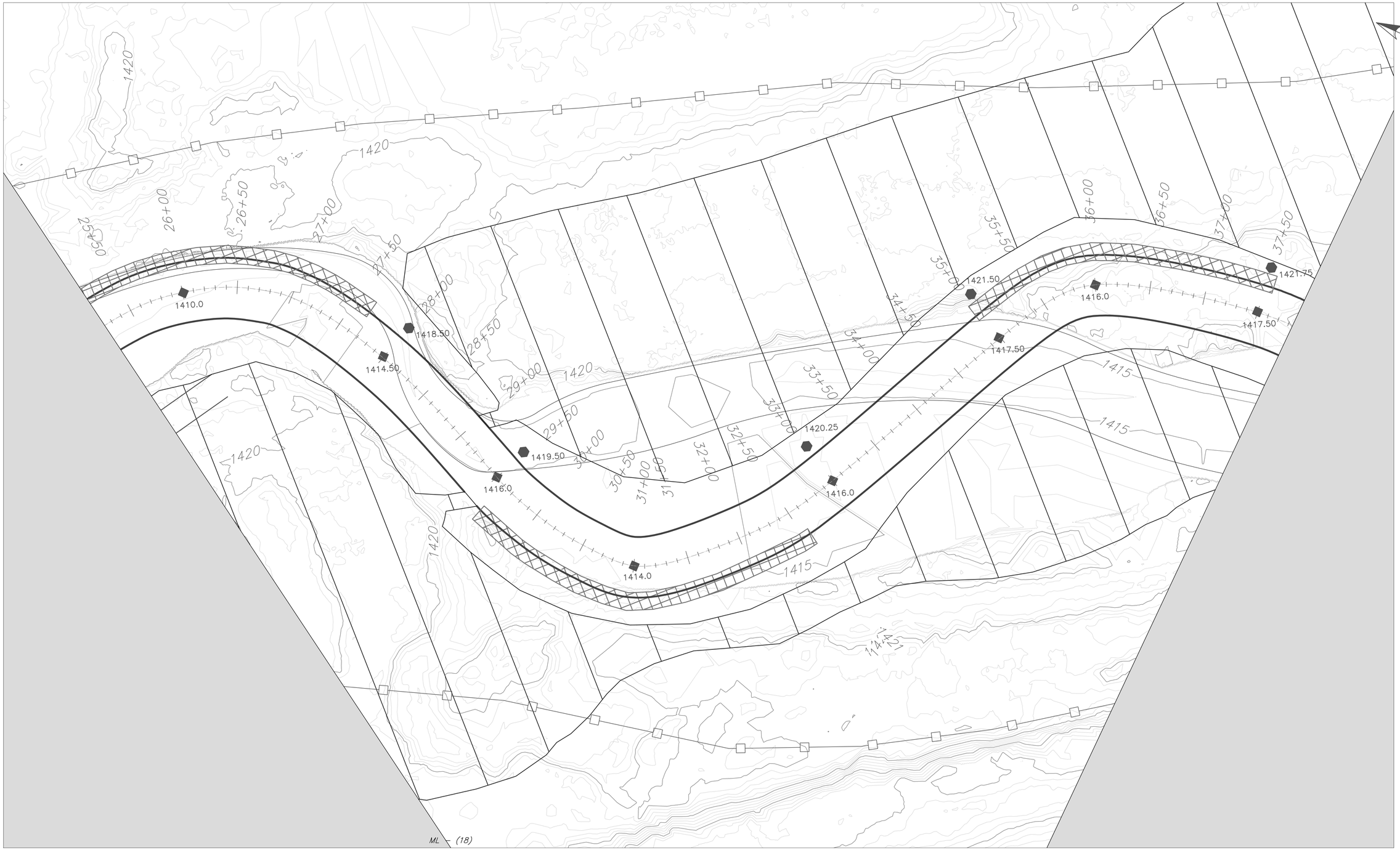
		DESIGN: RRS	CHECKED BY: BH
		SCALE: 1:40	

SHEET 4 OF 10

PC-3



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DRAFTING: KC
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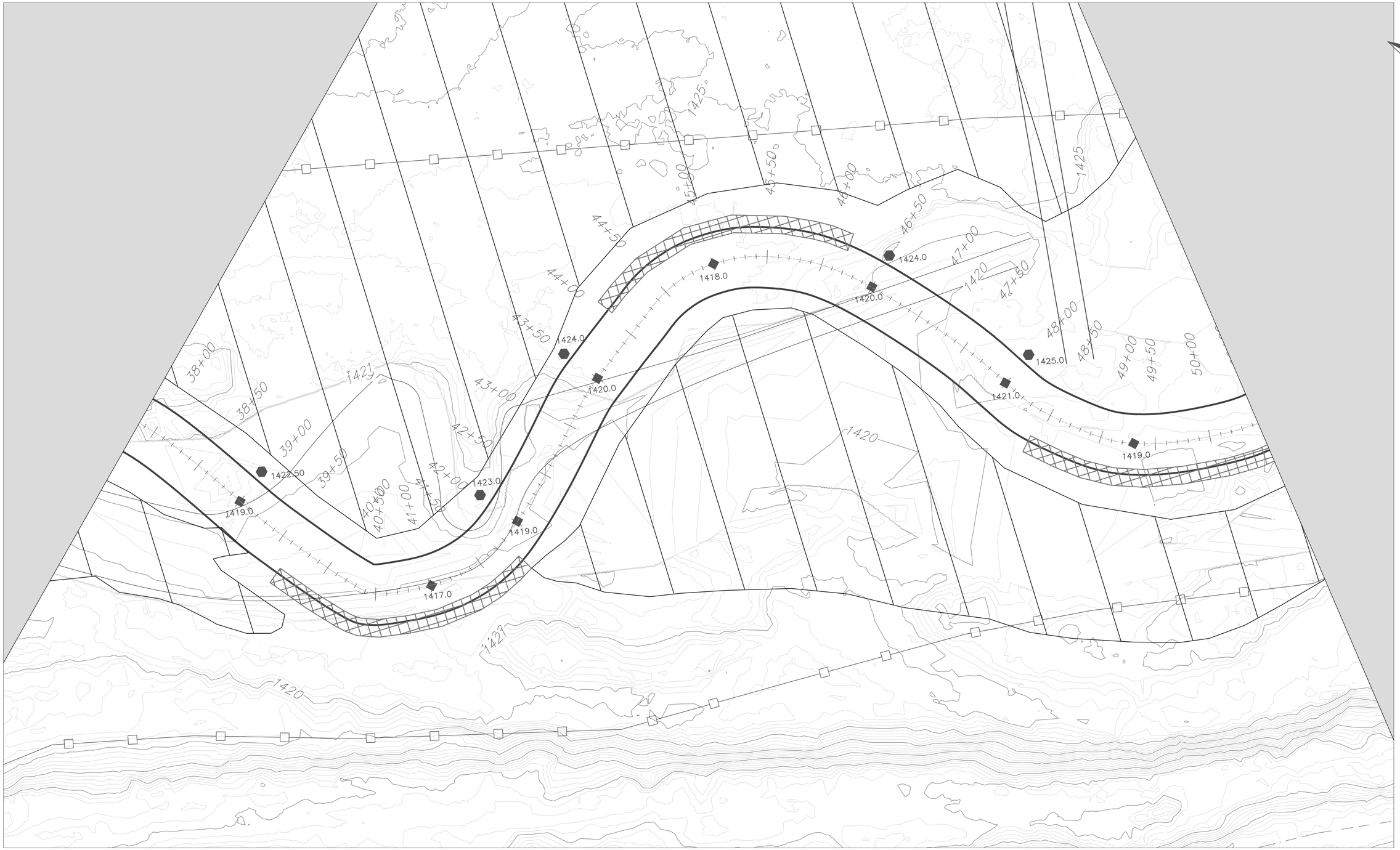
SHEET 5 OF 10

PC—4



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DRAFT 30% DESIGN PLAN

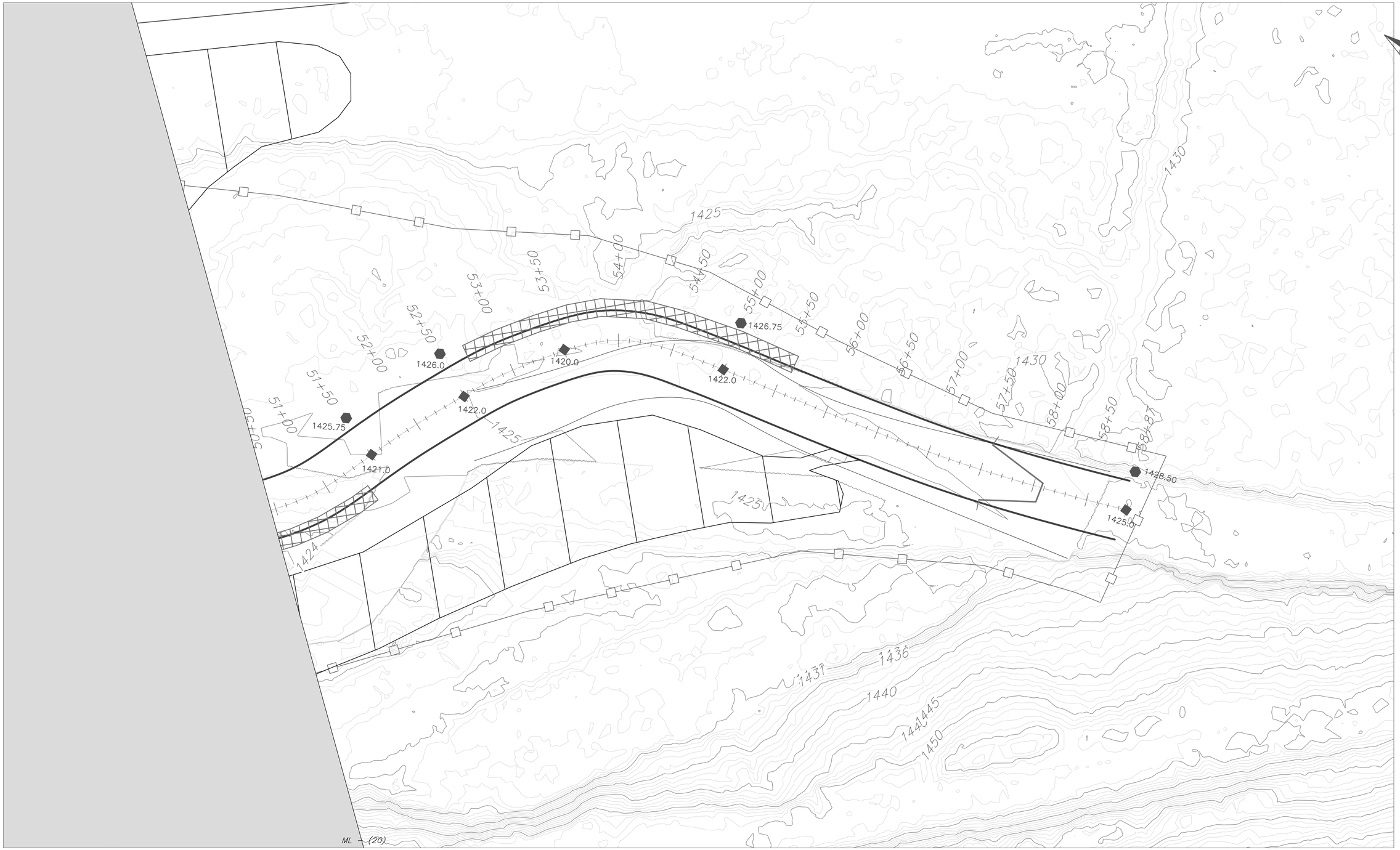
PROJECT MANAGER: RRS | DRAFTING: KC

DESIGN: RRS | CHECKED BY: BH

SCALE: 1:40

SHEET 6 OF 10

PC-5



Proposed Thalweg Elevation

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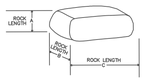
SHEET 7 OF 10

PC–6



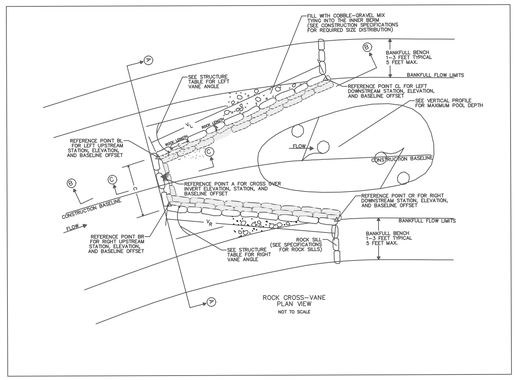
ROCK LENGTH
A < B < C

DETAIL FOR ROCK DIMENSIONS
(SEE ROCK SIZE TABLE)

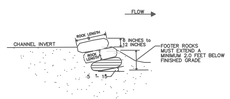
NOT TO SCALE

ROCK CROSS VANE NOTES:

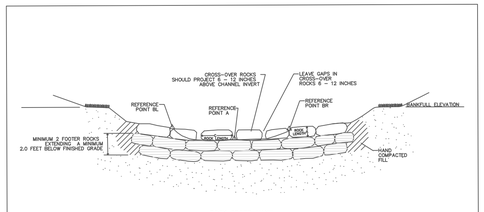
1. ALL ROCKS (EXCEPT BOTTOM LAYER OF FOOTER ROCKS) SHALL BE SUPPORTED BY A FOOTER ROCK AND WEDGED UPSTREAM OR INTO STREAM BANK. ALL ROCKS SHALL BE INTERLOCKED AND SHALL NOT ROCK OR ROTATE IN PLACE.
2. ALL ROCKS SHALL BE PLACED WITH THE PARALLEL FACES ORIENTED UP AND DOWN WITH THE TOP FACE TILTING UP FROM THE BED AT 5 DEGREES TO 15 DIRECTION OF FLOW IN THE DIRECTION OF FLOW ON THE CROSSOVER AND VANE ARMS.
3. ALL ROCKS (EXCEPT TOP LAYER OF CROSSOVER) SHALL BE PLACED TO FIRMLY ABUT ADJACENT ROCKS LEAVING NO GAPS BETWEEN ROCKS. GAPS SHALL BE LEFT BETWEEN THE TOP LAYER OF THE CROSSOVER ROCKS AS SHOWN IN PLANS.
4. STRUCTURE SHALL BE CONSTRUCTED SUCH THAT ROCKS FORM A CONTINUOUS, UNIFORM SLOPE WITH A MINIMUM OF STEEP, HIGH, OR LOW SPOTS ALONG THE TOP FINISHED SURFACE. SEE ROCK CROSS VANE SPECIFICATIONS FOR ALLOWABLE TOLERANCES.
5. CHANNEL STATION AND ELEVATION REFERENCE MAY NOT ALWAYS FALL ON BASELINE OF CONSTRUCTION, THALWEG, OR CHANNEL INVERT.
6. STREAM BOTTOM AROUND STRUCTURE SHALL BE BACKFILLED WITH FURNISHED OR SALVAGED STREAMBED MATERIAL TO MEET FINISHED GRADE AS DIRECTED IN SPECIFICATIONS.
7. SEE ROCK CROSS VANE STRUCTURE TABLE, PROFILE, AND GEOMETRY SHEET FOR ALL DIMENSIONS AND ELEVATIONS.



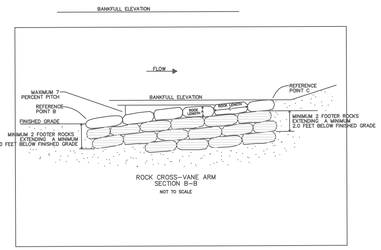
ROCK CROSS-VANE
PLAN VIEW
NOT TO SCALE



ROCK CROSS-VANE
PROFILE SECTION C-C
NOT TO SCALE

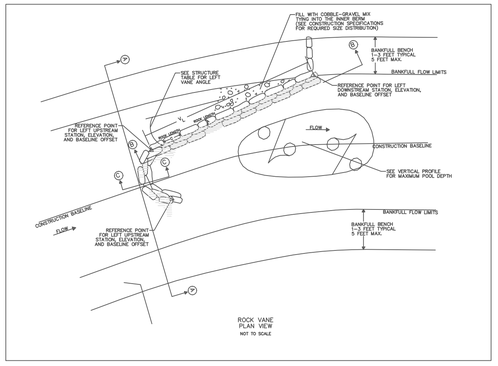


ROCK CROSS-VANE
CROSS OVER – SECTION A-A
NOT TO SCALE

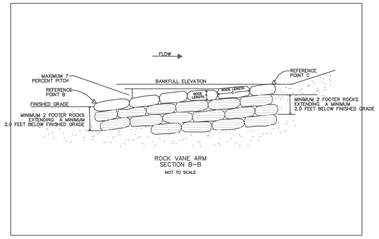


ROCK CROSS-VANE ARM
SECTION B-B
NOT TO SCALE

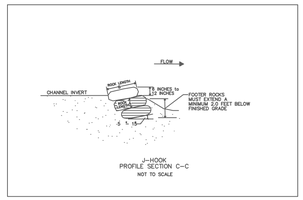
ROCK CROSS VANE



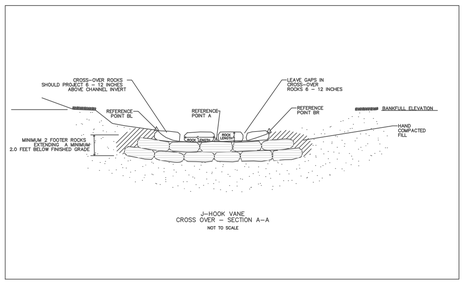
ROCK VANE
PLAN VIEW
NOT TO SCALE



ROCK VANE ARM
SECTION B-B
NOT TO SCALE



J-HOOK
PROFILE SECTION C-C
NOT TO SCALE



J-HOOK VANE
CROSS OVER – SECTION A-A
NOT TO SCALE

ROCK J-HOOK VANE NOTES:

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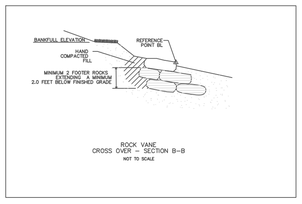

ROCK VANE
CROSS OVER – SECTION B-B
NOT TO SCALE

J-HOOK VANE

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LIVINGSTON MANOR

REVISIONS		
DATE	BY	
		30% DESIGN TYPICAL DETAILS
		PROJECT MANAGER: RRS / DRAFTING: KC
		DESIGN: RRS / CHECKED BY BH:

SHEET 8 OF 10

TD-1

TOE WOOD DETAIL AND SPECS

The Toe Wood Structure

by Dave Rosgen

Objectives:

- Enhance fish habitat/food chains
- Stabilize streambanks
- Maintain a low width/depth ratio
- Provide a more natural appearance & improve visual values
- Be compatible with geomorphic settings
- Eliminate the need for toe rock
- Be cost effective with a lower risk

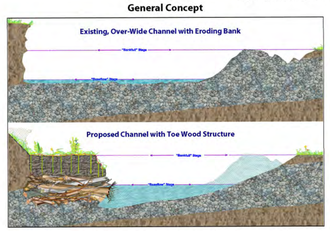
The Toe Wood Structure:

- Incorporates native woody material into a submerged undercut bank to replicate natural streambanks
- Toe wood is positioned on the lower 1/3 to 1/2 of bank to ensure it is submerged year round to prevent wood deterioration
- Cuttings with sod and live staking or woody transplants cover the toe wood and are installed up to the bankfull stage

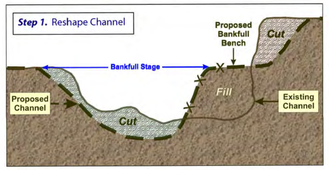
Variations in the Toe Wood Structure:

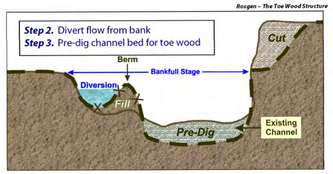
- ***Option 1*** – Use cuttings and sod mats that are staked and held down by interweaving shroud line
- ***Option 2*** – Instead of cuttings and sod mats, use woody transplants, such as willow, alder, cottonwood or dogwood
- ***Option 3*** – where sod mats and woody transplants are unavailable, use cuttings with "burrito" soil lifts

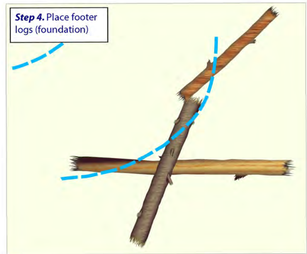
General Concept

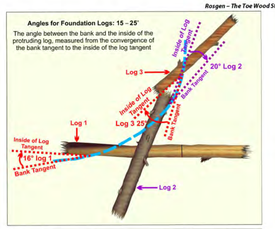


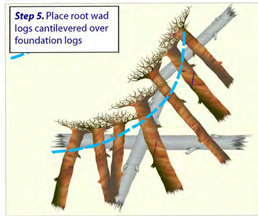
Installation Sequence for Option 1 –
Use Cuttings & Sod Mats with Staking

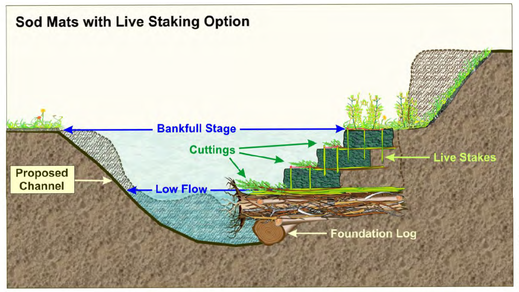


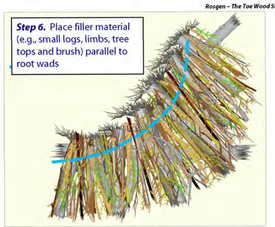


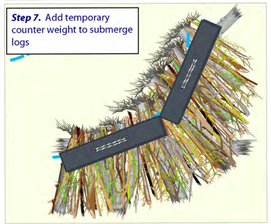


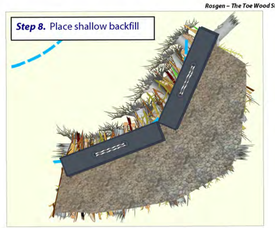


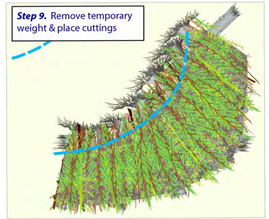


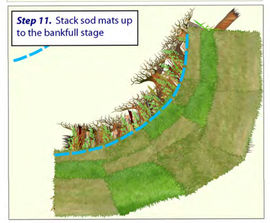


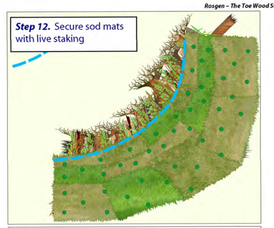


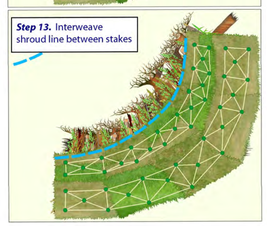












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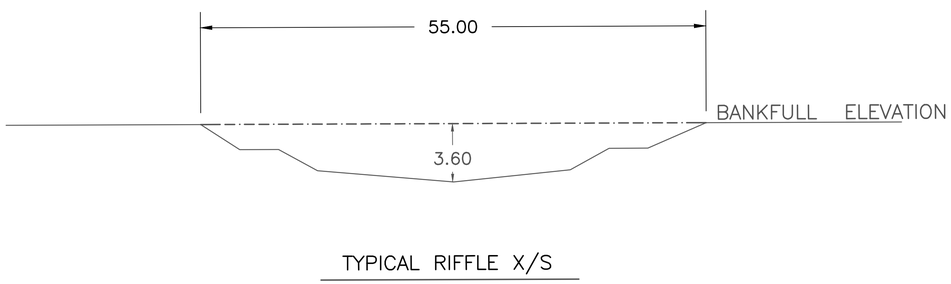
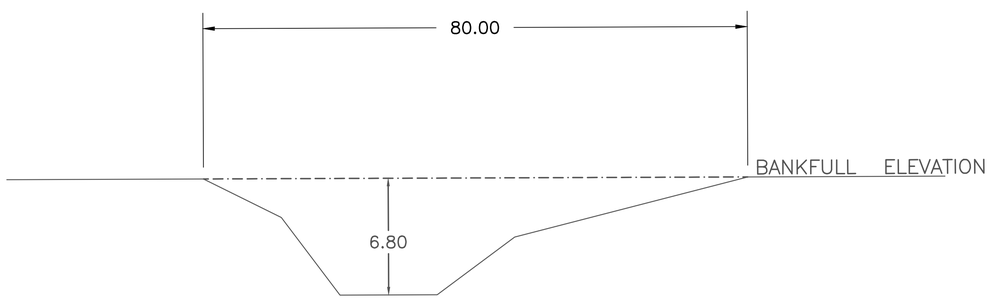
LIVINGSTON MANOR			SHEET
REVISIONS DATE	BY	30% DESIGN TYPICAL DETAILS	9 OF 10
		PROJECT MANAGER: RRS / DRAFTING: KC	TD–2
		DESIGN: RRS / CHECKED BY: BH	

DESIGN CRITERIA



TYPICAL RIFFLE X/S



TYPICAL POOL X/S

No.	Variable	Symbol	Units		Design Ratios and Criteria	Design Ratios and Criteria
1	Stream type				C4	B4c
2	Drainage area		mi^2	Mean	30.0	30.0
				Range	NA	NA
3	Riffle Bankfull width	W_{bkf}	feet	Mean	55.00	55.00
				Range	49 - 60	49 - 60
4	Riffle Bankfull mean depth	d_{bkf}	feet	Mean	2.70	2.70
				Range	2.5 - 2.9	2.5 - 2.9
5	Width depth ratio	W/d		Mean	14.00	14.00
				Range	12.0 - 16.0	12.0 - 16.0
6	Riffle Bankfull cross sectional area	A_{bkf}	ft_2	Mean	150.00	150.00
				Range	140 - 156	140 - 156
7	Bankfull mean velocity	V_{bkf}	ft/sec	Mean	5.20	5.20
				Range	4.7 - 5.7	4.7 - 5.7
8	Bankfull discharge	Q_{bkf}	cfs	Mean	780.00	780.00
				Range	740 - 820	740 - 820
9	Riffle Bankfull maximum depth	d_{max}	feet	Mean	3.60	3.60
				Range	3.4 - 3.8	3.4 - 3.8
10	Max Riffle depth/ Mean riffle depth	d_{riff}/d_{bkf}		Mean	1.30	1.30
				Range	NA	NA
11	Low bank height to max d_{bkf} ratio			Mean	1.00	1.00
				Range	NA	NA
12	Width of flood prone area	W_{fpa}	feet	Mean	500.00	140.00
				Range	450 - 550	77 - 200
13	Entrenchment Ratio	W_{fpa}/W_{bkf}		Mean	7.10	2.50
				Range	2.2 - 12.0	1.4 - 3.6
14	Meander Length	L_m	feet	Mean	578	NA
				Range	385 - 770	NA
15	Ratio of meander length to bankfull width	L_m/W_{bkf}		Mean	10.50	NA
				Range	7.0 - 14.0	NA
16	Radius of curvature	R_c		Mean	138	NA
				Range	110 - 165	NA
17	Ratio: Radius of curvature to bankfull width	R_c/W_{bkf}		Mean	2.50	NA
				Range	2.0 - 3.0	NA
18	Belt Width	W_{blt}	feet	Mean	317	NA
				Range	193 - 440	NA
19	Meander width ratio	W_{blt}/W_{bkf}		Mean	5.80	NA
				Range	3.5 - 8.0	NA
20	Sinuosity	K		Mean	1.30	1.20
				Range	1.2 - 1.4	1.1 - 1.3
21	Valley Slope	S_{val}	ft/ft		512.38	512.38
22	Average Water Surface Slope	S_{avg}	ft/ft	Mean	0.0040	0.00085
				Range	0.0033 - 0.0054	0.00071 - 0.00098
23	Pool Water Surface Slope	S_{pool}	ft/ft	Mean	0.0016	0.00034
				Range	0.0012 - 0.002	0.00026 - 0.00043
24	Pool WS slope / Average WS slope	S_{pool}/S_{avg}		Mean	0.40	0.40
				Range	0.3 - 0.5	0.3 - 0.5
25	Riffle Water Surface slope	Sriff	ft/ft	Mean	0.0056	0.0012
				Range	0.0048 - 0.006	0.00094 - 0.0015
26	Riffle WS slope / Average WS slope	S_{riff}/S_{avg}		Mean	1.40	1.45
				Range	1.20 - 1.50	1.1 - 1.8
27	Run WS Slope	S_{run}/S_{avg}	ft/ft	Mean	0.0028	NA
				Range	0.002 - 0.0032	NA
28	Run WS slope / Average WS slope	S_{run}/S_{avg}	ft/ft	Mean	0.70	NA
				Range	0.5 - 0.8	NA
29	Glide WS Slope	S_{glide}		Mean	0.0016	0.0003
				Range	0.0012 - 0.002	0.00026 - 0.00043
30	Glide WS slope / Average WS slope	S_{glide}/S_{avg}	ft/ft	Mean	0.40	0.40
				Range	0.3 - 0.5	0.3 - 0.5

No.	Variable	Symbol	Units		Design Ratios and Criteria	Design Ratios and Criteria
31	Maximum pool depth	d_{pool}	feet	Mean	6.80	7.40
				Range	4.1 - 9.5	5.4 - 9.5
32	Ratio of max pool depth to average bankfull depth	d_{pool}/d_{bkf}		Mean	2.50	2.75
				Range	1.5 - 3.5	2.0 - 3.5
33	Max Run Depth	d_{run}	feet	Mean	5.30	NA
				Range	4.6 - 6.0	NA
34	Ratio of max run depth to average bankfull depth	d_{run}/d_{bkf}		Mean	2.00	NA
				Range	1.7 - 2.2	NA
35	Max Riffle Depth	d_{run}	feet	Mean	3.60	3.50
				Range	3.2 - 4.0	3.2 - 3.8
36	Ratio of max riffle depth to average bankfull depth	d_{run}/d_{bkf}		Mean	1.35	1.30
				Range	1.2 - 1.5	1.2 - 1.4
37	Max Glide Depth	d_{glide}	feet	Mean	4.40	4.40
				Range	3.8 - 4.9	3.8 - 4.9
38	Ratio of max glide depth to average bankfull depth	d_{glide}/d_{bkf}	feet	Mean	1.60	1.60
				Range	1.4 - 1.8	1.4 - 1.8
39	Pool width	W_{pool}	feet	Mean	80.00	103.00
				Range	66 - 94	61 - 83
40	Ratio of pool width to bankfull width	W_{pool}/W_{bkf}		Mean	1.50	1.30
				Range	1.2 - 1.7	1.1 - 1.5
42	Point bar slope	S_{pb}		Mean	8.00	NA
				Range	6.0 - 10.0	NA
43	Pool to pool spacing	p-p	feet	Mean	289.00	248.00
				Range	193 - 385	220 - 275
44	Ratio of pool to pool spacing to bankfull width	$p\text{-}p/W_{bkf}$		Mean	5.30	4.50
				Range	3.5 - 7.0	4.0 - 5.0
Materials						
	Particle Size Distribution Channel	D_{16}	mm		18.64	18.64
		D_{35}	mm		32.39	32.39
		D_{50}	mm		42.17	42.17
		D_{84}	mm		76.48	76.48
		D_{95}	mm		89.35	89.35
	Particle Size Distribution Bar	D_{16}	mm		4.88	4.88
		D_{35}	mm		24.73	24.73
		D_{50}	mm		41.94	41.94
		D_{84}	mm		84.17	84.17
		D_{95}	mm		98.49	98.49
Largest Particle Size			mm		105.00	105.00

U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
Stream Habitat Assessment and Restoration Program

177 Admiral Cochrane Drive
Annapolis, Maryland 21401

Tel. (410) 573-4583

LIVINGSTON MANOR

REVISIONS

DATE	BY

30% DESIGN
TYPICAL DETAILS

PROJECT MANAGER: RRS
DRAFTING: KC
DESIGN: RRS
CHECKED BY: BH