

Vermont Stream Geomorphic Assessment Adjusted Phase 2 Field Forms for Stand-Alone Reach Habitat Assessment (RHA)

*****Yellow cells required for RHA Protocol*****

Field Notes Form for Steps 1 - 5

Cross-Section Worksheet

Field Quick Refer Tables

Quality Assurance Data Sheet

Rapid Habitat Assessment (RHA)

Rapid Geomorphic Assessment (RGA)

Rapid Stream Assessment Field Notes

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____

Segment I.D.: _____
 Date: _____ Sub-Reach
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.
 Segment Not Assessed: W/I/N/G/B/O

Rain Storm within past 7 days: Y / N Flood history known: Y / N

1. Valley and River Corridor

1.1 Segmentation: GC/CD/SS/PS/DF/CE/BB/FS/PA/SR/VW/OT/None **1.2 Alluvial Fan (FIT): Yes/No/UK**

1.3 River Corridor Encroachments (FIT)	Reach or Segment Length			1.4 Slope of the Adjacent Terrace or Hillside					
	One Bank	Both Banks	Height from tw	Left Corridor			Right Corridor		
Berms				flat (0-3%)	hilly (4-8%)	steep (9-15%)	flat (0-3%)	hilly (4-8%)	steep (9-15%)
Roads				very steep (16-25%)	x-steep (>25%)		very steep (16-25%)	x-steep (>25%)	
Railroads				Continuous w/bank A / S / N			Continuous w/bank A / S / N		
Improved Paths				Within 1x Wbckf A / S / N			Within 1x Wbckf A / S / N		
Development			NA	<u>Texture of Exposed Slope</u>			<u>Texture of Exposed Slope</u>		
				till	boulder/cobble	gravel	sand	silt	
				clay	bedrock	other	Not Evaluated		

1.5 Confinement	1.6 Grade Controls (FIT)	Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photo Yes / No
Valley width / Channel width Valley Width: _____ <input type="checkbox"/> Gorge Estimated / Measured <input type="checkbox"/> Human caused change in valley width	<input type="checkbox"/> none Fill out height fields for grade controls if applicable → Location in Reach (record locations on field map) Waterfall // Ledge // Dam // Weir			
Narrowly Confined (>=1 & <2)				
Semi-confined (>2 & <4)				
Narrow (>= 4 & <6)				
Broad (>= 6 & <10)				
Very Broad (>= 10)				

2. Stream Channel

2.1 Bankfull Width: _____ ft. **2.1a Wetted Width:** _____ ft. **2.1b Ratio (W_{wetted} / W_{bckf}):** _____

2.2 Max. Bankfull Depth: _____ ft. **2.3 Mean Bankfull Depth:** _____ ft.

2.4 Floodprone Width: _____ ft. **2.5 Recently Abandoned FP :** _____ ft. **2.6 Ratio W/d_{mean} :** _____

2.7 Entrenchment: _____ **2.8 Incision Ratio:** _____ IR_{net} : _____ **2.9 Sinuosity:** _____

2.10 Riffles/Steps: complete / eroded / sedimented / NA / NE
(partial or none) (diagonal or continuous) **2.11 Riffle/Step Spacing:** _____ ft.

2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder <small>>10 in >256 mm</small>	3 Cobble <small>2.5 - 10 in 64-256 mm</small>	4 Gravel Course Fine		5 Sand <small>0.002-0.1in .062-2mm</small>	6 Silt or Clay (present)	Embeddedness		2.13 Avg. Size of Largest Particles on: Bed: _____ Bar: _____ circle: inches or millimeters 2.13a % Exp. Substrate: _____
			0.6-2.5in 16-64mm	0.08-0.63in 2-16 mm			Mean Channel	Mean Margin	
						Y / N			

2.14 Stream Type: A G F B E C D 1 2 3 4 5 6 a b c
 Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type _____
 Reference Type

3. Riparian banks, Buffers, and Corridors

3.1	Typical Bank Slope		shallow moderate steep undercut (evaluate on the higher of the two banks)						
	Bank Texture-RB	Lower	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive
Upper		bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
Bank Texture-LB	Lower	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
	Upper	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
Bank Erosion (FIT)	Left	Length:	ft.	Height:	ft.	Bank Revetment Type:		Length: ft.	
	Right	Length:	ft.	Height:	ft.	Bank Revetment Type:		Length: ft.	
Near Bank Vegetation Type	Trees	L % cover	Invasive	Conifer	Deciduous	R % cover	Invasive	Conifer	Deciduous
	Shrubs / Saps.	L % cover	Invasive	WADs	Saplings	R % cover	Invasive	WADs	Saplings
	Herbs	L % cover	Invasive	Grasses	Forbs	R % cover	Invasive	Grasses	Forbs
Bank Canopy	Left	76 - 100%	51 - 75%	26 - 50%	1 - 25%	0%	Channel Canopy Open Closed		
	Right	76 - 100%	51 - 75%	26 - 50%	1 - 25%	0%			
3.2	Buffer Width (dom/sub) (FIT 0-25 ft)	Left	0 - 25 ft.	26 - 50 ft.	51 - 100 ft.	> 100 ft.	none (SD).		
		Right	0 - 25 ft.	26 - 50 ft.	51 - 100 ft.	> 100 ft.	none (SD).		
Buffer Vegetation Type	Trees	L % cover	Invasive	Conifer	Deciduous	R % cover	Invasive	Conifer	Deciduous
	Shrubs / Saps.	L % cover	Invasive	WADs	Saplings	R % cover	Invasive	WADs	Saplings
	Herbs	L % cover	Invasive	Grasses	Forbs	R % cover	Invasive	Grasses	Forbs
3.3	Riparian Corridor (dom/sub)	Left	forest shrub-sapling	crop/pasture/hay	commercial/industrial	residential	bare	none (SD)	
		Right	forest shrub-sapling	crop/pasture/hay	commercial/industrial	residential	bare	none (SD)	

- 4.1 Springs or Seeps: extensive / present / minimum / none / altered
- 4.2 Adjacent Wetlands: extensive / present / minimum / none / altered 4.3 Flow status: base / low / avg.
- 4.4 Current Debris Jams (FIT): # _____ 4.5 Flow Regs. & Withdrawals (FIT): TYPE: w|thdrawal / bypass / r-o-r / store & release / none / unk
- 4.7 Flow Regulation (FIT): SIZE : small / large ; USE: drinking / irrigation, flood-control / hydro-electric / recreation / other
- 4.6 Upstream/Downstream Flow Regs. : upstream / downstream / both / none
- 4.7 Stormwater Inputs (FIT): tile drain ___ / road ditch ___ / urban stormwater ___ / field ditch ___ / overland flow ___
- 4.8 Constrictions none menu: instream culvert // bridge // old abutment // bedrock outcrop // other

Constriction Type (from menu)	Width (ft)	Photo Yes / No	Problems (check all that apply)							
			channel constriction	floodprone constriction	deposition above	deposition below	scour above	scour below	alignment	none
			<input type="checkbox"/>	<input type="checkbox"/>						
			<input type="checkbox"/>	<input type="checkbox"/>						
			<input type="checkbox"/>	<input type="checkbox"/>						
			<input type="checkbox"/>	<input type="checkbox"/>						

4.9 Beaver Dams (FIT): # _____ ft. of the segment affected. Bridge & Culvert Assessments

5. Channel Bed and Planform Changes

(5.0 to 5.3 record on tally sheet)

5.4 Stream Ford or Animal Crossing (FIT): Yes / No

5.5 Channel Alterations (FIT) (circle all that apply): dredging gravel mining commercial mining none

Length of Straightening: _____ (With Windrowing : Yes / No)

Comments:

Sketch Form for Sites – Segments – Reaches

Stream Name: _____

Segment or Site ID: _____

Date: _____

Town: _____

Observers: _____

Elevation: _____ Ft.

Organization /Agency: _____

Site Sketch - see reverse side for sketch codes and tally columns for left and right bank erosion, revetments, and corridor developments and calculating the total length of the segment affected by beaver flowages.

Scale:

Height of bankfull features above water surface (Ft.)

Selected BKF Height

LWD tally
Debris Jams
Stormwater

Constrictions

α

Tally Sheet (page 1)

Stream Name: _____
 Location: _____

Segment I.D.: _____
 Date: _____

Sub-Reach

Step 2.1 Height of bankfull above water surface

Bankfull Height	Chan. Wdth	Comments (describe indicators)

Step 5. Channel Bed and Planform Changes

Record actual number of features		Tally
5.1	Depositional Features (Bar Type)	Mid
		Point
		Side
		Diagonal
		Delta
		Island
5.2 FIT	Flood Chutes	
	Neck Cut-offs	
	Channel Avulsions	
	Braiding	
5.3 FIT	Migration	
	Aggrade	Steep Riffles
	Degrade	Head Cuts
Tributary Rejuvenation?		Yes / No

Step 3.1 Bank Erosion FIT

Left Bank Length	Height	Right Bank Length	Height
Total:	Avg.	Total:	Avg.

Step 3.3 Mass Failures and Gullies FIT

Mass Fail - Length		Height	Gully - Length		Length
Left	Right		Left	Right	
Total:	Avg.	Total:	Avg.	Total:	Avg.

Step 3.1 Bank Revetment FIT

Length	
Left Bank	Right Bank
Total:	Total:

Step 4.8 Channel Constrictions

Constriction Type	Width	Photo?	GPS?	Ch. Constr.	FP. Constr.	DA	DB	SA	SB	A	None
1.)											
2.)											
3.)											
4.)											
5.)											

Tally

Step 2.12	Large Woody Debris	
Step 4.4	Debris Jams	
Step 2.11	Riffle/Step Spacing:	
Step 2.13	Avg. Largest Particle	On Bed: On Bar:

Step 1.3 River Corridor Encroachments FIT

Type	Length		Height of Fill
	One Side	Both Sides	

Step 4.6 Stormwater FIT

Tally

Field Ditch	
Overland Flow	
Road Ditch	
Tile Drain	
Urban Stormwater	
Other	

Tally Sheet (page 2)

Stream Name: _____
 Location: _____

Segment I.D.: _____
 Date: _____

Sub-Reach

Note CPOM, algae, location of fines

6.1 Large Woody Debris and Jams

Rank	D _{large} (ft)	L (w _{bkf})	Tally	#	%
1	0.5 - 1.0	< 0.5			
2	0.5 - 1.0	> 0.5			
3	1.0 - 2.0	< 0.5			
4	1.0 - 2.0	> 0.5			
5	> 2.0	< 0.5			
6	> 2.0	> 0.5			
Total LWDs					
# LWDs / mile					
# Debris jams					
# Debris jams / mile					

6.2 Pools (note vegetative cover, surface turbulence, fines)

Rank	D (ft)	L, W (w _{bkf})	Tally	#	%
1	1.0 - 2.0	< 0.5			
2	1.0 - 2.0	> 0.5			
3	2.0 - 3.0	< 0.5			
4	2.0 - 3.0	> 0.5			
5	> 3.0	< 0.5			
6	> 3.0	> 0.5			
7	> 3.0	≥ 1.0			
Total pools					
# Pools / mile					

6.3 Refuge Areas / Connections

ID	Location	Q _{access}	Notes
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	

6.4 Undercut Banks (note stability, overhanging vegetation)

Rank	D _{max} (ft)	L (ft)	Tally	#	%
1	0.5 - 1.0	< 2.0			
2	0.5 - 1.0	> 2.0			
3	1.0 - 2.0	< 2.0			
4	1.0 - 2.0	> 2.0			
5	> 2.0	< 2.0			
6	> 2.0	> 2.0			
Total undercuts					
# undercut banks / mile					

VTANR REACH HABITAT ASSESSMENT ----- RIFFLE-POOL STREAM TYPE

(Also use this form for dune-ripple stream type.)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 100					<input type="checkbox"/> $100 \geq$ LWD / mile > 50					<input type="checkbox"/> $50 \geq$ LWD / mile > 25					<input type="checkbox"/> LWD / mile ≤ 25				
	<input type="checkbox"/> LWD size rank 3-6 $> 50\%$					<input type="checkbox"/> $50 \geq$ LWD rank 3-6 $> 25\%$					<input type="checkbox"/> $25 \geq$ LWD rank 3-6 $> 10\%$					<input type="checkbox"/> LWD size rank 3-6 $\leq 10\%$				
	<input type="checkbox"/> debris jams / mile > 5					<input type="checkbox"/> $5 \geq$ jams / mile > 3					<input type="checkbox"/> $3 \geq$ jams / mile > 1					<input type="checkbox"/> debris jams absent				
	<input type="checkbox"/> high woody debris recruitment potential					<input type="checkbox"/> moderate woody debris recruitment potential					<input type="checkbox"/> low woody debris recruitment potential					<input type="checkbox"/> no woody debris recruitment potential				
	<input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> CPOM absent				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt. (Dune-ripple stream type: Fining only.)	<input type="checkbox"/> riffle embeddedness $< 20\%$ margin embeddedness $< 40\%$					<input type="checkbox"/> $20 \leq emb_{riffle} < 40\%$ $40 \leq emb_{margin} < 60\%$					<input type="checkbox"/> $40 \leq emb_{riffle} < 75\%$ $60 \leq emb_{margin} < 80\%$					<input type="checkbox"/> riffle embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$				
	<input type="checkbox"/> fining* $< 10\%$					<input type="checkbox"/> $10 \leq fining^* < 20\%$					<input type="checkbox"/> $20 \leq fining^* < 40\%$					<input type="checkbox"/> fining* $\geq 40\%$				
	<input type="checkbox"/> Riffle stability index $< 70\%$					<input type="checkbox"/> $70 \leq RSI < 80\%$					<input type="checkbox"/> $80 \leq RSI < 90\%$					<input type="checkbox"/> $RSI \geq 90\%$				
	<input type="checkbox"/> sediment apparently stable & sorted					<input type="checkbox"/> some evidence of sediment mobility & lack of sorting					<input type="checkbox"/> major evidence of sediment mobility & lack of sorting					<input type="checkbox"/> sediments unstable, unsorted, soft underfoot				
	<input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> most of substrate covered by dense algae growth				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.3 Scour and Deposition Features (Dune-ripple stream type: Only evaluate pools and ripples.) <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft)	<input type="checkbox"/> pools / mile > 40					<input type="checkbox"/> $40 \geq$ pools / mile > 20					<input type="checkbox"/> $20 \geq$ pools / mile > 10					<input type="checkbox"/> pools / mile ≤ 10				
	<input type="checkbox"/> pool size rank 3-7 $> 50\%$					<input type="checkbox"/> $50 \geq$ pool rank 3-7 $> 25\%$					<input type="checkbox"/> $25 \geq$ pool rank 3-7 $> 10\%$					<input type="checkbox"/> pool size rank 3-7 $\leq 10\%$				
	<input type="checkbox"/> good cover $> 75\%$ of total pool surface area					<input type="checkbox"/> $75 \geq$ good cover $> 50\%$ of total pool surface area					<input type="checkbox"/> $50 \geq$ good cover $> 25\%$ of total pool surface area					<input type="checkbox"/> good cover $\leq 25\%$ of total pool surface area				
	<input type="checkbox"/> riffle (ripple) coverage $> 25\%$ reach area, distinctly formed and complete					<input type="checkbox"/> $25 \geq$ riffle coverage $> 10\%$ reach area, moderately well formed and complete					<input type="checkbox"/> $25 \geq$ riffle coverage $> 10\%$ reach area, poorly formed and incomplete					<input type="checkbox"/> riffle (ripple) coverage $\leq 10\%$ reach area, or mostly indistinct				
	<input type="checkbox"/> $5 \leq$ riffle spacing ≤ 7 bankfull channel widths (w_{bkf})					<input type="checkbox"/> $3 \leq$ riffle spacing < 5 , or $7 <$ riffle spacing $\leq 10 \times w_{bkf}$					<input type="checkbox"/> $1 \leq$ riffle spacing < 3 , or $10 <$ riffle spacing $\leq 12 \times w_{bkf}$					<input type="checkbox"/> riffle spacing ≥ 12 bankfull channel widths				
	<input type="checkbox"/> well-defined riffle-run-pool-glide pattern with all four depth-velocity combinations present					<input type="checkbox"/> well-defined riffle-run-pool-glide pattern with three depth-velocity combinations dominant					<input type="checkbox"/> moderately defined riffle-run-pool-glide pattern with two depth-velocity combinations dominant					<input type="checkbox"/> poorly defined riffle-run-pool-glide pattern with one depth-velocity combination dominant				
	<input type="checkbox"/> finer deposition located entirely in slack water below larger substrates/debris, and along margins					<input type="checkbox"/> finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation					<input type="checkbox"/> very large depositional features below larger substrates/debris, abundant mid-channel accumulation					<input type="checkbox"/> finer deposition throughout channel, even filling pools, larger substrates almost buried or bed largely incised				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 15 , natural					<input type="checkbox"/> $15 \leq w / d < 25$, widening					<input type="checkbox"/> $25 \leq w / d < 40$, widening					<input type="checkbox"/> $w / d > 40$, over-widening				
	<input type="checkbox"/> entrenchment ratio ≥ 1.4 , incision ratio < 1.2 , good floodplain access					<input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.2 \leq$ incision ratio < 1.4 , reduced floodplain access					<input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.4 \leq$ incision ratio < 2.0 , limited floodplain access					<input type="checkbox"/> entrenchment ratio < 1.4 or incision ratio ≥ 2.0 , floodplain access unlikely				
	<input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> major historic or minor recent channel alteration					<input type="checkbox"/> extensive historic or major recent channel alteration				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkf} > 0.75$ <input type="checkbox"/> exposed substrate $< 20\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.75 \geq W_{wet} / W_{bkf} > 0.50$					<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkf} > 0.25$					<input type="checkbox"/> $W_{wet} / W_{bkf} \leq 0.25$									
	<input type="checkbox"/> $20 \leq \text{exp. substrate} < 40\%$					<input type="checkbox"/> $40 \leq \text{exp. substrate} < 60\%$					<input type="checkbox"/> exposed substrate $\geq 60\%$									
<input type="checkbox"/> adjacent springs, seeps, and wetlands present					<input type="checkbox"/> adjacent springs, seeps, and wetlands minimal					<input type="checkbox"/> adjacent springs, seeps, and wetlands absent or altered										
<input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species									
	<input type="checkbox"/> limited system obstructions					<input type="checkbox"/> system obstructions present					<input type="checkbox"/> many system obstructions									
<input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> refuge absent										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments					<input type="checkbox"/> $10 \leq$ bank erosion $< 30\%$, infrequent small areas, some bank revetments					<input type="checkbox"/> $30 \leq$ bank erosion $< 60\%$, mod. unstable banks, and/or extensive bank revetments					<input type="checkbox"/> bank erosion $\geq 60\%$, banks unstable, extensive erosion, and failing bank revetments				
	<input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $90 \geq$ bank vegetation $> 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $75 \geq$ bank vegetation $> 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank					<input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank				
<input type="checkbox"/> bank canopy $> 90\%$					<input type="checkbox"/> $90 \geq$ bank canopy $> 75\%$					<input type="checkbox"/> $75 \geq$ bank canopy $> 50\%$					<input type="checkbox"/> bank canopy $\leq 50\%$					
<input type="checkbox"/> undercut banks / mile > 30					<input type="checkbox"/> $30 \geq$ undercuts / mile > 15					<input type="checkbox"/> $15 \geq$ undercuts / mile > 5					<input type="checkbox"/> undercuts / mile ≤ 5					
<input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$					<input type="checkbox"/> $50 \geq$ undercut bank size rank 3-6 $> 25\%$					<input type="checkbox"/> $25 \geq$ undercut bank size rank 3-6 $> 10\%$					<input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$					
<input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency					<input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency					
<input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> ≥ 3 mass failures in valley					
SCORE (LB)	Left Bank		10	9	8	7	6	5	4	3	Right Bank		2	1						
SCORE (RB)	Right Bank		10	9	8	7	6	5	4	3	Left Bank		2	1						
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 150 ft					<input type="checkbox"/> $150 \geq$ buffer width > 100 ft					<input type="checkbox"/> $100 \geq$ buffer width > 50 ft					<input type="checkbox"/> buffer width ≤ 50 ft				
	<input type="checkbox"/> rip. vegetation $> 75\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. $> 50\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. $> 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy					<input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy				
<input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> river corridor development and infrastructure abundant					
SCORE (LB)	Left Bank		10	9	8	7	6	5	4	3	Right Bank		2	1						
SCORE (RB)	Right Bank		10	9	8	7	6	5	4	3	Left Bank		2	1						

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136 – 160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)

VTANR REACH HABITAT ASSESSMENT ----- STEP-POOL STREAM TYPE

(Also use this form for cascade and bedrock stream types.)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D.: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 200 <input type="checkbox"/> LWD size rank 3-6 $> 75\%$ <input type="checkbox"/> debris jams / mile > 25 <input type="checkbox"/> high woody debris recruitment potential <input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> $200 \geq$ LWD / mile > 100 <input type="checkbox"/> $75 \geq$ LWD rank 3-6 $> 50\%$ <input type="checkbox"/> $25 \geq$ jams / mile > 15 <input type="checkbox"/> moderate woody debris recruitment potential <input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> $100 \geq$ LWD / mile > 50 <input type="checkbox"/> $50 \geq$ LWD rank 3-6 $> 25\%$ <input type="checkbox"/> $15 \geq$ jams / mile > 5 <input type="checkbox"/> low woody debris recruitment potential <input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> LWD / mile ≤ 50 <input type="checkbox"/> LWD size rank 3-6 $\leq 25\%$ <input type="checkbox"/> jams / mile ≤ 5 <input type="checkbox"/> no woody debris recruitment potential <input type="checkbox"/> CPOM absent				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt.	<input type="checkbox"/> pool embeddedness $< 25\%$ margin embeddedness $< 40\%$ <input type="checkbox"/> fining* $< 10\%$ <input type="checkbox"/> sediment apparently stable & sorted <input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> $25 \leq emb_{pool} < 50\%$ $40 \leq emb_{margin} < 60\%$ <input type="checkbox"/> $10 \leq$ fining* $< 20\%$ <input type="checkbox"/> some evidence of sediment mobility & lack of sorting <input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> $50 \leq emb_{pool} < 75\%$ $60 \leq emb_{margin} < 80\%$ <input type="checkbox"/> $20 \leq$ fining* $< 40\%$ <input type="checkbox"/> major evidence of sediment mobility & lack of sorting <input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> pool embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$ <input type="checkbox"/> fining* $\geq 40\%$ <input type="checkbox"/> sediments unstable, unsorted, soft underfoot <input type="checkbox"/> most of substrate covered by dense algae growth				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
6.3 Scour and Deposition Features <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft)	<input type="checkbox"/> pools / mile > 70 <input type="checkbox"/> pool size rank 3-7 $> 50\%$ <input type="checkbox"/> good cover $> 75\%$ of total pool surface area <input type="checkbox"/> steps are distinctly formed, complete and stable <input type="checkbox"/> $5 \leq$ step spacing ≤ 7 bankfull channel widths (w_{bkf}) <input type="checkbox"/> more than two depth-velocity combinations present <input type="checkbox"/> finer deposition located entirely in slack water below larger substrates/debris, and along margins					<input type="checkbox"/> $70 \geq$ pools / mile > 50 <input type="checkbox"/> $50 \geq$ pool rank 3-7 $> 25\%$ <input type="checkbox"/> $75 \geq$ good cover $> 50\%$ of total pool surface area <input type="checkbox"/> steps are moderately well formed, complete and stable <input type="checkbox"/> $3 \leq$ step spacing < 5 , or $7 <$ step spacing $\leq 10 \times w_{bkf}$ <input type="checkbox"/> two depth-velocity combinations present <input type="checkbox"/> finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation					<input type="checkbox"/> $50 \geq$ pools / mile > 30 <input type="checkbox"/> $25 \geq$ pool rank 3-7 $> 10\%$ <input type="checkbox"/> $50 \geq$ good cover $> 25\%$ of total pool surface area <input type="checkbox"/> steps are poorly formed, incomplete and unstable <input type="checkbox"/> $1 \leq$ step spacing < 3 , or $10 <$ step spacing $\leq 15 \times w_{bkf}$ <input type="checkbox"/> one or two depth-velocity combinations present <input type="checkbox"/> very large depositional features below larger substrates/debris, abundant mid-channel accumulation					<input type="checkbox"/> pools / mile ≤ 30 <input type="checkbox"/> pool size rank 3-7 $\leq 10\%$ <input type="checkbox"/> good cover over $\leq 25\%$ of total pool surface area <input type="checkbox"/> steps are indistinct or absent, or very unstable <input type="checkbox"/> step spacing ≥ 15 bankfull channel widths <input type="checkbox"/> one depth-velocity combination present <input type="checkbox"/> finer deposition throughout channel, even filling pools, larger substrates almost buried or bed largely incised				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 12 , natural <input type="checkbox"/> entrenchment ratio ≥ 1.2 , incision ratio < 1.2 , good floodplain access <input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> $12 \leq w / d < 15$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.2 , $1.2 \leq$ incision ratio < 1.4 , reduced floodplain access <input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> $15 \leq w / d < 25$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.2 , $1.4 \leq$ incision ratio < 2.0 , limited floodplain access <input type="checkbox"/> major historic or minor recent alteration					<input type="checkbox"/> $w / d \geq 25$, over-widening <input type="checkbox"/> entrenchment ratio < 1.2 or incision ratio ≥ 2.0 , floodplain access unlikely <input type="checkbox"/> extensive historic or major recent alteration				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkr} > 0.75$ <input type="checkbox"/> exposed substrate $< 10\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.75 \geq W_{wet} / W_{bkr} > 0.50$					<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkr} > 0.25$					<input type="checkbox"/> $W_{wet} / W_{bkr} \leq 0.25$									
	<input type="checkbox"/> $10 \leq \text{exp. substrate} < 30\%$					<input type="checkbox"/> $30 \leq \text{exp. substrate} < 50\%$					<input type="checkbox"/> exposed substrate $\geq 50\%$									
<input type="checkbox"/> adjacent springs, seeps, and wetlands present					<input type="checkbox"/> adjacent springs, seeps, and wetlands minimal					<input type="checkbox"/> adjacent springs, seeps, and wetlands absent or altered										
<input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions	<input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows					<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species				
	<input type="checkbox"/> system obstructions absent					<input type="checkbox"/> limited system obstructions					<input type="checkbox"/> system obstructions present					<input type="checkbox"/> many system obstructions				
<input type="checkbox"/> abundant low and high flow refuge					<input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> refuge absent					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments					<input type="checkbox"/> $10 \leq$ bank erosion $< 20\%$, infrequent small areas, some bank revetments					<input type="checkbox"/> $20 <$ bank erosion $< 50\%$, mod. unstable banks, and/or extensive bank revetments					<input type="checkbox"/> bank erosion $\geq 50\%$, banks unstable, extensive erosion, and failing bank revetments				
	<input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $90 \geq$ bank vegetation $> 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $75 \geq$ bank vegetation $> 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank					<input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank				
<input type="checkbox"/> bank canopy $> 90\%$					<input type="checkbox"/> $90 >$ bank canopy $> 80\%$					<input type="checkbox"/> $80 \geq$ bank canopy $> 60\%$					<input type="checkbox"/> bank canopy $\leq 60\%$					
<input type="checkbox"/> undercut banks / mile > 15					<input type="checkbox"/> $15 \geq$ undercuts / mile > 10					<input type="checkbox"/> $10 \geq$ undercuts / mile > 5					<input type="checkbox"/> undercuts / mile ≤ 5					
<input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$					<input type="checkbox"/> $50 \geq$ undercut bank size rank 3-6 $> 25\%$					<input type="checkbox"/> $25 \geq$ undercut bank size rank 3-6 $> 10\%$					<input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$					
<input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency					<input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency					
<input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> > 3 mass failures in valley					
SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1									
SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1									
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 200 ft					<input type="checkbox"/> $200 \geq$ buffer width > 150 ft					<input type="checkbox"/> $150 \geq$ buffer width > 100 ft					<input type="checkbox"/> buffer width ≤ 100 ft				
	<input type="checkbox"/> rip. vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy					<input type="checkbox"/> $90 \geq$ rip. veg. $> 75\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. $> 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy					<input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy				
<input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> river corridor development and infrastructure abundant					
SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1									
SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1									

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136-160	85 - 100	Reference (None)
104 - 135	65 - 84	Good (Minor)
56 - 103	35 - 64	Fair (Major)
0 - 55	0 - 34	Poor (Severe)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 50 <input type="checkbox"/> LWD size rank 3-6 >50% <input type="checkbox"/> debris jams / mile > 5 <input type="checkbox"/> high woody debris recruitment potential <input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> $50 \geq$ LWD / mile > 25 <input type="checkbox"/> $50 \geq$ LWD rank 3-6 > 25% <input type="checkbox"/> $5 \geq$ jams / mile > 3 <input type="checkbox"/> moderate woody debris recruitment potential <input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> $25 \geq$ LWD / mile > 10 <input type="checkbox"/> $25 \geq$ LWD rank 3-6 > 10% <input type="checkbox"/> $3 \geq$ jams / mile > 1 <input type="checkbox"/> low woody debris recruitment potential <input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> LWD / mile ≤ 10 <input type="checkbox"/> LWD size rank 3-6 $\leq 10\%$ <input type="checkbox"/> debris jams absent <input type="checkbox"/> no woody debris recruitment potential <input type="checkbox"/> CPOM absent				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt.	<input type="checkbox"/> run embeddedness < 20% margin embeddedness < 40% <input type="checkbox"/> fining* < 10% <input type="checkbox"/> sediment apparently stable & sorted <input type="checkbox"/> imbrication limited, or mostly with the short axis of particles overlapping in the direction of flow <input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> $20 \leq emb_{run} < 40\%$ $40 \leq emb_{margin} < 60\%$ <input type="checkbox"/> $10 \leq fining^* < 20\%$ <input type="checkbox"/> some evidence of sediment mobility & lack of sorting <input type="checkbox"/> imbrication moderate, mostly with the short axis of particles overlapping in the direction of flow <input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> $40 \leq emb_{run} < 75\%$ $60 \leq emb_{margin} < 80\%$ <input type="checkbox"/> $20 \leq fining^* < 40\%$ <input type="checkbox"/> major evidence of sediment mobility & lack of sorting <input type="checkbox"/> imbrication moderate, mostly with the long axis of particles overlapping in the direction of flow <input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> run embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$ <input type="checkbox"/> fining* $\geq 40\%$ <input type="checkbox"/> sediments unstable, unsorted, soft underfoot <input type="checkbox"/> imbrication extensive, mostly with the long axis of particles overlapping in the direction of flow <input type="checkbox"/> most of substrate covered by dense algae growth				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
6.3 Scour and Deposition Features <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft)	<input type="checkbox"/> pool formation evident, with $\geq 50\%$ pool size rank 3-7 <input type="checkbox"/> widespread riffle formation <input type="checkbox"/> more than two depth-velocity combinations present <input type="checkbox"/> meandering thalweg clearly identifiable in cross section, with evidence of side and lateral bar formation <input type="checkbox"/> finer deposition located entirely in slack water below larger substrates/debris, and along margins					<input type="checkbox"/> pool formation evident, with <50% pool size rank 3-7 <input type="checkbox"/> moderate riffle formation <input type="checkbox"/> two depth-velocity combinations present <input type="checkbox"/> meandering thalweg moderately identifiable in cross section, with some evidence of bar formation <input type="checkbox"/> finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation					<input type="checkbox"/> limited trace of pool formation <input type="checkbox"/> limited riffle formation <input type="checkbox"/> one or two depth-velocity combinations present <input type="checkbox"/> meandering thalweg barely identifiable in the cross section, with minimal evidence of bar formation <input type="checkbox"/> very large depositional features below larger substrates/debris, abundant mid-channel accumulation					<input type="checkbox"/> pool formation completely absent <input type="checkbox"/> no riffle formation <input type="checkbox"/> one depth-velocity combination present <input type="checkbox"/> meandering thalweg not identifiable in the cross section, with no evidence of bar formation <input type="checkbox"/> finer deposition throughout channel, even filling pools, larger substrates almost buried or bed largely incised				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 15, natural <input type="checkbox"/> entrenchment ratio ≥ 1.4 , incision ratio < 1.2, good floodplain access <input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> $15 \leq w / d < 25$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.2 \leq$ incision ratio < 1.4, reduced floodplain access <input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> $25 \leq w / d < 40$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.4 \leq$ incision ratio < 2.0, limited floodplain access <input type="checkbox"/> major historic or minor recent channel alteration					<input type="checkbox"/> $w / d \geq 40$, over-widening <input type="checkbox"/> entrenchment ratio < 1.4 or incision ratio ≥ 2.0 , floodplain access unlikely <input type="checkbox"/> extensive historic or major recent channel alteration				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2

Habitat Parameter	Condition (Departure) Category																					
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)						
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkf} > 0.75$ <input type="checkbox"/> exposed substrate $< 20\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.75 \geq W_{wet} / W_{bkf} > 0.50$					<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkf} > 0.25$					<input type="checkbox"/> $W_{wet} / W_{bkf} \leq 0.25$											
	<input type="checkbox"/> $20 \leq \text{exp. substrate} < 40\%$					<input type="checkbox"/> $40 \leq \text{exp. substrate} < 60\%$					<input type="checkbox"/> exposed substrate $\geq 60\%$											
<input type="checkbox"/> adjacent springs, seeps, and wetlands present					<input type="checkbox"/> adjacent springs, seeps, and wetlands minimal					<input type="checkbox"/> adjacent springs, seeps, and wetlands altered or absent												
<input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence												
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species											
	<input type="checkbox"/> limited system obstructions					<input type="checkbox"/> system obstructions present					<input type="checkbox"/> many system obstructions											
<input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> refuge absent												
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments					<input type="checkbox"/> $10 \leq$ bank erosion $< 30\%$, infrequent small areas, some bank revetments					<input type="checkbox"/> $30 \leq$ bank erosion $< 60\%$, mod. unstable banks, and/or extensive bank revetments					<input type="checkbox"/> bank erosion $\geq 60\%$, banks unstable, extensive erosion, and failing bank revetments						
	<input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $90 \geq$ bank vegetation $> 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $75 \geq$ bank vegetation $> 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank					<input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank						
<input type="checkbox"/> bank canopy $> 90\%$					<input type="checkbox"/> $90 \geq$ bank canopy $> 75\%$					<input type="checkbox"/> $75 \geq$ bank canopy $> 50\%$					<input type="checkbox"/> bank canopy $\leq 50\%$							
<input type="checkbox"/> undercut banks / mile > 20					<input type="checkbox"/> $20 \geq$ undercuts / mile > 15					<input type="checkbox"/> $15 \geq$ undercuts / mile > 5					<input type="checkbox"/> undercuts / mile ≤ 5							
<input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$					<input type="checkbox"/> $50 \geq$ undercut bank size rank 3-6 $> 25\%$					<input type="checkbox"/> $25 \geq$ undercut bank size rank 3-6 $> 10\%$					<input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$							
<input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency					<input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency							
<input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> > 3 mass failures in valley							
SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	Left Bank	10	9	8	7	6	5	4	3	2	1
SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	Right Bank	10	9	8	7	6	5	4	3	2	1
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 150 ft					<input type="checkbox"/> $150 \geq$ buffer width > 100 ft					<input type="checkbox"/> $100 \geq$ buffer width > 50 ft					<input type="checkbox"/> buffer width ≤ 50 ft						
	<input type="checkbox"/> rip. vegetation $> 75\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. $> 50\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. $> 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy					<input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy						
<input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> river corridor development and infrastructure abundant							
SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	Left Bank	10	9	8	7	6	5	4	3	2	1
SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	Right Bank	10	9	8	7	6	5	4	3	2	1

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136 – 160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)

VTANR REACH HABITAT ASSESSMENT ----- BRAIDED STREAM TYPE

(Also use this form for alluvial fans.)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 100 <input type="checkbox"/> LWD size rank 3-6 $> 50\%$ <input type="checkbox"/> debris jams / mile > 5 <input type="checkbox"/> high woody debris recruitment potential <input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> $100 \geq$ LWD / mile > 50 <input type="checkbox"/> $50 \geq$ LWD rank 3-6 $> 25\%$ <input type="checkbox"/> $5 \geq$ jams / mile > 3 <input type="checkbox"/> moderate woody debris recruitment potential <input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> $50 \geq$ LWD / mile > 25 <input type="checkbox"/> $25 \geq$ LWD rank 3-6 $> 10\%$ <input type="checkbox"/> $3 \geq$ jams / mile > 1 <input type="checkbox"/> low woody debris recruitment potential <input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> LWD / mile ≤ 25 <input type="checkbox"/> LWD size rank 3-6 $\leq 10\%$ <input type="checkbox"/> debris jams absent <input type="checkbox"/> no woody debris recruitment potential <input type="checkbox"/> CPOM absent				
	SCORE					SCORE					SCORE					SCORE				
	20 19 18 17 16					15 14 13 12 11					10 9 8 7 6					5 4 3 2 1				
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt.	<input type="checkbox"/> riffle embeddedness $< 20\%$ margin embeddedness $< 40\%$ <input type="checkbox"/> fining* $< 10\%$ <input type="checkbox"/> Riffle stability index $< 70\%$ <input type="checkbox"/> sediment apparently stable & sorted <input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> $20 \leq emb_{riffle} < 40\%$ $40 \leq emb_{margin} < 60\%$ <input type="checkbox"/> $10 \leq fining^* < 20\%$ <input type="checkbox"/> $70 \leq RSI < 80\%$ <input type="checkbox"/> some evidence of sediment mobility & lack of sorting <input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> $40 \leq emb_{riffle} < 75\%$ $60 \leq emb_{margin} < 80\%$ <input type="checkbox"/> $20 \leq fining^* < 40\%$ <input type="checkbox"/> $80 \leq RSI < 90\%$ <input type="checkbox"/> major evidence of sediment mobility & lack of sorting <input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> riffle embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$ <input type="checkbox"/> fining* $\geq 40\%$ <input type="checkbox"/> RSI $\geq 90\%$ <input type="checkbox"/> sediments unstable, unsorted, soft underfoot <input type="checkbox"/> most of substrate covered by dense algae growth				
	SCORE					SCORE					SCORE					SCORE				
	20 19 18 17 16					15 14 13 12 11					10 9 8 7 6					5 4 3 2 1				
6.3 Scour and Deposition Features <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft)	<input type="checkbox"/> pools / mile > 40 <input type="checkbox"/> pool size rank 3-7 $> 50\%$ <input type="checkbox"/> good cover $> 75\%$ of total pool surface area <input type="checkbox"/> riffle coverage $> 25\%$ reach area, distinctly formed and complete <input type="checkbox"/> $5 \leq$ riffle spacing ≤ 7 bankfull channel widths (w_{bkf}) <input type="checkbox"/> well-defined riffle-run-pool-glide pattern with all four depth-velocity combinations present <input type="checkbox"/> stable bars, vegetative cover on depositional features $\geq 50\%$, particles well-sorted					<input type="checkbox"/> $40 \geq$ pools / mile > 20 <input type="checkbox"/> $50 \geq$ pool rank 3-7 $> 25\%$ <input type="checkbox"/> $75 \geq$ good cover $> 50\%$ of total pool surface area <input type="checkbox"/> $25 \geq$ riffle coverage $> 10\%$ reach area, moderately well formed and complete <input type="checkbox"/> $3 \leq$ riffle spacing < 5 , or $7 <$ riffle spacing $\leq 10 \times w_{bkf}$ <input type="checkbox"/> well-defined riffle-run-pool-glide pattern with three depth-velocity combinations dominant <input type="checkbox"/> mostly stable bars, vegetative cover on depositional features 50-25%, particles moderately sorted					<input type="checkbox"/> $20 \geq$ pools / mile > 10 <input type="checkbox"/> $25 \geq$ pool rank 3-7 $> 10\%$ <input type="checkbox"/> $50 \geq$ good cover $> 25\%$ of total pool surface area <input type="checkbox"/> $25 \geq$ riffle coverage $> 10\%$ reach area, poorly formed and incomplete <input type="checkbox"/> $1 \leq$ riffle spacing < 3 , or $10 <$ riffle spacing $\leq 12 \times w_{bkf}$ <input type="checkbox"/> moderately defined riffle-run-pool-glide pattern with two depth-velocity combinations dominant <input type="checkbox"/> unstable bars present, vegetative cover on depositional features 25-10%, particles minimally sorted					<input type="checkbox"/> pools / mile ≤ 10 <input type="checkbox"/> pool size rank 3-7 $\leq 10\%$ <input type="checkbox"/> good cover $\leq 25\%$ of total pool surface area <input type="checkbox"/> riffle coverage $\leq 10\%$ reach area, or mostly indistinct or absent <input type="checkbox"/> riffle spacing ≥ 12 bankfull channel widths <input type="checkbox"/> poorly defined riffle-run-pool-glide pattern with one depth-velocity combination dominant <input type="checkbox"/> mostly unstable bars, vegetative cover on depositional features $< 10\%$, particles not sorted				
	SCORE					SCORE					SCORE					SCORE				
	20 19 18 17 16					15 14 13 12 11					10 9 8 7 6					5 4 3 2 1				
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 30 , natural <input type="checkbox"/> entrenchment ratio ≥ 2.0 , incision ratio < 1.0 , good floodplain access <input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> $30 \leq w/d < 40$, widening <input type="checkbox"/> entrenchment ratio ≥ 2.0 , $1.0 \leq$ incision ratio < 1.2 , reduced floodplain access <input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> $40 \leq w/d < 50$, widening <input type="checkbox"/> entrenchment ratio ≥ 2.0 , $1.2 \leq$ incision ratio < 1.4 , limited floodplain access <input type="checkbox"/> major historic or minor recent channel alteration					<input type="checkbox"/> $w/d \geq 50$, over-widening <input type="checkbox"/> entrenchment ratio < 2.0 or incision ratio ≥ 1.4 , floodplain access unlikely <input type="checkbox"/> extensive historic or major recent channel alteration				
	SCORE					SCORE					SCORE					SCORE				
	20 19 18 17 16					15 14 13 12 11					10 9 8 7 6					5 4 3 2 1				

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkr} > 0.50$ <input type="checkbox"/> exposed substrate < 50% <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkr} > 0.30$					<input type="checkbox"/> $0.30 \geq W_{wet} / W_{bkr} > 0.10$					<input type="checkbox"/> $W_{wet} / W_{bkr} \leq 0.10$									
	<input type="checkbox"/> $50 \leq \text{exp. substrate} < 60\%$					<input type="checkbox"/> $60 \leq \text{exp. substrate} < 70\%$					<input type="checkbox"/> exposed substrate $\geq 70\%$									
<input type="checkbox"/> adjacent springs, seeps, and wetlands present					<input type="checkbox"/> adjacent springs, seeps, and wetlands minimal					<input type="checkbox"/> adjacent springs, seeps, and wetlands absent or altered										
<input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species									
	<input type="checkbox"/> limited system obstructions					<input type="checkbox"/> system obstructions present					<input type="checkbox"/> many system obstructions									
<input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> refuge absent										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion <10%, typical of natural conditions, little or no bank revetments					<input type="checkbox"/> $10 \leq$ bank erosion < 30%, infrequent small areas, some bank revetments					<input type="checkbox"/> $30 \leq$ bank erosion < 60%, mod. unstable banks, and/or extensive bank revetments					<input type="checkbox"/> bank erosion $\geq 60\%$, banks unstable, extensive erosion, and failing bank revetments				
	<input type="checkbox"/> bank vegetation > 90% in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $90 \geq$ bank vegetation > 75% in each layer, diverse assemblages, plants create good cover and roots help stabilize bank					<input type="checkbox"/> $75 \geq$ bank vegetation > 50%, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank					<input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank				
<input type="checkbox"/> bank canopy > 90%					<input type="checkbox"/> $90 \geq$ bank canopy > 75%					<input type="checkbox"/> $75 \geq$ bank canopy > 50%					<input type="checkbox"/> bank canopy $\leq 50\%$					
<input type="checkbox"/> undercut banks / mile > 30					<input type="checkbox"/> $30 \geq$ undercuts / mile > 15					<input type="checkbox"/> $15 \geq$ undercuts / mile > 5					<input type="checkbox"/> undercuts / mile ≤ 5					
<input type="checkbox"/> undercut bank size rank 3-6 > 50%					<input type="checkbox"/> $50 \geq$ undercut bank size rank 3-6 > 25%					<input type="checkbox"/> $25 \geq$ undercut bank size rank 3-6 > 10%					<input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$					
<input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency					<input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency					<input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency					
<input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> > 3 mass failures in valley					
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2				1
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2				1
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 150 ft					<input type="checkbox"/> $150 \geq$ buffer width > 100 ft					<input type="checkbox"/> $100 \geq$ buffer width > 50 ft					<input type="checkbox"/> buffer width ≤ 50 ft				
	<input type="checkbox"/> rip. vegetation > 75% in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. > 50% in each layer, one plant type absent, minimal invasives, maximum channel canopy					<input type="checkbox"/> $75 \geq$ rip. veg. > 50% in each layer, several types absent, altered patches, invasives present, reduced canopy					<input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy				
<input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> river corridor development and infrastructure abundant					
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2				1
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2				1

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136 – 160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)