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: Segment I.D: ☐ Sub-Reach Location: Date: Town: Observers: Elevation: _____ ft. Latitude (N/S): Organization / Agency: USGS Map Name(s): Longitude (E/W): Drainage Area: ______ sq. mi. Segment Length: _____ ft. Weather: Rain Storm within past 7 days: Y / N Flood history known: Y / N Segment Not Assessed: W/I/N/G/B/O 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 1.4 Slope of the Adjacent Terrace or Hillside **Reach or Segment Length Encroachments** One Both Height **Left Corridor Right Corridor** (FIT) **Banks** from tw Bank flat (0-3%) hilly (4-8%) steep (9-15%) flat (0-3%) hilly (4-8%) steep (9-15%) Berms very steep (16-25%) x-steep (>25%) very steep (16-25%) x-steep (>25%) Roads Continuous w/bank A / S / N Continuous w/bank A / S / N Railroads Within 1x Wbkf A / S / N Within 1x Wbkf A / S / N Texture of Exposed Slope Texture of Exposed Slope **Improved Paths** till boulder/cobble gravel sand silt till boulder/cobble gravel sand silt NA Development bedrock other Not Evaluated bedrock other Not Evaluated clav 1.6 Grade Controls (FIT) Fill out height fields 1.5 Confinement □ none for grade controls if Valley width / Channel width applicable -**Location in Reach** Height Above Photo Total Height Valley Width: ☐ Gorge (record locations on field map) Water Surface (0.0 ft)Estimated / Measured (0.0 ft)Yes / No Waterfall // Ledge // Dam // Weir ☐ Human caused change in valley width Narrowly Confined (>=1 & < 2) Semi-confined (>2 & < 4)Narrow (>= 4 & < 6)Broad (>= 6 & < 10)Very Broad (>=10)2. Stream Channel 2.1a Wetted Width: ____ ft. 2.1 Bankfull Width: ft. 2.1b Ratio (W_{wetted} / W_{bkf}): 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}: 2.8 Incision Ratio: _____ 2.9 Sinuosity: _____ 2.7 Entrenchment: 2.10 Riffles/Steps: complete / eroded / sedimented / NA / NE (partial or none) (diagonal or continuous) 2.12 Bed Substrate Composition (percent): 2.11 Riffle/Step Spacing: _____ ft. 2.13 Avg. Size of **Embeddedness Largest Particles on:** Bedrock Boulder Cobble Gravel Sand Silt or Course Fine Clav 2.5 - 10 in >10 in 0.002-0.1in Bed: Bar: Mean 0.6-2.5in 0.08-0.63in (present) Mean >256 mm 64-256 mm .062-2mm Channel **circle**: inches or millimeters Margin 16-64mm 2-16 mm Y / N 2.13a % Exp. Substrate:

2.14 Stream Type: A G F B E C D 2 3 4 5 1 b

| Stream Type | | |
|-------------|--|--|
| | | |

Reference Type

Plane Bed Cascade Step-Pool

Reach Habitat Assessment Forms (for stand-alone RHA)

Braided

Riffle-Pool Ripple-Dune

3. Riparian banks, Buffers, and Corridors

| 3.1 | Typical Ban | k Slope | shallow | moderate | steep | und | lercut | (evaluate | on the hi | gher of the | two bar | nks) |
|---------|---------------------------------|----------------------|-----------------|--------------|---------------------|-----------|---------|----------------------|---------------------|--------------------------|-------------|-------------|
| | Bank | Lower | bedrock | boulder/c | cobble gr | ravel | sand | d silt/cla | y mix | cohes | ive / n | on-cohesive |
| | Texture-RB | Upper | bedrock | boulder/c | | ravel | sand | · | | | | on-cohesive |
| | Bank Texture-LB | Lower | bedrock | boulder/c | | ravel | sano | | , | | | on-cohesive |
| | 1 exture-LB | Upper | bedrock | boulder/c | cobble gi | ravel | san | | | | | on-cohesive |
| | Bank | Left | Length: | ft. | Height: | ft. | Banl | k Revetment | t Type: | L | ength: | ft. |
| | Erosion (FIT) | Right | Length: | ft. | Height: | ft. | Banl | k Revetment | t Type: | L | ength: | ft. |
| | N. D. | Trees | L % cover | Invasive | Conifer | Decid | luous | R % cover | Invasiv | e Cor | nifer | Deciduous |
| | Near Bank Vegetation Type | Shrubs / Saps. | L % cover | Invasive | WADs | Sapl | | R % cover | Invasiv | | ADs | Saplings |
| | -JPC | Herbs | L % cover | Invasive | Grasses | For | rbs | R % cover | Invasiv | e Gra | sses | Forbs |
| | Bank | Left | 76 - 100% | 6 51 - 7 | 75% 26 | - 50% | | 1 - 25% | 0% | Chann | el Can | ору |
| | Canopy | Right | 76 - 100% | 6 51 - 7 | 75% 26 | 5 - 50% | | 1 - 25% | 0% | Open | C | losed |
| 3.2 | Buffer Width | Left | 0 - 25 ft. | 26 | - 50 ft. | 51 | - 100 |) ft. > | 100 ft | none | (SD). | |
| | (dom/sub) (FIT 0-25 ft) | Right | 0 - 25 ft. | 26 | -50 ft. | 51 | - 100 |) ft. > | 100 ft | none | (SD). | |
| | | Trees | L % cover | Invasive | Conifer | Decid | luous | R % cover | Invasiv | /e Cor | nifer | Deciduous |
| | Buffer Vegetation Type | Shrubs / Saps. | L % cover | Invasive | WADs | Sapl | | R % cover | Invasiv | | ADs | Saplings |
| | -JPC | Herbs | L % cover | Invasive | Grasses | For | rbs | R % cover | Invasiv | e Gra | sses | Forbs |
| 3.3 | Riparian Corridor | Left | forest shru | b-sapling o | crop/pasture/ | hay co | mmer | cial/industria | l reside | ential bar | re none | e (SD) |
| | (dom/sub) | Right | forest shru | b-sapling o | crop/pasture/ | hay c | omme | ercial/industri | ial resid | dential b | are no | ne (SD) |
| 4.1 S | prings or Seep | s: extensi | ve / present / | minimum / | none / altere | ed | | | | | | |
| 4.2 A | djacent Wetla | nds: extensi | ve / present / | minimum / | none / alter | ed 4.3 | Flow | v status: bas | e / low / a | avg. | | |
| 4.4 C | urrent Debris | Jams (FIT | Γ): # | _ 4.5 Flo | w Regs. & | Withd | rawa | ls (FIT): To store & | YPE: with release / | thdrawal / none / unl | bypass k | / r-o-r / |
| 4.7 F | low Regulation | ı (FIT): SI | ZE : small | / large ; US | E: drinking / | irrigatio | on, flo | | | | | other |
| 4.6 U | pstream/Down | stream Fl | ow Regs. : | upstream / | downstrea downstrea | m / bot | th / no | one | | | | |
| | - tormwater Inp | | · · | • | | | | | ield ditc | eh/ ov | erland | flow |
| 4.8 C | onstrictions | \square none | menu: | instream c | ulvert // bi | _ | | abutment / | | ck outcrop | o // o | ther |
| | striction Widt | h Photo | | | floodprone | deposi | tion | | scour | scour | alignm | ent none |
| Тур | e (from ment (ft) | Yes / No | CO | | constriction | above | | below a | above | below | angiiii | CIII HOHE |
| | | | | | | 1 | | | | | | |
| | | | | | | | + | | | | | |
| | | | | | | | | | | | | |
| 4.9 B | eaver Dams (F | TT): # | | | f the segmen | t affecte | d. | | ☐ Bri | dge & Cul | vert As | sessments |
| 5. C | hannel Bed a | nd Planf | orm Chan | nges | | | | | | | | |
| (5.0 t | o 5.3 record or | n tally shee | et) | | | | | | | | | |
| | Habitat Assessn | | | one RHA) | | | | Vermont Age | ncv of N | atural Rese | ources | |
| Index (| | -511,1 011115 | (-0. 500110 01) | | - 3- | | • | | , 0111 | | | |

| Length of Straightening: (Wit | h Windrowii | ng: Yes/No) | | |
|--|---------------|----------------------|-------------------------------|-----|
| nments: | | | | |
| etch Form for Sites – Segments – | Reaches | S | | |
| nm Name: | | Segment or | Site ID: | |
| :ervers: | | Town: | F | |
| inization /Agency: | | Lievation. | | ι. |
| Sketch - see reverse side for sketch codes and tally co | dumna for laf | t and right hank are | sion royatmants and aarriv | dor |
| opments and calculating the total length of the segment | | | ision, reveillents, and corre | uoi |
| | j | S | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Scale: | | | | |
| Scarc. | | | | |
| | | ` | | |
| Height of bankfull features above water s | urface (Ft. |) | LWD tally | |
| | Cala | cted BKF Height | Debris Jams | _ |
| | Selec | cted Dixi Height | | S |

Tally Sheet (page 1)

| Stream N | Name:_ | | | | | | | | | _ | | | | | | | | | | | |
|--|---------|---------|----------|-------------|-------------|----------|-------------------------|--------|---------|------|----------|--------------------------|-------------|----------|----------------|--------|------|------|------|----------|------|
| Location | 1 | | | | | | | | | _ | | Daic | · | | | | | | | | |
| | | | | | | | | | | | | \square S | Sub-Reac | h | | | | | | | |
| Step 2.1 | Height | of ban | kfull at | ove | water | surfa | ace | | | | Step | 5. Chai | nnel Be | ed a | nd Plan | forn | ı Ch | ang | es | | |
| Bankfull | | | mment | | | | | | | Ī | | rd actu | | | | | | | | | |
| Height | Wdth | 1 0 | шшеш | s (de | escribe | e mai | cators) | | | | features | | | | | | | | Tall | y | |
| | | | | | | | | | | | | | | 1id | | | | | | | |
| | | | | | | | | | | | | Depositional Features | \cap P | oint | t | | | | | | |
| | | | | | | | | | | | 5.1 | tio | <u>§</u> S | ide | | | | | | | |
| | | | | | | | | | | | | losi tur | Ę. T | | onal | | | | | | |
| | | | | | | | | | | | |)ер Рев | | elta | | | | | | | |
| G. 2.1 | D 1 F | , . | E.Y. | , | | | | | | | | | | slan | d | | | | | | |
| Step 3.1 | | | | | -1.4 D | 1- | TT - ! - 1 | | | | | | Chute | | | - | | | | | |
| | Bank | Heiş | gnt | | ght Ba | | Heigh | t | | | 5.2 | | Cut-of | | | | | | | | |
| Len | gtn | | | | Lengt | n | | | | | FIT | | nel Avi | 11510 | ons | - | | | | | |
| | | | | | | | | | | | | Braid: Migra | | | | | | | | | |
| | | | | | | | | | | | 5.3 | | | teer | Riffle | c | | | | | |
| | | | | | | | | | | | FIT | | ade H | | | 3 | | | | | |
| | | | | | | | | | | Ĺ | 111 | | | | enation | ? | | /es | / | No | |
| | | | | | | | | | | | | TITOU | ui y ixc | juv | CHation | • | | . 03 | | 110 | |
| | | | | | | | | | | | Step | 3.3 Mas | ss Failı | ires | and Gu | ıllies | FI | ΙΤ | | | |
| | | | | | | | | | Mas | s F | ail - L | | | | | fully | | | h | | 41 |
| | | | | | | | | | Le | | _ | Right | Heig | nt | Le | | | Rig | | Le | ngth |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Total: | | Avg. | 7 | Fota | l: | | Avg. | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | L_ | | | | |
| Step 3.1 | | | nt FIT | | G. | | 0.01 | 1.0 | , . ,. | | | | | | | | | | | | |
| T - 64 D - | Len | | 4 D l- | | St | | 8 Channe onstriction | | | | noto? | CDCO | CI | - 1 | FD | D. A | DD | C A | αD | T . | NT |
| Left Ba | nk | Kign | t Bank | | | Co | | n vv | latn | Pr | 1010? | GPS? | Ch. Cons | | FP. Constr. | DA | DB | SA | 28 | А | Non |
| | | | | | 1) | | Type | | | - | | | Cons | .1. | Consu. | | | | - | | |
| | | | | | 1.) 2.) | | | | | _ | | | | | | | | | | | |
| | | | | | 3.) | | | | | | | | | | | | | | | | 1 |
| | | | | | 4.) | | | | | + | | | | | | | | | | | |
| | | | | | 5.) | | | | | | | | | 1 | | | | | | | |
| | | | | | | <u> </u> | | | | | | 1 | | | | 1 | | 1 | - | 1 | |
| | | | | | | | | | | | | | | | Ta | ally | | | | | |
| | | | | | St | tep 2. | 12 Lar | ge W | oody D | ebi | ris | | | | | | | | | | |
| | | | | | St | tep 4. | 4 Del | ris Ja | ıms | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | ep 2. | | | p Spac | | | | | | | | | | | | |
| Total: | | Total: | | | St | tep 2. | .13 Av ş | g. Lar | gest Pa | ırti | cle C | n Bed: | | | | Oı | n Ba | r: | | | |
| Ct 1 2 | D: 4 | 1 نسم | . F | 0.01. | m a== 1 = | TATC | יי | | | | C4 | 1604 | maa 1 | البول من | IT | | nr. | 11_ | | | |
| Step 1.3 | Kiver (| JOITIQO | i Encro | | | rII | | ht |] | | | 4.6 Sto d Ditcl | | r Fl | 1.1 | | Ta | шу | | | 7 |
| Type Length Height One Side Both Sides of Fill | | | | | | | | erland | | | | | | | | | - | | | | |
| | | | 711C 31U | C | Dom | Siut | 55 ULT | 141 | | | | ad Ditcl | | | _ | | | | | | - |
| | | | | | | | | | | | | Drain | | | + | | | | | | 1 |
| | | | | | | | | | | | | oan Sto | | er | | | | | | | 1 |
| | | | | | | | | | | | Oth | | 17 64 6 | ~- | | | | | | | 1 |
| | | | | | | | | | | | | | | | | | | | | | |

Tally Sheet (page 2)

| | | | | Segment I.D: | | | | |
|----------|-------------------------|------------------------|-------------------------------|--------------|------------|------------------------------------|--|--|
| Location | n: | | | _ D | ate: | | | |
| | | | | 1 | □ Sub-Reac | h | | |
| 6 1 Lai | rge Woody l | Debris and Ja | ams | | | Note CPOM, algae, location of fine | | |
| Rank | D _{large} (ft) | L (w _{bkf}) | Tally | # | % | | | |
| 1 | 0.5 - 1.0 | < 0.5 | - 5555 | | , - | | | |
| 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 | | | | | | |
| | | jams/mile | | | | | | |
| | | - | | | | | | |
| | | | , 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 | | | | | | |
| | ш | Total pools | | | | | | |
| | # | Pools / mile | | | | | | |
| | | Connections | | | | | | |
| ID | Location | Qaccess | 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 low / bkf | | | | | | |
| | in / out | IOW / DKI | | | | | | |
| | | | | | | | | |
| | | | lity, 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 | | | | | | |
| 5 | 1.0 - 2.0 >2.0 | > 2.0 < 2.0 | | | - | | | |
| 6 | >2.0 | > 2.0 | | | - | | | |
| U | | l undercuts | | | | | | |
| | | | | | | | | |

undercut banks / mile

Cross-Section Worksheet

| Stream Name: Location: | | Reach-Segment: Date: | | _ |
|-----------------------------|------------------------------|--|---|---|
| Observers: | | Cro | ss-Section Notes Codes | |
| Comments: | BKF Height | LTER = Left Terrace LFPA = Left Flood Plane LTOB = Left Top of Bank LBF = Left Bankfull Stage | RTER = Right Terrace RFPA = Right Flood Plane RTOB = Right Top of Bank RBF = Right Bankfull Stage REW = Right Edge of Water | TW = Thalweg LPIN = Left Pin RPIN = Right Pin |
| Cross-sections - Number and | Location Description: | | | |

| Note Distance | Depth | Note Distance | Depth | Note Dista | nce Depth |
|------------------|-------------|-------------------|-------|-------------------|-------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| nkfull Width | | Bankfull Width | | Bankfull Width | |
| ax. Depth | | Max. Depth | | Max. Depth | |
| ean Depth | | Mean Depth | | Mean Depth | - |
| oodprone Width | | Floodprone Width | | Floodprone Width | |
| ow Bank Height | | Low Bank Height | | Low Bank Height | |
| idth/depth Ratio | | Width/depth Ratio | | Width/depth Ratio | 0 |
| ntrenchment | | Entrenchment | | Entrenchment | |
| cision Ratio | | Incision Ratio | | Incision Ratio | |
| etted Width | | Wetted Width | | Wetted Width | |

| Size Class | Millimeters | Inches | Relative Size | | | Distrib | Distribution of 100 Particles | | | |
|--------------------------|-------------|-------------|----------------------------|--------------|-----|---------|-------------------------------|-----|-----|-----|
| 1-Bedrock | > 4096 | > 160 | Bigger than a VW Bug | | | | | | | |
| 2-Boulder | 256 – 4096 | 10.1 - 160 | Basketball to VW Bug | | | | | | | |
| 3-Cobble | 64 – 256 | 2.5 - 10.1 | Tennis ball to basketball | | | | | | | |
| 4-Coarse Gravel | 16 – 64 | 0.63 - 2.5 | Marble to | tennis ball | | | | | | |
| 4-Fine Gravel | 2 – 16 | 0.08 - 0.63 | Pepper co | rn to marble | : | | | | | |
| 5-Sand or Smaller | < 2.00 | < 0.08 | Smaller than a pepper corn | | | | | | | |
| Embeddedness | Ch1 | Ch2 | Ch3 Ch4 Ch5 | | Ma1 | Ma2 | Ma3 | Ma4 | Ma5 | |
| Largest mobile particles | Bd1 | Bd2 | Bd3 | Bd4 | Bd5 | Br1 | Br2 | Br3 | Br4 | Br5 |

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

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

| Stream Name: | Segment I.D: | |
|---|------------------|---------|
| Location: | Date: | |
| | Town: | |
| Observers: | Elevation: | ft. |
| Organization / Agency: | Latitude (N/S): | |
| USGS Map Name(s): | Longitude (E/W): | |
| Weather: | | sq. mi. |
| Flow: base / low / avg. Storm within past 7 days: Y / N | Segment Length: | ft. |

| Flow: base / low / | avg. Storm within past 7 day | ys: Y / N | Segment Length: | ft. | | | |
|--|---|--|---|---|--|--|--|
| Habitat | | Condition (Depa | parture) Category | | | | |
| Parameter | Reference (None) | Good (Minor) | Fair (Major) | Poor (Severe) | | | |
| | ☐ LWD pieces / mile > 100 | $\Box 100 \ge LWD / mile > 50$ | $\Box 50 \ge LWD / mile > 25$ | \square LWD / mile \leq 25 | | | |
| 6.1 Woody Debris Cover | ☐ LWD size rank 3-6 >50% | □ $50 \ge LWD \text{ rank } 3-6 > 25\%$ | □ $25 \ge LWD \text{ rank } 3-6 > 10\%$ | ☐ LWD size rank 3-6 ≤ 10% | | | |
| LWD size rank variable | □ debris jams / mile > 5 | \Box 5 \geq jams / mile $>$ 3 | \square 3 \geq jams / mile > 1 | ☐ debris jams absent | | | |
| only used if ≥ 10 pieces | ☐ high woody debris recruitment potential | ☐ moderate woody debris recruitment potential | ☐ low woody debris recruitment potential | no woody debris recruitment potential | | | |
| | ☐ CPOM present in channel and margins | ☐ CPOM limited in channel and present in margins | ☐ CPOM limited in both channel and margins | ☐ 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 | □ riffle embeddedness < 20% margin embeddedness < 40% | $\begin{array}{l} \square \ 20 \leq emb_{riffle} < 40\% \\ 40 \leq emb_{margin} < 60\% \end{array}$ | $\begin{array}{c} \square \ 40 \leq emb_{riffle} < 75\% \\ 60 \leq emb_{margin} < 80\% \end{array}$ | □ riffle embeddedness ≥ 75% margin embeddedness ≥ 80% | | | |
| Cover | □ fining* < 10% | □ 10 ≤ fining* < 20% | □ 20 ≤ fining* < 40% | □ fining* ≥ 40% | | | |
| *fines: sand if $d_{50} \ge$ gravel, otherwise silt. | ☐ Riffle stability index < 70% | $\Box 70 \le RSI < 80\%$ | □ 80 ≤ RSI < 90% | □ RSI ≥ 90% | | | |
| (Dune-ripple stream type: Fining only.) | ☐ sediment apparently stable & sorted | □ some evidence of sediment mobility & lack of sorting | ☐ major evidence of sediment mobility & lack of sorting | ☐ sediments unstable, unsorted, soft underfoot | | | |
| | □ substrate free of dense algae growth | ☐ small substrate patches covered by dense algae growth | ☐ large substrate patches covered by dense algae growth | ☐ 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 | | | |
| | □ pools / mile > 40 | \square 40 \geq pools / mile $>$ 20 | \square 20 \geq pools / mile > 10 | \square pools / mile ≤ 10 | | | |
| 6.3 Scour and Deposition | □ pool size rank 3-7 >50% | \Box 50 \geq pool rank 3-7 $>$ 25% | \square 25 \geq pool rank 3-7 $>$ 10% | □ pool size rank 3-7 ≤ 10% | | | |
| Features | ☐ good cover > 75% of total pool surface area | ☐ 75 ≥ good cover > 50% of total pool surface area | □ 50 ≥ good cover > 25% of total pool surface area | ☐ good cover ≤ 25% of total pool surface area | | | |
| (Dune-ripple stream type: Only evaluate pools and ripples.) | ☐ riffle (ripple) coverage > 25% reach area, distinctly formed and complete | ☐ 25 ≥ riffle coverage > 10% reach area, moderately well formed and complete | □ 25 ≥ riffle coverage > 10% reach area, poorly formed and incomplete | ☐ riffle (ripple) coverage ≤ 10% reach area, or mostly indistinct | | | |
| Depth-velocity <u>combinations</u> fast-shallow | $□ 5 ≤ riffle spacing ≤ 7 bankfull channel widths (w_{bkf})$ | $\begin{tabular}{l} $ $ \exists $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ | □ 1 ≤ riffle spacing < 3, or 10 < riffle spacing ≤ 12 x wbkf | □ riffle spacing ≥ 12 bankfull channel widths | | | |
| fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft) | ☐ well-defined riffle-run-pool- glide pattern with all four depth-velocity combinations present | ☐ well-defined riffle-run-pool- glide pattern with three depth-velocity combinations dominant | ☐ moderately defined riffle- run-pool-glide pattern with two depth-velocity combinations dominant | ☐ poorly defined riffle-run- pool-glide pattern with one depth-velocity combination dominant | | | |
| Pool size rank variable only used if ≥ 5 pools | ☐ finer deposition located entirely in slack water below larger substrates/debris, and along margins | ☐ finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation | □ very large depositional features below larger substrates/debris, abundant mid-channel accumulation | ☐ 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 | □ width/depth < 15, natural □ entrenchment ratio ≥ 1.4, incision ratio < 1.2, good floodplain access | □ 15 ≤ w / d < 25, widening □ entrenchment ratio ≥ 1.4, 1.2 ≤ incision ratio < 1.4, reduced floodplain access | □ 25 ≤ w / d < 40, widening □ entrenchment ratio ≥ 1.4, 1.4 ≤ incision ratio < 2.0, limited floodplain access | □ w / d > 40, over-widening □ entrenchment ratio < 1.4 or incision ratio ≥ 2.0, floodplain access unlikely | | | |
| | ☐ no evidence of channel alteration | ☐ evidence of minor historic channel alteration | ☐ major historic or minor recent channel alteration | 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 | Condition (Departure) Category | | | | | | | | | | | |
|--|---|--|------------------------------|---|---|---------------------------|--|---|-----------------------------------|---|-----------------------------|--|
| Parameter | Refe | rence (N | one) | Go | od (Min | or) | F | air (Majo | r) | Poor (| Severe) | |
| | □ wetted w | ridth / W _{bkf} | > 0.75 | $\square 0.75 \ge V$ | V _{wet} / W _{bkf} | > 0.50 | \square 0.50 \geq V | W _{wet} / W _{bkf} | > 0.25 | \square W _{wet} / W _{bkf} \leq | 0.25 | |
| 6.5 Hydrologic Characteristics | □ exposed | substrate < | 20% | □ 20 ≤ exp | o. substrate | e < 40% | $\Box 40 \leq ex$ | p. substrate | e < 60% | □ exposed subs | trate ≥ 60% | |
| | □ adjacent wetlands | springs, se extensive | eps, and | ☐ adjacent wetland | t springs, s s present | seeps, and | | t springs, s s minimal | eeps, and | ☐ adjacent springs, seeps, and wetlands absent or altered | | |
| | □ no know | n flow alte | ration | due to f | ow alterati low regula changes | ion likely tion and/or | due to f | low alterati low regulate changes | | ☐ runoff characteristics r completely altered due to flow regulation and storm water influence | | |
| SCORE | 20 19 | 18 | 17 16 | 15 14 | | 12 11 | 10 9 | 8 | 7 6 | 5 4 | 3 2 1 | |
| 6.6 Connectivity Tend towards a | | ngitudinal r c species o | novement | obstruct | ck movem | nt in reach | bankful in reach | wo small to l obstruction that block ent of aqua | ons present | ☐ more than two obstructions that block me aquatic speci | present in reach | |
| higher/lower score for natural/man-made obstructions | □ system o | bstructions | absent | □ limited | system obs | structions | □ system | obstruction | s present | □ many system | obstructions | |
| | □ abundan refuge | t low and h | nigh flow | | nt refuge, v flow refug | | ☐ limited refuge | low and hi | gh flow | ☐ refuge absent | ; | |
| SCORE | 20 19 | | 17 16 | 15 14 | | 12 11 | 10 9 | 8 | 7 6 | | 3 2 1 | |
| 6.7 River Banks | | onditions, | , typical of little or no | infreque | nk erosion ent small a vetments | < 30%, areas, some | mod. ur | nk erosion nstable ban ve bank rev | ks, and/or | □ bank erosion ≥ 60%, banks unstable, extensive erosion, and failing bank revetments | | |
| Select different boxes for LB and RB if necessary | □ bank vegetation > 90% in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank | | | assemb | layer, dive lages, plan over and ro | erse its create | in two or reduced create l | nk vegetati of three lay I diversity, imited cove o not stabili | ers, plants er and | 6, □ bank vegetation ≤ 50% in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank | | |
| Undercut size rank variable only used if ≥ 5 | □ bank can | opy > 90% | Ö | □ 90 ≥ baı | nk canopy | > 75% | □ 75 ≥ bar | nk canopy | > 50% | □ bank canopy ≤ 50% | | |
| undercuts | □ undercut | | | □ 30 ≥ uno | | | _ | dercuts / m | | \square undercuts / mile ≤ 5 | | |
| | □ undercut 50% | bank size | rank 3-6 > | \Box 50 \geq uno 3-6 > 2: | | k size rank | \Box 25 \geq un 3-6 > 10 | | k size rank | nk ☐ undercut bank size rank 3-6 ≤ 10% | | |
| | overhang | banks with oundaries, a ging vegeta nt water ad | abundant ation, and | unstable reduced vegetati | ts with sore boundarie overhang on, and co | es or ing | unstable reduced vegetat | its with son e boundaried overhangition, and rec | es or ing | undercuts wi unstable bou overhanging reduced water | ndaries, no vegetation, and | |
| (score each bank) | □ no mass | failures in | valley | | djacency failure in v | vallev | | djacency ass failures | in vallev | $\square \ge 3$ mass fail | ures 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 | in the result of the results of the | | | □ 150 ≥ buffer width > 100 ft □ 75 ≥ rip. veg. > 50% in each layer, one plant type absent, minimal invasives, maximum channel canopy □ river corridor development | | | □ 75 ≥ rip layer, se altered p present, | uffer width veg. > 50 everal types patches, inv reduced ca rridor deve | % in each s absent, wasives anopy | □ buffer width ≤ 50 ft h □ rip. veg. ≤ 50% in each layer, several types absent, large altered areas, invasives present, reduced canopy □ river corridor development | | |
| channel) | | structure a | | | astructure | | | astructure | | | cture 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 Co | ndition: |
| | SHTD Existing Stream Ha | abitat 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: | Segment I.D: | |
|---|------------------|--------|
| Location: | Date: | |
| | Town: | |
| Observers: | Elevation: | ft |
| Organization /Agency: | Latitude (N/S): | |
| USGS Map Name(s): | Longitude (E/W): | |
| Weather: | Drainage Area: | sq. mi |
| Flow: base / low / avg. Storm within past 7 days: Y / N | Segment Length: | ft |

| Habitat | Condition (Departure) Category Poferonce (None) Cond (Miner) Fair (Major) Poor (Savare) | | | | | | | | |
|--|---|--|---|---|--|--|--|--|--|
| Parameter | Reference (None) | Good (Minor) | Fair (Major) | Poor (Severe) | | | | | |
| | ☐ LWD pieces / mile > 200 | \square 200 \geq LWD / mile \geq 100 | \square 100 \geq LWD / mile \geq 50 | \square LWD / mile \leq 50 | | | | | |
| 6.1 Woody Debris Cover | ☐ LWD size rank 3-6 >75% | □ $75 \ge LWD \text{ rank } 3-6 > 50\%$ | \square 50 \geq LWD rank 3-6 $>$ 25% | ☐ LWD size rank 3-6 ≤ 25% | | | | | |
| LWD size rank variable | □ debris jams / mile > 25 | $\square 25 \ge jams / mile > 15$ | \Box 15 \geq jams / mile $>$ 5 | □ jams / mile \leq 5 | | | | | |
| only used if ≥ 10 pieces | ☐ high woody debris recruitment potential | ☐ moderate woody debris recruitment potential | low woody debris recruitment potential | no woody debris recruitment potential | | | | | |
| | ☐ CPOM present in channel and margins | ☐ CPOM limited in channel and present in margins | ☐ CPOM limited in both channel and margins | ☐ 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 | □ pool embeddedness < 25% margin embeddedness < 40% | $\begin{array}{c} \square \ 25 \leq emb_{pool} < 50\% \\ 40 \leq emb_{margin} < 60\% \end{array}$ | $\begin{array}{c} \square \ 50 \leq emb_{pool} < 75\% \\ 60 \leq emb_{margin} < 80\% \end{array}$ | □ pool embeddedness ≥ 75% margin embeddedness ≥ 80% | | | | | |
| Cover | ☐ fining* < 10% | □ 10 ≤ fining* < 20% | □ 20 ≤ fining* < 40% | ☐ fining* ≥ 40% | | | | | |
| *fines: sand if $d_{50} \ge$ gravel, otherwise silt. \Box sediment apparently stable & sorted | | □ some evidence of sediment mobility & lack of sorting | ☐ major evidence of sediment mobility & lack of sorting | ☐ sediments unstable, unsorted, soft underfoot | | | | | |
| | □ substrate free of dense algae growth | ☐ small substrate patches covered by dense algae growth | ☐ large substrate patches covered by dense algae growth | ☐ 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 | | | | | |
| | \square pools / mile > 70 | \square 70 \geq pools / mile $>$ 50 | \square 50 \geq pools / mile > 30 | \square pools / mile \leq 30 | | | | | |
| 6.3 Scour and Deposition | □ pool size rank 3-7 >50% | \square 50 \geq pool rank 3-7 $>$ 25% | \square 25 \geq pool rank 3-7 $>$ 10% | □ pool size rank 3-7 ≤ 10% | | | | | |
| Features | ☐ good cover > 75% of total pool surface area | ☐ 75 ≥ good cover > 50% of total pool surface area | ☐ 50 ≥ good cover > 25% of total pool surface area | ☐ good cover over ≤ 25% of total pool surface area | | | | | |
| Depth-velocity <u>combinations</u> fast-shallow fast-deep | □ steps are distinctly formed, complete and stable | ☐ steps are moderately well formed, complete and stable | ☐ steps are poorly formed, incomplete and unstable | ☐ steps are indistinct or absent, or very unstable | | | | | |
| slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft) | □ 5 ≤ step spacing ≤ 7 bankfull channel widths (wbkf) | $□ 3 \le \text{step spacing} < 5, \text{ or } 7 < $ $\text{step spacing} \le 10 \text{ x } w_{bkf}$ | □ 1 ≤ step spacing < 3, or 10 < step spacing ≤ 15 x wbkf | ☐ step spacing ≥ 15 bankfull channel widths | | | | | |
| Pool size rank variable only used if \geq 5 pools | ☐ more than two depth-velocity combinations present | ☐ two depth-velocity combinations present | one or two depth-velocity combinations present | one depth-velocity combination present | | | | | |
| (Cascade and bedrock stream types: Do not evaluate variables related to step pattern.) | ☐ finer deposition located entirely in slack water below larger substrates/debris, and along margins | ☐ finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation | □ very large depositional features below larger substrates/debris, abundant mid-channel accumulation | ☐ 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 | | | | | |
| | □ width/depth < 12, natural | \Box 12 \leq w / d < 15, widening | \Box 15 \le w / d < 25, widening | \square w / d \ge 25, over-widening | | | | | |
| 6.4 Channel Morphology \Box entrenchment ratio ≥ 1.2 , incision ratio < 1.2 , good \Box entrenchment ratio ≥ 1.2 , \Box entrenchment ratio ≥ 1.2 , \Box entrenchment ratio ≥ 1.4 , \Box ent | | □ entrenchment ratio ≥ 1.2, 1.4 ≤ incision ratio < 2.0, limited floodplain access | □ entrenchment ratio < 1.2 or incision ratio ≥ 2.0, floodplain access unlikely | | | | | | |
| | ☐ no evidence of channel alteration | ☐ evidence of minor historic channel alteration | ☐ major historic or minor recent alteration | ☐ 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 1 | | | | | |

| Habitat | Condition (Departure) Category | | | | | | | | | | | | |
|--|--|---|---|---|---|---|---|---------------------------------------|---|-------------------|--------------------------------------|------------------------|--|
| Parameter | Refe | erence (N | one) | G | ood (Min | or) | | Fa | ir (Majo | or) | | Poor (| Severe) |
| | □ wetted w | idth / W _{bkf} | > 0.75 | □ 0.75 ≥ ¹ | W _{wet} / W _{bkt} | > 0.50 | □ 0.5 | $0 \ge V$ | V _{wet} / W _{bk} | $_{\rm f} > 0.25$ | □ W, | vet / W _{bkf} | ≤ 0.25 |
| 6.5 Hydrologic Characteristics | \square exposed | substrate < | < 10% | □ 10 ≤ ex | p. substrate | e < 30% | □ 30 ≤ | ≤ exp | . substrate | e < 50% | □ exp | osed subs | trate ≥ 50% |
| | □ adjacent and wetl | springs, se ands exten | | | t springs, s lands pres | | | | springs, s ands mini | | | | ngs, seeps, and ent or altered |
| | □ no know | o known flow alteration likely due to flow regulation and/or land use changes major flow alteration likely due to flow regulation and/or land use changes | | | | conflow | | tered due to on and storm | | | | | |
| SCORE | 20 19 | | 17 16 | 15 14 | | 12 11 | 10 | 9 | 8 | 7 6 | 5 | | 3 2 1 |
| 6.6 Connectivity Tend towards a higher/lower score for | block lor | | | obstruc | ck movem | nt in reach | ban in r | kfull each t | that block | ons present | obst that | ructions | o bankfull present in reach ovement of es |
| natural/man-made obstructions | □ system o | bstructions | s absent | □ limited | system ob | structions | □ syst | tem o | bstruction | is present | □ mar | y system | obstructions |
| | □ abundan refuge | t low and l | nigh flow | | nt refuge, v flow refug | | □ lim | | low and h | igh flow | □ refi | ige absen | t |
| 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 | | conditions, | , typical of little or no | infrequ | nk erosion ent small a vetments | < 20%, areas, some | mo | d. uns | k erosion stable ban e bank rev | ks, and/or | uns | table, ext | \geq 50%, banks ensive erosion, ank revetments |
| Select different boxes for LB and RB if necessary | | | | | ers, plants er and | , □ bank vegetation ≤ 50% in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank | | | | | | | |
| Undercut size rank variable only used if ≥ 5 | □ bank can | opy > 90% | ó | □ 90 > ba | nk canopy | > 80% | □ 80 ≥ | ≥ ban | k canopy | > 60% | □ bank canopy ≤ 60% | | ≤ 60% |
| undercuts | □ undercut | banks / m | ile > 15 | □ 15 ≥ un | dercuts / m | nile > 10 | □ 10 ≥ | ≥ und | ercuts / m | ile > 5 | \Box undercuts / mile ≤ 5 | | |
| | □ undercut 50% | bank size | rank 3-6 > | □ 50 ≥ un 3-6 > 2 | | k size rank | | $\frac{\geq}{0}$ und $0 > 10^{\circ}$ | | k size rank | undercut bank size rank 3-6 ≤ 10% | | |
| (score each bank) | stable boundaries, abundant un overhanging vegetation, and consistent water adjacency was | | unstabl reduced vegetat | undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency | | undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency | | | □ undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency □ > 3 mass failures in valley | | | | |
| | | 1 | | □ 1 mass | failure in v | 1 - | □ 1 - 3 | 2 mas | ss failures | | | | |
| SCORE(LB) | Left Bank | 10 | 9 | 8 | 7 | 6 | 5 | | 4 | 3 | | 2 | 1 |
| SCORE (RB) | Right Bank | 10 | 9 | 8 = 200 > b | 7 uffer widtl | 6 > 150 ft | 5 |) > bu | 4 ffor width | 3 > 100 ft | □ buft | 2 For width | 1 100 ft |
| 6.8 Riparian Area Select different boxes for LB and RB if necessary | □ buffer width > 200 ft □ rip. vegetation > 90% in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy | | □ 200 ≥ buffer width > 150 ft □ 90 ≥ rip. veg. > 75% in each layer, one plant type absent, minimal invasives, maximum channel canopy | | □ 150 ≥ buffer width > 100 ft □ 75 ≥ rip. veg. > 50% in each layer, several types absent, altered patches, invasives present, reduced canopy | | □ buffer width ≤ 100 ft □ rip. veg. ≤ 50% in each layer, several types absent, large altered areas, invasives present, reduced canopy | | | | | | |
| (score each side of the channel) | and infra | ridor devel | bsent | and infi | rridor deve | minimal | and | | ridor deve | common | | infrastru | development cture 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 scorex | x (100 / 160) = |
| | Overall Physical Habitat Condi | tion: |
| | SHTD Fyicting Stream Habit | at Tyne• |

| 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: | Segment I.D: |
|---|----------------------|
| Location: | Date: |
| | Town: |
| Observers: | Elevation: ft. |
| Organization /Agency: | Latitude (N/S): |
| USGS Map Name(s): | Longitude (E/W): |
| Weather: | Drainage Area:sq. mi |
| Flow: base / low / avg. Storm within past 7 days: Y / N | Segment Length: ft. |

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

| Habitat | | Condition (Departure) Category | | | | | | | | | | |
|--|--|--|--------------------------------|---|--|--|--|--|--------------------------|---|----------------------------------|--|
| Parameter | Refer | ence (No | ne) | Go | od (Min | or) | Fa | air (Majo | r) | Poor (Severe) | | |
| | □ wetted wi | dth / W _{bkf} | > 0.75 | $\square 0.75 \ge V$ | V _{wet} / W _{bkf} | > 0.50 | \square 0.50 \geq V | V _{wet} / W _{bkf} | > 0.25 | \square W _{wet} / W _{bkf} \leq | 0.25 | |
| 6.5 Hydrologic Characteristics | □ exposed s | | | - | | | \Box 40 \le exp. substrate < 60% | | | □ exposed substrate ≥ 60% | | |
| | ☐ adjacent springs, seeps, and wetlands extensive | | eps, and | | s present | eeps, and | ☐ adjacent springs, seeps, and wetlands minimal | | | ☐ adjacent sprin wetlands alte | ngs, seeps, and red or absent | |
| | □ no known | flow alter | ration | due to fl | ow alterati ow regulat changes | on likely tion and/or | due to fl | ow alterati low regulate changes | on likely tion and/or | ☐ runoff charac completely al flow regulation water influen | tered due to on and storm | |
| SCORE | 20 19 | 18 | 17 16 | 15 14 | | 12 11 | 10 9 | 8 | 7 6 | 5 4 3 | 3 2 1 | |
| 6.6 Connectivity Tend towards a | □ no obstruct block long of aquatic the lowest | gitudinal n species o | novement | obstruct | wo small lo ions preser ck moveme species | nt in reach | bankfull in reach | wo small to lobstruction that block ent of aqua | ns present | ☐ more than tw obstructions p that block mo aquatic specie | present in reach overment of | |
| higher/lower score for natural/man-made obstructions | □ system ob | structions | absent | ☐ limited s | system obs | structions | □ system o | obstruction | s present | □ many system | obstructions | |
| oosiideiioiis | □ abundant l refuge | low and h | igh flow | | it refuge, w flow refug | | ☐ limited l refuge | low and hi | gh flow | ☐ refuge absent | : | |
| SCORE | 20 19 | | 17 16 | 15 14 | | 12 11 | 10 9 | 8 | 7 6 | 5 4 3 2 1 | | |
| 6.7 River Banks | □ bank erosi natural co bank reve | nditions, | - 1 | _ | | | ☐ 30 ≤ bank erosion < 60%, mod. unstable banks, and/or extensive bank revetments | | | □ bank erosion \geq 60%, banks unstable, extensive erosion, and failing bank revetments | | |
| Select different boxes for LB and RB if necessary | tree, shrul diverse as create goo | vegetation > 90% in shrub and herb layers, rese assemblages, plants te good cover and roots stabilize bank | | | ers, plants er and | ☐ bank vegetati two of three diversity, pla cover and roo stabilize banl | layers, limited nts create no ots do not | | | | | |
| Undercut size rank variable only used if ≥ 5 | □ bank cano | py > 90% | | \square 90 \geq bank canopy $> 75\%$ | | | \Box 75 \geq bank canopy \geq 50% | | | ☐ bank canopy | ≤ 50% | |
| undercuts | □ undercut b | oanks / mi | le > 20 | \square 20 \geq und | | | \square 15 \geq uno | | | □ undercuts / mile ≤ 5 | | |
| | □ undercut t 50% | oank size i | rank 3-6 > | \Box 50 \geq und 3-6 > 25 | | k size rank | \Box 25 \geq uno 3-6 > 10 | | k size rank | □ undercut bank size rank 3-6 ≤ 10% | | |
| (score each bank) | □ undercut to stable bou overhangi consistent □ no mass f | indaries, a ing vegeta t water adj | bundant tion, and acency | unstable reduced vegetati | ts with son e boundarie overhangi on, and con djacency | es or ing | unstable reduced vegetati | ts with son e boundarie overhangi on, and red djacency | es or ng | □ undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency □ > 3 mass failures in valley | | |
| (*****) | _ no mass i | andres in | variey | □ 1 mass f | ailure in v | alley | □ 1 - 2 ma | ss failures | in valley | - 5 mass ran | ares in variey | |
| SCORE(LB) | Left Bank | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| SCORE (RB) | Right Bank | 10 | 9 ft | 8 □ 150 > bi | 7 ıffer width | > 100 ft | 5 □ 100 > bi | 4 uffer width | > 50 ft | 2 □ buffer width | < 50 ft | |
| 6.8 Riparian Area Select different boxes for LB and RB if necessary | in the second of | | % in tree, rs, diverse asives, | □ 150 ≥ buffer width > 100 ft □ 75 ≥ rip. veg. > 50% in each layer, one plant type absent, minimal invasives, maximum channel canopy | | | | | | □ rip. veg. ≤ 50% in each layer, several types absent, large altered areas, invasives present, reduced canopy | | |
| (score each side of the channel) | ☐ river corri | tructure al | osent | and infr | rridor deve | minimal | and infr | ridor deve | common | and infrastruc | development cture 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) |

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

(Also use this form for alluvial fans.)

| Stream Name: | Segment I.D: | |
|---|------------------|-----|
| Location: | Date: | |
| | Town: | |
| Observers: | Elevation: | ft. |
| Organization / Agency: | Latitude (N/S): | |
| USGS Map Name(s): | Longitude (E/W): | |
| Weather: | Drainage Area: | |
| Flow: base / low / avg. Storm within past 7 days: Y / N | Segment Length: | ft. |

| Flow: base / low / avg. Storm within past 7 days: Y / N Segment Length: ft. | | | | | | | |
|---|---|--|---|--|--|--|--|
| Habitat | | Condition (Depa | Condition (Departure) Category | | | | |
| Parameter | Reference (None) | Good (Minor) | Fair (Major) | Poor (Severe) | | | |
| | ☐ LWD pieces / mile > 100 | \square 100 \geq LWD / mile \geq 50 | \square 50 \geq LWD / mile $>$ 25 | ☐ LWD / mile ≤ 25 | | | |
| 6.1 Woody Debris Cover | □ LWD size rank 3-6 >50% | □ $50 \ge LWD \text{ rank } 3-6 > 25\%$ | □ $25 \ge LWD \text{ rank } 3-6 > 10\%$ | ☐ LWD size rank 3-6 ≤ 10% | | | |
| LWD size rank variable | □ debris jams / mile > 5 | \Box 5 \geq jams / mile $>$ 3 | \square 3 \geq jams / mile > 1 | □ debris jams absent | | | |
| only used if ≥ 10 pieces | ☐ high woody debris recruitment potential | ☐ moderate woody debris recruitment potential | low woody debris recruitment potential | ☐ no woody debris recruitment potential | | | |
| | ☐ CPOM present in channel and margins | ☐ CPOM limited in channel and present in margins | ☐ CPOM limited in both channel and margins | ☐ 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 | □ riffle embeddedness < 20% margin embeddedness < 40% | $\begin{array}{c} \square \ 20 \leq emb_{riffle} < 40\% \\ 40 \leq emb_{margin} < 60\% \end{array}$ | $\begin{array}{c} \square \ 40 \leq emb_{riffle} < 75\% \\ 60 \leq emb_{margin} < 80\% \end{array}$ | ☐ riffle embeddedness ≥ 75% margin embeddedness ≥ 80% | | | |
| Cover | □ fining* < 10% | □ 10 ≤ fining* < 20% | □ 20 ≤ fining* < 40% | □ fining* \geq 40% | | | |
| *fines: sand if $d_{50} \ge$ gravel, otherwise silt. | ☐ Riffle stability index < 70% | □ 70 ≤ RSI < 80% | □ 80 ≤ RSI < 90% | □ RSI ≥ 90% | | | |
| | ☐ sediment apparently stable & sorted | ☐ some evidence of sediment mobility & lack of sorting | ☐ major evidence of sediment mobility & lack of sorting | ☐ sediments unstable, unsorted, soft underfoot | | | |
| | □ substrate free of dense algae growth | small substrate patches covered by dense algae growth | ☐ large substrate patches covered by dense algae growth | ☐ 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 | | | |
| | □ pools / mile > 40 | \square 40 \geq pools / mile \geq 20 | \square 20 \geq pools / mile > 10 | \square pools / mile ≤ 10 | | | |
| 6.3 Scour and Deposition | □ pool size rank 3-7 >50% | \Box 50 \geq pool rank 3-7 > 25\% | \square 25 \geq pool rank 3-7 $>$ 10% | □ pool size rank 3-7 ≤ 10% | | | |
| Features | ☐ good cover > 75% of total pool surface area | ☐ 75 ≥ good cover > 50% of total pool surface area | ☐ 50 ≥ good cover > 25% of total pool surface area | ☐ good cover ≤ 25% of total pool surface area | | | |
| Depth-velocity <u>combinations</u> fast-shallow fast-deep slow-shallow | □ riffle coverage > 25% reach area, distinctly formed and complete | area, distinctly formed and reach area, moderately well | | ☐ riffle coverage ≤ 10% reach area, or mostly indistinct or absent | | | |
| slow-deep (cutoffs: 1.0 fps, 1.5 ft) | □ 5 ≤ riffle spacing ≤ 7 bankfull channel widths (wbkf) | $\begin{tabular}{l} \square & 3 \leq riffle \ spacing < 5, \ or \ 7 < \\ & riffle \ spacing \leq 10 \ x \ w_{bkf} \end{tabular}$ | $ \Box 1 \le \text{riffle spacing} < 3, \text{ or } 10 $ $< \text{riffle spacing} \le 12 \text{ x } w_{bkf} $ | ☐ riffle spacing ≥ 12 bankfull channel widths | | | |
| Pool size rank variable only used if ≥ 5 pools | ☐ well-defined riffle-run-pool- glide pattern with all four depth-velocity combinations present | ☐ well-defined riffle-run-pool- glide pattern with three depth-velocity combinations dominant | moderately defined riffle- run-pool-glide pattern with two depth-velocity combinations dominant | ☐ poorly defined riffle-run- pool-glide pattern with one depth-velocity combination dominant | | | |
| | □ stable bars, vegetative cover on depositional features ≥ 50%, particles well-sorted | □ mostly stable bars, vegetative cover on depositional features 50- 25%, particles moderately sorted | unstable bars present, vegetative cover on depositional features 25-10%, particles minimally sorted | ☐ mostly unstable bars, vegetative cover on depositional features < 10%, particles not sorted | | | |
| SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 | | | |
| | □ width/depth < 30, natural | \square 30 \leq w/ d \leq 40, widening | \Box 40 \leq w / d \leq 50, widening | \square w / d \ge 50, over-widening | | | |
| 6.4 Channel Morphology | □ entrenchment ratio ≥ 2.0 , incision ratio < 1.0 , good floodplain access □ entrenchment ratio ≥ 2.0 , $1.0 \le \text{incision ratio} < 1.2$, reduced floodplain access | | □ entrenchment ratio ≥ 2.0, 1.2 ≤ incision ratio < 1.4, limited floodplain access | □ entrenchment ratio < 2.0 or incision ratio ≥ 1.4, floodplain access unlikely | | | |
| | no evidence of channel alteration | □ evidence of minor historic channel alteration | ☐ major historic or minor recent channel alteration | ☐ 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 | Condition (Departure) Category | | | | | | | | | | | |
|---|--|-----------------------------|--|---|--|---|---|---|---|--|---------|--|
| Parameter | Reference (None) Good (Minor) | | | or) | Fair (Major) | | | Poor (Severe) | | | | |
| | □ wetted v | vidth / W _{bkf} | > 0.50 | □ 0.50 ≥ V | W _{wet} / W _{bkf} | > 0.30 | □ 0.30 ≥ V | W _{wet} / W _{bkf} | > 0.10 | \square W _{wet} / W _{bkf} \leq | 0.10 | |
| 6.5 Hydrologic Characteristics | □ exposed substrate < 50%□ adjacent springs, seeps, and wetlands extensive | | \Box 50 \le exp. substrate < 60% | | | \Box 60 \le exp. substrate < 70\% | | | □ exposed substrate ≥ 70% | | | |
| | | | ☐ adjacent springs, seeps, and wetlands present | | | ☐ adjacent springs, seeps, and wetlands minimal | | | ☐ adjacent springs, seeps, and wetlands absent or altered | | | |
| | ☐ no known flow alteration | | | ☐ minor flow alteration likely due to flow regulation and/or land use changes | | | ☐ major flow alteration likely due to flow regulation and/or land use changes | | | flow regulation and storm water influence | | |
| SCORE | 20 19 | | 17 16 | 15 14 | | 12 11 | 10 9 | 8 | 7 6 | J , , | 3 2 1 | |
| 6.6 Connectivity Tend towards a higher/lower score for | ☐ no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows | | | one or two small low flow obstructions present in reach that block movement of aquatic species | | | ☐ one or two small to medium bankfull obstructions present in reach that block movement of aquatic species | | | that block movement of | | |
| natural/man-made obstructions | □ system o | bstructions | absent | □ limited | system obs | structions | □ system o | obstruction | ns present many system obstructions | | | |
| | □ abundant low and high flow refuge or high flow refuge limited □ limited low and high flow refuge □ refuge | | | | | □ refuge absen | t | | | | | |
| SCORE | 20 19 | | 17 16 | 15 14 | _ | 12 11 | 10 9 | 8 | 7 6 | | 3 2 1 | |
| 6.7 River Banks | bank revetments | | | ☐ 10 ≤ bank erosion < 30%, infrequent small areas, some bank revetments | | | ☐ 30 ≤ bank erosion < 60%, mod. unstable banks, and/or extensive bank revetments | | | □ bank erosion ≥ 60%, banks unstable, extensive erosion, and failing bank revetments | | |
| Select different boxes for LB and RB if necessary | | | | □ 90 ≥ bank vegetation > 75% in each layer, diverse assemblages, plants create good cover and roots help stabilize bank | | □ 75 ≥ bank vegetation > 50%, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank | | □ bank vegetation ≤ 50% in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank | | | | |
| Undercut size rank variable only used if > 5 | □ bank canopy > 90% | | | \square 90 \geq bank canopy $> 75\%$ | | \Box 75 \geq bank canopy $>$ 50% | | □ bank canopy ≤ 50% | | | | |
| undercuts | □ undercu | t banks / mi | ile > 30 | □ 30 ≥ un | dercuts / m | nile > 15 | \Box 15 \geq undercuts / mile > 5 | | □ undercuts / mile \leq 5 | | | |
| | □ undercut bank size rank 3-6 > $0 \le 0$ undercut bank size rank $0 \le 0 \le 0 \le 0$ undercut bank size rank $0 \le 0 \le 0 \le 0$ undercut bank size rank $0 \le 0 \le 0 \le 0$ undercut bank size rank $0 \le 0 \le 0 \le 0 \le 0$ undercut bank size rank $0 \le 0 \le 0 \le 0 \le 0$ undercut bank size rank $0 \le 0 \le 0 \le 0 \le 0 \le 0$ undercut bank size rank $0 \le 0 $ | | | k size rank | size rank ☐ undercut bank size rank 3-6 ≤ 10% | | | | | | | |
| □ undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency (score each bank) □ no mass failures in valley □ undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency | | | undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency | | | □ undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency □ > 3 mass failures in valley | | | | | | |
| GCODE (I.D.) | 1.00.1 | 10 | 0 | | failure in v | | | ss failures | in valley | 2 | | |
| SCORE (LB) SCORE (RB) | Left Bank Right Bank | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 2 | 1 | |
| SCORE(RD) | | vidth > 150 | _ | \Box 150 \geq b | , | | | uffer width | _ | □ buffer width | < 50 ft | |
| 6.8 Riparian Area Select different boxes for LB and RB if necessary | □ rip. vegetation > 75% in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy | | □ 75 ≥ rip. veg. > 50% in each layer, one plant type absent, minimal invasives, maximum channel canopy | | □ 75 ≥ rip. veg. > 50% in each layer, several types absent, altered patches, invasives present, reduced canopy | | | | | | | |
| (score each side of the channel) | | ridor devel astructure a | | | rridor deve | | | rridor deve | | ☐ 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 | |

| 0.9 | 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) |