

Fetters Run (College to Fair) Field Assessment

121 E. Chestnut St., Suite 100,
Lancaster, OH 43130



LANCASTER

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Prepared By:

Hull & Associates, Inc.

HULL

Environment / Energy / Infrastructure

59 Grant Street
Newark, Ohio
740-344-5451

INTRODUCTION

Hull & Associates, Inc. (Hull) conducted field investigations to assess the stability, erosion potential, stream habitat and restoration potential on an approximate 6,735 linear foot section of Feters Run within the City of Lancaster (Project Area) on August 1st and 2nd, 2019. The Project Area encompassed the riparian corridor of Feters Run from College Avenue to the north, down to Fair Avenue to the South. Land use within the Project Area included the grounds of the Ohio University Lancaster Campus, Lancaster High School and the Thomas Ewing Junior High School. The purpose of the field investigation was to identify areas of erosion and denuded habitat to support future restoration grant opportunities that the City of Lancaster may target to improve the water quality of Feters Run. The results of the field evaluation have been synthesized into an existing conditions heat map that identifies the stream bank condition, river stability and stream habitat across 49 sections in four Reaches of the Project Area. The Reaches were identified as the open field areas of Ohio University, the forested areas of Lancaster Highschool and Ohio University upstream of the active Feters Run sewer line stability construction site (Construction Site), the forested areas of Lancaster Highschool downstream of the Construction Site, and open riparian corridor from the tennis courts south to the Junior High School.

METHODS

On August 1st and 2nd of 2019, Hull walked the entire 6,735 linear-foot stream channel and corridor and conducted three primary evaluations of stream quality. These assessments included 1) the Bank Erosion Hazard Index (BEHI, Rosgen 2002), 2) the Pfankuch (1975) reach inventory on channel stability (Pfankuch), and 3) the Qualitative Habitat Evaluation Index (QHEI).

Hull conducted 49 BEHI assessments across the left and right stream banks within the Project Area and these assessments were used to divide the Project Area into sections. The BEHI assessment is focused on the susceptibility of a stream bank to erosion which has been recognized as the primary contributor to in-stream sediment load. It is difficult to distinguish between stream banks that erode at a natural rate versus those that are eroding at unnaturally high-rates due to altered watershed hydrology or sediment loads. The BEHI is a procedure for assessing streambank erosion condition and potential. It assigns point values to several aspects of bank conditions and provides an overall score that has been used on Feters Run to inventory and prioritize eroding stream banks to target restoration activities. The BEHI considers the ratio of bank height to bankfull height, ratio of root depth to bank height, root density, surface protection, bank angle, and stream bank substrate and stratification. These metrics are evaluated to give adjective rating of moderate, high or very high erosion potential. Our observed scores were such that we created another bracket termed "extremely high" in order to help give priority to certain sections within the Project Area. There were a number of sections that were not evaluated for BEHI at all due to their stabilization by large rock and concrete slab along with vegetation which is inherently in a stable condition but may still warrant restoration.

The Pfankuch channel stability rating procedure was modified by Rosgen in 1996 and 2006. It evaluates the upper stream banks, lower stream banks and channel bottom. The Pfankuch assessment focusses on slope gradient, mass erosion, debris jam potential and vegetative protection of the upper stream banks. The lower stream banks area evaluated for channel capacity, bank rock content, obstructions to flow, raw bank exposure and deposition. The stream bottom is evaluated for rock angularity and brightness, consolidation of particle size, distribution of substrate size, scouring and deposition, and aquatic vegetation. Four Pfankuch assessments were conducted, one in each Reach of the Project Area.

The QHEI was developed by the Division of Surface Water at the Ohio EPA to assess habitat in flowing waters. The QHEI evaluates the type and quality of substrate and instream cover. The channel morphology is evaluated for sinuosity, development, channelization and stability. The width, quality and bank erosion observed within the riparian zone is assessed. The maximum depth, current and morphology of pools and the depth substrate stability and substrate embeddedness of the riffles are assessed. The gradient of the landscape is also evaluated. Five QHEI assessments were conducted within the Project Area, generally one per reach, although Reach 4 did receive two separate QHEI assessments.

RESULTS AND RECOMMENDATIONS

Approximately two sections scored as High, four as Very High, 16 as Extreme and 28 as Very Extreme on the BEHI assessments. The worse conditions were observed in areas where no forested riparian corridor existed and mowing was near the stream banks. The Pfankuch assessment scored everything as Poor with exception of the Reach around the Ohio University which scored Fair. The QHEI scored in the middle 40s to 50s in Reach 1 and Reach 4. The forested riparian corridors of Reach 2 and Reach 3 scored a 65. Generally, those areas which had the worst conditions observed were associated with little or no forested riparian buffer. The overall stream channel within the Project Area is straight and incised, and requires sinuosity, floodplain bench and grade control to minimize near bank stress. Existing land use, including concert fields, the university, high school and junior high school along with sewer utilities limit the ability to realign the stream channel and expand the forested riparian buffer. The attached restoration alternative graphic has used the aforementioned assessments to identify potential restoration activities throughout the Project Area.

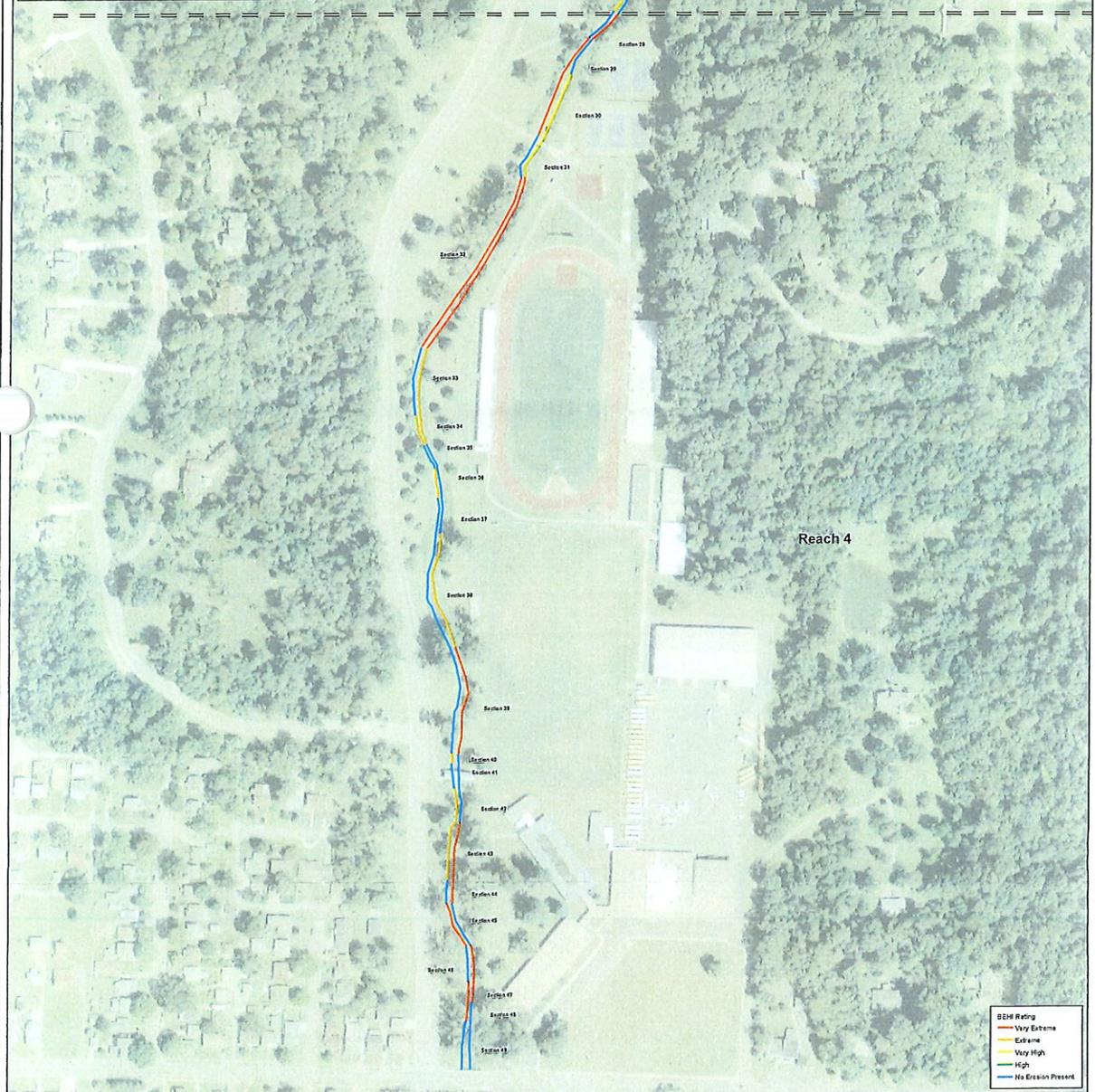
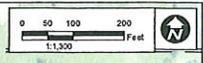
Prepared by:



Bradley J Petru, MS, PWS, ISA-CA
Ecology and Wetlands Practice Leader

Date: August 24, 2019

Reach	Section	Bank	Upland	BEHI	BEHI	BEHI	Plan/Reach	Plan/Reach	Comments
Reach	Section	Bank	Upland	Score	Adjective	Rating	Score	Rating	
Reach 3	Section 23	Right	178	41	Very Extreme	110	Poor	65	
	Section 23	Left	224	54	Extreme				
	Section 24	Right	43	58	Very Extreme				
	Section 24	Left	111	18	Very Extreme				
	Section 25	Right	78	43	Very High				
	Section 25	Left	102	33	Very Extreme				
	Section 26	Right	81	41	Very Extreme				
	Section 26	Left	111	41	Very Extreme				
	Section 27	Right	43	45	Very High				
	Section 27	Left	132	56	Very Extreme				
Reach 4	Section 38	Right	117	53	Extreme	111	Poor	54	Minor
	Section 38	Left	17	53	Extreme				
	Section 39	Right	88	15	Very Extreme				
	Section 39	Left	-	-	-				
	Section 40	Right	297	53	Extreme				
	Section 40	Left	238	63	Very Extreme				
	Section 41	Right	19	53	Extreme				
	Section 41	Left	-	-	-				
	Section 42	Right	19	54	Extreme				
	Section 42	Left	-	-	-				
Reach 5	Section 43	Right	118	54	Extreme	111	Poor	48.75	
	Section 43	Left	53	58.5	Very Extreme				
	Section 44	Right	55	58.5	Very Extreme				
	Section 44	Left	112	62.5	Very Extreme				
	Section 45	Right	83	57	Very Extreme				
	Section 45	Left	-	-	-				
	Section 46	Right	40	57	Very Extreme				
	Section 46	Left	44	58.5	Very Extreme				
	Section 47	Right	40	58.5	Very Extreme				
	Section 47	Left	-	-	-				



The BEHI photos were acquired from the Ohio Statewide Inventory Program (OSIP). Aerial photos copyright 2014. BEHI data from the OSIP. Bank elevation from the stream bed.



6397 Emerald Pkwy
Suite 200
Dublin, Ohio 43016

Phone: (614) 793-8777
Fax: (614) 793-9070
www.hullinc.com

August 2019
City of Lancaster
Erosion Study
BEHI Heat Map
Phase 3 and Phase 4

Figure
2b

Lancaster, Fairfield County, Ohio

DISCLAIMER
Hull & Associates, Inc. (HAI) has licensed the map to the City of Lancaster for use in the City's Erosion Study. The map is not to be used for any other purpose. HAI is not responsible for any errors or omissions in the map. The map is not a warranty, representation, or endorsement of any product or service. The map is not to be used for any other purpose. HAI is not responsible for any errors or omissions in the map. The map is not a warranty, representation, or endorsement of any product or service. The map is not to be used for any other purpose. HAI is not responsible for any errors or omissions in the map.

Worksheet 3-10. Pfrankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2006b).

Stream: Fetters Run - Reach 1		Location: Lancaster, Fairfield Cou			Valley Type: U-AL-AD			Observers: H. Hayter, B. Petru, P. Renner			Date: 8/2/2019		
Loca-tion	Key	Excellent		Good		Fair		Poor		Rating	Description	Rating	
		Description	Rating	Description	Rating	Description	Rating	Description	Rating				
Upper banks	1	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40-60%.	6	Bank slope gradient > 60%.	8	Bank slope gradient > 60%.	8	
	2	Mass erosion	No evidence of past or future mass erosion.	3	Infrequent. Mostly healed over. Low future potential.	6	Frequent or large, causing sediment nearly yearlong.	9	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	12	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	12	
	3	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	6	Moderate to heavy amounts, predominantly larger sizes.	8	Moderate to heavy amounts, predominantly larger sizes.	8	
	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense, soil-binding root mass.	3	70-90% density. Fewer species or less vigor suggest less dense or deep root mass.	6	50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	9	<50% density plus fewer species and less vigor indicating poor, discontinuous, and shallow root mass.	12	<50% density plus fewer species and less vigor indicating poor, discontinuous, and shallow root mass.	12	
Lower banks	5	Channel capacity	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0-1.1.	1	Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank-Height Ratio (BHR) = 1.0-1.1.	2	Bankfull stage is not contained. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) > 1.3.	3	Bankfull stage is not contained; over-bank flows are common with flows less than bankfull. Width/depth ratio departure from reference width/depth ratio > 1.4. Bank-Height Ratio (BHR) > 1.3.	4	Bankfull stage is not contained; over-bank flows are common with flows less than bankfull. Width/depth ratio departure from reference width/depth ratio > 1.4. Bank-Height Ratio (BHR) > 1.3.	4	
	6	Bank rock content	> 65% with large angular boulders. 12"+ common.	2	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	6	<20% rock fragments of gravel sizes, 1-3" or less.	8	<20% rock fragments of gravel sizes, 1-3" or less.	8	
	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	8	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	8	
	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcrops and constrictions. Raw banks may be up to 12".	6	Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16	
Bottom	9	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	16	Extensive deposit of predominantly fine particles. Accelerated bar development.	16	
	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	Rounded corners and edges. Surfaces smooth and flat.	2	Two dimensions.	3	Well-rounded in all dimensions. Surfaces smooth.	4	Well-rounded in all dimensions. Surfaces smooth.	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright.	1	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35-65% mixture range.	3	Predominantly bright, > 65% exposed or scoured surfaces.	4	Predominantly bright, > 65% exposed or scoured surfaces.	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	2	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	6	No packing evident. Loose assortment, easily moved.	8	No packing evident. Loose assortment, easily moved.	8	
Stream type	13	Bottom size distribution	No size change evident. Stable material 80-100%.	4	Distribution shift light. Stable material 50-80%.	8	Moderate change in sizes. Stable materials 20-50%.	12	Marked distribution change. Stable materials 0-20%.	16	Marked distribution change. Stable materials 0-20%.	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition.	6	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	24	More than 50% of the bottom in a state of flux or change nearly yearlong.	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	4	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	4	
			Excellent Total =		Good Total =		Fair Total =		Poor Total =				
		18		72		18		72		16			
		Grand Total =		Grand Total =		Grand Total =		Grand Total =					
		106		106		106		106					
		Existing Stream Type =		Existing Stream Type =		Existing Stream Type =		Existing Stream Type =					
		C4		C4		C4		C4					
		*Potential Stream Type =		*Potential Stream Type =		*Potential Stream Type =		*Potential Stream Type =					
		Modified channel stability rating =		Modified channel stability rating =		Modified channel stability rating =		Modified channel stability rating =					
		16		16		16		16					

*Rating is adjusted to potential stream type, not existing stream type

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2006b).

Stream: Fetters Run - Reach II		Location: Lancaster, Fairfield Cou		Valley Type:		Observers: H. Hayter, B. Petru, P. Renner Date: 8/2/2019																																																																																																																																																																																																																																																																																																																																																																					
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Good (Stable)	38-43	38-43	54-90	60-95	60-95	50-80	38-45	38-45	40-60	40-64	48-68	40-60	38-50	38-50	60-85	70-90	70-90	60-85	85-107	85-107	85-107	85-107																																																																																																																																																																																																																																																																																																																																																					
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Good (Stable)	40-63	40-63	40-63	40-63	40-63	50-75	50-75	40-63	60-85	65-110	85-110	85-110	90-115	80-95	40-60	40-60	85-107	85-107	90-112	85-107	85-107	85-107																																																																																																																																																																																																																																																																																																																																																					
Fair (Mod. unstable)	64-86	64-86	64-86	64-86	64-86	76-96	64-86	64-86	86-105	86-105	111-125	111-125	118-130	96-110	61-78	61-78	108-120	108-120	113-125	108-120	108-120	108-120																																																																																																																																																																																																																																																																																																																																																					
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Worksheet 3-10. Pflankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2006b).

Stream: Fetters Run - Reach III		Location: Lancaster, Fairfield Cou			Valley Type:			Observers: H. Hayter, B. Petru, P. Renner Date: 8/2/2019																			
Loca- tion	Key	Category	Excellent Description	Rating	Good Description	Rating	Fair Description	Rating	Poor Description	Rating																	
Upper banks	1	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40-60%.	6	Bank slope gradient > 60%.	8																	
	2	Mass erosion	No evidence of past or future mass erosion.	3	Infrequent. Mostly healed over. Low future potential.	6	Frequent or large, causing sediment nearly yearlong.	9	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	12																	
	3	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	6	Moderate to heavy amounts, predominantly larger sizes.	8																	
	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense, soil-binding root mass.	3	less vigor suggest less dense or deep root mass.	6	fewer species from a shallow, discontinuous root mass.	9	<50% density plus fewer species and less vigor indicating poor, discontinuous, and shallow root mass.	12																	
Lower banks	5	Channel capacity	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-High Ratio (BHR) = 1.0.	1	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-High Ratio (BHR) = 1.0-1.1.	2	Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-High Ratio (BHR) = 1.1-1.2.	3	flows are common with flows less than bankfull. Width/depth ratio departure from reference width/depth ratio > 1.4. Bank-High Ratio (BHR) = 1.1-1.2.	4																	
	6	Bank rock content	> 65% with large angular boulders. 12"+ common.	2	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	6	<20% rock fragments of gravel sizes, 1-3" or less.	8																	
	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6	Frequent obstructions and deflector's cause bank erosion yearlong. Sediment traps full, channel migration occurring.	8																	
	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcrops and constrictions. Raw banks may be up to 12".	6	Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16																	
Bottom	9	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	16																	
	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	Rounded corners and edges. Surfaces smooth and flat.	2	Comers and edges well-rounded in two dimensions.	3	Well-rounded in all dimensions, surfaces smooth.	4																	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright.	1	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35-65% mixture range.	3	Predominantly bright, > 65%, exposed or scored surfaces.	4																	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	2	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	6	No packing evident. Loose assortment, easily moved.	8																	
	13	Bottom size distribution	No size change evident. Stable material 80-100%.	4	Distribution shift light. Stable material 50-80%.	8	Moderate change in sizes. Stable materials 20-50%.	12	Marked distribution change. Stable materials 0-20%.	16																	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition.	6	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools.	18	More than 50% of the bottom in a state of flux or change nearly yearlong.	24																	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	4																	
	Excellent Total =				16	Good Total =				51	Fair Total =		51	Poor Total =		52											
	Stream type	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D3	D4	D5	D6	Grand Total =		119	
	Good (Stable)	38-43	38-43	54-90	60-95	60-95	60-95	38-45	38-45	40-64	48-88	40-60	40-60	38-50	38-50	60-85	70-90	70-90	60-85	85-107	85-107	85-107	85-107	85-107	85-107	87-98	87-98
	Fair (Mod. unstable)	44-47	44-47	91-129	96-132	96-142	81-110	46-58	46-58	61-78	69-88	61-78	61-78	51-61	51-61	86-105	91-110	91-110	86-105	108-132	108-132	108-132	108-132	108-132	108-132	99-125	99-125
	Poor (Unstable)	48+	48+	130+	133+	143+	111+	59+	59+	79+	85+	79+	79+	62+	62+	106+	111+	111+	106+	133+	133+	133+	133+	133+	133+	126+	126+
	Stream type	DA3	DA4	DA5	DA6	E3	E4	E5	E6	F1	F2	F3	F4	F5	F6	G1	G2	G3	G4	G5	G6	Stream Type =		Modified channel stability rating =			
	Good (Stable)	40-63	40-63	40-63	40-63	40-63	50-75	50-75	40-63	60-85	85-110	85-110	85-110	90-115	80-95	40-60	40-60	40-60	85-107	85-107	90-112	85-107	Stream Type =		Modified channel stability rating =		
	Fair (Mod. unstable)	64-86	64-86	64-86	64-86	64-86	76-96	76-96	64-86	86-105	111-125	111-125	111-125	116-130	96-110	61-78	61-78	108-120	108-120	113-125	108-120	108-120	Stream Type =		Modified channel stability rating =		
Poor (Unstable)	87+	87+	87+	87+	87+	97+	97+	87+	106+	126+	126+	126+	131+	111+	79+	79+	121+	121+	121+	126+	121+	Stream Type =		Modified channel stability rating =			

*Rating is adjusted to potential stream type, not existing stream type

Worksheet 3-10. Pfankuch (1975) channel stability rating procedure, as modified by Rosgen (1996, 2006b).

Stream: Fetters Run - Reach IV		Location: Lancaster, Fairfield Cou		Valley Type:		Observers: H. Hayter, B. Petru, P. Renner		Date: 8/2/2019																		
Loca-tion	Key	Category	Excellent Description	Rating	Good Description	Rating	Fair Description	Rating	Poor Description	Rating																
Upper banks	1	Landform slope	Bank slope gradient <30%.	2	Bank slope gradient 30-40%.	4	Bank slope gradient 40-60%.	6	Bank slope gradient > 60%.	8																
	2	Mass erosion	No evidence of past or future mass erosion.	3	Infrequent. Mostly healed over. Low future potential.	6	Frequent or large, causing sediment nearly yearlong.	9	Frequent or large, causing sediment nearly yearlong OR imminent danger of same.	12																
	3	Debris jam potential	Essentially absent from immediate channel area.	2	Present, but mostly small twigs and limbs.	4	Moderate to heavy amounts, mostly larger sizes.	6	Moderate to heavy amounts, predominantly larger sizes.	8																
	4	Vegetative bank protection	> 90% plant density. Vigor and variety suggest a deep, dense, soil-binding root mass.	3	70-90% density. Fewer species or less vigor suggest less dense or deep root mass.	6	50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass.	9	<50% density plus fewer species and less vigor indicating poor, discontinuous, and shallow root mass.	12																
Lower banks	5	Channel capacity	Bank heights sufficient to contain the bankfull stage. Width/depth ratio departure from reference width/depth ratio = 1.0. Bank-Height Ratio (BHR) = 1.0.	1	Bankfull stage is contained within banks. Width/depth ratio departure from reference width/depth ratio = 1.0-1.2. Bank-Height Ratio (BHR) = 1.0-1.1.	2	Width/depth ratio departure from reference width/depth ratio = 1.2-1.4. Bank-Height Ratio (BHR) = 1.1-1.3.	3	Bankfull stage is not contained; over-bank flows are common with flows less than bankfull. Width/depth ratio departure from reference width/depth ratio > 1.4. Bank-Height Ratio (BHR) > 1.4.	4																
	6	Bank rock content	> 65% with large angular boulders. 12"+ common.	2	40-65%. Mostly boulders and small cobbles 6-12".	4	20-40%. Most in the 3-6" diameter class.	6	<20% rock fragments of gravel sizes, 1-3" or less.	8																
	7	Obstructions to flow	Rocks and logs firmly imbedded. Flow pattern w/o cutting or deposition. Stable bed.	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4	Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6	Frequent obstructions and deflectors cause bank erosion yearlong. Sediment traps full, channel migration occurring.	8																
	8	Cutting	Little or none. Infrequent raw banks <6".	4	Some, intermittently at outcrops and constrictions. Raw banks may be up to 12".	6	Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident.	12	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16																
	9	Deposition	Little or no enlargement of channel or point bars.	4	Some new bar increase, mostly from coarse gravel.	8	Moderate deposition of new gravel and coarse sand on old and some new bars.	12	Extensive deposit of predominantly fine particles. Accelerated bar development.	16																
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	Rounded corners and edges. Surfaces smooth and flat.	2	Corners and edges well-rounded in two dimensions.	3	Well-rounded in all dimensions, surfaces smooth.	4																
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright.	1	Mostly dull, but may have <35% bright surfaces.	2	Mixture dull and bright, i.e., 35-65% mixture range.	3	Predominantly bright, > 65% exposed or scoured surfaces.	4																
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping.	2	Moderately packed with some overlapping.	4	Mostly loose assortment with no apparent overlap.	6	No packing evident. Loose assortment, easily moved.	8																
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	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	Common. Algae forms in low velocity and pool areas. Moss here too.	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3	Perennial types scarce or absent. Yellow-green, short-term bloom may be present.	4																
	Excellent Total =			Good Total =			Fair Total =			Poor Total =																
	10			81			81			20																
	Stream type	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D3	D4	D5	D6	Grand Total = 111		
	Good (Stable)	38-43	38-43	54-90	60-95	60-95	50-80	38-45	38-45	40-60	40-60	48-68	40-60	38-50	38-50	60-85	70-90	60-85	60-85	85-107	85-107	85-107	85-107	85-107	67-98	Existing Stream Type =
	Fair (Mod. unstable)	44-47	44-47	91-129	96-132	96-142	81-110	46-58	46-58	61-78	65-84	69-88	61-78	51-61	51-61	86-105	91-110	86-105	86-105	108-132	108-132	108-132	108-132	108-132	99-125	
	Poor (Unstable)	48+	48+	130+	133+	143+	111+	59+	59+	79+	85+	89+	79+	62+	62+	106+	111+	111+	106+	133+	133+	133+	133+	133+	126+	Modified channel stability rating =
Stream type	DA3	DA4	DA5	DA6	EA3	EA4	EA5	E6	F1	F2	F3	F4	F5	F6	F6	G1	G2	G3	G4	G5	G6	G6	G6			
Good (Stable)	40-63	40-63	40-63	40-63	50-75	50-75	50-75	40-63	60-85	60-85	85-110	85-110	90-115	80-95	80-95	40-60	40-60	85-107	85-107	90-112	85-107	85-107	85-107			
Fair (Mod. unstable)	64-86	64-86	64-86	64-86	76-96	76-96	64-86	64-86	86-105	86-105	111-125	111-125	116-130	96-110	96-110	61-78	61-78	108-120	108-120	113-125	108-120	108-120	108-120			
Poor (Unstable)	87+	87+	87+	87+	87+	87+	87+	87+	106+	106+	126+	126+	131+	111+	111+	79+	79+	121+	121+	126+	126+	126+	126+			

*Rating is adjusted to potential stream type, not existing stream type



Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 41.5

Stream & Location: Fettlers Run QHEI 1 **RM:** _____ **Date:** 8/2/19
Scorers Full Name & Affiliation: Helena H. Hull / Assoc.

River Code: _____ **STORET #:** _____ **Lat./ Long.:** _____ **18** **Office verified location**

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES		OTHER TYPES		ORIGIN		QUALITY	
<input type="checkbox"/> BLDR / SLABS [10]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> SILT	<input type="checkbox"/> HEAVY [-2]	6.5 Maximum 20
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/> COBBLE [8]	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/> MUCK [2]	<input checked="" type="checkbox"/> TILLS [1]	<input type="checkbox"/> WETLANDS [0]	<input checked="" type="checkbox"/> MODERATE [-1]	
<input checked="" type="checkbox"/> GRAVEL [7]	<u>15</u> / <u>40</u>	<input checked="" type="checkbox"/> SILT [2]	<u>60</u> / <u>5</u>	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> NORMAL [0]	
<input checked="" type="checkbox"/> SAND [6]	<u>30</u> / <u>40</u>	<input type="checkbox"/> ARTIFICIAL [0]		<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> RIP/RAP [0]	<input checked="" type="checkbox"/> EXTENSIVE [-2]	
<input type="checkbox"/> BEDROCK [5]				<input type="checkbox"/> LACUSTURINE [0]	<input type="checkbox"/> SHALE [-1]	<input checked="" type="checkbox"/> MODERATE [-1]	
NUMBER OF BEST TYPES: <input type="checkbox"/> 4 or more [2] <input checked="" type="checkbox"/> 3 or less [0]						<input type="checkbox"/> NORMAL [0]	

Comments: 6 2 1 -2.5

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input checked="" type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	5 Cover Maximum 20
<input checked="" type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	
<input type="checkbox"/> ROOTMATS [1]			

Comments: 1

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	9 Channel Maximum 20
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]	
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]	
<input type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input checked="" type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]	

Comments: 2 3 3 1

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	4.5 Riparian Maximum 10
<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	
<input checked="" type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	
<input checked="" type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input checked="" type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	

Comments: 2.5 0 2

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	3 Pool / Current Maximum 12
<input type="checkbox"/> > 1m [6]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	
<input type="checkbox"/> 0.7-1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input type="checkbox"/> VERY FAST [1]	
<input checked="" type="checkbox"/> 0.4-0.7m [2]	<input checked="" type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> INTERSTITIAL [-1]	

Comments: 2 0 1

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input checked="" type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input checked="" type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input checked="" type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]

Comments: 1 0 0.5

6] GRADIENT (25.9 ft/mi) VERY LOW - LOW [2-4] **% POOL:** 30 **% GLIDE:** 40
DRAINAGE AREA (6.1 m²) MODERATE [6-10] **% RUN:** 5 **% RIFFLE:** 25
 HIGH - VERY HIGH [10-6] **Gradient Maximum** 10

AJ SAMPLED REACH

Check ALL that apply

- METHOD**
- BOAT
 - WADE
 - L. LINE
 - OTHER
- DISTANCE**
- 0.6 Km
 - 0.2 Km
 - 0.16 Km
 - 0.12 Km
 - OTHER

- STAGE**
- 1st - sample pass - 2nd
 - HIGH
 - UP
 - NORMAL
 - LOW
 - DRY

- CLARITY**
- 1st - sample pass - 2nd
 - < 20 cm
 - 20-40 cm
 - 40-70 cm
 - > 70 cm / CTB
 - SECCHI DEPTH

- CANOPY**
- 1st _____ cm
 - 2nd _____ cm
 - > 85% OPEN
 - 30% - < 85%
 - 10% - < 30%
 - < 10% CLOSED

- CJ RECREATION**
- AREA DEPTH
 POOL: > 100ft² > 3ft

Comment RE: Reach consistency/Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

- BJ AESTHETICS**
- NUISANCE ALGAE
 - INVASIVE MACROPHYTES
 - EXCESS TURBIDITY
 - DISCOLORATION
 - FOAM / SCUM
 - OIL SHEEN
 - TRASH / LITTER
 - NUISANCE ODOR
 - SLUDGE DEPOSITS
 - CSOs/SSOs/OUTFALLS

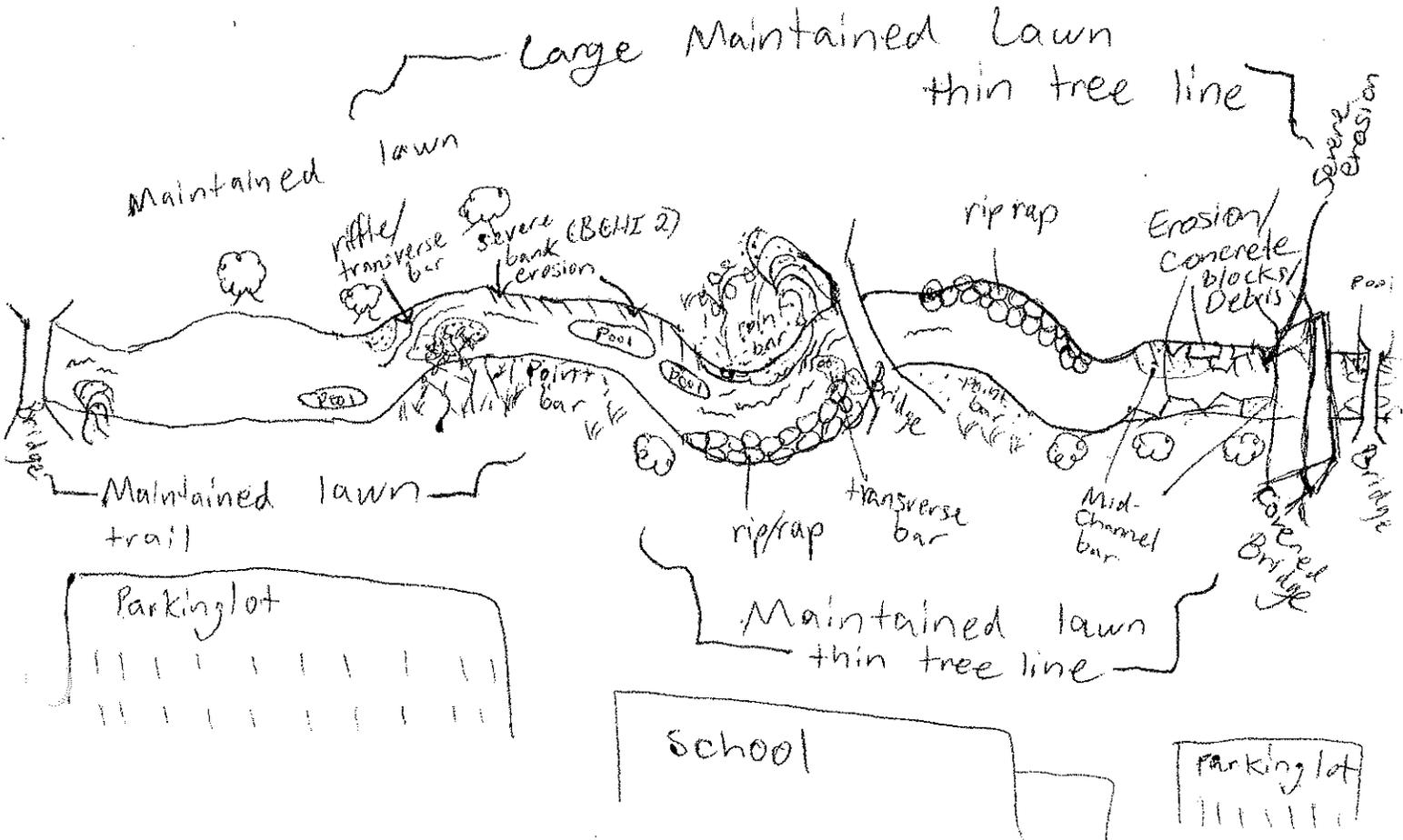
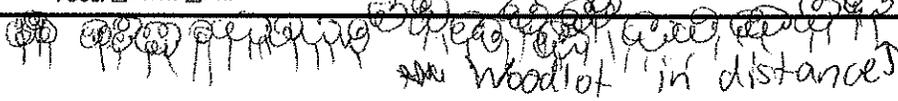
- DJ MAINTENANCE**
- PUBLIC / PRIVATE / BOTH / NA
 - ACTIVE / HISTORIC / BOTH / NA
 - YOUNG-SUCCESSION-OLD
 - SPRAY / SNAG / REMOVED
 - MODIFIED / DIPPED OUT / NA
 - LEVEED / ONE SIDED
 - RELOCATED / CUTOFFS
 - MOVING-BEDLOAD-STABLE
 - ARMoured / SLUMPS
 - ISLANDS / SCoured
 - IMPOUNDED / DESICCATED
 - FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

- EJ ISSUES**
- WWTP / CSO / NPDES / INDUSTRY
 - HARDENED / URBAN / DIRT&GRIME
 - CONTAMINATED / LANDFILL
 - BMPs-CONSTRUCTION-SEDIMENT
 - LOGGING / IRRIGATION / COOLING
 - BANK / EROSION / SURFACE
 - FALSE BANK / MANURE / LAGOON
 - WASH H₂O / TILE / H₂O TABLE
 - ACID / MINE / QUARRY / FLOW
 - NATURAL / WETLAND / STAGNANT
 - PARK / GOLF / LAWN / HOME
 - ATMOSPHERE / DATA PAUCITY

- FJ MEASUREMENTS**
- \bar{x} width
 - \bar{x} depth
 - max. depth
 - \bar{x} bankfull width
 - bankfull \bar{x} depth
 - W/D ratio
 - bankfull max. depth
 - floodprone \bar{x}^2 width
 - entrench. ratio
 - Legacy Tree:

Stream Drawing:





Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 50

Stream & Location: Fellers Run QHEI 2 **RM:** _____ **Date:** 8/2/19

Scorers Full Name & Affiliation: Helena H. Hull & Assoc.

River Code: _____ **STORET #:** _____ **Lat./ Long.:** _____ **Office verified location**

1) SUBSTRATE Check **ONLY** Two substrate **TYPE BOXES**; estimate % or note every type present

BEST TYPES		OTHER TYPES		ORIGIN		QUALITY	
<input type="checkbox"/> BLDR / SLABS [10]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/> POOL RIFFLE	<input checked="" type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> SILT	<input type="checkbox"/> HEAVY [-2]	6 Maximum 20
<input type="checkbox"/> BOULDER [9]		<input type="checkbox"/> DETRITUS [3]		<input checked="" type="checkbox"/> TILLS [1]		<input type="checkbox"/> MODERATE [-1]	
<input type="checkbox"/> COBBLE [8]		<input type="checkbox"/> MUCK [2]		<input type="checkbox"/> WETLANDS [0]		<input type="checkbox"/> NORMAL [0]	
<input checked="" type="checkbox"/> GRAVEL [7]	<u>65</u> / <u>15</u>	<input checked="" type="checkbox"/> SILT [2]	<u>30</u> / <u>20</u>	<input type="checkbox"/> HARDPAN [0]		<input type="checkbox"/> FREE [1]	
<input checked="" type="checkbox"/> SAND [6]	<u>65</u> / <u>65</u>	<input type="checkbox"/> ARTIFICIAL [0]		<input type="checkbox"/> SANDSTONE [0]		<input checked="" type="checkbox"/> EXTENSIVE [-2]	
<input type="checkbox"/> BEDROCK [5]				<input checked="" type="checkbox"/> RIP/RAP [0]		<input type="checkbox"/> MODERATE [-1]	

NUMBER OF BEST TYPES: 4 or more [2] 3 or less [0]

Comments: 6 2 will rip 0 -3

2) INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	9 Cover Maximum 20
<input checked="" type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	
<input type="checkbox"/> ROOTMATS [1]			

Comments: 1 2 1 9

3) CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	9 Channel Maximum 20
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]	
<input type="checkbox"/> MODERATE [3]	<input checked="" type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input type="checkbox"/> MODERATE [2]	
<input checked="" type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input checked="" type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]	

Comments: 2 3 3 1

4) BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY	6 Riparian Maximum 10
<input type="checkbox"/> NONE / LITTLE [3]	<input checked="" type="checkbox"/> WIDE > 50m [4]	<input checked="" type="checkbox"/> FOREST, SWAMP [3]	
<input type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input type="checkbox"/> SHRUB OR OLD FIELD [2]	
<input checked="" type="checkbox"/> HEAVY / SEVERE [1]	<input checked="" type="checkbox"/> NARROW 5-10m [2]	<input checked="" type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	

Comments: 2 6 4

5) POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	6 Pool / Current Maximum 12
<input type="checkbox"/> > 1m [0]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	
<input checked="" type="checkbox"/> 0.7-1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input checked="" type="checkbox"/> SLOW [1]	
<input type="checkbox"/> 0.4-0.7m [2]	<input checked="" type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> VERY FAST [1]	

Comments: 4 0 2

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input checked="" type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input checked="" type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input type="checkbox"/> MODERATE [0]

Comments: 0 1 0 -1

6) GRADIENT (25.9 ft/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]

DRAINAGE AREA (6.1 m²)

% POOL: 40 **% GLIDE:** 30 **% RUN:** 5 **% RIFFLE:** 25

Gradient Maximum 10

AJ SAMPLED REACH

Check ALL that apply

- METHOD**
- BOAT
 - WADE
 - L. LINE
 - OTHER
- STAGE**
- HIGH
 - UP
 - NORMAL
 - LOW
 - DRY
- DISTANCE**
- 0.6 Km
 - 0.2 Km
 - 0.16 Km
 - 0.12 Km
 - OTHER

- CLARITY**
- 1st sample pass - 2nd
- < 20 cm
 - 20-40 cm
 - 40-70 cm
 - > 70 cm/ CTB
 - SECCHI DEPTH

- CANOPY**
- 1st _____ cm
- 2nd _____ cm
- > 85% - OPEN
 - 56% - 86%
 - 30% - 55%
 - 10% - 30%
 - < 10% - CLOSED

- CJ RECREATION**
- AREA DEPTH
- POOL: > 100ft² > 3ft

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

BJ AESTHETICS

- NUISANCE ALGAE
- INVASIVE MACROPHYTES
- EXCESS TURBIDITY
- DISCOLORATION
- FOAM / SCUM
- OIL SHEEN
- TRASH / LITTER
- NUISANCE ODOR
- SLUDGE DEPOSITS
- CSOs/SSOs/OUTFALLS

DJ MAINTENANCE

- PUBLIC / PRIVATE / BOTH / NA
- ACTIVE / HISTORIC / BOTH / NA
- YOUNG-SUCCESSION-OLD
- SPRAY / SNAG / REMOVED
- MODIFIED / DIPPED OUT / NA
- LEVEED / ONE SIDED
- RELOCATED / CUTOFFS
- MOVING-BEDLOAD-STABLE
- ARMORED / SLUMPS
- ISLANDS / SCoured
- IMPOUNDED / DESICCATED
- FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

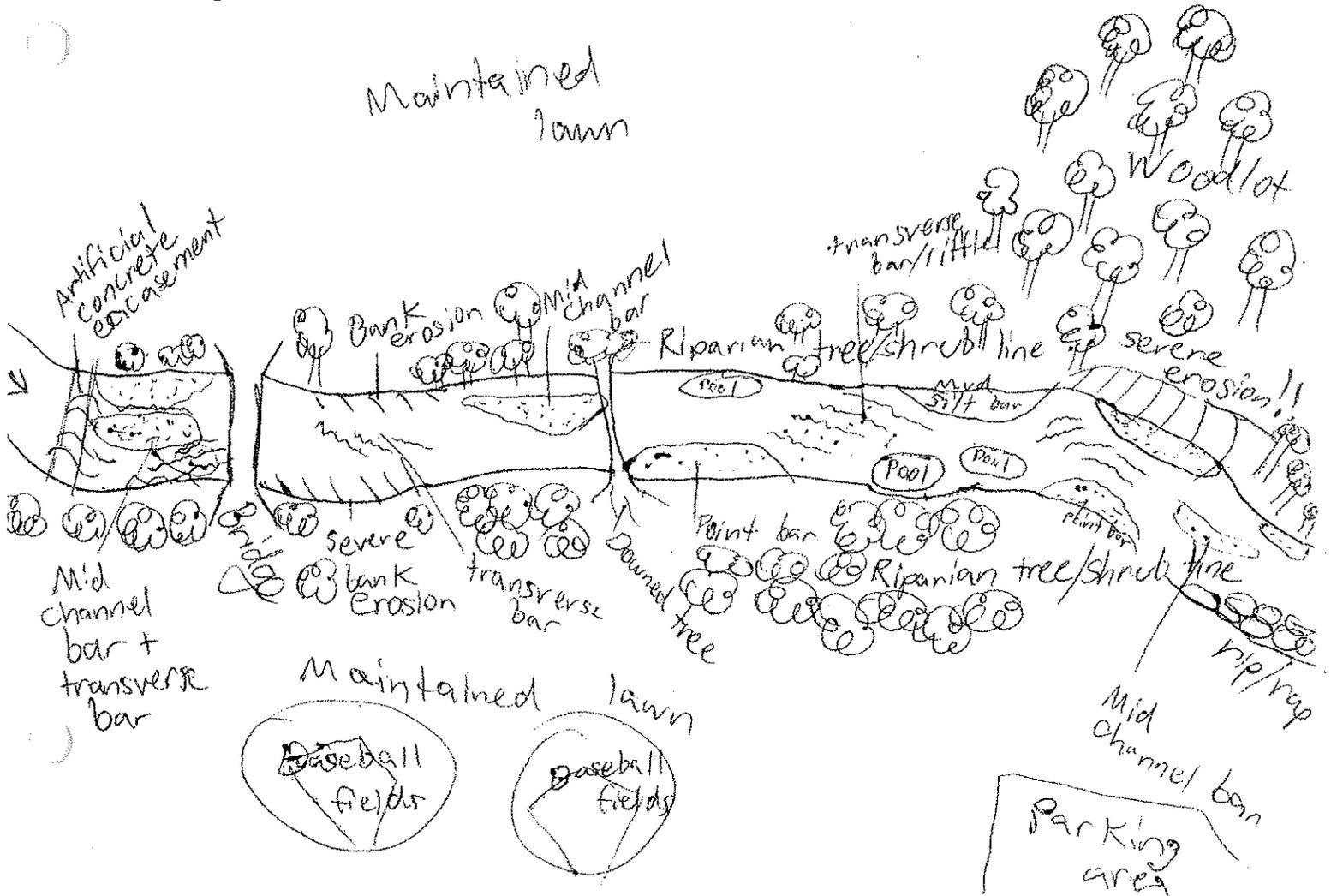
EJ ISSUES

- WWTP / CSO / NPDES / INDUSTRY
- HARDENED / URBAN / DIRT&GRIME
- CONTAMINATED / LANDFILL
- BMPs-CONSTRUCTION-SEDIMENT
- LOGGING / IRRIGATION / COOLING
- BANK / EROSION / SURFACE
- FALSE BANK / MANURE / LAGOON
- WASH H₂O / TILE / H₂O TABLE
- ACID / MINE / QUARRY / FLOW
- NATURAL / WETLAND / STAGNANT
- PARK / GOLF / LAWN / HOME
- ATMOSPHERE / DATA PAUCITY

FJ MEASUREMENTS

- \bar{x} width
- \bar{x} depth
- max. depth
- \bar{x} bankfull width
- bankfull \bar{x} depth
- W/D ratio
- bankfull max. depth
- floodprone \bar{x}^2 width
- entrench. ratio
- Legacy Tree:

Stream Drawing:



Stream & Location: Fetters Run QHEI 3 RM: Date: 8/2/19
Scorers Full Name & Affiliation: Helena H. Wittig Assoc.
River Code: STORET #: Lat./ Long.: 18 Office verified location

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average) ORIGIN QUALITY. Includes categories like BEST TYPES, POOL RIFFLE, OTHER TYPES, LIMESTONE, SILT, and BEDROCK. Substrate score: 14/20.

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts... AMOUNT Check ONE (Or 2 & average). Includes categories like UNDERCUT BANKS, OVERHANGING VEGETATION, SHALLOWS, POOLS, OXBOWS, ROOTWADS, AQUATIC MACROPHYTES, LOGS OR WOODY DEBRIS. Cover score: 15/20.

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY. Includes categories like HIGH, MODERATE, LOW, EXCELLENT, GOOD, FAIR, POOR, NONE, RECOVERED, RECOVERING, RECENT OR NO RECOVERY, HIGH, MODERATE, LOW. Channel score: 9.5/20.

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) RIPARIAN WIDTH FLOOD PLAIN QUALITY. Includes categories like EROSION, MODERATE, HEAVY/SEVERE, WIDE, MODERATE, NARROW, NONE, FOREST, SWAMP, SHRUB OR OLD FIELD, RESIDENTIAL, PARK, NEW FIELD, FENCED PASTURE, OPEN PASTURE, ROWCROP, CONSERVATION TILLAGE, URBAN OR INDUSTRIAL, MINING / CONSTRUCTION. Riparian score: 7/10.

5] POOL / GLIDE AND RIFFLE / RUN QUALITY MAXIMUM DEPTH CHANNEL WIDTH CURRENT VELOCITY Recreation Potential. Includes categories like > 1m, 0.7-1m, 0.4-0.7m, 0.2-0.4m, < 0.2m, POOL WIDTH > RIFFLE WIDTH, POOL WIDTH = RIFFLE WIDTH, POOL WIDTH < RIFFLE WIDTH, TORRENTIAL, VERY FAST, FAST, MODERATE, SLOW, INTERSTITIAL, INTERMITTENT, EDDIES. Pool/Current score: 5/12.

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS. Includes categories like BEST AREAS > 10cm, 5-10cm, < 5cm, MAXIMUM > 50cm, < 50cm, STABLE, MOD. STABLE, UNSTABLE, NONE, LOW, MODERATE, EXTENSIVE. Riffle/Run score: 5/8.

6] GRADIENT (25.9 ft/mi) DRAINAGE AREA (61 mi^2) VERY LOW - LOW, MODERATE, HIGH - VERY HIGH. %POOL: 20 %GLIDE: 60 %RUN: 5 %RIFFLE: 15 Gradient score: 10/10.

AJ SAMPLED REACH

Check ALL that apply

- METHOD**
- BOAT
 - WADE
 - L. LINE
 - OTHER
- STAGE**
- 1st -sample pass- 2nd
 - HJ&H
 - JP
 - NORMAL
 - LOW
 - DRY
- DISTANCE**
- 0.5 Km
 - 0.2 Km
 - 0.15 Km
 - 0.12 Km
 - OTHER

- CLARITY**
- 1st --sample pass-- 2nd
 - < 20 cm
 - 20-40 cm
 - 40-70 cm
 - > 70 cm/ CTB
 - SECCHI DEPTH
- meters

- CANOPY**
- 1st _____ cm
 - 2nd _____ cm
 - > 85% - OPEN
 - 65% - 85%
 - 30% - 65%
 - 10% - 30%
 - < 10% - CLOSED

- CJ RECREATION**
- AREA DEPTH
- POOL: >100ft² >3ft

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

BJ AESTHETICS

- NUISANCE ALGAE
- INVASIVE MACROPHYTES
- EXCESS TURBIDITY
- DISCOLORATION
- FOAM / SCUM
- OIL SHEEN
- TRASH / LITTER
- NUISANCE ODOR
- SLUDGE DEPOSITS
- CSOs/SSOs/OUTFALLS

DJ MAINTENANCE

- PUBLIC / PRIVATE / BOTH / NA
- ACTIVE / HISTORIC / BOTH / NA
- YOUNG-SUCCESSION-OLD
- SPRAY / SNAG / REMOVED
- MODIFIED / DIPPED OUT / NA
- LEVEED / ONE SIDED
- RELOCATED / CUTOFFS
- MOVING-BEDLOAD-STABLE
- ARMORED / SLUMPS
- ISLANDS / SCoured
- IMPOUNDED / DESICCATED
- FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

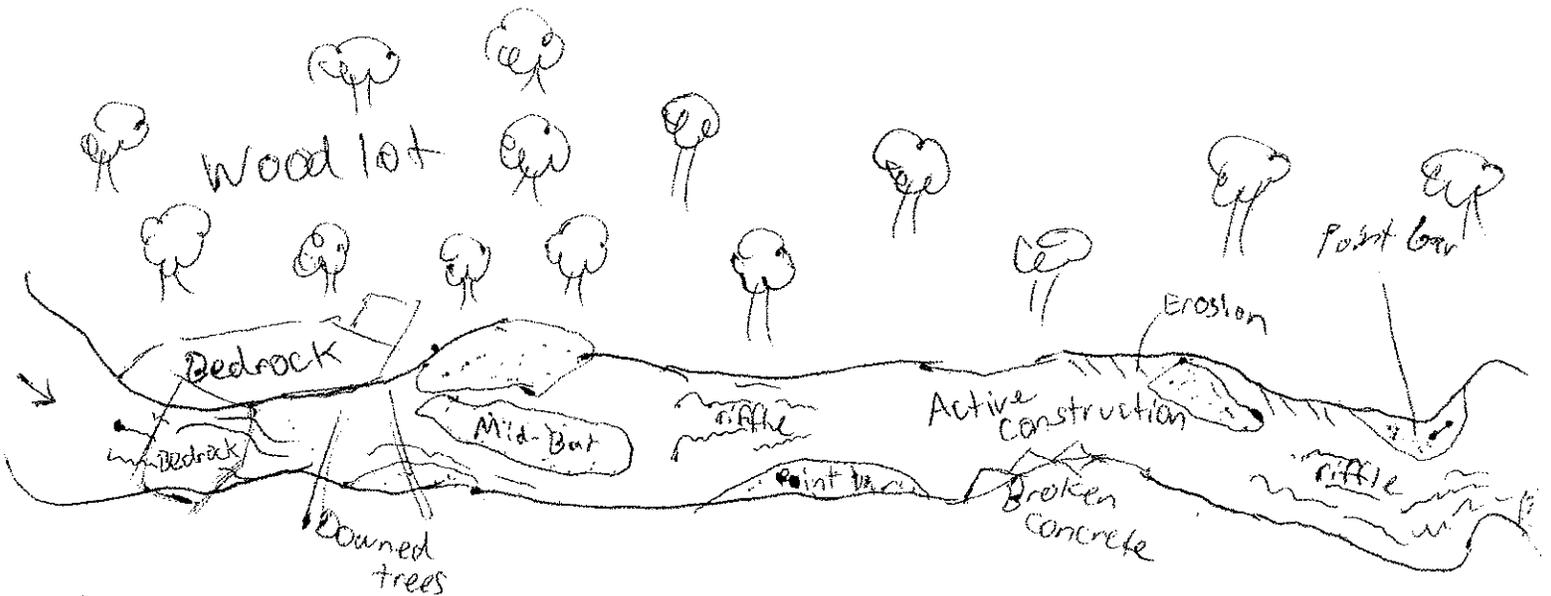
EJ ISSUES

- WWTP / CSO / NPDES / INDUSTRY
- HARDENED / URBAN / DIRT&GRIME
- CONTAMINATED / LANDFILL
- BMPs-CONSTRUCTION-SEDIMENT
- LOGGING / IRRIGATION / COOLING
- BANK / EROSION / SURFACE
- FALSE BANK / MANURE / LAGOON
- WASH H₂O / TILE / H₂O TABLE
- ACID / MINE / QUARRY / FLOW
- NATURAL / WETLAND / STAGNANT
- PARK / GOLF / LAWN / HOME
- ATMOSPHERE / DATA PAUCITY

FJ MEASUREMENTS

- \bar{x} width
- \bar{x} depth
- max. depth
- \bar{x} bankfull width
- bankfull \bar{x} depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio
- Legacy Tree:

Stream Drawing:





Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 54

Stream & Location: Peters Run QHEI 4 RM: _____ Date: 8/2/19

Scorers Full Name & Affiliation: Helena H. / HUI Assoc.

River Code: _____ STORET #: _____ Lat./ Long.: _____ 18 Office verified location

1] **SUBSTRATE** Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES		OTHER TYPES		ORIGIN		QUALITY	
<input type="checkbox"/> BLDR / SLABS [10]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/> POOL RIFFLE	<input type="checkbox"/> LIMESTONE [1]	<input type="checkbox"/> HEAVY [-2]	<input type="checkbox"/> MODERATE [-1]	<input type="checkbox"/> SUBSTRATE
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/> COBBLE [8]	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/> MUCK [2]	<input checked="" type="checkbox"/> TILLS [1]	<input type="checkbox"/> NORMAL [0]	<input type="checkbox"/> FREE [1]	<input type="checkbox"/> EXTENSIVE [-2]
<input checked="" type="checkbox"/> GRAVEL [7]	<u>20</u> / <u>50</u>	<input type="checkbox"/> SILT [2]	<u>20</u> / <u>70</u>	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> MODERATE [-1]	<input type="checkbox"/> MODERATE [-1]
<input checked="" type="checkbox"/> SAND [6]	<u>60</u> / <u>30</u>	<input type="checkbox"/> ARTIFICIAL [0]		<input type="checkbox"/> RIP/RAP [0]	<input type="checkbox"/> LACUSTURINE [0]	<input type="checkbox"/> NORMAL [0]	<input type="checkbox"/> NONE [1]
<input type="checkbox"/> BEDROCK [5]				<input type="checkbox"/> SHALE [-1]	<input type="checkbox"/> COAL FINES [-2]		

NUMBER OF BEST TYPES: 4 or more [2] 3 or less [0]

Comments: 13

2] **INSTREAM COVER** Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<u>1</u> UNDERCUT BANKS [1]	<u>1</u> POOLS > 70cm [2]	<u>1</u> OXBOWS, BACKWATERS [1]
<u>3</u> OVERHANGING VEGETATION [1]	<u>1</u> ROOTWADS [1]	<u>1</u> AQUATIC MACROPHYTES [1]
<u>1</u> SHALLOWS (IN SLOW WATER) [1]	<u>1</u> BOULDERS [1]	<u>2</u> LOGS OR WOODY DEBRIS [1]
<u>1</u> ROOTMATS [1]		

Comments: 11

3] **CHANNEL MORPHOLOGY** Check ONE in each category (Or 2 & average)

<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input checked="" type="checkbox"/> GOOD [6]	<input type="checkbox"/> RECOVERED [4]	<input checked="" type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input checked="" type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

Comments: 2 3 3 1.5

4] **BANK EROSION AND RIPARIAN ZONE** Check ONE in each category for EACH BANK (Or 2 per bank & average)

<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]	<input type="checkbox"/> CONSERVATION TILLAGE [1]
<input checked="" type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input checked="" type="checkbox"/> SHRUB OR OLD FIELD [2]	<input type="checkbox"/> URBAN OR INDUSTRIAL [0]
<input checked="" type="checkbox"/> HEAVY / SEVERE [1]	<input checked="" type="checkbox"/> NARROW 5-10m [2]	<input checked="" type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]	<input type="checkbox"/> MINING / CONSTRUCTION [0]
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]	
	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]	

Comments: 4

5] **POOL / GLIDE AND RIFFLE / RUN QUALITY**

<input type="checkbox"/> > 1m [6]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	<input type="checkbox"/> SLOW [1]
<input type="checkbox"/> 0.7-1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input type="checkbox"/> VERY FAST [1]	<input type="checkbox"/> INTERSTITIAL [-1]
<input type="checkbox"/> 0.4-0.7m [2]	<input checked="" type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input checked="" type="checkbox"/> FAST [1]	<input type="checkbox"/> INTERMITTENT [-2]
<input checked="" type="checkbox"/> 0.2-0.4m [1]		<input type="checkbox"/> MODERATE [1]	<input type="checkbox"/> EDDIES [1]
<input type="checkbox"/> < 0.2m [0]			

Comments: 0

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: NO RIFFLE [metric=0]

<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input checked="" type="checkbox"/> BEST AREAS 5-10cm [1]	<input checked="" type="checkbox"/> MAXIMUM < 50cm [1]	<input checked="" type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Comments: 0

6] **GRADIENT** (25.9 ft/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]

DRAINAGE AREA (6.1 mi²)

% POOL: % GLIDE: % RUN: % RIFFLE:

Comments: 10

AJ SAMPLED REACH

Check ALL that apply

- METHOD**
- BOAT
 - WADE
 - L. LINE
 - OTHER
- STAGE**
- 1st - sample pass - 2nd
- HIGH
 - UP
 - NORMAL
 - LOW
 - DRY
- DISTANCE**
- 0.6 Km
 - 0.2 Km
 - 0.16 Km
 - 0.12 Km
 - OTHER

- CLARITY**
- 1st - sample pass - 2nd
- < 20 cm
 - 20-40 cm
 - 40-70 cm
 - > 70 cm/ CTB.
 - SECCHI DEPTH

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

- CANOPY**
- 1st _____ cm
- 2nd _____ cm
- > 80% - OPEN
 - 55% - 86%
 - 30% - 55%
 - 10% - 30%
 - < 10% - CLOSED

BJ AESTHETICS

- NUISANCE ALGAE
- INVASIVE MAGROPHYTES
- EXCESS TURBIDITY
- DISCOLORATION
- FOAM / SCUM
- OIL SHEEN
- TRASH / LITTER
- NUISANCE ODOR
- SLUDGE DEPOSITS
- CSOs/SSOs/OUTFALLS

DJ MAINTENANCE

- PUBLIC / PRIVATE / BOTH / NA
- ACTIVE / HISTORIC / BOTH / NA
- YOUNG-SUCCESSION-OLD
- SPRAY / SNAG / REMOVED
- MODIFIED / DIPPED OUT / NA
- LEVEED / ONE SIDED
- RELOCATED / CUTOFFS
- MOVING-BEDLOAD-STABLE
- ARMoured / SLUMPS
- ISLANDS / SCoured
- IMPOUNDED / DESICCATED
- FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

EJ ISSUES

- WWTP / CSO / NPDES / INDUSTRY
- HARDENED / URBAN / DIRT&GRIME
- CONTAMINATED / LANDFILL
- BMPs-CONSTRUCTION-SEDIMENT
- LOGGING / IRRIGATION / COOLING
- BANK / EROSION / SURFACE
- FALSE BANK / MANURE / LAGOON
- WASH H₂O / TILE / H₂O TABLE
- ACID / MINE / QUARRY / FLOW
- NATURAL / WETLAND / STAGNANT
- PARK / GOLF / LAWN / HOME
- ATMOSPHERE / DATA PAUCITY

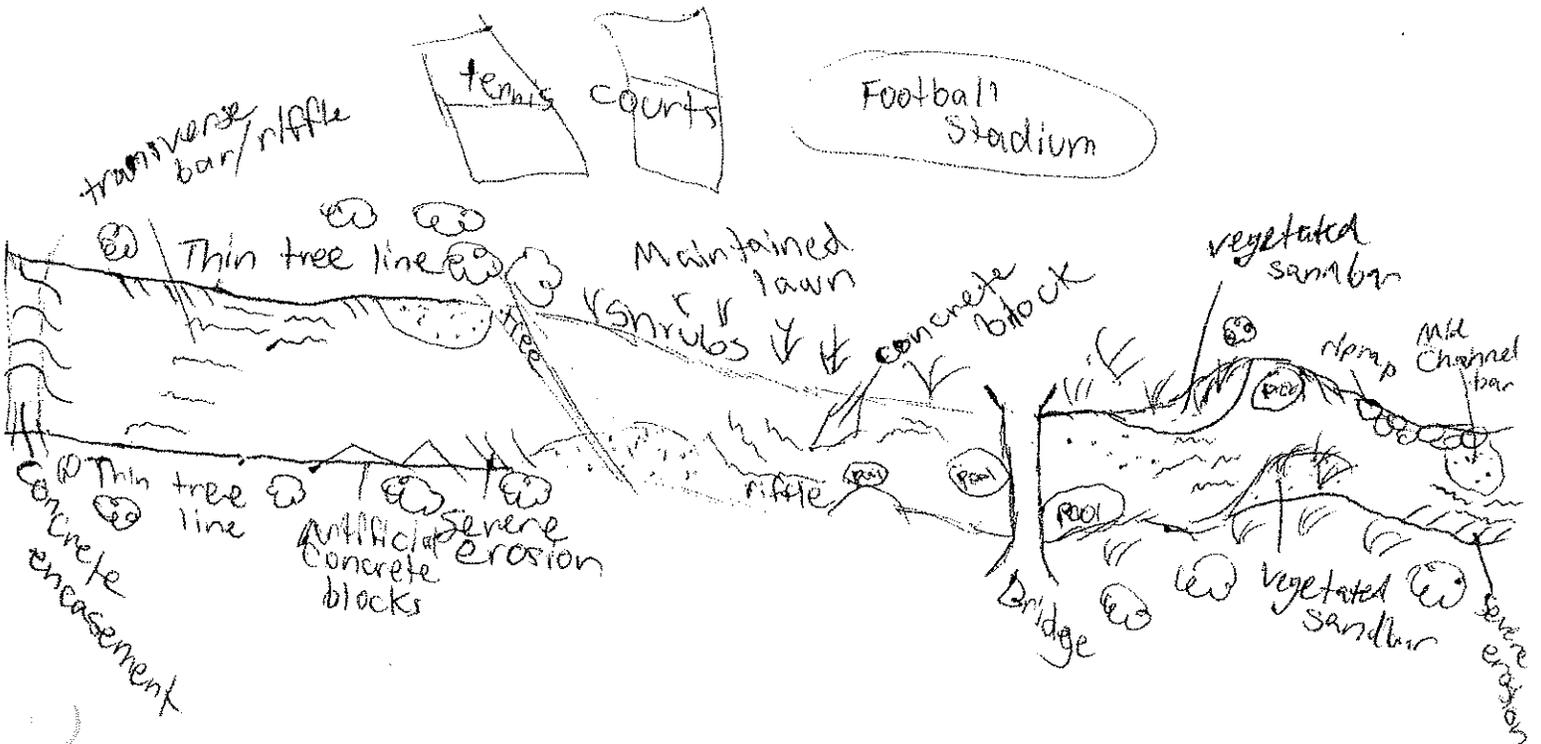
FJ MEASUREMENTS

- \bar{x} width
- \bar{x} depth
- max. depth
- \bar{x} bankfull width
- bankfull \bar{x} depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio
- Legacy Tree:

CJ RECREATION

- AREA DEPTH
- POOL: >100ft² >3ft

Stream Drawing:





Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 48.75

Stream & Location: Fetters Run QHEI 5 **RM:** _____ **Date:** 8/21/9
Scorers Full Name & Affiliation: Helena H. Hull & Assoc.

River Code: _____ **STORET #:** _____ **Lat./ Long.:** _____ **18** **Office verified location**

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL RIFFLE	OTHER TYPES	POOL RIFFLE	ORIGIN	QUALITY
<input type="checkbox"/> BLDR / SLABS [10]	<input type="checkbox"/>	<input type="checkbox"/> HARDPAN [4]	<input type="checkbox"/>	<input type="checkbox"/> LIMESTONE [1]	<input checked="" type="checkbox"/> HEAVY [-2]
<input type="checkbox"/> BOULDER [9]	<input type="checkbox"/>	<input type="checkbox"/> DETRITUS [3]	<input type="checkbox"/>	<input checked="" type="checkbox"/> TILLS [1]	<input type="checkbox"/> MODERATE [-1]
<input type="checkbox"/> COBBLE [8]	<u>20</u>	<input type="checkbox"/> MUCK [2]	<input type="checkbox"/>	<input type="checkbox"/> WETLANDS [0]	<input type="checkbox"/> NORMAL [0]
<input checked="" type="checkbox"/> GRAVEL [7]	<u>5</u> <u>40</u>	<input type="checkbox"/> SILT [2]	<u>40</u> <u>5</u>	<input type="checkbox"/> HARDPAN [0]	<input type="checkbox"/> FREE [1]
<input checked="" type="checkbox"/> SAND [6]	<u>95</u> <u>35</u>	<input type="checkbox"/> ARTIFICIAL [0]	<input type="checkbox"/>	<input type="checkbox"/> SANDSTONE [0]	<input type="checkbox"/> EXTENSIVE [-2]
<input type="checkbox"/> BEDROCK [5]				<input type="checkbox"/> RIP/RAP [0]	<input checked="" type="checkbox"/> MODERATE [-1]

NUMBER OF BEST TYPES: 4 or more [2] 3 or less [0]

Comments: 5/11 = Heavy upstream construction

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

<input type="checkbox"/> UNDERCUT BANKS [1]	<input type="checkbox"/> POOLS > 70cm [2]	<input type="checkbox"/> OXBOWS, BACKWATERS [1]	AMOUNT
<u>2</u> <input checked="" type="checkbox"/> OVERHANGING VEGETATION [1]	<input type="checkbox"/> ROOTWADS [1]	<input type="checkbox"/> AQUATIC MACROPHYTES [1]	Check ONE (Or 2 & average)
<input type="checkbox"/> SHALLOWS (IN SLOW WATER) [1]	<input type="checkbox"/> BOULDERS [1]	<input type="checkbox"/> LOGS OR WOODY DEBRIS [1]	<input type="checkbox"/> EXTENSIVE >75% [11]
<input type="checkbox"/> ROOTMATS [1]			<input checked="" type="checkbox"/> MODERATE 25-75% [7]
			<input type="checkbox"/> SPARSE 5-<25% [3]
			<input type="checkbox"/> NEARLY ABSENT <5% [1]

Comments: 1 1 7

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
<input type="checkbox"/> HIGH [4]	<input type="checkbox"/> EXCELLENT [7]	<input type="checkbox"/> NONE [6]	<input type="checkbox"/> HIGH [3]
<input type="checkbox"/> MODERATE [3]	<input type="checkbox"/> GOOD [5]	<input type="checkbox"/> RECOVERED [4]	<input checked="" type="checkbox"/> MODERATE [2]
<input checked="" type="checkbox"/> LOW [2]	<input checked="" type="checkbox"/> FAIR [3]	<input checked="" type="checkbox"/> RECOVERING [3]	<input checked="" type="checkbox"/> LOW [1]
<input type="checkbox"/> NONE [1]	<input type="checkbox"/> POOR [1]	<input type="checkbox"/> RECENT OR NO RECOVERY [1]	

Comments: 2 3 3 1.5

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

EROSION	RIPARIAN WIDTH	FLOOD PLAIN QUALITY
<input type="checkbox"/> NONE / LITTLE [3]	<input type="checkbox"/> WIDE > 50m [4]	<input type="checkbox"/> FOREST, SWAMP [3]
<input type="checkbox"/> MODERATE [2]	<input type="checkbox"/> MODERATE 10-50m [3]	<input checked="" type="checkbox"/> SHRUB OR OLD FIELD [2]
<input checked="" type="checkbox"/> HEAVY / SEVERE [1]	<input type="checkbox"/> NARROW 5-10m [2]	<input checked="" type="checkbox"/> RESIDENTIAL, PARK, NEW FIELD [1]
	<input checked="" type="checkbox"/> VERY NARROW < 5m [1]	<input type="checkbox"/> FENCED PASTURE [1]
	<input type="checkbox"/> NONE [0]	<input type="checkbox"/> OPEN PASTURE, ROWCROP [0]

Comments: 0 2 1

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH	CHANNEL WIDTH	CURRENT VELOCITY	Recreation Potential Primary Contact Secondary Contact <small>(circle one and comment on back)</small>
Check ONE (ONLY)	Check ONE (Or 2 & average)	Check ALL that apply	
<input type="checkbox"/> > 1m [6]	<input type="checkbox"/> POOL WIDTH > RIFFLE WIDTH [2]	<input type="checkbox"/> TORRENTIAL [-1]	Pool / Current Maximum 3
<input type="checkbox"/> 0.7-<1m [4]	<input type="checkbox"/> POOL WIDTH = RIFFLE WIDTH [1]	<input checked="" type="checkbox"/> VERY FAST [1]	
<input type="checkbox"/> 0.4-<0.7m [2]	<input checked="" type="checkbox"/> POOL WIDTH < RIFFLE WIDTH [0]	<input type="checkbox"/> INTERSTITIAL [-1]	Maximum 12
<input checked="" type="checkbox"/> 0.2-<0.4m [1]		<input checked="" type="checkbox"/> FAST [1]	
<input type="checkbox"/> < 0.2m [0]		<input type="checkbox"/> INTERMITTENT [-2]	

Comments: 1 0 2

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
<input type="checkbox"/> BEST AREAS > 10cm [2]	<input type="checkbox"/> MAXIMUM > 50cm [2]	<input type="checkbox"/> STABLE (e.g., Cobble, Boulder) [2]	<input type="checkbox"/> NONE [2]
<input checked="" type="checkbox"/> BEST AREAS 5-10cm [1]	<input type="checkbox"/> MAXIMUM < 50cm [1]	<input checked="" type="checkbox"/> MOD. STABLE (e.g., Large Gravel) [1]	<input type="checkbox"/> LOW [1]
<input type="checkbox"/> BEST AREAS < 5cm [metric=0]		<input type="checkbox"/> UNSTABLE (e.g., Fine Gravel, Sand) [0]	<input checked="" type="checkbox"/> MODERATE [0]
			<input type="checkbox"/> EXTENSIVE [-1]

Comments: 1 1 1 3

6] GRADIENT (25.9 ft/mi) VERY LOW - LOW [2-4] MODERATE [6-10] HIGH - VERY HIGH [10-6]

DRAINAGE AREA (6.1 mi²)

% POOL: 0 **% GLIDE:** 0

% RUN: 8 **% RIFFLE:** 8

Gradient Maximum 10

AJ SAMPLED REACH
Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of stream?, Recreation/ Observed - Inferred, Other/ Sampling observations, Concerns, Access directions, etc.

- METHOD**
- BOAT
 - WADE
 - L. LINE
 - OTHER
- DISTANCE**
- 0.8 Km
 - 0.2 Km
 - 0.16 Km
 - 0.12 Km
 - OTHER

- STAGE**
- 1st - sample pass - 2nd
- HIGH
 - UP
 - NORMAL
 - LOW
 - DRY

Construction active upstream

- CLARITY**
- 1st - sample pass - 2nd
- < 20 cm
 - 20-40 cm
 - 40-70 cm
 - > 70 cm/ GTB
 - SECCHI DEPTH
- CANOPY**
- 1st - sample pass - 2nd
- 80% - OPEN
 - 65% - 85%
 - 30% - 65%
 - 10% - 30%
 - < 10% - CLOSED

- BJ AESTHETICS**
- NUISANCE ALGAE
 - INVASIVE MACROPHYTES
 - EXCESS TURBIDITY
 - DISCOLORATION
 - FOAM / SCUM
 - OIL SHEEN
 - TRASH / LITTER
 - NUISANCE ODOR
 - SLUDGE DEPOSITS
 - CSOs/ISSOs/OUTFALLS

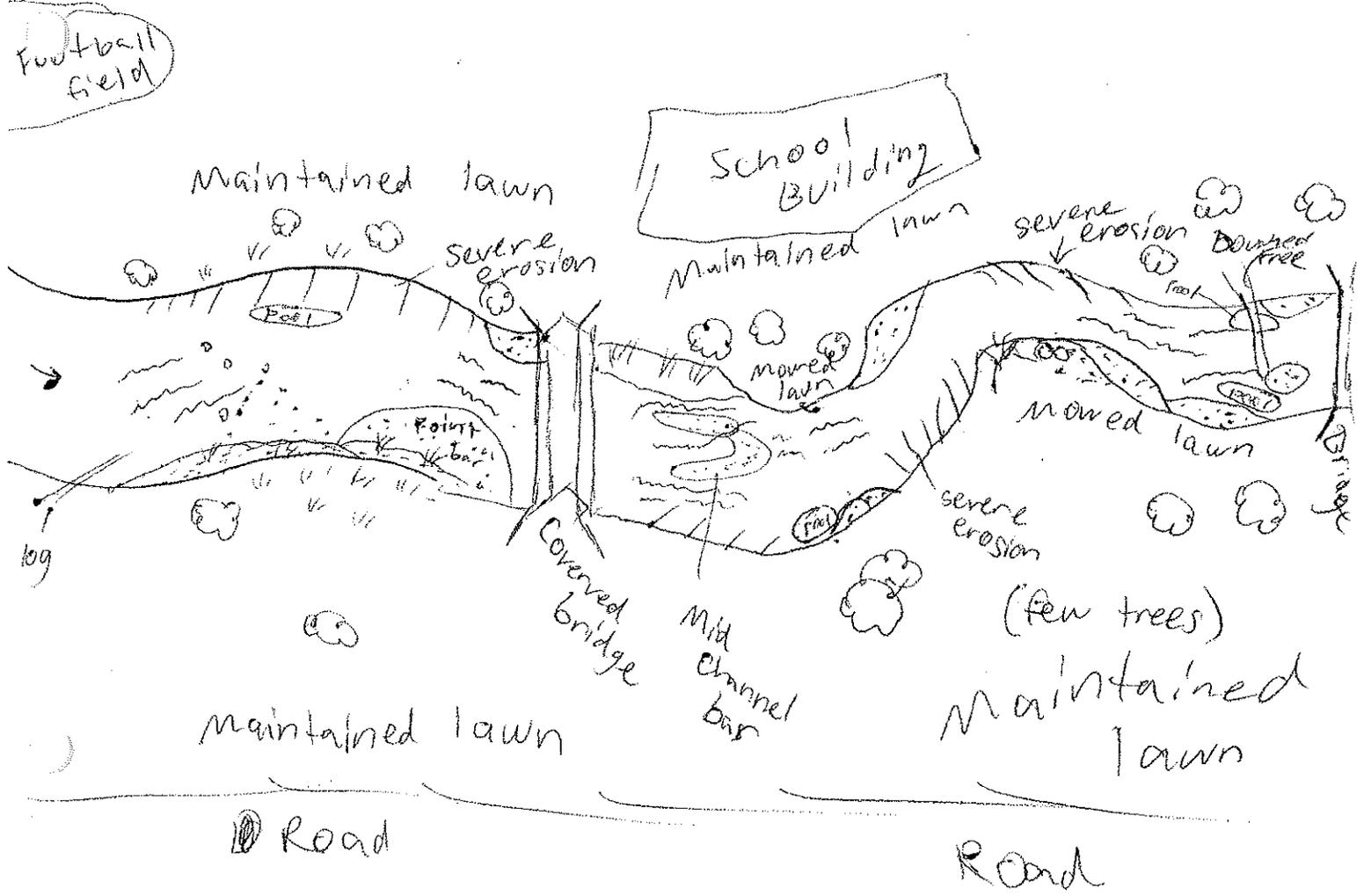
- DJ MAINTENANCE**
- PUBLIC / PRIVATE / BOTH / NA
 - ACTIVE / HISTORIC / BOTH / NA
 - YOUNG-SUCCESSION-OLD
 - SPRAY / SNAG / REMOVED
 - MODIFIED / DIPPED OUT / NA
 - LEVEED / ONE SIDED
 - RELOCATED / CUTOFFS
 - MOVING-BEDLOAD-STABLE
 - ARMoured / SLUMPS
 - ISLANDS / SCoured
 - IMPOUNDED / DESICCATED
 - FLOOD CONTROL / DRAINAGE

Circle some & COMMENT

- EJ ISSUES**
- WWTP / CSO / NPDES / INDUSTRY
 - HARDENED / URBAN / DIRT&GRIME
 - CONTAMINATED / LANDFILL
 - BMPs-CONSTRUCTION-SEDIMENT
 - LOGGING / IRRIGATION / COOLING
 - BANK / EROSION / SURFACE
 - FALSE BANK / MANURE / LAGOON
 - WASH H₂O / TILE / H₂O TABLE
 - ACID / MINE / QUARRY / FLOW
 - NATURAL / WETLAND / STAGNANT
 - PARK / GOLF / LAWN / HOME
 - ATMOSPHERE / DATA PAUCITY

- FJ MEASUREMENTS**
- \bar{x} width
 - \bar{x} depth
 - max. depth
 - \bar{x} bankfull width
 - bankfull \bar{x} depth
 - W/D ratio
 - bankfull max. depth
 - floodprone x^2 width
 - entrench. ratio
 - Legacy Tree:

Stream Drawing:



River Stability Field Guide Forms & Worksheets

- ✓ This file contains all the worksheets from the *River Stability Field Guide* (2nd Edition, 2014).
- ✓ Some of the worksheets contain checkbox functions; depending on which version of excel you have, the macros need to be enabled and the security settings need to be set to *medium*.
- ✓ Most worksheets are "protected" so you don't accidentally delete formulas and text. There is no protection password on the worksheets; you can "unprotect" the sheet within "Permissions" under the "File" tab.
- ✓ Most worksheets contain fields to insert the *Stream Name*, *Location*, *Observers*, *Stream Type*, *Valley Type*, and *Date*. Enter these fields below to have them automatically inserted in all the worksheets:

Stream:	Fetters Run	Stream Type:
Location:	Lancaster, Fairfield County, Ohio	Valley Type*:
Observers:	H. Hayter, B. Petru, P. Renner	Date: 8/1/2019

*For Valley Type, enter the identifier

Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 2, Right Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.96 (A)	Bankfull Height (ft) =	2.63 (B)	$(A) / (B) =$	1.89 (C)	7.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.33 (D)	Study Bank Height (ft) =	4.96 (A)	$(D) / (A) =$	0.27 (E)	6.5
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$			5.3629 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	120 (H)				10.0	
Surface Protection (I)						
Surface Protection as % =	0% (I)				10.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)						
Bank Material Adjustment					10	
Stratification Adjustment					10	
Add 5-10 points, depending on position of unstable layers in relation to bankfull stage					10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	Extreme
						63.0
Bank Sketch						
Vertical distance (ft)	Horizontal distance (ft)					
12						
11						
10						
9						
8						
7						
6						
5						
4						
3						
2						
1						
0						
0	1	2	3	4	5	6

Station: **Section 2, Right Bank**

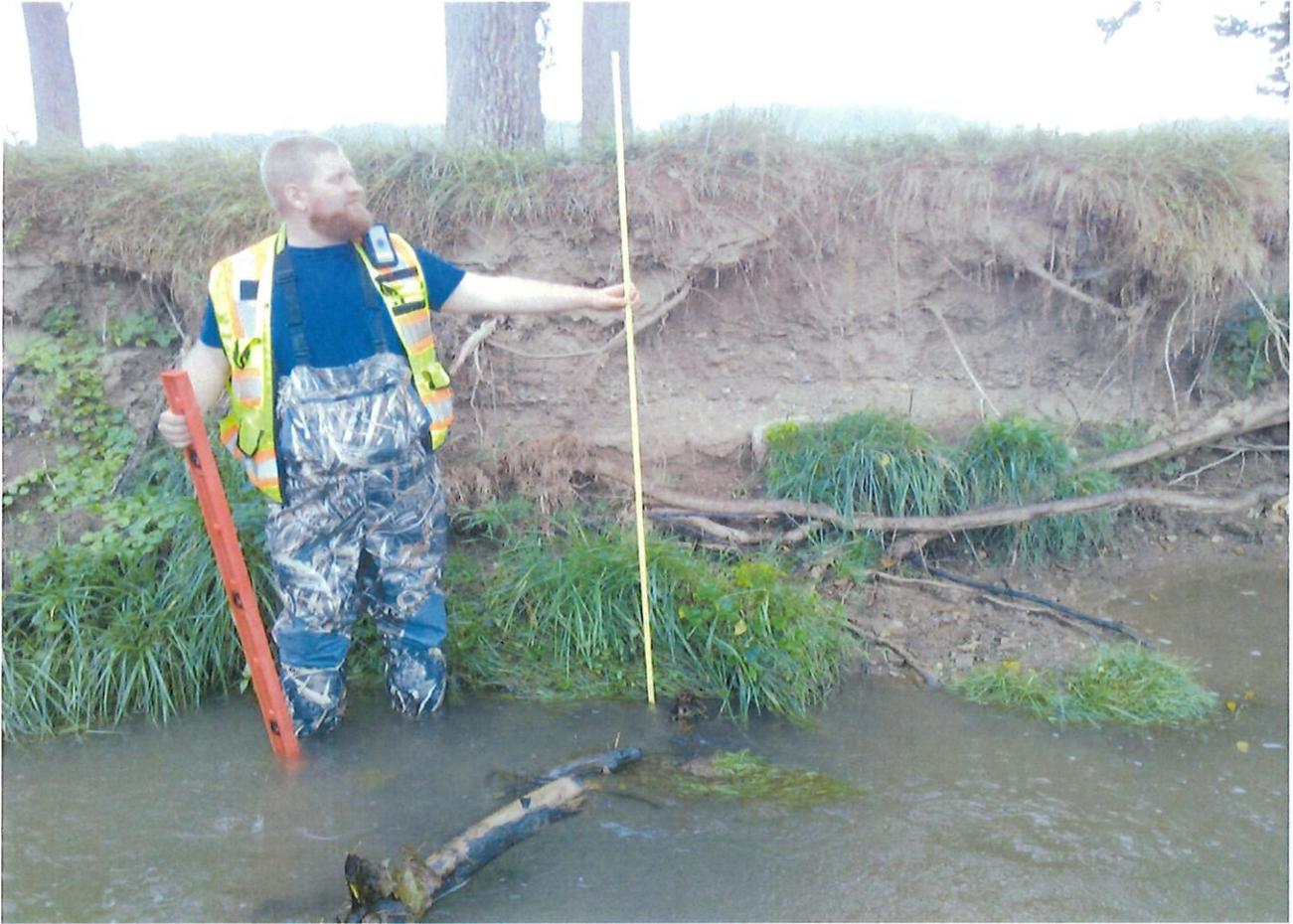


Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 3, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	6.00 (A)	Bankfull Height (ft) =	2.58 (B)	$(A) / (B) =$	2.33 (C)	8.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.00 (D)	Study Bank Height (ft) =	6.00 (A)	$(D) / (A) =$	0.17 (E)	7.5
Weighted Root Density (G)						
Root Density as % =	10.00 (F)	$(F) \times (E) =$			1.66667 (G)	10.0
Bank Angle (H)						
Bank Angle as Degrees =	111 (H)				8.5	
Surface Protection (I)						
Surface Protection as % =	20% (I)				7.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme 61.5

The diagram illustrates a cross-section of a stream bank. A dashed horizontal line represents the 'Bankfull' stage. The 'Study Bank Height (A)' is the vertical distance from the 'Start of Bank' to the top of the bank. The 'Bankfull Height (B)' is the vertical distance from the 'Start of Bank' to the 'Bankfull' line. 'Root Depth (D)' is the vertical distance from the ground surface to the roots of a plant. 'Bank Angle (H)' is the angle of the bank face. 'Surface Protection (I)' is the area of the bank face covered by vegetation. The 'Start of Bank' is the point where the bank meets the stream bed.

Station: **Section 3, Left Bank**



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 5, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.66 (A)	Bankfull Height (ft) =	1.90 (B)	$(A) / (B) =$	2.45 (C)	8.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.10 (D)	Study Bank Height (ft) =	4.66 (A)	$(D) / (A) =$	0.24 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	30.00 (F)	$(F) \times (E) =$			7.08155 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	45 (H)				3.0	
Surface Protection (I)						
Surface Protection as % =	80% (I)				2.0	
Bank Material Adjustment:						
<ul style="list-style-type: none"> Bedrock (Overall <i>Very Low</i> BEHI) Boulders (Overall <i>Low</i> BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 				Bank Material Adjustment	10	
				Stratification Adjustment	0	
				Adjective Rating and Total Score	High 39.5	
<i>Very Low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Very High</i>	<i>Extreme</i>	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation on the study bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective material.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Station: **Section 5, Left Bank**



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 6, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.66 (A)	Bankfull Height (ft) =	1.90 (B)	$(A) / (B) =$	2.45 (C)	8.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.10 (D)	Study Bank Height (ft) =	4.66 (A)	$(D) / (A) =$	0.24 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	30.00 (F)	$(F) \times (E) =$			7.08155 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	45 (H)				3.0	
Surface Protection (I)						
Surface Protection as % =	80% (I)				2.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)					Bank Material Adjustment	10
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage					Stratification Adjustment	0
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	High
						39.5

Section 6, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 6, Right Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	5.50 (A)	Bankfull Height (ft) =	3.40 (B)	$(A) / (B) =$	1.62 (C)	6.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.10 (D)	Study Bank Height (ft) =	5.50 (A)	$(D) / (A) =$	0.20 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	25.00 (F)			$(F) \times (E) =$	5 (G)	9.5
Bank Angle (H)						
		Bank Angle as Degrees =	45 (H)			3.0
Surface Protection (I)						
		Surface Protection as % =	75% (I)			2.5
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		5
<i>Very Low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Very High</i>	<i>Extreme</i>	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Very High 43.0

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation.
- Start of Bank:** The point where the bank meets the stream bed.

Section 6, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)																																																																					
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio																																																																		
Station: Section 7, Right Bank			Observers: H. Hayter, B. Petru, P. Renner																																																																		
Date: 8/1/2019		Stream Type:		Valley Type:																																																																	
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)																																																															
Study Bank Height (ft) =	6.25 (A)	Bankfull Height (ft) =	2.83 (B)	$(A) / (B) =$	2.21 (C)	8.5																																																															
Root Depth to Study Bank Height (E)																																																																					
Root Depth (ft) =	1.30 (D)	Study Bank Height (ft) =	6.25 (A)	$(D) / (A) =$	0.21 (E)	7.0																																																															
Weighted Root Density (G)																																																																					
Root Density as % =	20.00 (F)			$(F) \times (E) =$	4.16 (G)	9.5																																																															
Bank Angle (H)																																																																					
		Bank Angle as Degrees =			148 (H)	10.0																																																															
Surface Protection (I)																																																																					
		Surface Protection as % =			10% (I)	10.0																																																															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="5" style="text-align: left;">Bank Material Adjustment:</td> <td style="text-align: center;">Bank Material Adjustment</td> <td style="text-align: center; border: 1px solid black;">10</td> </tr> <tr> <td style="padding: 2px;">Bedrock (Overall Very Low BEHI)</td> <td colspan="4"></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Boulders (Overall Low BEHI)</td> <td colspan="4"></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Cobble (Subtract 10 points if uniform medium to large cobble)</td> <td colspan="4"></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand)</td> <td colspan="4"></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Sand (Add 10 points)</td> <td colspan="4"></td> <td></td> <td></td> </tr> <tr> <td style="padding: 2px;">Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)</td> <td colspan="4"></td> <td></td> <td></td> </tr> <tr> <td colspan="5"></td> <td style="text-align: center;">Stratification Adjustment</td> <td style="text-align: center; border: 1px solid black;">10</td> </tr> <tr> <td colspan="5"></td> <td style="padding: 2px;">Add 5-10 points, depending on position of unstable layers in relation to bankfull stage</td> <td></td> </tr> </table>							Bank Material Adjustment:					Bank Material Adjustment	10	Bedrock (Overall Very Low BEHI)							Boulders (Overall Low BEHI)							Cobble (Subtract 10 points if uniform medium to large cobble)							Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand)							Sand (Add 10 points)							Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)												Stratification Adjustment	10						Add 5-10 points, depending on position of unstable layers in relation to bankfull stage	
Bank Material Adjustment:					Bank Material Adjustment	10																																																															
Bedrock (Overall Very Low BEHI)																																																																					
Boulders (Overall Low BEHI)																																																																					
Cobble (Subtract 10 points if uniform medium to large cobble)																																																																					
Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand)																																																																					
Sand (Add 10 points)																																																																					
Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)																																																																					
					Stratification Adjustment	10																																																															
					Add 5-10 points, depending on position of unstable layers in relation to bankfull stage																																																																
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score																																																															
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	Extreme																																																															
						65.0																																																															

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The vertical distance from the stream bed to the surface of the bank.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 7, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 8, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	6.30 (A)	Bankfull Height (ft) =	4.00 (B)	$(A) / (B) =$	1.58 (C)	6.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.50 (D)	Study Bank Height (ft) =	6.30 (A)	$(D) / (A) =$	0.08 (E)	8.5
Weighted Root Density (G)						
Root Density as % =	10.00 (F)	$(F) \times (E) =$			0.79365 (G)	10.0
Bank Angle (H)						
Bank Angle as Degrees =	55 (H)				4.0	
Surface Protection (I)						
Surface Protection as % =	60% (I)				3.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)					Bank Material Adjustment	10
					Stratification Adjustment	5
					Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme
						47.0

The diagram illustrates a cross-section of a stream bank. Key features and measurements are labeled:

- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of a grass plant.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation.
- Start of Bank:** The point where the bank begins to rise from the streambed.
- Bankfull:** The top edge of the bank when the stream is at its normal stage.
- Bankfull Height (B):** The vertical distance from the streambed to the bankfull stage.
- Study Bank Height (A):** The vertical distance from the streambed to the top of the study bank.

Section 8, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 8, Right Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	8.42 (A)	Bankfull Height (ft) =	3.75 (B)	$(A) / (B) =$	2.25 (C)	8.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.00 (D)	Study Bank Height (ft) =	8.42 (A)	$(D) / (A) =$	0.12 (E)	8.5
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$			2.3753 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =	45 (H)				3.5	
Surface Protection (I)						
Surface Protection as % =	50% (I)				4.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)			Bank Material Adjustment		10	
			Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score Extreme 54.5
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective measures.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 8, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 9, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	6.00 (A)	Bankfull Height (ft) =	1.50 (B)	(A) / (B) =	4.00 (C)	10.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.40 (D)	Study Bank Height (ft) =	6.00 (A)	(D) / (A) =	0.23 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	15.00 (F)			(F) × (E) =	3.5 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =			70 (H)			5.0
Surface Protection (I)						
Surface Protection as % =			30% (I)			6.0
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment		0
				Adjective Rating and Total Score		47.5
<i>Very Low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Very High</i>	<i>Extreme</i>	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	

Section 9, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 10, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	8.42 (A)	Bankfull Height (ft) =	2.33 (B)	$(A) / (B) =$	3.61 (C)	10.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.50 (D)	Study Bank Height (ft) =	8.42 (A)	$(D) / (A) =$	0.06 (E)	9.0
Weighted Root Density (G)						
Root Density as % =	30.00 (F)	$(F) \times (E) =$			1.78147 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =	35 (H)				3.0	
Surface Protection (I)						
Surface Protection as % =	70% (I)				3.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment		8
				Adjective Rating and Total Score		52.5
Very Low	Low	Moderate	High	Very High	Extreme	
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the top of the bank at full stage.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective materials.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 10, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use **Figure 3-7** to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 10, Right Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	9.17 (A)	Bankfull Height (ft) =	3.00 (B)	$(A) / (B) =$	3.06 (C)	9.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.66 (D)	Study Bank Height (ft) =	9.17 (A)	$(D) / (A) =$	0.07 (E)	8.5
Weighted Root Density (G)						
Root Density as % =	30.00 (F)	$(F) \times (E) =$			2.15921 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =	30 (H)				2.5	
Surface Protection (I)						
Surface Protection as % =	85% (I)				1.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)			Bank Material Adjustment		10	
			Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		8	
Adjective Rating and Total Score						
Very Low	Low	Moderate	High	Very High	Extreme	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	49.5

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant growing on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective measures.
- Start of Bank:** The point where the bank meets the stream bed.

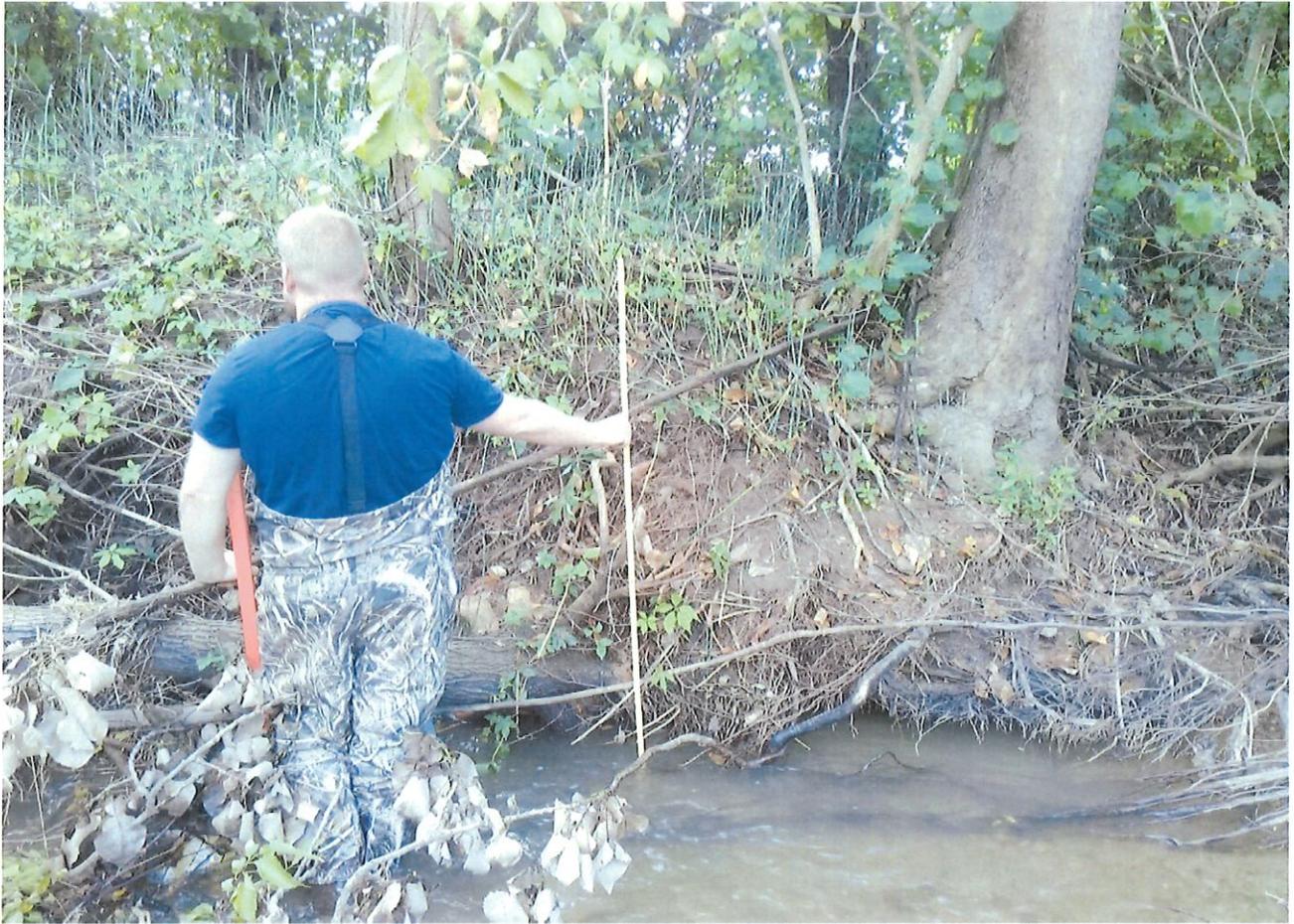
Section 10, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 12, Right Bank				Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	6.60 (A)	Bankfull Height (ft) =	2.80 (B)	(A) / (B) =	2.36 (C)	8.5	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	2.30 (D)	Study Bank Height (ft) =	6.60 (A)	(D) / (A) =	0.35 (E)	5.0	
Weighted Root Density (G)							
Root Density as % =	25.00 (F)	(F) × (E) =			8.71212 (G)	8.5	
Bank Angle (H)							
Bank Angle as Degrees =	57 (H)					3.5	
Surface Protection (I)							
Surface Protection as % =	20% (I)					7.0	
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		8	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						50.5	

Section 12, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 13, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	8.67 (A)	Bankfull Height (ft) =	2.67 (B)	(A) / (B) =	3.25 (C)	10.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.42 (D)	Study Bank Height (ft) =	8.67 (A)	(D) / (A) =	0.05 (E)	9.0
Weighted Root Density (G)						
Root Density as % =	15.00 (F)			(F) × (E) =	0.72664 (G)	10.0
Bank Angle (H)						
		Bank Angle as Degrees =	50 (H)			3.5
Surface Protection (I)						
		Surface Protection as % =	15% (I)			7.5
Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)			Bank Material Adjustment		10	
			Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme 60.0

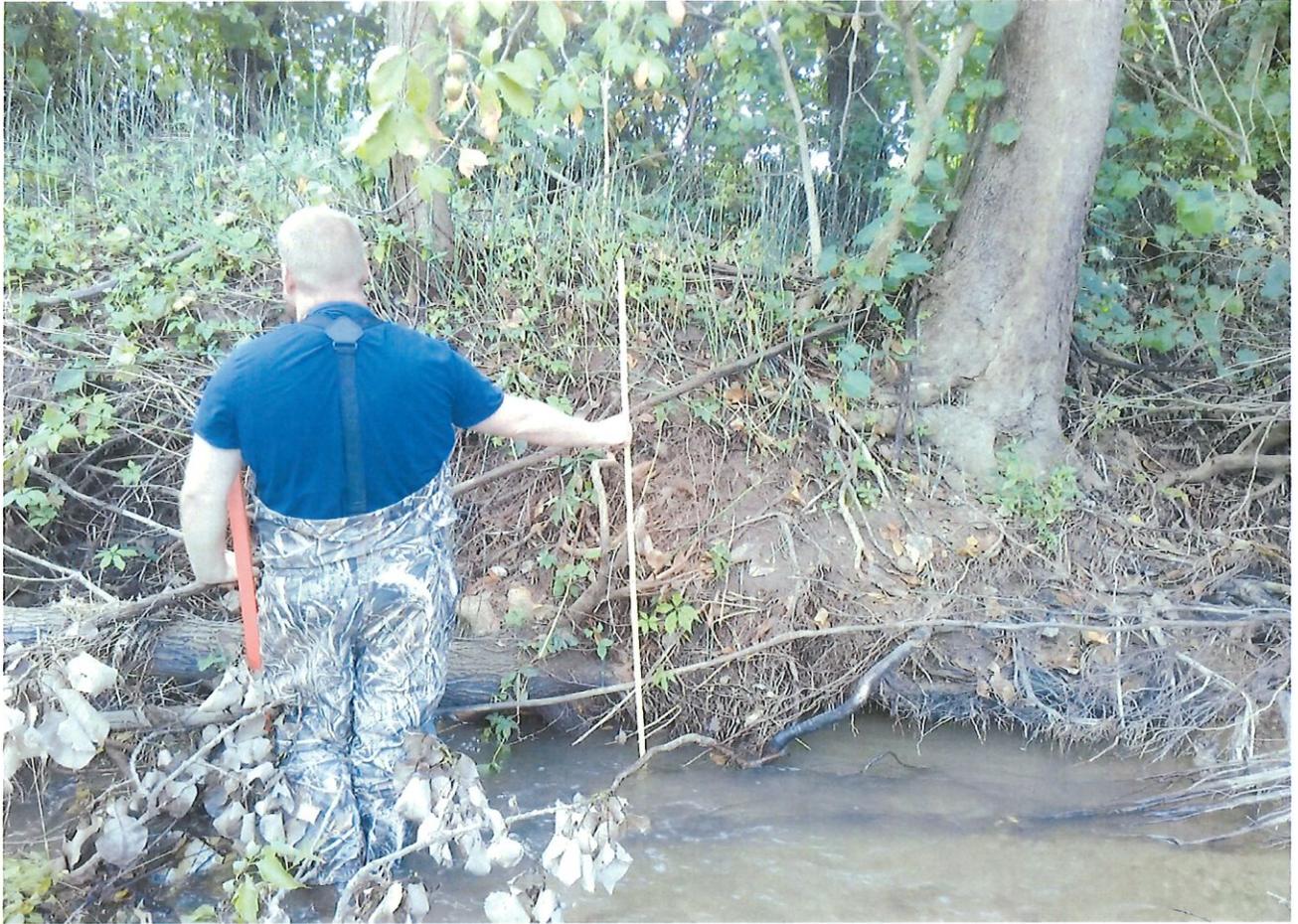
Section 13, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)																						
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio																		
Station: Section 13, Right Bank				Observers: H. Hayter, B. Petru, P. Renner																		
Date: 8/1/2019		Stream Type:		Valley Type:																		
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)															
Study Bank Height (ft) =	6.60 (A)	Bankfull Height (ft) =	2.80 (B)	$(A) / (B) =$		2.36 (C)	8.5															
Root Depth to Study Bank Height (E)																						
Root Depth (ft) =	2.30 (D)	Study Bank Height (ft) =	6.60 (A)	$(D) / (A) =$		0.35 (E)	5.0															
Weighted Root Density (G)																						
Root Density as % =	25.00 (F)			$(F) \times (E) =$		8.71212 (G)	8.5															
Bank Angle (H)																						
Bank Angle as Degrees =	57 (H)						3.5															
Surface Protection (I)																						
Surface Protection as % =	20% (I)						7.0															
Bank Material Adjustment:																						
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 				<div style="font-size: 2em; color: #ccc;">➔</div>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Bank Material Adjustment</td> <td style="text-align: center; font-size: 1.2em;">10</td> </tr> <tr> <td style="text-align: center;">Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage</td> <td style="text-align: center; font-size: 1.2em;">8</td> </tr> </table>	Bank Material Adjustment	10	Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	8												
Bank Material Adjustment	10																					
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	8																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Very Low</td> <td style="text-align: center;">Low</td> <td style="text-align: center;">Moderate</td> <td style="text-align: center;">High</td> <td style="text-align: center;">Very High</td> <td style="text-align: center;">Extreme</td> </tr> <tr> <td style="text-align: center;">5 – 9.5</td> <td style="text-align: center;">10 – 19.5</td> <td style="text-align: center;">20 – 29.5</td> <td style="text-align: center;">30 – 39.5</td> <td style="text-align: center;">40 – 45</td> <td style="text-align: center;">46 – 50</td> </tr> </table> <div style="text-align: center; font-size: 2em; color: #ccc; margin-top: 5px;">➔</div>						Very Low	Low	Moderate	High	Very High	Extreme	5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Adjective Rating and Total Score</td> <td style="text-align: center; font-size: 1.2em;">Extreme</td> </tr> <tr> <td style="text-align: center;">Total Score</td> <td style="text-align: center; font-size: 1.2em;">50.5</td> </tr> </table>	Adjective Rating and Total Score	Extreme	Total Score	50.5
Very Low	Low	Moderate	High	Very High	Extreme																	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50																	
Adjective Rating and Total Score	Extreme																					
Total Score	50.5																					

Section 13, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 14, Left Bank				Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	8.67	(A)	Bankfull Height (ft) =	2.67	(B)	(A) / (B) =	3.25
						(C)	10.0
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	0.42	(D)	Study Bank Height (ft) =	8.67	(A)	(D) / (A) =	0.05
						(E)	9.0
Weighted Root Density (G)							
Root Density as % =	15.00	(F)				(F) × (E) =	0.72664
						(G)	10.0
Bank Angle (H)							
		Bank Angle as Degrees =	50		(H)		3.5
Surface Protection (I)							
		Surface Protection as % =	15%		(I)		7.5
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 							Bank Material Adjustment
							10
Stratification Adjustment							
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	60.0	

The diagram illustrates a cross-section of a stream bank. Key features and measurements are labeled:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective material.
- Start of Bank:** The point where the bank meets the stream bed.

Section 14, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 15, Left Bank			Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	5.25 (A)	Bankfull Height (ft) =	1.91 (B)	$(A) / (B) =$	2.75 (C)	8.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.40 (D)	Study Bank Height (ft) =	5.25 (A)	$(D) / (A) =$	0.27 (E)	6.5
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$			5.33333 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	35 (H)				3.0	
Surface Protection (I)						
Surface Protection as % =	45% (I)				4.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)			Bank Material Adjustment		10	
			Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		8	
Adjective Rating and Total Score						
Very Low	Low	Moderate	High	Very High	Extreme	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	49.5

The diagram illustrates a cross-section of a river bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant growing on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation or other protective materials.
- Start of Bank:** The point where the bank meets the stream bed.

Section 15, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)																			
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio															
Station: Section 15, Right Bank				Observers: H. Hayter, B. Petru, P. Renner															
Date: 8/1/2019		Stream Type:		Valley Type:															
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)												
Study Bank Height (ft) =	7.08 (A)	Bankfull Height (ft) =	2.33 (B)	$(A) / (B) =$		3.04 (C)	9.0												
Root Depth to Study Bank Height (E)																			
Root Depth (ft) =	3.00 (D)	Study Bank Height (ft) =	7.08 (A)	$(D) / (A) =$		0.42 (E)	4.5												
Weighted Root Density (G)																			
Root Density as % =	10.00 (F)			$(F) \times (E) =$		4.23729 (G)	9.0												
Bank Angle (H)																			
		Bank Angle as Degrees =	35 (H)				3.0												
Surface Protection (I)																			
		Surface Protection as % =	5% (I)				10.0												
Bank Material Adjustment:																			
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 				Bank Material Adjustment		10													
				Stratification Adjustment		10													
				Add 5–10 points, depending on position of unstable layers in relation to bankfull stage															
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">Very Low</td> <td style="padding: 2px;">Low</td> <td style="padding: 2px;">Moderate</td> <td style="padding: 2px;">High</td> <td style="padding: 2px;">Very High</td> <td style="padding: 2px;">Extreme</td> </tr> <tr> <td style="padding: 2px;">5 – 9.5</td> <td style="padding: 2px;">10 – 19.5</td> <td style="padding: 2px;">20 – 29.5</td> <td style="padding: 2px;">30 – 39.5</td> <td style="padding: 2px;">40 – 45</td> <td style="padding: 2px;">46 – 50</td> </tr> </table>						Very Low	Low	Moderate	High	Very High	Extreme	5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Adjective Rating and Total Score	Extreme 55.5
Very Low	Low	Moderate	High	Very High	Extreme														
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50														

The diagram illustrates a cross-section of a stream bank. A dashed horizontal line represents the 'Bankfull' stage. The 'Study Bank Height (A)' is the vertical distance from the bankfull line to the top of the bank. The 'Bankfull Height (B)' is the vertical distance from the stream bed to the bankfull line. The 'Root Depth (D)' is the vertical distance from the ground surface to the deepest roots. The 'Bank Angle (H)' is the angle of the bank face. 'Surface Protection (I)' is indicated by grass on the bank surface. The 'Start of Bank' is the point where the bank meets the stream bed.

Section 15, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 16, Left Bank				Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	9.83 (A)	Bankfull Height (ft) =	2.42 (B)	$(A) / (B) =$	4.06 (C)	10.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.00 (D)	Study Bank Height (ft) =	9.83 (A)	$(D) / (A) =$	0.10 (E)	8.5	
Weighted Root Density (G)							
Root Density as % =	10.00 (F)	$(F) \times (E) =$			1.01729 (G)	10.0	
Bank Angle (H)							
Bank Angle as Degrees =	95 (H)					8.0	
Surface Protection (I)							
Surface Protection as % =	5% (I)					10.0	
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment		10	
				Add 5–10 points, depending on position of unstable layers in relation to bankfull stage			
<i>Very Low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Very High</i>	<i>Extreme</i>	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						66.5	

The diagram illustrates a cross-section of a stream bank. A dashed line represents the 'Bankfull' stage. The 'Study Bank Height (A)' is the vertical distance from the bankfull line to the top of the bank. The 'Bankfull Height (B)' is the vertical distance from the stream bed to the bankfull line. The 'Root Depth (D)' is the vertical distance from the ground surface to the roots of a plant. The 'Bank Angle (H)' is the angle of the bank face. The 'Surface Protection (I)' is the percentage of the bank surface covered by vegetation. The 'Start of Bank' is the point where the bank meets the stream bed.

Section 16, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 18, Left Bank				Observers: H. Hayter, B. Petru, P. Renner			
Date: 8/1/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	6.58 (A)	Bankfull Height (ft) =	1.67 (B)	$(A) / (B) =$	3.94 (C)	10.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	0.80 (D)	Study Bank Height (ft) =	6.58 (A)	$(D) / (A) =$	0.12 (E)	8.5	
Weighted Root Density (G)							
Root Density as % =	15.00 (F)	$(F) \times (E) =$	1.82371 (G)		10.0		
Bank Angle (H)							
Bank Angle as Degrees =	75 (H)					5.5	
Surface Protection (I)							
Surface Protection as % =	10% (I)					9.0	
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment		10	
				Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						63.0	

Section 18, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream:	Fetters Run	Location:	Lancaster, Fairfield County, Ohio			
Station:	Section 19, Right Bank	Observers:	H. Hayter, B. Petru, P. Renner			
Date:	8/1/2019	Stream Type:	Valley Type:			
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	8.75 (A)	Bankfull Height (ft) =	3.09 (B)	$(A) / (B) =$	2.83 (C)	9.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.60 (D)	Study Bank Height (ft) =	8.75 (A)	$(D) / (A) =$	0.07 (E)	8.5
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$	1.37143 (G)			10.0
Bank Angle (H)						
Bank Angle as Degrees =	30 (H)				2.5	
Surface Protection (I)						
Surface Protection as % =	15% (I)				8.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)						Bank Material Adjustment
						10
Stratification Adjustment						
Add 5-10 points, depending on position of unstable layers in relation to bankfull stage						10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	Extreme
						58.0

The diagram illustrates a cross-section of a stream bank. Key features and measurements include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank meets the stream bed.

Section 19, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio				
Station: Section 20, Left Bank			Observers: H. Hayter, B. Petru, P. Renner				
Date: 8/1/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	7.75 (A)	Bankfull Height (ft) =	2.67 (B)	(A) / (B) =	2.90 (C)	9.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	2.16 (D)	Study Bank Height (ft) =	7.75 (A)	(D) / (A) =	0.28 (E)	6.0	
Weighted Root Density (G)							
Root Density as % =	20.00 (F)	(F) × (E) =			5.57419 (G)	9.0	
Bank Angle (H)							
Bank Angle as Degrees =	112 (H)				9.0		
Surface Protection (I)							
Surface Protection as % =	25% (I)				6.5		
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 						Bank Material Adjustment	10
Stratification Adjustment							
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						59.5	

The diagram illustrates a cross-section of a stream bank. Key features and measurements are labeled:

- Study Bank Height (A):** The vertical distance from the bankfull stage to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the top of the bankfull stage.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation on the study bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 20, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio				
Station: Section 21, Right Bank			Observers: H. Hayter, B. Petru, P. Renner				
Date: 8/1/2019		Stream Type:			Valley Type:		
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	9.60 (A)	Bankfull Height (ft) =	2.75 (B)	(A) / (B) =	3.49 (C)	10.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.50 (D)	Study Bank Height (ft) =	9.60 (A)	(D) / (A) =	0.16 (E)	7.5	
Weighted Root Density (G)							
Root Density as % =	15.00 (F)	(F) × (E) =	2.34375 (G)			9.5	
Bank Angle (H)							
Bank Angle as Degrees =	40 (H)					5.0	
Surface Protection (I)							
Surface Protection as % =	5% (I)					10.0	
Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)			→		Bank Material Adjustment 10		
			→		Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage 5		
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	57.0	57.0

Section 21, Right Bank



River Stability Field Guide Forms & Worksheets

- ✓ This file contains all the worksheets from the *River Stability Field Guide* (2nd Edition, 2014).
- ✓ Some of the worksheets contain checkbox functions; depending on which version of excel you have, the macros need to be enabled and the security settings need to be set to *medium*.
- ✓ Most worksheets are "protected" so you don't accidentally delete formulas and text. There is no protection password on the worksheets; you can "unprotect" the sheet within "Permissions" under the "File" tab.
- ✓ Most worksheets contain fields to insert the *Stream Name*, *Location*, *Observers*, *Stream Type*, *Valley Type*, and *Date*. Enter these fields below to have them automatically inserted in all the worksheets:

Stream:	Fetters Run	Stream Type:	
Location:	Lancaster, Fairfield County, Ohio	Valley Type*:	
Observers:	B. Petru, P. Renner	Date:	8/2/2019

*For Valley Type, enter the identifier

Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 23, Right Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	11.00 (A)	Bankfull Height (ft) =	3.00 (B)	(A) / (B) =	3.67 (C)	10.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	3.50 (D)	Study Bank Height (ft) =	11.00 (A)	(D) / (A) =	0.32 (E)	5.5
Weighted Root Density (G)						
Root Density as % =	25.00 (F)	(F) × (E) =			7.95455 (G)	8.5
Bank Angle (H)						
Bank Angle as Degrees =	150 (H)				10.0	
Surface Protection (I)						
Surface Protection as % =	20% (I)				7.0	
Bank Material Adjustment:						
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 						Bank Material Adjustment
						10
Stratification Adjustment						
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme
						61.0
Bank Sketch						
Vertical distance (ft)	Horizontal distance (ft)					
12						
11						
10						
9						
8						
7						
6						
5						
4						
3						
2						
1						
0						
0	1	2	3	4	5	6

Station: **Section 23, Right Bank**



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)																											
Stream:	Fetters Run			Location:	Lancaster, Fairfield County, Ohio																						
Station:	Section 24, Left Bank			Observers:	B. Petru, P. Renner																						
Date:	8/2/2019		Stream Type:	Valley Type:																							
BEHI Score (Fig. 3-7)																											
Study Bank Height to Bankfull Height (C)																											
Study Bank Height (ft) =	9.30 (A)	Bankfull Height (ft) =	3.70 (B)	$(A) / (B) =$	2.51 (C)	8.5																					
Root Depth to Study Bank Height (E)																											
Root Depth (ft) =	1.20 (D)	Study Bank Height (ft) =	9.30 (A)	$(D) / (A) =$	0.13 (E)	8.0																					
Weighted Root Density (G)																											
Root Density as % =	20.00 (F)	$(F) \times (E) =$			2.58065 (G)	9.5																					
Bank Angle (H)																											
Bank Angle as Degrees =	70 (H)				4.5																						
Surface Protection (I)																											
Surface Protection as % =	30% (I)				6.0																						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%; padding: 5px;">Bank Material Adjustment:</td> <td style="width: 40%; padding: 5px;">Bank Material Adjustment</td> </tr> <tr> <td style="padding: 5px;"> <ul style="list-style-type: none"> Bedrock (Overall <i>Very Low</i> BEHI) Boulders (Overall <i>Low</i> BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) </td> <td style="padding: 5px; text-align: center;">8</td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;">Stratification Adjustment</td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;">Add 5–10 points, depending on position of unstable layers in relation to bankfull stage</td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px; text-align: center;">10</td> </tr> </table>							Bank Material Adjustment:	Bank Material Adjustment	<ul style="list-style-type: none"> Bedrock (Overall <i>Very Low</i> BEHI) Boulders (Overall <i>Low</i> BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 	8		Stratification Adjustment		Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10											
Bank Material Adjustment:	Bank Material Adjustment																										
<ul style="list-style-type: none"> Bedrock (Overall <i>Very Low</i> BEHI) Boulders (Overall <i>Low</i> BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 	8																										
	Stratification Adjustment																										
	Add 5–10 points, depending on position of unstable layers in relation to bankfull stage																										
	10																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 12.5%; padding: 5px;">Very Low</td> <td style="width: 12.5%; padding: 5px;">Low</td> <td style="width: 12.5%; padding: 5px;">Moderate</td> <td style="width: 12.5%; padding: 5px;">High</td> <td style="width: 12.5%; padding: 5px;">Very High</td> <td style="width: 12.5%; padding: 5px;">Extreme</td> <td style="width: 12.5%; padding: 5px;">Adjective Rating and Total Score</td> </tr> <tr> <td style="padding: 5px; text-align: center;">5 – 9.5</td> <td style="padding: 5px; text-align: center;">10 – 19.5</td> <td style="padding: 5px; text-align: center;">20 – 29.5</td> <td style="padding: 5px; text-align: center;">30 – 39.5</td> <td style="padding: 5px; text-align: center;">40 – 45</td> <td style="padding: 5px; text-align: center;">46 – 50</td> <td style="padding: 5px; text-align: center;">Extreme</td> </tr> <tr> <td colspan="6" style="padding: 5px;"></td> <td style="padding: 5px; text-align: center;">54.5</td> </tr> </table>							Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme							54.5
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score																					
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme																					
						54.5																					
<p>The diagram illustrates a cross-section of a stream bank. Key features and measurements are labeled: <ul style="list-style-type: none"> Study Bank Height (A): The vertical distance from the bankfull stage to the top of the study bank. Bankfull Height (B): The vertical distance from the stream bed to the top of the bankfull stage. Root Depth (D): The vertical distance from the ground surface to the deepest roots of the vegetation on the study bank. Bank Angle (H): The angle of the bank face relative to the horizontal. Surface Protection (I): The percentage of the bank surface covered by protective vegetation or structures. Start of Bank: The point where the bank begins to rise from the stream bed. </p>																											

Station: **Section 24, Left Bank**



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 25, Right Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	12.90 (A)	Bankfull Height (ft) =	3.60 (B)	$(A) / (B) =$	3.58 (C)	10.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.30 (D)	Study Bank Height (ft) =	12.90 (A)	$(D) / (A) =$	0.10 (E)	8.5	
Weighted Root Density (G)							
Root Density as % =	15.00 (F)	$(F) \times (E) =$	1.51163 (G)				10.0
Bank Angle (H)							
Bank Angle as Degrees =	65 (H)						4.5
Surface Protection (I)							
Surface Protection as % =	20% (I)						7.0
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment Add 5-10 points, depending on position of unstable layers in relation to bankfull stage		8	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	58.0	58.0

The diagram illustrates a cross-section of a stream bank. A dashed horizontal line represents the 'Bankfull' stage. The 'Study Bank Height (A)' is the vertical distance from the bankfull line to the top of the bank. The 'Bankfull Height (B)' is the vertical distance from the stream bed to the bankfull line. The 'Root Depth (D)' is the vertical distance from the ground surface to the roots of a plant. The 'Bank Angle (H)' is the angle of the bank face. The 'Surface Protection (I)' is the area of the bank face covered by vegetation. The 'Start of Bank' is the point where the bank meets the stream bed.

Station: **Section 25, Right Bank**



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio				
Station: Section 26, Left Bank			Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:			Valley Type:		
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	8.90 (A)	Bankfull Height (ft) =	3.10 (B)	(A) / (B) =	2.87 (C)	9.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.30 (D)	Study Bank Height (ft) =	8.90 (A)	(D) / (A) =	0.15 (E)	8.5	
Weighted Root Density (G)							
Root Density as % =	10.00 (F)	(F) × (E) =			1.46067 (G)	10.0	
Bank Angle (H)							
Bank Angle as Degrees =	70 (H)					4.5	
Surface Protection (I)							
Surface Protection as % =	15% (I)					7.0	
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 					Bank Material Adjustment	10	
					Stratification Adjustment	9	
				Adjective Rating and Total Score		9	
Very Low	Low	Moderate	High	Very High	Extreme	Extreme	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	58.0	

Section 26, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 27, Right Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.00 (A)	Bankfull Height (ft) =	2.50 (B)	$(A) / (B) =$	1.60 (C)	6.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	2.60 (D)	Study Bank Height (ft) =	4.00 (A)	$(D) / (A) =$	0.65 (E)	3.0
Weighted Root Density (G)						
Root Density as % =	25.00 (F)			$(F) \times (E) =$	16.25 (G)	8.0
Bank Angle (H)						
		Bank Angle as Degrees =	55 (H)			3.5
Surface Protection (I)						
		Surface Protection as % =	30% (I)			6.0
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)						
Bank Material Adjustment						10
Stratification Adjustment						
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						6
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Very High 43.0

Section 27, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)																						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio																			
Station: Section 28, Left Bank			Observers: B. Petru, P. Renner																			
Date: 8/2/2019		Stream Type:		Valley Type:																		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)																
Study Bank Height (ft) =	10.50 (A)	Bankfull Height (ft) =	3.60 (B)	$(A) / (B) =$	2.92 (C)	9.0																
Root Depth to Study Bank Height (E)																						
Root Depth (ft) =	0.80 (D)	Study Bank Height (ft) =	10.50 (A)	$(D) / (A) =$	0.08 (E)	8.5																
Weighted Root Density (G)																						
Root Density as % =	15.00 (F)			$(F) \times (E) =$	1.14286 (G)	10.0																
Bank Angle (H)																						
Bank Angle as Degrees =	50 (H)					3.5																
Surface Protection (I)																						
Surface Protection as % =	25% (I)					6.5																
Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)						<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Bank Material Adjustment</td> <td style="text-align: center; font-size: 1.5em;">10</td> </tr> <tr> <td style="text-align: center;">Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage</td> <td style="text-align: center; font-size: 1.5em;">10</td> </tr> </table>	Bank Material Adjustment	10	Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	10												
Bank Material Adjustment	10																					
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	10																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Very Low</td> <td style="text-align: center;">Low</td> <td style="text-align: center;">Moderate</td> <td style="text-align: center;">High</td> <td style="text-align: center;">Very High</td> <td style="text-align: center;">Extreme</td> <td style="text-align: center;">Adjective Rating and Total Score</td> <td style="text-align: center;">Extreme</td> </tr> <tr> <td style="text-align: center;">5 – 9.5</td> <td style="text-align: center;">10 – 19.5</td> <td style="text-align: center;">20 – 29.5</td> <td style="text-align: center;">30 – 39.5</td> <td style="text-align: center;">40 – 45</td> <td style="text-align: center;">46 – 50</td> <td style="text-align: center; font-size: 1.5em;">57.5</td> <td></td> </tr> </table>						Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme	5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	57.5		
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme															
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	57.5																

Section 28, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)								
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio				
Station: Section 29, Right Bank				Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:		Valley Type:				
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	14.00 (A)	Bankfull Height (ft) =	3.40 (B)	$(A) / (B) =$	4.12 (C)	10.0		
Root Depth to Study Bank Height (E)								
Root Depth (ft) =	2.00 (D)	Study Bank Height (ft) =	14.00 (A)	$(D) / (A) =$	0.14 (E)	8.0		
Weighted Root Density (G)								
Root Density as % =	20.00 (F)	$(F) \times (E) =$				2.85714 (G)	9.5	
Bank Angle (H)								
Bank Angle as Degrees =	85 (H)					7.0		
Surface Protection (I)								
Surface Protection as % =	25% (I)					6.5		
Bank Material Adjustment:								
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)							Bank Material Adjustment	10
Stratification Adjustment								
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							Stratification Adjustment	10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	61.0		

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant growing on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation or other protective materials.
- Start of Bank:** The point where the bank meets the stream bed.

Section 29, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 30, Left Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	5.80 (A)	Bankfull Height (ft) =	3.50 (B)	$(A) / (B) =$	1.66 (C)	6.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.80 (D)	Study Bank Height (ft) =	5.80 (A)	$(D) / (A) =$	0.31 (E)	5.5
Weighted Root Density (G)						
Root Density as % =	25.00 (F)	$(F) \times (E) =$			7.75862 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	70 (H)				4.5	
Surface Protection (I)						
Surface Protection as % =	60% (I)				3.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		8
Stratification Adjustment						
				Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		8
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Very High 45.0

The diagram illustrates a cross-section of a river bank. A dashed horizontal line represents the 'Bankfull' stage. The 'Study Bank Height (A)' is the vertical distance from the 'Start of Bank' to the top of the current bank. The 'Bankfull Height (B)' is the vertical distance from the 'Start of Bank' to the 'Bankfull' line. The 'Root Depth (D)' is the vertical distance from the ground surface to the roots of a grass plant. The 'Bank Angle (H)' is the angle of the bank face. 'Surface Protection (I)' is indicated by a shaded area on the bank face. The 'Start of Bank' is the point where the bank meets the river channel.

Section 30, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 30, Right Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	14.00 (A)	Bankfull Height (ft) =	3.40 (B)	$(A) / (B) =$	4.12 (C)	10.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	2.00 (D)	Study Bank Height (ft) =	14.00 (A)	$(D) / (A) =$	0.14 (E)	8.0
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$			2.85714 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =	85 (H)				7.0	
Surface Protection (I)						
Surface Protection as % =	25% (I)				6.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)					Bank Material Adjustment	10
					Stratification Adjustment	10
				Adjective Rating and Total Score		10
Very Low	Low	Moderate	High	Very High	Extreme	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	61.0

Study Bank Height (A)
 Bankfull Height (B)
 Root Depth (D)
 Bank Angle (H)
 Surface Protection (I)
 Start of Bank

Section 30, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)									
Stream: Fetters Run					Location: Lancaster, Fairfield County, Ohio				
Station: Section 31, Left Bank					Observers: B. Petru, P. Renner				
Date: 8/2/2019			Stream Type:			Valley Type:			
Study Bank Height to Bankfull Height (C)								BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	5.80 (A)	Bankfull Height (ft) =	3.50 (B)	(A) / (B) =		1.66 (C)	6.5		
Root Depth to Study Bank Height (E)									
Root Depth (ft) =	1.80 (D)	Study Bank Height (ft) =	5.80 (A)	(D) / (A) =		0.31 (E)	5.5		
Weighted Root Density (G)									
Root Density as % =	25.00 (F)			(F) × (E) =		7.75862 (G)	9.0		
Bank Angle (H)									
		Bank Angle as Degrees =	70 (H)				4.5		
Surface Protection (I)									
		Surface Protection as % =	60% (I)				3.5		
Bank Material Adjustment:					Bank Material Adjustment				
Bedrock (Overall Very Low BEHI)					<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage </div>				
Boulders (Overall Low BEHI)									
Cobble (Subtract 10 points if uniform medium to large cobble)									
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)									
Sand (Add 10 points)									
Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)					8				
					8				
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score			Very High
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	45.0			

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank meets the stream bed.

Section 31, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio				
Station: Section 32, Left Bank			Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	8.60 (A)	Bankfull Height (ft) =	3.10 (B)	(A) / (B) =	2.77 (C)	9.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	0.60 (D)	Study Bank Height (ft) =	8.60 (A)	(D) / (A) =	0.07 (E)	8.5	
Weighted Root Density (G)							
Root Density as % =	10.00 (F)	(F) × (E) =			0.69767 (G)	10.0	
Bank Angle (H)							
Bank Angle as Degrees =	50 (H)				3.5		
Surface Protection (I)							
Surface Protection as % =	40% (I)				5.0		
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 						Bank Material Adjustment	10
Stratification Adjustment							
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						56.0	

The diagram illustrates a cross-section of a river bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the start of the bank to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of the vegetation on the study bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by protective material.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 32, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio				
Station: Section 32, Right Bank			Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:			Valley Type:		
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.00 (A)	Bankfull Height (ft) =	3.00 (B)	$(A) / (B) =$	1.33 (C)	5.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	0.70 (D)	Study Bank Height (ft) =	4.00 (A)	$(D) / (A) =$	0.18 (E)	7.5	
Weighted Root Density (G)							
Root Density as % =	15.00 (F)	$(F) \times (E) =$			2.625 (G)	9.5	
Bank Angle (H)							
Bank Angle as Degrees =	90 (H)					8.0	
Surface Protection (I)							
Surface Protection as % =	25% (I)					6.5	
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 							
Bank Material Adjustment						10	
Stratification Adjustment						10	
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	56.5	

The diagram illustrates a cross-section of a river bank. Key features and measurements are labeled:

- Study Bank Height (A):** The vertical distance from the bankfull stage to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the top of the bankfull stage.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 32, Right Bank



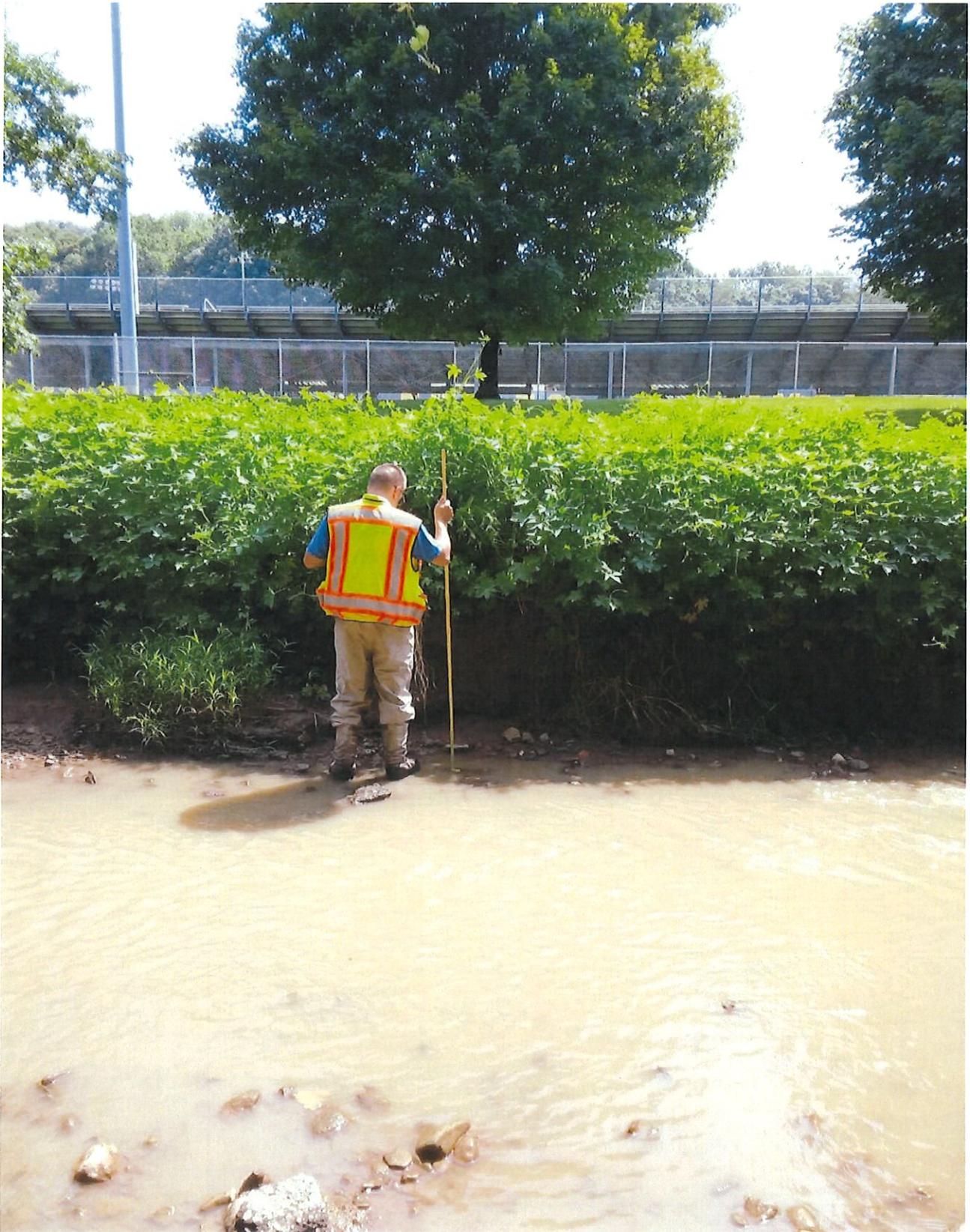
Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use **Figure 3-7** to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 33, Left Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.50 (A)	Bankfull Height (ft) =	2.90 (B)	$(A) / (B) =$		1.55 (C)	6.0
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	2.00 (D)	Study Bank Height (ft) =	4.50 (A)	$(D) / (A) =$		0.44 (E)	4.5
Weighted Root Density (G)							
Root Density as % =	5.00 (F)	$(F) \times (E) =$				2.22222 (G)	9.5
Bank Angle (H)							
Bank Angle as Degrees =	90 (H)					8.0	
Surface Protection (I)							
Surface Protection as % =	5% (I)					10.0	
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 							
Bank Material Adjustment							10
Stratification Adjustment							
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							5
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	53.0	

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 33, Left Bank



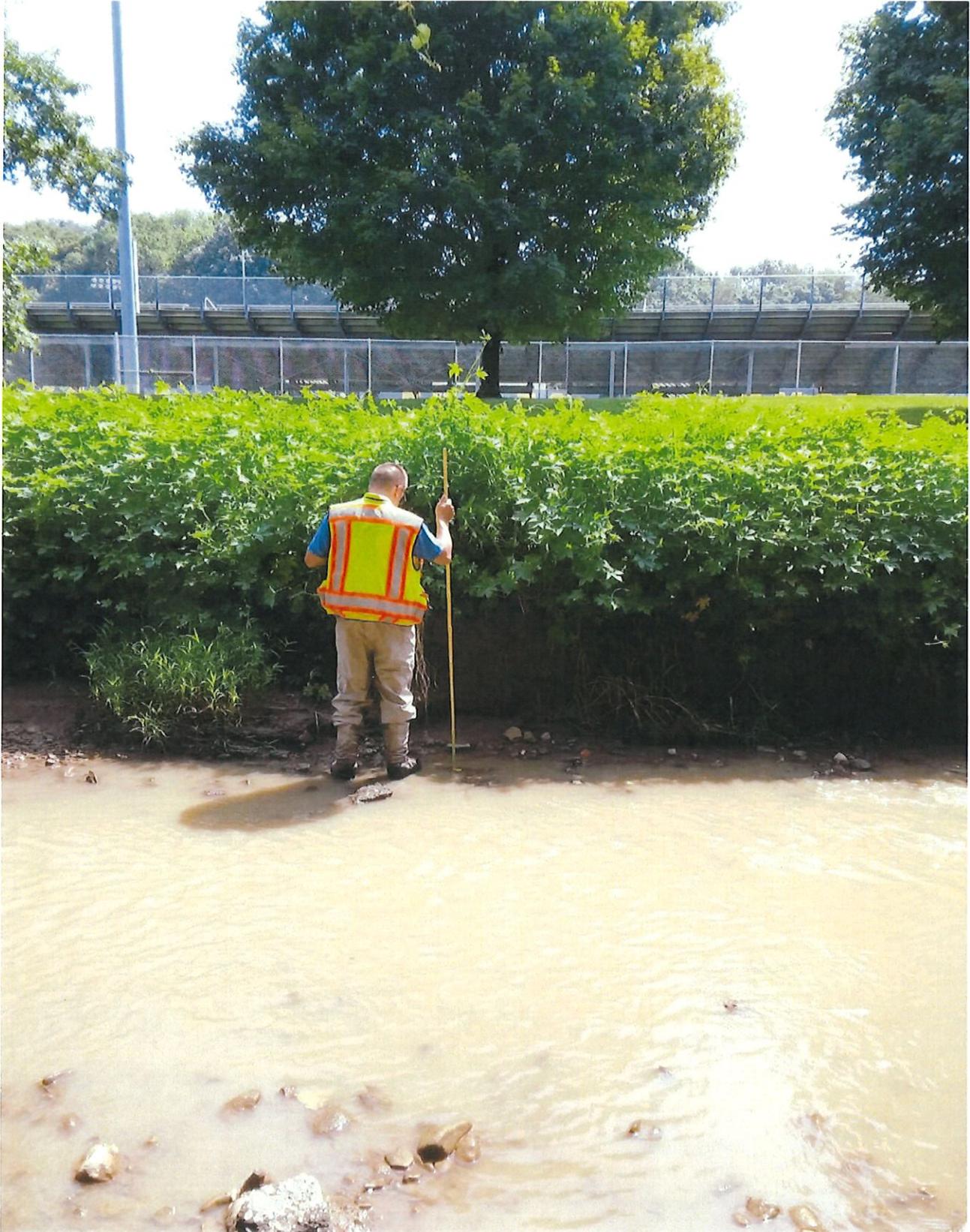
Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)								
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio				
Station: Section 34, Left Bank				Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:		Valley Type:				
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	4.50 (A)	Bankfull Height (ft) =	2.90 (B)	$(A) / (B) =$	1.55 (C)	6.0		
Root Depth to Study Bank Height (E)								
Root Depth (ft) =	2.00 (D)	Study Bank Height (ft) =	4.50 (A)	$(D) / (A) =$	0.44 (E)	4.5		
Weighted Root Density (G)								
Root Density as % =	5.00 (F)	$(F) \times (E) =$			2.22222 (G)	9.5		
Bank Angle (H)								
Bank Angle as Degrees =	90 (H)				8.0			
Surface Protection (I)								
Surface Protection as % =	5% (I)				10.0			
Bank Material Adjustment:								
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 							Bank Material Adjustment	10
Stratification Adjustment								
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							Stratification Adjustment	5
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	53.0		

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation on the study bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank meets the stream bed.

Section 34, Left Bank



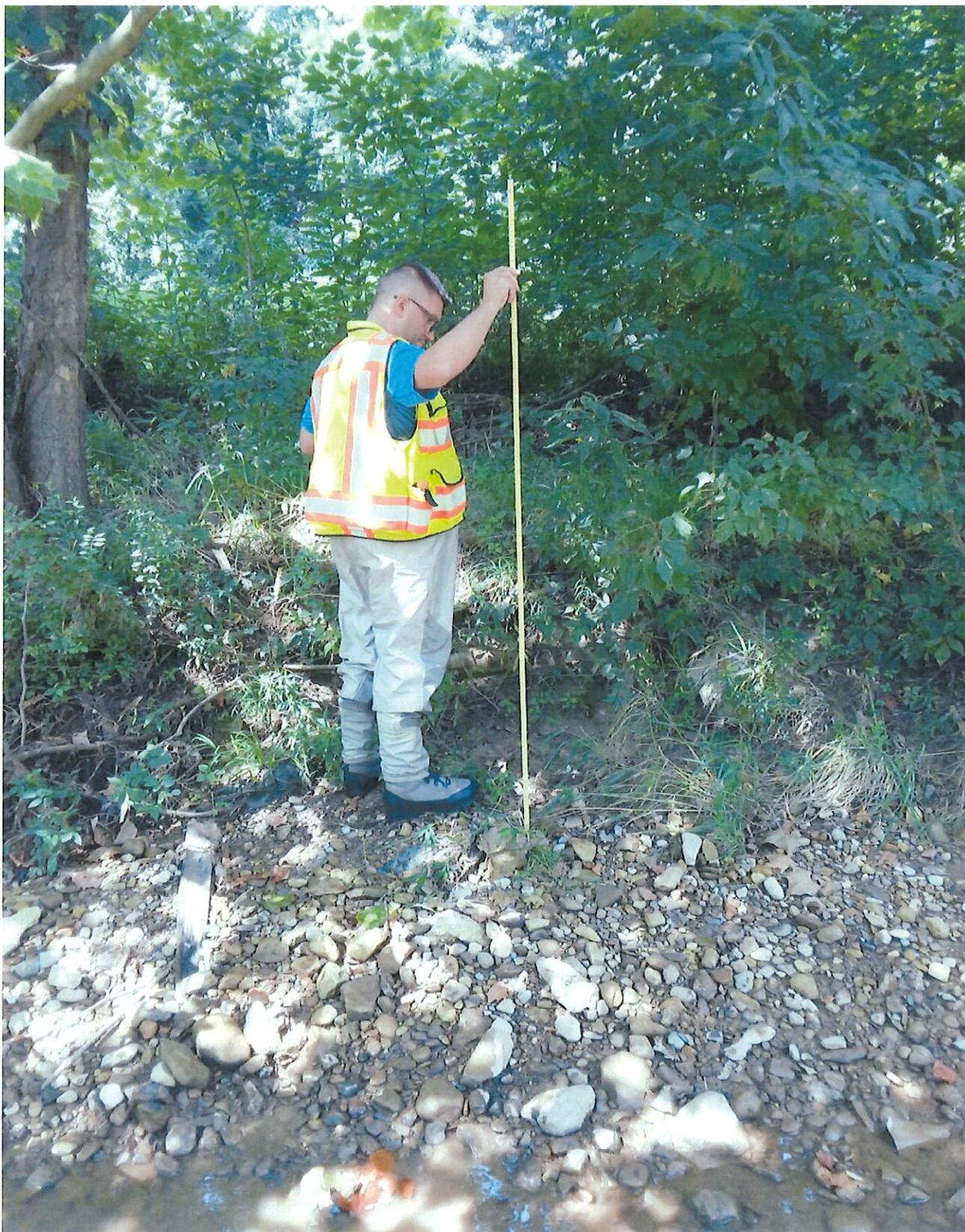
Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 34, Right Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	3.50 (A)	Bankfull Height (ft) =	2.30 (B)	$(A) / (B) =$	1.52 (C)	6.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	0.90 (D)	Study Bank Height (ft) =	3.50 (A)	$(D) / (A) =$	0.26 (E)	6.5	
Weighted Root Density (G)							
Root Density as % =	15.00 (F)	$(F) \times (E) =$			3.85714 (G)	9.5	
Bank Angle (H)							
Bank Angle as Degrees =	60 (H)					4.0	
Surface Protection (I)							
Surface Protection as % =	20% (I)					7.0	
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 				Bank Material Adjustment		10	
Stratification Adjustment							
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						5	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	48.0	

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation or other protective material.
- Start of Bank:** The point where the bank meets the stream bed.

Section 34, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 36, Right Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.00 (A)	Bankfull Height (ft) =	3.20 (B)	$(A) / (B) =$	1.25 (C)	4.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.80 (D)	Study Bank Height (ft) =	4.00 (A)	$(D) / (A) =$	0.20 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	15.00 (F)			$(F) \times (E) =$	3 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =	75 (H)					5.0
Surface Protection (I)						
Surface Protection as % =	10% (I)					9.0
Bank Material Adjustment:						
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 						10
Stratification Adjustment						
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						10
Very Low	Low	Moderate	High	Very High	Extreme	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	55.0
Adjective Rating and Total Score						55.0

The diagram illustrates a cross-section of a river bank. Key features and measurements are labeled:

- Study Bank Height (A):** The vertical distance from the bankfull stage to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the top of the bank at full stage.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation or structures.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 36, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio				
Station: Section 38, Left Bank			Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:			Valley Type:		
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.20 (A)	Bankfull Height (ft) =	3.20 (B)	(A) / (B) =	1.31 (C)	5.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	2.40 (D)	Study Bank Height (ft) =	4.20 (A)	(D) / (A) =	0.57 (E)	3.5	
Weighted Root Density (G)							
Root Density as % =	25.00 (F)	(F) × (E) =			14.2857 (G)	8.0	
Bank Angle (H)							
Bank Angle as Degrees =	110 (H)					8.5	
Surface Protection (I)							
Surface Protection as % =	2% (I)					10.0	
Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)					Bank Material Adjustment	10	
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							8
<i>Very Low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Very High</i>	<i>Extreme</i>	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	53.0	

Section 38, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 39, Left Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	9.80 (A)	Bankfull Height (ft) =	4.00 (B)	$(A) / (B) =$	2.45 (C)	8.5	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.20 (D)	Study Bank Height (ft) =	9.80 (A)	$(D) / (A) =$	0.12 (E)	8.0	
Weighted Root Density (G)							
Root Density as % =	5.00 (F)	$(F) \times (E) =$			0.61224 (G)	10.0	
Bank Angle (H)							
Bank Angle as Degrees =	90 (H)					8.0	
Surface Protection (I)							
Surface Protection as % =	10% (I)					8.5	
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	63.0	

The diagram illustrates a cross-section of a river bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant growing on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation or other protective materials.
- Start of Bank:** The point where the bank meets the stream bed.

Section 39, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 40, Right Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	7.50 (A)	Bankfull Height (ft) =	3.50 (B)	$(A) / (B) =$	2.14 (C)	8.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.80 (D)	Study Bank Height (ft) =	7.50 (A)	$(D) / (A) =$	0.24 (E)	6.5	
Weighted Root Density (G)							
Root Density as % =	20.00 (F)	$(F) \times (E) =$			4.8 (G)	9.0	
Bank Angle (H)							
Bank Angle as Degrees =		80 (H)					6.0
Surface Protection (I)							
Surface Protection as % =		60% (I)					3.5
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment		10	
				Add 5–10 points, depending on position of unstable layers in relation to bankfull stage			
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						53.0	

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the top of the bankfull stage.
- Root Depth (D):** The vertical distance from the ground surface to the roots of the vegetation on the study bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by protective vegetation or structures.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 40, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 42, Right Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	7.00 (A)	Bankfull Height (ft) =	3.50 (B)	(A) / (B) =	2.00 (C)	8.0	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.20 (D)	Study Bank Height (ft) =	7.00 (A)	(D) / (A) =	0.17 (E)	7.5	
Weighted Root Density (G)							
Root Density as % =	20.00 (F)	(F) x (E) =	3.42857 (G)				9.5
Bank Angle (H)							
Bank Angle as Degrees =	70 (H)						4.5
Surface Protection (I)							
Surface Protection as % =	50% (I)						4.5
Bank Material Adjustment:							
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10	
				Stratification Adjustment Add 5-10 points, depending on position of unstable layers in relation to bankfull stage		10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	54.0	54.0

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the 'Start of Bank' to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the 'Start of Bank' to the 'Bankfull' line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant growing on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The vertical distance from the 'Start of Bank' to the ground surface.
- Start of Bank:** The base of the bank where it meets the stream bed.

Section 42, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 43, Left Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	3.80 (A)	Bankfull Height (ft) =	2.60 (B)	$(A) / (B) =$	1.46 (C)	5.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	0.80 (D)	Study Bank Height (ft) =	3.80 (A)	$(D) / (A) =$	0.21 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	15.00 (F)	$(F) \times (E) =$			3.15789 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	90 (H)				8.0	
Surface Protection (I)						
Surface Protection as % =	10% (I)				9.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment		10
				Add 5-10 points, depending on position of unstable layers in relation to bankfull stage		
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	Extreme
						58.5

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the top of the bankfull stage.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation on the study bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by protective vegetation.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 43, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 43, Right Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	7.00 (A)	Bankfull Height (ft) =	3.50 (B)	$(A) / (B) =$	2.00 (C)	8.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.20 (D)	Study Bank Height (ft) =	7.00 (A)	$(D) / (A) =$	0.17 (E)	7.5
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$			3.42857 (G)	9.5
Bank Angle (H)						
Bank Angle as Degrees =	70 (H)				4.5	
Surface Protection (I)						
Surface Protection as % =	50% (I)				4.5	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme 54.0

The diagram illustrates a cross-section of a river bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the study bank.
- Bankfull Height (B):** The vertical distance from the start of the bank to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective measures.
- Start of Bank:** The point where the bank begins to rise from the river channel.

Section 43, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)								
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio				
Station: Section 44, Left Bank				Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:		Valley Type:				
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	3.80 (A)	Bankfull Height (ft) =	2.60 (B)	$(A) / (B) =$		1.46 (C)	5.5	
Root Depth to Study Bank Height (E)								
Root Depth (ft) =	0.80 (D)	Study Bank Height (ft) =	3.80 (A)	$(D) / (A) =$		0.21 (E)	7.0	
Weighted Root Density (G)								
Root Density as % =	15.00 (F)	$(F) \times (E) =$				3.15789 (G)	9.0	
Bank Angle (H)								
Bank Angle as Degrees =	90 (H)					8.0		
Surface Protection (I)								
Surface Protection as % =	10% (I)					9.0		
Bank Material Adjustment:								
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)							Bank Material Adjustment	10
Stratification Adjustment							10	
Add 5-10 points, depending on position of unstable layers in relation to bankfull stage								
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme	
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	58.5		

The diagram illustrates a cross-section of a stream bank. Key features and measurements are labeled: 'Bankfull' is indicated by a dashed horizontal line. 'Bankfull Height (B)' is the vertical distance from the 'Start of Bank' to the 'Bankfull' line. 'Study Bank Height (A)' is the vertical distance from the 'Start of Bank' to the top of the bank. 'Root Depth (D)' is shown at two locations: one for a grass root extending from the surface to the water table, and another for a root extending from the surface to the water table. 'Bank Angle (H)' is the angle of the bank face. 'Surface Protection (I)' is indicated by a vertical line on the bank face. 'Start of Bank' is the point where the bank meets the stream bed.

Section 44, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 45, Right Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	9.40	(A)	Bankfull Height (ft) =	2.90	(B)	$(A) / (B) =$	3.24
						(C)	9.5
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	1.20	(D)	Study Bank Height (ft) =	9.40	(A)	$(D) / (A) =$	0.13
						(E)	8.0
Weighted Root Density (G)							
Root Density as % =	15.00	(F)	$(F) \times (E) =$		1.91489	(G)	9.5
Bank Angle (H)							
Bank Angle as Degrees =	90					(H)	8.0
Surface Protection (I)							
Surface Protection as % =	15%					(I)	7.5
Bank Material Adjustment:							
<ul style="list-style-type: none"> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points) 							
Bank Material Adjustment							10
Stratification Adjustment							10
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme	
						62.5	

The diagram illustrates a cross-section of a river bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the roots of a plant growing on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The area of the bank face covered by vegetation or other protective materials.
- Start of Bank:** The point where the bank meets the stream bed.

Section 45, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)							
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio			
Station: Section 46, Left Bank				Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:			
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	10.50 (A)	Bankfull Height (ft) =	3.30 (B)	(A) / (B) =	3.18 (C)	9.5	
Root Depth to Study Bank Height (E)							
Root Depth (ft) =	2.20 (D)	Study Bank Height (ft) =	10.50 (A)	(D) / (A) =	0.21 (E)	7.0	
Weighted Root Density (G)							
Root Density as % =	25.00 (F)	(F) × (E) =				5.2381 (G)	9.0
Bank Angle (H)							
Bank Angle as Degrees =	80 (H)					6.0	
Surface Protection (I)							
Surface Protection as % =	35% (I)					5.5	
Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment 10		Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage 10	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	57.0	57.0

The diagram illustrates a cross-section of a river bank. A dashed horizontal line represents the 'Bankfull' stage. The 'Study Bank Height (A)' is the vertical distance from the bankfull line to the top of the bank. The 'Bankfull Height (B)' is the vertical distance from the water surface to the bankfull line. The 'Root Depth (D)' is the vertical distance from the ground surface to the roots of a grass plant. The 'Bank Angle (H)' is the angle of the bank face. The 'Surface Protection (I)' is the area of the bank face covered by vegetation. The 'Start of Bank' is the point where the bank meets the water.

Section 46, Left Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 47, Left Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	10.50 (A)	Bankfull Height (ft) =	3.30 (B)	(A) / (B) =	3.18 (C)	9.5
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	2.20 (D)	Study Bank Height (ft) =	10.50 (A)	(D) / (A) =	0.21 (E)	7.0
Weighted Root Density (G)						
Root Density as % =	25.00 (F)			(F) × (E) =	5.2381 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =			80 (H)			6.0
Surface Protection (I)						
Surface Protection as % =			35% (I)			5.5
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)						Bank Material Adjustment
						10
Stratification Adjustment						
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage						10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme
						57.0

The diagram illustrates a cross-section of a stream bank. Key features include:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the bankfull line to the top of the current bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the ground surface to the deepest roots of the vegetation.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation.
- Start of Bank:** The point where the bank meets the stream bed.

Section 47, Left Bank



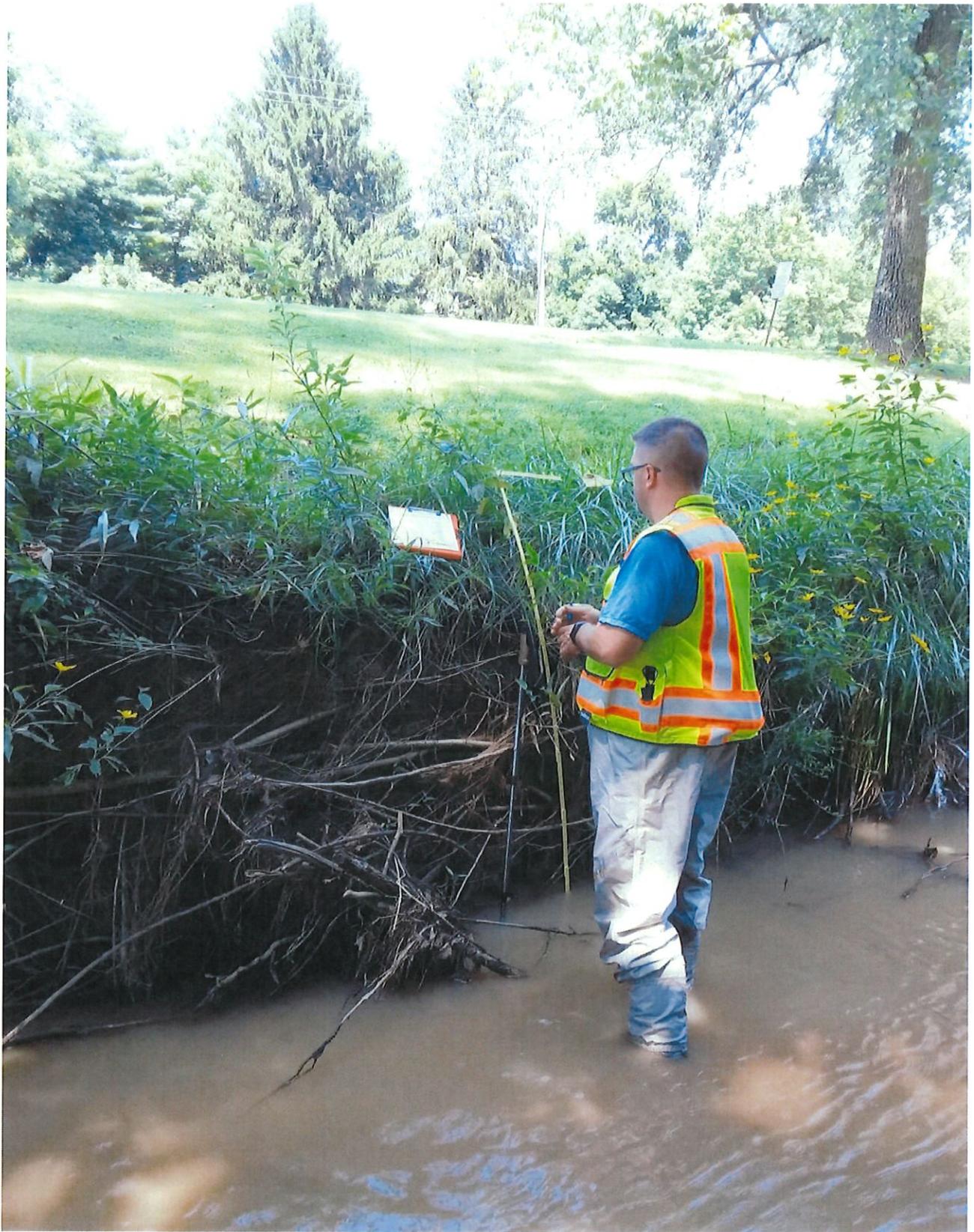
Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)						
Stream: Fetters Run			Location: Lancaster, Fairfield County, Ohio			
Station: Section 47, Right Bank			Observers: B. Petru, P. Renner			
Date: 8/2/2019		Stream Type:		Valley Type:		
Study Bank Height to Bankfull Height (C)						BEHI Score (Fig. 3-7)
Study Bank Height (ft) =	4.80 (A)	Bankfull Height (ft) =	3.20 (B)	$(A) / (B) =$	1.50 (C)	6.0
Root Depth to Study Bank Height (E)						
Root Depth (ft) =	1.30 (D)	Study Bank Height (ft) =	4.80 (A)	$(D) / (A) =$	0.27 (E)	6.5
Weighted Root Density (G)						
Root Density as % =	20.00 (F)	$(F) \times (E) =$			5.41667 (G)	9.0
Bank Angle (H)						
Bank Angle as Degrees =	90 (H)				8.0	
Surface Protection (I)						
Surface Protection as % =	10% (I)				9.0	
Bank Material Adjustment:						
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)				Bank Material Adjustment		10
				Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage		10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Extreme 58.5

The diagram illustrates a cross-section of a stream bank. Key features and measurements are labeled:

- Bankfull:** A dashed horizontal line representing the top of the bank when it is full.
- Study Bank Height (A):** The vertical distance from the stream bed to the top of the bank.
- Bankfull Height (B):** The vertical distance from the stream bed to the bankfull line.
- Root Depth (D):** The vertical distance from the stream bed to the roots of a plant on the bank.
- Bank Angle (H):** The angle of the bank face relative to the horizontal.
- Surface Protection (I):** The percentage of the bank surface covered by vegetation or other protective materials.
- Start of Bank:** The point where the bank begins to rise from the stream bed.

Section 47, Right Bank



Worksheet 3-11. Form to calculate an overall Bank Erosion Hazard Index (BEHI) rating. Use Figure 3-7 to determine individual BEHI scores.

Bank Erosion Hazard Index (BEHI)								
Stream: Fetters Run				Location: Lancaster, Fairfield County, Ohio				
Station: Section 48, Right Bank				Observers: B. Petru, P. Renner				
Date: 8/2/2019		Stream Type:		Valley Type:				
Study Bank Height to Bankfull Height (C)							BEHI Score (Fig. 3-7)	
Study Bank Height (ft) =	4.80 (A)	Bankfull Height (ft) =	3.20 (B)	$(A) / (B) =$	1.50 (C)	6.0		
Root Depth to Study Bank Height (E)								
Root Depth (ft) =	1.30 (D)	Study Bank Height (ft) =	4.80 (A)	$(D) / (A) =$	0.27 (E)	6.5		
Weighted Root Density (G)								
Root Density as % =	20.00 (F)	$(F) \times (E) =$			5.41667 (G)	9.0		
Bank Angle (H)								
Bank Angle as Degrees =	90 (H)					8.0		
Surface Protection (I)								
Surface Protection as % =	10% (I)					9.0		
Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform medium to large cobble) Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (no adjustment unless primarily clay, then subtract 20 points)							Bank Material Adjustment	10
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage							Stratification Adjustment	10
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	Extreme	
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Total Score	58.5	

Section 48, Right Bank

