Appendix D
Qualitative Habitat Evaluation Index (QHEI) Scores for the Mill Creek Basin

In the guidance document "Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams" (Ohio EPA, 1999), the importance of habitat quality is discussed as below:

> Ohio EPA uses the Qualitative Habitat Evaluation Index (QHEI; Rankin, 1989, 1995) to assess the physical habitat quality of streams and rivers. This index measures the important components of lotic macrohabitat that are essential to sustaining high value aquatic communities. The major categories of macrohabitat include substrate quality, instream cover (physical structure), stream channel morphology and condition, riparian quality and bank erosion, pool and run-riffle quality, and gradient. Comparisons between the QHEI and IBI resulted in a list of critical habitat components associated with the occurrence of IBI scores corresponding with the Warmwater Habitat (WWH) or Exceptional Warmwater Habitat (EWH) biocriteria ("warmwater attributes") and a list of components that are associated with degraded communities (high and moderate influence "modified attributes"; Rankin, 1989, 1995). These modified attributes were further divided into "high" influence or "moderate" influence attributes based on the statistical strength of the relationships. By examining a combined database of least impacted reference sites and physically modified reference sites essentially free from point source associated chemical impacts, a relationship was developed between the IBI and the accrual of modified habitat attributes.

The "associations report" goes on to discuss how the accumulation of attributes representative of a modified condition increases, the likelihood that a stream will attain a WWH use designation is decreased. This phenomenon is depicted in Table D-1.

Table D-1. Modified habitat attributes and percent attainment.

Number of Modified Habitat Attributes	Percentage of Streams That May Attain a Warmwater Habitat Use Designation.
4	< 50%
6	< 25%
7	rare occurrence

The associations report gives the following as guidance for assessing future implementation of Best Management Practices (BMPs):

> As a "rule of thumb", goals for BMPs and habitat restoration should strive to reduce

the number of modified attributes (moderate influence) to four or fewer, reduce the number of modified to warmwater attributes to less than 6, and eliminate all high influence modified attributes. These measures are needed to have a reasonable probability of attaining the WWH biocriteria.

Figure D-1 presents a flow chart that may be useful for evaluating a watershed or stakeholder group's approach to BMP implementation in a watershed. Table D-2 provides the detailed QHEI results from the 1995 Mill Creek water quality survey, the 2000 and 2001 follow-up surveys, as well as the 2001 results from Blues Creek. These results can be used in conjunction with the processes depicted in Figure D-1 and the types of BMPs to be implemented to evaluate the likelihood of attaining a WWH use designation.
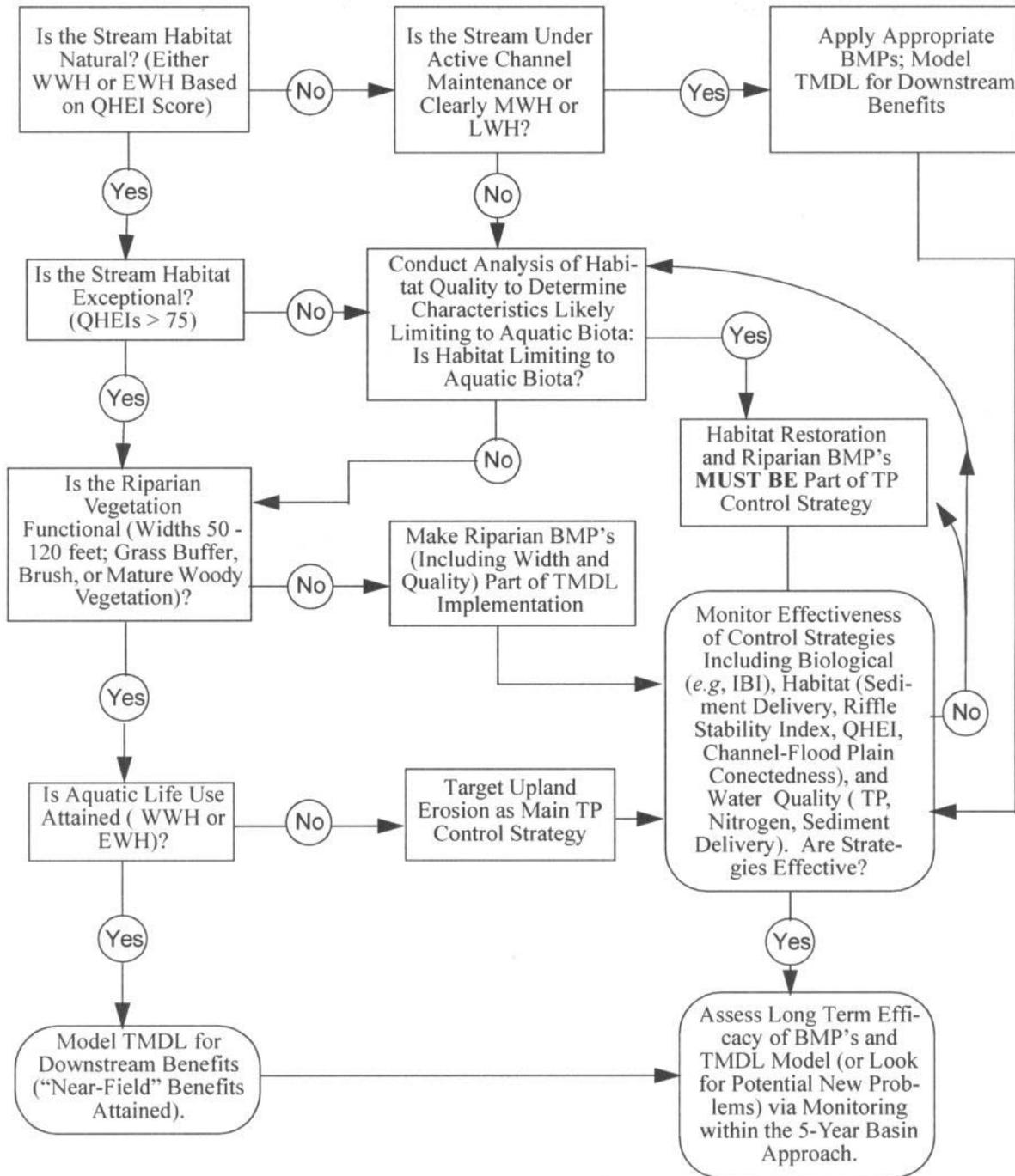
Figure D-1. Evaluation of habitat in BMP implementation (Ohio EPA, 1999).

Table D-2. QHEI results from the 1999 Mill Creek water quality survey.

| | | | WWH Attributes | | MWH Attributes | | |
| | | | | | High Influence | Moderate Influence | |

Key QHEI Components

Column headers (left to right):
- River Mile
- QHEI
- Gradient (ft/mile)
- WWH Attributes: No Channelization or Recovered; Boulder/Cobble/Gravel Substrates; Silt Free Substrates; Good/Excellent Substrates; Moderate/High Sinuosity; Extensive/Moderate Cover; Fast Current/Eddies; Low-Normal Overall Embeddedness; Max Depth > 40 cm; Low-Normal Riffle Embeddedness
- Total WWH Attributes
- MWH High Influence: Channelized or No Recovery; Silt/Muck Substrates; No Sinuosity; Sparse/No Cover; Max Depth < 40 cm (WD, HW)
- Total H.I. MWH Attributes
- MWH Moderate Influence: Recovering Channel; Heavy/Moderate Silt Cover; Sand Substrates (Boat); Hardpan Substrate Origin; Fair/Poor Development; Low Sinuosity; Only 1-2 Cover Types; Intermittent and Poor Pools; No Fast Current; High/Mod. Overall Embeddedness; High/Mod. Riffle Embeddedness; No Riffle
- Total M.I. MWH Attributes
- (MWH H.I.+1)/(WWH+1) Ratio
- (MWH M.I.+1)/(WWH+1) Ratio

River Mile	QHEI	Gradient (ft/mile)	Total WWH Attributes	Total H.I. MWH Attributes	Total M.I. MWH Attributes	(MWH H.I.+1)/(WWH+1) Ratio	(MWH M.I.+1)/(WWH+1) Ratio
(02-109) Mill Creek							
Year: 2001							
31.4	75.5	3.80	9	0	1	0.10	0.20
28.1	65.0	3.58	5	0	5	0.17	1.00
24.8	74.0	4.95	9	0	2	0.10	0.30
19.1	69.0	5.71	6	0	6	0.14	1.00
Year: 2000							
38.1	58.5	3.45	5	1	4	0.33	1.00
37.9	60.5	3.45	5	1	4	0.33	1.00
36.1	73.0	5.85	8	1	1	0.22	0.33
31.4	70.0	3.80	7	1	3	0.25	0.63
28.1	61.5	3.58	5	1	3	0.33	0.83
24.8	76.5	4.95	7	0	3	0.13	0.50
19.1	71.0	5.71	8	0	2	0.11	0.33
16.2	61.0	3.18	4	1	6	0.40	1.60
12.0	75.5	3.29	9	0	2	0.10	0.30
6.9	79.5	12.12	8	0	1	0.11	0.22
1.7	89.0	12.50	9	0	0	0.10	0.10
Year: 1999							
0.2	56.5	0.10	4	0	6	0.20	1.40
Year: 1998							
1.7	91.5	12.50	9	0	0	0.10	0.10
1.7	90.5	12.50	9	0	0	0.10	0.10
Year: 1995							
39.1	61.5	3.44	6	0	6	0.14	1.00
36.1	64.0	5.85	9	1	4	0.20	0.60
28.2	71.0	3.58	9	0	0	0.10	0.10
24.8	73.0	4.95	8	0	3	0.11	0.44
19.3	74.5	5.71	7	0	3	0.13	0.50
19.1	70.5	5.71	7	0	5	0.13	0.75
18.4	77.0	5.71	9	0	2	0.10	0.30
18.2	61.0	5.71	5	0	6	0.17	1.17
18.1	71.0	5.71	7	0	5	0.13	0.75

Table D-2. (Continued)

River Mile	QHEI	Gradient (ft/mile)	Total WWH Attributes	Total H.I. MWH Attributes	Total M.I. MWH Attributes	(MWH H.I.+1)/(WWH+1) Ratio	(MWH M.I.+1)/(WWH+1) Ratio
(02-109) Mill Creek							
Year: 1995							
16.2	63.0	3.18	5	0	6	0.17	1.17
14.6	68.0	3.29	7	0	3	0.13	0.50
12.0	78.5	3.29	9	0	1	0.10	0.20
11.6	74.5	3.29	9	0	3	0.10	0.40
6.9	74.5	12.12	8	0	3	0.11	0.44
4.4	88.5	9.35	9	0	0	0.10	0.10
3.7	81.0	9.35	9	0	2	0.10	0.30
1.7	91.0	12.50	9	0	0	0.10	0.10
(02-126) Blues Creek							
Year: 2001							
19.6	19.5	4.26	0	5	7	6.00	*.**
12.0	40.5	6.21	2	3	7	1.33	3.67
10.1	42.0	5.68	2	3	6	1.33	3.33
6.7	51.0	5.00	3	1	5	0.50	1.75
4.7	64.0	5.55	8	1	5	0.22	0.78
0.6	77.5	8.47	8	0	1	0.11	0.22
Year: 1995							
0.7	71.5	8.47	7	0	3	0.13	0.50