

Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Protocol

Version 1.0



**Bureau of Waterways Engineering and Wetlands
Division of Wetlands, Encroachments and Training**

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Waterways Engineering and Wetlands

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TITLE: Pennsylvania Lacustrine Condition Level 2 Rapid Assessment

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AUTHORITY: The Dam Safety and Encroachments Act, Act of November 26, 1978, P.L. 1375, No. 325, as amended, 32 P.S. §§ 693.1 *et seq.*

POLICY: This document provides guidance for assessing the condition of lacustrine aquatic resources for use in applicable requirements under 25 Pa. Code Chapter 105 regulations.

PURPOSE: To provide standard guidelines for evaluating the condition of lacustrine aquatic resources for the purposes of meeting regulatory requirements contained in 25 Pa. Code Chapter 105. The guidance outlines how to conduct assessments, the factors to consider when doing so and establishes a scoring system based upon condition categories.

APPLICABILITY: The guidance document applies to persons performing lacustrine condition assessments for planning, permitting, compliance, compensation, and other applicable requirements under 25 Pa. Code Chapter 105 regulations.

DISCLAIMER: The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures will affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the Department to give these rules that weight or deference. This document establishes the framework, within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

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Introduction

The Dam Safety and Encroachments Act requires a person to obtain a permit from the Department of Environmental Protection (DEP or Department) to construct, operate, maintain, modify, enlarge or abandon a dam, water obstruction or encroachment. 32 P.S. § 693.6(a). Regulations related to the dam safety and waterway management permitting process have been promulgated in Chapter 105 of Title 25 of the *Pennsylvania Code*. When impacts are proposed to a resource in connection with a proposed dam, water obstruction or encroachment, an applicant is required to, among other things, submit a mitigation plan with the application for an individual permit or the registration for a general permit in accordance with the definition of mitigation in Chapter 105. 25 Pa. Code § 105.13. The Department has developed this technical guidance to provide a methodology acceptable to the Department for the assessment of existing lacustrine resource conditions proposed to be impacted as part of a permit application.

This assessment protocol is neither a regulation, nor is intended to alter existing regulatory requirements. To the extent that restrictive language is used in this technical guidance, the restrictive language is intended to make sure that the assessment protocol is performed to assess the resource condition in a manner that the Department has determined is acceptable to attain the regulatory standard.

The Department recommends the use of this technical guidance to perform resource condition assessments. The Department may approve an alternative resource condition assessment (separate from and not contained in this technical guidance) if that methodology is determined by the Department to adequately identify and assess resource conditions for the purposes of meeting regulatory requirements under Chapter 105. Complete and legally defensible supporting documentation (justifications, calculations, etc.) must be included with the application to allow the Department to make an informed decision regarding the use of an alternative assessment protocol methodology. Additional application processing time may be necessary when using an alternative methodology because the methodology will require review and approval by the Director of the Bureau of Waterways Engineering and Wetlands prior to use in a final permit action.

The Department may require additional information necessary to adequately review a resource condition assessment or may require other information deemed necessary to review a proposed alternative resource condition assessment.

Background

This protocol is part of a comprehensive effort to ensure consistency in aquatic resource condition assessments, impact assessment and compensation determinations. It was developed to provide information regarding the condition of lakes, reservoirs and large streams and river systems with drainage areas greater than 2,000 square miles (herein, collectively addressed as lacustrine resources) for permit impact evaluation and compensatory mitigation purposes. Development and application of resource condition assessments on lentic systems is relatively new, especially for large rivers where the systems exhibit some lacustrine qualities while retaining unique riverine characteristics. Natural lakes, impoundments and large rivers may differ in terms of behavior, structure and function. However, this rapid assessment emphasizes the shared physical attributes characterizing these varied aquatic resource types.

This rapid condition assessment through the use of condition indices considers the depth of the impact area, the shoreline vegetation, the riparian zone of influence vegetation and human alterations to near shore areas. These condition indices do not consider the abundance or types of organisms present, nor do they consider the water quality of the lacustrine resource. Therefore, this protocol seeks to assess the suitability of **physical elements** within the AA to support aquatic organisms.

This protocol can be used to satisfy certain Chapter 105 application requirements as described in the Department's permit application and environmental assessment forms and instructions available in its online library found at www.dep.pa.gov. This qualitative rapid assessment is designed to limit subjectivity and provide a representation of the resource condition associated with an established assessment area. The resulting lacustrine condition index may be used by applicants seeking Chapter 105 authorizations from the Department or by the Department when evaluating proposed project impacts and determining compensatory mitigation requirements.

Assessors should follow general professional standards and collect or utilize supporting information such as photographic documentation as appropriate or reference such materials contained in the application that support observations, professional judgments or other circumstances as deemed necessary to provide an accurate and true representation of the resource conditions.

Resource Conditions for General Use

This protocol is for use to assess resource conditions in all natural or artificial lakes, reservoirs, ponds and large streams and rivers with drainage areas greater than 2,000 square miles. The Department should be consulted during pre-application meetings on the use of this protocol when the following circumstances are present:

- The depth of the proposed project area is greater than 20 feet; or
- The proposed project area is in a stream with less than or equal to 2,000 square mile drainage area that is dammed or otherwise controlled and maintains a normal pool elevation.

1.0 Project Site Assessment Area

The area of the lacustrine resource proposed to be affected along with adjacent areas, as described below, comprise the Assessment Area (AA). A project may have multiple AA's depending upon the number of structures or activities proposed and how close in proximity they are to each other. The assessor will establish the outer boundaries of the AA using the guidelines for the following circumstances:

Projects located along or within 50 feet of the shoreline or bank:

- 1) The AA will consist of the area(s) of the resource proposed to be impacted by the project;
- 2) The project footprint established in (1) above is bracketed by extending the upstream and downstream limits 100 feet on each side along the shoreline;
- 3) Then extend the AA limit 50 feet beyond the project's footprint water ward;
- 4) Then extend the AA a total distance of 100 feet landward from the shore line. This portion of the AA will be divided into two areas, the Riparian Shoreline Vegetation zone and the Riparian Zone of Influence Vegetation as described in Sections 3.0 and 4.0, respectively.

Projects located greater than 50 feet from the shoreline or bank:

- 1) The AA will consist of the area(s) of the resource proposed to be impacted by the project;
- 2) The project footprint established in (1) above is bracketed by an area extending 25 feet from each side.

Under the conditions immediately above, the assessor would only utilize the Average Depth Condition Index to establish the Lacustrine Condition Index (*see Section 6.0*).

1.1 Project Assessment Area Examples

In the example to the right, the AA is bounded by the yellow line. The red outlined area is the proposed area of direct impact (solid fill dock). The blue line represents the landward extent of the riparian shoreline area (50 feet landward from the shoreline) and the green line represents the riparian zone of influence boundary (50 feet landward from the edge of the riparian shoreline area). Total landward distance is 100 feet. The AA extends along the shoreline 100 feet left and right or above and below the proposed direct impact area to establish the outer limits of the AA. The AA extends 50 feet into the water beyond the edge of the proposed direct impact area as well.



In the second example middle right), the AA is again bounded by the yellow line. The red outlined area is the proposed area of direct impact. The blue line represents the landward extent of the riparian shoreline area (50 feet landward from the shoreline) and the green line represents the riparian zone of influence boundary (50 feet landward from the edge of the riparian shoreline area). Total landward distance is 100 feet. The AA extends along the shoreline 100 feet left and right or above and below the proposed direct impact area to establish the outer limits of the AA. The distance is measured along the shore in this case, since the shore extends linearly. The AA extends 50 feet into the water beyond the edge of the proposed direct impact area as well.



The third example (bottom right) depicts a project with an assessment area that is greater than 50 feet from the shoreline such as those encountered when constructing mid-channel piers for bridge crossings of large streams or rivers. The AA is bounded by the yellow line. The red outlined area is the footprint of a proposed bridge pier and the AA boundary is established by extending 25 feet outward on all sides from the impact area.



2.0 Average Depth (AD) Condition Index

In general, 90% of the species in a lacustrine environment either utilize or live within the littoral zone for critical life stages. The littoral zone extends from the shoreline to the point where sunlight (generally) no longer reaches the bottom (Holdren, C., W. Jones, and J. Taggert. 2001). Altering the littoral zone and the riparian shoreline vegetation can afflict an area much larger than the disturbance's footprint, thereby diminishing its ability to support aquatic and semi-aquatic species.

Little macrophyte growth, fish or amphibian reproduction occurs in lacustrine resource areas that are greater than ten feet of water depth, with some the exceptions such as a few pelagic fish species in Pennsylvania. Light attenuation in Pennsylvania lacustrine resources occurs at approximately 12 feet (median) with macrophyte presence generally beginning to diminish around 6-8 feet of water depth, although some lacustrine resources may support quality macrophyte growth at depths of 15-20 feet. In lacustrine resources without frequent, rigorous wind mixing, dissolved oxygen depletions can develop below approximately 10 feet. The presence of varying substrate sizes and types and macrophytes enhance the biotic potential of the littoral zone.

2.1 Determining the Average Depth

The average depth is determined by taking the average of a minimum of five measurements along a line that runs the width of the entire AA (parallel to the shoreline), midway between the shoreline and the outer boundary of the AA. The assessor should note in the assessment as to whether the water levels and/or depth of the resource are being affected by seasonal fluctuations and if so, estimate the extent of the differential.



The five blue dots represent five depth measurements to be averaged along midpoint between shoreline and outer boundary of AA.

$$\text{EQUATION: Avg Depth} = \frac{\sum \text{FiveDepthMeasurements}}{5}$$

2.2 Average Depth Condition Categories

The condition categories provide concise cutoff points using the average depth for scoring. Most of the macro-biological activity in lacustrine resources occurs in less than 10 feet of water and therefore, shallow water yields a higher score. Most fish spawning activity occurs in six feet of water or less, with the exception of a few pelagic species. Increased habitat complexity increases the biological carrying capacity. Special aquatic habitats such as mud flats, submerged aquatic vegetation beds, emergent wetlands (occurring within the defined limits of the lacustrine resources) are scored optimally regardless of depth conditions.

The assessor may raise the condition category score one condition category level if complex substrate is present in depths below the High Optimal sub-category (greater than 10 feet). Complex substrate is considered to be a combination of any two of the following; large woody debris, boulder, cobble, gravel, sand and coarse particulate organic matter (CPOM) when present over more than 25% of the aquatic portion of the AA. These patchy habitats contribute to the quality of the aquatic resource.

1. Average Depth Condition Index																					
Average Depth of Impact Area	Condition Category															CI= Total Score/ 20					
	Optimal					Suboptimal					Marginal						Poor				
	High Optimal: Depth of the AA is greater than 0 and less than or equal to 6 feet in depth on average.*		Low Optimal: Depth of the AA is greater than 6 and less than or equal to 10 feet in depth on average.			Depth of the AA is greater than 10 and less than or equal to 15 feet in depth on average.					Depth of the AA is greater than 15 and less than or equal to 20 feet in depth on average.					Depth of the AA is greater than 20 feet in depth on average.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
* Special aquatic habitats such as mud flats, submerged aquatic vegetation beds, emergent wetlands (occurring within the defined limits of the lacustrine resources) are scored optimally regardless of depth conditions.																					
** The average depth is determined by taking a minimum of five measurements along a line that runs the width of the entire AA (parallel to the shoreline), midway between the shoreline and the outer boundary of the AA. Note: The condition category can be raised one level if below High Optimal when habitat complexity is present as described in Section 2.0 narrative .																					

$$\text{EQUATION: } AD\ CI = \frac{\text{Condition Category Score}}{20}$$

Optimal 20 - 16

High Optimal (20 - 18): Depth of the AA is greater than 0 and less than or equal to 6 feet in depth on average. Special aquatic habitats such as mud flats, submerged aquatic vegetation beds, emergent wetlands (occurring within the defined limits of the lacustrine resources) are scored optimally regardless of depth conditions.

Low Optimal (18 - 16): Depth of the AA is greater than 6 and less than or equal to 10 feet in depth on average.

Suboptimal 15 - 11

Depth of the AA is greater than 10 and less than or equal to 15 feet in depth on average.

Marginal 10 - 6

Depth of the AA is greater than 15 and less than or equal to 20 feet in depth on average.

Poor 5 - 1

Depth of the AA is greater than 20 feet in depth on average.

3.0 Riparian Shoreline Vegetation (RSV) Condition Index

This condition index is not intended to be a detailed vegetative cover survey, but instead, a qualitative evaluation of the cover types that make up the riparian shoreline vegetation. The riparian shoreline vegetation is the land extending 50 feet into the adjacent land perpendicularly from the shoreline. The condition index is determined by evaluating what cover type occupies what percent of the total riparian area within the AA. The recommended procedure for determining the aerial coverage percentage of the category conditions is to identify the area on aerial photography and estimate the percentage of coverage for each applicable condition category. The estimated coverage percentage for each applicable condition category is then verified in the field through visual observations.

The optimal riparian shoreline vegetation would include land cover areas comprised of hardwood/conifer trees, wetlands, waterways and/or lacustrine resources (≥ 10 acres). All areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are categorized as optimal. It is highly likely that the riparian shoreline vegetation area will contain land covers that meet multiple condition categories. If the land cover composite is heterogeneous (example: 33% forested, 33% cropland, and 34% pavement), each condition category present within the riparian shoreline vegetation is scored and weighted based on the percentage of the total area it occupies within the riparian shoreline vegetation area. A percentage estimate of the total area that each cover type occupies is determined by using visual estimates of each different area to obtain its percentage of cover. The assessor will categorize and score the observed cover types accordingly, based upon the condition category descriptions. The assessor records the percentages on the form in decimal format (**0.00**).

2. Riparian Shoreline Vegetation Condition Index																											
	Condition Category																										
	Optimal					Suboptimal				Marginal				Poor													
Riparian Shoreline Vegetation (from water's edge to 50 ft. inland)	Riparian area vegetation consists of a tree stratum (diameter at breast height (dbh) > 3 inches) present, with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.					High Suboptimal: Riparian area vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.				Low Suboptimal: Riparian area vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with maintained understory.				High Marginal: Riparian area vegetation consists of a non-maintained, dense herbaceous vegetation with either a shrub layer or a tree stratum (dbh >3 inches) present, with less than 30% tree canopy cover.				Low Marginal: Riparian area vegetation consists of a non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum and areas of hay production, and ponds or open water areas (< 10 acres) present. If tree stratum (dbh >3 inches) present, less than 30% tree canopy cover with maintained understory.				High Poor: Riparian area consists of lawns, mowed and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.			Low Poor: Riparian area consists of impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.		
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
1. Identify all applicable Condition Category areas within the riparian shoreline area using the descriptors above.										Total Score = SUM(% Areas*Scores)																	
2. Estimate the % area within each condition category.																											
3. Enter the % Shoreline Area in decimal form (0.00) and Score for each category in the blocks below.																											
Scoring:	Condition Category:																										
	% Area:																										
	Score:																										
	Sub-score:																										

CI= Total Score/ 20

EQUATION: $RSV\ CI = \frac{\sum (\% \text{ Areas} \times \text{Scores})}{20}$

3.1 Riparian Shoreline Vegetation Condition Categories

The portion of the AA from water's edge 50 feet landward is assessed for the condition of the riparian vegetation using the following four categories:

Optimal 20 - 16

Riparian area vegetation consists of a tree stratum (diameter at breast height (dbh) > 3 inches) present, with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.

Suboptimal 15 - 11

High Suboptimal (15 - 13): Riparian area vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.

Low Suboptimal (13 - 11): Riparian area vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with maintained understory.

Marginal 10 - 6

High Marginal (10 - 8): Riparian area vegetation consists of a non-maintained, dense herbaceous vegetation with either a shrub layer or a tree stratum (dbh >3 inches) present, with less than 30% tree canopy cover.

Low Marginal (8 - 6): Riparian area vegetation consists of a non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum and areas of hay production, and ponds or open water areas (< 10 acres). If tree stratum (dbh >3 inches) present, less than 30% tree canopy cover with maintained understory.

Poor 5 - 1

High Poor (5 - 3): Riparian area consists of lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, pervious trails, recently seeded and stabilized, or other comparable condition.

Low Poor (3 - 1): Riparian area consists of impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.

3.2 Riparian Shoreline Vegetation Condition Category Photographs

Optimal: (Below Left) Note extensive mature canopy (>60%) and wetland margin. (Below Right) Note emergent wetland from shoreline extending landward.



Low Suboptimal-High Marginal: 30-60% canopy cover with maintained understory.



Poor: Impervious surface, mowed lawns, beach.



4.0 Riparian Zone of Influence (ZOI) Vegetation (RZOI) Condition Index

This index is not intended to be a detailed vegetative cover survey, but instead, is a qualitative evaluation of the cover types that make up the Riparian ZOI. The Riparian ZOI is an area that extends an additional 50 feet landward from the riparian shoreline vegetation boundary established under **Section 3.0**. The condition index is determined by evaluating what cover type(s) occupies what percentage of the total Riparian ZOI area. The recommended procedure for determining the aerial coverage percentage of the condition categories is to identify the ZOI on aerial photography and estimate the percent of total coverage for each applicable condition category. The estimated percent of coverage for each condition category is then verified in the field through visual observations.

The optimal Riparian ZOI vegetation would include land cover areas comprised of hardwood/conifer trees, wetlands, waterways and/or lacustrine resources (≥ 10 acres). All areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are categorized as optimal. It is highly likely that the ZOI area will contain land covers that meet multiple condition categories. If the land cover composite is heterogeneous (example: 33% forested, 33% cropland, and 34% pavement), each condition category present within the Riparian ZOI is scored and weighted based on the percentage of the total area it occupies within the Riparian ZOI. A percentage estimate of the total area that each cover type occupies is determined by using visual estimates of each different area to obtain its percentage of cover. The assessor will categorize and score the observed cover types accordingly, based upon the condition category descriptions. The assessor records the percentages on the form in decimal format (**0.00**).

3. Riparian Zone of Influence (ZOI) Vegetation Condition Index																																
	Condition Category																															
	Optimal					Suboptimal					Marginal					Poor																
Riparian Zone of Influence (from 50-100 feet inland)	Riparian ZOI vegetation consists of a tree stratum (diameter at breast height (dbh) > 3 inches) present, with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.					High Suboptimal: Riparian ZOI vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.					Low Suboptimal: Riparian ZOI vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with maintained understory.					High Marginal: Riparian ZOI vegetation consists of non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh >3 inches) present, with less than or equal to 30% tree canopy cover.					Low Marginal: Riparian ZOI vegetation consists of a non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum and areas of hay production, and ponds or open water areas (< 10 acres) present. If tree stratum (dbh >3 inches) present, less than 30% tree canopy cover with maintained understory.				High Poor: Riparian ZOI vegetation consists of lawns, mowed, and maintained areas, nurseries; no till cropland; actively grazed pasture, sparsely vegetated non-maintained area, pervious trails, recently seeded and stabilized, or other comparable condition.				Low Poor: Riparian ZOI vegetation consists of impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.			
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1											
1. Identify all applicable Condition Category areas within the riparian ZOI using the descriptors above.										2. Estimate the % area within each condition category. Calculators are provided for you below.										3. Enter the % ZOI Area in decimal form (0.00) and Score for each category in the blocks below.												
										Total Score = SUM(%Areas*Scores)																						
Condition Category:																					Total Sub-Scores:											
Scoring:	% ZOI Area:																															
	Score:																															
	Sub-score:																															

CI=
Total
Score/
20

$$\text{EQUATION: } RZOI \text{ CI} = \frac{\sum (\% \text{ Areas} \times \text{Scores})}{20}$$

4.1 Riparian ZOI Vegetation Condition Categories

The portion of the AA from 50 to 100 feet landward of the shoreline is assessed for the condition of the riparian vegetation using the following four categories:

Optimal 20 - 16

Riparian ZOI vegetation consists of a tree stratum (diameter at breast height (dbh) > 3 inches) present, with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.

Suboptimal 15 - 11

High Suboptimal (15 - 13): Riparian ZOI vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.

Low Suboptimal (13 - 11): Riparian ZOI vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with maintained understory.

Marginal 10 - 6

High Marginal (10 - 8): Riparian ZOI vegetation consists of non-maintained, dense herbaceous vegetation with either a shrub layer or a tree stratum (dbh >3 inches) present, with less than or equal to 30% tree canopy cover.

Low Marginal (8 - 6): Riparian ZOI vegetation consists of non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, areas of hay production, and ponds or open water areas (< 10 acres). If tree stratum (dbh >3 inches) present, less than 30% tree canopy cover with maintained understory.

Poor 5 - 1

High Poor (5 - 3): Riparian ZOI vegetation consists of lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, pervious trails, recently seeded and stabilized, or other comparable condition.

Low Poor (3 - 1): Riparian ZOI vegetation consists of impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.

4.2 Riparian ZOI Vegetation Condition Category Photographs

Optimal: Mature dense canopy.



Low Suboptimal/High Marginal: 30-40% areal canopy coverage with maintained understory.



Poor: No canopy, grazed.



5.0 Shoreline and Near-shore Human Alterations (SNSHA) Condition Index

This index measures the level of anthropogenic alteration to the shoreline or near shore areas (within 50 feet of the shore line, measured from the shoreline water ward) that have occurred within the AA. Aerial photography may be used to estimate the percentage of human alteration to the shoreline or near shore areas within the AA. Field verification measurements may be required to confirm the estimated percentage of human alteration. Human alterations may include, but are not limited to, roads along the shore, riprap armoring, bulkheads, solid fill piers, wharfs, docks, boat ramps, break waters, boat houses, etc. Disturbances along the shore and in the near shore areas directly affect numerous ecological processes and can have significant effects on the resource.

4. Shoreline and Near-shore Human Alterations Index																					
Shoreline and Near-shore Human Alterations Index	Condition Category										CI= Total Score/ 20										
	Optimal		Suboptimal			Marginal			Poor												
	High Optimal: No man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline.	Low Optimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying less than 10% of the shoreline.	High Suboptimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 10% but less than 25% of the shoreline.	Low Suboptimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 25% but less than 40% of the shoreline.	High Marginal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 40% but less than 55% of the shoreline.	Low Marginal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 55% but less than 70% of the shoreline.	High Poor: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine (shoreline) occupying greater than or equal to 70% but less than 85% of the shoreline.	Low Poor: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine (shoreline) occupying greater than or equal to 85% of the shoreline.													
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

$$\text{EQUATION: SNSHA CI} = \frac{\text{ConditionCategoryScore}}{20}$$

5.1 Shoreline and Near-shore Human Alterations Condition Categories

Optimal 20 - 16

High Optimal (20 - 18): No man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline.

Low Optimal (18 - 16): Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying less than 10% of the shoreline.

Suboptimal 15 - 11

High Suboptimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 10% but less than 25% of the shoreline.

Low Suboptimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 25% but less than 40% of the shoreline.

Marginal 10 - 6

High Marginal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 40% but less than 55% of the shoreline.

Low Marginal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 55% but less than 70% of the shoreline.

Poor 5 - 1

High Poor: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine (shoreline) occupying greater than or equal to 70% but less than 85% of the shoreline.

Low Poor: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine (shoreline) occupying greater than or equal to 85% of the shoreline.

5.2 Shoreline and Near-shore Human Alterations Condition Category Photographs

Optimal: Undisturbed



Low Suboptimal/High Marginal: Riprap, dock, beach.



Poor: Depending on project location here, up to 100% consists of man-made structures.



6.0 Overall Lacustrine Condition Index (LCI)

The overall lacustrine condition index is calculated by summing the previously calculated condition indexes and dividing the total by four (4). Each condition index score should result in a value from 0.05 - 1.0. The overall lacustrine condition index should result in a value from 0.05 - 1.0. If values greater than 1.0 result, then it is likely that the individual scores are being used and not the calculated indexes. Space is provided on the Lacustrine Condition Assessment Form to perform this calculation.

$$\text{EQUATION: } LCI = \frac{\sum CIs}{4}$$

Project areas located greater than fifty (50) feet from the shoreline will utilize the Average Depth Condition Index, unless otherwise instructed by the Department, to determine the LCI. The following equation is used:

$$\text{EQUATION: } LCI = \frac{ADCICategoryScore}{20}$$

NOTE: The Department may revise the LCI scores reported as part of an application for determining applicable compensatory requirements if the assessment submitted by the applicant does not adequately represent the resource condition.

Bibliography

- Flotemersch, J.E., J.B. Stribling, and M.J. Paul. 2006 *Concepts and Approaches for the Bioassessment of Non-wadeable Streams and Rivers*. EPA 600-R-06-127. U.S. Environmental Protection Agency, Cincinnati, Ohio.
- Holdren, C., W. Jones, and J. Taggert. 2001. *Managing Lakes and Reservoirs*. NALMS, Terrene Institute.
- Lane, J.A., C.B. Portt, and C.K. Minns. 1996. *Nursery habitat characteristics of Great Lakes fishes*. Can. MS Rep. Fish. Aquat. Sci. 2368:48.
- Minnesota DNR. *Improve and Protect Habitat*. 2001.
- Minns, C.K. 1989. *Factors affecting fish species richness observed in Ontario's inland lakes*. Trans. Am. Fish. Soc. 118:553-45.
- Rheinhardt, Richard, Mark Brinson, Robert Brooks, Mary McKenney-Easterling, Jennifer Masina Rubbo, Jeremy Hite, Brian Armstrong, 2007. Development of a reference-based method for identifying and scoring indicators of condition for coastal plain riparian reaches, *Ecological Indicators*, Volume 7, Issue 2, April 2007, Pages 339-361, ISSN 1470-160X, <http://dx.doi.org/10.1016/j.ecolind.2006.02.007>.
- U.S. EPA. 1999. Chapter 5, *Habitat Assessment and Physicochemical Parameters. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition*. EPA-841-B-99-002.
- Walsh, M.C., J. Deeds, and B. Nightingale. 2007. User's Manual and Data Guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

APPENDIX A

FORMS

Lacustrine Condition Assessment Form

Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Version 2.0

For use in lakes, reservoirs and non-wadeable rivers found within Pennsylvania.

Project #	Project Name	Date	Impact Size	AA #	AA SIZE
Name(s) of Evaluator(s)	Lat (dd)	Long (dd)			

1. Average Depth Condition Index

Average Depth of Impact Area	Condition Category														CI= Total Score/ 20						
	Optimal				Suboptimal					Marginal				Poor							
	High Optimal: Depth of the AA is greater than 0 and less than or equal to 6 feet in depth on average.*	Low Optimal: Depth of the AA is greater than 6 and less than or equal to 10 feet in depth on average.	Depth of the AA is greater than 10 and less than or equal to 15 feet in depth on average.					Depth of the AA is greater than 15 and less than or equal to 20 feet in depth on average.				Depth of the AA is greater than 20 feet in depth on average.									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

* Special aquatic habitats such as mud flats, submerged aquatic vegetation beds, emergent wetlands (occurring within the defined limits of the lacustrine resources) are scored optimally regardless of depth conditions.

** The average depth is determined by taking a minimum of five measurements along a line that runs the width of the entire AA (parallel to the shoreline), midway between the shoreline and the outer boundary of the AA. Note: The condition category can be raised one level if below High Optimal when habitat complexity is present as described in Section 2.0 narrative .

Comments:

2. Riparian Shoreline Vegetation Condition Index

Riparian Shoreline Vegetation (from water's edge to 50 ft. inland)	Condition Category														CI= Total Score/ 20						
	Optimal				Suboptimal					Marginal				Poor							
	Riparian area vegetation consists of a tree stratum (diameter at breast height (dbh) > 3 inches) present, with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.	High Suboptimal: Riparian area vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	Low Suboptimal: Riparian area vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with maintained understory.	High Marginal: Riparian area vegetation consists of a non-maintained, dense herbaceous vegetation with either a shrub layer or a tree stratum (dbh >3 inches) present, with less than 30% tree canopy cover.	Low Marginal: Riparian area vegetation consists of a non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum and areas of hay production, and ponds or open water areas (< 10 acres)present. If tree stratum (dbh >3 inches) present, less than 30% tree canopy cover with maintained understory.	Riparian area consists of lawns, mowed and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.				Riparian area consists of impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.											
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

1. Identify all applicable Condition Category areas within the riparian shoreline area using the descriptors above.
2. Estimate the % area within each condition category.
3. Enter the % Shoreline Area in decimal form (0.00) and Score for each category in the blocks below.

Condition Category:		Total Score = SUM(% Areas*Scores)																				
Scoring:	% Area:																					Total Sub-Scores:
	Score:																					
	Sub-score:																					

Comments:

Lacustrine Condition Assessment Form

Pennsylvania Lacustrine Condition Level 2 Rapid Assessment Version 2.0

For use in lakes, reservoirs and non-wadeable rivers found within Pennsylvania.

3. Riparian Zone of Influence (ZOI) Vegetation Condition Index

	Condition Category																						
	Optimal				Suboptimal				Marginal				Poor										
Riparian Zone of Influence (from 50-100 feet inland)	Riparian ZOI vegetation consists of a tree stratum (diameter at breast height (dbh) > 3 inches) present, with greater than or equal to 60% tree canopy cover. Areas comprised of stream channels, wetlands (regardless of classification or condition) and lacustrine resources ≥ 10 acres are scored as optimal.				High Suboptimal: Riparian ZOI vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.				Low Suboptimal: Riparian ZOI vegetation consists of a tree stratum (dbh >3 inches) present, with greater than or equal to 30% and less than 60% tree canopy cover with maintained understory.				High Marginal: Riparian ZOI vegetation consists of non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh >3 inches) present, with less than or equal to 30% tree canopy cover.				Low Marginal: Riparian ZOI vegetation consists of a non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum and areas of hay production, and ponds or open water areas (< 10 acres) present. If tree stratum (dbh >3 inches) present, less than 30% tree canopy cover with maintained understory.		High Poor: Riparian ZOI vegetation consists of lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, pervious trails, recently seeded and stabilized, or other comparable condition.		Low Poor: Riparian ZOI vegetation consists of impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, impervious trails, or other comparable conditions.		CI= Total Score/ 20
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
1. Identify all applicable Condition Category areas within the riparian ZOI using the descriptors above.														Total Score = SUM(%Areas*Scores)									
2. Estimate the % area within each condition category. Calculators are provided for you below.																							
3. Enter the % ZOI Area in decimal form (0.00) and Score for each category in the blocks below.																							
Scoring:	Condition Category:																				Total Sub-Scores:		
	% ZOI Area:																						
	Score:																						
	Sub-score:																						
Comments:																							

4. Shoreline and Near-shore Human Alterations Index

	Condition Category																										
	Optimal				Suboptimal				Marginal				Poor														
Shoreline and Near-shore Human Alterations Index	High Optimal: No man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline.				Low Optimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying less than 10% of the shoreline.				High Suboptimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 10% but less than 25% of the shoreline.				Low Suboptimal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 25% but less than 40% of the shoreline.				High Marginal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 40% but less than 55% of the shoreline.				Low Marginal: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine shoreline occupying greater than or equal to 55% but less than 70% of the shoreline.		High Poor: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine (shoreline) occupying greater than or equal to 70% but less than 85% of the shoreline.		Low Poor: Man-made structures, roads or other disturbances within 50 feet or along the lacustrine (shoreline) occupying greater than or equal to 85% of the shoreline.		CI= Total Score/ 20
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1						
Comments:																											
Overall Lacustrine Level 2 Condition Score: Sum all four of the Condition Indexes and divide by 4 to calculate the overall condition score (value between 0.05 and 1.0).																	Index Sum:										
																	Overall Condition Index:										
General Comments:																											