Proposed Stream Nutrient Assessment Procedure (SNAP)

STEP 1	*STEP 2*	*STEP 3*	*STEP 4*	
Biological Criteria	**DO Swing [2]**	**Benthic Chlorophyll [3]**	**Preliminary Assessment: Trophic Condition Status of Evaluated Reach or Waterbody**	
All indices attaining or in non-significant departure[1]	Normal or low swings (≤6.5 mg/l)	Low to moderate (≤320 mg/m^2)	Attaining use / Not threatened	
		High (>320 mg/m^2)	Attaining use, but may be threatened	*See Flow Chart A*
	Wide swings (>6.5 mg/l)	Low (≤182 mg/m^2)		
		Moderate to high (>182 mg/m^2)		
Non-attaining (one or more indices below non-significant departure)	Normal or low swings (≤6.5 mg/l)	Low to moderate (≤320 mg/m^2)	Impaired, but cause(s) other than nutrients	*See Flow Chart B*
		High (>320 mg/m^2)	Impaired; likely nutrients over-enrichment	*See Flow Chart C*
	Wide swings (>6.5 mg/l)	Low (≤182 mg/m^2)		
		Moderate to high (>182 mg/m^2)	Impaired; Nutrients over-enrichment	

Proposed Stream Nutrient Assessment Procedure (SNAP) -- continued

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Notes:

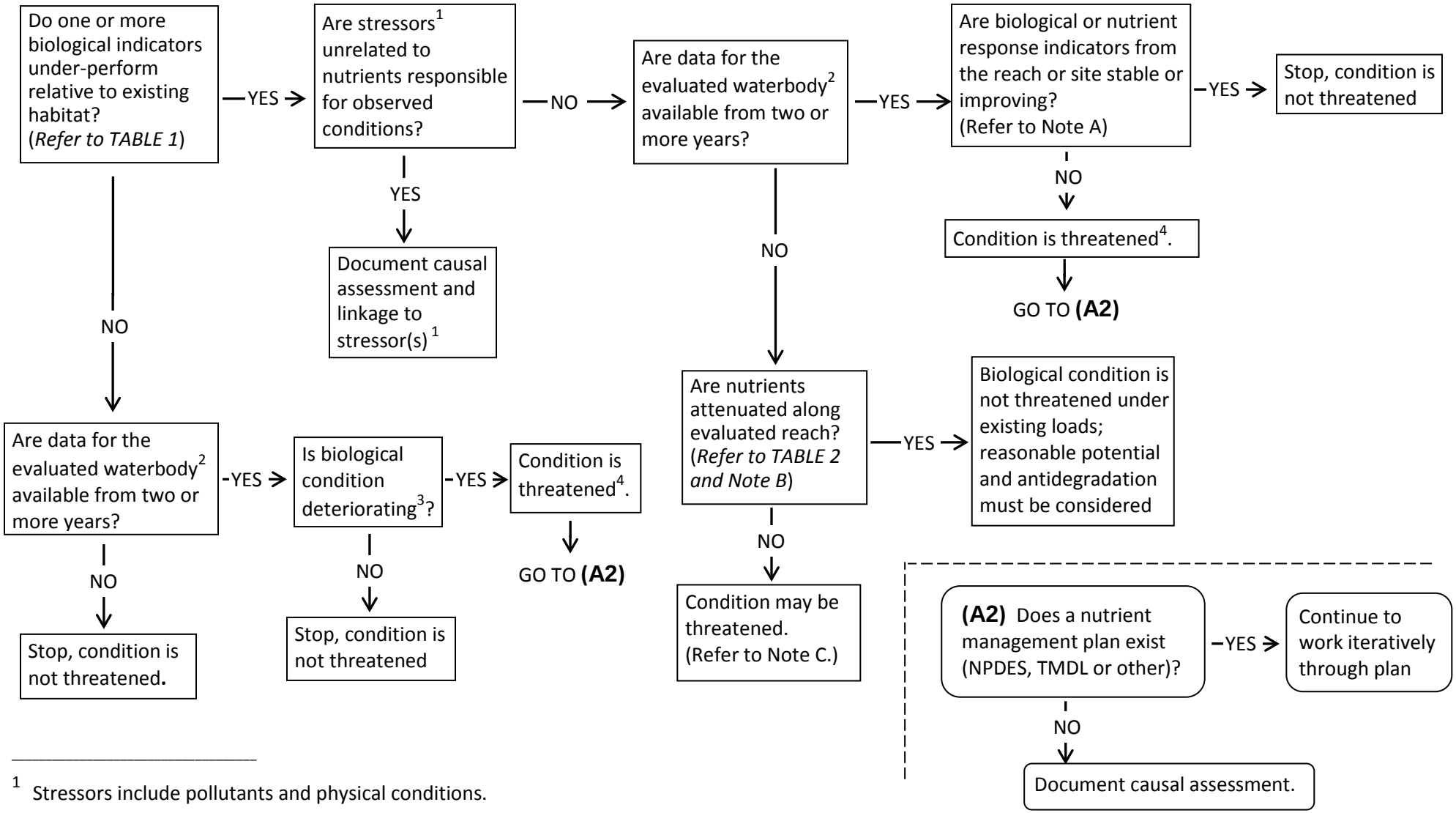
[1] Non-significant departure from biocriteria values accounts for background variability in measurements for biological indices. In accordance with "*Biological Criteria for the Protection of Aquatic Life: Volume II: Users Manual for Biological Field Assessment of Ohio Surface Waters*", Ohio EPA (1987, updated 1988, 1989, 2006), non-significant departure is 4 points for IBI and ICI, and 0.5 point for MIwb.

[2] Threshold value for 24-hour DO swing based upon a change point of 6.5 mg/l between DO swing and minimum DO. "Low to normal" DO swing is ≤6.5 mg/l. "Wide" DO swing is >6.5 mg/l. Data used for analysis from *Technical Support Document for Nutrient Water Quality Standards for Ohio Rivers and Streams*, Ohio EPA (2011).

[3] Threshold values for benthic chlorophyll *a* are based upon change points between benthic chlorophyll *a* and DO swings or Invertebrate Community Index (ICI). "Low" chlorophyll *a* is ≤182 mg/m^2. "Moderate" chlorophyll *a* is >182 and ≤320 mg/m^2. "High" chlorophyll *a* is >320 mg/m^2. Data used for analysis from *Technical Support Document for Nutrient Water Quality Standards for Ohio Rivers and Streams*, Ohio EPA (2011).

FLOW CHART A. – DECISION TREE FOR DETERMINING WHEN BIOLOGICALLY ATTAINING CONDITION STATUS IS THREATENED BY NUTRIENTS

For application when biological criteria are attaining, but one or both nutrient response indicators (DO swing or benthic chlorophyll) are elevated.



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[1] Stressors include pollutants and physical conditions.

[2] The geographic scope or length of evaluated reaches or waterbodies are defined in approved study plans.

[3] For a given site, a decrease of 5 or more IBI or ICI points, or 0.6 or more MIWb points between sampling years can represent a significant change. Trends for waterbodies are formally evaluated in Biological and Water Quality Technical Support Documents.

[4] As recommended by US EPA in its integrated reporting guidance, "threatened" waters are currently attaining WQSs but are expected to not meet WQSs by the next listing cycle (every two years). For example, a declining trend may indicate threatened status, whereas a stable or improving trend would not.

Flow Chart A (continued) – Additional Notes:

Note A. The top row provides for a conditional evaluation for a subset of cases where existing nutrient management plans exist, either via NPDES permits or a TMDL. To enter this row, the determination has already been made that nutrient response indicators are elevated, and biological indicators are under-performing relative to habitat. This evaluation identifies cases where biology may be under-performing, but is on an improving trajectory due to management. An existing management plan implies historic data exist, and that the reach was likely flagged as impaired; therefore, in most cases, to get to the right hand side of this row presupposes that the biological condition has already improved.

Note B. Attenuation of nutrients in an evaluated reach is demonstrated by nutrient concentrations measured at two or more successive sites downstream from a defined source decreasing through uptake, sequestration or dilution such that concentrations fall to either background levels or levels where risk of eutrophication to downstream waters is minimal (see Table 2). Where there are no historic data on which to base trends, attenuation of nutrients within the reach implies assimilation within what the waterbody can handle under existing conditions, and that stress from the nutrient load is spatially transient (i.e., localized to the immediate reach).

Note C. If attenuation appears ambiguous or cannot be determined because of an insufficient number of downstream sampling points between the source in question and the next downstream receiving water or the next major source contributor, additional sampling is needed to determine condition status.

TABLE 1 – Equations used as guidance to help determine whether biological indicators are underperforming relative to existing habitat.

To assist in determining whether measured biological indicator values at the site being assessed underperform relative to the existing habitat, the measured value(s) are compared with the 25th and 15th percentile values of all data classified as unimpaired in the Ohio EPA assessment database and stratified by the designated classification (EWH, WWH or MWH) within the specific ecoregion for the site. The 25th and 15th percentiles represent levels that most sites equal or exceed. If the respective measured biological indicator value is less than the 15th percentile value then the site is likely underperforming relative to what could be expected given the local habitat quality (QHEI). If the indicator value is between the 15th and 25th percentile values, additional information or observations should be used to determine whether or not the site is underperforming with respect to its habitat. If the indicator value is above the 25th percentile value, the site would be considered performing within the range expected for the existing habitat.

The following equations calculate the 25th and 15th percentile values as determined by regression analysis for the respective biological indicators for a given QHEI score, or a combination of QHEI score and drainage area. For small and headwater streams where insufficient stream flow prevents collection of a quantitative sample, thereby precluding calculation of an ICI score, the number of EPT taxa is used as the macroinvertebrate indicator. Such small streams are typically less than 20 square miles in drainage area, or larger if stream velocity is insufficient to collect a quantitative sample.

Class / Ecoregion		Percentile	IBI (fish)	MIWb (fish)	EPT Taxa (macroinvertebrates)	ICI (macroinvertebrates)
EWH / All Ecoregions		25th	40.67 + 0.118·QHEI	8.21 + 0.006·QHEI + 0.385·Log10(DA)	4.65 + 0.123·QHEI + 1.182·Log10(DA)	= 46
		15th	39.60 + 0.113·QHEI	NA	1.47 + 0.151··QHEI + 1.084·Log10(DA)	NA
WWH & MWH	HELP	25th	23.65 + 0.150··QHEI	5.64 + 0.959·Log10(DA)	4.26 + 2.585·Log10(DA)	All Ecoregions: 25th percentile: 25.60 + 0.160·QHEI 15th percentile: 19.32 + 0.213·QHEI
		15th	22.00 + 0.121·QHEI	NA	2.54 + 2.659·Log10(DA)	
	EOLP	25th	22.00 + 0.316·QHEI	4.76 + 0.043·QHEI + 0.491·Log10(DA)	NA	
		15th	18.24 + 0.336·QHEI	4.55 + 0.045·QHEI + 0.397·Log10(DA)	= 9 taxa	
	WAP	25th	31.30 + 0.200·QHEI	7.94 + 0.537·Log10(DA)	3.94 + 0.114·QHEI	
		15th	27.78 + 0.225·QHEI	7.58 + 0.543·Log10(DA)	2.14 + 0.113·QHEI	
	ECBP & IP	25th	29.96 + 0.157·QHEI	4.94 + 0.036·QHEI + 0.388·Log10(DA)	-0.95 + 0.147·QHEI + 0.927·Log10(DA)	
		15th	29.47 + 0.133·QHEI	4.96 + 0.034·QHEI + 0.362·Log10(DA)	-2.19 + 0.138·QHEI + 1.010·Log10(DA)	

NA = Not Available. Could not be determined because of limited data or data distribution.
DA = Drainage Area (in square miles)

TABLE 2 – Concentrations of total phosphorus (TP) and dissolved inorganic nitrogen (DIN) arrayed by narrative levels of ecological risk.

Table 2 presents narrative descriptions of various levels of ecological condition and potential risk, arrayed with ranges of nutrient concentrations commonly observed at the respective ecological condition levels. This information may be useful reference for nutrient assessment using Charts A or C. **Chart A**: Attenuation from a defined source may be inferred by nutrient concentrations measured at successive stations within an evaluated reach decreasing from a higher risk level to a lower risk level. **Chart C**: Table 2 may be used as a general reference in assessing impairment risk. Actual risks and the potential benefits of abatement are site-specific determinations.

		← *DECREASING RISK*				
	TP Conc. (mg/l)	**DIN Concentration** (mg/l)				
		<0.44	0.44 < 1.10	1.10 < 3.60	3.60 < 6.70	≥6.70
DECREASING RISK →	<0.040	background levels typical of least disturbed conditions	levels typical of developed lands; little or no risk to beneficial uses	levels typical of modestly enriched condition in phosphorus limited systems; low risk to beneficial use if allied responses are within normal ranges	levels typical of enriched condition in phosphorus limited systems; moderate risk to beneficial use if allied responses are elevated	characteristic of tile-drained lands; otherwise atypical condition with moderate risk to beneficial use if allied responses are elevated (1.1% of observations)
	0.040-<0.080	levels typical of developed lands; little or no risk to beneficial uses	levels typical of developed lands; little or no risk to beneficial uses	levels typical of working landscapes; low risk to beneficial use if allied responses are within normal ranges	levels typical of enriched condition in phosphorus limited systems; moderate risk to beneficial use if allied responses are elevated	characteristic of tile-drained lands; moderate risk to beneficial use if allied responses are elevated (1.1% of observations)
	0.080-<0.131	levels typical of modestly enriched condition in nitrogen limited systems; low risk to beneficial use if allied responses are within normal ranges	levels typical of working landscapes; low risk to beneficial use if allied responses are within normal ranges	levels typical of working landscapes; low risk to beneficial use if allied responses are within normal ranges	characteristic of tile-drained lands; moderate risk to beneficial use if allied responses are elevated; increased risk with poor habitat	characteristic of tile-drained lands; moderate risk to beneficial use if allied responses are elevated (1.0% of observations)
	0.131-<0.400	levels typical of modestly enriched condition in nitrogen limited systems; low risk to beneficial use if allied responses are within normal ranges	levels typical of enriched condition; low risk to beneficial use if allied responses are within normal ranges	levels typical of enriched condition; low risk to beneficial use if allied responses are within normal ranges; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors
	≥0.400	atypical condition (1.3% of observations)	atypical condition (1% of observations);	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors ; increased risk with poor habitat	enriched condition; generally high risk to beneficial uses; often co-occurring with multiple stressors

"allied responses" = allied response indicators (DO swing, benthic chlorophyll)

TABLE 2 (continued)

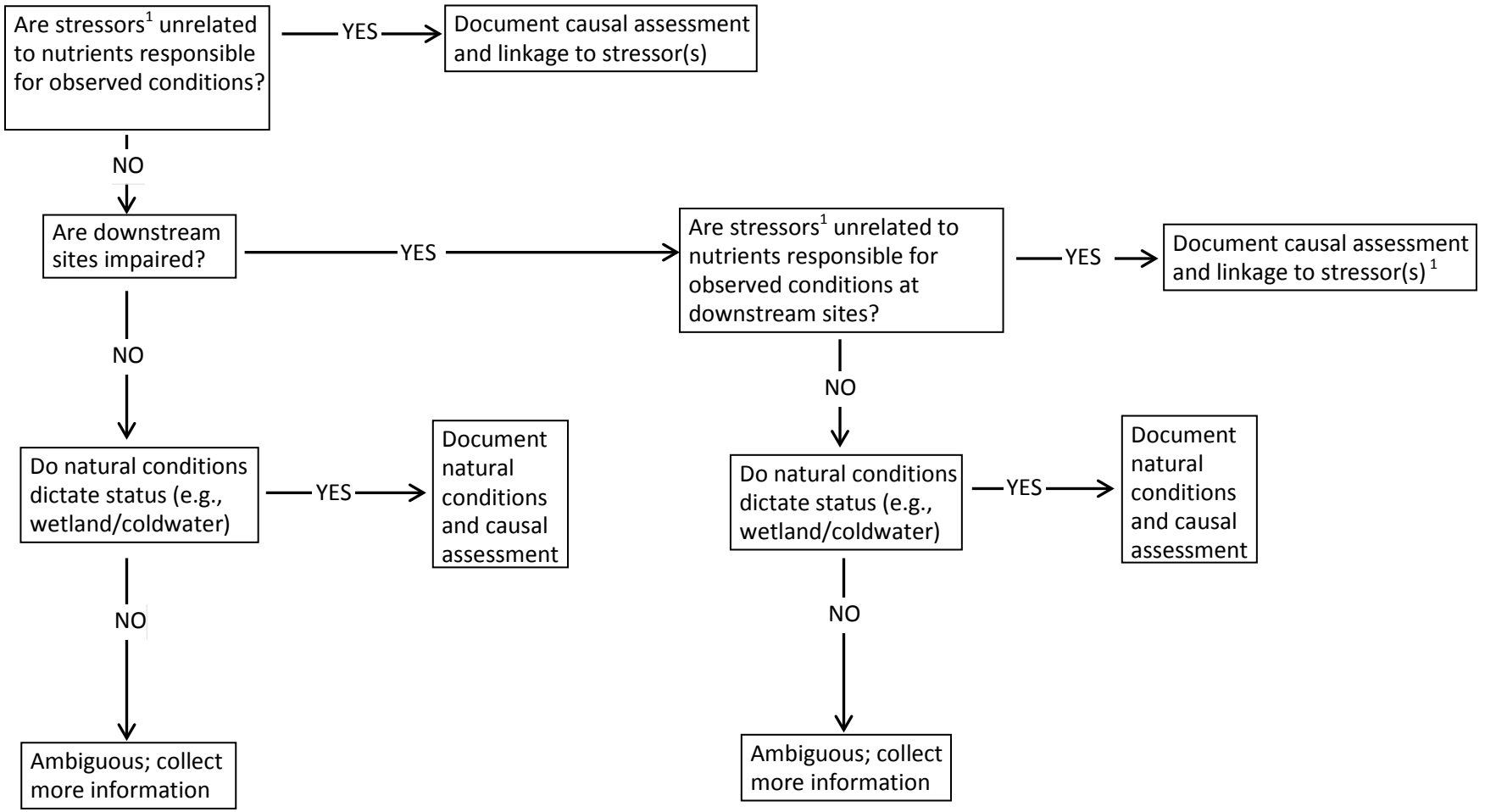
Ohio EPA's monitoring data for the years 1981 through 2011 (n = 16,870), from index period samples (June-October) and all stream sizes, was used to derive the information presented in Table 2. Following is the frequency of occurrence in the database for each nutrient concentration range, expressed as percent of total data values.

Frequency of Occurrence in Database, as Percent of Total (n=16,870)

Total Phosphorus (mg/l)	**Dissolved Inorganic Nitrogen** (mg/l)				
	<0.44	0.44 < 1.10	1.10 < 3.60	3.60 < 6.70	≥6.70
<0.040	18.14%	5.00%	4.26%	1.13%	0.66%
0.040 < 0.080	6.50%	5.66%	4.87%	1.11%	0.29%
0.080 < 0.131	3.30%	3.77%	5.20%	1.01%	0.31%
0.131 < 0.400	3.62%	4.31%	11.39%	3.01%	1.45%
≥0.400	1.33%	0.99%	4.84%	4.07%	3.78%

FLOW CHART B – DECISION TREE FOR DETERMINING BIOLOGICAL IMPAIRMENT CAUSED BY STRESSORS OTHER THAN NUTRIENTS

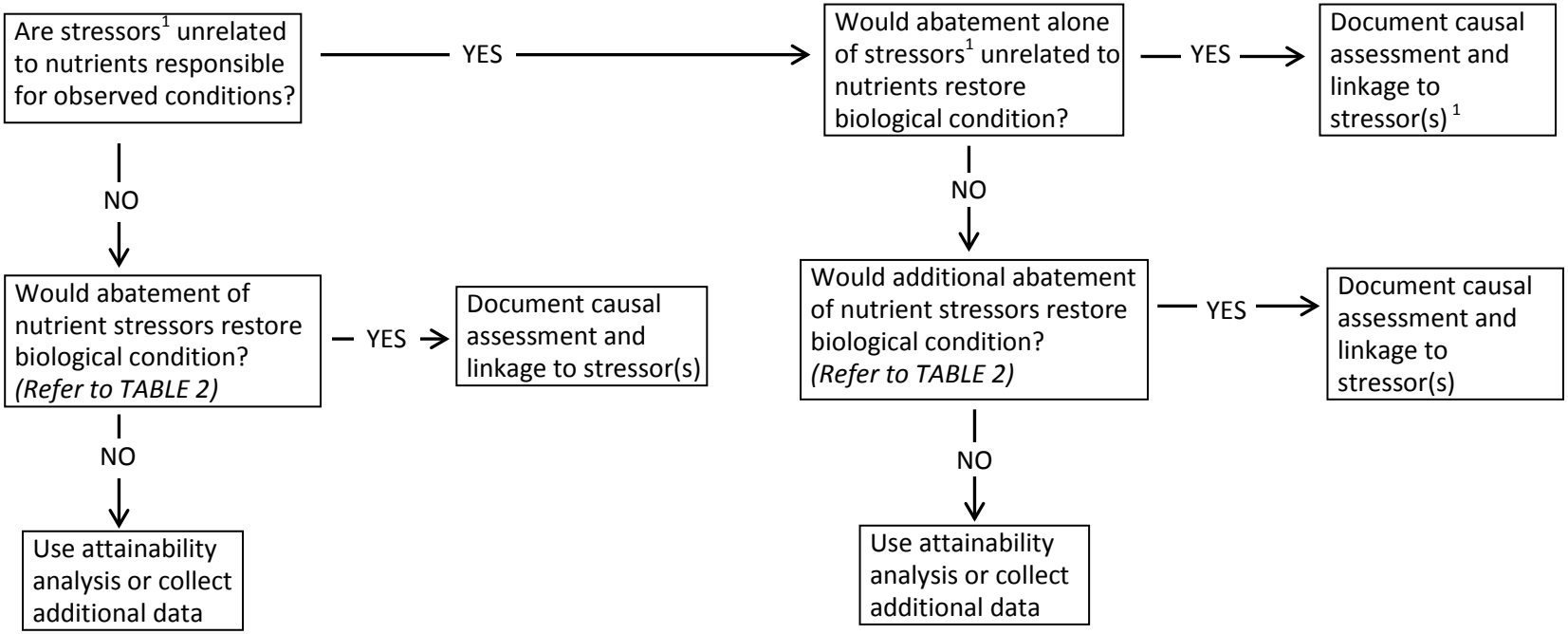
For application when one or more biological criteria are non-attaining, but no nutrient response indicators (DO swing or benthic chlorophyll) are elevated.



[1] Stressors include pollutants and physical conditions.

FLOW CHART C – DECISION TREE FOR CONFIRMING BIOLOGICAL IMPAIRMENT CAUSED BY NUTRIENTS

For application when one or more biological criteria are non-attaining, and either nutrient response indicator (DO swing or benthic chlorophyll) is elevated.



[1] Stressors include pollutants and physical conditions.

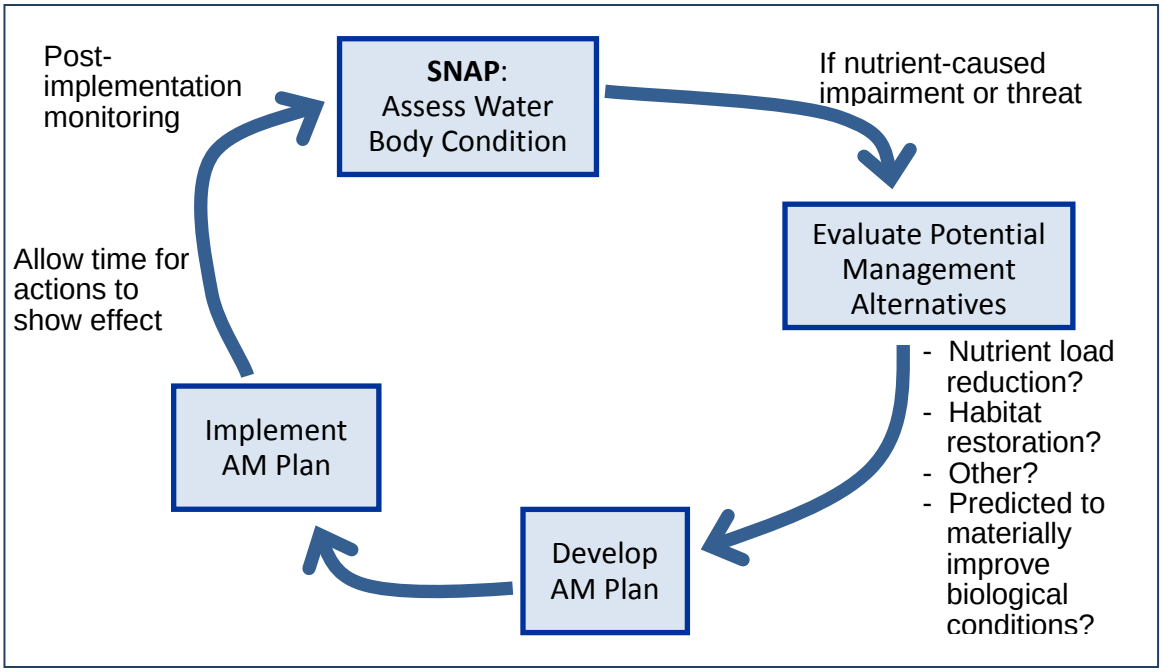
Adaptive Management

Adaptive management (AM) in the context of Ohio's nutrient water quality standards and reduction strategy is an iterative process to design and implement cost-effective management actions to abate threats or impairments to water quality caused in whole or in material part by nutrients. Recognizing that there is uncertainty regarding causal and restorative links between aquatic biology, nutrients, and other stressors, AM provides the opportunity to evaluate the SNAP-generated and other relevant information to design management alternatives. These management alternatives, including but not limited to nutrient reduction, habitat restoration/improvement, effluent trading, and other actions, should be evaluated based on their potential to materially improve biological conditions, cost-effectiveness, technical feasibility, affordability, time to implement, and other relevant factors.

An AM plan would be developed using one or more of the management alternatives. The plan should include a description of the actions to be taken, how they will be maintained, an implementation time schedule, the estimated cost, projected benefits, and a post-implementation monitoring program designed to assess the effectiveness of the plan.

As applied to permitted NPDES point sources, the AM plan will be submitted to Ohio EPA for approval. Upon approval, it will become an enforceable part of the NPDES permit. If post-implementation monitoring determines that nutrient-caused impairment or threat still exists using the SNAP, then the permittee shall prepare and, upon Ohio EPA approval, implement an updated AM plan, which shall assess the previous AM plan and consider alternative or additional actions.

Following is a conceptual diagram of the Ohio nutrient adaptive management (AM) process.



Nutrient Rule Implementation Process

No

Optimization:
- Study
- Implement

SNAP: nutrient impact?

Impaired

Threatened

Watch List

Initial management actions:
- Cap existing PS nutrient loads
- Pollution prevention for industrial sources & MS4s

Will PS reductions make material difference?

No

Maintain initial management actions

Yes

Enter Adaptive Management

or

Agree to final limit with compliance schedule

Develop AM Plan

Obtain Ohio EPA Approval for PS AM Plans

Revise AM Plan

Continue/ Update AM Plan

Implement AM Plan

Post-implementation monitoring

Is WQ (biocriteria) attaining?

Attaining

Maintain AM measures

Revise 303(d) & TMDL

Improving

Will continuing AM Plan further improve WQ? (biocriteria)

Yes

No

Will additional PS reductions materially improve?

Yes

Not Improving

No

Maintain AM measures

Evaluate UAA, WQ variance, other options

Implementation Subcommittee Consolidated Comments on Jan. 20, 2015 Working Draft of Nutrient Rule Issues

Ohio TAG Meeting
Friday March 6, 2015

OHIO EPA

Ohio EPA - Agree

- Any independently applicable nutrient statute rule (IJC stipulated TP effluent limits) continue to apply
- SNAP should be used for new 303(d) listings
- SNAP cannot be challenged once it is adopted in a rule, but case specific facts are appealable
- #5 comments
- We would like to help convince US EPA that a watch list is appropriate
- Agree to Interim limits (cap at existing load with adaptive mgmt) or accept a final limit
- Implementation credits
- Agree on index period (May-Oct)
- Modify existing rules (weekly/monthly P) to facilitate this rule (seasonal P; add “unless impracticable” to 33-05)
- Adaptive management plans to be developed by permittees/stakeholders
- Nutrient rule doesn’t need to address MOS and GA

Ohio EPA – Options to Address Resources Needed for Stream Assessment and AM

- Agency allocates more resources (prioritization of all resources, solicits 3rd party involvement)
- Extend time between assessment periods
- PS pays for reassessment akin to the Voluntary Action Program (reduce cost of re-assessment)
- Reduce scope of re-assessment (focus on DO swing or benthic chlorophyll)

Surrogate WQT values

"allied responses" = allied response indicators (DO swing, benthic chlorophyll)

← *DECREASING RISK*

TP Conc. (mg/l)	DIN Concentration (mg/l)				
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DECREASING RISK →

Ohio EPA – Seek Clarification

- Overall #3 – how to place SNAP in the OAC (integrate with nuisance rule?)
- "We believe the specific values listed here (0.4 mg/L TP and 3.6 mg/L DIN) are on the outer edge of *what might be selected as target values on a case by case basis*."
- If insufficient data exist to do a TMDL with SNAP, the nutrient portion of the TMDL should be put on hold and necessary data collected
- Agency should use DO/chla as targets for TMDLs if possible; if TMDL is done with TP/DIN targets, include language that the permit can be based on a DO/chla model
- "Situation [where non-nutrient stressors prevent material improvements] may fit use attainability analysis and change in Aquatic life use. "

Ohio EPA – Seek Clarification (2)

- We don't believe that the WI rule approach should be applied in Ohio
  - There should not be a default assumption that nutrient reductions are required or that they should be "technology based". SNAP should be the starting point and DO/chla modeling should be the mechanism by which final permit limits are derived.
- Adaptive management focuses on making progress to restore the biological uses. We want to make sure that effluent trading rules (which have only benefited one discharger) don't become a barrier to doing AM.
- Whether and how AM becomes enforceable part of the permit
- Reasonable potential
- Are how new sources of nutrients handled any different than other pollutants?
- Substantial compliance with permit (vs full compliance)? Why is AM singled out for this? Shouldn't AM be held to substantially complying with AM plan?

Ohio EPA – Seek Clarification (3)

- If biology is not improving, biocriteria are not being met, and further nutrient reductions will materially improve the situation, then a final limit (WQBEL) can be established. Otherwise, the agency should delay establishing a final limit.

Ohio EPA – Potential Concerns

- Affordability – Ohio is not bound by US EPA guidance; we can do better. EFAB's metrics are far more reflective of a community's ability to afford CWA obligations. These metrics should be included in the rule.
- Technology-based limits: we oppose this concept (starting point is capping loads)
- First permit limit should be a cap based on existing load

Sasson, Antosch, Meyer, Kocarek, Reash and PCS

CONSOLIDATED COMMENTS

Clarify

- WQS Guidance 4 v. the Associations Report (AR)
  - Review comments
  - Discuss with Ohio EPA since they intend to phase it out
  - Clarify we meant “stop using the target values in the AR”
- Discuss Watershed Management Plan
  - Anybody could do
  - Allows Ohio EPA to direct 319 funding
  - PS and NPS optimization studies
- Watchlist concept – give threatened streams additional and more timely attention
  - Get info from Larry about Ohio NPS Assessment document
- Nonpoint source reductions

Clarify (2)

- Point Source Contribution Spectrum and that feasibility assessments should occur early on in the AM process or as part of a TMDL implementation plan
- “Assessment” – create a graphic that shows the holistic implementation of the process
- Flow Chart A and limited data
- If poor habitat, then shouldn’t require nutrient removal (outside of Ohio EPA’s ability to address and outside of the nutrient rule)
- Variance could be an approach that could be used (needs further work)

Clarify (3)

- Effluent trading v. adaptive management
- Define terms
- How we came up with the 3x the seasonal limit as a monthly limit
- The nutrient rule is intended to address water bodies that are impaired or threatened due to nutrients. The SNAP is not designed to be used for antidegradation of water ways that are of superior biological condition.
- Discuss point and nonpoint sources (hortatory)
- Habitat – AM encourages fixing these problems; effluent trading instead focuses on pounds of P or DIN

Disagree

- Modeling to infer threatened/impairment status [A18] – shouldn’t happen and don’t want to do

PCS

- Understand concern about default WQ target values for TP and DIN, however, in absence of a DO/chla model, some WQTVs are inevitable [1]
- Disagree about quantitatively defining “materially improve” [3]
- Threatened is defined in SNAP [3]
- Inserted optimization for industrials as pollution prevention [4]
- Stream flow should be clarified – 80%, 66.7%, other? [6]
- Added industrial permit limits as issue TBD [7]
- Added reasonable potential as an issue TBD; anti-degradation doesn’t apply [8]
- Used many of the adaptive management (AM) components for draft AM structure [AM]
- Rule will address index period only (so concern about winter WLAs is moot) [AM]
- Disagree about requiring confirmatory SNAP sampling [AM]

Parking Lot

- Allocation b/w PS and NPS and intra-PS
- MS4s
- Additions/revisions for industrial PSs
- Integration with narrative nuisance conditions rule
- Definition of “materially improve”
- Do optimization studies when discharging to nutrient impaired streams regardless of material improvements. Need to define optimization and “not large expenditure”. Data suggest that cost of small POTWs are more than an order of magnitude greater than large POTWs per gallon treated.
- At what point do you step out of AM process into a numeric nutrient limit?
- Optimization should not require modifications to pretreatment requirements.
- Loading versus concentration limits.
- Notwithstanding 3745-2-02(58), need to spell out reasonable potential for nutrients
- Adaptive management (AM) – define in rule? Guidance with annual updates?
- AM reporting frequency and process to get approval for plan revisions
- Sediment loads of P – deal with this in TMDL guidance
- Reasonable potential for TP and/or DIN
- Offramp for situations where hydrologic modifications are preventing use attainment