

# ***Region V State Bioassessment and Ambient Monitoring Programs: Initial Evaluation and Review***

**NWQMC Conference**

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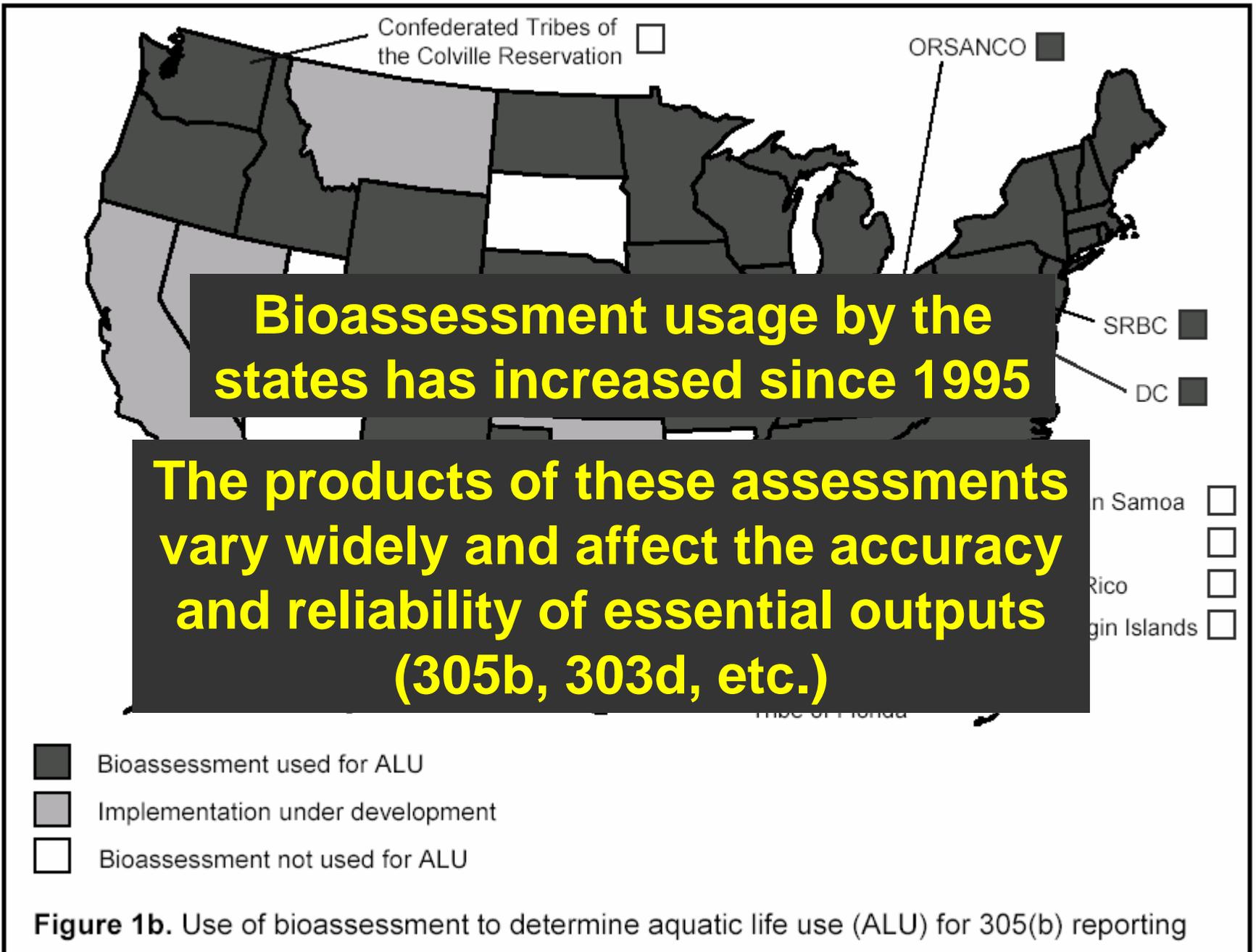
**Presented by Ed Rankin**

# Why An Interview Process?

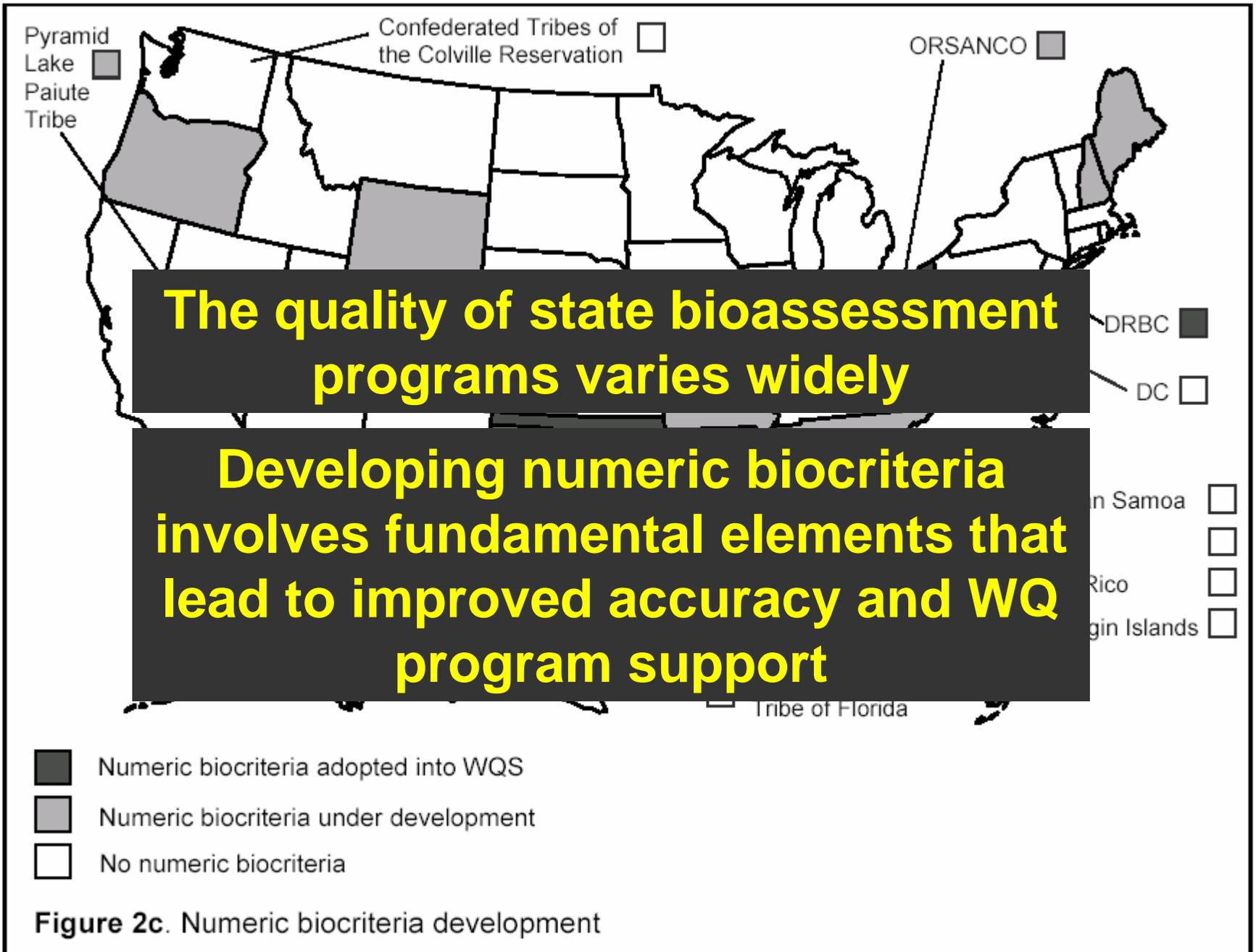
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*Each Region V State was interviewed over 2-3 days in 2002 with a follow-up in 2004*

- Allows for a detailed discussion of key technical and programmatic components
- Establishes a working relationship
- Focus is on staff and front line supervisors
- Traditional questionnaire approach lacks important context and detail – we need a better feedback process



Summary of Biological Assessment Programs and Biocriteria Development for States, Tribes, Territories, and Interstate Commissions: Streams and Wadeable Rivers (U.S. EPA 2003).



**Figure 2c.** Numeric biocriteria development

# The Relevancy of Aquatic Life Uses

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- Aquatic life issues occur in *all* jurisdictional waters and frequently dictate management responses
- Aquatic life condition is a “product” of the interaction of abiotic & biotic factors – WQ management focuses primarily on abiotic factors
- It represents the essential “ecological infrastructure” of watersheds – requires integration of multiple factors
- It easily fosters an interdisciplinary approach to water resource management

## *Key Premise*

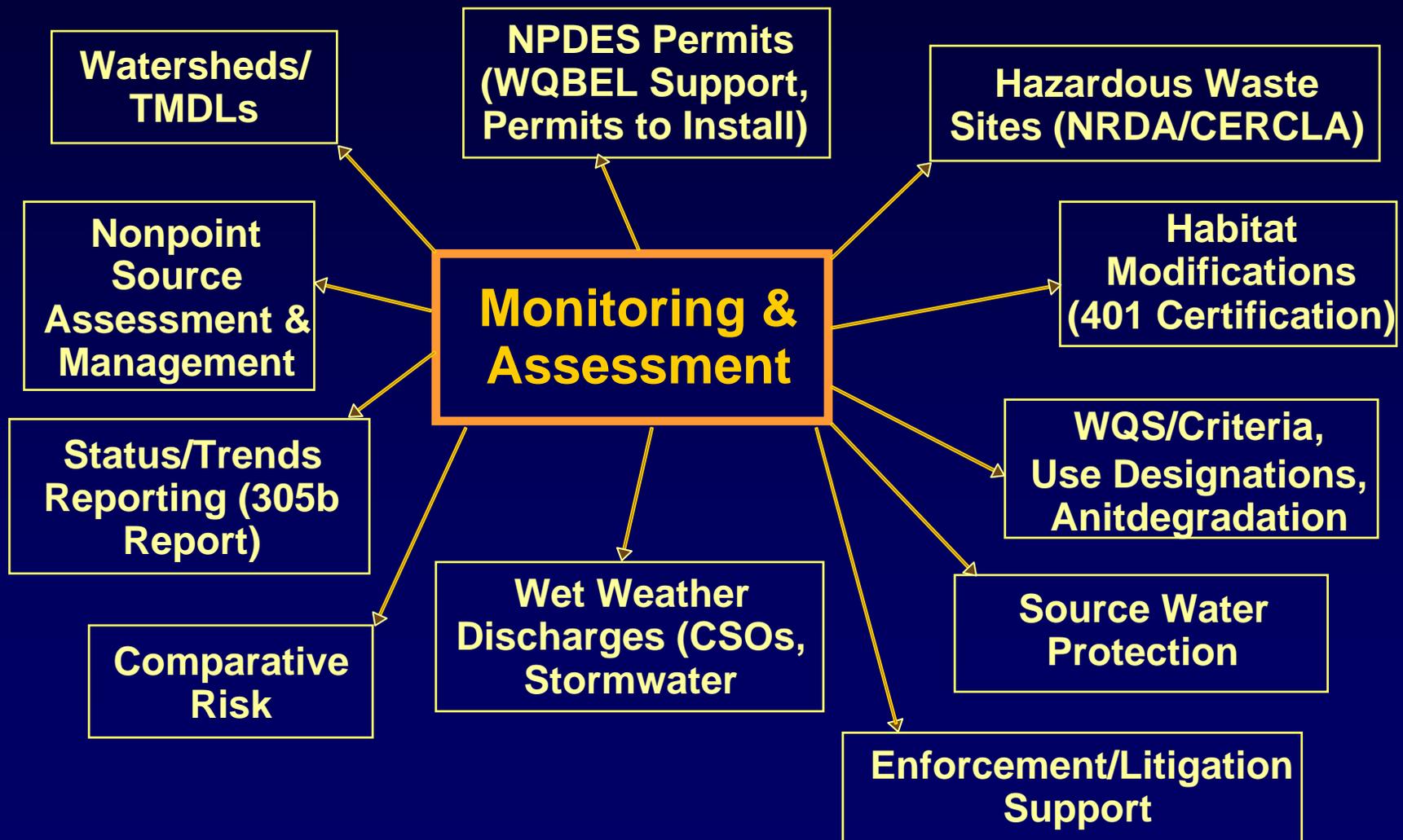
***“... ambient monitoring and assessment should function to support all relevant water quality management programs in addition to its more commonplace role of supporting status assessments.”***

## *Key Finding*

***“M&A program design in some states has been driven predominantly by status.”***

# Better Monitoring & Assessment Supports All Water Quality Management Programs

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# Purpose and Topics

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*Determine general status of region V State monitoring & assessment programs for ALUS\**

- Status and Trends
- Reporting and Listing
- Water Quality Standards
- Assessment and Integration
- Biological Assessment & Biocriteria

*\* ALUS – Aquatic Life Use Support*

# Goals and Desired Outcomes

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- Achieve better integration between monitoring & assessment and WQS – *if accomplished this will foster a more consistent and complete use of M&A in water programs*
- Improved delineation along a Biocondition Gradient (BCG) – baseline of EPA TALU
- Refined designated uses – benefits to programs
- Improved accuracy in assessing condition will lead to resolution of problems (e.g., TMDL listings)

# How Is Monitoring & Assessment Affecting Water Quality Management?

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*Is the overall approach “adequate”?*

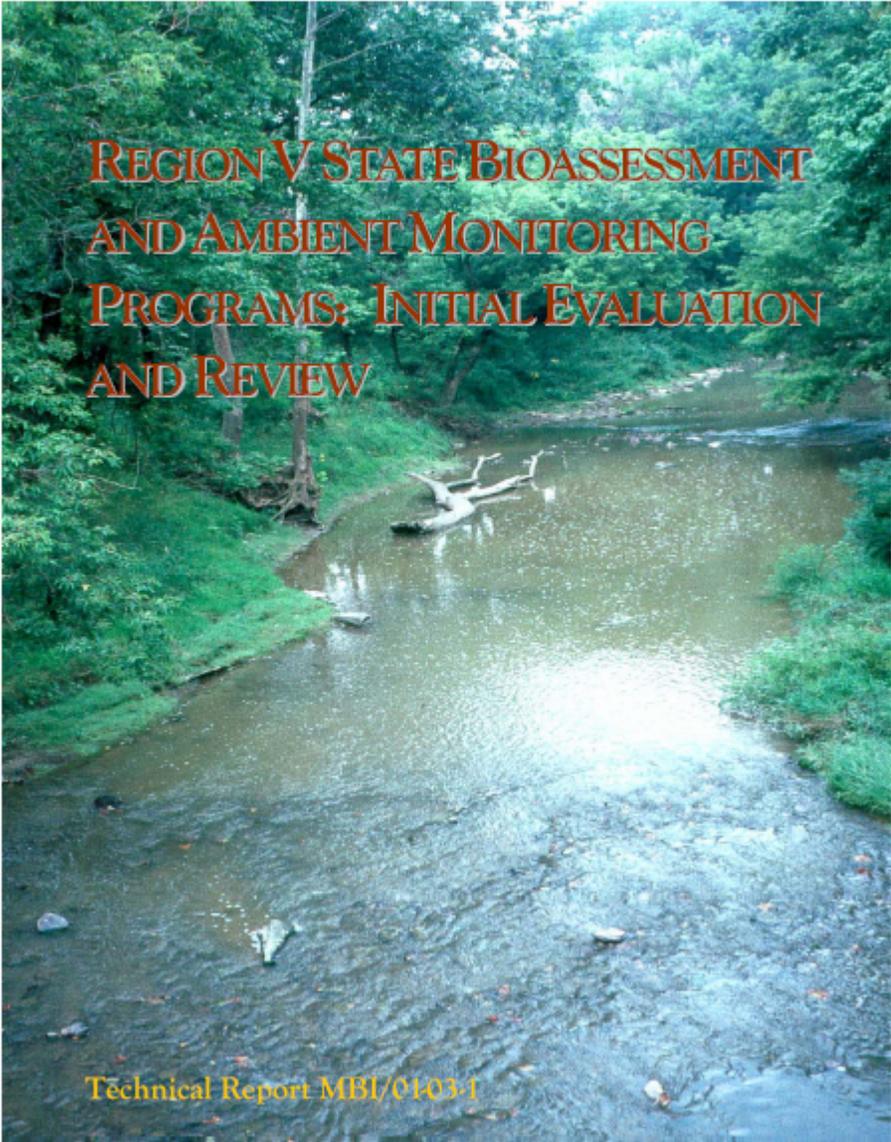
- Assessment process – structure and approach
- Indicators – ability to measure condition & support inferences about causal relationships
- Resolution – pass/fail or condition gradient?
- Spatial scale issues – sufficient to support management program needs?

# Method and Approach

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- State interview process – January 2002
- Review of State program documentation
- Report based on 2002-03 program review – recommendations for initiating improvements
- Follow-up interviews in March-May 2004 focused on building capacity in M&A and WQS programs relevant to bioassessment

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REGION V STATE BIOASSESSMENT  
AND AMBIENT MONITORING  
PROGRAMS: INITIAL EVALUATION  
AND REVIEW

Technical Report MBI/0403-1

Region V State Bioassessment and Ambient Monitoring Programs: Initial  
Evaluation and Review

February 28, 2003  
(Revised January 30, 2004)

Final Report

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# Adequate Monitoring & Assessment

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## *Important Precursors & Sources*

- ITFM process & resources (NWQMC)
- Important Concepts & Elements . . . Adequate Monitoring & Assessment (EPA/ASIWPCA)
- Elements of a State M&A Program (EPA)
- National Research Council Science in TMDLs
- Recent EPA developments and leading State program models

# National Academy of Sciences Committee to Assess Science in TMDLs<sup>1</sup>

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*Two Major WQ Program Areas Identified as  
Needing Improvement:*

## *Water Quality Standards*

- Refined designated uses
- UAA process
- Biological criteria

## *Monitoring and Assessment*

- “Adequacy” in terms of concepts and elements
- Appropriate roles of ambient indicators

<sup>1</sup>NRC (2001). *Assessing the TMDL Approach to Water Quality Management*

# Monitoring and Assessment Design Issues and Trends

## **“Old” Technology:**

- Fixed stations, paired streams
  - Upstream/downstream (single sites)
  - “Control” sites
  - Single issue/pollutant focused
  - Pass/fail assessment criteria
- *Few data quality concerns & no stds.*

## **“New” Technology:**

- Whole watersheds
  - Proportional comparisons
  - Regional reference condition
  - Stratified, intensive, and probabilistic designs
  - Multiple indicators/incremental assessments
- *Many data quality concerns - increased development of stds.*

# Elements and Concepts of Adequate Watershed Monitoring & Assessment

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- Concept driven – Karr's five factors
- Cost-effective indicators, yet comprehensive
- Indicator discipline – adherence to roles (stress, exposure, response)
- Key indicators tied to WQS (uses and criteria)
- Adapts quickly to improved science & technology
- Adequate resources, facilities, and **professionalism**
- Spatial design matches scale of management
- Product is the assessment, not just the data

Table 2A. Attributes and characteristics of Region V State biological monitoring and assessment programs: Macroinvertebrate field protocols and applications.

State	Sample Collection Methods <sup>1</sup>						Field Process			Capacity	Aquatic Ecotypes							
Agency	Quant. Sample	Effort Index	Qual. Sample	Effort Index	Standardization	Index Period	Habitat Protocol	Sort	I.D.	#Sites/Year	Primary HW	Head-water	Wade-able	Large River	Great River	Wet-lands	Lakes/Res. <sup>2</sup>	Great Lakes
IL EPA	Multiple Habitat Dipnet	Sampling Surface Area	Dip Net/Hand Pick	Time (>60 min.)	NO	June 1- Oct. 15	Quantitative Transect	NO	Qual only <sup>3</sup>	80-120	-	-	●	●	-	-	-	-
IN DEM	Mod. Hester-Dendy <sup>4</sup>	Sampling Surface Area	Kick Net (1 m <sup>2</sup> )	Surface Area	YES	July-Sept.	RBP-type Assessment	NO	NO	100	-	●	●	●	-	○	○	-
MI DEQ	Mod. Hester-Dendy <sup>5</sup>	Sampling Surface Area	Dip Net/Hand Pick	Time (>30 min.)	YES	June 1 Sept.30	RBP-type Assessment	YES	Family level	700	-	-	●	-	NA	-	-	-
MN PCA	NCNE	NA	D-Net/ Hand Pick	20 sweeps	YES	Septem-ber	RBP-type Assessment	NO	NO	90-100	-	●	●	●	-	●	○	-
OH EPA	Mod. Hester-Dendy	Sampling Surface Area	Dip Net/Hand Pick	Time (>30 min.)	YES	July 1- sept.30	Site description (No Index)	NO	Qual only <sup>3</sup>	450-500	●	●	●	●	●	●	-	●
WI DNR	NO	NA	D-Net/ Hand Pick	Visual Based (2-3 min.)	YES	Spring/ Fall	Wisconsin Protocol	NO	NO	400	-	○	●	-	-	●	○	-

● - Method and assessment are fully developed and used and numeric biocriteria are adopted in WQS.

● - Method and assessment are fully developed and used, but not adopted in WQS (may include general narrative biocriteria).

○ - Method and assessment are in development and in initial phases of usage.

- - Method and assessment are not developed.

<sup>1</sup> Principal methods are in shaded boxes.

<sup>2</sup> Includes biological assemblage assessments; does not include trophic state and other lake assessments or fishery management surveys.

<sup>3</sup> Gross field identification to determine if new taxa are being included.

<sup>4</sup> Used in lieu of kick net.

<sup>5</sup> Used historically – no longer a principal method – replaced by qualitative method.

Table 4. Structure and elements of water quality standards (WQS) and procedures related to the use of monitoring and assessment information in Region V States.

State	Aquatic Life Uses		Biocriteria <sup>16</sup>		Criteria Modifications			Biological Monitoring & Assessment Support			
	Structure	Criteria	Narrative	Numeric	Site-Specific	UAAs	Other	Use Designations	ALUS Support	Antidegradation	TMDL Listings
IL EPA	General; Non-specific	Numeric Chemical	NONE	NONE	NONE	Limited for AQL (case-specific)	Adjusted Standards Reviews (20-30 total)	NONE	Informal Process (via 306b)	Biological Stream Classification (BSC)	305(b) Monitored Level
IN DEM	General; Fishery-Based (Warm & Cold water)	Numeric Chemical	Proposed	NONE	5-6 Cases Statewide	Very Limited	NONE	NONE	Informal Process (via 306b)	NONE	Subset of 305(b)
MI DEQ	General; Fishery-Based (Warm & Cold water)	Numeric Chemical	NONE	NONE	6-7 Cases (most for copper)	NONE (no <CWA use categories available)	NONE	NONE	Informal Process (via 306b)	NONE	Close Subset of 305(b)
MN PCA	General; Fishery-Based (Warm & Cold water) with Limited Use	Numeric Chemical	1994; More specific adopted 2001	NONE	Three cases (ammonia & copper)	Class 7 (Limited Use) designations; 230 segments)	Outstanding Resource Waters	NONE	Informal Process (via 306b)	NONE	Subset of 305(b)
OH EPA	Tiered Warmwater Uses; Cold water fishery use	Biological & Chemical Criteria	Tiered AQL Use Descriptions	YES (Fish and Inverts; adopted 1990)	2 Cases	Routine Outcome of 5 Yr. Basin Process; >1500 since 1978	Biocriteria Caps on DMT; Biocrit. Derivation of chem. crit.	Directly tied to bioassessment results	Codified in WQS via AQL and Biocriteria	Formal criteria & procedure	Direct translation of 305(b)
WI DNR	Tiered Uses	Chemical criteria	NONE	NONE	<10 Cases Statewide	Developing Guidance; 104 changes proposed	NONE	Indirectly influenced	Informal Process (via 306b)	NONE	Subset of 305(b)

<sup>16</sup> Formally adopted in State administrative code or regulations.

Table 5. Attributes and characteristics of Region V State biological monitoring and assessment programs: Watershed and water body assessment process.

State	Watershed Assessment Design		Spatial Sampling Design						Assessment Process					
	Temporal	Spatial	Fixed Station	Targeted Synoptic	Targeted Intensive	Probability	Geo-metric	HUC Unit <sup>17</sup>	ALLUS <sup>18</sup> Arbiter	ALLUS Delineation <sup>19</sup>	Assessment Chain-of-Custody <sup>20</sup>	Site Extrapolation	Cause/Source	IA/Weight-of-Evidence
IL EPA	Five-Year Rotating Basin Process	Statewide Coverage Every 5 Years	●	●	●	—	—	8 digit	Biological Assessment	Pass/Fail	Lead Biologist follows established guidance	10-25 ml. (per EPA guidance)	Structured process (based on chem./phys. data)	Weight-of-Evidence
IN DEM	Five-Year Rotating Basin Process	Statewide Coverage Every 5 Years	●	—	●	●	—	8 digit	Chemical and/or Biological Assessment	Pass/Fail	Consensus Decision by Study Team	A "few" miles; mostly case specific	Follow EPA guidance; H, M, S	IA tendency
MI DEQ	Five-Year Rotating Basin Process	Assess 80% Wadeable in each cycle	●	—	●	—	—	11 digit	Biological and/or Chemical Assessment	Pass/Fail (Poor to fail)	Lead Biologist follows established guidance	Case specific (3-5 ml. max.)	Follow EPA guidance; H, M, S	IA
MN PCA	Rotating Basin Process	Statewide coverage by 2007	●	—	●	●	Future Design	8 digit	Chemical & Biological Assessment	Pass/Fail	Consensus Decision by Study Team	Varies (10 ml. on average)	Follow EPA Assessment Database	Weight-of-Evidence
OH EPA	Five-Year Rotating Basin Process	Intensive Coverage of Priority Subbasins	●	—	●	○	●	11-14 digit	Numeric Biocriteria	Numeric, Incremental Scale (Biocond Gradient)	Lead Biologist asst. by Study Team; Mgmt. Approval	Case specific; 0.5-1.0 ml. default	Integrated Process; Lines-of-Evidence; Biol. Response Signatures	Weight-of-Evidence
WI DNR	Five-Year Rotating Basin Process	Intensive Coverage of Priority Basins	●	—	●	○	—	11 digit	Biological and/or Chemical Assessment	Pass/Fail	Lead Biologist asst. by Study Team	BPJ	Do Not use H, M, S	Weight-of-Evidence

● - Principal method and design used to support WQ management.

● - Method/design used in a secondary support role.

○ - Method/design used on an infrequent or experimental basis.

— Method and assessment are not developed.

<sup>17</sup> Basin size within which watershed specific assessment is most commonly planned and conducted – gets at spatial intensity and resolution within a watershed sampling unit.

<sup>18</sup> ALLUS – Aquatic Life Use Support.

<sup>19</sup> Pass/fail is assigned to 305b delineations of full, partial, non-attainment; incremental scale is assigned for calibrated numeric biocriteria that are fully implemented.

<sup>20</sup> Process for developing site and/or reach assessment.

Table 6. Relative degree to which major water quality management program areas are supported by monitoring and assessment in each of the Region V states.

State	Basic Reporting		WQS Program					Watersheds/ NPS		TMDL/303d		NPDES/Other Permitting							
	Agency	Status <sup>21</sup>	Trend <sup>22</sup>	Tiered Uses <sup>23</sup>	UAA <sup>24</sup>	Refined WQC <sup>25</sup>	Anti-deg.	Site-Specific Crit. Mod. <sup>26</sup>	NPS/BMP Effectiveness	Habitat <sup>27</sup>	List/Delist	TMDL Dev. <sup>28</sup>	WQ BELs <sup>29</sup>	Priority Setting <sup>30</sup>	CSCs/ SSCs	Storm-water Ph. ISII	WET Limits/ Cond. <sup>31</sup>	Severity/ Extent <sup>32</sup>	Enforcement <sup>33</sup>
IL EPA	●	○	—	○	—	—	○	○	◐	◐	○	◐	○	○	—	—	○	◐	—
IN DEM	●	○	—	○	—	—	—	○	○	○	○	○	—	—	—	—	—	○	—
MI DEQ	●	○	—	—	—	—	○	◐	◐	●	◐	●	○	○	—	○	—	◐	—
MN PCA	●	○	—	◐	○	—	—	◐	◐	○	○	◐	○	—	—	○	○	○	—
OH EPA	●	●	●	●	●	●	⊙	●	●	●	●	⊙	⊙	⊙	⊙	⊙	●	●	⊙
WI DNR	●	○	○	◐	—	○	—	◐	●	○	○	◐	—	—	◐	—	◐	◐	—

- - Well developed and routine process for using monitoring & assessment for at least 5-10 years; based on an integrated indicators framework process and comprehensive watershed design.
- ⊙ - Process and tools are available, but usage is no longer routine and occurs only on a project or issue specific basis.
- ◐ - Project or site-specific use of monitoring & assessment consisting of upstream/downstream studies, paired stream studies (no comprehensive watershed design).
- - Occasional or infrequent usage or under development.
- No support from ambient monitoring & assessment.

<sup>21</sup> Basic attainment/non-attainment assessment for aquatic life use status including delineation of causes and sources of threat and impairment.

<sup>22</sup> Sufficient information to report aggregate status of ecotypes over at least a 10 year period; does not refer to analysis of fixed station chemical trends.

<sup>23</sup> Tiered uses that are developed based on assemblage assessments and which correspond to EPA's biological condition axis; does not include fishery based or general uses.

<sup>24</sup> Includes any use of ambient monitoring data to change designated uses, both "upgrades" and "downgrades".

<sup>25</sup> Ambient data is used to develop water quality criteria and/or influence the application or implementation of WQC (exclusive of pH, hardness, and other single modifiers).

<sup>26</sup> Ambient survey data is used to ground truth EPA's site specific criteria process (water effects ratio).

<sup>27</sup> Habitat assessment is linked to biological assessment and listed as a cause of impairment.

<sup>28</sup> Includes using ambient data to support TMDL development and determine success of TMDL implementation beyond basic calibration data.

<sup>29</sup> Water quality based effluent limits – ambient data is used to develop an assessment of the overall effect of the subject discharge on the receiving waters.

<sup>30</sup> Ambient data is used to influence priority setting for NPDES permitting and/or SRF funding priorities.

<sup>31</sup> Ambient survey data is used to develop WET testing requirements and/or effluent limits in NPDES permits.

<sup>32</sup> Assessment framework allows for determination of incremental departures and changes beyond pass/fail and communicates severity of problem over space & time.

<sup>33</sup> Direct use of ambient survey data to support enforcement in terms of demonstrating that action is both legal and reasonable.

<sup>34</sup> Direct support of general policy and site-specific decisions for the 401 certification of 404 dredge and fill permits.

# Initial Findings

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- All states have M&A programs – resources and quality varies
- All have biocriteria development issues
- Three states preparing to develop tiered uses
- Status assessment drives most state approaches
- One state emphasizes multiple program support
- One state reports aggregate trends
- One state with true tiered uses
- One state has a systematic UAA process

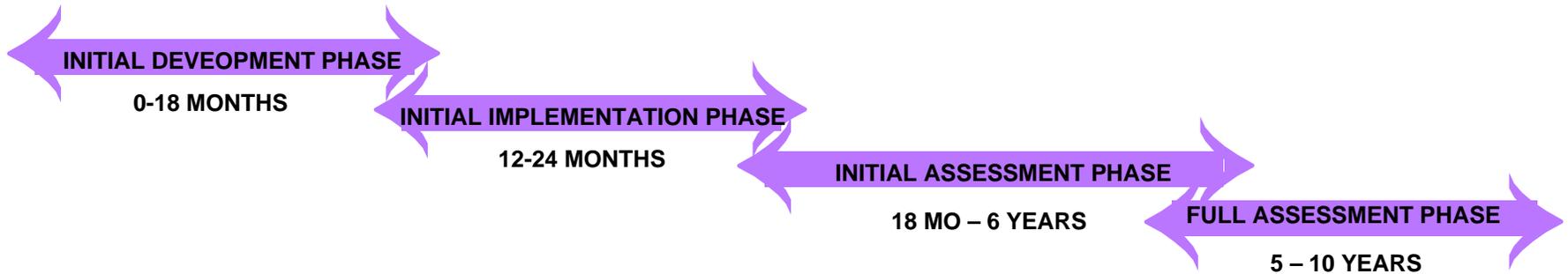
***By the  
same  
State***

# Other Key Findings

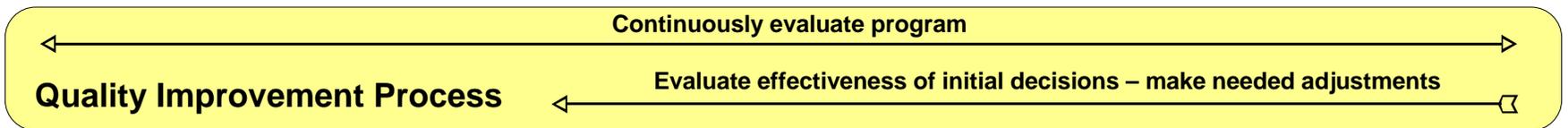
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- Most states already have the “nuts and bolts” of adequate M&A.
- The challenge is to organize the “nuts and bolts” into a standardized and sequential process.
- Supporting structure of indicators and criteria needs further development in some cases.

# Bioassessment and Biocriteria Program Development Timeline



Start-Up Tasks: Logistics	Start-Up Tasks: Implementation	Program Implementation	Program Maintenance
<p><b>Acquire Staffing:</b></p> <ul style="list-style-type: none"> <li>Professional biologists with expertise &amp; training</li> <li>Database manager</li> <li>Interns/technicians (field work, lab tasks)</li> </ul> <p><b>Acquire Facilities &amp; Equipment:</b></p> <ul style="list-style-type: none"> <li>Outfit laboratory and field facility</li> <li>Office accommodations</li> <li>Database support infrastructure</li> </ul> <p><b>Methods Development:</b></p> <ul style="list-style-type: none"> <li>Review and select candidate methods and protocols</li> <li>Consider MQO/DQO needs</li> <li>Test methods for applicability</li> <li>Analyze test results – select methods</li> </ul>	<p><b>Initiate Field Sampling:</b></p> <ul style="list-style-type: none"> <li>Review spatial designs</li> <li>Develop QA/QC and QAPP</li> <li>Develop sampling plans in accordance with monitoring strategy</li> <li>Pilot assessments</li> </ul> <p><b>Classification Issues:</b></p> <ul style="list-style-type: none"> <li>Consider spatial stratification issues</li> <li>Develop and test reference condition approach</li> <li>Select and sample reference sites</li> <li>Develop index development and calibration strategy</li> </ul>	<p><b>Biocriteria Development:</b></p> <ul style="list-style-type: none"> <li>Select candidate metrics and/or assessment tools</li> <li>Develop refined uses - narratives</li> <li>Test metrics and develop calibrated indices</li> <li>Evaluate via bioassessments</li> </ul> <p><b>Water quality Program Support:</b></p> <ul style="list-style-type: none"> <li>Develop capacity to support WQ programs (WQS/UAs, TMDLs, permits, planning)</li> <li>Formalize water quality program support as capacity is developed</li> </ul>	<p><b>Biocriteria Development:</b></p> <ul style="list-style-type: none"> <li>Refine metrics and develop calibrated indices</li> <li>Develop reference benchmarks for calibrated indices according to classification scheme and by major aquatic ecotype</li> </ul> <p><b>Water quality Program Support:</b></p> <ul style="list-style-type: none"> <li>Fully functioning bioassessment program supports WQS (UAs, aquatic life use support) and basic program needs (305b/303d)</li> <li>Program development should be fully initiated – e.g., integrated chemical, physical, and biological database supports criteria &amp; policy development</li> </ul>



# Administrative Outputs vs. Resource Outcomes Based Management

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## ADMINISTRATIVE OUTPUTS APPROACH

## RESOURCE OUTCOMES APPROACH

<b><u>Goal:</u></b>	<b>Program Performance</b> (Program execution)	<b>Environmental Performance</b> ( <b><u>Attain designated uses</u></b> )
<b><u>Measures:</u></b>	<b>Administrative Actions</b> (Lists, Permits, Funding, Rules)	<b>Indicator End-points</b> (Biological, Chemical, Physical)
<b><u>Results:</u></b>	<b>Improve Programs</b> (Reduce backlogs, improve timeliness)	<b>Programs are Tools to Improve the Environment</b> (Admin. actions evaluated by changes in env. indicators)