Florida Department of Environmental Protection

Data Usability Considerations for Biological Assessment Data

Aquatic Ecology and Quality Assurance

March 30, 2016

Presentation Overview

- Why is it necessary to evaluate biological data before using it?
- Key considerations for evaluating data for usability
- Reviews of Biological Assessment Data
  - Stream Condition Index (SCI) *Johnson Creek*
  - Linear Vegetation Survey (LVS) *St. John's River above Lake Washington*
  - Rapid Periphyton Survey (RPS) *Turkey Creek*
  - Lake Vegetation Index (LVI) *Lake Parker*

Why is it necessary to evaluate biological assessment data for usability?

- DEP's current biological assessment tools are the Stream Condition Index **(SCI)** (with the Habitat Assessment), Rapid Periphyton Survey **(RPS)**, Linear Vegetation Survey **(LVS)**, Lake Vegetation Index (**LVI**) the BioRecon, and the Shannon-Weaver Diversity Index.
- **All of these tools are included in the Impaired Water Rule**, Chapter 62-303, F.A.C., and are used for making listing and impairment decisions.
- **All of the stream tools are in the Surface Water Quality Standards Rule**, Chapter 62-302, F.A.C, used as components of numeric nutrient standards, and **all tools** are used in support of site-specific alternative criteria.
- **It is critical to evaluate these biological data carefully, to ensure that scientifically defensible decisions are made by the department.**

Key considerations when evaluating biological data

- User must understand the **purpose** for the sampling
- User must evaluate **field and lab quality control measures** and supporting data
- User must determine the **pattern, frequency, and magnitude of any QC issues** associated with results
- User must determine the **relationship between the bioassessment result** (SCI, RPS, LVS, LVI score), the **associated action level** (listing decision, etc;), **and the MDD** (minimum detectable difference—a measure of uncertainty) associated with the method
- User must determine, to the extent possible, a **reasonable cause for a failing or anomalous bioassessment score**.

Programs/Applications for Biological Data Review

- IWR list reviews
  - Related: review of external data to determine usability for assessments
- SSAC studies
- WQBEL studies
- Permits (NPDES, other wastewater)
- TMDL and BMAP activities

This presentation will focus on IWR list reviews, for the Group 3, Cycle 3 lists.

SCI Example Scenario

A waterbody (stream) has failed the biological impairment threshold** for the Impaired Waters Rule assessment. A causative pollutant has not been identified. **The waterbody has been placed on the category 4d "Study List."**

***The average of at least two temporally independent SCIs is <40, OR one of the two most recent scores is <35, OR if there are only two SCIs and the difference between the scores is >20 points, then a third SCI is required and the average of all three scores is used.*

SCI Example Scenario

Charge

Determine if the listing represents a legitimate non-attainment of water quality standards, or if there has been a misapplication of the SCI, or an error in the process that calls the results into question. If it is determined that the listing is a legitimate nonattainment of water quality standards, provide information on the possible stressors that caused or contributed to the SCI failure(s).

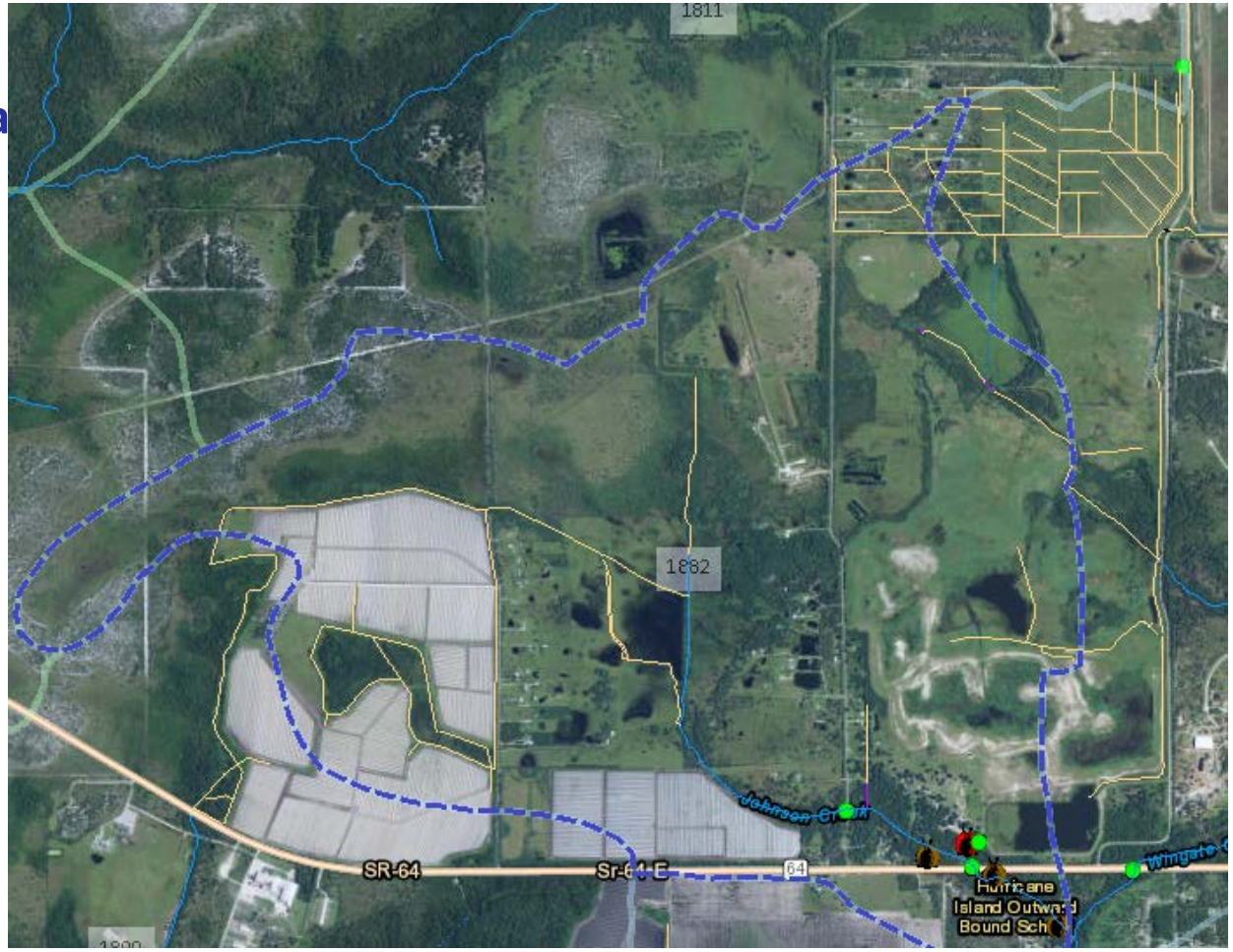
Helpful reference: *Implementation of Florida's Numeric Nutrient Standards*
http://www.dep.state.fl.us/water/wqssp/nutrients/docs/NNC_Implementation.pdf

SCI Example *Johnson Creek*

Review geographical information on the waterbody in question.

- **Sarasota-Peace-Myakka**
- **LDI=2.91**
- **Stations=TPJOHNS01F**
- **2 Mosaic Fertilizer**

Mining outfalls upstream



SCI Example *Johnson Creek*

Review SCI data for the listed water body

- Review SCI scores that contributed to the impairment
  - **41** 4/4/2013
  - **31** 10/29/2013
- Do SCI scores differ? Are there passing and failing scores? Does there appear to be a trend? Are assessment data different from historic SCI data (qualitatively, as methods and scales differ)? Two SCI 2004 samples in 2005, as part of an FYI. Both in poor category.
- Were samplers in pass status at the time of sampling? *Check bioassessment registry* http://fldeploc.dep.state.fl.us/sci/query.asp.

SampleID	Benth_IDs	STORET	Storet Org	Station Ni	Station De	Bioregion_	WBID	Latitude	Longitude	Sample Date	Nreps	Gear	SCI_2012	SCI_201
71316	42537	TPJOHNS0	21FLTPA	TPJOHNS0	Johnson C	Peninsula	1882	27.4573	-82.1428	4/4/2013	2	D-FrameX	41	A
72088	42809	TPJOHNS0	21FLTPA	TPJOHNS0	Johnson C	Peninsula	1882	27.4573	-82.1428	10/29/2013	2	D-FrameX	31	A

SCI Example *Johnson Creek*

Was the waterbody overall suitable for the SCI? Yes, appears to be a stream (not a lake, wetland, estuary).

Was the site selection appropriate for the SCI sampling? Yes, appears to be in an unchannelized portion of the waterbody, in an area that would be least-limited by habitat factors. See the SCI Primer Section 4.1, *Sampling Site Selection and System Classification,* for help with this and the above question.

Were the conditions on the site on the day of sampling appropriate for the SCI? If possible, check existing and antecedent conditions, via hydrographs.

SCI Example *Johnson Creek*

Review Habitat Assessment data, including overall scores, primary and secondary scores, and individual variables.

Overall

10/12/11: **135 (no SCI)**
10/12/11: **129 (no SCI)**
4/4/13: **126 (SCI)**
10/29/13: **95 (SCI)**

Primary/Secondary

10/12/11: Primary: 63, Secondary: 72
10/12/11: Primary: 67, Secondary: 62
4/4/13: Primary: 61, Secondary: 65
10/29/13:Primary: **41**, Secondary: 54

SCI Example *Johnson Creek*

Are substrate availability, substrate diversity, and artificial channelization in the Poor category? (If so, the system may be a managed conveyance that would not meet the stream definition in 62-302, F.A.C., and therefore the NNC would not apply, only the narrative)

None of these parameters were in the Poor category in 2011, 2012, or 2013.

What were the water velocity and artificial channelization scores? (Water velocity and artificial channelization scores can reflect the degree of hydrologic modification, which can have a strong effect on SCI scores)

Artificial channelization scored in the “Optimal” category.

Water velocity scored in the “Optimal” or “Suboptimal.”

SCI Example *Johnson Creek*

Review all field testing results (pH, dissolved oxygen, temperature, specific conductance)

Are the values for the field testing parameters within the expected range for what is known about the WBID? (hydrologic regime, stream order, season, region, underlying geology, groundwater vs. surface water fed, slope, etc;).

4/4/13: Cond: **403**, DO: 6.21, pH: 6.4, salinity: 0.19, Temp: 20.56, Velocity: 0.25

10/29/13: Cond: **407**, DO: 6.91, pH: 6.2, salinity: 0.2, Temp: 21.18, Velocity: 0.2

Specific conductance may appear elevated, but is not out of typical background for the area (similar to Horse and Oak Creeks, reference sites in the area).

SCI Example *Johnson Creek*

Looking in depth at Specific Conductance data

High conductivity is unfavorable for freshwater macroinvertebrates, and can cause or contribute to SCI failures. Elevated conductivity has several different potential sources, however, and it is important to determine the likely source in the waterbody you are evaluating:

- **Water Pollution**—dissolved ions in effluent
- **Salts in sea water**—tidal conditions are natural, but not appropriate for SCI
- **Groundwater**—springs and other surface water/groundwater interfaces; can be naturally high conductivity from dissolved limestone, but anthropogenic sources can also contaminate groundwater
- **Remnant salt water trapped in springs**—this is uncommon, but does occur in a few areas of the state
- **The St. John's River and its tributaries** are a special case in terms of bioassessment and specific conductivity. This system is very low-gradient, it is tidal for many miles inland (to the middle basin), and there is extensive groundwater seepage at the surface.
- Elevated specific conductance for Johnson Creek is likely due to wastewater discharges upstream in the WBID.

SCI Example *Johnson Creek*

Review Water Quality Data, Including Nutrient, Chlorophyll, and Physical Parameters

- Nutrients and chlorophyll should not exceed thresholds for NNC, otherwise they should be listed on the Category 5 verified list (Impaired for Biology, with Nutrients as the Pollutant of Concern) Nutrient and chlorophyll values are low
- High color and high TKN may indicate high levels of organic carbon (tannins and other dissolved organic matter) from forested wetlands in the watershed, particularly in low-gradient systems Color and TKN do not indicate high DOC. Knowledge of the regional landscape and land use in the watershed do not suggest significant swamp input.

STORET	Sample Date	SBIO_SampleID	LIMS#	Test	Component	Value	Units	Qualifiers	MDL	PQL
TPJOHNS01F	4/4/2013	71316	1493784	CHL-CORR-W	Phaeophytin-a	0.55	ug/L	U	0.55	1.6
TPJOHNS01F	4/4/2013	71316	1493784	CHL-CORR-W	Chlorophyll-a, Corrected	0.76	ug/L	U	0.76	2.3
TPJOHNS01F	10/29/2013	72088	1548165	CHL-CORR-W	Phaeophytin-a	0.4	ug/L	U	0.4	1.2
TPJOHNS01F	10/29/2013	72088	1548165	CHL-CORR-W	Chlorophyll-a, Corrected	0.55	ug/L	U	0.55	1.7
TPJOHNS01F	4/4/2013	71316	1493787	TURBIDITY	Turbidity	2.9	NTU	A	0.1	0.1
TPJOHNS01F	10/29/2013	72088	1548168	TURBIDITY	Turbidity	4.5	NTU	(null)	0.1	0.1
TPJOHNS01F	4/4/2013	71316	1493787	W-ALK	Alkalinity	22	mg CaCO3/L	A	0.65	2.5
TPJOHNS01F	10/29/2013	72088	1548168	W-ALK	Alkalinity	13	mg CaCO3/L	(null)	0.65	2.5
TPJOHNS01F	4/4/2013	71316	1493787	W-CL-IC	Chloride	11	mg Cl/L	(null)	0.2	0.5
TPJOHNS01F	10/29/2013	72088	1548168	W-CL-IC	Chloride	11	mg Cl/L	(null)	0.2	0.5
TPJOHNS01F	4/4/2013	71316	1493787	W-COLOR	Color (true)	40	PCU	(null)	2.5	6
TPJOHNS01F	10/29/2013	72088	1548168	W-COLOR	Color (true)	35	PCU	A	2.5	6
TPJOHNS01F	4/4/2013	71316	1493788	W-NH3	Ammonia-N	0.036	mg N/L	(null)	0.002	0.005
TPJOHNS01F	10/29/2013	72088	1548169	W-NH3	Ammonia-N	0.054	mg N/L	(null)	0.002	0.005
TPJOHNS01F	4/4/2013	71316	1493788	W-NO2NO3	NO2NO3-N	0.12	mg N/L	(null)	0.004	0.01
TPJOHNS01F	10/29/2013	72088	1548169	W-NO2NO3	NO2NO3-N	0.18	mg N/L	(null)	0.004	0.01
TPJOHNS01F	4/4/2013	71316	1493789	W-PO4-F	O-Phosphate-P	0.041	mg P/L	(null)	0.004	0.01
TPJOHNS01F	10/29/2013	72088	1548170	W-PO4-F	O-Phosphate-P	0.046	mg P/L	(null)	0.004	0.01
TPJOHNS01F	4/4/2013	71316	1493788	W-S-A-TP	Total-P	0.12	mg P/L	(null)	0.005	0.05
TPJOHNS01F	10/29/2013	72088	1548169	W-S-A-TP	Total-P	0.08	mg P/L	(null)	0.005	0.05
TPJOHNS01F	4/4/2013	71316	1493787	W-TDS	TDS	249	mg/L	(null)	15	25
TPJOHNS01F	10/29/2013	72088	1548168	W-TDS	TDS	256	mg/L	(null)	15	25
TPJOHNS01F	4/4/2013	71316	1493788	W-TKN	Kjeldahl Nitrogen	0.52	mg N/L	(null)	0.08	0.2
TPJOHNS01F	10/29/2013	72088	1548169	W-TKN	Kjeldahl Nitrogen	0.44	mg N/L	(null)	0.08	0.2
TPJOHNS01F	4/4/2013	71316	1493788	W-TOC	Organic Carbon	15	mg C/L	(null)	0.5	1
TPJOHNS01F	10/29/2013	72088	1548169	W-TOC	Organic Carbon	12	mg C/L	(null)	0.5	1
TPJOHNS01F	4/4/2013	71316	1493787	W-TSS	TSS	8	mg/L	I	2	10
TPJOHNS01F	10/29/2013	72088	1548168	W-TSS	TSS	7	mg/L	I	2	10

SCI Example *Johnson Creek*

Review SCI Taxonomic Laboratory Status

- It is important to know if a lab is adhering to DEP SOPs by following the sample processing and index calculation protocols. **The DEP Central taxonomic lab was audited by AEQA in 2013, and was found to comply with DEP SOP SCI 1000.** Some external labs also have been audited as part of the SCI sampler refresher audit process, or for other special studies. **If you are reviewing data from an external source, you can review the lab audits found here:** http://www.dep.state.fl.us/labs/cgi-bin/reports/search.asp or **contact Ashley O'Neal or Joy Jackson in AEQA,** who can give you further details.

LVS Example Scenario

A waterbody (stream)has been placed on the Impaired Waters Rule (IWR) list for nonattainment of the stream numeric nutrient criteria (Category 5, Verified List).

Macrophytes are the failing floral component, as determined by Linear Vegetation Survey (LVS).

(Note: with this type of listing, TP, TN, Chl a, or any combination of the three, MAY or MAY NOT also be listed)

LVS Example Scenario

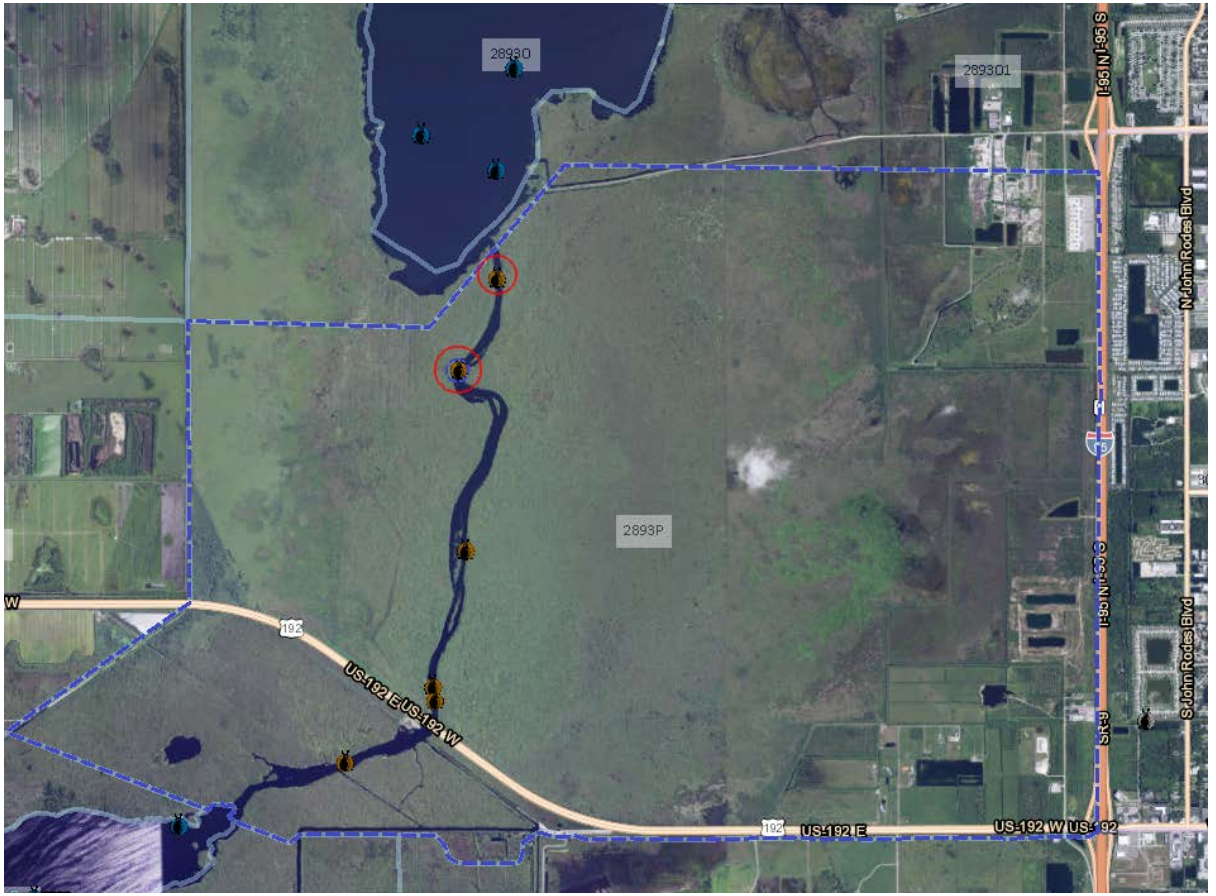
Charge

Determine if the listing represents a legitimate non-attainment of water quality standards, or if there has been a misapplication of the tool, or an error in the process that calls the results into question.

LVS Example *St. John's River above Lake Washington WBID 2893P*

Review geographical information on the waterbody in question

- **Upper St. John's Basin**
- **LDI: 3.22 (2013)**
- **Two stations:**
  - SJRNRWASH 275m above Lake Wash.
  - SJRABVWASH 975m above Lake Wash
- **High percentage of natural area (forested and shrub wetland) adjacent to system, agriculture and development further afield**



LVS Example *St. John's River above Lake Washington*

Review LVS data for the listed water body

The two LVS metrics are the mean CC score weighted by occurrence, and the % FLEPPC taxa, weighted by occurrence. Both metrics must exceed their thresholds to qualify as a macrophyte-related floral imbalance.

A mean CC score of <2.5 and a % FLEPPC score of >25% in two consecutive, temporally independent samples indicates a floral imbalance, and NNC are not achieved.

- Review LVS metrics that contributed to the impairment
  - 12/15/2013: Avg CC =1.6, % FLEPPC=41.18
  - 2/25/2014: Avg CC=1.78, % FLEPPC=39.58

LVS Example *St. John's River above Lake Washington*

Review LVS taxa lists

- Did LVS samples have at least 2m² of macrophyte coverage? Yes
- Are the taxa listed and their CC scores/FLEPPC status in agreement with the metric failures? Yes
- If taxa lists are very different from each other, a community shift may have happened (exotics can spread quickly), there may be issues with plant identification or data entry, or there may be variability among stations in the WBID. Differences may also be due to aquatic plant management.

LVS Example *St. John's River above Lake Washington*

LVS Taxa Lists *Pistia* and *Hydrocotyle* dominant in 71342.
No dominants assigned for 72628

SBIO_VISIT_ID	71342		SBIO_VISIT_ID	72628
Count of RESULT_TEXT			Count of RESULT_TEXT	
SCIENTIFIC_NAME	Total		SCIENTIFIC_NAME	Total
Alternanthera philoxeroides	2		Alternanthera philoxeroides	7
Azolla caroliniana	1		Ceratophyllum demersum	2
Bidens laevis	1		Eichhornia crassipes	10
Cicuta maculata	1		Hibiscus grandiflorus	1
Eupatorium capillifolium	1		Hydrocotyle	10
Hydrocotyle	10		Kosteletzkya	1
Lemna	1		Lemna	2
Ludwigia peruviana	1		Ludwigia peruviana	1
Mikania scandens	3		Nuphar luteum	5
Nuphar luteum	8		Paspalum repens	2
Pistia stratiotes	10		Phragmites australis	4
Polygonum glabrum	3		Pistia stratiotes	10
Sacciolepis striata	1		Salix caroliniana	10
Grand Total	43		Salvinia minima	2
			Woodwardia virginica	6
			Grand Total	73

LVS Example St. John's River above Lake Washington

Was the waterbody overall suitable for the LVS? Yes. This waterbody is a segment of the lower St. John's River, portions of which can be more lake-like or wetland-like, but this segment appears to be more river-like and suitable for the stream bioassessment tools.

Was the site selection appropriate for LVS sampling? Yes, the two stations appears to be in locations representative of the WBID (in terms of flow, cover, depth, and removed from disturbances)

Were the conditions on the site on the day of sampling appropriate for the LVS? Antecedent conditions are not as critical as for the SCI, but flow should be between 10th and 90th percentiles of long-term discharge.

LVS Example St. John's River above Lake Washington

Review all field testing results (pH, dissolved oxygen, temperature, specific conductance)

Are the values for the field testing parameters within the expected range for what is known about the WBID? (hydrologic regime, stream order, season, region, underlying geology, groundwater vs. surface water fed, slope, etc;).

4/2/2013 sample, Station: SJRABVWASH 975m above Lake Washington

Parameter	Result
pH	7.7 SU
temperature	23.8°C
DO	7.0 mg/L
Specific conductance	360 umhos/cm

LVS Example *St. John's River above Lake Washington*

Review Water Quality Data, Including Nutrient, Chlorophyll, and Physical Parameters

TN, TP, and chlorophyll a may or may not exceed numeric thresholds for nutrient criteria on the Category 5 (Verified) List.

Data indicate WBID is impaired for Total Nitrogen. TN Annual Geometric Mean(s):

- 2008 (2.50 mg/L)
- 2010 (1.75 mg/L)
- 2011 (2.00 mg/L)
- 2013 (1.65 mg/L)

Exceeds threshold of 1.54 mg/l. Waterbody is listed as Impaired (Category 5) for Nutrients.

RPS Example Scenario

A waterbody (stream)has been placed on the Impaired Waters Rule (IWR) list for nonattainment of the stream numeric nutrient criteria (Category 5, Verified List).

Algal Mats are the failing floral component, as determined by Rapid Periphyton Survey (RPS).

(Note: with this type of listing, TP, TN, Chl a, or any combination of the three, MAY or MAY NOT also be listed)

RPS Example Scenario

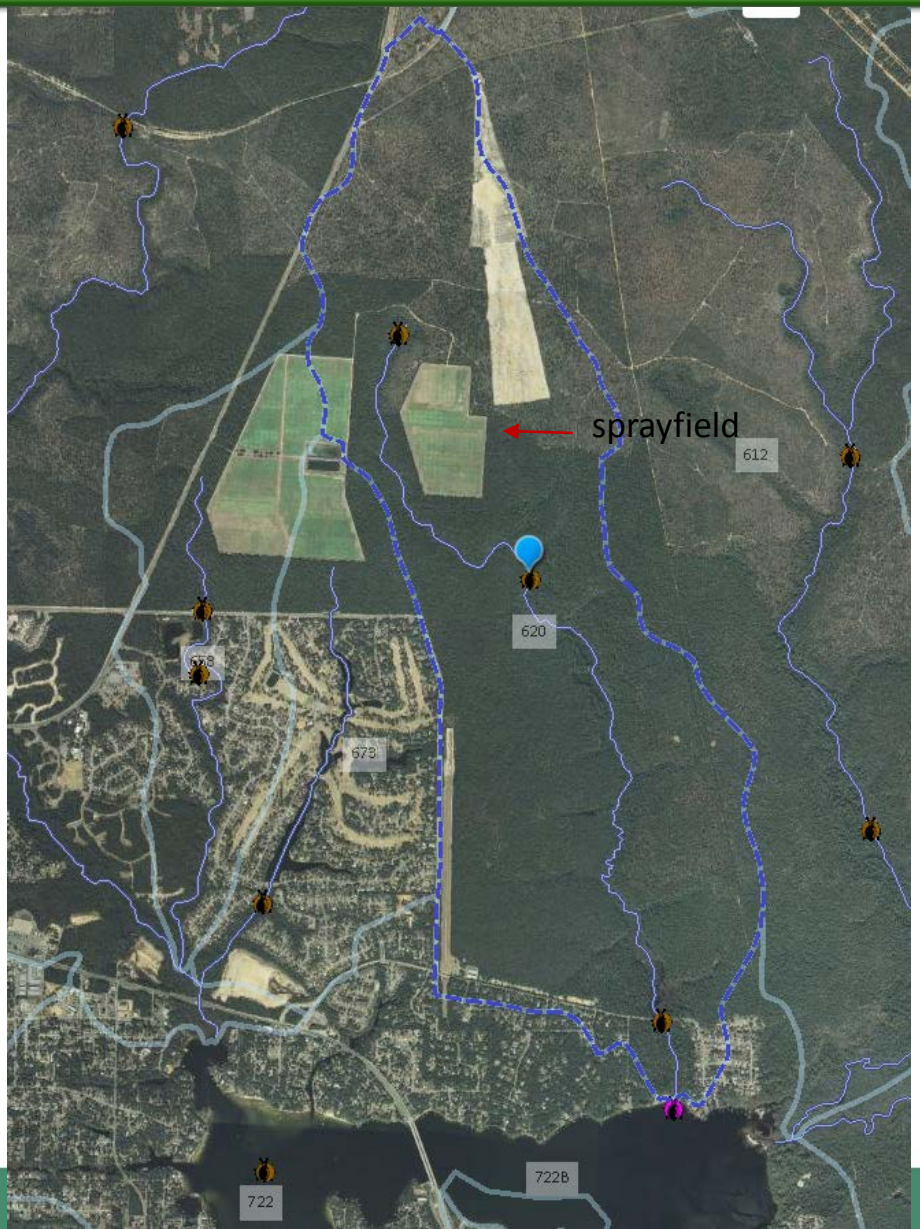
Charge

Determine if the listing represents a legitimate non-attainment of water quality standards, or if there has been a misapplication of the tool, or an error in the process that calls the results into question.

RPS Example Turkey Creek WBID 620

Review geographical information on the waterbody in question

- **Choctawhatchee-St. Andrew Basin**
- **Okaloosa County**
- **LDI: 1.07 (2010)**
- **Stations: Turkey Creek (Bolton) northeast of Niceville**
- **Eglin AFB, high % of natural area. Downstream of an Eglin sprayfield Turkey Creek receiving water is Rocky Bayou.**



RPS Example *Turkey Creek*

Review RPS data for the listed water body

The RPS ranks the amount of attached algae at 99 points in a 100m stream reach.

If more than 25% of points are ranks 4-6, there is a floral imbalance due to algal mats.

If between 20 and 25% of points are ranks 4-6, autecological data are evaluated and if problematic taxa are dominant, there is a floral imbalance.

If fewer than 20% of points are ranks 4-6, there is no floral imbalance related to algal mats

Two temporally independent (≥3 months apart) samples are needed to make this determination.

Review RPS samples that contributed to the impairment

- 7/21/2008: 86.25%
- 01/14/2009: 43.43%

RPS Example Turkey Creek

Was the waterbody overall suitable for the RPS? Yes. This waterbody is a stream, not wetland- or lake-like, or tidally influenced.

Was the site selection appropriate for RPS sampling? Yes, sampling location appears to be representative of the WBID (in terms of flow, cover, depth, and removed from disturbances)

Were the conditions on the site on the day of sampling appropriate for the RPS? Antecedent conditions are not as critical as for the SCI, but flow should be between 10th and 90th percentiles of long-term discharge.

RPS Example Turkey Creek

Review all field testing results (pH, dissolved oxygen, temperature, specific conductance)

Are the values for the field testing parameters within the expected range for what is known about the WBID? (hydrologic regime, stream order, season, region, underlying geology, groundwater vs. surface water fed, slope, etc;).

Range of field testing parameters in verified period.

Parameter	Range
pH	6.0-7.3 SU
temperature	14-22°C
DO	8.8-10.2 mg/L
Specific conductance	136-152 umhos/cm

RPS Example *Turkey Creek*

Review Water Quality Data, Including Nutrient, Chlorophyll, and Physical Parameters

TN, TP, and chlorophyll a may or may not exceed numeric thresholds for nutrient criteria on the Category 5 (Verified) List.
For this WBID, TN, TP, and Chlorophyll *a* are within limits?

Range of nutrient values associated with biological samples in the verified period. AGMs?

Parameter	Range
TN	3.09-3.56 mg/L
TP	.036-.037 mg/L
Chl a	0.55-0.75 µg/L

LVI Example Scenario

A waterbody (lake) has failed the biological impairment threshold** for the Impaired Waters Rule assessment. Nutrients have been identified as the causative pollutant (**exceeds the thresholds for TN, TP, and Chlorophyll a**). **The waterbody has been placed on the Verified List (Category 5).**

***The average score of at least two temporally independent LVI scores is <43; or if there are only two LVI scores and 20 point (or greater) difference, then a third sample must be collected and the average of the three is taken.*

LVI Example Scenario

Charge

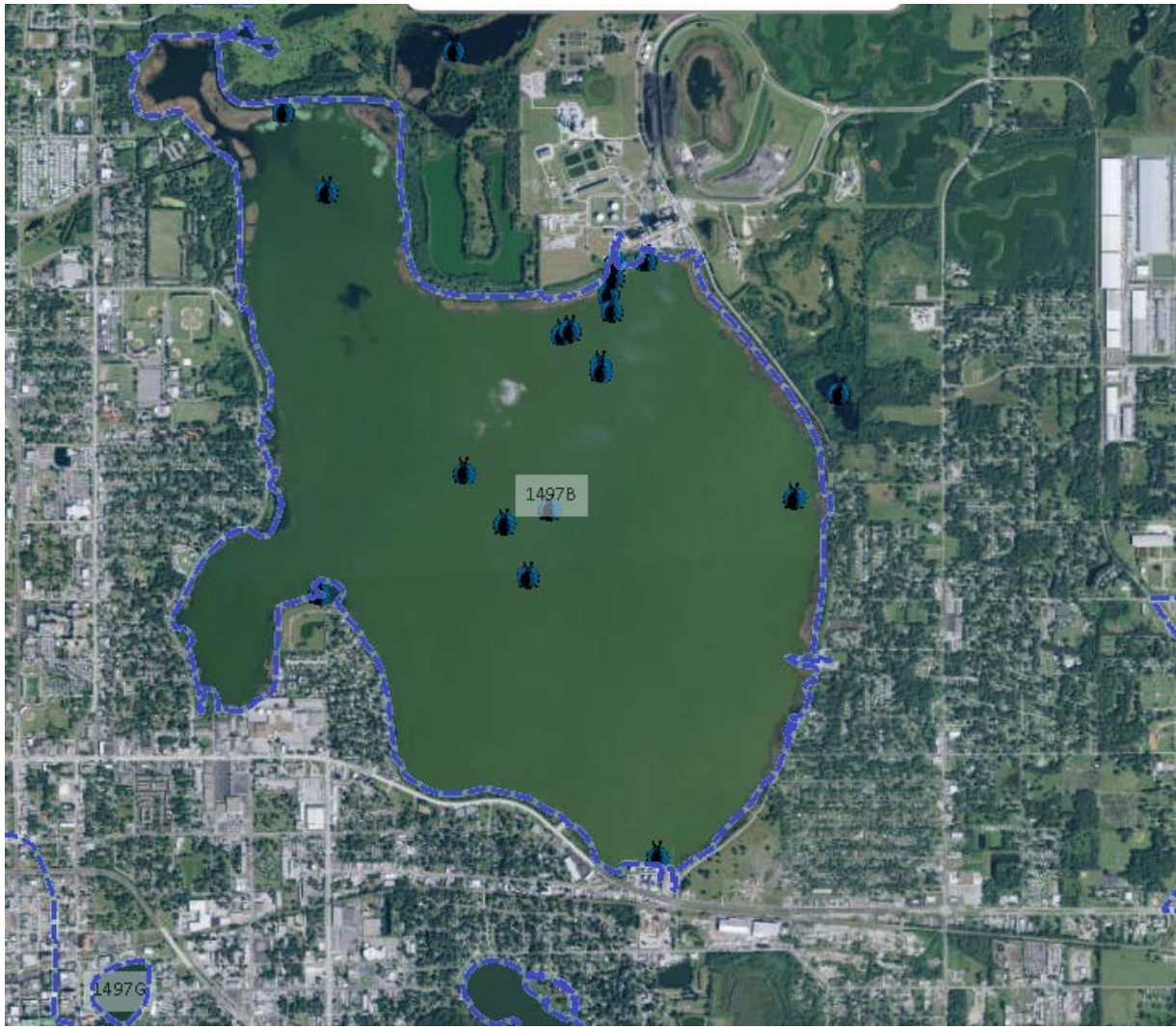
Determine if the listing represents a legitimate non-attainment of water quality standards, or if there may be an error in the process that calls the results into question. If it is determined that the listing is a legitimate nonattainment of water quality standards, provide any available information on the link between the biological failure and the causative pollutant(s).

Helpful reference: *Implementation of Florida's Numeric Nutrient Standards*
http://www.dep.state.fl.us/water/wqssp/nutrients/docs/NNC_Implementation.pdf

LVI Example *Lake Parker*

Review geographical information on the waterbody in question.

- **Sarasota-Peace-Myakka Basin**
- **Polk County**
- **LDI=5.44 (2011)**
- **NE of City of Lakeland**



LVI Example *Lake Parker*

Review LVI data for the listed water body

- Review LVI scores that contributed to the impairment
  - **34** 7/23/2009
  - **43** 5/21/2012
  - AVG=**39**
- Do LVI scores differ (outside of MDD?) Are there passing and failing scores? Yes Does there appear to be a trend? not enough data Are assessment data different from historic LVI data (qualitatively, as methods and scales differ)? No older LVIs
- Were samplers in pass status at the time of sampling? *Check bioassessment registry* Yes http://fldeploc.dep.state.fl.us/sci/query.asp.

Species 2012	C of C	Identifier	1	2	3	4	Column1	Species 2009	C of C	Identifier	1	2	3	4
Acer rubrum	4.65	Taylor, Rose	P			P		Acer rubrum	4.65	Taylor, Rose	P	P	P	
Alternanthera philoxeroides	0	Taylor, Rose			P			Alternanthera philoxeroides	0	Taylor, Rose				P
Boehmeria cylindrica	5.91	Taylor, Rose	P	P				Baccharis glomeruliflora	6.12	Taylor, Rose		P	P	
Colocasia esculenta	0	Taylor, Rose	P		P			Bacopa monnieri	4.49	Taylor, Rose				P
Cyperus odoratus	4.25	Taylor, Rose	P	P		P		Boehmeria cylindrica	5.91	Taylor, Rose		P		
Echinochloa walteri	3.36	Taylor, Rose	P					Cyperus lecontei	2.33	Taylor, Rose		P		
Eleocharis cellulosa	7.8	Taylor, Rose	P					Cyperus odoratus	4.25	Taylor, Rose		P	P	P
Eleocharis interstincta	7.8	Taylor, Rose	P		P			Cyperus polystachyos	1.56	Taylor, Rose		P		P
Eupatorium capillifolium	0.83	Taylor, Rose	P	P	P	P		Cyperus surinamensis	2.03	Taylor, Rose		P		P
Hydrilla verticillata	0	Taylor, Rose	P	P	P			Echinochloa walteri	3.36	Taylor, Rose		P	P	P
Hydrocotyle	2	Taylor, Rose				P		Eleocharis interstincta	7.8	Taylor, Rose		P		
Ilex cassine	7.66	Taylor, Rose			P			Eupatorium capillifolium	0.83	Taylor, Rose		P	P	
Liquidambar styraciflua	5.56	Taylor, Rose			P			Hydrilla verticillata	0	Taylor, Rose	C	C	C	C
Ludwigia leptocarpa	3.47	Taylor, Rose		P				Hydrocotyle	2	Taylor, Rose		P	P	P
Ludwigia octovalvis	4.09	Taylor, Rose	P					Ludwigia octovalvis	4.09	Taylor, Rose		P	P	P
Ludwigia peruviana	0.62	Taylor, Rose	P	P		P		Ludwigia peruviana	0.62	Taylor, Rose	P	P	P	P
Magnolia virginiana	9.44	Taylor, Rose				P		Mikania scandens	1.95	Taylor, Rose		P		
Mikania scandens	1.95	Taylor, Rose		P				Najas guadalupensis	5.07	Taylor, Rose	P	P	P	P
Myrica cerifera	3.82	Taylor, Rose			P	P		Nuphar	4.64	Taylor, Rose	P		P	P
Nelumbo lutea	6.26	Taylor, Rose	P	P	P			Panicum repens	0	Taylor, Rose		P	P	P
Nuphar	4.64	Taylor, Rose			P			Paspalidium geminatum	6.36	Taylor, Rose	P	P	P	P
Nyssa aquatica		Taylor, Rose			P			Pinus elliottii	4.21	Taylor, Rose	P			
Nyssa sylvatica biflora	9.04	Taylor, Rose			P			Pontederia cordata	5.38	Taylor, Rose		P	P	P
Oxycaryum cubense	3.77	Taylor, Rose	P					Sabal palmetto	4.85	Taylor, Rose	P		P	
Panicum repens	0	Taylor, Rose	P					Sagittaria lancifolia	4.96	Taylor, Rose				P
Paspalidium geminatum	6.36	Taylor, Rose	P	P	C	P		Salix caroliniana	2.95	Taylor, Rose	P	P	P	P
Pinus elliottii	4.21	Taylor, Rose	P		P	P		Salvinia minima	0	Taylor, Rose		P		
Polygonum glabrum	5.32	Taylor, Rose	P					Sambucus canadensis	1.48	Taylor, Rose		P		P
Pontederia cordata	5.38	Taylor, Rose	P	P	P	P		Schinus terebinthifolius	0	Taylor, Rose	P		P	
Sacciolepis striata	5.35	Taylor, Rose		P				Scirpus validus	5.55	Taylor, Rose		P	P	P
Sagittaria lancifolia	4.96	Taylor, Rose	P	P				Sesbania punicea	0	Taylor, Rose	P	P	P	P
Salix caroliniana	2.95	Taylor, Rose	P	P	P	P		Taxodium ascendens	7.21	Taylor, Rose		P	P	P
Sambucus canadensis	1.48	Taylor, Rose	P		P			Typha	0.8	Taylor, Rose	C	C	C	C
Sapium sebiferum	0	Taylor, Rose	P		P	P		Vallisneria americana	6.99	Taylor, Rose	P	P	P	P
Schinus terebinthifolius	0	Taylor, Rose	P	P		P		Comments: 1,4,7,10.Ver.in lab:S.validus,S.punicea.Typha covers shoreline.Turbid and green water, full of Hydrilla						
Schoenoplectus californicus	6.01	Taylor, Rose	P	D	P									
Spartina bakeri	5.98	Taylor, Rose	P											
Taxodium	7.2	Taylor, Rose	P	P	P									
Typha	0.8	Taylor, Rose	D	P	C	D								
Vallisneria americana	6.99	Taylor, Rose	P		P	P								
Vitis rotundifolia	1.18	Taylor, Rose		P		P								
Wedelia trilobata	0	Taylor, Rose		P	P									
Comments: Slices 3,6,9,12.Shorelines of slices 6 and 9 are sandy with sparse vegetation.Ver:N.aq.														

LVI Example Lake Parker

Was the waterbody overall suitable for the LVI? Yes. This waterbody is a natural lake, not a spring, wetland, or stream, and water levels were within typical range.

Note the dominant and co-dominant taxa, and how these may have shifted over time.
Codominant taxa in all segments in 2009 were *Hydrilla verticillata* (0) and *Typha* (0.8). Codominant/Dominant taxa in 2012 were *Typha*, *Schoenoplectus californicus* (6), and *Paspalidium geminatum* (6.3). Results suggest there may have been aquatic plant control for *Hydrilla* between sampling events.

LVI Example *Lake Parker*

Review LVI taxa lists

- If taxa lists are very different from each other, there are multiple possible reasons:
  - a community shift may have occurred (exotics can spread quickly)
  - Variability between the lake segments chosen (randomly) for the sampling
  - Aquatic plant management
  - QC issues with plant identification or data entry

LVI Example *Lake Parker*

For this type of biological data evaluation for the IWR, a review of field data sheets is not warranted. If there is a critical need to this level of review, these steps are recommended:

- Review Lake Vegetation Index Field Sheet (FD 9000-27), and the Lake Observation Field Sheet (FD 9000-31), or other datasheets used by the data provider to capture the information required in LVI 1110 and FD 5311.
  - Are sheets filled out completely and signed?
  - Is it indicated which segments are sampled?
  - Are there follow up IDs for plants that were indicated as collected?
  - Are dominants/codominants assigned?
  - Are there an abundance of genus level (or higher) IDs?

- If data is from an external provider, check the database or calculator to see if calculations are correct.

LVI Example *Lake Parker*

Review all field testing results (pH, dissolved oxygen, temperature, specific conductance)

Are the values for the field testing parameters within the expected range for what is known about the WBID? (color and alkalinity category, season, region, underlying geology, etc;)

range of pH: 7.4 to 9.4 (8 samples)

temperature: 19.7 (November)-29.7 (July)

specific conductance: 197-279

DO: 2.19-9.3

long term geo mean for color <40 PCU, alkalinity >20 mg/L $CaCO_3$

LVI Example *Lake Parker*

Review Water Quality Data, Including Nutrient, Chlorophyll, and Physical Parameters

- With this type of biology impairment, nutrients and chlorophyll may or may not also be listed on the Category 5 verified list (Impaired for Biology, with Nutrients as the Pollutant of Concern) This WBID is also impaired for nutrients. TN, TP, and Chlorophyll *a* all exceed the nutrient thresholds for low color (<40 PCU) and high alkalinity (>20mg/L $CaCO_3$) lakes.

- This WBID also had "Algal Complaint" sampling in 2012. No clear dominant taxon, but taxa belonging to Class Cyanophyceae (Cyanobacteria) were the most prevalent. Chlorophyll *a* for this sample was 130 µg/L.

Parameter	LAKES CRITERIA <40 PCU, >20mg/L $CaCO_3$	LAKE PARKER (Annual geo means) (must not exceed >1 in 3 yrs)
TN	Chl-a AGM ≤ 20 µg/L, TN AGM ≤ 1.91 mg/L; If Chl-a has Insufficient or No Data to calculate AGM or if Chl-a AGM > 20 µg/L, TN AGM ≤ 1.05 mg/L	AGM 2008 (4.74 mg/L) 2009 (3.26 mg/L) 2010 (2.55 mg/L) 2011 (2.73 mg/L) 2012 (2.86 mg/L) 2013 (2.52 mg/L)
TP	Chl-a AGM ≤ 20 µg/L, TP AGM ≤ 0.09 mg/L; If Chl-a has Insufficient or No Data to calculate AGM or if Chl-a AGM > 20 µg/L, TP AGM ≤ 0.03 mg/L	AGM 2008 (0.11 mg/L) 2009 (0.07 mg/L) 2010 (0.06 mg/L) 2011 (0.06 mg/L) 2012 (0.06 mg/L) 2013 (0.04 mg/L)
Chlorophyll *a*	≤ 20 µg/L	AGM 2008 (161 µg/L) 2009 (47 µg/L) 2010 (47 µg/L) 2011 (86 µg/L) 2012 (80 µg/L) 2013 (69 µg/L)