How is the Watershed?
An update on the most recent Aquatic Life Use assessment survey in the Christina Basin

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What is an Aquatic Life Use survey?

- A stream can be assessed for 4 different uses:
  - Aquatic Life → the use we are focusing on.
  - Fish Consumption
  - Potable Water Supply
  - Recreation

- Aquatic life Use is the ability of stream to support aquatic organisms such as fish and macroinvertebrates.

- Is a particular stream meeting its Designated Use for Aquatic Life?
Designated Uses

- Each stream has a Designated Use for aquatic life assigned to it.
  - Assigned in the 80s. Not usually changed.
  - A stream is either attaining or impaired for its Designated Use.
- A stream can be:
  - Exceptional Value
  - High Quality
  - Trout Stocked Fishery
  - Cold Water Fishery
  - Warm Water Fishery
- Special Protection streams are held to a higher standard.
How do we determine the stream status?

- The establishment of standards
- ICE sampling
- Habitat assessment
- Macroinvertebrate identification
- Station IBI score and assessment
- Stream segment assessment
- (If impaired) Source/Cause determination

** You only see the last two steps in eMAP **
The establishment of standards

- Metrics and IBI (Index of Biotic Integrity) scores.
  - Benthic macroinvertebrates are given values, which in turn help us evaluate a particular stream.
  - Methods and analysis, while based on the EPA RBP III manual (Rapid Bioassessment Protocol), are state specific. Streams are compared to the best in Pennsylvania.
  - Statistical analysis methods developed by Bureau of Water Quality Standards folks in Harrisburg, approved by EPA.

- Goal is to make our findings scientifically defensible.
  - Needed to stand up in a court of law.

- Current standards are tougher to achieve than the less technical analysis methods of the past.
  - More streams are impaired as a result.
ICE sampling

- Instream Comprehensive Evaluation. Methods also established by Harrisburg and approved by EPA.
- Probabilistic and Targeted sampling.
- Water properties and field chemistry.
  - pH, temperature, alkalinity, conductivity, and dissolved oxygen.
- Macroinvertebrate collection.
  - 100 meter reach with riffles selected.
  - 6 “kicks” in different locations with a D-frame net.
  - 1 square meter each for about 1 minute.
  - Net and sieve with 500 micron mesh.
  - Samples preserved and returned to lab for processing.
Sampling is a “kick”
Sometimes we have help
Habitat assessment

- Visual field assessment of various parameters:
  - Instream Fish Cover
  - Epifaunal Substrate
  - Embeddedness
  - Velocity/Depth Regimes
  - Channel Alteration
  - Sediment Deposition
  - Frequency of Riffles
  - Channel Flow Status
  - Condition of Banks
  - Bank Vegetative Protection
  - Grazing or Other Disruptive Pressure
  - Riparian Vegetative Zone Width.
Macroinvertebrate identification

- 200 count subsample for each station, +/- 20%
  - Selection process eliminates bias and excessive work.
- Identification to the genus level for most macroinvertebrates.
  - Notable exceptions being Chironomidae (family) and Oligochaeta (class).
  - Previous assessments only required identification down to the family level.
Station IBI score and assessment

- The collected macroinvertebrates and their attributed values are used to determine various metric scores.
  - Hilsenhoff, Becks, Shannon Diversity, % Intolerance, various taxa richness.
- The metric scores are used to determine the IBI score.
  - Different metrics are used based on season (summer vs winter) and stream type (freestone, limestone, low grade).
- The IBI score is compared to a criteria for biological assessment.
  - There is some room for best professional judgment in “grey” area scores.
  - Special protection streams are held to a higher threshold level.
- The Habitat score is evaluated for habitat assessment.
**IBI assessment criteria**

**2008 winter method**

- > 80  Attaining HQ and EV
- > 63  Attaining
- 50 < x < 63  Gray zone
- < 50  Impaired

**2008 summer method**

- > 80  Attaining HQ and EV
- > 50  Attaining
- 40 < x < 50  Gray zone
- < 40  Impaired

Grey zone considerations:
- Dominance of tolerant taxa?
- Absence of EPT taxa?
  - If so, then impaired.
Stream segment assessment

- Streams are assessed as being attaining or impaired for a designated use.

- Things to consider:
  - Assessment of sampled stations and their spatial relationship to the watershed.
  - Major changes in habitat across the landscape such as WWTP outfalls, point sources, urban areas, reservoirs, etc.
  - Previous assessment status (Delisting an impaired stream requires ample proof).
  - Manner in which special protection status was attained (survey vs conservation).
  - Similarity of streams without stations.
(If impaired) Source/Cause determination

- Sources can include: Urban Runoff, Agriculture, Habitat Modification, etc.
- Causes can include: Siltation, Water/Flow Variability, Organic Enrichment, etc.
- Determined by Biologist’s best professional judgment. Things to consider include:
  - Field observations of land use in the watershed.
  - Habitat scores.
  - Macroinvertebrate composition.
  - Changes in watershed since last survey (New development, new farm, new point source).
  - Previous Source/Cause listing.
Brandywine and Red Clay Basin
ICE sample sites
Tentative as of 5/20/2010. Subject to change.
Brandywine and Red Clay Basin Stream Assessments

Tentative as of 5/20/2010. Subject to change.
Brandywine and Red Clay Basin Assessment Changes

Tentative as of 5/20/2010. Subject to change.
Assessment changes

- Biggest changes include:
  - Impairment of long stretches of the Main Stem, East Branch, and West Branches of the Brandywine Creek.
  - Impairment of Brandywine tributaries such as Shamona Creek, Pocopson Creek, Culbertson Run, Broad Run, Harvey Run, and sections of the headwaters of Buck Run and Doe Run.
  - Impairment of the head waters of the East Branch of the Red Clay Creek
  - Attainment of Bennetts Run (Not depicted on previous map. See following detailed map) and segments of Indian Run and Beaver Run.
IBI score: 59.1
Assessment ID: 15471
IBI score falls within range for best professional judgement. Stream deemed attaining based on high number of intolerant stoneflies. Allocapnia is most abundant genera.
Rough grouping of Sources. For individual Source/Cause impairment listings, see eMAP PA

Brandywine and Red Clay Basin Impairment Sources
Tentative as of 5/20/2010. Subject to change.
In closing

- As the science behind stream assessment becomes more precise, our collection and data analysis methods change.
- This data is a summary of our most recent “Tentative” Assessments. Still subject to change.
- Currently the comment period is closed and EPA is considering our assessments for approval.
- The assessment changes have been mostly an increase in impairments. This is reflective of both tougher attainment standards and an increase in water quality stressors.
Any questions?

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