Indicators for Narragansett Bay Region
WORKSHOP SUMMARY
Freshwater Flow
Friday, November 19 from 9:00 AM – 1:00 PM

Meeting our goals for this workshop:

1. Develop consensus around communicating flow to the public on Earth Day 2011

We established a sub-committee to plan for Earth Day 2011. We will look at popular publications such as USA Today and how data are presented as a model for simplifying complex information. Several indicators were suggested:

- fish data (remember that it is an indicator of more than just flow)
- % forest cover (GIS data can misrepresent forest)
- Impervious cover

2. Identify monitoring priorities for advancing flow indicator

- Small streams
- Fish data on additional rivers (we have good data on the Hunt)
- Eastern drought region (Aquidneck Island) – there is currently no data

3. Identify research priorities for advancing flow indicator

- We need an economic analysis to look at the impacts of flow. We could look at the ratio of summer gpcd/winter use. What is the cost to wastewater treatment plants when flows are below the design flows that their permits are based on? Can we look at the cost benefit of infiltration?
- Model "what if" scenarios at build-out looking at drought and flood (see recent USGS publication). Add in LID, other BMPs and document the effects (see CT river modeling work).
- Generate 1 day maximum flows and 7 day minimum flows for the state.
- Establish rating curves on smaller streams and use volunteers to collect flow data (concern expressed about data quality when collected by volunteers – others spoke in support of volunteer data). The MA Riffles Program provides a model as does Watershed Watch. The Wood-Pawcatuck Watershed Assn. has also used volunteers to measure flow.
- Develop technical guidance for towns linking development to flow impacts. Perhaps create development check lists that provide technical guidance for evaluating streams.
- Document the effect of flow changes on the estuaries/Bay
- Develop signage around the watershed that reports on the various indicators (Assabet River Watershed provides a good model)
- We need to understand the role of dams in flow and fish populations
- And the correlation between stream temperature and flow (23° C is the threshold for brook trout)
- Tell the story of water availability/flow by running "what if" scenarios. What will happen during drought? Build out? Flood?
- URI Professor Mather – has done a good job educating the public about ticks. Can this be a model for educating the public about environmental issues such as flow?

SUMMARY OF PRESENTATIONS AND DISCUSSION

<u>Flow indicators used elsewhere</u>

Other programs are concerned with freshwater flow and include flow metrics as an environmental indicator. Examples include:

- Partnership for the Delaware Estuary reports on water use patterns (volume of water being used for drinking water, industry, agriculture, etc. in their indicators

- Puget Sound has reported on flow since 2003. After examining freshwater flow into the Sound over a long time frame, they have concluded that flow changes are primarily due to climate change impacts. The most recent reports have incorporated flow into integrated water quality index.
- Massachusetts's Ipswich River has experienced low flows. They report on progress with management strategies including LID, maintaining water within the watershed, etc.
- Chesapeake Bay – use benthic macroinvertebrates to integrate water quality

What do we know about freshwater flow in the NB Region?

RI Water Resources Board (Kathy Crawley)

The Rhode Island Water Resources Board (WRB) is an executive agency of state government charged with managing the proper development, utilization and conservation of water resources. Its primary responsibility is to ensure that sufficient water supply is available for present and future generations, apportioning available water to all areas of the state, if necessary.

Accurate water data collected over an extended time frame is essential to understanding water resources. Stream gages throughout the state allow managers and scientists to understand and evaluate flow conditions. The US Geological Survey (USGS) partners with state agencies to collect water data. USGS[1] provides real-time water-stage and streamflow data at over 39 sites across the state. Drought and flow prediction, stream flow statistics and sustainable yield investigations are underway. Nineteen groundwater wells are monitored by the USGS in Rhode Island and five are real time with hourly data available on the web.

In partnership with the RI WRB, USGS has completed nine water use and availability studies covering every basin in the state[2].The studies estimate gross yield for the basins (how much is there) recognizing that these are estimates only, the yield is extremely variable, depending on factors including precipitation and timing. The estimates in the USGS studies were intentionally conservative to recognize the low flow summer months.

In order to determine how to allocate water throughout the state, we need to understand the sustainable yield from each watershed. This is not a simple question. The current statutory definition of groundwater safe yield requires us to define "adverse impacts." In addition to the water use and availability studies, the WRB has supported the development of water models (Big River, Pawcatuck, Blackstone, Hunt-Annaquatucket-Pettaquamscutt). These studies look in detail at flow in the basins and model different water use regimes. Future models are planned pending funding (the Pawtuxet is important because it supplies water to more than 60% of the state and because of flooding issues within the watershed).

WRB collects data from major water suppliers. The statewide average day demand is roughly equal to what it was in 1990, but this does not tell the whole story. Residential use is increasing, especially in the suburban areas of the state. Residential demand increases substantially in the summer which impacts areas served by groundwater differently than those served by surface water.

[1] According to USGS web site: http://ri.water.usgs.gov/

[2] Available at the RI WRB web site: http://www.wrb.ri.gov/waterdata.htm

The WRB also leads efforts to anticipate and report on droughts. There are a variety of indices to track and report on drought. The Palmer Drought index and the Standard Precipitation index (SPI) might be worth looking at as a model for indices in general.

RI Department of Environmental Management (Alisa Richardson)

Healthy hydrology is not a simple metric. Flow is variable making it difficult to simplify into an indicator. We can generate flow statistics – for example, the Nature Conservancy has a statistics package that can be used to analyze gage data to provide useful flow metrics -- both high and low flows.

Natural, healthy stream flows incorporate a variety of metrics including the timing, frequency, duration, rate of change, and magnitude of flows:

Timing Large dams that create managed impoundments used primarily for hydropower and water supply are the largest drivers of timing. Run of the river dams do not affect timing substantially.

Frequency, Duration and Magnitude
Frequency indicates how many times the highs and lows happen and duration indicates how long these flow events last. The largest drivers for these attributes are precipitation, impervious cover and surcharging (wastewater). Climate change is another important driver for changes in precipitation.

Rhode Island has not had a big drought since the 1930s. If you look at the Palmer Drought Index from 1934 to present, you can see that there was a big drought in 1930s. Although we have had dry periods in recent years, none were of long duration. Yet we are experiencing rivers with low flow issues.

Ipswich River has become a "poster child" for over used rivers. The Ipswich is affected by water withdrawals and out of basin transfers. These can be issues here in RI as well. We need to do a better job making the connection between outdoor water use and stream flow and creating an understanding for the links between flow and stream biology.
Rate of change This is a measure of the flashiness of a stream. Rate of change is driven by impervious cover, large dams and loss of wetlands.

There are watersheds of concern in RI (Hunt, Chipuxet, Westerly, Jamestown, Cumberland and Woonsocket) -- areas where water use is exceeding what the watershed can sustain.

Suggested Education/Information objectives

- Reduce lawn watering
- Encourage changes in water use
- Advocate for allocation and conservation
- Increase recharge to protect groundwater supplies
- Measure and report on flow changes

Blackstone Coalition (Peter Coffin)

The Blackstone River Coalition has had success bringing together managers and local advocates on a bi-state basis to consider watershed issues.

The Blackstone is not a free flowing river, it is a series of impoundments. These impoundments change the ecology of the river and impact water quality. Massachusetts is ahead of Rhode Island in considering flow issue and has made significant progress with the development flow standards and safe yield.

The hydro plants on the Blackstone affect river flow. Some of the older plants run year round and discharges from plants can cause the river to rise and fall up to six inches diurnally. The Mumford River in MA is an interesting example. The MA DEP conducted a three year study of the watershed but it did not document the low flow issues as the data were collected during a wet season. The Blackstone Coalition has examined a private hydro facility and found that it has not been discharging during extreme low flows. The downstream portion of the river has therefore experienced river flows below the design low flow used for calculating discharge permits limits for downstream point source discharges.

Invasive weeds in lakes and ponds in the watershed are often managed through draw-downs. These draw-downs can affect the downstream river system. MA is beginning to push for infiltration as a stormwater management measure and also to protect flow.

Questions on presentations

E. Marks. As we consider flow, we need to remember vernal pools and the flow needs of diadramous fish.

A. Gold. We need to tie local precipitation information to gage information. K. Crawley: the WRB does look at CoCoRaHS data (local precipitation). There is large spatial variability in precipitation, especially with respect to intense summer storms. Precipitation data must be useful and understandable.

M. Pryor. Has the WRB looked at total water use since 2005? K. Crawley. Yes and the Board is developing an on-line data system for suppliers so they can enter water use data on a regular basis.

D. Poyer. Stream gages are not on the small stream. Is there any way to develop correlation to understand what is happening on small streams? A. Richardson. It is difficult to create the correlations. It requires detailed data on land use and water use in the watershed.

E. Heron. Watershed watch volunteer record dry steams and the data has been sent regularly to DEM. Is this information being used? A. Richardson. I did not know about this data. Please send it to my attention.

Discussion of a flow indicator

1. Our target audience in state and local decision makers. What do they need to know?

We recognize that our task is challenging. Most people (including local decision makers) do not understand water. They don't know where their water comes from, what a watershed is, the relationship between groundwater and surface water, the complexity of natural aquatic systems or the functions and values of stream systems.

Land use decisions do not currently consider streamflow. Decision makers need to be able to connect land use decisions to flow looking at a complex suite of factors (wastewater, water supply, impervious cover). They need standards for water withdrawal – concrete technical requirements that they can use to make decisions. Dr. Harold Ward stated that consistent with the Water Use and Efficiency Act of 2009, the Water Resources Board needs to tell each community how much water is available. The Statewide Planning program can then provide guidelines for growth and development that acknowledges water availability.

The message we craft for municipal decision makers will need to be more technical than the basic public message that we put forward. Local decision makers need local data in order to incorporate into their decisions and the data needs interpretation so decisions can be defended and understood

We waste so much water on lawn watering. Can we get across the message that we are putting lawns ahead of jobs? It is important to recognize how important green lawns are as a status symbol. In North Kingstown, the concern about adequate water for fire suppression had only limited impact on the Town Council. Could URI help re-brand lawn status? Is there a role for the Master Gardeners? Can we work through landscapers? What really motivated decision makers in NK was being told that they did not have adequate water (during peak summer demand) for any new development.

We recognize that when we pose fish vs. people, the fish will lose. People need to know how the issue will affect them personally. In Massachusetts, the message, "rivers need river fish" is working with decision makers (but don't presume that all watersheds will support riverine fish).

It would be helpful to show the implications of doing nothing. Can we communicate the economic consequences? If we run out of water, we lose jobs. The Coalition for Water Security has successfully used the quality of life/economic consequences as their argument for better water management. It is also worth noting that wastewater treatment plants are designed to discharge pollutants to a river at a defined low flow. If the low flow is decreased, we would need extra treatment to maintain stream standards.

At the most basic level, local officials need to know if they have to worry about a stream or lake. And if it is a problem, what do they need to do about it?

The impacts of climate change are important to communicate with messages around flow. Can't comment on climate change without understanding changes in precipitation, evapotranspiration and flow and high resolution scale, linked to gaged streams. To do this we may need to improve the scale

of ppt monitoring to better estimate the water budget within lower order watersheds. Could enhance monitoring of smaller streams by making use of properly trained volunteers. Must relate to land use, irrigated areas, and daily ppt data that is explicit. The current gages combine many factors, making it difficult to tease out connections between flow and activities within a watershed.
Is there an iconic, charismatic critter that relates to water flow that we could use in our communication?

2. What is our vision for a flow indicator?

- Develop a report on all our rivers and streams that answers the question: Are river fish where they should be or have they been replaced by lake/pond fish? Report by segment/reach. (The DEM OWR Streamflow depletion method incorporates data on fisheries).
- Can we identify a fish species that in an indicator (canary in the coalmine)? MA uses brook trout, black nosed dace and others. CT uses the USGS study[3] which is based on data from Georgia. A note of caution: be sure to separate streams based on the extent of ponded areas in the basin. A basin with many ponded areas is not likely to support riverine species due to the modified flow regimes and elevated temperatures.
- We should provide water availability estimates to local decision makers along with technical information that allows them to make development decisions that consider water availability and flow. Combine this information with LID information/training. Combine this with if/then scenarios (if development includes LID, then water use is…)
- Summer/Winter water use for municipal water districts. Normalize by summer/winter population estimates
- Can we create an indicator that looks at the cost of excessive runoff? The Charles River Watershed and Ipswich River have done this. Can we set targets for increased infiltration in specific areas?
- Look at annual peak flows as well as low flows (7 day minimum and 1 day max)
- Compare high and low flow statistics to the historic record to help communicate about flow within the context of climate change (eg. # times flows are outside of the "normal" boundary in different decades)
- An important factor is evapotranspiration (ET) within a basin, as is irrigation. Recognize that unirrigated Ag ET is not the same as irrigated Ag ET.
- Can we identify sentinel sites?
- Stream continuity is also important – continuity affects flow, temperature and fish communities. The RC&D Council has completed studies in the Pawcatuck and Blackstone.
- Forest cover is also important. The Forest service looked at the distribution of forest cover relative to drinking water in the northeast
- The Assabet River has developed a nice suite of indicators that could be used as models (http://assabetriver.org/our-work/monitoring/interpret-data/stream-health-index)
- Our indicator should recognize that diadromous fish/oysters rely on freshwater flows. It should consider the economics of these fisheries.

[3]M.C. Freeman and Marcinek, P.A. Fish Assemblage Responses to Water Withdrawals and Water Supply Reservoirs in Piedmont Streams. Environmental Management Vol 38, No 3, pp 435-450.

3. What do we want to do for Earth Day 2011?

(Subcommittee formed that includes Greg Gerrit, Lauren Russo, Margherita Pryor, Eugenia Marks, Naomi Detenbeck and Pam Luey)

- Earth Day is just about 1 year from the floods of 2010. Can we use this as a hook for our outreach? (Concern was raised that it might be very confusing to communicate about low flows if we lead with floods).
- Remember that the message needs to communicate to everyone – a family in Providence as well as a fisherman in Charlestown.
- Develop some simple statistics (eg watering x# lawns affects y# jobs)
- Weave in climate change. Spring flooding and dry summers will be our norm.
- Use inundation models to illustrate peak flow
- Link with the video computer gaming community. They communicate!
- The ocean project has detailed data about public knowledge of ocean/environmental issues that could be useful.
- Set up a project that gives people and opportunity to monitor flow – perhaps using tracers. Provide information on flow changes and impacts (think of the Secchi dip-in as a model). Caution – we don't want to inadvertently communicate that measuring flow is easy and that anyone could do it! Use this as an opportunity to show high water marks as well as low flows. Caution – April 22 is spring and water/weather is COLD!
- World monitoring day is in October.
- Enviroscape interactive watershed models –could have school groups present to towns.
- Focus communication on extremes – drought and flood
- Macroinvertebrates are a good integrator of water quality including flow conditions. Could do a survey across the state on one day.
- Watershed Watch volunteers are reporting on dry streams. Look at the % of visits when the streams are dry. Take photos of dry streams. Have volunteers upload photos with date/time.

Thank-you to all the presenters and participants in this discussion:

Ralph	Abele	US EPA
Rachel	Calabro	Save the Bay
Alice	Clemente	Blackstone Watershed Council/FOB
Peter	Coffin	Blackstone River Coalition
Ames	Colt	Bays, Rivers and Watersheds Coordination Team
Kathy	Crawley	RI Water Resources Board
Mike	Dahlquist	RI Department of Transportation
Chris	Deacutis	Narragansett Bay Estuary Program
Katie	DeGoosh	RI DEM Office of Water
Naomi	Detenbeck	US EPA Atlantic Ecology Division
Greg	Gerritt	Friends of the Moshassuck
Art	Gold	URI Natural Resources
Elizabeth	Herron	Watershed Watch
Nancy	Hess	RI Statewide Planning
Lorraine	Joubert	URI Cooperative Extension
Q	Kellogg	Coastal Institute
Meg	Kerr	Narragansett Bay Estuary Program
Sue	Kiernan	RI DEM Office of Water
Lesley	Lambert	Narragansett Bay Estuary Program
Pam	Luey	Narragansett Bay Commission
Eugenia	Marks	Audubon Society of RI
Veronica	Masson	RI DEM Office of Water
Dave	Newton	EPA Region 1, Blackstone Watershed Council
Mark	Nimiroski	RI DEM
Amie	Parris	RI DOH
Denise	Poyer	Wood Pawcatuck Watershed Association
Margherita	Pryor	EPA
Richard	Ribb	NBEP
Alisa	Richardson	RI DEM Office of Water
Lauren	Russo	RI DOH, Beach Program
Elizabeth	Scott	RI DEM Office of Water
Judith	Swift	Coastal Institute
Harold	Ward	Wood Pawcatuck Watershed Association
Peter	Weiskel	USGS