Chapter 2
ASSESSMENT – "READING THE RIVER"

Two questions are critical to determining what approach to take in design. First, is the stream's condition a reflection of a locally unstable situation or of a larger, watershed-wide problem? Secondly, how far from a "stable" form is the reach of stream you're proposing to remedy?

In order to answer these questions, it's important to properly "read the river" in its current state. This involves assessing the big picture (watershed assessment) as well as the local project area. Before attempting a solution, you must thoroughly identify and understand all causes of the observed problems.

Streams tend to evolve toward a state of equilibrium with their current flow and sediment load characteristics. We usually choose to intervene for a variety of reasons. To determine the degree of intervention needed, it's important to know the evolution of the stream -- at what evolutionary stage is a particular stream or river in relative to its potential equilibrium regime? Designs must be compatible with the stream's natural tendency to evolve into a particular channel form.

Channel evolution models and stream classification systems can help predict future upstream or downstream changes in habitat and stream morphology. Channel evolution models are based on adjustment processes and include Rosgen's evolution scenarios (*see* Appendix I) and Simon's channel evolution stages. Based on morphological parameters, stream classification systems include:

- Schumm's (relates straight, meandering and braided channels to sediment load)
- Montgomery & Buffington's (relates six classes of alluvial channels to sediment and bed load)
- Rosgen's (defines eight major stream classes with about 100 individual stream types using six morphological measurements)

At the heart of each sequence in Rosgen's scenario is the stream type -- when morphological changes exceed a "geomorphic threshold," stream type changes and there are new quantitative values of dimension, pattern, and profile.

The only way to be certain of a stream's evolutionary stage is to quantitatively assess the degree to which the stream's existing conditions differ from its full range of operating potential. Assessment includes comparing data for existing stream conditions to that of a similar, but unimpaired stream reach, or by comparing data collected for a stream reach at different points in time.

Designs must also consider man-made watershed influences, such as upstream storm water management, agricultural activity, urban development, coal mining, road and bridge construction, dams, and timber harvesting. Does your project consider these

influences as potential contributors to your problem? Think "big picture" here. Can your ideas fit into a larger watershed vision being developed for your area?

Another critical element of stream detective work is to think through monitoring needs early in the planning process. A monitoring plan should include pre-construction and post-construction monitoring to show success in meeting project objectives. Since funding for monitoring is often overlooked or not permitted in many government-funded projects, consider ways to use volunteer monitoring programs to measure long term success. Some permitted activities require monitoring components (*see* Chapter 9), so it's important to comply with permit conditions.

In summary, "reading the river" involves four phases of assessment:

- Watershed Assessment (the entire watershed)
- Preliminary Site Assessment (the project area)
- Data Collection and Analysis (at the project site)
- Monitoring for Success

Watershed Assessment

Any assessment of current stream conditions should include a watershed characterization since watershed properties affect the volume, timing, and routing of water and sediments from upland areas to a stream and along the stream to its outlet. This evaluation includes looking at the current landscape and at historical landscape changes that affect the magnitude and duration of peak and base flows and the yield and character of sediments from bank and bed erosion, roads and construction sites, and surface runoff. The hydrologic response of the watershed to various rainfall amounts is important in determining the appropriate size and shape of the stream channel and its floodplain.

You may not have the financial resources needed to collect information on *all* watershed characteristics. You may choose instead to collect just the information useful for your particular project's mission and goals. For cost savings, some of this information can be collected by watershed association members and other community volunteers.

When completing the watershed assessment, it is essential to include both *current* and *historical* information to establish baseline watershed conditions.

1) Collect *historical* information from sources such as:

Historical/Background Information		
Type of Information	**Information to Look For**	**Where to Find It**
General watershed & stream/river information	watershed size, drainage area	USGS topographic maps, fishing and boating clubs, watershed associations, etc.
	classification of stream types based on valley types and land forms	Simplified stream assessments can be used to help prioritize stream problems. See Appendix II for resource information.
Hydrology	stream flow data	USGS stream gages http://www.pa.water.usgs.gov/pa_hydro.html For location of gages in watershed or for nearby watersheds and later 9-207 data (packet of flow information not available on the web but upon request) which is used for design and when comparing gages
	flood history	residential - anecdotal information can help establish or confirm bankfull; US Geological Survey, Federal Emergency Management Association, PA Emergency Management Association
	stormwater management plans	Stormwater Management Act (Act 167) - county, conservation district, DEP, municipality
Historical information (location/condition/pattern)	historical photos, aerial photos	PA Historical and Museum Commission (PHMC) http://www.phmc.state.pa.us landowners, sportsmen groups, county, PA DEP, USGS, USDA Farm Service Agency, TerraServer. Google EARTH
	past projects (relocations, channelization, flood protection - successes & failures)	US ACE, Conservation District, FEMA
Geological Information	physiographic region (changes in rock structure)	USGS maps http://www.dcnr.state.pa.us/topogeo/indexbig.htm
	soils information	soil survey -- identify hydrologic groups, erodibility potential; county conservation district office, NRCS
Biological Information	fishery management survey reports	PA Fish & Boat Commission http://www.fish.state.pa.us, fishing clubs

Water Quality Information	water quality network stations	PA DEP; Susquehanna River Basin Commission - http://www.srbc.net
	Citizens' Volunteer Monitoring Program	Bureau of Watershed Management, DEP (717) 772-5807 http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/cvmp.htm
	local Total Maximum Daily Load data	PA DEP http://www.dep.state.pa.us/watermanagement_apps/tmdl/
	USGS Water Quality Data Warehouse	http://www.water.usgs.gov/nawqa/data
Land Use and Land Cover	land use maps, aerial photos	county or regional plans, PA DEP
	identify areas that have influence on stormwater runoff, discharge, sediment regimes, channel stability, or overall water quality	SHRP http://orser7.erri.psu.edu/loading/downloads.htm, planning offices, National Land Cover Database (NLCD 2001)
	DEP policy considering land use plans and zoning ordinances in issuing DEP permits	(General Information Forms include land use information as it relates to proposed projects permitted by DEP) http://www.dep.state.pa.us
Geographic Information Systems/ Watershed Assessment Information	coverage from Environmental Resources Research Institute (Penn State University)	http://www.environment.erri.psu.edu
	coverage from PA Spatial Data Access (PASDA)	http://www.pasda.psu.edu/
	Storm Water Management Plans, Water Supply and Wellhead Protections Plans	County planning departments

Key Watershed Contacts	
PA DEP Watershed Managers	Regional DEP Offices
County Watershed Specialists	County Conservation District Offices
Erosion & Sediment Pollution Control Technicians	County Conservation District Offices
Local watershed organizations/ Sportsmen's Clubs	http://www.pawatersheds.org
PA DEP Watershed Notebooks	http://www.dep.state.pa.us
US EPA Surf Your Watershed	http://www.epa.gov/surf
PA Fish and Boat Commission	http://www.fish.state.pa.us
Susquehanna River Basin Commission	http://www.srbc.net
Interstate Commission for the Potomac River Basin	http://www.potomacriver.org
Delaware River Basin Commission	http://www.drbc.net
Chesapeake Bay Program - Watershed Profiles	http://www.chesapeakebay.net

2) Collect *current* watershed information, planning information, and technical data from sources such as:

Watershed management plans - river conservation plans (most are funded by DCNR) - watershed management plans (most are funded by PA DEP)
PA Fish & Boat Commission, Division of Fisheries Management and Division of Environmental Services (Pleasant Gap)
PA DEP water quality network stations
River Network's Clean Water Projects (http://www.rivernetwork.org/library/librivcwastate.intro.cfm) - includes state contacts for water quality standards, NPDES permits, TMDLs, and designated uses)
Greenway plans
Regional curve data to provide bankfulls and channel dimensions (for gage sites only; cross-sections will most likely be upstream of OR downstream of gage) (*see* Appendix II).
Chapter 93 classification (http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/wqstandards)
Land use projections for the future (contact county or municipality)
FEMA flood map (if available) (contact municipality)
PA Natural Diversity Inventory (http://www.dcnr.state.pa.us/forestry/pndi/pndiweb.htm)
PA Scenic River status www.dcnr.state.pa.us/rivers
National Scenic River status (National Park Service) http://www.nps.gov/rivers/
TMDLs (http://www.dep.state.pa.us/watermanagement_apps/tmdl/)
303(d) listing (Assessed Waters program) (http://www.dep.state.pa.us/dep/deputate/watermgt/Wqp/WQStandards/wqstandards)
Current photos

Preliminary Site Assessment

A preliminary analysis of the proposed project area will help guide discussions about the specific information needed to design a restoration project for a particular watershed. This preliminary analysis is more qualitative than quantitative and relies heavily on visual assessment work and professional judgment. It's an important step to take, however, in identifying a stream's problems, and the results will be beneficial when meeting with the area's stakeholders to discuss the proposed restoration effort.

A preliminary site assessment may include the following evaluations:

- Identify stream reaches within your project area
- Take photos of key stream reaches that show signs of degradation
- Conduct physical and biological assessments of identified stream reaches

Begin by forming a multi-disciplinary team for data collection. To ensure consistency in assessment work, walk the site with the assessment team with data collection forms in hand. Review parameters for healthy stream conditions in your project area. This team approach helps eliminate individual interpretations of a stream's conditions. Where a local watershed organization exists, consider employing its assistance in conducting this preliminary site assessment.

Assessment Methodologies

Select a commonly accepted methodology for the physical and biological condition of your project area. Assessment methodologies include the following among others:

- **Simplified Stream Assessment Form** (bank stability, channel stability, riparian vegetation, and aquatic habitat).
- **Stream Visual Assessment Protocol (SVAP)**, USDA/NRCS, 1998
  An easy-to-use assessment protocol to evaluate the condition of aquatic ecosystems associated with streams; does not require expertise in aquatic biology or extensive training; least-impacted reference sites are used to provide a standard of comparison; states may modify the protocol based on a system of stream classification and a series of reference sites.
  http://www.nhq.nrcs.usda.gov/BCS/aqua/svapfnl.pdf
- **Stream Classification Worksheet** - stream classification worksheet used with Rosgen methods ("*Stream Corridor Restoration: Principles, Processes, and Practices", pp 7-33; 1998).* http://www.usda.gov/stream_restoration
- **USDA Stream Corridor and Inventory Assessment Techniques** - A guide to site, project and landscape approaches suitable for local conservation programs *(Technical Report, January 2001, revised).*
  http://www.wcc.nrcs.usda.gov/watershed/products.html
- **EPA's RBP** (Rapid Biological Assessment Protocol) – The RBP's are designed to provide basic aquatic life data for water quality management purposes such as problem screening, site ranking, and trend monitoring. *See* Rapid Bioassessment Protocols for Use in Wadeable Stream and Rivers: Periphyton, Benthic Macro-invertebrates, and Fish- 2nd Ed., Office of Water, EPA 841-B-99-002, July 1999.
- **PA Modified RBP** (Rapid Biological Assessment Protocol)
  Quality Assurance Plan: Cause/Effect Survey. PA DEP, Bureau of Water Management, on-line document warehouse, document 391-3200-003 or direct website:
  http://www.dep.state.pa.us/eps/default.asp?P=fldr200149e0051190%5Cfldr200149e32221af (PLEASE NOTE: This document will be updated in the near future. Use the current plan until update occurs)
- **AVStrEAMS –** A customized interface to ArcView GIS, this specially designed tool enables non-technical users to conduct and enter more than 15 different stream assessment protocols at designated stream monitoring sites. Once entered in GIS, the assessment information can easily be mapped, managed and displayed to illustrate problem or worksite attributes at specific stream segment locations. Contact: Ken Corradini, Penn State Institutes for the Environment, 1 Land and Water Research Bldg., University Park, PA 16802. Phone 814-865-6966 or visit
  http://www.avstreams.psu.edu

Based on an analysis of both watershed and site-specific information, begin to analyze the causes of impairment and draft a conceptual design of your restoration project. Special consideration should be given to managing *causes* as opposed to treating *symptoms*, as well as determining whether a *passive*, nonstructural alternative is appropriate or whether a more *active* restoration alternative is needed. Identify any gaps in information that may be crucial to a thorough assessment of the causes of impairment.