

Background/Introduction

Water quality is influenced by both natural and anthropogenic conditions. Underlying geology, topography, soils, and the presence of vegetation, combined with human activity on the landscape, interact to define water quality at any given location. The quality of surface water and ground water is vital to the health and quality of life for every Pennsylvanian and crucial to sustaining our indigenous water dependent biological communities.

Several factors can lead to the diminishment of water quality; the most common causes in Pennsylvania are sedimentation, metals, and nutrients. There are numerous sources that contribute to these causes including, agriculture, mining, wastewater treatment plants, development, and urban runoff. A factor that is often overlooked is how a change in the quantity of ground or surface water can affect water quality. While DEP manages and regulates many aspects of water, it is common for DEP programs to only consider the management and regulation for the single purpose of their program, such as a potable water supply. Additionally, the regulation of water is segregated into different categories (water supply, wastewater treatment, stormwater management, wetlands protection, etc.) making it difficult to evaluate the pressures created by multiple changes to the watershed. An integrated approach to comprehensive water use planning will account for all the users and dischargers in a watershed, provides for the proper siting of those users, protects sensitive areas, and will provide long term assurance that both water quantity and quality will be maintained for future generations.

Challenges

Causes and Sources of Impairment

Human activities that disturb the surface of the land have an impact on water quality; the goal is to conduct those activities in such a way that the impacts to the land surface and the potential impacts on water quality are minimized to the greatest extent possible. Pennsylvania has over 86,000 miles of streams, more than 16,200 miles of those streams are impaired due to sedimentation, metals, and nutrients.

A certain amount of erosion and sedimentation occurs naturally, and the watercourse is able to assimilate these naturally occurring sediments without permanent adverse water quality impacts. Adverse effects most often result from accelerated erosion due to earth disturbance activities such as mining, agriculture, development, and urban runoff. Approximately 8,700 miles of streams in Pennsylvania are listed as impaired due to sedimentation. Excess sediment has adverse effects on water quality and water dependant biological communities; sediment can cover fish eggs and aquatic insect habitat, resulting in declining fish populations. Sediment clouds the water and deprives plants of light needed for photosynthesis. Sediment has economic impacts through the increase of treatment costs for public drinking water suppliers and in the clean up and restoration of impaired waterways. Additionally, sediment acts as a means of

conveyance for other pollutants such as heavy metals, and excess nutrients that spread by water action and cause problems not only at the source, but also downstream.

Heavy metals, such as zinc, arsenic, selenium, lead, and cadmium degrade water quality and may have adverse effects on aquatic life. Heavy metals are introduced to surface and ground water through Acid Mine Drainage (AMD), and urban runoff as byproducts from petroleum products and industrial processes. Over 4,800 miles of streams in Pennsylvania are listed as impaired due to heavy metals. Some heavy metals, such as copper, selenium, and zinc, are essential in trace amounts to maintain the metabolism of the human body. At high concentrations however, these metals are toxic. Many heavy metals bioaccumulate, or build up in concentration in the body tissue of both animals and humans causing long term health concerns.

Nitrogen and phosphorous are vital to all forms of life and essential for crop production, however when present in excess amounts these nutrients have detrimental effects on water quality and aquatic life. The main sources of nutrients are agriculture, waste water treatment plants, and urban runoff. Over 2,700 miles of stream in Pennsylvania are listed as impaired due to nutrients, and nutrient pollution has been identified as the number one problem in the Chesapeake Bay. Excess nutrients stimulate algae and other aquatic plant growth. This excessive aquatic plant growth can result in deleterious effects on the physical, chemical, and biological properties of the ecosystem. This degradation has impacts on all water uses from aesthetics and quality for recreation and fishing to increased costs for treatment by drinking water suppliers.

Changes in Flow

In-stream flow reduction can reduce available habitat for aquatic communities and diminish the ability of a waterway to process or assimilate pollutants. Changes in flow magnitude, duration, frequency, timing, and rate-of-change all have consequences. A new withdrawal of significant volume could diminish available water, causing in-stream quality to deteriorate. Upstream withdrawals of either groundwater or surface water can reduce the base flow of a stream. Many areas are served by regional wastewater treatment plants that discharge at the base of the watershed. Water used by upstream residents and the surrounding community then travels through sewer pipes to the point of treatment, effectively removing it from the system because the stream no longer receives it as base flow in headwaters. This situation is exacerbated as development expands further up stream towards the headwaters.

Another in-stream flow concern affecting both water quantity and quality is “flashy” flows. A stream is characterized as flashy if it exhibits low flows and quickly fills to bank full or flood levels during storm events. While some streams are naturally flashy due to the geologic makeup of the watershed, many streams are made flashy by increased urban runoff from impervious surface areas and poor stormwater management practices. These wide fluctuations in flow produce increased bank erosion, resulting in a turbid, sediment laden stream. Stream flow spikes can change the geomorphology of the stream by altering its width and the riffle to pool ratio as well as its biology by physically

removing organisms when the stream bottom is scoured. These physical changes frequently lead to broadly varying temperatures and the dissolved oxygen levels in the water, both of which can have detrimental effects.

Protection of Sensitive Areas

The protection of sensitive areas such as, well heads, headwaters, wetlands, river and stream corridors and flood plains contribute to the improvement of both water quantity and quality. Over three million Pennsylvanians rely on ground water obtained from public or private wells. While public water supply wells are required to meet strict construction standards, private residential water well construction is largely unregulated and no minimum statewide construction standards are in place. Pennsylvania is one of only two states that do not have statewide standards regulating private water well construction. Properly sited and constructed water wells are reliable and safe sources of drinking water, and prevent ground and surface water contamination.

Headwaters where large rivers and streams begin consist of a network of small upstream tributaries. The continued development of land in the headwater regions alters the landscape, influencing changes in stream flow and water quality. Stream flow is affected by changes in natural stormwater runoff patterns and increased consumptive use of ground and surface water. These changes in stormwater patterns often include increases in volume and velocity which produces adverse impacts as noted earlier. Water quality, as discussed previously, may be altered by quantity changes, and also by the introduction of pollutants in stormwater runoff and from other human activities that previously did not occur in the area.

The corridors directly along streams and rivers, known as riparian zones, are vital to maintaining water quality. When managed properly riparian zones act as buffers to slow runoff to the stream, filter pollutants, and provide vegetation to stabilize stream banks. These corridors also act as floodplains to provide storage for excess water during flood events. Riparian zones are critical to providing habitat for Pennsylvania's wildlife and aquatic communities.

Water Dependent Biological Communities

There is an astounding diversity of aquatic life in Pennsylvania's streams and lakes that depend directly on an adequate amount of stream flow and appropriate habitat. The natural regime of high and low flow forms stream channels and supports the highest diversity of species. Consistent low flow conditions resulting from overtaxed aquifers, or frequent high flows where stormwater runoff is uncontrolled, reduce the number of species supported by an aquatic system.

Water dependent plant and animal life is found in perennial streams, intermittent and ephemeral streams, wetlands and the hyporeal zone, which is the interface between surface and groundwater. Pennsylvania's waters are crucial to some part of the lifecycle of at least 1200 kinds of insects and other invertebrates, such as, crayfish, aquatic worms,

and mussels. The presence and diversity of these biological communities are the greatest indicators of the water quality in our streams. Balancing water as a resource to meet sustainable consumptive uses while supporting Pennsylvania's diverse biological communities needs to be a basic tenet in integrated water resource planning.

Recommendations

In an effort to reduce sediment and nutrient loads for the improvement of Pennsylvania water quality, and to meet Chesapeake Bay Tributary Strategy goals the Commonwealth should provide funding for --

- Increased loans, grants, or tax incentives for infrastructure improvements of sewage treatment facilities.
- Increased loans, grants, or tax incentives for agricultural Best Management Practices.
- Establish loans, grants, or tax incentives for infrastructure improvements and retrofitting of stormwater facilities.

The Commonwealth should enact legislation for the certification of well drillers and the establishment of private water well construction standards -- There are currently national testing and certification programs available that measure the proficiency of applicants for initial licensing or renewal. The National Groundwater Association, among others, has functional model programs already developed. Pennsylvania should draw upon this expertise to establish a proficiency-based licensing and renewal system for well drillers. Legislation or should be enacted to establish construction standards for water well drilling. These standards should include:

- Well Siting/Location – Wells need to be protected from potential contamination sources and provide appropriate distances from known points of contamination.
- Construction – Specifications should be established for casings and screening materials in order to preclude the entrance of contaminants.
- Reporting – Requirement for post-drilling reports regarding quality and quantity measurements should be provided to the landowner and the appropriate regulatory agencies.

The Commonwealth should continue funding for Acid Mine Discharge (AMD) restoration – Pennsylvania has made great progress in the treatment of AMD by DEP partnering with local municipalities and watershed organizations. The continuation of that progress should be encouraged through the establishment of a dedicated funding source to implement and maintain AMD treatment facilities.

Local government land use planning decisions should consider the impacts on water as a resource--

- Land use planning and zoning ordinances should consider the impacts of land use, development, and redevelopment on water quantity and quality.

- The protection of our water resources must be considered early in the development planning process in order to address cumulative impacts to a watershed.
- The alterations to the landscape must also consider stormwater management. It is important that stormwater be considered as a resource, and be managed for re-use and recharge of the groundwater.
- Protect, maintain, and restore functions and values of sensitive areas during development and redevelopment. Sensitive areas within the watershed, such as wetlands, well heads, headwaters, and riparian zones should be protected from the impacts of future development.
- The last defense to protect water quality is the land immediately adjacent to rivers and streams. To the maximum extent practicable and cost effective, vegetated buffers should be preserved and restored along all waterways.

DEP along with other appropriate Commonwealth agencies should develop guidelines and tools for groundwater assessment – Guidelines should be developed for assessing and minimizing cumulative hydrologic impacts in a watershed resulting from any activities on the land. A tool, similar to the Water Budget Screening Tool, should be developed to assess the quality and quantity of groundwater and identify areas of impairment.