GROUNDWATER MANAGEMENT PLAN FOR THE SUSQUEHANNA RIVER BASIN

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1.0 INTRODUCTION

The Susquehanna River Basin Commission (Commission) is a federal-interstate body, formed by a 1971 compact to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin. The term of the Susquehanna River Basin Compact (Compact) is 100 years. The fundamental principle of the Commission is to manage water resources from a watershed perspective, not by political boundaries. To fulfill its mission, the Commission must balance environmental protection with meeting the needs for adequate water supply and economic development.

The Compact contains the powers and duties of the Commission, and states in Section 3.1 that "The Commission shall develop and effectuate plans, policies, and projects relating to the water resources of the basin. It shall adopt and promote uniform and coordinated policies of water resources conservation and management in the basin." In addition, Sections 3.4.2 to 3.4.5 of the Compact discuss the powers the Commission has in dealing with groundwater resources in the basin. The Commission's *Comprehensive Plan for Management and Development of the Water Resources of the Susquehanna River Basin*, June 1987, provides a broad-based strategy for "the development, use, control, management, and conservation of the water resources of the basin.…"

1.1 Background Information

The Commission has collected data for groundwater resource evaluation since its inception. In 1978, the Commission promulgated regulations specifically addressing large groundwater withdrawals to fill an identified gap in the regulatory authority of its member jurisdictions (New York, Maryland, Pennsylvania, and the federal government). In the early 1980s, the Commission conducted special studies of the groundwater resources of the basin, which included reconnaissance level appraisals, as well as numerical flow models of critical areas. The Commission adopted its first "Groundwater Management Plan" for the Susquehanna River Basin in July 1993.

The 1993 plan was prepared by Commission staff under the general guidance of the Commission's Water Resources Management Advisory Committee (WRMAC). The plan contains a summary of the water resources of the basin, as well as a description of the regulatory framework existing at that time within the basin, and identified the appropriate regulatory role for the member jurisdictions and the Commission. Perhaps the most important section of the plan consisted of a compilation of key groundwater-related issues in the basin, along with recommendations for proposed solutions and management actions. These included the compilation of accurate information on water use, a registration program for withdrawals exceeding 10,000 gallons per day (gpd), Commission allocation of groundwater through project approval (docket) based on long-term conservation management that considered the

reasonable needs of project sponsors, and education and outreach programs to assist local government in understanding groundwater management issues and responsibilities.

A recent, in-depth review of the 1993 plan's 60 recommendations determined that 23 of these recommendations have been implemented or are no longer relevant. The remaining 37 recommendations served as an initial basis for developing the current management plan. One of the 1993 recommendations was to conduct a periodic comprehensive review and update of the Groundwater Management Plan, which is accomplished by completion of this new plan. Appendix E of this report contains both the complete list of current recommendations and the 1993 plan recommendations that have been implemented or are not relevant today.

The need to review the 1993 plan and comprehensively update the groundwater issues, problems, and recommendations is due to changed conditions, programmatic revisions, and technological advances. The following information is pertinent to the purpose, objectives, scope, and existing conditions, groundwater resource, programs, and management principles and tools considered in the current plan.

1.2 Purpose and Objectives

This plan has been prepared to provide a framework that will allow the Commission, within the scope of the Commission's mission, powers and duties, to effectively manage groundwater resources in the basin, in cooperation with member jurisdictions and other organizations. The Commission meets its groundwater management responsibilities by regulation of withdrawals and consumptive use of water, coordination of groundwater quality issues, conducting planning studies, and public outreach and education. Withdrawals and consumptive water use are regulated under Commission Regulation §803.4, relating to projects requiring review and approval by the Commission. Regulation §803.42, effective since 1971, covers all sources consumptively using water in excess of 20,000 gpd, based on a consecutive 30-day average. In 1978, the Commission promulgated further regulation of groundwater withdrawals for large users (greater than 100,000 gpd) under Regulation §803.43.

Within this framework, the plan sets forth actions to address a variety of groundwater issues and problems. The plan is broad-based and is not meant to be a detailed implementation document for all recommendations. However, actions that can be taken in the near term toward implementation and be done relatively easily and quickly under existing programs were identified.

The vision reflected in the plan is for an organized and cooperative effort among the Commission, the federal government, the Commission's member states, local jurisdictions, business and environmental interests, and the public to make sound decisions for use and protection of groundwater resources in the Susquehanna River Basin. The plan will promote and serve as a catalyst for more effective management of groundwater, enhanced coordination, and improved knowledge of the resource and its use.

A critical part of the Commission's mission, as reflected in the 1971 Susquehanna River Basin Compact, is the achievement of a balance among environmental, human, and economic needs in the management of the basin's water resources. This is done by careful consideration of a wide range of factors, including water resource sustainability, protection of existing users, adverse environmental impacts, actions to minimize or mitigate impacts, protection of high quality water from degradation, effective interagency coordination, and public understanding of groundwater issues. The recommended actions in the plan were formulated with the goal of balancing economic development and environmental protection as a primary consideration.

Objectives of the Groundwater Management Plan are to:

1. Describe the existing conditions;
2. Describe the management framework of groundwater resources in the basin;
3. Discuss the management principles and various tools;
4. Assess the problems related to groundwater resources;
5. Recommend specific groundwater management actions for the basin; and
6. Prepare a management plan that includes the selected actions and implementation requirements.

1.3 Scope

The Susquehanna River Basin is defined by the surface water drainage area, as shown on Figure 1.1. The basin is divided into six major hydrologic subbasins. While groundwater divides may differ locally from surface water divides, the difference between the groundwater and surface water drainage areas for the Susquehanna River Basin is very small.

The Groundwater Management Plan addresses a number of issues and problems concerning the interaction of groundwater and surface water resources and, in particular, streamflow. Groundwater commonly supplies more than half of streamflow, and is the primary source of water for streamflow during periods between surface water runoff events (rainfalls and snowmelts). During periods of low flow (i.e., normal summer conditions and droughts), virtually all of the water flowing in stream channels is supplied by groundwater.

The plan covers all groundwater activities that currently fall within the purview of the Commission. The plan also identifies actions that are directly related to the Commission's program but are to be undertaken or recommended to be undertaken by its member jurisdictions and local jurisdictions.

Preparation of the Groundwater Management Plan was accomplished with guidance from the Commission's WRMAC. WRMAC is comprised of Commission staff and representatives of the four member jurisdictions, all of whom have extensive technical and/or management experience in water resources. Their expertise and contacts were of significant value in developing the plan. WRMAC members by jurisdiction and agency affiliation are the New York State Department of Environmental Conservation (NYSDEC), Pennsylvania Department of Environmental Protection (PADEP), Maryland Department of the Environment (MDE), United States Army Corps of Engineers (USACE), and Commission staff. In addition to the information provided by WRMAC members and the agencies they represent, Commission staff contacted a number of key agencies, including New York State Department of Health (NYSDOH), Pennsylvania Department of Conservation and Natural Resources (PADCNR), United States Environmental Protection Agency (USEPA), United States Fish and Wildlife Service (USFWS), and United States Geological Survey (USGS) to obtain information, views, and opinions.

1.4 Existing Groundwater Conditions

This section describes the existing conditions in the Susquehanna River Basin that affect groundwater resources. These conditions include aquifer characteristics and a number of other factors, including climate, physiography, groundwater quality, and groundwater use. More detailed information on groundwater conditions is contained in Appendix A.

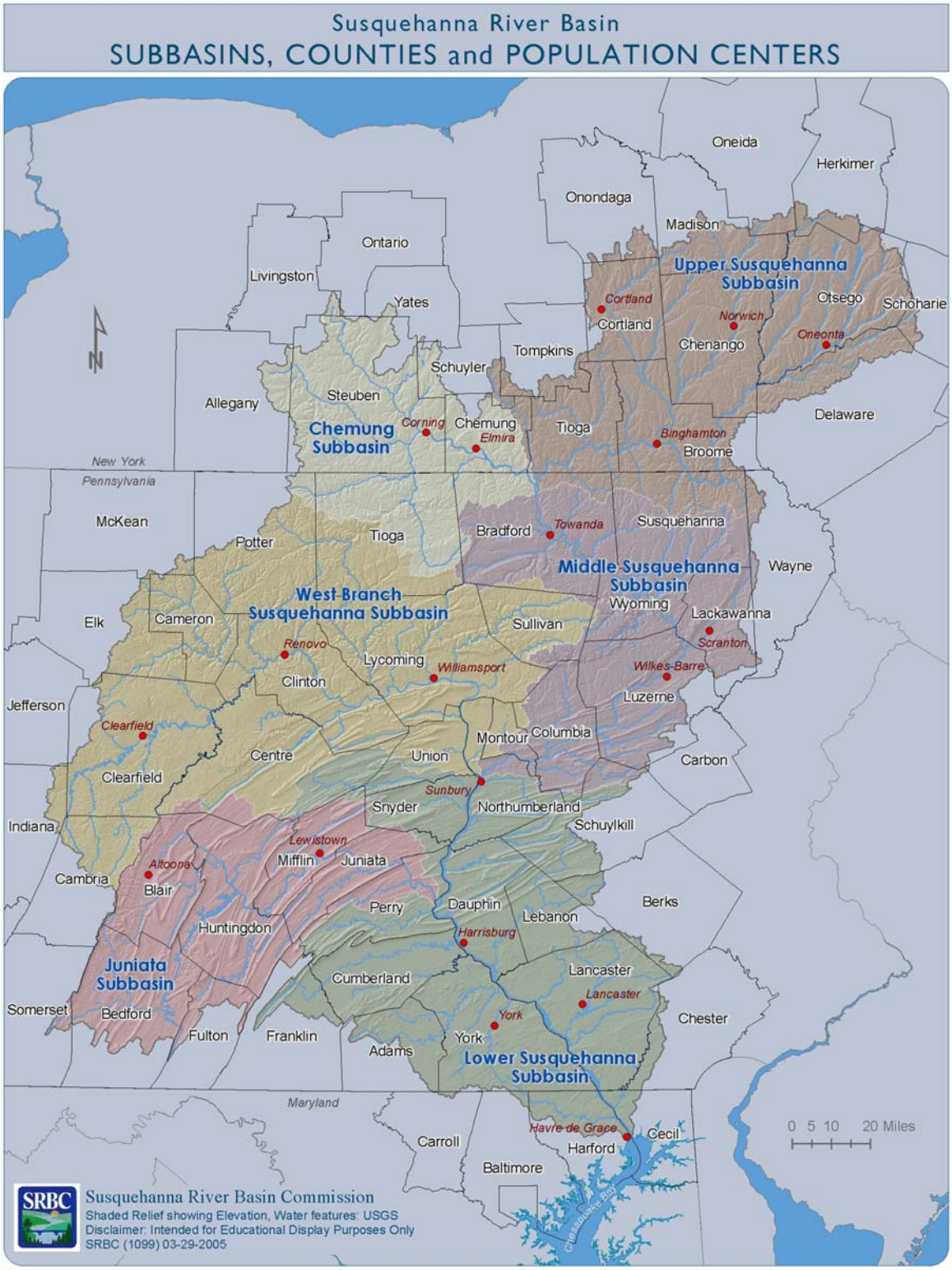

Figure 1.1. Susquehanna River Basin

1.4.1 Aquifers

There are commonly three types of aquifers found in the Susquehanna Basin: karst, fractured bedrock, and porous media (stratified drift, alluvium, and colluvium). Each aquifer type possesses unique hydrogeologic characteristics that influence groundwater occurrence and movement. The aerial extent of these aquifers is commonly limited and the aquifers are dependent on an annual infusion of recharge.

1.4.2 Climate

Although the Susquehanna River Basin receives a generous amount of precipitation (an average of 40 inches annually) in the form of snow and rain, the estimated recharge to groundwater resources during average conditions is 13 inches. Droughts have been fairly common during the last decade, causing some concern about groundwater use and availability in certain parts of the basin. In recent years, drought conditions have persisted for many consecutive months, resulting in multiyear drought events. A significant drought impact is insufficient groundwater recharge occurring during the period from the fall through spring runoff when aquifer levels are typically brought back into normal ranges. Consequently, groundwater storage can be abnormally low before the peak summer demand period begins. The 2002 drought is an example of a multiyear regional drought event that began in fall 2001.

1.4.3 Physiography

Groundwater geohydrology in the basin can best be described in the context of the three dominant physiographic provinces: the Appalachian Plateaus, Valley and Ridge, and Piedmont. Each province possesses distinct physical characteristics (topography, geology, and soils) that influence groundwater conditions within the Susquehanna Basin.

The predominantly forested Appalachian Plateaus Province, comprising approximately 40 percent of the basin, is characterized by nearly flat-lying sedimentary rocks with confined and semi-confined fractured bedrock aquifers of significant lateral extent. The other dominant aquifers, most common in the New York part of the province, are the valley-fill aquifers that communicate with the streams flowing across them.

The Valley and Ridge Province, located entirely in the Pennsylvania portion of the basin, is characterized by fractured bedrock and karst aquifers of relatively small areal extent. Recharge rates associated with the more extensive karst aquifers are among the highest in the entire Susquehanna River Basin, and are commonly associated with the more agriculturally productive valleys in the Commonwealth.

The Piedmont Province, within the Pennsylvania and Maryland portions of the basin, is comprised of complex geologic terrain with a very limited capacity to store and transmit groundwater, representing some of the least productive aquifers in the Susquehanna River Basin. However, there are some high yield aquifers that coincide with the presence of thick layers of saprolite within the metamorphic terrain in York/Lancaster Counties, as well as some karst aquifers in the Conestoga Valley.

1.4.4 Groundwater Quality

Groundwater quality in the basin is typically good; however, significant impacts to water quality from abandoned mine lands, agriculture, and developed areas have stressed the resource in certain areas of the basin. In addition to these land use impacts, problems can also arise from transportation corridors and rural septic systems. Specific groundwater quality issues in portions of the basin include elevated iron, manganese, nitrates, and organic contaminants.

1.4.5 Groundwater Use and Availability

The use of groundwater resources within the basin is extensive. In particular, groundwater plays a critical role in supplying drinking water and maintaining the economic viability. Outside of the major population centers, drinking water supplies are heavily dependent on groundwater supply wells. General household use from private wells is also a significant portion of the basin's overall use. Business and industry dependent on the basin's groundwater resources employ thousands of people and contribute billions of dollars to local/regional economies through payrolls, product distribution, and product sales. Examples of some of these industries include food, raw material, and chemical production.

The major categories of groundwater use include public water supply, commercial, domestic, industrial, thermoelectric power, mining, livestock, and irrigation. The best data available show a total groundwater use in the basin of about 391 million gallons per day (mgd). The largest users are public water suppliers (115 mgd), mining (90 mgd), domestic withdrawals (80 mgd), industrial (48 mgd), agriculture (42 mgd), and commercial (12 mgd).

From a basinwide standpoint, groundwater resources are in good condition, and generally of sufficient quantity and quality to meet both human and environmental needs. However, groundwater availability faces challenges in some areas of the basin. Some of the highest producing aquifers are located in the most developed areas of the basin, and are subject to competing uses, loss of recharge areas, diminishing stream/spring flows, and threatened water quality. These problems are only exacerbated during periods of drought. Areas with naturally low-yielding aquifers show stress even during normal hydrologic conditions. In the Pennsylvania portion of the basin, there is a significant problem with degradation of groundwater quality from acid mine drainage (AMD), making the resource largely unavailable for most uses in these areas. To a lesser extent, there also are localized problems with elevated nitrate from agricultural activities and septic systems. These situations put increasing pressure on already resource-constrained upstream headwater areas as communities and industry look for high quality groundwater resources.

1.5 Management and Regulatory Programs

There are long-standing and diverse authorities that require the federal government, Commission, states and local jurisdictions to manage, regulate, and protect various elements of groundwater resources. The groundwater responsibilities of the Commission and key federal and state agencies are briefly discussed in this section. In addition, local jurisdictions and watershed organizations play important roles in groundwater issues and these also are discussed. More detailed information on the agencies and local groups is included in Appendix B.

1.5.1 Federal Government

***United States Geological Survey (USGS*).** The USGS collects data and maintains databases on streamflow from its stream gaging network, on groundwater levels from its monitoring well network, and on ambient water quality.

United States Environmental Protection Agency (USEPA). The USEPA regulates activities that have the potential to pollute either surface water or groundwater. Additionally, the USEPA oversees the remediation of pollution sites when no responsible party can be identified.

United States Fish and Wildlife Service (USFWS). The USFWS investigates potential impacts to threatened and endangered species. If groundwater use is expected to cause impacts to natural resources, the USFWS can provide recommendations for mitigation of the impacts and protection of the resources.

United States Army Corps of Engineers (USACE). The USACE can provide technical and planning assistance to address water resources problems and needs, including those related to groundwater.

1.5.2 Susquehanna River Basin Commission

A critical part of the Commission's mission, as reflected in the 1971 Compact, is to achieve a balance among environmental, human, and economic needs when managing the basin's water resources. The Commission carries out its groundwater management responsibilities in a number of ways. These include regulating withdrawals and consumptive use of water, coordinating groundwater quality issues, conducting a variety of planning studies (watershed based, special studies, and water budget analyses), conducting public outreach and education, and preparing this Groundwater Management Plan.

1.5.3 New York State

New York State Department of Environmental Conservation (NYSDEC). The NYSDEC's Division of Water (DOW) issues permits for all takings for public water supply, from groundwater or surface water sources. Detailed information on completed water wells is submitted to NYSDEC for use in groundwater resource evaluation and development of a database. The DOW, in partnership with the USGS, conducts statewide aquifer mapping to obtain information on significant water-bearing formations. The DOW also issues permits for discharges of wastewater and stormwater, and works closely with local governments to implement nonpoint source control and groundwater resource protection programs.

New York State Department of Health (NYSDOH). Water that has been withdrawn by public water suppliers for distribution to the consumer is regulated by the NYSDOH. Other tasks performed by the NYSDOH are the establishment of state drinking water standards and enforcement of both state and federal drinking water standards.

1.5.4 Commonwealth of Pennsylvania

Pennsylvania Department of Environmental Protection (PADEP). PADEP conducts many groundwater management activities, most of which relate to groundwater pollution and quality. Public groundwater supplies are regulated and monitored by field staff with a primary concern being water potability. Pennsylvania's Wellhead Protection Program and Ambient Groundwater Monitoring Network Program are administered by PADEP. Other actions that can impact groundwater and are regulated by PADEP include sewage disposal, solid waste activities, coal mining operations, and oil and gas drilling. Comprehensive water resource planning for the Commonwealth (e.g., the State Water Plan) is done by PADEP.

Pennsylvania Department of Conservation and Natural Resources (PADCNR). The Bureau of Topographic and Geologic Survey in PADCNR conducts groundwater studies and administers the Water Well Drillers License Act 610, which provides a mechanism to obtain groundwater and subsurface data. This bureau also maintains inventories of water well records.

1.5.5 State of Maryland

Maryland Department of the Environment (MDE). The Water Management Administration (WMA), through its Water Rights Division (WRD), has the responsibility for issuing groundwater appropriation permits for most new uses of groundwater. The WRD analyzes the area-wide effects of collective water appropriations and formulates management alternatives to resolve problems when needed. The MDE has the primary responsibility for protection of groundwater quality from contamination. Other MDE activities related to groundwater include administration of the state's Wellhead Protection Program, regulation of well construction, review and approval of county comprehensive water and sewage plans, and permitting of municipal waste landfills and other environmentally sensitive actions.

Maryland Department of Natural Resources (MDNR). Within MDNR, the Maryland Geological Survey is responsible for the maintenance of a statewide water-data network and the investigation of the hydrologic and geologic characteristics of Maryland's water resources.

1.5.6 Local Governments

Within the basin, there are a total of about 1,350 municipalities that control land use, land development, stormwater management, and several aspects of water resource management and use. Local government has a responsibility to both promote and protect the integrity of water resources, including groundwater. It is, therefore, incumbent upon local governments to become advocates for the control of land use policies that foster prudent water resource protection and development.

1.5.7 Watershed Organizations

There are approximately 189 watershed and lake organizations in the Susquehanna River Basin. These grassroots organizations seek solutions for water resource problems and issues, conduct grant-funded studies and research, and participate in local education and environmental planning with local governments.

1.6 Management Principles and Tools

This section discusses principles considered to be fundamental to groundwater management and tools available to achieve management goals. While the information is presented in relation to the Commission's groundwater management activities, it has applicability to programs and projects of others. More detailed information on groundwater management tools is presented in Appendix C.

1.6.1 Management Principles

Certain principles form the foundation for management of the groundwater resources by the Commission. Many are basic facts or axioms—propositions that are universally recognized as indisputable—and are reviewed below as background for the discussion of management. Others are concepts adopted from the successes of a variety of existing and ongoing efforts. Overall, the principles serve to guide the Commission in its policy development and its actions to implement management goals.

1. Water is a valuable asset and a finite natural resource; it is essential to all life.

2. Groundwater occurs almost everywhere beneath the land surface. However, earth materials differ widely in their ability to store and transmit water, which causes a disparate distribution of groundwater resources in watersheds and poses a challenge for equitable allocation and use. Furthermore, the volumes of water pumped from a groundwater system must come from somewhere and must cause a change in the groundwater flow system.

3. From the standpoint of water use and water management, all groundwater is not equal—the quality of the water may make it unsuitable for some uses without treatment. Groundwater quality is a key consideration in developing water management strategies.

4. Groundwater management needs to be consistent with the objectives of the Compact to promote the "orderly, integrated and comprehensive development, use and conservation" of the basin's waters and to secure and maintain "a proper balance among industrial, commercial, agricultural, water supply, residential, recreational, and other legitimate uses of the water resources of the basin." As the Susquehanna River Basin continues to experience growth in population and economic enterprise, and as our communities continue to develop and mature, it is essential that the Commission practice good stewardship and utilize the basin's water resources in a thoughtful and balanced fashion to serve all legitimate purposes.

5. The use of groundwater resources needs to be managed to promote sustainability in the face of short-term and long-term growth. Sustainable development requires the development and use of groundwater in a manner that yields can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences. Sustainability requires a long-term perspective to groundwater management.

   The Commission has defined the sustainable limit of water resource development as the average annual base flow (recharge) available in the "local" watershed during a 1-in-10-year average annual drought. That is, the total amount of water withdrawn by all users on an annual basis should only exceed the normal amount of water recharge on an average of once every 10 years. Users draw a higher percentage of water from groundwater storage during the drought years than they do during non-drought years, and the groundwater system is allowed to recover (that is, storage refills) during the intervening years. The selection of the 1-in-10-year drought recharge standard strikes a balance among resource conservation, environmental needs, regulatory restriction of growth and development, and the need for adequate and often expensive constructed water storage facilities.

6. Water resources management, and particularly groundwater resources management, requires an integrated approach, recognizing that the chemical, biological, and physical aspects of groundwater systems are interrelated; that many natural processes and human activities affect these interactions; that water supply and water quality cannot be managed separately; and that groundwater and surface water are inextricably linked parts of the same resource. Integrated management means that the Commission, in its decision-making, needs to consider all of the aspects of the water resource that are fundamentally interrelated.

7. Decision-making should be based on sound scientific principles, policies, and requirements in laws and regulations.

8. For proper management and protection, the Commission, as well as its member jurisdictions, should work to build long-term, local capability to foster critical "local stewardship" of water

resources. Whenever possible, the Commission should be involved in establishing and nurturing watershed organizations, assisting in the development of local plans, and supporting enactment of appropriate local ordinances, especially those concerning land use.

9. Prudent groundwater management requires that the Commission and its member jurisdictions recognize the likelihood of continuing limitations in fiscal and staffing resources, and focus on key issues where they can make a positive and substantial impact. The Commission must strive for the most efficient use of its human and technical resources and prioritize its efforts accordingly. This should be done for all program areas, including when considering regulatory options such as general permits, as appropriate, and selecting priority items such as "Potentially Stressed Areas" (PSAs) as a focus for its management program. Implementation of actions related to the plan should be staged over time as resources are available.

10. Coordination among member state and federal agencies and the Commission results in efficient data collection, planning, monitoring, and management of the basin's groundwater resources.

1.6.2 Resource Evaluation

The Commission evaluates groundwater availability, utilization, and potential environmental impacts using a number of different analytical methods and tools which are discussed in this section. Areas having intense water resource utilization require additional analyses to maintain a balance between groundwater withdrawals and aquifer recharge on a local level in order to prevent local resource depletion, environmental impacts, and water supply failure.

Water Budget Analysis. A water budget analysis treats the water resources of an area as an account, with income (recharge), expenses (withdrawals and instream flow needs), and savings (storage). The natural flow system that encompasses all the budget expenses (wells, springs, stream intakes, instream flow needs, etc.) and their recharge areas must be carefully defined. On a project-specific basis, this will generally correspond to a subsection of a local watershed. Water budgets are useful for evaluating the groundwater resources available for development, troubleshooting water supply and well interference issues, and planning for future water needs (expenses).

Critical Aquifer Recharge Areas. Critical aquifer recharge areas (CARAs) are land surface areas that are responsible for a large fraction of the recharge to a well capture area and/or are closely hydraulically coupled to a withdrawal or area of discharge (spring, stream, or wetland). An area may be classified as a CARA by virtue of its high aquifer permeability, soil characteristics, vegetative cover, and location with respect to discharge areas and/or withdrawals, topographic setting, or a combination of these. Delineation and proper management of CARAs will help to ensure that the amount of water allocated (e.g., in a project approval action) will be available for the duration of the approval and to preserve the local base flow in streams.

Water Level Monitoring. The flow of groundwater from recharge areas to areas of discharge is driven by the difference in water levels (head) of these areas. The monitoring of water levels in an area of concentrated development can provide information on the functioning of the groundwater flow system and an early warning of over utilization.

Special Studies and Models. Special studies and/or modeling are used to check the "health" and utilization level of the groundwater flow system in areas with concentrated water resource development, or address other water resource management issues. A current example of such an effort by

the Commission is a special study of alternative management options for both surface water and groundwater to address agricultural consumptive use in the Susquehanna River Basin in Pennsylvania.

Water Resource Management Database. A large amount of water resource management-related information is available from many sources and in various formats. In order to efficiently and most effectively use this information, it can be organized under a common database and placed in a Geographic Information System (GIS). A GIS-based database can greatly facilitate cumulative impact analyses, water budgets, and the delineation of CARAs.

1.6.3 Regulatory Program

The primary groundwater management "tool" used by the Commission is its regulatory program. The various facets of the program are discussed below.

Registration. The Commission adopted water withdrawal registration regulations to document water use throughout the basin and provide the necessary data to make informed water management decisions. Registration is important to the Commission's permitting activities because it provides basic water use data, thereby allowing the Commission to protect existing uses. Information on water use is important for other Commission water management activities, including preparation of water budgets.

Regulation of Groundwater Withdrawals. The Commission adopted withdrawal regulations to manage large water users (in excess of 100,000 gpd or 20,000 gpd used consumptively) in order to avoid conflicts between users and to ensure beneficial management of the water resources. By regulation, withdrawals are limited to the amount (quantity and rate) that is needed to meet the reasonably foreseeable needs of a project and that can be withdrawn without causing adverse impacts. The Commission's application process has a number of standard criteria that are applied to all projects. These include a constant-rate pumping test, metering, monitoring and reporting, mitigation of adverse impacts, water conservation, and a docket reopener provision.

The Commission's staff formulates specific recommendations so that the project can operate without causing any undesirable environmental effects. Water quantities and rates of withdrawal can be reduced from those requested or otherwise limited, as necessary, to protect other uses or mitigate impacts. Many projects are conditioned with instream passby flow requirements or a minimum groundwater level that must be maintained in the production well.

Compliance Monitoring and Enforcement. The Commission's objective is to have all water users in the basin in compliance with the Commission's water management regulations in order to properly manage the basin's water resources. The Commission requires certain monitoring data be submitted for approved projects.

Protected Areas. The Compact allows for the creation of protected areas in regions of water shortage within the basin. According to the Compact, protected areas are intended to correct, mitigate, and manage local area water supply shortfalls or threatened shortfalls on a quantitative basis. Protected areas may be managed to limit groundwater withdrawals, surface water withdrawals, both groundwater and surface water withdrawals, and cumulative consumptive water uses. To date, the Commission has not exercised its protected areas authority, but could do so if needed.

Development of Standards and Guidance. Commission staff has developed both standards and internal and external guidance to promote consistency and efficiency in the Project Review Program. The most important of these, from a groundwater perspective, is the Pumping Test Guidance

(2002) that specifies the procedures, monitoring, evaluation, and data analyses needed for conducting constant-rate pumping tests. Other guidance includes passby flow evaluations, out-of-basin diversion protocol, criteria for waiving pumping tests, guidance for evaluating cumulative impacts, establishing "grandfathered" quantities, and reviewing consumptive water uses. The development of standards and guidance is an ongoing process, and will continue as important issues arise and time permits.

Water Conservation. A requirement to institute appropriate water conservation measures is included, by regulation, for any project that is subject to Commission approval. A number of specific requirements apply to public water suppliers (source and customer metering, unaccounted-for water to be less than 20 percent, an appropriate rate structure, etc.). The regulations do not include specific conservation measures for other water users. Incentives for promoting conservation measures and implementing technical solutions may also be considered by the Commission.

Water Reuse. Groundwater used by municipalities and industries is typically treated and discharged to a stream. AMD from many flooded underground coal mines is treated and discharged to streams. The quality of treated water is generally quite good and is potentially usable for many non-potable uses. The reuse of treated wastewater will allow the water budget to be "stretched" in areas of rapid growth and limited water resources.

Conjunctive Use. The availability of groundwater and surface water resources frequently varies in a complementary manner during the year, such that one of them is relatively abundant while the other is relatively scarce. Water users can develop both groundwater and surface water sources, and rely on each as it is "in season." This approach is called conjunctive use and it should be generally encouraged and, perhaps, incentivised in areas where groundwater resources are nearing exhaustion.

1.6.4 Public Outreach and Education

Public outreach and education on groundwater concepts are important for managing the resource. Since most issues concerning groundwater availability and use hinge on land use planning and development decisions, local government and citizens are a critical audience for focusing efforts on outreach and education. Other groups concerned with water resource issues are important to the process and they include professional organizations, watershed organizations, and schools. Topics such as recharge, conservation, and water reuse/recycling are an important component of groundwater resource education.

Outreach and education can be conducted effectively using a variety of methods. These include presentations, publications, multimedia products, seminars, and interagency coordination of workgroups and task forces. The Commission is active in all these endeavors.