all users of water, without regard to political boundaries. Applying this principle of uniform treatment of water users within this local government network is challenging.

Because of the interrelationship between economic development and the availability of an adequate water supply, local governments have the responsibility to both promote and protect the integrity of the resource, including the groundwater component. Municipalities must plan for and accommodate different types of land uses and their water demands within their respective municipal boundaries.

Stormwater management and water resource planning and use are best addressed through multi-jurisdictional coordination or on a watershed basis. Watershed boundaries and groundwater basins, or aquifers, do not usually coincide with a single municipal boundary. A municipality that is a good steward of a resource may be juxtaposed with municipal neighbors that are not. The consequences are that the benefits derived from the stewardship could be exploited by the neighbors, leading to a competition by the good steward to exploit its own resource. The end result is that the resource is depleted, and any economic gains are short-lived or unsustainable.

It is, therefore, incumbent upon local governments to become advocates for the control of land use policies that foster prudent resource protection and development through the variety of legal tools available.

The framers of the Compact recognized the problem of too many government agencies attempting to manage the waters of the Susquehanna. Duplicative, overlapping, and uncoordinated activities were resulting in a splintering of authority and responsibility in the basin. To prevent this splintering, the framers concluded in the Compact that "a single administrative agency is essential for effective and economical direction, supervision, and coordination of water resources efforts and programs of federal, state, and local governments and of private enterprise." The Commission is that single agency.

The Commission's groundwater regulations preempt local groundwater regulations for projects that meet the Commission's criteria as large water users, and provide a basis for managing water regionally as a shared resource. In combination with the special conditions it places on projects, they provide the necessary safeguards to protect adjoining well owners.

That notwithstanding, local governments are a valuable part of the groundwater resource management picture. Municipalities and counties are notified of project applications (as required by regulation), and the Commission, in its decision-making, carefully weighs any comments they submit. Local governments can exert control over many projects and activities through resource planning, land use controls, and zoning ordinances.

Watershed Organizations

Although the number of associations varies, currently there are 187 watershed and lake associations in the Susquehanna River Basin Commission's database (Figure B.1). These grassroots organizations can be a powerful force in setting priorities on the public agenda. Not only are watershed organizations capable of motivating members of the general public to seek solutions for water resource problems and issues, but they also can conduct grant-funded studies and research, such as watershed assessment planning, watershed restoration and protection activities, and participate in local education and environmental planning with local governments. Land trusts, although not exclusively linked to watershed organizations, can play a special role in local land use issues, including developing and implementing watershed conservation plans and strategies, identifying critical habitats and parcels within

watersheds, and even removing land from development pressures through acquisitions and conservation easements.

In addition to the grass-roots organizations described above, state rural water associations (New York, Pennsylvania, and Maryland) are not-for-profit organizations that promote the development, improvement, and sound operation of rural drinking water and wastewater systems. These organizations promote the effective exchange of knowledge among systems, and serve as liaisons among the government, public, and rural water and wastewater systems.

State rural water associations hold a variety of training programs and offer on-site assistance in areas of management compliance, operation, maintenance, finance, and governance. The training sessions for water and wastewater industry professionals allow system operators, managers, and elected officials to upgrade their skills, improve the quality of their utility's service, and protect their users' health. On-site, hands-on technical assistance to rural and small community water and wastewater systems is commonly free to association members.

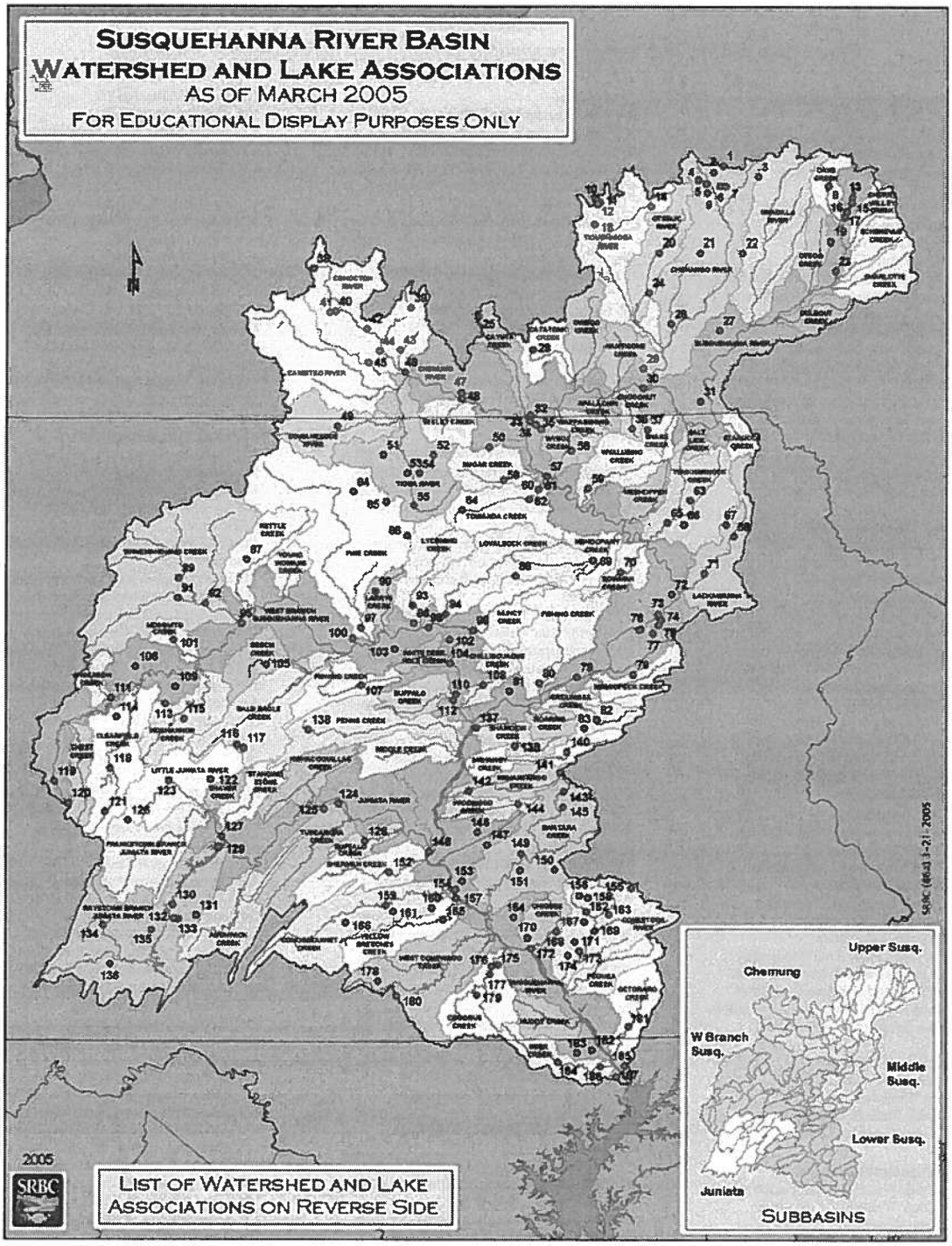

Figure B.1. ***Watershed and Lake Associations in the Susquehanna River Basin***
(See next page for list of associations.)

Table B.1. Susquehanna River Basin Watershed and Lake Associations

March 2005

Please note that the map points are spatially depicted in a north-to-south orientation

Upper Susquehanna Subbasin
1 Madison Lake Association
2 Leland Pond Betterment Association
3 Gorton Lake Association
4 Eatonbrook Reservoir Association
5 Lake Moraine Association
6 Lake Craine Lot Owners Association
7 Tuscarora Lake Association
8 Canadarago Lake Association
9 Lebanon Reservoir Association
10 Crooked Lake Home Owners Association
11 Tully Lake Property Owners Association
12 Song Lake Association
13 Otsego Lake Association
14 Tioughnioga Lake Association
15 Otsego Lake Watershed Council
16 Otsego 2000
17 Otsego County Conservation Association
18 Little York Improvement Society
19 Arnolds Lake Association
20 Otselic River Riparian Working Group
21 Plymouth Reservoir Association
22 Chenango Lake Property Owners Association
23 Goodyear Lake Association
24 Melody Lake Association
25 Cayuta Lake Property Owners Association
26 Geneganslet Lake Association
27 Echo Lake Association, Inc.
28 Citizens for the Catatonk Creek
29 Lake Warn Association
30 Upper Susquehanna Coalition
31 Broome County Beaver Lake Association
32 Valley Project Impact
33 Carantouan Greenway
34 Upper Susquehanna Riverkeeper
35 Satterlee Creek Watershed Association
36 Choconut Creek Watershed Association
37 Snake Creeks Watershed Association

Chemung Subbasin
38 Loon Lake Association
39 Lamoka-Waneta Lakes Association, Inc.
40 Loucks Pond Association
41 Smith Pond Sportsmen's Association
42 Lake Salubria Association
43 Meads Creek Watershed Association
44 Tanglewood Lake Association
45 Lake Demmon Association
46 Chemung Basin River Trail Partnership
47 Town of Elmira Storm Water Task Force
48 Town of Southport Drainage Committee
49 Cowanesque Valley Watershed Association
50 Penn-York Bentley Creek Watershed Association
51 Crooked Creek Coalition
52 Mill Creek Association
53 Ellen Run Watershed Projects
54 Corey Creek Watershed Association
55 Tioga County Concerned Citizens Committee

Middle Susquehanna Subbasin
56 Wysox Creek Watershed Association
57 Laning Creek Watershed Association
58 Sugar Creek Watershed Association
59 Wyalusing Creek Watershed Association
60 Stephen Foster Lake Association
61 Bradford County Lakes & Ponds Organization
62 Schrader Creek Watershed Association
63 Countryside Conservancy
64 Towanda Creek Watershed Association
65 Tunkhannock Creek Watershed Association
66 Lake Sheridan Tarn Watch
67 Newton Lake Watershed Association
68 Lackawanna River Corridor Association
69 Mehoopany Creek Watershed Association
70 Bowmans Creek Watershed Association
71 Lackawanna County PaSEC
72 Hicks Creek Watershed Association
73 Eastern Pennsylvania Coalition for Aband. Mine Reclamation
74 Luzerne-Wyoming County PaSEC
75 Wyoming Valley Watershed Coalition
76 Nanticoke Conservation Club
77 Earth Conservancy
78 Friends of the Nescopeck
79 Briar Creek Watershed Association
80 Fishing Creek Watershed Association
81 Mahoning Creek Watershed Association
82 Eastern Middle Anthracite Region Recovery, Inc.
83 Catawissa Creek Restoration Association

West Branch Susquehanna Subbasin
84 Pine Creek Headwaters Protection Group
85 Babb Creek Watershed Association & Reclamation Task Force
86 Blockhouse Creek Preservation Group
87 Kettle Creek Watershed Association
88 Eagles Mere Lake and Watershed Committee
89 Sterling Run Watershed Association
90 Lawshe Run Watershed Association
91 Bennett Branch Watershed Association
92 Bucktail Watershed Association
93 Lycoming Creek Watershed Association
94 Loyalsock Creek Watershed Association
95 Centre County PaSEC
96 North Central Pennsylvania Conservancy
97 Pine Creek Preservation Association
98 Lycoming-Clinton PaSEC
99 Muncy Creek Watershed Association
100 Chatham Run Concerned Citizens
101 Mosquito Creek Sportman's Watershed Association
102 Black Hole Creek Watershed Association
103 Greater Nippenose Valley Watershed Association
104 White Deer Creek Watershed Association
105 Beech Creek Watershed Association
106 Clearfield County PaSEC
107 Sugar Valley Watershed Association
108 Chillisquaque/Limestone Watershed Association
109 Hubler Run Watershed Association
110 Merrill Linn Conservancy
111 Anderson Creek Watershed Association
112 Union-Snyder Counties PaSEC
113 Emigh Run/ Lakeside Watershed Association
114 Little Clearfield Creek Watershed Association
115 Moshannon Creek Watershed Association
116 Spring Creek Watershed Community
117 ClearWater Conservancy
118 Beaverdam Branch Watershed Coalition
119 West Branch Susquehanna River Rescue
120 West Branch Susquehanna River Watershed Association
121 Clearfield Creek Watershed Association

Juniata Subbasin
122 Spruce Creek Watershed Association
123 Friends of Sinking Valley
124 Muddy Run Watershed Association
125 Juniata Valley PaSEC
126 Blair County PaSEC
127 Juniata Clean Water Partnership
128 Buffalo Creek Watershed Alliance
129 Friends of Raystown Lake
130 Shoups Run Watershed Association
131 Trough Creek Watershed Association
132 Broad Top Twp./Coaldale Borough Watershed Committee
133 Six Mile Run Area Watershed Committee
134 Bob's Creek Stream Guardians
135 Yellow Creek Coalition
136 Southern Alleghenies Conservancy

Lower Susquehanna Subbasin
137 Little Shamokin Creek Watershed Association
138 Penns Valley Conservation Association
139 Shamokin Creek Restoration Alliance
140 Mahanoy Creek Watershed Association
141 Schuylkill County PaSEC
142 Tri-Valley Watershed Association
143 Northern Swatara Watershed Association
144 Wiconisco Creek Restoration Associatio
145 Sweet Arrow Lake Conservation Association
146 Powell's & Armstrong Creeks Watershed Association
147 Stony Creek Watershed Association
148 Central Pennsylvania Conservancy
149 Swatara Creek Watershed Association
150 Lebanon Valley Conservancy
151 Quittapahilla Watershed Association
152 Shermans Creek Conservation Associatio
153 Paxton Creek Watershed and Education Association
154 Susquehanna River Trail Association
155 Berks County Conservancy
156 Furnace Run/Segloch Run Watershed Alliance
157 Susquehanna River Wetlands Trust
158 Middle Creek Watershed Association
159 Conodoguinet Creek Watershed Association
160 Capitol Region PaSEC
161 LeTort Regional Authority
162 Hammer Creek Watershed Association
163 Save Our Creek
164 Tri-County Conewago Creek Association
165 Yellow Breeches Watershed Association
166 Big Spring Watershed Association
167 Lititz Run Watershed Alliance
168 Chiques Creek Watershed Alliance
169 Cocalico Creek Watershed Association
170 Donegal Fish and Conservation Association
171 Lancaster County PaSEC
172 Little Chiques Watershed Association
173 Lancaster County Conservancy
174 Little Conestoga Watershed Alliance
175 Watershed Alliance of York County
176 Codorus Creek Improvement Partnership
177 York County PaSEC
178 Adams County PaSEC
179 Codorus Creek Watershed Association
180 Watershed Alliance of Adams County
181 Octoraro Watershed Association
182 Lower Susquehanna Heritage Greenway
183 Broad Creek Civic Association
184 Deer Creek Scenic River Advisory Board
185 Upper Chesapeake Watershed Associatio
186 Deer Creek Watershed Association, Inc.
187 Upper Western Shore Tributary Team

LIST OF FEDERAL AND STATE AGENCY CONTACT INFORMATION

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New York State Department of Health

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New York State Geological Survey

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The New York State Education Department
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Pennsylvania State Government

Pennsylvania Department of Environmental Protection

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Department of Conservation and Natural Resources

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Maryland Department of Natural Resources

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APPENDIX C

Management Principles and Tools

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MANAGEMENT PRINCIPLES AND TOOLS

Appendix C discusses principles considered to be fundamental to groundwater management and tools available to achieve management goals.

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.

Resource Evaluation

The Commission evaluates groundwater availability, utilization, and potential environmental impacts using a number of tools. During the mid- to late-80s, the Commission, in cooperation with the Pennsylvania Geological Survey (PGS) and the USGS, performed and published water resource evaluations of four major tributaries to the Susquehanna River (Taylor, 1984, 1997; Taylor and others, 1982, 1983, 1984). These studies provided information on the amount of surface water and groundwater received by the subject basins, and provided the basis for developing water budgets. For the most part, the Commission reviewed groundwater projects on a case-by-case basis.

In recent years, withdrawals in some areas are at, or approaching, a sufficient concentration and magnitude to create problems of well interference and local depletion of groundwater and/or surface water resources. To prevent local resource depletion, environmental impacts, and water supply failure, areas having intensive water resource utilization require additional analysis. There are a number of analytical methods and tools available to meet this goal.

Water Budget Analysis

A water budget analysis treats the water resources of an area as an account, with recharge serving as the income, withdrawals and instream flow needs as the expenses, and storage as savings. Recharge is the fraction of precipitation received by the groundwater flow system. The recharge received

during a one-year period is generally recalculated to an average daily amount. In a natural groundwater flow system, "expenses" generally include discharges to springs and streams, and the loss of water to plants, and evaporation (evapotranspiration) in areas where the water table approaches the ground surface. In most areas of the basin, expenses also include man-made uses, such as water supply wells and interbasin diversions (Figure C.1). The amount of groundwater in storage varies with the position of the water table. Storage is highest during high-water table periods and least during extreme low-water table periods (i.e., severe droughts).

If a water budget is used for the review of a project, it must include the area of the natural flow system that encompasses all the budget expenses (wells, springs, stream intakes, and instream flow needs, etc.) and their recharge areas. On a project-specific basis, this will generally correspond to a subsection of a local watershed. The water budget may be calculated for a year with an average amount of precipitation or for a drought year with a specified recurrence interval. The Commission currently utilizes the 1-in-10-year average annual drought as a "water income" design level. The design level sets an upper limit of the resource available for the Commission to approve for development (withdrawal). 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).

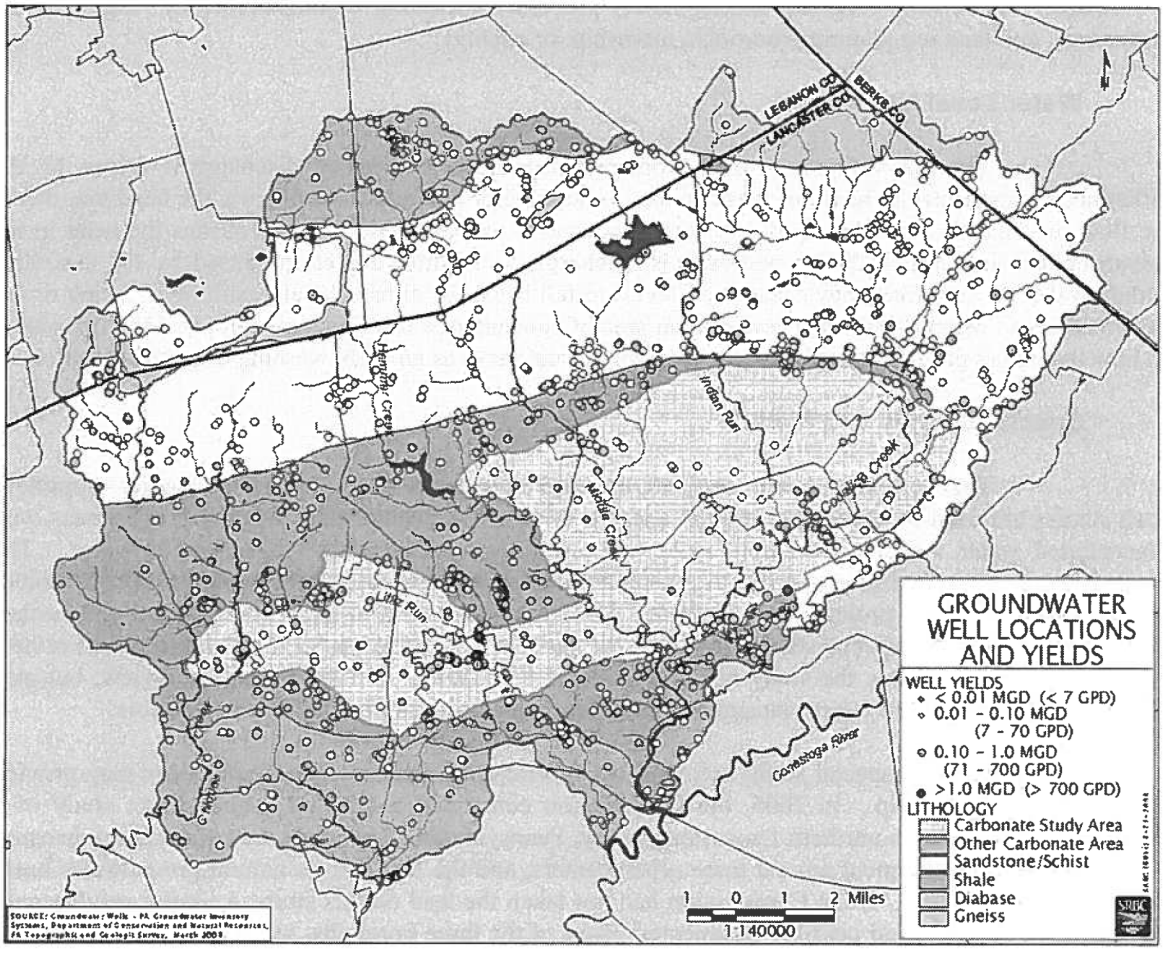

Figure C.1. Well Yields Used as One Component of a Water Budget Analysis

Critical Aquifer Recharge Areas

Critical aquifer recharge areas (CARAs) are areas having high recharge productivity. They 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). As such, a CARA is a relatively small area and linked to a groundwater source. 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. The maintenance of the recharge received from these areas is best assured by land development and use that either: (1) minimizes impervious cover, destruction of soil structure, and changes to the vegetative cover and the topography; or (2) offsets any negative impacts to recharge resulting from such changes through engineered solutions.

Delineation and proper management of CARAs, on a project-by-project basis, will help to ensure that the amount of water allocated to a project in an approval will be available for the duration of the approval, and will help to preserve the local base flow in streams. Delineating CARAs will help preserve existing water supply well capacity and provide for planning and zoning to ensure that development and land use will be beneficial for water resources. The protection of CARAs can be coordinated with existing programs and regulatory processes, including wellhead protection areas, zoning ordinances, and land use planning (borough, township, or county).

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. As an aquifer approaches depletion, the head that drives the flow of water through the aquifer gradually decreases in magnitude and approaches the head in the stream or lake into which the groundwater is discharging. Aquifer depletion caused by the excessive withdrawal of groundwater may cause head levels to fall below local base level, resulting in losing or dry stream reaches. Monitoring water levels in an area of concentrated development can provide information on how that area's groundwater flow system functions and serve as an early warning of over-utilization.

Special Studies and Models

The Commission may perform, or require the performance of, special studies or models. Such studies are used to check the "health" and use level of the groundwater flow system in areas with concentrated water resource development or address other water resource management topics. The Commission has required several project sponsors to perform water resource evaluations as a condition of project approval. These projects were large and dominant water users in small groundwater and surface water basins, and so the special studies provided the necessary information for the Commission to review the projects. In each case, the study not only assisted the Commission in making its review, but also formed the basis for future water management planning and monitoring by the project sponsors.

Where a special study encompasses several municipalities, the Commission may provide organization or leadership. In 2005, the Commission completed a detailed water budget study of a carbonate/karst aquifer in northern Lancaster County, Pennsylvania. The study area was chosen because of intense urban development around three urban centers, and the fact that its natural groundwater basin covers seven watersheds. If the Commission had not taken the lead on this study, a similar result would require the cooperative and possibly fragmented effort of the three boroughs, seven townships, and three watershed groups and/or the integration of seven watershed-based studies.

At the time of developing this plan, the Commission was also performing a detailed study to develop methods or alternatives to compensate for agricultural consumptive use during times of low flow. The alternatives are intended to find options for agriculture to comply with the Commission's consumptive water use regulation. The study has identified, and explored, the use of a number of innovative solutions and technologies.

Water Resource Management Database

There are many sources for existing water resource management-related information in various formats. To efficiently and most effectively use this information, it can be organized under a common database and placed into a Geographic Information System (GIS) for enhanced utility. Using GIS, a variety of information types (topographic contours, land use, vegetation, wetlands, etc.) can be overlaid on maps of optimum scale. In this way, spatial relationships can be recognized and considered in management decisions. A GIS-based database will greatly facilitate cumulative impact analysis, water budgets, and the delineation of CARAs. A GIS database will take these, and many other water resource management tasks that are currently in the realm of research projects, and enable them to be used as practical management tools.

Regulatory Program

The primary groundwater management "tool" used by the Commission is its regulatory program.

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.

Water withdrawal registration is codified in the Commission Regulations, Part 804, Subpart A, §804.1-5. The regulation requires that, subject to the consent of the affected member state to the requirement, all persons withdrawing or diverting in excess of an average of 10,000 gpd for any consecutive 30-day period, from groundwater or surface water sources, shall register the amount of the withdrawal with the Commission. Re-registration also is required.

Grandfathered withdrawals are not required to secure Commission approval. As a result, there is a deficit of information on this use. In developing areas, grandfathered sources may share the same groundwater basin with newer sources. To evaluate the sustainability of new withdrawals, and their impacts to existing sources and the environment (wetlands, springs, and streams), all major withdrawals (including grandfathered) must be considered. The registration of grandfathered withdrawals will allow these evaluations and protect the grandfathered withdrawals.

The Commission can arrange for states to carry out this registration requirement, as has been done in Maryland and, most recently, in the Commonwealth of Pennsylvania, under the Pennsylvania Water Resources Planning Act of 2002.

Regulation of Groundwater Withdrawals

The Commission adopted withdrawal regulations to avoid conflicts between water 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. Adverse impacts include: excessive lowering of water levels; rendering competing supplies unreliable; causing permanent loss of aquifer storage capacity; degradation of water quality that may be injurious to any existing or potential water use, adversely affecting fish, wildlife, or other living resources or their habitat; and substantially impacting the low flow of perennial streams.

The Commission's water withdrawal regulations are designed to manage large water users, that is, those users withdrawing groundwater or surface water in excess of 100,000 gpd. Potential water users meeting this requirement must first apply to the Commission.

The Commission recognizes "grandfathered" quantities withdrawn prior to the effective dates of the regulations, provided that the project sponsor can provide adequate documentation.

The Commission's application process has a number of standard requirements that are applied to all projects. Project sponsors requesting approval of a groundwater withdrawal are required to conduct a constant-rate pumping test (commonly 48 hours in duration), which is used to evaluate the production capability of the well, the aquifer, and the local groundwater basin, and to evaluate potential impacts to existing users and to the environment. These must be adequate to supply the needs of the project, and do so without causing significant adverse impact to neighboring water supplies, surface water bodies, and wetlands.

The Commission adopted pumping test guidelines in 2002 to assist in the development of acceptable plans for the constant-rate pumping test. The guidelines require a groundwater availability analysis that demonstrates sufficient recharge to support the desired withdrawal during a 1-in-10-year average annual drought and a hydrogeologic description of the test site in addition to the testing plan.

During technical review, the Commission's staff evaluates the impact (including cumulative impacts) of the proposed withdrawal or use on public concerns and interests, and reflects the Commission's concern for both protection and utilization of water resources within the basin.

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 passby flow requirements. The intent of the passby flow requirement is to protect streams during low flow conditions by determining a prescribed quantity of water that must pass a specific point downstream from a water intake at any time a withdrawal occurs. Other projects require a minimum groundwater level that must be maintained on the production well. For all projects, the appropriate monitoring requirements are established during the technical review phase so that the Commission staff can track project operations over the term of an approval. There are some standard docket conditions contained in the Commission's approvals:

> *Metering*—The Commission requires metering on both withdrawals and consumptive water uses to measure and track water use throughout the basin. In certain situations, there is an allowance for modeling and certain analytical methods to calculate use, particularly for projects with consumptive water uses.

Monitoring and Reporting—The Commission requires monitoring and reporting of withdrawal quantities (commonly daily) so the agency can undertake the broader management responsibilities and ensure that the project sponsors are in compliance with their requirements. Projects with groundwater withdrawals also report water levels and water quality in approved wells.

Mitigation—On occasions, when a project sponsor's use does cause an adverse impact either to the resources or to another user, the Commission requires the project sponsor to mitigate those impacts. The Commission could restrict their usage, require them to develop an alternative water supply, or provide other appropriate mitigating measures.

Water Conservation—The Commission requires, as a general rule, that project sponsors maintain certain minimum water conservation standards to minimize water usage. These standards include the use of applicable water conservation devices, recirculation and reuse strategies, properly designed irrigation systems, and metering for sources and customers.

Docket Reopener—A standard provision in all dockets gives the Commission the right to reopen any project docket to modify and issue such additional orders, as may be necessary, to mitigate or avoid adverse impacts either to the resources or other water users.

The Commission also regulates large withdrawals from surface water (consecutive 30-day average of more than 100,000 gpd), Commission Regulation §803.44 (effective date: November 11, 1995), and consumptive water use, Commission Regulation §803.42 (effective date: January 23, 1971). Consumptive use of water means the water will be used and not returned to the Susquehanna River system, usually because it evaporates, is diverted, or is incorporated into products such as concrete. Regulated consumptive water users are required to compensate for their consumptive use during times of critical low flows through one of several options. The three primary methods of compliance listed in the regulations and utilized by most project sponsors are use of storage to mitigate any adverse impact during low flow periods, discontinuance of the consumptive use of water during low flow conditions, or payments in-lieu-of providing actual compensation water. The Commission also can review and evaluate other alternatives proposed by project sponsors.

Consumptive uses generally peak during the summer months. Unfortunately, this also is the period when streamflows and groundwater levels are at their lowest. Maximum consumptive water use in the Susquehanna Basin has increased from about 270 mgd in 1970 to about 500 mgd in 2000, and is projected to continue increasing in the future, by as much as 55 percent by 2020. The Commission adopted the consumptive water use regulations to ensure adequate flows for the many competing water uses, including public water supplies, industries, agriculture, and recreation, and to protect aquatic life, habitat, and water quality during times of critical low flows.

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. Universal compliance enhances the Commission's ability to properly plan for and manage the basin's water resources.

The Commission requires approved projects to submit monitoring data related to withdrawals and use and any special conditions contained in the approved docket. These data are used to evaluate whether additional water is available for use.

Protected Areas

Article 11, Section 11.2, of the Compact allows for the creation of protected areas in regions of water shortage within the basin. An area may be designated as a protected area with the consent of the member (or members) from the affected state or states. Designated areas are flexibly sized and may be watersheds, aquifers, groups of municipalities, or entire counties. William Voigt, in The Susquehanna Compact, Guardian of the River's Future, gives some insight into the intent of the drafters of the Compact by indicating that protected areas should be: (1) smaller, rather than larger; (2) implemented in advance of water shortage emergency conditions in order to have sufficient time to manage the water resources; and (3) balanced in terms of supplies and demands.

Water budgets, comparing available supply with projected demand for varying magnitudes of drought, as previously described in Section 3.1.1, are the most effective tool available for identifying water shortage areas requiring protected area status.

According to the Compact, protected areas clearly are intended to correct, mitigate, and manage local area water supply shortfalls or threatened shortfalls on a quantitative basis. However, the Compact is silent with respect to whether the shortages might be derived from groundwater or surface water withdrawals or consumptive water uses. Consequently, protected areas may be managed to limit groundwater withdrawals, surface water withdrawals, both groundwater and surface water withdrawals, or cumulative consumptive water uses.

For protected areas involving only groundwater supplies, aquifers may be the appropriate unit for protected area designation. However, since most groundwater divides within the Susquehanna River Basin roughly coincide with surface water divides, the watershed may be an appropriate unit for designation.

How large should the units for designation of protected areas be? A reasonable size for watershed assessments within protected areas is believed to be about 25 square miles in area. Watersheds of significantly greater size than 25 square miles could possibly result in management and implementation problems because of difficulties in coordination and consensus among multiple municipalities. Coordination and consensus among municipalities are essential for effective water resources planning and management. Conversely, watersheds less than 10 square miles are thought to be too small for meaningful management at the Commission level.

For groundwater-protected areas, cumulative groundwater withdrawals generally are limited to some acceptable aquifer recharge or base flow frequency level, such as the 25-year frequency base flow. Cumulative consumptive water use limits have never been established or implemented by a water resource management agency. However, this approach may prove to be the most effective tool of all for managing future protected areas.

As a final note, the original Compact drafters, in Section 11.2, acknowledged that they could not foresee all possible future uses for protected area designation when they added the caveat "or conflict with the requirements or effectuation of the comprehensive plan" in their definition of protected area. Thus, the Compact leaves some discretion for the Commission to determine other beneficial uses and applications for the designation. Naturally, the Commission would have to exercise this power very judiciously. Conceivably, the goals of protection through special water management practices can be

accomplished through adding an objective to the Commission's Comprehensive Plan that would allow for a new designation. The Comprehensive Plan has legal standing in the Compact, and the Commission can assume jurisdiction in virtually any water resource matter to fulfill the requirements of the Comprehensive Plan.

Development of Standards and Guidance

Commission staff has developed both internal and external guidance documents, as necessary, 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), written for project sponsors and specifying the necessary procedures, proper monitoring, and evaluation and data analyses for conducting the required constant-rate pumping test for submission with a groundwater withdrawal application. Other guidance includes passby flow guidance (Susquehanna River Basin Commission, 2003), out-of-basin diversion protocol (Susquehanna River Basin Commission, 1998), criteria for waiving pumping tests, internal guidance for evaluating cumulative impacts (draft), establishing "grandfathered" quantities, and reviewing consumptive water uses.

Commission staff also prepares fact sheets about a variety of topics, including the project review process, the regulations, and individual projects, as needed, to inform and help educate the public.

The development of standards and guidance is an ongoing process, and will continue as important issues arise and time permits.

Water Conservation

Water conservation requirements are specified in the Commission Regulations, Part 804, Subpart B, §804.20-22. The regulation requires that any project that is subject to Commission approval under Part 803 or 804 proposing to withdraw water either directly or indirectly (through another user) shall institute appropriate water conservation measures. The regulations specify a number of requirements for public water suppliers (source and customer metering, unaccounted-for water to be less than 20 percent, an appropriate rate structure, etc.). However, for other types of projects, the regulation is silent on important conservation measures. Commission staff has recognized that these regulations should be strengthened at the time of the next revision of the regulations, and may consider incentives for promoting conservation measures and implementing technical solutions.

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 from municipal, industrial, and mine treatment plants, while generally not meeting safe drinking water standards, is generally quite good before it is discharged to streams. It is potentially usable for many non-potable uses such as irrigation and non-contact cooling. The reuse of treated wastewater would decrease the amount of groundwater withdrawn by the amount of water that is reused. Reuse will allow the water budget to be "stretched" in areas of rapid growth and limited water resources such as the PSAs (see Section 2.1). The Commission should develop incentives for reuse.

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." A community, recreational facility, or industry may rely on surface water during periods of high flow, then switch over to groundwater when surface flows diminish during the late summer and early fall. Where only groundwater is available naturally, a surface water impoundment may be constructed to capture snowmelt, spring precipitation, and stormwater runoff. This stored water may be used when groundwater resources are stressed, or may be used to provide a passby flow during low flow periods. Conjunctive use should be generally encouraged and, perhaps, incentivised in areas where groundwater resources are nearing exhaustion, such as the PSAs.

Public Outreach and Education

Public outreach and education on groundwater concepts are important for managing the resource. With increasing water demands in some portions of the basin, coupled with several recent drought years, there exists a need to balance availability with use. Since most issues concerning 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. Topics such as recharge, conservation, and water reuse/recycling are an important component of groundwater resource education as well. Additionally, other groups concerned with water resource issues are important to the process both as an audience and as partners, in efforts to improve the management of groundwater resources. These groups may include professional organizations, watershed organizations, and schools.

Outreach and education can be conducted effectively using a variety of methods. The following paragraphs detail some of the methods employed by the Commission.

Presentations

The Commission regularly gives presentations or participates in panel discussions on various water resource issues before audiences of wide-ranging background and experiences. Presentations of groundwater resource issues may be requested by the public, or initiated by the Commission, if a need is identified. Additionally, the Commission can give oral presentations or display exhibits at various constituents' workshops and conferences. The Commission currently maintains a speakers' bureau, which provides the public an opportunity to request presentations by the appropriate staff member, or volunteer experts, on numerous water resource issues. The Commission's presentations concerning groundwater concepts/resources can be updated, and new material created, based on the information presented in this Groundwater Management Plan.

Publications

The Commission publishes a quarterly newsletter, brochures, and technical reports, and produces many information sheets and issue-specific information pieces, as needed, on various water resources issues within the Susquehanna Basin. The Commission also issues press releases, editorials, and letters to the editor. Using these forms of printed media, the Commission can focus periodically on specific groundwater issues in the basin, as well as feature educational articles explaining important groundwater concepts. In addition, the Commission drafts and submits articles for other agency and organization publications. Publications produced by the Commission that are related to the issues and recommendations outlined in this plan can be found in Appendix D.

Multimedia Products

The Commission currently operates and maintains a website. The Groundwater Management Plan has been posted to the website, making it available for a large audience. A section of the website also can be dedicated to groundwater information developed under this plan. In addition, the

same type of materials can be made available on a compact disk for distribution at meetings and conferences, or upon request from the public. Educational videos also have been a successful method for conveying information on water resource issues. The Commission could partner with other organizations to produce videos highlighting important groundwater resource issues. Similar to compact disks, videos are easy to duplicate and distribute to the public, and are an excellent outreach tool for school groups.

Seminars

The Commission has held seminars in the past covering a variety of topics related to water and the environment. With respect to groundwater, Commission staff has held several educational seminars on the occurrence and movement of groundwater in the Susquehanna Basin at the request of the public. These seminars were held in communities within the basin that experienced a significant strain on their groundwater supplies during the recent droughts. The seminars provided a needed forum for the public to voice concerns about their own private wells and public supply and to ask questions, while, at the same time, expanding their understanding of various concepts such as the affect of recharge and withdrawals on groundwater availability. Seminars also provide the opportunity to provide technical guidance on the proper use and management of groundwater resources.

Interagency Coordination of Workgroups and Task Forces

As an interstate agency, the Commission is in a unique position to assist state/federal/local agencies in water resource management issues that cross jurisdictional boundaries. The Commission actively maintains relations with water resource partners at all levels, from the federal level to citizen groups and local municipalities. The Commission can facilitate efforts to address groundwater resource problems on a basinwide approach, bringing to bear a wide range of both the technical and financial resources needed to solve complex problems. Interagency coordination efforts, led by the Commission in the past, have included the Sediment Task Force, Agricultural Advisory Committee, Water Quality Advisory Committee, and Flood Forecast and Warning System. These coordination efforts have focused on pertinent water resource issues, and assisted with moving toward solutions using interagency/interstate cooperation. The use of websites and bulletin boards provide a convenient means for accessing and exchanging information.

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APPENDIX D

Commission Publications Related to Groundwater Issues

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Appendix D lists Commission publications related to the issues and recommendations outlined in this plan. It is important to note that this list is solely those publications produced under the control of the Commission. This list of studies and documents does not include related publications produced by other agencies.

Report Number	Report Title
1.	Susquehanna River Basin Compact – May 1972
7.	Coal Mine Drainage in the Susquehanna River Basin, Executive Summary –September 1973
8.	Coal Mine Drainage in the Susquehanna River Basin – September 1973
10.	Comprehensive Plan for Management & Development of the Water Resources of the Susquehanna River Basin – December 1973
28.	Regulations & Procedures for Review of Projects – June 1975
34.	Nonpoint Source Pollution Assessment of the Chemung & Susquehanna River Subbasins – September 1975
43.	Staff Review of Eastern Susquehanna River Basin Regional Water Resources Planning Board, Final Draft Report for the Eastern Susquehanna River Basin – September 1976
48.	Commission Review of Signatory Parties' Laws & Regulations Relating to Underground Waste Discharges – January 1977
50.	Proceedings on Water Quality Management in the Susquehanna River Basin – Second Quarterly Meeting – April 1977
54.	Nonpoint Source Pollution Assessment of the Lower Susquehanna River Basin – November 1977
55.	Nonpoint Source Pollution Assessment of Two Susquehanna River Subbasins in Pa.: 1. Between the New York Border & Sunbury, 2. West Branch Susquehanna River – December 1977
59.	Staff Review of Signatory Parties Laws & Regulations Relating to the Management of Hazardous Wastes – November 1978
75.	Water Use Data in the Susquehanna Basin: Part I Status of Data Collection – February 1982
81.	Special Ground-Water Study, Executive Summary – May 1983

85.	Water Use Data in the Susquehanna Basin, Part II Water Use Inventory in New York – December 1983
96-1.	Staff Summary – Drought Conditions – May 1985
96-2.	Staff Summary – Drought Conditions – June 1985
98.	Review of New York's Section 208 Water Quality Management Plan & Pa.' s Comprehensive Water Quality Mgt. Plan for Interstate Streams – July 1985
115.	Ground-Water Resources of the Chemung River Basin, N.Y. & Pa. – March 1988
116.	Ground-Water Flow Model of the Corning Area, N.Y. – March 1988
117.	Eastern Subbasin Low Flow Management Framework Plan – April 1988
121.	West Branch Susquehanna River Subbasin Low Flow Mgt. Framework Plan – March 1989
126.	Juniata Subbasin Low Flow Management Framework Plan – January 1990
137.	The Susquehanna River – A Characterization of its Water Resources & Water Supply Demand – March 1991
138.	Upper Susquehanna Subbasin Low Flow Management Framework Plan – September 1991
144.	Water Quality Assessment Report Susquehanna River Basin – January 1992
154.	Ground-Water Management Plan – July 1993
155.	Water Quality and Hydrogeology of Two Small Agricultural Basins in Central Pennsylvania – September 1993
156.	Development of Technical Procedures for Managing Nonpoint Source Pollution – October 1993
168.	Susquehanna River Basin Commission Strategic Plan
169.	Nitrate Reduction in the Armstrong Creek Basin – January 1996
175.	Chesapeake Bay Low Flow Strategy Study – September 1996

176. The 1996 Susquehanna River Basin Water Quality Assessment 305(b) Report – November 1996

184. Water Budget for the Spring Creek Basin – April 1997

197. Use of a Field Drain and an Artificial Wetland to Minimize Ground-Water Contamination from an Agricultural Site – July 1998

201. The 1998 Susquehanna River Basin Water Quality Assessment 305(b) Report

204. Assessment of Conditions Contributing Acid Mine Drainage to the Little Nescopeck Creek Watershed, Luzerne County, Pennsylvania, and an Abatement Plan to Mitigate Impaired Water Quality in the Watershed – July 1999

208. Water Balance for the Jeddo Tunnel Basin, Luzerne County, Pennsylvania – August 1999

212. Susquehanna River Basin Drought Coordination Plan – August 2000)

219. Use of a Constructed Reedbed Wetland in the Mitigation of Highway Runoff on the Ground-Water Quality in Carbonate Areas, January 2002

220. The 2002 Susquehanna River Basin Water Quality Assessment 305(b) Report – March 2002

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APPENDIX E

Summary of 2005 and 1993 Groundwater Management Plan Recommendations

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Appendix E presents summary lists of the recommendations developed for the current Groundwater Management Plan and those recommendations from the previous (1993) plan that either have been implemented or are no longer applicable.

Table E1 contains a list of current recommendations categorized into the topics of: (1) actions to address groundwater resource issues and problems; (2) actions to address management issues; and (3) groundwater management support programs. A discussion of the issues and problems that each recommendation addresses is presented in the main report Sections 2, 3, and 4.

Table E2 is a summary list of those recommendations from the Commission's 1993 Groundwater Management Plan that either have been implemented or are not applicable today due to changed conditions or criteria. Information included in the list for each recommendation is its location in the 1993 report on the plan and a summary of actions taken since 1993.

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Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan

Issues	Problems	Recommendations
A. ACTIONS TO ADDRESS GROUNDWATER RESOURCE ISSUES AND PROBLEMS		
1. Areas of Intense Growth and Development, and Consequent Water Resource Development (see Section 2.1 in main report)	Well interference.	Where time and water resources are limited, a groundwater model should be used to provide a rapid prediction and evaluation. The use of a model would take into account the appropriateness of the particular approach, as well as the capabilities/limitations of the chosen model. In situations where the availability of water resources allows a more flexible, less time-sensitive approach, water level monitoring is recommended. For many cases, a combination of these approaches will provide the most effective solution, which could include mitigation of impacts. The implementation of such plans may require the coordination of appropriate federal, state and local agencies.
	Exceedance of sustainable yield.	Continue to require and review groundwater availability analyses for new projects and detailed water budgets for PSAs. For areas where undesirable effects have stemmed from groundwater withdrawals, and sustainable yields have been exceeded during the last few decades, review and reopen dockets, require a water budget analysis, and adjust the withdrawal rates for sustainability.
	Loss of recharge areas.	The Commission should base its sustainable yield determination for approval quantities on estimates of the recharge available to a well that include post build-out conditions. Further, the Commission should encourage the use of "best management practices" (BMPs) that minimize the loss of recharge, such as those developed by the Commission's member jurisdictions. Available recharge should be verified after build-out and the approval amount increased (or decreased), based on the outcome of the verification study.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
A. ACTIONS TO ADDRESS GROUNDWATER RESOURCE ISSUES AND PROBLEMS (Continued)		
2. Intensive Water Use in Small Basins (see Section 2.2 in main report)	Loss of base flow. Loss of perennial streamflow.	In recognition of the importance of headwater areas with respect to water quality, the Commission, in cooperation with member jurisdictions and other organizations, should educate the public and local land-use planners about the sustainability of these areas and the need to properly manage them. The Commission, in cooperation with member jurisdictions and other organizations, should evaluate headwater streams with respect to habitat, and apply special conditions prescribing passby and conservation flows to its approvals for both surface water and groundwater withdrawals in order to manage water quantity and quality of the stream. The recognition and management of critical recharge areas also would benefit these areas.
3. Watershed "Transfers" (see Section 2.3 in main report)	Wastewater is not returned to the watershed where it was withdrawn.	The Commission, in cooperation with member jurisdictions and other organizations, should educate the appropriate professional groups about the options of maintaining groundwater withdrawals and post-use discharges in the same watershed, and the factors involved in this decision. The Commission should evaluate the transfer of water from the source basin during its review.
4. Loss of "Clean" Water Input to AMD-Impacted Streams (see Section 2.4 in main report)	Degradation of stream quality.	The Commission's permitting process should include an evaluation of cumulative impacts from consumptive water uses to downstream water quality in AMD-impacted areas. The review of consumptive water use projects in watersheds that are tributary to streams not meeting state and federal water quality standards should consider cumulative impacts and the cost of mitigating the impacts. The Commission should coordinate with the appropriate state and federal agencies in its evaluation.
5. Unknown and Unregulated Groundwater Use (see Section 2.5 in main report)	Data gaps can prevent evaluation of true sustainability and cumulative impact.	The Commission should collect information on the magnitude, location and seasonality of agricultural, grandfathered, and unknown or unregulated withdrawals to improve its evaluation of the resources available to new projects.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
A. ACTIONS TO ADDRESS GROUNDWATER RESOURCE ISSUES AND PROBLEMS (Continued)		
5. Unknown and Unregulated Groundwater Use (Continued)	Loss of base flow during the growing season.	Where loss of base flow is a recurring problem, a water budget and cumulative impact analysis will be essential tools needed to manage withdrawals for sustainability, and minimize impact to other water sources and the environment. Adverse impacts to base flow during periods of low flow should be addressed by managing withdrawals, storage, and conjunctive water use.
	Interference with existing water sources.	A water budget should be performed to determine the available water resources. Alternating and/or non-synchronous pumping of interfering sources will often address local, marginal overdraws.
6. Scarcity of Clean Water in Coal-Mined Areas (see Section 2.6 in main report)	Preferential development of high quality groundwater sources.	The Commission, in cooperation with member jurisdictions and other organizations, should act to manage the quantity and quality of water from these watersheds, recognizing that water resources are necessary for the economic growth of mining-affected regions. Education of local government officials and municipal engineering firms is imperative. In the long-term, this would be most effectively accomplished through coordination among the Commission, the appropriate state and federal agencies, and other organizations. The Commission and others must recognize, however, that if municipalities in coal mining affected areas are to experience beneficial economic growth and development, they must turn to these clean watersheds for water supply while maintaining a balance with the need to protect aquatic resources. The Commission should also support efforts by the member jurisdictions for "grayfields" initiatives which encourage the beneficial use of AMD-affected waters.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
A. ACTIONS TO ADDRESS GROUNDWATER RESOURCE ISSUES AND PROBLEMS (Continued)		
7. Drought Impact to Base Flow (see Section 2.7 in main report)	Insufficient streamflow to sustain instream flow needs or downstream water supplies.	The Commission, in cooperation with member jurisdictions and other organizations, should act to maintain stream base flow by protecting the groundwater flow that sustains it by: (1) educating local jurisdictions about maximizing high quality groundwater recharge through the support for implementation of stormwater management practices that promote infiltration, identification of CARAs, and application of "best management practices for development"; and (2) carrying out and/or supporting research on fisheries, particularly warm-water fisheries to provide improved knowledge of required conditions for their survival and a scientific basis for their protection.
8. Impacts of Mining (see Section 2.8 in main report)	The positive and beneficial use of water discharged from mining operations is underutilized as a resource. Extensive aquifer dewatering.	The Commission should encourage cooperative efforts to promote the development of reliable water supplies related to active and abandoned mining operations, for public drinking water, commercial operations, and industrial supplies. The area of influence and capture area for the mine withdrawal should be delineated, and the impacts identified. This is best accomplished through a study, which may incorporate a water budget analysis, field mapping of aquifer permeability features and water levels, and groundwater modeling. Once identified, the impacts may be mitigated through a variety of methods, including redirection/redistribution of the mine pumpage and modification or replacement of impacted sources. Where exceedence of sustainable yield is occurring, mine pumpage can be reduced through the grouting of water inflow points, or other methods as appropriate, if economically and technically feasible.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
A. ACTIONS TO ADDRESS GROUNDWATER RESOURCE ISSUES AND PROBLEMS (Continued)		
8. Impacts of Mining (Continued)	Exceedance of sustainable yield.	Where mining withdrawals of groundwater exceed sustainable yield, mine pumpage can be reduced through the grouting of water inflow points if technically and economically feasible, or other methods, as appropriate. In cases where the aquifer is otherwise unused, the effects of exceedence of sustainable yield may be mitigated by various means as appropriate. These mitigation procedures should be coordinated through the appropriate state and federal agencies, in concert with the project's engineering and hydrogeological staff and consultants. Mine pumpage may reach or exceed the sustainable groundwater yield of a basin, and thus effectively limit the potential for other withdrawals to be approved.
9. Flow Compensation for Consumptive Water Uses (see Section 2.9 in main report)	Need for additional low flow augmentation to compensate for consumptive water uses.	The Commission should bring together key stakeholders to help promote the use of groundwater stored in "artificial" aquifers created by mining or flooded quarries to offset consumptive water uses and support instream flow needs during droughts.
B. ACTIONS TO ADDRESS MANAGEMENT ISSUES		
1. Multi-Agency Coordination (see Section 3.1 in main report)	Coordination among water resource agencies can be ineffective or incomplete.	The Commission's water resource data collection, planning, monitoring, and management procedures should be closely coordinated through multi-agency committees, and the Commission and all appropriate agencies should closely communicate on the Project Review Program to avoid conflicting actions.
2. Changes to Water Resource Utilization Over Time (see Section 3.2 in main report)	Water resource management programs can become less efficient with changes in technology and water use. Water supply sustainability and stream low flow conditions can be adversely impacted by lack of the best and most efficient use of groundwater resources.	To effectively manage changes in the utilization of the basin's water resources, the Commission must assess water resources utilization periodically through updated water budget analyses, preferably for watersheds at a scale of between 15 and 25 square miles focusing on PSAs of the basin, and make appropriate changes in its policies, procedures, and project review process. The Commission, in cooperation with member jurisdictions and other organizations, should strengthen requirements for water conservation and encourage reuse of treated wastewater and conjunctive use of groundwater and surface water.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
B. ACTIONS TO ADDRESS MANAGEMENT ISSUES (Continued)		
3. Regulatory Duplication (see Section 3.3 in main report)	Change in the regulatory programs of the member jurisdictions may make some of the Commission's regulatory program redundant, inefficient, or inappropriate.	Close and effective coordination, including the use of formal arrangements such as memorandum of understanding, should be maintained among the Commission, its member jurisdictions, and key agencies to ensure that implementation of this plan's recommendations is effective, current groundwater information and technology are shared, consistency is maintained, and redundancy is minimized.
4. Increased Knowledge About Groundwater as a Resource (see Section 3.4 in main report)	Useful information about groundwater occurrence, availability, transmissivity, and yield is collected by various government permitting agencies and others, but is not compiled and shared among agencies nor disseminated to the professional community, developers of policy, or local decision-makers.	Capture and compile groundwater data submitted to the Commission by project sponsors to allow its use by the Commission and others.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
B. ACTIONS TO ADDRESS MANAGEMENT ISSUES (Continued)		
4. Increased Knowledge About Groundwater as a Resource (Continued)	Lack of fundamental knowledge of groundwater resources by many policy/decision-makers at the local, municipality level and by their constituents, and at the corporate level of private businesses, has hindered the understanding of sound groundwater management practices.	Identify the various constituents that would benefit from a multifaceted outreach and educational program, including local governments; regulated community and related associations; consultants; environmental, conservation and citizen organizations; and possibly colleges and high schools. Develop tools these groups can use to make informed decisions.
	Lack of consideration of factors important to groundwater protection and sustainability within the municipal planning process, resulting from limited knowledge of groundwater resources, has hindered the implementation of sound groundwater management practices.	Encourage and assist local governments to include groundwater management concepts in planning and land-use control. Use the various tools identified below, including video, information sheets, informational meetings, etc.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
B. ACTIONS TO ADDRESS MANAGEMENT ISSUES (Continued)		
4. Increased Knowledge About Groundwater as a Resource (Continued)	There is the absence of an educational framework needed to present groundwater concepts and issues to a variety of audiences through several forms of media.	Incorporate the following methods into the multifaceted outreach and education program: Publications: Periodically publish articles in the Commission quarterly newsletter; draft and submit articles to be published in the various constituents' publications; produce related information sheets, etc. Conferences, workshops, and informational meetings: Identify the various constituents' conferences and determine their schedules; create new exhibits/displays on the topic; exhibit and/or speak at the conferences, workshops and information meetings; conduct Commission-sponsored conferences, workshops, and informational meetings, as the need arises. Speakers' Bureau: Update and enhance the Commission's existing groundwater management presentation and publicize its availability. Web Site: Establish a new link and announce the availability of the plan on CD-Rom, any related information sheets or related links, and short video clips (see below). Video: Obtain funds to produce a video targeted particularly to local governments (short clips of the video can be included in the web site). Media Relations: Issue a press release on the new plan, pointing out key benefits and uses; periodically submit articles on the benefits of groundwater planning and management; and periodically participate in radio and television talk shows.
5. Plan Performance and Accountability (see Section 3.5 in main report)	The management plan will not be productive unless the tasks identified are performed and accountability for accomplishing the tasks is established.	Periodic reporting on implementation of the plan's recommendations by the accountable agencies and groups and any new and significant groundwater management issues should be made by Commission staff to WRMAC.
6. Review and Update of the Plan (see Section 3.6 in main report)	This management plan needs to be reviewed and updated on a recurring basis in order to be current and of continuing value.	While the overall planning process should be continuous, a more comprehensive review and revision of this plan by WRMAC should occur at intervals not to exceed 10 years.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
B. ACTIONS TO ADDRESS MANAGEMENT ISSUES (Continued)		
7. Funding to Implement the Plan (see Section 3.7 in main report)	Adequate long-term funding needs to be made available to implement the actions recommended in the plan.	Funding to implement the plan's recommended actions should be made available and/or proactively sought by the lead jurisdiction(s) for each action.
C. GROUNDWATER MANAGEMENT SUPPORT PROGRAMS (Continued)		
1. Protection of Groundwater Sources of Supply and Aquifers (see Section 4.1 in main report)	Contamination of groundwater resources from the affects of improper land use planning and zoning.	Encourage the states and local jurisdictions to develop regulations and programs designed to protect critical aquifers from contamination because wellhead protection programs do not provide for protecting future public supply wells, domestic wells, and other uses of wells.
	Lack of comprehensive groundwater quality datasets showing the extent and severity of nonpoint source pollution affecting groundwater resources basinwide, and the lack of management plans necessary for improving conditions.	Continue and expand monitoring and research, in cooperation with member jurisdictions, related to nonpoint source contamination, including agricultural and other sources of groundwater. In addition, the Commission has in the past used private/existing wells to collect monitoring data, and plans to continue such efforts when appropriate. The Commission recommends encouraging such cooperative efforts both for Commission initiatives, and those initiated by other agencies and local jurisdictions. The information obtained can be used to assess the severity of the problem and the need for management initiatives. Several programs support the assessment and implementation of such actions and include TMDLs, USEPA's 319 Nonpoint Source Program, and United States Department of Agriculture/Natural Resource Conservation Service (USDA/NRCS) water programs.
	Degradation of water quality conditions in aquifers from point source discharges.	Support the member jurisdictions in their efforts to consider the affect of wastewater discharges on groundwater, including sensitive recharge areas, when issuing NPDES or SPDES permits. This should potentially include the installation of monitoring wells in particularly vulnerable aquifers.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
C. GROUNDWATER MANAGEMENT SUPPORT PROGRAMS (Continued)		
1. Protection of Groundwater Sources of Supply and Aquifers (Continued)	Limited support for local development of source water protection plans.	Assist communities with groundwater source protection by utilizing existing source-water assessment data and aquifer test data to provide educational and technical assistance in formulation of protection plans. The overwhelming need for education on this subject far exceeds the resource capabilities of any one agency or organization. The success of source water education and protection activities resides with building broad partnerships among both public and private partners, based on the need for the protection of water supplies to span a number of issues/areas (i.e., land use planning, hazardous material handling, municipal ordinances, water quality monitoring).
2. Water Use and Availability Information (see Section 4.2 in main report)	Not all large volume withdrawals (>10,000 gpd) are registered (documented).	Require large volume users of groundwater (>10,000 gpd) to register (document) their use. In addition, require all registered (documented) withdrawals to be reregistered (updated) periodically. Coordinate with member states and others to maintain a vibrant data set.
	Data on large volume users needs to be available for management use.	Maintain a centralized database containing information on large users, and make these data available to planners and managers throughout the basin. Access and use of the information would be subject to security considerations.
	Well information (water use) is not available to all agencies and local managers.	Maintain a centralized database containing well location information, and make these data available to planners and managers throughout the basin. Access and use of the information would be subject to security considerations.
	Groundwater managers, planners, and decision-makers often do not have ready access to fundamentally important, basinwide information on groundwater.	The Commission should partner with the appropriate agencies to develop the required information for the entire basin, and make it available on-line at an appropriate web location.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
C. GROUNDWATER MANAGEMENT SUPPORT PROGRAMS (Continued)		
3. Well Requirements (see Section 4.3 in main report)	Improper well construction and abandonment procedures can cause aquifer contamination.	Support state and local programs for well construction and abandonment standards and improved controls to prevent pollution. Several towns and municipalities in the basin have established successful ordinances to protect groundwater quality through controls on well abandonment and construction procedures. Examples are available from the state or respective state rural water associations. The Commission will continue to support state/local efforts for developing construction standards, as outlined in the Commission's Annual Water Resources Program document.
	Lack of certification program for drillers in Pennsylvania and the need for improving existing licensing/certification programs and well driller training in other basin states.	Support legislation that works toward the development of a well driller's certification program in Pennsylvania, and support the improvement of programs that provide training and licensing/certification for all well drillers.
	The observation well network does not have the capability to monitor the dynamic response of aquifers in the basin to changes in precipitation.	The Commission should support effective maintenance of the observation well network by the USGS, and work toward improving the network, through cooperative agreements between USGS and the member jurisdictions. The goal is to provide a useful observation well with real-time monitoring capability in each county in the basin. Well OG-23 should be replaced with a well located in an aquifer that is commonly used for water supply and constructed to provide accurate monitoring of the water table or aquifer head.

Table E1. Summary of Current Recommendations for the 2005 Groundwater Management Plan (Continued)

Issues	Problems	Recommendations
C. GROUNDWATER MANAGEMENT SUPPORT PROGRAMS (Continued)		
4. Assessment of State/Federal Groundwater Programs and Program Coordination (see Section 2.4 in main report)	State and federal agencies need to ensure their groundwater programs are current and responsive. In addition, these programs need to coordinate management activities to enhance program effectiveness and efficiency.	The Commission's member jurisdictions should continue periodic assessments of their groundwater programs to identify needed improvements and plan for their implementation.

Table E2. ***Implemented or Deleted Recommendations from the Susquehanna River Basin Commission's 1993 Groundwater Management Plan***

Topic	Page in 1993 Report	Recommendations	Actions Taken to Date and Comments
RESOURCE EVALUATION AND PROTECTION			
1. Groundwater Use		The Commission should:	
	16	• Issue withdrawal permits based on long-term conservation management (the resource must be managed as a replenishable resource such that withdrawals do not exceed long-term recharge).	The Commission is doing this for each water use request.
	16	• Determine that the proposed withdrawal is needed for a reasonable and beneficial use (reasonable and beneficial use means the use of groundwater in the requested quantity is necessary for an economic, social, or environmental purpose within the public interest, including, but not limited to, domestic, agricultural, industrial, mining, power, municipal, fish and wildlife, and recreational uses).	The Commission determines if the requested quantity is reasonable. Beneficial use is accepted at face value.
	17	• Insure that the proposed use will not cause unavoidable or unreasonable adverse environmental impacts.	The Commission does this for each water use request for localized impacts.
2. Balancing of Competing Users		The Commission should:	
	18	• Verify that identified impacts are mitigated prior to issuing a permit; and require monitoring to assure there are no unforeseen impacts.	The Commission is verifying impact mitigation for local area only. Compliance and enforcement issues need to be addressed and are now part of a new recommendation in the current plan.

Table E2. Implemented or Deleted Recommendations from the Susquehanna River Basin Commission's 1993 Groundwater Management Plan (Continued)

Topic	Page in 1993 Report	Recommendations	Actions Taken to Date and Comments
RESOURCE EVALUATION AND PROTECTION (Continued)			
3. Monitoring and Research		The Commission should:	
	25	• Continue and expand research related to nonpoint source contamination of groundwater.	The Commission has done some limited work on this. This action has been incorporated into a new recommendation in the current plan.
	25	• Support and promote consistency in the pollution source and public water supply monitoring efforts of the member states.	No actions to date by the Commission. This is not a proactive action.
	25	• Encourage ambient-quality monitoring efforts that focus on random sampling of wells and the sampling of surface streams under base flow conditions.	No actions to date by the Commission. Limited monitoring efforts are done by state agencies, as required by USEPA.
MANAGEMENT AND REGULATORY			
1. Water Use Registration		The Commission should:	
	15	• Develop indirect methods to estimate the use by small-volume users in the basin	No actions taken to date. Work unlikely to be funded and results would be of limited value.

Table E2. Implemented or Deleted Recommendations from the Susquehanna River Basin Commission's 1993 Groundwater Management Plan (Continued)

Topic	Page in 1993 Report	Recommendations	Actions Taken to Date and Comments
MANAGEMENT AND REGULATORY (Continued)			
2. Groundwater Use		The Commission should:	
	16	• Require permits of all users of groundwater in excess of 100,000 gallons per day. This permit should be in the form of a water allocation that provides some level of protection to the applicant.	The Commission is doing this. However, "permit" and "allocations" are incorrect terms and should be referred to as approvals.
	17	• Issue permits for a specific period to provide for the recovery of investments made in developing a particular project. Modifications to an allocation during this period could only be made on an emergency basis, or as a result of conflicting water uses. In general, the 12-year duration for permits used by Maryland should be adequate.	The Commission is issuing approvals based on a 25-year duration.
3. Protection of Sources of Supply		The Commission should:	
	20	• Support the states' efforts in establishing wellhead protection programs.	**NY**— Wellhead protection programs, which complement the baseline program implemented through state agency programs (NYSDOH and NYSDEC) are developed and adopted voluntarily by county and local governments and water suppliers.

Table E2. Implemented or Deleted Recommendations from the Susquehanna River Basin Commission's 1993 Groundwater Management Plan (Continued)

Topic	Page in 1993 Report	Recommendations	Actions Taken to Date and Comments
MANAGEMENT AND REGULATORY (Continued)			
3. Protection of Sources of Supply (Continued)	20	The Commission should: • Support the states' efforts in establishing wellhead protection programs.	**PA**—Wellhead Protection Plans are voluntary, but the water supplier is required to own or control the Zone One Wellhead Protection Area (having a 100-400 foot radius depending on source and aquifer characteristics). Also, source water assessments are required for new public water supply sources serving populations of 3300 or more. **MD**—WHP Plans voluntary at state level. Some local communities require them through ordinance. MDE provides funding and technical assistance and a model ordinance.
4. Minimum Testing Requirements for Domestic Wells	23	The Commission should promote the development of programs in Pennsylvania and New York: ▪ For subdivisions using individual wells, establish minimum lot sizes and establish minimum offset distances for wells. Review subdivision plans for impacts on groundwater.	States have programs in place and local jurisdictions are doing subdivision reviews.

Table E2. Implemented or Deleted Recommendations from the Susquehanna River Basin Commission's 1993 Groundwater Management Plan (Continued)

Topic	Page in 1993 Report	Recommendations	Actions Taken to Date and Comments
PUBLIC OUTREACH AND EDUCATION			
5. Monitoring and Research		The Commission should:	
	25	• Establish a basinwide well registration program for all wells withdrawing more than 10,000 gallons per day.	No actions taken to date. This was duplicative of another 1993 recommendation and has been incorporated into a new recommendation in the current plan.
	25	• Develop better estimates of present and projected self-supplied use of groundwater, including agricultural use.	No actions taken to date. Water source is domestic wells that are not large water suppliers.
		The Commission should:	
	26	• Actively participate in informational meetings and seminars on groundwater.	The Commission has been and will continue to do this
	26	• Develop a public information "hot line" via a computerized bulletin board system.	No action taken specifically on a "hot line", but the Commission's web site is a vehicle for public information.
	26	• Insure that any agency publications and newsletters containing information related to groundwater reach the appropriate local governments.	The Commission has been and will continue to do this.
	26	• When appropriate, review and comment on local management plans and ordinances related to groundwater.	The Commission does reviews of plans and ordinances as needed during normal work processes.

Table E2. Implemented or Deleted Recommendations from the Susquehanna River Basin Commission's 1993 Groundwater Management Plan (Continued)

Topic	Page in 1993 Report	Recommendations	Actions Taken to Date and Comments
PUBLIC OUTREACH AND EDUCATION (Continued)			
		The Commission should:	
	27	• Develop a handbook for the development and operation of individual water supply systems in the basin.	No action to date by the Commission. USGS has developed a handbook.
	27	• Encourage and participate in the development and presentation of educational programs, including scholastic programs.	The Commission has and will continue to participate in educational programs.
	27	• Develop educational materials (i.e., brochures, pamphlets, and handbooks) targeted for private well owners.	No actions to date by the Commission. Material is being prepared by states and USGS.
MAINTENANCE OF MANAGEMENT PLAN			
	29	• A committee should be established with the agencies of the signatory parties to provide ongoing review and to recommend modifications to this plan.	WRMAC has continued to serve as the review body for the plan. There is no need to establish a separate committee
	29	• Assessments of the reliable yield of aquifers and larger regions during periods of drought should be attached to this plan as they become available.	Work done for assessments is discussed under another recommendation in the current plan. The Commission does not believe there is a significant value added by attaching this potentially voluminous information to the plan.

APPENDIX F

PUBLIC REVIEW COMMENTS AND RESPONSES

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APPENDIX F

PUBLIC REVIEW COMMENTS AND RESPONSES

Appendix F presents a summary of public review comments on the June 2004 draft Groundwater Management Plan and responses to the comments. The review of the plan was conducted during a 90-day period that began on June 9, 2004. Three public workshops were held in July 2004 to present the draft plan and provide the opportunity for approximately 175 attendees to make oral comments. A record of all comments from the workshops was made. More formal written comments (by letter and/or e-mail) were also received by the Commission from 21 interested parties during the review period. Over 400 comments were received from the workshops and written submittals.

All comments were reviewed and addressed. The final plan has incorporated additional or revised information, as needed, to reflect changes in response to the comments. The review comments were organized by major topics for effective presentation in this appendix and a response is provided for each topic. Also noted for the written review comments is the list of interested parties who provided input on each major topic. A concerted effort was made to include representative and significant comments while accounting for numerous similarities in input received from multiple sources at workshops or in written form.

The list of interested parties that provided written comments is provided below. Acronyms or shortened names are noted and were used in the topic-by-topic responses which follow.

1. EPA = Environmental Protection Agency
2. PADEP = PA Department of Environmental Protection (3 offices provided comments)
3. PAFBC = PA Fish and Boat Commission
4. MDE = MD Department of the Environment (2 offices provided comments)
5. DCDWA = Delaware County, NY Department of Watershed Affairs
6. CCPC = Centre County, PA Planning Commission
7. SCWA and CTWA = State College, PA and College Township, PA Water Authorities (provided consolidated set of comments)
8. YCPC = York County, PA Planning Commission
9. STCRPDB = Southern Tier, NY Central Regional Planning and Development Board (2 sets of comments provided)
10. PCBI = Pennsylvania Chamber of Business and Industry
11. P&G = Procter and Gamble
12. Exelon = Exelon Corp.
13. PAGWA = Pennsylvania Ground Water Association
14. PAACA = Pennsylvania Aggregate and Concrete Association
15. SCCTU = Spring Creek, PA Chapter of Trout Unlimited
16. SCWC = Spring Creek, PA Watershed Community
17. Parizek = Richard R. Parizek and Associates
18. ARM = ARM Group, Inc.
19. Giddings = Todd Giddings and Associates
20. Converse = Converse Consultants
21. PSU = Pennsylvania State University

TOPIC 1: SCOPE OF THE PLAN

A. Workshop Comments. The document does not present a plan since it does not include a collection of data with specific recommendations. The recommendations that are in the draft plan are generic

and should be specific to the Susquehanna Basin. The draft plan is more a statement of policies and guidelines rather than a real plan.

B. Written Comments. The draft plan is more of a policy statement and provides no goals, objectives or means to measure accomplishments. The Commission should focus on a few key items over which it has control, and can make a positive and substantial impact, with actions prioritized to do this. Emphasis should be placed on the need to balance groundwater management, through preservation and/or sustainable use of the resource as a long term goal, with economic growth and public needs. Conjunctive use management of groundwater and surface water merits greater consideration and promotion. More extensive data gathering efforts are required prior to finalizing the plan.

Sources of comments: PADEP, MDE, PCBI, P&G, Exelon, PAACA, ARM, PSU.

C. Response. The scope of the plan was purposely set to be a framework that will guide the Commission and other responsible entities in effectively managing groundwater resources in the basin. Major problems, all of which are applicable to the Susquehanna Basin and 39 proactive recommended actions to address them were developed. Although broad based, the plan goes well beyond policy statements and identifies issues, problems, actions, roles, responsibilities, priorities and schedules. There are a number of actions that can be taken in the near term. Twelve continuing actions are identified in Section 6.2 and are defined to be those actions that should be initiated and/or implemented relatively easily and quickly under existing programs, although full implementation of some initiated actions may take years. The remaining actions are defined to be short-term (initiate within two years) or long-term (two to five years) and will require implementation measures such as development of new guidelines or regulations, provision of adequate resources, and interagency coordination. The discussion of goals and objectives has been expanded in Section 1.1 to be more complete. A means to measure and assess accomplishments is discussed in Section 3.5 and calls for an annual progress report.

Additional emphasis has been placed on the need to balance environmental needs, related to preservation of groundwater resources, with sustainable use of the resource to foster economic growth and meet public needs. See Sections 1.1 and 9. In a related matter, discussion of conjunctive water use management has been added in Section 1.6.3, and is part of a new recommendation discussed in Section 3.2.

The Commission recognizes the merits of focusing resources on the most critical items, but strongly believes all recommended actions are important and need to be addressed in the long term view. By assessing each action under a prioritization rating system, focus can be placed on those that are most critical. See Section 6.2 for further discussion of the prioritization of actions.

A purpose of the plan was not to conduct extensive data collection and assessment efforts, but rather outline needs based on existing data gaps as discussed in Sections 4.1 and 4.2. Significantly, several recommended actions relate to improved data collection.

TOPIC 2: WATER QUALITY

A. Workshop Comments. The plan should be expanded to more fully discuss water quality. There is a noted lack of water quality components and any in depth discussion of water quality issues and concerns. Water quality needs to be balanced in the plan.

B. Written Comments. Discuss and consider nutrient and/or pesticide loading, storm water run off impacts, non-AMD water quality issues, and degradation of groundwater quality by agricultural

practices. Address other agencies that manage water quality. Include actions to protect groundwater from pollution from gas drilling activities. There are serious concerns with restricting use of groundwater in areas upstream of AMD-impacted streams and thereby denying legitimate water use. The prohibition of consumptive use in TMDL-affected watersheds is unnecessarily broad. Consider water quality impacts in approval of projects.

Sources of comments: EPA, CCPC, STCRPDB, PCBI, P&G, Converse.

C. **Response.** The importance of water quality in effective groundwater management is recognized. Discussion has been added to the plan on water quality issues, data, and current programs (e.g., by states); see Section 1.4 and Appendix A of the plan. The role of the Commission is to provide effective coordination since it does not have a primacy in a water quality mission; see Section 4 of the plan for further discussion. Implementation of new or revised actions to address specific groundwater quality issues (e.g., pollution protection from gas drilling activities) is beyond the scope of the plan. The plan proposes possible restricted groundwater use in high quality, non-AMD-impacted areas based on an evaluation of downstream water quality impacts; see Section 2.4. Many types of activities that use water are possible in these watersheds with minimal impact to water quality and existing water uses will be grandfathered. Potential prohibition of consumptive use of groundwater is limited to those areas impacted by AMD and is not meant to broadly apply to other areas with TMDL issues. The plan proposes the Commission review individual consumptive use projects with respect to sustainability recognizing that the loss of water quantity is generally accompanied by a related reduction in water quality.

TOPIC 3: POTENTIAL STRESSED AREAS AND CARA'S

A. **Workshop Comments.** Plan should include standards and guidelines for identifying groundwater stressed areas. Concerned about statement describing State College as a groundwater stressed area. Identification of State College as a groundwater stressed area is a very positive point. Will there be regulatory controls to stop development in identified groundwater stressed areas? Has the Commission considered mapping of recharge areas?

B. **Written Comments.** State College (PA) was identified as a potential groundwater stressed area with no substantive documentation provided. We question both the identification of State College as a potential groundwater stressed area and the criteria used for this assessment. SCTU strongly supports the conclusion that the Spring Creek watershed (State College area) is a potentially groundwater stressed area. More than 43 years of study and personal observations indicate that the sustained yield of carbonate aquifers in Nittany and Penns Valleys (State College area) has not been exceeded. CARA's need to be identified and made available to land use planners. As a recharge and basin headwater area, Delaware County (NY) is targeted for "preservation" for the benefit of downstream communities.

Sources of comments: PADEP, DCDWA, SCWA and CTWA, SCCTU, Parizek.

C. **Response.** Information has been added in Section 2.1 of the plan on the criteria and assessments used to identify potential stressed areas. The Commission will review proposed projects in these areas with a greater degree of scrutiny and may invoke special conditions for any approved projects. Regulatory control of new development will be at the local level. Issues particular to the State College, PA area were thoroughly discussed at meetings requested by local interests and held in October 2004. Protection of groundwater recharge in headwater areas is important for sustaining water supplies and streamflow both locally (e.g., in Delaware County, NY) and in areas further downstream. Critical recharge areas (CARA's) will be identified for locations not included in the

currently identified potentially stressed areas during Commission project reviews, if sufficient information is available, or if/when funding is made available to do this work as a special study for a certain area. CARA results will be made available to interested parties.

TOPIC 4: PRISTINE AREAS

A. **Workshop Comments.** Protecting pristine watersheds sounds like anti-degradation and could be a land use issue. Need to clarify this is not a regulatory action, but land preservation and conservation management. The Commission should not generally prohibit consumptive use in headwater areas, but work out solutions.

B. **Written Comments.** Water preserves suggest that the Commission become involved in a broad land use management program which goes far beyond the purpose of the Compact's protected area program. Water preserves need to be identified and made available to land use planners.

Source of comments: PADEP, PCBI.

C. **Response.** After further consideration, the recommendation calling for the Commission to develop a long term protection program for pristine areas has been dropped. The protection of areas with pristine water quantity and quality is intended to be accomplished by (1) thorough Commission review of all impacts by proposed water use projects and (2) public outreach and education on the high value of pristine areas. The Commission will not be responsible for land use controls or land management which is a local prerogative. Local land use planners should be closely involved in actions to preserve/conserve lands in pristine areas.

TOPIC 5: FUNDING OF GROUNDWATER MANAGEMENT PROGRAMS

A. **Workshop Comments.** Need to specifically state in the plan that funding is paramount. The plan should tell decision-makers how much money is needed to implement the plan. The Commission should recommend funding for the Act 220 Program.

B. **Written Comments.** Apply a major effort to seek long-term sustained funding from state, federal, and other sources.

Source of comment: ARM.

C. **Response.** Long term, sustained funding at all levels is paramount to implementing the actions identified in the management plan and, accordingly, a new recommendation has been added to address this. See Section 3.7 for further discussion. The total implementation cost of all recommended actions is beyond the scope of the plan, but a limited discussion of costs is included in Section 6.3.

TOPIC 6: EFFECTIVE COORDINATION

A. **Workshop Comments.** The Commission should not work in a vacuum – need to ensure coordination with other agencies and ensure coordination with the Act 220 Program. Need to partner with the business community to avoid surprises on environmental protection and regulation.

B. **Written Comments.** The plan does not acknowledge the importance of engaging local communities. Local public perception is that the Commission is only interested in perpetuating its existence and regulatory authority through its fee structure. The plan and any implementing requirements must be

very closely integrated with state level program development (e.g., Act 220). Division of Drinking Water Management (PADEP) offers to take a co-lead on 12 recommendations and work with the Commission to create a workable program.

Sources of comments: PADEP, DCDWA, P&G.

C. **Response.** Several plan recommendations call for enhanced coordination as part of the Commission's Project Review Program, possibly including formal arrangements (e.g. MOU's); see Section 3 of the plan for further discussion. Improved coordination with business and environmental interests will be considered. The Commission is actively involved with Pennsylvania's Act 220 Program and has included the Groundwater Management Plan in coordination and meeting discussions. The importance of engaging local communities is recognized by the Commission and is reflected in Section 3.4, Increased Knowledge About Groundwater as a Resource, which targets local jurisdiction, among other groups, for public outreach and education. The assistance of PADEP's Division of Drinking Water Management will be considered during the implementation phase of identified actions.

TOPIC 7: AGRICULTURAL WATER USE

A. **Workshop Comments.** The whole issue of agricultural impact on water quality and quantity does not show up in the plan. Will the temporary suspension of consumptive use requirements for agriculture be addressed in the plan? How will the Commission bring agriculture into the management picture concerning nonpoint pollution?

B. **Written Comments.** Ag use should be exempt from groundwater restrictions, if not, who will conduct analyses and pay for water use?

Source of comment: DCDWA

C. **Response.** The issue of the quantity of agricultural water use is part of the topic of unknown and unregulated groundwater use discussed in Section 2.5. Water quality impacts are discussed in Section 1.4 and Appendix A. The suspension of consumptive use requirements has been added in Appendix B. The Commission does not have a lead in regulating or managing water quality efforts, including those related to agriculture. The impacts of agricultural water use can be significant and should not be permanently exempted from regulatory control. In the absence of a temporary suspension, the costs for water use applications, including analyses required, would be paid by the water user.

TOPIC 8: MINING

A. **Workshop Comments.** The plan needs more discussion on the issue of finding reliable water sources for municipalities in the lower basin where noncoal mining activities are significant users of groundwater. Are groundwater withdrawals in AMD-impacted areas looked at more critically than those in other areas? Do existing mining regulations achieve what the plan's recommendations for impacts of mining contain?

B. **Written Comments.** If there are major concerns on mining sand and gravel aquifers, recommendations would be welcome. The Groundwater Management Plan should also note the positive contributions of aggregate mining to groundwater management.

Source of comment: STCRPDB, PAACA

C. **Response.** The discussion of increasing and possibly conflicting groundwater demands in areas of both significant growth and mining activities has been expanded in Section 2.8. Withdrawals in AMD areas are critically reviewed and this has been clarified in Section 2.4 and 2.6 of the plan. The mining recommendations are meant to supplement existing regulations by providing additional analyses (e.g., water budgets). Section 2.8 discusses issues, problems, and recommendations related to groundwater mining and impacts to aquifers. Bedrock quarries present a unique set of both challenges and potential opportunities (i.e., positive contributions). The plan proposes that these be carefully evaluated and an approach to their review be developed.

TOPIC 9: PUBLIC OUTREACH AND EDUCATION

A. **Workshop Comments.** A key role for the Commission is to educate planners, local governments, the agricultural community, etc. Outreach should be relevant and targeted. It is important to keep water resource managers informed through outreach and education with possible use of electronic newsletters and bulletin boards. Consider increased coordination with agencies and organizations doing education and outreach to identify education needs.

B. **Written Comments.** Increase the emphasis on the technical information and assistance that can be provided to local decision-makers. Include more data and information that can be used for local planning efforts by including a reference list of all the water budget, groundwater modeling, and water quality monitoring projects that have been done over the years. Focus specifically on development and sharing of practical tools and implementation techniques for effective groundwater management.

Source of comment: STCRPDB, P&G

C. **Response.** The Commission agrees with the workshop comments and has addressed them in the plan; see Section 3.4. Several of the plan's recommendations in Section 3.4 call for outreach and education actions to include identifying constituencies, assisting local governments, and using a variety of methods. Additional emphasis has been added in Section 3.4 on providing technical information and assistance to local decision-makers. The research effort needed to document all water budgets, modeling, and water quality monitoring done in an area the size of the Susquehanna River Basin is outside of the scope of the plan.

TOPIC 10: REORGANIZATION AND REFORMATTING OF PLAN

A. **Workshop Comments.** The report should be reorganized to reduce redundancies, place emphasis on charts and group like items together. Charts should be placed up front followed by text that supports the charts.

B. **Written Comments.** Start with Table A-1 and reorganize verbiage portion of report. Organization needs improvement and length of document distracts from content.

Source of comment: PADEP, MDE

C. **Response.** The plan has been reorganized by grouping the discussion and recommendations for resource issues and problems, management issues, and support programs in their separate sections (Sections 2, 3, and 4, respectively). Charts and tables are placed immediately after discussion of their purpose and content for clarity and effective understanding. The main portion of the plan has been further reduced in length by placing much of the detailed information on existing conditions and

management principles and tools in appendices. A short summary report has been prepared for general distribution with the full and detailed plan prepared for more limited distribution. A summary of the recommended actions contained in Table E1 (which was Table A1 in the June 2004 draft plan) is included in the first portion of the plan, the Executive Summary. Improved organization of the plan should enhance its content despite the length.

TOPIC 11: STATE COLLEGE, PENNSYLVANIA, AREA ISSUES

A. Workshop Comments. Concerned about the strong statement in the draft plan describing State College as a potentially groundwater stressed area and the map identifying stressed areas. Is this identification based on Commission data? Is this map intended to be a complete map? If a community is identified as such by the Commission, and a community disagrees, what's their recourse? Does this mean that Commission's regulatory decisions related will be impacted (i.e., will it be harder to get approvals)? Maybe the Commission should make public notifications when decisions involving these areas are taking place.

What are the limits in these potentially stressed areas...are we talking about safe yields? We need to take into account aquifer storage capacity factors, not just look at drought-year factors, i.e., the 1-in-10-year drought factor.

Some feel the stressed area identification is a positive point, not negative, and unless we work at the municipal levels, we are never going to protect those areas. This information should be kept in the report.

B. Written Comments. State College was identified as a potential groundwater stressed area with no substantial documentation provided. The Commission plan portrays that the region's water suppliers are not managing the groundwater supplies in a sustainable manner. We (i.e., certain local jurisdictions) question both the identification of State College as a potential groundwater stressed area and the criteria used for this assessment, and believe the groundwater resource is being managed in a very sustainable manner. More than 43 years of study and personal observations indicate that the sustained yield of carbonate aquifers in Nittany and Penns Valleys has not been exceeded. SCTU (Spring Creek Chapter of Trout Unlimited) strongly supports the conclusion that the Spring Creek watershed is a potentially groundwater stressed area.

Source of comment: CCPC, SCWA, CTWA, SCWC, Parizek, PSU

C. Response. The high degree of interest and concern in the State College area resulted in a large number of comments and local interests requested a meeting with Commission staff. On October 18 and 19, 2004, two meetings were held in the State College area. Representatives of the following groups participated in discussions with Commission staff at one or both meetings.

Centre Regional Planning Agency	Pennsylvania State University
Centre County Planning Commission	Meiser and Earl, Inc.
State College Borough Water Authority	North American Water Systems
Spring Creek Watershed Community	

All significant issues raised in the comments were thoroughly discussed and the Commission's positions explained. The major issue concerned the identification of the State College area as a potentially stressed area and Commission staff discussed its criteria and data used to establish the identification. Section 2.1 of the final plan has been expanded to include the information (on both data and criteria used by the Commission) and site-specific conditions which led to the identification

of several locations in the Susquehanna River Basin, including State College, as potentially stressed areas. One particular criteria that is very important to understand is the use of existing plus additional approved groundwater withdrawal amounts, not just current withdrawals, by the Commission in assessing potentially stressed areas. Thus, the Commission's identification of potentially stressed areas is based on existing withdrawals and approved increases in withdrawal quantities. The plan has been clarified in Section 2.1 to explain the Commission's use of this criteria in assessing an area's problems and issues.

TOPIC 12: PRIORITIES

A. Workshop Comments. Seems like the Commission prioritized by feasibility.

B. Written Comments. Start with actions the Commission has regulatory control/authority over. Prioritize actions where the Commission can make a positive and substantial impact. Education is critical. Top Priorities: Maintain centralized database for well information and assist communities by utilizing existing source water assessment data.

Source of comment: PADEP, PCBI, STCRPDB

C. Response. The prioritization rating system considered four factors as discussed in Section 6.2 of the plan. The feasibility of the recommended actions is part of two of the rating factors in terms of development time, related actions required, technological and staffing requirements, and legal or policy constraints. Therefore, feasibility of the recommended actions was part of the prioritization rating process, but not the sole basis for setting priorities. The Commission's regulatory control/authority is an element considered in three factors (coverage under existing programs, timing and sequencing, and ease/difficulty of implementation). From a broader perspective, the Commission believes the full range of selected actions needs to be addressed and prioritized on an equal basis. Prioritizing by selecting only actions that the Commission can make a positive and substantial impact on limits the scope of the plan. It is believed the prioritization rating system used is a reasonable and balanced approach for assessing all actions.

Education is critical and the related recommended actions are included as either top or high priorities in Table 6.3. Maintaining a centralized database for well information is rated as a high priority, rather than top priority, due to implementation issues with a new program. Assisting communities by utilizing existing data has been changed from a priority to high priority action; see Table 6.3.

TOPIC 13: TECHNICAL EVALUATIONS

A. Workshop Comments.

1. Referencing a groundwater model in recommendation A1 can mean anything; need to describe a "standard" model. How will the model be applied?
2. Could the Commission and PADEP develop uniform procedures for doing water budget analyses? Will Penn State's Living Filter and proposed beneficial re-use project be factored into a water budget?
3. How satisfied is the Commission with the 48-hour pump test and the methodologies and data that come from the 48-hour tests? Are there any changes planned?
4. You need to recognize and clarify the time lag between taking of groundwater and the impacts. How restrictive should the Commission be? When will you hold a user to a lower level?
5. Has the Commission considered doing any kind of mapping to look at how much recharge might be needed for different aquifers – to use as a planning tool to guide future development?

B. Written Comments. The Commission needs to develop standard guidelines for preparing groundwater availability analysis. More work is needed on the evaluation of location, magnitude, and duration of groundwater pumping on surface water flows. When to apply groundwater modeling verses analytical solutions should be well defined.

Source of comment: PADEP, PFBC.

C. Response.

1. A model would use computerized mathematical simulations to predict groundwater flow. A standard model is not envisioned since the choice of the specific code or program to be used will be based on the conditions and technical needs for a particular area. A groundwater model would be used only if other less expensive analytical solutions are not adequate. (responds to third written comment also)
2. During scoping and conduct of future groundwater availability analyses, consideration will be given to developing uniform procedures. Elements such as beneficial reuse projects can be included in the analyses if they would have an impact on study results. (responds to first written comment also)
3. Pump tests required by the Commission have proven to be generally satisfactory and no significant changes are planned. However, staff agrees that in many cases, the 48-hour pumping test is of insufficient duration to allow documentation of the interaction of groundwater withdrawals with surface water bodies. Even so, the more intensive monitoring of surface water bodies required in the Commission's "Pumping Test Guidance" has resulted in many more such interactions being detected. Much more work in this area is needed, but until such time as this information becomes available, staff will interpret most fractured bedrock aquifer flow systems as being predominantly local, with minimal flow lost to regional flow systems. Site-specific data indicating the presence of a quantitatively significant regional flow system will be considered when available. (responds to second written comment also)
4. The issue of time lag between the taking of groundwater and surface water impacts is recognized, but the identification of specific time lags and impacts is difficult to quantify. The Commission will strive to identify this information for proposed projects if conditions, such as large withdrawals near high quality streams, warrant this effort. Restricted groundwater use will be an option available if significant impacts are identified.
5. The Commission can provide available aquifer recharge data and mapping to local jurisdictions for their planning purposes. This information will be limited to the areas where sufficient project related groundwater analyses have been done.

TOPIC 14: BALANCE BETWEEN ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION

A. Workshop Comments. The draft plan does not go far enough in putting it all together, including recommendations, policy issues regarding the balance between economic development and environmental protection. Suggest that the draft plan recognize that groundwater is a dynamic resource and that the Commission's purpose in managing groundwater is twofold, i.e., an impacts balancing approach, not one of preserve and protect. Caution against a "1-size fits all" approach. Noted the lack of discussion on conjunctive water use and management (as reflected in recommendation A1).

B. Written Comments. Such a balancing requires that the Commission develop a plan and administer regulations that do not promote one type of use over another (such as rules that elevate fish over people, or visa versa). The plan needs to provide for a balancing of the shortfalls to minimize economic dislocation and avoid serious environmental harm.

Source of comment: PCBI

C. Response. Additional emphasis has been placed on the need to balance environmental needs, related to preservation of groundwater resources, with sustainable use of the resource to foster economic growth and meet public needs. See Sections 1.1 and 9. Information has been added in Section 1.4 on the economics of groundwater use in the basin and to provide a more balanced view of economic development and environmental protection. Discussion has been added on the subject of conjunctive use in Section 1.6.3, and a recommendation has been added in Section 3.2 dealing with conjunctive use.

TOPIC 15: REGULATORY ISSUES

A. Workshop Comments.

1. Will this plan result in changes to Commission regulations and impact upcoming groundwater withdrawal applications (e.g., Shrewsbury's)?
2. Suggest that local governments perhaps should have water allocation powers. Would the Commission consider delegating any regulatory review responsibilities to the counties? It is nice to know the Commission is looking at the "big picture" and would not want any delegation process to result in the loss of that bigger-picture look.
3. There will be problems/issues if the Commission attempts to adjust approved withdrawal amounts for public water suppliers as referenced in the groundwater mining section of the draft groundwater plan.
4. Will the Commission's Pumping Test Guidelines include enforcement? In the recommendation that references the Pumping Test Guidelines, perhaps the Commission should indicate that there are regulatory requirements backing up the guidelines.
5. Does the Commission have any model well head protection ordinances for municipalities to use? Is the Commission tied into NYSDEC's water well drillers registration program, and has the Commission looked at the data?
6. What are the results of the Commission's registration program (referenced on page 118 of the draft plan)?

B. Written Comments.

1. The regulators and regulated community need standard definitions for stressed areas, critical areas, impact, and significant impact.
2. If other solutions to water supply problems are not forthcoming, consider invoking the Commission's protected area program authority to adjust regulatory standards (such as project review triggers) and focus other actions as necessary to assure a balanced sharing of water among all legitimate users.

Source of comment: PADEP, PCBI

C. Response. For A1-A6 comments:

A1. It is not anticipated that the plan will directly result in changes to Commission regulations, but implementation of the plan's recommended actions over the long term could require some changes in regulations.

A2. The Commission's mission is based on the authority and responsibility to ensure water resource management from a basinwide perspective, irregardless of political boundaries. Maintaining this "big-picture" view is important and regulatory responsibilities should not be delegated.

A3. If groundwater availability has or is expected to become a critical issue in a certain area, then the Commission must consider all prudent alternatives. Any action will be carefully considered, particularly if they could impact existing water users, and the public will have the opportunity to comment. It is expected that reductions in approved withdrawals would be rare if they do occur.

A4. The pumping test guidelines are provided to applicants for information and guidance in preparing project proposals. If an applicant does not meet or exceed the pumping test information required by the Commission, the proposed project will not be approved.

A5. The Commission does not have model well head ordinances, but can provide technical information upon request. We are aware of NYSDEC's water well drillers registration program, but have not reviewed the data.

A6. The referenced action calls for a new registration of groundwater uses that exceed 10,000 gpd. This requirement would supplement the current registration level of use exceeding 100,000 gpd. Results of the new registration program will be known only after a period of time following its implementation.

For B1 and B2 comments:

B1. Establishing standard definitions is not practical in view of varying site conditions and the number of agencies with regulatory responsibilities. Each agency must determine and clearly communicate the definitions and/or criteria they apply based on project information and site-specific conditions.

B2. In the rare event that issues and/or conflicts cannot be resolved, the Commission has the authority to take actions to assure an equitable use of groundwater resources among competing legitimate users. Before taking this step, the Commission will provide available technical information to project proponents for their use in the preparation of project material and in scoping a sound project. Commission staff can attend stakeholder meetings, if requested, to help identify potential solutions to groundwater use problems. If hydrogeological conditions warrant, Commission manpower can be made available, and if funding is provided to the Commission, staff can develop water budget analyses for a local jurisdiction(s).

TOPIC 16: LAND USE PLANNING AND DEVELOPMENT

A. Workshop Comments. Suggest that the Commission encourage and assist local groundwater concepts in planning and land use control. How does the Commission plan to address land use decisions and manage growth as referenced on page 54? Suggest that the Commission's plan identify where growth should occur. This plan needs to address the differences in land use requirements among the states, i.e. Maryland land use law is different from Pennsylvania. Suggest getting water addressed in local plan/ordinances via regional plans such as the one developed in northeast Pennsylvania. Do human activity and economic development culminate in an ultimate limit on water? What are the limits?

B. Written Comments. Critical aquifer recharge areas and water preserves need to be defined and made available to land use planners. The plan seems to discount the role of local governments who have control over land use decisions. Zoning and subdivision regulations, as well as establishment of

critical environmental areas, are handled at the local level; therefore recommendation C1 (develop regulations and programs to protect groundwater from contamination) should show the states and others (local jurisdictions) as co-leads for implementation.

Source of comment: PADEP, DCDWA

C. **Response.** The Commission does not regulate land use planning, as such, it does not engage in activities that are administered by other entities (i.e. planning commissions, local zoning boards). However, the Commission, through its outreach and education efforts, may make recommendations as to how groundwater resources may be affected by land use activities. When applicable, the Commission also coordinates it activities with other agencies with responsibilities relevant to the issues. The statement on page 54 of the draft plan, the Commission must "effectively manage changing land use and growth" was in error and has been corrected in the final plan. Concerning the limit of groundwater resources to support human activity and development, additional information has been added to Section 2.1 on potential groundwater stressed areas. The identification of CARA's and water preserves will be a long-term effort that will require substantial resources and support of interested parties; information will be made available as the work progresses. Implementation of the initial element of recommendation C1 has been revised to show the states and local jurisdictions as co-leads with the Commission in a support role; see Table 6.1.

TOPIC 17: RELATIONSHIP TO PENNSYLVANIA ACT 220

A. **Workshop Comments.** How does this plan relate to the Act 220 critical areas water planning? Need to ensure coordination. There is an opportunity to actively show how Commission activities fit into Act 220 requirements as a short-term solution, particularly the critical areas planning. The procedures for coming up with critical areas are being developed now to include scale under the Act 220 implementation process. The Commission's scale should not be different from DEP's pending scale.

B. **Written Comments.** We also believe strongly that the plan and any implementing requirements must be very closely integrated with State-level program development, especially in Pennsylvania as actions required to implement the Water Resources Planning Act (Act 220) are formulated. We support maintaining and strengthening this integration as a top priority in the Commission's Groundwater Management Plan. As a member of the Upper/Middle Susquehanna Regional Committee, I believe that your plan will be of great assistance to our committee in developing our regional component of the new State Water Plan under Act 220.

Source of comment: Giddings, P&G

C. **Response.** The Commission is coordinating very closely with PADEP concerning implementation of Act 220 activities, including critical areas planning, procedures, and designations. Funding has been provided by the Commonwealth for the Commission to assist in this effort. Discussion has been added in Section 6.1 explaining that the Commission's Groundwater Management Program is complimentary to and aligned with the state programs. As an example, Pennsylvania is actively pursuing groundwater planning and management improvements under their Act 220 Program. This effort includes water budget analyses which are recognized in this plan as being critical to sound groundwater management in areas of high demand in relation to sustainable water supply.

TOPIC 18: MEASURING PROGRESS UNDER THE PLAN

A. Workshop Comments. Need a way to measure/assess accomplishments, such as including goals and objectives. There are no outcomes identified so who will ensure that anything gets carried out? The Commission needs to figure out what to measure and develop models. What will the Commission do about the recommendations in the draft groundwater plan?

B. Written Comments. The plan as written provides no goals and objectives nor a way to measure/assess accomplishments. Without objectives and clear measures, it is difficult to measure progress.

Source of comment: PADEP

C. Response. Accomplishments will be measured by periodic assessments by the Commission of progress made toward implementation of the recommended actions. An annual progress report will be made to the Commission's Water Resources Management Advisory Committee. In addition issues related to plan implementation will be identified and resolved on an on going basis. A comprehensive review and revision of the plan will be made at intervals not to exceed ten years in order to ensure its continuing relevancy. It is believed the periodic assessments discussed above will help ensure recommended actions are being addressed. If significant issues of plan implementation arise the Commission will take steps to lead or support resolution of the issues.

TOPIC 19: MISCELLANEOUS

A. Workshop Comments.

1. Is there a trend of increased groundwater use in the basin?
2. Does the Commission have concerns about using 1995 water use data and is this the best available data?
3. The importance of sustainability was mentioned. Regarding the fact that we are dealing with the 13 inches of rain left for management, are we orders of magnitude away to achieving sustainability (supply versus demand)?
4. Under the Intense Growth Areas section, there does not seem to be anything related to conservation (pg 115). Recommend that we strengthen conservation elements.
5. Suggest that the Commission attempt to do cost/benefit analysis to determine which recommendations should be prioritized for implementation. This approach would get the most bang for the buck.

B. Written Comments.

1. We recommend a "Definitions" section be added to the document. Adding a glossary to the plan would enable local elected and appointed officials to better understand the concepts, data, and recommendations.
2. An issue that as not mentioned in the plan was the ever present need for new stream gages as well as the continuation of existing gages.
3. One way to allay concerns about costs to the Commission is to allocate funds to local municipalities who can do projects much more cost-effectively than the Commission.
4. It would be helpful to list the members of WRMAC and the groups or agencies that they represent.

Source of comments: PADEP, DCDWA, EPA

C. Response. For A1 to A5 comments:

A1. Any trends concerning increasing/decreasing water use are difficult to discern based on the lack of a consistent, uniform approach for any data collected on a basinwide scale. The Commission has been able to make determinations concerning trends in use within particular areas of the basin, and only using data collected as part of its regulatory program. The recommendations in this plan outline potential efforts to initiate a more comprehensive approach to collecting data for trends analysis, and also hopes to develop partnerships with other agencies/groups in order to create a more accurate and reliable database.

A2. Yes, the Commission does have concerns with using data from 1995, particularly considering growth in certain parts of the basin. It was the best available dataset for comparing groundwater use throughout the basin, especially concerning uniformity/consistency in collection methods. The lack of current data available for this particular type of water use reinforces the importance of implementing the recommendations outlining the need for a comprehensive, basinwide groundwater database, increased groundwater monitoring, water budgets, cumulative impact analysis, etc.

A3. On a basinwide basis (27,500 square miles) as well as for the major subbasins, demand is far less than supply. However, on a local watershed or groundwater basin basis several areas are nearing sustainability limits, as covered in Section 2.1.

A4. In Section 2.1 of the final document, the importance of using BMPs (best management practices) in areas of intensive development to minimize loss of recharge is recognized. Although conservation is not explicitly listed as a solution, the referenced BMP guidance developed by the Commission's member jurisdictions details conservation elements, as well as many other BMPs, used for improving stormwater management and increasing groundwater recharge.

A5. The concept of cost/benefit comparisons is sound, but requires economic analyses which are beyond the scope of this plan. It is believed the four factor priority rating system, discussed in Section 6.2, provides a reasonable basis for deciding which recommended actions are top priority, high priority, or priority.

For B1 to B4 comments:

B1. Agree. A Glossary of Terms has been added at the end of the main report.

B2. Agree. Statements were added to Appendix B (USGS information) to emphasize the need for existing and new gages.

B3. The Commission's lead role for groundwater management actions is based on broad regulatory and water resources responsibilities for the 27,500 square mile Susquehanna Basin which includes hundreds of municipalities. Funding for the Commission's broad based programs is not meant to implement local municipal projects. In addition, local governments do not have the regional water resource regulatory authority required to implement many of the Commission actions.

B4. Agree. The composition of WRMAC, including agencies represented, has been added to Section 1.3.