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The Delaware River Basin Commission: An Innovative Approach to Water Management within a Federal System

Keith W. Muckleston, USA

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ABSTRACT

Intensive competition over water by states in the Delaware River basin prompted the formation of an innovative management mechanism. The Delaware River Basin Commission (DRBC) was the first federal-interstate compact in the U.S. Comprised of a single federal representative who is designed to coordinate federal actors and of the governors of each of the signatory states, the DRBC has successfully apportioned water during two droughts when water availability fell to such low levels that it was impossible to manage the river in accordance with the Supreme Court Decree of 1954. In addition, the DRBC has contributed significantly to water quality management and salinity repulsion. The DRBC faces challenges, however, in that New York has become less willing to support its share of the DRBC management costs, charging that as the upstream member it has relatively little to gain from DRBC operations while losing some of its water management options to downstream members (Pennsylvania and New Jersey) The DRBC also experiences occasional problems when federal agencies operating in the Delaware basin are unwilling to recognize the legitimate role of regional water management. The DRBC has functioned well enough, however, that this once unique institutional approach has been adopted in an adjacent river basin and has been seriously considered for use in additional river basins.

ZUSAMMENFASSUNG

DIE DELEWARE - FLUSSGEBIETSKOMMISSION: EIN NEUER WEG ZWISCHEN-STAATLICHER WASSERBEWIRTSCHAFTUNG

Im Flußgebiet des Delaware war die Wasserwirtschaft durch starke Interessenskonflikte in den Anliegerstaaten gekennzeichnet, die schließlich zu einer neuen Organisationsform geführt haben. Die Delaware Flußgebietskommission (DRBC) war die erste wasserwirtschaftliche Vereinbarung zwischen dem Bundesstaat und den Anliegerstaaten in den USA. Sie wird durch einen Vertreter des Bundesstaates, der die entsprechenden Interessen vertritt, und die Gouverneure der Unterzeichnerstaaten, koordiniert. In zwei extremen Trockenperioden konnte die DRBC eine erfolgreiche Wasserbewirtschaftung durchführen, die bei solch niedrigen Wassermengen auf der Grundlage des Dekrets des Supreme Courts von 1954 nicht möglich gewesen wäre. Neben der Wasserbewirtschaftung umfaßt das Aufgabengebiet der DRBC die Gewässergüte und der Schutz vor einer Versalzung. Probleme treten auf, indem die Oberlieger wie z.B. New York trotz der Beitragskosten weniger von den Aktivitäten der DRBC profitieren als die Unterlieger (Pennsylvania und New Jersey). Auch die im Flußgebiet des Delaware arbeitenden bundesstaatlichen Einrichtungen mußten lernen, die legitimen Ansprüche der regionalen Wasserwirtschaft zu akzeptieren. DRBC hat so gut funktioniert, daß die zunächst einmalige Einrichtung Nachahmer in weiteren Flußgebieten gefunden hat und noch finden wird.

I Introduction

A principal goal of water resources management is to utilize hydrologic interdependencies in such a manner that the resulting direct and indirect positive effects are maximized. Whatever institutional approach is utilized towards attaining this goal, water management in all but the smallest drainage basins is often complex and challenging. The challenges facing water management are increased appreciably when a river basin is in two or more units within a federal system, because each of the administrative sub-units exercises a certain degree of sovereignty over the waters within its borders.

Within the American federal system a number of different approaches are utilized to meet the challenges of managing interstate rivers. Most common is the interstate compact between two or more states. Although the U.S. Congress must consent to the formation of this type of approach, the federal government is not a signatory to the compact and does not directly participate in it, NATIONAL WATER COMMISSION, 1973.

When the U.S. Federal government becomes directly involved in water management within a main river basin, four approaches are common. The Basin Inter-Agency Committee is constituted of representatives from federal agencies operating within the basin who coordinate and plan on an informal basis. State representatives may participate although meaningful participation by units below the federal level is unusual. Projects are built and operated by the respective federal agencies. The Title II River Basin Commissions covered most of the northern half of the conterminous U.S. until they were abolished by the Reagan Administration. Authorized under Title II of the Water Resources Planning Act of 1965, these commissions were composed of both federal and state members but had no authority to construct or operate projects; their principal function was to prepare and keep current plans for water development within their respective basins. The Federal Regional Agency is only found in one river basin of the U.S., the

Tennessee. The well known Tennessee Valley Authority (TVA) can, among other things, plan, regulate, construct, and operate multi-purpose projects within its area of jurisdiction. Nonfederal entities have no legal powers in the TVA operations, although TVA seeks and receives informal input from states and local governments. TVA is the "U.S. export model," highly recommended by government officials for adoption in other countries but not practiced elsewhere in the U.S. because it is often considered to be a radical departure from traditional approaches to water management, eclipsing as it does certain water related powers traditionally held by state governments and federal agencies.

The Federal Interstate Compact, of which there are presently two, is the type of institutional arrangement pioneered in the Delaware River drainage area since 1961. This approach differs from the more popular interstate compact in two ways. First the federal government is a signatory member; and second, a federal interstate commission is provided with an extensive arsenal of water management tools. The remainder of this paper addresses water management by the Delaware River Basin Commission (DRBC).

2 BACKGROUND TO THE FORMATION OF THE DRBC

Although the Delaware River basin is not large by American standards, 33 061 km², it provides a variety of water related goods and services to approximately twenty million people. Over seven million people live within the Delaware basin while another twelve to thirteen million inhabitants of New York City and northeastern New Jersey derive a significant part of their water from transfers out of the Delaware basin. Moreover, water based recreation and associated leisure time activities annually draw many millions to the Delaware basin.

Pratically all of the Delaware basin is shared by four states -- New York, Pennsylvania, New Jersey and Delaware. Although New York is the most populous of the basin states it has the least

inhabitants living within the Delaware drainage area. But the 7.6 million people in New York City (NYC) derive about half of their water from the Delaware River.

Even though NYC lies far outside of the Delaware River basin it played a pivotal role in the eventual formation of the DRBC and the city continues to play a major role in the use, storage, and flow management of the Delaware system. During the 1920s the NYC Water Department planned to continue expanding its ownership of water bearing areas far from the city. Plans to divert waters of the Delaware to NYC alarmed downstream interests in other states. Pennsylvania expressed concern over Philadelphia's water supply, which it was feared would be jeopardized by upstream encroachment of saline water resulting from large diversions of water out of the basin to NYC. New Jersey charged NYC with extravagant use of its present water supplies and claimed that the proposed diversion to NYC would deprive New Jersey of its common law riparian rights of undiminished flow. The ensuing litigation was eventually settled by the U.S. Supreme Court Decree of 1931 which allowed NYC to use 1665.4 mld (440 mgd) while requiring the city to release flows adequate to repulse saline water. The court determined that releases from NYC reservoirs would have to be large enough to assure a $43.47 \text{ m}^3/\text{s}$ (1535 cfs) flow at Port Jarvis, New York and $96.29 \text{ m}^3/\text{s}$ (3400 cfs) at Trenton, New Jersey, respectively.

By 1948 NYC water managers perceived that water demands had increased so much that additional water from the Delaware was needed. Subsequently NYC petitioned the Supreme Court to increase its allocation from the Delaware appreciably. This proposed expansion of Delaware water export was once again vigorously opposed by downstream interests. In 1954 the Supreme Court amended the Decree of 1931. NYC's allocation of the Delaware waters was almost doubled to 3028 mld (800 mgd) but more water from the expanded storage reservoir system had to be released into the Delaware headwater so that flows at Montague, New Jersey (a short distance downstream from Part Jarvis) must not fall below $49.56 \text{ m}^3/\text{s}$ (1750 cfs). In addition, New Jersey was allocated 378.5 mld (100 mgd) of

Delaware waters for export to the water short northeastern part of that state. Unlike NYC, New Jersey was not required to supply downstream releases in return for exporting water out of the Delaware Basin.

As much as lower basin interests may dislike NYC's diversion and use of Delaware water, it is noteworthy that storage provided by the City's reservoirs markedly increase flows during droughts over what they would be if the reservoirs did not exist. The Executive Director of the DRBC noted that during the worst period of the 1980 drought (August 1 - October 31), releases from NYC reservoirs constituted on an average 25 percent of the flows at Trenton, New Jersey; and that during the lowest potential flows within this three month period, these reservoir releases contributed more than eighty percent of the flow at Montague and over fifty percent at Trenton, DRBC, 1980.

Even after the Supreme Court ruling of 1954 attempts were made to create an innovative approach to water management in the Delaware basin. This was necessary for several reasons. First, parties in the basin remained dissatisfied with the allocation of waters; second, disastrous flooding associated with the hurricane of 1955 illustrated that flood control and floodplain management were needed; and third, there were continued serious water quality problems, especially in the estuary of the Delaware. The DRBC was finally formed in 1961. At the formal signing of the bill President Kennedy noted the unique character of the DRBC. The DRBC was unique in 1961 because the federal government was a signatory with states in an interstate compact. A single federal representative appointed by the President was designated to coordinate federal actions within the Delaware basin thereby obviating the necessity of the compact states to separately coordinate operations with each of the several federal agencies involved with water related goods and/or services within the basin. The governors of each of the signatory states were DRBC members. Thus, the entire state would be represented and not just those interests traditionally associated with state level agencies dealing with selected aspects of

water management. Unlike the Title II River Basin Commissions whose limited planning powers had to reflect a consensus of their members, DRBC actions result from a majority vote. Although this characteristic allows decisive actions to be taken, it also contains the seeds of divisiveness within the DRBC.

3 POWERS AND RESPONSIBILITIES OF THE DRBC

The powers and purposes of the DRBC are stated in general terms. It is "to facilitate the planning, conservations, utilization, development, management and control of the basin," DERTHICK, 1974. The DRBC powers may be divided between what it must do and what it may do. It is required to develop a plan for water use within the Delaware basin and to encourage and coordinate water management in accordance with the plan. On the other hand, it may exercise a broad range of water management techniques over all water related goods and services except navigation. As Derthick notes the DRBC has done what it is required to do, but has proceeded rather cautiously before exercising any of its broad discretionary powers. The reason for this is that the exercise of these powers may well detract from if not displace the powers of the members' own executive agencies. In assessing the progress made by the DRBC over the last 23 years it is necessary to ask how well the Commission has managed water resources -- i.e., anticipated, planned for, and acted on -- physical, economic, and social effects stemming from hydrologic interdependencies within its area of jurisdiction. Two major albeit interrelated thrusts will be considered in this context: the allocation of water between states during drought periods and water quality management. It must be noted that in addition to these two major concerns the DRBC has also been involved with managing various aspects of other water related goods and services within the basin. These include flood-plain management, water supply, recreation, fish and wildlife management, and energy production. Space does not permit consideration of these other activities.

4 ALLOCATION OF WATER DURING DROUGHTS

A major challenge before the DRBC has been to apportion water during drought. The need for this became evident soon after creation of the DRBC, during the severe drought in the northeastern U.S. that lasted from 1961-67. Under those drought conditions water yield in the Delaware basin was insufficient to meet the Supreme Court allocations to NYC and northeast New Jersey while maintaining the required flows downstream. Mutual sacrifices by both upstream and downstream interests were necessary, which the DRBC had to enforce under its delegated powers during droughts.

The recently formed DRBC was forced to exercise its full responsibilities during the drought of the 1960s after NYC stopped downstream releases of stored water in violation of the Supreme Court Decree. The DRBC then declared a drought emergency which empowered it to take control of diversions and releases from NYC reservoirs. Under the same powers the DRBC also assumed control over operations at other reservoirs within the Delaware River basin, including those operated by the Corps of Engineers, private utility companies in New York State and Pennsylvania, and state owned reservoirs. In addition, mandatory conservation measures were imposed on water users within the basin. The DRBC took the same actions during a less protracted drought in the early 1980s.

A major achievement of the DRBC was to facilitate negotiations which automatically start drought related actions by those interests utilizing Delaware River water. After years of negotiation, aided by experience gained in two droughts, agreement on drought procedures was finally reached in 1983. Both the diversions to NYC and northeastern New Jersey as well as the reservoir releases into the Delaware River system are reduced in increments as storage decreases. The reductions are based on the available combined storage of the three NYC reservoirs. This new drought condition management agreement is more realistic and flexible than the Supreme Court Decree of 1954. But when normal conditions return,

as determined by the level of storage in the three NYC reservoirs, the DRBC relinquishes management control to the River Master who operates the reservoirs in accordance with the Supreme Court Decree of 1954.

An important contribution to the creation of the new agreement was a better data base to which the DRBC had contributed by sponsoring research. A case in point is the salinity model which enabled negotiators to allow lower salinity repulsion flows in the Delaware River than had formerly been considered possible. Thus, the upstream signatories, New Jersey and especially New York, are able to import more Delaware water during declared drought emergencies than they would otherwise have been allocated.

The Interstate Water Management Agreement calls for several additional steps to meet increasing depletive uses. These include agreement to endorse and promote additional storage in existing reservoirs of NYC and the Corps of Engineers and the creation of new storage by utilities within the basin. The later category of storage will be used to compensate for depletive losses by new thermoelectric plants.

5 WATER QUALITY MANAGEMENT

The DRBC'S role in quality management is considered under two major categories: control of waste loading and salinity repulsion. The estuary of the Delaware has long been the principal area of concern regarding water quality. Urban-industrial concentrations had already created severe pollution problems early in the 20th century. Within the first six years of its formation in 1961 the DRBC had set stringent water quality standards. Using a newly released U.S. Public Health Service study of the Delaware, waste disposal standards were assigned to over ninety dischargers along the estuary. A subsequent analysis by the DRBC determined the assimilative capacity of various reaches of the Delaware River system upon which individual waste discharge permits were based. This was a unique and innovative approach to waste management in the

U.S. Goals were set for biological levels of waste treatment by municipalities while industries were also required to employ higher levels of treatment.

By 1981 waste loading in the estuary had dropped to approximately fifty percent of what it had been in 1958. When the largest sources of municipal waste loading (Trenton, Camden and especially Philadelphia) complete their belated further upgrading of treatment plants by 1984/5, water quality in the estuary is expected to rise markedly. In the meantime it has improved enough so that large runs of the anadromous American shad are once again ascending the river after being absent for decades.

The other major aspect of water quality management is salinity repulsion. The major purpose of maintaining the "salt front" below a designated point in the Delaware estuary is that millions of municipal users would otherwise be adversely affected. The two crucial points on the estuary are: 1) Philadelphia's municipal intake at Torresdale at river kilometer 177.6 (mile 110.4); and 2) the estimated seaward limit of the major connection between the Delaware estuary and the Potomac-Raritan-Magothy aquifer (P-R-M) at river kilometer 157.7 (mile 98). The P-R-M aquifer system provides the city of Camden, New Jersey and inhabitants of three suburban New Jersey counties with their municipal and domestic water supply. By the 1970's overpumping of this aquifer during the previous decades had lowered the level of the P-R-M aquifer to the extent that during normal years about half of its recharge came from the Delaware estuary. During drought years the Delaware contributed a significantly higher percent of the recharge. Overpumping has continued into the 1980's. Encroachment of saline water into the P-R-M aquifer via the Delaware estuary would prove disastrous to the municipal and domestic water supply situation in southwestern New Jersey.

During most of its existence the DRBC had designated the confluence of the Schuylkill and Delaware Rivers, at river kilometer 148.8 (mile 92.5), as the point where instantaneous concentrations

of salt must not exceed 250 mg/l. Using the 1970 level of depletive uses, a minimum flow of $84.96 \text{ m}^3/\text{s}$ (3000 cfs) at Trenton, New Jersey was needed to hold the salt front below the Schuylkill. Given expected changes in sea level and increased depletive uses, by the year 2000 a four month minimum flow of $110.5 \text{ m}^3/\text{s}$ (3900 cfs) would be needed to hold that salt level below the mouth of the Schuylkill. It was problematic that by the year 2000 this flow could be maintained during drought years given the expected out-of-basin diversions, depletive uses in the basin, and levels of storage.

DRBC developed a new mathematical model of salinity, the results from which indicate that smaller flows are required for salinity repulsion than originally anticipated. Related to this is the fact that salinity standards have been relaxed and the critical point moved upstream 8.9 kilometers from the Schuylkill-Delaware confluence to the seaward limit of the major connection between the P-R-M aquifer and the Delaware estuary.

The DRBC has made additional contributions to water quality management including but not limited to the requirement for regional waste treatment plants and strict enforcement on construction and operating procedures for oil pipeline companies seeking permits from the DRBC. One of the more innovative management strategies employed by the DRBC was, however, its requirement that electrical utilities operating new thermoelectric plants within the basin provide storage to replace depletive losses during drought emergencies or cease generation of electric energy during that time. Since this policy came into effect in the middle 1970's, utility companies have embarked on plans to cooperatively build and operate such a storage reservoir. The ten participating utilities have apportioned the costs of the reservoir based on the benefits each will derive from the project.

6 FACING THE PROBLEMS AND ISSUES OF REGIONAL WATER MANAGEMENT

No small part of the DRBC's success may be attributed to its flexibility. A case in point is the Commission's handling of the Tocks Island project. This Corps of Engineers project would have been the largest water management structure in the Delaware system, providing low flow augmentation, flood control, a large recreational pool, and electrical energy. The newly formed DRBC not only placed Tocks Island in its Comprehensive Plan in 1962 but made that project the center piece of future water management in the basin. By the late 1960's, however, growing public concern for environmental quality -- a concern which generally opposed construction of any dam -- began to erode support for Tocks Island. In 1975 the DRBC in a contentious split decision voted to defer Tocks Island, an act which severely limited short run options for the structural control of waters within the basin.

The DRBC quickly refocused efforts towards nonstructural approaches to water management. Thus, more efficient use of water rather than new storage was emphasized; while floodplain management was stressed rather than the construction of dams, levees, floodwalls, etc. In addition the DRBC encouraged parties to the Supreme Court Decree to start "good faith" negotiations on apportionment of waters during periods of drought. The DRBC's recent "Level B Study" reflects a balance between structural and nonstructural approaches to water resources management. For example, Tocks Island remains in the long range plan for reconsideration in the year 2000, DRBC, 1981.

The most pressing problem appears to be the inability of signatory parties of the DRBC to agree on what constitutes an equitable apportionment of management costs. During the earlier years of DRBC operations, costs were apportioned at twenty-three percent each for New York, Pennsylvania, New Jersey, and the federal member while Delaware contributed eight percent. Since the 1970's, however, New York State has become unwilling to contribute as much as Pennsylvania or New Jersey on the grounds that as an upstream

interest it has little to gain from DRBC operations, U.S. GENERAL ACCOUNTING OFFICE, 1981. Underfunding has caused reductions of the DRBC staff, which if continued indefinitely could at best make it difficult to carry out its responsibilities and at worst jeopardize its viability. Until the question of equitable funding is resolved the DRBC must function with a handicap.

Another problem facing the DRBC -- and any regional organization in the U.S. -- is how to gain acceptance from traditional actors within a system that does not readily accept "additional layers of government." It must be asked whether the DRBC is allowed to meaningfully interact with the federal, state, and local levels of government or whether it is considered by established actors to be an excrescence disfiguring the federal system. The answer appears to be mixed. On the one hand, the Secretary of Interior, the federal government's representative on the DRBC, has been able to coordinate and channel federal actions much of the time so that the DRBC did not have to involve itself with each of the many federal agencies concerned with various aspects of water in the basin. In similar fashion the governors of the signatory states have been able to coordinate the various activities of the numerous state agencies involved with water resources with DRBC plans. Examples of successful interagency/intergovernmental service by the DRBC include: 1) The DRBC has worked well with the Federal Emergency Management Agency (FEMA), and its predecessors, regarding the implementation of the National Flood Insurance Act. In this respect the DRBC has functioned over much of the Delaware basin as a mapping contractor and consultant for the preparation of maps with information necessary for floodplain management by local governments. Thus the DRBC not only provided expertise to local governments but also facilitated the necessary flow of information between FEMA at the federal level and local level of governments; 2) The DRBC has worked cooperatively with the National Park Service in preparation of a management plan for the upper and middle reaches of the Delaware River that were incorporated into the National System of Wild and Scenic Rivers; and 3) In 1981 the DRBC

with the cooperation and concurrence of Pennsylvania implemented a ground water protection program in a 3885 km² area of southeastern Pennsylvania. In this rapidly growing suburban area regulations and restrictions on ground water use are designed to protect existing users against large withdrawals. In this partnership program Pennsylvania pays the DRBC's costs of administering the program.

On the other hand, the sudden and massive movement by the federal government into the area of water quality control resulted in the DRBC being either bypassed or undercut as federal agencies ignored DRBC's earlier activities in this area of water management and dealt directly with state and/or local governments. For example, the Corps of Engineers acting under the long neglected Rivers and Harbor's Act of 1899, suddenly began to require permits for the discharge of waste into navigable waters; while the EPA, attempting to implement the Water Pollution Control Amendments of 1972, undercut the DRBC's "unique policy of allocating shares of the river's assimilative capacity to dischargers", DERTHICK, 1974. This happened as EPA promulgated an unprecedented national policy on the prohibition of waste discharges into surface waters of the country. New rules and regulations imposed directly on the states by EPA reportedly reduced the former levels of state cooperation with the DRBC. Complaints by the DRBC that new federal regulations jeopardized its established pollution control program were ignored by federal agencies.

7 SUMMARY AND CONCLUSIONS

Competition over Delaware River water eventually led to an innovative approach to water management within the basin. The approach was unprecedented in the U.S. in that it combined participating state and federal governments in a commission which was given far reaching discretionary powers in water management.

Since its formation in 1961 the DRBC has successfully managed two droughts by requiring mutual sacrifices between the parties. This was necessary because the Supreme Court Decree of 1954 allocated more water than is available during droughts with a one percent return frequency. By 1983 automatic responses to serious drought conditions had been negotiated. The DRBC has also shown some success in water quality management, but its role was partially usurped by federal agencies in the 1970s as the federal government moved decisively into water pollution control. A potentially serious problem has developed over the allocation of costs between parties and the DRBC. New York, the upstream interest, has reduced its contributions because it believes that it does not benefit as much from DRBC activities as downstream interests do. Nevertheless the DRBC continues to function rather effectively despite staff reductions related to the cost allocation problem and occasional problems of acceptance as a legitimate entity by established actors in the water management system.

The DRBC has functioned well enough so that this once unique institutional approach has been repeated in an adjacent basin -- the Susquehanna -- and has been considered for use in other river basins as well.

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Author's address:

Prof. Keith Muckleston
Dep. of Geography
Oregon State University
Corvallis, OR 97331
USA