

EXECUTIVE SUMMARY

1. INTRODUCTION

Background

The inflatable dam and associated recreational facilities are part of the mitigation plan for the Wyoming Valley Levee Raising Project. The construction of the levee raising project, which began in 1997, involves raising approximately 13 miles of levee and flood walls between 3 and 5 feet. These modifications further reduce the visibility and access to the Susquehanna River, and isolate residents from the many recreational opportunities offered by the river. The purpose of the inflatable dam is to compensate for these losses by creating incentives for revitalizing interest in the Susquehanna River through new recreation, scenic, and economic opportunities.

In 1991, by request of Congressman Paul E. Kanjorski, the U.S. Army Corps of Engineers studied concepts for an inflatable dam on the Susquehanna River in the Wyoming Valley. The Corps' reconnaissance study concluded that an inflatable dam project was economically justified. The study also concluded that with appropriate mitigation, there would be no overriding adverse environmental impacts. Further, the project was noted as having the potential to focus attention on the positive features of the river system and create a "destination" for the area through carefully planned riverfront development.

Study Objectives and Approach

A sum of \$14 million was set aside by the Corps for the inflatable dam project as part of the mitigation plan for the levee raising project. This funding is to be cost-shared with 75 percent to be provided by the federal government, and 25 percent by Luzerne County. Water resources studies undertaken by the Corps are normally conducted in several phases with the initial reconnaissance phase advancing to a feasibility phase where conditions warrant. Since the Corps' reconnaissance study resulted in favorable technical findings for the project, a second-phase feasibility study was commissioned by the Luzerne County Flood Protection Authority to further investigate engineering, environmental, and economic issues, and public acceptance of the project.

The primary objective of the feasibility study is to provide the Luzerne County Flood Protection Authority with sufficient information to make an informed decision as to whether or not to proceed with the permit application, final design, and construction of the project. Investigations were focused on determining the project configuration and features that minimize environmental impacts and costs, and maximize project benefits.

The Study Team

Because the study involved an all-encompassing effort requiring the expertise and experience of engineering, economics, and environmental disciplines, a diversified team of professionals was engaged by the Luzerne County Flood Protection Authority. The project team included Gannett Fleming as the leader with their strong dam engineering and environmental science capabilities; the

Greeley-Polhemus Group for their well-known economic analysis capabilities; Borton-Lawson Engineering for their in-depth knowledge of the U.S. Army Corps of Engineers's Wyoming Valley Flood Control Project and local infrastructure; and the Wilkes University Geographical Information System (GIS) Center for their ability to develop special mapping and study information. The team's prior knowledge of specific issues and existing conditions within the Wyoming Valley expedited and enhanced the study.

2. THE SUNBURY INFLATABLE DAM PROJECT

The 30-year-old inflatable dam project at Sunbury, Pennsylvania provides a source of information that is directly relevant to the proposed inflatable dam. The Sunbury dam is located just 40 miles downstream of Wilkes-Barre, on the Susquehanna River. The similarities between the existing inflatable dam at Sunbury, and the proposed inflatable dam at Wilkes-Barre include the type and height of dam, geographic locale, and exposure conditions. In addition they are both subject to many of the same environmental and regulatory issues, and type of use. Valuable insights were gained by studying the well documented performance record of the dam at Sunbury. It provides insights on potential environmental and flood control project impacts and operation and maintenance requirements and costs.



Figure 1 Inflatable Dam at Sunbury.

The Sunbury dam creates a 6.5-mile long, 3,000-acre recreation lake for an average of 130 recreation days/year, and attracts more than 300,000 visitors per year. Fishing and boating are very popular, and water-based recreation appears to be increasing with time. The seasonal lake, named Lake Augusta, is a resource that is valued by the local residents and surrounding communities.

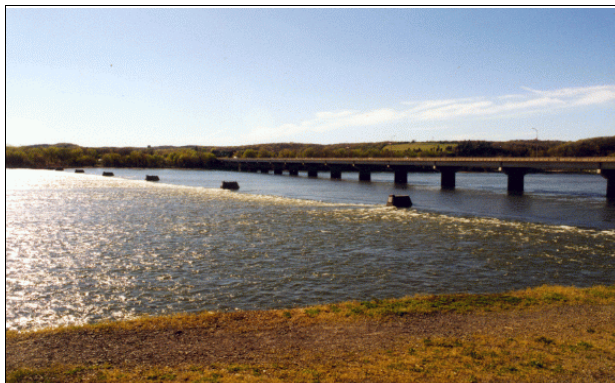


Figure 2 Sunbury inflatable dam deflated.



Figure 3 Sunbury inflatable dam inflated.

Over its 30-year life, the dam at Sunbury has experienced structural problems. However, most of these problems occurred during the first 15 years of operation, and stemmed from the use of early rubber dam bodies that were not structurally suited for the hydraulic environment of the Susquehanna River. The 1984 replacement of the rubber dam bodies with heavily reinforced components manufactured by Bridgestone has resulted in fewer problems. Recent improvements in the Bridgestone rubber dam bodies are expected to alleviate the few remaining problems that have been encountered. The newly installed automatic controls maintain the lake level within 0.2 feet of the desired elevation and have reduced the rim impacts around the lake.



Figure 4 Lake Augusta viewed from overlook facing Shikellamy State Park.

The construction of the dam has impacted the Sunbury Flood Control Project. The raised water level above the dam resulted in the closure of sluice gates at three pumping stations, and increased the activation and cycling of the pumps. As a result, these pumps have deteriorated prematurely. In addition, fish passage facilities need to be constructed at the dam in the near future to fulfill the 1966 dam permit agreement. The initial cost for the fish passage facilities is estimated to be between \$4 and \$5 million.

3. DAM SITE SELECTION

A first step of the feasibility study was the selection of the dam site. The project team conducted a thorough review of potential dam sites in the Wyoming Valley between Nanticoke and Pittston. The site selection approach was intended to provide an objective and unbiased evaluation of possible dam sites with the objective of identifying the best overall dam site.

Planning level data were collected and used to evaluate potential dam sites. Property ownership along both sides of the river, potential site access, and the locations of existing and proposed public parks were assessed. Historical features, population demographics, river morphology, reservoir geometry, and sensitive environmental features such as islands and sewer outfalls were also

considered. An initial site reconnaissance of the study area was performed in November 1998. During this reconnaissance, a boat survey was performed to inspect and photograph conditions along the channel banks.

Ten evaluation criteria were established and applied to the selection process. The overall evaluation criteria were based on engineering, environmental, economic, and recreation factors. The objective was to identify a dam site which:

1. Improves public access and enjoyment of the Susquehanna River.
2. Takes advantage of existing facilities.
3. Minimizes construction costs.
4. Optimizes reservoir conditions.
5. Minimizes environmental impacts.
6. Minimizes impacts to cultural resources.
7. Minimizes impacts to drainage structures and pumping stations.
8. Maximizes economic development potential.
9. Maximizes proximity and use of public lands.
10. Does not increase flood levels or otherwise negatively impact the flood control project.

Although other dam sites are possible, the best site considering all factors is the site upstream of Richard Island and the former Delaware and Hudson Railroad Bridge. The selected site is very close to the site selected by the Army Corps of Engineers in the 1991 reconnaissance study. At this site, the Susquehanna River is about 800 feet wide. A dam at this location would create a lake that extends upstream along a large portion of the Wilkes-Barre metropolitan area, borders most of the existing river parks, and avoids impacting the large islands in the river. This site also produces the most favorable reservoir conditions and would create the deepest and largest lake for the range of dam heights considered. Access for construction is excellent and sufficient public land is available for developing recreation areas.

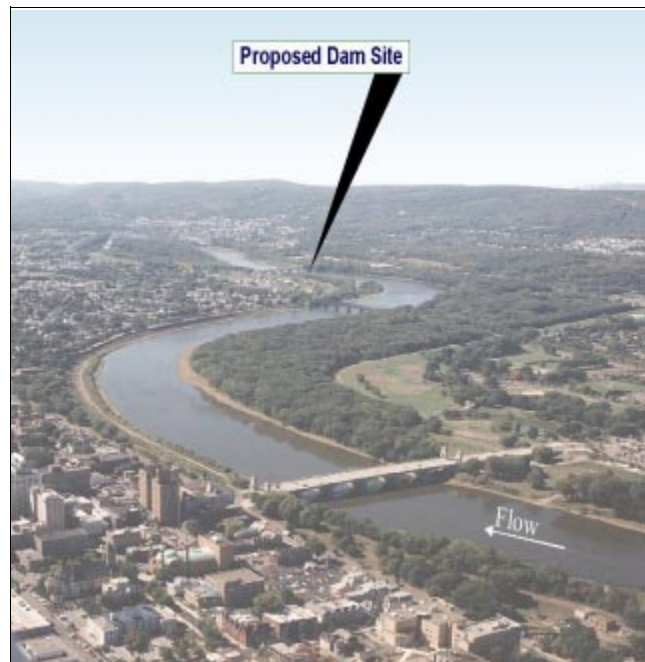


Figure 5 Birds-eye-view of proposed dam site.

4. DAM HEIGHT SELECTION

After determining the most advantageous location for the dam, alternate dam heights were considered. The height of the inflatable dam is a critical variable because it affects the physical characteristics of the recreation lake and the cost of the dam. The project team conducted a thorough evaluation of a range of potential dam heights to identify the optimum height. The final selection of the optimum dam height was based on site specific field investigations and analyses.

Six general evaluation criteria were established and applied to the selection process. The overall evaluation criteria were based on engineering, environmental, economic, and recreation factors. The objective was to identify a dam height which:

1. Minimizes environmental impacts to wetlands, fish passage, and wildlife habitat.
2. Optimizes reservoir conditions for boating and recreation.
3. Minimizes impacts to drainage structures and other rim features.
4. Maximizes economic development potential.
5. Does not negatively impact the existing flood control project.
6. Minimizes construction costs.
7. Minimizes operating and maintenance costs.

Project costs, benefits, and environmental impacts vary with the dam height. A review of the evaluation criteria reveals that some of the criteria are at odds with each other. For example, optimizing the reservoir conditions for boating, recreation, and economic development tend to favor making the dam as high as possible, since the higher the dam, the greater the depth, width, length, and overall area of the recreation lake. A higher dam also creates a more desirable recreation pool by calming the river flow and reducing flow velocities. Conversely, minimizing environmental impacts to wetlands and fish passage, minimizing impacts to drainage structures and other rim features, and minimizing construction costs, tends to favor making the dam as low as possible.

Within the range of dam heights considered, maximum and minimum thresholds for various types of impacts were identified to help narrow the range of potential dam heights. For example, there are limitations to the maximum height of rubber dam bodies available. In addition, cost curves for the various sizes of rubber dams available indicate that there are breakpoints for specific dam heights that are based on manufacturing constraints. There is also a minimum water depth required to make the lake accessible and safe for most kinds of boating activity. Thresholds for key environmental and rim impacts were also identified, such as the elevation at which the natural river banks would begin to be overtopped, and the level at which the performance of drainage structures would be affected. A hydraulic analysis that represents the theoretical operation of the dam for the 100 years of historical data available at the site was performed to determine the earliest possible inflation dates and the frequency of complete deflation to accommodate river flood discharges. These issues and others were evaluated in detail.

After a careful evaluation, it was determined that an inflatable dam with a fully inflated height of 9.5 feet would provide the optimal recreation lake. At a height of 9.5 feet, the inflatable dam will maintain the level of the recreation lake near elevation 517 feet (NGVD). This elevation corresponds to gage height 4.9 feet at the Market Street Bridge. On average, the water surface elevation of the river in the vicinity of Market Street will be raised approximately 4 feet higher than average during the period when the dam is inflated. With this dam height, the recreation lake would be confined within the natural channel banks of the river, and inundation of overbank areas and wetlands would be minimal. Also, impacts to the existing flood control project, including the pumping stations and drainage structures, would be easily mitigated.

The earliest date for inflating the dam was determined, on average, to be May 22. This inflation date would provide sufficient time to install floating docks and other support facilities before the

Memorial Day weekend. Complementary recreation facilities such as shoreline paths, permanent docking facilities and access points, fishing piers, etc., can also be constructed around the perimeter of the proposed recreation pool, with a 3-foot freeboard (vertical buffer zone), and not experience inundation by natural river flows at an unacceptable frequency. The average depth of the impoundment would be similar to the average depth at Lake Augusta at Sunbury, and should provide sufficient draft for a similar variety of watercraft.

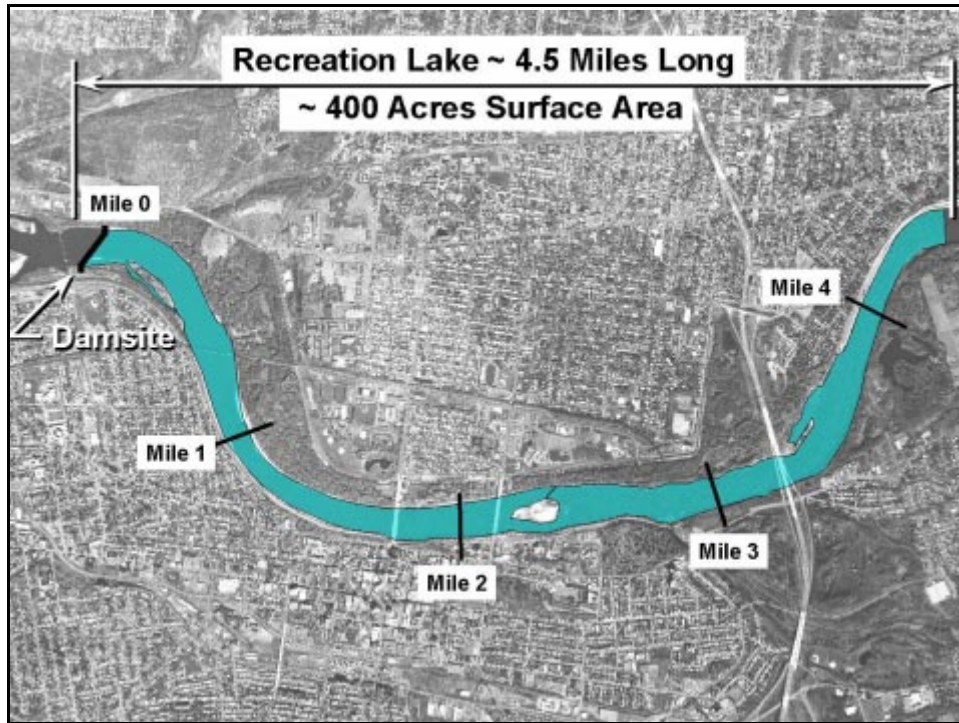


Figure 6 Approximate limits of proposed recreation lake.

The proposed recreation pool will extend approximately 4.5 miles upstream from the dam, along the waterfronts of Wilkes-Barre and Kingston, to a point on the river near the Wilkes-Barre/Wyoming Valley Airport in Forty Fort. The surface area of the lake will be approximately 400 acres. The width of the lake will vary between 550 and 1,000 feet and encompass one small island just upstream of Pierce Street. The average depth of the lake will be approximately 8-10 feet with the deepest area more than 25 feet deep. Five public parks will abut the shoreline including: Kirby Park, River Common Park, Nesbitt Park, Riverbend Park, and the downstream end of the Luzerne County Recreational Facility.

5. PRELIMINARY DESIGN OF DAM AND APPURTENANCES

Features of the Proposed Dam

The proposed dam consists of five separate segments: a fixed-crest dam section on the east side, a 6.5-foot high inflatable dam section, two 9.5-foot high inflatable dam sections, and a fish passage structure on the west side. The two 9.5-foot high inflatable dam sections form the longest part of the dam and span diagonally across the river. The fish passage structure consists of four inflatable weir sections in series to incrementally raise the water levels from the tailwater to the headwater.

This configuration is the most favorable for passage of fish as it tends to guide migratory fish toward the fish passage structure. The diagonal footprint of the dam is significantly different from the straight footprint assumed by the Corps in their 1991 reconnaissance study. The diagonal footprint and addition of a separate fish passage structure increases the overall length and construction cost of the dam. These changes are necessary, however, in order to effectively provide fish passage at the inflatable dam.

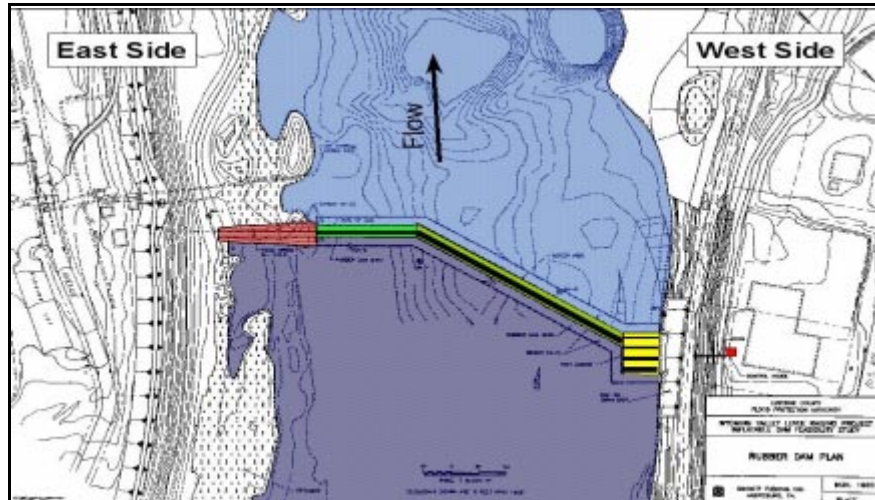


Figure 7 Plan showing footprint of the proposed dam.

Two types of inflatable dams can be constructed at this site; a Bridgestone Rubber Dam or an Obermeyer Hydro Gate Dam. The Bridgestone Rubber Dam consists of a sealed tube fabricated from a heavy-duty, nylon-reinforced rubber attached to a reinforced concrete foundation with metal clamping lines. The rubber body is inflated with air or water to impound water. The rubber material used for the dam body is similar to that used for conveyor belts, marine fenders, marine hoses for crude oil transportation, tires for heavy construction equipment, and tires for aircraft. Since the first installation in 1978, Bridgestone Rubber Dams have been installed in countries all over the world.



Figure 8 Schematic of Bridgestone Inflatable Dam.

Bridgestone Rubber Dams are operated by low-pressure air. When deflated, the rubber body of the dam lies completely flat on its concrete foundation, permitting water, sediment, and debris to pass over the dam unencumbered. The air is supplied by standard air compressors. The rubber dam body may be raised or lowered (inflated or deflated) manually or by automatic controls. The automatic control system monitors one or more water-level gages and manipulates the air pressure in the dam to adjust its height and maintain a prescribed water level in the upstream pool.



Figure 9 Inflatable dam at Sunbury.

The Obermeyer Hydro Gate System consists of a row of bottom hinged steel gate panels supported on their downstream side by inflatable air bladders. The individual steel gate panels are fabricated in widths of 5 to 10 feet. The gaps between adjacent panels are spanned by reinforced rubber webs clamped to adjacent gate panel edges. By controlling the pressure in the bladders, the pool elevation maintained by the gates can be infinitely adjusted within the system control range (full inflation to full deflation) and accurately maintained at user-selected set points.

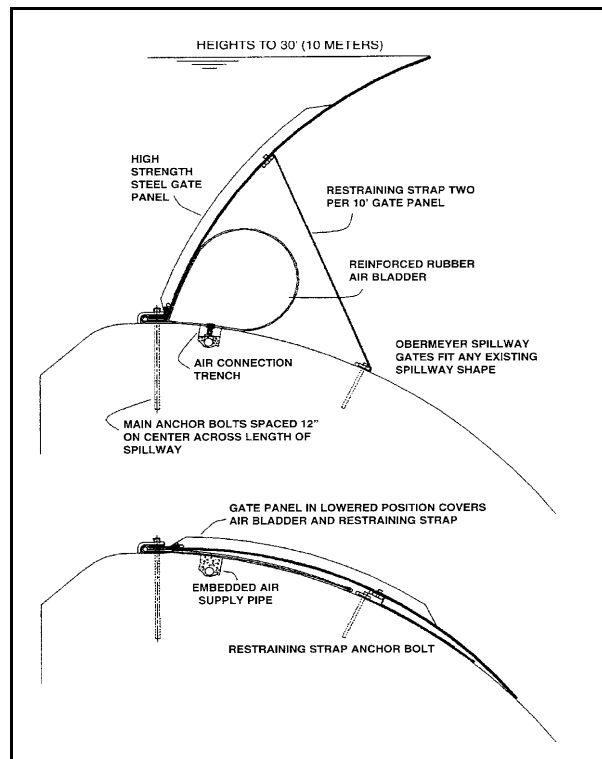


Figure 10 Obermeyer Hydro Gate System.

The Obermeyer Hydro air bladders are designed and manufactured by methods similar to those used in the manufacture of automotive tires. A butyl rubber inner liner provides the air retention characteristics, while the high tensile strength rubber compounds containing multiple layers of polyester or Kevlar fiber tire cord reinforcement provide the mechanical strength needed to contain the internal pressure.



Figure 11 Side view of gate panel and bladder.

After reviewing the costs and comparing the features of the Bridgestone Rubber Dam and the Obermeyer Hydro Gate System, there does not appear to be an overriding reason to select one over the other. Both types of dams satisfy the desired performance requirements and essentially use the same type of foundation structure. It is recommended that both dam types be considered during final design. If during final design, it is determined that both dam types are interchangeable with minor

modifications to the substructure and abutments, both dam types could be included in the bid documents. The final decision could then be made on the basis of cost.

Dam Construction Issues

The construction of the proposed dam would involve routine heavy construction practices with the additional complexity of having to perform the construction work within a large flowing river. Construction of a dam across the Susquehanna River presents a very real construction challenge. Flooding has the potential to increase construction costs by damaging work in progress and causing delays.

Assuming no flood conditions are experienced at the site, the total time required to construct the dam is approximately 12 months. This estimate assumes that the contract would be awarded in December or January and allows the contractor time to plan construction activities, obtain approval of his plan for diversion and care of water, develop suitable access to the site and staging areas, and order construction materials. Construction in the river would begin as soon as spring river flows receded, and would continue until the essential dam facilities in the river were completed. Additional construction time would be required if frequent flooding of the work area occurs.

If a short construction schedule is desired, the components for the inflatable dam including the rubber dam bodies, piping, and controls may need to be ordered in advance so that they are available to the contractor when needed.

Dam Operation and Maintenance

Operation of the proposed dam will consist of performing procedures that will monitor and maintain a water surface elevation upstream of the dam that continuously meets established recreational, environmental, and flood control objectives.

Anticipated Dam Operation Tasks:

1. Routine visits to the dam to observe and record specified physical parameters. This effort can be simplified by installing automated controls and a surveillance system.
2. Visits to the dam during rising and falling flood flows on the river to ensure proper raising and lowering of the adjustable dam components.
3. Implementation and management of the fish passage monitoring program.
4. Operation and maintenance efforts at the beginning and end of the recreation season.

Anticipated Dam Maintenance Tasks:

1. Routine, preventive maintenance, such as lubrication and/or cleaning of all moving components on motors, valves, gates, and gages.
2. Periodic maintenance, such as removal of silt, gravel, and floating debris.
3. Emergency maintenance, such as repair to a dam body because of damage.
4. Inspection of riverbanks affected by possible shoreline erosion and installation of appropriate bank protection measures.
5. Major replacement of components as their expected useful life is approached.

6. IMPACTS TO EXISTING SHORELINE FACILITIES

A component of this study was to analyze potential impacts of the proposed dam on the existing upstream infrastructure. A rim impact analysis was performed to assess potential impacts to the flood control pumping stations, sewer and stormwater outfalls, levees and floodwalls, riverbank erosion and stability, groundwater levels at locations along the rim of the proposed recreation pool, and other features.

Flood Control Pumping Stations

Nine flood control and stormwater pumping stations are located within the extent of the recreation pool created by the proposed inflatable dam. The increase in river level as a result of the proposed impoundment will affect five pumping stations. These outfalls and intake chambers would be subject to continuous inundation when the dam is inflated. The pumping stations with intake chambers below the proposed pool elevation include the Old River Road, Ross Street, Union Street, Loveland Avenue, and Church Street flood control pumping stations.

Overall, the increase in the river level from the inflatable dam is not expected to have significant adverse impacts on these pumping stations. The most notable effect is inundation of the gates in the intake chambers, potential seepage into pump station wet wells, and backflow/leakage into upstream combination sewer systems.

The gates at several of the pumping stations located around the proposed impoundment are already inundated throughout most of the year. They have been subjected to high river stages over the past 50 years since their construction. In the pumping station upgrade contract that is part of the Wyoming Valley Levee Raising Project, the gates in all of these pumping stations are scheduled to be replaced. The new gates will be specially treated to resist deterioration when exposed for extended periods in wet environments or when submerged.

Recommendations to mitigate impacts of the inflatable dam on the pumping stations include installing Tideflex gates and leak detection sensors as a secondary means of seepage protection at the pumping stations that have sanitary facilities or combination sewers upstream. Regular inspection and maintenance of the gates in the intake chambers will be critical to ensure that backflow or seepage is kept to a minimum.

Sewer/Stormwater Outfalls

The rim impact investigations found that the only outfalls adversely affected by the inflatable dam are the six gravity sewer outfalls located below the maximum projected recreation pool elevation. The possible effects of constant inundation of these outfalls may include reduction in flow capacity, increase in sediment deposition and solids in the outfall conduit and at the outlet, and the potential for backflow from the river into the upstream sanitary sewer system where combination sewers exist.

Recommendations to mitigate impacts of the inflatable dam on the outfalls include installing secondary backflow prevention gates, performing pipe repairs, and installing leak detection sensors.

Levees and Floodwalls

In general, the sections of the levee that will be in direct contact with the proposed pool are armored with rip-rap and will not be affected by the proposed recreation pool. The remaining levees and floodwalls are located where the proposed pool is well below the toe of the levees and walls. In addition, many of these flood control structures are located a considerable distance from the riverbank. No impacts to these structures are anticipated from the proposed inflatable dam project.

Riverbank Erosion and Stability

The proposed temporary increase in river level created by the inflatable dam has the potential to create riverbank erosion at certain areas along the rim of the recreation lake as a result of wakes from boating activity, increased human activity along the banks, and loss of vegetative growth on the submerged banks which are exposed after the dam is deflated. The areas potentially susceptible to bank erosion are primarily on the Kingston side of the river from the Market Street Bridge to the dam site. Some of these riverbank areas may have man-made bank protection or natural armoring beneath the exposed erodible riverbank material.

Several options to address potential riverbank erosion include: (1) installing bank protection as part of the project; (2) managing activity along the riverbanks by establishing “no wake zones” along sensitive bank areas and managing human traffic along riverbank areas using riverbank setbacks and excluding access; (3) doing nothing and monitoring the susceptible shoreline areas to see if significant bank erosion occurs, and later installing bank protection or managing the activities causing the erosion; and (4) doing nothing and allowing shoreline erosion to occur.

For this project, it is recommended that no riverbank protection be installed, and that a contingency fund be established to cover the costs for installing riverbank protection at a later date should it become needed. The riverbank areas that have been identified as potentially sensitive to erosion from boat wakes and recreational traffic should be monitored. If significant erosion does occur, an assessment can then be made to see if bank protection or other management techniques are necessary, or if effective natural armoring has been established. If it is determined that erosion protection is required, protection can be installed as needed.

Groundwater and Mine Pools

Anticipated impacts of the proposed impoundment on mine pools and shallow groundwater systems are expected to be minimal. The depth and extent of the impoundment will not be large enough to introduce water into any mine pools not already inundated, and any increases in seepage into the mines will be so slight as to have no adverse effect. Rises in groundwater levels adjacent to the river during impoundment periods will also be small, and are expected to remain mostly within the area 200 feet from the river banks.

Other Rim Impacts

The proposed dam would affect the existing river gaging station at the North Street Bridge during its period of inflation and impact the low-flow measurements at this gage. An additional streamflow

monitoring station will need to be constructed immediately downstream of the proposed dam in order to continue to provide streamflow information over the full range of river stages.

7. ENVIRONMENTAL ANALYSES

General

Environmental analyses were performed to evaluate many issues related to the proposed impoundment. Of the issues investigated, four were determined to be of greatest importance and include: fish passage, wetlands, water quality, and combined sewer overflows. Summaries of these primary environmental issues follow.

Fish Passage

A tremendous amount of time and financial resources have been put forth by various agencies and groups involved in the restoration of migratory fishes to the Susquehanna River. Their long-term commitment to success of the program is evident in the increasing populations of wild shad returning to the Susquehanna River. The inflatable dam, if constructed, will need to be consistent with the goals of the restoration effort. A fish passage facility can be incorporated into the design of the inflatable dam that successfully passes migratory fish whenever the dam is inflated. Fish passage will not be hindered while the dam is deflated.

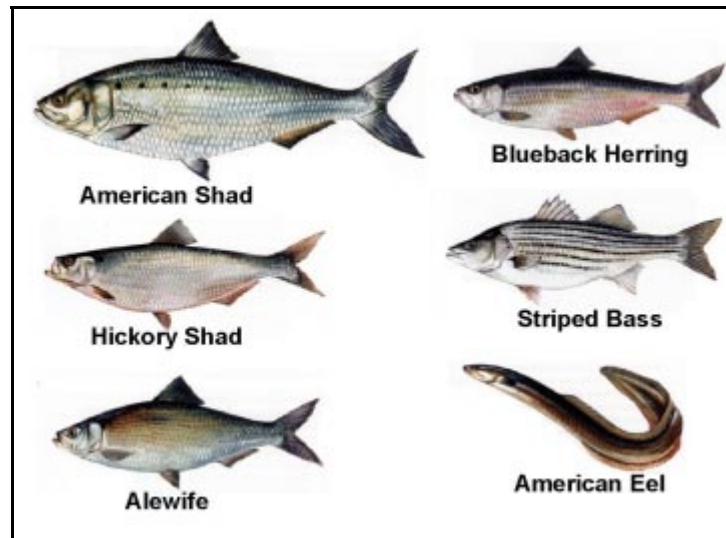


Figure 12 Migratory fish in Susquehanna River.

The proposed fish passage structure is located at the upstream end of the dam. This configuration is most favorable for passage of fish as it tends to guide migratory fish toward the fish passage structure. The riverbed topography favors locating the fishway at the west side of the river. The conceptual design of the fishway is intended to be very conservative and most closely resembles the pool and weir type fishway. Four water-filled Bridgestone Rubber Dams or Obermeyer Hydro Gates would be used to create the submerged weirs. It can be demonstrated that only three weirs are needed; however, the fourth weir is included as a contingency to account for long-term changes in downstream tailwater conditions and to provide additional flexibility in the operation of the facility. The crest elevations of the four weirs would be fully adjustable. During low-flow conditions, most of the river flow would be discharged through the fish passage facility. With the proposed configuration, even during the lowest flow on record, some flow would discharge over the main air-filled sections of the dam. The crest elevations of the air-filled sections of the main dam can also be regulated to concentrate most of the river flow near the upstream end of the dam to direct or guide migratory fish to the fishway.

Based on the information gathered to date, the concept for the proposed fish passage structure appears to be feasible. Final design, if authorized, should be modeled after fish passage design work currently being undertaken for a fish passage structure for the inflatable dam at Sunbury.

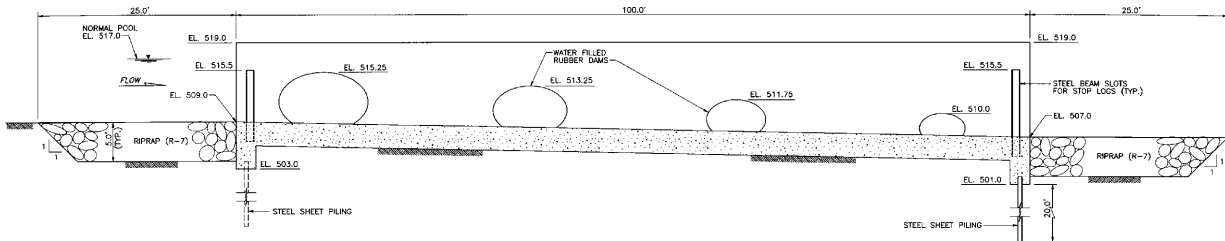


Figure 13 Profile of proposed fish passage facility using Bridgestone water-filled rubber bodies.

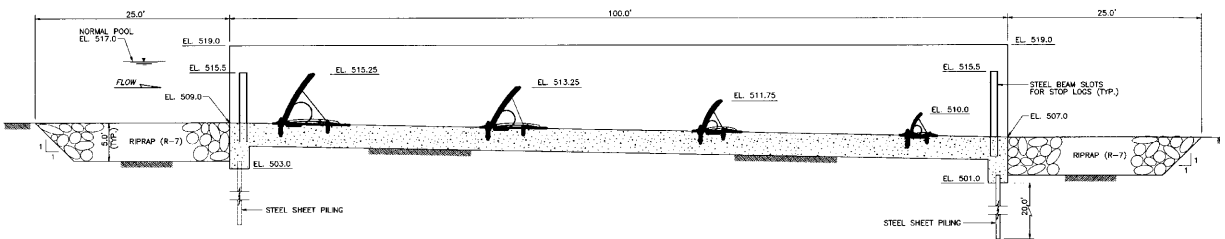


Figure 14 Profile of proposed fish passage facility using Obermeyer Hydro inflatable gate system.

An annual fish monitoring program will be required to count and record the number of adult American shad that use the fish passage facility during the migratory season. The data collected from this monitoring program will be used to assess the performance of the structure. Remotely operated acoustic methods similar to those used to count migratory fish at other dams could be used at the fishway for the inflatable dam.

Wetlands

Based on information currently available, the feasibility of the proposed dam project would not be affected by the presence of existing wetlands. If wetland losses are unavoidable, replacement of wetlands could occur in other locations throughout the flood plain along the river as mitigation. New wetlands may also form in the flood plain areas adjacent to the project area.

Water Quality

The water quality of the Susquehanna River at Wilkes-Barre suffers from the effects of a once prevalent coal mining industry. In addition, the river is impacted by organic wastes from combined sewer overflows, industrial discharges, and urban runoff. Consequently, the reach of the Susquehanna River in the Wyoming Valley has poorer water quality than other reaches of the river further upstream or downstream. The water quality of the Susquehanna River at Wilkes-Barre has,

however, improved substantially over the last few decades. The presence of an inflatable dam would not be expected to reverse this trend or result in new additional impacts to water quality.

Thermal stratification, changes in dissolved oxygen levels, eutrophication, and sedimentation have the potential to occur behind an impoundment, but the continuous flow-through condition at the proposed dam is not anticipated to allow these processes to occur at this site. Fecal coliform levels in the river at Wilkes-Barre have exceeded Pennsylvania Department of Health water quality standards for primary contact on several occasions. Fecal coliform levels are expected to continue to periodically exceed these water quality standards until significant separation of the combined sewer outflows from upstream sources occurs.

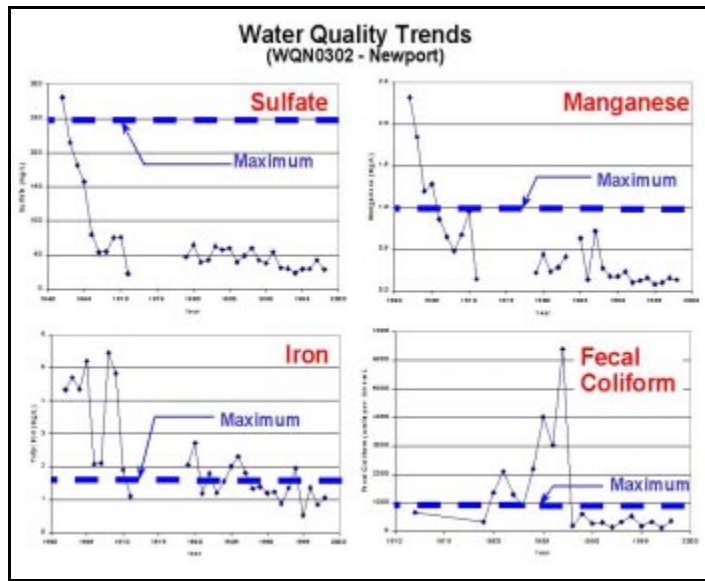


Figure 15 Graphs of several water quality parameters.



Figure 16 The Butler Mine Tunnel.

One of the most publicized source of pollutants into the Susquehanna River is the Butler Mine Tunnel. The Butler Mine Tunnel is located in the City of Pittston, approximately seven miles upstream of the proposed dam. The tunnel drains a five square mile area of underground mine caverns and waterways.

Many individuals and companies used bore holes into the mine to dispose of various wastes, including residential and commercial wastes containing hazardous substances and waste oil. After two incidents of overflows of waste oil and other substances from the mine in 1979 and 1985, hydrogeologic studies were performed by the Environmental Protection Agency. These studies concluded that there is a low probability of a future discharge of hazardous wastes from the tunnel. No discharge of hazardous materials have been detected from the mine since 1985.

Combined Sewer Overflows and Acid Mine Drainage

Although acid mine drainage (AMD) is a significant problem, the single largest detriment to the most meaningful recreational use of the proposed project is the existence of combined sewer outfalls (CSOs). Within the limits of the proposed impoundment, there are currently 16 CSO outfalls, with

an additional 23 CSO outfalls upstream between Forty Fort and West Pittston. Impacts to the recreation pool from CSO discharges can include increases in fecal coliform and pathogenic microorganism counts, nitrogen and phosphorus loading, organic loading, and the presence of floatable wastes. Regular or frequent CSO discharges can also reduce dissolved oxygen levels, create local algae blooms, pose health hazards with water contact, impact fish populations, and have adverse visual and odorous impacts that would negatively impact the recreational use of the impoundment, riverfront pathways, and other areas around the impoundment. Although considerable resources appear to be focused on AMD abatement projects, and significant improvements in pH levels, concentration of metals, and sulfate content of the Susquehanna River have been achieved, there has only been limited incremental improvements in CSO abatement. Of the 16 CSO abatement projects listed in the Upper Susquehanna-Lackawanna Watershed Master Plan, only \$50,000 of the \$52 million worth of projects appear to have funding.

An important feature of this feasibility study is the identification and evaluation of the CSO problem in the Wyoming Valley. A thorough inventory and discussion of the CSOs is presented and includes a preliminary assessment and planning-level costs for recommended studies, structural improvements and other initiatives to reduce the combined sewer overflows. Without addressing the CSO problem in conjunction with the development of the dam project, the potential success of the desired integrated recreational activities will be adversely affected. A planning-level cost estimate of the work required to address the CSO problem in the Wyoming Valley is approximately \$40 million.

Further Investigations

The feasibility of the proposed project is directly related to how the regulatory and other participating environmental resource agencies view the potential impacts to the natural environment. Meetings with the agencies have shown that there are several environmental issues that are key to how the project is regarded. Fish passage, wetlands loss, and terrestrial habitat loss are examples of these issues. Discussions with agency representatives at meetings in 1998 and 1999 indicate that mitigative efforts could offset the overall unavoidable project impacts, but permits to construct and maintain the dam would require additional information to support the project and satisfy compliance with the Clean Water Act and the National Environmental Policy Act (NEPA). Additional detailed environmental studies and data collection activities in the project area are anticipated to be required in support of NEPA compliance and the permit application submissions.

8. RECREATION FACILITIES

Proposed New Recreation Facilities

There must be a basic level of investment in additional recreation facilities to guarantee the success of the inflatable dam project and be able to recover the operation, maintenance, and replacement cost of the project. Any recreation facilities constructed should also be consistent with existing planning efforts including the master plans for the Riverfront Parks and Riverbend Park. Fortunately, provision for the inflatable dam has already been incorporated into aspects of these master plans. In order to make the inflatable dam functional, construction of the following facilities, as a minimum, is recommended:

1. **Boat launch facility with small dock at Nesbitt Park:** At least one multi-lane boat launch facility is needed. The existing boat launch ramp at Nesbitt Park should be improved to accommodate two lanes with a small permanent concrete dock along the shoreline and several removable floating docks projecting from the shore. Small fishing boats, rowing sculls, and other small watercraft could be launched from this location. Rental boats could also be launched here.
2. **Restrooms at Nesbitt Park:** Restrooms need to be provided as close as possible to the proposed boat launch at Nesbitt Park. As recommended in the Riverfront Parks Master Plan, these facilities should be permanent and easily accessible to patrons at Nesbitt Park. This will likely require construction on the riverside of the levee which is prone to flooding.
3. **Parking at Nesbitt Park:** A parking area is needed at Nesbitt Park to accommodate vehicles launching boats. The parking spaces should be suitable for vehicles with boat trailers. The parking area at the boat launch should be able to accommodate at least 50 vehicles with trailers.
4. **Parking near the damsite and access for shoreline fishing:** A smaller parking lot should be provided near the dam for shoreline fishermen wanting to take advantage of the favorable fishing conditions at the toe of the dam. The parking lot could be located on the landside of the levee, and pedestrian access could be gained using the new levee ramp at the dam site.
5. **Canoe and kayak portage at dam site:** The proposed dam will present an obstacle for canoeists and kayakers. A convenient portage will need to be provided around the dam. The portage should consist of a well-groomed path with a mild slopes around the abutment of the dam.

Master Riverfront Development Plan

Developing the full potential of the proposed recreation pool would involve full implementation of the master plans for the entire riverfront area from the dam to the upstream limit of the impoundment. This could include engineered breaches in the levee along River Commons Park to improve access to the river, a large amphitheater near the Market Street Bridge, riverward walks and

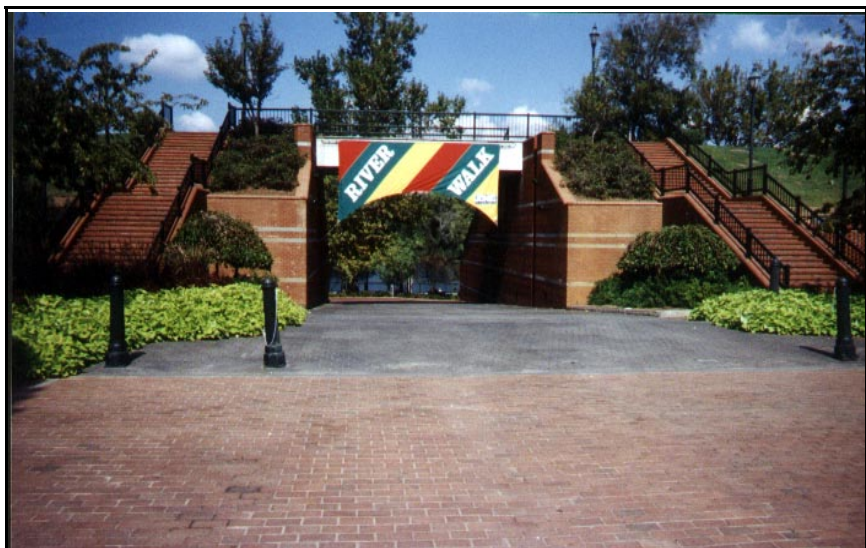


Figure 17 Photo showing typical "breach" through the levee providing passage to the river in Augusta, Georgia.

outdoor dining, restaurants and shops built on top of the levees, flags and banners along the waterfront, destination points along the impoundment, additional boat launching facilities and marinas, calming of the vehicular traffic on River Street to provide a setting for events and shoppers, and connected trails and bikeways for recreationists. The former Woolworth's building, the Sterling Hotel Annex, or some other riverfront location could be used for the proposed River Landing Project with an IMAX Theater for entertainment, education facilities and shops. Water taxis and dinner cruises could also be offered. Well-planned annual recreation activities and festivals could include sculling competitions between Kings College and Wilkes University, youth programs, barge concerts, environmental education programs, and other outdoor events.



Figure 18 Riverwalk along marina in Augusta, Georgia.



Figure 19 Riverwalk along toe of levee in Augusta, Georgia.

Full development of the waterfront as discussed above would be part of a carefully executed long-term development plan. The success of such a plan would depend on the cooperation of local governments and authorities. Park administration, planning and coordination would require a new management arrangement and structure.

9. PUBLIC INVOLVEMENT AND AGENCY COORDINATION

Providing study information to the public and regulatory agencies was a significant and important part of the feasibility study. This was accomplished through public meetings at study milestones, meetings with community leaders and regulatory agencies, a project web site, a television interview, participation in a waterfront visioning workshop, the solicitation of opinions by mailing questionnaires to local businesses, and by providing information for newspaper articles. The purpose of the public involvement and agency coordination was to communicate study goals and findings, and to solicit input to ascertain concerns, interests, and views regarding the proposed project.

The current regulatory climate for constructing new dams, regardless of their benefits and need, is not favorable. Representatives of the regulatory agencies that are influential in the permit process and private groups have voiced their concerns, and may oppose the dam. Water quality issues, the American shad migration, migratory bird habitat, and wetlands within the vicinity of the dam are the primary concerns of resource agency officials and the general public.

10. ECONOMIC AND FINANCIAL ANALYSIS

The purpose of the economic and financial analysis of a proposed inflatable dam in the Wilkes-Barre area is two-fold: (1) to evaluate how such a project would affect the economy of the region, and (2) to determine if the project would be financially self-sufficient, that is, be able to pay, with new revenue sources from the project, the annual costs of the inflatable dam's operation, maintenance, and subsequent replacement.

ANALYSIS OBJECTIVES:

- Evaluate Effect on the Economy
 - Determine Self-sufficiency of the Project
-

The economic success of an inflatable dam project will depend to a great extent on two primary factors: (1) How many additional people will be drawn to the seasonal lake?, and (2) How much will they spend? The benefits of these visitors can then be compared to the costs to determine a benefit/cost ratio. If the benefit/cost ratio is greater than one, the project is a good investment, since a dollar spent creates more than a dollar of benefits.

In addition, the economic impacts of direct spending by visitors can be assessed to determine the total economic impacts, including indirect and induced effects at the State, and County/local levels. The increased visitor spending produces additional economic effects, including jobs, earnings (wages), and tax revenues for the area.

In a similar way, the financial analysis, which is focused on paying the annual operation, maintenance and replacement costs, is also dependent upon the number of users, and how much they spend, since a direct user charge would be one way to pay for the annual costs. The greater the number of users, the less each would have to pay. How much visitors would be willing to spend is also a factor in various methods of recovering the costs, such as special charges on businesses in a "riverfront district". As a result, the more money people spend, the better the opportunity to absorb the annual project costs.

In order to determine the economic impacts and evaluate the financial requirements of the proposed inflatable dam, two (2) options for riverfront development were considered. In addition to a "No-Action Plan" (Option 1) with an open, flowing river, two inflatable dam options were considered. The major difference between the inflatable dam options is that Option 2 is low-key and emphasizes a limited recreational setting, a minimal step up from Option 1, while Option 3 provides more recreation facilities, and a starting point for an economic revitalization of the downtown Wilkes-Barre and Kingston areas.

An inflatable dam will provide an opportunity for economic growth in the Wilkes-Barre area. The seasonal lake will provide direct benefits to Wilkes-Barre and Luzerne County by attracting an additional 200,000 (Option 2) and 400,000 (Option 3) visitors to the area. These are estimates of the unmet, additional or "pent up demand" for public recreation in the area.

The Luzerne County area is described by Pennsylvania's Recreation Plan 1991-1997 as deficient, since it has the second lowest activity level of the State's ten regions. The Recreation Plan also

states that water-oriented recreation facilities in Region 3 of the Pennsylvania Recreation Plan are “uneven”, since the abundance of facilities is in the eastern Poconos portion of the region, and not in Luzerne County.

Other factors are, of course, important to the economic analysis. The study reviewed the trends in population and economic activity in the region and the very disturbing problem of out-migration of young people and an aging population. The study also evaluated the impacts of long-term flooding and the risk impacts that the floods have on economic growth and investments. Deficiencies in recreation and tourism opportunities were also studied. Another important facet of the study was a review of existing riverfront and recreation lake projects to see how they work in order to provide economic benefits to a community or region.

Not only would additional recreation facilities lessen the existing recreational deficit in the Wyoming Valley, but recreation and tourism would provide greater opportunities for growth than the traditional businesses in the area. Luzerne County already benefits from about \$0.5 billion a year (1997) in tourist spending and is moving up in rank as one of the top ten (10) counties in Pennsylvania for tourist spending.

Visitors to the seasonal lake that would be created by an inflatable dam are assumed to increase in numbers gradually, and to spend more money on the broader attractions of Option 3. They will come, primarily, from the immediate area, within 30 miles of the riverfront, and also from the larger area that extends as far as 2-hours away by car, and which includes over 13 million people. The expenditures by these visitors will produce permanent sales, earnings, jobs, and tax revenues to local and State governments. Annually, these direct expenditures will produce additional indirect and induced economic impacts to the local and State economies, respectively, as suppliers provide inputs to the directly affected firms, and as wages are spent on goods and services in the area.

Economic benefits to the region will come during the construction phase of the project and continue over the future years of operations by increasing sales, earnings, jobs and tax revenues. The construction of the dam will produce temporary benefits to the region. Long-term operations will produce permanent benefits. Regional Impact Multipliers (RIMS), developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), when applied to the direct expenditures for construction and to visitor spending, provide estimates of the direct, indirect (supplier impacts) and induced (consumer re-circulation of wages in the area) impacts during the temporary construction period and annually over the lifetime of the project.

During construction, temporary economic benefits at the County level will be about \$13.9 million for Option 2, and slightly more (\$15.3 million) for Option 3, with a proposed marina and floating docks. Employment will increase by about 100 jobs over the construction period, and County and local tax revenues will increase by over \$1 million for either option.

TEMPORARY CONSTRUCTION IMPACTS:

- Option 2 Sales: \$13.9 Million
 - Option 3 Sales: \$15.3 Million
 - Both about 100 Temporary Jobs
 - Both about \$1 Million in Tax Revenues
-

During operations, economic benefits will increase gradually due to more visitors and additional spending. These permanent benefits will impact the State/regional, County/local levels, with sales, earnings, employment and tax revenues. For Option 2, the ultimate effect of 200,000 visitors per year will be \$2.4 million and \$1.4 million, respectively in additional sales, at the State (including the County and local areas) and the County/local level. The final buildout of 200,000 visitors produces an additional eighteen (18) jobs and \$200,000 per year in County and local tax revenues.

PERMANENT IMPACTS (OPTION 2):

- 200,000 Visitors Annually
 - \$2.4 Million Additional Annual State Sales
 - \$1.4 Million Additional Annual County Sales
 - 18 New Jobs
 - \$0.2 Million Additional Annual Tax Revenues
 - Local Costs Benefit Cost Ratio 3.4:1
-

Option 3, with more visitors and higher levels of spending per visitor, will produce an estimated \$41.8 million in annual spending at the State level (again including County and local), and \$24.5 million at the County/local level. At the County level, an estimated 320 permanent jobs will be created, and tax revenues will increase by \$3.4 million per year.

PERMANENT IMPACTS (OPTION 3):

- 400,000 Visitors Annually
 - \$41.8 Million Additional Annual State Sales
 - \$24.5 Million Additional Annual County Sales
 - 320 New Jobs
 - \$3.4 Million Additional Annual Tax Revenues
 - Local Costs Benefit Cost Ratio 33:1
-

A benefit/cost analysis was used to assess and compare the two inflatable dam options. A very conservative approach was used to calculate the benefit/cost ratios (BCRs), that tended to down - play benefits and emphasize costs.

Based on estimated local annual expenditures to operate, maintain and replace the dam components in 20 years, a benefit/cost ratio was calculated for each option. For Option 2, a benefit/cost ratio of 3.4:1 was calculated. This assumes a 20-year project life, an 8 percent discount rate, and includes only economic benefits from visitors and modest spending (but not from construction and possible riverfront events such as festivals). The annual cost was estimated at \$338,350 per year which was discounted to a present value and compared with the discounted present value of the annual benefits which gradually increase over six years after construction is completed until 200,000 visitors is attained. This build-out of visitor usage and spending is assumed to be maintained through the remainder of the 20-year analysis period.

For Option 3, a slower buildout achieves 400,000 visitors over twelve (12) years. The benefit/cost ratio is much higher at 33:1 (about 10 times the impact of Option 2). This analysis assumes a similar 20-year project life and analysis period, as well as an 8 percent discount rate, and no benefits from the construction activity, as were assumed for Option 2, but spending from visitors is higher. The annual cost, however, for Option 3 was estimated at \$437,900 for local operation, maintenance

and replacement. This additional cost for Option 3 represents personnel needs and expenses associated with a marina and docks.

One output of the economic impact analysis was the increase in County/local tax revenues cited above that would be produced by the direct, indirect and induced economic impacts. This was used as a measure of new revenues that could be used for covering costs. This analysis indicates a shortfall in revenue for Option 2, based on the estimated \$200,000 per year of new tax revenues (full 200,000 visitation) versus annual operation, maintenance and replacement costs of \$338,350 per year. Option 3 easily produces new tax revenues from this new economic activity, and yields about \$3.4 million per year in additional tax revenues versus the estimated annual costs of \$437,900.

A project like this one will rely on both public and private investment sources. Investors will require leadership, a prepared development plan, a strategy and schedule for financing and development, as well as specified zoning and operating responsibilities and policies. In addition, new institutional arrangements will be required to successfully plan and implement the project. A task force is recommended for overseeing the development of an integrated riverfront and downtown development plan. It would also be responsible for developing operating procedures, and defining the roles and jurisdictions of participating public and private stake holders. A single point of authority, such as a *Riverfront Authority*, will be essential for control during the development and operations phase of the project.

A survey of business owners was used to elicit opinions about the economy of the Luzerne County area and the potential for a riverfront project to benefit the region. The responses to the questionnaire were overwhelmingly in favor of a quality riverfront development project. Option 3, with an inflatable dam and seasonal lake, was preferred by 83 percent of the respondents, although only 68 percent felt they would benefit directly. Between 60 and 90 percent of the responses to specific attributes for the riverfront favored an area with shops, cafes, marinas, boat and bicycle rentals, river taxis and other similar features.



Figure 20 Option 3 provides more recreation facilities and a starting point for economic revitalization of the downtown Wilkes-Barre and Kingston areas.

The questionnaire also asked questions about methods for recovering costs of annual operations and maintenance. With the exception of local property tax increases, which were soundly rejected, all other methods of fees, charges and special assessments on a "marina district" were supported.

If the objective is to create additional sales, jobs, income, and tax revenues for the County and local communities, Option 3 is, by far, the better project, and it is supported by businesses in the area. This project will also easily produce new revenue sources that can cover annual operating costs with no existing tax revenues being used.

11. SUMMARY OF BASIC PROJECT COSTS (OPTION 2)

Project Construction Costs

The estimated total project construction costs are presented in Table 1. The cost estimates presented in Table 1 are intended to be comprehensive and include foreseeable expenses that could be incurred to obtain permits and construct the recommended inflatable dam and recreation facilities. Included in the total project construction cost is the cost for this feasibility study, anticipated National Environmental Policy Act (NEPA) investigations required to obtain the construction permit, final design, land and right-of-way acquisition, construction of the dam, mitigation of rim impacts, and the construction of recreation facilities.

Table 1
Project Construction Cost Estimate with Recreation Facilities
 (April 2000 Price Level)

| Description | Estimated Cost |
|---|---------------------|
| Feasibility Study (Current Study) | \$520,000 |
| NEPA Investigations and Permit Applications | \$700,000 |
| Final Design | \$950,000 |
| Land for Control Building and Access Road | \$150,000 |
| Construction of Dam and Appurtenant Works | \$9,920,000 |
| Mitigation of Rim Impacts | \$585,000 |
| Recreation Facilities (Option 2) | \$730,000 |
| Construction Management | \$430,000 |
| Total Project Cost | \$13,985,000 |

The total construction cost for the project of \$13,985,000 includes contingencies at 15 percent. The 15 percent contingency factor was judged to be appropriate for the feasibility phase, given the level of detail at which the study was conducted.

Annual Operation, Maintenance, and Replacement Costs

Annual operation, maintenance and replacement costs estimated for the dam are presented in Table 2. The annual costs include costs for operating the new river gaging station downstream of the dam, utilities for the dam and recreation facilities, operation and maintenance of the new facilities, the fish passage monitoring program, a fund for the replacement of the rubber dam after its service life has expired, and a fund for repair of the dam and recreation facilities due to flood damage.

Table 2
Estimated Annual Operation, Maintenance and Replacement Costs
(April 2000 Price Level)

| Item Description | Annual Cost |
|--|------------------|
| Annual Operation and Maintenance Costs | |
| USGS Gaging Station | \$5,500 |
| Utilities | \$3,000 |
| Operation & Maintenance of Dam & Recreation Facilities | \$50,000 |
| Fish Passage Monitoring Program | \$50,000 |
| Flood Damage Repairs to Dam & Recreation Facilities | \$10,000 |
| Total Annual Operation & Maintenance Costs | \$118,500 |
| Rubber Dam Replacement Fund | \$220,000 |
| Total Annual Costs | \$338,500 |

The most significant annual cost in Table 2 is the fund for replacement of the components of the inflatable dam. The annual replacement cost was computed assuming a conservatively short 20-year service life.

Based on input from various regulatory agencies responsible for the restoration of migratory fish to the Susquehanna River, the fish passage monitoring program will be a requirement for the proposed project. The fish passage monitoring program may be discontinued or scaled back after several years once it is clearly demonstrated that the fish passage facility effectively passes migratory fish.

12. SUMMARY AND RECOMMENDATIONS

Summary

The Corps' General Design Memorandum for the Wyoming Valley Levee Raising Project provides the following general directive for the inflatable dam project:

“The inflatable dam would provide economic development potential for the Wyoming Valley region and improve public access to the river. In addition, the inclusion of the inflatable dam will mitigate the intangible negative socio-economic impacts caused by the levee raising project.”

Findings of this study indicate that the proposed inflatable dam is economically and financially feasible, compatible with the existing flood control project, and poses no overriding threat of significant adverse environmental impacts. Further, the project represents an opportunity to focus the valley’s attention on the positive attributes of the Susquehanna River and create a destination for recreation and tourism. Of the two dam options analyzed, Option 3 (the inflatable dam with significant recreational facilities and enhanced landside access) was found to best meet the Corps’ general directive for the inflatable dam project, and would maximize the County’s investment by generating the most economic development and improving public access and enjoyment of the river.

The feasibility of the inflatable dam is predicated on the assumption that the following four requirements would be addressed prior to construction of the dam project:

1. The water quality immediately upstream of the dam is improved.
2. Environmental concerns are carefully addressed.
3. A plan for riverfront development and operation is prepared and implemented.
4. Institutional arrangements for a waterfront district are established.

Without meaningful water quality improvements, the present conditions in the Susquehanna River at Wilkes-Barre limit recreational use of the proposed impoundment to those activities that do not involve significant primary contact. Activities such as swimming and waterskiing would be discouraged. Of the water quality problems identified, combined sewer overflows (CSOs) are the most significant pollutant source. Without addressing the CSO problem, the potential success of the desired water-based recreational activities and real economic development will be impaired. Discharges of untreated wastewater often contain fecal coliform and other wastewater-related microorganisms that are harmful to the health of those in primary contact with the water. In addition to the public health concerns, CSO discharges will tend to diminish public interest in all recreational uses of the project by creating unpleasant odors, unsightly algae blooms, and deposits of suspended wastes within the pool. Further, CSO discharges are known to deplete the natural level of dissolved oxygen in the pool threatening the survival of fish and other aquatic life. The success of either Option 2 (the inflatable dam with limited landside improvements) or Option 3 (the inflatable dam with significant recreational facilities and enhanced landside access), is based on the assumption that the CSO problem is corrected. The CSO problem should be corrected even if these options are not pursued.

In order for the project to realize the economic benefits envisioned under Option 3, significant public and private investment in riverfront development is needed. Public funded riverfront development should provide for improved access to the river, calming of vehicular traffic on River Street, and well-planned annual community based recreation activities and festivals. Construction of amenities such as a large riverside amphitheater near the Market Street Bridge and riverside walks would attract tourists and local residents to the project, and generate high levels of private investment, expenditures, and revenue.

A major benefit of this project would be the economic stimulation of the Wilkes-Barre and Kingston downtown areas. Since the riverfront areas surrounding the recreation pool created by the dam encompass several political jurisdictions, local cooperation and planning will be essential. The feasibility of the dam is also predicated upon the assumption that a *Riverfront District* would be established and managed by a *Riverfront Authority* with appropriate representation from local governments, businesses, and other community organizations. The designated authority would oversee the design and implementation of a comprehensive Riverfront Development Plan, coordinate zoning to protect aesthetics and compatibility of land uses, and develop a funding program to maintain the project and manage the operations in the *Riverfront District*. The desired private investments and benefits will not be fully realized without the support and cooperation of affected local governments, the business sector, and other community groups.

Four hundred questionnaires were mailed to local businesses and potential entrepreneurs interested in investing in the Wilkes-Barre area. The purpose of the questionnaire was to assess the possible effects of an inflatable dam on the regional Wyoming Valley economy, and on the businesses of the respondents. The 29 percent response rate provides a strong representation of the local business position. The vast majority (95%) of the responses came from businesses located in communities in the Wyoming Valley. Overwhelmingly, (83 %), of the respondents support Option 3 of three options presented. In addition, 86 percent, by a margin of 6:1, indicated that Option 3 would be most beneficial to a respondent's business or investment plan, and 96 percent believe the "time is right" for Wilkes-Barre to develop a "destination".

A protracted and arduous effort is anticipated to secure regulatory agency permits to construct the dam. Based on feedback from the public meetings and e-mail from the project web site, there could be considerable organized opposition to the dam from various groups. Position statements prepared by the Wyoming Valley Audubon Society, the Pennsylvania Marine Trades Association, and the Coalition of Associations for River Protection clearly state their opposition to the proposed dam. In addition, some private citizens and representatives from the regulatory agencies that are influential in the permit process have voiced their concerns, and may oppose the dam. Key issues of concern include water quality, the American Shad migration, migratory bird habitat, and the potential impacts to wetlands. In order to obtain a permit to construct the dam, these issues and others will need to be carefully addressed.

The current \$14 million funding allocated for the inflatable dam project is a fixed sum that does not accrue interest or otherwise grow to keep pace with inflation. The project construction cost estimate for Option 2, which includes construction of the inflatable dam with the basic features required to make the project functional, is just under \$14 million. Although a 15 percent contingency has been applied to this estimate, and some cost saving measures are possible, there is no allowance for inflation if construction of the inflatable dam is delayed. Additional significant public and private funding will be required to address the CSO problem, and to design and construct riverfront development features consistent with Option 3.

Recommendations

The Gannett Fleming Study Team believes the inflatable dam project represents a unique opportunity to focus the valley's attention on the positive attributes of the Susquehanna River and

create a destination for recreation and tourism. The dam and resulting recreation pool would be a vital component of a larger development that links and expands the existing parks and economic centers to the riverfront. Significant economic benefits can be expected if the project is carefully planned and implemented. Since the project funding is intended as mitigation for socioeconomic losses from the levee raising project and to improve public access to the river, it is recommended that the County proceed with the construction of the inflatable dam as it relates to Option 3. Option 3 would clearly produce the greatest economic return, provide the most economic benefits on the County's investment, and guarantee the success of the project. In addition, the project will be self sufficient and the added economic activity will produce additional revenues that could be used to pay for the annual operation and maintenance costs.

Although the dam is a critical component of the envisioned riverfront development, the study team believes that several important steps should be taken before the dam is constructed. These steps include creating a *Riverfront District*, appointing a *Riverfront Authority*, preparing a Riverfront Development Plan, addressing the CSO problem, addressing environmental and local concerns related to the dam, and constructing the riverfront amenities to ensure the financial success of the project. To attempt to obtain a construction permit to build the inflatable dam without taking these foundational steps would jeopardize the public and private support needed for the project to go forward. Similarly, the study team recommends that the County move swiftly to create the *Riverfront District*, to appoint the *Riverfront Authority* and to complete the Riverfront Development Plan to be in a position to move forward with the construction of the dam at the earliest possible date. The CSO problem also needs to be addressed as soon as possible, independently from the riverfront development and inflatable dam project.

The Gannett Fleming Study Team recommends proceeding with the inflatable dam project with the following general approach:

- 1. Create a *Riverfront District*, Appoint a *Riverfront Authority*, and Develop a Riverfront Development Plan that Emphasizes Economic Revitalization (Option 3).** A *Riverfront District* should be established that defines and delineates the functional, geographic and jurisdictional boundaries of the riverfront project. The district should be managed by a *Riverfront Authority* with appropriate representation from local governments, businesses, and other community organizations to construct, implement and manage the project. The *Riverfront Authority* would coordinate with project stakeholders on matters concerning ownership, long-term operation, and maintenance responsibilities for the proposed dam and related recreation facilities. The *Riverfront Authority* would also develop and manage the project funding program, and oversee the design and implementation of a comprehensive Riverfront Development Plan.

The Riverfront Development Plan would be developed by a *Riverfront Task Force* appointed by the Luzerne County Flood Protection Authority, drawing from participants of the 1999 visioning workshop and reaching beyond to include a broad representation of the citizenry and local businesses. The primary purpose of the *Riverfront Task Force* would be to establish a Riverfront Development Plan. Development plans have already been prepared for many of the riverfront parks. A goal of the *Riverfront Task Force* would be to unify and connect the parks along both sides of the river in a manner that is complementary with the

proposed impoundment and recreation facilities. The plan would be developed most effectively with assistance from a consulting firm specializing in riverfront developments.

Before embarking on this process, a small delegation of the *Riverfront Task Force* and the Luzerne County Flood Protection Authority would research and directly observe similar riverfront development projects that have been incorporated into other major U.S. Army Corps of Engineers' levee projects, such as at Augusta, Georgia. The delegation should also visit other riverfront projects such as Providence, Rhode Island; Chattanooga, Tennessee; and Hartford, Connecticut. In each place, the delegation can learn about successful projects.

To ensure quality design and execution, the *Riverfront Task Force* would develop design guidelines and recommend zoning requirements for the riverfront. The plan would incorporate both short-range and long-range goals and objectives for riverfront development.

2. **Address the CSO Problem.** Improvements must be made to the existing sanitary sewer systems to reduce and possibly eliminate the CSO problem. Planning-level estimates for modifications to separate the sanitary water from storm drainage and reduce CSOs are \$40 million, however, considerable improvements can be made with relatively modest (several million dollars) expenditures. These improvements could include enforcing local ordinances to prohibit stormwater connections to sanitary sewers, modifications to key storm/sanitary interconnections and providing coarse screening of overflows. A comprehensive study should be performed to evaluate the sources and extent of the CSO problems, and to recommend and prioritize solutions to achieve specific water quality goals. Modifications should then be made to the sanitary sewer systems as recommended in the study. The CSO problem needs to be addressed independently from the riverfront development and inflatable dam project.
3. **Begin Environmental Studies.** The Luzerne County Flood Protection Authority would initiate NEPA investigations required to obtain the construction permit for the inflatable dam. Before formally proceeding with the NEPA investigations and permit process, it is recommended that any unsettled issues related to *purpose and need* and *alternatives analyses* be addressed with the regulatory and resource agencies.

A strategic planning process to better understand the issues and concerns of the regulatory agencies, and particularly the Susquehanna River Basin Commission, National Marine Fisheries Service, Pennsylvania Fish and Boat Commission, Pennsylvania Department of Natural Resources, and United States Fish and Wildlife Service should be initiated. The purpose of the strategic planning process would be to identify what, if anything, could be offered (in terms of overall project approach, design, and/or operation) to enlist these agencies as project partners.

4. **Address Local Concerns.** Hold meetings and discussions with the Wyoming Valley Audubon Society, Coalition of Associations for River Protection, Pennsylvania Trades Association and other groups currently opposed to the project, so that the project design, features and operation accommodates, as much as possible, their concerns and needs.

5. **Secure Other Sources of Project Funding.** No funding is currently in place for addressing the CSO problem or for planning and implementing the kind of riverfront development necessary to sustain the operation, maintenance, and future replacement of the inflatable dam. Since correcting the CSO problem is necessary to make the inflatable dam project feasible, it is recommended that the County explore alternate sources of funding to correct this problem in the mean time.

Potential sources of funding for correcting the CSOs include: the Pennsylvania Department of Environmental Protection, Bureau of Water Quality; Appalachian Regional Commission; US Environmental Protection Agency; Pennvest; Rural Development Administration; and the American Rivers Heritage Program.

Potential sources of funding for riverfront development include: Pennsylvania "Growing Greener" legislation (December 15, 1999) which targets funds for acid mine drainage cleanup, watershed protection and restoration, as well as parks, greenways and trails; the Federal Transportation Equity Act of the 21st Century (TEA-21), a major source of riverfront development funds in Boston, Massachusetts, and Providence, Rhode Island, which authorizes highway and highway safety improvements (if changes are made to River Street); Keystone Opportunity Zone Act (Wilkes-Barre, Pittston, Hanover, Nanticoke); the Pennsylvania Department of Community and Economic Development (Community Development Block Grant and Urban Development Action Grant programs); and innovative public/private partnership approaches. In addition to the Appalachian Regional Commission, and the American Heritage River Programs, these programs provide grants, loans, loan guarantees, tax credits and technical assistance.

6. **Reallocate Current Project Funding.** The existing \$14 million project funding appears to be designated exclusively for permitting, design, and construction of an inflatable dam with limited recreation facilities. Since the project funding is intended for facilities that mitigate the socioeconomic losses from the levee raising project and improve public access to the river, it is recommended that the Authority explore the possibility of reallocating the funds for the dam to assist and expedite efforts related to the riverfront development needed to support the dam, and to proceed with the NEPA and design work for the dam. Promotion of the inflatable dam and additional funding that would be needed to construct the dam should then be pursued in order to proceed with the inflatable dam project in an orderly fashion based upon clearly defined objectives.