



## *Questions and Answers*

### *Rehabilitation of Norwalk River Site 2 Dam*

### *Ridgefield, Connecticut*

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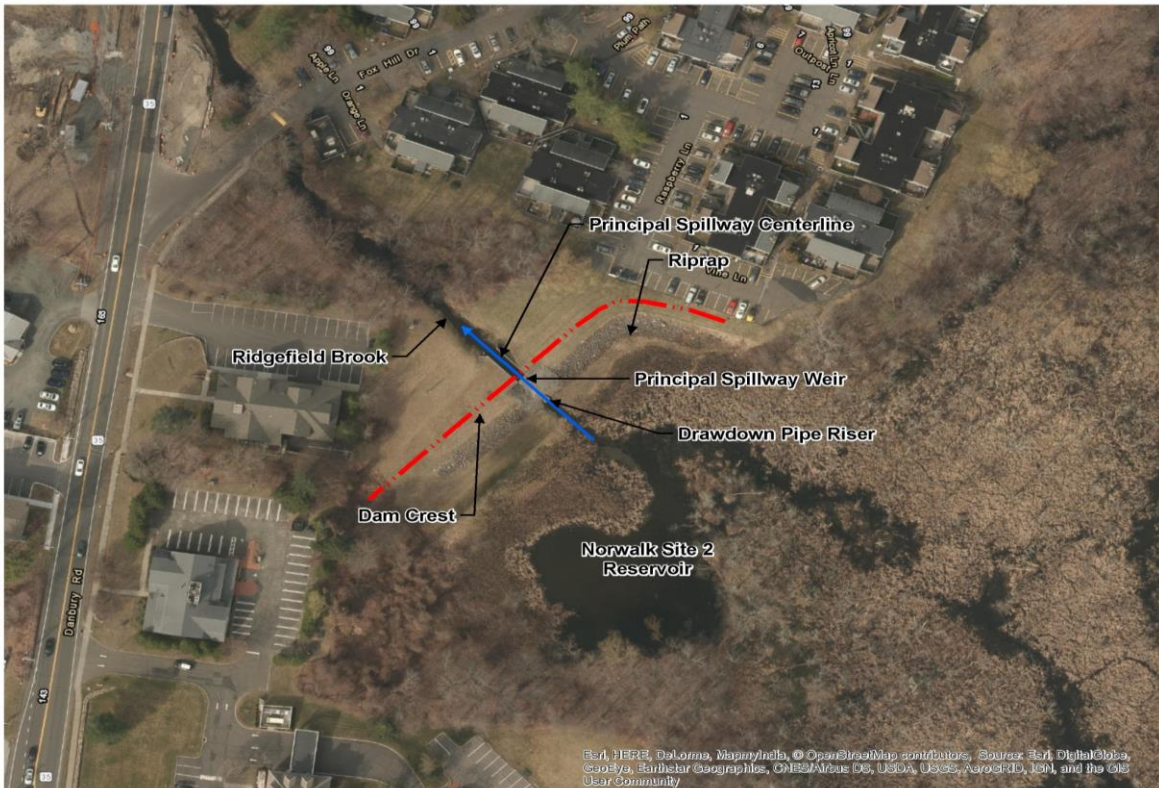
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**Background:** The original Norwalk River Watershed Work Plan was prepared, and the works of improvement were installed, including the Site 2 Dam, under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The rehabilitation of floodwater retarding structures is authorized under Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

The Work Plan was developed in 1965 and a supplemental plan was developed in 1972. At that time, the major land uses in the Norwalk River Watershed were: forest land – 12,500 acres; urban and built-up – 3,000 acres; and the remaining 4,810 acres were in homesteads, fields not yet reverted to woods, grassland, orchards and a small acreage of cropland. Since construction of the Norwalk River Site 2 Dam in 1979, the hazard from floodwater damage has increased from year to year due to increased development in the floodplain downstream of the dam and land use changes in the form of residential growth in the watershed above the dam. Based on as-built drawings, the dam provides 1,162 acre-feet of flood storage to the top of dam, and 87 acres of wetland wildlife habitat in the upstream storage area.

The Dam Safety Section of the DEEP's Bureau of Water Protection and Land Reuse is charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. The existing statutes require that permits be obtained to construct, repair or alter dams, dikes or similar structures and that existing dams, dikes and similar structures be registered and periodically inspected to assure that their continued operation and use does not constitute a hazard to life, health or property. The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies have been enacted which govern the registration, classification, and inspection of dams in Connecticut.

Figure 1 – Aerial View of the Norwalk River Site 2 Dam and Adjoining Areas



## Q. How do flood control dams work?

A. In a watershed without a dam, a flood event can be caused any time that precipitation creates more runoff than can be safely carried in the stream network. The most important function that a flood control dam does is detain water behind the dam so that flood water can be released slowly in amounts that match the capacity of the stream. Secondly, the dam traps sediment that would otherwise be transported downstream.

The main components of a flood control dam are the earthen embankment; the normal pool; the floodpool; the principal spillway; and the auxiliary spillway. The principal spillway at Site 2 is a weir and pipe that controls the day-to-day elevation of the water and provides for a controlled release of the water in the floodpool. The floodpool, which is the water storage area between the principal spillway crest and the auxiliary spillway crest, is designed to detain the water that would accumulate behind the dam in events equal to or smaller than an event with a 100-year annual recurrence interval. This storm is the event that has a one percent chance of occurring in any given year. In a bigger flood event, the water level will be higher than the crest of the auxiliary spillway and the excess water will pass safely around the dam embankment through the auxiliary spillway.

The reservoir is designed to store sediment in the area below the elevation of the lowest principal spillway inlet and to detain flood water in the area between the lowest principal spillway inlet and the crest of the auxiliary spillway. After the dam is completed, water may accumulate below the lowest principal spillway inlet to create a lake or pool. As the pool fills with sediment, the

amount of water in the pool decreases. When the sediment pool has filled to the elevation of the lowest principal spillway inlet, the pool no longer has permanent water storage, but the designed flood water detention storage is still intact. If the actual sedimentation rate is greater than the designed sedimentation rate, the sediment storage volume will be filled before the design life of the structure has been reached. The Norwalk River Dam was planned for a design sediment life of 100 years.

Figure 2 - Dam Embankment with Inlets to the Left



**Q. How is the Norwalk River Site 2 Dam constructed and how does it work?**

**A.** Site 2 is a multi-purpose dam for floodwater retention and wetland wildlife enhancement. It is located at the outlet of Great Swamp. The dam system consists of three major elements; an embankment with a total length of 440 feet, a straight inlet drop principal spillway also serving as the auxiliary spillway, and a low flow outlet pipe with a weir board riser at the entrance. The principal spillway extends through the top of the embankment dividing it into two parts. The weir board riser can be used to vary the pool depth behind the dam. The dam is about 10 feet high and with a 10 foot top width.

The embankment consists of a two-zone compacted earth fill with a cutoff into a dense silt and fine sand foundation. The upstream and downstream slopes of the embankments are 3:1. An 18-inch thick layer of riprap has been placed on the upstream slope to within 3 feet of the top of dam. There is a 4-foot wide trench drain with a 6-inch perforated pipe at the toe of the embankment and adjacent to the principal spillway side walls on either side of the principal spillway. These drains are connected with a tee that exits on the sidewalls of the stilling basin section of the principal spillway. A two-stage filter surrounds the drains.

The centerline of the principal spillway is located approximately 180 feet from the left abutment of the embankment. The spillway is a straight drop spillway structure with a weir depth of 4.8

feet and a crest length of 10 feet. The entrance to the weir is a grouted riprap level trapezoidal section with a 12-foot bottom width and 2:1 side slopes. The stilling basin after the drop is 35 feet long. The sidewalls of the stilling basin are 9.8 feet high. At the exit of the stilling basin there are 8.5-foot long wingwalls at a 45° angle. The 10-foot long grouted riprap outlet channel joins the natural stream channel.

Figure 3 - Riser for Low Flow Pipe



Figure 4 - Grouted Riprap Approach Channel to Straight Inlet Drop Principal Spillway



Figure 5 - Principal Spillway Outlet Looking Upstream



**Q. What is wrong with the dam?**

**A.** The hazard classification of the dam changed from significant hazard to high hazard. This change in hazard classification means that the dam must be upgraded to meet more stringent performance criteria than those required when the dam was built. The capacity must be sufficient to pass the volume of water associated with the Probable Maximum Precipitation (PMP) without breaching the dam embankment.

A breach would cause a very quick release of all of the water impounded behind the dam. Little or no warning would be available to people downstream. There are many roads and bridges downstream of the dam. The auxiliary spillway does not meet current NRCS standards.

**Q. What does “hazard class” mean?**

**A.** All impounding structures are grouped into one of three hazard classifications. For the purposes of this classification, hazards pertain to potential loss of human life or damage to the property of others downstream from the impounding structure in the event of failure or faulty operation of the impounding structure or appurtenant facilities.

Hazard potential classifications are:

1. High Hazard Potential: an impounding structure failure will cause probable loss of human life or serious economic damage.
2. Significant Hazard Potential: an impounding structure failure may cause the loss of human life or appreciable economic damage.
3. Low Hazard Potential: an impounding structure failure would result in no expected loss of human life and would cause no more than minimal economic damage.

The performance criteria for a dam are based upon the hazard class. A high hazard dam must be able to safely pass the volume of water associated with an event that hydrologists call the “Probable Maximum Precipitation” or “PMP”.

**Q. Who is responsible for the upkeep of this dam?**

**A.** The dam is owned, operated, and maintained by the Connecticut Department of Energy and Environmental Protection (DEEP).

**Q. Is the dam structurally safe?**

**A.** The dam was designed to last 100 years. By all visual appearances, it is in good physical condition. The earth embankment is stable and the combined principal and auxiliary spillway is functioning appropriately. The internal integrity of the a low flow outlet pipe and the weir board riser that controls the water level of the pool upstream of the dam appear to be in good condition. An assessment of the overall integrity of the structural components will be needed as we move forward with rehabilitation to assure that the dam continues to provide flood control for at least the next 50 years.

Figure 6 – Fox Hill Drive is Immediately Downstream of the Dam



Figure 7 – Route 35 (Danbury Road) Bridge is Downstream of the Dam



**Q. What has the State done about the dam?**

A. Every dam regulated by the State is required to be certified as safe in accordance with the Connecticut Dam Safety Regulations. Because the auxiliary spillway does not have sufficient capacity to convey the PMP event without overtopping the earthen dam embankment, likely causing a breach, the State is requiring that the dam be rehabilitated.

**Q. What is the role of the federal government?**

A. The role of the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) in rehabilitation of our nation's aging watershed dam infrastructure is spelled out by Public Law 83-566 (PL-566), as supplemented by PL 106-472, otherwise known as "The Small Watershed Rehabilitation Amendments of 2000". Since 1948, federal assistance through NRCS has been used to install more than 11,000 small dams across the country to provide public benefits such as flood protection, recreation, municipal and industrial water supplies, etc. These dams are part of our nation's public infrastructure just as roads and bridges are, and like roads and bridges, they require annual maintenance and eventual replacement as they reach the end of their designed useful life. Congress recognized that the nation has a large number of small watershed dams, such as Norwalk River Site 2, that need rehabilitation.

**Q. What does the federal dam rehabilitation legislation actually require for dams to be rehabilitated?**

A. Anticipating a growing need to rehabilitate these dams, Congress passed legislation in November of 2000 to allow the NRCS to work with local owners of dams built under PL-566 to determine the technical needs and feasibility of rehabilitating our aging dams. Scientific understanding of the functions and values of these dams, and the associated environmental issues and concerns have increased substantially since the 1950's, 60's and 70's when most of the nation's small dams were constructed. These laws are designed to: 1) better protect public safety and the environment; 2) assure sound technology is used; 3) assure economic justification and 4) make sure that federal projects have public support. Specifically, Congress mandated that federal technical and financial assistance be provided only:

- Where there is local leadership and decision making, typically led by a local watershed committee with full public participation by all affected individuals and parties; and
- Within the context of the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), Section 7 of the Endangered Species Act, and the Economic and Environmental Principles and Guidelines for Water Related Land Resources Implementation Studies (P&G).

NEPA requires that environmental considerations be central to any federal investment that alters the landscape and our natural resources. NHPA requires that historic preservation (cultural and historic resources) be considered, and appropriately dealt with, whenever federal funds result in physical changes on the landscape. Section 7 of the Endangered Species Act, directs all Federal agencies to ensure that any action they authorize, fund, or carry-out does not jeopardize the continued existence of an endangered or threatened species



or designated or proposed critical habitat. P&G, like NEPA, addresses environmental evaluation procedures and also requires that the economic and social costs and benefits of any federal action be identified, accounted for, and used to contribute to the public investment decision making process.

Therefore, dam rehabilitation supported by the NRCS requires planning and evaluation in view of identified social, economic, historic and environmental considerations. The end objective of this process is to only provide federal funds to projects that are technically and environmentally sound, socially acceptable, economically justified, and supported by grass-roots democratic processes.

### **Q. What does the NRCS planning process require?**

**A.** The federal statute stipulates:

- that there must be a local sponsor who supports and leads the planning process;
- that NRCS technical expertise serve the locally-led planning process to arrive at any recommended works of improvement; and
- that the evaluation of alternatives includes:
  - 1) No action (termed the “future without federal project condition”, i.e., what happens if the federal government doesn’t do anything);
  - 2) Decommissioning (removal of the dam through a controlled breach followed by stabilization of the site);
  - 3) Rehabilitation of the existing dam to establish a minimum projected useful life of 50 years (this usually involves consideration of several technically feasible solutions); and
  - 4) Identification of an alternative that meets National Economic Development criteria (economic defensibility whereby an alternative is identified as maximizing net monetary benefits; this may be one of the other alternatives or a combination of several).

When applicable, non-structural alternatives will be evaluated. These include relocation and/or flood-proofing of “at-risk” inhabited dwellings and other properties in the downstream floodplain to prevent possible loss of life and property should the dam breach. (“Non-structural” is a term that refers to not repairing the dam, but instead taking actions, such as elevating buildings, homes, roads, etc., and building small floodwalls around buildings to reduce future damages

### **Q. What does the planning process mean to the local people?**

**A.** The planning process allows for public participation and input into the planning of the dam rehabilitation project. The local sponsor must initiate the process by applying for federal assistance. The sponsor (Connecticut DEEP) made application in July 2014. The sponsor must also commit to supporting, leading and guiding the planning process. The sponsor must then support the process in practical terms by facilitating communication with the local

residents, including hosting public information, education and participation meetings; by hosting environmental scoping meetings<sup>1</sup>; by providing guidance on what the local community desires to have happen; and by obtaining landowner permissions to allow access to private property for data gathering.

**Q. What activities will need to be conducted in the watershed to complete the plan?**

**A.** Planning for dam rehabilitation will involve a number of different actions. The local sponsor and general public should be willing to facilitate all needed investigations and analyses. NRCS staff and their contractors will be doing most of the on-site investigations and studies. The following investigations and analyses will be needed:

- Sediment survey;
- Analysis of the rainfall and runoff characteristics and the stream hydraulics;
- Investigations and analysis of the dam’s existing components, layout, and size for conformance to NRCS and State design criteria.
- Surveys of the downstream floodplain and the assets (homes, businesses, roads and bridges, and utilities that are in harm’s way);
- Survey of upstream properties that may be in harm’s way;
- Analysis of the expected flooding damages that would likely occur in the future;
- An assessment of the in-stream and floodpool plants and animals, and water quality, as well as the associated wetlands and upland areas immediately adjacent to the floodpool and stream and below the dam; and
- Analysis of all required alternatives as well as any other alternatives identified in the planning process.

**Q. What is the planning and implementation process?**

**A.** For a typical dam rehabilitation project, the process should generally proceed as follows:

**The Water Resource Planning Process**

- 1) An application for federal assistance is made (already completed).
- 2) Upon authorization to act on the request, the NRCS initiates discussions on how to proceed (already underway).
- 3) Contacts are made with local landowners to get their permission to conduct the needed surveys and investigations.
- 4) A scoping meeting is held to solicit the knowledge and ideas of other interested federal, state and local agencies, university scientists, etc. (already completed).

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<sup>1</sup> Scoping is a federal planning term used to describe identification of relevant issues and concerns.

- 5) Public meetings are held.
- 6) The needed inventories, investigations, and analyses are initiated and completed.
- 7) Additional public meetings are held to inform the public of what has been learned and again solicit the ideas of the local leaders and members of the public.
- 8) A draft of a watershed supplement to the original Norwalk River “Work Plan” is prepared that contains the technical alternatives along with their associated economic, social, and environmental implications.
- 9) An interagency and public review of the watershed supplement is carried-out. Comments are accepted and incorporated, as deemed appropriate.
- 10) The final watershed supplement is prepared and signed by the local Sponsor and NRCS State Conservationist.
- 11) The supplement is submitted to NRCS headquarters for authorization to implement the selected plan as soon as funds are available.
- 12) A design for the rehabilitation project is prepared.
- 13) When Congress and the local sponsor provide the needed construction funds, a detailed project agreement is developed between the NRCS and the sponsor. Preparation of a new Operation and Maintenance (O&M) Agreement and an Emergency Action Plan are also required prior to construction.
- 14) All necessary State and/or Federal environmental and related permits are obtained by the local sponsor.
- 15) The local sponsor will obtain any required easements prior to construction.
- 16) The competitive bidding process is used to select a construction firm.
- 17) The contractor performs the work under either a local contract administered by DEEP or a federal contract administered by NRCS.
- 18) After completion of the rehabilitation, annual O&M is carried out, and annual safety inspections are made, by the local sponsor.

**Q. How long does the planning process usually take?**

**A.** Typically 18 months to 2 years.

**Q. How long does the design phase usually take?**

**A.** Typically 6-12 months are required from preparing a request for proposals to completion of the design.

**Q. How long does the permitting phase take usually?**

**A.** Getting the needed permits usually takes 2-4 months.

**Q. How long does it take to actually implement a recommended solution?**

A. The length of time it actually takes to perform the work depends upon the amount and complexity of the work undertaken. For example, relocation of properties out of the floodplain is a vastly different process than repair of an existing dam. Each alternative can also have unforeseen obstacles pop up that must be resolved. Assuming construction is the selected alternative, the entire implementation process from start to finish shouldn't take more than one year. This also assumes good weather conditions for construction.

**Q. How does the federal cost/sharing work?**

A. Federal funds for dam rehabilitation are authorized for up to 65% of the total costs of a project, but will not exceed 100% of the actual construction costs incurred for rehabilitation. The local sponsor is responsible for the remaining 35%. Any nonfederal funds can be used as part of the local cost-share. Credits towards the sponsor's 35% share of the total cost include acquisition of land rights and valuation of in-kind contributions such as services provided by local staff. The cost of environmental permits will solely be the responsibility of the local sponsor. NRCS pays 100% of the technical assistance costs for planning and design and for all assistance provided by the agency.

**Q. Will you have to dredge the pool?**

A. No. For the purpose of the rehabilitation program, NRCS must ensure that there is a minimum future life of 50 years. Even though the sediment survey has not been completed yet, there appears to be adequate sediment storage currently in the upstream pool.

**Q. Will you have to drain the pool?**

A. We don't know yet. During the planning process, NRCS has to evaluate all of the components of the dam to be sure that they will last for the life of the rehabilitated dam. Most of the parts of the dam are in good shape. However, the final decision cannot be made until the evaluation is complete.

**Q. Rehabilitation seems to be a foregone conclusion. Are there any other choices?**

A. If the dam is not rehabilitated to meet the current safety standards, the only other choice would be to remove it in its entirety. This would reduce the threat to loss of life from a dam breach but could increase the flooding caused by fairly common rainfall events. Downstream flooding would occur more frequently and there would be a loss of wetland wildlife enhancement area.

**Final Comments: At the end of the dam rehabilitation planning and implementation process:**

- 1) The environmental, social and economic benefits of the end result should serve the public interests for at least the next 50 years.
- 2) The local sponsor, and public in general, should feel that the process worked effectively and responsibly to meet their needs; and
- 3) The entire process should have been conducted in a professional and open manner, supportive of our mutual values for fair and democratic public procedures.

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