

# Gilboa Dam Reconstruction

## Project Summary Contracts CAT-212B and CAT-212C

### Joint Permit Application USACE Section 404 Permit & NYSDEC Protection of Waters

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# 1 INTRODUCTION AND PROJECT BACKGROUND

## 1.1 INTRODUCTION AND NEED FOR THE PROPOSED PROJECT

The Gilboa Dam (Dam), part of New York City's Catskill Water Supply System, is located within Schoharie County at the northern point of the Schoharie Reservoir (Reservoir). The Dam, was constructed between 1919 and 1927, created the Schoharie Reservoir impoundment which is a key component of the City's Water Supply System and was built exclusively for the purpose of supplying water to New York City (see [Figure 1-New York City Water Supply System](#)). The Dam is a stair-stepped gravity cyclopean<sup>1</sup> concrete design with a stone masonry Spillway and rolled Earthfill Embankment with a concrete core wall. After nearly 80 years of service, the Dam and its appurtenances started to show signs of deterioration and needed reconstruction to extend their service life and to meet current New York State Department of Environmental Conservation (NYSDEC) dam safety guidelines.

In November 2005, engineering analyses indicated that the structural stability of the Dam's Spillway did not meet NYSDEC dam safety guidelines for existing concrete dams and posed a potential hazard to downstream communities during an extreme flood event. In response, the NYCDEP issued a declaration of emergency for Gilboa Dam and Schoharie Reservoir and installed post-tensioned anchors through the Dam's structure to the underlying bedrock, along with several remedial emergency measures. The anchor installation was a component of the original general reconstruction project proposed for the Dam, but was expedited under an emergency authorization to increase the sliding safety factor<sup>2</sup> to a minimum of 1.25 for a flood event equivalent to one half of the Probable Maximum Flood (PMF<sup>3</sup>). The remaining Dam reconstruction work is now focused on addressing the deterioration of the stone façade, improving the Dam's long term hydraulic performance and providing a functioning reservoir drain through the installation of a new Low Level Outlet (LLO). Upon completion of the remaining proposed reconstruction work, the Gilboa Dam and Schoharie Reservoir would be in compliance with the current NYSDEC dam safety guidelines and ensure their continued long-term reliability as part of the New York City Water Supply System.

## 1.2 AUTHORITY

The proposed project is classified as a Type I action; it effectively falls under 6 NYCRR Part 617.4(b)(6)(i) because the project "...involves the physical alteration of 10 acres". Due to the magnitude of the reconstruction activities (i.e., reconstruction schedule and public safety issues) as well as the sensitive character of the project study areas (i.e., historic sensitivity and natural resources) the NYCDEP conducted an assessment of the proposed construction activities. This included an evaluation of potential environmental impacts to the natural environment and the surrounding community.

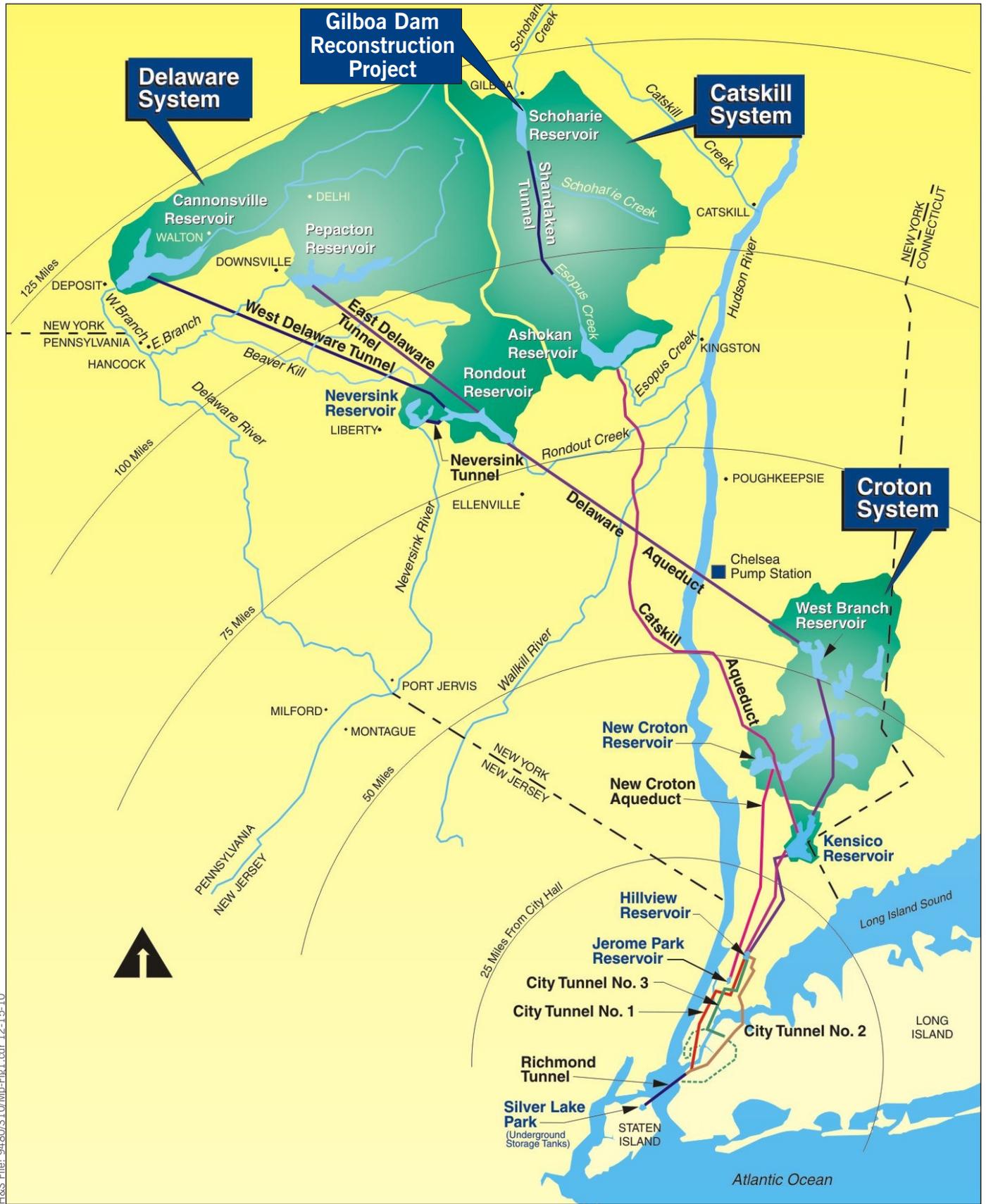
The environmental assessment for the Dam reconstruction project was prepared in accordance with the New York City Environmental Quality Review (CEQR) process as set forth in Executive Order 91 of 1977 and its amendments creating the Rules of Procedure for CEQR, Article 8 of the Environmental Conservation Law (Section 8-0113) establishing the New York State Environmental Quality Review Act (SEQRA) and its regulations as set forth in 6NYCRR Part 617, and the State Environmental Review Process (SERP) as required by the State Revolving Loan Fund Program. The NYCDEP assumed lead agency to conduct an environmental assessment of the Dam reconstruction and published the environmental assessment for the project on July 11, 2008. The NYCDEP determined that the proposed action would not have a significant effect on the environment and issued a Negative Declaration to that effect on October 10, 2008.

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<sup>1</sup> Cyclopean concrete is mass concrete in which large stones (approximately 100 lbs or more) are placed and embedded as ordinary concrete is deposited, forming what is sometimes referred to as a "plum" stones. Cyclopean concrete was generally used between the 1870's and 1930's in large gravity dams and other massive structures where enormous volumes of concrete are required.

<sup>2</sup> The sliding safety factor is a ratio of the total stabilizing and driving forces experienced by a gravity dam and is used in dam design to assess the estimated margin of safety for a dam's structural stability with regard to sliding.

<sup>3</sup> PMF is a hypothetical worst-case-scenario flood for a given watershed. The PMF is developed by performing a statistical analysis of historical meteorological data for the area in question to estimate the most severe flood that can be anticipated under the most extreme meteorological and hydrologic conditions that are reasonably likely to occur. This maximum flow rate of the PMF is incorporated into the Dam design criteria to determine the appropriate factors of safety for the Dam.



H&S File: 9480/310/Mp-Fig1.cdr 12-15-10



CAT 211

Engineering Design Services and Design During Construction for the Reconstruction of Catskill Watershed Dams and Associated Facilities

# New York City Water Supply System



**Gannett Fleming**

**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

A Joint Venture

Figure 1

### **1.3 Gilboa Dam Reconstruction Project Description**

The major components of the Dam Reconstruction are the Downstream West Training Wall, East Training Wall, North Training Wall, Spillway and Channel Reconstruction, Upper Gate Chamber and Earthfill Embankment Dam and Upstream West Wing Wall. Descriptions of these structures and anticipated construction techniques are described in the following subsections. Refer to [Figure 2-Gilboa Dam Reconstruction Project Components](#) for locations of components listed in this document.

#### **1.3.1 Downstream West Training Wall**

The Downstream West Training Wall is a concrete gravity structure that extends 530 feet in a northerly direction from the west end of the concrete spillway and forms the west boundary of the spillway channel and plunge pool. Stabilization efforts would include post-tensioned anchoring, repair of upper portions of the wall, and extension of the north end. High capacity post-tensioned rock anchors would be installed in the Downstream West Training Wall to meet factors of safety for various load conditions.

#### **1.3.2 East Training Wall**

The East Training Wall is a concrete gravity structure comprised of a downstream section bearing on bedrock and an upstream section bearing on bedrock and soil. The downstream section of the East Training Wall would be stabilized using post-tensioned rock anchors, similar to the Downstream West Training Wall.

#### **1.3.3 North Training Wall**

The North Training Wall is a concrete gravity structure bearing on bedrock and provides the north boundary of the entire spillway channel. Stabilization includes removal of the backfill soil and replacement with free-draining material and lowering the grade behind the wall by 4 feet.

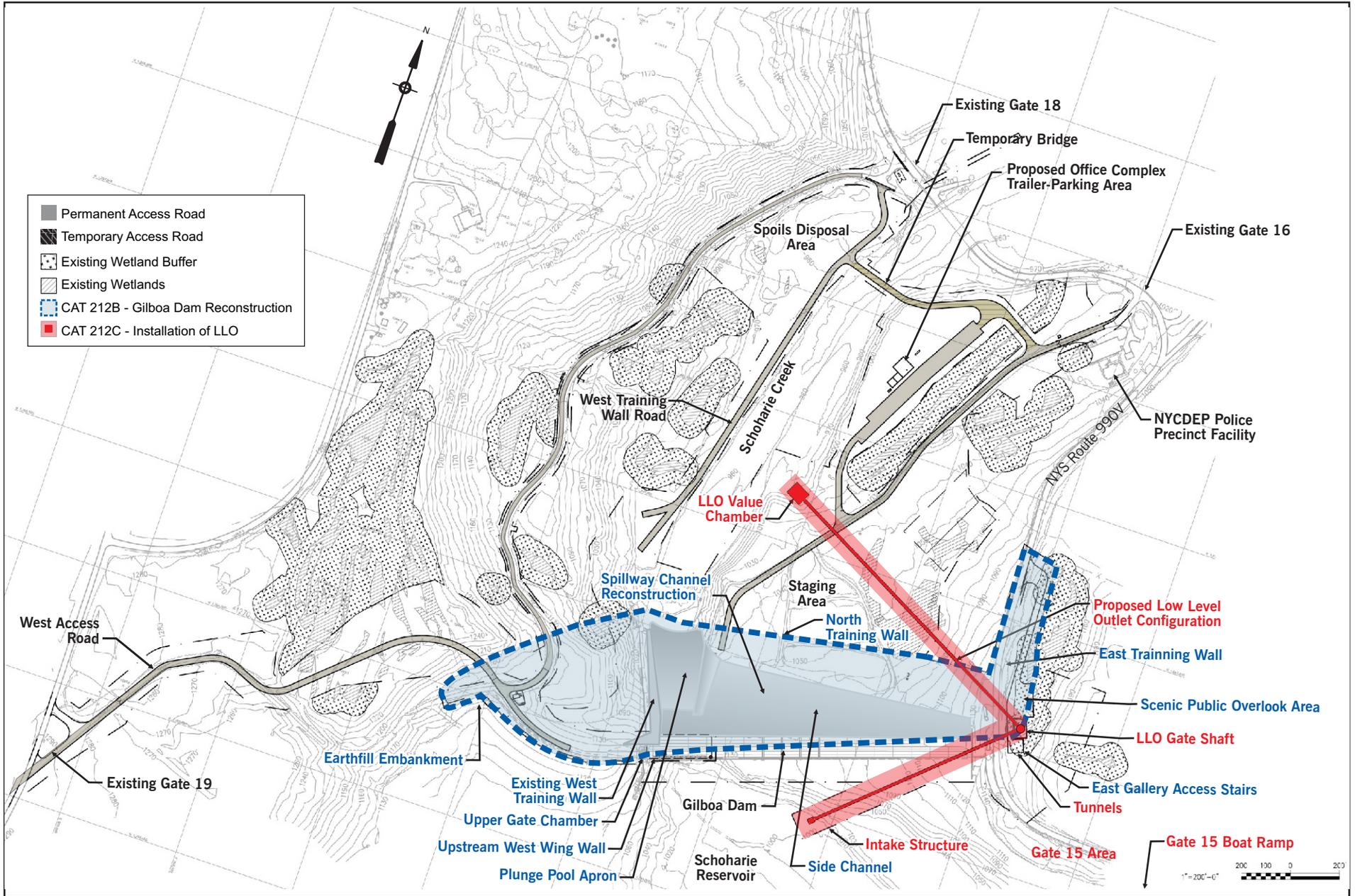
#### **1.3.4 Spillway and Channel Reconstruction**

Approximately 10,000 cubic yards (CY) of the existing deteriorated stone façade and concrete from the spillway crest and downstream face would be removed and replaced using 55,000 CY of mass concrete, which would be produced onsite in a portable concrete batch plant. The stone removal work would occur in sections so that the portion of the Dam not under reconstruction would remain operational and all removed deteriorated stone would be stored in the spoils disposal area or disposed of offsite. Temporary diversion facilities would be installed to facilitate the construction of permanent work within the Spillway.

Approximately 40,000 CY of existing concrete and masonry paving would be removed from the Spillway Channel, Intermediate Channel Step, Plunge Pool and End Sill/Apron areas. This material would be replaced to a very similar grade with dental and reinforced structural concrete that is anchored to bedrock.

#### **1.3.5 Upper Gate Chamber**

The Upper Gate Chamber building is located aboveground and within the transition section of the western edge of the Spillway. It serves as an access point to the Lower Gate Chamber, which houses the original Reservoir drain blowoff works. Investigations have indicated that the chamber's superstructure is in need of repair and replacement. Therefore, the superstructure would be dismantled and completely reconstructed and facility upgrades such as lighting, ventilation, handrails, and doors to the stairway and entranceway would be installed so that the existing space can be reused.



# Gilboa Dam Reconstruction Project Components

**NYC Environmental Protection** CAT 211 | Engineering Design Services and Design During Construction for the Reconstruction of Catskill Watershed Dams and Associated Facilities

### **1.3.6 Earthfill Embankment Dam and Upstream West Wing Wall**

The Earthfill Embankment Dam (Embankment) is located along the northern shore of Schoharie Reservoir to the west of the Spillway. This section consists of homogenous soil earthfill with a concrete core wall. The crest of the Embankment is uneven in some areas due to long-term settlement and rutting. The Upstream West Wing Wall is a concrete gravity structure that is believed to be bearing on bedrock at its northern limits and on soil at its southern limits. Under the proposed project, the embankment crest would be restored to original grade and approximately 70,000 CY of rock fill would be placed on the reservoir side of the wall to improve the embankment stability and essentially remove the upstream west wall from service by buttressing it with rock fill. The tree-line would be moved approximately 20 to 30 feet back from the downstream toe of the Embankment to facilitate future facility safety and security monitoring.

### **1.3.7 Scenic Public Overlook Area**

The Scenic Public Overlook Area is positioned on the eastern end of the Spillway and consists of several parking spaces, a flat area for viewing Schoharie Reservoir and Spillway, and a kiosk that presents the Town of Gilboa history. The area is overgrown with vegetation and the fencing is failing. Under the proposed project, this area would be cleared and redeveloped with a new interpretive center equipped with benches and walkways would be constructed for public access and viewing of the site. In addition, a new parking area, landscaping plants, stormwater features, and new fencing and guiderail would be installed. Additionally, the NYCDEP would be using recovered bluestone facing within the Scenic Public Overlook Area to the Reservoir for historical preservation purposes as per Memorandum of Agreement (MOA) with New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP).

### **1.3.8 East Gallery Access Stairs**

A new reinforced concrete East Gallery Access Stair Tower is proposed to access the Drainage Gallery from the east end of the Dam. The tower would be buried at grade and built down to a finished floor Elev. 1101.00. The East Training Wall would be penetrated at this elevation for access to the proposed gallery.

### **1.3.9 Miscellaneous Dam Reconstruction Items**

The following items would also be included in the Dam Reconstruction:

- Exterior lighting;
- Dam monitoring instruments;
- Various stairs, walkways, access ramps, fence and railings to permit safe access to the Dam for future operation and maintenance; and
- Chinking of the upstream embankment slope stone paving.

## **1.4 Low Level Outlet**

The installation of the Low Level Outlet (LLO), would take place concurrent with the concrete refacing of the Dam. The major components of the LLO are the Intake Structure, tunnels, Gate Shaft and Valve Chamber and improvements to Gate 15. Descriptions of these structures and anticipated construction techniques are described in the following subsections.

### **1.4.1 Intake Structure**

The installation of the intake structure would require in-reservoir construction and consist of the installation of the 138 inch bell mouth, 90 degree bend, and associated 108 inch diameter transition section, as well as the intake foundation, the portable bulkhead and the stainless steel screen intake structure. The initial phase of construction for the intake structure would be to prepare a suitable receiving pit for the wet retrieval of the microtunnel boring machine (MTBM). This portion of the work would involve dredging and underwater grading predominantly accomplished from the Reservoir surface with finished grades verified by sonar. Approximately 9,500 CY of dredge material would be removed from

the proposed intake location on Schoharie Reservoir bottom and transported via muck barge southeast within the Reservoir where it would be deposited on the Reservoir bottom. Dredging activities are anticipated to be accomplished primarily by clam shell and pumping, but very loose material may be vacuumed or pumped from the Reservoir bottom to the mud barge. Limited diver support may also be needed.

#### **1.4.2 Tunnels**

Two distinct tunnel segments are proposed for the LLO: the upstream tunnel segment that would extend from the intake structure to the Gate Shaft, located just upstream of the Dam at the right abutment and the downstream segment that would extend from the Gate Shaft to the Discharge Structure at Schoharie Creek. Conventional tunneling techniques such as a tunnel boring machine (TBM) or hand mining, drilling and blasting or a more unconventional technique of microtunnelling are proposed to tunnel through bedrock. All remaining excavation in non-bedrock soil would be performed manually via hand mining methods or cut and cover excavation.

#### **1.4.3 Gate Shaft**

In addition to being a permanent shaft, the proposed Gate Shaft would also serve as the primary point of initiation of the tunnel segments, especially the upstream (water) tunnel leg. All microtunneling operations for the upstream leg would be performed from the Gate Shaft and progress towards Schoharie Reservoir. All tunneling operations for the downstream leg would also be conducted from the Gate Shaft.

After tunnel construction is completed, the Gate Shaft would be modified to include two roller gates that would be situated at the upstream and downstream sides of the shaft. The roller gates would provide a means for dewatering the tunnel as well as the Gate Shaft for inspection and maintenance. The roller gates would also provide a means for additional security and a source of redundancy to control Reservoir levels if there were problems with the downstream control valves. The final shaft diameter is expected to be approximately 40 feet.

#### **1.4.4 Valve Chamber**

A temporary portal would be installed during the construction period near the interface of the rock and soft ground portions of the land leg of the tunnel, approximately 150 feet upstream of the Valve Chamber. The portal would provide a means for terminating the tunnel operation and transitioning to open cut and cover for construction of the lower portions for LLO.

#### **1.4.5 Gate 15 Site Improvements**

Site improvements are planned for Gate 15 area located in the northeast section of Schoharie Reservoir just south of the East Training Wall to provide staging and storage areas and improve access to the Reservoir for heavy equipment barges and boats. These improvements would include limited grading and placement of soil and stone fill to provide a flat site, the extension of the existing site access road so that it may be used as a boat ramp and the installation of 160 linear feet of seawall. Once the installation of the LLO is complete, Gate 15 is expected to become a permanent boat launch facility for the Reservoir inspection and maintenance and may possibly be open to the public for fishing activities.

### **1.5 Future Improvements**

#### **1.5.1 Shandaken Tunnel Intake Facility Rehabilitation**

NYCDEP has planned maintenance and repair to the Shandaken Tunnel Intake Facility to ensure continued reliability in diverting water from Schoharie Reservoir through the Shandaken Tunnel.

#### **1.5.2 Site Restoration**

Following the completion of land disturbance activities as a result of reconstruction work in different portions of the project site (i.e., the West Access Road), these areas would be restored with native vegetation.

## **1.6 Construction Phasing**

To expedite initiation of construction work at the Dam Reconstruction project site, the NYCDEP has elected to complete the work with multiple construction contracts and phases. The contracts/phases would be staged to allow some construction to be initiated while other design activities are progressing. Installation of the crest gates (Phase One) commenced in early 2009 and is anticipated to be completed in 2011. Site preparation activities (Phase Two) commenced in fall 2009 and are also anticipated to be completed in 2011 that Dam reconstruction and installation of LLO (Phase Three) can be completed by the end of 2016. Rehabilitation of the Shandaken Tunnel Intake Facility (Phase Four) is anticipated to take place during this time period between the 2014 and 2017. Site restoration activities (Phase Five) would take place from 2016 through 2018. The workforce would consist of approximately 120 workers (depending on construction activities) working up to two shifts a day for a 6-day work week; the dayshift would comprise approximately 80 workers and the evening shift approximately 40 workers. Construction activities are planned for the spring, summer and fall with temporary work stoppages or limited work during the winter months (e.g., late December to early March). The various phases of the Dam Reconstruction project are discussed in greater detail in the following sections.

### CAT-359: Crest Gates Installation (Phase One)

The first phase of work consists of the installation of crest gates in the existing notch. This work commenced in January 2009 and is anticipated to be complete in 2011. This phase includes the construction of a control building for the crest gates and installation of temporary electrical utilities onsite to provide power to the system. The Dam emergency work would be concluded upon completion of this phase.

### CAT-212A: Site Preparation Activities (Phase Two)

The second phase of the proposed work consists of preparation of the Dam site for heavy construction which includes the establishment of primary work areas and other site preparation activities. Construction commenced in September 2009 and is anticipated to be complete in 2011. The major activities performed in this phase include:

The site preparation work is being performed in three stages, in order to provide a logical and efficient sequence of work as well as to minimize erosion and sedimentation of the work area during clearing and regrading activities.

### CAT-212B and CAT 212C: Dam Reconstruction and Installation of LLO (Phase Three)

The third phase of work consists of major Dam reconstruction activities to improve Dam and Reservoir safety, as well as the installation of the LLO. The work to be included in this contract includes all items required to address dam safety considerations in addition to other improvements intended to facilitate operation of the Dam and appurtenances.

### CAT-212D: Shandaken Intake Improvements (Phase Four)

The fourth phase of the proposed work would consist of improvements to the Shandaken Tunnel Intake located upstream along the Reservoir shoreline which would be performed independently of the Dam reconstruction work.

### CAT-212E: Environmental Restoration (Phase Five)

The fifth and final phase of work would consist of site restoration activities to address and/or mitigate any lasting environmental effects of the Dam reconstruction.